

Hydrogeological Investigation, Activa Baden North Subdivision, Township of Wilmot, Ontario

Revised Draft Plan Submission

December 19, 2024

Prepared for:
Activa Holdings Inc.

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Project Number:
60305680



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Abbreviations

Activa	Activa Holdings Inc.
AFB1	Aquifer 1
AGS	above ground surface
AMSL	above mean sea level
ASTM	American Society for Testing and Materials
ATB1	Aquitard 1
BGS	below ground surface
(D)	deep
EASR	Environmental Activity Sector Registry
GRCA	Grand River Conservation Area
GRIN	Grand River Information Network
HDPE	high density polyethylene
HVA	Highly Vulnerable Aquifer
IF	infiltration factor
IPZ	Intake Protection Zone
LID	Low Impact Development
m	meters
MECP	Ministry of Environment, Conservation and Parks
m/s	meters per second
mm/hour	millimeters per hour
mm/year	millimeters per year



Hydrogeological Investigation, Activa Baden North Subdivision, Township of Wilmot, Ontario
Abbreviations

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OGS	Ontario Geological Survey
PTTW	Permit to Take Water
(S)	shallow
SCS	Site Condition Standards
SGRA	Significant Groundwater Recharge Area
Site	Activa Baden North Subdivision, Lot 15, German Block North of Snyders Road, Township of Wilmot
SPP	Source Protection Plan
Stantec	Stantec Consulting Ltd.
SWM	stormwater management
TUA	Township Urban Area
WHPA	Well Head Protection Area
ZOI	(dewatering) zone of influence



1 Introduction

Activa Holdings Inc. (Activa) retained Stantec Consulting Limited (Stantec) to complete a hydrogeological assessment of the lands for the proposed Activa Baden North Subdivision, located on Lot 15, German Block North of Snyders Road, Township of Wilmot (Site) in support of Draft Plan approvals. The current Draft Plan Application is being submitted for the lands owned by Activa within the established Township Urban Area (TUA) (i.e., TUA Lands - boundary of the TUA development area within the Site is shown on Figure 15). Lands outside of the TUA (i.e., Non-TUA Lands) are not proposed for development other than for related infrastructure (e.g., SWM facility) that supports the development within the TUA. Proposed development within the TUA Lands will consist of up to 344 residential units (combination of singles and townhomes) serviced by municipal water and sewage infrastructure, private and municipal roadways, a municipal SWM Facility (SWMF), and a municipal trail/drainage corridor.

The Site is bounded by wooded area associated with the Phillipsburg Southeast Wetland Complex to the north, active agricultural lands to the east and west, and existing phases of the Activa Baden Subdivision to the south (Figure 1). Most of the lands within the boundaries of the Site are utilized for agricultural purposes, with the northwest portion of the property being occupied by a combination of deciduous forest and wetlands, with the wetland areas consisting of meadow marsh and deciduous swamp.

The objective of the hydrogeological investigation was to assess baseline groundwater conditions throughout the Site and evaluate how the form and/or function of the hydrogeological system could be impacted by the proposed residential development and recommend potential mitigation measures to be employed throughout the Site to maintain pre-development groundwater functions under post-development conditions. Stantec structured the investigation to address requirements for proposed developments as outlined in the *Conservation Authority Guidelines to Support Development Applications – Hydrogeological Assessment Submissions* (June 2013). Specifically, the hydrogeological investigation included the following tasks:

1. Characterize the existing geological and hydrogeological conditions within the Site, including a discussion of hydrostratigraphic units, seasonal fluctuations in groundwater levels and hydraulic gradients, existing hydraulic interactions between the local wetlands and groundwater system, and groundwater quality conditions.
2. Assessment of whether future buildings / underground parking structure, servicing (i.e., storm/sanitary sewers and water mains) and associated construction activities will intercept the groundwater table and evaluate if any measures are required to mitigate potential disturbances on pre-development groundwater elevations and flow patterns.
3. Preliminary assessment as to whether construction and/or permanent dewatering may be required for the proposed development.
4. Perform a pre- and post-development water balance and assess how potential land use changes could affect the groundwater recharge function of the Site and the hydroperiod of the nearby wetlands (i.e., seasonal pattern of surface water and groundwater interactions with the wetlands).



5. Review the proposed Site land use activities for conformity with Source Water Protection requirements as stipulated in the Clean Water Act, 2006, S.O. 2006, c. 22.
6. Identify any other potential hydrogeological constraints to the development of the Site and evaluate potential mitigation measures to alleviate these constraints

This report is arranged into eight sections, including this introduction (Section 1). Section 2 presents the physical setting of the Site at a regional scale. Section 3 outlines the methods utilized to evaluate the Site hydrogeological conditions. Section 4 presents the results of the Site investigation, with Section 5 presenting the water balance assessment. Section 6 discusses the potential hydrogeological impacts of the project and recommended mitigation measures. Report conclusions and references are listed in Sections 7 and 8, respectively.

All figures and tables referenced in this report are presented in Appendices A and B, respectively. Appendices C to G include Regional Vertical Hydraulic Gradient and Groundwater Recharge Mapping, Borehole Logs, Laboratory Certificates of Analysis, Hydraulic Conductivity Analytical Solutions, and Water Balance Calculations respectively.



2 Physical Setting

2.1 Physiography, Topography and Drainage

The Site is situated within the Waterloo Hills physiographic region (Figure 2). The Waterloo Hills, also commonly referred to as the Waterloo Moraine, occupies a large portion of the Regional Municipality of Waterloo with the surface of this physiographic feature consisting of sandy hills, ridges of sandy till, kames or kame moraines and intervening hollows of outwash sand and gravel, which all can be capped by glacial till (Chapman and Putnam, 1984, 2007).

The Waterloo Moraine represents a regionally extensive depositional feature that reaches a maximum elevation of approximately 405 m above mean sea level (AMSL), with the crest of this feature trending to the southeast between Regional Road No.12 and Township Road No.16. The community of Baden is located on the western flank of the Waterloo Moraine, with the regional topographic profile generally sloping in a western direction from Baden to the banks of the Nith River (Figure 3).

As shown on Figure 1, topographic conditions within the Site are classified as moderately rolling and have local slopes that range from two to five percent. Ground surface elevations within the Site range from approximately 355 to 364 m AMSL. In general, the ground surface slopes from the northwest corner of the Site (containing Wetlands 3 and 13) to the southeast and from the eastern limits of the property to the southwest to a topographically low-lying area located in the central portions of the Site. These previously mentioned areas are delineated as Catchments 100 and 101, with surface water runoff from these catchments being funnelled in a northern direction and flowing into Wetland 8 and the offsite Phillipsburg Southeast Wetland Complex to the north of the Site (Figure 1).

A portion of the Site also drains in a southern direction towards the existing built-out phase of the Activa Baden Subdivision (i.e., Catchment 104, Figure 1), where this surface water runoff once flowing off-Site is conveyed to an existing stormwater (SWM) facility via the subdivision stormwater sewer system. Some external flows enter the Site from the existing agricultural fields to the northeast (i.e., Catchment 102 drains to Catchment 101, Catchment 103 drains to Catchment 104; Figure 1), while most runoff occurring in the agricultural fields to the southwest of the Site remains offsite and drains to local depressions (i.e., Catchment 105).

2.2 Regional Geology and Hydrogeology

The Site is located within the Waterloo Moraine, a kame moraine formed in an interlobate position between ice lobes extending from the Lake Ontario-Erie, Huron, and Georgian bay areas (Karrow, 1993). Numerous advances and retreats of the ice lobes during the Wisconsin glacialiation resulted in a complex deposit of ice-contact and glacial outwash sands and gravels separated by silt- and clay-rich tills. The conceptual hydrogeologic model for the Waterloo Moraine comprises four main aquifers and aquitards after Terraqua Investigations Ltd. (1995), which was broken down further into 19 hydrostratigraphic units after Bajc and Shirota (2007). The model generally does not include more recent deposits shown on



surficial geology mapping such as organics (Unit 20, Figure 4) or modern alluvium (Unit 19, Figure 4), which are found in wetlands and creek/river valleys.

The hydrostratigraphic units generally encountered in the subsurface where the Site occurs are described below. The units are described from ground surface downward, with Bajc and Shirota (2007) unit names shown in parentheses.

Perched Aquifer (AFA1): This hydrostratigraphic unit comprises ice-contact and outwash deposits of sand, silt, and gravel (referred to as the Whittlesey Sand), which typically overlies Aquitard 1 and contains a perched groundwater system. The Perched Aquifer is not encountered west of Township Road No.16 (i.e., Sandhills Road) and, subsequently, does not occur beneath the Site. The Perched Aquifer is reported to be a key source of base flow to the upper tributaries of the Baden and Hunsburger Creeks (Golder, 2011).

Aquitard 1 (ATB1): Surficial and spatially discontinuous glacial till unit, which along the western flank of the Waterloo Moraine consists of the Port Stanley Till (clayey silt to silty clay) (Bajc and Shirota, 2007). Aquitard 1 is characterized by low permeability and forms a relatively impermeable barrier that effectively limits the downward movement of surface water to the deeper aquifer systems (Unit 5d, Figure 4).

Aquifer 1 (AFB1/ATB2/AFB2): This hydrostratigraphic unit represents the main water supply aquifer in the core areas of the Waterloo Moraine. Depending on the depositional environment, the composition of Aquifer 1 varies from a layered silt and fine sand to coarse sand and gravel (Unit 6, Figure 4). Throughout the core areas of the moraine, Aquifer 1 corresponds to a thick, laterally extensive sand and/or gravel aquifer overlying Aquitard 2 and is often exposed at surface. In some areas, Aquifer 1 is interpreted to be bisected by the Middle Maryhill Till (ATB2), which effectively separating Aquifer 1 into two units: AFB1 and AFB2. Where Aquifer 1 is overlain by Aquitard 1, the aquifer behaves as a confined to semi-confined aquifer system. Where Aquitard 1 is absent and the sediments of Aquifer 1 are exposed at ground surface, such as in the areas to the north of Baden (Figure 4), these deposits represent an important source of groundwater recharge to this aquifer system. These at surface deposits of Aquifer 1 are also reported to provide a source of groundwater discharge to the tributaries of Baden and Hunsburger Creek (Golder, 2011).

Aquitard 2 (ATB3): Aquitard 2 corresponds to the Lower Maryhill Till, an overconsolidated, stony, clayey silt till, that represents one of the primary regional hydrostratigraphic units (Bajc and Shirota, 2007). Along the flanks of the Waterloo Moraine, the Lower Maryhill Till is often found to be discontinuous.

Salina Formation (Bedrock): Upper Silurian formation consisting of shaley dolostone, with discontinuous minor bedding planes of anhydrite. Due to anhydrite and gypsum content, groundwater quality in the Salina Formation is typically poor, having elevated concentrations of iron and sulphate. As per GRCA (2001), the bedrock surface near the Site is encountered at an approximate depth of 280 m AMSL.



Regional studies completed by Terraqua Investigations (1995), Waterloo Hydrogeologic Inc. (1999), and the Grand River Conservation Authority (2001) indicate that to the west of the Waterloo Moraine and near the community of Baden, groundwater flow through Aquifer 1 is generally from northeast to southwest and moves towards the Nith River.

Regionally, the lands containing the Site are characterized by groundwater recharge conditions. Mapping created using the Grand River Information Network (GRIN) (GRCA, 2021) indicates that downward vertical hydraulic gradients are present beneath the Site, with annual groundwater recharge rates across the property mostly ranging from less than 50 to 100 mm/year in those areas where the silt to clay deposits of Aquitard 1 occur at ground surface (Figures C-1 and C-2, Appendix C). In the northwest corner of the Site where the silty sand, sandy silt, and sand deposits of Aquifer 1 are exposed at ground surface, annual recharge rates are notably higher with values ranging from 300 mm/year to greater than 400 mm/year (Figure C-2, Appendix C).

2.3 Source Water Protection

As established under the Ontario Clean Water Act, 2006, S.O., 2006, c. 22, source protection areas and associated land use restrictions exist for all municipal drinking water sources located throughout the Lake Erie Source Protection Area (LESPA).

The Ontario Ministry of the Environment (now the MECP) introduced the Clean Water Act as a means of ensuring the protection of drinking water sources within the Province. The Clean Water Act requires that a detailed Assessment Report be prepared for each municipal drinking water system, with this Assessment Report incorporating numerous components as outlined in the document “Technical Rules: Assessment Report, Clean Water Act (2006), November 16, 2009”. This legislation provides a basic framework for communities to follow in developing an approach to protecting their municipal water supplies, with the key components of this approach being as follows:

- Identification and assessment of risks to the quality and quantity of municipal drinking water sources and determine which risks are significant and require immediate action, which risks need monitoring to ensure they do not become significant, or which pose low to negligible risk. This information is presented in a detailed Assessment Report, with the content of this report consisting of (i) the defining of Well Head Protection Areas (WHPA) for groundwater drinking water sources and Intake Protection Zones (IPZ) for surface water drinking water sources, (ii) completion of a vulnerability assessment for each WHPA and IPZ, and (iii) identification of drinking water issues and threats.
- Preparation of a Source Protection Plan (SPP) that addresses identified drinking water threats, particularly significant threats.

Within the LESPA and specifically the Grand River Source Protection Area, the MECP has designated five types of vulnerable areas that apply to drinking water sources.



Wellhead Protection Area (WHPA): an area delineated on the ground surface that represents the capture zone for the underlying aquifer in which a given municipal well draws its water. The zone represents the total amount of time it would take for groundwater to flow through the aquifer system and reach the intake of a given municipal well. The zones are defined as follows:

- WHPA-A: 100 m radius around the municipal well.
- WHPA-B: Time-of-travel to the municipal well is two years or less.
- WHPA-C: Time-of-travel to the municipal well is equal to or less than five years and greater than two years.
- WHPA-D: Time-of-travel to the municipal well is equal to or less than 25 years and greater than five years.

Based on a review of the online MECP Source Water Protection Information Atlas (2024) and as shown in Figure 5, the Site does not occur within an area designated as WHPA. Stantec notes that the Baden Well Field is situated approximately 1.8 km southeast of the Site; however, these municipal production wells (Wells B1 and B2) were taken off line in 2001 due to the presence of elevated nitrate concentrations in the groundwater pumped from these wells and, subsequently, to minimize potential nitrate migration towards the Wilmot Centre Well Field (Wells K50 and K51) (Golder, 2011).

Significant Groundwater Recharge Areas (SGRA): Groundwater recharge represents the proportion of precipitation and/or surface water runoff that infiltrates to the subsurface and reaches the groundwater table. The volume of water that infiltrates to the subsurface is largely influenced by site topography, the physical properties of the soil, and land cover characteristics. The LESPC (2021a) defines a significant groundwater recharge area (SGRA) to be an area where the annual recharge rate is greater than the average plus 15% or more across the source protection region. As per the Assessment Report (LESPC, 2017a), lands within the Grand River Source Protection Area (i.e., the Grand River Watershed) are deemed to be SGRA when the annual recharge rate is greater than 176 mm/year. The areas designated as SGRA within the Site are shown on Figure 5, which indicates that the SGRA occurs within the property where ice-contact stratified deposits of silty sand, sandy silt, and sand associated with Aquifer 1 are mapped by the OGS (2010) as occurring at ground surface (Figure 4).

Highly Vulnerable Aquifer (HVA): Defined as subsurface, geologic formations that are sources of drinking water, which could be easily affected by the release of pollutants on the ground surface. The HVA is identified using variables that include depth to the aquifer, physical properties of the overlying soil and/or rock, and the aquifer composition. In general, an HVA will consist of granular aquifer materials (i.e., sands and gravels) that are exposed near the ground surface and where a relatively shallow water table is present. Based on a review of the online MECP Source Water Protection Information Atlas (2024) and as shown in Figure 5, the Site does not occur within an area designated as HVA.



Intake Protection Zones (IPZ): A zone established around a drinking / surface water intake within which a spill or leak may get to the intake too quickly for the operators of the municipal water treatment plant to shut the intake down until the pollutant passes by. These zones also include land adjacent to streams and storm sewers where surface water runoff can quickly reach the intake. As shown in Figure 5, the Site does not intercept any surface water system IPZs.

Water Quantity Vulnerable Areas: Water quantity vulnerable areas are determined through a tiered process of water budget analyses as set out in the Technical Rules under O. Reg. 287/07. WHPA-Q is defined as an area where an activity can occur and pose a threat to drinking water quantities. Any activity that takes water without returning it to the same source or an activity which reduces recharge may be a threat in WHPA-Q. Based on a review of the online MECP Source Water Protection Information Atlas (2024) and as shown in Figure 5, the Site does not occur within an area designated as WHPA-Q.



3 Methodology

Section 3.0 provides the methodology used to obtain the data required to complete the hydrogeological investigation. The key components of the investigation included:

- drilling/advancement of boreholes
- installation and development of monitoring wells
- installation of drive-point piezometers
- monitoring of groundwater levels
- collection of groundwater samples for quality testing
- performing hydraulic response (hydraulic conductivity) testing
- performing soil permeability / infiltration testing.

The sections below provide detailed descriptions of the hydrogeological investigation components.

3.1 Borehole Drilling and Monitoring Well Installations

Between June 15 and 19, 2020 boreholes were advanced at 21 locations across the Site as part of the geotechnical investigation (Stantec, 2021) (Figure 1). Seven of the locations involved the drilling of a borehole, which was then equipped with a single monitoring well (i.e., BH/MW01-20, BH/MW02-20, BH/MW03-20, BH/MW05-20, BH/MW07-20, BH/MW08-20, BH/MW09-20). Two of the locations involved the installation of a multi-level monitoring well (i.e., BH/MW04-20 and BH/MW06-20) where two boreholes (one shallow and one deep) were drilled within meters of each other, with each of these boreholes then being equipped with a single monitoring well. Overall, the boreholes were strategically positioned throughout the Site to obtain a spatially representative understanding of soil conditions, groundwater depths and fluctuations, and to evaluate local patterns of groundwater flow.

Stantec, on behalf of Activa, retained a qualified drilling contractor (i.e., London Soil Test Ltd.) to complete the borehole drilling and monitoring well installations. The boreholes were drilled using a Diedrich D50T track-mounted drilling rig equipped with a solid stem and hollow stem (i.e., to permit the installation of monitoring wells) auger drilling system. Soil samples were collected using split-spoon sampling techniques. Soil sampling occurred using a 0.6 m long stainless-steel split spoon sampler at combinations of 0.75 m (2.5 feet) and 1.52 m (5 feet) intervals to the termination depth of the boreholes. The completed depths of the boreholes ranged from 5.2 m to 9.8 m below ground surface (BGS). Stantec directed the drilling and soil sampling operations and logged the borehole stratigraphy using the American Society for Testing and Materials (ASTM) guideline for the description and identification of soils (ASTM, 2009). The borehole logs contain descriptions (where relevant and possible) of soil type, texture, colour, structure, consistency, plasticity, moisture content, and other visual and olfactory observations. Copies of the borehole logs are provided in Appendix D.



The drilling contractor installed the monitoring wells adhering to construction requirements outlined under Ontario Regulation 903 (O. Reg. 903) (MOE, 1990). Each monitoring well is constructed of 50 mm inside 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 silica sand to a height of approximately 0.3 m above the top of screen, followed by granular bentonite to ground surface to 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 within a lockable steel casing.

Following installation, Stantec purged each monitoring well using dedicated 16 mm (2/3 inch) inside diameter high density polyethylene (HDPE) tubing connected to a D-25 Waterra™ foot valve. Using the dedicated tubing, Stantec purged up to 10 standing column volumes from each well (where possible) to clear out any fine-grained sediments and, subsequently, establish a proper hydraulic connection with the native aquifer material.

Stantec Geomatics completed a geodetic survey of the Universal Transverse Mercator (UTM) coordinates and top-of-pipe elevation of each monitoring well. The well construction details, coordinates and elevation data obtained from the geodetic survey are presented in Table 1 and summarized on the borehole logs provided in Appendix D.

3.2 Drive-Point Piezometer Installations

On July 15, 2020, Stantec personnel installed one multi-level drive-point piezometer, consisting of a shallow (S) and a deep (D) piezometer, into each of Wetlands 3, 8, and 13 within the northwest portion of the Site (Figure 1). The multi-level piezometers (i.e., DP1-20(S/D) to DP3-20(S/D)) were installed to evaluate whether each wetland functions as a groundwater recharge feature (i.e., contributes water to subsurface), discharge feature (receives water from the subsurface), or a combination of both.

Each drive-point piezometer is constructed of a 0.42 m long steel screen (19 mm diameter) connected to 25 mm diameter steel riser pipes. Stantec drove the drive-point piezometers into the substrate using a fence post driver, with shallow and deep pipes being constructed within one meter of each other and their screens being separated by a vertical distance ranging from 0.34 to 0.56 m. Construction details for the drive-point piezometers are presented in Table 1 and summarized on the borehole logs provided in Appendix D.

3.3 Groundwater Level Monitoring

Stantec manually measured water levels in the monitoring wells and drive-point piezometers between July 2020 and July 2024 using a battery operated Heron™ water level meter. Equipped with an electrode connected to a graduated polyethylene tape, Stantec used the meter to measure the depth to water by slowly lowering the electrode into the well until the buzzer sounded. Stantec recorded the water level measurements in meters to the nearest 0.01 m. A summary of the manual water level measurements obtained by Stantec at the monitoring wells and drive-point piezometers throughout the investigation is provided in Tables 2 and 3, respectively.



The continuous recording of groundwater level fluctuations occurred in all monitoring wells and drive-point piezometers installed across the Site from July 2020 to July 2024 using Solinst® Edge Levelloggers® (Levelloggers). Suspended into the water column at each monitoring well and drive-point piezometer, the Levelloggers were programmed to record water levels at 60-minute intervals. Levelloggers are not vented to the atmosphere and, therefore, record total pressure (where total pressure is the sum of the atmospheric pressure and the height of water column). To obtain an accurate measurement of the groundwater level at each well, the water level data obtained from the Levelloggers are corrected for atmospheric pressure using data obtained from a Solinst® Edge Barologger® (Barologger), which was suspended in the air column within one of the on-Site monitoring wells. Hydrographs showing the fluctuations of groundwater levels in monitoring wells and drive-point piezometers over time are presented in Figures 6 to 8 and Figure 9, respectively.

3.4 Groundwater Sampling and Quality Testing

On July 14, 2020, Stantec collected groundwater samples from selected monitoring wells (i.e., BH/MW01-20 to BH/MW03-20, BH/MW05-20, BH/MW08-20, and BH/MW09-20) for quality analysis, with these results being compared against the *Ministry of the Environment, Conservation and Parks (MECP) (2011) Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act - Site Condition Standards (SCS) (Full Depth Background – All Types of Property Uses)* (Table 4).

Stantec pumped each monitoring well with the same tubing used to develop the well, with up to 10 well volumes of water being removed from each well prior to collecting the sample. Field measurements of conductivity, temperature, and pH were monitored in the purged water until these parameters stabilized, indicating that all stagnant water had been removed from the well casing prior to collecting a sample from the well. A casing volume is defined as the volume of water stored inside the well casing.

Following purging, groundwater samples from each monitoring well were collected by pouring water directly from the HDPE tubing into the appropriate pre-labeled sample containers. Groundwater samples submitted for the analysis of dissolved metals were field filtered using disposable, in line, 0.45 µm (micron) filters attached to the HDPE tubing. Groundwater samples were packed carefully into a sample cooler, which was refrigerated using freezer packs and delivered to an accredited laboratory (i.e., Bureau Veritas Labs) for analyses. The groundwater samples were analyzed for general inorganic chemistry, metals, petroleum hydrocarbons, and volatile organic compounds. Chain of custody forms were completed and included with the samples. Results of the groundwater quality testing completed are presented in Table 4, with copies of the laboratory Certificates of Analysis being provided in Appendix E.

3.5 Hydraulic Response Testing

To estimate the horizontal hydraulic conductivity of the deposits beneath the Site, Stantec performed in-situ hydraulic response testing on all monitoring wells, except for BH/MW05 and BH/MW07. The tests consisted of creating an instantaneous change in the monitoring well water level by either removing a known volume of water from the well (i.e., rising head / bail test), followed by recording the time taken for the resulting water level to return to static conditions using a combination of manual water level measurements and a Levellogger temporarily installed into the water column of each well to collect



groundwater level measurements at specified intervals during the testing. Data obtained from the Leveloggers were corrected for atmospheric pressure using a barometric logger installed in one of the on-Site monitoring wells. The testing results were analyzed using the Bouwer and Rice (1976) / Bouwer (1989) solution provided in the software package AQTESOLV™ Pro Version 4.5 (Duffield, 2014) to calculate the horizontal hydraulic conductivity of the aquifer sediments within the immediate vicinity of the screened interval of each monitoring well. Table 1 provides a summary of the calculated horizontal hydraulic conductivities, with the analytical solutions for the data being presented in Appendix F.

3.6 Infiltration Testing

Assessment of the infiltration potential for the on-Site soils involved the use of a Guelph Permeameter (a constant head permeameter designed to measure in-situ vertical hydraulic conductivities of a given substrate). Stantec personnel used a hand auger to drill 0.6 to 0.7 m deep, 50 mm diameter cylindrical holes into the native soil at nine locations for testing. The Guelph Permeameter was then filled with water, inserted into the hole while making a concerted effort to avoid knocking debris into the excavation, and stabilized against the substrate. Stantec then proceeded to record the eventual steady-state rate of water recharge into the soil. The infiltration rate for each soil tested was converted from the measured vertical hydraulic conductivity using the established relationship between vertical hydraulic conductivity and infiltration rate presented in the Credit Valley Conservation and Toronto and Region Conservation (2010) Low Impact Stormwater Management Planning and Design Guideline. Out of the nine locations tested, only two locations (i.e., GP2 and GP6; Figure 1) yielded measurable results, with the soils tested at these locations consisting of sandy silt to silt deposits. The remaining testing locations consisted of surficial deposits of silt, clay, and/or clay to clayey silt till (i.e., GP1, GP3 to GP5, GP7 to GP9; Figure 1), with the absence of a measurable infiltration response at these locations indicating that the infiltration potential of these on-Site soils is notably low. Table 5 presents the results of this soil infiltration testing.

Stantec also used the in-situ hydraulic response testing results obtained from the monitoring wells discussed in Section 3.5 to estimate infiltration rates of the deeper overburden soils (i.e., between 3.0 m and 7.9 m BGS). Since hydraulic conductivity in the horizontal direction is generally an order (potentially two orders for clay-based deposits) of magnitude higher than hydraulic conductivity in the vertical direction (Todd 1980; Freeze and Cherry 1979), the vertical hydraulic conductivities for overburden deposits surrounding the well screens were assumed to be one order of magnitude lower than in-situ measured horizontal hydraulic conductivities. The Credit Valley Conservation-Toronto and Region Conservation (CVC-TRCA) (2010) method for converting vertical hydraulic conductivity to an infiltration rate was then applied to these data, with the results being presented in Table 5.



4 Local Geology and Hydrogeology

4.1 Geology and Hydrostratigraphy

Figure 4 presents the surficial geology within the Site as mapped by the OGS (2010), which indicates that these lands are mostly covered by glaciolacustrine-derived deposits of silt and clay inferred to largely represent the Port Stanley Till. The mapping indicates that ice-contact stratified deposits, which are confirmed to consist of sandy silt, silty sand, and sand, occur at ground surface in the northwest portions of the Site. These sand-based soils are inferred to represent the deposits associated with Aquifer 1 (AFB1). Overall, the onsite drilling results completed as a part of this investigation support the OGS interpreted spatial distribution of surficial soils that cover the Site.

Figure 4 shows the locations of Cross Sections A-A' (Figure 10), B-B' (Figure 11), and C-C' (Figure 12), which were constructed using the results of the on-Site drilling investigation. A summary of these drilling results is shown on the borehole logs provided in Appendix D. The investigation results indicate that a 0.2 m to 1.2 m thick layer of topsoil covers the Site, with up to 1.6 m of fill material (matrix of silt to clayey silt) being encountered near the southeastern limits of the property near the existing Activa Baden Subdivision (i.e., BH/MW01-20 and BH/MW03-20). In general, the topsoil and fill overlie deposits of silt, clay, and clay to clayey silt till (i.e., Aquitard 1), which extend up to 9.8 m BGS beneath the Site. As shown in Figure 11, the thickness of Aquitard 1 (ATB1) thins near the northwestern portion of the Site, where the sand-based deposits of Aquifer 1 (AFB1) are exposed at ground surface. The top of Aquifer 1 (AFB1) is interpreted to occur at elevations ranging from 350 to 356 m AMSL throughout the subsurface of the Site (Figures 10 and 12). Layers/seams of silty sand and sandy silt are also found to be occasionally interspersed within Aquitard 1 (ATB1).

4.2 Hydrogeology

4.2.1 Groundwater Levels

Figures 6 to 9 and Tables 2 and 3 present the continuous and manual water levels recorded within the monitoring wells and drive-point piezometers between July 2020 and July 2024. Groundwater elevations across the Site ranged from 6.4 m BGS (at BH/MW01-20) to 0.4 m above ground surface (AGS) (at DP1-20) over the monitoring period, equating to elevations ranging from 352.5 m to 359.6 m AMSL.

As shown in Figures 6 to 9, the groundwater table demonstrated a similar pattern in fluctuations across the Site. Although the seasonal fluctuations are relatively subdued, the highest groundwater conditions are still shown to occur in the spring, with groundwater elevations typically beginning their steady rise in the late fall. This groundwater table rise is attributed to a reduction in soil moisture losses to evapotranspiration that occurs over the late fall to spring together with a melting snowpack that occurs during the spring, which in turn provides a greater volume of water available to infiltrate and recharge the groundwater system. In contrast, during the summer months the groundwater table is at its lowest elevation due to more water being drawn from the subsurface to meet an increased evapotranspiration



demand. This cyclical pattern of groundwater fluctuations is common within shallow groundwater systems in southern Ontario.

In general, the groundwater table within Aquitard 1 (ATB1) demonstrates a restricted response to precipitation events as evidenced by the absent to minor spikes observed in groundwater levels within the on-Site monitoring wells (screened within this unit) following such events (Figures 7 and 8). Although infiltration to the subsurface is occurring, the volume of this infiltration appears to be notably restricted by the fine-grained deposits of silt and clay, and clay to clayey silt till (i.e., Port Stanley Till). This restricted response is not surprising, given that these deposits of Aquitard 1 (ATB1) are characterized by a geometric mean hydraulic conductivity of 3.4×10^{-8} m/s (Table 1; Appendix F). The low infiltration potential of this unit is further supported by the on-Site Guelph Permeameter testing completed by Stantec (Section 4.2.4), where testing of the silt to clay soils yielded non-measurable results. Additionally, these results are in general agreement with regional GRCA (2021) mapping, which indicates annual groundwater recharge rates across the Site where Aquitard 1 (ATB1) occurs at ground surface is less than 50 mm/year to 100 mm/year (i.e., low groundwater recharge potential) (Figure C-2, Appendix C). Overall, the difference between the minimum and maximum groundwater elevations observed within the monitoring wells screened in Aquitard 1 (ATB1) ranged from 0.4 m (BH/MW01-20) to 1.7 m (BH/MW03-20).

4.2.2 Groundwater Flow

Figure 13 presents groundwater elevation contours and the inferred direction of horizontal flow through the groundwater system beneath the Site using water level measurements collected from the on-site monitoring wells in April 2021. In general, groundwater contours generally mimic the existing topography of the Site, with an interpreted localized groundwater divide running from southwest to northeast in line with the surface water flow divide separating Catchments 100, 101 and 102 from Catchments 103 and 104 (Figure 13). From this divide, a portion of the groundwater flows in a northern direction to the topographically low-lying area located in the central portions of the Site and follows this depressed area to the northern Site limits and onward to the Phillipsburg Southeast Wetland Complex, with some flow also likely being directed to Wetland 8. Groundwater is also inferred to flow in an eastern direction from beneath Wetlands 3 and 13 (via Catchment 100) and to the west from the elevated lands in Catchment 101 to this topographic low-lying area. To the south of the divide, groundwater is inferred to flow in a southern direction towards the existing built-out phase of the Activa Baden Subdivision.

Horizontal hydraulic conductivity estimates calculated from hydraulic response testing completed at the on-Site monitoring wells screened in Aquitard 1 (ATB1; silt, clay, and/or clay to clayey silt till) ranged from 5.1×10^{-7} m/s to 8.0×10^{-10} m/s, with values for those wells partially to fully screened in Aquifer 1 (AFB1; sandy silt, silty sand, and sand) ranging from 9.3×10^{-5} m/s to 1.7×10^{-5} m/s (Table 1; Appendix F). These calculated values are consistent with the literature values of hydraulic conductivity provided for these deposits (Fetter, 1994). Overall, the geometric mean horizontal hydraulic conductivity calculated for the deposits of Aquifer 1 (AFB1) and Aquitard 1 (ATB1) beneath the Site are 3.4×10^{-5} m/s and 3.4×10^{-8} m/s, respectively (Table 1; Appendix F).



The velocity at which groundwater horizontally flows through the subsurface is calculated through the application of Darcy's law, where:

$$v = \frac{K \nabla}{\theta}$$

where: v = velocity (m/s)
 K = hydraulic conductivity (m/s)
 ∇ = hydraulic gradient (m/m)
 θ = effective porosity (unitless)

As discussed in Section 4.1, the bulk of the Site is covered by the deposits of Aquitard 1 (ATB1; silt, clay, and/or clay to clayey silt till) that vertically extend to a depth of up to 9.8 m BGS, with the groundwater table being positioned within this unit. Assuming a soil porosity of 0.2 for glacial till (Fetter, 1994), a calculated average horizontal hydraulic gradient of 0.017 m/m, and geometric mean hydraulic conductivity of 3.4×10^{-8} m/s (Table 1), the estimated velocity of groundwater flowing through Aquitard 1 (ATB1) to the north and south of the divide is calculated to be approximately 0.09 m/year (i.e., one meter every 10.8 years). In comparison, for infiltrating precipitation occurring in the northwestern portion of the Site where the sand-based deposits of Aquifer 1 (AFB1) are exposed at ground surface, once reaching the water table, this groundwater recharge will move through Aquifer 1 at an estimated velocity of approximately 52 m/year (i.e., one meter every seven days) (assuming a soil porosity of 0.35, calculated average horizontal hydraulic gradient of 0.021 m/m, and geometric mean hydraulic conductivity of 3.4×10^{-5} m/s).

4.2.3 Groundwater-Surface Water Interaction

Figure 9 presents the results of continuous and manual groundwater and surface water monitoring completed from July 2020 to July 2024 at the multi-level drive-point piezometers installed in Wetland 3 (DP1-20), Wetland 8 (DP3-20), and Wetland 13 (DP2-20).

As shown in the hydrograph for DP1-20(S/D), groundwater levels beneath Wetland 3 fluctuated from 0.4 m above ground surface (AGS) to 1.3 m BGS over the monitoring period, with the groundwater table largely occurring above the wetland substrate over the fall to spring months and periodically during the summer (Figure 9, Table 3). Vertical hydraulic gradients recorded at DP1-20(S/D) were also mostly upward. The combination of the groundwater table often occurring above ground surface together with the mostly upward vertical hydraulic gradients present beneath the wetland suggest that Wetland 3 is a groundwater discharge feature, although based on interpreted groundwater flow mapping (Figure 13) the source of these groundwater inputs appears to originate from the lands to the west of the Site.

For Wetland 13, strong downward vertical hydraulic gradients have been consistently recorded at DP2-20(S/D) (-0.71 to -1.00), suggesting that the wetland is a groundwater recharge feature. This interpretation is further supported by data collected from the adjacent BH/MW04-20(S/D) where persistent downward vertical hydraulic gradients (-0.14 to -0.38; Figure 7) occur near the periphery of Wetland 13.



At DP3-20(S/D), groundwater levels fluctuated between 0.4 and 1.1 m BGS over the monitoring period, with calculated vertical hydraulic gradients ranging from -0.38 (downward) to 0.04 (upward) (Figure 9, Table 3). Although weak upward vertical hydraulic gradients are observed to occur beneath Wetland 8 periodically in the fall (i.e., September and October) and during the spring (i.e., April and May), vertical hydraulic gradients have remained mostly downward (i.e., average gradient of -0.08), suggesting that Wetland 8 is a predominantly groundwater recharge feature. This is also supported by regional GRCA (2021) mapping, which shows Wetland 8 to be in an area characterized by downward vertical hydraulic gradients (Figure C-1, Appendix C) and groundwater recharge conditions (Figure C-2, Appendix C).

4.2.4 Infiltration Potential

Estimated infiltration rates for the overburden deposits are provided in Table 5. Infiltration rates were calculated based on an established relationship between vertical hydraulic conductivity and infiltration rate presented in CVC-TRCA (2010), with vertical hydraulic conductivities being estimated based on a combination of results obtained from Guelph Permeameter testing of surficial soils, and in-situ hydraulic response testing completed at selected monitoring wells (Section 3.5).

The tested vertical hydraulic conductivity for the surficial silty sand deposits of Aquifer 1 (AFB1) was 4.7×10^{-6} m/s, equating to an infiltration rate of 70 mm/hour (Table 5). Fill material found on-Site, consisting of a matrix of silt, some fine sand, and trace gravel, has a similar vertical hydraulic conductivity of 2.3×10^{-6} m/s, equating to an infiltration rate of 58 mm/hour. For the native surficial deposits of silt, clay, and/or clay to clayey silt till (Aquitard 1, ATB1), testing resulted in the absence of a measurable infiltration response, indicating that the infiltration potential of these on-Site soils is notably low. This is not surprising given that for those areas of the Site where the deposits of Aquitard 1 occur at ground surface, annual recharge rates are mapped by the GRCA (2021) as ranging from less than 50 to 100 mm/year (Figure C-1, Appendix C).

Vertical hydraulic conductivities for overburden deposits screened at depths between 0.6 m to 9.1 m beneath the Site and tested via in-situ hydraulic response testing completed at the onsite monitoring wells is assumed to be one order of magnitude lower than in-situ measured horizontal hydraulic conductivities at these locations (Todd, 1980; Freeze and Cherry, 1979). For the deposits of Aquitard 1 (ATB1), vertical hydraulic conductivities are estimated to range from 5.1×10^{-8} m/s to 8.0×10^{-11} m/s, equating to infiltration rates ranging from 3 mm/hour to 21 mm/hour (Table 5). For the silty sand to sandy silt deposits of Aquifer 1 (AFB1), vertical hydraulic conductivities ranged from 1.7×10^{-6} m/s to 2.4×10^{-6} m/s, equating to infiltration rates ranging from 53 mm/hour to 84 mm/hour (Table 5).

4.2.5 Groundwater Quality

On July 14, 2020, Stantec collected groundwater samples from selected monitoring wells (i.e., BH/MW01-20 to BH/MW03-20, BH/MW05-20, BH/MW08-20, and BH/MW12-20) for quality analysis, with these results being compared against the *Ministry of the Environment, Conservation and Parks (MECP) (2011) Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act - Site Condition Standards (SCS) (Full Depth Background – All Types of Property Uses)* (Table 4).



The groundwater samples had no concentrations that exceeded the Table 1 SCS for general chemical parameters and volatile organic compounds. Most petroleum hydrocarbons (PHC) did not exceed their corresponding Table 1 SCS concentration except for fraction F3 (i.e., PHC F3), which was slightly exceeded in the groundwater sample collected from BH/MW03-20 (510 µg/L versus 500 µg/L). Similarly, the bulk of dissolved metals did not exceed their corresponding Table 1 SCS concentration, except for copper (0.0078 mg/L versus 0.0050 mg/L) and lead (0.0042 mg/L versus 0.0019 mg/L) at BH/MW01-20.



5 Water Balance

5.1 Methodology

Within the hydrologic cycle, the flow of water into and out of system can be described through a simplified water balance equation as follows:

$$P = ET + S + R + I \quad \text{Equation 1}$$

Where:

P	= precipitation
ET	= evapotranspiration
S	= change in groundwater storage
R	= runoff
I	= infiltration (groundwater recharge)

Equation 1 may be further simplified by ignoring the change in groundwater storage (S), which trends over time to zero. The various components of the hydrologic cycle may be estimated through calculations or based on measurements made in the field. Precipitation (P) is typically a measured value. Evapotranspiration (ET) is calculated based on measured air temperatures. Infiltration (I) and Runoff (R) are calculated based on P and ET, where the difference between P and ET is the water surplus (WS) available for Infiltration (I) and Recharge (R) as follows:

$$WS = P - ET \quad \text{Equation 2}$$

Where WS is used to calculate I after applying an infiltration factor (IF),

$$I = WS \times IF \quad \text{Equation 3}$$

And R is estimated by subtracting I from WS,

$$R = WS - I \quad \text{Equation 4}$$

For this assessment, ET was calculated using the soil moisture balance model by Thornthwaite and Mather (1955). In the Thornthwaite and Mather model, monthly potential evapotranspiration (PET) is calculated based on the measured average monthly daily temperature (T_a) and a heat index (H_i) value that assumes 12 hours of daylight in a day and 30 days in a month, as follows:

$$PET = 16 \times \left(\frac{10T_a}{H_i} \right)^\alpha \quad \text{Equation 5}$$



Where T_a is taken as 0 degrees Celsius for months with negative temperatures, and H_i , the heat index is estimated as,

$$H_i = \sum_{i=1}^{12} \left(\frac{10T_a}{5} \right)^{1.514} \quad \text{Equation 6}$$

For α

$$\alpha = 0.49 + (0.0179 \times H_i) - (0.0000771 \times H_i^2) + (0.000000675 \times H_i^3) \quad \text{Equation 7}$$

PET values are then multiplied by an adjustment factor, after Thornthwaite and Mather (1957), which represents the average number of daylight hours per month at the latitude of the subject property to give the Adjusted Potential Evapotranspiration (PET_{adj}).

Actual Evapotranspiration (AET) is derived as,

$$AET = PET_{adj} - \Delta S \quad \text{Equation 8}$$

Where ΔS is the change in storage for the month, calculated as

$$\Delta S = S_{mc} \times e^{\left(\frac{APWL}{S_{mc}} \right)} \quad \text{Equation 9}$$

Where:

S_{mc} = soil moisture capacity

$APWL$ = accumulated potential water loss, calculated for $\Delta P < 0$ as $APWL = -\sum_{i=0}^{12} PET_i$, and for $\Delta P > 0$ by rearranging equation 8; with ΔP = net precipitation = $P - PET_{adj}$

WS is derived by subtracting AET from the monthly precipitation,

$$WS = P - AET \quad \text{Equation 10}$$

And the infiltration and runoff calculated per Equations 3 and 4 above.

Details pertaining to the water balance analysis completed for the Site are provided in the sections below.

5.2 Pre-Development

The pre-development water balance for the Site was split into two separate analyses to reflect the surface water divide that characterizes the property. Catchments 100, 101 and 102 are analyzed as one land unit given that surface water and groundwater within these catchments are interpreted to flow in a northern direction towards the on-Site wetlands (i.e., Wetlands 3, 8, and 13) and the Phillipsburg Southeast Wetland Complex located immediately beyond the northern limits of the property (Table G-1, Appendix G; Figure 14). Similarly, Catchments 103 and 104 are analyzed as a separate land unit as surface water and



groundwater are interpreted to flow in a southern direction within these catchments towards the existing built-out phase of the Activa Baden Subdivision (Table G-2, Appendix G; Figure 14).

The Site was broken down into a series of sub-areas based on topographic, soil type, and land cover characteristics. Figure 14 shows the distribution of the sub-areas used in the pre-development water balance analysis. The overall infiltration factor (IF) for a sub-area represents the sum of infiltration factors assigned to each of the sub-area characteristics (i.e., topography, soil type, land use) based on published values presented by the MECP (2003). As per Equation 3 (Section 5.1), the IF is then multiplied against the water surplus (WS) for a given sub-area to provide a calculated value of infiltration (INF). The sum of all sub-area INF associated with each catchment then represents the overall pre-development infiltration value for that area.

Topographic conditions across the Site are deemed to be moderately rolling based on calculated slopes ranging from two to five percent, with the two main soil types either being sands associated with Aquifer 1 (AFB1) or clays associated with Aquitard 1 (ATB1). Land cover throughout the Site, based on the Ecological Land Classification (ELC) mapping presented in the WSP *Scoped Environmental Impact Study* (EIS), consists of pasture/shrub lands, mature forest, and shallow rooted crops. Based on these parameters, infiltration factors ranged from 0.25 to 0.95 in the sub-areas (where a value of 1.00 indicates that the full WS volume infiltrates). Stantec notes that the IF for soils was adjusted to values outside the typical range of factor values published in MECP (2003) to allow for calculated infiltration rates in each sub-area to be in line with annual groundwater recharge rates assigned to the Site by the GRCA (Figure C-2, Appendix C).

The Roseville climate station provided long-term monthly average (1981-2010) air temperature and precipitation data for use in the water balance analysis. Located approximately 16 km to the southeast of the Site, the assumption is that the monthly average precipitation and air temperatures recorded at the station is reflective of the precipitation and air temperature fluctuation trends that have historically occurred at the Site.

Based on the previously mentioned water balance components, the annual volume of infiltration occurring within combined Catchments 100, 101 and 102 (Figure 14) under the pre-development condition is calculated to be 23,378 m³, equating to a rate of 117 mm/year (Table G-1, Appendix G). For Catchments 103 and 104 (Figure 14), the annual volume of infiltration occurring within these combined catchments is estimated at 14,898 m³ (101 mm/year) (Table G-2, Appendix G). Overall, the **total annual volume of infiltration** occurring across all the previously mentioned catchments is **38,276 m³** (i.e., 23,378 m³ + 14,898 m³).

The average annual volume of surface water runoff occurring under existing conditions within Catchments 100, 101 and 102, which is directed northward towards the wetlands, is 48,473 m³ (242 mm/year) (Table G-1, Appendix G). For Catchments 103 and 104 (Figure 14) where runoff flows towards the adjacent Activa Baden Subdivision to the south, the annual volume of surface water runoff occurring within these combined catchments is estimated at 39,782 m³ (270 mm/year) (Table G-2, Appendix G). Overall, the **total annual volume of runoff** flowing off all previously mentioned catchments is **88,255 m³** (i.e., 48,473 m³ + 39,782 m³).



5.3 Post-Development

The projected post-development catchments for the Site are presented in Figure 15 and new sub-areas were derived accordingly based on topographic, soil type and land cover characteristics. For the analysis, the moderately rolling topography and distribution of surficial soils found under the pre-development condition is assumed to remain relatively unchanged under the post-development condition, with the land cover predominantly becoming more representative of developed area having varying degrees of impervious surfaces (e.g., rooftops, concrete/asphalt roadways, and walkways) and urban vegetation cover (e.g., urban lawns). Stantec notes that the assignment of new sub-areas occurred solely within the TUA Lands, given that the Non-TUA Lands are not proposed for development.

As shown in Figure 15, under the post-development condition a larger proportion of the Site will direct runoff to the north and into the proposed SWMF (i.e., from Catchments 200 to 203, 205 and 206), with this water then being slowly discharged to Wetland 8. A small portion of the Site (i.e., Catchments 204 and 207) will direct runoff to the south into the Activa Baden Subdivision. For the analysis, Stantec assumes that post-development grading activities will likely alter the inferred pre-development groundwater flow divide that traverses the Site, making it challenging to predict which direction infiltration reaching the groundwater table will flow under the post-development condition. To simplify the infiltration component of the pre-to post-development water balance analysis, Stantec assumes that all post-development groundwater recharge (infiltration that reaches the water table) will flow northward towards Wetland 8 and the greater Phillipsburg Southeast Wetland Complex (noting that Wetlands 3 and 13 are interpreted to not receive groundwater inputs from the Site). Stantec notes that Wetland 8 is identified largely as a groundwater recharge feature and, as such, balancing the pre- to post-development runoff inputs to this wetland will be of greater importance with regards to potentially impacting the form and function of this feature compared to the balancing of groundwater recharge across the Site.

5.3.1 Runoff

Directed North Towards Wetlands

The post-development catchments that will direct runoff northward towards Wetland 8 and the greater Phillipsburg Southeast Wetland Complex from the TUA Lands within the Site include Catchments 200, 201, and 202, with Catchments 203, 205, and 206 (Non-TUA Lands) also directing runoff to these features (Figure 15). Runoff from the TUA Lands is calculated to be 101,368 m³ under the post-development condition (Table G-3A), with runoff from the Non-TUA Lands being 35,174 m³ (Table G-3B). Combined runoff to the wetlands from the TUA and Non-TUA Lands under the post-development condition is predicted to be 136,542 m³, resulting in a **runoff surplus of 88,069 m³** discharging to the wetlands when compared to the pre-development condition (i.e., 136,542 m³ - 48,473 m³ = 88,069 m³) (Table 6).



Directed South Towards Activa Baden Subdivision

The post-development catchments that will direct runoff southward towards the existing Activa Baden Subdivision from the TUA Lands within the Site include Catchment 204, with Catchment 207 (Non-TUA Lands) also directing runoff to the subdivision (Figure 15). Runoff from the TUA Lands is calculated to be 11,107 m³ under the post-development condition (Table G-4A), with runoff from the Non-TUA Lands being 13,074 m³ (Table G-4B). Combined runoff to the Activa Baden Subdivision from the TUA and Non-TUA Lands under the post-development condition is predicted to be 24,182 m³, resulting in a **runoff loss (deficit) of 15,600 m³** flowing into the existing subdivision from the Site when compared to the pre-development condition (i.e., 39,782 m³ – 24,182 m³ = 15,600 m³) (Table 7). Stantec notes that runoff draining from the Site to the Activa Baden Subdivision will be conveyed to an existing SWMF through this subdivision's storm system.

5.3.2 Infiltration

To simplify the infiltration component of the pre-to post-development water balance analysis, Stantec is assuming that all post-development groundwater recharge (infiltration that reaches the water table) will flow northward towards Wetland 8 and the greater Phillipsburg Southeast Wetland Complex (assuming that post-development grading activities of the TUA Lands and eventually the Non-TUA Lands will likely alter the inferred pre-development groundwater flow divide that traverses the Site). Within the TUA Lands, infiltration occurring within Catchments 200, 201 and 202 (i.e., 9,612 m³; Table G-3A, Appendix G) and Catchment 204 (i.e., 629 m³; Table G-4A, Appendix G) under the post-development condition is calculated to be 10,241 m³. Within the Non-TUA Lands, infiltration occurring within Catchments 203, 205, and 206 (i.e., 13,256 m³; Table G-3B, Appendix G) and Catchment 207 (i.e., 4,358 m³; Table G-4B, Appendix G) is calculated to be 17,614 m³. Overall, the total annual volume of infiltration occurring across all previously mentioned catchments post-development is **27,855 m³** (i.e., 9,612 m³ + 629 m³ + 13,256 m³ + 4,358 m³), equating to an **infiltration deficit of 10,420 m³** when compared to the pre-development condition (i.e., 38,276 m³ - 27,855 m³ = 10,421 m³).



6 Effects Assessment

6.1 Post-Development Infiltration and Runoff

Proposed development for the Site will involve the construction of residential homes and townhouse blocks, residential roadways, and associated site servicing including sanitary sewers, storm sewers, and piping connections to the municipal water supply. With this development will come the introduction of impervious surfaces (e.g., rooftops, concrete/asphalt roadways, parking lots and walkways) and, subsequently, a corresponding reduction in the volume of water infiltrating to the subsurface. The potential impacts associated with the introduction of impervious surfaces on the recharge function of the Site are discussed below.

As discussed in Section 5.0, the Site is predicted to experience an infiltration deficit of 10,420 m³ from the pre- to post-development condition. Although infiltration deficits are projected, the potential effects of this infiltration loss from across the Site on Wetlands 3, 8 and 13 due to the proposed development is expected to be minimal for the following reasons:

- Groundwater inputs to Wetland 3, an interpreted groundwater discharge feature, appear to originate offsite to the west of the Site (Figure 13).
- Strong downward vertical hydraulic gradients are consistently present beneath Wetland 13, indicating that this wetland is a groundwater recharge feature.
- Vertical hydraulic gradients beneath Wetland 8 are predominantly downward, indicating that this wetland is essentially a groundwater recharge feature, with this interpreted function being supported by regional mapping provided by the GRCA (Figure C1, Appendix C). As shown in Figure C1 (Appendix C), the offsite Phillipsburg Southeast Wetland Complex located immediately to the north of the Site is also shown to be characterized by downward vertical hydraulic gradients (i.e., groundwater recharge condition).
- Even if the previously mentioned wetlands did receive groundwater inputs from the Site, the volume of these contributions are expected to be minimal, given that most of the property is covered by deposits of low permeability deposits of silt, clay, and/or clay to clayey silt till associated with Aquitard 1 (ATB1) where the horizontal movement of groundwater through this unit is calculated to be in the range of 0.09 m/year (i.e., one meter every 10.8 years). Any groundwater recharge occurring on-Site that would be of some consequence to these wetlands would be from the surficial sand deposits of Aquifer 1 (AFB1), which will remain largely untouched under the post-development condition.

The greater potential for impact to the form and function of Wetland 8 and the greater Phillipsburg Southeast Wetland Complex is expected to occur from the runoff volumes that will be discharged to these features under the post-development condition. As discussed in Section 5.0, the annual volume of runoff that will be discharged to the wetlands from the pre- to post-development condition is predicted to increase by 88,069 m³ (i.e., from 48,473 m³ to 136,542 m³) (Table 6). As such, the utilization of low



impact development (LID) measures, a stormwater management strategy that provides opportunities to offset potential infiltration losses associated with the increase in impervious surfaces while also reducing runoff surpluses, is recommended for the Site.

Infiltration augmentation options (as described in CVC-TRCA Low Impact Development Stormwater Management Planning and Design Guide, 2010) that could potentially be available for use across the Site to assist in maximizing infiltration under the post-development condition include:

- Roof downspout disconnection
- Extra depth topsoil and/or amended soils
- Bioretention facilities
- Enhanced grass swales
- Permeable pavement
- Perforated pipe systems (i.e., linear infiltration trenches or linear soakaways)
- Surface and subsurface infiltration basins and chambers

A key constraint in using several of the previously mentioned post-development infiltration augmentation measures is the positioning of the seasonally high groundwater table. As per CVC-TRCA (2010), the recommended vertical separation between the base of a given infiltration augmentation option and the high groundwater table is at least one meter; however, distances of less than one meter of separation in soils having higher infiltration potential may still be effective (i.e., higher permeability sand deposits of Aquifer 1). At the Site, the opportunities to utilize LID measures in such sand-based deposits is limited, given that these deposits are confined to a relatively small area near the northern limits of the property (Figure 4) and groundwater levels in these deposits are shown to consistently fluctuate between 0.3 m to 1.4 m of ground surface (i.e., BH/MW06-20, Figure 8). Although the clay-based deposits of Aquitard 1 (ATB1) that cover most of the Site present greater opportunities for the potential utilization of LID measures, given that the groundwater table tends to be positioned at greater depths in these areas (Figures 7 and 8), the low permeability of these deposits (i.e., calculated infiltration rates ranging from 3 mm/hour to 21 mm/hour) are likely to limit the effectiveness of such measures.

As discussed in the Stantec (2024) *Functional Servicing and Stormwater Management Report*, the projected post-development annual runoff surplus to the wetlands and overall infiltration deficit for the Site will be mitigated via a proposed SWMF designed with an infiltration cell. This facility will be constructed to the east of Wetland 8 in the northwest portion of the Site (Figure 15). This proposed location for the SWMF facility is ideal for the following key reasons:

- This area of the Site is underlain by ice-contact stratified deposits of sandy silt, silty sand, and sand, associated with Aquifer 1 (AFB1), which are characterized by high infiltration potential compared to most of the Site where low permeability, glaciolacustrine-derived deposits of silt and clay (i.e., Port Stanley Till) associated with Aquitard 1 (ATB1) is present.
- The location occurs in an existing topographic low point of the Site where runoff already flows and discharges to the wetlands under the pre-development condition.



Details pertaining to the design and operation of the SWMF infiltration are presented in Section 6.7 of the Stantec (2024) *Functional Servicing and Stormwater Management Report*, including the measures that will be employed to achieve the required one meter of separation of these facilities above the high groundwater table.

As discussed in Section 5.3.2, in the absence of post-development infiltration (groundwater recharge) augmentation measures, the proposed development of the TUA Lands will result in an annual infiltration deficit of 10,420 m³ across the Site. Based on the proposed post-development infiltration strategy for the Site, which is to include directing runoff from post-development impervious and pervious surfaces to the SWMF infiltration cell, the annual volume of runoff that will be returned to the subsurface across the Site will total 117,239 m³ (i.e., 111,429 m³ (Table 6) + 5,810 m³ (Table 7)). Consequently, based on the pre-development infiltration estimate of 38,276 m³ (Section 5.2), the implementation of the previously mentioned infiltration augmentation measures is projected to result in an **annual infiltration surplus of 78,963 m³** occurring across the Site under the post-development condition (i.e., 117,239 m³ - 38,276 m³ = 78,963 m³).

In returning stormwater to the subsurface via the previously mentioned infiltration augmentation strategy, this proposed management approach will concurrently reduce the volume of runoff being discharged to the northern wetlands from the Site under the post-development condition. As presented in Table 6, an annual runoff volume of 47,981 m³ is predicted to discharge to the northern wetlands from the Site under the post-development condition, equating to an **annual runoff deficit of 492 m³** when compared to the pre-development condition (i.e., 47,981 m³ - 48,473 m³ = 492 m³). Based on the proposed winter and summer infiltration strategy explained in the Stantec (2024) *Functional Servicing and Stormwater Management Report*, this annual runoff difference will be managed so that the post-development monthly discharge of runoff to the wetlands will closely match the pre-development condition (Figure 16).

6.2 Source Water Protection

A drinking-water threat is an activity or condition that adversely affects or has the potential to adversely affect the quality or quantity of any water that is or may be used as a source of drinking water. The following activities are prescribed by the province of Ontario under O. Reg. 287/07 to be drinking water threats (i.e., Significant Drinking Water Threat Policy Categories):

1. The establishment, operation, or maintenance of a waste disposal site within the meaning of Part V of the *Environmental Protection Act*.
 - a. Untreated sewage
 - b. Waste disposal
 - c. Mine tailings
2. The establishment, operation, or maintenance of a system that collects, stores, transmits, treats, or disposes of sewage.
 - a. Stormwater management
 - b. Wastewater treatment plants/sewer systems
 - c. On-site sewage systems



- d. Industrial effluent
- 3. The application of agricultural source material to land.
- 4. The storage of agricultural source material.
- 5. The management of agricultural source material.
- 6. The application of non-agricultural source material to land.
- 7. The handling and storage of non-agricultural source material.
- 8. The application of commercial fertilizer to land.
- 9. The handling and storage of commercial fertilizer.
- 10. The application of pesticide to land.
- 11. The handling and storage of pesticide.
- 12. The application of road salt.
- 13. The handling and storage of road salt.
- 14. The storage of snow.
- 15. The handling and storage of fuel.
- 16. The handling and storage of a dense non-aqueous phase liquid (DNAPL).
- 17. The handling and storage of an organic solvent.
- 18. The management of runoff that contains chemicals used in the de-icing of aircraft.
- 19. An activity that takes water from an aquifer or a surface water body without returning the water taken to the same aquifer or surface water body.
- 20. An activity that reduces the recharge of an aquifer.
- 21. The use of land as livestock grazing or pasturing land, an outdoor confinement area or a farm-animal yard. O. Reg. 385/08, s. 3.
- 22. The establishment and operation of a liquid hydrocarbon pipeline as per O. Reg. 385/08, s. 3.

As discussed in Section 2.3, no WHPA, WHPA-Q, or IPZ intercept the Site, nor is the Site designated as HVA (Figure 5). Consequently, no protection policies specified in the Source Protection Plan (SPP) (LESPC, 2021b) for these source water protection designations apply to the Site.



Policies in the SPP that address significant threat activities that pose a risk to the quantity of source water available for municipal well use (i.e., Significant Drinking Water Threat Policy 19 and 20) only apply to WHPA-Q. As mentioned previously, no WHPA-Q intercepts the Site. Although SGRA is identified as occurring in the Site where ice-contact stratified deposits of silty sand, sandy silt, and sand associated with Aquifer 1 (AFB1) are present at ground surface (Figure 4), there are no protection policies specified in the SPP that are applicable to SGRA.

6.3 Groundwater Dewatering

With the construction of below ground structures (e.g., basements, underground parking facilities) and servicing infrastructure (e.g., sewer and watermain, SWM pond facilities) comes the potential of intercepting the groundwater table and, consequently, the need for short-term construction dewatering and/or the installation of permanent drainage systems (in the absence of waterproofing). Where required, dewatering will result in the lowering of the groundwater table to the base of a given excavation and/or underground structure. The effects of local dewatering in general cannot be mitigated, since dewatering deliberately seeks to create an effect (i.e., lowering of groundwater levels). For dewatering occurring in low permeability deposits such as Aquitard 1, the dewatering zone of influence (ZOI) (i.e., horizontal extent of groundwater level declines / drawdown caused by dewatering activities at a point source) is expected to be low and isolated to a small distance around excavations and/or subsurface structures, given that these deposits across the Site are characterized by hydraulic conductivities ranging from 5.1×10^{-7} m/s to 8.0×10^{-10} m/s (Table 1, Appendix F). At these hydraulic conductivities, low volumes of groundwater are expected to discharge into temporary construction excavations and/or permanent drainage systems. In comparison, excavations occurring below the groundwater table within the higher permeability sand-based deposits of Aquifer 1 (i.e., shown to have hydraulic conductivities ranging from 1.7×10^{-5} m/s to 9.3×10^{-5} m/s at the Site; Table 1, Appendix F) will result in a greater dewatering ZOI and greater volumes of groundwater discharging into on-site construction excavations and/or permanent drainage systems.

6.3.1 Permitting

If excavations are anticipated to occur below the groundwater table and dewatering is required at volumes that exceed 50,000 L/day, registration of an MECP EASR or for a PTTW is needed for this dewatering to occur under O. Reg 64/16 and O. Reg 63/16A. A PTTW is required when groundwater volumes for construction dewatering are expected to exceed 400,000 L/day or when groundwater collected and discharged from a permanent drainage system exceeds 50,000 L/day. An EASR is required when construction dewatering volumes are projected to range from 50,000 L to 400,000 L/day.

Stantec notes that amendments made to EASR requirements by the MECP for construction dewatering include the following:

- 1) The ability to register multiple dewatering pits for a single project under the same EASR.
- 2) Allowing construction dewatering of up to 400,000 L/day for each dewatering pit as long as the dewatering zone of influence (ZOI) do not overlap.



- 3) Stormwater runoff into excavations does not count towards the 400,000 L/day water taking limit, however, registrants will at a minimum be required to keep a record of precipitation events, or if determined by a Qualified Person (QP), detailed monitoring/documentation.
- 4) Registrants will be required to notify the local municipalities and conservation authorities if the water taking is intended to continue for more than 365 days.

When dewatering volumes are projected to be greater than 50,000 L/day, the following mitigation measures are likely to be required for either an EASR or PTTW application:

- **Groundwater Discharge Management** – Establishment of an appropriate dewatering system that will dissipate the energy and reduce the sediment content of discharging water for the purpose of limiting potential erosion effects if groundwater is to be discharged to a receiving surface water feature. Common measures include the use of sediment control basins, erosion pads, geotextile filter bags, and the positioning of straw bale/filter cloth barriers downgradient of the discharge point. The quality of the groundwater discharge must also meet Provincial Water Quality Objectives (PWQO) (MOEE, 1994). If groundwater is to be discharged to the regional sewer system for disposal, the quality of this water must not exceed parameter concentrations as listed under Regional Municipality of Waterloo Sewer Use By-Law No. 1-90.
- **Private Well Monitoring** – The monitoring of private wells expected to be located within the dewatering ZOI (as estimated from the dewatering assessment) for drawdown interference, which could potentially affect the operation of private wells with regards to water quantities. The providing of affected well owners with temporary potable water supplies or reducing dewatering rates and/or duration would be required if notable interference effects are observed.

Dewatering assessments are recommended for completion during detailed design to specifically determine anticipated dewatering volumes and associated water taking permitting requirements.

6.4 Servicing Alignments and Groundwater Flow

In areas where Site servicing extends below the groundwater table, Stantec recommends that anti-seepage (cut-off) collars be installed to prevent the preferential movement of groundwater along the servicing alignments. The use of anti-seepage collars will likely be required given that most of the Site subsurface is characterized by deposits where groundwater movement is more restricted (e.g., silt to clay-based soils). An assessment for the need, total number, and exact placements of anti-seepage collars along the servicing alignments can be explored in more detail during the detailed design phase of the project.



6.5 Spill Containment and Response

The potential exists for spills during any construction activity, with the most probable type of spill occurring being attributable to the refuelling of major construction equipment that cannot readily leave the Site (e.g., earth movers). The potential impacts of a spill could be the contamination of soils, groundwater and/or surface water. By implementing proper protocols for the handling of fuels and lubricants during construction, the risk of a spill occurring will be greatly reduced. The procedures to be implemented to prevent onsite spills are as follows:

- All trucks or other road vehicles would be refueled and maintained offsite, where practicable.
- Refueling and lubrication of other construction equipment would not be allowed within 30 m of a drainage system or dewatering excavation.
- Regular inspections of hydraulic and fuel systems on machinery, with leaks being repaired immediately upon detection or the equipment being removed from Site.
- Spill kits containing absorbent materials will be kept on hand.
- Implement best management practices and develop an emergency spill response plan.

Given that anticipated construction activities at the Site are not expected to involve the storage or use of bulk chemicals or fuels, a potential spill that may occur would be localized and involve a small volume of material. If there were to be an accidental release of a deleterious substance, the low permeable soils that cover most of the Site will prevent the rapid infiltration and movement of these substances through the subsurface, allowing response personnel sufficient time to contain and clean-up such a release before it causes potential harm to the quality of the groundwater system. Overall, standard containment facilities and emergency response materials are to be maintained on-Site as required, with refuelling, equipment maintenance, and other potentially contaminating activities being confined to designated areas. As appropriate, spills are to be reported immediately to the MECP Spills Action Centre.



7 Conclusions

The following conclusions are provided based on the completed hydrogeological assessment:

1. Stratigraphic conditions beneath the Site consist of a 0.2 m to 1.2 m thick layer of topsoil and pockets of fill material (up to 1.6 m thick) that is mostly underlain by deposits of silt, clay, and clay to clayey silt till (i.e., Aquitard 1), which extend up to 9.8 m BGS beneath the Site. The thickness of Aquitard 1 (ATB1) thins near the northwestern portion of the Site, where the sand-based deposits of Aquifer 1 (AFB1) are exposed at ground surface. In general, the top of Aquifer 1 (AFB1) is inferred to occur at elevations ranging from 350 to 356 m AMSL throughout the subsurface of the Site. Layers/seams of silty sand and sandy silt are also found to be occasionally interspersed within Aquitard 1 (ATB1).
2. Groundwater elevations across the Site ranged from 6.4 m BGS (at BH/MW01-20) to 0.4 m above ground surface (AGS) (at DP1-20) over the monitoring period, equating to elevations ranging from 352.5 m to 359.6 m AMSL.
3. In general, groundwater contours generally mimic the existing pre-development topography of the Site, with an interpreted localized groundwater divide running from southwest-northeast through the south-central portion of the property. From this divide, groundwater flows in a northern direction to the topographically low-lying area located in the central portions of the Site and follows this depressed area to the northern Site limits and onward to the Phillipsburg Southeast Wetland Complex, with some flow also likely being directed towards Wetland 8. To the south of the divide, groundwater is inferred to flow in a southern direction towards the existing built-out phase of the Activa Baden Subdivision.
4. The horizontal movement of groundwater through Aquitard 1 is calculated to be in the range of 0.09 m/year (i.e., one meter every 10.8 years), due to the low hydraulic conductivity associated with these deposits (i.e., 10^{-7} to 10^{-10} m/s). In comparison, for infiltrating precipitation occurring in the northwestern portion of the Site where the sand-based deposits of Aquifer 1 (AFB1) are exposed at ground surface, once reaching the water table, this groundwater recharge will move through Aquifer 1 at an estimated velocity of approximately 52 m/year (i.e., one meter every seven days).
5. Regional mapping indicates that the Site is characterized as a groundwater recharge area, although the recharge potential for most of the property will be limited by the low permeability deposits associated with Aquitard 1 (ATB1) where infiltration rates ranging from 3 mm/hour to 21 mm/hour occur. For the silty sand to sandy silt deposits of Aquifer 1 (AFB1), vertical hydraulic conductivities are estimated to be in the range of 10^{-6} m/s, equating to infiltration rates ranging from 53 mm/hour to 84 mm/hour.
6. Groundwater sampled from the upper overburden had no concentrations that exceeded the Table 1 SCS for general chemical parameters and volatile organic compounds. Most petroleum hydrocarbons (PHC) did not exceed their corresponding Table 1 SCS concentration except for fraction F3 (i.e., PHC F3), which was slightly exceeded in the groundwater sample collected from BH/MW03-20 (510 µg/L versus 500 µg/L). Similarly, the bulk of dissolved metals did not exceed their corresponding Table 1 SCS concentration, except for copper (0.0078 mg/L versus 0.0050 mg/L) and lead (0.0042 mg/L versus 0.0019 mg/L) at BH/MW01-20.



7 Conclusions

December 19, 2024

7. In the absence of post-development infiltration (groundwater recharge) augmentation measures, the proposed development of the TUA Lands will result in an annual infiltration deficit of 10,241 m³ across the Site. Based on the proposed post-development infiltration strategy for the Site, which is to include directing runoff from post-development impervious and pervious surfaces to the SWMF infiltration cell, the annual volume of runoff that will be returned to the subsurface across the Site will total 117,239 m³. Consequently, based on the Site pre-development infiltration estimate of 38,276 m³, the implementation of the previously mentioned infiltration augmentation measures is projected to result in an annual infiltration surplus of 78,963 m³ occurring across the Site under the post-development condition.
8. In returning stormwater to the subsurface via the previously mentioned infiltration augmentation strategy, this proposed management approach will concurrently reduce the volume of runoff being discharged to the northern wetlands (i.e., Wetland 8 and the greater Phillipsburg Southeast Wetland Complex) from the Site under the post-development condition. An annual runoff volume of 47,981 m³ is predicted to discharge to the northern wetlands from the Site under the post-development condition, equating to an annual runoff deficit of 492 m³ when compared to the pre-development condition (48,473 m³). Based on the proposed winter and summer infiltration strategy explained in the Stantec (2024) *Functional Servicing and Stormwater Management Report*, this annual runoff difference will be managed so that the post-development monthly discharge of runoff to the wetlands will closely match the pre-development condition (Figure 16).
9. No WHPA, WHPA-Q, or IPZ intercept the Site, nor is the Site designated as HVA. Consequently, no protection policies specified in the Source Protection Plan (LESPC, 2021b) for these source water protection designations apply to the Site. Although SGRA is identified as occurring in the Site where ice-contact stratified deposits of silty sand, sandy silt, and sand associated with Aquifer 1 (AFB1) are present at ground surface, there are no protection policies specified in the SPP that are applicable to SGRA.
10. Construction dewatering will likely be required at the Site due to an elevated groundwater table; however, for dewatering occurring in low permeability deposits such as Aquitard 1 (ATB1), the dewatering zone of influence (ZOI) (i.e., horizontal extent of groundwater level declines / drawdown caused by dewatering activities at a point source) is expected to be low and isolated to a small distance around excavations and/or subsurface structures, given that these deposits across the Site are characterized by hydraulic conductivities ranging from 10⁻⁷ m/s to 10⁻¹⁰ m/s. However, excavations occurring below the groundwater table within the higher permeability sand-based deposits of Aquifer 1 (AFB1) are likely to result in greater dewatering volumes due to higher hydraulic conductivities (i.e., range of 10⁻⁵ m/s). Dewatering assessments are recommended for completion during detailed design to specifically determine anticipated dewatering volumes and associated water taking permitting requirements for the Site development.
11. In areas where Site servicing extends below the groundwater table, Stantec recommends that anti-seepage (cut-off) collars be installed to prevent the preferential movement of groundwater along the servicing alignments. The use of anti-seepage collars will likely be required given that most of the subsurface throughout the Site is characterized by deposits where groundwater movement is more restricted (e.g., silt to clay-based soils). An assessment for the need, total number, and exact placements of anti-seepage collars along the servicing alignments can be explored in more detail during the detailed design phase of the project.



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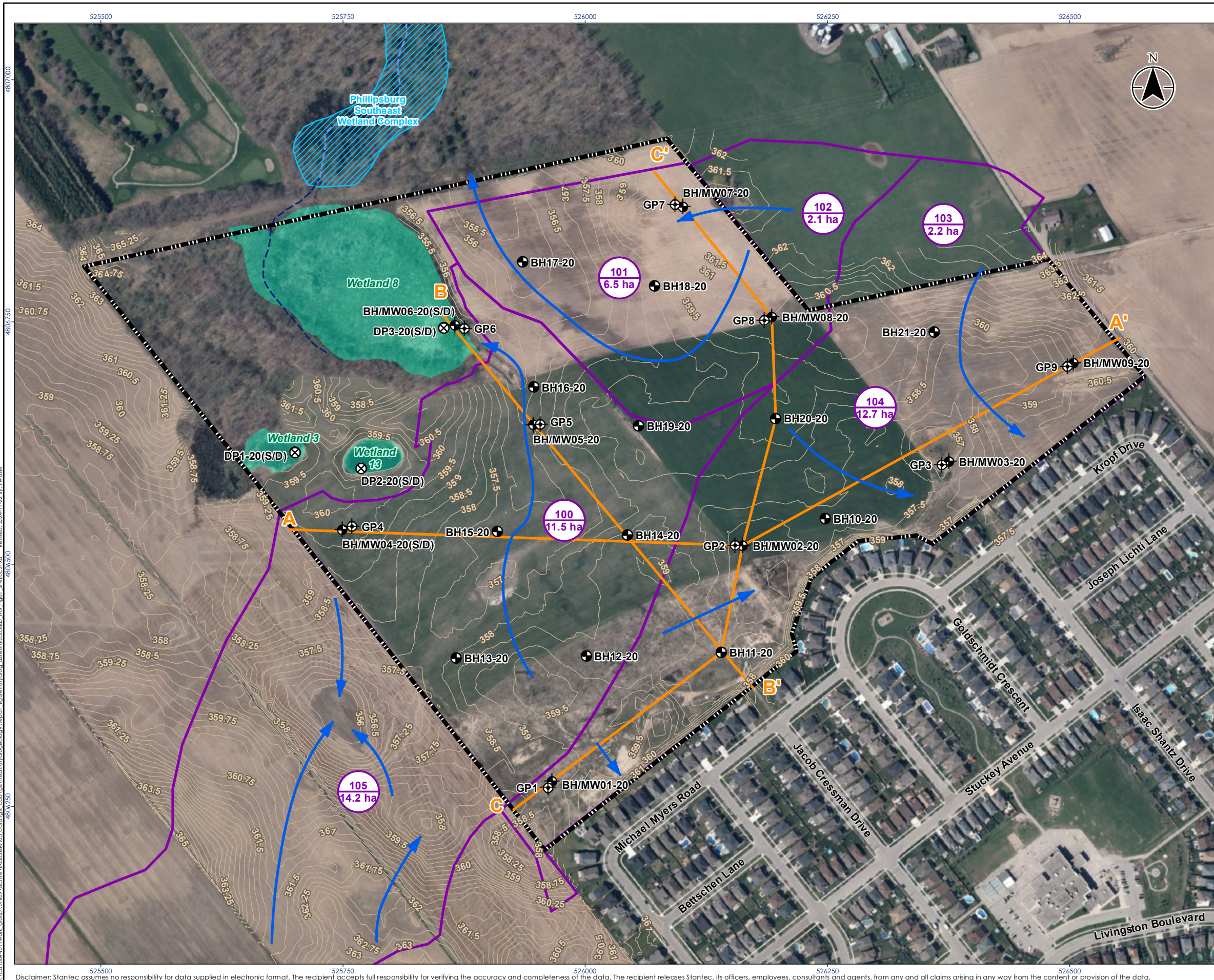
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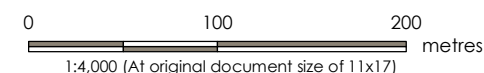


Appendix A Figures



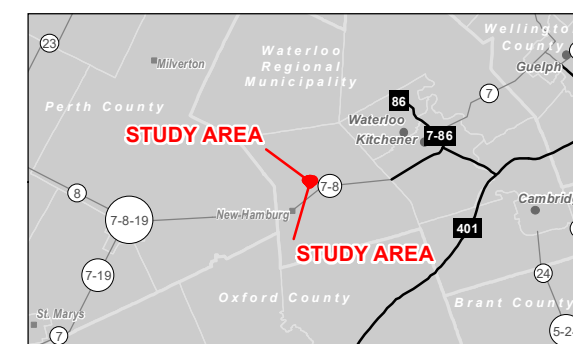
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-  Site Boundary
 Monitoring Well (Stantec, 2020)
 Borehole (Stantec, 2020)
 Drive-Point Piezometer (Stantec, 2020)
 Guelph Permeameter Testing (Stantec, 2020)
 Cross-Section Location
 Topographic Contour (mAMSL)
 Intermittent Watercourse (WSP) (Approximate)
 Watercourse - Intermittent (LIO)
 Overland Flow Direction
 Wetland Extent (WSP/GRCA, 2021)
 Wetland - Evaluated (Other)
 Stormwater Catchment (Existing Conditions)



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, 2020.
3. Orthoimagery © First Base Solutions, 2020. Imagery Date, 2018.



Project Location
Baden, ON

60305680 REVA
Prepared by CMC on 2024-11-22
Technical Review by GW on 2024-11-22

Client/Project
ACTIVA HOLDINGS INC.
ACTIVA BADEN NORTH SUBDIVISION
HYDROGEOLOGICAL ASSESSMENT

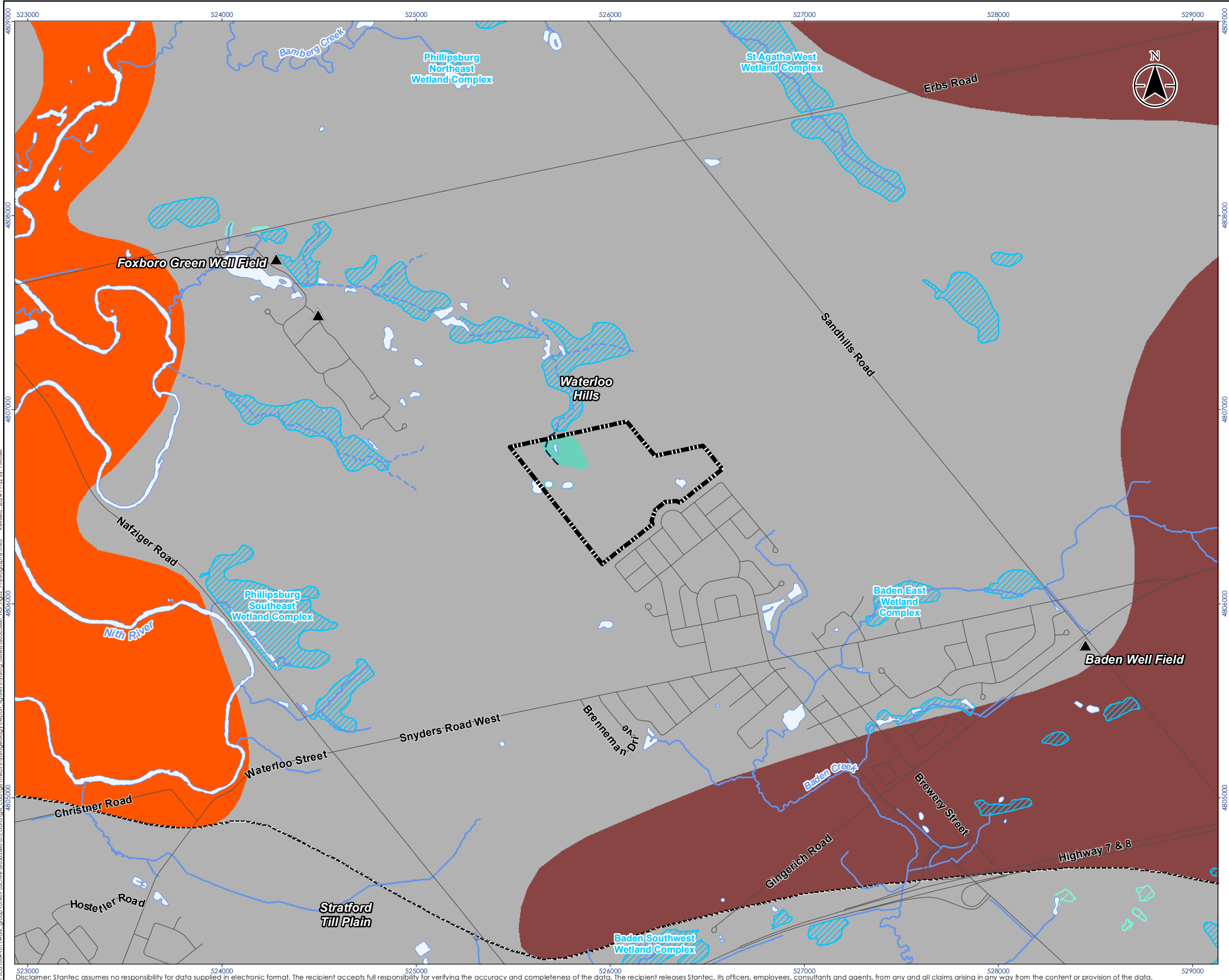
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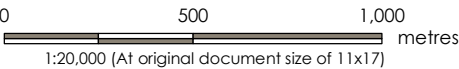
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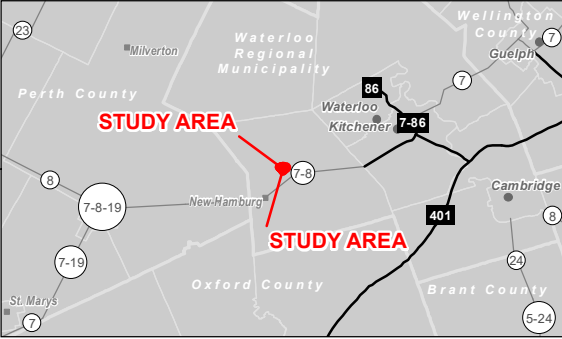
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- Legend
- Site Boundary
 - Municipal Production Well
 - Road
 - Intermittent Watercourse (WSP) (Approximate)
 - Watercourse - Permanent
 - Watercourse - Intermittent (LIO)
 - Waterbody
 - Wetland Extent (WSP/GRCA, 2021)
 - Wetland - Evaluated (Other)
 - Wetland - Not evaluated per Ontario Wetland Evaluation System
 - Physiographic Region Boundary
- Physiography
- 5: Till Plains (Undrumlinized)
 - 4: Kame Moraines
 - 3: Spillways



- Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
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 3. Chapman, L.J. and Putnam, D.F. 2007. Physiography of southern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 228.



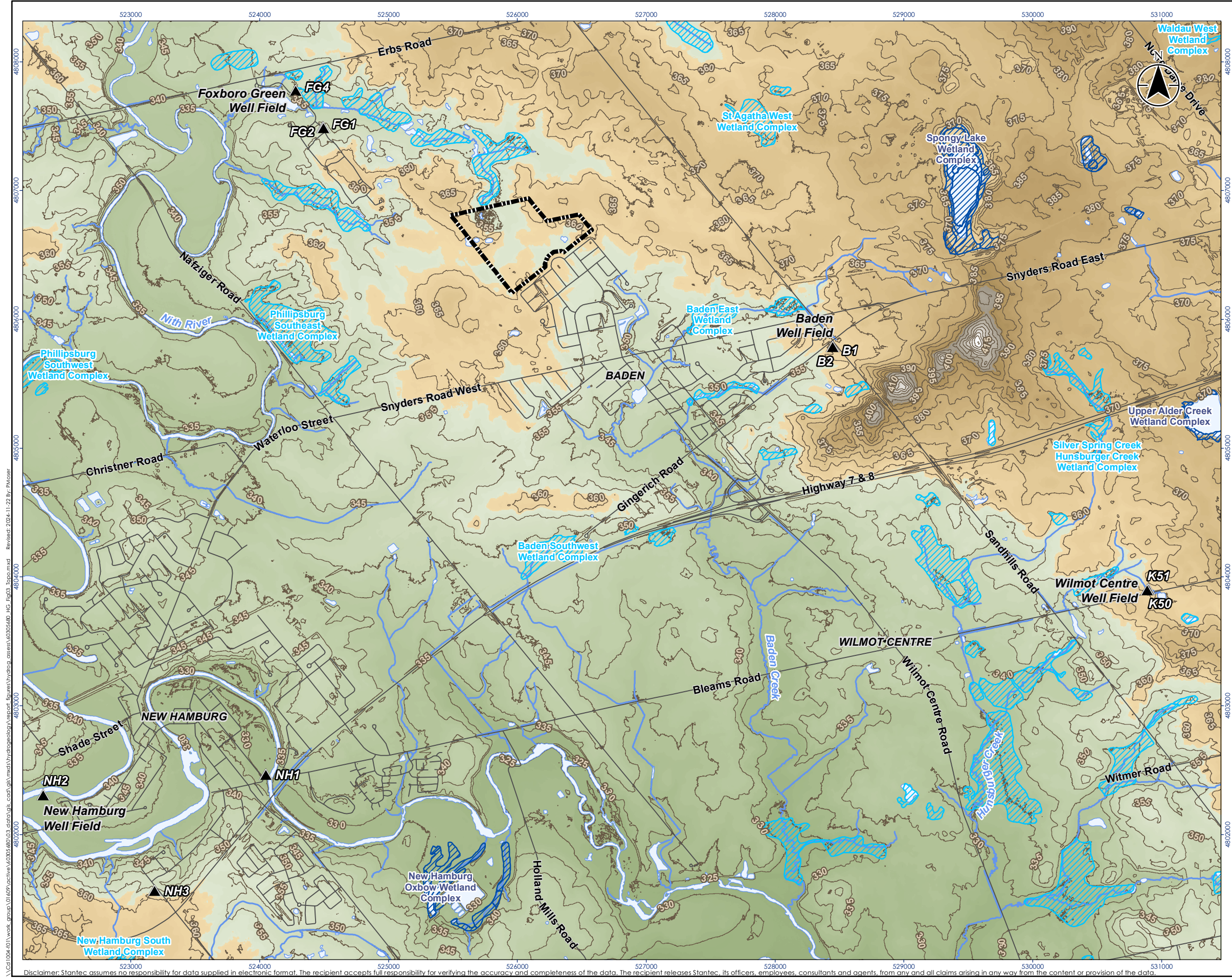
Project Location
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HYDROGEOLOGICAL ASSESSMENT

Figure No.
2

Title
Physiography



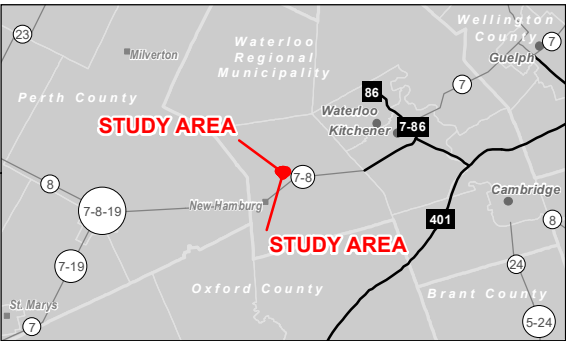
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- Site Boundary
- Municipal Production Well
- Road
- Topographic Contour (mAMS)
- Watercourse
- Waterbody
- Wetland - Evaluated (Provincial)
- Wetland - Evaluated (Other)

Elevation (mAMS)
High : 435.54
Low : 319.36

0 500 1,000 metres
1:30,000 (At original document size of 11x17)

- Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
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 3. Topography derived from the Southwestern Ontario Orthophotography Project (SWOOP) DEM, 2015 © Queen's Printer for Ontario, 2020.



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Figure No.

3

Title

Topography

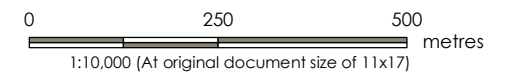
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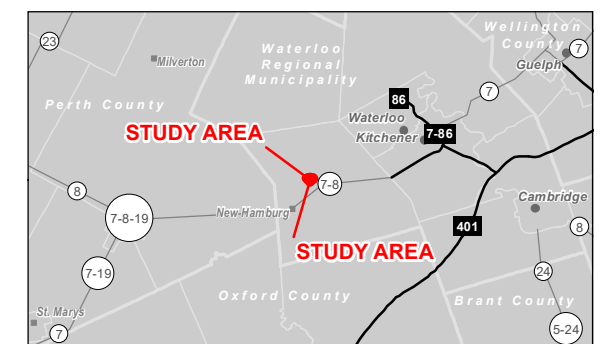
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- Site Boundary
- Monitoring Well (Stantec, 2020)
- Borehole (Stantec, 2020)
- MECP Water Well Record
- Cross-Section Location
- Road
- Intermittent Watercourse (WSP) (Approximate)
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- Wetland - Evaluated (Other)
- Surficial Geology**
 - 20: Organic deposits
 - 19: Modern alluvial deposits
 - 6: Ice-contact stratified deposits
 - 5d: Glaciolacustrine-derived silty to clayey till (Port Stanley 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, 2020.
3. Ontario Geological Survey 2010. Surficial geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128-REV ISBN 978-1-4435-2483-4



Project Location
Baden, ON

60305680 REVA
Prepared by PRM on 2024-11-22
Technical Review by GW on 2024-11-22

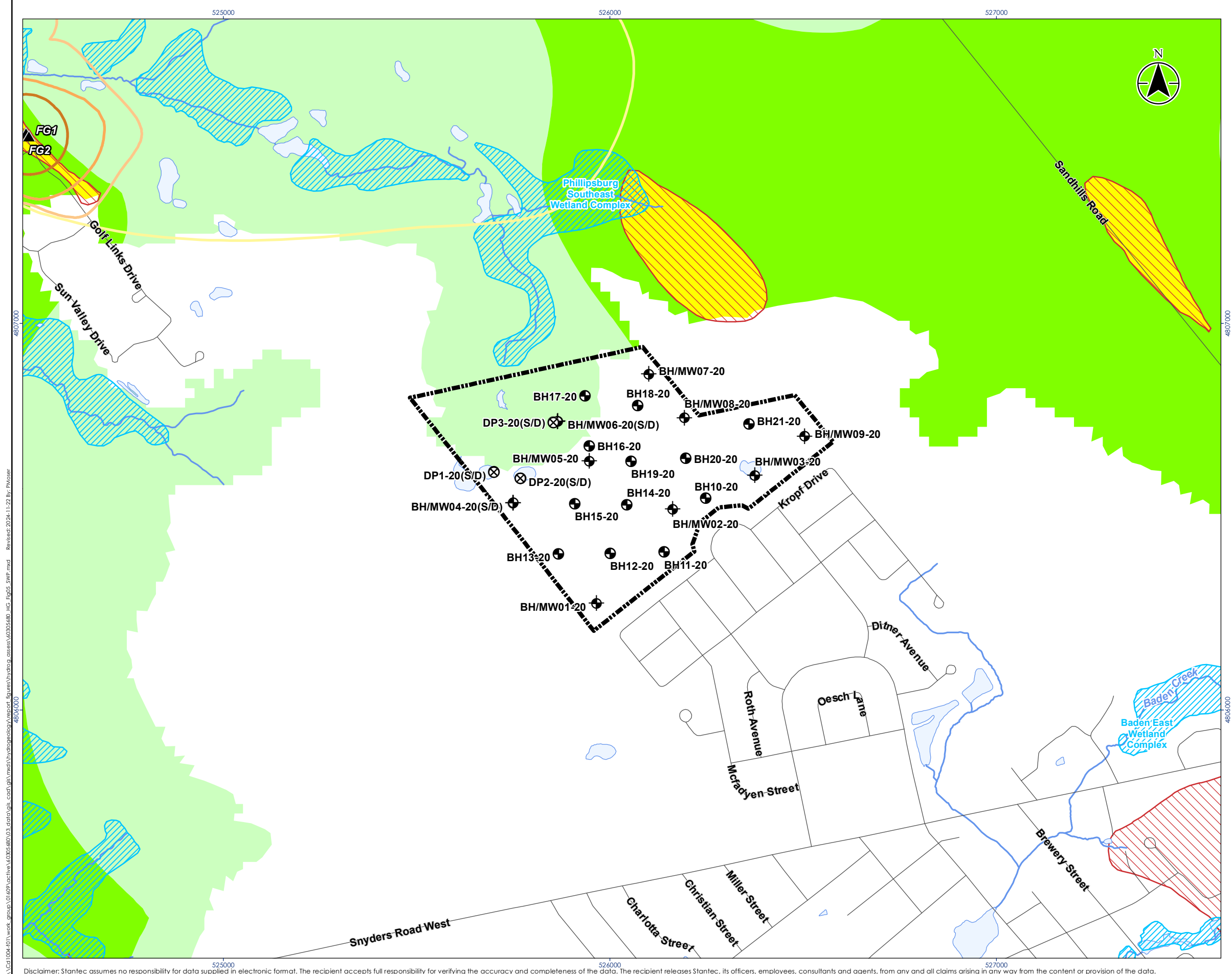
Client/Project
ACTIVA HOLDINGS INC.
ACTIVA BADEN NORTH SUBDIVISION
HYDROGEOLOGICAL ASSESSMENT

Figure No.

4

Title

Surficial Geology



Legend

- Site Boundary
- Monitoring Well (Stantec, 2020)
- Borehole (Stantec, 2020)
- Drive-Point Piezometer (Stantec, 2020)
- Municipal Production Well
- Road
- Watercourse
- Waterbody
- Wetland - Evaluated (Other)
- Highly Vulnerable Aquifer
- Wellhead Protection Areas**
- WHPA-A
- WHPA-B
- WHPA-C
- WHPA-D
- Significant Groundwater Recharge Area Vulnerability Score**
- 6
- 4
- 2

Notes

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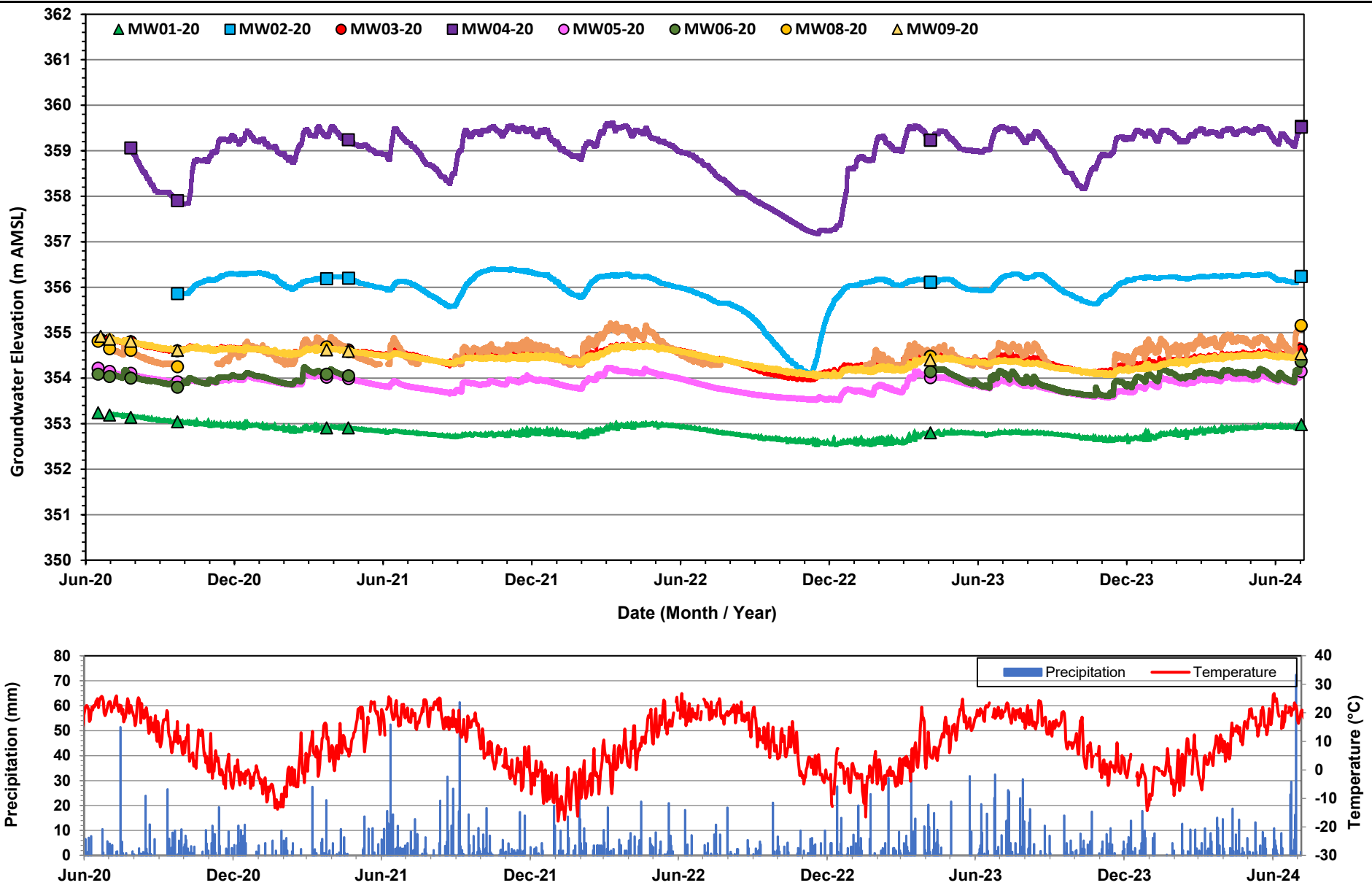
Project Location
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60305680 REVA
Prepared by CMC on 2024-11-22
Technical Review by GW on 2024-11-22

Client/Project
ACTIVA HOLDINGS INC.
ACTIVA BADEN SUBDIVISION
HYDROGEOLOGICAL ASSESSMENT

Figure No.
5

Title
Source Water Protection



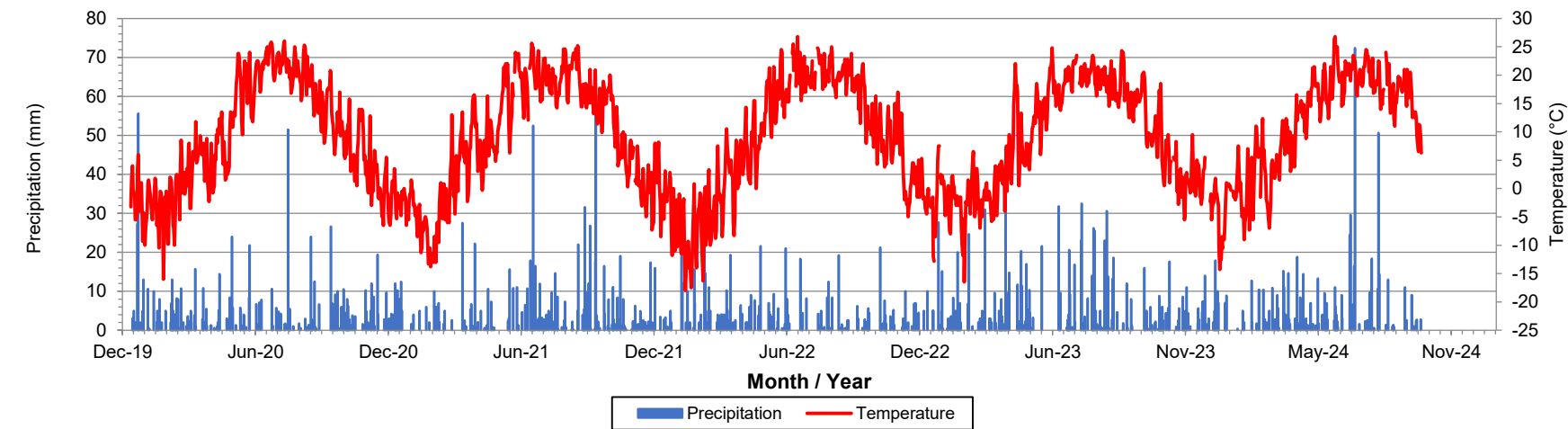
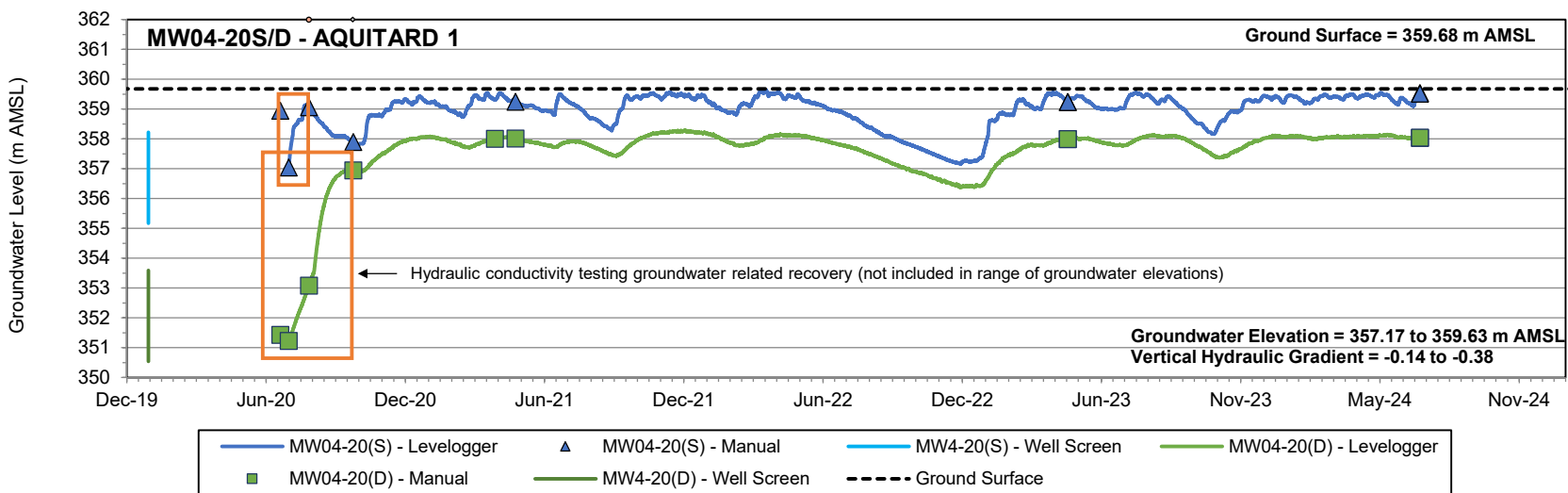
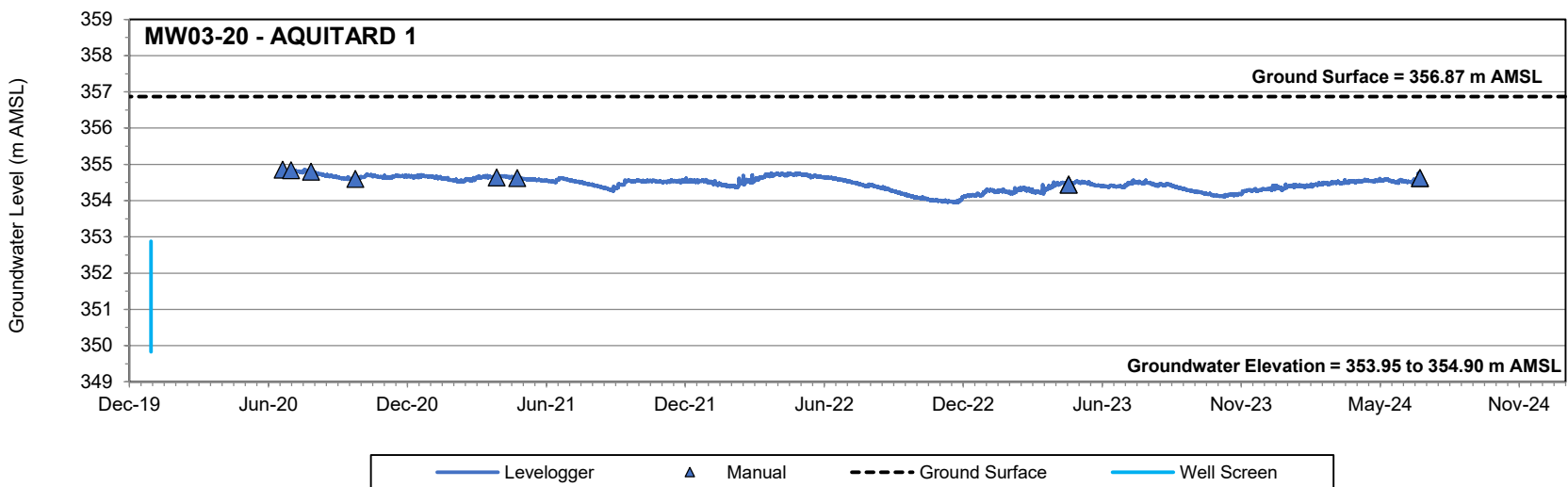
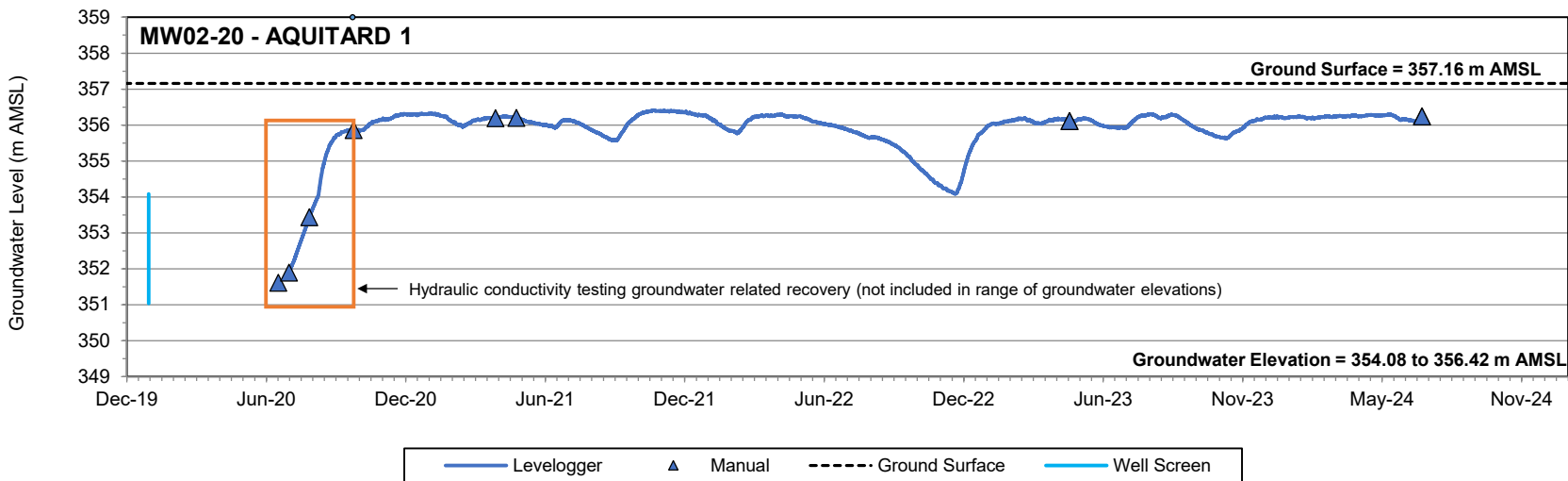
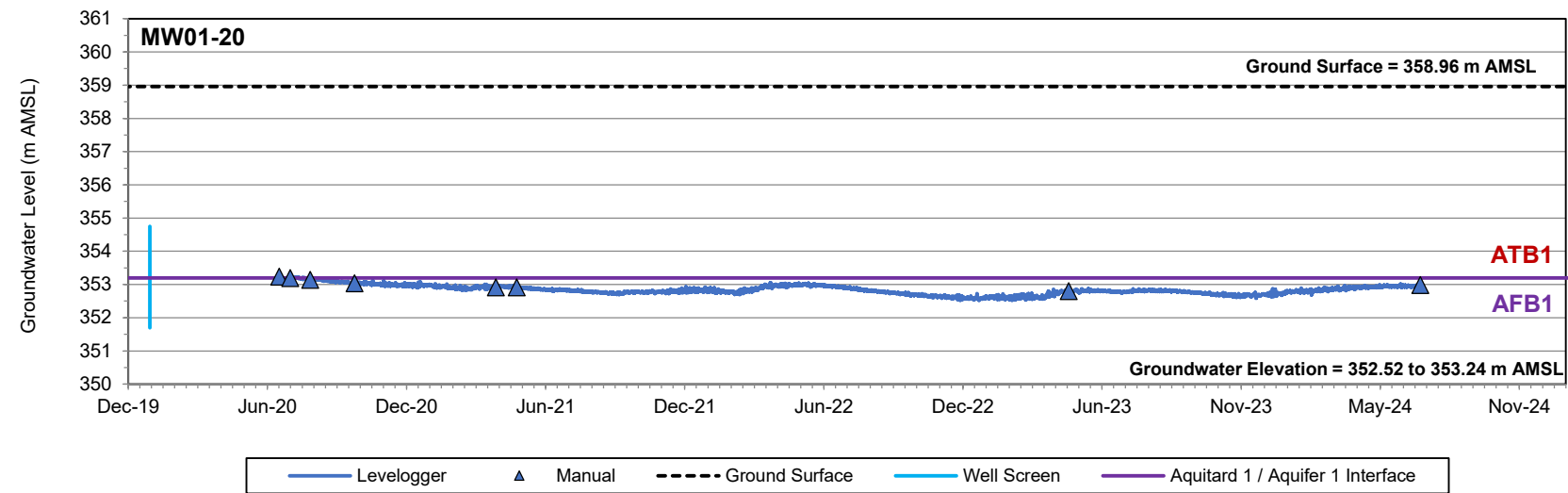
Precipitation and temperature data obtained from Environment Canada for the Roseville Climate Station (Station ID 6147188), accessed October 2024.



Project: Activa Baden North Subdivision
Hydrogeological Assessment

Figure: 6

Title: HYDROGRAPHS - ALL MONITORING WELLS



Notes:

Precipitation and temperature data obtained from Environment Canada for the Roseville Climate Station (Station ID 6147188), accessed October 2024

Client/Project

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Activa Baden North Subdivision
Hydrogeological Assessment

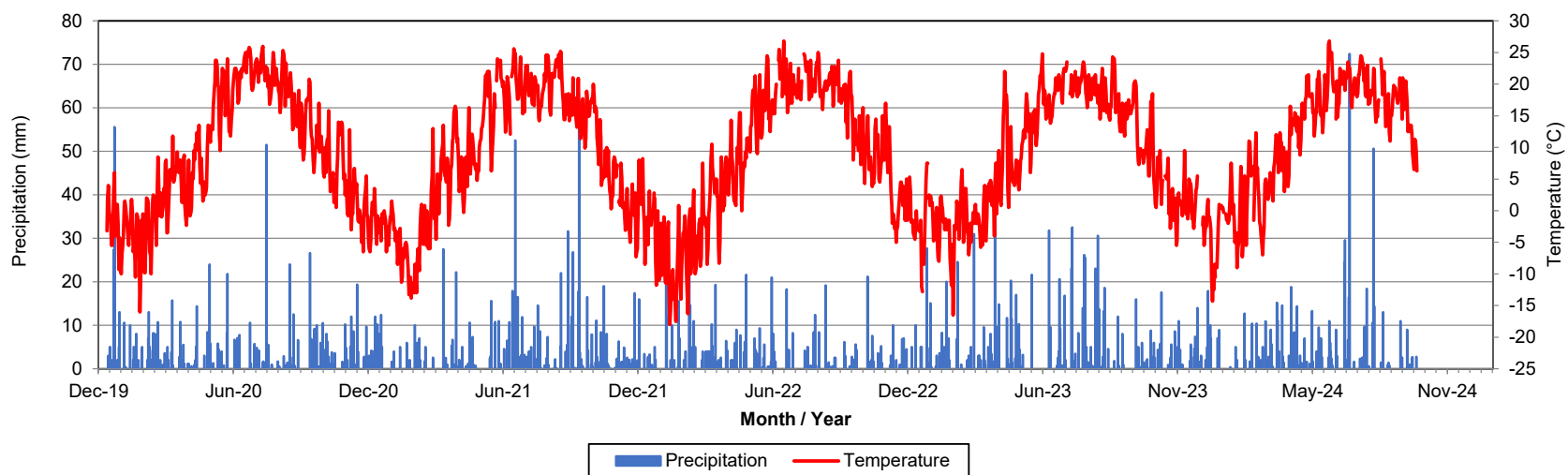
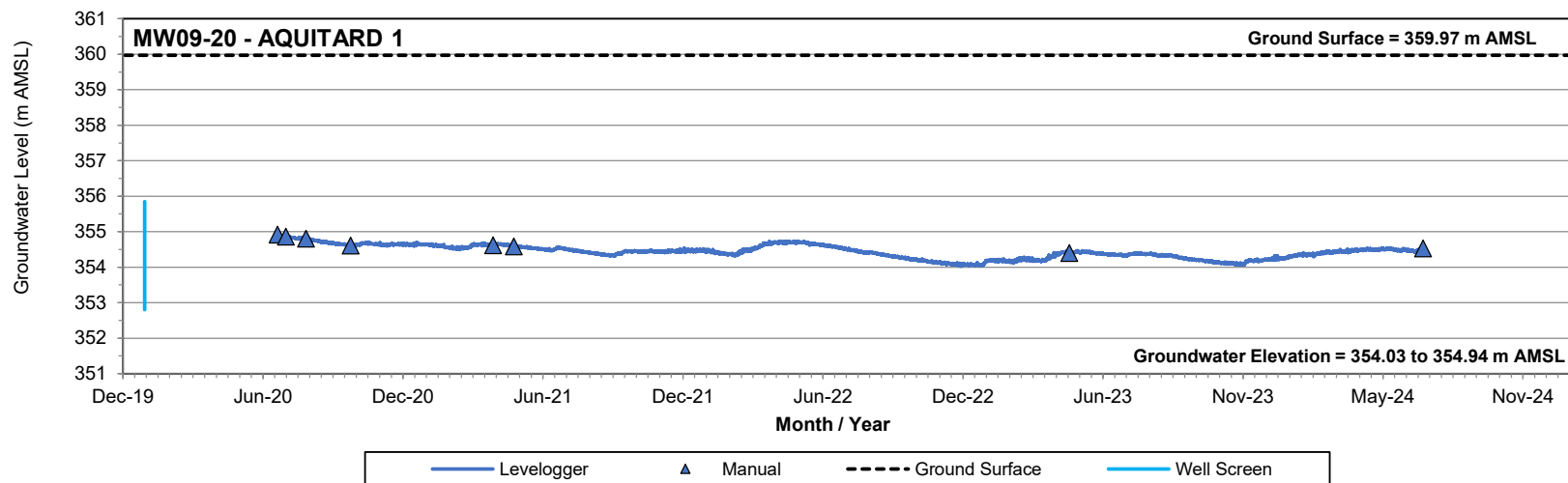
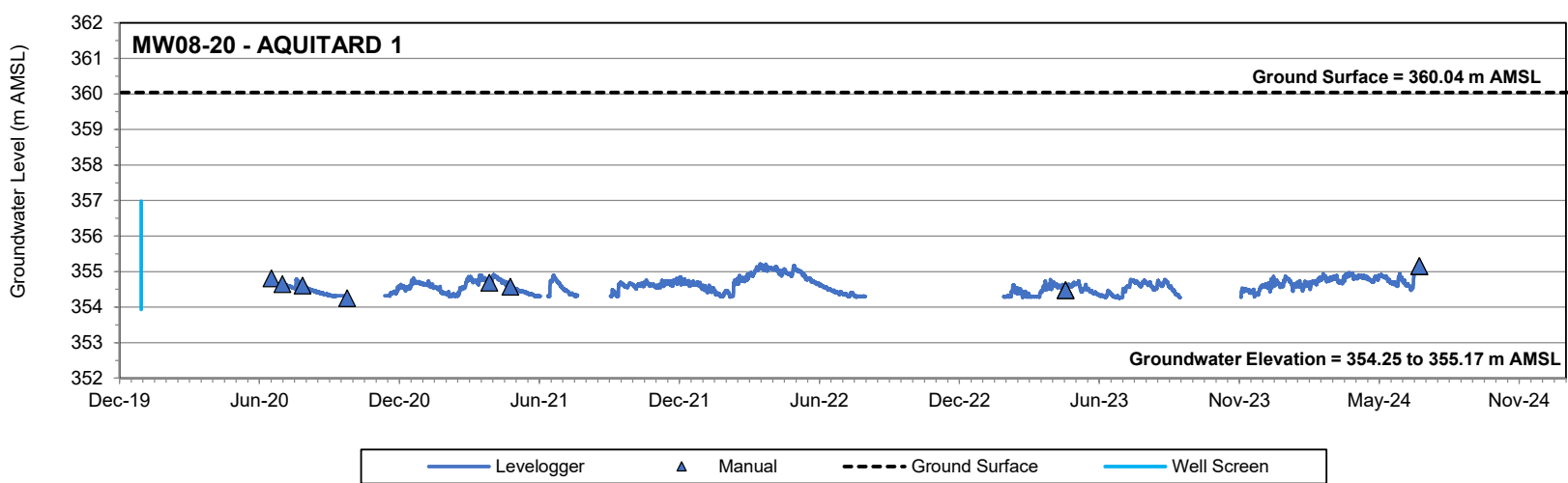
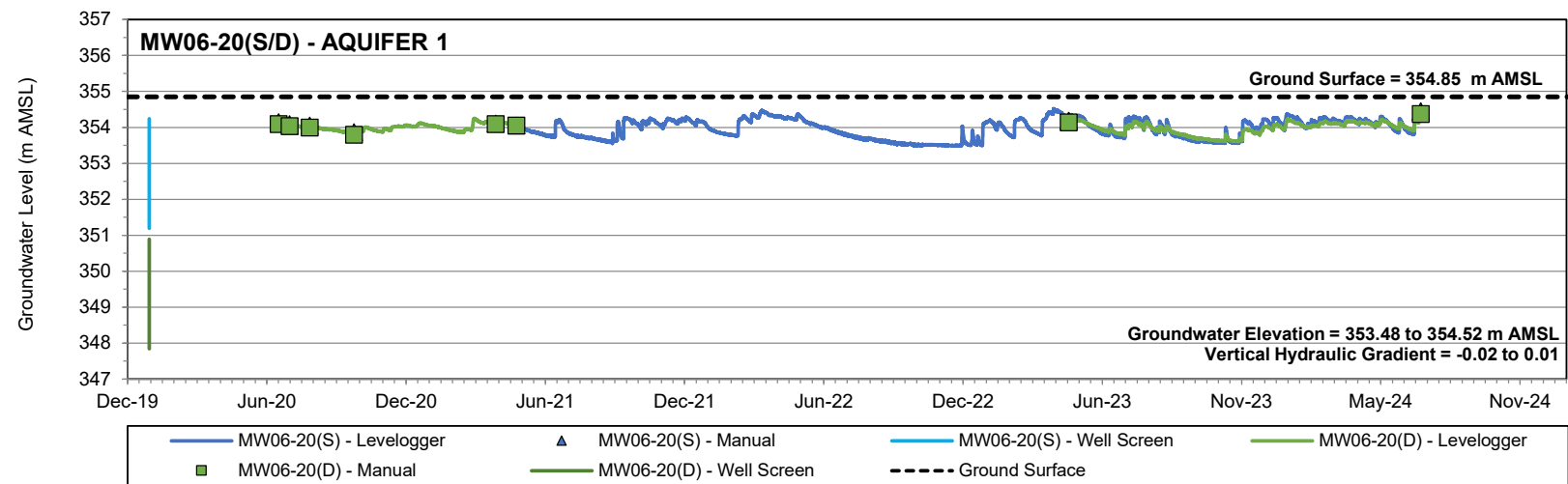
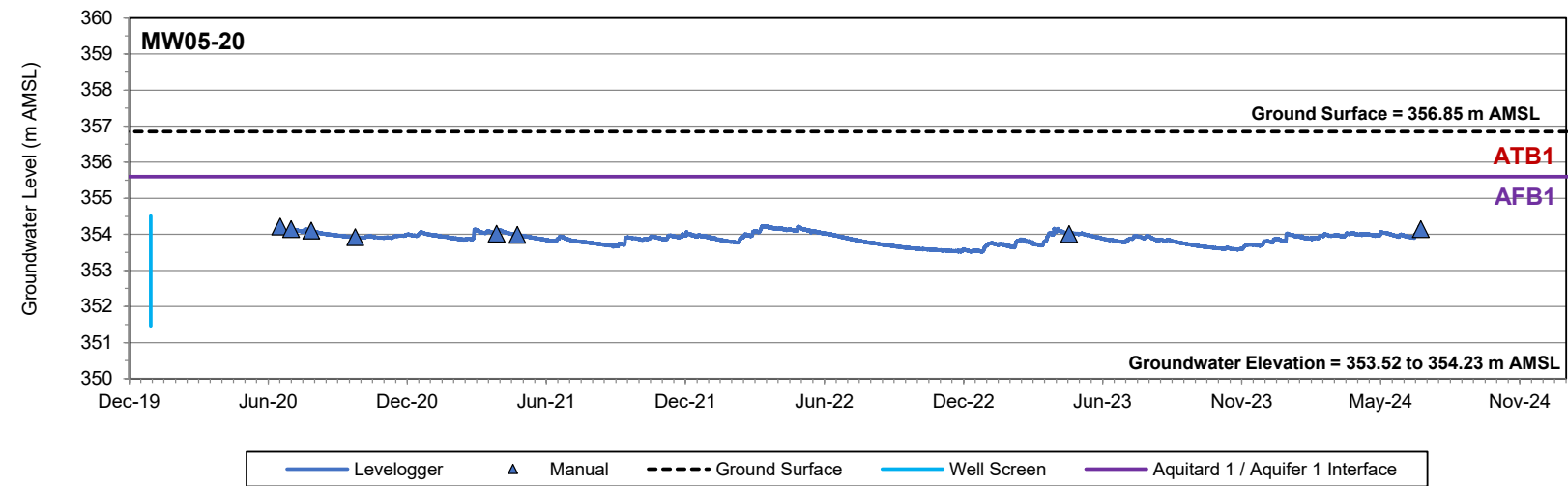
Figure No.

7



Title

HYDROGRAPHS
MW01-20 to MW04-20(S/D)



Notes:

- (1) Precipitation and temperature data obtained from Environment Canada for the Roseville Climate Station (Station ID 6147188), accessed October 2024.
- (2) Continuous data measurements for MW06-20(S) from October 2020 to May 2021 lost due to Levellogger malfunction.

Client/Project

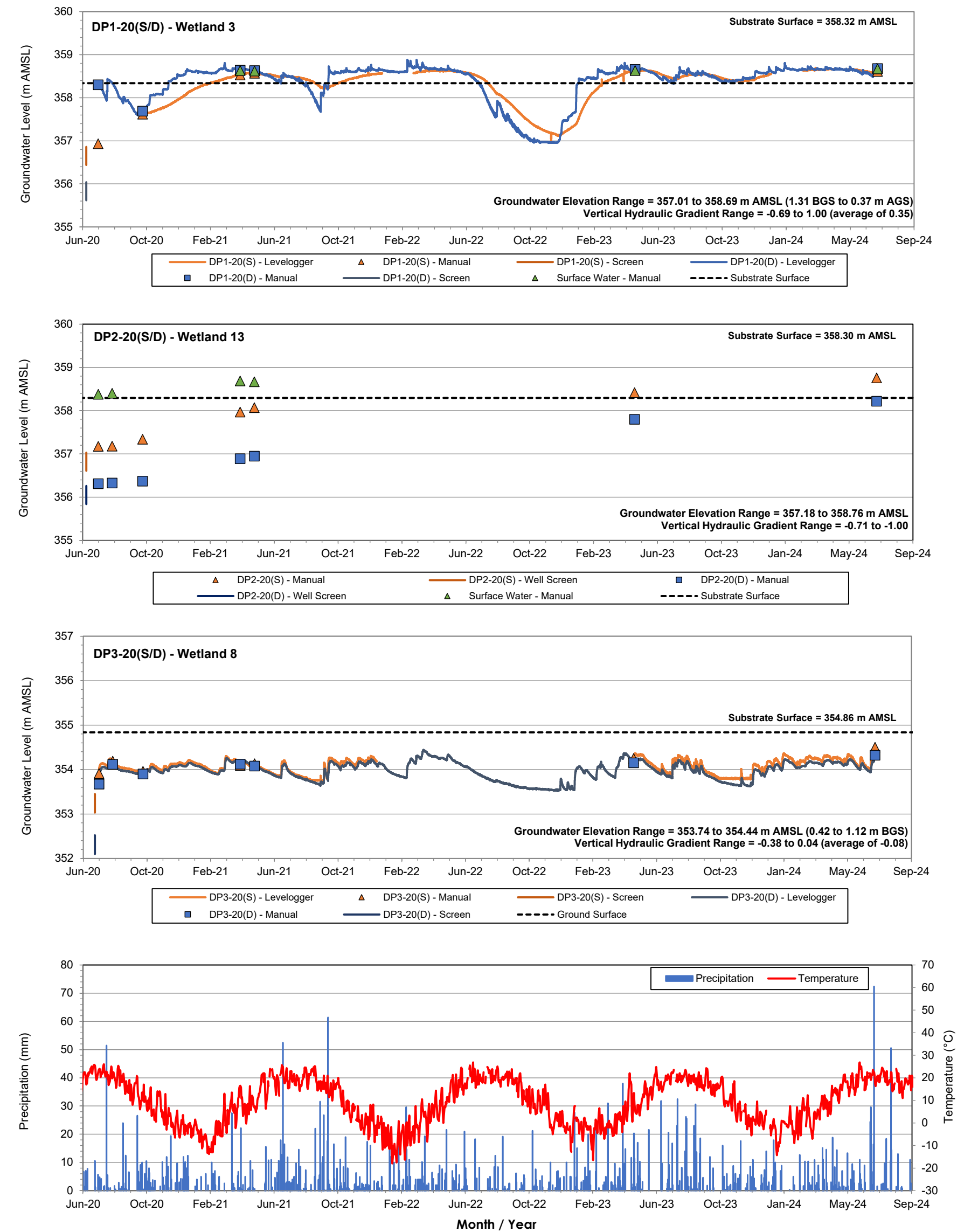
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Figure No.

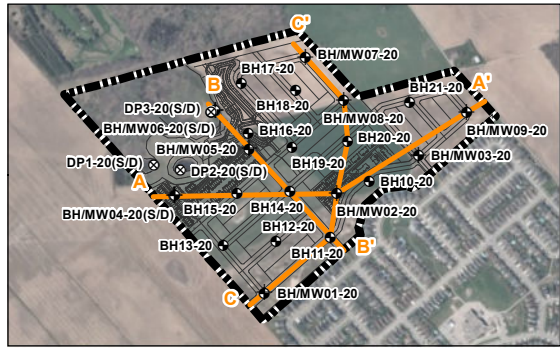
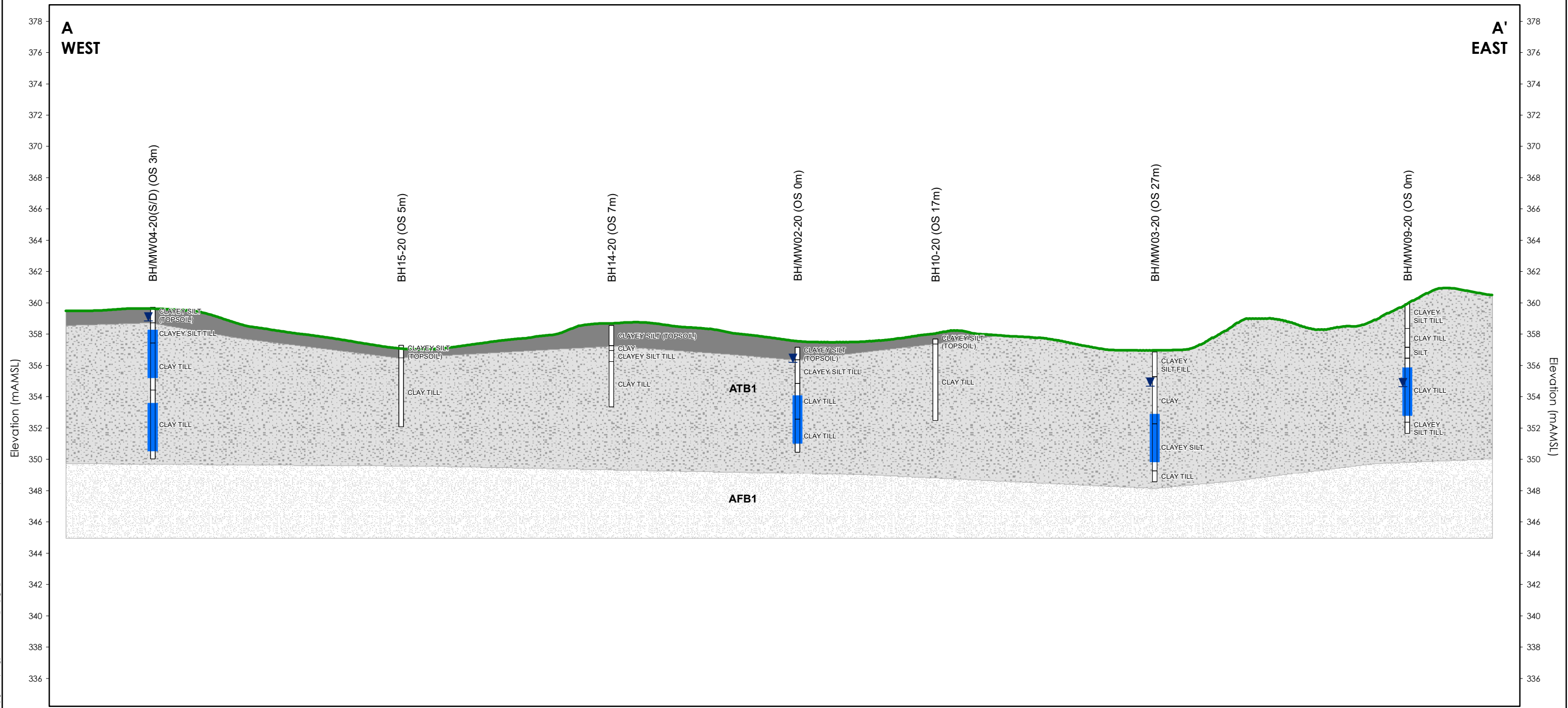
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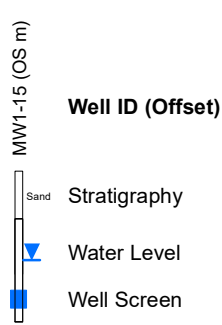
HYDROGRAPHS
MW05-20 to MW09-20



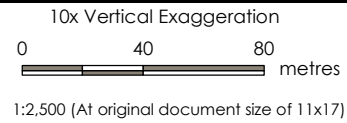
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Notes
1. Orthoimagery © First Base Solutions, 2020. Imagery flown in 2018.



- Water Level (April 9, 2021)
- Fill/Topsoil
- ATB1 Port Stanley Till (silty to clayey till) - Aquitard 1
- AFB1 Upper Moraine stratified sediments (fine to coarse sand, silt) - Aquifer 1
- Surficial Geology**
- 5d: Glaciolacustrine-derived silty to clayey till (Port Stanley Till)



Project Location
Baden, ON

60305680 REV A
Prepared by PMoser on 2024-11-22
Technical Review by GW on 2024-11-22

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HYDROGEOLOGICAL ASSESSMENT

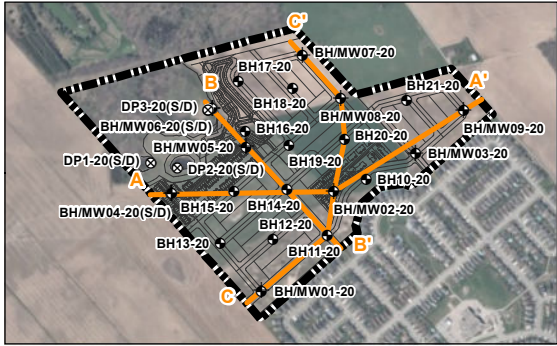
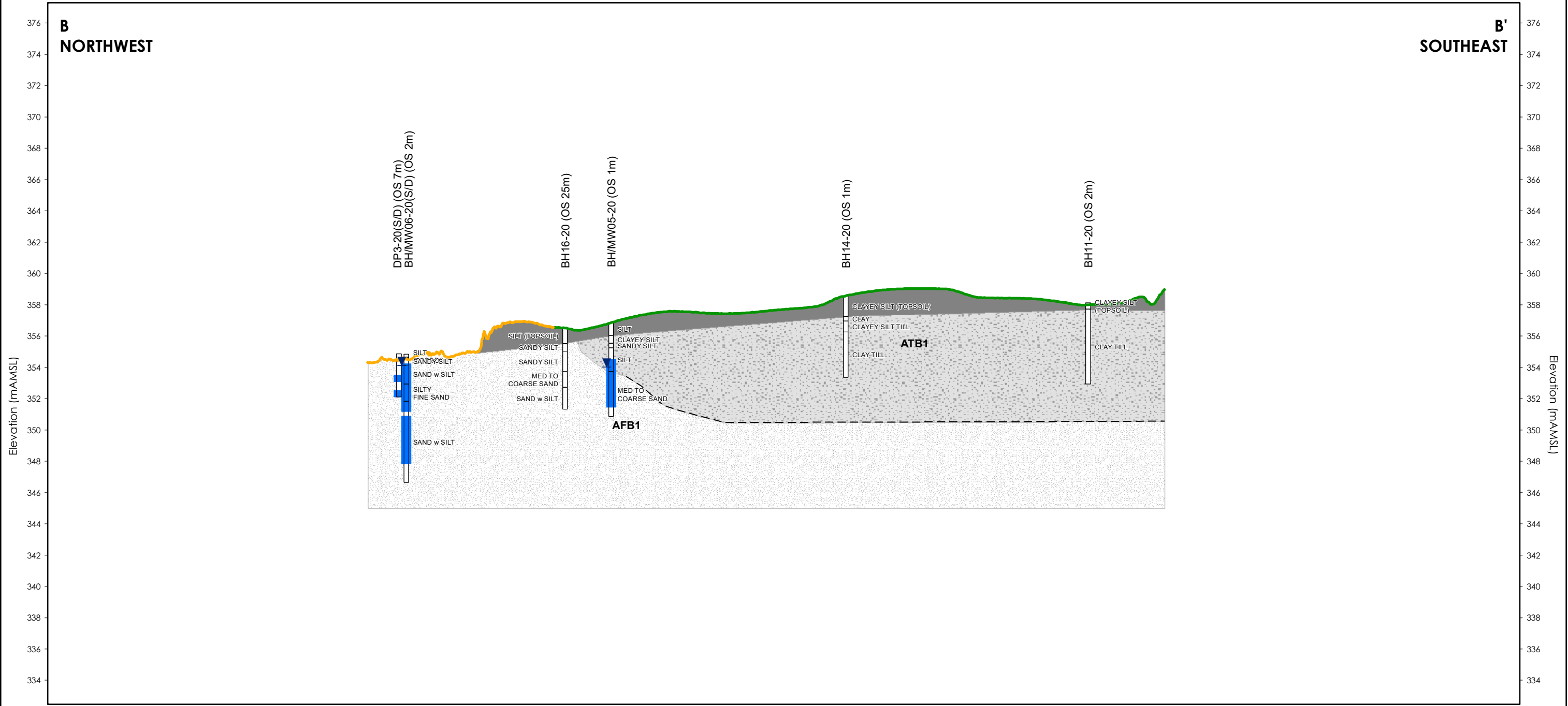
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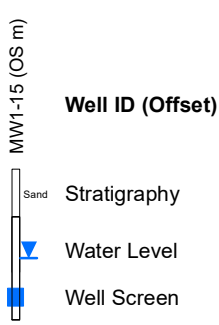
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Cross-Section A-A'

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Notes
1. Orthoimagery © First Base Solutions, 2020. Imagery flown in 2018.



- Water Level (April 9, 2021)
- Fill/Topsoil
- ATB1 Port Stanley Till (silty to clayey till) - Aquitard 1
- AFB1 Upper Moraine stratified sediments (fine to coarse sand, silt) - Aquifer 1
- Surficial Geology**
- 6: Ice-contact stratified deposits
- 5d: Glaciolacustrine-derived silty to clayey till (Port Stanley Till)

10x Vertical Exaggeration

0 40 80 metres

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



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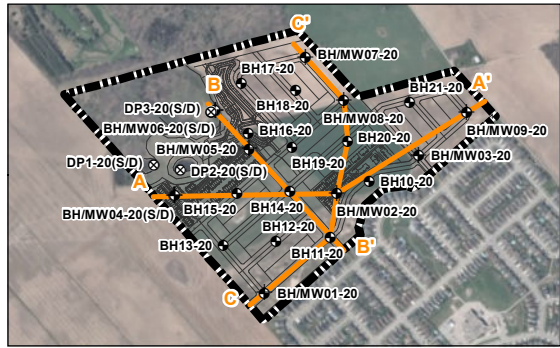
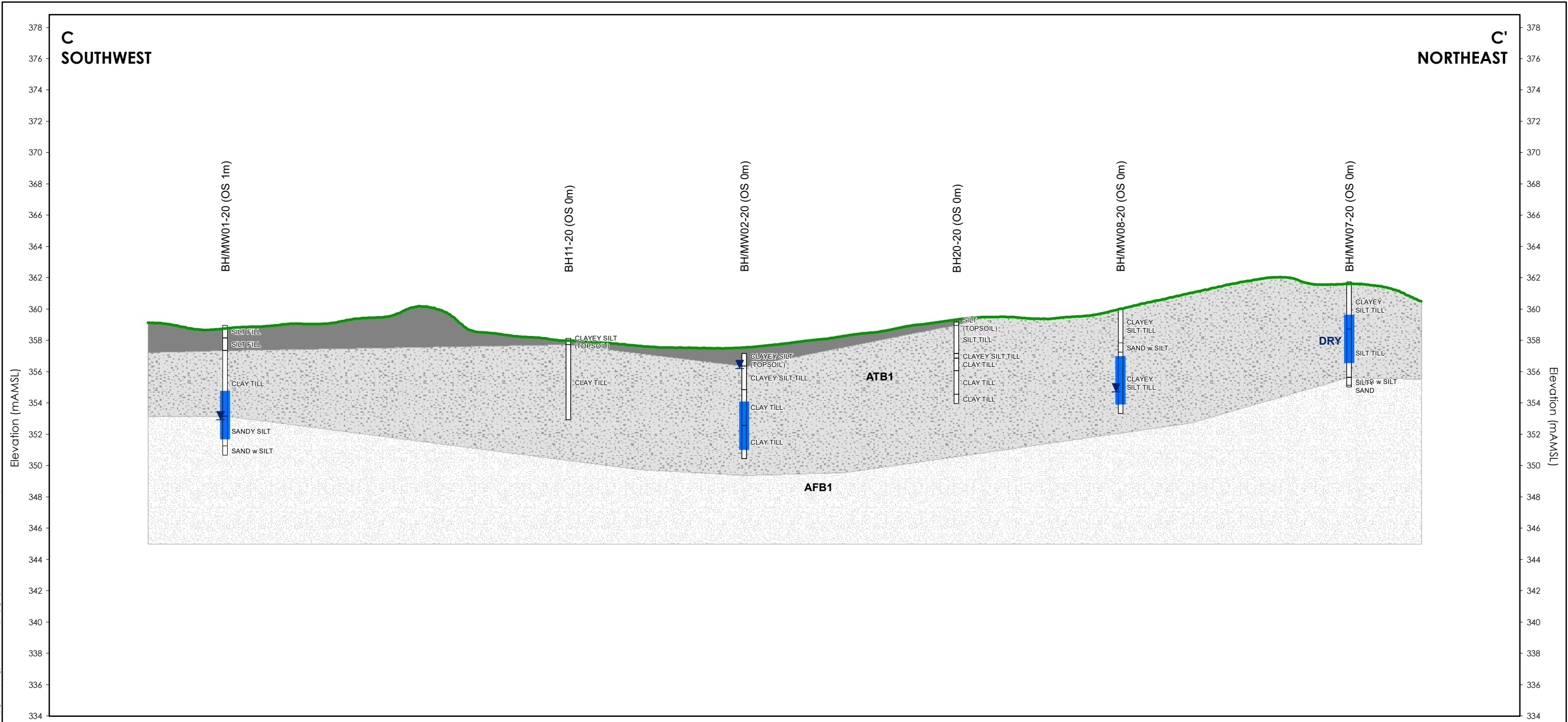
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Title

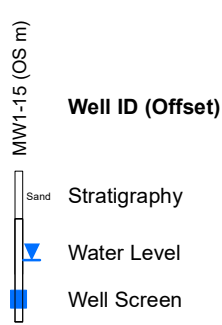
Cross-Section B-B'

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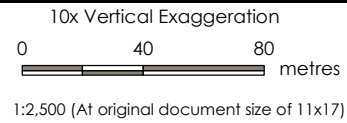
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Notes
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- Water Level (April 9, 2021)
- Fill/Topsoil
- ATB1 Port Stanley Till (silty to clayey till) - Aquitard 1
- AFB1 Upper Moraine stratified sediments (fine to coarse sand, silt) - Aquifer 1
- Surficial Geology**
- 6: Ice-contact stratified deposits
- 5d: Glaciolacustrine-derived silty to clayey till (Port Stanley Till)



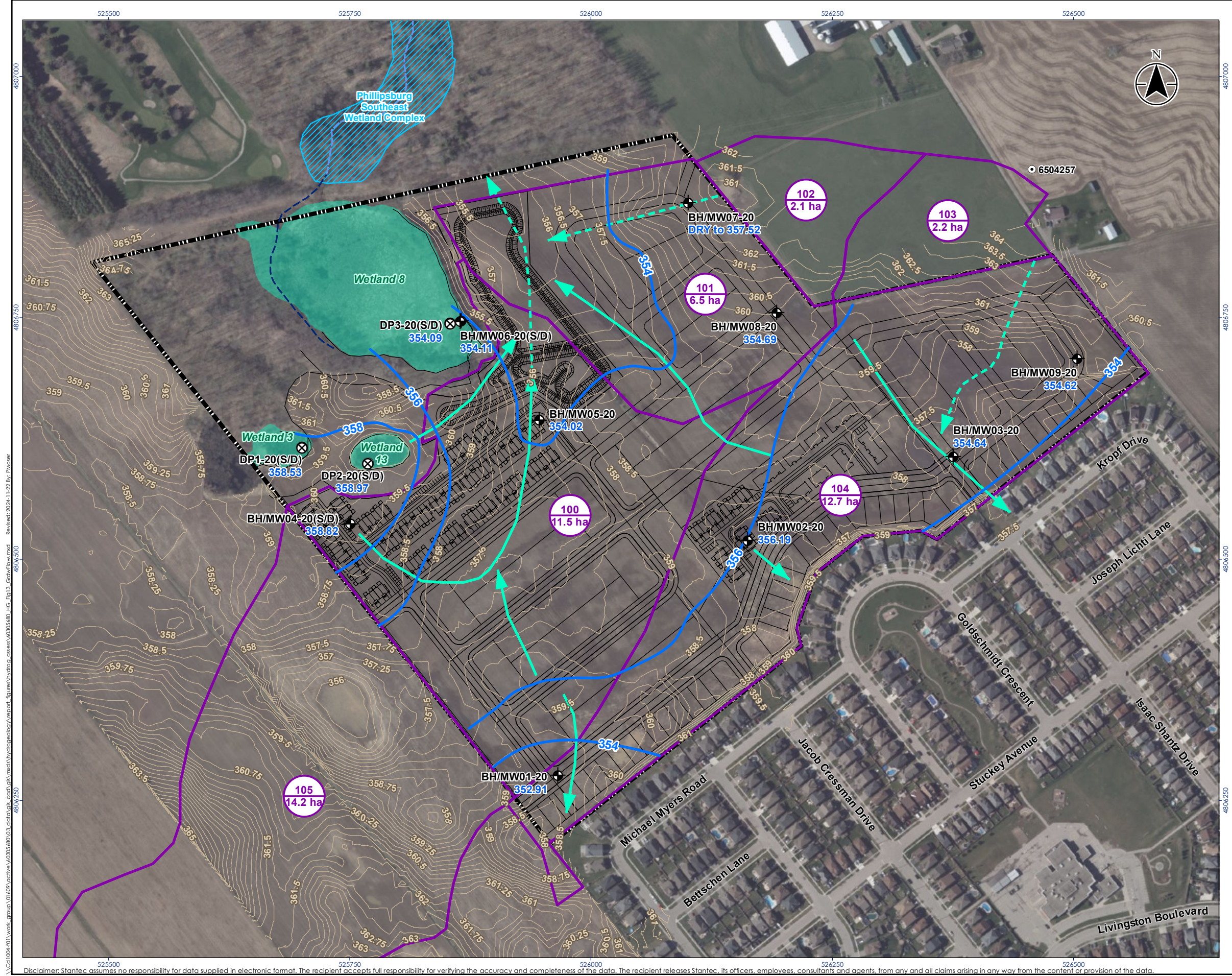
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HYDROGEOLOGICAL ASSESSMENT

Figure No.
12

Title
Cross-Section C-C'



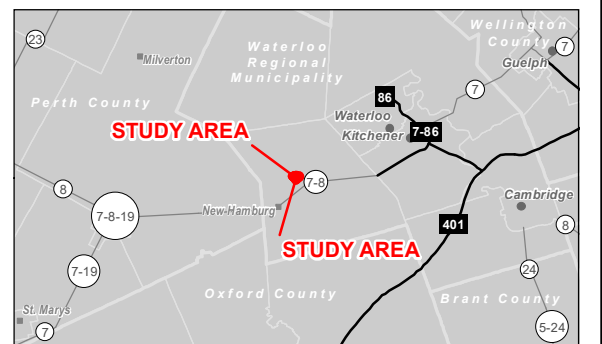
Legend

- Site Boundary
- Monitoring Well (Stantec, 2020)
- Drive-Point Piezometer (Stantec, 2020)
- MECP Water Well Record
- Topographic Contour (mAMSL)
- 357.54 Groundwater Elevation (April 9, 2021)
- Groundwater Contour (April 9, 2021)
- Interpreted Direction of Groundwater Flow
- Stormwater Catchment (Existing Conditions)
- Watercourse - Intermittent (LIO)
- Intermittent Watercourse (WSP) (Approximate)
- Wetland Extent (WSP/GRCA, 2021)
- Wetland - Evaluated (Other)

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1:4,000 (At original document size of 11x17)

Notes

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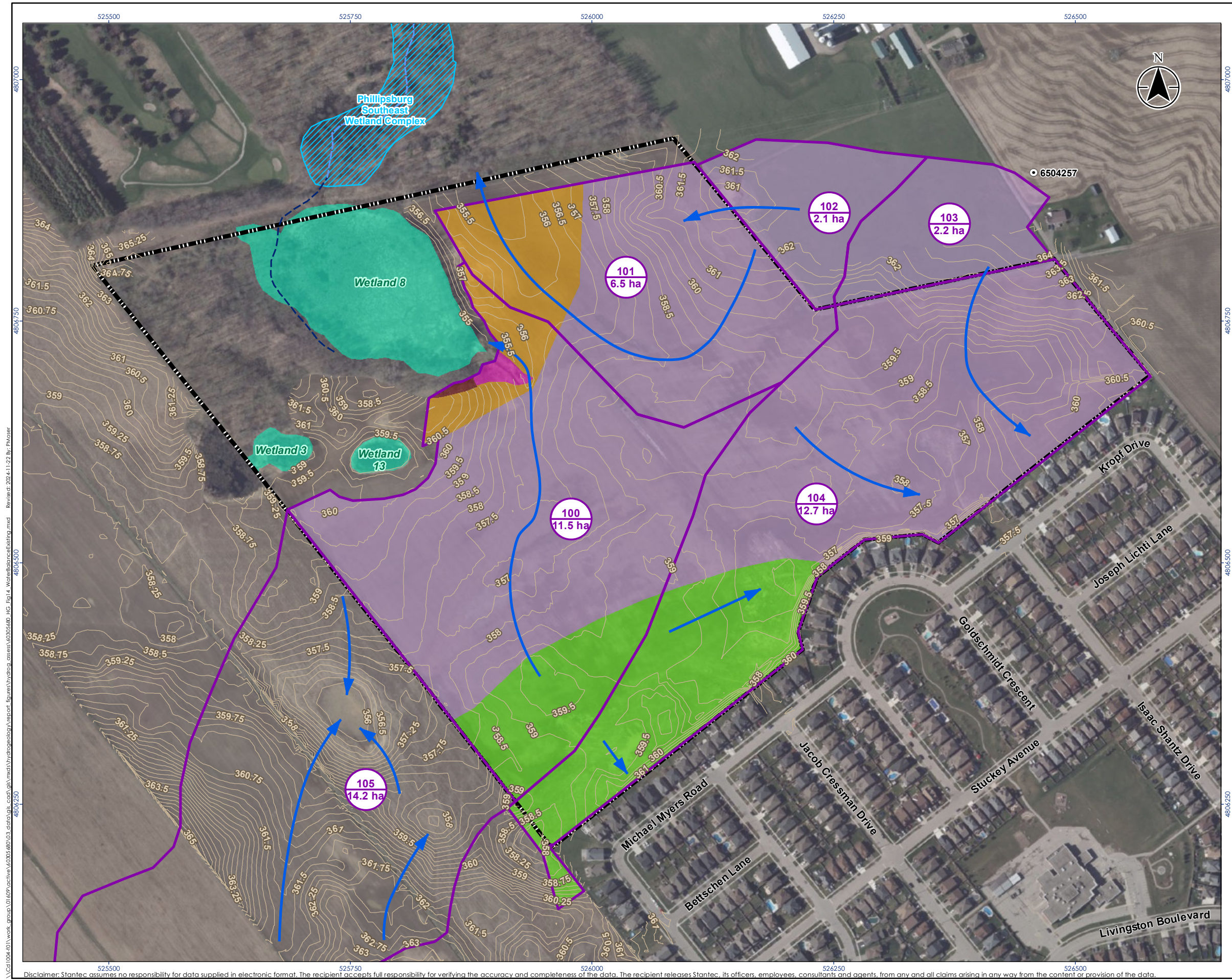
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ACTIVA BADEN NORTH SUBDIVISION
HYDROGEOLOGICAL ASSESSMENT

Figure No.

13

Title

Groundwater Flow



Legend

- Site Boundary
- MECP Water Well Record
- Topographic Contour (mAMSL)
- Overland Flow Direction
- Watercourse - Intermittent (LIO)
- Intermittent Watercourse (WSP) (Approximate)
- Wetland Extent (WSP/GRCA, 2021)
- Wetland - Evaluated (Other)
- Stormwater Catchment (Existing Conditions)

Water Balance Sub-Areas

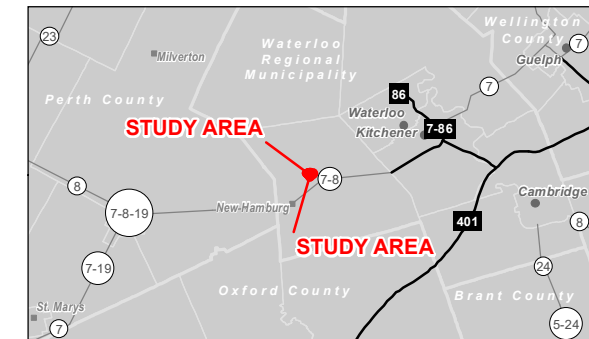
- Sub-Area A: Rolling, Silty Sand to Sandy Silt (Sand), Shallow Rooted Crops
- Sub-Area B: Rolling, Silty Sand to Sandy Silt (Sand), Pasture and Shrubs
- Sub-Area C: Rolling, Silty Sand to Sandy Silt (Sand), Mature Forest
- Sub-Area D: Rolling, Clayey Silt to Silty Clay (Clay), Pasure and Shrubs
- Sub-Area E: Rolling, Clayey Silt to Silty Clay (Clay), Shallow Rooted Crops

Notes

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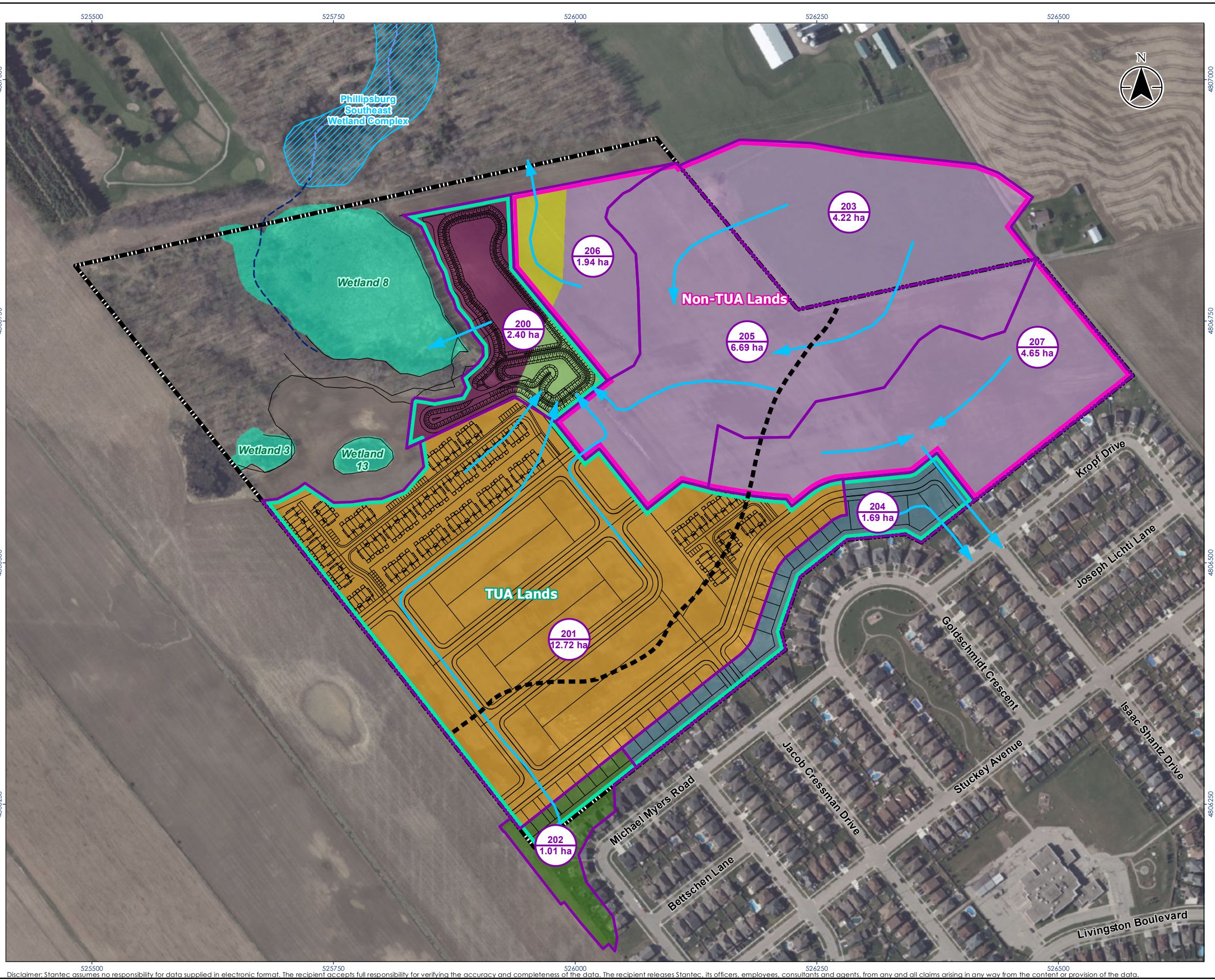
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HYDROGEOLOGICAL ASSESSMENT

Figure No.
14

Title
Pre-Development Water Balance

\\Cd\1004\01\work_group\01\609\active\60305680\3_data\gis\cad_gis\mxd\hydrogeology\report_figures\hydro_gis\assets\60305680_HG_Fig15_WaterBalancePreDevelopment.mxd Revised: 2024-11-28 By: PMover

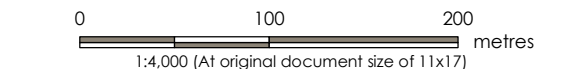


Legend

- Site Boundary
- Proposed Development Plan
- Overland Flow Direction
- Interpreted Groundwater Flow Divide (Pre-Development)
- Watercourse - Intermittent (LIO)
- Intermittent Watercourse (WSP) (Approximate)
- Wetland Extent (WSP/GRCA, 2021)
- Wetland - Evaluated (Other)
- Stormwater Catchment (Proposed Conditions)
- TUA Lands Boundary
- Non-TUA Lands Boundary

Water Balance Sub-Areas

- Sub-Area A: Rolling, Silty Sand to Sandy Silt (Sand), Shallow Rooted Crops
- Sub-Area E: Shallow Rooted Crops, Clayey Silt to Silty Clay (Clay), Rolling Land
- Sub-Area G: Rolling Silty Sand to Sandy Silt (Sand), Urban Lawn, 20% Impervious
- Sub-Area H: Rolling, Clayey Silt to Silty Clay (Clay), Urban Lawn, 65% Impervious
- Sub-Area I: Rolling, Clayey Silt to Silty Clay (Clay), Urban Lawn, 60% Impervious
- Sub-Area J: Rolling, Clayey Silt to Silty Clay (Clay), Urban Lawn, 40% Impervious
- Sub-Area K: Rolling, Clayey Silt to Silty Clay (Clay), 20% Impervious



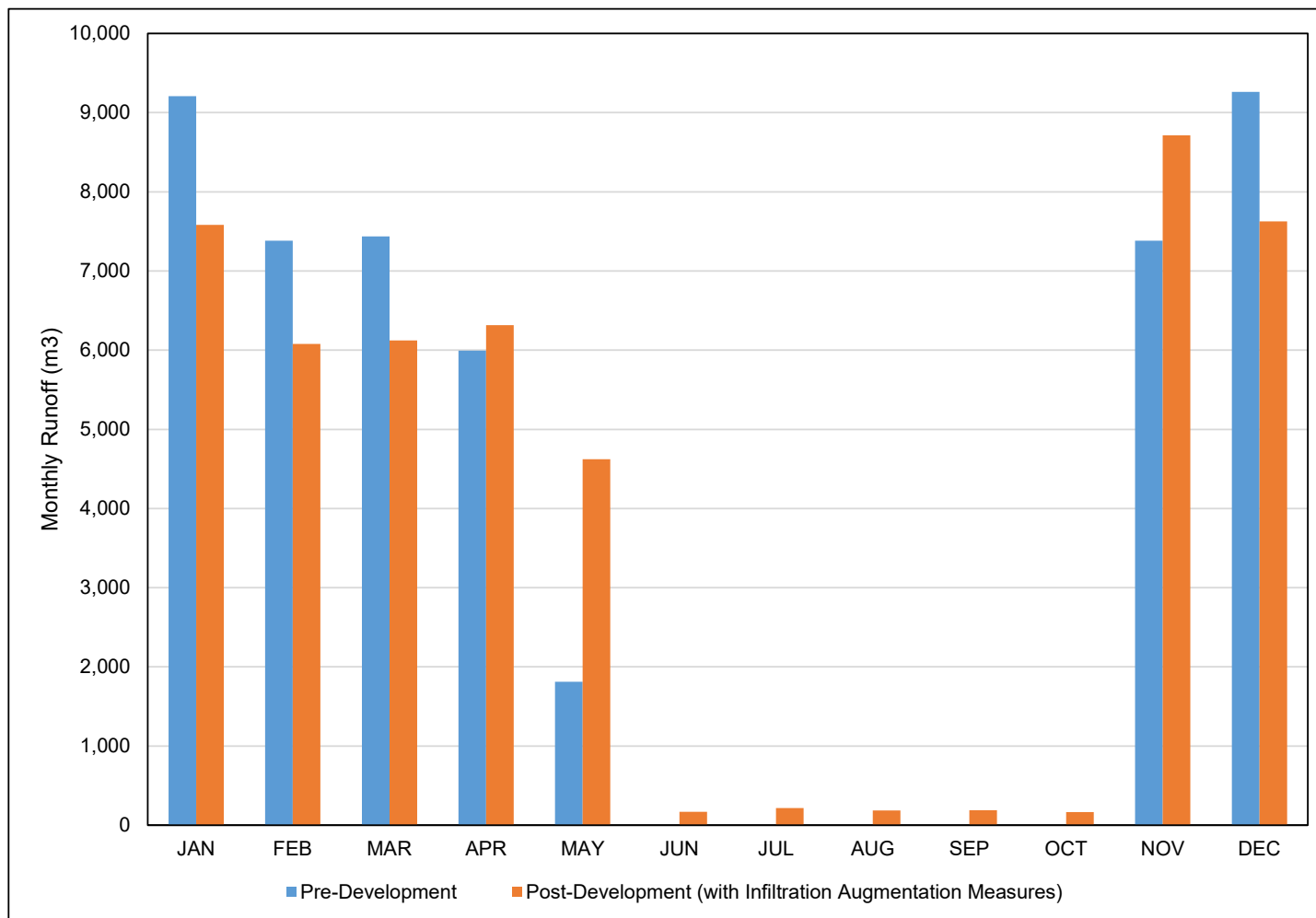
- Notes**
- Coordinate System: NAD 1983 CSRS UTM Zone 17N
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 - Orthoimagery © First Base Solutions, 2021. Imagery Date, 2020.

Project Location: Baden, ON
60305680 REVA
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Technical Review by GW on 2024-11-28

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ACTIVA HOLDINGS INC.
ACTIVA BADEN NORTH SUBDIVISION
HYDROGEOLOGICAL ASSESSMENT

Figure No.
15

Title
Post-Development Water Balance



Notes:

Client/Project
Activa Holdings Inc.
Activa Baden North Subdivision
Hydrogeological Assessment

Figure No.

16



Title

**PRE- TO POST-DEVELOPMENT RUNOFF
MONTHLY DISCHARGE TO WETLANDS**

Appendix B Tables

TABLE 1 - WELL CONSTRUCTION DETAILS

Well ID	UTM Coordinates		Elevations		Well Stick-up (m)	Well Depth (m BTOC)	Well Depth (m BGS)	Well Base Elevation (m AMSL)	Screened Interval				Screened Material Description ^(a)	Hydraulic Conductivity ^(b) (m/s)
	Northing	Easting	Top of Casing (m AMSL)	Ground Surface (m AMSL)					Top Elevation (m BGS) (m AMSL)		Bottom Elevation (m BGS) (m AMSL)			
Stantec Monitoring Wells														
BH/MW01-20	4806276	525966	359.75	358.96	0.79	8.05	7.26	351.70	4.21	354.75	7.26	351.70	CLAY TILL (50%) / Sandy SILT (50%)	2.4E-05
BH/MW02-20	4806519	526162	357.98	357.16	0.82	6.95	6.13	351.03	3.08	354.08	6.13	351.03	Clayey SILT TILL (4%) / CLAY TILL (96%)	8.2E-08
BH/MW03-20	4806606	526375	357.66	356.87	0.79	7.83	7.04	349.83	3.99	352.88	7.04	349.83	CLAY (19%) / Clayey SILT (81%)	6.0E-08
BH/MW04-20(S)	4806536	525749	360.60	359.68	0.92	5.43	4.51	355.17	1.46	358.22	4.51	355.17	Clayey SILT TILL (27%) / CLAY TILL (73%)	5.8E-09
BH/MW04-20(D)	4806536	525750	360.49	359.73	0.76	9.95	9.19	350.54	6.14	353.59	9.19	350.54	CLAY TILL (100%)	8.0E-10
BH/MW05-20	4806644	525946	357.77	356.85	0.92	6.31	5.39	351.46	2.34	354.51	5.39	351.46	SILT (23%) / Medium to Coarse SAND (76%)	-
BH/MW06-20(S)	4806747	525865	355.65	354.86	0.79	4.45	3.66	351.20	0.61	354.25	3.66	351.20	Sandy SILT (5%) / SAND with SILT (59%) / Silty Fine SAND (36%)	1.7E-05
BH/MW06-20(D)	4806746	525864	355.67	354.84	0.83	7.84	7.01	347.83	3.96	350.88	7.01	347.83	SAND with SILT (100%)	9.3E-05
BH/MW07-20	4806869	526101	362.67	361.73	0.94	6.09	5.15	356.58	2.10	359.63	5.15	356.58	Clayey SILT TILL (31%) / SILT TILL (69%)	-
BH/MW08-20	4806755	526193	360.93	360.04	0.89	7.00	6.11	353.93	3.06	356.98	6.11	353.93	Clayey SILT TILL (100%), frequent silty sand to sand seams	5.1E-07
BH/MW09-20	4806708	526504	360.83	359.97	0.86	8.03	7.17	352.80	4.12	355.85	7.17	352.80	CLAY TILL (100%), frequent silty sand to sand seams	1.3E-07
													GEOMEAN - AQUIFER 1 (Silty Sand, Sandy Silt, and Sand) =	3.4E-05
													GEOMEAN - AQUITARD 1 (Silt, Clay, Clayey Silt to Silty Clay Till) =	3.4E-08
													GEOMEAN (All Wells) =	3.4E-07
Stantec Drive-Point Piezometers														
DP1-20(S)	4806615	525700	359.04	358.32	0.72	2.60	1.88	356.44	1.46	356.86	1.88	356.44	-	-
DP1-20(D)	4806615	525700	359.16	358.36	0.80	3.54	2.74	355.62	2.32	356.04	2.74	355.62	-	-
DP2-20(S)	4806599	525769	359.21	358.30	0.91	2.60	1.69	356.61	1.27	357.03	1.69	356.61	-	-
DP2-20(D)	4806599	525769	359.38	358.29	1.09	3.54	2.45	355.84	2.03	356.26	2.45	355.84	-	-
DP3-20(S)	4806744	525854	355.63	354.81	0.82	2.60	1.78	353.03	1.36	353.45	1.78	353.03	-	-
DP3-20(D)	4806744	525854	355.64	354.86	0.78	3.54	2.76	352.10	2.34	352.52	2.76	352.10	-	-

Notes:

(a) Refer to **Appendix D** for borehole and well construction logs

(b) Refer to **Appendix F** hydraulic conductivity analytical solutions

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	UTM Coordinates		Date	Time	Well Depth			Screen Length (m)	Screen Separation ⁽¹⁾ (m)	Top of Casing Elevation (m AMSL)	Ground Surface Elevation (m AMSL)	Pipe Stick-up (m)	Groundwater Level			Vertical Hydraulic Gradient ⁽³⁾ (+) = Upward (-) = Downward
	Northing	Easting			(m BTOC)	(m BGS)	(m AMSL)						(m BGS) ⁽²⁾	(m BTOC)	(m AMSL)	
BH/MW01-20	4806276	525966	3-Jul-20	8:51 AM	8.05	7.26	352.49	3.05		359.75	358.96	0.79	5.72	6.51	353.24	
			17-Jul-20	10:59 AM									5.77	6.56	353.19	
			12-Aug-20	9:31 AM									5.82	6.61	353.14	
			8-Oct-20	1:40 PM									5.92	6.71	353.04	
			9-Apr-21	4:06 PM									6.05	6.84	352.91	
			6-May-21	11:36 AM									6.05	6.84	352.91	
			20-Apr-23	2:39 PM									6.16	6.95	352.80	
			18-Jul-24	4:01 PM									5.98	6.77	352.98	
BH/MW02-20	4806519	526162	3-Jul-20	9:20 AM	6.95	6.13	351.85	3.05		357.98	357.16	0.82	5.55	6.37	351.61	
			17-Jul-20	10:31 AM									5.27	6.09	351.89	
			12-Aug-20	9:42 AM									3.73	4.55	353.43	
			8-Oct-20	3:21 PM									1.30	2.12	355.86	
			9-Apr-21	3:15 PM									0.97	1.79	356.19	
			6-May-21	1:36 PM									0.96	1.78	356.20	
			20-Apr-23	2:52 PM									1.05	1.87	356.11	
			18-Jul-24	10:31 AM									0.92	1.74	356.24	
BH/MW03-20	4806606	526375	3-Jul-20	1:09 PM	7.83	7.04	350.62	3.05		357.66	356.87	0.79	2.02	2.81	354.85	
			17-Jul-20	11:28 AM									2.03	2.82	354.84	
			12-Aug-20	9:51 AM									2.07	2.86	354.80	
			8-Oct-20	1:14 PM									2.26	3.05	354.61	
			9-Apr-21	3:00 PM									2.23	3.02	354.64	
			6-May-21	11:11 AM									2.25	3.04	354.62	
			20-Apr-23	11:37 AM									2.43	3.22	354.44	
			18-Jul-24	11:02 AM									2.25	3.04	354.62	
BH/MW04-20(S)	4806536	525749	3-Jul-20	9:40 AM	5.43	4.51	356.09	3.05		360.60	359.68	0.92	0.74	1.66	358.94	
			17-Jul-20	8:38 AM									2.64	3.56	357.04	
			12-Aug-20	11:10 AM									0.62	1.54	359.06	
			8-Oct-20	1:51 PM									1.78	2.70	357.90	
			9-Apr-21	3:54 PM									0.86	1.78	358.82	
			6-May-21	11:50 AM									0.44	1.36	359.24	
			20-Apr-23	2:12 PM									0.45	1.37	359.23	
			18-Jul-24	3:43 PM									0.16	1.08	359.52	
BH/MW04-20(D)	4806536	525750	3-Jul-20	9:43 AM	9.95	9.19	351.30	3.05	4.68	360.49	359.73	0.76	8.30	9.06	351.43	-1.00
			17-Jul-20	8:40 AM									8.49	9.25	351.24	-1.00
			12-Aug-20	11:13 AM									6.65	7.41	353.08	-1.00
			8-Oct-20	1:51 PM									2.79	3.55	356.94	-0.21
			9-Apr-21	3:54 PM									1.73	2.49	358.00	-0.18
			6-May-21	11:55 AM									1.72	2.48	358.01	-0.26
			20-Apr-23	2:06 PM									1.73	2.49	358.00	-0.26
			18-Jul-24	3:30 PM									1.69	2.45	358.04	-0.32

TABLE 2
GROUNDWATER LEVEL DATA - MONITORING WELLS

Well ID	UTM Coordinates		Date	Time	Well Depth			Screen Length (m)	Screen Separation ⁽¹⁾ (m)	Top of Casing Elevation (m AMSL)	Ground Surface Elevation (m AMSL)	Pipe Stick-up (m)	Groundwater Level			Vertical Hydraulic Gradient ⁽³⁾ (+) = Upward (-) = Downward
	Northing	Easting			(m BTOC)	(m BGS)	(m AMSL)						(m BGS) ⁽²⁾	(m BTOC)	(m AMSL)	
BH/MW05-20	4806644	525946	3-Jul-20	9:49 AM	6.31	5.39	352.27	3.05		357.77	356.85	0.92	2.63	3.55	354.22	
			17-Jul-20	9:58 AM									2.70	3.62	354.15	
			12-Aug-20	10:36 AM									2.74	3.66	354.11	
			8-Oct-20	2:27 PM									2.93	3.85	353.92	
			9-Apr-21	3:32 PM									2.83	3.75	354.02	
			6-May-21	12:40 PM									2.86	3.78	353.99	
			20-Apr-23	1:42 PM									2.84	3.76	354.01	
			18-Jul-24	1:42 PM									2.70	3.62	354.15	
BH/MW06-20(S)	4806747	525865	3-Jul-20	10:50 AM	4.45	3.66	351.99	3.05		355.65	354.86	0.79	0.71	1.50	354.15	
			17-Jul-20	9:51 AM									0.77	1.56	354.09	
			12-Aug-20	10:20 AM									0.81	1.60	354.05	
			8-Oct-20	2:36 PM									0.99	1.78	353.87	
			9-Apr-21	3:32 PM									0.75	1.54	354.11	
			6-May-21	12:48 PM									0.81	1.60	354.05	
			20-Apr-23	1:13 PM									0.67	1.46	354.19	
			18-Jul-24	12:22 PM									0.41	1.20	354.45	
BH/MW06-20(D)	4806746	525864	3-Jul-20	10:54 AM	7.84	7.01	348.66	3.05	3.35	355.67	354.84	0.83	0.68	1.51	354.16	0.003
			17-Jul-20	9:53 AM									0.73	1.56	354.11	0.006
			12-Aug-20	10:22 AM									0.77	1.60	354.07	0.006
			8-Oct-20	2:38 PM									0.97	1.80	353.87	0.000
			9-Apr-21	3:35 PM									0.75	1.58	354.09	-0.006
			6-May-21	12:50 PM									0.79	1.62	354.05	0.000
			20-Apr-23	1:07 PM									0.70	1.53	354.14	-0.015
			18-Jul-24	12:39 PM									0.47	1.30	354.37	-0.024
BH/MW07-20	4806869	526101	3-Jul-20	10:35 AM	6.09	5.15	357.52	3.05		362.67	361.73	0.94	DRY to 5.15	DRY to 6.09	DRY to 357.52	
			17-Jul-20	-									-	-	-	
			12-Aug-20	11:37 AM									DRY to 5.15	DRY to 6.09	DRY to 357.52	
			8-Oct-20	3:03 PM									DRY to 5.15	DRY to 6.09	DRY to 357.52	
			9-Apr-21	3:27 PM									DRY to 5.15	DRY to 6.09	DRY to 357.52	
			6-May-21	1:18 PM									DRY to 5.15	DRY to 6.09	DRY to 357.52	
			20-Apr-23	12:48 PM									DRY to 5.15	DRY to 6.09	DRY to 357.52	
			18-Jul-24	11:56 AM									DRY to 5.15	DRY to 6.09	DRY to 357.52	

TABLE 2
GROUNDWATER LEVEL DATA - MONITORING WELLS

Well ID	UTM Coordinates		Date	Time	Well Depth			Screen Length (m)	Screen Separation ⁽¹⁾ (m)	Top of Casing Elevation (m AMSL)	Ground Surface Elevation (m AMSL)	Pipe Stick-up (m)	Groundwater Level			Vertical Hydraulic Gradient ⁽³⁾ (+) = Upward (-) = Downward
	Northing	Easting			(m BTOC)	(m BGS)	(m AMSL)						(m BGS) ⁽²⁾	(m BTOC)	(m AMSL)	
BH/MW08-20	4806755	526193	3-Jul-20	10:09 AM	7.00	6.11	354.82	3.05		360.93	360.04	0.89	5.23	6.12	354.81	
			17-Jul-20	10:12 AM									5.39	6.28	354.65	
			12-Aug-20	11:28 AM									5.43	6.32	354.61	
			8-Oct-20	3:12 PM									5.79	6.68	354.25	
			9-Apr-21	3:08 PM									5.35	6.24	354.69	
			6-May-21	1:26 PM									5.46	6.35	354.58	
			20-Apr-23	11:28 AM									5.56	6.45	354.48	
			18-Jul-24	11:47 AM									4.88	5.77	355.16	
BH/MW09-20	4806708	526504	3-Jul-20	1:32 PM	8.03	7.17	350.81	3.05		360.83	359.97	0.86	5.05	5.91	354.92	
			17-Jul-20	11:47 AM									5.11	5.97	354.86	
			12-Aug-20	10:02 AM									5.16	6.02	354.81	
			8-Oct-20	1:23 PM									5.36	6.22	354.61	
			9-Apr-21	3:08 PM									5.35	6.21	354.62	
			6-May-21	11:20 AM									5.38	6.24	354.59	
			20-Apr-23	11:58 AM									5.57	6.43	354.40	
			18-Jul-24	11:21 AM									5.43	6.29	354.54	

Notes:
(1) Distance between the screen mid-point in the deep well and the screen mid-point in the shallow well.
(2) A negative value indicates that the water level measured within the pipe is located above ground surface
(3) Negative and positive values indicate downward and upward gradients, respectively.

m BGS = meters below ground surface
m BTOC = meters below top of casing
DRY = no water level present in the monitoring well
- = measurement not available

TABLE 3
GROUNDWATER LEVEL DATA - DRIVE-POINT PIEZOMETERS

Piezometer ID	UTM Coordinates		Total Depth		Screen Length (m)	Screen Separation ⁽¹⁾ (m)	Pipe Stick-up (m)	Ground Surface Elevation (m AMSL)	Top of Casing Elevation (m AMSL)	Date	Time	Groundwater Level			Surface Water Level		Vertical Hydraulic Gradient ⁽⁴⁾ (+) = Upward (-) = Downward
	Northing	Easting	(m BTOC)	(m BGS)								(m BGS) ⁽²⁾	(m BTOC)	(m AMSL)	(m BTOC) ⁽³⁾	(m AMSL)	
DP1-20(S)	4806615	525700	2.60	1.88	0.42		0.72	358.32	359.04	17-Jul-20 12-Aug-20 8-Oct-20 9-Apr-21 6-May-21 20-Apr-23 18-Jul-24	8:59 AM 10:57 AM 2:00 PM 4:15 PM 12:05 PM 5:09 PM 3:10 PM	1.39 0.20 0.70 -0.21 -0.25 -0.27 -0.29	2.11 0.92 1.42 0.51 0.47 0.45 0.43	356.93 358.12 357.62 358.53 358.57 358.59 358.61	DRY DRY DRY 0.42 0.42 - -	- - - 358.62 358.62 - -	
DP1-20(D)	4806615	525700	3.54	2.74	0.42	0.86	0.80	358.36	359.16	17-Jul-20 12-Aug-20 8-Oct-20 9-Apr-21 6-May-21 20-Apr-23 18-Jul-24	9:01 AM 11:00 AM 2:02 PM 4:19 PM 12:08 PM 5:08 PM 3:01 PM	0.06 0.01 0.67 -0.28 -0.27 -0.30 -0.32	0.86 0.81 1.47 0.52 0.53 0.50 0.48	358.30 358.35 357.69 358.64 358.63 358.66 358.68	DRY DRY DRY 0.42 0.54 0.53 0.49	- - - 358.74 358.62 358.63 358.67	1.00 0.27 0.08 0.13 0.07 0.08 0.08
DP2-20(S)	4806599	525769	2.60	1.69	0.42		0.91	358.30	359.21	17-Jul-20 12-Aug-20 8-Oct-20 9-Apr-21 6-May-21 20-Apr-23 18-Jul-24	9:22 AM 10:45 AM 2:10 PM 4:24 PM 12:20 PM 5:58 PM 2:18 PM	1.12 1.12 0.96 0.33 0.23 -0.12 -0.46	2.03 2.03 1.87 1.24 1.14 0.79 0.45	357.18 357.18 357.34 357.97 358.07 358.42 358.76	0.80 - - 0.50 0.52 0.57 0.57	358.41 - - 358.71 358.69 358.64 358.64	
DP2-20(D)	4806599	525769	3.54	2.45	0.42	0.76	1.09	358.29	359.38	17-Jul-20 12-Aug-20 8-Oct-20 9-Apr-21 6-May-21 20-Apr-23 18-Jul-24	9:24 AM 10:48 AM 2:13 PM 4:27 PM 12:24 PM 6:06 PM 2:09 PM	1.97 1.96 1.92 1.40 1.34 0.49 0.07	3.06 3.05 3.01 2.49 2.43 1.58 1.16	356.32 356.33 356.37 356.89 356.95 357.80 358.22	1.00 0.97 DRY 0.69 0.71 - -	358.38 358.41 - 358.69 358.67 - -	-1.00 -1.00 -1.00 -1.00 -1.00 -0.82 -0.71
DP3-20(S)	4806744	525854	2.60	1.78	0.42		0.82	354.81	355.63	17-Jul-20 12-Aug-20 8-Oct-20 9-Apr-21 6-May-21 20-Apr-23 18-Jul-24	2:00 PM 10:27 AM 2:43 PM 3:39 PM 12:57 PM 4:20 PM 1:10 PM	0.90 0.62 0.85 0.72 0.68 0.56 0.31	1.72 1.44 1.67 1.54 1.50 1.38 1.13	353.91 354.19 353.96 354.09 354.13 354.25 354.50	DRY - DRY DRY DRY DRY DRY	- - - - - - -	
DP3-20(D)	4806744	525854	3.54	2.76	0.42	0.98	0.78	354.86	355.64	17-Jul-20 12-Aug-20 8-Oct-20 9-Apr-21 6-May-21 20-Apr-23 18-Jul-24	2:00 PM 10:30 AM 2:45 PM 3:42 PM 1:01 PM 4:17 PM 1:06 PM	1.19 0.74 0.96 0.74 0.78 0.71 0.54	1.97 1.52 1.74 1.52 1.56 1.49 1.32	353.67 354.12 353.90 354.12 354.08 354.15 354.32	DRY DRY DRY DRY DRY DRY 0.73	- - - - - - 354.92	-0.24 -0.07 -0.06 0.03 -0.05 -0.10 -0.18

TABLE 3
GROUNDWATER LEVEL DATA - DRIVE-POINT PIEZOMETERS

- Notes:**
- (1) Distance between the mid-point of the screened intervals of the shallow and deep piezometer.
 - (2) A negative value indicates that the water level measured within the pipe is located above ground surface
 - (3) A negative value indicates that the surface water level is above the top of the piezometer
 - (4) Vertical hydraulic gradient between the surface water feature substrate and the piezometer screened interval.

m BGS = meters below ground surface
m BTOC = meters below top of casing
DRY = no groundwater or surface water was observed in the piezometer or surface water feature, respectively
FRZN = water frozen in pipe
n/a = measurement not available

TABLE 4 - GROUNDWATER QUALITY RESULTS

Sample Location			BH/MW01-20	BH/MW02-20	BH/MW03-20	BH/MW05-20	BH/MW08-20	BH/MW09-20
Sample Date			14-Jul-20	14-Jul-20	14-Jul-20	14-Jul-20	14-Jul-20	14-Jul-20
Sample ID			WG-60305680-20200714-SB-02	WG-60305680-20200714-SB-01	WG-60305680-20200714-SB-05	WG-60305680-20200714-SB-03	WG-60305680-20200714-SB-04	WG-60305680-20200714-SB-06
Sampling Company			STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC
Laboratory			BV	BV	BV	BV	BV	BV
Laboratory Work Order			C0H6972	C0H6972	C0H6972	C0H6972	C0H6972	C0H6972
Laboratory Sample ID			NCS994	NCS993	NCS997	NCS995	NCS996	NCS998
Sample Type	Units	Ontario SCS						
Well Depth (m BGS)			7.3	6.1	7.0	5.4	6.1	7.2
General Chemistry								
Chloride	mg/L	790 ^A	7.9	3.7	3.9	7.9	22	19
Cyanide (Free)	µg/L	5 ^A	<1	<1	<1	<1	<1	<1
BTEX and Petroleum Hydrocarbons								
PHC F1 (C6-C10 range)	µg/L	^A _{s7}	<25	-	<25	<25	-	<25
PHC F1 (C6-C10 range) minus BTEX	µg/L	420 ^A _{s7}	<25	-	<25	<25	-	<25
PHC F2 (>C10-C16 range)	µg/L	150 ^A _{s15}	100	-	<100	<100	-	<100
PHC F3 (>C16-C34 range)	µg/L	500 ^A _{s8}	<200	-	510 ^A	<200	-	<200
PHC F4 (>C34-C50 range)	µg/L	500 ^A _{s10}	<200	-	<200	<200	-	<200
Chromatogram to baseline at C50	none	n/v	YES	-	YES	YES	-	YES
Metals								
Antimony	mg/L	0.0015 ^A	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic	mg/L	0.013 ^A	0.0013	<0.0010	0.0040	<0.0010	<0.0010	0.0012
Barium	mg/L	0.61 ^A	0.15	0.15	0.45	0.030	0.11	0.22
Beryllium	mg/L	0.0005 ^A	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Boron	mg/L	1.7 ^A	0.033	0.14	0.051	<0.010	<0.010	0.016
Cadmium	mg/L	0.0005 ^A	<0.000090	<0.000090	<0.000090	<0.000090	<0.000090	<0.000090
Chromium	mg/L	0.011 ^A	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Chromium (Hexavalent)	mg/L	0.025 ^A	<0.00050	0.00053	<0.00050	0.0013	0.00060	<0.00050
Cobalt	mg/L	0.0038 ^A	0.0010	<0.00050	0.0015	<0.00050	0.00059	0.0011
Copper	mg/L	0.005 ^A	0.0078 ^A	0.0015	0.0011	<0.00090	0.0011	<0.00090
Lead	mg/L	0.0019 ^A	0.0042 ^A	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Mercury	mg/L	0.0001 ^A	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Molybdenum	mg/L	0.023 ^A	<0.00050	0.0049	0.0020	0.0013	<0.00050	0.00096
Nickel	mg/L	0.014 ^A	0.0024	0.0011	0.0041	0.0013	0.0014	0.0016
Selenium	mg/L	0.005 ^A	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Silver	mg/L	0.0003 ^A	<0.000090	<0.000090	<0.000090	<0.000090	<0.000090	<0.000090
Sodium	mg/L	490 ^A	12	29	14	4.6	13	17
Thallium	mg/L	0.0005 ^A	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Uranium	mg/L	0.0089 ^A	0.0062	0.0048	0.0034	0.00052	0.0015	0.0024
Vanadium	mg/L	0.0039 ^A	0.0021	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	0.16 ^A	0.011	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Volatile Organic Compounds								
Acetone	µg/L	2,700 ^A	<10	-	<10	<10	-	16
Benzene	µg/L	0.5 ^A	<0.20	-	<0.20	0.20	-	<0.20
Bromodichloromethane	µg/L	2 ^A	<0.50	-	<0.50	<0.50	-	<0.50
Bromoform (Tribromomethane)	µg/L	5 ^A	<1.0	-	<1.0	<1.0	-	<1.0
Bromomethane (Methyl bromide)	µg/L	0.89 ^A	<0.50	-	<0.50	<0.50	-	<0.50
Carbon Tetrachloride (Tetrachloromethane)	µg/L	0.2 ^A	<0.20	-	<0.20	<0.20	-	<0.20
Chlorobenzene (Monochlorobenzene)	µg/L	0.5 ^A	<0.20	-	<0.20	<0.20	-	<0.20
Chloroform (Trichloromethane)	µg/L	2 ^A	<0.20	-	<0.20	<0.20	-	<0.20
Dibromochloromethane	µg/L	2 ^A	<0.50	-	<0.50	<0.50	-	<0.50
Dichlorobenzene, 1,2-	µg/L	0.5 ^A	<0.50	-	<0.50	<0.50	-	<0.50
Dichlorobenzene, 1,3-	µg/L	0.5 ^A	<0.50	-	<0.50	<0.50	-	<0.50
Dichlorobenzene, 1,4-	µg/L	0.5 ^A	<0.50	-	<0.50	<0.50	-	<0.50
Dichlorodifluoromethane (Freon 12)	µg/L	590 ^A	<1.0	-	<1.0	<1.0	-	<1.0
Dichloroethane, 1,1-	µg/L	0.5 ^A	<0.20	-	<0.20	<0.20	-	<0.20
Dichloroethane, 1,2-	µg/L	0.5 ^A	<0.50	-	<0.50	<0.50	-	<0.50
Dichloroethene, 1,1-	µg/L	0.5 ^A	<0.20	-	<0.20	<0.20	-	<0.20
Dichloroethene, cis-1,2-	µg/L	1.6 ^A	<0.50	-	<0.50	<0.50	-	<0.50
Dichloroethene, trans-1,2-	µg/L	1.6 ^A	<0.50	-	<0.50	<0.50	-	<0.50
Dichloropropane, 1,2-	µg/L	0.5 ^A	<0.20	-	<0.20	<0.20	-	<0.20
Dichloropropene, 1,3- (sum of isomers cis + trans)	µg/L	0.5 ^A _{s11}	<0.50	-	<0.50	<0.50	-	<0.50
Dichloropropene, cis-1,3-	µg/L	^A _{s11}	<0.30	-	<0.30	<0.30	-	<0.30
Dichloropropene, trans-1,3-	µg/L	^A _{s11}	<0.40	-	<0.40	<0.40	-	<0.40
Ethylbenzene	µg/L	0.5 ^A	<0.20	-	<0.20	<0.20	-	<0.20
Ethylene Dibromide (Dibromoethane, 1,2-)	µg/L	0.2 ^A	<0.20	-	<0.20	<0.20	-	<0.20
Hexane (n-Hexane)	µg/L	5 ^A	<1.0	-	<1.0	<1.0	-	<1.0
Methyl Ethyl Ketone (MEK) (2-Butanone)	µg/L	400 ^A	<10	-	<10	<10	-	<10
Methyl Isobutyl Ketone (MIBK)	µg/L	640 ^A	<5.0	-	<5.0	<5.0	-	<5.0
Methyl tert-butyl ether (MTBE)	µg/L	15 ^A	<0.50	-	<0.50	<0.50	-	<0.50
Methylene Chloride (Dichloromethane)	µg/L	5 ^A	<2.0	-	<2.0	<2.0	-	<2.0
Styrene	µg/L	0.5 ^A	<0.50	-	<0.50	<0.50	-	<0.50
Tetrachloroethane, 1,1,1,2-	µg/L	1.1 ^A	<0.50	-	<0.50	<0.50	-	<0.50
Tetrachloroethane, 1,1,2,2-	µg/L	0.5 ^A	<0.50	-	<0.50	<0.50	-	<0.50
Tetrachloroethene (PCE)	µg/L	0.5 ^A	<0.20	-	<0.20	<0.20	-	<0.20
Toluene	µg/L	0.8 ^A	0.32	-	0.27	0.40	-	0.37
Trichloroethane, 1,1,1-	µg/L	0.5 ^A	<0.20	-	<0.20	<0.20	-	<0.20
Trichloroethane, 1,1,2-	µg/L	0.5 ^A	<0.50	-	<0.50	<0.50	-	<0.50
Trichloroethene (TCE)	µg/L	0.5 ^A	<0.20	-	<0.20	<0.20	-	<0.20
Trichlorofluoromethane (Freon 11)	µg/L	150 ^A	<0.50	-	<0.50	<0.50	-	<0.50
Vinyl Chloride	µg/L	0.5 ^A	<0.20	-	<0.20	<0.20	-	<0.20
Xylene, m & p-	µg/L	^A _{s1}	0.22	-	0.20	0.25	-	0.26
Xylene, o-	µg/L	^A _{s1}	<0.20	-	<0.20	<0.20	-	<0.20
Xylenes, Total	µg/L	72 ^A _{s1}	0.22	-	0.20	0.25	-	0.26

Notes:	
Ontario SCS	Soil, Ground Water and Sediment Standards for Use under Part XV.I of the Environmental Protection Act (MOE, 2011) Site Condition Standards (SCS)
^A	Table 1 - All Types of Property Uses
6.5 ^A	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
<0.50	Laboratory reporting limit was greater than the applicable standard.
<0.03	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.
-	Parameter not analyzed / not available.
s1	Standard is applicable to total xylenes, and m & p-xylenes and o-xylenes should be summed for comparison.
s7	Standard is applicable to PHC in the F1 range minus BTEX.
s8	Standard is applicable to PHC in the F3 range, minus PAHs (other than naphthalene). If PAHs were not analyzed, the standard is applied to F3.
^A _{s10}	If baseline is not reached during F4 analysis, then gravimetric analysis is to be performed, and the standard is applied to the higher of the two results.
^C _{s10}	Use of the BC AWQG of 30 ug/L for the maximum acceptable concentration of the sum of all xylene isomers has been noted by MECF to be an acceptable approach.
^A _{s11}	Standard is applicable to 1,3-Dichloropropene, and the individual isomers (cis + trans) should be added for comparison.
^A _{s15}	Standard is applicable to PHC in the F2 range minus naphthalene. If naphthalene was not analyzed, the standard is applied to F2.

TABLE 5
INFILTRATION TESTING RESULTS

Testing Location ID	UTM Coordinates		Horizontal Hydraulic Conductivity (m/s)	Vertical Hydraulic Conductivity ⁽²⁾		Infiltration Rate ⁽¹⁾ (mm/hr)	Pit Depth (m BGS)	Screened Interval (m BGS)	Soil Substrate Tested
	Northing	Easting		(cm/s)	(m/s)				
Guelph Permeameter Testing (Surficial Deposits)									
GP1	4805274	525967	-	-	-	nm	0.69	-	Clayey SILT
GP2	4806520	526161	-	2.3E-04	2.3E-06	58	0.69	-	FILL (silt, some fine sand, trace fine gravel)
GP3	4806606	526374	-	-	-	nm	0.70	-	Clayey SILT
GP4	4806538	525751	-	-	-	nm	0.63	-	Clayey SILT
GP5	4806645	525947	-	-	-	nm	0.65	-	Clayey SILT
GP6	4806748	525867	-	4.7E-04	4.7E-06	70	0.71	-	Sandy SILT, some sand
GP7	4806870	525100	-	-	-	nm	0.72	-	Clayey SILT TILL
GP8	4806754	526192	-	-	-	nm	0.70	-	Clayey SILT TILL
GP9	4806707	526505	-	-	-	nm	0.71	-	Clayey SILT TILL
In-situ Hydraulic Response Testing (Deeper Overburden)									
BH/MW01-20	4806276	525966	2.4E-05	-	2.4E-06	58	-	4.2 - 7.2	CLAY TILL / Sandy SILT
BH/MW02-20	4806519	526162	8.2E-08	-	8.2E-09	13	-	3.1 - 6.1	Clayey SILT TILL / CLAY TILL
BH/MW03-20	4806606	526375	6.0E-08	-	6.0E-09	12	-	4.0 - 7.0	CLAY / Clayey SILT
BH/MW04-20(S)	4806536	525749	5.8E-09	-	5.8E-10	6	-	1.5 - 4.5	Clayey SILT TILL / CLAY TILL
BH/MW04-20(D)	4806536	525750	8.0E-10	-	8.0E-11	3	-	6.1 - 9.1	CLAY TILL
BH/MW06-20(S)	4806747	525865	1.7E-05	-	1.7E-06	53	-	0.6 - 3.6	Sandy SILT / SAND with SILT / Silty Fine SAND
BH/MW06-20(D)	4806746	525864	9.3E-05	-	9.3E-06	84	-	4.0 - 7.0	SAND with SILT
BH/MW08-20	4806755	526193	5.1E-07	-	5.1E-08	21	-	3.0 - 6.0	Clayey SILT TILL with sand seams
BH/MW09-20	4806708	526504	1.3E-07	-	1.3E-08	14	-	4.1 - 7.1	CLAY TILL with sand seams
GEOMEAN - AQUIFER 1 (Silty Sand, Sandy Silt, and Sand) =					2.8E-06	61			
GEOMEAN - AQUITARD 1 (Silt, Clay, Clayey Silt to Silty Clay Till) =					3.4E-09	10			

Notes:

(1) Infiltration rate calculated based on established relationship between vertical hydraulic conductivity and infiltration rate presented in *Credit Valley Conservation and Toronto and Region Conservation (2010) Low Impact Stormwater Management Planning and Design Guideline - Version 1.0*.

(2) Vertical hydraulic conductivities for deeper overburden deposits assumed to be one order of magnitude lower than in-situ measured horizontal hydraulic conductivities

nm = No measurable infiltration recorded over duration of test.

TABLE 6: MONTHLY WATER BALANCE CALCULATIONS SUMMARY
TUA and Non-TUA Lands

Runoff Directed North Towards Wetlands

PRE-DEVELOPMENT						
PRE-DEVELOPMENT - CATCHMENTS 100, 101 and 102 (FIGURE 14)					Site Area (ha) =	20.04
Pre-Development Infiltration (INF)	23,378	m ³ /yr	117	mm/yr	0.7	L/s
Pre-Development Runoff (R)	48,473	m ³ /yr	242	mm/yr	1.5	L/s
Pre-Development Evapotranspiration (ET)	112,299	m ³ /yr	560	mm/yr	3.6	L/s
Total = INF + R + ET	184,151	m ³ /yr	919	mm/yr	5.8	L/s
Precipitation	184,151	m ³ /yr	919	mm/yr	5.8	L/s

Notes:

[1] Refer to Table G-1 (Appendix G) for detailed calculations

[2] Refer to Figure 14 for delineation of catchments and sub-areas.

POST-DEVELOPMENT - No Infiltration Augmentation Measures (TUA and Non-TUA Lands)						
POST-DEVELOPMENT - LANDS LOCATED WITHIN THE TOWNSHIP URBAN AREA (TUA) - CATCHMENTS 200, 201 and 202 (FIGURE 15)				Site Area (ha) =		
Post-Development Infiltration (INF)	9,612	m ³ /yr	59	mm/yr	0.3	L/s
Post-Development Runoff (R)	101,368	m ³ /yr	625	mm/yr	3.2	L/s
Post-Development Evapotranspiration (ET)	38,025	m ³ /yr	234	mm/yr	1.2	L/s
Total = INF + R + ET	149,005	m ³ /yr	919	mm/yr	4.7	L/s
Precipitation	149,005	m ³ /yr	919	mm/yr	4.7	L/s

Notes:

[1] Refer to Table G-3A (Appendix G) for detailed calculations

[2] Refer to Figure 15 for delineation of catchments and sub-areas.

POST-DEVELOPMENT - LANDS LOCATED OUTSIDE OF THE TOWNSHIP URBAN AREA (Non-TUA) - CATCHMENTS 203, 205 and 206 (FIGURE 15)				Site Area (ha) =		
Post-Development Infiltration (INF)	13,256	m ³ /yr	103	mm/yr	0.4	L/s
Post-Development Runoff (R)	35,174	m ³ /yr	273	mm/yr	1.1	L/s
Post-Development Evapotranspiration (ET)	69,900	m ³ /yr	543	mm/yr	2.2	L/s
Total = INF + R + ET	118,331	m ³ /yr	919	mm/yr	3.7	L/s
Precipitation	118,331	m ³ /yr	919	mm/yr	3.7	L/s

Notes:

[1] Refer to Table G-3B (Appendix G) for detailed calculations

[2] Refer to Figure 15 for delineation of catchments and sub-areas.

RUNOFF - NO AUGMENTATION MEASURES		
Pre-Development	48,473	m ³ /yr
Post-Development	136,542	m ³ /yr
Pre- to Post Surplus (+) / Deficit (-)	88,069	m ³ /yr

TUA and Non-TUA Lands Combined	from	from	
	TUA	Non-TUA	
	= 101,368	+ 35,174	m ³ /yr

INFILTRATION - NO AUGMENTATION MEASURES		
Pre-Development	23,378	m ³ /yr
Post-Development	22,869	m ³ /yr
Pre- to Post Surplus (+) / Deficit (-)	-509	m ³ /yr

TUA and Non-TUA Lands Combined	from	from	
	TUA	Non-TUA	
	= 9,612	+ 13,256	m ³ /yr

TABLE 6: MONTHLY WATER BALANCE CALCULATIONS SUMMARY
TUA and Non-TUA Lands

Runoff Directed North Towards Wetlands

POST-DEVELOPMENT - With Infiltration Augmentation Measures

INFILTRATION MEASURES (LOT-LEVEL GALLERIES + SWMF) PROPOSED - POST-DEVELOPMENT

Added Infiltration from End-of-Pipe SWMF from TUA Lands	71,822	m ³ /yr	443	mm/yr	2.3	L/s
POST-DEVELOPMENT - TUA Lands - CATCHMENTS 200, 201 and 202 - with INFILTRATION AUGMENTATION						Site Area (ha) = 16.22
Post-Development Infiltration (INF)	81,434	m ³ /yr	502	mm/yr	2.6	L/s
Post-Development Runoff (R)	29,546	m ³ /yr	182	mm/yr	0.9	L/s
Post-Development Evapotranspiration (ET)	38,025	m ³ /yr	234	mm/yr	1.2	L/s
Total = INF + R + ET	149,005	m ³ /yr	919	mm/yr	4.7	L/s
Precipitation	149,005	m ³ /yr	919	mm/yr	4.7	L/s

See Table G-3A

Remaining Pervious		Augmented	
= 9,612	+	71,822	m ³ /yr
= 101,368	-	71,822	m ³ /yr

Notes:

[1] Refer to Table G-3A (Appendix G) for detailed calculations

[2] Refer to Figure 15 for proposed locations of infiltration galleries within the TUA lands.

Added Infiltration from End-of-Pipe SWMF (runoff received from Non-TUA Lands)	16,739	m ³ /yr	130	mm/yr	0.5	L/s
POST-DEVELOPMENT - Non-TUA Lands (NO CONSTRUCTION) - CATCHMENTS 203, 205 and 206						Site Area (ha) = 12.88
Post-Development Infiltration (INF)	29,995	m ³ /yr	233	mm/yr	1.0	L/s
Post-Development Runoff (R)	18,435	m ³ /yr	143	mm/yr	0.6	L/s
Post-Development Evapotranspiration (ET)	69,900	m ³ /yr	543	mm/yr	2.2	L/s
Total = INF + R + ET	118,331	m ³ /yr	919	mm/yr	3.7	L/s
Precipitation	118,331	m ³ /yr	919	mm/yr	3.7	L/s

See Table G-3B

Remaining Pervious		Augmented	
= 13,256	+	16,739	m ³ /yr
= 35,174	-	16,739	m ³ /yr

Notes:

[1] Refer to Table G-3B (Appendix G) for detailed calculations

[2] Refer to Figure 15 for delineation of catchments and sub-areas.

RUNOFF - WITH AUGMENTATION

Pre-Development	48,473	m ³ /yr
Post-Development	47,981	m ³ /yr
Pre- to Post Surplus (+) / Deficit (-)	-492	m ³ /yr

TUA and Non-TUA Lands Combined

Increase by -1.0%

from TUA	from Non-TUA	
= 29,546	+	18,435 m ³ /yr

INFILTRATION - WITH AUGMENTATION

Pre-Development	23,378	m ³ /yr
Post-Development	111,429	m ³ /yr
Pre- to Post Surplus (+) / Deficit (-)	88,051	m ³ /yr

TUA and Non-TUA Lands Combined

Increase by 376.6%

from TUA	from Non-TUA	
= 81,434	+	29,995 m ³ /yr

TABLE 7: MONTHLY WATER BALANCE CALCULATIONS SUMMARY
TUA and Non-TUA Lands

Runoff Directed South to Activa Baden Subdivision

PRE-DEVELOPMENT

PRE-DEVELOPMENT - CATCHMENTS 103 and 104					Site Area (ha) =	14.75
Pre-Development Infiltration (INF)	14,898	m ³ /yr	101	mm/yr	0.5	L/s
Pre-Development Runoff (R)	39,782	m ³ /yr	270	mm/yr	1.3	L/s
Pre-Development Evapotranspiration (ET)	80,825	m ³ /yr	548	mm/yr	2.6	L/s
Total = INF + R + ET	135,505	m ³ /yr	919	mm/yr	4.3	L/s
Precipitation	135,505	m ³ /yr	919	mm/yr	4.3	L/s

Notes:

[1] Refer to Table G-2 for detailed calculations

[2] Refer to Figure 14 for delineation of catchments and sub-areas.

POST-DEVELOPMENT - No Infiltration Augmentation Measures (TUA and Non-TUA Lands)

POST-DEVELOPMENT - LANDS LOCATED WITHIN THE TOWNSHIP URBAN AREA (TUA) - CATCHMENT 204 (FIGURE 15)					Site Area (ha) =	1.67
Post-Development Infiltration (INF)	629	m ³ /yr	38	mm/yr	0.0	L/s
Post-Development Runoff (R)	11,107	m ³ /yr	664	mm/yr	0.4	L/s
Post-Development Evapotranspiration (ET)	3,631	m ³ /yr	217	mm/yr	0.1	L/s
Total = INF + R + ET	15,367	m ³ /yr	919	mm/yr	0.5	L/s
Precipitation	15,367	m ³ /yr	919	mm/yr	0.5	L/s

Notes:

[1] Refer to Table G-4A (Appendix G) for detailed calculations

[2] Refer to Figure 15 for delineation of catchments and sub-areas.

POST-DEVELOPMENT - LANDS LOCATED OUTSIDE OF THE TOWNSHIP URBAN AREA (Non-TUA) - CATCHMENT 207 (FIGURE 15)					Site Area (ha) =	4.64
Post-Development Infiltration (INF)	4,358	m ³ /yr	94	mm/yr	0.1	L/s
Post-Development Runoff (R)	13,074	m ³ /yr	282	mm/yr	0.4	L/s
Post-Development Evapotranspiration (ET)	25,161	m ³ /yr	543	mm/yr	0.8	L/s
Total = INF + R + ET	42,593	m ³ /yr	919	mm/yr	1.3	L/s
Precipitation	42,593	m ³ /yr	919	mm/yr	1.3	L/s

Notes:

[1] Refer to Table G-4B (Appendix G) for detailed calculations

[2] Refer to Figure 15 for delineation of catchments and sub-areas.

RUNOFF - NO AUGMENTATION MEASURES		
Pre-Development	39,782	m ³ /yr
Post-Development (TUA + Non-TUA)	24,182	m ³ /yr
Pre- to Post Surplus (+) / Deficit (-)	-15,600	m ³ /yr

TUA and Non-TUA Lands Combined = $\begin{matrix} \text{from} \\ \text{TUA} \end{matrix} 11,107 + \begin{matrix} \text{from} \\ \text{Non-TUA} \end{matrix} 13,074 \text{ m}^3/\text{yr}$

INFILTRATION - NO AUGMENTATION MEASURES		
Pre-Development	14,898	m ³ /yr
Post-Development (TUA + Non-TUA)	4,987	m ³ /yr
Pre- to Post Surplus (+) / Deficit (-)	-9,911	m ³ /yr

TUA and Non-TUA Lands Combined = $\begin{matrix} \text{from} \\ \text{TUA} \end{matrix} 629 + \begin{matrix} \text{from} \\ \text{Non-TUA} \end{matrix} 4,358 \text{ m}^3/\text{yr}$

TABLE 7: MONTHLY WATER BALANCE CALCULATIONS SUMMARY
TUA and Non-TUA Lands

Runoff Directed South to Activa Baden Subdivision

POST-DEVELOPMENT - With Infiltration Augmentation Measures					
INFILTRATION MEASURES (LOT-LEVEL GALLERIES) PROPOSED - POST-DEVELOPMENT					
Added Infiltration from Lot-Level Galleries	823	m ³ /yr	49	mm/yr	0.0 L/s
POST-DEVELOPMENT - TUA Lands - CATCHMENT 204 - with INFILTRATION AUGMENTATION				Site Area (ha) = 1.67	
Post-Development Infiltration (INF)	1,452	m ³ /yr	87	mm/yr	0.0 L/s
Post-Development Runoff (R)	10,284	m ³ /yr	615	mm/yr	0.3 L/s
Post-Development Evapotranspiration (ET)	3,631	m ³ /yr	217	mm/yr	0.1 L/s
Total = INF + R + ET	15,367	m ³ /yr	919	mm/yr	0.5 L/s
Precipitation	15,367	m ³ /yr	919	mm/yr	0.5 L/s

See Table G-4A

	Remaining Pervious		Augmented	
=	629	+	823	m ³ /yr
=	11,107	-	823	m ³ /yr

Notes:

[1] Refer to Stantec (2022) *Functional Servicing and Stormwater Management Report* for detailed calculations.

[2] Refer to Figure 15 for proposed locations of infiltration galleries within the TUA Lands.

POST-DEVELOPMENT - Non-TUA Lands (NO CONSTRUCTION) - CATCHMENT 207				Site Area (ha) = 4.64	
Post-Development Infiltration (INF)	4,358	m ³ /yr	94	mm/yr	0.1 L/s
Post-Development Runoff (R)	13,074	m ³ /yr	282	mm/yr	0.4 L/s
Post-Development Evapotranspiration (ET)	25,161	m ³ /yr	543	mm/yr	0.8 L/s
Total = INF + R + ET	42,593	m ³ /yr	919	mm/yr	1.3 L/s
Precipitation	42,593	m ³ /yr	919	mm/yr	1.3 L/s

Notes:

[1] Refer to Table G-4B (Appendix G) for detailed calculations

[2] Refer to Figure 15 for delineation of catchments and sub-areas.

RUNOFF - WITH AUGMENTATION		
Pre-Development	39,782	m ³ /yr
Post-Development (TUA + Non-TUA)	23,359	m ³ /yr
Pre- to Post Surplus (+) / Deficit (-)	-16,423	m ³ /yr

TUA and Non-TUA Lands Combined

Decrease by -41.3%

	from TUA		from Non-TUA	
=	10,284	+	13,074	m ³ /yr

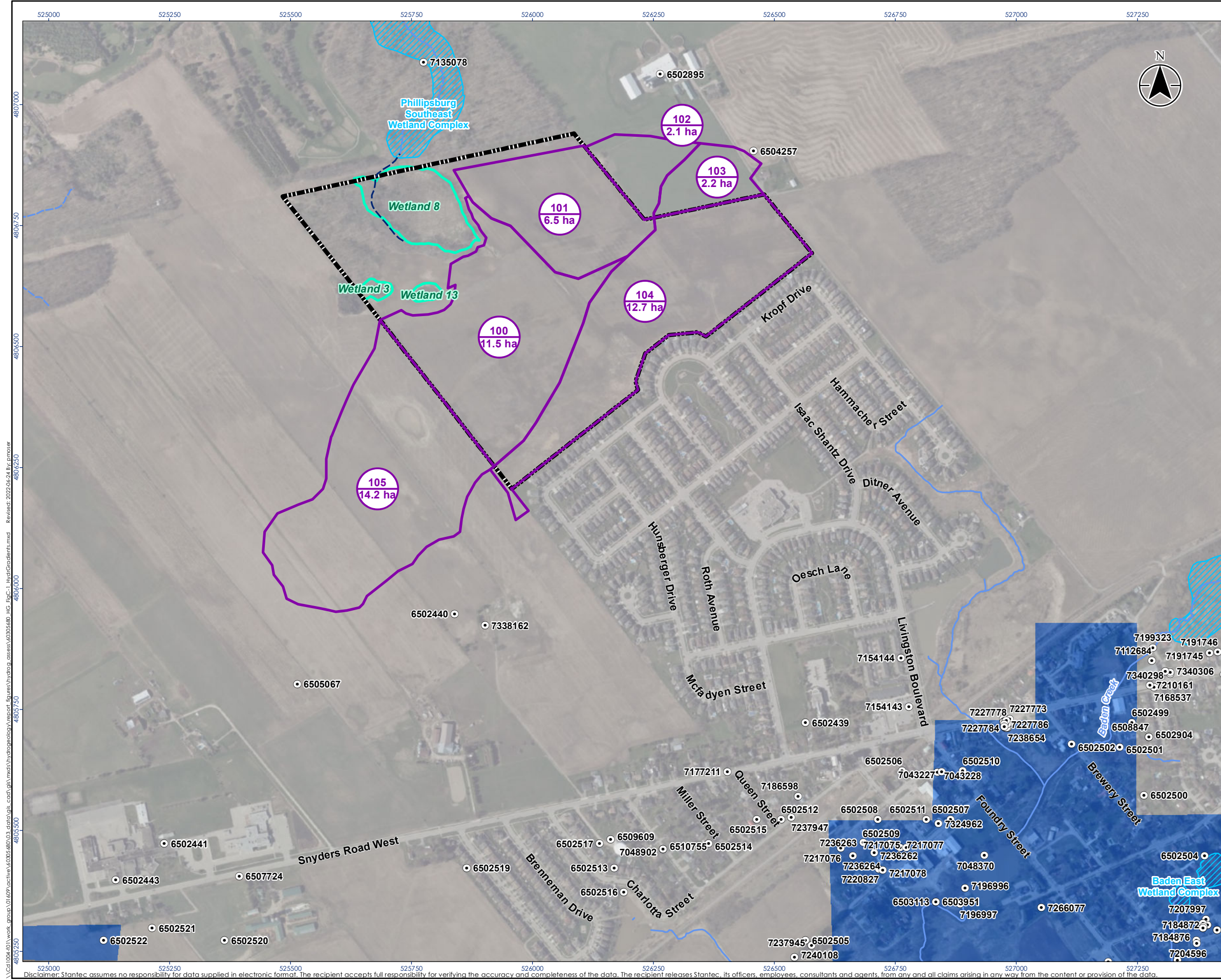
INFILTRATION - WITH AUGMENTATION		
Pre-Development	14,898	m ³ /yr
Post-Development (TUA + Non-TUA)	5,810	m ³ /yr
Pre- to Post Surplus (+) / Deficit (-)	-9,088	m ³ /yr

TUA and Non-TUA Lands Combined

Decrease by -61.0%

	from TUA		from Non-TUA	
=	1,452	+	4,358	m ³ /yr

Appendix C Regional Vertical Hydraulic Gradient and Average Annual Recharge Mapping (GRCA, 2021)

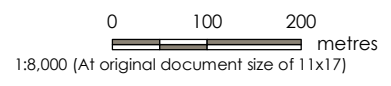


Legend

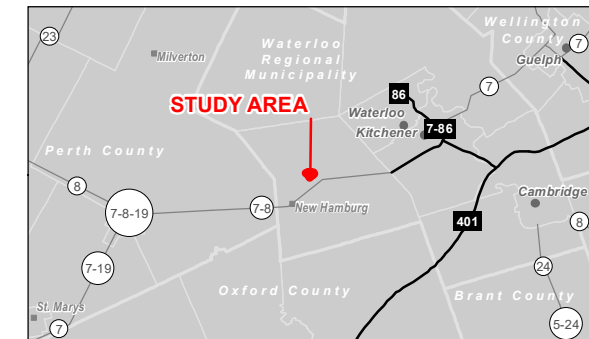
- Site Boundary
- MECP Water Well Record
- Stormwater Catchment (Existing Conditions)
- Watercourse - Permanent
- Watercourse - Intermittent (LIO)
- Intermittent Watercourse (WSP) (Approximate)
- Wetland Extent (WSP/GRCA, 2021)
- Wetland - Evaluated (Other)

Hydraulic Gradient (GRCA)

- Upward
- Downward



- 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, 2020.
 3. Orthoimagery © First Base Solutions, 2021. Imagery Date, 2020.
 4. Contains Information made available under Grand River Conservation Authority's Open Data Licence v2.0.



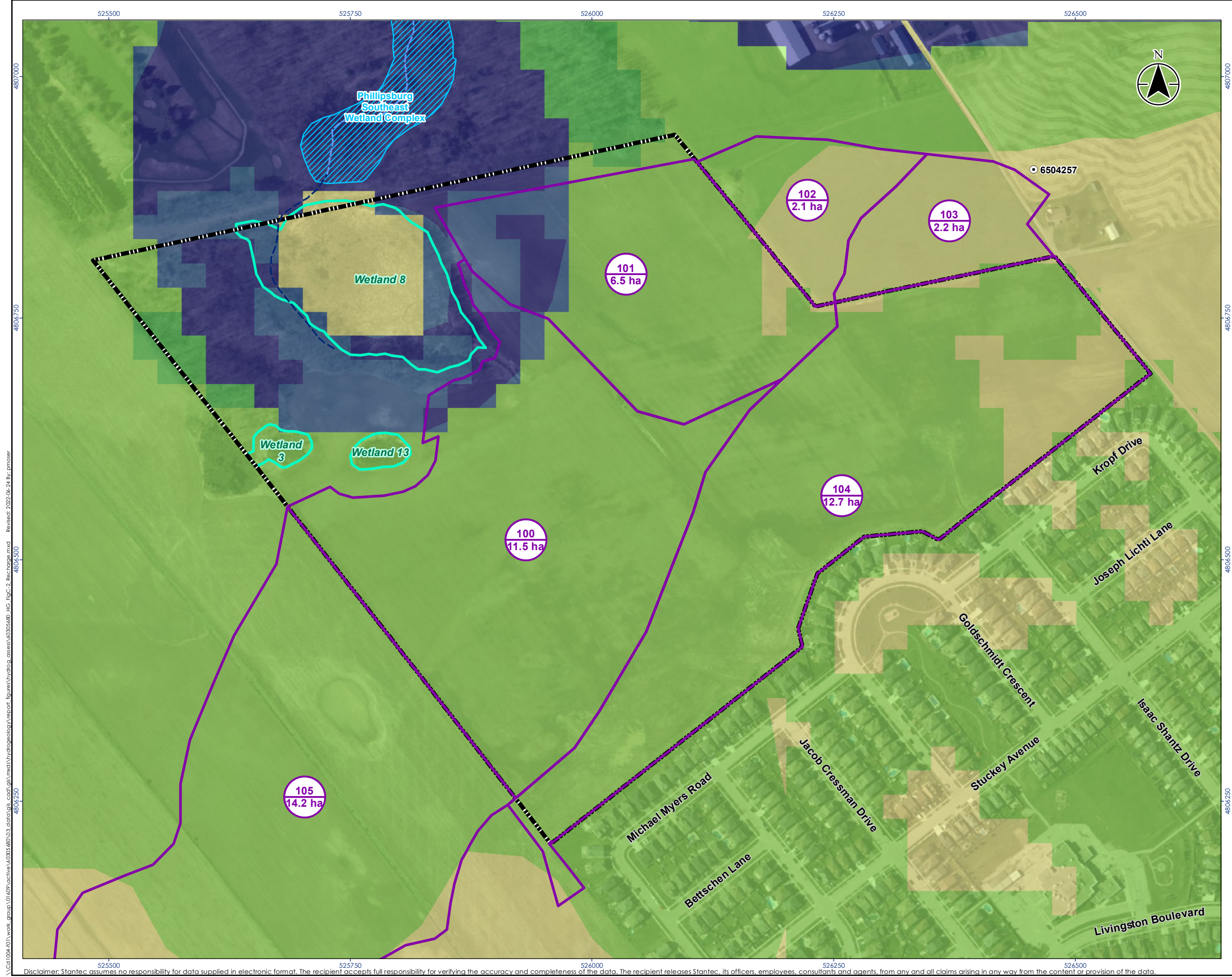
Project Location: Baden, ON
60305680 REVA
Prepared by PRM on 2022-06-24
Technical Review by GW on 2022-06-24

Client/Project: ACTIVA HOLDINGS INC.
ACTIVA BADEN NORTH SUBDIVISION
HYDROGEOLOGICAL ASSESSMENT

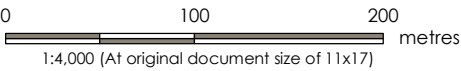
Figure No.: C-1
Title: Vertical Hydraulic Gradients

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Revised: 2022-06-24 by: pmcaser

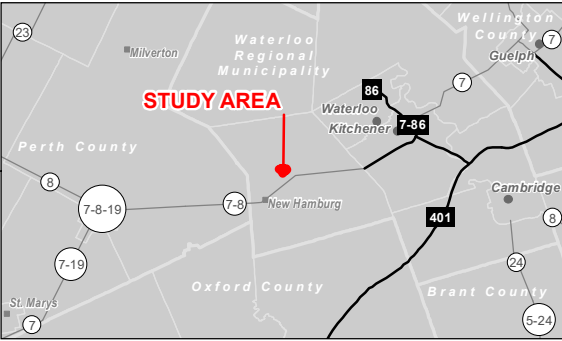
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- Legend
- Site Boundary
 - MECP Water Well Record
 - Stormwater Catchment (Existing Conditions)
 - Watercourse - Intermittent (LIO)
 - Intermittent Watercourse (WSP) (Approximate)
 - Wetland Extent (WSP/GRCA, 2021)
 - Wetland - Evaluated (Other)
- Average Annual Recharge (mm/year) (GRCA)**
- < 50 mm/year
 - 50 - 100
 - 100 - 200
 - 300 - 400
 - > 400



- 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, 2020.
 3. Orthoimagery © First Base Solutions, 2021. Imagery Date, 2020.
 4. Contains Information made available under Grand River Conservation Authority's Open Data Licence v2.0.



Project Location
Baden, ON

60305680 REVA
Prepared by PRM on 2022-06-24
Technical Review by GW on 2022-06-24

Client/Project
ACTIVA HOLDINGS INC.
ACTIVA BADEN NORTH SUBDIVISION
HYDROGEOLOGICAL ASSESSMENT

Figure No.
C-2

Title
Annual Average Recharge

Appendix D Borehole Logs

CLIENT Activa Holdings Inc.

 PROJECT No. 60305680

 LOCATION Brubacher Street, Baden, Ontario

DATUM _____

 DATES: BORING June 18, 2020

 WATER LEVEL May 6, 2021

TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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- Field Vane Test, kPa
 ■ Remoulded Vane Test, kPa
 △ Pocket Penetrometer Test, kPa

CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 18, 2020 WATER LEVEL May 6, 2021 TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
						TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	WATER CONTENT & ATTERBERG LIMITS										
										50 100 150 200 10 20 30 40 50 60 70 80 90 100										
7	352.1				23															
	351.3				24															
8		Compact, greybrown, SAND with SILT (SP-SM) - saturated			25															
	350.7				26	SS	10	510 610	12	●										
9		Borehole terminated at 8.2 m BGS. 50 mm diameter PVC monitoring well with 3.1 m screen between 4.6 and 7.6 m BGS. Native cave to 7.3 m BGS. Sand pack to 4.0 m BGS. Bentonite to 0.3 m BGS. Concrete and stick-up protective casing from 0.3 m BGS. MECP Well Tag # A291235			27															
					28															
					29															
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10					33															
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13					43															
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☐ Field Vane Test, kPa
☒ Remoulded Vane Test, kPa
☐ Pocket Penetrometer Test, kPa

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CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 15, 2020 WATER LEVEL May 6, 2021 TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL										
						TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	50 100 150 200																				
											WATER CONTENT & ATTERBERG LIMITS DYNAMIC CONE PENETRATION TEST, BLOWS/0.3m STANDARD PENETRATION TEST, BLOWS/0.3m										W _p W W _L									
0	356.9	Field Grasses			0																									
1		Greybrown, clayey silt FILL - trace sand, trace to some organics - APL - topsoil inclusions			1	SS	1	360 / 610	4																					
					2																									
					3																									
					4	SS	2	25 / 610	2																					
2	355.3	Firm to stiff, greybrown, CLAY (CL) - silty, some sand - WTPL			5																									
3	354.6	Stiff to very stiff, greybrown, CLAY (CL) - silty - WTPL to APL			6	SS	3	430 / 610	4																					
					7																									
					8																									
					9	SS	4	460 / 610	6																					
4					10																									
					11	SS	5	510 / 610	11																					
					12																									
					13																									
5	352.3	Stiff to very stiff, greybrown, CLAYEY SILT (CL-ML) - WTPL to APL - layers/seams of silty sand, wet to saturated, dilatant			15																									
					16	SS	6	510 / 610	10																					
					17																									
					18																									
6					19																									
					20																									
					21	SS	7	510 / 610	26																					
					22																									
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- Field Vane Test, kPa
 ■ Remoulded Vane Test, kPa
 △ Pocket Penetrometer Test, kPa

CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 15, 2020 WATER LEVEL May 6, 2021 TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
						TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)											
7	350.0				23															
	349.3				24															
8	348.6	Very stiff, greybrown, CLAY (CL) TILL - silty, trace sand and gravel - APL - layers of sandy silt, wet			25															
					26	SS	8	510 / 610	15											
					27															
9		Borehole terminated at 8.2 m BGS. Upon completion water at ground surface.			28															
		50 mm diameter PVC monitoring well with 3.1 m screen between 4.6 and 7.6 m BGS. Sand pack to 4.0 m BGS. Bentonite to 0.3 m BGS. Concrete and stick-up protective casing from 0.3 m BGS. MECP Well Tag # A291230			29															
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☐ Field Vane Test, kPa
☒ Remoulded Vane Test, kPa
☐ Pocket Penetrometer Test, kPa

CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 17, 2020 WATER LEVEL May 6, 2021 TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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- Field Vane Test, kPa
- Remoulded Vane Test, kPa
- △ Pocket Penetrometer Test, kPa

CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 17, 2020 WATER LEVEL May 6, 2021 TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
						TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	WATER CONTENT & ATTERBERG LIMITS DYNAMIC CONE PENETRATION TEST, BLOWS/0.3m STANDARD PENETRATION TEST, BLOWS/0.3m										
7	352.8				23	SS	10	510 / 610	16	50 100 150 200 W_p W W_L 10 20 30 40 50 60 70 80 90 100										10 20 30 40 50 60 70 80 90 100
24																				
25																				
26	SS				11	510 / 610	14													
27																				
28																				
29	SS				12	510 / 610	16													
30																				
31																				
32	350.0	Borehole terminated at 9.8 m BGS. 50 mm diameter PVC monitoring well with 3.1 m screen between 6.1 and 9.1 m BGS. Sand pack to 5.5 m BGS. Bentonite to 0.3 m BGS. Concrete and stick-up protective casing from 0.3 m BGS. MECP Well Tag # A291233			33															
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☐ Field Vane Test, kPa
☒ Remoulded Vane Test, kPa
 Pocket Penetrometer Test, kPa

CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 17, 2020 WATER LEVEL May 6, 2021 TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
						TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	WATER CONTENT & ATTERBERG LIMITS DYNAMIC CONE PENETRATION TEST, BLOWS/0.3m STANDARD PENETRATION TEST, BLOWS/0.3m										
0	359.7	Agricultural Field			0					50 100 150 200 W_p W W_L										
		Dark brown to greybrown, clayey silt (TOPSOIL) - some sand, trace organics - DTPL to APL - topsoil inclusions			1															
1	358.6	Very stiff to hard, mottled greybrown, CLAYEY SILT (CL-ML) TILL - trace sand and gravel - DTPL - trace sand seams, wet			2															
2					3															
					4															
					5															
					6															
					7															
	357.4	Hard to very stiff, greybrown, CLAY (CL) TILL - silty, trace sand and gravel - DTPL to APL			8															
3					9															
					10															
					11															
					12															
					13															
4					14															
					15															
	355.1	Borehole terminated at 4.6 m BGS. 50 mm diameter PVC monitoring well with 3.1 m screen between 1.5 and 4.6 m BGS. Sand pack to 1.2 m BGS. Bentonite to 0.3 m BGS. Concrete and stick-up protective casing from 0.3 m BGS. MECP Well Tag # A291234			16															
5					17															
					18															
					19															
					20															
6					21															
					22															

☐ Field Vane Test, kPa
☒ Remoulded Vane Test, kPa
☐ Pocket Penetrometer Test, kPa

CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 18, 2020 WATER LEVEL May 6, 2021 TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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- Field Vane Test, kPa
 ■ Remoulded Vane Test, kPa
 △ Pocket Penetrometer Test, kPa

CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 18, 2020 WATER LEVEL May 6, 2021 TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)		REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
						TYPE	NUMBER	RECOVERY (mm) / TCR(%) / SCR(%)	N-VALUE OR RQD(%)	50	100	
	349.9											
7		protective casing from 0.3 m BGS. MECP Well Tag # A291237			23							
		*SPT N value affected by heave and considered not representative.			24							
					25							
8					26							
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☐ Field Vane Test, kPa
☒ Remoulded Vane Test, kPa
☐ Pocket Penetrometer Test, kPa

CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 17, 2020 WATER LEVEL May 6, 2021 TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
						TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	50 100 150 200											
										WATER CONTENT & ATTERBERG LIMITS DYNAMIC CONE PENETRATION TEST, BLOWS/0.3m STANDARD PENETRATION TEST, BLOWS/0.3m											
										10 20 30 40 50 60 70 80 90 100											
0	354.8	Field Grasses			0																
	354.6	Dark brown, silt (TOPSOIL) - some sand, trace organics - wet			1	SS	1	380 610	2												
	354.1	Very loose, mottled greybrown, SANDY SILT (ML) - some clay - wet			2																
1		Very loose, greybrown, SAND with SILT (SP-SM) - wet to saturated - saturated at 1.1 m BGS			3	SS	2	360 610	0												
					4																
					5																
2	352.9				6	SS	3	480 610	2												
		Very loose to loose, greybrown, SILTY FINE SAND (SM) - saturated			7																
					8																
					9	SS	4	410 610	8												
3	351.8				10																
		Loose to compact, greybrown, SAND with SILT (SP-SM) - saturated			11	SS	5	410 610	9												
					12																
4		- trace gravel			13																
					14	SS	6	250 610	8												
					15																
5					16	SS	7	410 610	11												
					17																
					18																
					19																
6					20																
					21	SS	8	410 610	13												
					22																
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- ☐ Field Vane Test, kPa
☒ Remoulded Vane Test, kPa
 Pocket Penetrometer Test, kPa

CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 17, 2020 WATER LEVEL May 6, 2021 TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)		REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
						TYPE	NUMBER	RECOVERY (mm) / TCR(%) / SCR(%)	N-VALUE OR RQD(%)	50	100	
	347.9											
7					23							
					24							
					25							
8					26	SS	9	460 / 610	12			
	346.6				27							
		Borehole terminated at 8.2 m BGS. 50 mm diameter PVC monitoring well with 3.1 m screen between 4.4 and 7.5 m BGS. Sand cave / sand pack to 3.8 m BGS. Bentonite to 0.3 m BGS. Concrete and stick-up protective casing from 0.3 m BGS. MECP Well Tag # A291238			28							
					29							
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☐ Field Vane Test, kPa
☒ Remoulded Vane Test, kPa
☐ Pocket Penetrometer Test, kPa

CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 16, 2020 WATER LEVEL May 6, 2021 TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
						TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	50 100 150 200																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
											WATER CONTENT & ATTERBERG LIMITS DYNAMIC CONE PENETRATION TEST, BLOWS/0.3m STANDARD PENETRATION TEST, BLOWS/0.3m										W _p W W _L																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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- Field Vane Test, kPa
 ■ Remoulded Vane Test, kPa
 △ Pocket Penetrometer Test, kPa

CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 16, 2020 WATER LEVEL May 6, 2021 TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)		REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
						TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	50	100	
	354.8											
7		Borehole terminated at 6.7 m BGS. Bentonite seal between 5.2 and 6.7 m BGS. 50 mm diameter PVC monitoring well with 3.1 m screen between 2.1 and 5.2 m BGS. Sand pack to 1.8 m BGS. Bentonite to 0.3 m BGS. Concrete and stick-up protective casing from 0.3 m BGS. MECP Well Tag # A291232			23							
					24							
					25							
					26							
8					27							
					28							
					29							
9					30							
					31							
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				40								
				41								
				42								
13				43								
				44								
				45								

☐ Field Vane Test, kPa
☒ Remoulded Vane Test, kPa
☐ Pocket Penetrometer Test, kPa

[illegible]

CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 16, 2020 WATER LEVEL May 6, 2021 TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
						TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	WATER CONTENT & ATTERBERG LIMITS											
										50 100 150 200 W _p W W _L DYNAMIC CONE PENETRATION TEST, BLOWS/0.3m ▼ STANDARD PENETRATION TEST, BLOWS/0.3m ●											
										10	20	30	40	50	60	70	80	90	100		
7	353.1	50 mm diameter PVC monitoring well with 3.1 m screen between 3.1 and 6.1 m BGS. Sand pack to 2.7 m BGS. Bentonite to 0.3 m BGS. Concrete and stick-up protective casing from 0.3 m BGS. MECP Well Tag # A291231			23																
						24															
						25															
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☐ Field Vane Test, kPa
☒ Remoulded Vane Test, kPa
☐ Pocket Penetrometer Test, kPa

CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 15, 2020 WATER LEVEL May 6, 2021 TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%)	
						TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	50 100 150 200											
										WATER CONTENT & ATTERBERG LIMITS											
										DYNAMIC CONE PENETRATION TEST, BLOWS/0.3m										▼	
										STANDARD PENETRATION TEST, BLOWS/0.3m										●	
										10 20 30 40 50 60 70 80 90 100										○	
																				△	
0	360.0	Agricultural Field			0																
		Stiff to hard, greybrown, CLAYEY SILT (CL-ML) TILL			1	SS	1	360 / 610	7												
		- some sand, trace gravel			2																
		- DTPL to APL			3																
		- trace organics in upper 150 mm			4	SS	2	460 / 610	21												
1	358.4				5																
		Hard, greybrown, CLAY (CL) TILL			6	SS	3	510 / 610	27												
		- silty, trace sand and gravel			7																
		- DTPL			8																
	357.2				9	SS	4	510 / 610	20												
3	356.5	Compact, greybrown, SILT (ML)			10																
		- some sand to sandy, trace gravel			11	SS	5	460 / 610	16												
		- wet to saturated			12																
		Hard to stiff, grey, CLAY (CL) TILL			13																
4		- silty, trace to some sand, trace fine gravel			14																
		- DTPL to APL			15																
					16	SS	6	510 / 610	15												
5		- silty sand, trace gravel layer, wet to saturated			17																
					18																
					19																
6		- frequent layers/seams of sandy silt, wet to saturated			20																
					21	SS	7	510 / 610	32												
					22																
Continued Next Page										□ Field Vane Test, kPa											
										■ Remoulded Vane Test, kPa											
										△ Pocket Penetrometer Test, kPa											

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- ☐ Field Vane Test, kPa
- ☒ Remoulded Vane Test, kPa
- ☐ Pocket Penetrometer Test, kPa

[illegible]

CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 19, 2020 WATER LEVEL _____ TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
						TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	50100150200											
										WATER CONTENT & ATTERBERG LIMITS DYNAMIC CONE PENETRATION TEST, BLOWS/0.3m STANDARD PENETRATION TEST, BLOWS/0.3m											
										WpWwL											
0	357.7	Agricultural Field			0					10	20	30	40	50	60	70	80	90	100		
	357.4	Dark brown, clayey silt (TOPSOIL) - some sand, trace gravel - APL			1	SS	1	460 610	4	●		○	△								
		Stiff to hard, greybrown, CLAY (CL) TILL - silty, trace sand and gravel - APL to DTPL - black, wet, organic silt inclusions at 1.2 m BGS			2																
1					3	SS	2	460 610	12	●	○										
					4																
					5																
2					6	SS	3	25 610	24			●									
		- grey - APL - saturated silt seams			7																
					8	SS	4	510 610	15	●	○								△		
					9																
3		- APL to WTPL			10																
					11	SS	5	510 610	10	●	○		△								
					12																
4					13																
					14																
		- trace, silt seams, wet			15																
5					16	SS	6	510 610	10	●	○		△								
	352.5				17																
		Borehole terminated at 5.2 m BGS. Upon completion, borehole open and dry. Borehole backfilled with bentonite and native cuttings.			18																
6					19																
					20																
					21																
					22																
										□ Field Vane Test, kPa ■ Remoulded Vane Test, kPa △ Pocket Penetrometer Test, kPa											

CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 19, 2020 WATER LEVEL _____ TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
						TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	50 100 150 200 WATER CONTENT & ATTERBERG LIMITS DYNAMIC CONE PENETRATION TEST, BLOWS/0.3m STANDARD PENETRATION TEST, BLOWS/0.3m 10 20 30 40 50 60 70 80 90 100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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- Field Vane Test, kPa
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						TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	50100150200											
										WATER CONTENT & ATTERBERG LIMITS											
										DYNAMIC CONE PENETRATION TEST, BLOWS/0.3m										▼	
										STANDARD PENETRATION TEST, BLOWS/0.3m										●	
										102030405060708090100											
0	358.6	Agricultural Field			0																
	358.4	Greybrown, clayey silt (TOPSOIL) - some sand, trace gravel, trace organics - APL			1	SS	1	410 610	9		●	○							△		
		Stiff to hard, greybrown, CLAY (CL) TILL - silty, trace sand and gravel - APL to DTPL			2																
1					3	SS	2	410 610	18			●								>>△	
					4																
					5																
2					6	SS	3	510 610	17			●○								>>△	
					7																
					8	SS	4	510 610	12		●	○						△			
					9																
3					10																
					11	SS	5	510 610	12		●	○							△		
					12																
4					13																
					14																
		- APL to WTPL - trace wet seams			15																
5	353.4				16	SS	6	510 610	11		●	○						△			
		Borehole terminated at 5.2 m BGS. Upon completion, borehole open and dry. Borehole backfilled with bentonite and native cuttings.			17																
					18																
6					19																
					20																
					21																
					22																
											□ Field Vane Test, kPa ■ Remoulded Vane Test, kPa △ Pocket Penetrometer Test, kPa										

- ☐ Field Vane Test, kPa
- ☒ Remoulded Vane Test, kPa
- ☐ Pocket Penetrometer Test, kPa

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 DATES: BORING June 18, 2020 WATER LEVEL _____ TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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						TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	50100150200										
						WATER CONTENT & ATTERBERG LIMITS										W _p W		W _L		
						DYNAMIC CONE PENETRATION TEST, BLOWS/0.3m										▼				
						STANDARD PENETRATION TEST, BLOWS/0.3m										●				
						102030405060708090100														
0	357.3	Agricultural Field			0															
		Mottled, greybrown, clayey silt (TOPSOIL)			1	SS	1	410 610	5											
		- trace organics			2															
	356.5	- trace of brick in upper 50 mm*																		
1		Very stiff to hard, mottled greybrown, CLAY (CL) TILL			3	SS	2	410 610	10											
		- silty, trace sand and gravel			4															
		- APL to DTPL			5															
2					6	SS	3	510 610	10											
					7															
					8															
					9	SS	4	410 610	29											
3					10															
					11	SS	5	510 610	18											
					12															
4					13															
					14															
		- grey			15															
5					16	SS	6	180 610	18											
	352.1				17															
		Borehole terminated at 5.2 m BGS. Upon completion, borehole open and dry. Borehole backfilled with bentonite and native cuttings.			18															
6					19															
		* Brick pieces noted in topsoil layer likely brought into the field by farming activities from adjacent subdivision.			20															
					21															
					22															
										□ Field Vane Test, kPa										
										■ Remoulded Vane Test, kPa										
										△ Pocket Penetrometer Test, kPa										

☐ Field Vane Test, kPa
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DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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- ☐ Field Vane Test, kPa
☒ Remoulded Vane Test, kPa
 Pocket Penetrometer Test, kPa

CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 16, 2020 WATER LEVEL _____ TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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CLIENT Activa Holdings Inc. PROJECT No. 60305680
 LOCATION Brubacher Street, Baden, Ontario DATUM _____
 DATES: BORING June 15, 2020 WATER LEVEL _____ TPC ELEVATION _____

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	SAMPLES				UNDRAINED SHEAR STRENGTH (kPa)										REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
						TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)	WATER CONTENT & ATTERBERG LIMITS DYNAMIC CONE PENETRATION TEST, BLOWS/0.3m ▽ STANDARD PENETRATION TEST, BLOWS/0.3m ● 50 100 150 200 W _p W W _L 10 20 30 40 50 60 70 80 90 100													
0	358.7	Agricultural Field			0																		
	358.5	Brown, sandy silt (TOPSOIL) - some clay - DTPL			1	SS	1	430 610	4	●	○		△										
		Very loose to compact, brown, SILTY SAND (SM)			2																		
1	357.8	- trace gravel - moist to wet			3	SS	2	510 610	10	●	○												
		Very stiff, greybrown, CLAY (CL) TILL			4																		
	357.1	- silty, trace gravel			5																		
	356.8	- APL to DTPL			6	SS	3	510 610	13	●	○												
2		Compact, greybrown, SILTY SAND (SM) - some gravel - wet			7																		
		Very stiff, greybrown, CLAYEY SILT (CL-ML) TILL			8	SS	4	300 610	18	●													
		- trace sand and gravel			9																		
3	355.6	- APL to DTPL - sand seams			10																		
		Very stiff, greybrown, CLAY (CL) TILL			11	SS	5	510 610	12	●	○												
		- silty, trace sand and gravel			12																		
4		- DTPL to APL - grey at 3.4 m BGS			13																		
					14																		
	354.1				15																		
5		Compact, greybrown, SILT (ML) - wet - layers of sandy silt, saturated			16	SS	6	460 610	13	●	○												
	353.5				17																		
6		Borehole terminated at 5.2 m BGS. Upon completion, borehole open and dry. Borehole backfilled with bentonite and native cuttings.			18																		
					19																		
					20																		
					21																		
					22																		
										□ Field Vane Test, kPa ■ Remoulded Vane Test, kPa △ Pocket Penetrometer Test, kPa													

- Field Vane Test, kPa
 ■ Remoulded Vane Test, kPa
 △ Pocket Penetrometer Test, kPa

Appendix E Laboratory Certificates of Analysis



Your Project #: 60305680.802
Your C.O.C. #: 780223-01-01

Attention: Simon Baer

Stantec Consulting Ltd
300 Hagey Blvd
Suite 100
Waterloo, ON
CANADA N2L 0A4

Report Date: 2020/07/21
Report #: R6255056
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C0H6972

Received: 2020/07/14, 16:24

Sample Matrix: Water
Samples Received: 6

Analyses	Date		Laboratory Method	Analytical Method
	Quantity	Extracted	Analyzed	
1,3-Dichloropropene Sum	4	N/A	2020/07/19	EPA 8260C m
Chloride by Automated Colourimetry	6	N/A	2020/07/20	CAM SOP-00463 SM 23 4500-Cl E m
Chromium (VI) in Water	6	N/A	2020/07/20	CAM SOP-00436 EPA 7199 m
Free (WAD) Cyanide	6	N/A	2020/07/17	CAM SOP-00457 OMOE E3015 m
Petroleum Hydrocarbons F2-F4 in Water (1)	4	2020/07/17	2020/07/18	CAM SOP-00316 CCME PHC-CWS m
Mercury	6	2020/07/17	2020/07/17	CAM SOP-00453 EPA 7470A m
Dissolved Metals by ICPMS	6	N/A	2020/07/20	CAM SOP-00447 EPA 6020B m
Volatile Organic Compounds and F1 PHCs	4	N/A	2020/07/18	CAM SOP-00230 EPA 8260C m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas Laboratories conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods



Your Project #: 60305680.802
Your C.O.C. #: 780223-01-01

Attention: Simon Baer

Stantec Consulting Ltd
300 Hagey Blvd
Suite 100
Waterloo, ON
CANADA N2L 0A4

Report Date: 2020/07/21
Report #: R6255056
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C0H6972

Received: 2020/07/14, 16:24

September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ronklin Gracian, Project Manager
Email: Ronklin.Gracian@bvlabs.com
Phone# (905)817-5752

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This report has been generated and distributed using a secure automated process.

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



BUREAU
VERITAS

BV Labs Job #: COH6972
Report Date: 2020/07/21

Stantec Consulting Ltd
Client Project #: 60305680.802
Sampler Initials: SB

O.REG 153 METALS & INORGANICS PKG (WTR)

BV Labs ID		NCS993	NCS994	NCS995	NCS996		
Sampling Date		2020/07/14 10:32	2020/07/14 10:10	2020/07/14 11:15	2020/07/14 12:10		
COC Number		780223-01-01	780223-01-01	780223-01-01	780223-01-01		
	UNITS	WG-60305680- 20200714-SB-01	WG-60305680- 20200714-SB-02	WG-60305680- 20200714-SB-03	WG-60305680- 20200714-SB-04	RDL	QC Batch

Inorganics

WAD Cyanide (Free)	ug/L	<1	<1	<1	<1	1	6841840
Dissolved Chloride (Cl-)	mg/L	3.7	7.9	7.9	22	1.0	6842116

Metals

Chromium (VI)	ug/L	0.53	<0.50	1.3	0.60	0.50	6842560
Mercury (Hg)	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	6841244
Dissolved Antimony (Sb)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	6841227
Dissolved Arsenic (As)	mg/L	<0.0010	0.0013	<0.0010	<0.0010	0.0010	6841227
Dissolved Barium (Ba)	mg/L	0.15	0.15	0.030	0.11	0.0020	6841227
Dissolved Beryllium (Be)	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	6841227
Dissolved Boron (B)	mg/L	0.14	0.033	<0.010	<0.010	0.010	6841227
Dissolved Cadmium (Cd)	mg/L	<0.000090	<0.000090	<0.000090	<0.000090	0.000090	6841227
Dissolved Chromium (Cr)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	6841227
Dissolved Cobalt (Co)	mg/L	<0.00050	0.0010	<0.00050	0.00059	0.00050	6841227
Dissolved Copper (Cu)	mg/L	0.0015	0.0078	<0.00090	0.0011	0.00090	6841227
Dissolved Lead (Pb)	mg/L	<0.00050	0.0042	<0.00050	<0.00050	0.00050	6841227
Dissolved Molybdenum (Mo)	mg/L	0.0049	<0.00050	0.0013	<0.00050	0.00050	6841227
Dissolved Nickel (Ni)	mg/L	0.0011	0.0024	0.0013	0.0014	0.0010	6841227
Dissolved Selenium (Se)	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	6841227
Dissolved Silver (Ag)	mg/L	<0.000090	<0.000090	<0.000090	<0.000090	0.000090	6841227
Dissolved Sodium (Na)	mg/L	29	12	4.6	13	0.10	6841227
Dissolved Thallium (Tl)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	6841227
Dissolved Uranium (U)	mg/L	0.0048	0.0062	0.00052	0.0015	0.00010	6841227
Dissolved Vanadium (V)	mg/L	<0.00050	0.0021	<0.00050	<0.00050	0.00050	6841227
Dissolved Zinc (Zn)	mg/L	<0.0050	0.011	<0.0050	<0.0050	0.0050	6841227

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch



BUREAU
VERITAS

BV Labs Job #: COH6972
Report Date: 2020/07/21

Stantec Consulting Ltd
Client Project #: 60305680.802
Sampler Initials: SB

O.REG 153 METALS & INORGANICS PKG (WTR)

BV Labs ID		NCS997	NCS998			NCS998		
Sampling Date		2020/07/14 14:01	2020/07/14 14:55			2020/07/14 14:55		
COC Number		780223-01-01	780223-01-01			780223-01-01		
	UNITS	WG-60305680- 20200714-SB-05	WG-60305680- 20200714-SB-06	RDL	QC Batch	WG-60305680- 20200714-SB-06 Lab-Dup	RDL	QC Batch

Inorganics								
WAD Cyanide (Free)	ug/L	<1	<1	1	6841840			
Dissolved Chloride (Cl-)	mg/L	3.9	19	1.0	6842116			
Metals								
Chromium (VI)	ug/L	<0.50	<0.50	0.50	6842560	<0.50	0.50	6842560
Mercury (Hg)	ug/L	<0.10	<0.10	0.10	6841244			
Dissolved Antimony (Sb)	mg/L	<0.00050	<0.00050	0.00050	6841227			
Dissolved Arsenic (As)	mg/L	0.0040	0.0012	0.0010	6841227			
Dissolved Barium (Ba)	mg/L	0.45	0.22	0.0020	6841227			
Dissolved Beryllium (Be)	mg/L	<0.00040	<0.00040	0.00040	6841227			
Dissolved Boron (B)	mg/L	0.051	0.016	0.010	6841227			
Dissolved Cadmium (Cd)	mg/L	<0.000090	<0.000090	0.000090	6841227			
Dissolved Chromium (Cr)	mg/L	<0.0050	<0.0050	0.0050	6841227			
Dissolved Cobalt (Co)	mg/L	0.0015	0.0011	0.00050	6841227			
Dissolved Copper (Cu)	mg/L	0.0011	<0.00090	0.00090	6841227			
Dissolved Lead (Pb)	mg/L	<0.00050	<0.00050	0.00050	6841227			
Dissolved Molybdenum (Mo)	mg/L	0.0020	0.00096	0.00050	6841227			
Dissolved Nickel (Ni)	mg/L	0.0041	0.0016	0.0010	6841227			
Dissolved Selenium (Se)	mg/L	<0.0020	<0.0020	0.0020	6841227			
Dissolved Silver (Ag)	mg/L	<0.000090	<0.000090	0.000090	6841227			
Dissolved Sodium (Na)	mg/L	14	17	0.10	6841227			
Dissolved Thallium (Tl)	mg/L	<0.000050	<0.000050	0.000050	6841227			
Dissolved Uranium (U)	mg/L	0.0034	0.0024	0.00010	6841227			
Dissolved Vanadium (V)	mg/L	<0.00050	<0.00050	0.00050	6841227			
Dissolved Zinc (Zn)	mg/L	<0.0050	<0.0050	0.0050	6841227			

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate



BUREAU
VERITAS

BV Labs Job #: COH6972

Report Date: 2020/07/21

Stantec Consulting Ltd

Client Project #: 60305680.802

Sampler Initials: SB

O.REG 153 VOCs BY HS & F1-F4 (WATER)

BV Labs ID		NCS994			NCS994		
Sampling Date		2020/07/14 10:10			2020/07/14 10:10		
COC Number		780223-01-01			780223-01-01		
	UNITS	WG-60305680- 20200714-SB-02	RDL	QC Batch	WG-60305680- 20200714-SB-02 Lab-Dup	RDL	QC Batch
Calculated Parameters							
1,3-Dichloropropene (cis+trans)	ug/L	<0.50	0.50	6839536			
Volatile Organics							
Acetone (2-Propanone)	ug/L	<10	10	6841062	<10	10	6841062
Benzene	ug/L	<0.20	0.20	6841062	<0.20	0.20	6841062
Bromodichloromethane	ug/L	<0.50	0.50	6841062	<0.50	0.50	6841062
Bromoform	ug/L	<1.0	1.0	6841062	<1.0	1.0	6841062
Bromomethane	ug/L	<0.50	0.50	6841062	<0.50	0.50	6841062
Carbon Tetrachloride	ug/L	<0.20	0.20	6841062	<0.20	0.20	6841062
Chlorobenzene	ug/L	<0.20	0.20	6841062	<0.20	0.20	6841062
Chloroform	ug/L	<0.20	0.20	6841062	<0.20	0.20	6841062
Dibromochloromethane	ug/L	<0.50	0.50	6841062	<0.50	0.50	6841062
1,2-Dichlorobenzene	ug/L	<0.50	0.50	6841062	<0.50	0.50	6841062
1,3-Dichlorobenzene	ug/L	<0.50	0.50	6841062	<0.50	0.50	6841062
1,4-Dichlorobenzene	ug/L	<0.50	0.50	6841062	<0.50	0.50	6841062
Dichlorodifluoromethane (FREON 12)	ug/L	<1.0	1.0	6841062	<1.0	1.0	6841062
1,1-Dichloroethane	ug/L	<0.20	0.20	6841062	<0.20	0.20	6841062
1,2-Dichloroethane	ug/L	<0.50	0.50	6841062	<0.50	0.50	6841062
1,1-Dichloroethylene	ug/L	<0.20	0.20	6841062	<0.20	0.20	6841062
cis-1,2-Dichloroethylene	ug/L	<0.50	0.50	6841062	<0.50	0.50	6841062
trans-1,2-Dichloroethylene	ug/L	<0.50	0.50	6841062	<0.50	0.50	6841062
1,2-Dichloropropane	ug/L	<0.20	0.20	6841062	<0.20	0.20	6841062
cis-1,3-Dichloropropene	ug/L	<0.30	0.30	6841062	<0.30	0.30	6841062
trans-1,3-Dichloropropene	ug/L	<0.40	0.40	6841062	<0.40	0.40	6841062
Ethylbenzene	ug/L	<0.20	0.20	6841062	<0.20	0.20	6841062
Ethylene Dibromide	ug/L	<0.20	0.20	6841062	<0.20	0.20	6841062
Hexane	ug/L	<1.0	1.0	6841062	<1.0	1.0	6841062
Methylene Chloride(Dichloromethane)	ug/L	<2.0	2.0	6841062	<2.0	2.0	6841062
Methyl Ethyl Ketone (2-Butanone)	ug/L	<10	10	6841062	<10	10	6841062
Methyl Isobutyl Ketone	ug/L	<5.0	5.0	6841062	<5.0	5.0	6841062
Methyl t-butyl ether (MTBE)	ug/L	<0.50	0.50	6841062	<0.50	0.50	6841062
Styrene	ug/L	<0.50	0.50	6841062	<0.50	0.50	6841062
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
Lab-Dup = Laboratory Initiated Duplicate							



BUREAU
VERITAS

BV Labs Job #: COH6972

Report Date: 2020/07/21

Stantec Consulting Ltd

Client Project #: 60305680.802

Sampler Initials: SB

O.REG 153 VOCs BY HS & F1-F4 (WATER)

BV Labs ID		NCS994			NCS994		
Sampling Date		2020/07/14 10:10			2020/07/14 10:10		
COC Number		780223-01-01			780223-01-01		
	UNITS	WG-60305680- 20200714-SB-02	RDL	QC Batch	WG-60305680- 20200714-SB-02 Lab-Dup	RDL	QC Batch
1,1,1,2-Tetrachloroethane	ug/L	<0.50	0.50	6841062	<0.50	0.50	6841062
1,1,2,2-Tetrachloroethane	ug/L	<0.50	0.50	6841062	<0.50	0.50	6841062
Tetrachloroethylene	ug/L	<0.20	0.20	6841062	<0.20	0.20	6841062
Toluene	ug/L	0.32	0.20	6841062	0.34	0.20	6841062
1,1,1-Trichloroethane	ug/L	<0.20	0.20	6841062	<0.20	0.20	6841062
1,1,2-Trichloroethane	ug/L	<0.50	0.50	6841062	<0.50	0.50	6841062
Trichloroethylene	ug/L	<0.20	0.20	6841062	<0.20	0.20	6841062
Trichlorofluoromethane (FREON 11)	ug/L	<0.50	0.50	6841062	<0.50	0.50	6841062
Vinyl Chloride	ug/L	<0.20	0.20	6841062	<0.20	0.20	6841062
p+m-Xylene	ug/L	0.22	0.20	6841062	0.24	0.20	6841062
o-Xylene	ug/L	<0.20	0.20	6841062	<0.20	0.20	6841062
Total Xylenes	ug/L	0.22	0.20	6841062	0.24	0.20	6841062
F1 (C6-C10)	ug/L	<25	25	6841062	<25	25	6841062
F1 (C6-C10) - BTEX	ug/L	<25	25	6841062	<25	25	6841062
F2-F4 Hydrocarbons							
F2 (C10-C16 Hydrocarbons)	ug/L	100	100	6842144			
F3 (C16-C34 Hydrocarbons)	ug/L	<200	200	6842144			
F4 (C34-C50 Hydrocarbons)	ug/L	<200	200	6842144			
Reached Baseline at C50	ug/L	Yes		6842144			
Surrogate Recovery (%)							
o-Terphenyl	%	95		6842144			
4-Bromofluorobenzene	%	94		6841062	93		6841062
D4-1,2-Dichloroethane	%	110		6841062	110		6841062
D8-Toluene	%	96		6841062	96		6841062
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate							



BUREAU
VERITAS

BV Labs Job #: COH6972
Report Date: 2020/07/21

Stantec Consulting Ltd
Client Project #: 60305680.802
Sampler Initials: SB

O.REG 153 VOCs BY HS & F1-F4 (WATER)

BV Labs ID		NCS995	NCS997	NCS998		
Sampling Date		2020/07/14 11:15	2020/07/14 14:01	2020/07/14 14:55		
COC Number		780223-01-01	780223-01-01	780223-01-01		
	UNITS	WG-60305680- 20200714-SB-03	WG-60305680- 20200714-SB-05	WG-60305680- 20200714-SB-06	RDL	QC Batch
Calculated Parameters						
1,3-Dichloropropene (cis+trans)	ug/L	<0.50	<0.50	<0.50	0.50	6839536
Volatile Organics						
Acetone (2-Propanone)	ug/L	<10	<10	16	10	6841062
Benzene	ug/L	0.20	<0.20	<0.20	0.20	6841062
Bromodichloromethane	ug/L	<0.50	<0.50	<0.50	0.50	6841062
Bromoform	ug/L	<1.0	<1.0	<1.0	1.0	6841062
Bromomethane	ug/L	<0.50	<0.50	<0.50	0.50	6841062
Carbon Tetrachloride	ug/L	<0.20	<0.20	<0.20	0.20	6841062
Chlorobenzene	ug/L	<0.20	<0.20	<0.20	0.20	6841062
Chloroform	ug/L	<0.20	<0.20	<0.20	0.20	6841062
Dibromochloromethane	ug/L	<0.50	<0.50	<0.50	0.50	6841062
1,2-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	0.50	6841062
1,3-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	0.50	6841062
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	0.50	6841062
Dichlorodifluoromethane (FREON 12)	ug/L	<1.0	<1.0	<1.0	1.0	6841062
1,1-Dichloroethane	ug/L	<0.20	<0.20	<0.20	0.20	6841062
1,2-Dichloroethane	ug/L	<0.50	<0.50	<0.50	0.50	6841062
1,1-Dichloroethylene	ug/L	<0.20	<0.20	<0.20	0.20	6841062
cis-1,2-Dichloroethylene	ug/L	<0.50	<0.50	<0.50	0.50	6841062
trans-1,2-Dichloroethylene	ug/L	<0.50	<0.50	<0.50	0.50	6841062
1,2-Dichloropropane	ug/L	<0.20	<0.20	<0.20	0.20	6841062
cis-1,3-Dichloropropene	ug/L	<0.30	<0.30	<0.30	0.30	6841062
trans-1,3-Dichloropropene	ug/L	<0.40	<0.40	<0.40	0.40	6841062
Ethylbenzene	ug/L	<0.20	<0.20	<0.20	0.20	6841062
Ethylene Dibromide	ug/L	<0.20	<0.20	<0.20	0.20	6841062
Hexane	ug/L	<1.0	<1.0	<1.0	1.0	6841062
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	2.0	6841062
Methyl Ethyl Ketone (2-Butanone)	ug/L	<10	<10	<10	10	6841062
Methyl Isobutyl Ketone	ug/L	<5.0	<5.0	<5.0	5.0	6841062
Methyl t-butyl ether (MTBE)	ug/L	<0.50	<0.50	<0.50	0.50	6841062
Styrene	ug/L	<0.50	<0.50	<0.50	0.50	6841062
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						

BUREAU
VERITAS

BV Labs Job #: COH6972

Report Date: 2020/07/21

Stantec Consulting Ltd

Client Project #: 60305680.802

Sampler Initials: SB

O.REG 153 VOCs BY HS & F1-F4 (WATER)

BV Labs ID		NCS995	NCS997	NCS998		
Sampling Date		2020/07/14 11:15	2020/07/14 14:01	2020/07/14 14:55		
COC Number		780223-01-01	780223-01-01	780223-01-01		
	UNITS	WG-60305680- 20200714-SB-03	WG-60305680- 20200714-SB-05	WG-60305680- 20200714-SB-06	RDL	QC Batch
1,1,1,2-Tetrachloroethane	ug/L	<0.50	<0.50	<0.50	0.50	6841062
1,1,2,2-Tetrachloroethane	ug/L	<0.50	<0.50	<0.50	0.50	6841062
Tetrachloroethylene	ug/L	<0.20	<0.20	<0.20	0.20	6841062
Toluene	ug/L	0.40	0.27	0.37	0.20	6841062
1,1,1-Trichloroethane	ug/L	<0.20	<0.20	<0.20	0.20	6841062
1,1,2-Trichloroethane	ug/L	<0.50	<0.50	<0.50	0.50	6841062
Trichloroethylene	ug/L	<0.20	<0.20	<0.20	0.20	6841062
Trichlorofluoromethane (FREON 11)	ug/L	<0.50	<0.50	<0.50	0.50	6841062
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	0.20	6841062
p+m-Xylene	ug/L	0.25	0.20	0.26	0.20	6841062
o-Xylene	ug/L	<0.20	<0.20	<0.20	0.20	6841062
Total Xylenes	ug/L	0.25	0.20	0.26	0.20	6841062
F1 (C6-C10)	ug/L	<25	<25	<25	25	6841062
F1 (C6-C10) - BTEX	ug/L	<25	<25	<25	25	6841062
F2-F4 Hydrocarbons						
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	<100	100	6842144
F3 (C16-C34 Hydrocarbons)	ug/L	<200	510	<200	200	6842144
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	<200	200	6842144
Reached Baseline at C50	ug/L	Yes	Yes	Yes		6842144
Surrogate Recovery (%)						
o-Terphenyl	%	97	96	96		6842144
4-Bromofluorobenzene	%	96	93	94		6841062
D4-1,2-Dichloroethane	%	110	112	111		6841062
D8-Toluene	%	93	96	93		6841062
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						



BUREAU
VERITAS

BV Labs Job #: COH6972

Report Date: 2020/07/21

Stantec Consulting Ltd

Client Project #: 60305680.802

Sampler Initials: SB

TEST SUMMARY

BV Labs ID: NCS993
Sample ID: WG-60305680-20200714-SB-01
Matrix: Water

Collected: 2020/07/14
Shipped:
Received: 2020/07/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	6842116	N/A	2020/07/20	Deonarine Ramnarine
Chromium (VI) in Water	IC	6842560	N/A	2020/07/20	Lang Le
Free (WAD) Cyanide	SKAL/CN	6841840	N/A	2020/07/17	Gnana Thomas
Mercury	CV/AA	6841244	2020/07/17	2020/07/17	Medhat Nasr
Dissolved Metals by ICPMS	ICP/MS	6841227	N/A	2020/07/20	Nan Raykha

BV Labs ID: NCS994
Sample ID: WG-60305680-20200714-SB-02
Matrix: Water

Collected: 2020/07/14
Shipped:
Received: 2020/07/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
1,3-Dichloropropene Sum	CALC	6839536	N/A	2020/07/19	Automated Statchk
Chloride by Automated Colourimetry	KONE	6842116	N/A	2020/07/20	Deonarine Ramnarine
Chromium (VI) in Water	IC	6842560	N/A	2020/07/20	Lang Le
Free (WAD) Cyanide	SKAL/CN	6841840	N/A	2020/07/17	Gnana Thomas
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	6842144	2020/07/17	2020/07/18	Ksenia Trofimova
Mercury	CV/AA	6841244	2020/07/17	2020/07/17	Medhat Nasr
Dissolved Metals by ICPMS	ICP/MS	6841227	N/A	2020/07/20	Nan Raykha
Volatile Organic Compounds and F1 PHCs	GC/MSFD	6841062	N/A	2020/07/18	Anna Gabrielyan

BV Labs ID: NCS994 Dup
Sample ID: WG-60305680-20200714-SB-02
Matrix: Water

Collected: 2020/07/14
Shipped:
Received: 2020/07/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Volatile Organic Compounds and F1 PHCs	GC/MSFD	6841062	N/A	2020/07/18	Anna Gabrielyan

BV Labs ID: NCS995
Sample ID: WG-60305680-20200714-SB-03
Matrix: Water

Collected: 2020/07/14
Shipped:
Received: 2020/07/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
1,3-Dichloropropene Sum	CALC	6839536	N/A	2020/07/19	Automated Statchk
Chloride by Automated Colourimetry	KONE	6842116	N/A	2020/07/20	Deonarine Ramnarine
Chromium (VI) in Water	IC	6842560	N/A	2020/07/20	Lang Le
Free (WAD) Cyanide	SKAL/CN	6841840	N/A	2020/07/17	Gnana Thomas
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	6842144	2020/07/17	2020/07/18	Ksenia Trofimova
Mercury	CV/AA	6841244	2020/07/17	2020/07/17	Medhat Nasr
Dissolved Metals by ICPMS	ICP/MS	6841227	N/A	2020/07/20	Nan Raykha
Volatile Organic Compounds and F1 PHCs	GC/MSFD	6841062	N/A	2020/07/18	Anna Gabrielyan



BV Labs Job #: COH6972
Report Date: 2020/07/21

Stantec Consulting Ltd
Client Project #: 60305680.802
Sampler Initials: SB

TEST SUMMARY

BV Labs ID: NCS996
Sample ID: WG-60305680-20200714-SB-04
Matrix: Water

Collected: 2020/07/14
Shipped:
Received: 2020/07/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	6842116	N/A	2020/07/20	Deonarine Ramnarine
Chromium (VI) in Water	IC	6842560	N/A	2020/07/20	Lang Le
Free (WAD) Cyanide	SKAL/CN	6841840	N/A	2020/07/17	Gnana Thomas
Mercury	CV/AA	6841244	2020/07/17	2020/07/17	Medhat Nasr
Dissolved Metals by ICPMS	ICP/MS	6841227	N/A	2020/07/20	Nan Raykha

BV Labs ID: NCS997
Sample ID: WG-60305680-20200714-SB-05
Matrix: Water

Collected: 2020/07/14
Shipped:
Received: 2020/07/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
1,3-Dichloropropene Sum	CALC	6839536	N/A	2020/07/19	Automated Statchk
Chloride by Automated Colourimetry	KONE	6842116	N/A	2020/07/20	Deonarine Ramnarine
Chromium (VI) in Water	IC	6842560	N/A	2020/07/20	Lang Le
Free (WAD) Cyanide	SKAL/CN	6841840	N/A	2020/07/17	Gnana Thomas
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	6842144	2020/07/17	2020/07/18	Ksenia Trofimova
Mercury	CV/AA	6841244	2020/07/17	2020/07/17	Medhat Nasr
Dissolved Metals by ICPMS	ICP/MS	6841227	N/A	2020/07/20	Nan Raykha
Volatile Organic Compounds and F1 PHCs	GC/MSFD	6841062	N/A	2020/07/18	Anna Gabrielyan

BV Labs ID: NCS998
Sample ID: WG-60305680-20200714-SB-06
Matrix: Water

Collected: 2020/07/14
Shipped:
Received: 2020/07/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
1,3-Dichloropropene Sum	CALC	6839536	N/A	2020/07/19	Automated Statchk
Chloride by Automated Colourimetry	KONE	6842116	N/A	2020/07/20	Deonarine Ramnarine
Chromium (VI) in Water	IC	6842560	N/A	2020/07/20	Lang Le
Free (WAD) Cyanide	SKAL/CN	6841840	N/A	2020/07/17	Gnana Thomas
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	6842144	2020/07/17	2020/07/18	Ksenia Trofimova
Mercury	CV/AA	6841244	2020/07/17	2020/07/17	Medhat Nasr
Dissolved Metals by ICPMS	ICP/MS	6841227	N/A	2020/07/20	Nan Raykha
Volatile Organic Compounds and F1 PHCs	GC/MSFD	6841062	N/A	2020/07/18	Anna Gabrielyan

BV Labs ID: NCS998 Dup
Sample ID: WG-60305680-20200714-SB-06
Matrix: Water

Collected: 2020/07/14
Shipped:
Received: 2020/07/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	6842560	N/A	2020/07/20	Lang Le



BUREAU
VERITAS

BV Labs Job #: COH6972

Report Date: 2020/07/21

Stantec Consulting Ltd

Client Project #: 60305680.802

Sampler Initials: SB

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	15.0°C
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Results relate only to the items tested.

BUREAU
VERITAS

BV Labs Job #: C0H6972

Report Date: 2020/07/21

QUALITY ASSURANCE REPORT

Stantec Consulting Ltd

Client Project #: 60305680.802

Sampler Initials: SB

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6841062	4-Bromofluorobenzene	2020/07/18	99	70 - 130	100	70 - 130	93	%		
6841062	D4-1,2-Dichloroethane	2020/07/18	111	70 - 130	108	70 - 130	107	%		
6841062	D8-Toluene	2020/07/18	101	70 - 130	101	70 - 130	98	%		
6842144	o-Terphenyl	2020/07/17	96	60 - 130	96	60 - 130	95	%		
6841062	1,1,1,2-Tetrachloroethane	2020/07/18	104	70 - 130	105	70 - 130	<0.50	ug/L	NC	30
6841062	1,1,1-Trichloroethane	2020/07/18	101	70 - 130	103	70 - 130	<0.20	ug/L	NC	30
6841062	1,1,2,2-Tetrachloroethane	2020/07/18	98	70 - 130	97	70 - 130	<0.50	ug/L	NC	30
6841062	1,1,2-Trichloroethane	2020/07/18	109	70 - 130	107	70 - 130	<0.50	ug/L	NC	30
6841062	1,1-Dichloroethane	2020/07/18	100	70 - 130	101	70 - 130	<0.20	ug/L	NC	30
6841062	1,1-Dichloroethylene	2020/07/18	108	70 - 130	110	70 - 130	<0.20	ug/L	NC	30
6841062	1,2-Dichlorobenzene	2020/07/18	92	70 - 130	90	70 - 130	<0.50	ug/L	NC	30
6841062	1,2-Dichloroethane	2020/07/18	106	70 - 130	104	70 - 130	<0.50	ug/L	NC	30
6841062	1,2-Dichloropropane	2020/07/18	97	70 - 130	97	70 - 130	<0.20	ug/L	NC	30
6841062	1,3-Dichlorobenzene	2020/07/18	96	70 - 130	94	70 - 130	<0.50	ug/L	NC	30
6841062	1,4-Dichlorobenzene	2020/07/18	101	70 - 130	99	70 - 130	<0.50	ug/L	NC	30
6841062	Acetone (2-Propanone)	2020/07/18	111	60 - 140	104	60 - 140	<10	ug/L	NC	30
6841062	Benzene	2020/07/18	102	70 - 130	102	70 - 130	<0.20	ug/L	NC	30
6841062	Bromodichloromethane	2020/07/18	102	70 - 130	102	70 - 130	<0.50	ug/L	NC	30
6841062	Bromoform	2020/07/18	101	70 - 130	99	70 - 130	<1.0	ug/L	NC	30
6841062	Bromomethane	2020/07/18	97	60 - 140	95	60 - 140	<0.50	ug/L	NC	30
6841062	Carbon Tetrachloride	2020/07/18	101	70 - 130	103	70 - 130	<0.20	ug/L	NC	30
6841062	Chlorobenzene	2020/07/18	94	70 - 130	95	70 - 130	<0.20	ug/L	NC	30
6841062	Chloroform	2020/07/18	99	70 - 130	99	70 - 130	<0.20	ug/L	NC	30
6841062	cis-1,2-Dichloroethylene	2020/07/18	96	70 - 130	96	70 - 130	<0.50	ug/L	NC	30
6841062	cis-1,3-Dichloropropene	2020/07/18	96	70 - 130	92	70 - 130	<0.30	ug/L	NC	30
6841062	Dibromochloromethane	2020/07/18	104	70 - 130	103	70 - 130	<0.50	ug/L	NC	30
6841062	Dichlorodifluoromethane (FREON 12)	2020/07/18	93	60 - 140	93	60 - 140	<1.0	ug/L	NC	30
6841062	Ethylbenzene	2020/07/18	89	70 - 130	91	70 - 130	<0.20	ug/L	NC	30
6841062	Ethylene Dibromide	2020/07/18	103	70 - 130	101	70 - 130	<0.20	ug/L	NC	30
6841062	F1 (C6-C10) - BTEX	2020/07/18					<25	ug/L	NC	30
6841062	F1 (C6-C10)	2020/07/18	97	60 - 140	93	60 - 140	<25	ug/L	NC	30

BUREAU
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BV Labs Job #: C0H6972

Report Date: 2020/07/21

QUALITY ASSURANCE REPORT(CONT'D)

Stantec Consulting Ltd
Client Project #: 60305680.802
Sampler Initials: SB

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6841062	Hexane	2020/07/18	102	70 - 130	104	70 - 130	<1.0	ug/L	NC	30
6841062	Methyl Ethyl Ketone (2-Butanone)	2020/07/18	98	60 - 140	94	60 - 140	<10	ug/L	NC	30
6841062	Methyl Isobutyl Ketone	2020/07/18	97	70 - 130	94	70 - 130	<5.0	ug/L	NC	30
6841062	Methyl t-butyl ether (MTBE)	2020/07/18	89	70 - 130	89	70 - 130	<0.50	ug/L	NC	30
6841062	Methylene Chloride(Dichloromethane)	2020/07/18	104	70 - 130	103	70 - 130	<2.0	ug/L	NC	30
6841062	o-Xylene	2020/07/18	90	70 - 130	92	70 - 130	<0.20	ug/L	NC	30
6841062	p+m-Xylene	2020/07/18	93	70 - 130	96	70 - 130	<0.20	ug/L	6.5	30
6841062	Styrene	2020/07/18	90	70 - 130	93	70 - 130	<0.50	ug/L	NC	30
6841062	Tetrachloroethylene	2020/07/18	94	70 - 130	96	70 - 130	<0.20	ug/L	NC	30
6841062	Toluene	2020/07/18	88	70 - 130	89	70 - 130	<0.20	ug/L	5.8	30
6841062	Total Xylenes	2020/07/18					<0.20	ug/L	6.5	30
6841062	trans-1,2-Dichloroethylene	2020/07/18	103	70 - 130	104	70 - 130	<0.50	ug/L	NC	30
6841062	trans-1,3-Dichloropropene	2020/07/18	98	70 - 130	91	70 - 130	<0.40	ug/L	NC	30
6841062	Trichloroethylene	2020/07/18	104	70 - 130	105	70 - 130	<0.20	ug/L	NC	30
6841062	Trichlorofluoromethane (FREON 11)	2020/07/18	107	70 - 130	109	70 - 130	<0.50	ug/L	NC	30
6841062	Vinyl Chloride	2020/07/18	97	70 - 130	99	70 - 130	<0.20	ug/L	NC	30
6841227	Dissolved Antimony (Sb)	2020/07/20	109	80 - 120	104	80 - 120	<0.00050	mg/L	NC	20
6841227	Dissolved Arsenic (As)	2020/07/20	106	80 - 120	100	80 - 120	<0.0010	mg/L	0.99	20
6841227	Dissolved Barium (Ba)	2020/07/20	106	80 - 120	102	80 - 120	<0.0020	mg/L	1.6	20
6841227	Dissolved Beryllium (Be)	2020/07/20	103	80 - 120	101	80 - 120	<0.00040	mg/L	NC	20
6841227	Dissolved Boron (B)	2020/07/20	104	80 - 120	103	80 - 120	<0.010	mg/L	1.8	20
6841227	Dissolved Cadmium (Cd)	2020/07/20	106	80 - 120	102	80 - 120	<0.000090	mg/L	NC	20
6841227	Dissolved Chromium (Cr)	2020/07/20	100	80 - 120	96	80 - 120	<0.0050	mg/L	NC	20
6841227	Dissolved Cobalt (Co)	2020/07/20	102	80 - 120	100	80 - 120	<0.00050	mg/L	4.0	20
6841227	Dissolved Copper (Cu)	2020/07/20	103	80 - 120	99	80 - 120	<0.00090	mg/L	0.64	20
6841227	Dissolved Lead (Pb)	2020/07/20	101	80 - 120	99	80 - 120	<0.00050	mg/L	NC	20
6841227	Dissolved Molybdenum (Mo)	2020/07/20	104	80 - 120	100	80 - 120	<0.00050	mg/L	1.5	20
6841227	Dissolved Nickel (Ni)	2020/07/20	99	80 - 120	96	80 - 120	<0.0010	mg/L	NC	20
6841227	Dissolved Selenium (Se)	2020/07/20	103	80 - 120	100	80 - 120	<0.0020	mg/L	NC	20
6841227	Dissolved Silver (Ag)	2020/07/20	98	80 - 120	96	80 - 120	<0.000090	mg/L	NC	20
6841227	Dissolved Sodium (Na)	2020/07/20	NC	80 - 120	100	80 - 120	<0.10	mg/L	1.1	20



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VERITAS

BV Labs Job #: C0H6972

Report Date: 2020/07/21

QUALITY ASSURANCE REPORT(CONT'D)

Stantec Consulting Ltd

Client Project #: 60305680.802

Sampler Initials: SB

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6841227	Dissolved Thallium (Tl)	2020/07/20	104	80 - 120	100	80 - 120	<0.000050	mg/L	NC	20
6841227	Dissolved Uranium (U)	2020/07/20	106	80 - 120	102	80 - 120	<0.00010	mg/L	1.1	20
6841227	Dissolved Vanadium (V)	2020/07/20	104	80 - 120	98	80 - 120	<0.00050	mg/L	8.9	20
6841227	Dissolved Zinc (Zn)	2020/07/20	103	80 - 120	97	80 - 120	<0.0050	mg/L	1.6	20
6841244	Mercury (Hg)	2020/07/17	88	75 - 125	99	80 - 120	<0.10	ug/L	NC	20
6841840	WAD Cyanide (Free)	2020/07/17	107	80 - 120	104	80 - 120	<1	ug/L	9.5	20
6842116	Dissolved Chloride (Cl-)	2020/07/20	NC	80 - 120	104	80 - 120	<1.0	mg/L	0.78	20
6842144	F2 (C10-C16 Hydrocarbons)	2020/07/18	85	50 - 130	85	60 - 130	<100	ug/L	NC	30
6842144	F3 (C16-C34 Hydrocarbons)	2020/07/18	104	50 - 130	106	60 - 130	<200	ug/L	NC	30
6842144	F4 (C34-C50 Hydrocarbons)	2020/07/18	102	50 - 130	101	60 - 130	<200	ug/L	NC	30
6842560	Chromium (VI)	2020/07/20	93	80 - 120	100	80 - 120	<0.50	ug/L	NC	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference $\leq 2 \times \text{RDL}$).



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VERITAS

BV Labs Job #: COH6972

Report Date: 2020/07/21

Stantec Consulting Ltd

Client Project #: 60305680.802

Sampler Initials: SB

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Anastassia Hamanov, Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



Bureau Veritas Laboratories
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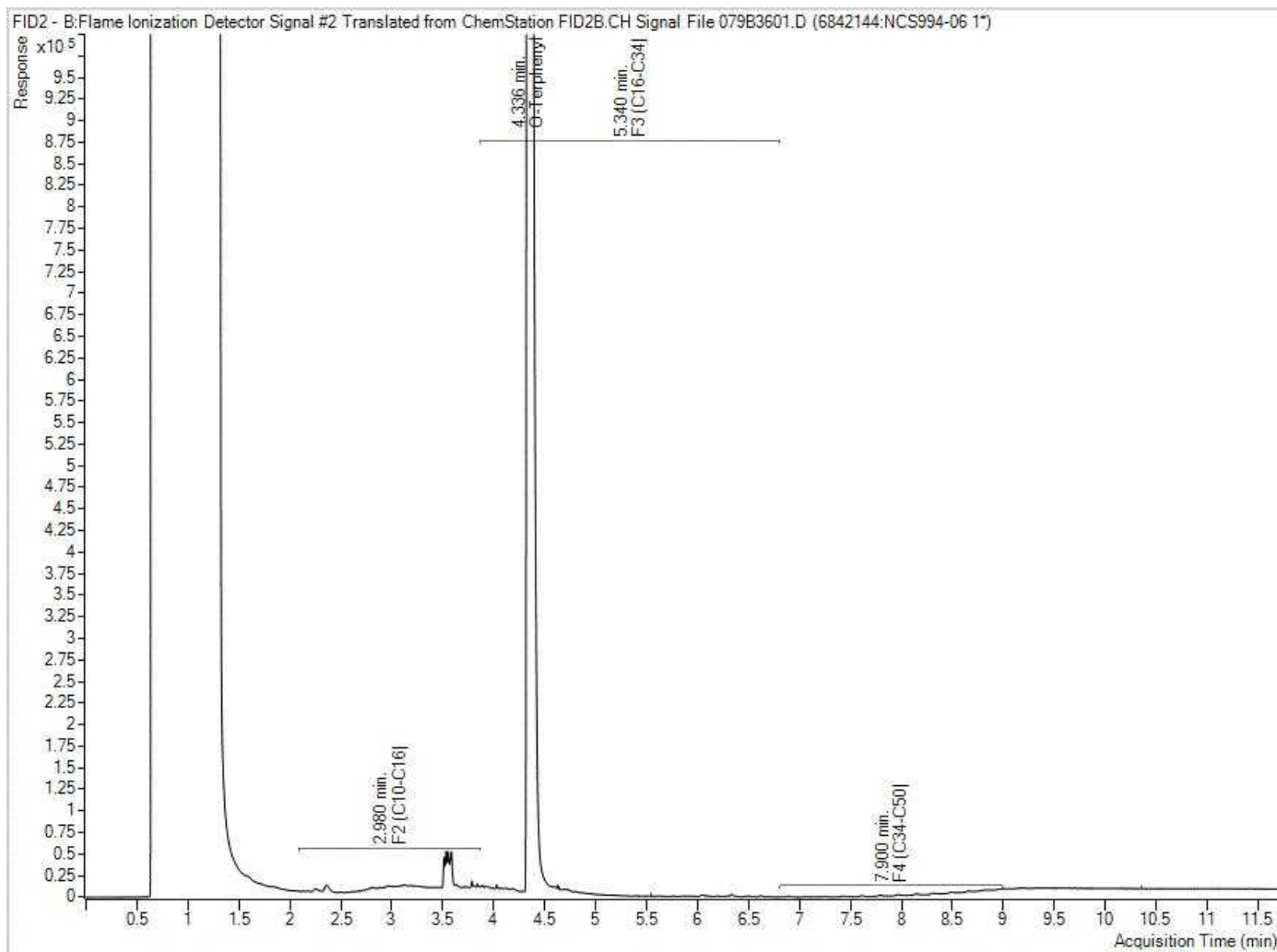
CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name: #9197 Stantec Consulting Ltd		Company Name: Simon Baer		Quotation #: C01624		BV Labs Job #: 780223	
Attention: Accounts Payable		Attention: Simon Baer		P.O. #: 60305680.802		Bottle Order #: 780223	
Address: 300 Hagey Blvd Suite 100 Waterloo ON N2L 0A4		Address:		Project Name:		COC #: Project Manager:	
Tel: (519) 579-4410 Fax: (519) 579-6733		Tel: (519) 585-7461 Fax:		Site #: S. Baer		Ronklin Gracian	
Email: SAPinvoices@Stantec.com		Email: Simon.Baer@stantec.com G.M.T. Whitehead@stantec.com		Sampled By:		C#780223-01-01	
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY							
Regulation 153 (2011)		Other Regulations		Special Instructions		Turnaround Time (TAT) Required:	
☒ Table 1 ☐ Res/Park ☐ Medium/Fine		☐ CCME ☐ Sanitary Sewer Bylaw		Not regulated drinking water		Regular (Standard) TAT: (will be applied if Rush TAT is not specified): Standard TAT = 5-7 Working days for most tests. ☒	
☐ Table 2 ☐ Ind/Comm ☐ Coarse		☐ Reg 558 ☐ Storm Sewer Bylaw				Please provide advance notice for rush projects	
☐ Table 3 ☐ Agri/Other ☐ For RSC		☐ MISA Municipality				Job Specific Rush TAT (if applies to entire submission)	
☐ Table		☒ PWQO ☐ Reg 406 Table				Date Required: Time Required: ☐	
☐ Other						Rush Confirmation Number: (call lab for #)	
Include Criteria on Certificate of Analysis (Y/N)?							
Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): (Metal) (Hg) (Cr VI)	# of Bottles	Comments
1	WG-60305680-20200714-SB01	14/07/2020	10:32	GW	Y	5	REC'D IN WATERLOO
2	WG-60305680-20200714-SB02		10:10	GW	Y	10	
3	WG-60305680-20200714-SB03		11:15	GW	Y	10	
4	WG-60305680-20200714-SB04		12:10	GW	Y	5	
5	WG-60305680-20200714-SB05		14:01	GW	Y	10	
6	WG-60305680-20200714-SB06		14:55	GW	Y	10	
7							
8							
9							
10							
RELINQUISHED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)		Date: (YY/MM/DD)	Time
Simon Baer		20/07/14	16:12	Amr MAHMOUD AMIN		20/07/14	16:24
				Sukuma		20/07/14	17:56
# jars used and not submitted		Laboratory Use Only		Time Sensitive		Temperature (°C) on Receipt	
		Custody Seal		Present		23/11/14	
		Intact		Yes			
		No					
* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.		* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.		* SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.		White: BV Labs Yellow: Client	
				Sukuma		S/5/16	
				SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS			

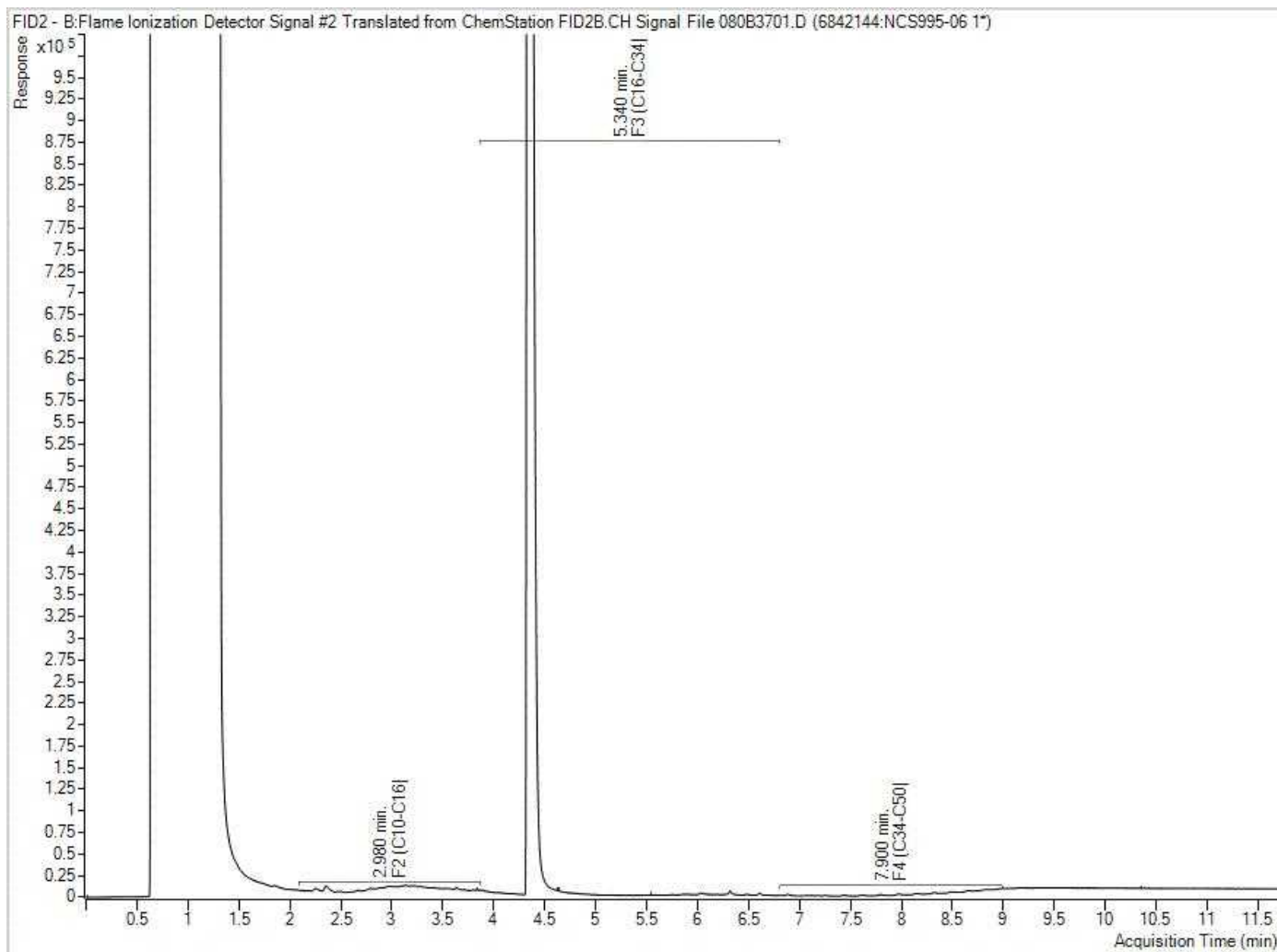
Bureau Veritas Canada (2019) Inc.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



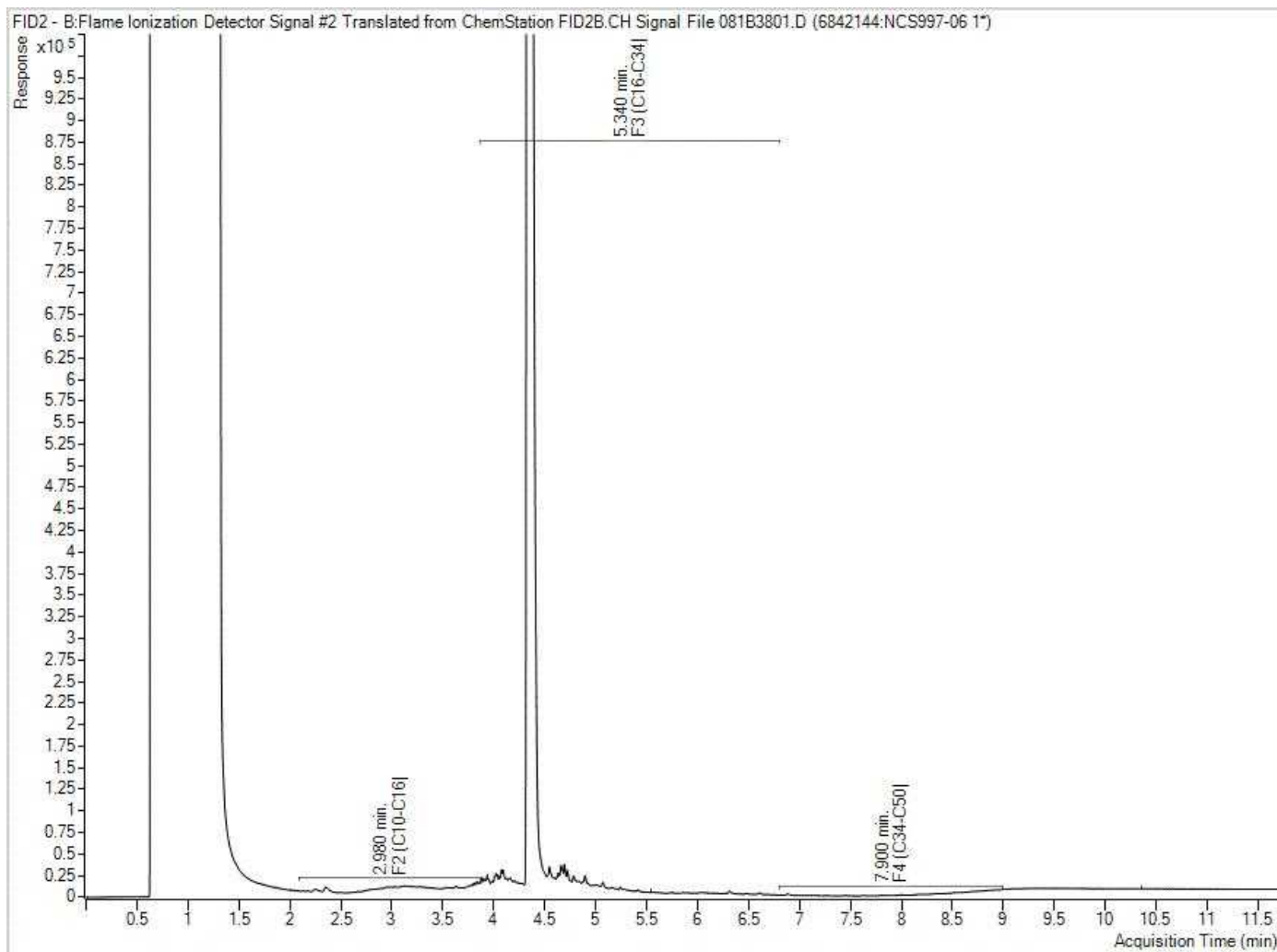
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



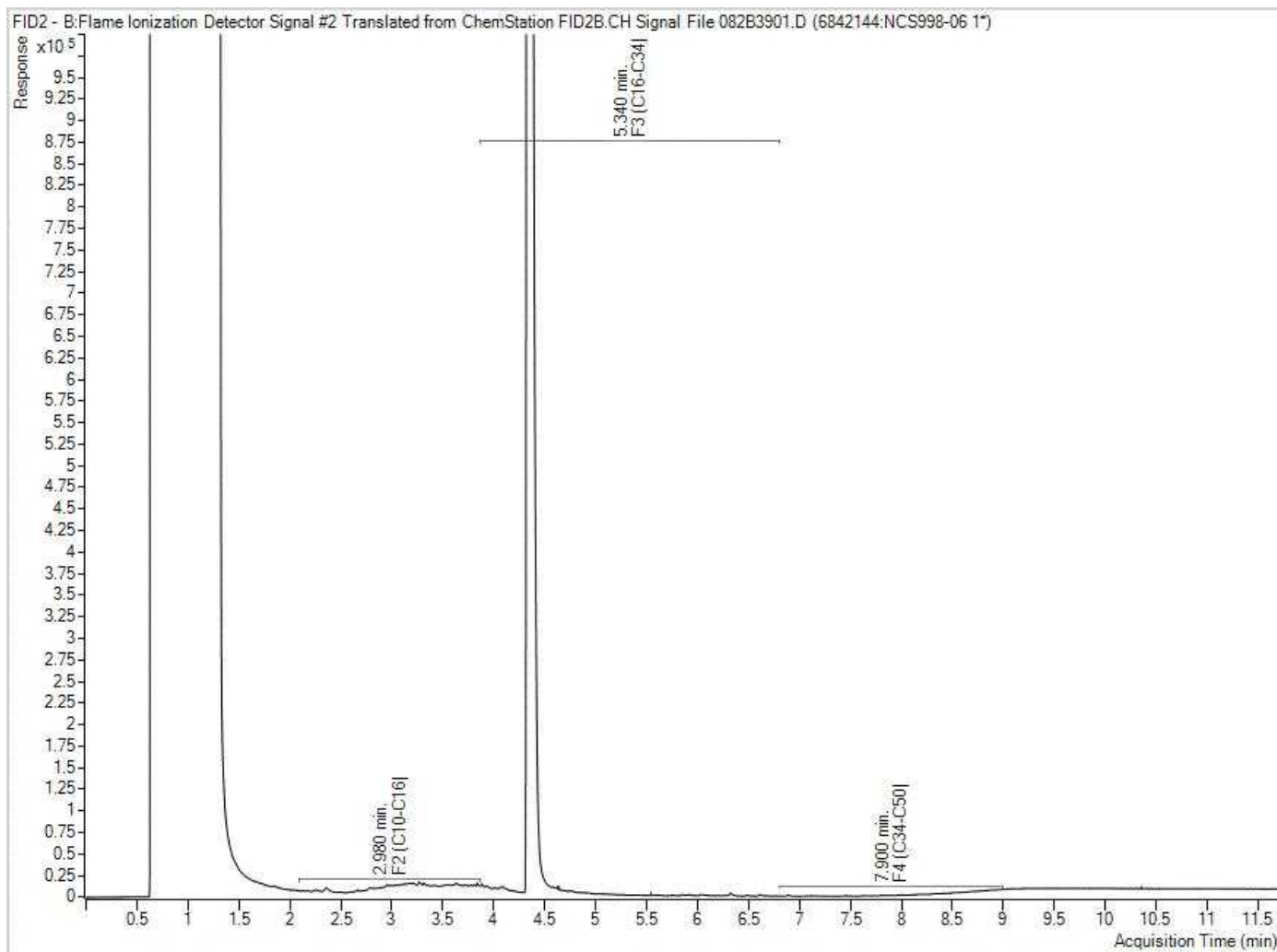
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



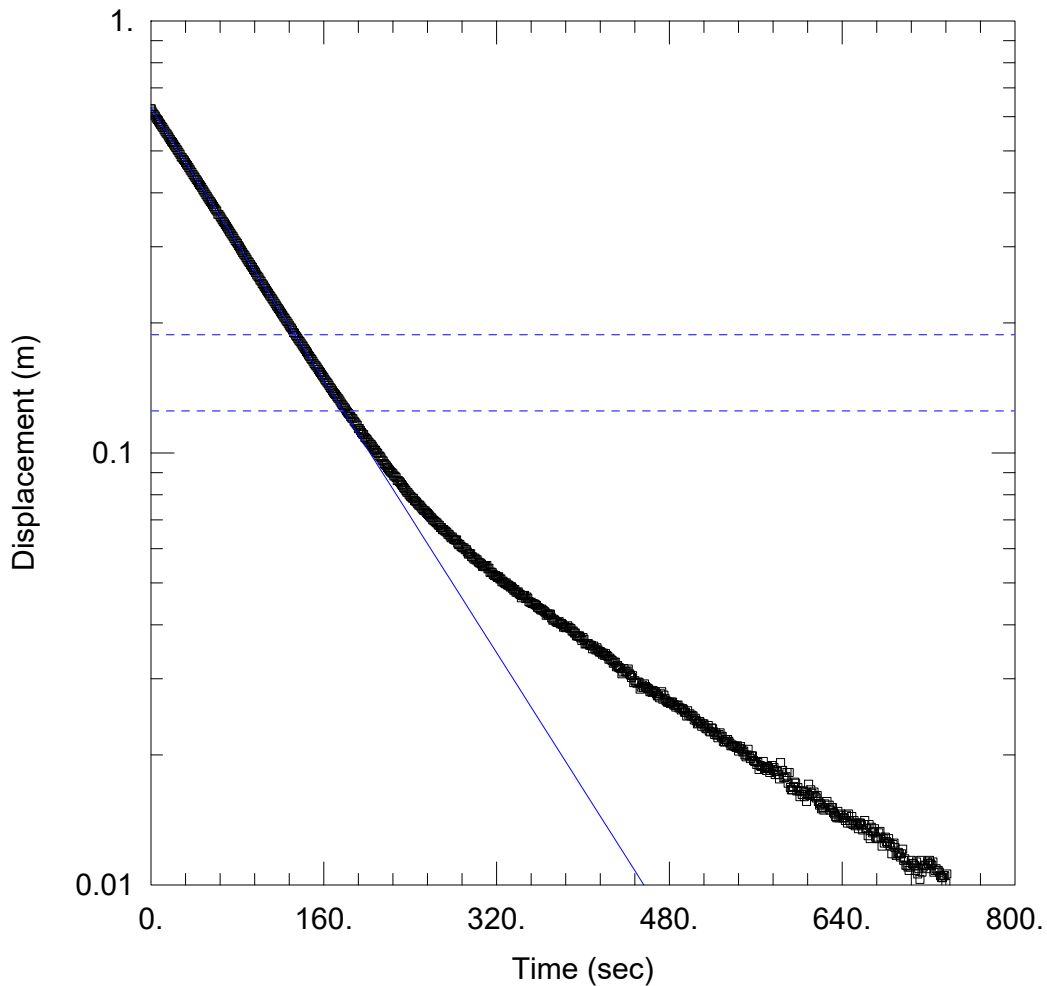
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Appendix F Hydraulic Conductivity Testing Solutions



MW01-20 - TEST 1

Data Set: \...\mw01-20_1_ah_JK.aqt
Date: 06/17/21

Time: 09:57:53

PROJECT INFORMATION

Company: Stantec Consulting, Ltd
Project: 60305680
Location: Baden, ON
Test Well: MW01-20
Test Date: 3-July-20

AQUIFER DATA

Saturated Thickness: 2.15 m

Anisotropy Ratio (K_z/K_r): 0.2

WELL DATA (MW01-20)

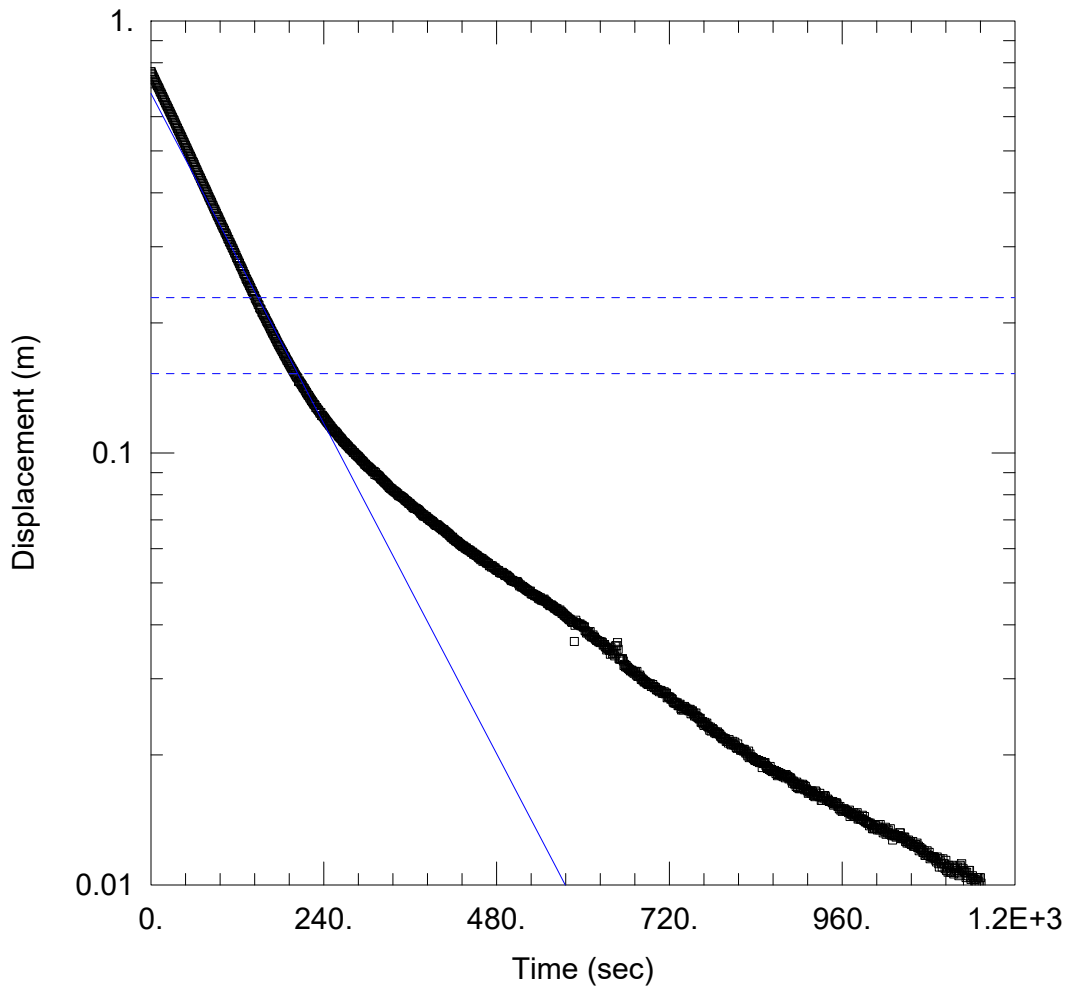
Initial Displacement: 0.6257 m
Total Well Penetration Depth: 1.55 m
Casing Radius: 0.0254 m

Static Water Column Height: 1.55 m
Screen Length: 1.55 m
Well Radius: 0.105 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
 $K = 2.6E-5$ m/sec

Solution Method: Bouwer-Rice
 $y_0 = 0.6297$ m



MW01-20 - TEST 2

Data Set: \...\mw01-20_2_ah_JK.aqt
Date: 06/17/21

Time: 10:04:15

PROJECT INFORMATION

Company: Stantec Consulting, Ltd
Project: 60305680
Location: Baden, ON
Test Well: MW01-20
Test Date: 6-July-20

AQUIFER DATA

Saturated Thickness: 2.15 m

Anisotropy Ratio (K_z/K_r): 0.2

WELL DATA (MW01-20)

Initial Displacement: 0.7627 m
Total Well Penetration Depth: 1.55 m
Casing Radius: 0.0254 m

Static Water Column Height: 1.55 m
Screen Length: 1.55 m
Well Radius: 0.105 m
Gravel Pack Porosity: 0.3

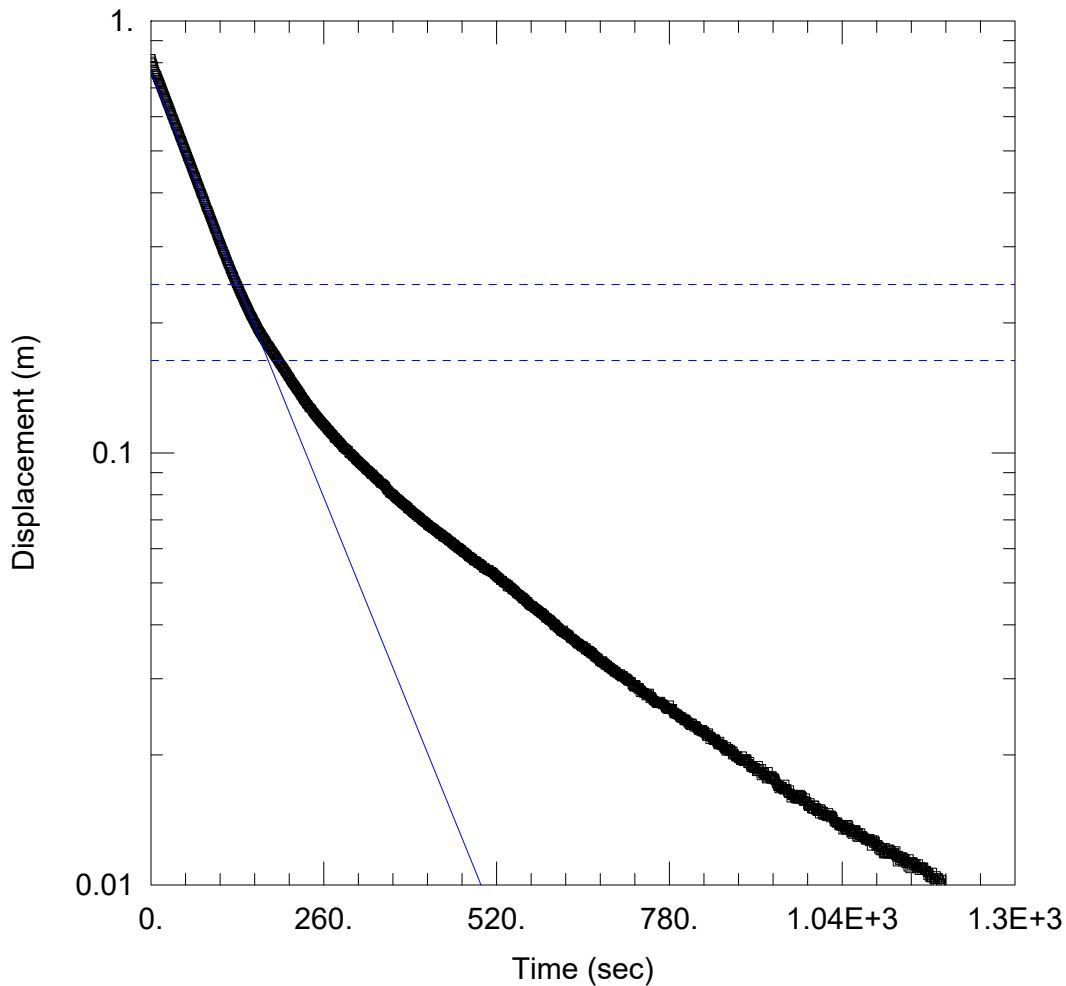
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 2.1E-5$ m/sec

$y_0 = 0.6795$ m



MW01-20 - TEST 3

Data Set: \...\mw01-20_3_ah_JK.aqt
Date: 06/17/21

Time: 10:05:37

PROJECT INFORMATION

Company: Stantec Consulting, Ltd
Project: 60305680
Location: Baden, ON
Test Well: MW01-20
Test Date: 7-July-20

AQUIFER DATA

Saturated Thickness: 2.15 m

Anisotropy Ratio (K_z/K_r): 0.2

WELL DATA (MW01-20)

Initial Displacement: 0.8179 m
Total Well Penetration Depth: 1.55 m
Casing Radius: 0.0254 m

Static Water Column Height: 1.55 m
Screen Length: 1.55 m
Well Radius: 0.105 m
Gravel Pack Porosity: 0.3

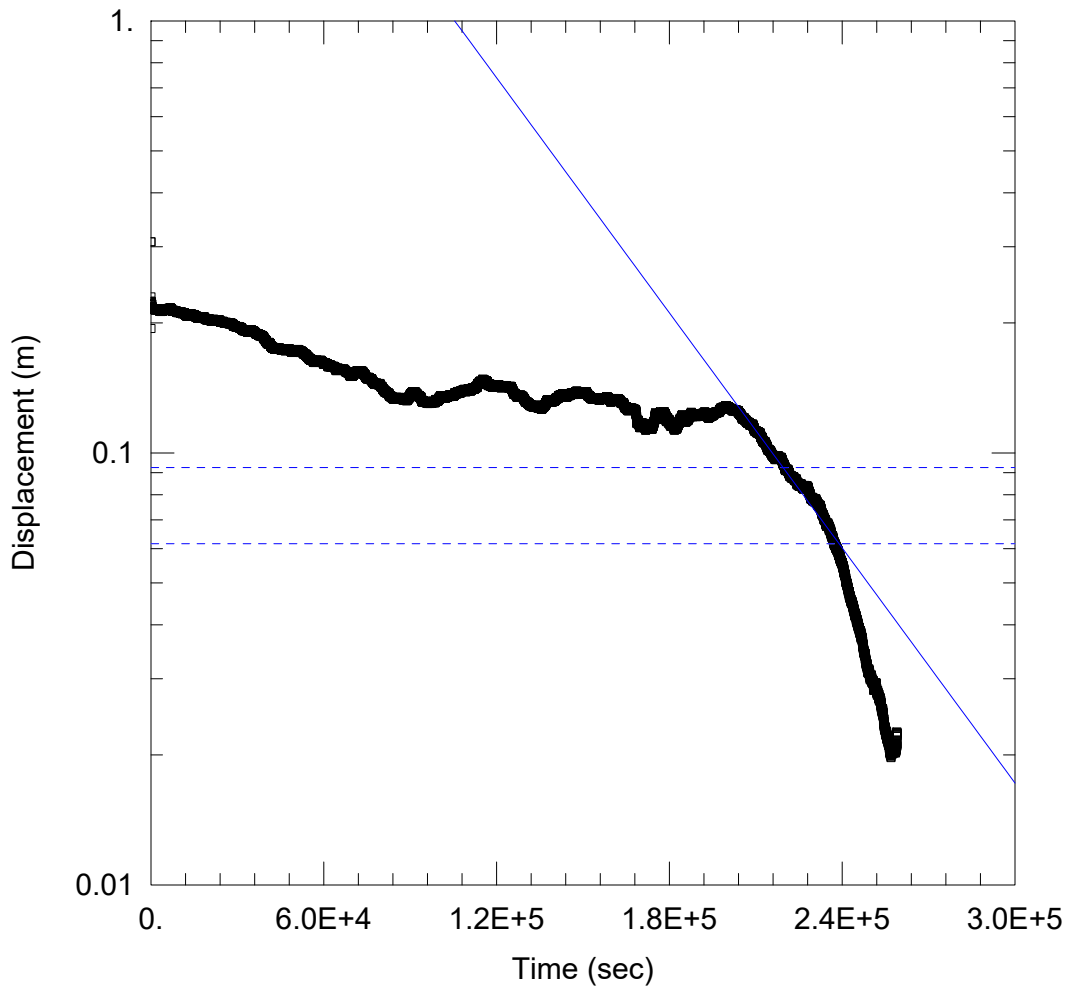
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 2.5E-5$ m/sec

$y_0 = 0.7628$ m



MW02-20 - TEST 4

Data Set: \...\mw02-20_4_higherslope_ah_JK.aqt

Date: 06/17/21

Time: 10:43:41

PROJECT INFORMATION

Company: Stantec Consulting, Ltd

Project: 60305680

Location: Baden, ON

Test Well: MW02-20

Test Date: 14-July-20

AQUIFER DATA

Saturated Thickness: 0.6 m

Anisotropy Ratio (K_z/K_r): 0.2

WELL DATA (MW02-20)

Initial Displacement: 0.3082 m

Static Water Column Height: 0.6 m

Total Well Penetration Depth: 0.6 m

Screen Length: 0.6 m

Casing Radius: 0.0254 m

Well Radius: 0.105 m

Gravel Pack Porosity: 0.3

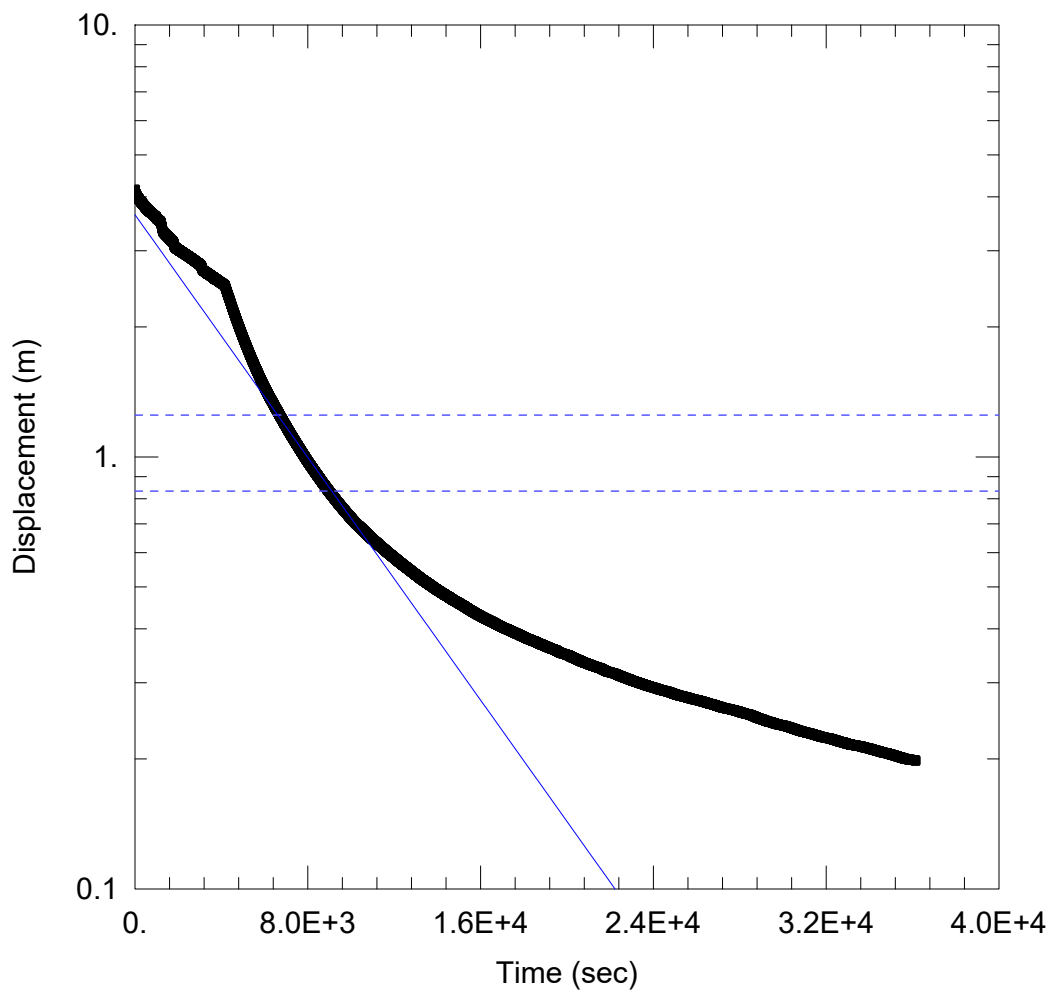
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 8.2E-8$ m/sec

$y_0 = 9.054$ m



MW03-20 - TEST 2

Data Set: \...\mw03-20_2_ah_JK.aqt

Date: 06/17/21

Time: 12:22:30

PROJECT INFORMATION

Company: Stantec Consulting, Ltd

Project: 60305680

Location: Baden, ON

Test Well: MW03-20

Test Date: 7-July-20

AQUIFER DATA

Saturated Thickness: 4.93 m

Anisotropy Ratio (K_z/K_r): 0.2

WELL DATA (MW03-20)

Initial Displacement: 4.167 m

Static Water Column Height: 4.93 m

Total Well Penetration Depth: 4.93 m

Screen Length: 3.05 m

Casing Radius: 0.0254 m

Well Radius: 0.105 m

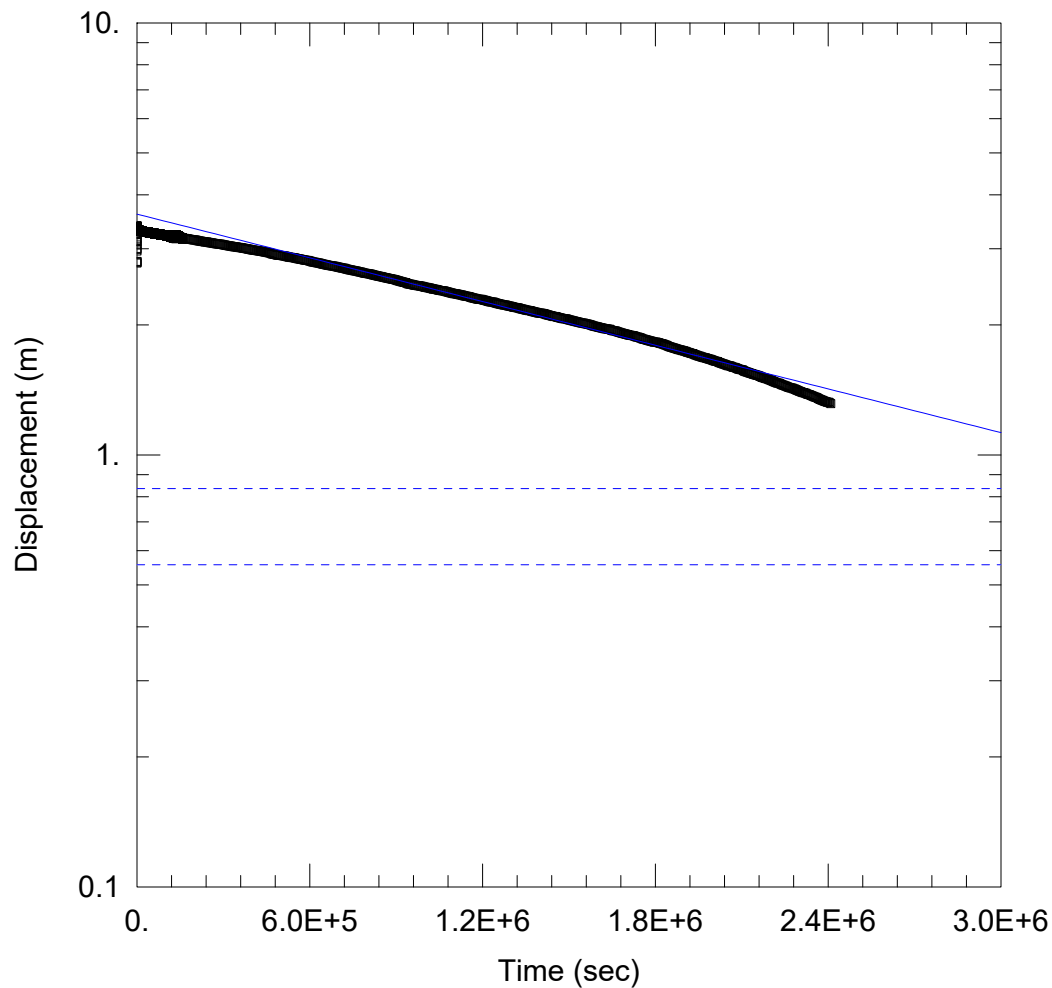
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 6.0E-8$ m/sec

$y_0 = 3.636$ m



MW04-20D - TEST 2

Data Set: \...\mw04-20d_2_ah_JK.aqt
Date: 06/17/21

Time: 12:38:41

PROJECT INFORMATION

Company: Stantec Consulting, Ltd
Project: 60305680
Location: Baden, ON
Test Well: MW04-20D
Test Date: 15-July-20

AQUIFER DATA

Saturated Thickness: 3.15 m

Anisotropy Ratio (K_z/K_r): 0.2

WELL DATA (MW04-20D)

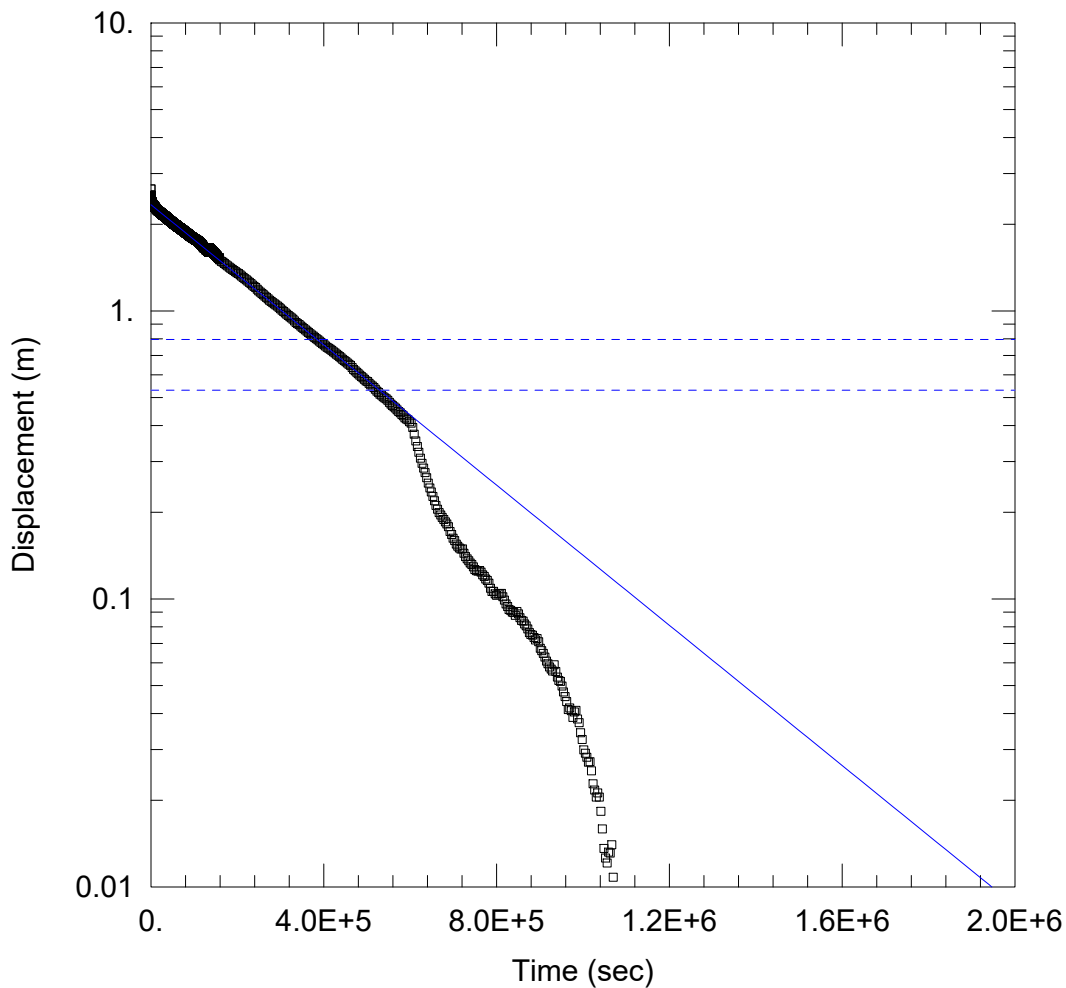
Initial Displacement: 2.785 m
Total Well Penetration Depth: 2.54 m
Casing Radius: 0.0254 m

Static Water Column Height: 2.54 m
Screen Length: 2.54 m
Well Radius: 0.105 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
K = 8.0E-10 m/sec

Solution Method: Bouwer-Rice
 y_0 = 3.609 m



MW04-20S - TEST 2

Data Set: \...\mw04-20s_2_ah_JK.aqt
Date: 06/17/21

Time: 13:07:19

PROJECT INFORMATION

Company: Stantec Consulting, Ltd
Project: 60305680
Location: Baden, ON
Test Well: MW04-20S
Test Date: 15-July-20

AQUIFER DATA

Saturated Thickness: 3.89 m

Anisotropy Ratio (K_z/K_r): 0.2

WELL DATA (MW04-20S)

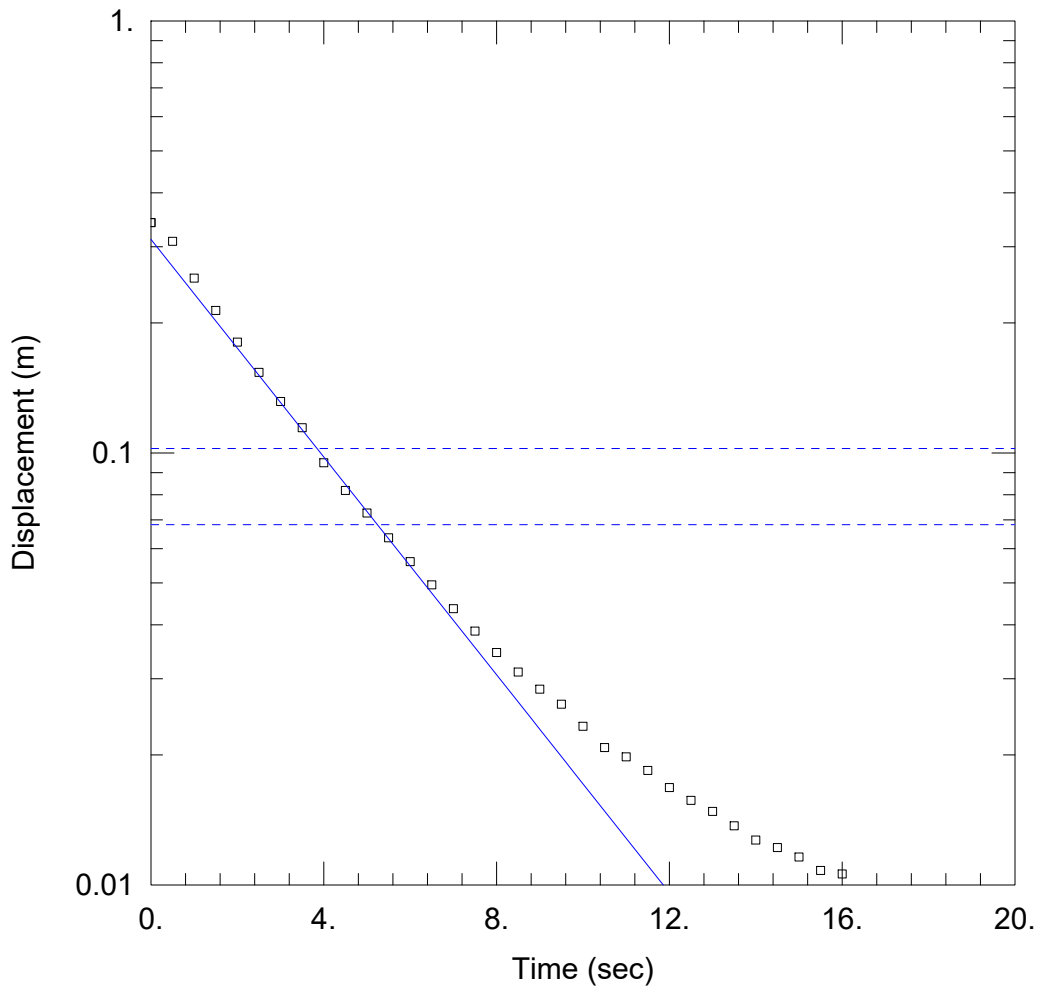
Initial Displacement: 2.654 m
Total Well Penetration Depth: 3.89 m
Casing Radius: 0.0254 m

Static Water Column Height: 3.89 m
Screen Length: 3.05 m
Well Radius: 0.105 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
K = 5.8E-9 m/sec

Solution Method: Bouwer-Rice
 y_0 = 2.337 m



MW06-20D - TEST 3

Data Set: \...\mw06-20d_3_ah_JK.aqt

Date: 06/17/21

Time: 13:30:02

PROJECT INFORMATION

Company: Stantec Consulting, Ltd

Project: 60305680

Location: Baden, ON

Test Well: MW06-20D

Test Date: 7-July-20

AQUIFER DATA

Saturated Thickness: 7. m

Anisotropy Ratio (K_z/K_r): 0.4

WELL DATA (MW06-20D)

Initial Displacement: 0.3412 m

Static Water Column Height: 6.31 m

Total Well Penetration Depth: 6.31 m

Screen Length: 3.05 m

Casing Radius: 0.0254 m

Well Radius: 0.105 m

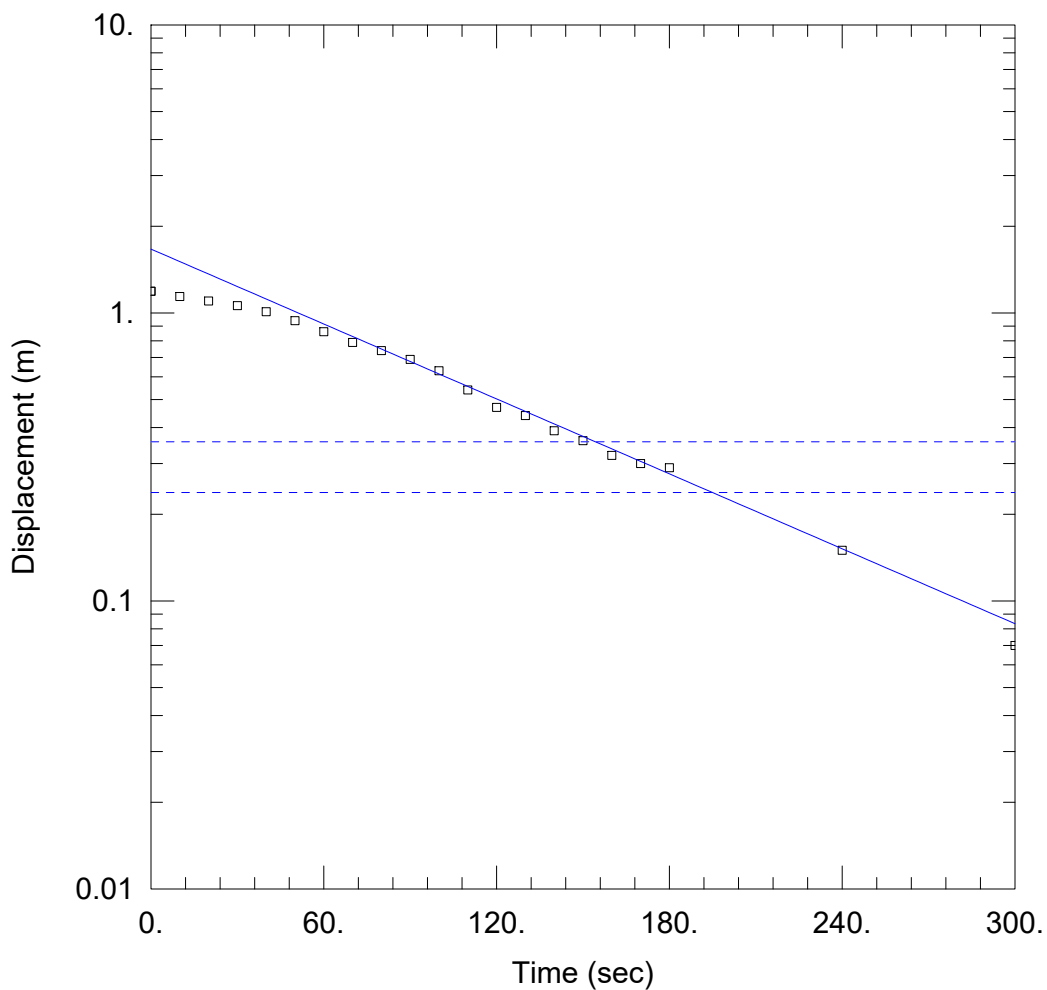
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 9.3E-5$ m/sec

$y_0 = 0.3122$ m



MW06-20S - TEST 1

Data Set: \...\mw06-20s_1_ah_JK.aqt

Date: 06/17/21

Time: 14:18:29

PROJECT INFORMATION

Company: Stantec Consulting, Ltd

Project: 60305680

Location: Baden, ON

Test Well: MW06-20S

Test Date: 3-July-20

AQUIFER DATA

Saturated Thickness: 3.31 m

Anisotropy Ratio (K_z/K_r): 0.4

WELL DATA (MW06-20S)

Initial Displacement: 1.19 m

Static Water Column Height: 2.97 m

Total Well Penetration Depth: 2.97 m

Screen Length: 2.97 m

Casing Radius: 0.0254 m

Well Radius: 0.105 m

Gravel Pack Porosity: 0.3

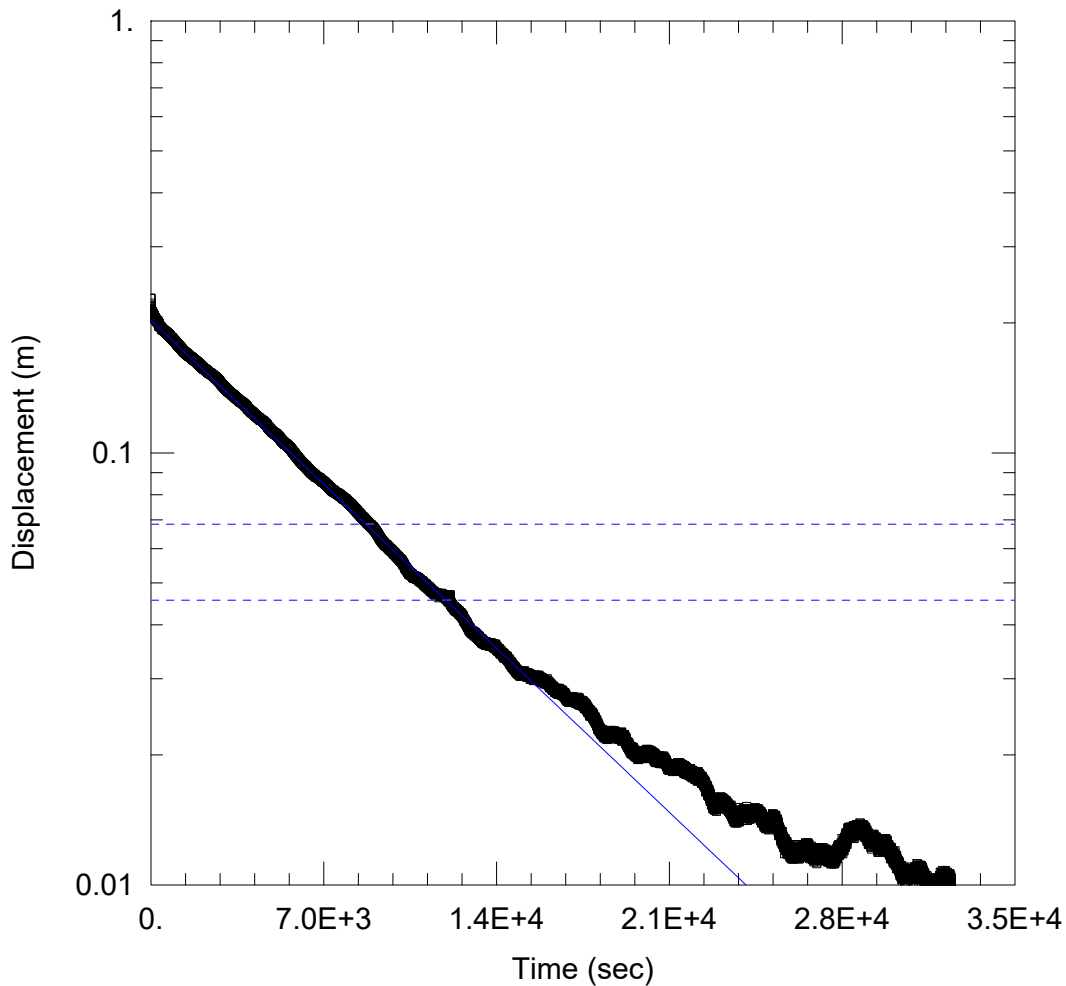
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 1.7E-5$ m/sec

$y_0 = 1.666$ m



MW08-20 - TEST 2

Data Set: \...\mw08-20_2_ah_JK.aqt
Date: 06/17/21

Time: 14:24:43

PROJECT INFORMATION

Company: Stantec Consulting, Ltd
Project: 60305680
Location: Baden, ON
Test Well: MW08-20
Test Date: 14-July-20

AQUIFER DATA

Saturated Thickness: 1.45 m

Anisotropy Ratio (K_z/K_r): 0.2

WELL DATA (MW08-20)

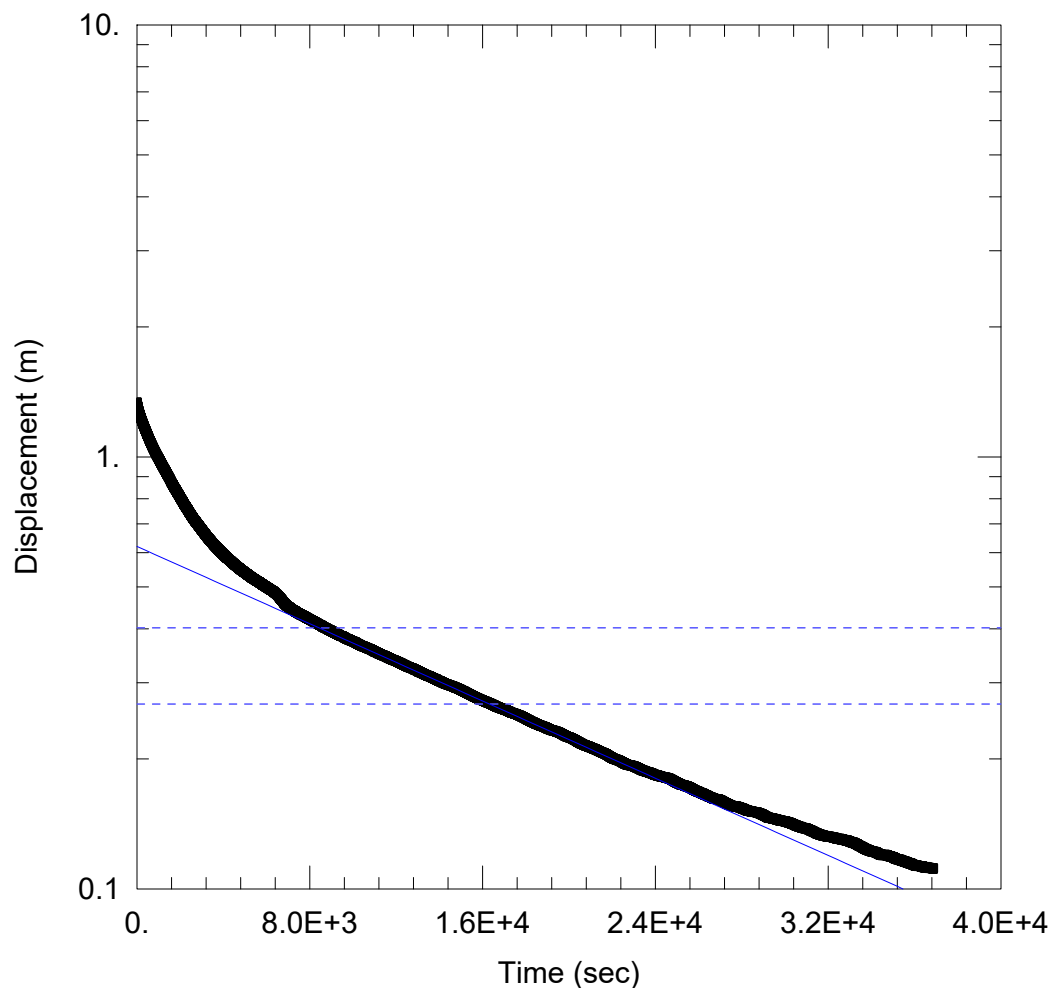
Initial Displacement: 0.228 m
Total Well Penetration Depth: 0.85 m
Casing Radius: 0.0254 m

Static Water Column Height: 0.85 m
Screen Length: 0.85 m
Well Radius: 0.105 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
 $K = 5.1E-7$ m/sec

Solution Method: Bouwer-Rice
 $y_0 = 0.2027$ m



MW09-20 - TEST 1

Data Set: \...\mw09-20_1_ah_JK.aqt

Date: 06/17/21

Time: 14:29:50

PROJECT INFORMATION

Company: Stantec Consulting, Ltd

Project: 60305680

Location: Baden, ON

Test Well: MW09-20

Test Date: 6-July-20

AQUIFER DATA

Saturated Thickness: 2.58 m

Anisotropy Ratio (K_z/K_r): 0.2

WELL DATA (MW09-20)

Initial Displacement: 1.34 m

Static Water Column Height: 2.15 m

Total Well Penetration Depth: 2.15 m

Screen Length: 2.15 m

Casing Radius: 0.0254 m

Well Radius: 0.105 m

Gravel Pack Porosity: 0.3

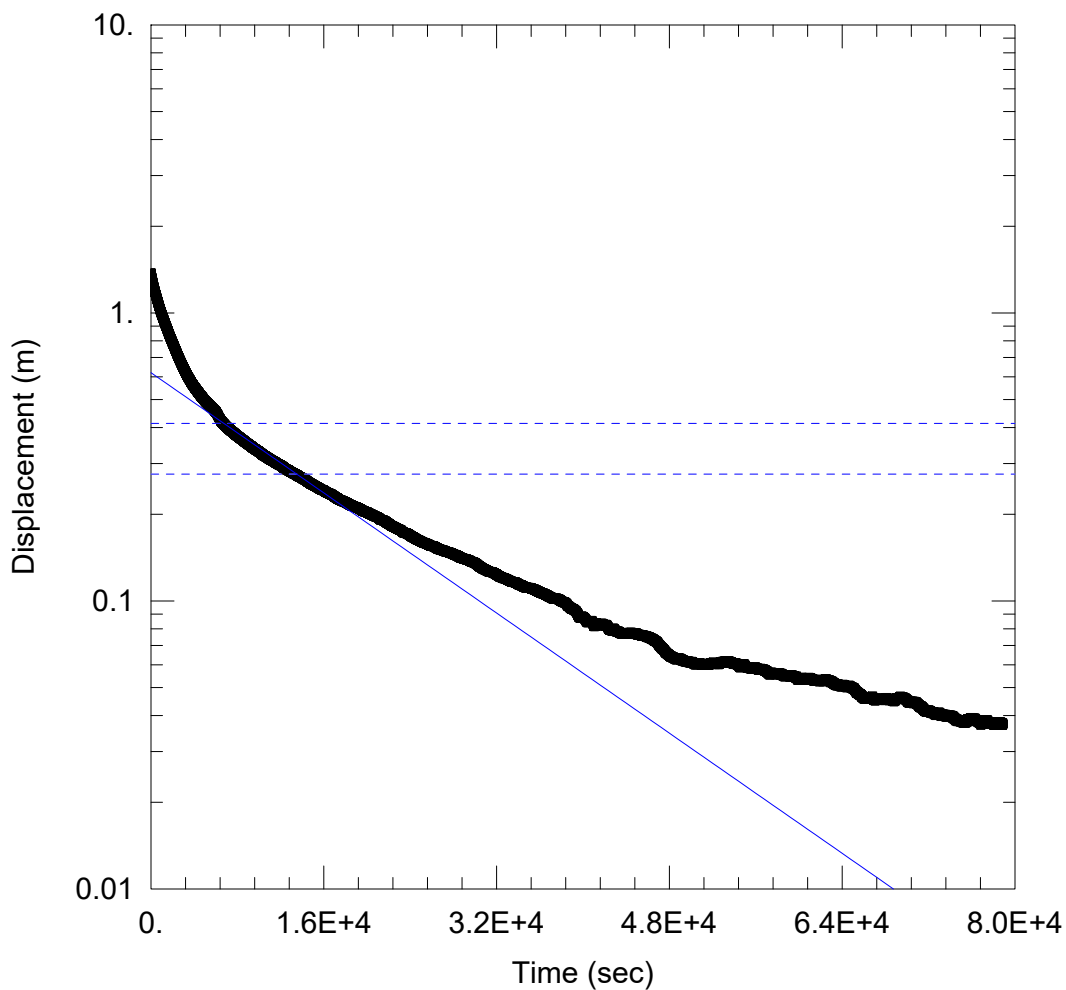
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 1.2E-7$ m/sec

$y_0 = 0.6204$ m



MW09-20 - TEST 2

Data Set: \...\mw09-20_2_ah_JK.aqt

Date: 06/17/21

Time: 14:32:49

PROJECT INFORMATION

Company: Stantec Consulting, Ltd

Project: 60305680

Location: Baden, ON

Test Well: MW09-20

Test Date: 7-July-20

AQUIFER DATA

Saturated Thickness: 2.58 m

Anisotropy Ratio (K_z/K_r): 0.2

WELL DATA (MW09-20)

Initial Displacement: 1.378 m

Static Water Column Height: 2.15 m

Total Well Penetration Depth: 2.15 m

Screen Length: 2.15 m

Casing Radius: 0.0254 m

Well Radius: 0.105 m

Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 1.4E-7$ m/sec

$y_0 = 0.62$ m

Appendix G Water Balance Calculations

TABLE G-1: PRE-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
CATCHMENTS 100, 101, AND 102
Runoff Directed North Towards Wetland

Pre-Development

Model Type: Thornthwaite and Mather (1955)
Client: Ativa Holdings Inc.
Location **Ativa Baden North Subdivision - Catchments 100, 101 & 102**
Total Site Area (ha)20.04

Land Description Factors (Sub-area descriptions provided below)	Sub-Area A	Sub-Area B	Sub-Area C	Sub-Area D	Sub-Area E								Total
Topography	0.15	0.15	0.15	0.15	0.15								
Soils	0.60	0.60	0.60	0.05	0.05								
Cover	0.05	0.15	0.20	0.15	0.05								
Sum (Infiltration Factor) [†]	0.80	0.90	0.95	0.35	0.25								
Soil Moisture Capacity (mm)	150	150	300	200	150								20.04
Site area (ha)	2.22	0.11	0.04	1.90	15.77								
Imperviousness Coefficient	0.00	0.00	0.00	0.00	0.00								
Impervious Area (ha)	0.00	0.00	0.00	0.00	0.00								0.00
Percentage of Total Site Area	0.0%	0.0%	0.0%	0.0%	0.0%								0%
Remaining Pervious Area (ha)	2.22	0.11	0.04	1.90	15.77								20.04
Total Pervious Site Area (ha)	2.22	0.11	0.04	1.90	15.77								20.04
Percentage of Total Site Area	11.1%	0.56%	0.2%	9.5%	78.7%								100%

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Climate Data (Roseville Climate Normals, 1981 - 2010) [‡]													
Average Daily Temperature (°C)	-6.5	-5.4	-1	6.5	12.7	18.2	20.5	19.5	15.2	8.7	2.6	-3.5	7.3
Precipitation (mm)	68.1	54.6	55	77.2	87.9	76.3	98.2	83.9	85.4	75.3	88.4	68.5	919

Potential Evapotranspiration Analysis for Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heat Index	0.0	0.0	0.0	1.5	4.1	7.1	8.5	7.9	5.4	2.3	0.4	0.0	37
Unadjusted Potential Evapotranspiration (mm)	0.0	0.0	0.0	29.4	60.6	89.5	101.8	96.4	73.6	40.3	10.9	0.0	502
Potential Evapotranspiration Adjusting Factor for Latitude*	0.77	0.87	0.99	1.12	1.23	1.29	1.26	1.16	1.04	0.92	0.81	0.75	
Adjusted Potential Evapotranspiration (PET)(mm)	0	0	0	33	75	115	128	112	77	37	9	0	585
Precipitation - PET (mm)	68	55	55	44	13	-39	-30	-28	9	38	80	69	333

Evapotranspiration Analysis													
Sub-Area A	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-81	-27	0	0	
Storage (S)	150	150	150	150	150	116	95	79	87	126	150	150	
Change in Storage	0	0	0	0	0	-34	-21	-16	9	38	24	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	110	119	100	77	37	9	0	560
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	55	69	359
Potential Infiltration (I)	54	44	44	35	11	0	0	0	0	0	44	55	287
Potential Direct Surface Water Runoff (R)	14	11	11	9	3	0	0	0	0	0	11	14	72
Potential Infiltration (mm)	0	0	0	232	11	0	0	0	0	0	44	0	287
Pervious Evapotranspiration (m ³)	0	0	0	731	1656	2455	2648	2229	1706	822	196	0	12,442
Pervious Runoff (m ³)	303	243	245	197	60	0	0	0	0	0	245	305	1,596
Pervious Infiltration (m ³)	0	0	0	5166	238	0	0	0	0	0	980	0	6,384
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m ³)	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE G-1: PRE-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
CATCHMENTS 100, 101, AND 102
Runoff Directed North Towards Wetland

Evapotranspiration Analysis													
Sub-Area B	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-81	-27	0	0	
Storage (S)	150	150	150	150	150	116	95	79	87	126	150	150	
Change in Storage	0	0	0	0	0	-34	-21	-16	9	38	24	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	110	119	100	77	37	9	0	560
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	55	69	359
Potential Infiltration (I)	61	49	50	40	12	0	0	0	0	0	50	62	323
Potential Direct Surface Water Runoff (R)	7	5	6	4	1	0	0	0	0	0	6	7	36
Potential Infiltration (mm)	0	0	0	261	12	0	0	0	0	0	50	0	323
Pervious Evapotranspiration (m³)	0	0	0	37	83	123	133	112	86	41	10	0	624
Pervious Runoff (m³)	8	6	6	5	1	0	0	0	0	0	6	8	40
Pervious Infiltration (m³)	0	0	0	292	13	0	0	0	0	0	55	0	360
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0

Evapotranspiration Analysis													
Sub-Area C	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-85	-38	0	0	
Storage (S)	300	300	300	300	300	264	239	217	226	264	300	300	
Change in Storage	0	0	0	0	0	-36	-25	-22	9	38	36	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	113	123	105	77	37	9	0	571
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	44	69	348
Potential Infiltration (I)	65	52	52	42	13	0	0	0	0	0	41	65	330
Potential Direct Surface Water Runoff (R)	3	3	3	2	1	0	0	0	0	0	2	3	17
Potential Infiltration (mm)	0	0	0	276	13	0	0	0	0	0	41	0	330
Pervious Evapotranspiration (m³)	0	0	0	13	28	43	47	40	29	14	3	0	218
Pervious Runoff (m³)	1	1	1	1	0	0	0	0	0	0	1	1	7
Pervious Infiltration (m³)	0	0	0	106	5	0	0	0	0	0	16	0	126
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0

Evapotranspiration Analysis													
Sub-Area D	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-83	-32	0	0	
Storage (S)	200	200	200	200	200	165	142	123	132	170	200	200	
Change in Storage	0	0	0	0	0	-35	-23	-19	9	38	30	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	112	121	103	77	37	9	0	565
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	50	69	354
Potential Infiltration (I)	24	19	19	16	5	0	0	0	0	0	17	24	124
Potential Direct Surface Water Runoff (R)	44	35	36	29	9	0	0	0	0	0	32	45	230
Potential Infiltration (mm)	0	0	0	102	5	0	0	0	0	0	17	0	124
Pervious Evapotranspiration (m³)	0	0	0	625	1417	2122	2303	1954	1460	704	167	0	10,753
Pervious Runoff (m³)	842	675	680	548	166	0	0	0	0	0	614	847	4,373
Pervious Infiltration (m³)	0	0	0	1935	89	0	0	0	0	0	331	0	2,355
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE G-1: PRE-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
CATCHMENTS 100, 101, AND 102
Runoff Directed North Towards Wetland

Evapotranspiration Analysis													
Sub-Area E	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-81	-27	0	0	
Storage (S)	150	150	150	150	150	116	95	79	87	126	150	150	
Change in Storage	0	0	0	0	0	-34	-21	-16	9	38	24	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	110	119	100	77	37	9	0	560
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	55	69	359
Potential Infiltration (I)	17	14	14	11	3	0	0	0	0	0	14	17	90
Potential Direct Surface Water Runoff (R)	51	41	41	33	10	0	0	0	0	0	41	51	269
Potential Infiltration (mm)	0	0	0	73	3	0	0	0	0	0	14	0	90
Pervious Evapotranspiration (m³)	0	0	0	5184	11747	17413	18784	15811	12103	5833	1387	0	88,261
Pervious Runoff (m³)	8053	6457	6504	5242	1584	0	0	0	0	0	6517	8101	42,458
Pervious Infiltration (m³)	0	0	0	11452	528	0	0	0	0	0	2172	0	14,153
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0
Catchments 100, 101 & 102													
Pre-Development Infiltration (INF)	23,378	m³/yr	117	mm/yr	0.7	L/s							
Pre-Development Runoff (R)	48,473	m³/yr	242	mm/yr	1.5	L/s							
Pre-Development Evapotranspiration (ET)	112,299	m³/yr	560	mm/yr	3.6	L/s							
Total = INF + R + ET	184,151	m³/yr	919	mm/yr	5.8	L/s							
Precipitation	184,151	m³/yr	919	mm/yr	5.8	L/s							

Notes:
† Infiltration factors after Ontario Ministry of the Environment, 2003. Stormwater Management Planning and Design Manual. March 2003.; and Ontario Ministry of Environment and Energy (MOEE). 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications. April 1995.
* PET adjustment factors after Thornthwaite, C.W., and J.R. Mather, 1957. Instructions and Tables for Computing Potential Evapotranspiration and the water balance. Drexel Institute of Technology, Laboratory of Climatology, Publications in Climatology, Volume X, No. 3.
‡ Climate Data after Environment Canada, 2021. Canadian Climate Normals 1981-2010, Roseville Station, Climate ID 6151042. [Online] http://climate.weather.gc.ca/climate_normals/index_e.html. Accessed June 2021.

- Assumptions:
- [1] The monthly average precipitation collected at the Roseville climate station is reflective of the precipitation trends that have historically occurred at the Site.
 - [2] Surplus water is not available for runoff and recharge during months where water losses from actual evapotranspiration exceed precipitation inputs.
 - [3] Runoff, infiltration and evapotranspiration do not occur in months where the average daily temperature is below 0°C, which is the case for the months of December through March at the Site.
 - [4] Precipitation during freezing months (i.e., December to March) is assumed to accumulate as snow and result in additional precipitation in the first month thereafter where the average temperature is greater than 0°C (i.e., April).
 - [5] Soil moisture capacity is at a maximum in April.

TABLE G-2: PRE-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
CATCHMENTS 103 and 104
Runoff Directed South to Activa Baden Subdivision

Pre-Development

Model Type: Thornthwaite and Mather (1955)
Client: Activa Holdings Inc.
Location **Activa Baden North Subdivision - Catchments 103 and 104**
Total Site Area (ha)14.75

Land Description Factors (Sub-area descriptions provided below)	Sub-Area A	Sub-Area B	Sub-Area C	Sub-Area D	Sub-Area E								Total
Topography	0.15	0.15	0.15	0.15	0.15								
Soils	0.60	0.60	0.60	0.05	0.05								
Cover	0.05	0.15	0.20	0.15	0.05								
Sum (Infiltration Factor) [†]	0.80	0.90	0.95	0.35	0.25								
Soil Moisture Capacity (mm)	75	150	300	200	75								
Site area (ha)	0.00	0.00	0.00	3.47	11.27								14.75
Imperviousness Coefficient	0.00	0.00	0.00	0.00	0.00								
Impervious Area (ha)	0.00	0.00	0.00	0.00	0.00								0.00
Percentage of Total Site Area	0.0%	0.0%	0.0%	0.0%	0.0%								0%
Remaining Pervious Area (ha)	0.00	0.00	0.00	3.47	11.27								14.75
Total Pervious Site Area (ha)	0.00	0.00	0.00	3.47	11.27								14.75
Percentage of Total Site Area	0.0%	0.00%	0.0%	23.5%	76.4%								100%

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Climate Data (Roseville Climate Normals, 1981 - 2010) [‡]													
Average Daily Temperature (°C)	-6.5	-5.4	-1	6.5	12.7	18.2	20.5	19.5	15.2	8.7	2.6	-3.5	7.3
Precipitation (mm)	68.1	54.6	55	77.2	87.9	76.3	98.2	83.9	85.4	75.3	88.4	68.5	919

Potential Evapotranspiration Analysis for Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heat Index	0.0	0.0	0.0	1.5	4.1	7.1	8.5	7.9	5.4	2.3	0.4	0.0	37
Unadjusted Potential Evapotranspiration (mm)	0.0	0.0	0.0	29.4	60.6	89.5	101.8	96.4	73.6	40.3	10.9	0.0	502
Potential Evapotranspiration Adjusting Factor for Latitude*	0.77	0.87	0.99	1.12	1.23	1.29	1.26	1.16	1.04	0.92	0.81	0.75	
Adjusted Potential Evapotranspiration (PET)(mm)	0	0	0	33	75	115	128	112	77	37	9	0	585
Precipitation - PET (mm)	68	55	55	44	13	-39	-30	-28	9	38	80	69	333

Evapotranspiration Analysis													
Sub-Area A	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-71	-8	0	0	
Storage (S)	75	75	75	75	75	45	30	21	29	68	75	75	
Change in Storage	0	0	0	0	0	-30	-15	-9	9	38	7	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	107	113	93	77	37	9	0	543
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	72	69	376
Potential Infiltration (I)	54	44	44	35	11	0	0	0	0	0	58	55	301
Potential Direct Surface Water Runoff (R)	14	11	11	9	3	0	0	0	0	0	14	14	75
Potential Infiltration (mm)	0	0	0	232	11	0	0	0	0	0	58	0	301
Pervious Evapotranspiration (m ³)	0	0	0	0	0	0	0	0	0	0	0	0	0
Pervious Runoff (m ³)	0	0	0	0	0	0	0	0	0	0	0	0	0
Pervious Infiltration (m ³)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m ³)	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE G-2: PRE-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
CATCHMENTS 103 and 104
Runoff Directed South to Activa Baden Subdivision

Evapotranspiration Analysis													
Sub-Area B	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-81	-27	0	0	
Storage (S)	150	150	150	150	150	116	95	79	87	126	150	150	
Change in Storage	0	0	0	0	0	-34	-21	-16	9	38	24	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	110	119	100	77	37	9	0	560
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	55	69	359
Potential Infiltration (I)	61	49	50	40	12	0	0	0	0	0	50	62	323
Potential Direct Surface Water Runoff (R)	7	5	6	4	1	0	0	0	0	0	6	7	36
Potential Infiltration (mm)	0	0	0	261	12	0	0	0	0	0	50	0	323
Pervious Evapotranspiration (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0
Pervious Runoff (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0
Pervious Infiltration (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0

Evapotranspiration Analysis													
Sub-Area C	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-85	-38	0	0	
Storage (S)	300	300	300	300	300	264	239	217	226	264	300	300	
Change in Storage	0	0	0	0	0	-36	-25	-22	9	38	36	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	113	123	105	77	37	9	0	571
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	44	69	348
Potential Infiltration (I)	65	52	52	42	13	0	0	0	0	0	41	65	330
Potential Direct Surface Water Runoff (R)	3	3	3	2	1	0	0	0	0	0	2	3	17
Potential Infiltration (mm)	0	0	0	276	13	0	0	0	0	0	41	0	330
Pervious Evapotranspiration (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0
Pervious Runoff (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0
Pervious Infiltration (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0

Evapotranspiration Analysis													
Sub-Area D	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-83	-32	0	0	
Storage (S)	200	200	200	200	200	165	142	123	132	170	200	200	
Change in Storage	0	0	0	0	0	-35	-23	-19	9	38	30	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	112	121	103	77	37	9	0	565
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	50	69	354
Potential Infiltration (I)	24	19	19	16	5	0	0	0	0	0	17	24	124
Potential Direct Surface Water Runoff (R)	44	35	36	29	9	0	0	0	0	0	32	45	230
Potential Infiltration (mm)	0	0	0	102	5	0	0	0	0	0	17	0	124
Pervious Evapotranspiration (m³)	0	0	0	1142	2588	3873	4205	3566	2666	1285	306	0	19,630
Pervious Runoff (m³)	1537	1233	1242	1001	302	0	0	0	0	0	1121	1546	7,983
Pervious Infiltration (m³)	0	0	0	3532	163	0	0	0	0	0	604	0	4,298
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE G-2: PRE-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
CATCHMENTS 103 and 104
Runoff Directed South to Activa Baden Subdivision

Evapotranspiration Analysis													
Sub-Area E	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-71	-8	0	0	
Storage (S)	75	75	75	75	75	45	30	21	29	68	75	75	
Change in Storage	0	0	0	0	0	-30	-15	-9	9	38	7	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	107	113	93	77	37	9	0	543
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	72	69	376
Potential Infiltration (I)	17	14	14	11	3	0	0	0	0	0	18	17	94
Potential Direct Surface Water Runoff (R)	51	41	41	33	10	0	0	0	0	0	54	51	282
Potential Infiltration (mm)	0	0	0	73	3	0	0	0	0	0	18	0	94
Pervious Evapotranspiration (m³)	0	0	0	3707	8400	12014	12730	10527	8654	4171	992	0	61,195
Pervious Runoff (m³)	5759	4617	4651	3748	1133	0	0	0	0	0	6099	5792	31,799
Pervious Infiltration (m³)	0	0	0	8189	378	0	0	0	0	0	2033	0	10,600
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0
Catchments 103 and 104													
Pre-Development Infiltration (INF)	14,898	m³/yr	101	mm/yr	0.5	L/s							
Pre-Development Runoff (R)	39,782	m³/yr	270	mm/yr	1.3	L/s							
Pre-Development Evapotranspiration (ET)	80,825	m³/yr	548	mm/yr	2.6	L/s							
Total = INF + R + ET	135,505	m³/yr	919	mm/yr	4.3	L/s							
Precipitation	135,505	m³/yr	919	mm/yr	4.3	L/s							

Sub-Area Descriptions (topography, soils, cover)					
Sub-Area A	Rolling, Silty Sand to Sandy Silt (Sand), Shallow Rooted Crops				
Sub-Area B	Rolling, Silty Sand to Sandy Silt (Sand), Pasture and Shrubs				
Sub-Area C	Rolling, Silty Sand to Sandy Silt (Sand), Mature Forest				
Sub-Area D	Rolling, Clayey Silt to Silty Clay (Clay), Pasture and Shrubs				
Sub-Area E	Rolling, Clayey Silt to Silty Clay (Clay), Shallow Rooted Crops				

Notes:
† Infiltration factors after Ontario Ministry of the Environment, 2003. Stormwater Management Planning and Design Manual. March 2003.; and Ontario Ministry of Environment and Energy (MOEE). 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications. April 1995.
* PET adjustment factors after Thornthwaite, C.W., and J.R. Mather, 1957. Instructions and Tables for Computing Potential Evapotranspiration and the water balance. Drexel Institute of Technology, Laboratory of Climatology, Publications in Climatology, Volume X, No. 3.
‡ Climate Data after Environment Canada, 2021. Canadian Climate Normals 1981-2010, Roseville Station, Climate ID 6151042. [Online] http://climate.weather.gc.ca/climate_normals/index_e.html. Accessed June 2021.

- Assumptions:
- [1] The monthly average precipitation collected at the Roseville climate station is reflective of the precipitation trends that have historically occurred at the Site.
 - [2] Surplus water is not available for runoff and recharge during months where water losses from actual evapotranspiration exceed precipitation inputs.
 - [3] Runoff, infiltration and evapotranspiration do not occur in months where the average daily temperature is below 0°C, which is the case for the months of December through March at the Site.
 - [4] Precipitation during freezing months (i.e., December to March) is assumed to accumulate as snow and result in additional precipitation in the first month thereafter where the average temperature is greater than 0°C (i.e., April).
 - [5] Soil moisture capacity is at a maximum in April.

TABLE G-3A: POST-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
LANDS LOCATED WITHIN TOWNSHIP URBAN AREA (TUA) - CATCHMENTS 200, 201, and 202
Runoff Directed North Towards Wetlands

Post-Development													
Model Type: Thornthwaite and Mather (1955)													
Client: Activa Holdings Inc.													
Location Activa Baden North Subdivision - Lands Located Within the Township Urban Area (TUA) - Catchments 200, 201, and 202													
Total Site Area (ha)16.22													
Land Description Factors (Sub-area descriptions provided below)	Sub-Area E	Sub-Area G	Sub-Area H	Sub-Area J	Sub-Area K								Total
Topography	0.15	0.15	0.15	0.15	0.15								
Soils	0.05	0.60	0.05	0.05	0.05								
Cover	0.05	0.05	0.05	0.05	0.05								
Sum (Infiltration Factor) [†]	0.25	0.80	0.25	0.25	0.25								
Soil Moisture Capacity (mm)	75	75	75	75	75								16.22
Site area (ha)	0.00	1.83	12.81	1.01	0.56								
Imperviousness Coefficient	0.00	0.20	0.65	0.40	0.20								
Impervious Area (ha)	0.00	0.37	8.33	0.41	0.11								9.21
Percentage of Total Site Area	0.0%	2.3%	51.4%	2.5%	0.7%								57%
Remaining Pervious Area (ha)	0.00	1.46	4.48	0.61	0.45								7.01
Total Pervious Site Area (ha)	0.00	1.46	4.48	0.61	0.45								7.01
Percentage of Total Site Area	0.0%	9.0%	27.7%	3.7%	2.8%								43%
Singles Rooftop Infiltration Area (ha)	N/A		N/A	N/A	N/A								
% of Sub-Area Runoff (non-rooftop) directed to SWMF	100%		100%	100%	100%								
Infiltration sized for % of 25mm volume from remaining site (winter/spring)	68%	68%	68%	68%	68%								
Infiltration sized for % of 25mm volume from remaining site (summer/fall)	122%	122%	122%	122%	122%								

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Climate Data (Roseville Climate Normals, 1981 - 2010) [†]													
Average Daily Temperature (°C)	-6.5	-5.4	-1	6.5	12.7	18.2	20.5	19.5	15.2	8.7	2.6	-3.5	7.3
Precipitation (mm)	68.1	54.6	55	77.2	87.9	76.3	98.2	83.9	85.4	75.3	88.4	68.5	919

Potential Evapotranspiration Analysis for Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heat Index	0.0	0.0	0.0	1.5	4.1	7.1	8.5	7.9	5.4	2.3	0.4	0.0	37
Unadjusted Potential Evapotranspiration (mm)	0.0	0.0	0.0	29.4	60.6	89.5	101.8	96.4	73.6	40.3	10.9	0.0	502
Potential Evapotranspiration Adjusting Factor for Latitude*	0.77	0.87	0.99	1.12	1.23	1.29	1.26	1.16	1.04	0.92	0.81	0.75	
Adjusted Potential Evapotranspiration (PET)(mm)	0	0	0	33	75	115	128	112	77	37	9	0	585
Precipitation - PET (mm)	68	55	55	44	13	-39	-30	-28	9	38	80	69	333

Evapotranspiration Analysis													
Sub-Area G	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-71	-8	0	0	
Storage (S)	75	75	75	75	75	45	30	21	29	68	75	75	
Change in Storage	0	0	0	0	0	-30	-15	-9	9	38	7	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	107	113	93	77	37	9	0	543
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	72	69	376
Potential Infiltration (I)	54	44	44	35	11	0	0	0	0	0	58	55	301
Potential Direct Surface Water Runoff (R)	14	11	11	9	3	0	0	0	0	0	14	14	75
Potential Infiltration (mm)	0	0	0	232	11	0	0	0	0	0	58	0	301
Pervious Evapotranspiration (m³)	0	0	0	481	1090	1559	1652	1366	1123	541	129	0	7,941
Pervious Runoff (m³)	199	160	161	130	39	0	0	0	0	0	211	200	1,100
Pervious Infiltration (m³)	0	0	0	3400	157	0	0	0	0	0	844	0	4,401
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m³)	249	200	201	282	322	279	359	307	312	275	323	251	3,361

TABLE G-3A: POST-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
LANDS LOCATED WITHIN TOWNSHIP URBAN AREA (TUA) - CATCHMENTS 200, 201, and 202
Runoff Directed North Towards Wetlands

Evapotranspiration Analysis													
Sub-Area H	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-71	-8	0	0	
Storage (S)	75	75	75	75	75	45	30	21	29	68	75	75	
Change in Storage	0	0	0	0	0	-30	-15	-9	9	38	7	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	107	113	93	77	37	9	0	543
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	72	69	376
Potential Infiltration (I)	17	14	14	11	3	0	0	0	0	0	18	17	94
Potential Direct Surface Water Runoff (R)	51	41	41	33	10	0	0	0	0	0	54	51	282
Potential Infiltration (mm)	0	0	0	73	3	0	0	0	0	0	18	0	94
Pervious Evapotranspiration (m³)	0	0	0	1474	3341	4778	5063	4187	3442	1659	394	0	24,338
Pervious Runoff (m³)	2290	1836	1850	1491	451	0	0	0	0	0	2426	2304	12,647
Pervious Infiltration (m³)	0	0	0	3257	150	0	0	0	0	0	809	0	4,216
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m³)	5671	4547	4580	6429	7320	6354	8178	6987	7112	6271	7362	5705	76,516

Evapotranspiration Analysis													
Sub-Area J	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-71	-8	0	0	
Storage (S)	75	75	75	75	75	45	30	21	29	68	75	75	
Change in Storage	0	0	0	0	0	-30	-15	-9	9	38	7	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	107	113	93	77	37	9	0	543
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	72	69	376
Potential Infiltration (I)	17	14	14	11	3	0	0	0	0	0	18	17	94
Potential Direct Surface Water Runoff (R)	51	41	41	33	10	0	0	0	0	0	54	51	282
Potential Infiltration (mm)	0	0	0	73	3	0	0	0	0	0	18	0	94
Pervious Evapotranspiration (m³)	0	0	0	200	453	648	686	567	466	225	53	0	3,299
Pervious Runoff (m³)	310	249	251	202	61	0	0	0	0	0	329	312	1,714
Pervious Infiltration (m³)	0	0	0	441	20	0	0	0	0	0	110	0	571
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m³)	276	221	223	313	356	309	398	340	346	305	358	278	3,723

Evapotranspiration Analysis													
Sub-Area K	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-71	-8	0	0	
Storage (S)	75	75	75	75	75	45	30	21	29	68	75	75	
Change in Storage	0	0	0	0	0	-30	-15	-9	9	38	7	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	107	113	93	77	37	9	0	543
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	72	69	376
Potential Infiltration (I)	17	14	14	11	3	0	0	0	0	0	18	17	94
Potential Direct Surface Water Runoff (R)	51	41	41	33	10	0	0	0	0	0	54	51	282
Potential Infiltration (mm)	0	0	0	73	3	0	0	0	0	0	18	0	94
Pervious Evapotranspiration (m³)	0	0	0	148	336	480	509	421	346	167	40	0	2,447
Pervious Runoff (m³)	230	185	186	150	45	0	0	0	0	0	244	232	1,272
Pervious Infiltration (m³)	0	0	0	327	15	0	0	0	0	0	81	0	424
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m³)	77	62	62	87	99	86	111	95	96	85	100	77	1,036

TABLE G-3A: POST-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
LANDS LOCATED WITHIN TOWNSHIP URBAN AREA (TUA) - CATCHMENTS 200, 201, and 202
Runoff Directed North Towards Wetlands

Sub-Area Descriptions (topography, soils, cover)	
Sub-Area G	Rolling, Silty Sand to Sandy Silt (Sand), Urban Lawn, 20% Impervious
Sub-Area H	Rolling, Clayey Silt to Silty Clay (Clay), Urban Lawn, 65% Impervious
Sub-Area J	Rolling, Clayey Silt to Silty Clay (Clay), Urban Lawn, 40% Impervious
Sub-Area K	Rolling, Clayey Silt to Silty Clay (Clay), Urban Lawn, 20% Impervious

Notes:
† Infiltration factors after Ontario Ministry of the Environment, 2003. Stormwater Management Planning and Design Manual. March 2003.; and Ontario Ministry of Environment and Energy (MOEE). 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications. April 1995.

* PET adjustment factors after Thornthwaite, C.W., and J.R. Mather, 1957. Instructions and Tables for Computing Potential Evapotranspiration and the water balance. Drexel Institute of Technology, Laboratory of Climatology, Publications in Climatology, Volume X, No. 3. Centerton, New Jersey.
‡ Climate Data after Environment Canada, 2021. Canadian Climate Normals 1981-2010, Roseville Station, Climate ID 6151042. [Online] http://climate.weather.gc.ca/climate_normals/index_e.html. Accessed June 2021.

Assumptions:
[1] The monthly average precipitation collected at the Roseville climate station is reflective of the precipitation trends that have historically occurred at the Site.
[2] Surplus water is not available for runoff and recharge during months where water losses from actual evapotranspiration exceed precipitation inputs.
[3] Runoff, infiltration and evapotranspiration do not occur in months where the average daily temperature is below 0°C, which is the case for the months of December through March at the Site.
[4] Precipitation during freezing months (i.e., December to March) is assumed to accumulate as snow and result in additional precipitation in the first month thereafter where the average temperature is greater than 0°C (i.e., April).
[5] Soil moisture capacity is at a maximum in April.

POST-DEVELOPMENT - NO INFILTRATION AUGMENTATION / MITIGATION MEASURES (TUA Lands)

TUA Lands - CATCHMENTS 200, 201 and 202					
Post-Development Infiltration (INF)	9,612	m³/yr	59	mm/yr	0.3 L/s
Post-Development Runoff (R)	101,368	m³/yr	625	mm/yr	3.2 L/s
Post-Development Evapotranspiration (ET)	38,025	m³/yr	234	mm/yr	1.2 L/s
Total = INF + R + ET	149,005	m³/yr	919	mm/yr	4.7 L/s
Precipitation	149,005	m³/yr	919	mm/yr	4.7 L/s
Error	0.000	(m³/yr)	0.000	mm/yr	0.000 L/s

Sum of infiltration volumes from pervious surfaces in Sub-Areas G, H, J, and K.
Sum of runoff volumes from pervious and impervious surfaces in Sub-Areas G, H, J, and K.

PHASE 1 - INFILTRATION (with Augmentation)					
Pre-Development INFILTRATION (INF)	23,378	m³/yr	117	mm/yr	0.7 L/s
Pre- to Post Surplus (+) / Deficit (-)	-13,766	m³/yr	-58	mm/yr	-0.4 L/s

PHASE 1 - RUNOFF (with Augmentation)					
Pre-Development RUNOFF (R)	48,473	m³/yr	242	mm/yr	1.5 L/s
Pre- to Post Surplus (+) / Deficit (-)	52,895	m³/yr	383	mm/yr	1.7 L/s

POST-DEVELOPMENT - with INFILTRATION AUGMENTATION / MITIGATION MEASURES (TUA Lands)

End-Of-Pipe Infiltration (Runoff Directed to SWMF)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Remaining Impervious Runoff to SWMF ^(a)	6,273	5,029	5,066	7,111	8,097	7,028	9,046	7,728	7,867	6,936	8,143	6,310	
Remaining Pervious Runoff to SWMF ^(b)	3,030	2,430	2,447	1,972	596	0	0	0	0	0	3,209	3,048	
Total Remaining Runoff to SWMF ^(c)	9,303	7,459	7,514	9,084	8,693	7,028	9,046	7,728	7,867	6,936	11,352	9,358	
Total Runoff Infiltrated by SWMF ^(d)	5,061	4,058	4,087	4,941	4,729	6,860	8,829	7,543	7,678	6,770	6,176	5,091	71,822
	Winter Infiltration					Summer Infiltration					Winter Infiltration		

Total Infiltration Provided by TUA Lands = 71,822

Combined Infiltration Measures (TUA and Non-TUA Lands)	29.10	ha
Infiltration Augmentation (from TUA Area)	71,822	m³/yr
Infiltration Augmentation (from Non-TUA drainage)	16,739	m³/yr
Total Infiltration Augmentation	88,560	m³/yr

Refer to calculations presented in this table.
Refer to calculations presented in Table G-3B (Appendix G) for Non-TUA Lands

Notes (Post-Development with Infiltration Augmentation Measures):
(a) All runoff from impervious surfaces (e.g., concrete/asphalt roadways, parking lots and walkways) associated with Sub-Areas G, H, J and K that is discharged to SWMF minus volume captured by rooftops for lot-level infiltration.
(b) All runoff from pervious surfaces (i.e., landscaped and natural areas) associated with Sub-Areas G, H, J and K that is discharged to SWMF.
(c) Total annual runoff volume directed to the SWMF from TUA Lands (Sub-Areas G, H, J and K) for infiltration after removing rooftop runoff volumes directed to lot-level infiltration galleries.
(d) SWMF infiltration basin designed to infiltrate volume equal to 68% of the 25mm volume in the winter and 122% of the 25mm volume in the summer. The 25mm volume is approximately equal to 80% of precipitation volume.
For winter, infiltration is equal to: (Site Runoff - lot level infiltration) * 80% * 68%. For summer, infiltration is equal to (Site Runoff - lot level infiltration) * 80% * 122%.
Refer to Stantec (2024) *Functional Servicing and Stormwater Management Report* for discussion on how SWMF Winter and Summer Infiltration strategy works.

TABLE G-3B: POST-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
LANDS LOCATED OUTSIDE OF THE TOWNSHIP URBAN AREA (Non-TUA) - CATCHMENTS 203, 205 and 206
Runoff Directed North Towards Wetlands

Post-Development													
Model Type: Thornthwaite and Mather (1955)													
Client: Activa Holdings Inc.													
Location Activa Baden North Subdivision - Lands Located Outside of the Township Urban Area (Non-TUA) - Catchments 203, 205, and 206													
Total Site Area (ha) 12.88													
Land Description Factors (Sub-area descriptions provided below)	Sub-Area A	Sub-Area E	Sub-Area H	Sub-Area I	Sub-Area J								Total
Topography	0.15	0.15	0.15	0.15	0.15								
Soils	0.60	0.05	0.05	0.05	0.05								
Cover	0.05	0.05	0.05	0.05	0.05								
Sum (Infiltration Factor) [†]	0.80	0.25	0.25	0.25	0.25								
Soil Moisture Capacity (mm)	75	75	75	75	75								
Site area (ha)	0.56	12.32	0.00	0.00	0.00								12.88
Imperviousness Coefficient	0.00	0.00	0.65	0.60	0.40								
Impervious Area (ha)	0.00	0.00	0.00	0.00	0.00								0.00
Percentage of Total Site Area	0.0%	0.0%	0.0%	0.0%	0.0%								0%
Remaining Pervious Area (ha)	0.56	12.32	0.00	0.00	0.00								12.88
Total Pervious Site Area (ha)	0.56	12.32	0.00	0.00	0.00								12.88
Percentage of Total Site Area	4.3%	95.7%	0.0%	0.0%	0.0%								100%
Singles Rooftop Infiltration Area (ha)	N/A	N/A											
% of Area to Pond	0.0%	88.5%											
Infiltration sized for % of 25mm volume from remaining site (winter/spring)	68%	68%											
Infiltration sized for % of 25mm volume from remaining site (summer/fall)	122%	122%											

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Climate Data (Roseville Climate Normals, 1981 - 2010) [‡]													
Average Daily Temperature (°C)	-6.5	-5.4	-1	6.5	12.7	18.2	20.5	19.5	15.2	8.7	2.6	-3.5	7.3
Precipitation (mm)	68.1	54.6	55	77.2	87.9	76.3	98.2	83.9	85.4	75.3	88.4	68.5	919

Potential Evapotranspiration Analysis for Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heat Index	0.0	0.0	0.0	1.5	4.1	7.1	8.5	7.9	5.4	2.3	0.4	0.0	37
Unadjusted Potential Evapotranspiration (mm)	0.0	0.0	0.0	29.4	60.6	89.5	101.8	96.4	73.6	40.3	10.9	0.0	502
Potential Evapotranspiration Adjusting Factor for Latitude*	0.77	0.87	0.99	1.12	1.23	1.29	1.26	1.16	1.04	0.92	0.81	0.75	
Adjusted Potential Evapotranspiration (PET)(mm)	0	0	0	33	75	115	128	112	77	37	9	0	585
Precipitation - PET (mm)	68	55	55	44	13	-39	-30	-28	9	38	80	69	333

Evapotranspiration Analysis													
Sub-Area A	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-71	-8	0	0	
Storage (S)	75	75	75	75	75	45	30	21	29	68	75	75	
Change in Storage	0	0	0	0	0	-30	-15	-9	9	38	7	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	107	113	93	77	37	9	0	543
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	72	69	376
Potential Infiltration (I)	54	44	44	35	11	0	0	0	0	0	58	55	301
Potential Direct Surface Water Runoff (R)	14	11	11	9	3	0	0	0	0	0	14	14	75
Potential Infiltration (mm)	0	0	0	232	11	0	0	0	0	0	58	0	301
Pervious Evapotranspiration (m ³)	0	0	0	183	414	592	627	519	426	205	49	0	3,015
Pervious Runoff (m ³)	76	61	61	49	15	0	0	0	0	0	80	76	418
Pervious Infiltration (m ³)	0	0	0	1291	60	0	0	0	0	0	321	0	1,671
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m ³)	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE G-3B: POST-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
LANDS LOCATED OUTSIDE OF THE TOWNSHIP URBAN AREA (Non-TUA) - CATCHMENTS 203, 205 and 206
Runoff Directed North Towards Wetlands

Evapotranspiration Analysis													
Sub-Area E	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-71	-8	0	0	
Storage (S)	75	75	75	75	75	45	30	21	29	68	75	75	
Change in Storage	0	0	0	0	0	-30	-15	-9	9	38	7	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	107	113	93	77	37	9	0	543
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	72	69	376
Potential Infiltration (I)	17	14	14	11	3	0	0	0	0	0	18	17	94
Potential Direct Surface Water Runoff (R)	51	41	41	33	10	0	0	0	0	0	54	51	282
Potential Infiltration (mm)	0	0	0	73	3	0	0	0	0	0	18	0	94
Pervious Evapotranspiration (m³)	0	0	0	4051	9181	13131	13914	11506	9459	4559	1084	0	66,886
Pervious Runoff (m³)	6294	5046	5083	4097	1238	0	0	0	0	0	6666	6331	34,756
Pervious Infiltration (m³)	0	0	0	8951	413	0	0	0	0	0	2222	0	11,585
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0

Sub-Area Descriptions (topography, soils, cover)	
Sub-Area A	Rolling, Silty Sand to Sandy Silt (Sand), Shallow Rooted Crops
Sub-Area E	Rolling, Clayey Silt to Silty Clay (Clay), Shallow Rooted Crops

Notes:
† Infiltration factors after Ontario Ministry of the Environment, 2003. Stormwater Management Planning and Design Manual. March 2003.; and Ontario Ministry of Environment and Energy (MOEE). 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications. April 1995.

* PET adjustment factors after Thornthwaite, C.W., and J.R. Mather, 1957. Instructions and Tables for Computing Potential Evapotranspiration and the water balance. Drexel Institute of Technology, Laboratory of Climatology, Publications in Climatology, Volume X, No. 3. Centerton, New Jersey.
‡ Climate Data after Environment Canada, 2021. Canadian Climate Normals 1981-2010, Roseville Station, Climate ID 6151042. [Online] http://climate.weather.gc.ca/climate_normals/index_e.html. Accessed June 2021.

- Assumptions:
[1] The monthly average precipitation collected at the Roseville climate station is reflective of the precipitation trends that have historically occurred at the Site.
[2] Surplus water is not available for runoff and recharge during months where water losses from actual evapotranspiration exceed precipitation inputs.
[3] Runoff, infiltration and evapotranspiration do not occur in months where the average daily temperature is below 0°C, which is the case for the months of December through March at the Site.
[4] Precipitation during freezing months (i.e., December to March) is assumed to accumulate as snow and result in additional precipitation in the first month thereafter where the average temperature is greater than 0°C (i.e., April).
[5] Soil moisture capacity is at a maximum in April.

POST-DEVELOPMENT - NO INFILTRATION AUGMENTATION / MITIGATION MEASURES (Non-TUA Lands)

Non-TUA Lands - CATCHMENTS 203, 205, AND 206					
Post-Development INFILTRATION (INF)	13,256	m³/yr	103	mm/yr	0.4 L/s
Post-Development RUNOFF (R)	35,174	m³/yr	273	mm/yr	1.1 L/s
Post-Development EVAPOTRANSPIRATION (ET)	69,900	m³/yr	543	mm/yr	2.2 L/s
Total = INF + R + ET	118,331	m³/yr	919	mm/yr	3.7 L/s
Precipitation	118,331	m³/yr	919	mm/yr	3.7 L/s
Error	0.000	(m³/yr)	0.000	mm/yr	0.000 L/s

PHASE 2 LANDS - INFILTRATION					
Pre-Development INFILTRATION (INF)	23,378	m³/yr	117	mm/yr	0.7 L/s
Pre- to Post Surplus (+) / Deficit (-)	-10,122	m³/yr	-14	mm/yr	-0.3 L/s

PHASE 2 LANDS - RUNOFF					
Pre-Development RUNOFF (R)	48,473	m³/yr	242	mm/yr	1.5 L/s
Pre- to Post Surplus (+) / Deficit (-)	-13,299	m³/yr	677	mm/yr	2.2 L/s

POST-DEVELOPMENT - with INFILTRATION AUGMENTATION / MITIGATION MEASURES (Non-TUA Lands)

End-Of-Pipe Infiltration (Runoff Directed to SWMF)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Total Runoff Infiltrated by SWMF ^(a)	3,031	2,430	2,448	1,973	596	0	0	0	0	0	3,210	3,049	16,739
	Winter Infiltration					Summer infiltration					Winter Infiltration		

TABLE G-3B: POST-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
LANDS LOCATED OUTSIDE OF THE TOWNSHIP URBAN AREA (Non-TUA) - CATCHMENTS 203, 205 and 206
Runoff Directed North Towards Wetlands

Notes (Post-Development with Infiltration Augmentation Measures):

- (a) SWMF infiltration basin designed to infiltrate volume equal to 68% of the 25mm volume in the winter and 122% of the 25mm volume in the summer. The 25mm volume is approximately equal to 80% of precipitation volume.
For winter, infiltration is equal to: (Site Runoff - lot level infiltration) * 80% * 68%. For summer, infiltration is equal to (Site Runoff - lot level infiltration) * 80% * 122%.
Refer to Stantec (2024) *Functional Servicing and Stormwater Management Report* for discussion on how SWMF Winter and Summer Infiltration strategy works.

TABLE G-4A: POST-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
LANDS LOCATED WITHIN THE TOWNSHIP URBAN AREA (TUA) - CATCHMENT 204
Runoff Directed South to Activa Baden Subdivision

Post-Development Model Type: Thornthwaite and Mather (1955) Client: Activa Holdings Inc. Location Activa Baden North Subdivision - Lands Located Within the Township Urban Area (TUA) - Catchment 204 Total Site Area (ha)1.67													
Land Description Factors (Sub-area descriptions provided below)	Sub-Area E	Sub-Area F	Sub-Area G	Sub-Area H	Sub-Area I								Total
Topography	0.15	0.15	0.15	0.15	0.15								
Soils	0.05	0.60	0.60	0.05	0.05								
Cover	0.05	0.05	0.05	0.05	0.05								
Sum (Infiltration Factor) [†]	0.25	0.80	0.80	0.25	0.25								
Soil Moisture Capacity (mm)	75	75	75	75	75								1.67
Site area (ha)	0.00	0.00	0.00	0.00	1.67								
Imperviousness Coefficient	0.00	0.65	0.50	0.65	0.60								
Impervious Area (ha)	0.00	0.00	0.00	0.00	1.00								1.00
Percentage of Total Site Area	0.0%	0.0%	0.0%	0.0%	60.0%								60%
Remaining Pervious Area (ha)	0.00	0.00	0.00	0.00	0.67								0.67
Total Pervious Site Area (ha)	0.00	0.00	0.00	0.00	0.67								0.67
Percentage of Total Site Area	0.0%	0.00%	0.0%	0.0%	40.0%								40%
Singles Rooftop Infiltration Area (ha)					0.11	= Total projected rooftop area within Sub-Area I connected to galleries (i.e., 8 homes * 140 m ² per home = 1,120 m2 / 10,000 = 0.11 ha)							

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Climate Data (Roseville Climate Normals, 1981 - 2010) [†]													
Average Daily Temperature (°C)	-6.5	-5.4	-1	6.5	12.7	18.2	20.5	19.5	15.2	8.7	2.6	-3.5	7.3
Precipitation (mm)	68.1	54.6	55	77.2	87.9	76.3	98.2	83.9	85.4	75.3	88.4	68.5	919
Potential Evapotranspiration Analysis for Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heat Index	0.0	0.0	0.0	1.5	4.1	7.1	8.5	7.9	5.4	2.3	0.4	0.0	37
Unadjusted Potential Evapotranspiration (mm)	0.0	0.0	0.0	29.4	60.6	89.5	101.8	96.4	73.6	40.3	10.9	0.0	502
Potential Evapotranspiration Adjusting Factor for Latitude*	0.77	0.87	0.99	1.12	1.23	1.29	1.26	1.16	1.04	0.92	0.81	0.75	
Adjusted Potential Evapotranspiration (PET)(mm)	0	0	0	33	75	115	128	112	77	37	9	0	585
Precipitation - PET (mm)	68	55	55	44	13	-39	-30	-28	9	38	80	69	333

Evapotranspiration Analysis													
Sub-Area I	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-71	-8	0	0	
Storage (S)	75	75	75	75	75	45	30	21	29	68	75	75	
Change in Storage	0	0	0	0	0	-30	-15	-9	9	38	7	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	107	113	93	77	37	9	0	543
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	72	69	376
Potential Infiltration (I)	17	14	14	11	3	0	0	0	0	0	18	17	94
Potential Direct Surface Water Runoff (R)	51	41	41	33	10	0	0	0	0	0	54	51	282
Potential Infiltration (mm)	0	0	0	73	3	0	0	0	0	0	18	0	94
Pervious Evapotranspiration (m ³)	0	0	0	220	498	713	755	625	514	247	59	0	3,631
Pervious Runoff (m ³)	342	274	276	222	67	0	0	0	0	0	362	344	1,887
Pervious Infiltration (m ³)	0	0	0	486	22	0	0	0	0	0	121	0	629
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m ³)	683	548	552	775	882	766	985	842	857	756	887	687	9,220

TABLE G-4A: POST-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
LANDS LOCATED WITHIN THE TOWNSHIP URBAN AREA (TUA) - CATCHMENT 204
Runoff Directed South to Activa Baden Subdivision

Sub-Area Descriptions (topography, soils, cover)	
Sub-Area I	Rolling, Clayey Silt to Silty Clay (Clay), Urban Lawn, 60% Impervious

Notes:
† Infiltration factors after Ontario Ministry of the Environment, 2003. Stormwater Management Planning and Design Manual. March 2003.; and Ontario Ministry of Environment and Energy (MOEE). 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications. April 1995.
* PET adjustment factors after Thornthwaite, C.W., and J.R. Mather, 1957. Instructions and Tables for Computing Potential Evapotranspiration and the water balance. Drexel Institute of Technology, Laboratory of Climatology, Publications in Climatology, Volume X, No. 3. Centerton, New Jersey.
‡ Climate Data after Environment Canada, 2021. Canadian Climate Normals 1981-2010, Roseville Station, Climate ID 6151042. [Online] http://climate.weather.gc.ca/climate_normals/index_e.html. Accessed June 2021.

Assumptions:
[1] The monthly average precipitation collected at the Roseville climate station is reflective of the precipitation trends that have historically occurred at the Site.
[2] Surplus water is not available for runoff and recharge during months where water losses from actual evapotranspiration exceed precipitation inputs.
[3] Runoff, infiltration and evapotranspiration do not occur in months where the average daily temperature is below 0°C, which is the case for the months of December through March at the Site.
[4] Precipitation during freezing months (i.e., December to March) is assumed to accumulate as snow and result in additional precipitation in the first month thereafter where the average temperature is greater than 0°C (i.e., April).
[5] Soil moisture capacity is at a maximum in April.

POST-DEVELOPMENT - NO INFILTRATION AUGMENTATION / MITIGATION MEASURES

LANDS LOCATED WITHIN TOWNSHIP URBAN AREA (TUA) LAND - CATCHMENT 204						
Post-Development Infiltration (INF)	629	m ³ /yr	38	mm/yr	0.0	L/s
Post-Development Runoff (R)	11,107	m ³ /yr	664	mm/yr	0.4	L/s
Post-Development Evapotranspiration (ET)	3,631	m ³ /yr	217	mm/yr	0.1	L/s
Total = INF + R + ET	15,367	m ³ /yr	919	mm/yr	0.5	L/s
Precipitation	15,367	m ³ /yr	919	mm/yr	0.5	L/s
Error	0.000	(m ³ /yr)	0.000	mm/yr	0.000	L/s

POST-DEVELOPMENT - with INFILTRATION AUGMENTATION / MITIGATION MEASURES

Rooftop Runoff Captured from Single Family Homes (Lot-Level) ^(a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Lot-Level Infiltration (Infiltration Galleries)	61	49	49	69	79	68	88	75	77	67	79	61	823

Notes (Post-Development with Infiltration Augmentation Measures):
(a) Total rooftop area within Sub-Area I (Catchment 204) multiplied by 80% (i.e., annual precipitation volume captured by rooftops from a 25mm event) and discharged to lot-level infiltration galleries (sized for 25 mm precipitation event).

TABLE G-4B: POST-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
LANDS LOCATED OUTSIDE THE THE TOWNSHIP URBAN AREA (Non-TUA) - CATCHMENT 207
Runoff Directed South to Activa Baden Subdivision

Post-Development													
Model Type: Thornthwaite and Mather (1955)													
Client: Activa Holdings Inc.													
Location Activa Baden North Subdivision - Lands Located Outside of the Township Urban Area (Non-TUA) - Catchment 207													
Total Site Area (ha) 4.64													

Land Description Factors (Sub-area descriptions provided below)	Sub-Area E	Sub-Area F	Sub-Area G	Sub-Area H	Sub-Area I								Total
Topography	0.15	0.15	0.15	0.15	0.15								
Soils	0.05	0.60	0.60	0.05	0.05								
Cover	0.05	0.05	0.05	0.05	0.05								
Sum (Infiltration Factor) [†]	0.25	0.80	0.80	0.25	0.25								
Soil Moisture Capacity (mm)	75	75	75	75	75								4.64
Site area (ha)	4.64	0.00	0.00	0.00	0.00								
Imperviousness Coefficient	0.00	0.65	0.50	0.65	0.60								
Impervious Area (ha)	0.00	0.00	0.00	0.00	0.00								0.00
Percentage of Total Site Area	0.0%	0.0%	0.0%	0.0%	0.0%								0%
Remaining Pervious Area (ha)	4.64	0.00	0.00	0.00	0.00								4.64
Total Pervious Site Area (ha)	4.64	0.00	0.00	0.00	0.00								4.64
Percentage of Total Site Area	100.0%	0.00%	0.0%	0.0%	0.0%								100%

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Climate Data (Roseville Climate Normals, 1981 - 2010) [†]													
Average Daily Temperature (°C)	-6.5	-5.4	-1	6.5	12.7	18.2	20.5	19.5	15.2	8.7	2.6	-3.5	7.3
Precipitation (mm)	68.1	54.6	55	77.2	87.9	76.3	98.2	83.9	85.4	75.3	88.4	68.5	919

Potential Evapotranspiration Analysis for Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heat Index	0.0	0.0	0.0	1.5	4.1	7.1	8.5	7.9	5.4	2.3	0.4	0.0	37
Unadjusted Potential Evapotranspiration (mm)	0.0	0.0	0.0	29.4	60.6	89.5	101.8	96.4	73.6	40.3	10.9	0.0	502
Potential Evapotranspiration Adjusting Factor for Latitude*	0.77	0.87	0.99	1.12	1.23	1.29	1.26	1.16	1.04	0.92	0.81	0.75	
Adjusted Potential Evapotranspiration (PET)(mm)	0	0	0	33	75	115	128	112	77	37	9	0	585
Precipitation - PET (mm)	68	55	55	44	13	-39	-30	-28	9	38	80	69	333

Evapotranspiration Analysis													
Sub-Area E	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-39	-69	-97	-71	-8	0	0	
Storage (S)	75	75	75	75	75	45	30	21	29	68	75	75	
Change in Storage	0	0	0	0	0	-30	-15	-9	9	38	7	0	
Actual Evapotranspiration (mm)	0	0	0	33	75	107	113	93	77	37	9	0	543
Recharge/Runoff Analysis													
Water Surplus (mm)	68	55	55	44	13	0	0	0	0	0	72	69	376
Potential Infiltration (I)	17	14	14	11	3	0	0	0	0	0	18	17	94
Potential Direct Surface Water Runoff (R)	51	41	41	33	10	0	0	0	0	0	54	51	282
Potential Infiltration (mm)	0	0	0	73	3	0	0	0	0	0	18	0	94
Pervious Evapotranspiration (m ³)	0	0	0	1524	3454	4940	5234	4328	3558	1715	408	0	25,161
Pervious Runoff (m ³)	2368	1898	1912	1541	466	0	0	0	0	0	2508	2382	13,074
Pervious Infiltration (m ³)	0	0	0	3367	155	0	0	0	0	0	836	0	4,358
Potential Impervious Evaporation (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Potential Impervious Runoff (mm)	68	55	55	77	88	76	98	84	85	75	88	69	919
Impervious Runoff (m ³)	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE G-4B: POST-DEVELOPMENT MONTHLY WATER BALANCE CALCULATIONS
LANDS LOCATED OUTSIDE THE THE TOWNSHIP URBAN AREA (Non-TUA) - CATCHMENT 207
Runoff Directed South to Activa Baden Subdivision

Sub-Area Descriptions (topography, soils, cover)	
Sub-Area E	Rolling, Clayey Silt to Silty Clay (Clay), Shallow Rooted Crops

Notes:
† Infiltration factors after Ontario Ministry of the Environment, 2003. Stormwater Management Planning and Design Manual. March 2003.; and Ontario Ministry of Environment and Energy (MOEE). 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications. April 1995.

* PET adjustment factors after Thornthwaite, C.W., and J.R. Mather, 1957. Instructions and Tables for Computing Potential Evapotranspiration and the water balance. Drexel Institute of Technology, Laboratory of Climatology, Publications in Climatology, Volume X, No. 3.
‡ Climate Data after Environment Canada, 2021. Canadian Climate Normals 1981-2010, Roseville Station, Climate ID 6151042. [Online] http://climate.weather.gc.ca/climate_normals/index_e.html. Accessed June 2021.

Assumptions:
[1] The monthly average precipitation collected at the Roseville climate station is reflective of the precipitation trends that have historically occurred at the Site.
[2] Surplus water is not available for runoff and recharge during months where water losses from actual evapotranspiration exceed precipitation inputs.
[3] Runoff, infiltration and evapotranspiration do not occur in months where the average daily temperature is below 0°C, which is the case for the months of December through March at the Site.
[4] Precipitation during freezing months (i.e., December to March) is assumed to accumulate as snow and result in additional precipitation in the first month thereafter where the average temperature is greater than 0°C (i.e., April).
[5] Soil moisture capacity is at a maximum in April.

POST-DEVELOPMENT - NO INFILTRATION AUGMENTATION / MITIGATION MEASURES

LANDS LOCATED OUTSIDE OF THE TOWNSHIP URBAN AREA (TUA) - CATCHMENT 207					
Post-Development Infiltration (INF)	4,358	m ³ /yr	94	mm/yr	0.1 L/s
Post-Development Runoff (R)	13,074	m ³ /yr	282	mm/yr	0.4 L/s
Post-Development Evapotranspiration (ET)	25,161	m ³ /yr	543	mm/yr	0.8 L/s
Total = INF + R + ET	42,593	m ³ /yr	919	mm/yr	1.3 L/s
Precipitation	42,593	m ³ /yr	919	mm/yr	1.3 L/s
Error	0.000	(m ³ /yr)	0.000	mm/yr	0.000 L/s