# Hydrogeological Assessment

**FINAL REPORT**

*York Developments*

**Project Name:**
Medway Creek – Bridle Path Subdivision
Arva, Ontario

**Project Number:**
KCH-21002415-A0

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**Date Submitted:**
April 22, 2025

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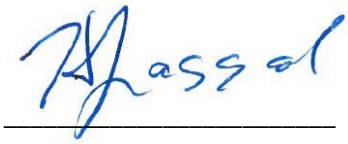

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**Date Submitted:**

April 22, 2025

# Executive Summary

EXP Services Inc. (EXP) was retained by **York Developments** to conduct a hydrogeological assessment for the proposed development located on the north and south side of Medway Road and west of Richmond Street in Arva, Ontario, hereinafter referred to as the 'Site'.

The objective of the hydrogeological assessment was to examine the hydrogeological characteristics of the Site by reviewing the Ministry of the Environment, Conservation and Parks (MECP) Water Well Records (WWR), reviewing the soils and groundwater information provided from a series of sampled boreholes and monitoring wells at the Site, compiling a site wide water balance, collecting groundwater elevations to identify any seasonal variations, and assess the natural heritage features on the property. It is understood that the hydrogeological assessment will be submitted for review and approval by the Upper Thames River Conservation Authority (UTRCA) and a peer-review will also be completed by another consultant for the Municipality of Middlesex Centre.

Based on the results of the hydrogeological assessment, the following findings are presented:

- The Site is located in the Medway Creek watershed. Medway Creek is located north and west of the Site boundary. The creek and lands located in the north and west portions of the Site are situated within UTRCA regulated lands;
- Based on topographic mapping, runoff at the Site is expected to flow to towards Medway Creek;
- The stratigraphy at the Site consists of surficial sand and gravel layer (unconfined aquifer) across the majority of the Site which is underlain by till (aquitard). The till overlies a deeper sand layer (confined to unconfined aquifer);
- Shallow groundwater levels (between 1 m and 2 m bgs) were observed in monitoring wells BH2/MW, BH8/MW-B, and BH9/MW. These are all shallow wells, installed across the upper sand and gravel unit. The deepest groundwater levels were noted in BH4/MW which is screened in the lower sand unit (ranged from dry conditions to 7.49 m bgs). Dry conditions were observed on several occasions at BH3/MW (screened across the upper sand and gravel unit) and at BH5-MW-B since June 2022 (screened in sandy silt in vicinity of Medway Creek)
- The majority of the Site is mapped as a significant groundwater recharge area and a highly vulnerable aquifer;
- Groundwater seepage areas have been identified along the northern slope and also associated with the Headwater Drainage Feature (HDF) along the southern site boundary. In order to maintain the ecological function and groundwater dependence of these areas, consideration will be necessary for implementation of Low Impact Development (LID) strategies during development. The specific type and design of LID will be identified during the detailed design stage;
- Based on the MECP WWR, there are 15 water supply wells within a 500 m radius of the Site that are installed into the shallow overburden (approximately 10 m bgs or less);

- Single Well Response Tests (SWRT) were completed on four (4) of the monitoring wells. Based on these tests, the estimated hydraulic conductivities were 3.1 x $10^{-8}$ m/s for silt till (aquitard), 5.9 x $10^{-7}$m/s for the upper sandy silt (unconfined aquifer), 3.7 x $10^{-5}$ m/s for the lower sand (confined aquifer), and 2.1 x $10^{-4}$ in monitoring well BH8/MW-B screened across the upper sand and gravel and sandy silt (unconfined aquifer);

- Groundwater chemistry results did not exceed the Ontario Drinking Water Quality Standards, Objectives and Guidelines (ODWQS) Maximum Acceptable Concentrations (MAC) for any of the analyzed parameters with the exception of nitrate and uranium which exceeded the ODWQS of 10 mg/L and 20 ug/L, respectively. It is noted that the groundwater on Site is not planned for use as drinking water, and the evaluation to the ODWQS are used for comparison's sake only. The nitrate was exceeded in BH8/MW-B in October 2021 with a concentration of 11 mg/L and uranium was exceeded in BH5/MW-A in March 2021 with a concentration of 11 ug/L. The Ontario Provincial Water Quality Objectives (PWQO) guidelines were exceeded for several analyzed parameters in surface water, collected from Medway Creek;

- The monitoring wells on Site have been maintained for ongoing study past the completion of this report. When the wells are no longer required, they should be decommissioned in accordance with O. Reg. 903;

- The site-wide monthly water balance assessment estimates post-development runoff and infiltration volumes to be 191% and 40% of the pre-development volumes, respectively. In addition, pre-development runoff and infiltration volumes were estimated for the existing marshes in the north portion of the Site and the headwater drainage feature in the south portion of the Site. Various mitigation measures are being considered under the post-development scenario in order to maintain reasonable post-development runoff and infiltration volumes to Medway Creek and the on-Site natural features; and

- Based on the measured shallow groundwater elevations, groundwater may be encountered during the construction activities at the Site. The volume of water requiring management will depend on the excavation depths below the water table, and the encountered soils. Further information is required in order to complete detailed dewatering calculations. This includes the grading plan, building finished floor elevations, and servicing elevations. A detailed dewatering assessment that includes calculations of dewatering rates, radius of influence, and dewatering discharge assessment can be completed at the detailed design stage once the design details are known.

# Table of Contents

**Appendices**



**Drawings (Appendix A)**

# 1. Introduction and Background

## 1.1 Background

EXP Services Inc. (EXP) was retained by York Developments to conduct a hydrogeological study and water balance assessment for the proposed development located on the north and south side of Medway Road and west of Richmond Street in Arva, Ontario, hereinafter referred to as the 'Site' or 'Subject Lands' (**Appendix A, Drawing 1**). The Subject Lands are irregular in shape and occupies a total area of approximately 23.5 hectares (ha). The proposed development consists of low and medium density blocks, medium/high density residential apartment blocks, park and open space blocks, stormwater management blocks, a pump station, and municipal roadways. The Preliminary Draft Plan of Subdivision dated April 4, 2025, is included in **Appendix B**.

This report provides an assessment of hydrogeological characteristics of the Site, including soil conditions, groundwater flow and quality, surface water and groundwater interactions, and an assessment of potential impacts to the groundwater as a result of the proposed development. A site-wide and feature-based monthly water balances have also been completed.

The objective of the assessment is to examine and summarize the hydrogeological characteristics of the Site by reviewing available information on the geological and hydrogeological characteristics of the area, reviewing the Ontario Ministry of the Environment, Conservation and Parks (MECP) Water Well Record (WWR) database, assessing soil and groundwater conditions on the Site by completing a subsurface drilling and monitoring well installation program, as well as complete surface water installations to better identify surface and groundwater interactions.

This report has been prepared for submission to the Municipality of Middlesex Centre and to the Upper Thames River Conservation Authority (UTRCA) in support of the proposed development.

Medway Creek is present to the north and west of the Subject Lands, located approximately 5 m west of the Site at its closest point. Regulated lands of the UTRCA are present along the west and northern areas of the Site associated with Medway Creek.

The UTRCA administers a regulation made under Section 28 of the Conservation Authorities Act, known as Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (O. Reg. 157/06). The regulation was approved by the Minister of Natural Resources and Forestry on May 4, 2006. This regulation allows the UTRCA to ensure that proposed development and other activities have regard for natural hazard features. The UTRCA implements the regulation by issuing Section 28 permits for works in or near watercourses, valleys, wetlands, or shorelines, when required.

Property owners must obtain permission and/or a letter of clearance from the local Conservation Authority before beginning any development, site alteration, construction, or placement of fill within the regulated area. Permits are also required for any wetland interference, or for altering, straightening, diverting or interfering in any way with the existing channel of a creek, stream or river. It is EXP's understanding that the Site is subject to this regulation, and requires a Section 28 permit, as it is adjacent to the Thames River and associated regulated areas.

## 1.2 Proposed Development

The current Plan of Subdivision includes:

- Streets B, C, D, and E in their entirety for dedication to the municipality;
- Low Density Residential Blocks;
- Medium Density Residential Blocks consisting of street townhouses and cluster townhouses;
- Medium/High Density Residential Apartment Blocks;
- One park block;
- Two stormwater management blocks; and
- One Utility and Pump Station Block.

The planned development will include landscaping features surrounding buildings, including hardscaping (steps, walkways, patios, etc.), and soft-scaping (grass, shrubs, plants, topsoil, etc.) and along street frontages. The park block will function as a recreational space providing community-oriented facilities.

### 1.2.1 Stormwater Management

The stormwater management plans for the Site are described in the "Arva, Ontario Functional Stormwater Management Report" prepared by Stantec Consulting Inc., dated February 3, 2025 (Stantec, 2025a).

As described in the Stantec report (Stantec, 2025a), the proposed development will direct stormwater runoff from the developed areas in both the southern and northern portions of the site to two stormwater management facilities (SWMFs). One SWMF will be located in the southern portion of the site at the corner of Streets B, D and E, while the other will be situated in the western part of the northern portion of the site. These SWMFs will be designed to accommodate runoff from the proposed multi-block townhomes, as well as from the surrounding residential and external land uses.

The Stormwater Management (SWM) strategy for the site has been developed to mitigate potential offsite water quality and quantity impacts associated with the development of the subject lands. The SWM criteria are as follows:

- Water Quality - Provide sufficient permanent pool and extended detention volume to meet the Ministry of the Environment, Conservation and Parks (MECP) Enhanced (80% TSS Removal) criteria and promote the at-source removal of potential contaminants;
- Water Quantity - Provide water quantity control through attenuation of post development peak flow rates to the calculated 2-year existing target rate for the full range of flows from the 2- to 100-year storm events, while safely passing the 250-year event;
- Erosion Control - Provides sufficient extended detention for the 25 mm storm event with a minimum 24-hour drawdown period; and
- Erosion and Sediment Control - Provide appropriate erosion and sediment control during construction/area grading to protect adjacent properties from potential siltation.

The proposed development includes a residential area and two SWMFs. The SWMF in the southern portion will discharge into Medway Creek, providing both water quality and quantity control for the southern part of the development. In the northern portion, water quantity will be managed by an on-site SWMF, discharge to Medway Creek, and water quality control will be provided by an Oil Grit Separator (OGS).

The proposed SWM strategy for the site lands incorporated minor system conveyance via storm sewer networks and major system conveyance via private roads and swales to the proposed SWMFs and Oil Grit Separators (OGS) for water quality and quantity control.

### 1.3 Scoping Meetings with Regulatory Authorities

Prior to initiating the field activities in 2021, EXP met with staff from the UTRCA to discuss and obtain a general agreement on the planned scope of work for the Hydrogeological Investigation and to ensure that the proposed scope of work properly addressed any potential concerns the UTRCA would have. A summary of the scoping meeting discussion held with the UTRCA is 2021 is provided in **Appendix C**.

A subsequent pre-consultation meeting was held on April 11, 2024, with representatives from the UTRCA, the Municipality of Middlesex Centre, and the County of Middlesex present. A formal copy of the record of pre-consultation was provided by the UTRCA, dated April 30, 2024, which provided additional details relating to the hydrogeological study requirements for the Site.

### 1.4 Scope of Work

The scope of work for the Hydrogeological Assessment consisted of the following tasks:

1. Desktop Study

This task consisted of a review of existing information including Site plans, previous reports, geological maps, geological cross sections, groundwater level information, borehole logs, and MECP WWR.

EXP completed a geotechnical investigation at the Site in conjunction with the hydrogeological assessment. Relevant details from the geotechnical investigation are provided in this report, where applicable.

2. Field Program

Drilling of 11 boreholes was completed as part of the 2021 geotechnical and hydrogeological field programs, with monitoring wells installed in all 11 boreholes. Two (2) of the locations were completed with sets of nested wells (BH5/MW-A/B and BH8/MW-A/B). Water levels were measured, groundwater samples were collected in the spring and fall, and single well response tests (SWRT) were completed for the purposes of characterizing the hydrogeological conditions at the Site.

In 2023, seven (7) boreholes were completed as part of a geotechnical drilling program. No monitoring wells were installed in these new boreholes. This additional subsurface investigation was undertaken in order to provide additional soil information throughout the Site.

A Phase II Environmental Site Assessment (ESA) investigation was also completed at the Site by EXP in 2023, which included the assessment of both soil and groundwater. The findings of the Phase II ESA were compiled in a Phase II ESA report, under separate cover.

A surface water monitoring program was established in March 2021 for Medway Creek, west of the Site. This included the installation of a staff gauge and mini-piezometer comprising surface water monitoring “Station 1”.

An additional two (2) surface water monitoring stations were installed immediately north of the northern property boundary in October 2024, where groundwater seepages along the slope toward Medway Creek were observed. Lastly, one (1) surface water monitoring station was installed in the south portion of the Site, within the Headwater Drainage Feature (HDF) identified by the ecological study of the Site, completed by others. Groundwater and surface water monitoring at the Site is on-going and will continue through the 2025 spring freshet to capture seasonal high observations within these new surface water monitoring stations.

3. Data Evaluation

This task consisted of the evaluation of the available field and laboratory data, a preliminary assessment of the dewatering requirements, and an assessment of potential impacts to groundwater and nearby sensitive features (i.e. watercourses, wetlands, etc.) from the proposed development.

4. Water Balance

This task consisted of the preparation of a monthly site-wide water balance assessment of the subject Site evaluating pre- and post-development conditions. In addition, feature based water balances were completed for three (3) marshes in the northern site area, and the Headwater Drainage Feature (HDF) located in the southern site area.

5. Reporting:

This task consisted of preparing this hydrogeological assessment report. In preparing this report, EXP has considered the guidance material available in the Conservation Ontario Guidelines for Hydrogeological Assessments (Conservation Ontario, 2013).

# 2. Methodology

## 2.1 Borehole Drilling, Test Pits, and Monitoring Well Installations

The borehole drilling programs were completed in conjunction with the Geotechnical Investigation for the Site. Two (2) separate drilling programs were completed on the Site in 2021 and 2023. The 2021 field program included the completion of 11 boreholes across the Site with monitoring wells installed in all 11 boreholes to allow for hydrogeological evaluation. Two (2) nested sets of monitoring wells were installed in two (2) areas of the Site. Additionally, 10 test pits were completed throughout the Site during the 2021 program.

The 2023 field program included the completion of seven (7) boreholes across the Site. None of the boreholes advanced in 2023 were completed as monitoring wells. The boreholes are monitoring well locations are shown on **Drawing 2**.

Borehole drilling and monitoring well installation was completed under the technical supervision of EXP. The location and depth of the boreholes was based on the proposed development plan which was provided to EXP.

The boreholes were completed using a track-mounted drill rig and standard 21 cm (8”) OD hollow stem auger drilling techniques with split spoon sampling. During the drilling, the stratigraphy in the boreholes was examined and logged in the field by EXP technical personnel. Representative samples of the soils found in the boreholes were submitted for laboratory testing that included moisture content and gradation of selected samples. Borehole and test pit logs are provided in **Appendix D**. Copies of the soil gradation analyses are included in **Appendix E**.

Monitoring wells were constructed from 5.1 cm (2”) diameter, schedule 40, polyvinyl chloride (PVC), flush-threaded casing. The appropriate number of risers were coupled with screen sections via threaded joints to construct the well. The well screens consisted of PVC pipe with 0.010-inch factory-generated slots. A summary of the well installation details is provided in **Table 1**.

A primary filter pack consisting of Silica Sand was placed around the well screen in the borehole and extended above the top of the well screen. Hole Plug, a swelling Bentonite clay that forms an effective barrier to the vertical movement of fluids when installed in a borehole, was used as a seal above the filter pack.

**Table 1: Monitoring Well Construction Details**

| Well ID | Ground Surface Elevation (m amsl) | Top of Standpipe Elevation (m amsl) | Completion Depth (m bgs) | Screen Length (m) | Screened Strata |
|---|---|---|---|---|---|
| **BH1/MW** | 269.01 | 270.02 | 6.7 | 1.52 | Sand |
| **BH2/MW** | 269.20 | 270.14 | 3.1 | 1.52 | Sand and Gravel; Sandy Silt |
| **BH3/MW** | 262.37 | 263.53 | 3.1 | 1.52 | Sand and Gravel; Silt Till |
| **BH4/MW** | 268.12 | 269.06 | 9.1 | 1.52 | Sand |
| **BH5/MW-A** | 261.44 | 262.52 | 7.6 | 1.52 | Sand |
| **BH5/MW-B** | 261.49 | 262.53 | 4.6 | 1.52 | Sandy Silt |
| **BH6/MW** | 261.06 | 262.14 | 6.1 | 1.52 | Sand |
| **BH7/MW** | 261.14 | 262.31 | 6.1 | 1.52 | Sand; Sandy Silt |
| **BH8/MW-A** | 266.70 | 267.54 | 12.2 | 3.05 | Silt Till |
| **BH8/MW-B** | 266.70 | 267.79 | 3.1 | 1.52 | Sand and Gravel; Sandy Silt |
| **BH9/MW** | 270.95 | 271.96 | 3.7 | 1.52 | Sand and Gravel; Silt |

Notes: 1. m amsl denotes metres above mean sea level.
2. Elevations are surveyed using Sokkia.

## 2.2 Surface Water Stations

A total of one surface water station (SW1) was installed within Medway Creek on March 12, 2021. This station consists of one mini-piezometer (P1) and one (1) staff gauge (SG1).

An additional three (3) surface water stations were installed at the Site on October 3, 2024, with two (2) stations installed immediately north of the north Site boundary, within the slope towards Medway Creek (P2 and P3), and one (1) station installed in a Headwater Drainage Feature (HDF-1) identified in the south portion of the Site by the ecological consultant (P4). The surface water monitoring stations are shown on **Drawing 2**. The following **Table 2** outlines the mini-piezometer construction details.

The mini-piezometers were installed with a 6-inch Solinst drive point end (6-inch screen length). The Solinst drive point piezometer end has a stainless steel, 50 mesh cylindrical filter screen, within a ¾ inch (20mm) stainless steel drive-point body.

The staff gauge installed as part of SW1 was established within the Medway Creek surface water body in order to capture monthly surface water elevations. Due to dry conditions the staff gauge was reinstalled within the bed of Medway Creek on May 5, 2021 to better reflect surface water levels within the creek.

**Table 2: Surface Water Station Details**

| Station | Location | Monitoring Equipment | ID | Datalogger | Mini-Piezometer Completion Depth (m bgs) | Mini-Piezometer Screened Strata | Installation Date |
|---|---|---|---|---|---|---|---|
| **1** | **Medway Creek (West of Site)** | Mini-piezometer<br>Staff Gauge | P1<br>SG1 | Yes<br>No | 1.26 | Sand and Gravel | March 2021 |
| **2** | **North Seepage Area** | Mini-piezometer | P2 | No | 0.87 | Silty Clay | October 2024 |
| **3** | **North Seepage Area** | Mini-piezometer | P3 | No | 0.85 | Silty Clay | October 2024 |
| **4** | **HDF-1** | Mini-piezometer | P4 | No | 0.81 | Silt, some sand | October 2024 |

## 2.3 Well Development and Groundwater Sampling

Monitoring wells were developed following installation. The wells were developed to:

- remove fine soil particles adjacent to the well screen that may otherwise interfere with water quality analyses;
- restore the groundwater properties that may have been disturbed during the drilling process;
- improve the hydraulic communication between the well and the geologic materials; and,
- remove water, if any, added during the drilling process.

Wells were generally developed by removing a minimum of ten times the volume of water contained in the well casing (casing volume) where possible using rigid high-density polyethylene (HDPE) tubing fitted with Waterra™ inertial pumps, or purging the well dry a minimum of three (3) times.

After appropriate well development, groundwater samples were collected from monitoring wells BH5/MW-A, BH5/MW-B, BH7/MW and BH8/MW-B for analysis of general groundwater quality. Groundwater samples were collected on March 12, 2021 and October 12, 2021. Prior to sample collection, the stagnant water in the well was purged to allow groundwater representative of the surrounding formation to enter the well. A minimum of three (3) well casing volumes of water was removed ("purged") from each well immediately prior to sampling.

Monitoring wells were purged using either a peristaltic pump or rigid high density polyethylene (HDPE) tubing fitted with Waterra™ inertial pumps that are dedicated to each monitoring well. Water samples were collected by direct transfer of groundwater from the Waterra™ pumping system to appropriate pre-labelled sample containers provided by the analytical laboratory, with filtering and preservation as appropriate. The samples were submitted to Maxxam Analytics (presently named Bureau Veritas Labs) in London, Ontario, for analysis of dissolved metals, cations and anions, nitrogen species (nitrate, nitrite, and ammonia), phosphate, and chloride.

Groundwater chemistry results are presented and discussed in **Section 4.5**.

### 2.4 Surface Water Sampling

Surface water samples were collected from SW1 on March 12, 2021 and October 12, 2021 in order to assess baseline surface water quality of Medway Creek. Surface water chemistry results are presented and discussed in **Section 4.5**.

### 2.5 Long-Term Groundwater and Surface Water Elevation Monitoring

Groundwater and surface water level monitoring at SW1 was completed on a monthly basis from March 2021 to March 2022 followed by monitoring on a quarterly basis until September 2024. The water level monitoring at the Site is on-going and is slated to continue to capture the 2025 spring freshet. Water level measurements are manually collected using a battery-signal water level tape.

Electronic pressure transducers (dataloggers) were installed in monitoring wells BH2/MW, BH5/MW-A/B, BH7/MW, BH8/MW-B and piezometer P-1 to facilitate the assessment of groundwater elevations and influence of precipitation events on groundwater levels. An additional logger was placed at surface and used for barometric compensation. The water level dataloggers were installed in March, 2021 and remain in place for continued monitoring. The dataloggers were programmed to record a reading every 24 hours.

### 2.6 Hydraulic Conductivity Testing

Single well response tests (SWRTs) were completed in monitoring wells BH5/MW-B, BH6/MW, BH8/MW-A and BH8/MW-B on March 30, 2022, to evaluate the hydraulic characteristics of the screened overburden. The test method consisted of a recorder test (i.e. rising head test) whereby the well was purged dry, and the water level recovery was monitored using a datalogger until it was observed to reach the static or near-static level.

The mathematical solution by Hvorslev (1951) was used to interpret the data and involved matching a straight-line solution to water-level displacement data collected during the recovery test.

Hvorslev (1951) was selected as the analytical method since research has shown that the Hvorslev analysis typically results in higher K estimates compared to several other analytical methods, including Bouwer and Rice (1976), and Dagan (1978) (Ismael, 2016). Ismael (2016) also states:

> *Larger K values typical of pump tests are generally known to be superior to smaller values from slug tests, largely due to inadequate development of wells that are slugged (Butler and Healy, 1998). Butler (1998) says that "the hydraulic-conductivity estimate obtained from a slug test should virtually always be viewed as a lower bound on the hydraulic conductivity of the formation in the vicinity of the well." That is why larger K values are considered to be inherently better or more potentially true than smaller values*.

Assumptions in the Hvorslev method for estimating K are:

- The aquifer has infinite aerial extent;
- The aquifer is homogeneous and of uniform thickness;
- The tested well is fully or partially penetrating;

- Flow to the well is quasi-steady-state (storage is negligible); and
- Water is injected into or discharged from the well instantaneously.

# 3. Site Description and Geologic Setting

## 3.1 Site Location and Description

The Site comprises an overall area of approximately 23.5 hectares and is located on the north and south side of Medway Road and west of Richmond Street in Arva, Ontario. Current land use at the Site is primarily cultivated agricultural land, with some treed are grassed areas. A residence and farming outbuildings are present in the southeast portion of the Site.

The Site is bounded by treed areas to the north and west, followed by grassed floodplain lands of Medway Creek. Medway Creek is located north and west of the Site at distances varying between roughly 5 m at the closest point to roughly 230 m at its furthest point from the Site. Additional floodplain and agricultural lands are present further to the north and west, beyond Medway Creek.

Commercial properties (Appliance Centre and Tack Shop) are present immediately east of the northern portion of the Site while a church and cemetery (institutional property use) are present immediately northeast of the southern portion of the Site. Richmond Street (Highway 4) is present further east, with commercial and residential developments present beyond. The Site Location Plan is provided in **Drawing 1**.

## 3.2 Topography and Drainage

The Site is relatively hilly sloping from a topographic high of roughly 270 m above mean sea level (amsl) in the east to 258 m amsl to the west (based on the Lidar-Derived Digital Terrain Model provide on the Ontario Geohub website). The Site is located within the Medway Creek – North Thames River Subwatershed.

Surface drainage at the Site is directed primarily to Medway Creek, present to the north and west of the Site. Medway Creek and surrounding floodplain lands are UTRCA regulated lands, as shown on **Drawing 3**. These UTRCA regulated lands extend within the Site limits in the north and west portions of the Site.

## 3.3 Natural Heritage Features

Medway Creek is present to the north and west of the Site with associated UTRCA regulated lands surrounding the creek and extending onto the north and west portions of the Site. The Arva Moraine Provincially Significant Wetland (PSW) is present approximately 195 m east of the northern Site boundary.

The Middlesex County Official Plan (Amendment No. 3 dated June 17, 2022) shows ‘Natural Heritage System’ areas within the north, west, and south portions of the Site. The Middlesex County Official Plan states that the County’s Natural Heritage System comprises features such as woodlands, wetlands, valley lands, and watercourses.

### 3.3.1 Ecological Study (Stantec)

A detailed ecological study for the Site was completed by Stantec Consulting Inc. (Stantec), with a Final ecological report dated April 16, 2025 (Stantec, 2025b). The following summary has been referenced from the ecological report.

The Stantec Ecological Land Classification (ELC) and Field Study Results drawing, and the Compensation Areas and Open Space drawing provided by Stantec is included in **Appendix B**. As shown on the ELC mapping provided by Stantec, there are small areas classified as a Mixed Mineral Meadow Marsh ecosites (ELC - MAMM3) within the

northwest and northeast portions of the Site. Stantec identified groundwater seepage areas on the valley slopes north and south of Medway Road. The areas of groundwater seepage found along the northern slope, north of the development limit, was found within the provincially rare ELC community Fresh-Moist Black Maple Lowland Deciduous Forest Type (FODM7-5). The area of seepage within this vegetation community was dominated by skunk cabbage (groundwater indicator) on the valley slope (Stantec, 2025b).

Additionally, a Headwater Drainage Feature (labelled 'HDF-1') was identified in the south portion of the Site and a full assessment of the feature was completed by Stantec. Further water level and on-site observations were made by EXP through the winter-early spring 2025 and a groundwater seepage area was identified along this HDF-1 feature in April 2025. The location of this seepage area is labelled on our **Drawing 2** located in **Appendix A**. This observation in April 2025 was the only time this seepage area was identified and mapped by EXP.

The HDF-1 feature is planned to be overprinted by development. The main function of the HFD-1 provides surface water infiltration and to transport water ephemerally down-slope toward the Medway Creek Floodplain. Post-development that function will be replicated using Low Impact Development (LID) techniques utilizing infiltration and/or with an engineered vegetated swale, or similar. This is further discussed in Section 5.1.7 (LID Design Considerations).

Open space areas are included in the development plan in the northeast area of the site, as well as in the western portion of the site, immediately south of Medway Road. An area designated Compensation Lands is planned for the northern portion of the site, as indicated in Stantec Ecology Figure 5, included in **Appendix B**.

The Ministry of Natural Resources (MNR) online Natural Heritage Areas mapping shows there are no Areas of Scientific Interest (ANSI) present within or adjacent to the Site.

## 3.4 Site Geology

### 3.4.1 Bedrock Geology

The Site is underlain by limestone, dolostone of the Dundee Formation (OGS, 2011). This formation consists of 60 to 160 feet (18 to 49 m) of light brown, medium-grained with some minor chert (Hewitt, 1972), and is part of the Algonquin Arch, which forms a ridge along the southwestern Ontario peninsula between the Michigan Basin (to the northwest) and the Appalachian Basin (to the southwest). Bedrock is generally not exposed in the area.

Review of bedrock topography mapping (**Drawing 4**) indicates the bedrock surface elevation ranges from 221 m to 218 m amsl in the vicinity of the Site. Overburden thickness mapping (OGS, 2011) indicates the bedrock surface to be roughly 54 to 37 m bgs in the vicinity of the Site. Bedrock was not encountered during the drilling programs completed as part of this investigation.

### 3.4.2 Overburden Geology

The physiography of Southwestern Ontario was altered significantly by the glacial and interglacial periods that took place throughout the Quaternary period. The overburden deposits which are present in the study area were formed by numerous glacial events during the late Wisconsinan glacial stage approximately 10,000 to 23,000 years before present. There were two distinct glacial lobes present in Southwestern Ontario during this period. The Huron Lobe advanced from Lake Huron southwards, and the Erie Lobe advanced from the northeast, receding to the east.

During the advancement of the glacial ice sheets, bedrock and unconsolidated sediments were eroded. During the recession of the glaciers, the eroded materials were deposited in lakes, rivers and along spillways, contributing to the present configuration of moraines, abandoned spillways, drumlins, eskers, abandoned shorelines, and various still-water sediment deposits.

Deposits in the area can be contributed to the Port Bruce Stadial period. In the London area, a series of east-west recessional and end moraines were formed, along with the Port Stanley Till Plain. Deposition of the basal portion of the Port Stanley Till was formed during the initial advance of the Erie Lobe. Overlying till was deposited during subsequent cycles of advance and retreat, resulting in silt and sand layering within the till plain.

The surficial deposits were mapped and categorized into a number of physiographic regions by Chapman and Putnam (1984). The physiographic regional mapping shows that the Site is located within the Stratford Till Plain physiographic region (**Drawing 5**).

Review of physiographic landform mapping shows that the majority of the Site is located within a spillway with a small area in the southeast portion of the Site located within an undrumlinized till plain (**Drawing 6**).

Surficial geology mapping (OGS, 2010) shows the majority of the Site is located within a glaciofluvial outwash deposit consisting primarily of coarse-grained sediments (gravel and sand) with high permeability. Small areas within the west and north portions of the Site are located within modern alluvial deposits predominantly consisting of silt with some sand and gravel. A small area in the southeast portion of the Site is located within a sandy silt loam till (Tavistock Till) characterizing as having low to medium permeability (**Drawing 7**).

### 3.4.3 Site Specific Surficial Geology

Generally, the Site consists of topsoil underlain by native sand/sand and gravel at select boreholes. The sand/sand and gravel unit was characterized as moist to wet since groundwater seepage was observed within this unit. Fill consisting of brown sandy silt and silt was observed beneath the topsoil and overlying the native deposits at boreholes BH3 and BH7, and Test Pits TP1 and TP7. A silt/sandy silt unit was encountered in select test pits and boreholes underlying the native sand/sand and gravel which was observed as moist to wet.

All boreholes with the exception of BH4 to BH7 encountered a glacial till unit beneath the sand/sand and gravel/silt/sandy silt units. The till was observed to consist predominantly of silt to sand silt and was observed to be brown in colour, transitioning to grey with depth. Occasional wet silt layering was observed within the till unit.

The detailed soil profiles encountered in each borehole and test pit are provided in the borehole and test pit logs in **Appendix D**. It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous soil sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones for the hydrogeological investigation and shall not be interpreted as exact planes of geological change.

Generalized stratigraphic cross sections through the Site, as shown in **Drawing 8**, are provided in **Drawings 9** and **10**.

Geological cross-section A-A' (**Drawing 9**) extends from north to south through the Site and illustrates the subsurface to consist of a shallow sand and gravel deposit overlying fine-grained sediments of silt till/clayey silt till/silt/silty sand. A sand deposit was encountered beneath the silt in the southern portion of the cross-section.

The northern portion of the cross-section extends across Medway Creek, north of the Site. Groundwater seepage is present along the northern slope towards Medway Creek, which is interpreted to result from the sandy silt/clayey silt till underlying the shallow sand and gravel deposit acting to "hold up" water in the shallow sand and gravel unit. The groundwater seepage along the slope occurs where the interface between the sand and gravel and silt/clayey silt till unit daylights along the slope.

The southern portion of the cross-section extends across the HDF identified in the southern portion of the Site by Stantec. As shown on the cross-section the HDF is located within a topographic low area in this portion of the Site and is interpreted to terminate within a fine-grained silt deposit.

Geological cross-section B-B' (**Drawing 10**) extends from west to east through the Site and illustrates the subsurface consists of sand and gravel overlying sandy silt/silt/clayey silt till/silt till in the eastern to central portions of the Site. A fill unit is illustrated overlying the sand and gravel unit in the central portion of the Site, near BH3/MW. A silty sand deposit is shown to be present at ground surface in the western portion of the Site, extending to Medway Creek located west of the Site.

A sand unit is illustrated beneath the sandy silt in the western portion of the Site and beneath the till units in the central portion of the Site. This unit likely extends further to the east; however, was not encountered at the terminated depth of BH2/MW. Monitoring well BH5/MW-A is screened in this lower sand unit in the western portion of the Site, as shown on the cross-section. The water level in BH5/MW-A is shown to rise above the top of the sand unit indicating that the sand unit represents a confined aquifer in this portion of the Site. It is noted that BH4/MW (shown on cross-section A-A') is also interpreted to be installed within this lower sand unit; however, this well has been observed as dry. Therefore, the sand unit likely transitions from a confined aquifer in the western portion of the Site to an unconfined aquifer in the eastern portion of the Site.

As shown on cross-section B-B', the groundwater measured at mini-piezometer P-1, installed in the vicinity of Medway Creek, coincides with the interpreted shallow water table across the Site.

# 4. Hydrogeologic Setting

In addition to the groundwater information collected from the monitoring wells installed at the Site, the following documents were reviewed to gain an understanding of the hydrogeological conditions in the area:

- Dillon Consulting Limited and Golder Associates Ltd. Middlesex-Elgin Groundwater Study, Final Report, submitted to Middlesex and Elgin Counties, dated July 2004, henceforth referred to as the Middlesex-Elgin Groundwater Study;
- Goff, K and D.R. Brown, 1981. Ground-Water Resources – Summary. Thames River Basin Water Management Study Technical Report. Ontario Ministry of the Environment, Water Resources Report 14;
- Thames-Sydenham and Region Source Protection Committee. 2011. Upper Thames River Source Protection Area, Approved Updated Assessment Report. 12 August; and,
- MECP WWR within 500 m of the Site.

## 4.1 Regional Aquifer

Goff and Brown (1981) described the potential for four regional aquifers in the study area; shallow unconfined overburden aquifer, intermediate and deep confined aquifers and a bedrock aquifer.

### 4.1.1 Overburden Aquifers

The uppermost shallow and unconfined overburden aquifer was described as consisting of lacustrine or glacio-fluvial sands that may, in some locations, be overlain by lower permeability silts and clays. Regionally, the shallow aquifer is generally associated with the Stratford Till Plain and glacial deposits and are typically less than 15 m in thickness. Shallow overburden aquifers are discontinuous in nature and are expected to be linked more directly to precipitation and recharge compared to the intermediate and deep overburden aquifers.

Intermediate depth (15 to 30 m bgs) and deep overburden aquifers (>30 m bgs) aquifers generally consist of saturated sand and gravel deposits in the overburden and are very discontinuous in nature due to the heterogeneous nature of glacial deposits. Sand and gravel layers are present in the Port Stanley and Catfish Creek glacial till sheets. The intermediate depth and deep overburden aquifers are generally confined by overlying silt, clay and glacial till deposits which limit vertical migration of shallow groundwater.

Locally, shallow groundwater flow is expected to follow the local topography, and generally drain west/southwest towards Medway Creek. Similarly, on a regional scale, the deep overburden aquifer flow direction is reported to be towards the south-southwest (Dillon and Golder, 2004).

### 4.1.2 Bedrock Aquifer

The bedrock aquifer is contained within limestone of the Dundee Formation. The water quality is generally good with elevated levels of iron, sodium and chloride in some wells. As with the intermediate and deep overburden aquifers, the bedrock aquifer is confined by the overlying till material. Wells extending into the shallow fractured bedrock (up to about 3 m) are typically considered to be hydraulically connected to the overlying sand and gravel deposits that are present at the bedrock-overburden interface.

Flow direction in the deeper confined aquifer(s) and regional groundwater system has not been assessed as part of this investigation. However, as part of the Middlesex-Elgin Groundwater Study (Dillon and Golder, 2004), groundwater flow within the deeper aquifer is generally in a south-southwest direction towards Lake Erie.

### 4.2 Site Specific Groundwater Monitoring

Manual water levels in the monitoring wells were collected monthly from March 2021 to March 2022 followed by monitoring on a quarterly basis. Monitoring is currently ongoing. The manual water levels and elevations are provided in **Appendix G**.

Dataloggers were installed in monitoring wells BH2/MW, BH5/MW-A, BH5/MW-B, BH7/MW, BH8/MW-B and within the mini- piezometer at surface water station SW1, to provide continuous groundwater monitoring. Dataloggers were installed on March 12, 2021, and have been collecting daily measurement. Hydrographs illustrating the continuous groundwater trends are provided in **Appendix G**. Precipitation data from weather station London CS (ID 6144478), located approximately 12.3 km east of the Site, and temperature data collected by the dataloggers are also shown on the hydrographs.

Overall, shallow groundwater levels (between 1 m and 2 m bgs) were observed in monitoring wells BH2/MW, BH8/MW-B, and BH9/MW. These are all shallow wells, installed across the upper sand and gravel unit.

The deepest groundwater levels were noted in BH4/MW which is screened in the lower sand unit. Measurable water levels were recorded at this well in June, July, August, and September 2021, and has been measured dry since. Dry conditions were also recorded on several occasions at BH3/MW screened across the upper sand and gravel unit, and at BH5/MW-B since June 2022, which is screened in the sandy silt unit in the vicinity of Medway Creek.

**Hydrograph 1** illustrates the groundwater trends observed at BH2/MW, screened across the upper sand and gravel unit. The hydrograph generally shows groundwater lows occur in the summer months (June to August) and highs during the late winter to spring (February to April). This is typical due to the infiltration of snowmelt to the subsurface during the spring freshet, and is particularly evident at this location since the well is screened relatively shallow within a coarse-sediment deposit. Acute responses to precipitation events are also apparent, with immediate groundwater level increases following precipitation events and water levels falling relatively quickly following the precipitation event.

**Hydrograph 2** illustrates the groundwater trends observed at BH5/MW-A (deep) and BH5/MW-B (shallow). BH5/MW-A is screened in the lower sand and gravel unit and the water levels in this well have consistently been observed to be within the overlying sandy silt unit, indicating the sand aquifer may exist as an artesian condition in this area of the Site. Seasonal groundwater fluctuations in BH/MW5-A are less apparent which is likely due to the installation depth of the well; however, highs are generally observed in the late winter to spring months and lows are generally observed in the summer. Immediate responses to precipitation events are also apparent with water levels falling relatively quickly following the precipitation event.

BH5/MW-B is screened in the silty sand unit overlying the saturated sand. Seasonal groundwater fluctuations are more apparent at this location likely due to the well installation depth. Seasonal lows are generally observed in the summer while highs are generally observed in the late winter to spring, coinciding with the spring freshet. Immediate responses to precipitation events are apparent and levels fall relatively quickly following the precipitation event.

The water levels in BH5/MW-B (shallow well) were observed to be consistently higher than those observed in BH5/MW-A (deeper well), with the exception of a dry period in BH5/MW-B in the summer of 2022. This indicates there is a downward vertical gradient between the two wells.

**Hydrograph 3** illustrates the groundwater trends observed in BH7/MW, screened in the lower sand unit underlying the silt till in the northern portion of the Site. Seasonal groundwater fluctuations are less apparent at this location in comparison to the upper aquifer wells, likely resulting from the installation depth of the well and that the screened sand unit is underlying the fine-grained silt till sediments which will act to hinder snow melt or precipitation from reaching the underlying sand unit. Despite this, groundwater lows were generally observed in the summer while highs were generally observed in the spring months, corresponding to the spring freshet. Immediate responses to precipitation events are also apparent and levels fall relatively quickly following the precipitation event.

**Hydrograph 4** illustrates the groundwater trends observed at BH8/MW-A (deep) and BH8/MW-B (shallow). A datalogger was installed in BH8/MW-B only; however, the manual groundwater level measurements from BH8/MW-A are also shown on the hydrograph. BH8/MW-A is screened in the silt till unit at a depth of 12.2 mbgs. As noted in the borehole log for BH8/MW-A, coarse-grained sand layering was encountered near 11.0 m bgs indicating that the transition to the lower sand unit may be near the bottom of the borehole. The manual measurements for BH8/MW-A shown on Hydrograph 4 generally show seasonal highs during the spring months while lows were generally observed in the summer.

Monitoring well BH8/MW-B is screened across the upper sand and gravel and sandy silt layers overlying the till. Similarly, seasonal highs were generally observed in the spring while lows are observed in the summer. Responses to precipitation events are also apparent with water levels typically falling relatively quickly following the precipitation event.

**Hydrograph 5** illustrates the groundwater and surface water trends observed at surface water monitoring station SW1, containing both a mini-piezometer monitoring shallow groundwater (P1) and a staff gauge to monitor surface water levels (SG1). A datalogger was installed in P1 to facilitate continuous groundwater level monitoring. As shown on the hydrograph, groundwater levels were typically higher in the spring while lows/dry conditions were typically observed in the late summer with the exception of high-volume precipitation events. A total of 19 manual monitoring events were conducted where both manual groundwater (P1) and surface water (SG1) measurements were collected. Of these 19 events, 11 were recorded where groundwater levels were higher than the surface water measurements indicating groundwater was discharging to the surface water at these times. These events typically occurred in the spring to early summer. Responses to precipitation events are also evident in the continuous groundwater data collected from P1, with sharp increases followed by relatively quick decreases following the event.

### 4.2.1 Groundwater Seepage Areas

A total of two (2) mini-piezometers were installed in October 2024 into the seepage areas identified along the northern slope to Medway Creek. Monitoring of these features is ongoing, through to spring 2025.

## 4.3 Groundwater Flow

### 4.3.1 Horizontal Groundwater Flow Direction

Shallow groundwater flow across the Site is affected by hydraulic conductivity, topography, drainage, and geology.

Based on the groundwater elevations in wells screened in the upper groundwater system, the groundwater flow direction within this system is interpreted to be predominantly westerly, towards Medway Creek, as shown in **Drawing 11A**.

Based on the groundwater elevations in wells screened in the lower groundwater system, the groundwater flow direction within this system is also interpreted to be westerly, towards Medway Creek, as shown on **Drawing 11B**.

### 4.3.2 Hydraulic Conductivity

Single well response tests (SWRT) were performed on four (4) monitoring wells on Site (BH5/MW-B, BH6/MW, BH8/MW-A and BH8/MW-B) to evaluate the hydraulic characteristics of the screened soils. The results of the tests are summarized in **Table 3**, and the calculations are presented in **Appendix H**. The hydraulic conductivity testing results are provided in the table below. These results agree with literature values of hydraulic conductivities for sand ranging from $10^{-5}$ to $10^{-2}$ m/s and silt ranging from $10^{-9}$ to $10^{-5}$ m/s (Table 2.2, Freeze and Cherry; 1979).

**Table 3: Hydraulic Conductivity Results**

| Sample ID | Lithology | Hydraulic Conductivity (m/s) | Screened Unit |
|---|---|---|---|
| **BH5/MW-B** | Sandy Silt | $5.9 \times 10^{-7}$ | Upper System (Unconfined Aquifer) |
| **BH6/MW** | Sand | $3.7 \times 10^{-5}$ | Lower System (Confined Aquifer) |
| **BH8/MW-A** | Silt Till | $3.1 \times 10^{-8}$ | Lower (Aquitard) |
| **BH8/MW-B** | Sand and Gravel; Sandy Silt | $2.1 \times 10^{-4}$ | Upper (Unconfined Aquifer) |

### 4.3.1 Hydraulic Gradient

The horizontal hydraulic gradient across the Site will vary due to the range in topography and resulting range in groundwater elevations.

The horizontal hydraulic gradient of the upper groundwater system was estimated based on groundwater measurements collected at BH2/MW and BH5/MW-B, both screened within the upper system, on June 18, 2024. Based on the measured water levels, the horizontal hydraulic gradient was calculated to be approximately 0.02 m/m.

The horizontal hydraulic gradient of the lower groundwater system was estimated based on measurements collected at BH1/MW and BH5/MW-A, both screened within the lower system, on June 18, 2024. Based on the measured water levels, the horizontal hydraulic gradient was calculated to be approximately 0.01 m/m.

Vertical hydraulic gradient in nested monitoring wells BH5/MW-A/B and BH8/MW-A/B was consistently downwards.

### 4.3.3 Groundwater Velocity

The average linear groundwater velocity can be calculated using the following equation based on Darcy's Law, as outlined in Fetter (2001):

$$v_x = -\frac{ki}{n_e}$$

Where:

$v_x$ = the average linear groundwater velocity (m/s)

$i$ = the horizontal hydraulic gradient (m/m), and

$n_e$ = the effective soil porosity (dimensionless).

Soil porosity is the total volume of void space in rock or sediment divided by the total volume whereas effective soil porosity is the volume of void space through which water or other fluids can travel in a rock or sediment divided by the total volume of the rock or sediment. Therefore, effective soil porosity is used in the calculation since this takes into consideration the connectedness of the void spaces and the ability of the soil to transmit water. An effective porosity value of 0.3 was used for the purpose of estimating the average linear groundwater velocity which is considered representative of sand (Bonazountas & Wagner, 1981).

Using the hydraulic conductivity geometric mean for the upper sand/sand and gravel (1.1 x $10^{-5}$ m/s) and the horizontal hydraulic gradient of the upper unconfined system (0.02 m/m), the average linear groundwater velocity of the upper system was calculated to be 7.4 x $10^{-7}$ m/s, or approximately 23 m/year.

Using the hydraulic conductivity calculated from the lower confined sand (3.7 x $10^{-5}$ m/s) and the horizontal hydraulic gradient of the lower system (0.01 m/m), the average linear groundwater velocity of the lower system was calculated to be 1.2 x $10^{-6}$ m/s, or approximately 39 m/year.

## 4.4 Groundwater and Surface Water Quality

Groundwater and surface water sampling was completed on March 12, 2021 and October 12, 2021. A total of four (4) groundwater monitoring wells (BH5/MW-A, BH5/MW-B, BH7/MW and BH8/MW-B) and one (1) surface water station (SW1) were selected for sampling. Water quality tables are presented in **Appendix I** and complete laboratory chain of custody results are provided in **Appendix J**.

Groundwater quality was compared to the Ontario Drinking Water Quality Standards, Objectives and Guidelines (ODWQS) Maximum Acceptable Concentrations (MAC; O.Reg. 169/03). Since the groundwater on Site is not planned for use as drinking water, these guidelines are used for comparison's sake only. As demonstrated in the tabulated

results in **Appendix I**, no parameters exceeded the ODWQS MAC for any sampled monitoring wells with the exception of nitrate and uranium.

The ODWQS MAC for nitrate (10 mg/L) was exceeded in BH8/MW-B on October 12, 2021 with a nitrate concentration of 11 mg/L. This monitoring well is installed at a shallow depth of 3.1 m bgs within sandy silt overlain by sand and gravel. Due to its location adjacent to an agricultural field and shallow installation depth, the elevated nitrate concentration likely results from the agricultural activities at the Site.

The ODWQS MAC for uranium (20 ug/L) was exceeded in BH5/MW-A on March 12, 2021 with a dissolved uranium concentration of 21 ug/L. This exceedance correlates with high concentrations of total dissolved solids (TDS), higher metal concentrations and dissolved organic carbon (DOC). It is possible that the higher concentration is the result of a biological factor and/or phosphate fertilizers which may contain uranium.

Surface water quality was compared to Ontario Provincial Water Quality Objectives (PWQO) (MOEE 1994). The PWQO guidelines for both total aluminum and total iron were exceeded at surface water Station SW1, within Medway Creek. The PWQO guideline for total aluminum (75 mg/L) was exceeded in March (900 mg/L) and October (130 mg/L), 2021. The PWQO guideline for total iron (300 mg/L) was exceeded in March, 2021 (990 mg/L).

All the remaining tested parameters met the PWQO guidelines. The laboratory Certificates of Analysis are provided in **Appendix J**.

Piper and Schoeller Diagrams for major and minor ions are provided in **Appendix I**. Both the groundwater and surface water quality results generally plot within the calcium magnesium bicarbonate alkaline zone of the Piper Diagram. Higher concentrations of sodium and chloride were observed in BH8/MW-B in March and October 2021. This monitoring well is screened relatively shallow with sand and gravel at ground surface; likely allowing for direct road salt impacts on the shallow groundwater quality.

Higher sodium concentrations were also noted in BH5/MW-A in March 2021. However, they do not correspond with higher chloride concentrations suggesting this is not the result of road salt impact and may be related to higher concentration of total dissolved solids noted at this sampling event. The groundwater and surface water quality results are all generally quite similar, suggesting interaction of the shallow groundwater table and Medway Creek.

# 5. Monthly Water Balance Assessments

The water balance assessments for the Site were completed in accordance with the recommendations indicated in the guidance document "Hydrogeological Assessment Submissions: Conservation Authority Guidelines to Support Development Applications" (Conservation Ontario, 2013), and using appropriate site condition values obtained from Table 3.1 of the MOE Stormwater Management Planning and Design Manual (MOE, 2003).

## 5.1 Site-Wide Water Balance

### 5.1.1 Background Information

The water balance calculations have been completed based on the Preliminary Draft Plan of Subdivision dated November 18, 2024, prepared by MHBC Planning Ltd., provided in **Attachment A.**

### 5.1.2 Pre-Development Condition

The total Site area is 23.517 hectares (235,170 $m^2$). The majority of the Site is primarily comprised of cultivated agricultural land. Grass and treed areas are located along the north, west, and south portions of the Site. A residential dwelling and farming outbuildings are located in the southeast portion of the Site.

The pre-development land use is summarized in **Table 4** and **Figure K-1** provided in **Appendix K** illustrates the pre-development conceptual model for the purposes of the water balance. The entirety of the Site is located within the catchment area of Medway Creek; therefore, the Site is considered as one catchment area.

### 5.1.3 Proposed Post-Development Condition

The proposed development includes low and medium density residential blocks, park blocks, a stormwater management block, open space blocks, a utility block and pump station, and roadways.

It is our understanding at this time that Low Impact Development (LID) strategies are being explored for the proposed development; however, specific strategies to be implemented have not yet been determined.

The calculated post-development land use is summarized in **Table 4**.

**Table 4: Pre-Development and Post-Development Condition**

| Total Site Area – 235,150 $m^2$ | Pre-Development | Post-Development |
|---|---|---|
| **Pervious Area** | | |
| Pasture and Shrubs ($m^2$) | 26,849 | 6,375 |
| Moderately Rooted Crops ($m^2$) | 193,331 | 0 |
| Mature Forest ($m^2$) | 12,536 | 1,369 |
| Urban Lawn | 0 | 88,680 |
| **Impervious Area** | | |
| Buildings & Paved Surfaces ($m^2$) | 2,454 | 138,746 |
| **Total ($m^2$)** | **235,170** | **235,170** |

### 5.1.4 Thornthwaite-Mather Water Balance

The water balance accounts for all water in and out-flows in the hydrologic cycle. Precipitation (P) falls as rain and snow. It can then run off towards wetlands, ponds, lakes, and streams (R), infiltrate into the ground (I), or evaporate from surface water and vegetation (ET). When long-term average values of P, R, I, and ET are used, then minimal or no net change to groundwater storage (ΔS) is assumed.

The traditionally used annual water balance can be stated as follows:

**$P = ET + R + I + \Delta S$**

Where:

P = precipitation (mm/year)
ET = evapotranspiration (mm/year)
R = runoff (mm/year)
I = Infiltration (mm/year)
ΔS = change in groundwater storage (taken as zero) (mm/year)

EXP has gone beyond the traditional annual water balance calculation and further considers monthly water-balance computations, as outlined in the U.S. Geological Survey Open-File Report 2007-1088. The U.S. Geological Survey created a monthly water-balance model, referred to as the Thornthwaite water-balance program, which analyses various components of the hydrological system using a monthly accounting procedure based on the methodology originally presented by Thornthwaite and Mather. The model and associated calculations further consider average monthly temperature, snow storage and snow melt in the volume calculations for surplus, runoff and infiltration. In

our calculations, surplus volumes can be negative in the summer months resulting in zero runoff and infiltration due to excess evapotranspiration in the summer. The surplus volumes are calculated as:

**Surplus = rain + actual snowmelt – ET**

The volumes of runoff and infiltration are then calculated from surplus, considering average monthly temperature (i.e. zero infiltration in winter months when temperatures are below zero degrees C).

**Precipitation and Evapotranspiration**

The annual total precipitation used for this water balance (1011.5 mm/yr) is based on data provided by Environment Canada, based on the 30 year average data for climate normals, using the nearest local weather station information (London, ON). In this detailed monthly water balance, precipitation as rain and snow are both considered. Snow storage and resulting snow melt in the winter and early spring months is considered as part of the evapotranspiration volumes.

Evapotranspiration combines evaporation and transpiration and refers to the water lost to the atmosphere. The rate of evapotranspiration is a function of the water holding capacity of the soil and varies with soil and vegetation type and amount of impermeable surface cover.

Monthly evapotranspiration volumes were calculated using the monthly water balance graphical interface created by the U.S. Geological Survey (USGS), Open-File report 2007-1088 (McCabe and Markstrom, 2007). This interface uses the principles outlined by Thornthwaite and Mather (1957) and permits the user to easily modify water balance parameters and provide useful estimates of water balance components for a specified location.

**Infiltration and Runoff**

The soil water holding capacities were determined using values presented in Table 3.1 of the MOE Stormwater Management Planning and Design Manual (MOE, 2003) based on the vegetative cover and the Hydrologic Soil Group (HSG). The drilling program completed at the Site indicates that, in general, the near surface native soils consist of coarse-grained sand / silty sand / silt / sand and gravel sediments (HSG-A/B). Some small areas in the eastern portion of the Site were observed to consist of clayey silt till near surface (HSG-D). Lastly, surficial geology mapping provided by the Ontario Geological Survey (2011) was reviewed to assess the shallow soils in areas of the Site where boreholes were not advanced as part of the drilling program. The majority of these areas are mapped as within an alluvium deposit consisting of sandy silt (HSG-B), or a glaciofluvial outwash deposit consisting of sand and gravel. For the purposes of the preliminary water balance, these areas were classified as HSG-B.

The weighted values based on the Site conditions are presented in the calculation sheets provided in **Appendix K** as well as in the tables presented below.

**Table 5: Pre-Development and Post-Development Water Holding Capacities**

| Land Use | Soil Type | Hydrologic Soil Group | Water Holding Capacity (mm/year) | |
|---|---|---|---|---|
| | | | Pre-Development | Post-Development |
| Moderately Rooted Crops | Sand/Sand and Gravel/Silty Sand/Silt | A-B | 113 (Rounded) | - |
| | Clayey Silt Till | D | 150 | - |
| Pasture and Shrubs | Silt/Silt Loam/ with some Sand and Gravel | B | 150 | 150 |
| Mature Forest | Silt/Silt Loam/ with some Sand and Gravel | B | 300 | 300 |
| Urban Lawn | Sand/Sand and Gravel/Silty Sand/Silt | A-B | - | 63 (Rounded) |
| | Clayey Silt Till | D | - | 75 |

The Infiltration Factors for the Site were determined based on the values presented in Table 3.1 of the MOE Stormwater Management Planning and Design Manual (MOE, 2003), summarized below:

**Table 6: Summary of Infiltration Factors**

| Land Use | HSG | Topography | Soil | Cover | Total Infiltration Factor | Total Runoff/Surplus |
|---|---|---|---|---|---|---|
| Moderately Rooted Crops | A-B | 0.1 | 0.4 | 0.1 | 0.6 | 0.4 |
| | D | 0.1 | 0.1 | 0.1 | 0.3 | 0.7 |
| Pasture and Shrubs | B | 0.1 | 0.3 | 0.1 | 0.5 | 0.5 |
| Mature Forest | B | 0.1 | 0.3 | 0.2 | 0.6 | 0.4 |
| Urban Lawn | A-B | 0.1 | 0.4 | 0.1 | 0.6 | 0.4 |
| | D | 0.1 | 0.1 | 0.1 | 0.3 | 0.7 |

Local infiltration rates will vary based on factors such as the field-saturated hydraulic conductivity of shallow soils, land slope, rainfall intensity, relative soil moisture at the start of a rainfall event, and type of cover on the ground surface.

Several assumptions were made to complete the preliminary water balance, including the following:

- Evapotranspiration occurs year-round despite freezing temperatures in the winter months, as fluctuation above and below the freezing temperature of water does occur;
- Precipitation falling when the temperature is above 3.3˚C is rain and below -10˚C falls as snow. When average monthly temperature falls between these values, precipitation form is derived by assuming a linear interpolation between these values;
- Surplus is calculated as the sum of precipitation as rain and actual snow melt, minus estimated evapotranspiration;
- Snow storage melts fully each month;
- Negative surplus values are possible in the summer months as water storage in the vadose zone of the soil is subject to evapotranspiration; and
- Infiltration does not occur in December, January, February, and half of March as frost is typically present during these months.

### 5.1.5 Water Balance Analysis

**Table 7** summarizes the pre- and post-development water balance calculations. Calculation worksheets are provided in **Appendix K**.

**Table 7: Summary of Preliminary Water Balance Estimates**

| Land Use | Pre-Development | Post-Development | Difference | % Maintained |
|---|---|---|---|---|
| Estimated Runoff ($m^3$/year) | 76,415 | 145,656 | 69,240 | 191% |
| Estimated Infiltration ($m^3$/year) | 40,279 | 16,258 | -24,021 | 40% |

Based on the above, the proposed development maintains 40% of the pre-development infiltration volume. Therefore, the use of secondary infiltration (LIDs) would be required in order to achieve a post-development infiltration target of approximately 80%.

### 5.1.6 Post-Development Mitigation

In order to achieve a post-development infiltration volume that maintains approximately 80% of the pre-development condition, a total of 16,022 $m^3$ (representing 11% of the estimated post-development runoff) would need to be redirected from runoff to infiltration facilities. It is noted that this assumes that the mitigation strategy operates at 100% efficiency. Efficiency of the mitigation strategy to be implemented (i.e. subsurface infiltration chambers, bioswales, etc.) should be considered when evaluating strategies to be implemented.

The mitigation calculations are provided in **Appendix K**.

As per the *Evaluation of Residential Lot Level Stormwater Practices Technical Brief* (Young, et. al, 2013), increased topsoil thickness can provide runoff reduction benefits. The study indicates that applying an increased topsoil thickness can result in a 5% reduction of runoff, and thus a 5% increase in infiltration. Therefore, it was estimated that applying an increased topsoil thickness of at least 300 mm would result in an annual runoff reduction and infiltration increase of 7,283 $m^3$. The resulting post-development infiltration volume would then maintain 58% of the pre-development condition when implementing increased topsoil thickness only.

The additional mitigation (runoff reduction) to achieve a post-development infiltration of 80% with increased topsoil thickness is 8,680 $m^3$, representing 6% of the estimated post-development runoff.

### 5.1.7 LID Design Considerations

The subsurface investigations have identified the shallow native soils to generally consist of coarse-grained sand/silty sand/sand and gravel throughout the majority of the Site. Given these soil types and the measured depths to groundwater across the Site, the implementation of LIDs in the form of infiltration facilities may be feasible at the Site. In-situ infiltration testing at proposed infiltration facility locations would be required to confirm the actual infiltration rates, soil types, and groundwater conditions at the proposed locations. The specific location, type and design of LID facilities will be determined through detailed design.

As discussed in the Stantec Ecology Report (Stantec, 2025b), the Headwater Drainage Feature (HDF-1) located in the southern area of the Site is planned to be overprinted by development. The main function of HDF-1 provides surface water infiltration and to transport water ephemerally down-slope toward the Medway Creek floodplain. In the Post-Development environment, LID techniques will be required to replicate this function, utilizing infiltration and/or with an engineered vegetated swale, or similar.

The groundwater seepage area along the northern slope of the site, classified as the rare ecological community FODM7-5, is dependent on groundwater flows from the adjacent lands. Consideration should be given to management of groundwater in building design in these areas, in order to maintain the form and function of the groundwater seepage areas along the northern slope. It is recommended that buildings be designed above the high groundwater table or appropriate waterproofing of buildings should be considered. Additional LIDs may be considered for design in this area of the site.

## 5.2 Feature-Based Water Balances

### 5.2.1 Background Information

An ecological study of the Site was undertaken by Stantec Consulting Inc. which delineated the areas of the Site by their Ecological Land Classifications (ELCs), and identified the location of a HDF in the southern portion of the Site. Based on the ELC mapping, there are three (3) marsh areas in the north portion of the Site that are located within the Site boundary. Catchment areas and the pre-development land use for the three (3) marsh areas and the HDF feature are shown on **Figure K-2** in **Appendix K**.

### 5.2.2 Water Balance Analysis

The feature-based water balance assessments for Catchments A1, A2, and B (marshes) exclude the areas of the wetlands themselves. The feature-based water balance calculation spreadsheets are provided in **Appendix K**. **Table 8** provides a summary of the pre-development water balance calculations. **Table 8: Summary of Pre-Development Water Balance Estimates**

| | Pre-Development |
|---|---|
| **Northwest Marsh (Catchment A1)** | |
| **Estimated Runoff ($m^3$/year)** | 167 |
| **Estimated Infiltration ($m^3$/year)** | 79 |
| **Northwest Marsh (Catchment A2)** | |
| **Estimated Runoff ($m^3$/year)** | 1,614 |
| **Estimated Infiltration ($m^3$/year)** | 942 |
| **Northeast Marsh (Catchment B)** | |
| **Estimated Runoff ($m^3$/year)** | 675 |
| **Estimated Infiltration ($m^3$/year)** | 299 |
| **Headwater Drainage Feature (Catchment C)** | |
| **Estimated Runoff ($m^3$/year)** | 16,529 |
| **Estimated Infiltration ($m^3$/year)** | 6,843 |

At the time of writing, mitigation measures are being explored to promote infiltration and direct runoff to these features post-development. These include infiltration chambers in the north portion of the Site for the marsh areas and a swale along the southern property boundary limit to collect and direct runoff post-development, similar to the existing function of the existing HDF.

Further assessment of the mitigation measures to be implemented will be conducted at the detailed design stage.

# 6. Source Water Protection Considerations

## 6.1 Significant Groundwater Recharge Areas (SGRA)

Groundwater recharge is largely controlled by soil conditions, and typically occurs in upland areas. As defined in the Clean Water Act (2006), an area is a significant groundwater recharge area if,

1. the area annually recharges water to the underlying aquifer at a rate that is greater than the rate of recharge across the whole of the related groundwater recharge area by a factor of 1.15 or more; or

2. the area annually recharges a volume of water to the underlying aquifer that is 55% or more of the volume determined by subtracting the annual evapotranspiration for the whole of the related groundwater recharge area from the annual precipitation for the whole of the related groundwater recharge area.

An assessment report for the Upper Thames River Source Protection Area was completed by the Thames-Sydenham and Region Source Protection Committee. As defined by the Clean Water Act (2006) and identified by the Thames-Sydenham and Region Source Protection Committee, the majority of the Site is located within a SGRA, as shown on **Drawing 12**.

## 6.2 Highly Vulnerable Aquifers (HVA)

The susceptibility of an aquifer to contamination is a function of the susceptibility of its recharge area to the infiltration of contaminants. As defined in the *Clean Water Act (2006)*, the vulnerability of groundwater within a source protection area shall be assessed using one or more of the following groundwater vulnerability assessment methods:

1. Intrinsic susceptibility index (ISI).
2. Aquifer vulnerability index (AVI).
3. Surface to aquifer advection time (SAAT).
4. Surface to well advection time (SWAT).

In the Thames-Sydenham and Region, HVAs were mapped using the ISI method. The ISI method is an indexing approach using existing provincial Water Well Information System (WWIS) database. The ISI method is described in detail in the MECP's Technical Terms of Reference (2001). However, in short, the ISI method is a scoring system that takes into consideration the unique hydrogeologic conditions at a particular location. The scores are determined using a combination of the saturated thickness of each unit and an index number related to the soil type, and as such, the scores reflect the susceptibility of the aquifer to contamination.

As defined in the MECP's 2001 Technical Rules,

- an area having an ISI score of less than 30 is considered to be an area of high vulnerability;
- an area having an ISI score greater than or equal to 30, but less than or equal to 80, is considered to be an area of medium vulnerability; and,
- an area having an ISI score of greater than 80 is considered to be an area of low vulnerability.

The Thames-Sydenham and Region Source Protection Committee has determined, using the ISI method, that the majority of the Site is located within an HVA, as shown on **Drawing 13**.

# 7. Impact Assessment

## 7.1 Water Well Users

A search of the Ontario MECP WWR database was completed using a buffer of 500 m from the Site. This resulted in the identification of 85 records, as shown on **Drawing 14**. Of these 85 records:

- 47 records were listed as Water Supply wells. Of these:
  - 34 were listed with the primary use as domestic;
  - 7 were listed with the primary use as public;
  - 1 was listed with the primary use as municipal;
  - 1 was listed with the primary use as commercial;
  - 2 were listed with the primary use as livestock; and
  - 2 were listed with the primary use as irrigation;
- 21 records were listed as test holes, observation wells, or monitoring and test holes;
- 12 records were listed as abandoned; and
- 5 records did not specify a well use.

The MECP WWR Summary provided in **Appendix F**.

Water supply wells in the area are generally drawing from the confined intermediate sand and gravel aquifer or from the bedrock aquifer. There are 15 shallow water supply wells within 500 m that are about 10 m deep or less. The presence of shallow private wells in the vicinity of the Site was confirmed by EXP during the completion of other investigations in the vicinity of the Site. Construction activities extending into the sand and gravel aquifer will need to consider potential impacts to the shallow water supply wells. Further assessment of construction dewatering activities and potential impacts can be completed at the detailed design stage once design details (i.e. finished floor and servicing elevations) are known.

## 7.2 Surface Water and Seepage Features

Medway Creek is located north and west of the development boundaries. Based on the topography and groundwater flow direction interpretations, both groundwater and surface water are expected to flow towards Medway Creek.

Based on the groundwater and surface water level monitoring and chemistry data, there appears to be interaction between the shallow groundwater table and Medway Creek.

A site-wide water balance was completed for the Site which estimated the total runoff and infiltration volumes occurring at the Site annually. Mitigation measures to be implemented post-development are currently being explored in order to maintain reasonable post-development runoff and infiltration volumes to Medway Creek.

Headwater Drainage Feature (HDF-1) located in the southern area of the Site is planned to be overprinted by development. In the Post-Development environment, LID techniques will be required to replicate this function, utilizing infiltration and/or with an engineered vegetated swale, or similar.

The groundwater seepage area along the northern slope of the site, classified as the rare ecological community FODM7-5, is dependent on groundwater flows from the adjacent lands. Consideration should be given to management of groundwater in building design in these areas, in order to maintain the form and function of the groundwater seepage areas along the northern slope. It is recommended that buildings be designed above the high groundwater table or appropriate waterproofing of buildings should be considered. Additional LIDs may be considered for design in this area of the site.

### 7.2.1 General Comments

Medway Creek is considered vulnerable to contamination from surface sources. During construction, short term impacts to the surface water may be anticipated, particularly where vegetation on nearby land is stripped and area grading works are underway.

The following comments are provided with recommendations to help minimize impact to the surface water feature at the site:

- During the site grading work, suitable sedimentation controls will be required to help control and reduce the turbidity of run-off water which may flow towards the surface water feature;
- A Best Management Practice (BMP) and spill contingency plan (including a spill action response plan) should be in place for fuel handling, storage and onsite equipment maintenance activities to minimize the risk of contaminant releases as a result of the proposed construction activities;
- Re-establishing vegetative cover in disturbed areas following the completion of the construction work;
- Limit the use of commercial fertilizers in landscaped areas which border a habitat feature; and,
- Limit the use of salts or other additives for ice and snow control on the roadways and parking areas.

## 7.3 Preliminary Construction Dewatering Considerations

Daily construction water takings between 50,000 and 400,000 L/day require registration on the Environmental Activity and Sector Registry (EASR) in accordance with Ontario Regulation 63/16. Daily water takings exceeding 400,000 L/day require a Category 3 permit to take water (PTTW) that is reviewed and approved by the MECP according to Sections 34 and 98 of the Ontario Water Resources Act R.S.O. 1990 and the Water Taking and Transfer Regulation O. Reg. 387/04.

Based on the measured shallow groundwater elevations, groundwater may be encountered during the construction activities at the Site. The volume of water requiring management will depend on the excavation extent below the water table, and the encountered soils. In areas of the Site with coarse-sediments (i.e. sand/sand and gravel) at surface coinciding with shallow groundwater levels, the daily water taking volumes may exceed 400,000 L/day, requiring a Category 3 PTTW.

Further information is required in order to complete detailed dewatering calculations. This includes the grading plan, building finished floor elevations, and servicing elevations. A detailed dewatering assessment that includes calculations of dewatering rates, radius of influence, and dewatering discharge assessment can be completed at the detailed design stage once the design details are known.

# 8. Qualifications of Assessors

EXP Services Inc. provides a full range of environmental services through a full-time Earth and Environmental Services Group. EXP's Environmental Services Group has developed a strong working relationship with clients in both the private and public sectors and has developed a positive relationship with the Ontario MECP. Personnel in the numerous branch offices form part of a large network of full-time dedicated environmental professionals in the EXP organization.

This report was authored by Ms. Kassandra Wallace, B.B.R.M. Ms. Wallace has more than 8 years' experience in the environmental consulting industry that includes conducting hydrogeological assessments for various types of development projects, Phase One and Phase Two Environmental Site Assessments, and remediation projects. She obtained her Bachelor's degree in Bio-Resource Management (Environmental Management Major) from the University of Guelph and obtained her Ontario College Graduate Certificate in Environmental Engineering Applications from Conestoga College.

This report was co-authored by Ms. Hagit Blumenthal, M.Sc., P.Geo. Ms. Blumenthal has experience in conducting hydrogeological assessments. Ms. Blumenthal is a hydrogeologist and environmental geoscientist with more than 10 years' experience in the environmental field, and is a licensed Professional Geoscientist (P.Geo.) in Ontario. She obtained a Master of Science (M.Sc.) in 2010 from the University of Waterloo and has worked in the Hydrogeological and Environmental fields since then.

This report was reviewed by Ms. Heather Jaggard, M.Sc., P.Geo. Ms. Jaggard is a hydrogeologist and environmental geoscientist with more than 12 years in the environmental field and is a licensed Professional Geoscientist (P.Geo.) in Ontario. She obtained a Master's of Science (M.Sc.) in 2012 from Queen's University in Kingston, and is a Qualified Person (QP) registered with the Ontario MECP. She has worked in the Hydrogeological and Environmental fields since that time. In her professional career for the past few years, Ms. Jaggard has completed numerous hydrogeological assessments and modelling works for land development sites. Environmental site assessments and preparation of submissions for PTTW have been part of her routine assignments.

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# 10. General Limitations

The information presented in this report is based on a limited investigation designed to provide information to support an assessment of the current environmental conditions within the subject property. The conclusions and recommendations presented in this report reflect Site conditions existing at the time of the investigation. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent. Should this occur, EXP Services Inc. should be contacted to assess the situation, and the need for additional testing and reporting. EXP has qualified personnel to provide assistance in regard to any future geotechnical and environmental issues related to this property.

Our undertaking at EXP, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the engineering profession. It is intended that the outcome of this investigation assist in reducing the client's risk associated with environmental impairment. Our work should not be considered 'risk mitigation'. No other warranty or representation, either expressed or implied, is included or intended in this report.

The comments given in this report are intended only for the guidance of design engineers. The number of test holes required to determine the localized underground conditions between test holes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

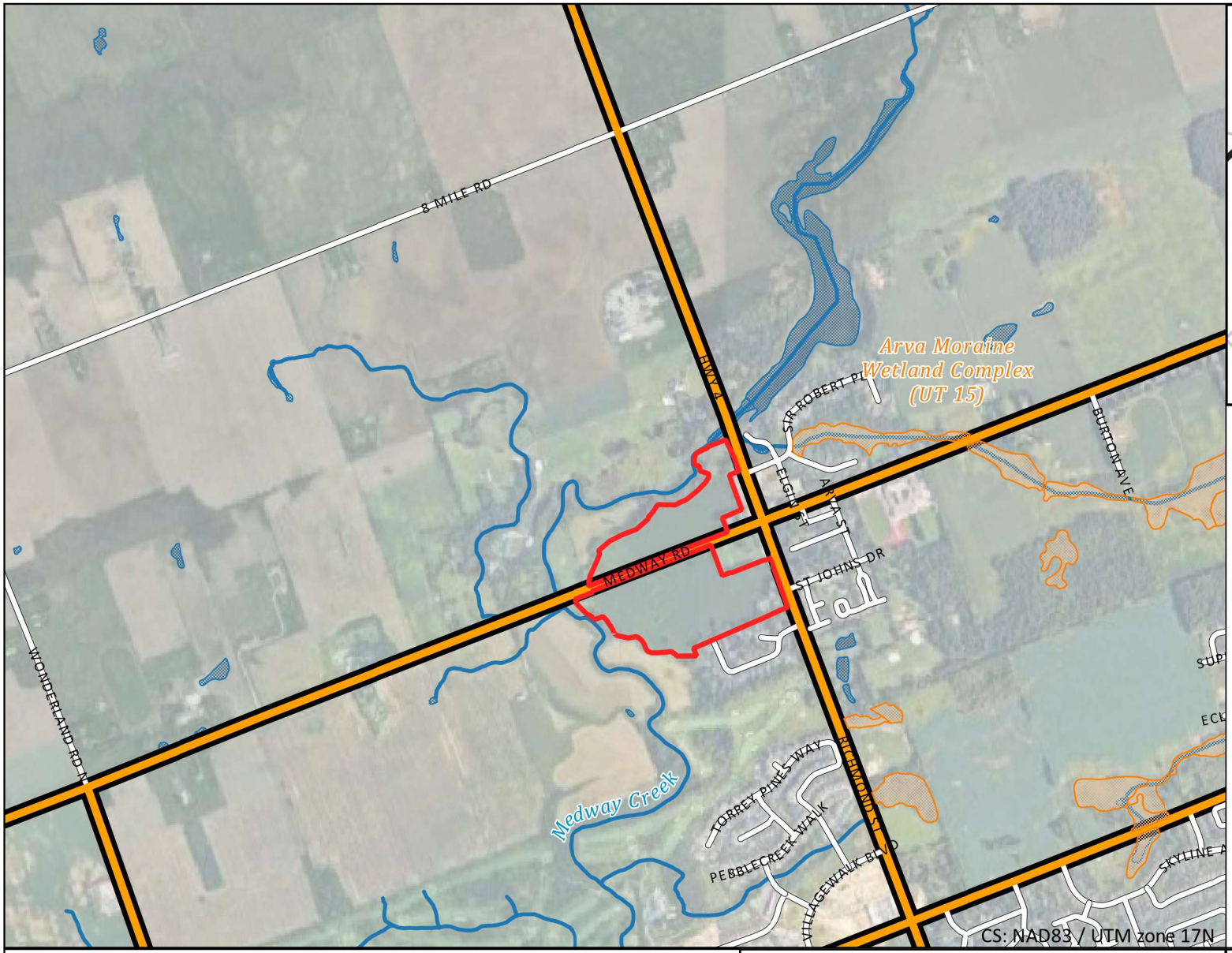
EXP Services Inc. should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not afforded the privilege of making this review, EXP Services Inc. will assume no responsibility for interpretation of the recommendations in this report

This report was prepared for the exclusive use of **York Developments** and may not be reproduced in whole or in part, without the prior written consent of EXP, or used or relied upon in whole or in part by other parties for any purposes whatsoever. Any use which a third party makes of this report, or any part thereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

# Appendix A - Drawings

6-405 Maple Grove Road | Cambridge, Ontario | Canada
t: +1.519.650.4918 | f: +1.519.650.4603 | exp.com





-LEGEND-

- Subject Lands
- Waterbody (OHN)
- Watercourse (OHN)
- Evaluated-Provincially Significant Wetland

Notes:

Data Sources:
Contains information licensed under the Open Government License - Ontario
Google Earth Imagery (c) 2022 CNES / Airbus, Maxar Technologies

Hydrogeological Assessment

**Bridle Path Subdivision**

Medway Creek, Arva, ON

| | |
|---|---|
| CLIENT | Bridle Path North Arva Inc. |
| TITLE | Site Location Plan |
| Prepared By: K.W. | Reviewed By: H.J./H.B. |

EXP Services Inc.
405 Maple Grove Road, Cambridge, ON, N5V 0A5

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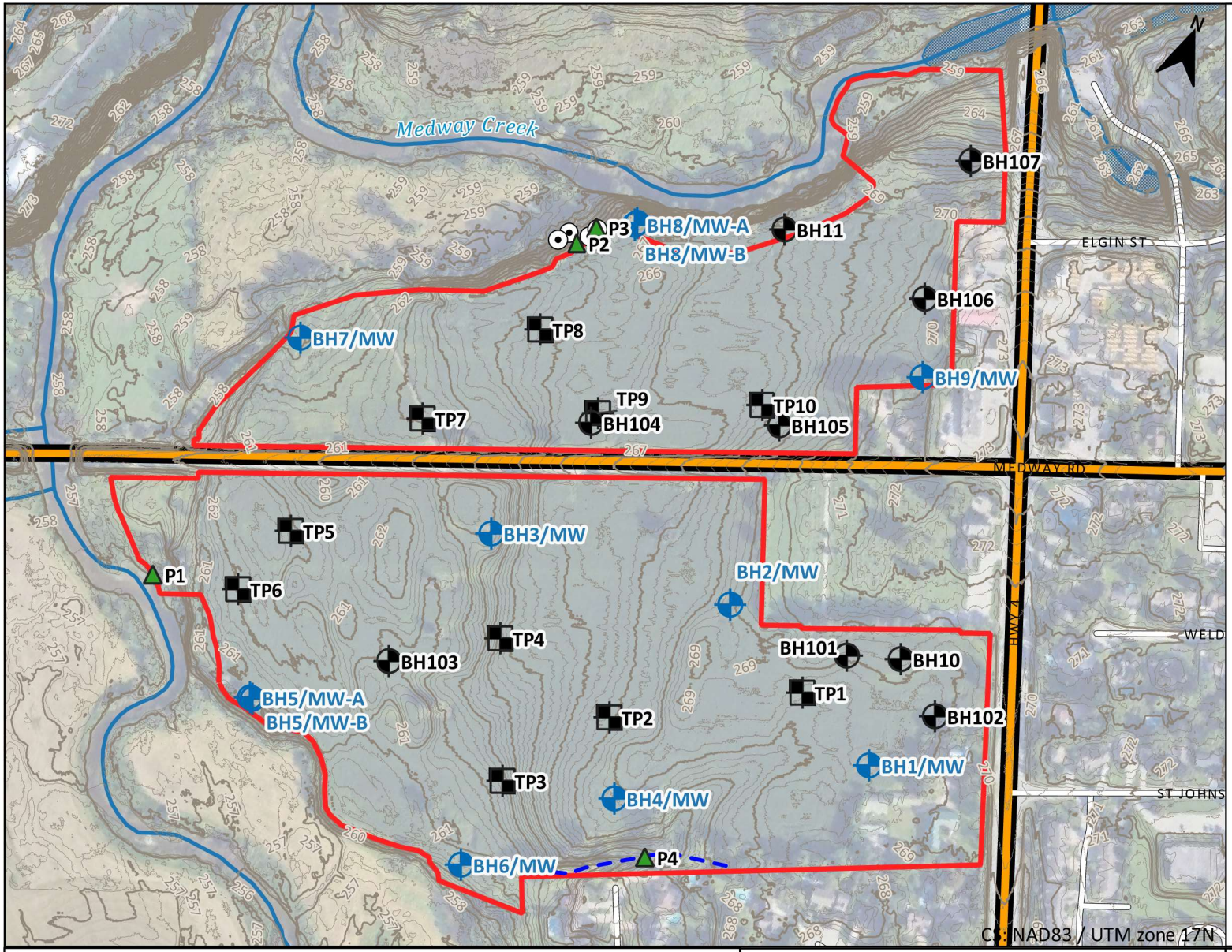


-LEGEND-

- Subject Lands
- Watercourse (OHN)
- Waterbody (OHN)
- Headwater Drainage Feature
- Seepage Location

Ground Surface Elevation Contour (mamsl)

- Major
- Minor

Investigative Locations

- Monitoring Well
- Borehole
- Test Pit
- Minipiezometer

Notes:
Ground surface elevation contours are generated from the Ontario Digital Terrain Model (Lidar-Derived).
OHN - Ontario Hydro Network

Data Sources:
Contains information licensed under the Open Government License - Ontario
Google Earth Imagery (c) 2022 City of London, First Base Solutions, Maxar Technologies

# Hydrogeological Assessment

## Bridle Path Subdivision

Medway Creek, Arva, ON

| | |
|---|---|
| CLIENT | Bridle Path North Arva Inc. |
| TITLE | Site Features & Borehole Location Plan |
| Prepared By: K.W. | Reviewed By: H.J./H.B. |

EXP Services Inc.
405 Maple Grove Road, Cambridge, ON, N5V 0A5

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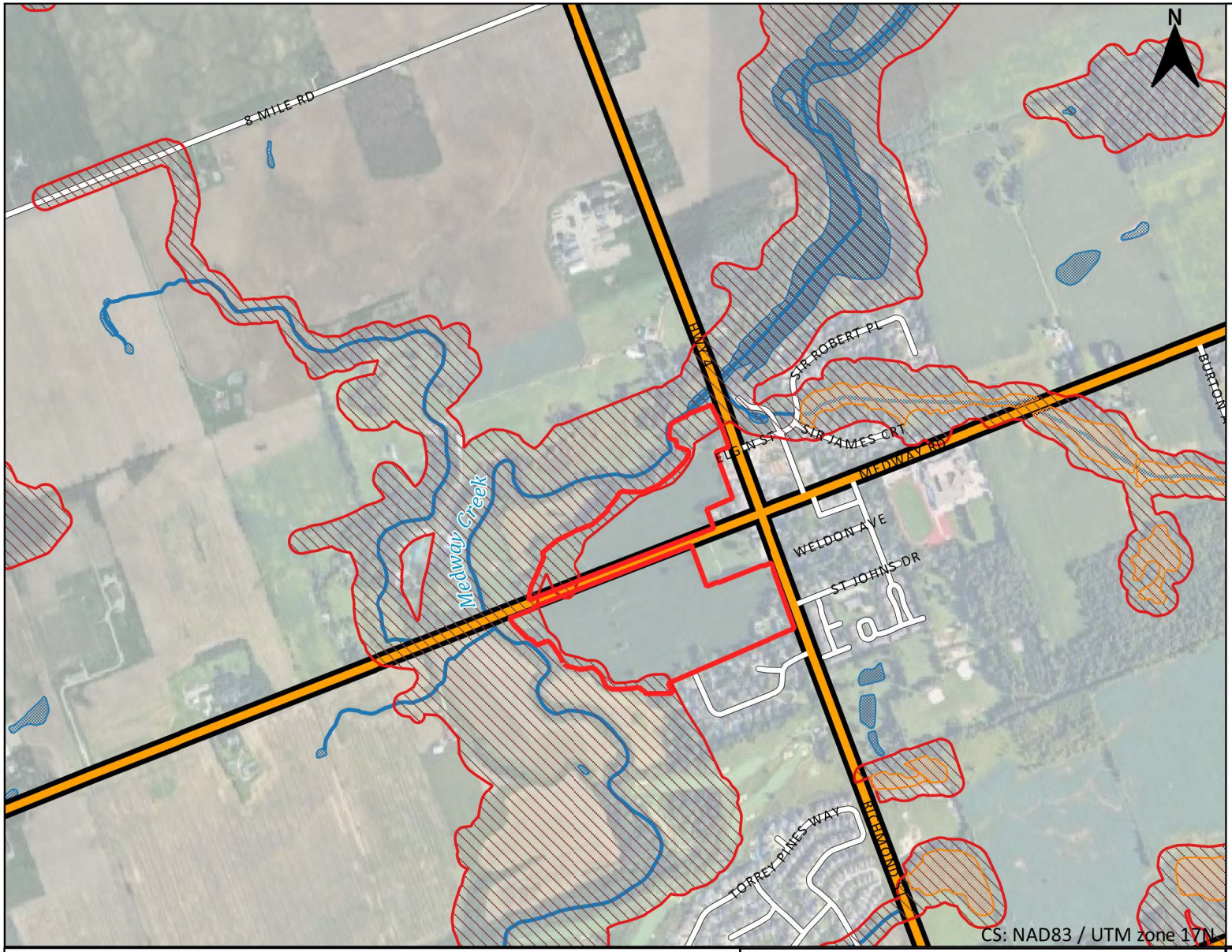


-LEGEND-

- Subject Lands
- Waterbody (OHN)
- Watercourse (OHN)
- UTRCA Regulated (O. Reg 41/24)

Notes:

Data Sources:
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Hydrogeological Assessment

**Bridle Path Subdivision**

Medway Creek, Arva, ON

| | |
|---|---|
| CLIENT | Bridle Path North Arva Inc. |
| TITLE | Regulated Lands of the UTRCA |
| Prepared By: K.W. | Reviewed By: H.J./H.B. |

EXP Services Inc.
405 Maple Grove Road, Cambridge, ON, N5V 0A5

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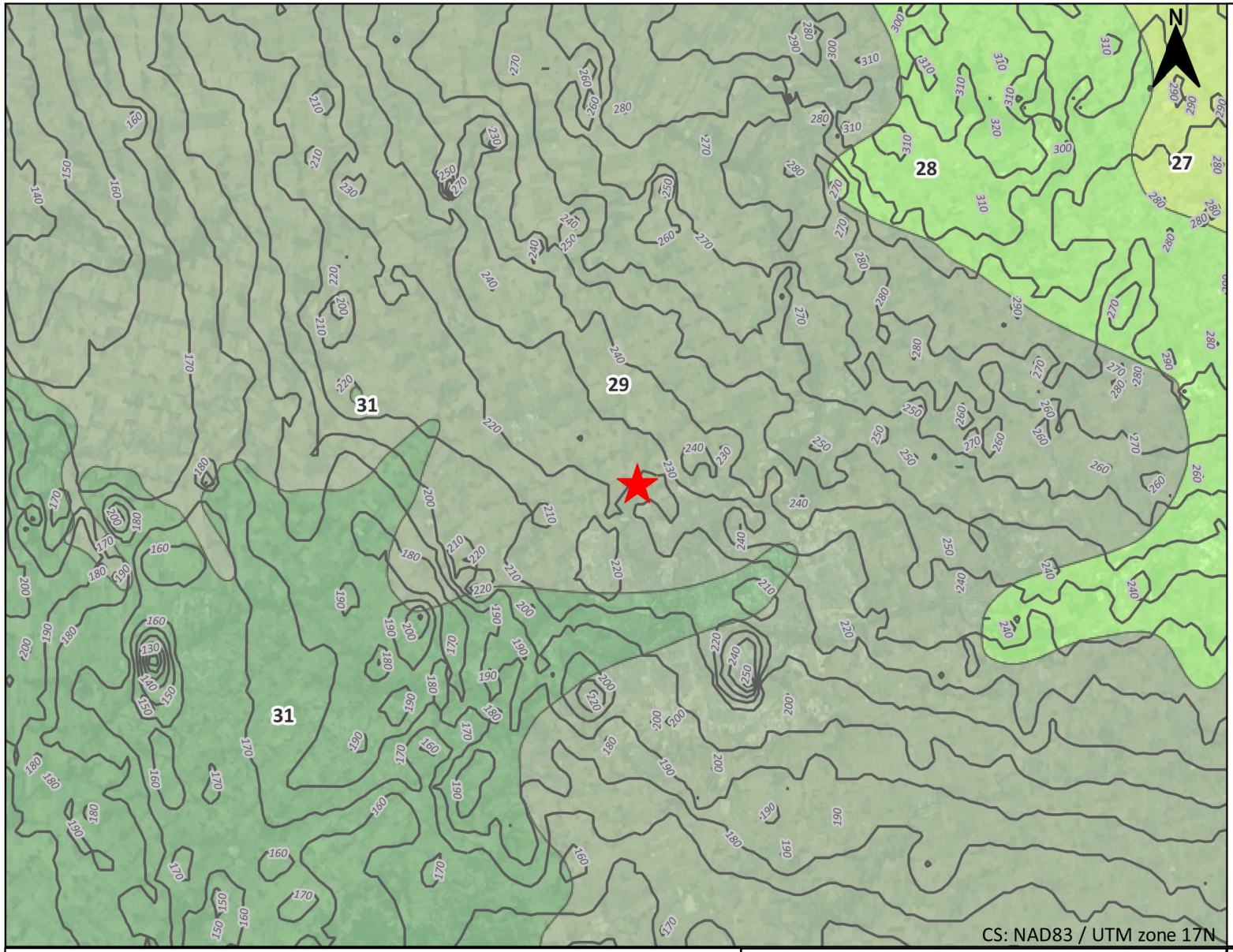


-LEGEND-

Subject Lands

Bedrock Topography Contour (mamsl)

Paleozoic Geology

27 Amherstburg Formation

28 Lucas Formation

29 Dundee Formation

31 Kettle Point Formation

Notes:

Data Sources:
Bedrock topography contours extrapolated from Paleozoic Geology data provided by the Ministry of Northern Development, Mines, Natural Resources and Forestry OGSEarth Mapping.
Armstrong, D.K. and Dodge, J.E.P. 2007. Paleozoic geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release - Data 219.

Hydrogeological Assessment

**Bridle Path Subdivision**

Medway Creek, Arva, ON

CLIENT: Bridle Path North Arva Inc.

TITLE: Bedrock Geology & Topography

Prepared By: K.W. | Reviewed By: H.J./H.B.

EXP Services Inc.
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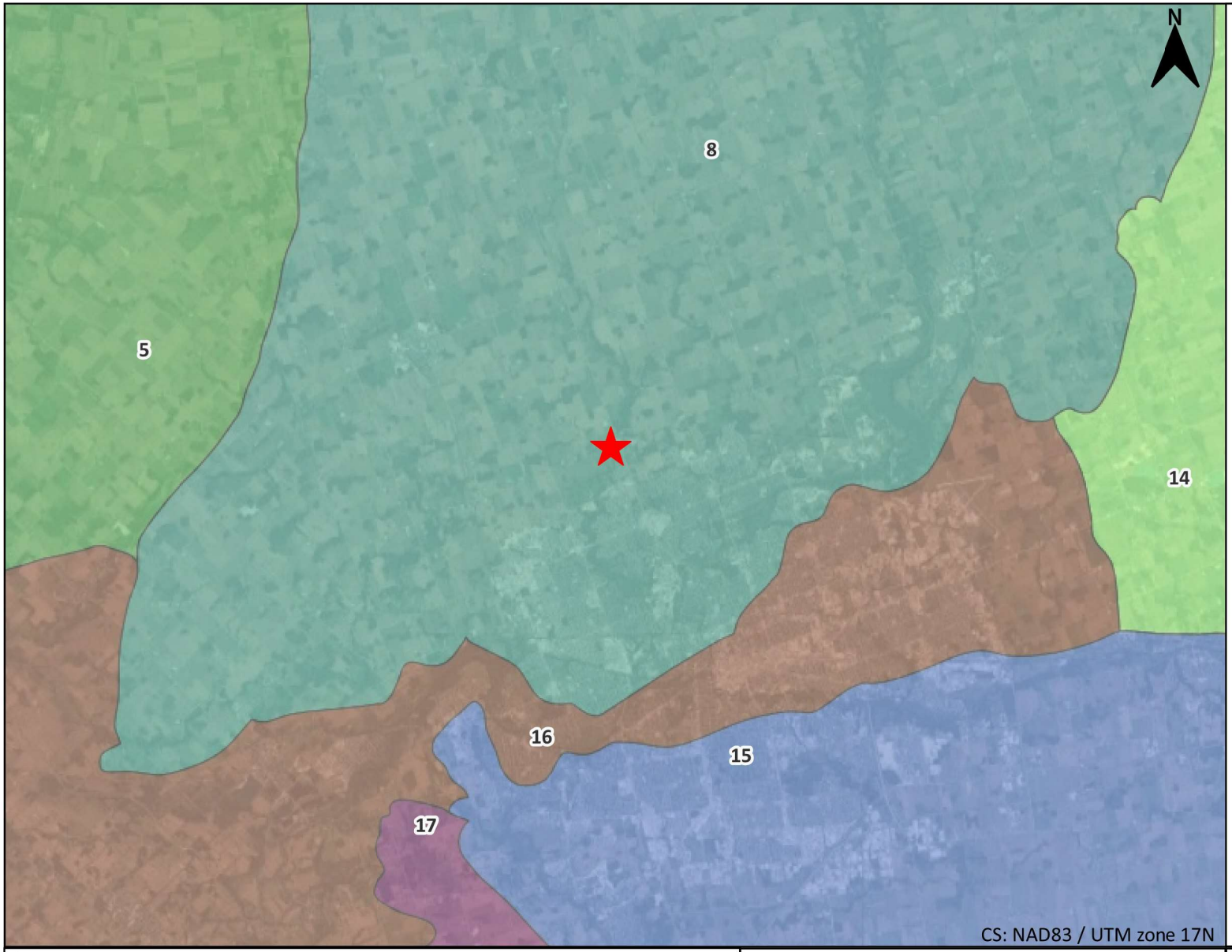


-LEGEND-

Subject Lands

Physiographic Regions

- 5 Horseshoe Moraines
- 8 Stratford Till Plain
- 14 Oxford Till Plain
- 15 Mount Elgin Ridges
- 16 Caradoc Sand Plains and London Annex
- 17 Ekfrid Clay Plain

Notes:

Data Sources:
Contains information licensed under the Open Government Licence – Ontario.
Chapman, L.J. and Putnam, D.F. 2007. Physiography of southern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 228.

Hydrogeological Assessment

**Bridle Path Subdivision**

Medway Creek, Arva, ON

| | |
|---|---|
| CLIENT | Bridle Path North Arva Inc. |
| TITLE | Physiographic Regions |
| Prepared By: K.W. | Reviewed By: H.J./H.B. |

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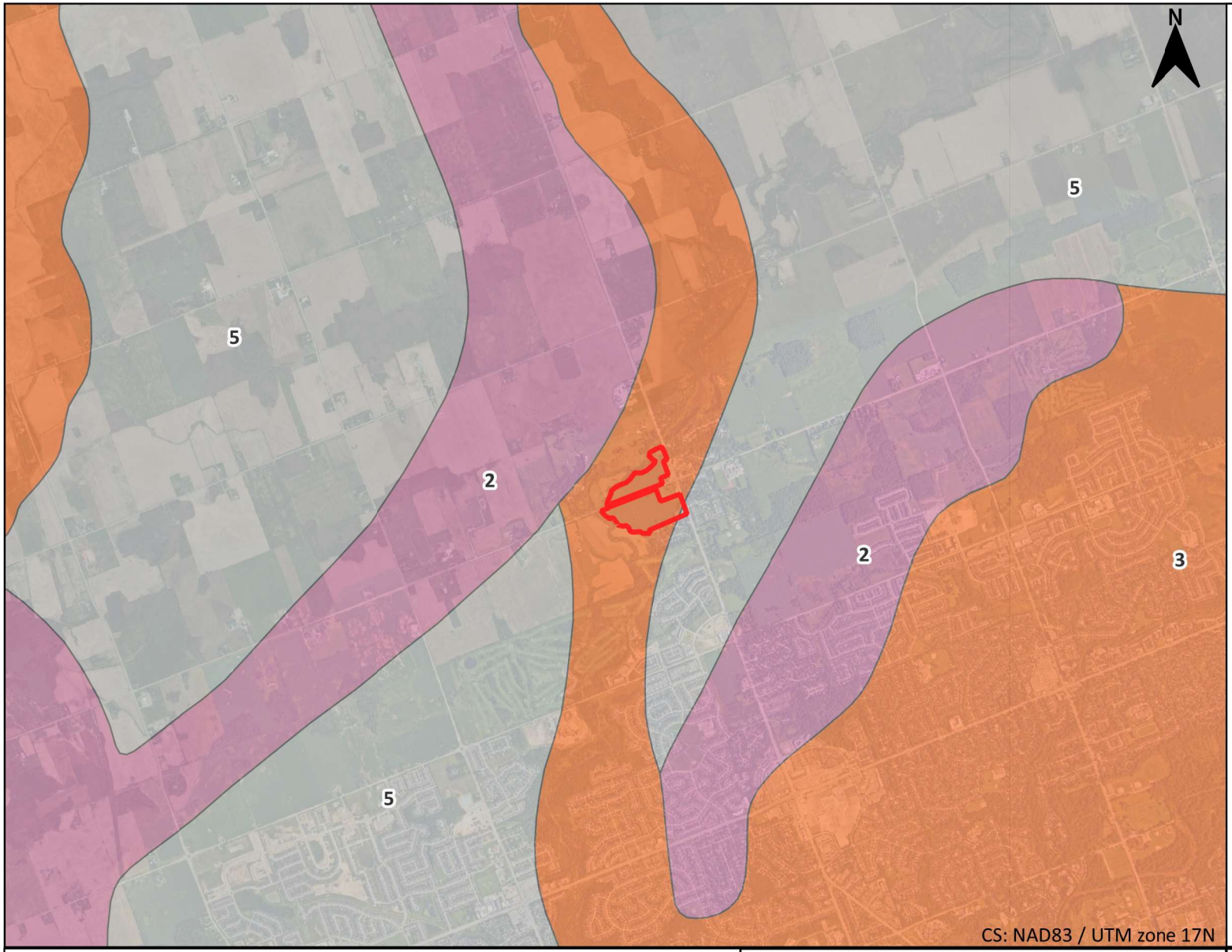


-LEGEND-

Subject Lands

Physiographic Landforms

2 Till Moraines

3 Spillways

5 Till Plains (Undrumlinized)

Notes:

Data Sources:
Contains information licensed under the Open Government Licence – Ontario.
Chapman, L.J. and Putnam, D.F. 2007. Physiography of southern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 228.

Hydrogeological Assessment

**Bridle Path Subdivision**

Medway Creek, Arva, ON

| | |
|---|---|
| CLIENT | Bridle Path North Arva Inc. |
| TITLE | Physiographic Landforms |
| Prepared By: K.W. | Reviewed By: H.J./H.B. |

EXP Services Inc.
405 Maple Grove Road, Cambridge, ON, N5V 0A5

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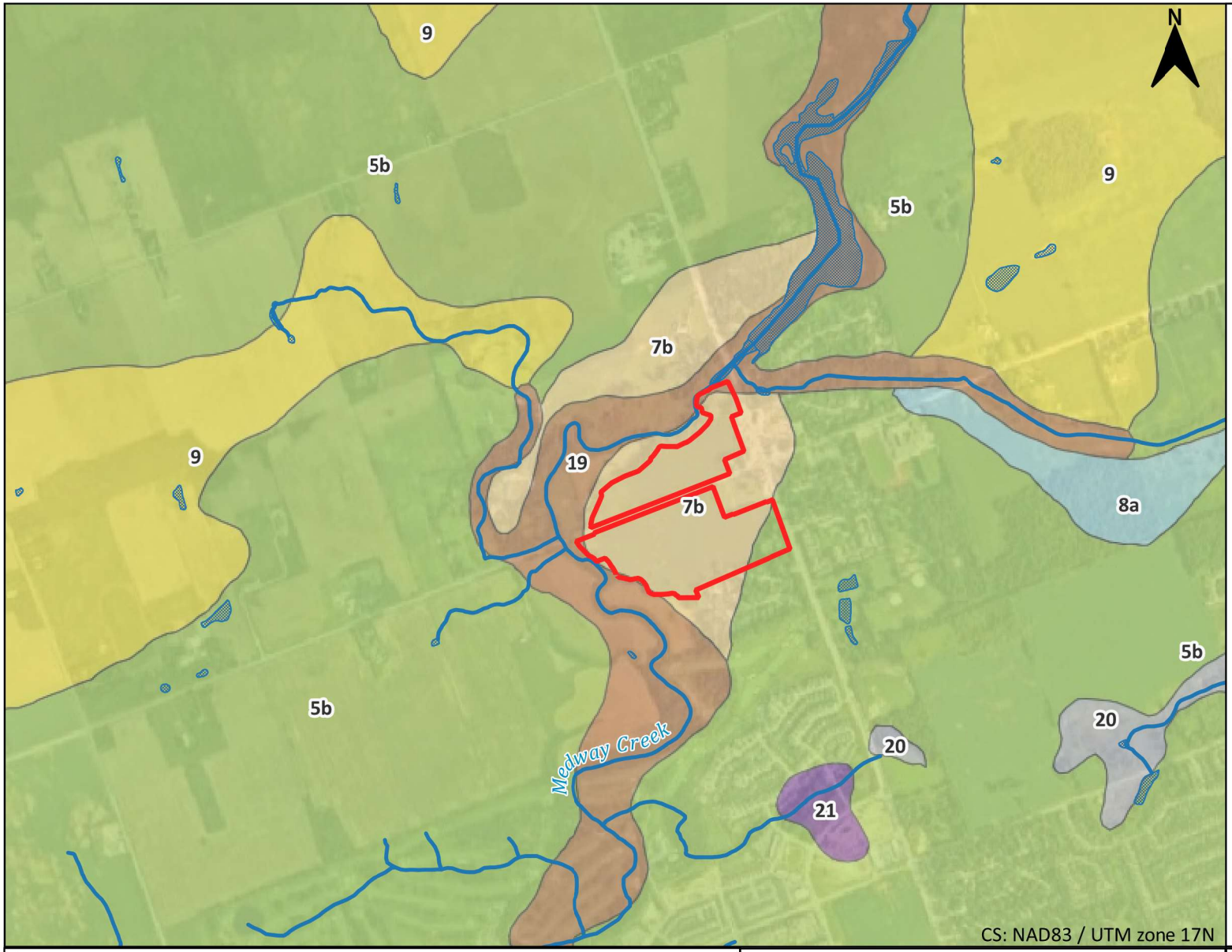


-LEGEND-

- Subject Lands
- Waterbody (OHN)
- Watercourse (OHN)

Surficial Geology

- 21 Man-made Deposits: fill, sewage lagoon, landfill, urban development
- 20 Organic Deposits: peat, muck, marl
- 19 Modern Alluvial Deposits: clay, silt, sand, gravel, may contain organic remains
- 9 Coarse-textured Glaciolacustrine Deposits: sand, gravel, minor silt and clay
- 8 Fine-textured Glaciolacustrine Deposits: silt and clay, minor sand and gravel
- 8a Massive to well laminated
- 7 Glaciofluvial Deposits: river deposits and delta top facies
- 7b Gravelly Deposits
- 5b Stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain

Notes:

Data Sources:
Contains information licensed under the Open Government Licence – Ontario.
Ontario Geological Survey 2010. Surficial geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 128 – Revised.

Hydrogeological Assessment

**Bridle Path Subdivision**

Medway Creek, Arva, ON

CLIENT: Bridle Path North Arva Inc.

TITLE: Surficial Geology

Prepared By: K.W. | Reviewed By: H.J./H.B.

EXP Services Inc.
405 Maple Grove Road, Cambridge, ON, N5V 0A5

| DATE | SCALE | PROJECT NO. | DWG. |
|---|---|---|---|
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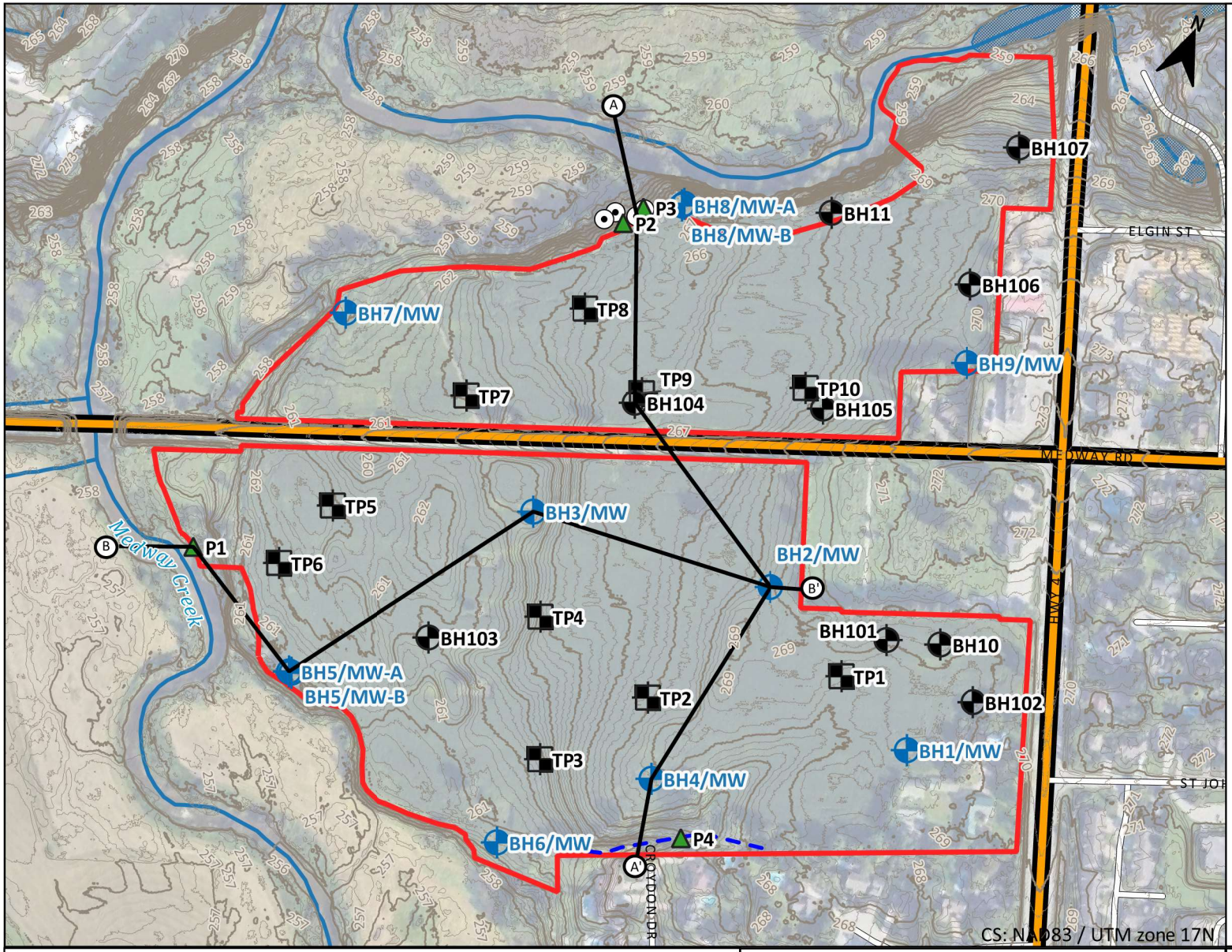


-LEGEND-

- Subject Lands
- Waterbody (OHN)
- Watercourse (OHN)
- Headwater Drainage Feature
- Seepage Location
- Geological Cross-Section

Ground Surface Elevation Contour (mamsl)

- Major
- Minor

Investigative Locations

- Monitoring Well
- Borehole
- Test Pit
- Minipiezometer

Notes:
Ground surface elevation contours are generated from the Ontario Digital Terrain Model (Lidar-Derived).

Data Sources:
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Hydrogeological Assessment

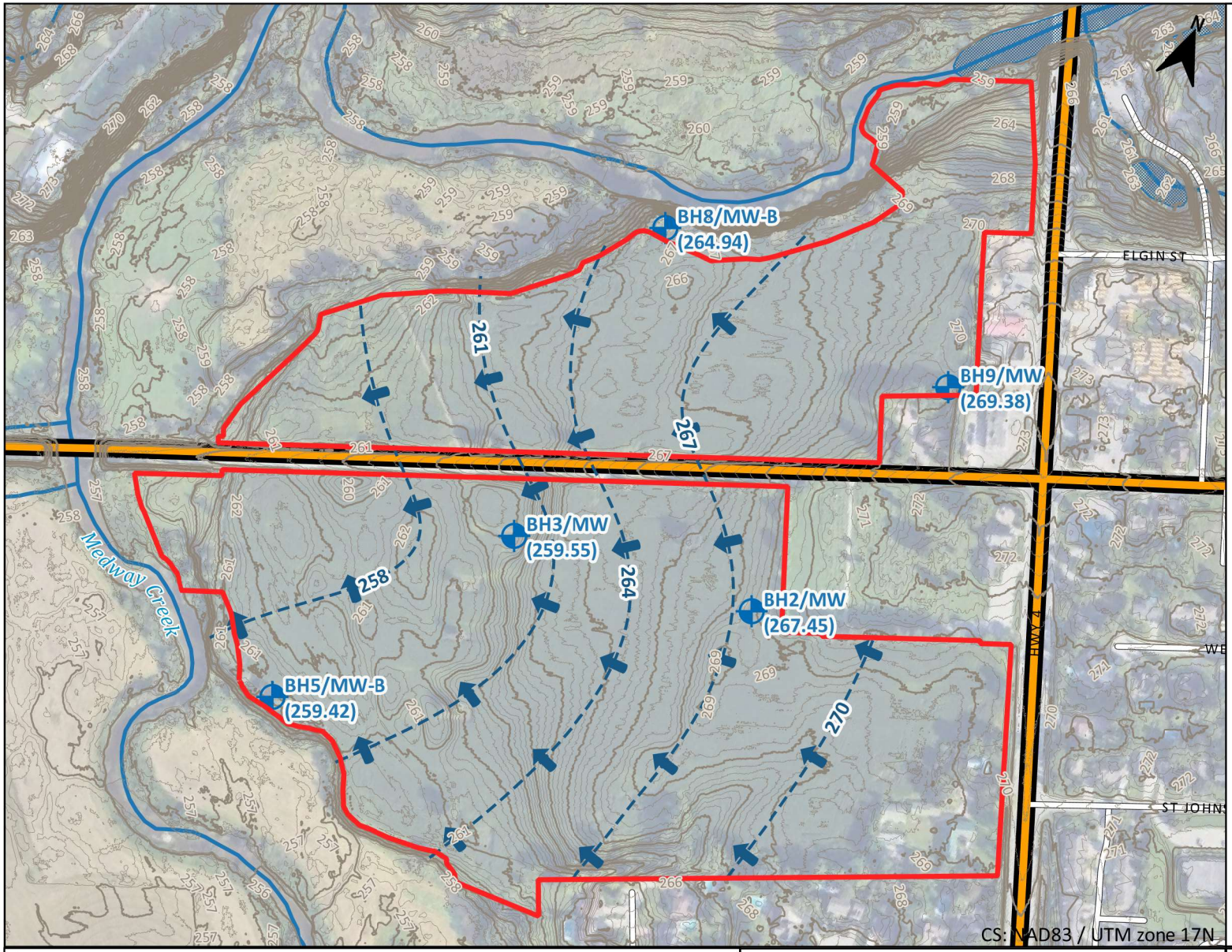
**Bridle Path Subdivision**

Medway Creek, Arva, ON

| | |
|---|---|
| CLIENT | Bridle Path North Arva Inc. |
| TITLE | Cross-Section Location Plan |
| Prepared By: K.W. | Reviewed By: H.J./H.B. |

EXP Services Inc.
405 Maple Grove Road, Cambridge, ON, N5V 0A5

| DATE | SCALE | PROJECT NO. | DWG. |
|---|---|---|---|
| Oct. 2024 | 1:4,500 | KCH-21002415 | 8 |




-LEGEND-

- Subject Lands
- Watercourse (OHN)
- Waterbody (OHN)

Ground Surface Elevation Contour (mamsl)

- Major
- Minor

Monitoring Wells Screened in Upper System

- Monitoring Well (Groundwater Elevation, mamsl)
- Upper System Groundwater Elevation Contour (mamsl) & Flow Direction

Notes:
Groundwater flow interpretation is based on manual measurements collected June 18, 2024.
Ground surface elevation contours are generated from the Ontario Digital Terrain Model (Lidar-Derived).

Data Sources:
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Google Earth Imagery (c) 2022 CNES / Airbus, Maxar Technologies

# Hydrogeological Assessment

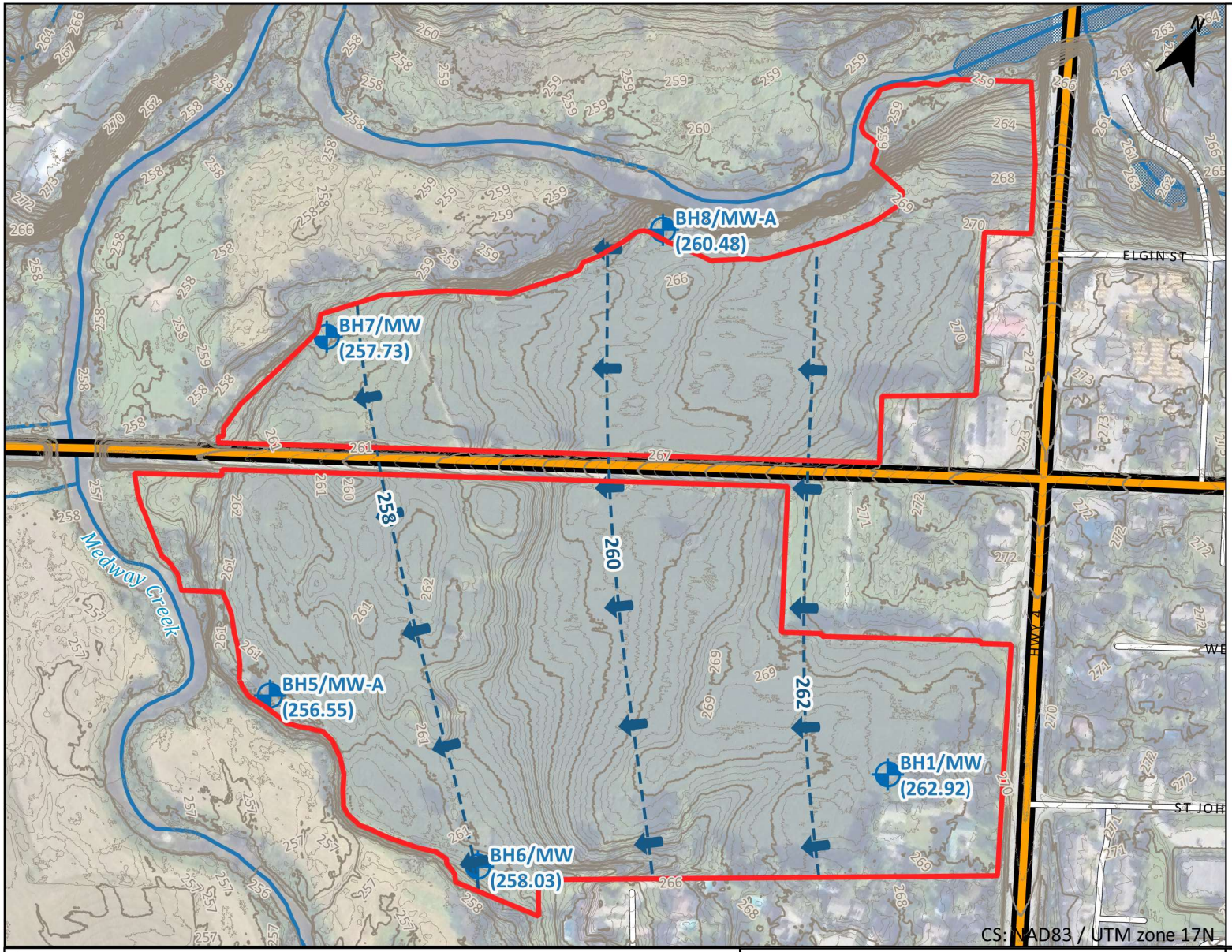
## Bridle Path Subdivision

Medway Creek, Arva, ON

| | |
|---|---|
| CLIENT | Bridle Path North Arva Inc. |
| TITLE | Shallow (Upper) Groundwater Flow |
| Prepared By: K.W. | Reviewed By: H.J./H.B. |

EXP Services Inc.
405 Maple Grove Road, Cambridge, ON, N5V 0A5

| DATE | SCALE | PROJECT NO. | DWG. |
|---|---|---|---|
| Oct. 2024 | 1:4,500 | KCH-21002415 | 11A |




-LEGEND-

- Subject Lands
- Watercourse (OHN)
- Waterbody (OHN)

Ground Surface Elevation Contour (mamsl)

- Major
- Minor

Monitoring Wells Screened in Lower System

- Monitoring Well (Groundwater Elevation, mamsl)
- Lower System Groundwater Elevation Contour (mamsl) & Flow Di

Notes:
Groundwater flow interpretation is based on manual measurements collected June 18, 2024.
Ground surface elevation contours are generated from the Ontario Digital Terrain Model (Lidar-Derived).

Data Sources:
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# Hydrogeological Assessment

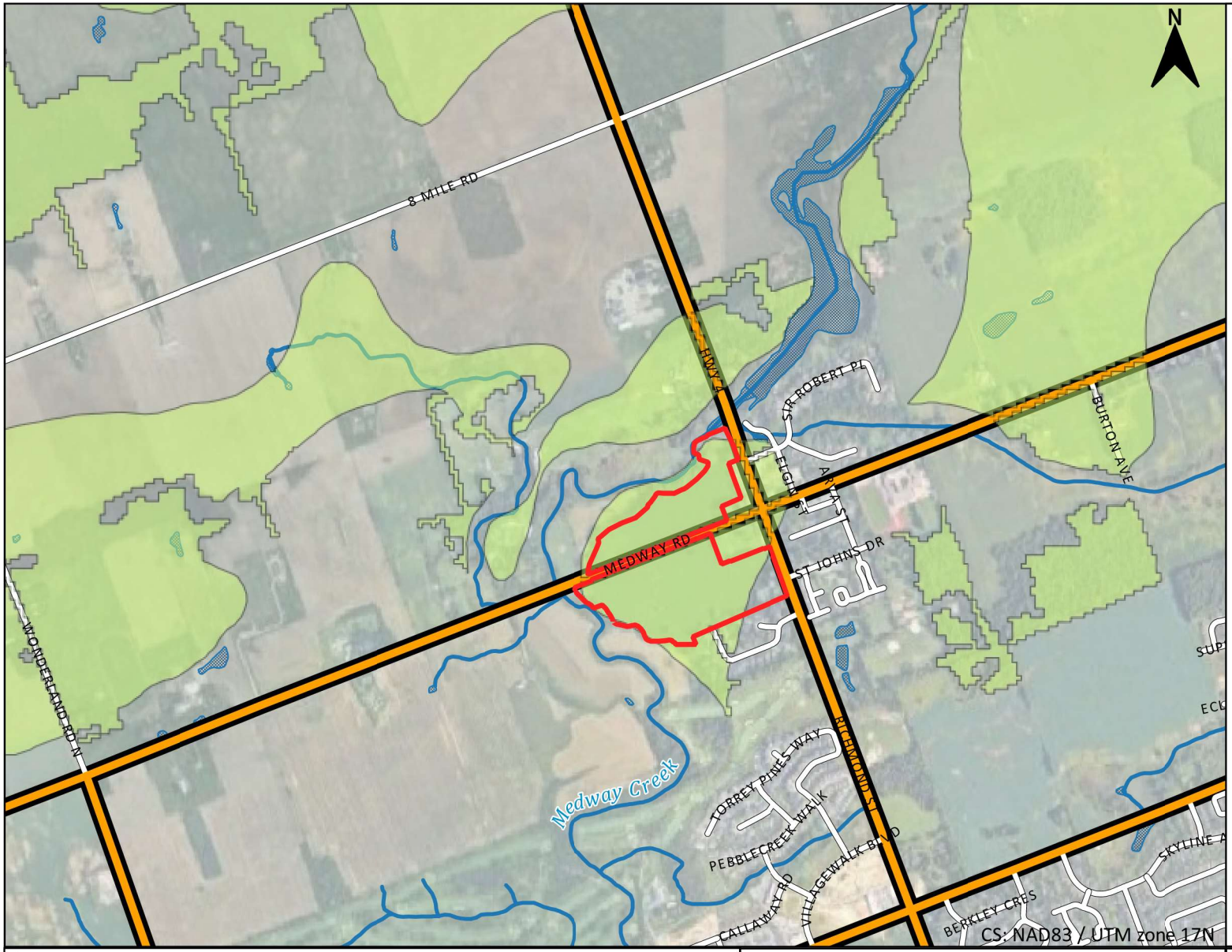
## Bridle Path Subdivision

Medway Creek, Arva, ON

| | |
|---|---|
| CLIENT | Bridle Path North Arva Inc. |
| TITLE | Deep (Lower) Groundwater Flow |
| Prepared By: K.W. | Reviewed By: H.J./H.B. |

EXP Services Inc.
405 Maple Grove Road, Cambridge, ON, N5V 0A5

| DATE | SCALE | PROJECT NO. | DWG. |
|---|---|---|---|
| Oct. 2024 | 1:4,500 | KCH-21002415 | 11B |




-LEGEND-

- Subject Lands
- Waterbody (OHN)
- Watercourse (OHN)
- SGRA (UTRCA)

Notes:

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Hydrogeological Assessment

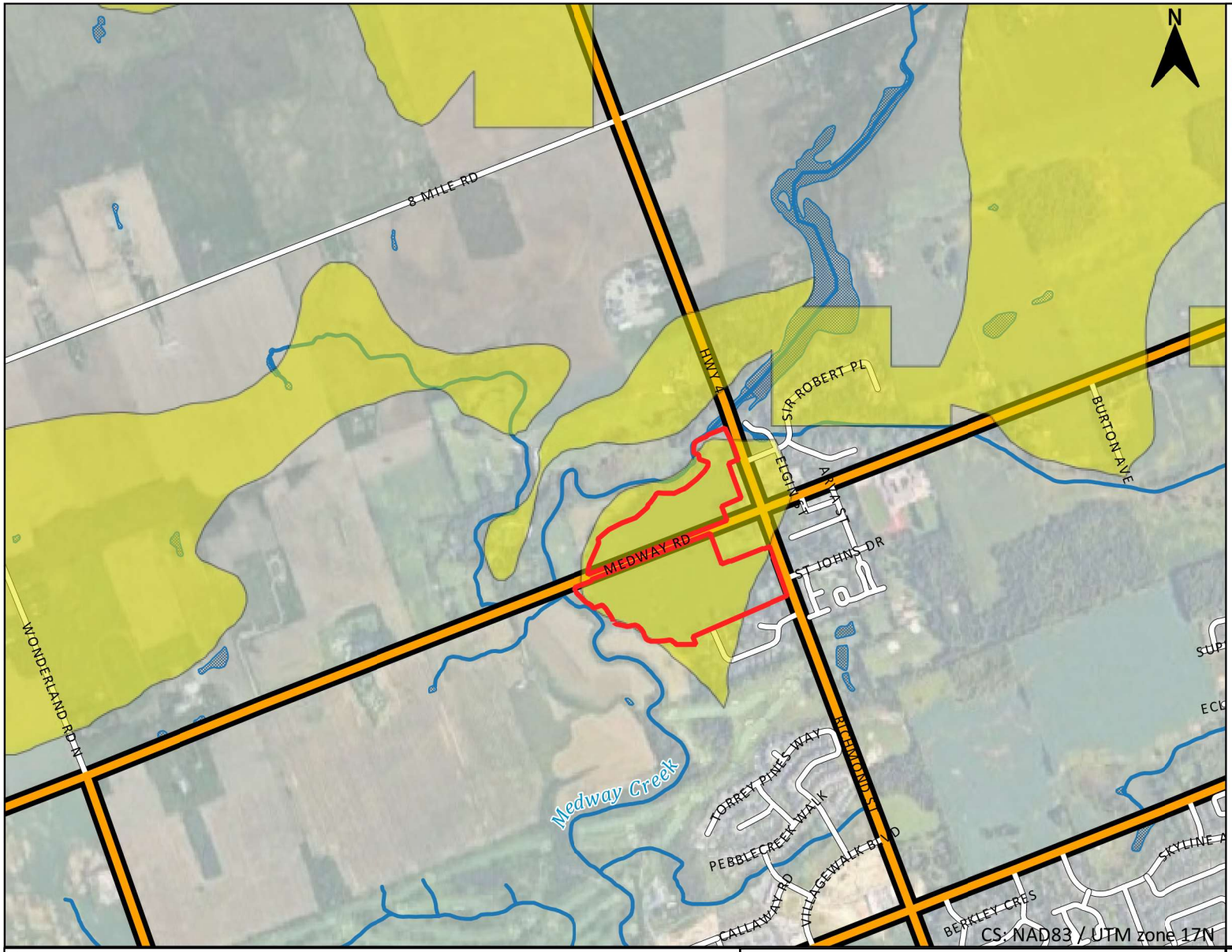
**Bridle Path Subdivision**

Medway Creek, Arva, ON

| | |
|---|---|
| CLIENT | Bridle Path North Arva Inc. |
| TITLE | Significant Groundwater Recharge Areas |
| Prepared By: K.W. | Reviewed By: H.J./H.B. |

EXP Services Inc.
405 Maple Grove Road, Cambridge, ON, N5V 0A5

| DATE | SCALE | PROJECT NO. | DWG. |
|---|---|---|---|
| Oct. 2024 | 1:20,000 | KCH-21002415 | 12 |




-LEGEND-

- Subject Lands
- Waterbody (OHN)
- Watercourse (OHN)
- HVA (UTRCA)

Notes:

Data Sources:
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Hydrogeological Assessment

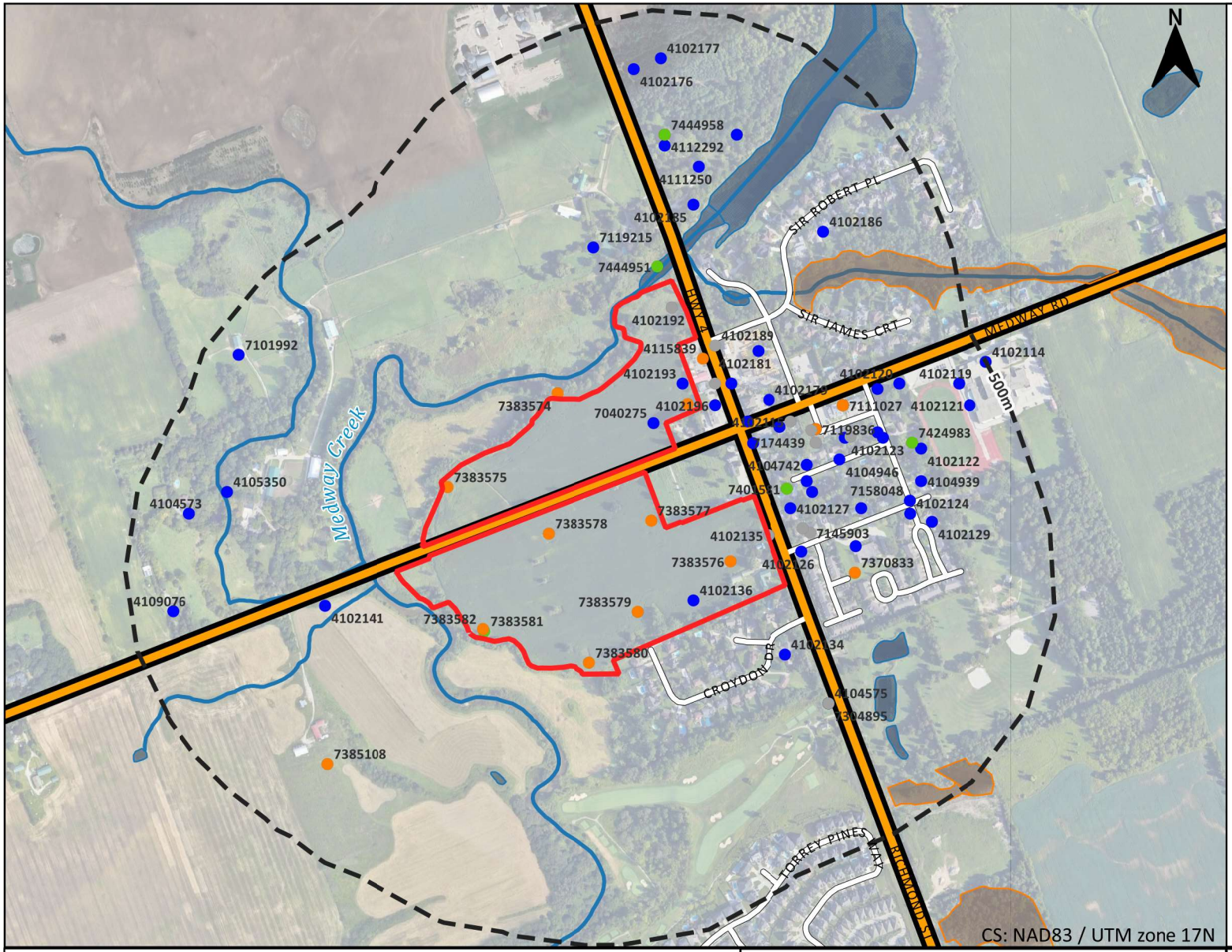
**Bridle Path Subdivision**

Medway Creek, Arva, ON

| | |
|---|---|
| CLIENT | Bridle Path North Arva Inc. |
| TITLE | Highly Vulnerable Aquifers |
| Prepared By: K.W. | Reviewed By: H.J./H.B. |

EXP Services Inc.
405 Maple Grove Road, Cambridge, ON, N5V 0A5

| DATE | SCALE | PROJECT NO. | DWG. |
|---|---|---|---|
| Oct. 2024 | 1:20,000 | KCH-21002415 | 13 |




-LEGEND-

- Subject Lands
- 500m Buffer
- Waterbody (OHN)
- Watercourse (OHN)
- Evaluated-Provincially Significant Wetland

MECP WWR & Final Status

- Water Supply
- Monitoring and Test Hole/Observation Wells/Test Hole
- Abandoned (Other/Quality/Supply)
- Final Status Not Provided

Notes:
MECP well locations provided by the MECP Water Well Information System (WWIS) online database. Actual locations may differ.

Data Sources:
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Google Earth Imagery (c) 2022 City of London, First Base Solutions, Maxar Technologies

Hydrogeological Assessment

**Bridle Path Subdivision**

Medway Creek, Arva, ON

| | |
|---|---|
| CLIENT | Bridle Path North Arva Inc. |
| TITLE | Approximate Location of MECP Registered Wells |
| Prepared By: K.W. | Reviewed By: H.J./H.B. |

EXP Services Inc.
405 Maple Grove Road, Cambridge, ON, N5V 0A5

| DATE | SCALE | PROJECT NO. | DWG. |
|---|---|---|---|
| Oct. 2024 | 1:11,000 | KCH-21002415 | 14 |

# Appendix B – Development Plan & Ecological Drawings

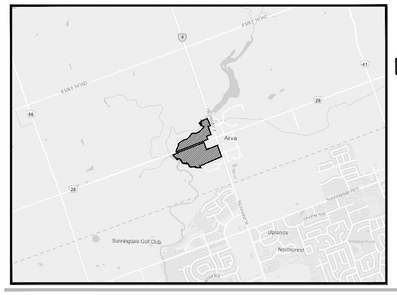
6-405 Maple Grove Road | Cambridge, Ontario | Canada
t: +1.519.650.4918 | f: +1.519.650.4603 | exp.com


PART OF LOT 17,
CONCESSION 6 & 7
MUNICIPALITY OF MIDDLESEX CENTRE
COUNTY OF MIDDLESEX

I HEREBY AUTHORIZE MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED TO SUBMIT THIS PLAN FOR APPROVAL.

**Surveyor's Certificate**

I HEREBY AUTHORIZE CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED ON THIS PLAN AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.




SUBJECT TO THE CONDITIONS, IF ANY, SET FORTH IN OUR IN OUR LETTER DATED_____,2020
THIS DRAFT PLAN IS APPROVED UNDER SECTION 51 OF THE *PLANNING ACT*
_____ DAY OF _____ ,2020

| | | | |
|---|---|---|---|
| **5** | April 4, 2025 | Issued | CCF & RM |
| **4** | November 18, 2024 | Request from Client | PL |
| **3** | October 18, 2024 | Request from Client | PL |
| **2** | October 1, 2024 | Revised Apartment blocks, SWM | PL |
| **1** | July 26, 2024 | Issued | CCF |
| | **Date** | **Issued / Revision** | **By** |

Additional Information Required Under Section 51(17) of the Planning Act R.S.O. 1990, c.P.13 as Amended

| | | |
|---|---|---|
| A. As Shown | B. As Shown | C. As Shown |
| D. Residential | E. As Shown | F. As Shown |
| G. As Shown | H. Municipal Water Supply Available | I. Silt Loam |
| J. As Shown | J. All Services As Required | L. As Shown |

| Description | Lots/Blocks | Units | Area (ha) |
|---|---|---|---|
| Low Density Residential | 1, 3, 7, 16 - 21, 24, 25 | 122 | 8.122 |
| Medium Density Residential (Street Townhouses) | 5, 9, 10, 12, 22, 27 | 49 | 1.594 |
| Medium Density Residential (Cluster Townhouses) | 13 - 15 | 62 | 1.892 |
| Medium/High Density Residential (Apartments) | 8, 11, 23 | 699 | 4.215 |
| Park | 35 | | 0.315 |
| Walkway | 31, 43 | | 0.082 |
| Maintenance Setback | 4, 6 | | 0.584 |
| Storm Water Management | 30, 37 | | 1.275 |
| Pump Station | 36 | | 0.160 |
| Open Space | 2, 29 | | 0.946 |
| 0.3m Reserves | 40, 41 | | 0.009 |
| Road Widening | 32, 33 | | 0.457 |
| Roads | | | 3.865 |
| Total | 37 | 932 | 23.516 ha |

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
540 BINGEMANS CENTRE DRIVE, SUITE 200, KITCHENER, ON, N2B 3X9 | P: 519 576 3650 | WWW.MHBCPLAN.COM

| File No. | Drawn By | Date |
|---|---|---|
| **1094 'BE'** | **L.M./P.L./C.C.F./R.M.** | April 4, 2025 |

# PRELIMINARY DRAFT PLAN OF SUBDIVISION

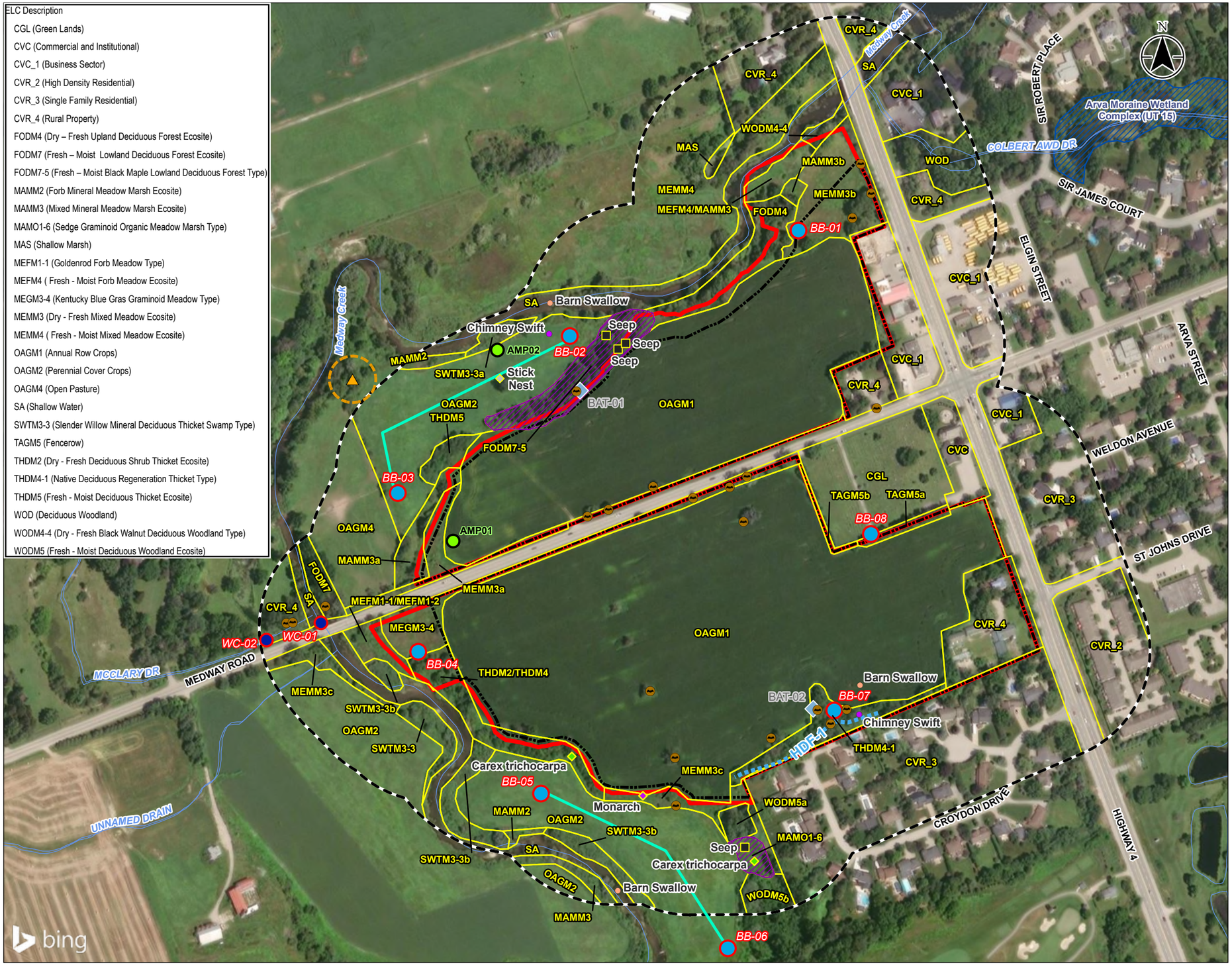
**Plan Scale 1:2000**
10 20 40 60 80 100

North

Q:\1094 'BE' - ARVA\GRAPHICS\DP\MHBC PROPOSED DP_04APR2025.DWG

ELC Description

- CGL (Green Lands)
- CVC (Commercial and Institutional)
- CVC_1 (Business Sector)
- CVR_2 (High Density Residential)
- CVR_3 (Single Family Residential)
- CVR_4 (Rural Property)
- FODM4 (Dry – Fresh Upland Deciduous Forest Ecosite)
- FODM7 (Fresh – Moist Lowland Deciduous Forest Ecosite)
- FODM7-5 (Fresh – Moist Black Maple Lowland Deciduous Forest Type)
- MAMM2 (Forb Mineral Meadow Marsh Ecosite)
- MAMM3 (Mixed Mineral Meadow Marsh Ecosite)
- MAMO1-6 (Sedge Graminoid Organic Meadow Marsh Type)
- MAS (Shallow Marsh)
- MEFM1-1 (Goldenrod Forb Meadow Type)
- MEFM4 ( Fresh - Moist Forb Meadow Ecosite)
- MEGM3-4 (Kentucky Blue Gras Graminoid Meadow Type)
- MEMM3 (Dry - Fresh Mixed Meadow Ecosite)
- MEMM4 ( Fresh - Moist Mixed Meadow Ecosite)
- OAGM1 (Annual Row Crops)
- OAGM2 (Perennial Cover Crops)
- OAGM4 (Open Pasture)
- SA (Shallow Water)
- SWTM3-3 (Slender Willow Mineral Deciduous Thicket Swamp Type)
- TAGM5 (Fencerow)
- THDM2 (Dry - Fresh Deciduous Shrub Thicket Ecosite)
- THDM4-1 (Native Deciduous Regeneration Thicket Type)
- THDM5 (Fresh - Moist Deciduous Thicket Ecosite)
- WOD (Deciduous Woodland)
- WODM4-4 (Dry - Fresh Black Walnut Deciduous Woodland Type)
- WODM5 (Fresh - Moist Deciduous Woodland Ecosite)




Stantec

Legend

- Project Development Boundary
- Subject Lands
- Study Area
- Constructed Drain
- Watercourse (Permanent)
- Wetland, Provincially Significant
- Waterbody

**Survey Station Locations**

- Headwater Drainage Feature
- Grassland Bird Transect
- SWH – Rare Vegetation Communities
- ELC

**SAR and SOCC Observations**

- Butternut Location
- Butternut Location 25m Buffer
- Carex trichocarpa (Hairy-fruited Sedge) - SOCC,S3
- Monarch
- Seep
- Stick Nest
- Barn Swallow
- Chimney Swift

**Survey Station Locations**

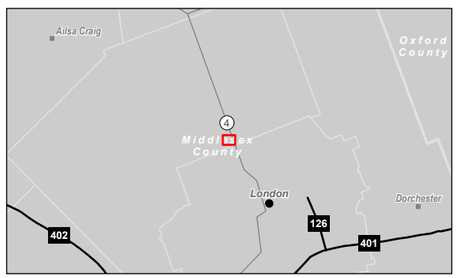
- Amphibian Call Station
- Breeding Bird Survey Station
- Aquatic Sampling Location
- Bat Community Survey Station
- Suitable Bat Maternity Roost Tree

0 125 250 m

1:4,250 (At original document size of 11x17)

**Notes**

1. Coordinate System:NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2023.
3. Orthoimagery: © 2025 Microsoft Corporation © 2025 Maxar ©CNES (2025) Distribution Airbus DS.




Project Location
County of Middlesex, ON

161414396 REVA
Prepared by bcowper on 2025-04-07

Client/Project
York Developments (London) Inc
Bridle Path North Subdivision
Development Assessment Report

Figure No.
**3**

Title
**ELC and Field Study Results**


Stantec

Legend

- Study Area
- Project Development Boundary
- Subject Lands
- Compensation Area
- Open Space

0 100 200 m

1:4,100 (At original document size of 11x17)

**Notes**

1. Coordinate System:NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2023.
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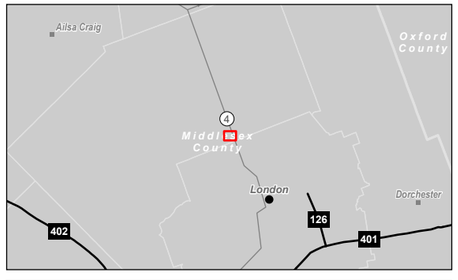


Project Location
County of
Middlesex, ON

161414396 REVA
Prepared by bcowper on 2025-04-07

Client/Project
York Developments (London) Inc
Bridle Path North Subdivision
Development Assessment Report

Figure No.
**5**

Title
**Compensation Areas and Open Space**



\\ca0215-ppfs01\work_group\01169\Active_other_pcs_1169_GIS\161414396\03_data\gis_cad\gis\mxpd\ecosystems\report_figures\DAR\161414396_DAR_2024072a.aprx\161414396_DAR_fig05_Compensation_Area Revised: 2025-04-07 By: bcowper

# Appendix C – Scoping Meeting Notes (February 10, 2021)

6-405 Maple Grove Road | Cambridge, Ontario | Canada
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## Hagit Blumenthal

**From:** Heather Jaggard
**Sent:** February 12, 2021 12:38 PM
**To:** Karen Winfield
**Cc:** David Ailles; Eric Buchanan; Linda Nicks
**Subject:** RE: EXTERNAL EXTERNAL RE: Pre-consultation Request - Hydrogeology
**Attachments:** Prelim Draft Plan_with Proposed Well Locations.pdf

Hi Karen and Linda,

As discussed, the following is a summary of the Hydrogeological study to be completed on 2 proposed subdivision properties in Arva, owned by Bridle Path North Arva Inc (c/o York Developments). Please see attached drawing indicating monitoring well locations (2 nested locations) and 1 surface water location. The proposed scope of work is as follows:

- Installation of 11 monitoring wells at 9 locations (2 nested locations)
- At least 3 monitoring wells will be installed into the underlying sand, spread across both properties
- At least 1 piezometer location will be established along seepage areas where it is safe to access by personnel year round (locations to be determined in the spring or ASAP)
- 1 surface water station established in Medway Creek (staff gauge)
- Dataloggers to be installed in 3 lower sand wells, 3 upper wells, 1 piezometer location, 1 surface water staff gauge location (8 dataloggers total), and will collect data for 12 months
- Monthly manual water levels will be collected for 12 months
- Water quality samples to be collected during seasonal high (March-April) and seasonal low (August to October)
    - 2 groundwater quality in upper wells
    - 2 groundwater quality in lower sand wells
    - 1 piezometer water quality
    - 1 surface water quality
- Water quality analysis will be presented with Piper and Schoeller diagrams
- Monthly water balance to be included in final hydroG report

A Geotechnical and Slope Stability study will be completed in collaboration with the Hydrogeological drilling program.

Please let me know if you have any further comments or questions. We will be installing the monitoring wells the first week of March 2021.

Thanks very much. Take care.

Heather

**Heather Jaggard, M.Sc., P.Geo., QP**
EXP | Hydrogeologist, Project Manager
t : +1.226.616.0748 | m : +1.905.977.9030 | e : heather.jaggard@exp.com

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**From:** Karen Winfield <WinfieldK@thamesriver.on.ca>
**Sent:** Monday, February 8, 2021 6:05 PM
**To:** Heather Jaggard <Heather.Jaggard@exp.com>
**Cc:** David Ailles <david.ailles@yorkdev.ca>; Eric Buchanan <Eric.Buchanan@exp.com>; Linda Nicks <NicksL@thamesriver.on.ca>
**Subject:** EXTERNAL EXTERNAL RE: Pre-consultation Request - Hydrogeology



Hi Heather,

Received.

It looks like both Linda and myself would be available for a meeting February 10th, 16th or 17th - all at 10 am.

Would any of those dates and that time work for your group?

Please advise on a preferred date/time and let us know if you want us to send the Zoom invite or if you have it covered....

Thank-you,

**Karen Winfield**
Land Use Regulations Officer
1424 Clarke Road London, Ontario, N5V 5B9
519.451.2800 Ext. 237 | Fax: 519.451.1188
winfieldk@thamesriver.on.ca

UPPER THAMES RIVER
CONSERVATION AUTHORITY

Thank you for your email. Please note that the UTRCA Office is closed due to COVID-19. We continue to process Permits and Planning applications. Response times are longer than normally anticipated due to staff working remotely and reductions in staffing. Your patience is appreciated and we will respond as soon as we are able. Check the UTRCA website at www.thamesriver.on.ca for some Frequently Asked Questions and to access our mapping.

>>> Heather Jaggard <Heather.Jaggard@exp.com> 2/8/2021 10:56 AM >>>
Hi Karen,

Please confirm you have received the email below, sent on Wednesday February 3rd. We are scheduled to install the monitoring wells starting March 1. It would be ideal to have a pre-consult with the UTRCA and Linda prior to the drilling program otherwise we will be reprimanded for installing the wells and not discussing locations with you.

Please provide available times for when you and your team are available for a pre-consultation meeting.

Thanks very much.

Heather

**Heather Jaggard, M.Sc., P.Geo., QP**
EXP | Hydrogeologist, Project Manager
t : +1.226.616.0748 | m : +1.905.977.9030 | e : heather.jaggard@exp.com

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---

**From:** Heather Jaggard
**Sent:** Wednesday, February 3, 2021 4:29 PM
**To:** Karen Winfield <WinfieldK@thamesriver.on.ca>
**Cc:** David Ailles <david.ailles@yorkdev.ca>; Eric Buchanan <Eric.Buchanan@exp.com>
**Subject:** Pre-consultation Request - Hydrogeology

Hi Karen,

I am working with Bridle Path North Arva Inc (c/o York Developments) on 2 proposed subdivision properties in Arva. We are hoping to begin our hydrogeological investigations of these properties the first week of March in order to capture spring high elevations in early spring. Please see attached proposed monitoring well installation locations.

I would like to set up a pre-consultation with you and Linda Nicks regarding our proposed hydrogeological program for the 2 properties.

Let me know what times you are available in the next few weeks to discuss the program.

Thanks very much.

Heather

**Heather Jaggard, M.Sc., P.Geo., QP**
EXP | Hydrogeologist, Project Manager
t : +1.226.616.0748 | m : +1.905.977.9030 | e : heather.jaggard@exp.com
405 Maple Grove Road
Unit 6
Cambridge, ON N3E 1B6
CANADA

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# Appendix D – Borehole & Test Pit Logs

6-405 Maple Grove Road | Cambridge, Ontario | Canada
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# BOREHOLE LOG

**BH101**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Inc.** PROJECT NO. **LON-23015294-A0**

PROJECT **Medway Creek Development** DATUM **Geodetic**

LOCATION **Medway Road, Arva, ON** DATES: Boring **December 29, 2023** Water Level

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | TYPE | NUMBER | RECOVERY (mm) | N VALUE (blows) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|
| | **269.9** | | | | | | |
| 0 | 269.6 | **TOPSOIL** - 300 mm | | | | | |
| 1 | | **CLAYEY SILT TILL** - brown, weathered, some sand, trace gravel, stiff to very stiff, moist | SS | S1 | 400 | 14 | 18 |
| 2 | | | SS | S2 | 200 | 18 | 9 |
| | | - becoming grey near 2.1 m bgs | SS | S3 | 450 | 16 | 12 |
| 3 | | | SS | S4 | 400 | 15 | 13 |
| 4 | | | | | | | |
| 5 | | - possible cobble encountered near 4.9 m bgs | SS | S5 | 250 | 28 | 13 |
| 6 | | - wet sand laminations encountered near 6.1 m bgs | SS | S6 | 100 | 50* | 14 |
| 7 | 262.8 | - possible cobble encountered near 6.3 m bgs | | | | | |
| | | **SILT TILL** - grey, some to trace clay, some sand, very dense, moist | | | | | |
| 8 | | - possible cobble encountered near 7.8 m bgs | SS | S7 | 150 | 50* | 7 |
| 9 | | | SS | S8 | 225 | 50* | 11 |
| 10 | | | | | | | |
| 11 | | | SS | S9 | 50 | 50* | 11 |
| 12 | | | SS | S10 | 0 | 50* | 15 |
| 13 | | | | | | | |
| 14 | 255.7 | | SS | S11 | 0 | 50* | 16 |
| | | **End of borehole at 14.2 m bgs.** | | | | | |
| 15 | | | | | | | |
| 16 | | | | | | | |

**SHEAR STRENGTH**
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

**Atterberg Limits and Moisture**
$W_P$ W $W_L$
SPT N Value Dynamic Cone
10 20 30 40

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others and must be read in conjunction with EXP Report LON-23015294-A0.
2) bgs denotes below ground surface.
3) Borehole open to 5.5 m bgs and water measured near 5.5 m bgs upon completion of drilling.
4) No significant methane gas concentration was detected upon completion.

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS
G Specific Gravity C Consolidation
H Hydrometer CD Consolidated Drained Triaxial
S Sieve Analysis CU Consolidated Undrained Triaxial
γ Unit Weight UU Unconsolidated Undrained Triaxial
P Field Permeability UC Unconfined Compression
K Lab Permeability DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

# BOREHOLE LOG

**BH102**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Inc.** PROJECT NO. **LON-23015294-A0**

PROJECT **Medway Creek Development** DATUM **Geodetic**

LOCATION **Medway Road, Arva, ON** DATES: Boring **December 28, 2023** Water Level

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 269.0 | | | | | | | | |
| | 268.7 | **TOPSOIL** - 300 mm | | | | | | | |
| 1 | 268.1 | **FILL** - clayey silt, brown/black, intermixed with topsoil, loose, moist | | | SS | S1 | 300 | 7 | 15 |
| | 267.7 | **SANDY SILT** - brown, weathered, some clay, loose, very moist | | | SS | S2 | 400 | 15 | 13 |
| 2 | | **CLAYEY SILT TILL** - brown, weathered, some sand, trace gravel, very stiff, moist | | | SS | S3 | 200 | 20 | 17 |
| 3 | 265.8 | - becoming grey near 2.7 m bgs | | | SS | S4 | 250 | 19 | 10 |
| 4 | | **SAND** - grey, fine to medium grained, trace silt, compact, moist<br>- becoming wet near 4.0 m bgs | | ▽ | | | | | |
| 5 | 263.5 | | | | SS | S5 | 400 | 16 | 20 |
| 6 | | **CLAYEY SILT TILL** - grey, some sand, trace gravel, very stiff, moist | | | SS | S6 | 450 | 27 | 12 |
| 7 | 261.9 | | | | | | | | |
| 8 | | **SILT TILL** - grey, some to trace clay, some sand, very dense, moist | | | SS | S7 | 400 | 58 | 16 |
| 9 | | | | | SS | S8 | 300 | 68 | 6 |
| 10 | | | | | | | | | |
| 11 | | - sand layering encountered near 10.7 m bgs | | | SS | S9 | 250 | 50* | 7 |
| 12 | | | | | SS | S10 | 300 | 50* | 12 |
| 13 | | | | | | | | | |
| 14 | | | | | SS | S11 | 125 | 50* | 10 |
| 15 | | | | | | | | | |
| | 253.3 | | | | SS | S12 | 125 | 50* | 9 |
| 16 | | **End of borehole at 15.7 m bgs.** | | | | | | | |

**SHEAR STRENGTH**
S Field Vane Test (#=Sensitivity)
▲ Penetrometer ■ Torvane
100 200 kPa

**Atterberg Limits and Moisture**
$W_P$ W $W_L$
● SPT N Value × Dynamic Cone
10 20 30 40

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others and must be read in conjunction with EXP Report LON-23015294-A0.
2) bgs denotes below ground surface.
3) Borehole open to 4.6 m bgs and water measured near 4.0 m bgs upon completion of drilling.
4) No significant methane gas concentration was detected upon completion.

SAMPLE LEGEND
☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube
▥ Rock Core (eg. BQ, NQ, etc.) ▥ VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| γ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
▽ Apparent ▼ Measured ▲ Artesian (see Notes)

# BOREHOLE LOG

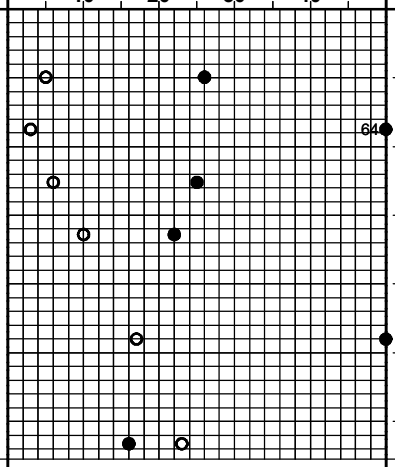
**BH103**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Inc.** PROJECT NO. **LON-23015294-A0**

PROJECT **Medway Creek Development** DATUM **Geodetic**

LOCATION **Medway Road, Arva, ON** DATES: Boring **December 28, 2023** Water Level

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 261.3 | | | | | | | | |
| | 261.0 | **TOPSOIL** - 250 mm | | | | | | | |
| 1 | 259.9 | **SILTY SAND** - brown/grey, weathered, some gravel, compact, very moist | | | SS | S1 | 300 | 26 | 5 |
| 2 | | **SAND** - brown, medium to coarse grained, trace silt, trace gravel, very dense to compact, moist<br>- possible cobble encountered near 2.0 m bgs<br>- becoming wet near 2.1 m bgs | | ▽ | SS | S2 | 200 | 64 | 3 |
| | | | | | SS | S3 | 300 | 25 | 6 |
| 3 | | | | | SS | S4 | 450 | 22 | 10 |
| 4 | 257.3 | | | | | | | | |
| | | **SANDY SILT** - brown, dense, very moist | | | | | | | |
| 5 | 255.7 | | | | SS | S5 | 300 | 50 | 17 |
| 6 | | **SAND** - brown, fine to medium grained, trace silt, compact, wet | | | | | | | |
| | 254.7 | | | | SS | S6 | 400 | 16 | 23 |
| 7 | | **End of borehole at 6.6 m bgs.** | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | | | | |




***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others and must be read in conjunction with EXP Report LON-23015294-A0.
2) bgs denotes below ground surface.
3) Borehole open to 2.4 m bgs and water measured near 2.1 m bgs upon completion of drilling.
4) No significant methane gas concentration was detected upon completion.

SAMPLE LEGEND
- AS Auger Sample
- SS Split Spoon
- ST Shelby Tube
- Rock Core (eg. BQ, NQ, etc.)
- VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| γ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
- ▽ Apparent
- ▼ Measured
- ▲ Artesian (see Notes)

# BOREHOLE LOG

**BH104**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Inc.** PROJECT NO. **LON-23015294-A0**
PROJECT **Medway Creek Development** DATUM **Geodetic**
LOCATION **Medway Road, Arva, ON** DATES: Boring **January 2, 2024** Water Level

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|---|
| | 266.7 | | | | | | | | |
| 0 | 266.3 | **TOPSOIL** - 340 mm | | | | | | | |
| 1 | 265.3 | **SAND AND GRAVEL** - brown, trace silt, occasional cobbles, compact, moist | | | SS | S1 | 150 | 18 | 10 |
| 2 | | **CLAYEY SILT TILL** - brown, trace sand, stiff to very stiff, moist | | | SS | S2 | 400 | 13 | 21 |
| 3 | | - occasional wet sandy silt lenses encountered near 2.3 m bgs<br>- sand layering encountered near 2.9 m bgs | | | SS | S3 | 450 | 26 | 15 |
| 4 | | | | | SS | S4 | 400 | 22 | 6 |
| 5 | | | | | SS | S5 | 450 | 28 | 7 |
| 6 | | - becoming wet near 5.6 m bgs | | | SS | S6 | 450 | 28 | 15 |
| 7 | | - sandy silt layering encountered near 7.1 m bgs | | | | | | | |
| 8 | 258.6 | - becoming grey near 8.0 m bgs | | | SS | S7 | 450 | 26 | 23 |
| 9 | | **End of borehole at 8.1 m bgs.** | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | | | | |

**SHEAR STRENGTH**
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

**Atterberg Limits and Moisture**
$W_P$ W $W_L$

SPT N Value × Dynamic Cone
10 20 30 40

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others and must be read in conjunction with EXP Report LON-23015294-A0.
2) bgs denotes below ground surface.
3) Borehole open to 4.3 m bgs and dry upon completion of drilling.
4) No significant methane gas concentration was detected upon completion.

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS
G Specific Gravity C Consolidation
H Hydrometer CD Consolidated Drained Triaxial
S Sieve Analysis CU Consolidated Undrained Triaxial
γ Unit Weight UU Unconsolidated Undrained Triaxial
P Field Permeability UC Unconfined Compression
K Lab Permeability DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

# BOREHOLE LOG

**BH105**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Inc.** PROJECT NO. **LON-23015294-A0**

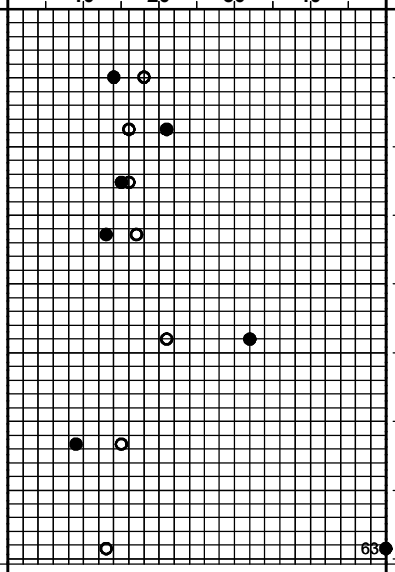
PROJECT **Medway Creek Development** DATUM **Geodetic**

LOCATION **Medway Road, Arva, ON** DATES: Boring **January 2, 2024** Water Level

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | **269.0** | | | | | | | | |
| | 268.7 | **TOPSOIL** - 320 mm | | | | | | | |
| 1 | 267.6 | **FILL** - clayey silt, brown, trace sand, trace gravel, stiff, moist | | | SS | S1 | 150 | 14 | 18 |
| 2 | | **CLAYEY SILT TILL** - brown, trace sand, trace gravel, very stiff to stiff, moist | | | SS | S2 | 350 | 21 | 16 |
| | | - becoming grey near 2.1 m bgs | | | SS | S3 | 225 | 15 | 16 |
| 3 | | | | ▽ | SS | S4 | 0 | 13 | 17 |
| 4 | | | | | | | | | |
| 5 | | - sandy silt layering encountered near 4.8 m bgs | | | SS | S5 | 400 | 32 | 21 |
| 6 | | - becoming grey with occasional cobbles encountered throughout layer and stiff to hard near 5.6 m bgs | | | SS | S6 | 100 | 9 | 15 |
| 7 | | | | | | | | | |
| 8 | 260.9 | | | | SS | S7 | 450 | 63 | 13 |
| | | **End of borehole at 8.1 m bgs.** | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | | | | |

**SHEAR STRENGTH**
S Field Vane Test (#=Sensitivity)
▲ Penetrometer ■ Torvane
100 200 kPa

**Atterberg Limits and Moisture**
$W_P$ W $W_L$
● SPT N Value × Dynamic Cone
10 20 30 40




***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others and must be read in conjunction with EXP Report LON-23015294-A0.
2) bgs denotes below ground surface.
3) Borehole open to 4.9 m bgs and water measured near 3.4 m bgs upon completion of drilling.
4) No significant methane gas concentration was detected upon completion.

SAMPLE LEGEND
☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube
▥ Rock Core (eg. BQ, NQ, etc.) ▥ VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| γ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
▽ Apparent ▼ Measured ▲ Artesian (see Notes)

# BOREHOLE LOG

**BH106**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Inc.** PROJECT NO. **LON-23015294-A0**
PROJECT **Medway Creek Development** DATUM **Geodetic**
LOCATION **Medway Road, Arva, ON** DATES: Boring **January 2, 2024** Water Level

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|---|
| | 270.6 | | | | | | | | |
| 0 | 270.3 | **TOPSOIL** - 350 mm | | | | | | | |
| | | **SANDY SILT** - brown, trace gravel, loose to very loose, very moist | | | SS | S1 | 150 | 9 | 22 |
| 1 | | | | | SS | S2 | 0 | 3 | 21 |
| 2 | 268.2 | - 300 mm thick wet sand and gravel layer encountered near 2.1 m bgs | | | SS | S3 | 400 | 15 | 13 |
| | | **CLAYEY SILT TILL** - brown, some sand, trace gravel, stiff to very stiff, very moist | | ▽ | SS | S4 | 200 | 14 | 18 |
| 3 | | - sand and gravel layering encountered near 2.9 m bgs | | | | | | | |
| 4 | | - becoming grey near 4.0 m bgs | | | | | | | |
| | | | | | SS | S5 | 400 | 8 | 13 |
| 5 | | | | | | | | | |
| 6 | | - sand layering encountered near 5.5 m bgs | | | SS | S6 | 400 | 15 | 21 |
| 7 | | - becoming hard near 7.1 m bgs | | | | | | | |
| | 262.5 | | | | SS | S7 | 425 | 51 | 13 |
| 8 | | **End of borehole at 8.1 m bgs.** | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | | | | |

**SHEAR STRENGTH**
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

**Atterberg Limits and Moisture**
$W_P$ W $W_L$

SPT N Value × Dynamic Cone
10 20 30 40

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others and must be read in conjunction with EXP Report LON-23015294-A0.
2) bgs denotes below ground surface.
3) Borehole open to 3.0 m bgs and water measured near 3.0 m bgs upon completion of drilling.
4) No significant methane gas concentration was detected upon completion.

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS
G Specific Gravity C Consolidation
H Hydrometer CD Consolidated Drained Triaxial
S Sieve Analysis CU Consolidated Undrained Triaxial
γ Unit Weight UU Unconsolidated Undrained Triaxial
P Field Permeability UC Unconfined Compression
K Lab Permeability DS Direct Shear

WATER LEVELS
▽ Apparent ▼ Measured ▲ Artesian (see Notes)

# BOREHOLE LOG

**BH107**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Inc.** PROJECT NO. **LON-23015294-A0**
PROJECT **Medway Creek Development** DATUM **Geodetic**
LOCATION **Medway Road, Arva, ON** DATES: Boring **January 2, 2024** Water Level

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 268.6 | | | | | | | | |
| | 268.4 | **TOPSOIL** - 280 mm | | | | | | | |
| 1 | | **CLAYEY SILT TILL** - brown, some sand, trace gravel, stiff, moist | | | SS | S1 | 325 | 12 | 14 |
| 2 | | | | | SS | S2 | 300 | 13 | 14 |
| | | - sandy silt layering encountered near 2.4 m bgs | | | SS | S3 | 400 | 15 | 24 |
| 3 | | - sand layering encountered near 3.2 m bgs | | ▽ | SS | S4 | 425 | 18 | 22 |
| 4 | | - silt layering encountered near 4.0 m bgs | | | | | | | |
| 5 | | | | | SS | S5 | 175 | 50* | 14 |
| 6 | | | | | SS | S6 | 375 | 50* | 14 |
| 7 | | | | | | | | | |
| 8 | 260.6 | | | | SS | S7 | 400 | 50* | 13 |
| | | **End of borehole at 8.1 m bgs.** | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | | | | |

**SHEAR STRENGTH**
S Field Vane Test (#=Sensitivity)
▲ Penetrometer ■ Torvane
100 200 kPa

**Atterberg Limits and Moisture**
$W_P$ W $W_L$
● SPT N Value × Dynamic Cone
10 20 30 40

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others and must be read in conjunction with EXP Report LON-23015294-A0.
2) bgs denotes below ground surface.
3) Borehole open to 6.1 m bgs and water measured near 3.7 m bgs upon completion of drilling.
4) No significant methane gas concentration was detected upon completion.

SAMPLE LEGEND
☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube
▥ Rock Core (eg. BQ, NQ, etc.) ▥ VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| γ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
▽ Apparent ▼ Measured ▲ Artesian (see Notes)

# BOREHOLE LOG

**BH1/MW**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Incorporated** PROJECT NO. **LON-21002415-A0**
PROJECT **Arva Medway Creek Development** DATUM **Geodetic**
LOCATION **Medway Road, Arva, ON** DATES: Boring **March 2, 2021** Water Level **Sept 22/21**

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|
| | 269.01 | | | | | | |
| 0 | 268.71 | **TOPSOIL** - 300 mm | | | | | |
| | | **SANDY SILT TILL** - brown, trace clay, trace gravel, dilatant, very moist, compact | | | | | |
| 1 | 267.64 | | SS | SA 1 | 350 | 12 | |
| | | **SILT TILL** - brown, some clay, some sand, trace gravel, damp to moist, compact | SS | SA 2 | 450 | 20 | |
| 2 | | - wet seam encountered near 2.0 m bgs | SS | SA 3 | 450 | 20 | |
| 3 | | - becoming grey near 2.7 m bgs | SS | SA 4 | 450 | 19 | |
| 4 | 264.97 | | | | | | |
| | | **SAND** - fine to medium grained, brown, trace silt, trace gravel, damp, loose to compact | SS | SA 5 | 450 | 28 | |
| 5 | | - becoming wet near 5.3 m bgs | | | | | |
| 6 | | | SS | SA 6 | 200 | 9 | |
| 7 | 261.92 | | | | | | |
| | | **SILT TILL** - grey, trace to some clay, some clay, trace gravel, damp, very dense | SS | SA 7 | 450 | 62 | |
| 8 | 260.93 | | | | | | |
| | | **End of borehole at 8.1 m bgs.** | | | | | |
| 9 | | | | | | | |
| 10 | | | | | | | |
| 11 | | | | | | | |
| 12 | | | | | | | |
| 13 | | | | | | | |

STRATA PLOT / WELL LOG

**SHEAR STRENGTH**
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

**Atterberg Limits and Moisture**
$W_P$ W $W_L$
SPT N Value × Dynamic Cone
10 20 30 40

62

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON-21002415-A0.
2) No significant methane gas detected upon completion of drilling.
3) bgs denotes below ground surface.
4) Water Level readings:
September 22, 2021 - 6.33 m bgs, Geodetic Elevation 262.68 m

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| γ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
Apparent Measured Artesian (see Notes)

# BOREHOLE LOG

**BH10**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Incorporated** PROJECT NO. **LON-21002415-A0**
PROJECT **Arva Medway Creek Development** DATUM **Geodetic**
LOCATION **Medway Road, Arva, ON** DATES: Boring **March 2, 2021** Water Level

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.25 | **TOPSOIL** - 250 mm | | | | | | | |
| | | **CLAYEY SILT** - brown, trace sand, dilatant layering, moist, stiff | | | SS | SA 1 | 300 | 11 | |
| 1 | | | | | SS | SA 2 | 350 | 11 | |
| | 1.75 | | | | | | | | |
| 2 | | **SILT TILL** - brown, some clay, some sand, trace gravel, moist, compact | | | SS | SA 3 | 300 | 23 | |
| | 2.44 | | | | | | | | |
| | 2.90 | **SAND and GRAVEL** - brown, trace silt, very moist, compact | | | | | | | |
| 3 | | **SILT TILL** - grey, some clay, some sand, trace gravel, moist, compact | | | SS | SA 4 | 300 | 13 | |
| 4 | | | | | | | | | |
| | 4.88 | | | | SS | SA 5 | 450 | 14 | |
| 5 | | - dilatant sandy silt lens encountered near 4.7 m bgs | | | | | | | |
| | 5.56 | **SAND** - fine to medium grained, brown, trace silt, wet, compact | | | | | | | |
| 6 | | **CLAYEY SILT TILL** - grey, trace sand, trace gravel, moist, stiff | | | SS | SA 6 | 450 | 14 | |
| | 7.09 | | | | | | | | |
| 7 | | **SILT TILL** - grey, trace to some clay, some sand, damp, very dense | | | | | | | |
| 8 | | | | | SS | SA 7 | 350 | 54 | |
| 9 | | - very moist to wet silt layering encountered near 8.6 m bgs. | | | | | | | |
| | 9.60 | | | | SS | SA 8 | 450 | 82 | |
| 10 | | **End of borehole at 9.6 m bgs.** | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |

**SHEAR STRENGTH**
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

**Atterberg Limits and Moisture**
$W_P$ W $W_L$
SPT N Value × Dynamic Cone
10 20 30 40

54
82

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON-21002415-A0.
2) Borehole open to 5.2 m bgs and water observed near 4.6 m bgs upon completion of drilling.
3) No significant methane gas detected upon completion of drilling.
4) bgs denotes below ground surface.

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| γ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
Apparent Measured Artesian (see Notes)

# BOREHOLE LOG

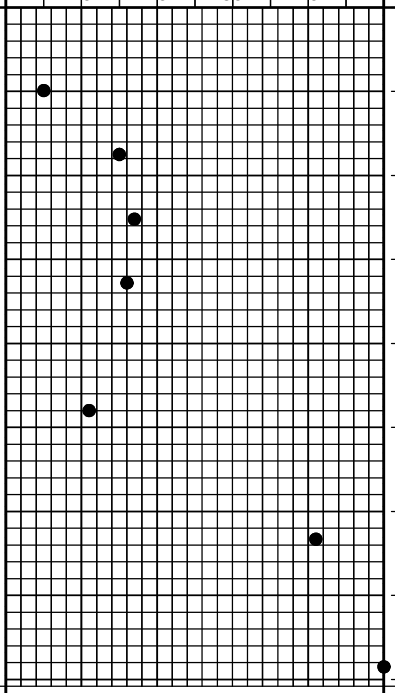
**BH11**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Incorporated** PROJECT NO. **LON-21002415-A0**
PROJECT **Arva Medway Creek Development** DATUM **Geodetic**
LOCATION **Medway Road, Arva, ON** DATES: Boring **March 4, 2021** Water Level

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.20 | **TOPSOIL** - 200 mm | | | | | | | |
| 1 | 1.37 | **SAND and GRAVEL** - brown, trace silt, occasional cobbles, moist, loose | | | SS | SA 1 | 50 | 5 | |
| 2 | 2.13 | **SAND** - fine to medium grained, light brown, trace silt, moist, compact | | | SS | SA 2 | 400 | 15 | |
| 3 | | **SILT** - brown, trace clay, trace sand, moist, compact<br>- becoming grey near 2.9 m bgs | | | SS | SA 3 | 450 | 17 | |
| 4 | 4.04 | | | | SS | SA 4 | 450 | 16 | |
| 5 | | **CLAYEY SILT TILL** - grey, trace sand, trace gravel, moist, stiff | | | SS | SA 5 | 450 | 11 | |
| 6 | 6.50 | | | | SS | SA 6 | 450 | 41 | |
| 7 | | **SILTY SAND** - grey, trace silt, wet, dense | | | | | | | |
| 8 | 8.08 | | | | SS | SA 7 | 450 | 50* | |
| 9 | | **End of borehole at 8.1 m bgs.** | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |

**SHEAR STRENGTH**
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

**Atterberg Limits and Moisture**
$W_P$ W $W_L$
SPT N Value Dynamic Cone
10 20 30 40



***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON-21002415-A0.
2) * denotes 50 blows per less than 150 mm split spoon sampler penetration.
3) No significant methane gas detected upon completion of drilling.
4) bgs denotes below ground surface.

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| γ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
Apparent Measured Artesian (see Notes)

# BOREHOLE LOG

**BH2/MW**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Incorporated** PROJECT NO. **LON-21002415-A0**
PROJECT **Arva Medway Creek Development** DATUM **Geodetic**
LOCATION **Medway Road, Arva, ON** DATES: Boring **March 2, 2021** Water Level **Sept 22/21**

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) | SHEAR STRENGTH / Atterberg Limits and Moisture |
|---|---|---|---|---|---|---|---|---|---|---|
| | 269.20 | | | | | | | | | S Field Vane Test (#=Sensitivity); Penetrometer; Torvane; 100 / 200 kPa; $W_P$ W $W_L$; SPT N Value; Dynamic Cone; 10 20 30 40 |
| 0 | 268.90 | **TOPSOIL** - 300 mm | | | | | | | | |
| | | **SAND and GRAVEL** - brown, trace silt, moist, compact | | | SS | SA 1 | 250 | 22 | | |
| 1 | | - becoming wet near 1.1 m bgs | | | SS | SA 2 | 150 | 18 | | |
| 2 | 266.53 | | | | SS | SA 3 | 200 | 13 | | |
| | | **SANDY SILT** - brown, trace clay, moist, compact | | | | | | | | |
| 3 | 265.95 | | | | SS | SA 4 | 325 | 11 | | |
| | | **SILT TILL** - grey, some clay, some sand, trace gravel, moist, compact to dense | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | SS | SA 5 | 450 | 11 | | |
| 6 | | | | | | | | | | |
| | | - dilatant silt layering encountered near 6.4 m bgs | | | SS | SA 6 | 400 | 15 | | |
| 7 | | - wet and fine grained sand layer encountered near 6.6 m bgs | | | | | | | | |
| 8 | | - possible cobble encountered near 7.9 m bgs | | | SS | SA 7 | 400 | 36 | | |
| | 260.59 | | | | | | | | | |
| 9 | | **SILT TILL** - grey, some coarse gravel, trace clay, damp, dense | | | | | | | | |
| | 259.60 | | | | SS | SA 8 | 450 | 43 | | |
| 10 | | **End of borehole at 9.6 m bgs.** | | | | | | | | |
| 11 | | | | | | | | | | |
| 12 | | | | | | | | | | |
| 13 | | | | | | | | | | |

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON-21002415-A0.
2) No significant methane gas detected upon completion of drilling.
3) bgs denotes below ground surface.
4) Water Level readings:
September 22, 2021 - 2.3 m bgs, Geodetic Elevation 266.90 m

SAMPLE LEGEND
AS Auger Sample; SS Split Spoon; ST Shelby Tube; Rock Core (eg. BQ, NQ, etc.); VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| $\gamma$ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
Apparent; Measured; Artesian (see Notes)

# BOREHOLE LOG

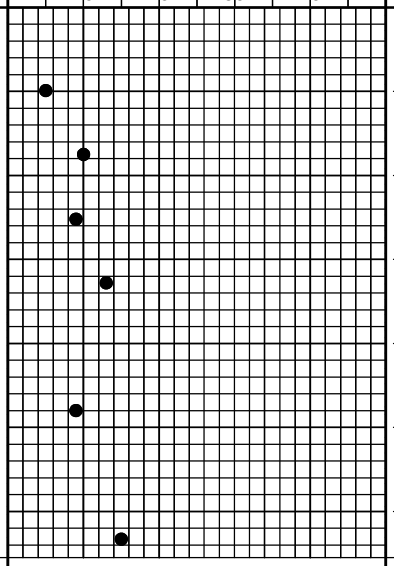
**BH3/MW**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Incorporated** PROJECT NO. **LON-21002415-A0**
PROJECT **Arva Medway Creek Development** DATUM **Geodetic**
LOCATION **Medway Road, Arva, ON** DATES: Boring **March 2, 2021** Water Level **Sept 22/21**

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 262.37 | | | | | | | | |
| | 262.07 | **TOPSOIL** - 300 mm | | | | | | | |
| 1 | | **FILL** - sandy silt, dark brown, trace clay, trace gravel, trace organics, moist, loose | | | SS | SA 1 | 300 | 5 | |
| | 261.00 | | | | | | | | |
| 2 | | **SAND and GRAVEL** - brown, trace silt, moist, compact<br>- becoming wet near 1.9 m bgs | | | SS | SA 2 | 300 | 10 | |
| | 259.93 | | | | | | | | |
| 3 | | **SILT TILL** - brown, clayey to trace clay, some sand, trace gravel, moist, stiff/compact<br>- dilatant layering encountered near 3.4 m bgs | | | SS | SA 3 | 400 | 9 | |
| | 258.33 | | | | | | | | |
| 4 | | **SAND** - fine to medium grained, brown/grey, trace silt, wet, loose to compact | | | SS | SA 4 | 450 | 13 | |
| 5 | | - silt layering encountered near 4.8 m bgs | | | SS | SA 5 | 450 | 9 | |
| 6 | | - becoming grey near 5.3 m bgs | | | SS | SA 6 | 450 | 15 | |
| | 255.82 | | | | | | | | |
| 7 | | **End of borehole at 6.6 m bgs.** | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |

**SHEAR STRENGTH**
✤ S Field Vane Test (#=Sensitivity)
▲ Penetrometer ■ Torvane
100 200 kPa

**Atterberg Limits and Moisture**
$W_P$ W $W_L$
● SPT N Value × Dynamic Cone
10 20 30 40



***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON-21002415-A0.
2) No significant methane gas detected upon completion of drilling.
3) bgs denotes below ground surface.
4) Water Level readings:
September 22, 2021 - 2.92 m bgs, Geodetic Elevation 259.45 m

SAMPLE LEGEND
☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube
▯ Rock Core (eg. BQ, NQ, etc.) ▯ VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| γ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
▽ Apparent ▼ Measured ▲ Artesian (see Notes)

# BOREHOLE LOG

**BH4/MW**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Incorporated** PROJECT NO. **LON-21002415-A0**
PROJECT **Arva Medway Creek Development** DATUM **Geodetic**
LOCATION **Medway Road, Arva, ON** DATES: Boring **March 1, 2021** Water Level **Sept 22/21**

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 268.12 | | | | | | | | |
| | 267.92 | **TOPSOIL** - 200 mm | | | | | | | |
| | | **SAND and GRAVEL** - brown, trace silt, moist, dense | | | SS | SA 1 | 300 | 38 | |
| 1 | | | | | | | | | |
| | 266.45 | - becoming wet near 1.4 m bgs | | | SS | SA 2 | 350 | 16 | |
| | | **SILT** - brown, some sand, some gravel, trace clay, very moist to wet, compact | | | SS | SA 3 | 450 | 17 | |
| 2 | | | | | | | | | |
| 3 | | - becoming grey near 2.9 m bgs | | | SS | SA 4 | 200 | 17 | |
| 4 | | | | | | | | | |
| 5 | | | | | SS | SA 5 | 450 | 26 | |
| | 262.56 | | | | | | | | |
| | | **SAND** - fine to medium grained, grey, trace silt, moist, compact | | | SS | SA 6 | 350 | 28 | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| | | | | | SS | SA 7 | 300 | 24 | |
| 8 | | | | | | | | | |
| 9 | | - becoming wet near 8.6 m bgs | | | | | | | |
| | 258.52 | | | | SS | SA 8 | 450 | 28 | |
| 10 | | **End of borehole at 9.6 m bgs.** | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |

**SHEAR STRENGTH**
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

**Atterberg Limits and Moisture**
$W_P$ W $W_L$
SPT N Value Dynamic Cone
10 20 30 40

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON-21002415-A0.
2) No significant methane gas detected upon completion of drilling.
3) bgs denotes below ground surface.
4) Water Level readings:
September 22, 2021 - 7.63 m bgs, Geodetic Elevation 260.49 m

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| γ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
Apparent Measured Artesian (see Notes)

# BOREHOLE LOG

**BH5/MW - A**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Incorporated** PROJECT NO. **LON-21002415-A0**
PROJECT **Arva Medway Creek Development** DATUM **Geodetic**
LOCATION **Medway Road, Arva, ON** DATES: Boring **March 1, 2021** Water Level **Sept 22/21**

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) | SHEAR STRENGTH / Atterberg Limits and Moisture |
|---|---|---|---|---|---|---|---|---|---|---|
| | 261.44 | | | | | | | | | S Field Vane Test (#=Sensitivity); Penetrometer; Torvane; 100 200 kPa; $W_P$ W $W_L$; SPT N Value; Dynamic Cone; 10 20 30 40 |
| 0 | 261.19 | **TOPSOIL** - 250 mm | | | | | | | | |
| | | **SANDY SILT** - brown, trace clay, weathered, moist to very moist, dilatant, compact | | | | | | | | |
| 1 | | | | | SS | SA 1 | 300 | 11 | | |
| | | | | | SS | SA 2 | 300 | 12 | | |
| 2 | | - becoming wet near 1.9 m bgs | | | SS | SA 3 | 400 | 13 | | |
| 3 | | | | | SS | SA 4 | 450 | 15 | | |
| 4 | | - becoming grey near 3.8 m bgs | | | | | | | | |
| | | - stiff clay layering near 3.8 m bgs | | | SS | SA 5 | 450 | 9 | | |
| 5 | 255.88 | | | | | | | | | |
| | | **SAND** - fine to medium grained, grey, trace silt, wet, compact | | | | | | | | |
| 6 | | | | | SS | SA 6 | 400 | 23 | | |
| 7 | | | | | | | | | | |
| 8 | 253.36 | | | | SS | SA 7 | 400 | 15 | | |
| | | **End of borehole at 8.1 m bgs.** | | | | | | | | |
| 9 | | | | | | | | | | |
| 10 | | | | | | | | | | |
| 11 | | | | | | | | | | |
| 12 | | | | | | | | | | |
| 13 | | | | | | | | | | |

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON-21002415-A0.
2) No significant methane gas detected upon completion of drilling.
3) bgs denotes below ground surface.
4) Water Level readings:
September 22, 2021 - 4.59 m bgs, Geodetic Elevation 256.85 m

SAMPLE LEGEND
AS Auger Sample; SS Split Spoon; ST Shelby Tube; Rock Core (eg. BQ, NQ, etc.); VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| $\gamma$ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
Apparent; Measured; Artesian (see Notes)

# BOREHOLE LOG

**BH5/MW - B**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Incorporated** PROJECT NO. **LON-21002415-A0**
PROJECT **Arva Medway Creek Development** DATUM **Geodetic**
LOCATION **Medway Road, Arva, ON** DATES: Boring **March 1, 2021** Water Level **Sept 22/21**

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) | SHEAR STRENGTH / Atterberg Limits and Moisture |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 261.49 | | | | | | | | | S Field Vane Test (#=Sensitivity); Penetrometer; Torvane; 100 200 kPa; $W_P$ W $W_L$; SPT N Value; Dynamic Cone; 10 20 30 40 |
| | 261.24 | **TOPSOIL** - 250 mm | | | | | | | | |
| 1 | | **SANDY SILT** - brown, trace clay, weathered, moist to very moist, dilatant, compact | | | | | | | | |
| 2 | | - becoming wet near 1.9 m bgs | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | - becoming grey near 3.8 m bgs | | | | | | | | |
| | 256.92 | | | | | | | | | |
| 5 | | **End of borehole at 4.6 m bgs.** | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |
| 10 | | | | | | | | | | |
| 11 | | | | | | | | | | |
| 12 | | | | | | | | | | |
| 13 | | | | | | | | | | |

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON-21002415-A0.
2) bgs denotes below ground surface.
3) Water Level readings:
September 22, 2021 - 4.44 m bgs, Geodetic Elevation 257.05 m

SAMPLE LEGEND
AS Auger Sample; SS Split Spoon; ST Shelby Tube; Rock Core (eg. BQ, NQ, etc.); VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| $\gamma$ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
Apparent; Measured; Artesian (see Notes)

# BOREHOLE LOG

**BH6/MW**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Incorporated** PROJECT NO. **LON-21002415-A0**
PROJECT **Arva Medway Creek Development** DATUM **Geodetic**
LOCATION **Medway Road, Arva, ON** DATES: Boring **March 1, 2021** Water Level **Sept 22/21**

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|
| | 261.06 | | | | | | |
| 0 | 260.86 | **TOPSOIL** - 200 mm | | | | | |
| | 260.20 | **SANDY SILT** - brown, trace organics, moist | | | | | |
| 1 | 259.69 | **SAND and GRAVEL** - brown, trace silt, moist, dense | SS | SA 1 | 250 | 38 | |
| | | **SILT** - brown, trace to some sand, trace clay, very moist to wet, loose compact | SS | SA 2 | 300 | 7 | |
| 2 | | - dilatant layering encountered near 2.3 m bgs | SS | SA 3 | 450 | 13 | |
| 3 | | - becoming grey near 2.9 m bgs | SS | SA 4 | 400 | 6 | |
| | 257.25 | | | | | | |
| 4 | | **SAND** - fine to medium grained, brown, trace silt, wet, compact | | | | | |
| 5 | | | SS | SA 5 | 450 | 29 | |
| 6 | | | | | | | |
| | 254.51 | | SS | SA 6 | 450 | 11 | |
| 7 | | **End of borehole at 6.6 m bgs.** | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| 10 | | | | | | | |
| 11 | | | | | | | |
| 12 | | | | | | | |
| 13 | | | | | | | |

**SHEAR STRENGTH**
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

**Atterberg Limits and Moisture**
$W_P$ W $W_L$
SPT N Value Dynamic Cone
10 20 30 40

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON-21002415-A0.
2) No significant methane gas detected upon completion of drilling.
3) bgs denotes below ground surface.
4) Water Level readings:
September 22, 2021 - 3.62 m bgs, Geodetic Elevation 257.44 m

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| γ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
Apparent Measured Artesian (see Notes)

# BOREHOLE LOG

**BH7/MW**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Incorporated** PROJECT NO. **LON-21002415-A0**
PROJECT **Arva Medway Creek Development** DATUM **Geodetic**
LOCATION **Medway Road, Arva, ON** DATES: Boring **March 3, 2021** Water Level **Sept 22/21**

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 261.14 | | | | | | | | |
| | 260.89 | **TOPSOIL** - 250 mm | | | | | | | |
| 1 | | **SILT TILL** - brown, trace to some clay, some sand, trace gravel, moist, loose<br>- dilatant layering encountered near 1.1 m bgs | | | SS | SA 1 | 300 | 6 | |
| 2 | | | | | SS | SA 2 | 400 | 4 | |
| | 258.70 | | | | | | | | |
| 3 | | **SAND** - fine to medium grained, brown, trace to some silt, moist, compact<br>- becoming wet near 2.7 m bgs | | | SS | SA 3 | 300 | 10 | |
| 4 | | | | | SS | SA 4 | 300 | 14 | |
| 5 | | | | | SS | SA 5 | 400 | 10 | |
| | 255.58 | | | | | | | | |
| 6 | | **SANDY SILT** - brown, trace silt, dilatant, very moist to wet, compact | | | | | | | |
| | 254.59 | | | | SS | SA 6 | 450 | 13 | |
| 7 | | **End of borehole at 6.6 m bgs.** | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |

**SHEAR STRENGTH**
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa
**Atterberg Limits and Moisture**
$W_P$ W $W_L$
SPT N Value Dynamic Cone
10 20 30 40

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON-21002415-A0.
2) No significant methane gas detected upon completion of drilling.
3) bgs denotes below ground surface.
4) Water Level readings:
September 22, 2021 - 3.67 m bgs, Geodetic Elevation 257.47 m

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| $\gamma$ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
Apparent Measured Artesian (see Notes)

# BOREHOLE LOG

**BH8/MW - A**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Incorporated** PROJECT NO. **LON-21002415-A0**
PROJECT **Arva Medway Creek Development** DATUM **Geodetic**
LOCATION **Medway Road, Arva, ON** DATES: Boring **March 3, 2021** Water Level **Sept 22/21**

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 266.70 | | | | | | | | |
| | 266.40 | **TOPSOIL** - 300 mm | | | | | | | |
| 1 | | **SAND and GRAVEL** - brown, trace silt, damp to moist, compact to dense | | | SS | SA 1 | 250 | 30 | |
| 2 | | | | | SS | SA 2 | 300 | 21 | |
| | 264.57 | | | | | | | | |
| | | **SANDY SILT** - brown, dilatant, wet, compact | | | SS | SA 3 | 300 | 14 | |
| | 263.80 | | | | | | | | |
| 3 | | **CLAYEY SILT TILL** - grey, trace to some sand, moist, stiff to very stiff<br>- damp silt laminations throughout | | | SS | SA 4 | 450 | 16 | |
| 4 | | | | | | | | | |
| 5 | | | | | SS | SA 5 | 450 | 12 | |
| | 261.14 | | | | | | | | |
| 6 | | **SILT TILL** - grey, trace clay, some sand, trace gravel, damp, dense to very dense | | | SS | SA 6 | 450 | 26 | |
| 7 | | | | | | | | | |
| 8 | | | | | SS | SA 7 | 300 | 70 | |
| | | - dilatant silt layering encountered near 8.4 m bgs | | | | | | | |
| 9 | | | | | SS | SA 8 | 300 | 46 | |
| 10 | | | | | | | | | |
| 11 | | | | | SS | SA 9 | 450 | 45 | |
| | | - wet, medium to coarse grained sand layering encountered near 11.0 m bgs | | | | | | | |
| 12 | | | | | | | | | |
| | 254.05 | | | | SS | SA 10 | 450 | 41 | |
| 13 | | **End of borehole at 12.7 m bgs.** | | | | | | | |

**SHEAR STRENGTH**
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa
**Atterberg Limits and Moisture**
$W_P$ W $W_L$
SPT N Value Dynamic Cone
10 20 30 40

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON-21002415-A0.
2) No significant methane gas detected upon completion of drilling.
3) bgs denotes below ground surface.
4) Water Level readings:
September 22, 2021 - 6.42 m bgs, Geodetic Elevation 260.28 m

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| γ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
Apparent Measured Artesian (see Notes)

# BOREHOLE LOG

**BH8/MW - B**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Incorporated** PROJECT NO. **LON-21002415-A0**
PROJECT **Arva Medway Creek Development** DATUM **Geodetic**
LOCATION **Medway Road, Arva, ON** DATES: Boring **March 3, 2021** Water Level **Sept 22/21**

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) | SHEAR STRENGTH / Atterberg Limits and Moisture |
|---|---|---|---|---|---|---|---|---|---|---|
| | 266.70 | | | | | | | | | S Field Vane Test (#=Sensitivity); Penetrometer; Torvane; 100 200 kPa; $W_P$ W $W_L$; SPT N Value; Dynamic Cone; 10 20 30 40 |
| 0 | 266.40 | **TOPSOIL** - 300 mm | | | | | | | | |
| | | **SAND and GRAVEL** - brown, trace silt, damp to moist, compact to dense | | | | | | | | |
| 1 | | | | | | | | | | |
| 2 | 264.57 | | | | | | | | | |
| | | **SANDY SILT** - brown, dilatant, wet, compact | | | | | | | | |
| | 263.80 | | | | | | | | | |
| 3 | 263.65 | **CLAYEY SILT TILL** - grey, trace to some sand, moist, stiff to very stiff<br>- damp silt laminations throughout | | | | | | | | |
| 4 | | **End of borehole at 3.0 m bgs.** | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |
| 10 | | | | | | | | | | |
| 11 | | | | | | | | | | |
| 12 | | | | | | | | | | |
| 13 | | | | | | | | | | |

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON-21002415-A0.
2) bgs denotes below ground surface.
3) Water Level readings:
September 22, 2021 - 2.06 m bgs, Geodetic Elevation 264.64 m

SAMPLE LEGEND
AS Auger Sample; SS Split Spoon; ST Shelby Tube; Rock Core (eg. BQ, NQ, etc.); VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| $\gamma$ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
Apparent; Measured; Artesian (see Notes)

# BOREHOLE LOG

**BH9/MW**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Incorporated** PROJECT NO. **LON-21002415-A0**
PROJECT **Arva Medway Creek Development** DATUM **Geodetic**
LOCATION **Medway Road, Arva, ON** DATES: Boring **March 4, 2021** Water Level **Sept 22/21**

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 270.95 | | | | | | | | |
| | 270.75 | **TOPSOIL** - 200 mm | | | | | | | |
| 1 | | **SANDY SILT** - brown, trace clay, trace organics, moist, very loose | | | SS | SA 1 | 300 | 3 | |
| | 269.58 | | | | | | | | |
| 2 | | **SILT** - brown, trace clay, trace sand, weathered, moist, loose to compact | | | SS | SA 2 | 350 | 8 | |
| | 268.82 | | | | | | | | |
| | 268.36 | **SAND and GRAVEL** - brown, trace silt, wet, loose | | | SS | SA 3 | 400 | 6 | |
| 3 | | **SILT** - brown, some clay, trace to some sand, trace gravel, dilatant, moist, loose | | | SS | SA 4 | 200 | 5 | |
| 4 | 266.91 | | | | | | | | |
| | | **CLAYEY SILT TILL** - grey, trace sand, trace gravel, moist, stiff to very stiff | | | SS | SA 5 | 450 | 8 | |
| 5 | | | | | | | | | |
| 6 | | | | | SS | SA 6 | 450 | 16 | |
| 7 | 263.86 | | | | | | | | |
| | | **SILT TILL** - grey, trace clay, some sand, trace gravel, moist, very dense | | | SS | SA 7 | 450 | 60 | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| | 261.35 | | | | SS | SA 8 | 400 | 64 | |
| 10 | | **End of borehole at 9.6 m bgs.** | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |

**SHEAR STRENGTH**
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

**Atterberg Limits and Moisture**
$W_P$ W $W_L$
SPT N Value × Dynamic Cone
10 20 30 40

60
64

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON-21002415-A0.
2) No significant methane gas detected upon completion of drilling.
3) bgs denotes below ground surface.
4) Water Level readings:
September 22, 2021 - 1.97 m bgs, Geodetic Elevation 268.98 m

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| γ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
Apparent Measured Artesian (see Notes)

# BOREHOLE LOG

**BH9-DCT**
Sheet 1 of 1

CLIENT **Bridle Path North Arva Incorporated** PROJECT NO. **LON-21002415-A0**

PROJECT **Arva Medway Creek Development** DATUM **Geodetic**

LOCATION **Medway Road, Arva, ON** DATES: Boring **March 4, 2021** Water Level

| DEPTH (m bgs) | ELEVATION (~m) | STRATA DESCRIPTION | STRATA PLOT | WELL LOG | SAMPLES TYPE | SAMPLES NUMBER | SAMPLES RECOVERY (mm) | SAMPLES N VALUE (blows) | MOISTURE CONTENT (%) | SHEAR STRENGTH / Atterberg Limits and Moisture |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 270.95 | | | | | | | | | |
| 6 | 264.85 | **End of borehole at 6.1 m bgs.** | | | | | | | | |

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa
Atterberg Limits and Moisture
$W_P$ W $W_L$
SPT N Value Dynamic Cone
10 20 30 40

***NOTES***

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON-21002415-A0.
2) Dynamic Cone Penetration Testing performed adjacent to BH9. Please refer to the stratigraphy from BH9.
3) bgs denotes below ground surface.

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

| | |
|---|---|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| γ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS
Apparent Measured Artesian (see Notes)

| **Depth** (m below grade) | **Soil Description** |
|---|---|
| **TP1** | Approximate Elevation: 267.7 m |
| 0.00 – 0.30 | TOPSOIL – 300 mm |
| 0.30 – 1.8 | FILL – silt, brown, trace clay, some sand, some gravel, loose, moist |
| 1.2 | - concrete rubble encountered near 1.2 m bgs |
| 1.8 – 3.0 | SANDY SILT – brown, trace clay, some gravel, compact, moist to very moist |
| 3.0 | *Test pit terminated.* |
| | *Test pit sidewalls caved near 1.2 m below grade during excavation; minor groundwater seepage was observed near 1.2 m below grade upon completion of excavation.* |
| **TP2** | Approximate Elevation: 267.2 m |
| 0.00 – 0.30 | TOPSOIL – 300 mm |
| 0.30 – 0.50 | SILT – dark brown, weathered, some sand, trace organics, loose, moist |
| 0.50 – 1.5 | SAND AND GRAVEL – brown, trace silt, compact, moist |
| 1.5 – 3.0 | SILT TILL – brown, trace to some clay, some sand, trace gravel, compact, moist |
| 3.0 | *Test pit terminated.* |
| | *Test pit was open upon completion of excavation; no groundwater seepage was observed upon completion of excavation.* |
| **TP3** | Approximate Elevation: 266.6 m |
| 0.00 – 0.30 | TOPSOIL – 300 mm |
| 0.30 – 2.0 | SAND AND GRAVEL – brown, trace silt, compact, moist |
| 1.2 | - becoming wet near 1.2 m bgs |
| 2.0 | *Test pit terminated.* |
| | *Test pit sidewalls caved near 0.9 m below grade during excavation; groundwater seepage was observed near 1.2 m below grade upon completion of excavation.* |
| **TP4** | Approximate Elevation: 264.2 m |
| 0.00 – 0.30 | TOPSOIL – 300 mm |
| 0.30 – 0.90 | SAND AND GRAVEL – brown, trace silt, compact, moist |
| 0.90 – 3.0 | SAND – brown, fine to medium grained, trace silt, compact, moist |
| 3.0 | *Test pit terminated.* |
| | *Test pit was open upon completion of excavation; no groundwater seepage was observed upon completion of excavation.* |

| | |
|---|---|
| **TP5** | Approximate Elevation: 262.5 m |
| 0.00 – 0.20 | TOPSOIL – 200 mm |
| 0.20 – 1.4 | SAND AND GRAVEL – brown, trace silt, compact, moist |
| 1.4 – 3.0 | SAND – brown, medium to coarse grained, trace silt, some fine gravel, compact, moist |
| 3.0 | *Test pit terminated.* |
| | *Test pit was open to 2.3 m below grade upon completion of excavation; no groundwater seepage was observed upon completion of excavation.* |
| **TP6** | Approximate Elevation: 262.2 m |
| 0.00 – 0.30 | TOPSOIL – 300 mm |
| 0.30 – 2.6 | SAND AND GRAVEL – brown, trace silt, compact, moist |
| 2.6 – 3.0 | SAND – brown, fine to medium grained, trace silt, compact, moist |
| 3.0 | *Test pit terminated.* |
| | *Test pit was open upon completion of excavation; no groundwater seepage was observed upon completion of excavation.* |
| **TP7** | Approximate Elevation: 263.6 m |
| 0.00 – 0.30 | TOPSOIL – 300 mm |
| 0.30 – 2.0 | FILL – sandy silt, brown, trace clay, some gravel, loose, moist |
| 2.0 – 3.0 | SAND AND GRAVEL – brown, trace silt, compact, moist |
| 3.0 | *Test pit terminated.* |
| | *Test pit sidewalls caved near 2.0 m below grade during excavation; no groundwater seepage was observed upon completion of excavation.* |
| **TP8** | Approximate Elevation: 265.8 m |
| 0.00 – 0.30 | TOPSOIL – 300 mm |
| 0.30 – 0.60 | SILT – brown, trace clay, trace sand, some gravel, loose, moist |
| 0.60 – 1.6 | SAND AND GRAVEL – brown, trace silt, compact, moist |
| 1.6 – 2.5 | SAND – brown, fine to medium grained, trace silt, trace to some gravel, compact, moist |
| 2.5 | *Test pit terminated.* |
| | *Test pit was open upon completion of excavation; minor groundwater seepage was observed near 1.2 m below grade upon completion of excavation.* |
| **TP9** | Approximate Elevation: 266.7 m |
| 0.00 – 0.30 | TOPSOIL – 300 mm |
| 0.30 – 0.60 | SILT – brown, some clay, trace sand, cobbles/boulder, loose, moist |
| 0.60 – 1.2 | SAND AND GRAVEL – brown, trace silt, compact, moist |
| 1.2 – 2.5 | SILT TILL – brown, some clay, some sand, trace gravel, compact, moist |
| 1.2 | - becoming wet near 1.2 m bgs |
| 2.5 | *Test pit terminated.* |
| | *Test pit was open upon completion; minor groundwater seepage was observed near 1.2 m below grade upon completion of excavation.* |

| **TP10** | Approximate Elevation: 268.0 m |
|---|---|
| 0.00 – 0.30 | TOPSOIL – 300 mm |
| 0.30 – 1.3 | SILTY SAND – brown, occasional silt layering, loose, moist to very moist |
| 1.3 – 1.6 | SAND AND GRAVEL – brown, trace silt, compact, wet |
| 1.6 – 2.5 | SILT TILL – grey, some clay, some sand, some gravel, compact, moist |
| 2.5 | *Test pit terminated.* |
| | *Test pit was open upon completion of excavation; groundwater seepage was observed near 1.3 m bgs upon completion of excavation.* |

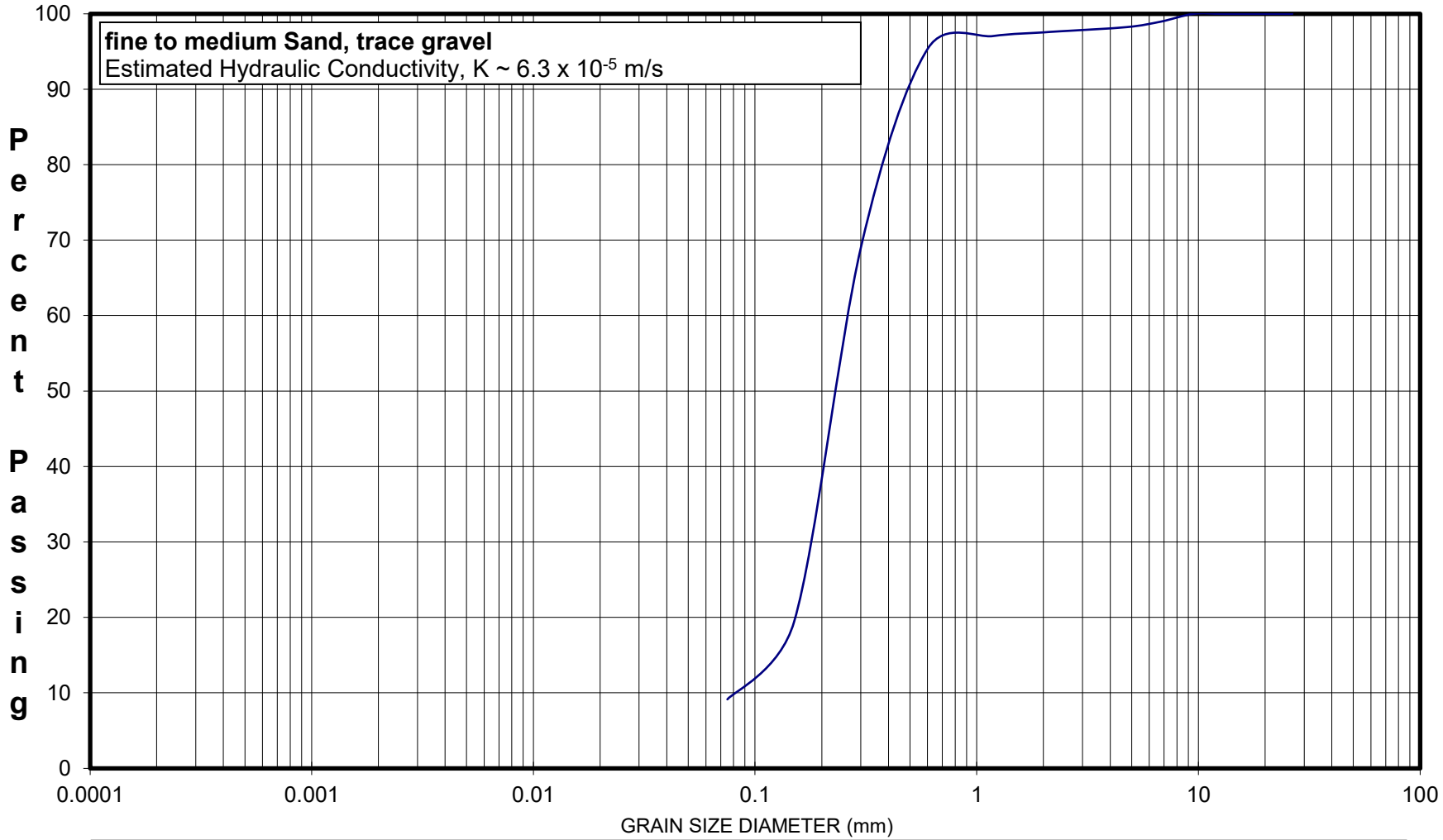
Notes: Test pits were excavated on March 1, 2021.

Ground surface elevations inferred from topographic plan provided by client.

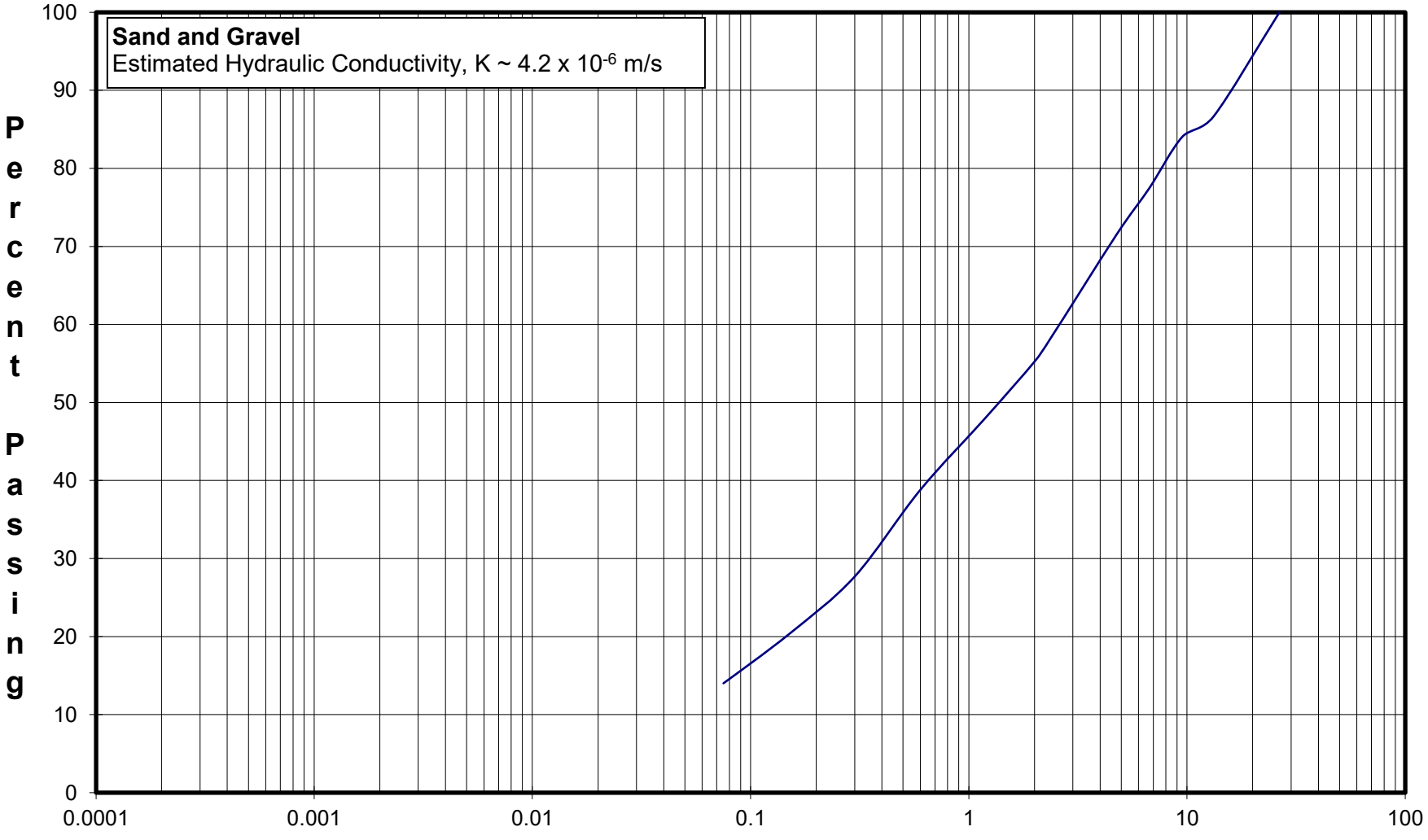
# Appendix E – Grain Size Analyses

6-405 Maple Grove Road | Cambridge, Ontario | Canada
t: +1.519.650.4918 | f: +1.519.650.4603 | exp.com

## MECHANICAL GRAIN SIZE ANALYSIS

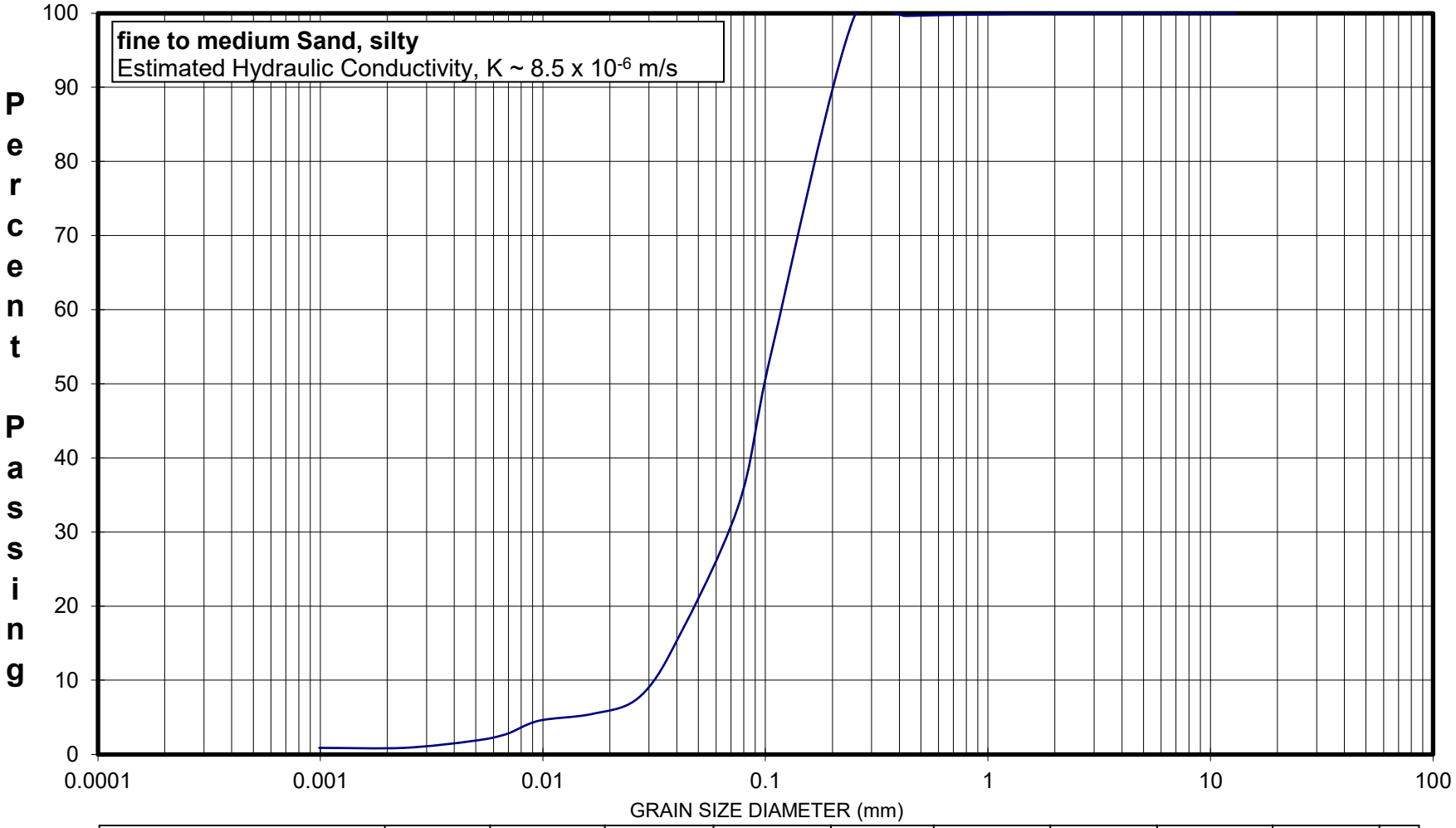


## MECHANICAL GRAIN SIZE ANALYSIS



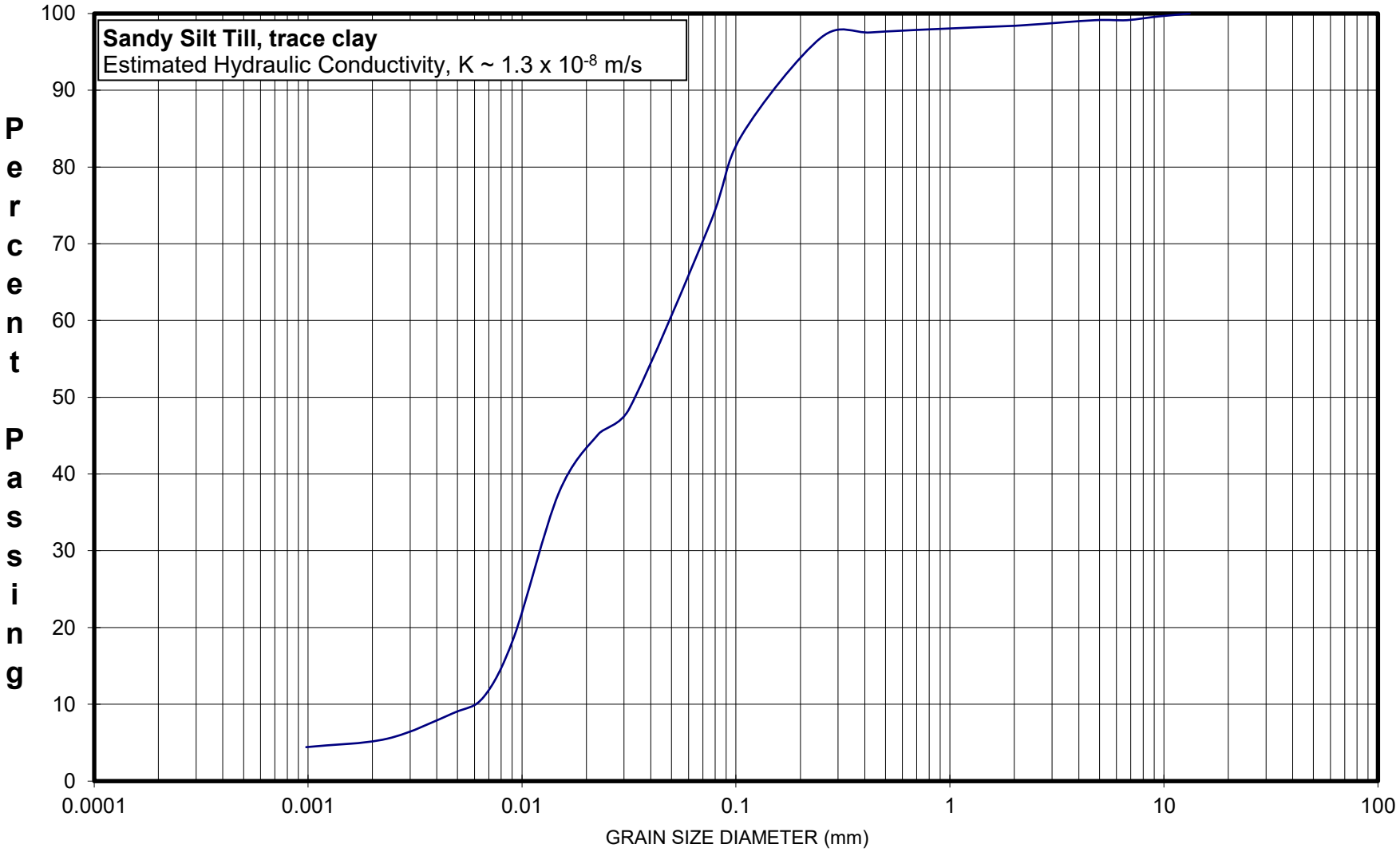

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CLAY | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | |
| | SILT | | | SAND | | | GRAVEL | | | |
| MODIFIED M.I.T. CLASSIFICATION | **Sample Description: Sand and Gravel (BH 2 SA 2)** | | | | | | **Arva Medway Creek Development Project: LON-21002415-A0** | | | **Figure 2** |

## MECHANICAL GRAIN SIZE ANALYSIS




| CLAY | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SILT | | | SAND | | | GRAVEL | | | |
| MODIFIED M.I.T. CLASSIFICATION | **Sample Description: fine to medium Sand (BH 7 SA 4)** | | | | | | **Arva Medway Creek Development** | | | **Figure 3** |

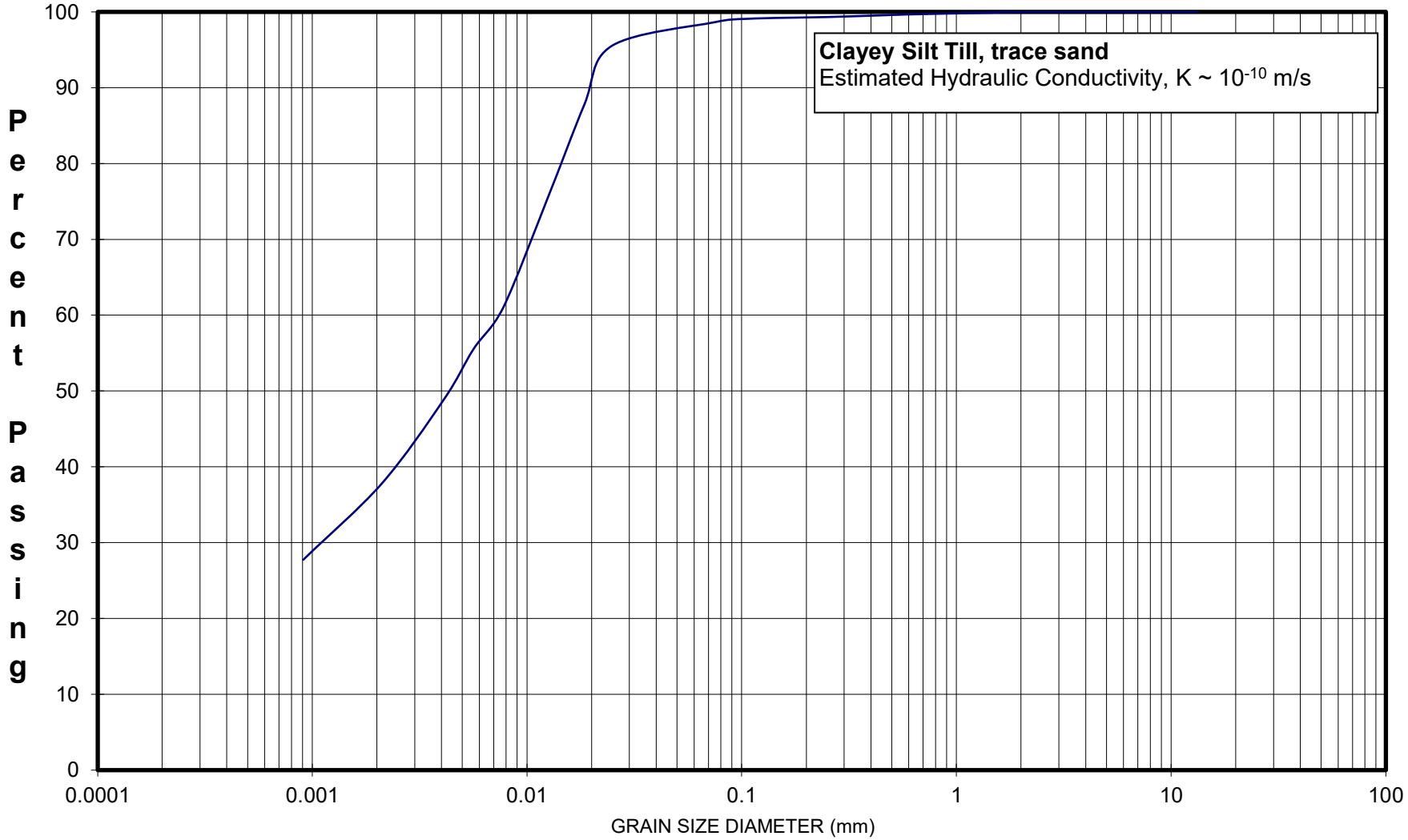
## MECHANICAL GRAIN SIZE ANALYSIS




| CLAY | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SILT | | | SAND | | | GRAVEL | | | |

| MODIFIED M.I.T. CLASSIFICATION | **Sample Description:** **Sandy Silt Till (BH 7 SA 6)** | **Arva Medway Creek Development** **Project: LON-21002415-A0** | **Figure 4** |
|---|---|---|---|

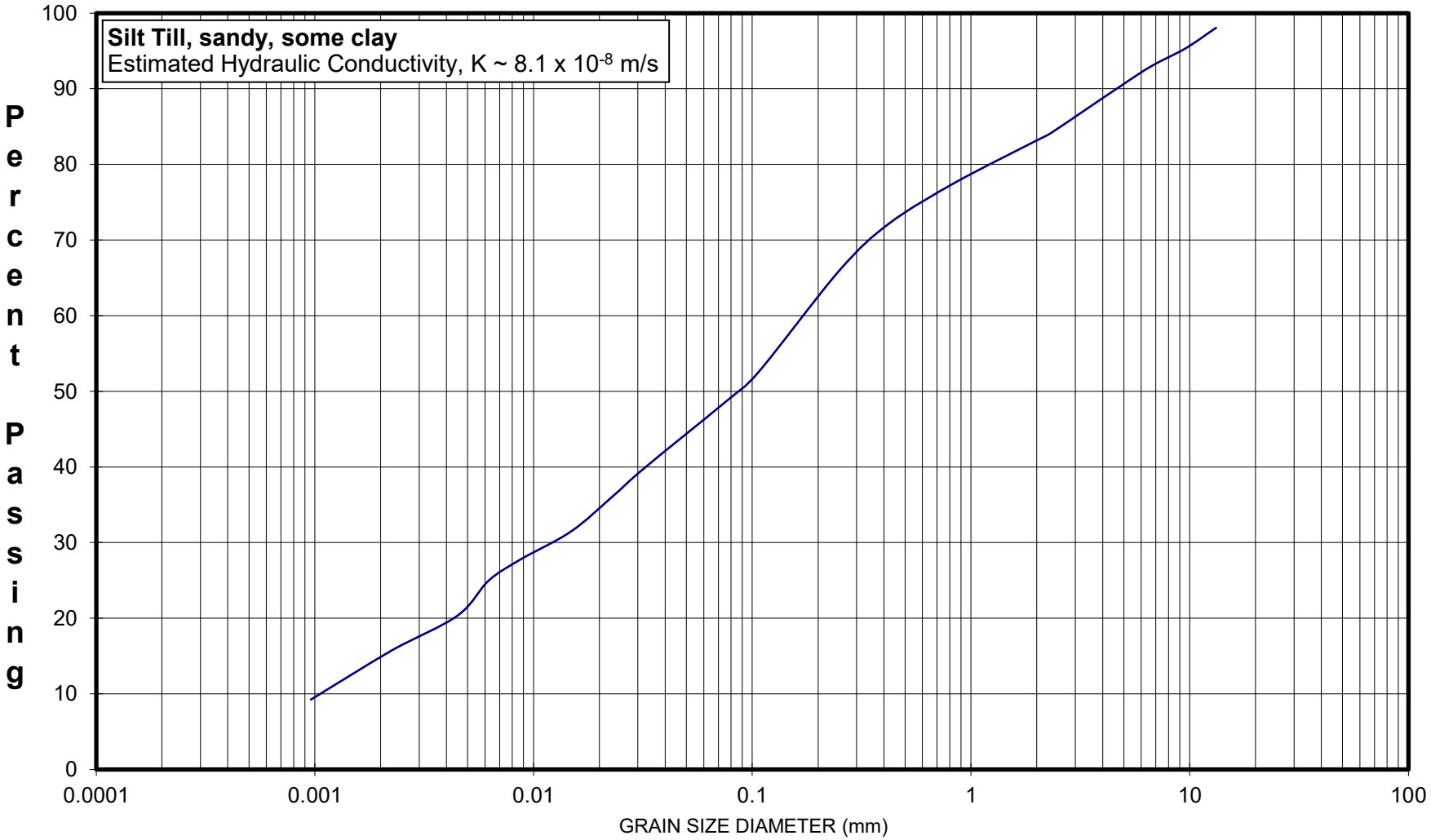
## MECHANICAL GRAIN SIZE ANALYSIS




| CLAY | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SILT | | | SAND | | | GRAVEL | | | |

| MODIFIED M.I.T. CLASSIFICATION | **Sample Description:**<br>**Clayey Silt Till (BH 8 SA5)** | **Arva Medway Creek Development**<br>**Project: LON-21002415-A0** | **Figure 5** |
|---|---|---|---|

## MECHANICAL GRAIN SIZE ANALYSIS




| CLAY | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SILT | | | SAND | | | GRAVEL | | | |

| MODIFIED M.I.T. CLASSIFICATION | **Sample Description: Silt Till (BH 8 SA 6)** | **Arva Medway Creek Development Project: LON-21002415-A0** | **Figure 6** |
|---|---|---|---|

# Appendix F – MECP Water Well Record Summary

6-405 Maple Grove Road | Cambridge, Ontario | Canada
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| Well ID | Easting | Northing | Date Completed | Well Depth | Final Status | Primary Use | Secondary Use |
|---|---|---|---|---|---|---|---|
| 4102136 | 475893.6 | 4766143 | 3/30/1964 | 46.6 | Water Supply | Domestic | N.A. |
| 4102141 | 475213.6 | 4766133 | 4/4/1954 | 38.4 | Water Supply | Municipal | N.A. |
| 4102114 | 476433.6 | 4766583 | 5/27/1948 | 14.6 | Water Supply | Public | N.A. |
| 4102116 | 476053.6 | 4766463 | 3/20/1951 | 52.1 | Water Supply | Domestic | N.A. |
| 4102119 | 476383.6 | 4766543 | 8/8/1953 | 39.6 | Water Supply | Public | N.A. |
| 4102120 | 476273.6 | 4766543 | 8/21/1953 | 56.7 | Water Supply | Commerical | N.A. |
| 4102121 | 476403.6 | 4766503 | 11/28/1953 | 41.8 | Water Supply | Public | N.A. |
| 4102122 | 476313.6 | 4766423 | 3/16/1954 | 73.2 | Water Supply | Domestic | N.A. |
| 4102123 | 476173.6 | 4766443 | 10/8/1957 | 10.4 | Water Supply | Domestic | N.A. |
| 4102124 | 476293.6 | 4766303 | 12/4/1957 | 10.4 | Water Supply | Domestic | N.A. |
| 4102125 | 476233.6 | 4766533 | 12/6/1957 | 10.4 | Water Supply | Domestic | N.A. |
| 4102126 | 476093.6 | 4766233 | 6/15/1959 | 49.4 | Water Supply | Domestic | N.A. |
| 4102127 | 476073.6 | 4766313 | 3/4/1960 | 44.5 | Water Supply | Domestic | N.A. |
| 4102128 | 476203.6 | 4766313 | 7/21/1962 | 6.7 | Water Supply | Domestic | N.A. |
| 4102129 | 476333.6 | 4766288 | 7/2/1964 | 6.1 | Water Supply | Public | N.A. |
| 4102131 | 476193.6 | 4766243 | 11/5/1966 | 8.2 | Water Supply | Public | N.A. |
| 4102132 | 476103.6 | 4766363 | 1/4/1967 | 8.2 | Water Supply | Domestic | N.A. |
| 4102133 | 476003.6 | 4766433 | 7/15/1946 | 47.2 | Water Supply | Domestic | N.A. |
| 4102134 | 476063.6 | 4766043 | 10/9/1948 | 67.7 | Water Supply | Domestic | N.A. |
| 4102135 | 476033.6 | 4766263 | 8/15/1954 | 46 | Water Supply | Livestock | Domestic |
| 4102176 | 475783.6 | 4767123 | 7/26/1954 | 17.1 | Water Supply | Domestic | N.A. |
| 4102177 | 475833.6 | 4767143 | 6/10/1958 | 15.2 | Water Supply | Domestic | N.A. |
| 4102179 | 476033.6 | 4766513 | 2/14/1959 | 50.6 | Water Supply | Public | N.A. |
| 4102181 | 476013.6 | 4766603 | 11/30/1959 | 50.3 | Water Supply | Domestic | N.A. |
| 4102183 | 475963.6 | 4766543 | 7/13/1962 | 51.2 | Water Supply | Domestic | N.A. |
| 4102184 | 475993.6 | 4766473 | 9/8/1962 | 8.8 | Water Supply | Domestic | N.A. |
| 4102185 | 475893.6 | 4766873 | 1/22/1964 | 52.7 | Water Supply | Domestic | N.A. |
| 4102186 | 476133.6 | 4766823 | 9/14/1964 | 45.7 | Water Supply | Domestic | N.A. |
| 4102193 | 475873.6 | 4766543 | 7/15/1955 | 54.6 | Water Supply | Irrigation | Domestic |
| 4102196 | 475933.6 | 4766503 | 9/27/1966 | 9.8 | Water Supply | Domestic | N.A. |
| 4104573 | 474963.6 | 4766303 | 2/24/1968 | 35.1 | Water Supply | Domestic | N.A. |
| 4104575 | 476143.6 | 4765953 | 11/12/1968 | 5.2 | Water Supply | Livestock | Domestic |
| 4104618 | 476243.6 | 4766443 | 2/12/1969 | 8.2 | Water Supply | Domestic | N.A. |
| 4104619 | 476233.6 | 4766453 | 2/14/1969 | 8.2 | Water Supply | Domestic | N.A. |
| 4104742 | 476103.6 | 4766393 | 7/4/1969 | 8.5 | Water Supply | Domestic | N.A. |
| 4104939 | 476313.6 | 4766363 | 12/17/1969 | 49.7 | Water Supply | Domestic | N.A. |
| 4104946 | 476163.6 | 4766403 | 2/27/1970 | 7.6 | Water Supply | Domestic | N.A. |
| 4105350 | 475033.6 | 4766343 | 9/30/1970 | 22.3 | Water Supply | Domestic | N.A. |
| 4105463 | 476113.6 | 4766343 | 6/22/1971 | 7 | Water Supply | Domestic | N.A. |
| 4109076 | 474933.6 | 4766123 | 3/29/1979 | 48.5 | Water Supply | Domestic | N.A. |
| 4111250 | 475903.6 | 4766943 | 4/15/1988 | 57.6 | Water Supply | Domestic | N.A. |
| 4112279 | 475973.6 | 4767002 | 9/15/1990 | 27.4 | Water Supply | Domestic | N.A. |
| 4112291 | 475840.6 | 4766982 | 3/23/1990 | 61 | Water Supply | Domestic | N.A. |
| 7040275 | 475820 | 4766470 | 4/27/2006 | 53.6 | Water Supply | Irrigation | N.A. |
| 7101992 | 475055 | 4766596 | 7/11/2007 | 23.2 | Water Supply | Domestic | Livestock |
| 7119215 | 475709 | 4766794 | 10/17/2008 | 56.4 | Water Supply | Domestic | N.A. |
| 7158048 | 476293 | 4766327 | 8/4/2010 | 103.6 | Water Supply | Public | N.A. |
| 4112292 | 475840.6 | 4767002 | 3/4/1990 | 54.9 | Test Hole | N.A. | N.A. |
| 7111027 | 476170 | 4766503 | 7/31/2008 | 4.6 | Test Hole | Monitoring | N.A. |
| 7111027 | 476170 | 4766503 | 7/31/2007 | 0 | Test Hole | Monitoring | N.A. |
| 7111027 | 476170 | 4766503 | 7/31/2007 | 0 | Test Hole | Monitoring | N.A. |
| 7111027 | 476170 | 4766503 | 7/31/2007 | 0 | Test Hole | Monitoring | N.A. |
| 7111027 | 476170 | 4766503 | 7/31/2007 | 0 | Test Hole | Monitoring | N.A. |
| 7119836 | 476120 | 4766459 | 2/10/2009 | 0 | Test Hole | Monitoring | N.A. |
| 7119836 | 476120 | 4766459 | 2/10/2009 | 0 | Test Hole | Monitoring | N.A. |
| 7119836 | 476120 | 4766459 | 2/10/2009 | 4.3 | Test Hole | Monitoring | N.A. |
| 4115839 | 475911 | 4766589 | 11/8/2004 | 6 | Observation Wells | N.A. | N.A. |
| 7370833 | 476192 | 4766194 | 10/1/2020 | 6.1 | Observation Wells | Monitoring | N.A. |
| 7385108 | 475218 | 4765841 | 3/18/2021 | 4.6 | Observation Wells | Monitoring | N.A. |
| 7383581 | 475507 | 4766086 | 3/1/2021 | 4.6 | N.A. | N.A. | N.A. |
| 7401581 | 476067 | 4766349 | 10/11/2021 | 0 | N.A. | N.A. | N.A. |
| 7424983 | 476297 | 4766434 | 7/8/2022 | 0 | N.A. | N.A. | N.A. |
| 7444951 | 475827 | 4766759 | 3/21/2022 | 0 | N.A. | N.A. | N.A. |
| 7444958 | 475840.6 | 4767002 | 1/1/2023 | 0 | N.A. | N.A. | N.A. |
| 7383572 | 475883 | 4766505 | 3/4/2021 | 3.7 | Monitoring and Test Hole | Monitoring and Test Hole | N.A. |
| 7383574 | 475642 | 4766525 | 3/3/2021 | 12.2 | Monitoring and Test Hole | Monitoring and Test Hole | N.A. |
| 7383575 | 475440 | 4766352 | 3/3/2021 | 6.1 | Monitoring and Test Hole | Test Hole | N.A. |
| 7383576 | 475962 | 4766215 | 3/3/2021 | 6.7 | Monitoring and Test Hole | Test Hole | N.A. |
| 7383577 | 475816 | 4766290 | 3/2/2021 | 3 | Monitoring and Test Hole | Monitoring and Test Hole | N.A. |
| 7383578 | 475626 | 4766266 | 3/2/2021 | 3 | Monitoring and Test Hole | Monitoring and Test Hole | N.A. |
| 7383579 | 475791 | 4766122 | 3/2/2021 | 9.1 | Monitoring and Test Hole | Test Hole | N.A. |
| 7383580 | 475701 | 4766028 | 3/1/2021 | 6.1 | Monitoring and Test Hole | Monitoring and Test Hole | N.A. |
| 7383582 | 475505 | 4766090 | 3/1/2021 | 7.6 | Monitoring and Test Hole | Monitoring and Test Hole | N.A. |
| 4102115 | 476073.6 | 4766473 | 12/20/1950 | 39 | Abandoned-Supply | N.A. | N.A. |
| 4102178 | 476033.6 | 4766513 | 11/6/1958 | 37.2 | Abandoned-Supply | N.A. | N.A. |
| 4102189 | 475933.6 | 4766613 | 10/14/1965 | 5.8 | Abandoned-Supply | N.A. | N.A. |
| 4102192 | 475853.6 | 4766683 | 6/20/1955 | 67.1 | Abandoned-Supply | N.A. | N.A. |
| 7200116 | 476033.6 | 4766263 | 10/26/2012 | 0 | Abandoned-Supply | N.A. | N.A. |
| 4102194 | 475933.6 | 4766543 | 11/15/1957 | 16.8 | Abandoned-Quality | Not Used | N.A. |
| 7145903 | 476110 | 4766268 | 4/27/2010 | 6.7 | Abandoned-Other | N.A. | N.A. |
| 7163008 | 476096 | 4766276 | 5/3/2011 | 0 | Abandoned-Other | N.A. | N.A. |
| 7174437 | 476120 | 4766434 | 12/20/2011 | 0 | Abandoned-Other | Monitoring | N.A. |
| 7174438 | 476184 | 4766445 | 12/20/2011 | 0 | Abandoned-Other | Monitoring | N.A. |
| 7174439 | 476112 | 4766457 | 12/20/2011 | 0 | Abandoned-Other | Monitoring | N.A. |
| 7304895 | 476143.6 | 4765953 | | 0 | Abandoned-Other | N.A. | N.A. |

***Notes:***

Information is as provided by the MECP WWIS Online Database. Actual locations may differ.

N.A. - Information not provided in the MECP WWIS Database

# Appendix G – Water Levels and Hydrographs

6-405 Maple Grove Road | Cambridge, Ontario | Canada
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## Groundwater Elevation Monitoring

| Well ID | BH1/MW | BH2/MW | BH3/MW | BH4/MW | BH5/MW-A | BH5/MW-B | BH6/MW | BH7/MW | BH8/MW-A | BH8/MW-B | BH9/MW |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ground Surface Elevation (m amsl) | 269.01 | 269.20 | 262.37 | 268.12 | 261.44 | 261.49 | 261.06 | 261.14 | 266.70 | 266.70 | 270.95 |
| Top of Pipe Elevation (m amsl) | 270.02 | 270.14 | 263.53 | 269.06 | 262.52 | 262.53 | 262.14 | 262.31 | 267.54 | 267.79 | 271.96 |
| *Groundwater Elevation (m amsl)* | | | | | | | | | | | |
| 12-Mar-21 | 262.76 | 268.17 | 260.20 | Dry | 257.53 | 259.99 | 258.07 | 258.16 | 260.55 | 265.07 | 269.91 |
| 30-Apr-21 | 262.83 | 267.43 | Dry | Dry | 256.54 | 259.40 | 257.81 | 257.61 | 260.39 | 264.90 | 269.84 |
| 5-May-21 | 262.82 | 267.37 | Dry | Dry | 256.52 | 259.28 | 257.78 | 257.58 | 260.35 | 264.88 | 269.42 |
| 28-Jun-21 | 262.74 | 267.25 | Dry | 260.62 | 256.63 | 257.99 | 257.68 | 257.59 | 260.14 | 264.90 | 269.16 |
| 30-Jul-21 | 262.68 | -- | -- | 260.55 | 256.55 | 257.36 | 257.53 | 257.42 | 260.10 | 264.76 | 269.11 |
| 26-Aug-21 | 262.62 | -- | -- | 260.43 | 256.67 | 257.07 | 257.42 | 257.39 | 260.01 | 264.69 | 268.96 |
| 22-Sep-21 | 262.66 | 266.89 | Dry | 260.53 | 256.87 | 257.07 | 257.50 | 257.51 | 260.06 | 264.69 | 269.05 |
| 12-Oct-21 | 262.72 | 267.83 | -- | Dry | 256.86 | 258.50 | 257.78 | 257.83 | 260.31 | 265.01 | 269.56 |
| 23-Nov-21 | 262.83 | 267.85 | Dry | Dry | 256.72 | 260.09 | 257.91 | 257.89 | 260.74 | 264.89 | 269.68 |
| 7-Dec-21 | 262.87 | 268.05 | 260.08 | Dry | 256.86 | 260.36 | 258.04 | 258.09 | 260.62 | 265.02 | 269.84 |
| 7-Jan-22 | 262.87 | 267.70 | Dry | Dry | 256.64 | 259.93 | 257.97 | 257.84 | 260.52 | 264.95 | 269.61 |
| 10-Feb-22 | 262.82 | 267.29 | Dry | Dry | 256.52 | 259.08 | 257.82 | 257.59 | 260.34 | 264.82 | 269.32 |
| 30-Mar-22 | 262.94 | 267.98 | 260.35 | Dry | 256.82 | 260.28 | 258.09 | 258.02 | 260.63 | 265.02 | 269.41 |
| 22-Jun-22 | 262.88 | 267.23 | Dry | Dry | 256.49 | 258.44 | 257.83 | 257.55 | 260.32 | 264.86 | 269.26 |
| 20-Sep-22 | 262.76 | 266.76 | 259.51 | Dry | 256.67 | Dry | 257.72 | 257.35 | 260.01 | 264.59 | 268.81 |
| 21-Dec-22 | 262.70 | 266.67 | 259.50 | Dry | 256.55 | Dry | 257.65 | 257.52 | 260.06 | 264.50 | 268.85 |
| 17-Mar-23 | 262.82 | 268.14 | 259.52 | Dry | 257.36 | Dry | 257.97 | 258.76 | 260.43 | 264.95 | 269.83 |
| 13-Jun-23 | 262.90 | 267.27 | 259.52 | Dry | 256.45 | 258.57 | 257.89 | 257.65 | 260.40 | 264.86 | 269.31 |
| 22-Sep-23 | 262.82 | 267.18 | 259.53 | Dry | 256.52 | Dry | 257.79 | 257.56 | 260.28 | 264.77 | 269.09 |
| 19-Dec-23 | 262.79 | 267.68 | 259.52 | Dry | 257.00 | 259.61 | 257.99 | 257.97 | 260.43 | 264.89 | 269.48 |
| 21-Mar-24 | 262.90 | 267.68 | 259.87 | Dry | 256.69 | 259.96 | 258.11 | 257.93 | 260.48 | 264.95 | 269.58 |
| 18-Jun-24 | 262.92 | 267.45 | 259.55 | Dry | 256.55 | 259.42 | 258.03 | 257.73 | 260.48 | 264.94 | 269.38 |
| 20-Sep-24 | 262.89 | 267.08 | 259.52 | Dry | - | - | 257.95 | 257.67 | 260.33 | 264.71 | 269.08 |

## Groundwater Level Monitoring

| Well ID | BH1/MW | BH2/MW | BH3/MW | BH4/MW | BH5/MW-A | BH5/MW-B | BH6/MW | BH7/MW | BH8/MW-A | BH8/MW-B | BH9/MW |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Groundwater Level (m bgs)* | | | | | | | | | | | |
| 12-Mar-21 | 6.25 | 1.04 | 2.18 | Dry | 3.92 | 1.50 | 2.98 | 2.98 | 6.15 | 1.63 | 1.04 |
| 30-Apr-21 | 6.18 | 1.78 | Dry | Dry | 4.91 | 2.09 | 3.24 | 3.53 | 6.31 | 1.80 | 1.11 |
| 5-May-21 | 6.19 | 1.84 | Dry | Dry | 4.93 | 2.21 | 3.27 | 3.56 | 6.35 | 1.82 | 1.53 |
| 28-Jun-21 | 6.27 | 1.96 | Dry | 7.49 | 4.82 | 3.50 | 3.37 | 3.55 | 6.56 | 1.80 | 1.79 |
| 30-Jul-21 | 6.33 | -- | -- | 7.56 | 4.90 | 4.13 | 3.52 | 3.72 | 6.60 | 1.94 | 1.84 |
| 26-Aug-21 | 6.39 | -- | -- | 7.68 | 4.78 | 4.42 | 3.63 | 3.75 | 6.69 | 2.01 | 1.99 |
| 22-Sep-21 | 6.35 | 2.32 | Dry | 7.58 | 4.58 | 4.42 | 3.55 | 3.63 | 6.64 | 2.01 | 1.90 |
| 12-Oct-21 | 6.29 | 1.38 | -- | Dry | 4.59 | 2.99 | 3.27 | 3.31 | 6.39 | 1.69 | 1.39 |
| 23-Nov-21 | 6.18 | 1.36 | Dry | Dry | 4.73 | 1.40 | 3.14 | 3.25 | 5.96 | 1.81 | 1.27 |
| 7-Dec-21 | 6.14 | 1.16 | 2.30 | Dry | 4.59 | 1.13 | 3.01 | 3.05 | 6.08 | 1.68 | 1.11 |
| 7-Jan-22 | 6.14 | 1.51 | Dry | Dry | 4.81 | 1.56 | 3.08 | 3.30 | 6.18 | 1.75 | 1.34 |
| 10-Feb-22 | 6.19 | 1.92 | Dry | Dry | 4.93 | 2.41 | 3.23 | 3.55 | 6.36 | 1.88 | 1.63 |
| 30-Mar-22 | 6.07 | 1.23 | 2.03 | Dry | 4.63 | 1.21 | 2.96 | 3.12 | 6.07 | 1.68 | 1.54 |
| 22-Jun-22 | 6.13 | 1.98 | Dry | Dry | 4.96 | 3.05 | 3.22 | 3.59 | 6.38 | 1.84 | 1.69 |
| 20-Sep-22 | 6.25 | 2.45 | 2.87 | Dry | 4.78 | Dry | 3.33 | 3.79 | 6.69 | 2.11 | 2.14 |
| 21-Dec-22 | 6.31 | 2.54 | 2.88 | Dry | 4.90 | Dry | 3.40 | 3.62 | 6.64 | 2.20 | 2.10 |
| 17-Mar-23 | 6.19 | 1.07 | 2.86 | Dry | 4.09 | Dry | 3.08 | 2.38 | 6.27 | 1.75 | 1.12 |
| 13-Jun-23 | 6.11 | 1.94 | 2.86 | Dry | 5.00 | Dry | 3.16 | 3.49 | 6.30 | 1.84 | 1.64 |
| 22-Sep-23 | 6.19 | 2.03 | 2.85 | Dry | 4.93 | Dry | 3.26 | 3.58 | 6.42 | 1.93 | 1.86 |
| 19-Dec-23 | 6.22 | 1.53 | 2.86 | Dry | 4.45 | Dry | 3.06 | 3.17 | 6.27 | 1.81 | 1.47 |
| 21-Mar-24 | 6.11 | 1.53 | 2.51 | Dry | 4.76 | Dry | 2.94 | 3.21 | 6.22 | 1.75 | 1.37 |
| 18-Jun-24 | 6.09 | 1.76 | 2.83 | Dry | 4.90 | Dry | 3.02 | 3.41 | 6.22 | 1.76 | 1.57 |
| 20-Sep-24 | 6.12 | 2.13 | 2.86 | Dry | - | Dry | 3.10 | 3.47 | 6.37 | 1.99 | 1.87 |

Notes:
-- indicates not measured

## Water Elevation Monitoring

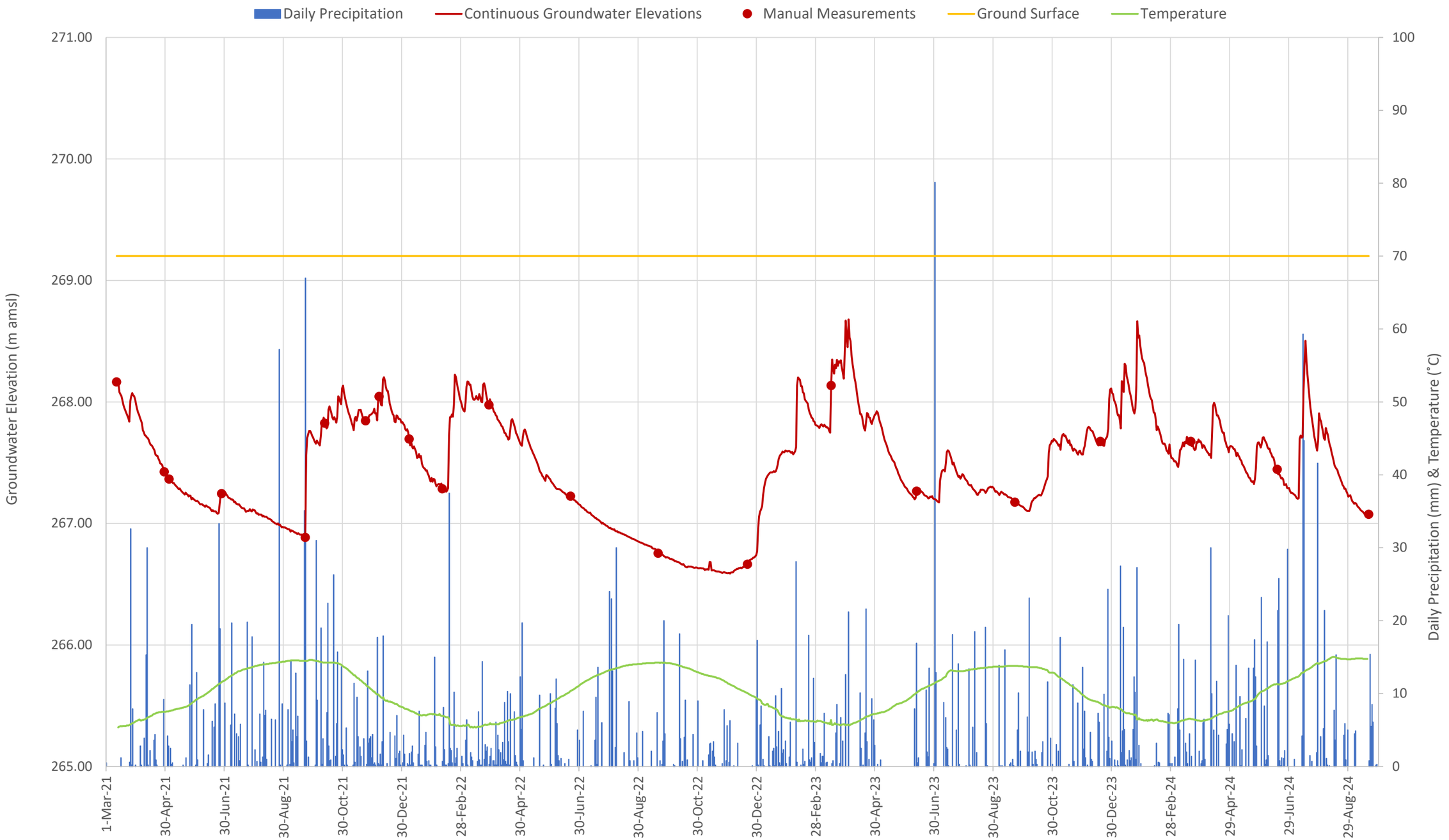
| Well ID | P1 Inside | P1 Outside | SG1 (old) | SG1 (new) |
|---|---|---|---|---|
| Ground Surface Elevation (masl) | 257.71 | 257.71 | 256.75 | 256.22 |
| Top of Pipe Elevation (masl) | 258.59 | 258.59 | -- | -- |
| *Groundwater and Surface Water Elevation* | | | | |
| 12-Mar-21 | Installed | Installed | 257.65 | -- |
| 30-Apr-21 | 256.62 | Dry | Dry | -- |
| 5-May-21 | Dry | Dry | Dry | 256.52 |
| 28-Jun-21 | 256.76 | 257.56 | -- | 256.62 |
| 30-Jul-21 | 256.76 | Dry | -- | 256.51 |
| 26-Aug-21 | 256.84 | Dry | -- | 256.99 |
| 22-Sep-21 | 256.79 | Dry | -- | 256.90 |
| 12-Oct-21 | 257.10 | Dry | -- | 256.96 |
| 23-Nov-21 | 256.94 | Dry | -- | 256.72 |
| 7-Dec-21 | 257.04 | Dry | -- | 256.82 |
| 7-Jan-22 | 256.78 | Dry | -- | 256.68 |
| 10-Feb-22 | Frozen | Dry | -- | 256.52 |
| 30-Mar-22 | 256.99 | Dry | -- | 256.82 |
| 22-Jun-22 | 256.60 | Dry | -- | 256.59 |
| 20-Sep-22 | 256.56 | Dry | -- | 256.66 |
| 21-Dec-22 | 256.66 | Dry | -- | 256.64 |
| 17-Mar-23 | 256.74 | Dry | -- | >257.22 |
| 13-Jun-23 | Dry | Dry | -- | 256.55 |
| 22-Sep-23 | -- | -- | -- | -- |
| 19-Dec-23 | 256.779 | Dry | -- | 257.19 |
| 21-Mar-24 | 256.829 | Dry | -- | 256.794 |
| 18-Jun-24 | 256.829 | Dry | -- | 256.602 |
| 20-Sep-24 | 256.759 | Dry | -- | 256.522 |

## Water Level Monitoring

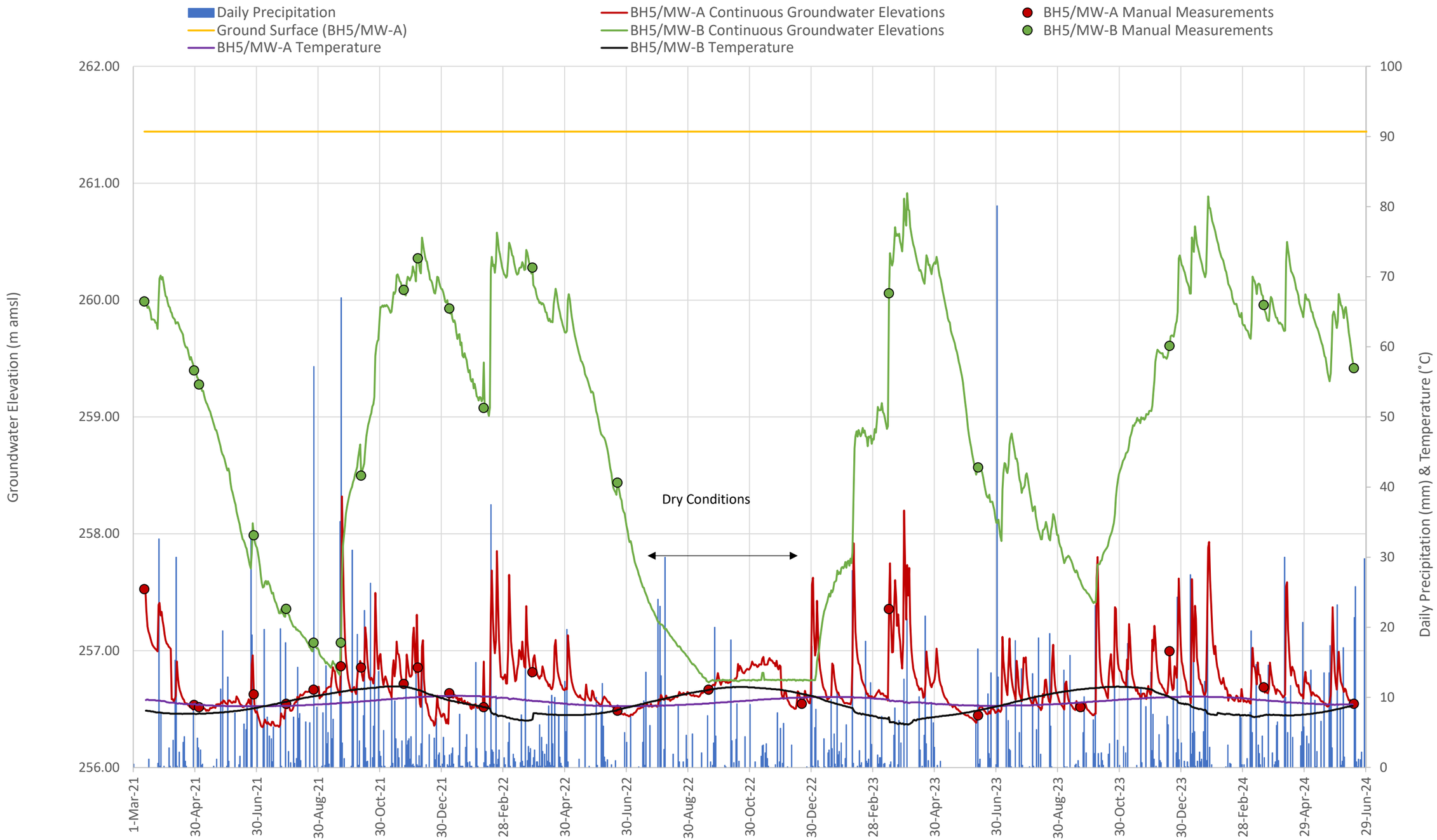
| Well ID | P1 Inside |
|---|---|
| *Groundwater Level (m bgs)* | |
| 12-Mar-21 | Installed |
| 30-Apr-21 | 1.09 |
| 5-May-21 | Dry |
| 28-Jun-21 | 0.95 |
| 30-Jul-21 | 0.95 |
| 26-Aug-21 | 0.87 |
| 22-Sep-21 | 0.92 |
| 12-Oct-21 | 0.61 |
| 23-Nov-21 | 0.77 |
| 7-Dec-21 | 0.67 |
| 7-Jan-22 | 0.93 |
| 10-Feb-22 | Frozen |
| 30-Mar-22 | 0.72 |
| 22-Jun-22 | 1.11 |
| 20-Sep-22 | 1.15 |
| 21-Dec-22 | 1.05 |
| 17-Mar-23 | 0.97 |
| 13-Jun-23 | Dry |
| 22-Sep-23 | -- |
| 19-Dec-23 | 0.93 |
| 21-Mar-24 | 0.88 |
| 18-Jun-24 | 0.88 |
| 20-Sep-24 | 1.83 |

Notes:
-- indicates not measured

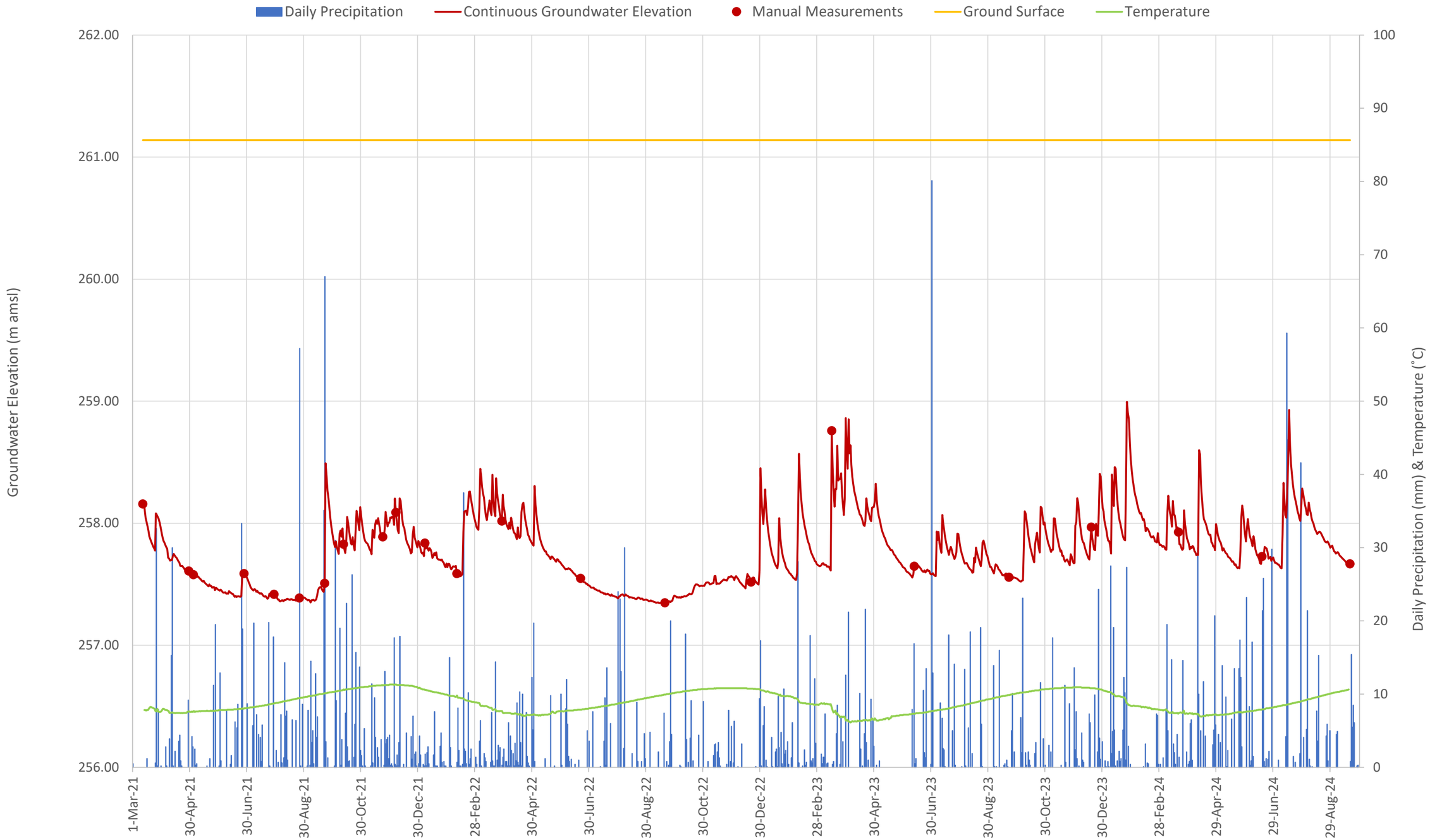
## Hydrograph 1: BH2/MW



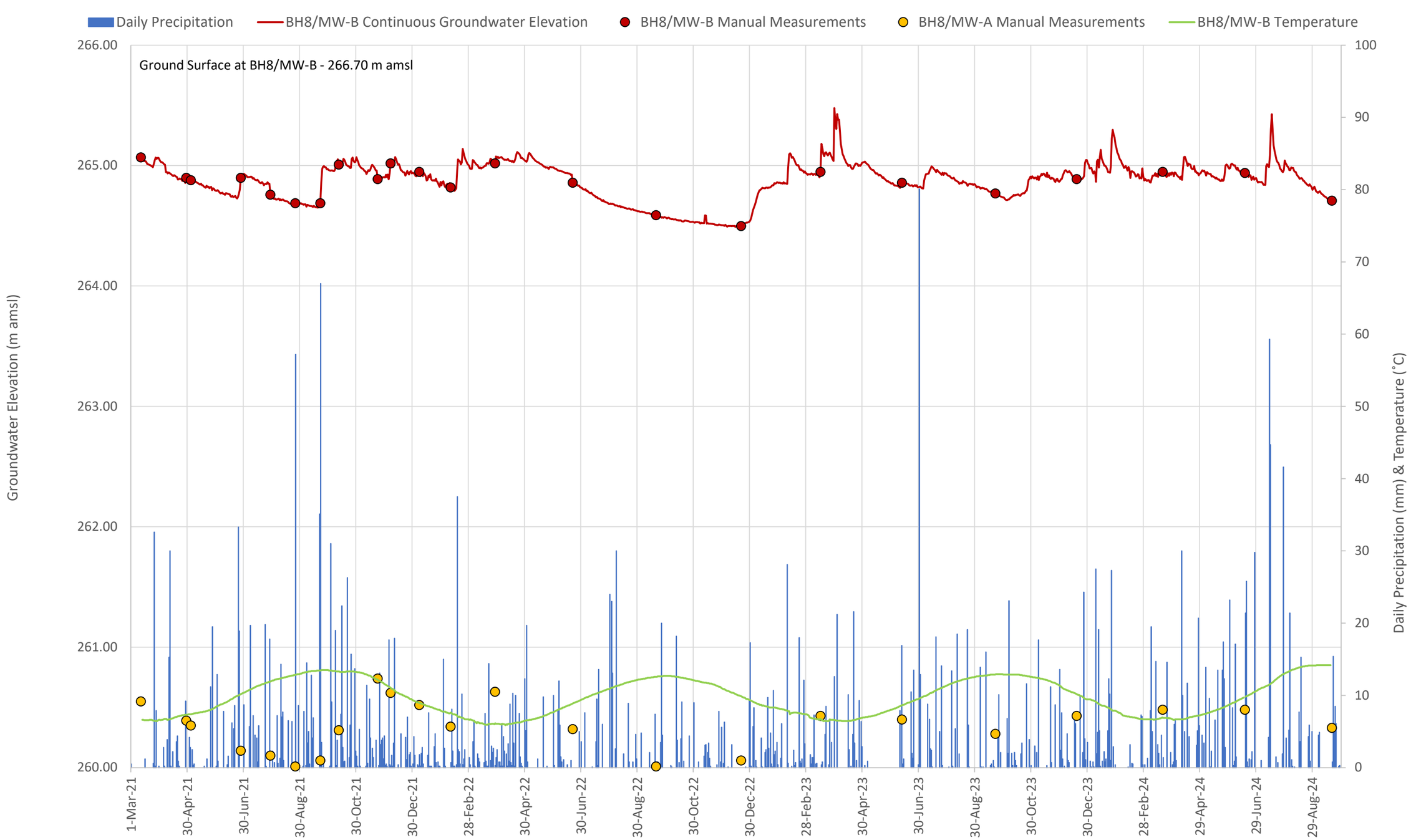
## Hydrograph 2: BH5/MW-A/B



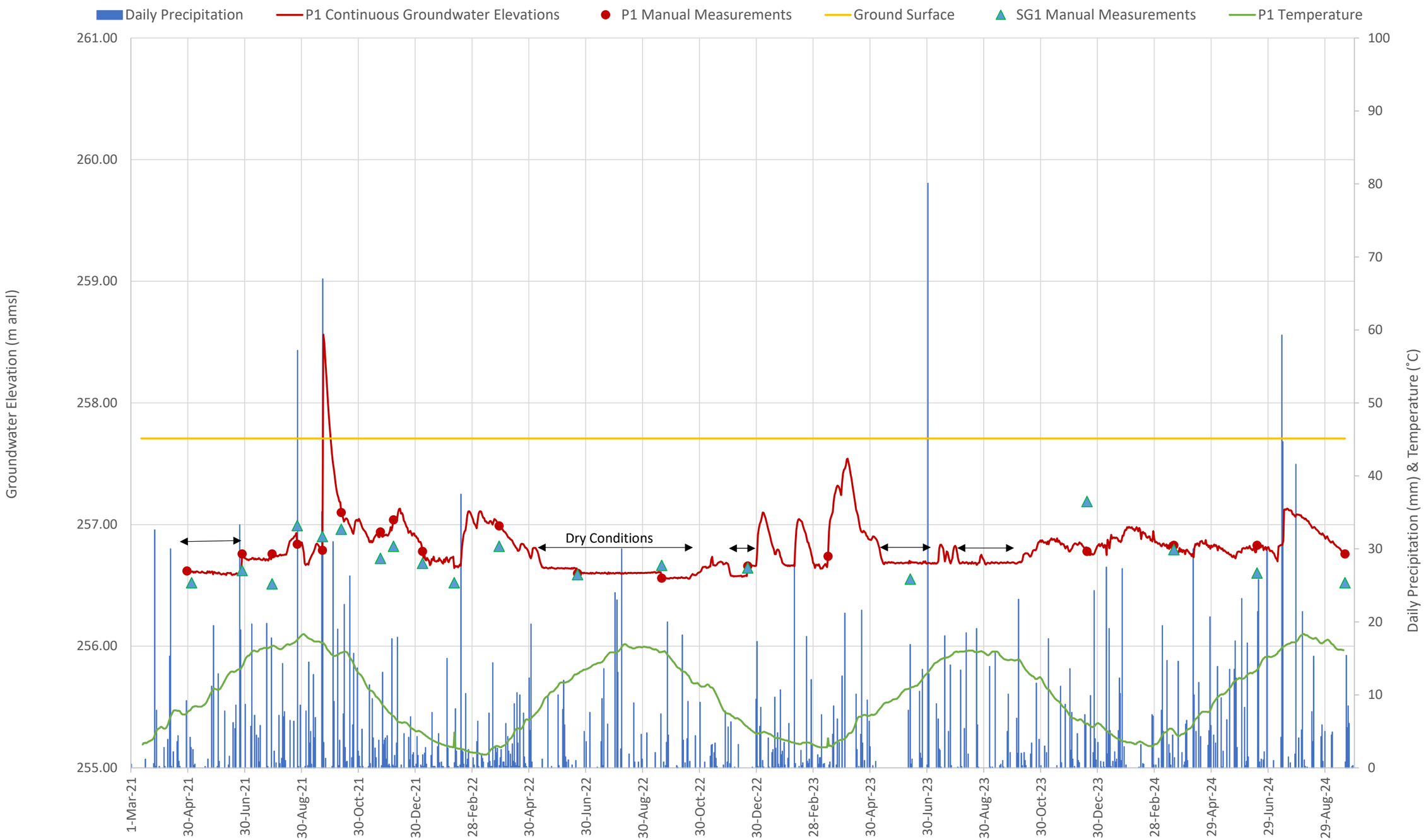
## Hydrograph 3: BH7/MW



## Hydrograph 4: BH8/MW-A/B



## Hydrograph 5: P1 & SG1



# Appendix H – Single Well Response Test Data

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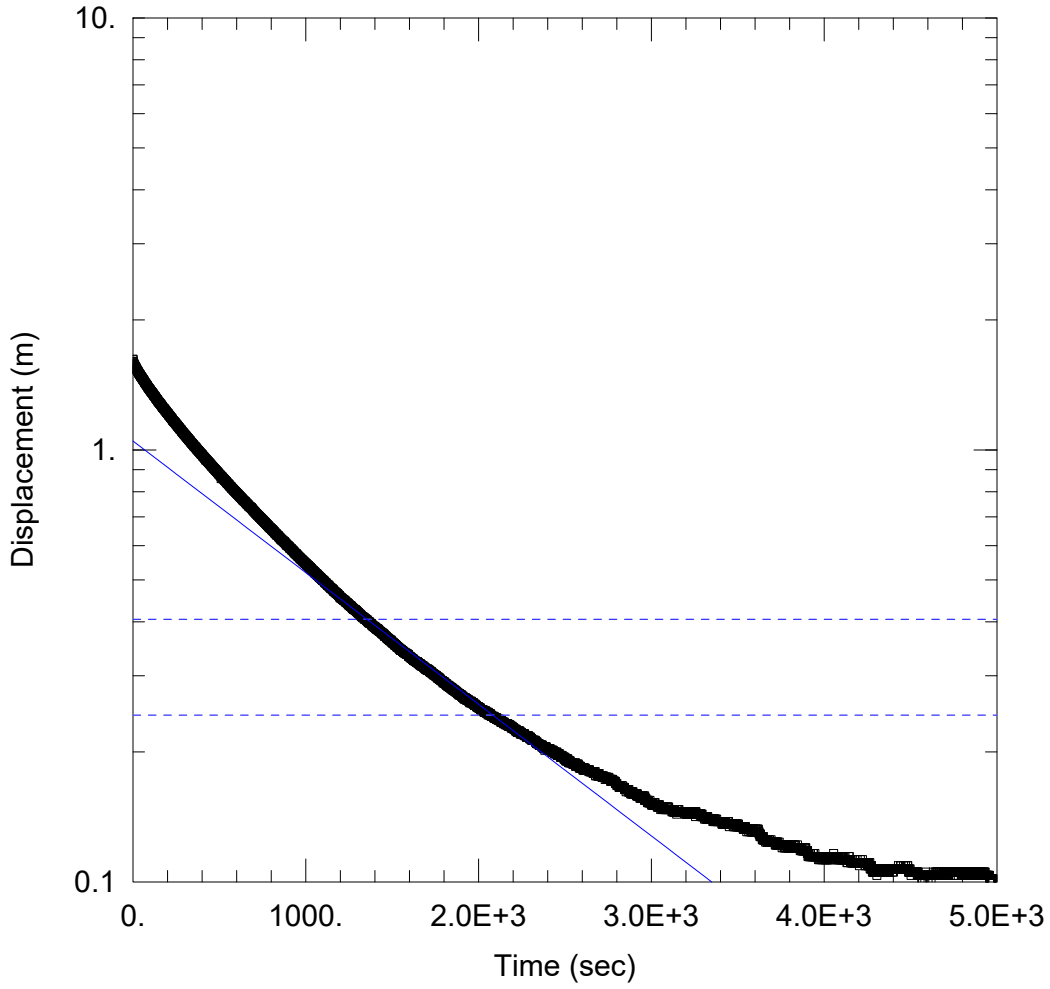



## RISING HEAD TEST

Data Set: \...\BH5B.aqt
Date: 04/08/22 Time: 13:29:46

## PROJECT INFORMATION

Company: EXP Services Inc.
Client: Bridle Path North Arva Inc.
Project: KCH-21002415-A0
Location: Medway Rd. Arva, Ontario
Test Date: March 30, 2022

## AQUIFER DATA

Saturated Thickness: 3.342 m Anisotropy Ratio (Kz/Kr): 0.3

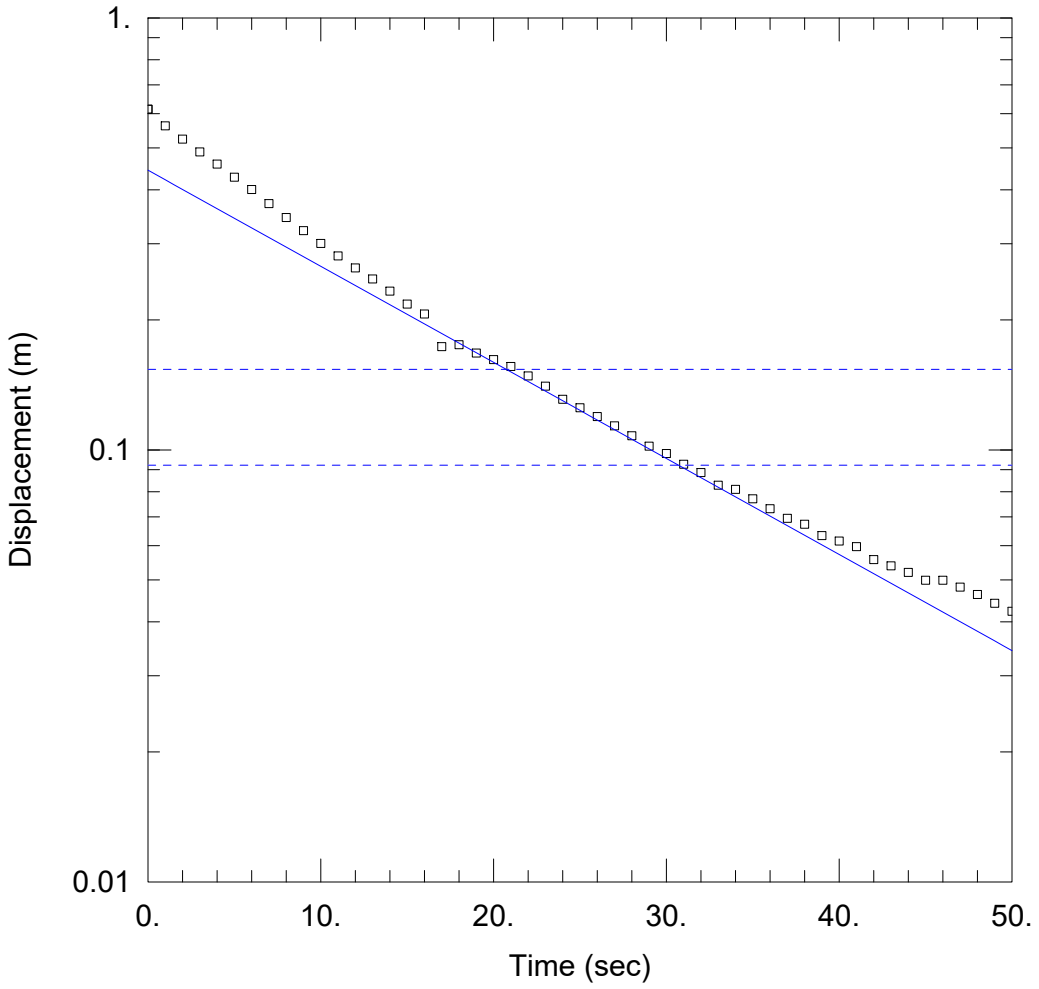
## WELL DATA (BH5/MW-B)

Initial Displacement: 1.622 m
Total Well Penetration Depth: 3.342 m
Casing Radius: 0.0254 m
Static Water Column Height: 3.342 m
Screen Length: 1.524 m
Well Radius: 0.1048 m

## SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 5.9E-7 m/sec y0 = 1.049 m




## RISING HEAD TEST 1

Data Set: \...\BH6.aqt
Date: 04/08/22 Time: 13:32:15

## PROJECT INFORMATION

Company: EXP Services Inc.
Client: Bridle Path North Arva Inc.
Project: KCH-21002415-A0
Location: Medway Rd. Arva, Ontario
Test Date: March 30, 2022

## AQUIFER DATA

Saturated Thickness: 3.56 m Anisotropy Ratio (Kz/Kr): 0.4

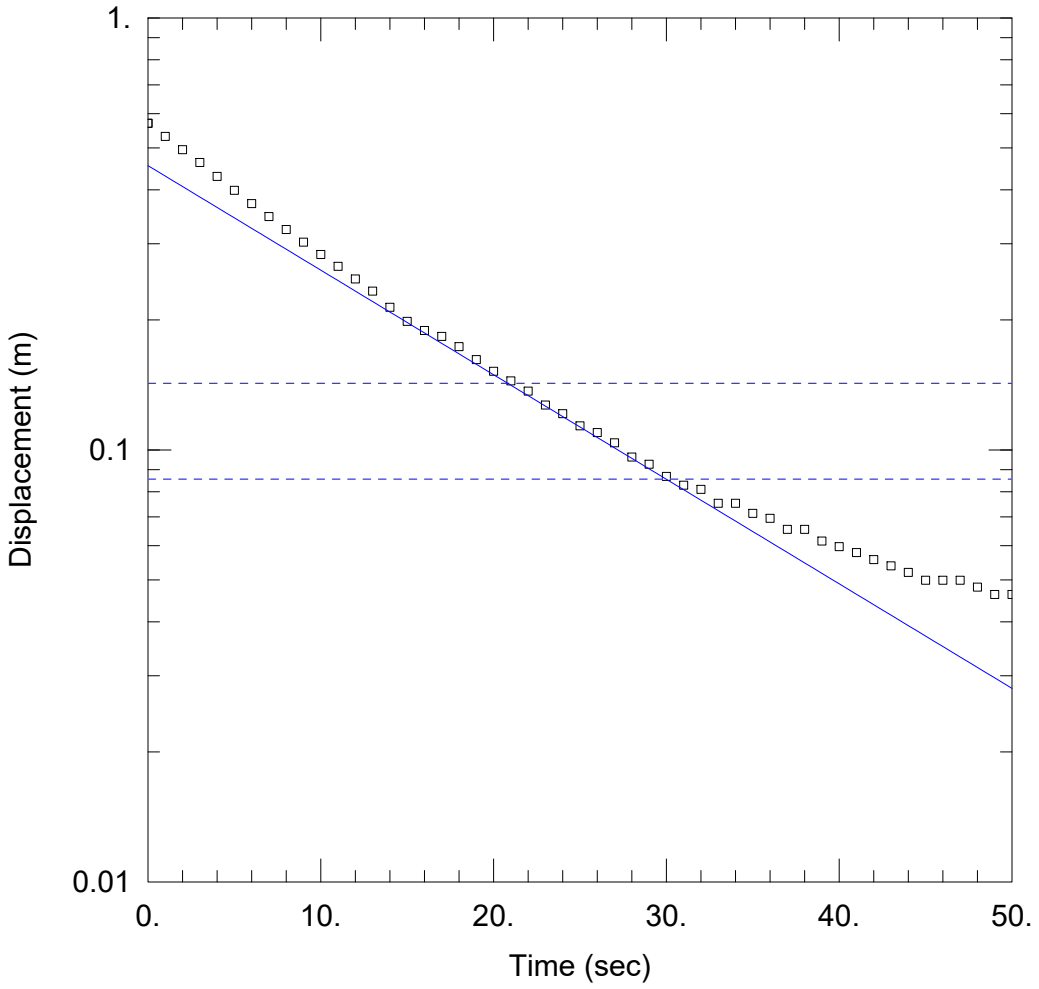
## WELL DATA (BH6/MW)

Initial Displacement: 0.6147 m
Total Well Penetration Depth: 3.056 m
Casing Radius: 0.0254 m
Static Water Column Height: 3.056 m
Screen Length: 1.524 m
Well Radius: 0.1048 m

## SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 3.4E-5 m/sec y0 = 0.444 m




## RISING HEAD TEST 2

Data Set: \...\BH6_2.aqt
Date: 04/08/22 Time: 13:34:11

## PROJECT INFORMATION

Company: EXP Services Inc.
Client: Bridle Path North Arva Inc.
Project: KCH-21002415-A0
Location: Medway Rd. Arva, Ontario
Test Date: March 30, 2022

## AQUIFER DATA

Saturated Thickness: 3.56 m Anisotropy Ratio (Kz/Kr): 0.4

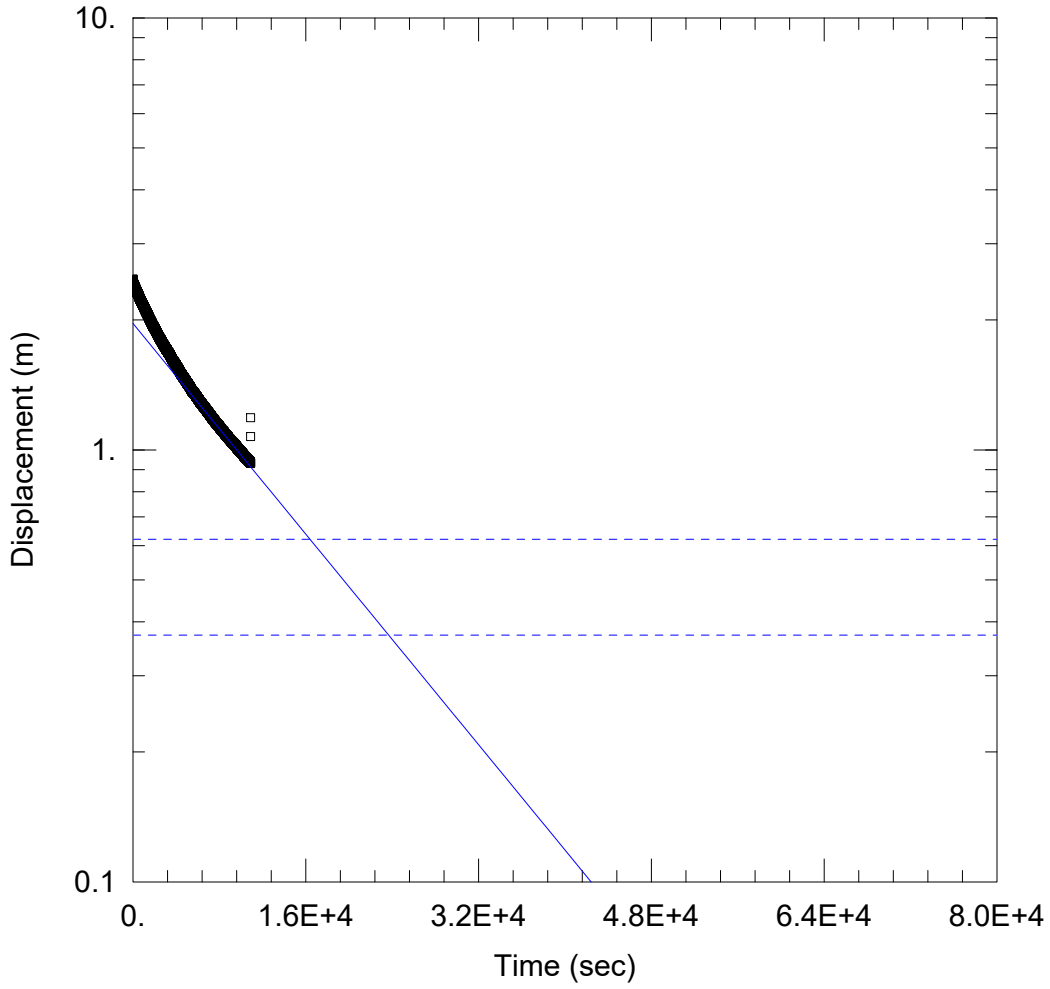
## WELL DATA (BH6/MW)

Initial Displacement: 0.5705 m
Total Well Penetration Depth: 3.056 m
Casing Radius: 0.0254 m
Static Water Column Height: 3.056 m
Screen Length: 1.524 m
Well Radius: 0.1048 m

## SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 3.7E-5 m/sec y0 = 0.455 m




## RISING HEAD TEST

Data Set: \...\BH8A.aqt
Date: 04/08/22 Time: 13:37:37

## PROJECT INFORMATION

Company: EXP Services Inc.
Client: Bridle Path North Arva Inc.
Project: KCH-21002415-A0
Location: Medway Rd. Arva, Ontario
Test Date: March 30, 2022

## AQUIFER DATA

Saturated Thickness: 6.82 m Anisotropy Ratio (Kz/Kr): 0.2

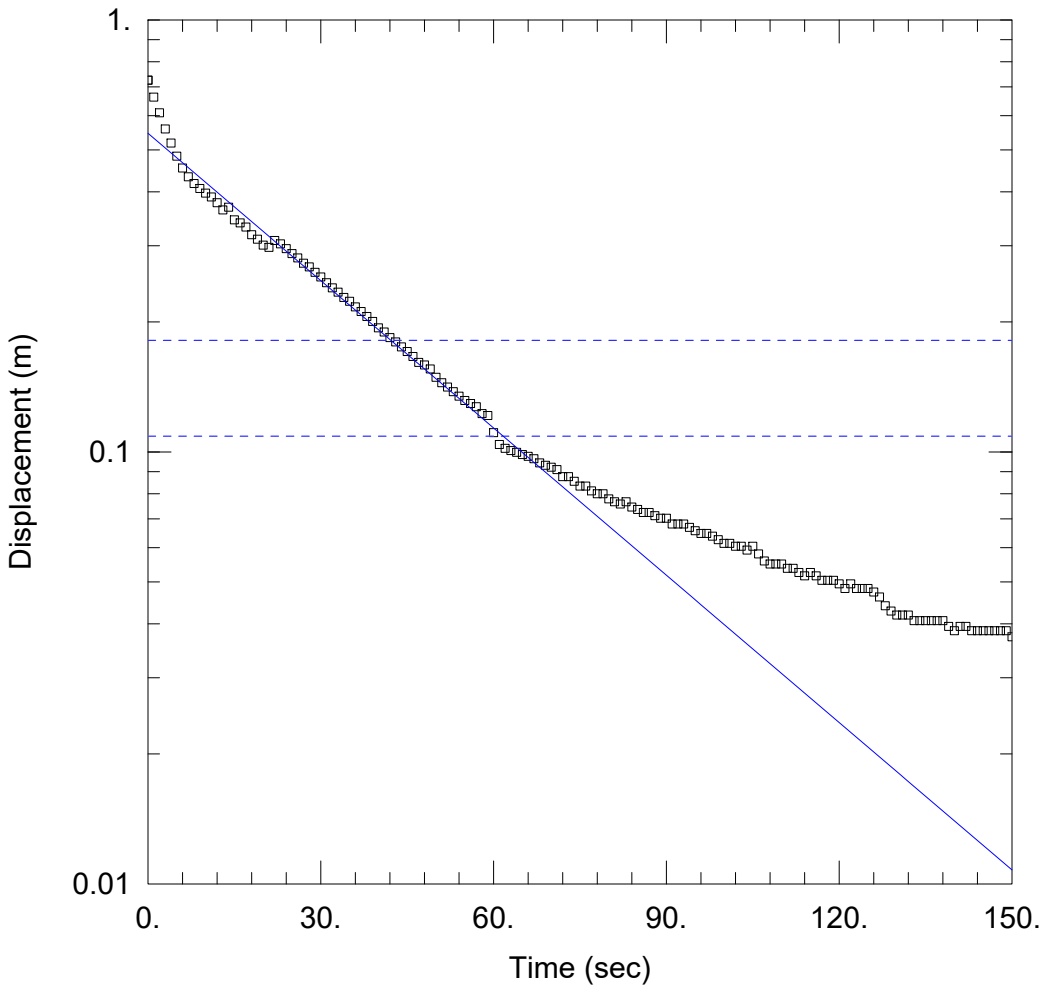
## WELL DATA (BH8/MW-A)

Initial Displacement: 2.485 m
Total Well Penetration Depth: 6.308 m
Casing Radius: 0.0254 m
Static Water Column Height: 6.31 m
Screen Length: 3.048 m
Well Radius: 0.1048 m

## SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 3.1E-8 m/sec y0 = 1.962 m




## RISING HEAD TEST

Data Set: \...\BH8B.aqt
Date: 04/08/22 Time: 13:42:18

## PROJECT INFORMATION

Company: EXP Services Inc.
Client: Bridle Path North Arva Inc.
Project: KCH-21002415-A0
Location: Medway Rd. Arva, Ontario
Test Date: March 30, 2022

## AQUIFER DATA

Saturated Thickness: 1.248 m Anisotropy Ratio (Kz/Kr): 0.35

## WELL DATA (BH8/MW-B)

Initial Displacement: 0.7253 m
Total Well Penetration Depth: 1.248 m
Casing Radius: 0.0254 m
Static Water Column Height: 1.248 m
Screen Length: 1.248 m
Well Radius: 0.1048 m
Gravel Pack Porosity: 0.3

## SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 0.0002082 m/sec y0 = 0.5465 m

# Appendix I – Water Quality Analytical Results, Piper & Schoeller Diagrams

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**Groundwater Quality Results**
**Medway Creek,**
**Arva, ON**
**Project No. KCH-21002415-A0**

| CRITERIA | ODWQS | UNITS | 12-Mar-21 BH5/MW-A | 12-Oct-21 BH5/MW-A | 12-Mar-21 BH5/MW-B | 12-Oct-21 BH5/MW-B | 12-Mar-21 BH7/MW | 12-Oct-21 BH7/MW | 12-Mar-21 BH8/MW-B | 12-Oct-21 BH8/MW-B |
|---|---|---|---|---|---|---|---|---|---|---|
| **Calculated Parameters** | | | | | | | | | | |
| Anion Sum | - | me/L | 12.9 | 6 | 6.02 | 5.68 | 10.3 | 9.8 | 9.5 | 11 |
| Bicarb. Alkalinity (calc. as CaCO3) | - | mg/L | 260 | 240 | 270 | 260 | 370 | 380 | 240 | 300 |
| Calculated TDS | - | mg/L | 790 | 330 | 330 | 300 | 560 | 530 | 530 | 620 |
| Carb. Alkalinity (calc. as CaCO3) | - | mg/L | 2.2 | 2.5 | 2.6 | 2.9 | 2.3 | 3.1 | 2.2 | 2.7 |
| Cation Sum | - | me/L | 12.7 | 6.2 | 6.51 | 5.81 | 9.97 | 10.1 | 9.65 | 11.2 |
| Hardness (CaCO3) | - | mg/L | 290 | 300 | 320 | 280 | 450 | 440 | 280 | 370 |
| Ion Balance (% Difference) | - | % | 0.99 | 1.66 | 3.88 | 1.14 | 1.65 | 1.71 | 0.77 | 0.95 |
| Langelier Index (@ 20C) | - | N/A | 0.774 | 0.967 | 1.03 | 1.04 | 1.09 | 1.22 | 0.875 | 1.06 |
| Langelier Index (@ 4C) | - | N/A | 0.527 | 0.718 | 0.78 | 0.789 | 0.846 | 0.974 | 0.627 | 0.815 |
| Saturation pH (@ 20C) | - | N/A | 7.17 | 7.08 | 6.98 | 7.04 | 6.74 | 6.72 | 7.11 | 6.91 |
| Saturation pH (@ 4C) | - | N/A | 7.42 | 7.33 | 7.23 | 7.29 | 6.99 | 6.97 | 7.36 | 7.16 |
| **Inorganics** | | | | | | | | | | |
| Total Ammonia-N | - | mg/L | <0.050 | <0.050 | <0.050 | 0.091 | <0.050 | 0.19 | <0.050 | <0.050 |
| Conductivity | - | umho/cm | 1200 | 560 | 590 | 510 | 1000 | 890 | 1100 | 1100 |
| Dissolved Organic Carbon | - | mg/L | 21 | 0.87 | 0.87 | 0.67 | 1.8 | 1.9 | 1.6 | 1.4 |
| Orthophosphate (P) | - | mg/L | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| pH | - | pH | 7.94 | 8.05 | 8.01 | 8.08 | 7.83 | 7.94 | 7.99 | 7.97 |
| Dissolved Sulphate (SO4) | - | mg/L | 320 | 20 | 6.5 | 4.8 | 88 | 36 | 14 | 11 |
| Alkalinity (Total as CaCO3) | - | mg/L | 260 | 240 | 270 | 260 | 370 | 380 | 240 | 300 |
| Dissolved Chloride (Cl-) | - | mg/L | 35 | 9.5 | 7 | 3.5 | 24 | 41 | 140 | 140 |
| Nitrite (N) | 1 | mg/L | 0.132 | 0.018 | <0.010 | 0.016 | <0.010 | 0.016 | <0.010 | <0.010 |
| Nitrate (N) | 10 | mg/L | 1.1 | 6.63 | 3.97 | 2.92 | 5.59 | 3.06 | 5.49 | **11** |
| Nitrate + Nitrite (N) | - | mg/L | 1.24 | 6.64 | 3.97 | 2.94 | 5.59 | 3.08 | 5.49 | 11 |
| **Metals** | | | | | | | | | | |
| Dissolved Aluminum (Al) | - | ug/L | 7.8 | <4.9 | 8.8 | 5.4 | 6.6 | <4.9 | 8.1 | 7.1 |
| Dissolved Antimony (Sb) | 6 | ug/L | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| Dissolved Arsenic (As) | 10 | ug/L | 1.3 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Dissolved Barium (Ba) | 1000 | ug/L | 67 | 29 | 21 | 13 | 110 | 66 | 42 | 43 |
| Dissolved Beryllium (Be) | - | ug/L | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 |
| Dissolved Boron (B) | 5000 | ug/L | 40 | 10 | 12 | 11 | 20 | 20 | 17 | 30 |
| Dissolved Cadmium (Cd) | 5 | ug/L | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | 0.095 | <0.090 | <0.090 |
| Dissolved Calcium (Ca) | - | ug/L | 85000 | 91000 | 100000 | 91000 | 150000 | 150000 | 94000 | 130000 |
| Dissolved Chromium (Cr) | 50 | ug/L | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Dissolved Cobalt (Co) | - | ug/L | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| Dissolved Copper (Cu) | - | ug/L | 1 | 1.3 | <0.90 | <0.90 | 1.4 | 2.1 | 1.1 | 1.1 |
| Dissolved Iron (Fe) | - | ug/L | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 |
| Dissolved Lead (Pb) | 10 | ug/L | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| Dissolved Magnesium (Mg) | - | ug/L | 19000 | 17000 | 14000 | 14000 | 18000 | 18000 | 11000 | 13000 |
| Dissolved Manganese (Mn) | - | ug/L | 28 | <2.0 | <2.0 | <2.0 | 16 | 21 | <2.0 | <2.0 |
| Dissolved Molybdenum (Mo) | - | ug/L | 10 | 0.68 | 0.75 | <0.50 | 0.73 | <0.50 | 0.77 | 0.78 |
| Dissolved Nickel (Ni) | - | ug/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 1 | <1.0 | <1.0 |
| Dissolved Phosphorus (P) | - | ug/L | 110 | <100 | <100 | <100 | 110 | <100 | <100 | <100 |
| Dissolved Potassium (K) | - | ug/L | 3000 | 1300 | 610 | 530 | 14000 | 8800 | 3000 | 3300 |
| Dissolved Selenium (Se) | 50 | ug/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| Dissolved Silicon (Si) | - | ug/L | 5000 | 5200 | 4400 | 5800 | 4000 | 3900 | 2500 | 3600 |
| Dissolved Silver (Ag) | - | ug/L | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 |
| Dissolved Sodium (Na) | - | ug/L | 160000 | 5100 | 3600 | 2300 | 15000 | 23000 | 92000 | 87000 |
| Dissolved Strontium (Sr) | - | ug/L | 130 | 95 | 83 | 80 | 200 | 180 | 110 | 130 |
| Dissolved Thallium (Tl) | - | ug/L | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Dissolved Titanium (Ti) | - | ug/L | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Dissolved Uranium (U) | 20 | ug/L | **21** | 1.7 | 0.64 | 0.47 | 1.3 | 0.89 | 0.55 | 0.67 |
| Dissolved Vanadium (V) | - | ug/L | <0.50 | <0.50 | <0.50 | 0.59 | <0.50 | <0.50 | <0.50 | <0.50 |
| Dissolved Zinc (Zn) | - | ug/L | <5.0 | 36 | <5.0 | <5.0 | <5.0 | 220 | <5.0 | 8.6 |

**TABLE NOTES:**

Results compared to Ontario Drinking Water Quality Standards (ODWQS).

**Values highlighted GREY and bold exceed parameter guidelines**

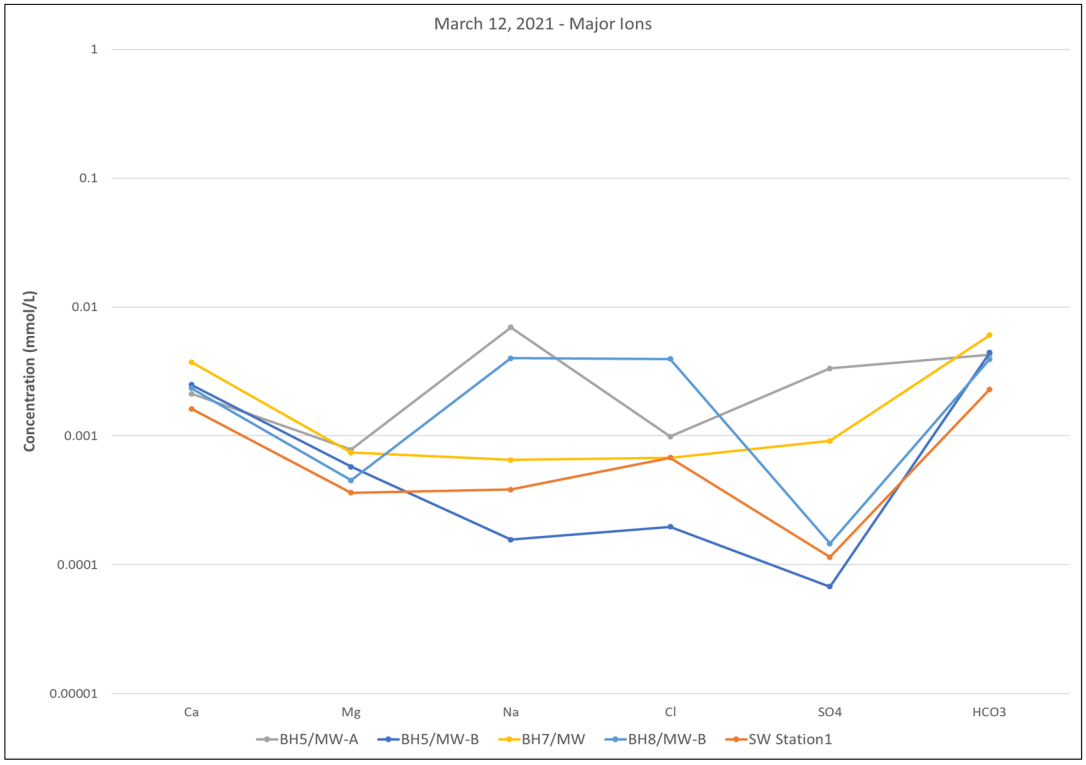
**Surface Water Quality Results**
**Medway Creek,**
**Arva, ON**
**Project No. KCH-21002415-A0**

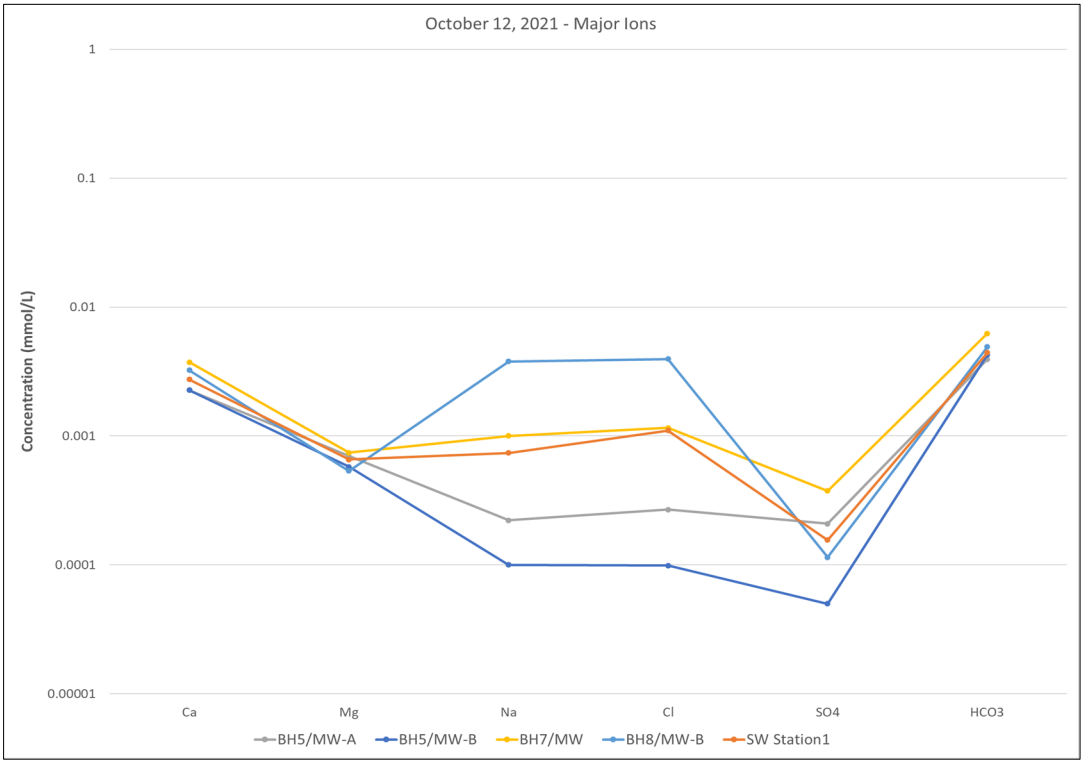
| CRITERIA | PWQO | UNITS | 12-Mar-21 | 12-Oct-21 |
|---|---|---|---|---|
| | | | SW Station1 | SW Station1 |
| **Calculated Parameters** | | | | |
| Bicarb. Alkalinity (calc. as CaCO3) | - | mg/L | 140 | 270 |
| Calculated TDS | - | mg/L | 250 | 420 |
| Carb. Alkalinity (calc. as CaCO3) | - | mg/L | 1.8 | 4.6 |
| Hardness (CaCO3) | - | mg/L | 200 | 350 |
| Langelier Index (@ 20C) | - | N/A | 0.703 | 1.29 |
| Langelier Index (@ 4C) | - | N/A | 0.453 | 1.04 |
| Saturation pH (@ 20C) | - | N/A | 7.43 | 6.96 |
| Saturation pH (@ 4C) | - | N/A | 7.68 | 7.21 |
| **Inorganics** | | | | |
| Total Ammonia-N | - | mg/L | <0.050 | <0.050 |
| Conductivity | - | umho/cm | 450 | 720 |
| Total Organic Carbon (TOC) | - | mg/L | 5.2 | 3.6 |
| Orthophosphate (P) | - | mg/L | 0.11 | 0.047 |
| pH | 6.5 - 8.5 | pH | 8.13 | 8.25 |
| Total Phosphorus | - | mg/L | 0.17 | 0.065 |
| Dissolved Sulphate (SO4) | - | mg/L | 11 | 15 |
| Turbidity | - | NTU | 16 | 3.5 |
| Alkalinity (Total as CaCO3) | - | mg/L | 150 | 280 |
| Dissolved Chloride (Cl-) | - | mg/L | 24 | 39 |
| Nitrite (N) | - | mg/L | 0.02 | 0.039 |
| Nitrate (N) | - | mg/L | 8.44 | 10.5 |
| **Metals** | | | | |
| Dissolved Calcium (Ca) | - | mg/L | 65 | 110 |
| Dissolved Magnesium (Mg) | - | mg/L | 8.8 | 16 |
| Dissolved Potassium (K) | - | mg/L | 3 | 3 |
| Dissolved Sodium (Na) | - | mg/L | 8.8 | 17 |
| Total Aluminum (Al) | 75 | ug/L | **900** | **130** |
| Total Antimony (Sb) | 20 | ug/L | <0.50 | <0.50 |
| Total Arsenic (As) | 5 | ug/L | <1.0 | <1.0 |
| Total Barium (Ba) | - | ug/L | 23 | 37 |
| Total Beryllium (Be) | 1100 | ug/L | <0.40 | <0.40 |
| Total Boron (B) | 200 | ug/L | 11 | 22 |
| Total Cadmium (Cd) | 0.5 | ug/L | <0.090 | <0.090 |
| Total Calcium (Ca) | - | ug/L | 64000 | 120000 |
| Total Chromium (Cr) | 8.9 | ug/L | <5.0 | <5.0 |
| Total Cobalt (Co) | 0.9 | ug/L | <0.50 | <0.50 |
| Total Copper (Cu) | 5 | ug/L | 2.5 | 1.6 |
| Total Iron (Fe) | 300 | ug/L | **990** | 160 |
| Total Lead (Pb) | 5 | ug/L | 0.68 | <0.50 |
| Total Magnesium (Mg) | - | ug/L | 9200 | 17000 |
| Total Manganese (Mn) | - | ug/L | 21 | 18 |
| Total Molybdenum (Mo) | 40 | ug/L | <0.50 | 0.5 |
| Total Nickel (Ni) | 25 | ug/L | 1.3 | 1.1 |
| Total Potassium (K) | - | ug/L | 3100 | 3100 |
| Total Selenium (Se) | 100 | ug/L | <2.0 | <2.0 |
| Total Silicon (Si) | - | ug/L | 3800 | 3800 |
| Total Silver (Ag) | 0.1 | ug/L | <0.090 | <0.090 |
| Total Sodium (Na) | - | ug/L | 8800 | 18000 |
| Total Strontium (Sr) | - | ug/L | 85 | 160 |
| Total Thallium (Tl) | 0.3 | ug/L | <0.050 | <0.050 |
| Total Titanium (Ti) | - | ug/L | 30 | 6.1 |
| Total Tungsten (W) | 30 | ug/L | - | <1.0 |
| Total Uranium (U) | 5 | ug/L | - | 1 |
| Total Vanadium (V) | 6 | ug/L | 2.2 | 1.1 |
| Total Zinc (Zn) | 20 | ug/L | 5.8 | 5.5 |
| Total Zirconium (Zr) | 4 | ug/L | - | <1.0 |

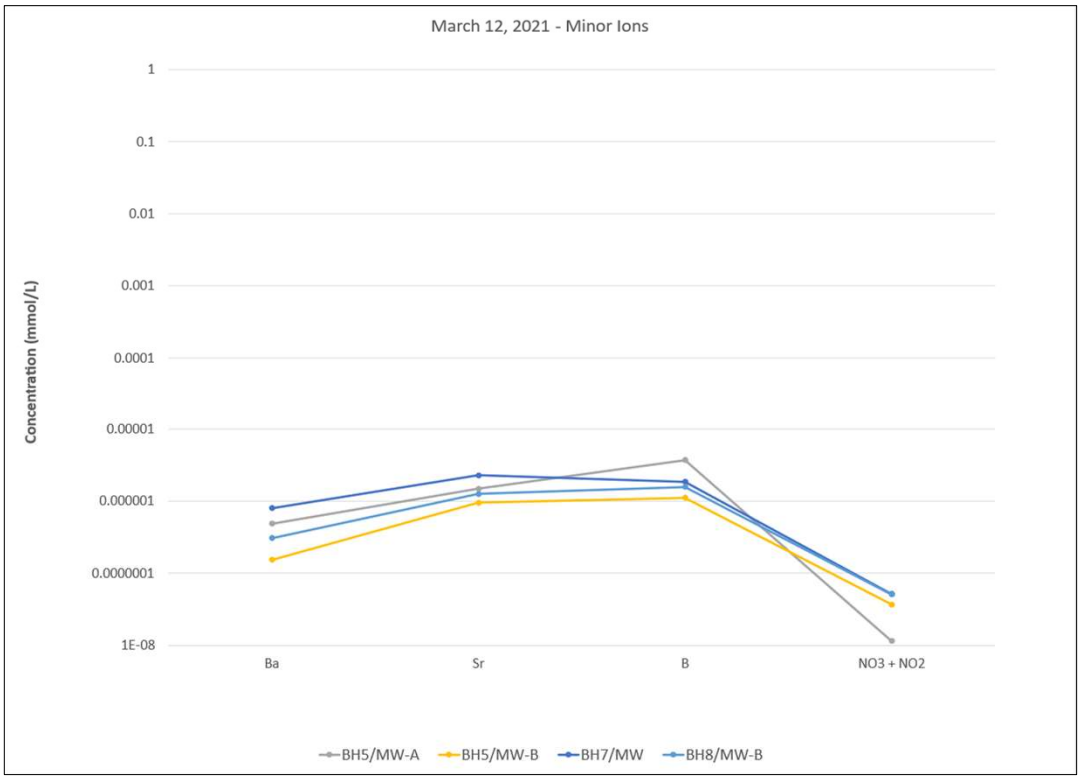
**TABLE NOTES:**

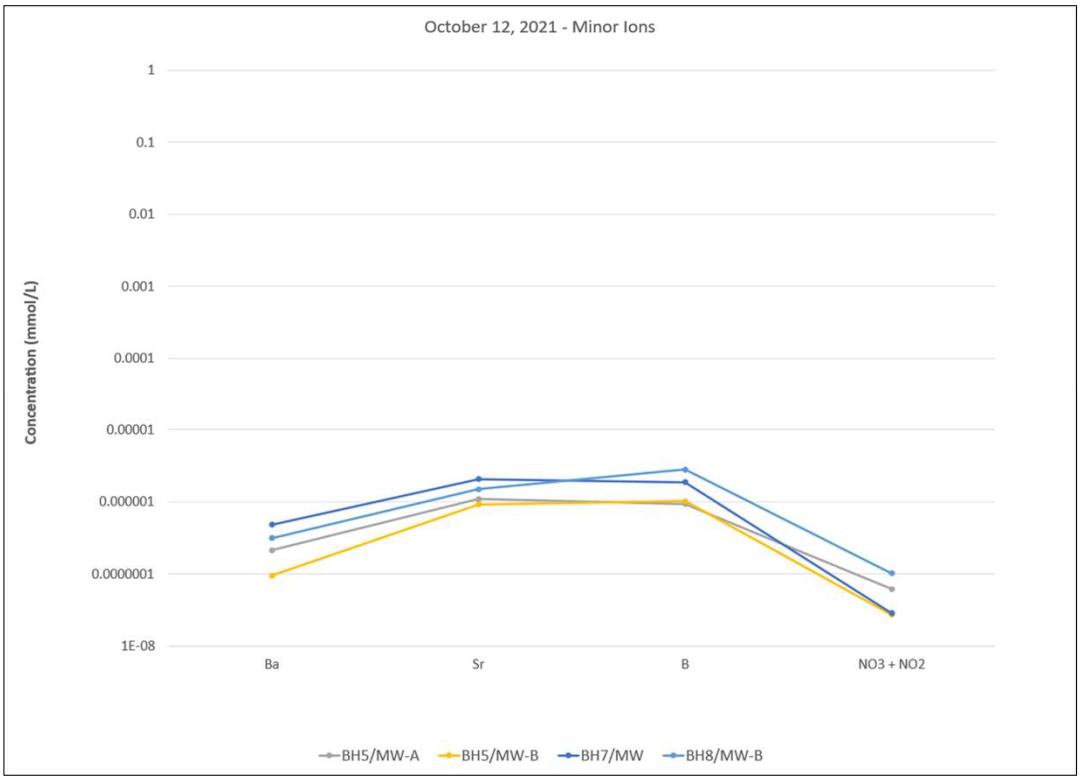
Results compared to Provincial Water Quality Objectives (PWQO), Ministry of the Environment and Energy (1994, revised 1999)

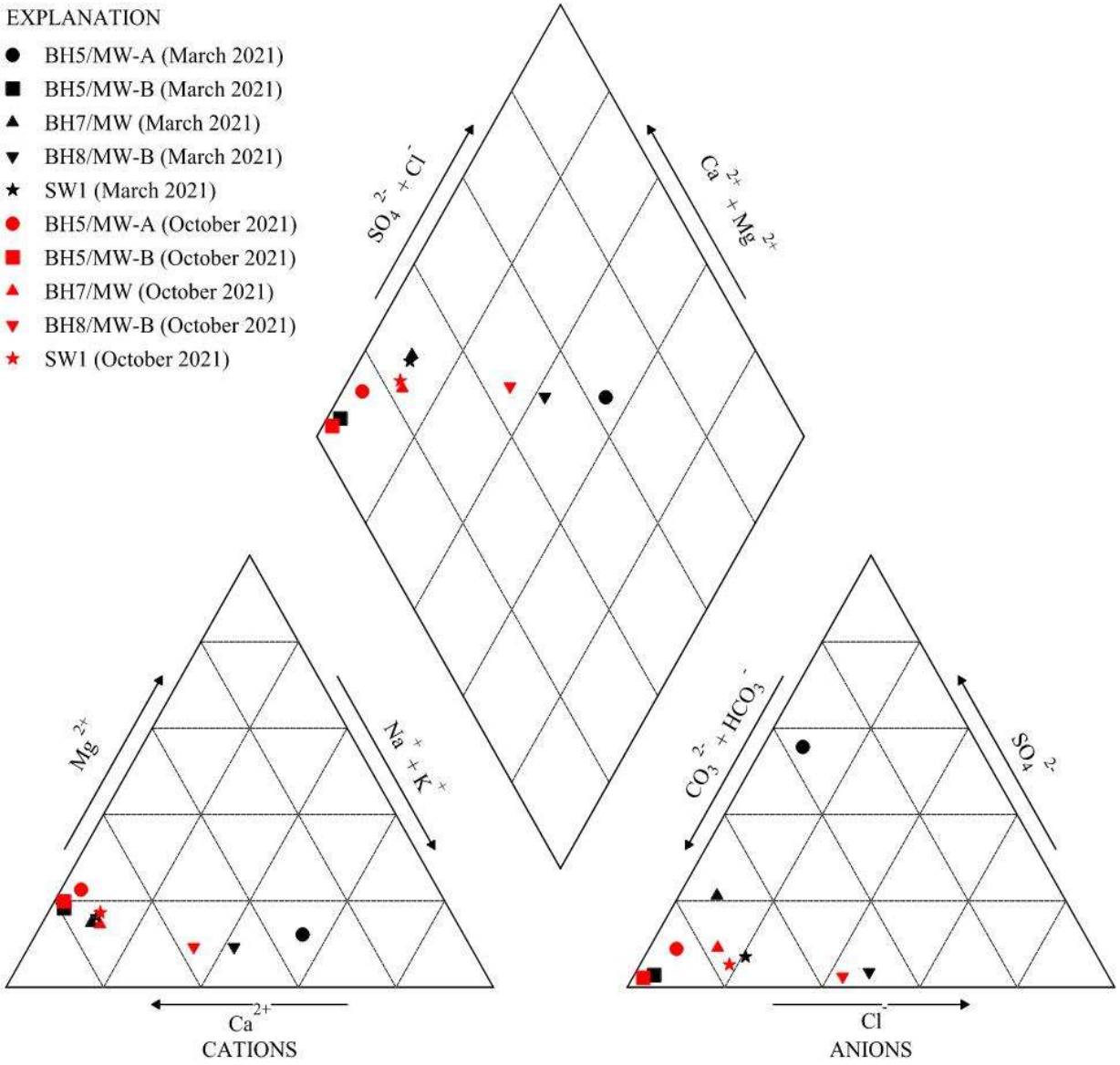
**Values highlighted GREY and bold exceed parameter guidelines**


March 12, 2021 - Major Ions
Concentration (mmol/L)
1
0.1
0.01
0.001
0.0001
0.00001
Ca
Mg
Na
Cl
SO4
HCO3
BH5/MW-A
BH5/MW-B
BH7/MW
BH8/MW-B
SW Station1


October 12, 2021 - Major Ions
Concentration (mmol/L)
1
0.1
0.01
0.001
0.0001
0.00001
Ca
Mg
Na
Cl
SO4
HCO3
BH5/MW-A
BH5/MW-B
BH7/MW
BH8/MW-B
SW Station1


March 12, 2021 - Minor Ions
Concentration (mmol/L)
1
0.1
0.01
0.001
0.0001
0.00001
0.000001
0.0000001
1E-08
Ba
Sr
B
NO3 + NO2
BH5/MW-A
BH5/MW-B
BH7/MW
BH8/MW-B


October 12, 2021 - Minor Ions
Concentration (mmol/L)
1
0.1
0.01
0.001
0.0001
0.00001
0.000001
0.0000001
1E-08
Ba
Sr
B
NO3 + NO2
BH5/MW-A
BH5/MW-B
BH7/MW
BH8/MW-B


EXPLANATION
BH5/MW-A (March 2021)
BH5/MW-B (March 2021)
BH7/MW (March 2021)
BH8/MW-B (March 2021)
SW1 (March 2021)
BH5/MW-A (October 2021)
BH5/MW-B (October 2021)
BH7/MW (October 2021)
BH8/MW-B (October 2021)
SW1 (October 2021)
$SO_4^{2-} + Cl^-$
$Ca^{2+} + Mg^{2+}$
$Mg^{2+}$
$Na^+ + K^+$
$Ca^{2+}$
CATIONS
$CO_3^{2-} + HCO_3^-$
$SO_4^{2-}$
$Cl^-$
ANIONS

# Appendix J – Laboratory Certificates of Analysis

6-405 Maple Grove Road | Cambridge, Ontario | Canada
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Your Project #: KCH-21002415
Site Location: MEDWAY ARVA
Your C.O.C. #: 849541-01-01

**Attention: David Leech**

exp Services Inc
London Branch
15701 Robin's Hill Rd
Unit 2
London, ON
CANADA N5V 0A5

**Report Date: 2021/10/21**
Report #: R6862289
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**BV LABS JOB #: C1T9445**
**Received: 2021/10/14, 13:59**

Sample Matrix: Water
# Samples Received: 5

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|---|---|---|---|---|
| Alkalinity | 5 | N/A | 2021/10/18 | CAM SOP-00448 | SM 23 2320 B m |
| Carbonate, Bicarbonate and Hydroxide | 5 | N/A | 2021/10/19 | CAM SOP-00102 | APHA 4500-CO2 D |
| Chloride by Automated Colourimetry | 2 | N/A | 2021/10/18 | CAM SOP-00463 | SM 23 4500-Cl E m |
| Chloride by Automated Colourimetry | 3 | N/A | 2021/10/19 | CAM SOP-00463 | SM 23 4500-Cl E m |
| Conductivity | 5 | N/A | 2021/10/18 | CAM SOP-00414 | SM 23 2510 m |
| Dissolved Organic Carbon (DOC) (1) | 1 | N/A | 2021/10/18 | CAM SOP-00446 | SM 23 5310 B m |
| Dissolved Organic Carbon (DOC) (1) | 3 | N/A | 2021/10/19 | CAM SOP-00446 | SM 23 5310 B m |
| Hardness (calculated as CaCO3) | 4 | N/A | 2021/10/19 | CAM SOP 00102/00408/00447 | SM 2340 B |
| Hardness (calculated as CaCO3) | 1 | N/A | 2021/10/21 | CAM SOP 00102/00408/00447 | SM 2340 B |
| Lab Filtered Metals Analysis by ICP | 1 | 2021/10/18 | 2021/10/20 | CAM SOP-00408 | EPA 6010D m |
| Lab Filtered Metals by ICPMS | 4 | 2021/10/18 | 2021/10/19 | CAM SOP-00447 | EPA 6020B m |
| Total Metals Analysis by ICPMS | 1 | N/A | 2021/10/19 | CAM SOP-00447 | EPA 6020B m |
| Ion Balance (% Difference) | 4 | N/A | 2021/10/19 | | |
| Anion and Cation Sum | 4 | N/A | 2021/10/19 | | |
| Total Ammonia-N | 5 | N/A | 2021/10/18 | CAM SOP-00441 | USGS I-2522-90 m |
| Nitrate & Nitrite as Nitrogen in Water (2) | 5 | N/A | 2021/10/19 | CAM SOP-00440 | SM 23 4500-NO3I/NO2B |
| pH | 5 | 2021/10/16 | 2021/10/18 | CAM SOP-00413 | SM 4500H+ B m |
| Orthophosphate | 3 | N/A | 2021/10/18 | CAM SOP-00461 | EPA 365.1 m |
| Orthophosphate | 2 | N/A | 2021/10/19 | CAM SOP-00461 | EPA 365.1 m |
| Sat. pH and Langelier Index (@ 20C) | 4 | N/A | 2021/10/19 | | Auto Calc |
| Sat. pH and Langelier Index (@ 20C) | 1 | N/A | 2021/10/21 | | Auto Calc |
| Sat. pH and Langelier Index (@ 4C) | 4 | N/A | 2021/10/19 | | Auto Calc |
| Sat. pH and Langelier Index (@ 4C) | 1 | N/A | 2021/10/21 | | Auto Calc |
| Sulphate by Automated Colourimetry | 3 | N/A | 2021/10/18 | CAM SOP-00464 | EPA 375.4 m |
| Sulphate by Automated Colourimetry | 2 | N/A | 2021/10/19 | CAM SOP-00464 | EPA 375.4 m |
| Total Dissolved Solids (TDS calc) | 4 | N/A | 2021/10/19 | | Auto Calc |
| Total Dissolved Solids (TDS calc) | 1 | N/A | 2021/10/21 | | Auto Calc |

Your Project #: KCH-21002415
Site Location: MEDWAY ARVA
Your C.O.C. #: 849541-01-01

**Attention: David Leech**

exp Services Inc
London Branch
15701 Robin's Hill Rd
Unit 2
London, ON
CANADA N5V 0A5

**Report Date: 2021/10/21**
Report #: R6862289
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**BV LABS JOB #: C1T9445**
**Received: 2021/10/14, 13:59**

Sample Matrix: Water
# Samples Received: 5

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|---|---|---|---|---|
| Total Organic Carbon (TOC) (3) | 1 | N/A | 2021/10/19 | CAM SOP-00446 | SM 23 5310B m |
| Total Phosphorus (Colourimetric) | 1 | 2021/10/19 | 2021/10/19 | CAM SOP-00407 | SM 23 4500 P B H m |
| Turbidity | 1 | N/A | 2021/10/19 | CAM SOP-00417 | SM 23 2130 B m |

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas 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 Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas 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.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas 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 Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas 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 Bureau Veritas, results relate to the supplied samples tested.

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) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(3) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.

Your Project #: KCH-21002415
Site Location: MEDWAY ARVA
Your C.O.C. #: 849541-01-01

**Attention: David Leech**

exp Services Inc
London Branch
15701 Robin's Hill Rd
Unit 2
London, ON
CANADA N5V 0A5

**Report Date: 2021/10/21**
Report #: R6862289
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**BV LABS JOB #: C1T9445**
**Received: 2021/10/14, 13:59**

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Christine Gripton, Senior Project Manager
Email: Christine.Gripton@bureauveritas.com
Phone# (519)652-9444
==========
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 Job #: C1T9445
Report Date: 2021/10/21

exp Services Inc
Client Project #: KCH-21002415
Site Location: MEDWAY ARVA
Sampler Initials: D.L

## RCAP - COMPREHENSIVE (LAB FILTERED)

| Bureau Veritas ID | | QYA121 | | QYA122 | | QYA123 | | |
|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2021/10/12 | | 2021/10/12 | | 2021/10/12 | | |
| COC Number | | 849541-01-01 | | 849541-01-01 | | 849541-01-01 | | |
| | UNITS | MW5A | QC Batch | MW5B | QC Batch | MW7 | RDL | QC Batch |
| **Calculated Parameters** | | | | | | | | |
| Anion Sum | me/L | 6.00 | 7639700 | 5.68 | 7639700 | 9.80 | N/A | 7639700 |
| Bicarb. Alkalinity (calc. as CaCO3) | mg/L | 240 | 7638709 | 260 | 7638709 | 380 | 1.0 | 7638709 |
| Calculated TDS | mg/L | 330 | 7639677 | 300 | 7639677 | 530 | 1.0 | 7639677 |
| Carb. Alkalinity (calc. as CaCO3) | mg/L | 2.5 | 7638709 | 2.9 | 7638709 | 3.1 | 1.0 | 7638709 |
| Cation Sum | me/L | 6.20 | 7639700 | 5.81 | 7639700 | 10.1 | N/A | 7639700 |
| Hardness (CaCO3) | mg/L | 300 | 7638721 | 280 | 7638721 | 440 | 1.0 | 7638721 |
| Ion Balance (% Difference) | % | 1.66 | 7639697 | 1.14 | 7639697 | 1.71 | N/A | 7639697 |
| Langelier Index (@ 20C) | N/A | 0.967 | 7639674 | 1.04 | 7639674 | 1.22 | | 7639674 |
| Langelier Index (@ 4C) | N/A | 0.718 | 7639675 | 0.789 | 7639675 | 0.974 | | 7639675 |
| Saturation pH (@ 20C) | N/A | 7.08 | 7639674 | 7.04 | 7639674 | 6.72 | | 7639674 |
| Saturation pH (@ 4C) | N/A | 7.33 | 7639675 | 7.29 | 7639675 | 6.97 | | 7639675 |
| **Inorganics** | | | | | | | | |
| Total Ammonia-N | mg/L | <0.050 | 7642803 | 0.091 | 7642803 | 0.19 | 0.050 | 7642803 |
| Conductivity | umho/cm | 560 | 7641358 | 510 | 7641358 | 890 | 1.0 | 7641358 |
| Dissolved Organic Carbon | mg/L | 0.87 | 7644270 | 0.67 | 7641760 | 1.9 | 0.40 | 7645607 |
| Orthophosphate (P) | mg/L | <0.010 | 7641389 | <0.010 | 7641411 | <0.010 | 0.010 | 7641411 |
| pH | pH | 8.05 | 7641359 | 8.08 | 7641359 | 7.94 | | 7641359 |
| Dissolved Sulphate (SO4) | mg/L | 20 | 7641388 | 4.8 | 7641410 | 36 | 1.0 | 7641410 |
| Alkalinity (Total as CaCO3) | mg/L | 240 | 7641353 | 260 | 7641353 | 380 | 1.0 | 7641353 |
| Dissolved Chloride (Cl-) | mg/L | 9.5 | 7641385 | 3.5 | 7641408 | 41 | 1.0 | 7641408 |
| Nitrite (N) | mg/L | 0.018 | 7641371 | 0.016 | 7641371 | 0.016 | 0.010 | 7641550 |
| Nitrate (N) | mg/L | 6.63 | 7641371 | 2.92 | 7641371 | 3.06 | 0.10 | 7641550 |
| Nitrate + Nitrite (N) | mg/L | 6.64 | 7641371 | 2.94 | 7641371 | 3.08 | 0.10 | 7641550 |
| **Metals** | | | | | | | | |
| Dissolved Aluminum (Al) | ug/L | <4.9 | 7644251 | 5.4 | 7644251 | <4.9 | 4.9 | 7644251 |
| Dissolved Antimony (Sb) | ug/L | <0.50 | 7644251 | <0.50 | 7644251 | <0.50 | 0.50 | 7644251 |
| Dissolved Arsenic (As) | ug/L | <1.0 | 7644251 | <1.0 | 7644251 | <1.0 | 1.0 | 7644251 |
| Dissolved Barium (Ba) | ug/L | 29 | 7644251 | 13 | 7644251 | 66 | 2.0 | 7644251 |
| Dissolved Beryllium (Be) | ug/L | <0.40 | 7644251 | <0.40 | 7644251 | <0.40 | 0.40 | 7644251 |
| Dissolved Boron (B) | ug/L | 10 | 7644251 | 11 | 7644251 | 20 | 10 | 7644251 |
| Dissolved Cadmium (Cd) | ug/L | <0.090 | 7644251 | <0.090 | 7644251 | 0.095 | 0.090 | 7644251 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable



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Bureau Veritas Job #: C1T9445
Report Date: 2021/10/21

exp Services Inc
Client Project #: KCH-21002415
Site Location: MEDWAY ARVA
Sampler Initials: D.L

## RCAP - COMPREHENSIVE (LAB FILTERED)

| Bureau Veritas ID | | QYA121 | | QYA122 | | QYA123 | | |
|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2021/10/12 | | 2021/10/12 | | 2021/10/12 | | |
| COC Number | | 849541-01-01 | | 849541-01-01 | | 849541-01-01 | | |
| | UNITS | MW5A | QC Batch | MW5B | QC Batch | MW7 | RDL | QC Batch |
| Dissolved Calcium (Ca) | ug/L | 91000 | 7644251 | 91000 | 7644251 | 150000 | 200 | 7644251 |
| Dissolved Chromium (Cr) | ug/L | <5.0 | 7644251 | <5.0 | 7644251 | <5.0 | 5.0 | 7644251 |
| Dissolved Cobalt (Co) | ug/L | <0.50 | 7644251 | <0.50 | 7644251 | <0.50 | 0.50 | 7644251 |
| Dissolved Copper (Cu) | ug/L | 1.3 | 7644251 | <0.90 | 7644251 | 2.1 | 0.90 | 7644251 |
| Dissolved Iron (Fe) | ug/L | <100 | 7644251 | <100 | 7644251 | <100 | 100 | 7644251 |
| Dissolved Lead (Pb) | ug/L | <0.50 | 7644251 | <0.50 | 7644251 | <0.50 | 0.50 | 7644251 |
| Dissolved Magnesium (Mg) | ug/L | 17000 | 7644251 | 14000 | 7644251 | 18000 | 50 | 7644251 |
| Dissolved Manganese (Mn) | ug/L | <2.0 | 7644251 | <2.0 | 7644251 | 21 | 2.0 | 7644251 |
| Dissolved Molybdenum (Mo) | ug/L | 0.68 | 7644251 | <0.50 | 7644251 | <0.50 | 0.50 | 7644251 |
| Dissolved Nickel (Ni) | ug/L | <1.0 | 7644251 | <1.0 | 7644251 | 1.0 | 1.0 | 7644251 |
| Dissolved Phosphorus (P) | ug/L | <100 | 7644251 | <100 | 7644251 | <100 | 100 | 7644251 |
| Dissolved Potassium (K) | ug/L | 1300 | 7644251 | 530 | 7644251 | 8800 | 200 | 7644251 |
| Dissolved Selenium (Se) | ug/L | <2.0 | 7644251 | <2.0 | 7644251 | <2.0 | 2.0 | 7644251 |
| Dissolved Silicon (Si) | ug/L | 5200 | 7644251 | 5800 | 7644251 | 3900 | 50 | 7644251 |
| Dissolved Silver (Ag) | ug/L | <0.090 | 7644251 | <0.090 | 7644251 | <0.090 | 0.090 | 7644251 |
| Dissolved Sodium (Na) | ug/L | 5100 | 7644251 | 2300 | 7644251 | 23000 | 100 | 7644251 |
| Dissolved Strontium (Sr) | ug/L | 95 | 7644251 | 80 | 7644251 | 180 | 1.0 | 7644251 |
| Dissolved Thallium (Tl) | ug/L | <0.050 | 7644251 | <0.050 | 7644251 | <0.050 | 0.050 | 7644251 |
| Dissolved Titanium (Ti) | ug/L | <5.0 | 7644251 | <5.0 | 7644251 | <5.0 | 5.0 | 7644251 |
| Dissolved Uranium (U) | ug/L | 1.7 | 7644251 | 0.47 | 7644251 | 0.89 | 0.10 | 7644251 |
| Dissolved Vanadium (V) | ug/L | <0.50 | 7644251 | 0.59 | 7644251 | <0.50 | 0.50 | 7644251 |
| Dissolved Zinc (Zn) | ug/L | 36 | 7644251 | <5.0 | 7644251 | 220 | 5.0 | 7644251 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch



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Bureau Veritas Job #: C1T9445
Report Date: 2021/10/21

exp Services Inc
Client Project #: KCH-21002415
Site Location: MEDWAY ARVA
Sampler Initials: D.L

## RCAP - COMPREHENSIVE (LAB FILTERED)

| Bureau Veritas ID | | QYA124 | | |
|---|---|---|---|---|
| Sampling Date | | 2021/10/12 | | |
| COC Number | | 849541-01-01 | | |
| | UNITS | MW8B | RDL | QC Batch |
| **Calculated Parameters** | | | | |
| Anion Sum | me/L | 11.0 | N/A | 7639700 |
| Bicarb. Alkalinity (calc. as CaCO3) | mg/L | 300 | 1.0 | 7638709 |
| Calculated TDS | mg/L | 620 | 1.0 | 7639677 |
| Carb. Alkalinity (calc. as CaCO3) | mg/L | 2.7 | 1.0 | 7638709 |
| Cation Sum | me/L | 11.2 | N/A | 7639700 |
| Hardness (CaCO3) | mg/L | 370 | 1.0 | 7638721 |
| Ion Balance (% Difference) | % | 0.950 | N/A | 7639697 |
| Langelier Index (@ 20C) | N/A | 1.06 | | 7639674 |
| Langelier Index (@ 4C) | N/A | 0.815 | | 7639675 |
| Saturation pH (@ 20C) | N/A | 6.91 | | 7639674 |
| Saturation pH (@ 4C) | N/A | 7.16 | | 7639675 |
| **Inorganics** | | | | |
| Total Ammonia-N | mg/L | <0.050 | 0.050 | 7642803 |
| Conductivity | umho/cm | 1100 | 1.0 | 7641358 |
| Dissolved Organic Carbon | mg/L | 1.4 | 0.40 | 7640257 |
| Orthophosphate (P) | mg/L | <0.010 | 0.010 | 7641411 |
| pH | pH | 7.97 | | 7641359 |
| Dissolved Sulphate (SO4) | mg/L | 11 | 1.0 | 7641410 |
| Alkalinity (Total as CaCO3) | mg/L | 300 | 1.0 | 7641353 |
| Dissolved Chloride (Cl-) | mg/L | 140 | 1.0 | 7641408 |
| Nitrite (N) | mg/L | <0.010 | 0.010 | 7641371 |
| Nitrate (N) | mg/L | 11.0 | 0.10 | 7641371 |
| Nitrate + Nitrite (N) | mg/L | 11.0 | 0.10 | 7641371 |
| **Metals** | | | | |
| Dissolved Aluminum (Al) | ug/L | 7.1 | 4.9 | 7644251 |
| Dissolved Antimony (Sb) | ug/L | <0.50 | 0.50 | 7644251 |
| Dissolved Arsenic (As) | ug/L | <1.0 | 1.0 | 7644251 |
| Dissolved Barium (Ba) | ug/L | 43 | 2.0 | 7644251 |
| Dissolved Beryllium (Be) | ug/L | <0.40 | 0.40 | 7644251 |
| Dissolved Boron (B) | ug/L | 30 | 10 | 7644251 |
| Dissolved Cadmium (Cd) | ug/L | <0.090 | 0.090 | 7644251 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable



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## RCAP - COMPREHENSIVE (LAB FILTERED)

| Bureau Veritas ID | | QYA124 | | |
|---|---|---|---|---|
| Sampling Date | | 2021/10/12 | | |
| COC Number | | 849541-01-01 | | |
| | UNITS | MW8B | RDL | QC Batch |
| Dissolved Calcium (Ca) | ug/L | 130000 | 200 | 7644251 |
| Dissolved Chromium (Cr) | ug/L | <5.0 | 5.0 | 7644251 |
| Dissolved Cobalt (Co) | ug/L | <0.50 | 0.50 | 7644251 |
| Dissolved Copper (Cu) | ug/L | 1.1 | 0.90 | 7644251 |
| Dissolved Iron (Fe) | ug/L | <100 | 100 | 7644251 |
| Dissolved Lead (Pb) | ug/L | <0.50 | 0.50 | 7644251 |
| Dissolved Magnesium (Mg) | ug/L | 13000 | 50 | 7644251 |
| Dissolved Manganese (Mn) | ug/L | <2.0 | 2.0 | 7644251 |
| Dissolved Molybdenum (Mo) | ug/L | 0.78 | 0.50 | 7644251 |
| Dissolved Nickel (Ni) | ug/L | <1.0 | 1.0 | 7644251 |
| Dissolved Phosphorus (P) | ug/L | <100 | 100 | 7644251 |
| Dissolved Potassium (K) | ug/L | 3300 | 200 | 7644251 |
| Dissolved Selenium (Se) | ug/L | <2.0 | 2.0 | 7644251 |
| Dissolved Silicon (Si) | ug/L | 3600 | 50 | 7644251 |
| Dissolved Silver (Ag) | ug/L | <0.090 | 0.090 | 7644251 |
| Dissolved Sodium (Na) | ug/L | 87000 | 100 | 7644251 |
| Dissolved Strontium (Sr) | ug/L | 130 | 1.0 | 7644251 |
| Dissolved Thallium (Tl) | ug/L | <0.050 | 0.050 | 7644251 |
| Dissolved Titanium (Ti) | ug/L | <5.0 | 5.0 | 7644251 |
| Dissolved Uranium (U) | ug/L | 0.67 | 0.10 | 7644251 |
| Dissolved Vanadium (V) | ug/L | <0.50 | 0.50 | 7644251 |
| Dissolved Zinc (Zn) | ug/L | 8.6 | 5.0 | 7644251 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Bureau Veritas Job #: C1T9445
Report Date: 2021/10/21

exp Services Inc
Client Project #: KCH-21002415
Site Location: MEDWAY ARVA
Sampler Initials: D.L

## RCAP - SURFACE WATER (WATER)

| Bureau Veritas ID | | QYA125 | | |
|---|---|---|---|---|
| Sampling Date | | 2021/10/12 | | |
| COC Number | | 849541-01-01 | | |
| | UNITS | SW1 | RDL | QC Batch |
| **Calculated Parameters** | | | | |
| Bicarb. Alkalinity (calc. as CaCO3) | mg/L | 270 | 1.0 | 7638709 |
| Calculated TDS | mg/L | 420 | 1.0 | 7639677 |
| Carb. Alkalinity (calc. as CaCO3) | mg/L | 4.6 | 1.0 | 7638709 |
| Hardness (CaCO3) | mg/L | 350 | 1.0 | 7638721 |
| Langelier Index (@ 20C) | N/A | 1.29 | | 7639674 |
| Langelier Index (@ 4C) | N/A | 1.04 | | 7639675 |
| Saturation pH (@ 20C) | N/A | 6.96 | | 7639674 |
| Saturation pH (@ 4C) | N/A | 7.21 | | 7639675 |
| **Inorganics** | | | | |
| Total Ammonia-N | mg/L | <0.050 | 0.050 | 7642803 |
| Conductivity | umho/cm | 720 | 1.0 | 7641358 |
| Total Organic Carbon (TOC) | mg/L | 3.6 | 0.40 | 7643529 |
| Orthophosphate (P) | mg/L | 0.047 | 0.010 | 7641389 |
| pH | pH | 8.25 | | 7641359 |
| Total Phosphorus | mg/L | 0.065 | 0.004 | 7644915 |
| Dissolved Sulphate (SO4) | mg/L | 15 | 1.0 | 7641388 |
| Turbidity | NTU | 3.5 | 0.1 | 7641325 |
| Alkalinity (Total as CaCO3) | mg/L | 280 | 1.0 | 7641353 |
| Dissolved Chloride (Cl-) | mg/L | 39 | 1.0 | 7641385 |
| Nitrite (N) | mg/L | 0.039 | 0.010 | 7641371 |
| Nitrate (N) | mg/L | 10.5 | 0.10 | 7641371 |
| **Metals** | | | | |
| Dissolved Calcium (Ca) | mg/L | 110 | 0.05 | 7644260 |
| Dissolved Magnesium (Mg) | mg/L | 16 | 0.05 | 7644260 |
| Dissolved Potassium (K) | mg/L | 3 | 1 | 7644260 |
| Dissolved Sodium (Na) | mg/L | 17 | 0.5 | 7644260 |
| Total Aluminum (Al) | ug/L | 130 | 4.9 | 7644108 |
| Total Antimony (Sb) | ug/L | <0.50 | 0.50 | 7644108 |
| Total Arsenic (As) | ug/L | <1.0 | 1.0 | 7644108 |
| Total Barium (Ba) | ug/L | 37 | 2.0 | 7644108 |
| Total Beryllium (Be) | ug/L | <0.40 | 0.40 | 7644108 |
| Total Boron (B) | ug/L | 22 | 10 | 7644108 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch



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## RCAP - SURFACE WATER (WATER)

| Bureau Veritas ID | | QYA125 | | |
|---|---|---|---|---|
| Sampling Date | | 2021/10/12 | | |
| COC Number | | 849541-01-01 | | |
| | UNITS | SW1 | RDL | QC Batch |
| Total Cadmium (Cd) | ug/L | <0.090 | 0.090 | 7644108 |
| Total Calcium (Ca) | ug/L | 120000 | 200 | 7644108 |
| Total Chromium (Cr) | ug/L | <5.0 | 5.0 | 7644108 |
| Total Cobalt (Co) | ug/L | <0.50 | 0.50 | 7644108 |
| Total Copper (Cu) | ug/L | 1.6 | 0.90 | 7644108 |
| Total Iron (Fe) | ug/L | 160 | 100 | 7644108 |
| Total Lead (Pb) | ug/L | <0.50 | 0.50 | 7644108 |
| Total Magnesium (Mg) | ug/L | 17000 | 50 | 7644108 |
| Total Manganese (Mn) | ug/L | 18 | 2.0 | 7644108 |
| Total Molybdenum (Mo) | ug/L | 0.50 | 0.50 | 7644108 |
| Total Nickel (Ni) | ug/L | 1.1 | 1.0 | 7644108 |
| Total Potassium (K) | ug/L | 3100 | 200 | 7644108 |
| Total Selenium (Se) | ug/L | <2.0 | 2.0 | 7644108 |
| Total Silicon (Si) | ug/L | 3800 | 50 | 7644108 |
| Total Silver (Ag) | ug/L | <0.090 | 0.090 | 7644108 |
| Total Sodium (Na) | ug/L | 18000 | 100 | 7644108 |
| Total Strontium (Sr) | ug/L | 160 | 1.0 | 7644108 |
| Total Thallium (Tl) | ug/L | <0.050 | 0.050 | 7644108 |
| Total Titanium (Ti) | ug/L | 6.1 | 5.0 | 7644108 |
| Total Tungsten (W) | ug/L | <1.0 | 1.0 | 7644108 |
| Total Uranium (U) | ug/L | 1.0 | 0.10 | 7644108 |
| Total Vanadium (V) | ug/L | 1.1 | 0.50 | 7644108 |
| Total Zinc (Zn) | ug/L | 5.5 | 5.0 | 7644108 |
| Total Zirconium (Zr) | ug/L | <1.0 | 1.0 | 7644108 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Bureau Veritas Job #: C1T9445
Report Date: 2021/10/21

exp Services Inc
Client Project #: KCH-21002415
Site Location: MEDWAY ARVA
Sampler Initials: D.L

## TEST SUMMARY

**Bureau Veritas ID:** QYA121
**Sample ID:** MW5A
**Matrix:** Water

**Collected:** 2021/10/12
**Shipped:**
**Received:** 2021/10/14

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 7641353 | N/A | 2021/10/18 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 7638709 | N/A | 2021/10/19 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 7641385 | N/A | 2021/10/18 | Alina Dobreanu |
| Conductivity | AT | 7641358 | N/A | 2021/10/18 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 7644270 | N/A | 2021/10/19 | Julianna Castiglione |
| Hardness (calculated as CaCO3) | | 7638721 | N/A | 2021/10/19 | Automated Statchk |
| Lab Filtered Metals by ICPMS | ICP/MS | 7644251 | 2021/10/18 | 2021/10/19 | Arefa Dabhad |
| Ion Balance (% Difference) | CALC | 7639697 | N/A | 2021/10/19 | Automated Statchk |
| Anion and Cation Sum | CALC | 7639700 | N/A | 2021/10/19 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 7642803 | N/A | 2021/10/18 | Amanpreet Sappal |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 7641371 | N/A | 2021/10/19 | Chandra Nandlal |
| pH | AT | 7641359 | 2021/10/16 | 2021/10/18 | Surinder Rai |
| Orthophosphate | KONE | 7641389 | N/A | 2021/10/19 | Avneet Kour Sudan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 7639674 | N/A | 2021/10/19 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 7639675 | N/A | 2021/10/19 | Automated Statchk |
| Sulphate by Automated Colourimetry | KONE | 7641388 | N/A | 2021/10/19 | Avneet Kour Sudan |
| Total Dissolved Solids (TDS calc) | CALC | 7639677 | N/A | 2021/10/19 | Automated Statchk |

**Bureau Veritas ID:** QYA122
**Sample ID:** MW5B
**Matrix:** Water

**Collected:** 2021/10/12
**Shipped:**
**Received:** 2021/10/14

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 7641353 | N/A | 2021/10/18 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 7638709 | N/A | 2021/10/19 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 7641408 | N/A | 2021/10/19 | Alina Dobreanu |
| Conductivity | AT | 7641358 | N/A | 2021/10/18 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 7641760 | N/A | 2021/10/18 | Julianna Castiglione |
| Hardness (calculated as CaCO3) | | 7638721 | N/A | 2021/10/19 | Automated Statchk |
| Lab Filtered Metals by ICPMS | ICP/MS | 7644251 | 2021/10/18 | 2021/10/19 | Arefa Dabhad |
| Ion Balance (% Difference) | CALC | 7639697 | N/A | 2021/10/19 | Automated Statchk |
| Anion and Cation Sum | CALC | 7639700 | N/A | 2021/10/19 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 7642803 | N/A | 2021/10/18 | Amanpreet Sappal |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 7641371 | N/A | 2021/10/19 | Chandra Nandlal |
| pH | AT | 7641359 | 2021/10/16 | 2021/10/18 | Surinder Rai |
| Orthophosphate | KONE | 7641411 | N/A | 2021/10/18 | Avneet Kour Sudan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 7639674 | N/A | 2021/10/19 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 7639675 | N/A | 2021/10/19 | Automated Statchk |
| Sulphate by Automated Colourimetry | KONE | 7641410 | N/A | 2021/10/18 | Avneet Kour Sudan |
| Total Dissolved Solids (TDS calc) | CALC | 7639677 | N/A | 2021/10/19 | Automated Statchk |



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Bureau Veritas Job #: C1T9445
Report Date: 2021/10/21

exp Services Inc
Client Project #: KCH-21002415
Site Location: MEDWAY ARVA
Sampler Initials: D.L

## TEST SUMMARY

**Bureau Veritas ID:** QYA123
**Sample ID:** MW7
**Matrix:** Water

**Collected:** 2021/10/12
**Shipped:**
**Received:** 2021/10/14

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 7641353 | N/A | 2021/10/18 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 7638709 | N/A | 2021/10/19 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 7641408 | N/A | 2021/10/19 | Alina Dobreanu |
| Conductivity | AT | 7641358 | N/A | 2021/10/18 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 7645607 | N/A | 2021/10/19 | Julianna Castiglione |
| Hardness (calculated as CaCO3) | | 7638721 | N/A | 2021/10/19 | Automated Statchk |
| Lab Filtered Metals by ICPMS | ICP/MS | 7644251 | 2021/10/18 | 2021/10/19 | Arefa Dabhad |
| Ion Balance (% Difference) | CALC | 7639697 | N/A | 2021/10/19 | Automated Statchk |
| Anion and Cation Sum | CALC | 7639700 | N/A | 2021/10/19 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 7642803 | N/A | 2021/10/18 | Amanpreet Sappal |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 7641550 | N/A | 2021/10/19 | Chandra Nandlal |
| pH | AT | 7641359 | 2021/10/16 | 2021/10/18 | Surinder Rai |
| Orthophosphate | KONE | 7641411 | N/A | 2021/10/18 | Avneet Kour Sudan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 7639674 | N/A | 2021/10/19 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 7639675 | N/A | 2021/10/19 | Automated Statchk |
| Sulphate by Automated Colourimetry | KONE | 7641410 | N/A | 2021/10/18 | Avneet Kour Sudan |
| Total Dissolved Solids (TDS calc) | CALC | 7639677 | N/A | 2021/10/19 | Automated Statchk |

**Bureau Veritas ID:** QYA124
**Sample ID:** MW8B
**Matrix:** Water

**Collected:** 2021/10/12
**Shipped:**
**Received:** 2021/10/14

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 7641353 | N/A | 2021/10/18 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 7638709 | N/A | 2021/10/19 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 7641408 | N/A | 2021/10/19 | Alina Dobreanu |
| Conductivity | AT | 7641358 | N/A | 2021/10/18 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 7640257 | N/A | 2021/10/19 | Julianna Castiglione |
| Hardness (calculated as CaCO3) | | 7638721 | N/A | 2021/10/19 | Automated Statchk |
| Lab Filtered Metals by ICPMS | ICP/MS | 7644251 | 2021/10/18 | 2021/10/19 | Arefa Dabhad |
| Ion Balance (% Difference) | CALC | 7639697 | N/A | 2021/10/19 | Automated Statchk |
| Anion and Cation Sum | CALC | 7639700 | N/A | 2021/10/19 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 7642803 | N/A | 2021/10/18 | Amanpreet Sappal |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 7641371 | N/A | 2021/10/19 | Chandra Nandlal |
| pH | AT | 7641359 | 2021/10/16 | 2021/10/18 | Surinder Rai |
| Orthophosphate | KONE | 7641411 | N/A | 2021/10/18 | Avneet Kour Sudan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 7639674 | N/A | 2021/10/19 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 7639675 | N/A | 2021/10/19 | Automated Statchk |
| Sulphate by Automated Colourimetry | KONE | 7641410 | N/A | 2021/10/18 | Avneet Kour Sudan |
| Total Dissolved Solids (TDS calc) | CALC | 7639677 | N/A | 2021/10/19 | Automated Statchk |



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Bureau Veritas Job #: C1T9445
Report Date: 2021/10/21

exp Services Inc
Client Project #: KCH-21002415
Site Location: MEDWAY ARVA
Sampler Initials: D.L

## TEST SUMMARY

**Bureau Veritas ID:** QYA125
**Sample ID:** SW1
**Matrix:** Water

**Collected:** 2021/10/12
**Shipped:**
**Received:** 2021/10/14

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 7641353 | N/A | 2021/10/18 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 7638709 | N/A | 2021/10/19 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 7641385 | N/A | 2021/10/18 | Alina Dobreanu |
| Conductivity | AT | 7641358 | N/A | 2021/10/18 | Surinder Rai |
| Hardness (calculated as CaCO3) | | 7638721 | N/A | 2021/10/21 | Automated Statchk |
| Lab Filtered Metals Analysis by ICP | ICP | 7644260 | 2021/10/18 | 2021/10/20 | Suban Kanapathippllai |
| Total Metals Analysis by ICPMS | ICP/MS | 7644108 | N/A | 2021/10/19 | Arefa Dabhad |
| Total Ammonia-N | LACH/NH4 | 7642803 | N/A | 2021/10/18 | Amanpreet Sappal |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 7641371 | N/A | 2021/10/19 | Chandra Nandlal |
| pH | AT | 7641359 | 2021/10/16 | 2021/10/18 | Surinder Rai |
| Orthophosphate | KONE | 7641389 | N/A | 2021/10/19 | Avneet Kour Sudan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 7639674 | N/A | 2021/10/21 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 7639675 | N/A | 2021/10/21 | Automated Statchk |
| Sulphate by Automated Colourimetry | KONE | 7641388 | N/A | 2021/10/19 | Avneet Kour Sudan |
| Total Dissolved Solids (TDS calc) | CALC | 7639677 | N/A | 2021/10/21 | Automated Statchk |
| Total Organic Carbon (TOC) | TOCV/NDIR | 7643529 | N/A | 2021/10/19 | Julianna Castiglione |
| Total Phosphorus (Colourimetric) | LACH/P | 7644915 | 2021/10/19 | 2021/10/19 | Shivani Shivani |
| Turbidity | AT | 7641325 | N/A | 2021/10/19 | Neil Dassanayake |



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Bureau Veritas Job #: C1T9445
Report Date: 2021/10/21

exp Services Inc
Client Project #: KCH-21002415
Site Location: MEDWAY ARVA
Sampler Initials: D.L

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 8.3°C |

**Results relate only to the items tested.**



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# QUALITY ASSURANCE REPORT



| | | | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | | QC Standard | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits | % Recovery | QC Limits |
| 7640257 | Dissolved Organic Carbon | 2021/10/18 | 93 | 80 - 120 | 95 | 80 - 120 | <0.40 | mg/L | 1.4 | 20 | | |
| 7641325 | Turbidity | 2021/10/19 | | | 95 | 85 - 115 | <0.1 | NTU | 0.51 | 20 | | |
| 7641353 | Alkalinity (Total as CaCO3) | 2021/10/18 | | | 97 | 85 - 115 | <1.0 | mg/L | 0.41 | 20 | | |
| 7641358 | Conductivity | 2021/10/18 | | | 101 | 85 - 115 | <1.0 | umho/cm | 0.18 | 25 | | |
| 7641359 | pH | 2021/10/18 | | | 101 | 98 - 103 | | | 0.57 | N/A | | |
| 7641371 | Nitrate (N) | 2021/10/19 | 110 | 80 - 120 | 101 | 80 - 120 | <0.10 | mg/L | NC | 20 | | |
| 7641371 | Nitrite (N) | 2021/10/19 | 107 | 80 - 120 | 101 | 80 - 120 | <0.010 | mg/L | NC | 20 | | |
| 7641385 | Dissolved Chloride (Cl-) | 2021/10/18 | NC | 80 - 120 | 103 | 80 - 120 | <1.0 | mg/L | 1.3 | 20 | | |
| 7641388 | Dissolved Sulphate (SO4) | 2021/10/19 | NC | 75 - 125 | 104 | 80 - 120 | <1.0 | mg/L | 0.66 | 20 | | |
| 7641389 | Orthophosphate (P) | 2021/10/19 | 163 (1) | 75 - 125 | 100 | 80 - 120 | <0.010 | mg/L | 4.9 | 25 | | |
| 7641408 | Dissolved Chloride (Cl-) | 2021/10/19 | 106 | 80 - 120 | 103 | 80 - 120 | <1.0 | mg/L | NC | 20 | | |
| 7641410 | Dissolved Sulphate (SO4) | 2021/10/18 | 107 | 75 - 125 | 100 | 80 - 120 | <1.0 | mg/L | NC | 20 | | |
| 7641411 | Orthophosphate (P) | 2021/10/18 | 120 | 75 - 125 | 101 | 80 - 120 | <0.010 | mg/L | NC | 25 | | |
| 7641550 | Nitrate (N) | 2021/10/19 | 106 | 80 - 120 | 101 | 80 - 120 | <0.10 | mg/L | 1.6 | 20 | | |
| 7641550 | Nitrite (N) | 2021/10/19 | 103 | 80 - 120 | 99 | 80 - 120 | <0.010 | mg/L | NC | 20 | | |
| 7641760 | Dissolved Organic Carbon | 2021/10/18 | 96 | 80 - 120 | 95 | 80 - 120 | <0.40 | mg/L | 1.6 | 20 | | |
| 7642803 | Total Ammonia-N | 2021/10/18 | 95 | 75 - 125 | 102 | 80 - 120 | <0.050 | mg/L | 20 | 20 | | |
| 7643529 | Total Organic Carbon (TOC) | 2021/10/19 | 94 | 80 - 120 | 92 | 80 - 120 | <0.40 | mg/L | 1.1 | 20 | | |
| 7644108 | Total Aluminum (Al) | 2021/10/19 | 107 | 80 - 120 | 103 | 80 - 120 | <4.9 | ug/L | 4.1 | 20 | | |
| 7644108 | Total Antimony (Sb) | 2021/10/19 | 107 | 80 - 120 | 105 | 80 - 120 | <0.50 | ug/L | NC | 20 | | |
| 7644108 | Total Arsenic (As) | 2021/10/19 | 106 | 80 - 120 | 103 | 80 - 120 | <1.0 | ug/L | NC | 20 | | |
| 7644108 | Total Barium (Ba) | 2021/10/19 | 101 | 80 - 120 | 100 | 80 - 120 | <2.0 | ug/L | 5.3 | 20 | | |
| 7644108 | Total Beryllium (Be) | 2021/10/19 | 104 | 80 - 120 | 103 | 80 - 120 | <0.40 | ug/L | NC | 20 | | |
| 7644108 | Total Boron (B) | 2021/10/19 | 95 | 80 - 120 | 98 | 80 - 120 | <10 | ug/L | 3.2 | 20 | | |
| 7644108 | Total Cadmium (Cd) | 2021/10/19 | 103 | 80 - 120 | 102 | 80 - 120 | <0.090 | ug/L | NC | 20 | | |
| 7644108 | Total Calcium (Ca) | 2021/10/19 | 115 | 80 - 120 | 106 | 80 - 120 | <200 | ug/L | 6.1 | 20 | | |
| 7644108 | Total Chromium (Cr) | 2021/10/19 | 99 | 80 - 120 | 96 | 80 - 120 | <5.0 | ug/L | NC | 20 | | |
| 7644108 | Total Cobalt (Co) | 2021/10/19 | 110 | 80 - 120 | 106 | 80 - 120 | <0.50 | ug/L | NC | 20 | | |
| 7644108 | Total Copper (Cu) | 2021/10/19 | 108 | 80 - 120 | 102 | 80 - 120 | <0.90 | ug/L | NC | 20 | | |
| 7644108 | Total Iron (Fe) | 2021/10/19 | 102 | 80 - 120 | 97 | 80 - 120 | <100 | ug/L | NC | 20 | | |



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## QUALITY ASSURANCE REPORT(CONT'D)



| | | | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | | QC Standard | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits | % Recovery | QC Limits |
| 7644108 | Total Lead (Pb) | 2021/10/19 | 103 | 80 - 120 | 103 | 80 - 120 | <0.50 | ug/L | NC | 20 | | |
| 7644108 | Total Magnesium (Mg) | 2021/10/19 | 108 | 80 - 120 | 99 | 80 - 120 | <50 | ug/L | 5.7 | 20 | | |
| 7644108 | Total Manganese (Mn) | 2021/10/19 | 101 | 80 - 120 | 98 | 80 - 120 | <2.0 | ug/L | 5.5 | 20 | | |
| 7644108 | Total Molybdenum (Mo) | 2021/10/19 | 102 | 80 - 120 | 99 | 80 - 120 | <0.50 | ug/L | 1.7 | 20 | | |
| 7644108 | Total Nickel (Ni) | 2021/10/19 | 105 | 80 - 120 | 103 | 80 - 120 | <1.0 | ug/L | NC | 20 | | |
| 7644108 | Total Potassium (K) | 2021/10/19 | 101 | 80 - 120 | 102 | 80 - 120 | <200 | ug/L | 5.3 | 20 | | |
| 7644108 | Total Selenium (Se) | 2021/10/19 | 110 | 80 - 120 | 107 | 80 - 120 | <2.0 | ug/L | NC | 20 | | |
| 7644108 | Total Silicon (Si) | 2021/10/19 | 102 | 80 - 120 | 101 | 80 - 120 | <50 | ug/L | 6.6 | 20 | | |
| 7644108 | Total Silver (Ag) | 2021/10/19 | 100 | 80 - 120 | 98 | 80 - 120 | <0.090 | ug/L | NC | 20 | | |
| 7644108 | Total Sodium (Na) | 2021/10/19 | 114 | 80 - 120 | 104 | 80 - 120 | <100 | ug/L | 5.5 | 20 | | |
| 7644108 | Total Strontium (Sr) | 2021/10/19 | 102 | 80 - 120 | 96 | 80 - 120 | <1.0 | ug/L | 5.4 | 20 | | |
| 7644108 | Total Thallium (Tl) | 2021/10/19 | 102 | 80 - 120 | 103 | 80 - 120 | <0.050 | ug/L | NC | 20 | | |
| 7644108 | Total Titanium (Ti) | 2021/10/19 | 100 | 80 - 120 | 98 | 80 - 120 | <5.0 | ug/L | NC | 20 | | |
| 7644108 | Total Tungsten (W) | 2021/10/19 | 110 | 80 - 120 | 108 | 80 - 120 | <1.0 | ug/L | NC | 20 | | |
| 7644108 | Total Uranium (U) | 2021/10/19 | 103 | 80 - 120 | 105 | 80 - 120 | <0.10 | ug/L | 0.43 | 20 | | |
| 7644108 | Total Vanadium (V) | 2021/10/19 | 101 | 80 - 120 | 98 | 80 - 120 | <0.50 | ug/L | 0 | 20 | | |
| 7644108 | Total Zinc (Zn) | 2021/10/19 | 106 | 80 - 120 | 105 | 80 - 120 | <5.0 | ug/L | NC | 20 | | |
| 7644108 | Total Zirconium (Zr) | 2021/10/19 | 105 | 80 - 120 | 103 | 80 - 120 | <1.0 | ug/L | NC | 20 | | |
| 7644251 | Dissolved Aluminum (Al) | 2021/10/19 | 100 | 80 - 120 | 101 | 80 - 120 | <4.9 | ug/L | NC | 20 | | |
| 7644251 | Dissolved Antimony (Sb) | 2021/10/19 | 101 | 80 - 120 | 100 | 80 - 120 | <0.50 | ug/L | NC | 20 | | |
| 7644251 | Dissolved Arsenic (As) | 2021/10/19 | 99 | 80 - 120 | 101 | 80 - 120 | <1.0 | ug/L | NC | 20 | | |
| 7644251 | Dissolved Barium (Ba) | 2021/10/19 | 101 | 80 - 120 | 98 | 80 - 120 | <2.0 | ug/L | 1.1 | 20 | | |
| 7644251 | Dissolved Beryllium (Be) | 2021/10/19 | 95 | 80 - 120 | 101 | 80 - 120 | <0.40 | ug/L | NC | 20 | | |
| 7644251 | Dissolved Boron (B) | 2021/10/19 | 92 | 80 - 120 | 97 | 80 - 120 | <10 | ug/L | 2.7 | 20 | | |
| 7644251 | Dissolved Cadmium (Cd) | 2021/10/19 | 99 | 80 - 120 | 99 | 80 - 120 | <0.090 | ug/L | NC | 20 | | |
| 7644251 | Dissolved Calcium (Ca) | 2021/10/19 | 106 | 80 - 120 | 103 | 80 - 120 | <200 | ug/L | 0.74 | 20 | | |
| 7644251 | Dissolved Chromium (Cr) | 2021/10/19 | 91 | 80 - 120 | 94 | 80 - 120 | <5.0 | ug/L | NC | 20 | | |
| 7644251 | Dissolved Cobalt (Co) | 2021/10/19 | 98 | 80 - 120 | 102 | 80 - 120 | <0.50 | ug/L | NC | 20 | | |
| 7644251 | Dissolved Copper (Cu) | 2021/10/19 | 97 | 80 - 120 | 98 | 80 - 120 | <0.90 | ug/L | 3.4 | 20 | | |
| 7644251 | Dissolved Iron (Fe) | 2021/10/19 | 97 | 80 - 120 | 99 | 80 - 120 | <100 | ug/L | NC | 20 | | |
| 7644251 | Dissolved Lead (Pb) | 2021/10/19 | 94 | 80 - 120 | 98 | 80 - 120 | <0.50 | ug/L | NC | 20 | | |



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## QUALITY ASSURANCE REPORT(CONT'D)



| | | | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | | QC Standard | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits | % Recovery | QC Limits |
| 7644251 | Dissolved Magnesium (Mg) | 2021/10/19 | 98 | 80 - 120 | 104 | 80 - 120 | <50 | ug/L | 0.28 | 20 | | |
| 7644251 | Dissolved Manganese (Mn) | 2021/10/19 | 98 | 80 - 120 | 99 | 80 - 120 | <2.0 | ug/L | 3.9 | 20 | | |
| 7644251 | Dissolved Molybdenum (Mo) | 2021/10/19 | 98 | 80 - 120 | 96 | 80 - 120 | <0.50 | ug/L | 5.2 | 20 | | |
| 7644251 | Dissolved Nickel (Ni) | 2021/10/19 | 94 | 80 - 120 | 99 | 80 - 120 | <1.0 | ug/L | 7.0 | 20 | | |
| 7644251 | Dissolved Phosphorus (P) | 2021/10/19 | 99 | 80 - 120 | 102 | 80 - 120 | <100 | ug/L | NC | 20 | | |
| 7644251 | Dissolved Potassium (K) | 2021/10/19 | 96 | 80 - 120 | 99 | 80 - 120 | <200 | ug/L | 2.3 | 20 | | |
| 7644251 | Dissolved Selenium (Se) | 2021/10/19 | 101 | 80 - 120 | 101 | 80 - 120 | <2.0 | ug/L | NC | 20 | | |
| 7644251 | Dissolved Silicon (Si) | 2021/10/19 | 99 | 80 - 120 | 99 | 80 - 120 | <50 | ug/L | 0.59 | 20 | | |
| 7644251 | Dissolved Silver (Ag) | 2021/10/19 | 96 | 80 - 120 | 97 | 80 - 120 | <0.090 | ug/L | NC | 20 | | |
| 7644251 | Dissolved Sodium (Na) | 2021/10/19 | 95 | 80 - 120 | 101 | 80 - 120 | <100 | ug/L | 3.0 | 20 | | |
| 7644251 | Dissolved Strontium (Sr) | 2021/10/19 | 109 | 80 - 120 | 98 | 80 - 120 | <1.0 | ug/L | 4.6 | 20 | | |
| 7644251 | Dissolved Thallium (Tl) | 2021/10/19 | 95 | 80 - 120 | 103 | 80 - 120 | <0.050 | ug/L | NC | 20 | | |
| 7644251 | Dissolved Titanium (Ti) | 2021/10/19 | 98 | 80 - 120 | 98 | 80 - 120 | <5.0 | ug/L | NC | 20 | | |
| 7644251 | Dissolved Uranium (U) | 2021/10/19 | 97 | 80 - 120 | 98 | 80 - 120 | <0.10 | ug/L | 3.3 | 20 | | |
| 7644251 | Dissolved Vanadium (V) | 2021/10/19 | 94 | 80 - 120 | 97 | 80 - 120 | <0.50 | ug/L | NC | 20 | | |
| 7644251 | Dissolved Zinc (Zn) | 2021/10/19 | 97 | 80 - 120 | 100 | 80 - 120 | <5.0 | ug/L | NC | 20 | | |
| 7644260 | Dissolved Calcium (Ca) | 2021/10/20 | 96 | 80 - 120 | 103 | 80 - 120 | <0.05 | mg/L | 0.012 | 25 | | |
| 7644260 | Dissolved Magnesium (Mg) | 2021/10/20 | 97 | 80 - 120 | 100 | 80 - 120 | <0.05 | mg/L | 0.13 | 25 | | |
| 7644260 | Dissolved Potassium (K) | 2021/10/20 | 100 | 80 - 120 | 102 | 80 - 120 | <1 | mg/L | 0.025 | 25 | | |
| 7644260 | Dissolved Sodium (Na) | 2021/10/20 | 100 | 80 - 120 | 101 | 80 - 120 | <0.5 | mg/L | 1.1 | 25 | | |
| 7644270 | Dissolved Organic Carbon | 2021/10/19 | 96 | 80 - 120 | 95 | 80 - 120 | <0.40 | mg/L | 0.76 | 20 | | |
| 7644915 | Total Phosphorus | 2021/10/19 | 102 | 80 - 120 | 99 | 80 - 120 | <0.004 | mg/L | 2.5 | 20 | 96 | 80 - 120 |



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## QUALITY ASSURANCE REPORT(CONT'D)



| | | | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | | QC Standard | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits | % Recovery | QC Limits |
| 7645607 | Dissolved Organic Carbon | 2021/10/19 | 96 | 80 - 120 | 95 | 80 - 120 | <0.40 | mg/L | NC | 20 | | |

N/A = Not Applicable

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.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

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.

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 <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



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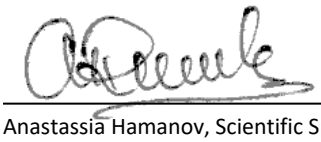
Bureau Veritas Job #: C1T9445
Report Date: 2021/10/21

exp Services Inc
Client Project #: KCH-21002415
Site Location: MEDWAY ARVA
Sampler Initials: D.L

## VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



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.



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14-Oct-21 13:59
Christine Gripton
C1T9445
YTH ENV-1548

# Presence of Visible Particulate/Sediment

Maxxam Analytics
CAM FCD-01013/5


*When there is >1cm of visible particulate/sediment, the amount will be recorded in the field below*

| | | Bottle Types | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ...ics | | | | | Organics | | | | | | | | | | | Hydrocarbons | | | | | | | Volatiles | | | | Other |
| | Sample ID | All | CrVI | CN | General | Hg | Metals (Diss.) | Organic 1 of 2 | Organic 2 of 2 | PCB 1 of 2 | PCB 2 of 2 | Pest/ Herb 1 of 2 | Pest/ Herb 2 of 2 | SVOC/ ABN 1 of 2 | SVOC/ ABN 2 of 2 | PAH 1 of 2 | PAH 2 of 2 | Dioxin /Furan | F1 Vial 1 | F1 Vial 2 | F1 Vial 3 | F1 Vial 4 | F2-F4 1 of 2 | F2-F4 2 of 2 | F4G | VOC Vial 1 | VOC Vial 2 | VOC Vial 3 | VOC Vial 4 | |
| 1 | MW5A | TS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | MW5B | TS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | MW7 | TS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | MW8B | TS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**Comments:**
N/A.

| Legend: | |
|---|---|
| P | Suspended Particulate |
| TS | Trace Settled Sediment (just covers bottom of container or less) |
| S | Sediment greater than (>) Trace, but less than (<) 1 cm |

**Recorded By**: (signature/print) Y. THOMPSON

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**IMMEDIATE TEST**

RECD IN LONDON

# CHAIN OF CUSTODY RECORD

Page of

| INVOICE TO: | | REPORT TO: | | PROJECT INFORMATION: | | Laboratory Use Only: | |
|---|---|---|---|---|---|---|---|
| Company Name: | #28124 exp Services Inc | Company Name: | | Quotation #: | B91718 | BV Labs Job #: | Bottle Order #: 849541 |
| Attention: | Accounts Payable | Attention: | | P.O. #: | | | |
| Address: | 15701 Robin's Hill Rd Unit 2<br>London ON N5V 0A5 | Address: | | Project: | KCH-21002415 | COC #: C#849541-01-01 | Project Manager: Christine Gripton |
| Tel: | (519) 963-3000 Fax: (519) 963-1152 | Tel: | Fax: | Project Name: | Meadows Area | | |
| Email: | AP@exp.com, Karen.Burke@exp.com | Email: | | Site #: | | | |
| | | | | Sampled By: | D Lamb | | |

**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)**
☐ Table 1 ☐ Res/Park ☐ Medium/Fine
☐ Table 2 ☐ Ind/Comm ☐ Coarse
☐ Table 3 ☐ Agri/Other ☐ For RSC
☐ Table ___

**Other Regulations**
☐ CCME ☐ Sanitary Sewer Bylaw
☐ Reg 558 ☐ Storm Sewer Bylaw
☐ MISA Municipality: ___
☐ PWQO ☐ Reg 406 Table ___
☐ Other ___

**Special Instructions**

*Include Criteria on Certificate of Analysis (Y/N)?* ___

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

**Regular (Standard) TAT:** ✓
*(will be applied if Rush TAT is not specified)*
*Standard TAT = 5-7 Working days for most tests.*
*Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.*

**Job Specific Rush TAT (if applies to entire submission)**
Date Required: ___ Time Required: ___ ☐
Rush Confirmation Number: ___ *(call lab for #)*

| | Sample Barcode Label | Sample (Location) Identification | Date Sampled | Time Sampled | Matrix | Field Filtered (please circle): Metals / Hg / Cr VI | RCAp - Comprehensive (Lab Filtered) | RCAP - Surface Water | Lab Filtered Metals by ICPMS | # of Bottles | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | MW 5A | 10/12/21 | AM | GW | | ✓ | | ✓ | 3 | |
| 2 | | MW 5B | " | | GW | | ✓ | | ✓ | 3 | |
| 3 | | MW 7 | " | | GW | | ✓ | | ✓ | 3 | |
| 4 | | MW BB | " | | GW | | ✓ | | ✓ | 3 | |
| 5 | | SW1 | " | | SW | | | ✓ | | 5 | |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

14-Oct-21 13:59
Christine Gripton
C1T9445
YTH ENV-1548
On Ice

| * RELINQUISHED BY: (Signature/Print) | Date: (YY/MM/DD) | Time | RECEIVED BY: (Signature/Print) | Date: (YY/MM/DD) | Time | # jars used and not submitted |
|---|---|---|---|---|---|---|
| D Lamb | 10/14/21 | | [illegible] Jay Bai | 21/10/14 | 15:59 | |
| | | | Y. THOMPSON | 21/10/14 | 17:35 | |

**Laboratory Use Only**

| Time Sensitive | Temperature (°C) on Recei | Custody Seal Present | Yes | No |
|---|---|---|---|---|
| | 8, 8, 9 | Intact | | ✓ |

* 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.

SAMPLES MUST BE KEPT COOL ( < 10° C ) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

White: BV Labs Yellow: Client

Bureau Veritas Canada (2019) Inc.

11/10/11 #418566

Your Project #: LON-21002415-A0
Site#: Arva Medway Creek Development
Site Location: Arva Medway Creek Development - York
Your C.O.C. #: 817231-01-01

**Attention: Mark Bertens**

exp Services Inc
London Branch
15701 Robin's Hill Rd
Unit 2
London, ON
CANADA N5V 0A5

**Report Date: 2021/03/22**
Report #: R6564866
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**BV LABS JOB #: C167405**
**Received: 2021/03/12, 17:16**

Sample Matrix: Water
# Samples Received: 5

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|---|---|---|---|---|
| Alkalinity | 1 | N/A | 2021/03/16 | CAM SOP-00448 | SM 23 2320 B m |
| Alkalinity | 4 | N/A | 2021/03/22 | CAM SOP-00448 | SM 23 2320 B m |
| Carbonate, Bicarbonate and Hydroxide | 1 | N/A | 2021/03/17 | CAM SOP-00102 | APHA 4500-CO2 D |
| Carbonate, Bicarbonate and Hydroxide | 4 | N/A | 2021/03/22 | CAM SOP-00102 | APHA 4500-CO2 D |
| Chloride by Automated Colourimetry | 5 | N/A | 2021/03/17 | CAM SOP-00463 | SM 23 4500-Cl E m |
| Conductivity | 5 | N/A | 2021/03/16 | CAM SOP-00414 | SM 23 2510 m |
| Dissolved Organic Carbon (DOC) (1) | 4 | N/A | 2021/03/15 | CAM SOP-00446 | SM 23 5310 B m |
| Hardness (calculated as CaCO3) | 4 | N/A | 2021/03/16 | CAM SOP 00102/00408/00447 | SM 2340 B |
| Hardness (calculated as CaCO3) | 1 | N/A | 2021/03/17 | CAM SOP 00102/00408/00447 | SM 2340 B |
| Lab Filtered Metals Analysis by ICP | 1 | 2021/03/15 | 2021/03/17 | CAM SOP-00408 | EPA 6010D m |
| Lab Filtered Metals by ICPMS | 4 | 2021/03/15 | 2021/03/16 | CAM SOP-00447 | EPA 6020B m |
| Total Metals Analysis by ICPMS | 1 | N/A | 2021/03/16 | CAM SOP-00447 | EPA 6020B m |
| Ion Balance (% Difference) | 4 | N/A | 2021/03/22 | | |
| Anion and Cation Sum | 4 | N/A | 2021/03/17 | | |
| Total Ammonia-N | 5 | N/A | 2021/03/16 | CAM SOP-00441 | USGS I-2522-90 m |
| Nitrate (NO3) and Nitrite (NO2) in Water (2) | 5 | N/A | 2021/03/16 | CAM SOP-00440 | SM 23 4500-NO3I/NO2B |
| pH | 5 | 2021/03/15 | 2021/03/16 | CAM SOP-00413 | SM 4500H+ B m |
| Orthophosphate | 5 | N/A | 2021/03/17 | CAM SOP-00461 | EPA 365.1 m |
| Sat. pH and Langelier Index (@ 20C) | 1 | N/A | 2021/03/17 | | Auto Calc |
| Sat. pH and Langelier Index (@ 20C) | 4 | N/A | 2021/03/22 | | Auto Calc |
| Sat. pH and Langelier Index (@ 4C) | 1 | N/A | 2021/03/17 | | Auto Calc |
| Sat. pH and Langelier Index (@ 4C) | 4 | N/A | 2021/03/22 | | Auto Calc |
| Sulphate by Automated Colourimetry | 4 | N/A | 2021/03/16 | CAM SOP-00464 | EPA 375.4 m |
| Sulphate by Automated Colourimetry | 1 | N/A | 2021/03/17 | CAM SOP-00464 | EPA 375.4 m |
| Total Dissolved Solids (TDS calc) | 1 | N/A | 2021/03/17 | | Auto Calc |
| Total Dissolved Solids (TDS calc) | 4 | N/A | 2021/03/22 | | Auto Calc |
| Total Organic Carbon (TOC) (3) | 1 | N/A | 2021/03/16 | CAM SOP-00446 | SM 23 5310B m |

Your Project #: LON-21002415-A0
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Site Location: Arva Medway Creek Development - York
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# CERTIFICATE OF ANALYSIS

**BV LABS JOB #: C167405**
**Received: 2021/03/12, 17:16**

Sample Matrix: Water
# Samples Received: 5

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|---|---|---|---|---|
| Total Phosphorus (Colourimetric) | 1 | 2021/03/16 | 2021/03/17 | CAM SOP-00407 | SM 23 4500 P B H m |
| Turbidity | 1 | N/A | 2021/03/15 | CAM SOP-00417 | SM 23 2130 B m |

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas 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 Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas 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.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas 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 Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas 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 Bureau Veritas, 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) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(3) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.



Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Your Project #: LON-21002415-A0
Site#: Arva Medway Creek Development
Site Location: Arva Medway Creek Development - York
Your C.O.C. #: 817231-01-01

**Attention: Mark Bertens**

exp Services Inc
London Branch
15701 Robin's Hill Rd
Unit 2
London, ON
CANADA N5V 0A5

**Report Date: 2021/03/22**
Report #: R6564866
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**BV LABS JOB #: C167405**
**Received: 2021/03/12, 17:16**

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Christine Gripton, Senior Project Manager
Email: Christine.Gripton@bureauveritas.com
Phone# (519)652-9444
==========
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.

BV Labs Job #: C167405
Report Date: 2021/03/22

exp Services Inc
Client Project #: LON-21002415-A0
Site Location: Arva Medway Creek Development - York

## RCAP - COMPREHENSIVE (LAB FILTERED)

| BV Labs ID | | PBK652 | | PBK653 | PBK654 | | PBK655 | | |
|---|---|---|---|---|---|---|---|---|---|
| Sampling Date | | | | | | | | | |
| COC Number | | 817231-01-01 | | 817231-01-01 | 817231-01-01 | | 817231-01-01 | | |
| | UNITS | MW5A | QC Batch | MW5B | MW7 | RDL | MW8B | RDL | QC Batch |
| **Calculated Parameters** | | | | | | | | | |
| Anion Sum | me/L | 12.9 | 7246302 | 6.02 | 10.3 | N/A | 9.50 | N/A | 7246302 |
| Bicarb. Alkalinity (calc. as CaCO3) | mg/L | 260 | 7256754 | 270 | 370 | 1.0 | 240 | 1.0 | 7256754 |
| Calculated TDS | mg/L | 790 | 7246307 | 330 | 560 | 1.0 | 530 | 1.0 | 7246307 |
| Carb. Alkalinity (calc. as CaCO3) | mg/L | 2.2 | 7256754 | 2.6 | 2.3 | 1.0 | 2.2 | 1.0 | 7256754 |
| Cation Sum | me/L | 12.7 | 7246302 | 6.51 | 9.97 | N/A | 9.65 | N/A | 7246302 |
| Hardness (CaCO3) | mg/L | 290 | 7246105 | 320 | 450 | 1.0 | 280 | 1.0 | 7246105 |
| Ion Balance (% Difference) | % | 0.990 | 7246301 | 3.88 | 1.65 | N/A | 0.770 | N/A | 7246301 |
| Langelier Index (@ 20C) | N/A | 0.774 | 7246305 | 1.03 | 1.09 | | 0.875 | | 7246305 |
| Langelier Index (@ 4C) | N/A | 0.527 | 7246306 | 0.780 | 0.846 | | 0.627 | | 7246306 |
| Saturation pH (@ 20C) | N/A | 7.17 | 7246305 | 6.98 | 6.74 | | 7.11 | | 7246305 |
| Saturation pH (@ 4C) | N/A | 7.42 | 7246306 | 7.23 | 6.99 | | 7.36 | | 7246306 |
| **Inorganics** | | | | | | | | | |
| Total Ammonia-N | mg/L | <0.050 | 7247190 | <0.050 | <0.050 | 0.050 | <0.050 | 0.050 | 7247190 |
| Conductivity | umho/cm | 1200 | 7247320 | 590 | 1000 | 1.0 | 1100 | 1.0 | 7247377 |
| Dissolved Organic Carbon | mg/L | 21 | 7246355 | 0.87 | 1.8 | 0.40 | 1.6 | 0.40 | 7246355 |
| Orthophosphate (P) | mg/L | <0.010 | 7247339 | <0.010 | <0.010 | 0.010 | <0.010 | 0.010 | 7247339 |
| pH | pH | 7.94 | 7247324 | 8.01 | 7.83 | | 7.99 | | 7247523 |
| Dissolved Sulphate (SO4) | mg/L | 320 | 7250081 | 6.5 | 88 | 1.0 | 14 | 1.0 | 7247334 |
| Alkalinity (Total as CaCO3) | mg/L | 260 | 7258493 | 270 | 370 | 1.0 | 240 | 1.0 | 7258493 |
| Dissolved Chloride (Cl-) | mg/L | 35 | 7247328 | 7.0 | 24 | 1.0 | 140 | 2.0 | 7247328 |
| Nitrite (N) | mg/L | 0.132 | 7247092 | <0.010 | <0.010 | 0.010 | <0.010 | 0.010 | 7247092 |
| Nitrate (N) | mg/L | 1.10 | 7247092 | 3.97 | 5.59 | 0.10 | 5.49 | 0.10 | 7247092 |
| Nitrate + Nitrite (N) | mg/L | 1.24 | 7247092 | 3.97 | 5.59 | 0.10 | 5.49 | 0.10 | 7247092 |
| **Metals** | | | | | | | | | |
| Dissolved Aluminum (Al) | ug/L | 7.8 | 7246380 | 8.8 | 6.6 | 4.9 | 8.1 | 4.9 | 7246380 |
| Dissolved Antimony (Sb) | ug/L | <0.50 | 7246380 | <0.50 | <0.50 | 0.50 | <0.50 | 0.50 | 7246380 |
| Dissolved Arsenic (As) | ug/L | 1.3 | 7246380 | <1.0 | <1.0 | 1.0 | <1.0 | 1.0 | 7246380 |
| Dissolved Barium (Ba) | ug/L | 67 | 7246380 | 21 | 110 | 2.0 | 42 | 2.0 | 7246380 |
| Dissolved Beryllium (Be) | ug/L | <0.40 | 7246380 | <0.40 | <0.40 | 0.40 | <0.40 | 0.40 | 7246380 |
| Dissolved Boron (B) | ug/L | 40 | 7246380 | 12 | 20 | 10 | 17 | 10 | 7246380 |
| Dissolved Cadmium (Cd) | ug/L | <0.090 | 7246380 | <0.090 | <0.090 | 0.090 | <0.090 | 0.090 | 7246380 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable



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## RCAP - COMPREHENSIVE (LAB FILTERED)

| BV Labs ID | | PBK652 | | PBK653 | PBK654 | | PBK655 | | |
|---|---|---|---|---|---|---|---|---|---|
| Sampling Date | | | | | | | | | |
| COC Number | | 817231-01-01 | | 817231-01-01 | 817231-01-01 | | 817231-01-01 | | |
| | UNITS | MW5A | QC Batch | MW5B | MW7 | RDL | MW8B | RDL | QC Batch |
| Dissolved Calcium (Ca) | ug/L | 85000 | 7246380 | 100000 | 150000 | 200 | 94000 | 200 | 7246380 |
| Dissolved Chromium (Cr) | ug/L | <5.0 | 7246380 | <5.0 | <5.0 | 5.0 | <5.0 | 5.0 | 7246380 |
| Dissolved Cobalt (Co) | ug/L | <0.50 | 7246380 | <0.50 | <0.50 | 0.50 | <0.50 | 0.50 | 7246380 |
| Dissolved Copper (Cu) | ug/L | 1.0 | 7246380 | <0.90 | 1.4 | 0.90 | 1.1 | 0.90 | 7246380 |
| Dissolved Iron (Fe) | ug/L | <100 | 7246380 | <100 | <100 | 100 | <100 | 100 | 7246380 |
| Dissolved Lead (Pb) | ug/L | <0.50 | 7246380 | <0.50 | <0.50 | 0.50 | <0.50 | 0.50 | 7246380 |
| Dissolved Magnesium (Mg) | ug/L | 19000 | 7246380 | 14000 | 18000 | 50 | 11000 | 50 | 7246380 |
| Dissolved Manganese (Mn) | ug/L | 28 | 7246380 | <2.0 | 16 | 2.0 | <2.0 | 2.0 | 7246380 |
| Dissolved Molybdenum (Mo) | ug/L | 10 | 7246380 | 0.75 | 0.73 | 0.50 | 0.77 | 0.50 | 7246380 |
| Dissolved Nickel (Ni) | ug/L | <1.0 | 7246380 | <1.0 | <1.0 | 1.0 | <1.0 | 1.0 | 7246380 |
| Dissolved Phosphorus (P) | ug/L | 110 | 7246380 | <100 | 110 | 100 | <100 | 100 | 7246380 |
| Dissolved Potassium (K) | ug/L | 3000 | 7246380 | 610 | 14000 | 200 | 3000 | 200 | 7246380 |
| Dissolved Selenium (Se) | ug/L | <2.0 | 7246380 | <2.0 | <2.0 | 2.0 | <2.0 | 2.0 | 7246380 |
| Dissolved Silicon (Si) | ug/L | 5000 | 7246380 | 4400 | 4000 | 50 | 2500 | 50 | 7246380 |
| Dissolved Silver (Ag) | ug/L | <0.090 | 7246380 | <0.090 | <0.090 | 0.090 | <0.090 | 0.090 | 7246380 |
| Dissolved Sodium (Na) | ug/L | 160000 | 7246380 | 3600 | 15000 | 100 | 92000 | 100 | 7246380 |
| Dissolved Strontium (Sr) | ug/L | 130 | 7246380 | 83 | 200 | 1.0 | 110 | 1.0 | 7246380 |
| Dissolved Thallium (Tl) | ug/L | <0.050 | 7246380 | <0.050 | <0.050 | 0.050 | <0.050 | 0.050 | 7246380 |
| Dissolved Titanium (Ti) | ug/L | <5.0 | 7246380 | <5.0 | <5.0 | 5.0 | <5.0 | 5.0 | 7246380 |
| Dissolved Uranium (U) | ug/L | 21 | 7246380 | 0.64 | 1.3 | 0.10 | 0.55 | 0.10 | 7246380 |
| Dissolved Vanadium (V) | ug/L | <0.50 | 7246380 | <0.50 | <0.50 | 0.50 | <0.50 | 0.50 | 7246380 |
| Dissolved Zinc (Zn) | ug/L | <5.0 | 7246380 | <5.0 | <5.0 | 5.0 | <5.0 | 5.0 | 7246380 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch



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## RCAP - SURFACE WATER (WATER)

| BV Labs ID | | PBK656 | | |
|---|---|---|---|---|
| Sampling Date | | | | |
| COC Number | | 817231-01-01 | | |
| | UNITS | SW#1 | RDL | QC Batch |
| **Calculated Parameters** | | | | |
| Bicarb. Alkalinity (calc. as CaCO3) | mg/L | 140 | 1.0 | 7246300 |
| Calculated TDS | mg/L | 250 | 1.0 | 7246307 |
| Carb. Alkalinity (calc. as CaCO3) | mg/L | 1.8 | 1.0 | 7246300 |
| Hardness (CaCO3) | mg/L | 200 | 1.0 | 7246105 |
| Langelier Index (@ 20C) | N/A | 0.703 | | 7246305 |
| Langelier Index (@ 4C) | N/A | 0.453 | | 7246306 |
| Saturation pH (@ 20C) | N/A | 7.43 | | 7246305 |
| Saturation pH (@ 4C) | N/A | 7.68 | | 7246306 |
| **Inorganics** | | | | |
| Total Ammonia-N | mg/L | <0.050 | 0.050 | 7247190 |
| Conductivity | umho/cm | 450 | 1.0 | 7247320 |
| Total Organic Carbon (TOC) | mg/L | 5.2 | 0.40 | 7247857 |
| Orthophosphate (P) | mg/L | 0.11 | 0.010 | 7247339 |
| pH | pH | 8.13 | | 7247324 |
| Total Phosphorus | mg/L | 0.17 | 0.02 | 7249088 |
| Dissolved Sulphate (SO4) | mg/L | 11 | 1.0 | 7247334 |
| Turbidity | NTU | 16 | 0.1 | 7247079 |
| Alkalinity (Total as CaCO3) | mg/L | 150 | 1.0 | 7247323 |
| Dissolved Chloride (Cl-) | mg/L | 24 | 1.0 | 7247328 |
| Nitrite (N) | mg/L | 0.020 | 0.010 | 7247092 |
| Nitrate (N) | mg/L | 8.44 | 0.10 | 7247092 |
| **Metals** | | | | |
| Dissolved Calcium (Ca) | mg/L | 65 | 0.05 | 7242028 |
| Dissolved Magnesium (Mg) | mg/L | 8.8 | 0.05 | 7242028 |
| Dissolved Potassium (K) | mg/L | 3 | 1 | 7242028 |
| Dissolved Sodium (Na) | mg/L | 8.8 | 0.5 | 7242028 |
| Total Aluminum (Al) | ug/L | 900 | 4.9 | 7247789 |
| Total Antimony (Sb) | ug/L | <0.50 | 0.50 | 7247789 |
| Total Arsenic (As) | ug/L | <1.0 | 1.0 | 7247789 |
| Total Barium (Ba) | ug/L | 23 | 2.0 | 7247789 |
| Total Beryllium (Be) | ug/L | <0.40 | 0.40 | 7247789 |
| Total Boron (B) | ug/L | 11 | 10 | 7247789 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch



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## RCAP - SURFACE WATER (WATER)

| BV Labs ID | | PBK656 | | |
|---|---|---|---|---|
| Sampling Date | | | | |
| COC Number | | 817231-01-01 | | |
| | UNITS | SW#1 | RDL | QC Batch |
| Total Cadmium (Cd) | ug/L | <0.090 | 0.090 | 7247789 |
| Total Calcium (Ca) | ug/L | 64000 | 200 | 7247789 |
| Total Chromium (Cr) | ug/L | <5.0 | 5.0 | 7247789 |
| Total Cobalt (Co) | ug/L | <0.50 | 0.50 | 7247789 |
| Total Copper (Cu) | ug/L | 2.5 | 0.90 | 7247789 |
| Total Iron (Fe) | ug/L | 990 | 100 | 7247789 |
| Total Lead (Pb) | ug/L | 0.68 | 0.50 | 7247789 |
| Total Magnesium (Mg) | ug/L | 9200 | 50 | 7247789 |
| Total Manganese (Mn) | ug/L | 21 | 2.0 | 7247789 |
| Total Molybdenum (Mo) | ug/L | <0.50 | 0.50 | 7247789 |
| Total Nickel (Ni) | ug/L | 1.3 | 1.0 | 7247789 |
| Total Potassium (K) | ug/L | 3100 | 200 | 7247789 |
| Total Selenium (Se) | ug/L | <2.0 | 2.0 | 7247789 |
| Total Silicon (Si) | ug/L | 3800 | 50 | 7247789 |
| Total Silver (Ag) | ug/L | <0.090 | 0.090 | 7247789 |
| Total Sodium (Na) | ug/L | 8800 | 100 | 7247789 |
| Total Strontium (Sr) | ug/L | 85 | 1.0 | 7247789 |
| Total Thallium (Tl) | ug/L | <0.050 | 0.050 | 7247789 |
| Total Titanium (Ti) | ug/L | 30 | 5.0 | 7247789 |
| Total Vanadium (V) | ug/L | 2.2 | 0.50 | 7247789 |
| Total Zinc (Zn) | ug/L | 5.8 | 5.0 | 7247789 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch



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## TEST SUMMARY

**BV Labs ID:** PBK652
**Sample ID:** MW5A
**Matrix:** Water

**Collected:**
**Shipped:**
**Received:** 2021/03/12

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 7258493 | N/A | 2021/03/22 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 7256754 | N/A | 2021/03/22 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 7247328 | N/A | 2021/03/17 | Deonarine Ramnarine |
| Conductivity | AT | 7247320 | N/A | 2021/03/16 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 7246355 | N/A | 2021/03/15 | Nimarta Singh |
| Hardness (calculated as CaCO3) | | 7246105 | N/A | 2021/03/16 | Automated Statchk |
| Lab Filtered Metals by ICPMS | ICP/MS | 7246380 | 2021/03/15 | 2021/03/16 | Nan Raykha |
| Ion Balance (% Difference) | CALC | 7246301 | N/A | 2021/03/22 | Automated Statchk |
| Anion and Cation Sum | CALC | 7246302 | N/A | 2021/03/17 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 7247190 | N/A | 2021/03/16 | Alina Dobreanu |
| Nitrate (NO3) and Nitrite (NO2) in Water | LACH | 7247092 | N/A | 2021/03/16 | Chandra Nandlal |
| pH | AT | 7247324 | 2021/03/15 | 2021/03/16 | Surinder Rai |
| Orthophosphate | KONE | 7247339 | N/A | 2021/03/17 | Avneet Kour Sudan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 7246305 | N/A | 2021/03/22 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 7246306 | N/A | 2021/03/22 | Automated Statchk |
| Sulphate by Automated Colourimetry | KONE | 7250081 | N/A | 2021/03/17 | Deonarine Ramnarine |
| Total Dissolved Solids (TDS calc) | CALC | 7246307 | N/A | 2021/03/22 | Automated Statchk |

**BV Labs ID:** PBK653
**Sample ID:** MW5B
**Matrix:** Water

**Collected:**
**Shipped:**
**Received:** 2021/03/12

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 7258493 | N/A | 2021/03/22 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 7256754 | N/A | 2021/03/22 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 7247328 | N/A | 2021/03/17 | Deonarine Ramnarine |
| Conductivity | AT | 7247377 | N/A | 2021/03/16 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 7246355 | N/A | 2021/03/15 | Nimarta Singh |
| Hardness (calculated as CaCO3) | | 7246105 | N/A | 2021/03/16 | Automated Statchk |
| Lab Filtered Metals by ICPMS | ICP/MS | 7246380 | 2021/03/15 | 2021/03/16 | Nan Raykha |
| Ion Balance (% Difference) | CALC | 7246301 | N/A | 2021/03/22 | Automated Statchk |
| Anion and Cation Sum | CALC | 7246302 | N/A | 2021/03/17 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 7247190 | N/A | 2021/03/16 | Alina Dobreanu |
| Nitrate (NO3) and Nitrite (NO2) in Water | LACH | 7247092 | N/A | 2021/03/16 | Chandra Nandlal |
| pH | AT | 7247523 | 2021/03/15 | 2021/03/16 | Surinder Rai |
| Orthophosphate | KONE | 7247339 | N/A | 2021/03/17 | Avneet Kour Sudan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 7246305 | N/A | 2021/03/22 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 7246306 | N/A | 2021/03/22 | Automated Statchk |
| Sulphate by Automated Colourimetry | KONE | 7247334 | N/A | 2021/03/16 | Avneet Kour Sudan |
| Total Dissolved Solids (TDS calc) | CALC | 7246307 | N/A | 2021/03/22 | Automated Statchk |



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BV Labs Job #: C167405
Report Date: 2021/03/22

exp Services Inc
Client Project #: LON-21002415-A0
Site Location: Arva Medway Creek Development - York

## TEST SUMMARY

**BV Labs ID:** PBK654
**Sample ID:** MW7
**Matrix:** Water

**Collected:**
**Shipped:**
**Received:** 2021/03/12

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 7258493 | N/A | 2021/03/22 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 7256754 | N/A | 2021/03/22 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 7247328 | N/A | 2021/03/17 | Deonarine Ramnarine |
| Conductivity | AT | 7247377 | N/A | 2021/03/16 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 7246355 | N/A | 2021/03/15 | Nimarta Singh |
| Hardness (calculated as CaCO3) | | 7246105 | N/A | 2021/03/16 | Automated Statchk |
| Lab Filtered Metals by ICPMS | ICP/MS | 7246380 | 2021/03/15 | 2021/03/16 | Nan Raykha |
| Ion Balance (% Difference) | CALC | 7246301 | N/A | 2021/03/22 | Automated Statchk |
| Anion and Cation Sum | CALC | 7246302 | N/A | 2021/03/17 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 7247190 | N/A | 2021/03/16 | Alina Dobreanu |
| Nitrate (NO3) and Nitrite (NO2) in Water | LACH | 7247092 | N/A | 2021/03/16 | Chandra Nandlal |
| pH | AT | 7247523 | 2021/03/15 | 2021/03/16 | Surinder Rai |
| Orthophosphate | KONE | 7247339 | N/A | 2021/03/17 | Avneet Kour Sudan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 7246305 | N/A | 2021/03/22 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 7246306 | N/A | 2021/03/22 | Automated Statchk |
| Sulphate by Automated Colourimetry | KONE | 7247334 | N/A | 2021/03/16 | Avneet Kour Sudan |
| Total Dissolved Solids (TDS calc) | CALC | 7246307 | N/A | 2021/03/22 | Automated Statchk |

**BV Labs ID:** PBK655
**Sample ID:** MW8B
**Matrix:** Water

**Collected:**
**Shipped:**
**Received:** 2021/03/12

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 7258493 | N/A | 2021/03/22 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 7256754 | N/A | 2021/03/22 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 7247328 | N/A | 2021/03/17 | Deonarine Ramnarine |
| Conductivity | AT | 7247377 | N/A | 2021/03/16 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 7246355 | N/A | 2021/03/15 | Nimarta Singh |
| Hardness (calculated as CaCO3) | | 7246105 | N/A | 2021/03/16 | Automated Statchk |
| Lab Filtered Metals by ICPMS | ICP/MS | 7246380 | 2021/03/15 | 2021/03/16 | Nan Raykha |
| Ion Balance (% Difference) | CALC | 7246301 | N/A | 2021/03/22 | Automated Statchk |
| Anion and Cation Sum | CALC | 7246302 | N/A | 2021/03/17 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 7247190 | N/A | 2021/03/16 | Alina Dobreanu |
| Nitrate (NO3) and Nitrite (NO2) in Water | LACH | 7247092 | N/A | 2021/03/16 | Chandra Nandlal |
| pH | AT | 7247523 | 2021/03/15 | 2021/03/16 | Surinder Rai |
| Orthophosphate | KONE | 7247339 | N/A | 2021/03/17 | Avneet Kour Sudan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 7246305 | N/A | 2021/03/22 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 7246306 | N/A | 2021/03/22 | Automated Statchk |
| Sulphate by Automated Colourimetry | KONE | 7247334 | N/A | 2021/03/16 | Avneet Kour Sudan |
| Total Dissolved Solids (TDS calc) | CALC | 7246307 | N/A | 2021/03/22 | Automated Statchk |



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BV Labs Job #: C167405
Report Date: 2021/03/22

exp Services Inc
Client Project #: LON-21002415-A0
Site Location: Arva Medway Creek Development - York

## TEST SUMMARY

**BV Labs ID:** PBK656
**Sample ID:** SW#1
**Matrix:** Water

**Collected:**
**Shipped:**
**Received:** 2021/03/12

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 7247323 | N/A | 2021/03/16 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 7246300 | N/A | 2021/03/17 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 7247328 | N/A | 2021/03/17 | Deonarine Ramnarine |
| Conductivity | AT | 7247320 | N/A | 2021/03/16 | Surinder Rai |
| Hardness (calculated as CaCO3) | | 7246105 | N/A | 2021/03/17 | Automated Statchk |
| Lab Filtered Metals Analysis by ICP | ICP | 7242028 | 2021/03/15 | 2021/03/17 | Meghaben Patel |
| Total Metals Analysis by ICPMS | ICP/MS | 7247789 | N/A | 2021/03/16 | Nan Raykha |
| Total Ammonia-N | LACH/NH4 | 7247190 | N/A | 2021/03/16 | Alina Dobreanu |
| Nitrate (NO3) and Nitrite (NO2) in Water | LACH | 7247092 | N/A | 2021/03/16 | Chandra Nandlal |
| pH | AT | 7247324 | 2021/03/15 | 2021/03/16 | Surinder Rai |
| Orthophosphate | KONE | 7247339 | N/A | 2021/03/17 | Avneet Kour Sudan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 7246305 | N/A | 2021/03/17 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 7246306 | N/A | 2021/03/17 | Automated Statchk |
| Sulphate by Automated Colourimetry | KONE | 7247334 | N/A | 2021/03/16 | Avneet Kour Sudan |
| Total Dissolved Solids (TDS calc) | CALC | 7246307 | N/A | 2021/03/17 | Automated Statchk |
| Total Organic Carbon (TOC) | TOCV/NDIR | 7247857 | N/A | 2021/03/16 | Nimarta Singh |
| Total Phosphorus (Colourimetric) | LACH/P | 7249088 | 2021/03/16 | 2021/03/17 | Shivani Shivani |
| Turbidity | AT | 7247079 | N/A | 2021/03/15 | Tarunpreet Kaur |

**BV Labs ID:** PBK656 Dup
**Sample ID:** SW#1
**Matrix:** Water

**Collected:**
**Shipped:**
**Received:** 2021/03/12

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Chloride by Automated Colourimetry | KONE | 7247328 | N/A | 2021/03/17 | Deonarine Ramnarine |
| Total Metals Analysis by ICPMS | ICP/MS | 7247789 | N/A | 2021/03/16 | Nan Raykha |
| Orthophosphate | KONE | 7247339 | N/A | 2021/03/17 | Avneet Kour Sudan |
| Sulphate by Automated Colourimetry | KONE | 7247334 | N/A | 2021/03/16 | Avneet Kour Sudan |
| Total Phosphorus (Colourimetric) | LACH/P | 7249088 | 2021/03/16 | 2021/03/17 | Shivani Shivani |
| Turbidity | AT | 7247079 | N/A | 2021/03/15 | Tarunpreet Kaur |



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## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 9.0°C |

**Results relate only to the items tested.**



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## QUALITY ASSURANCE REPORT



| | | | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | | QC Standard | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits | % Recovery | QC Limits |
| 7242028 | Dissolved Calcium (Ca) | 2021/03/17 | 76 (1) | 80 - 120 | 101 | 80 - 120 | <0.05 | mg/L | 0.69 | 25 | | |
| 7242028 | Dissolved Magnesium (Mg) | 2021/03/17 | 100 | 80 - 120 | 98 | 80 - 120 | <0.05 | mg/L | 0.76 | 25 | | |
| 7242028 | Dissolved Potassium (K) | 2021/03/17 | 115 | 80 - 120 | 99 | 80 - 120 | <1 | mg/L | 0.53 | 25 | | |
| 7242028 | Dissolved Sodium (Na) | 2021/03/17 | 5140 (1) | 80 - 120 | 99 | 80 - 120 | <0.5 | mg/L | 0.53 | 25 | | |
| 7246355 | Dissolved Organic Carbon | 2021/03/15 | 94 | 80 - 120 | 95 | 80 - 120 | <0.40 | mg/L | 0.92 | 20 | | |
| 7246380 | Dissolved Aluminum (Al) | 2021/03/16 | 111 | 80 - 120 | 95 | 80 - 120 | <4.9 | ug/L | 6.9 | 20 | | |
| 7246380 | Dissolved Antimony (Sb) | 2021/03/16 | 114 | 80 - 120 | 100 | 80 - 120 | <0.50 | ug/L | 3.4 | 20 | | |
| 7246380 | Dissolved Arsenic (As) | 2021/03/16 | 108 | 80 - 120 | 99 | 80 - 120 | <1.0 | ug/L | NC | 20 | | |
| 7246380 | Dissolved Barium (Ba) | 2021/03/16 | 112 | 80 - 120 | 99 | 80 - 120 | <2.0 | ug/L | 3.6 | 20 | | |
| 7246380 | Dissolved Beryllium (Be) | 2021/03/16 | 115 | 80 - 120 | 101 | 80 - 120 | <0.40 | ug/L | NC | 20 | | |
| 7246380 | Dissolved Boron (B) | 2021/03/16 | 110 | 80 - 120 | 97 | 80 - 120 | <10 | ug/L | 2.4 | 20 | | |
| 7246380 | Dissolved Cadmium (Cd) | 2021/03/16 | 106 | 80 - 120 | 98 | 80 - 120 | <0.090 | ug/L | NC | 20 | | |
| 7246380 | Dissolved Calcium (Ca) | 2021/03/16 | 110 | 80 - 120 | 94 | 80 - 120 | <200 | ug/L | 2.5 | 20 | | |
| 7246380 | Dissolved Chromium (Cr) | 2021/03/16 | 103 | 80 - 120 | 94 | 80 - 120 | <5.0 | ug/L | NC | 20 | | |
| 7246380 | Dissolved Cobalt (Co) | 2021/03/16 | 103 | 80 - 120 | 96 | 80 - 120 | <0.50 | ug/L | 1.4 | 20 | | |
| 7246380 | Dissolved Copper (Cu) | 2021/03/16 | 114 | 80 - 120 | 96 | 80 - 120 | <0.90 | ug/L | 4.9 | 20 | | |
| 7246380 | Dissolved Iron (Fe) | 2021/03/16 | 106 | 80 - 120 | 97 | 80 - 120 | <100 | ug/L | NC | 20 | | |
| 7246380 | Dissolved Lead (Pb) | 2021/03/16 | 101 | 80 - 120 | 96 | 80 - 120 | <0.50 | ug/L | NC | 20 | | |
| 7246380 | Dissolved Magnesium (Mg) | 2021/03/16 | 110 | 80 - 120 | 99 | 80 - 120 | <50 | ug/L | 0.54 | 20 | | |
| 7246380 | Dissolved Manganese (Mn) | 2021/03/16 | 105 | 80 - 120 | 95 | 80 - 120 | <2.0 | ug/L | 0.59 | 20 | | |
| 7246380 | Dissolved Molybdenum (Mo) | 2021/03/16 | 115 | 80 - 120 | 99 | 80 - 120 | <0.50 | ug/L | 3.9 | 20 | | |
| 7246380 | Dissolved Nickel (Ni) | 2021/03/16 | 98 | 80 - 120 | 94 | 80 - 120 | <1.0 | ug/L | 14 | 20 | | |
| 7246380 | Dissolved Phosphorus (P) | 2021/03/16 | 132 (1) | 80 - 120 | 118 | 80 - 120 | <100 | ug/L | 15 | 20 | | |
| 7246380 | Dissolved Potassium (K) | 2021/03/16 | 118 | 80 - 120 | 99 | 80 - 120 | <200 | ug/L | 2.9 | 20 | | |
| 7246380 | Dissolved Selenium (Se) | 2021/03/16 | 101 | 80 - 120 | 94 | 80 - 120 | <2.0 | ug/L | NC | 20 | | |
| 7246380 | Dissolved Silicon (Si) | 2021/03/16 | 112 | 80 - 120 | 94 | 80 - 120 | <50 | ug/L | 1.4 | 20 | | |
| 7246380 | Dissolved Silver (Ag) | 2021/03/16 | 100 | 80 - 120 | 95 | 80 - 120 | <0.090 | ug/L | NC | 20 | | |
| 7246380 | Dissolved Sodium (Na) | 2021/03/16 | 194 (1) | 80 - 120 | 97 | 80 - 120 | <100 | ug/L | 0.49 | 20 | | |
| 7246380 | Dissolved Strontium (Sr) | 2021/03/16 | 103 | 80 - 120 | 96 | 80 - 120 | <1.0 | ug/L | 0.62 | 20 | | |
| 7246380 | Dissolved Thallium (Tl) | 2021/03/16 | 100 | 80 - 120 | 99 | 80 - 120 | <0.050 | ug/L | NC | 20 | | |
| 7246380 | Dissolved Titanium (Ti) | 2021/03/16 | 107 | 80 - 120 | 91 | 80 - 120 | <5.0 | ug/L | 6.2 | 20 | | |



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## QUALITY ASSURANCE REPORT(CONT'D)



| | | | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | | QC Standard | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits | % Recovery | QC Limits |
| 7246380 | Dissolved Uranium (U) | 2021/03/16 | 101 | 80 - 120 | 95 | 80 - 120 | <0.10 | ug/L | NC | 20 | | |
| 7246380 | Dissolved Vanadium (V) | 2021/03/16 | 108 | 80 - 120 | 96 | 80 - 120 | <0.50 | ug/L | 1.7 | 20 | | |
| 7246380 | Dissolved Zinc (Zn) | 2021/03/16 | 101 | 80 - 120 | 96 | 80 - 120 | <5.0 | ug/L | NC | 20 | | |
| 7247079 | Turbidity | 2021/03/15 | | | 97 | 85 - 115 | <0.1 | NTU | 0.67 | 20 | | |
| 7247092 | Nitrate (N) | 2021/03/16 | 99 | 80 - 120 | 97 | 80 - 120 | <0.10 | mg/L | NC | 20 | | |
| 7247092 | Nitrite (N) | 2021/03/16 | 106 | 80 - 120 | 106 | 80 - 120 | <0.010 | mg/L | NC | 20 | | |
| 7247190 | Total Ammonia-N | 2021/03/16 | 99 | 75 - 125 | 99 | 80 - 120 | <0.050 | mg/L | 1.8 | 20 | | |
| 7247320 | Conductivity | 2021/03/16 | | | 102 | 85 - 115 | <1.0 | umho/cm | 0 | 25 | | |
| 7247323 | Alkalinity (Total as CaCO3) | 2021/03/16 | | | 95 | 85 - 115 | <1.0 | mg/L | 1.2 | 20 | | |
| 7247324 | pH | 2021/03/16 | | | 102 | 98 - 103 | | | 0.025 | N/A | | |
| 7247328 | Dissolved Chloride (Cl-) | 2021/03/17 | 88 | 80 - 120 | 103 | 80 - 120 | <1.0 | mg/L | 3.5 | 20 | | |
| 7247334 | Dissolved Sulphate (SO4) | 2021/03/16 | 124 | 75 - 125 | 104 | 80 - 120 | <1.0 | mg/L | 0.39 | 20 | | |
| 7247339 | Orthophosphate (P) | 2021/03/17 | 101 | 75 - 125 | 97 | 80 - 120 | <0.010 | mg/L | 4.5 | 25 | | |
| 7247377 | Conductivity | 2021/03/16 | | | 102 | 85 - 115 | <1.0 | umho/cm | 0 | 25 | | |
| 7247523 | pH | 2021/03/16 | | | 102 | 98 - 103 | | | 0.15 | N/A | | |
| 7247789 | Total Aluminum (Al) | 2021/03/16 | 203 (1) | 80 - 120 | 92 | 80 - 120 | <4.9 | ug/L | 7.8 | 20 | | |
| 7247789 | Total Antimony (Sb) | 2021/03/16 | 97 | 80 - 120 | 95 | 80 - 120 | <0.50 | ug/L | NC | 20 | | |
| 7247789 | Total Arsenic (As) | 2021/03/16 | 97 | 80 - 120 | 96 | 80 - 120 | <1.0 | ug/L | NC | 20 | | |
| 7247789 | Total Barium (Ba) | 2021/03/16 | 94 | 80 - 120 | 92 | 80 - 120 | <2.0 | ug/L | 5.7 | 20 | | |
| 7247789 | Total Beryllium (Be) | 2021/03/16 | 98 | 80 - 120 | 96 | 80 - 120 | <0.40 | ug/L | NC | 20 | | |
| 7247789 | Total Boron (B) | 2021/03/16 | 93 | 80 - 120 | 90 | 80 - 120 | <10 | ug/L | 7.0 | 20 | | |
| 7247789 | Total Cadmium (Cd) | 2021/03/16 | 96 | 80 - 120 | 94 | 80 - 120 | <0.090 | ug/L | NC | 20 | | |
| 7247789 | Total Calcium (Ca) | 2021/03/16 | 85 | 80 - 120 | 92 | 80 - 120 | <200 | ug/L | 3.3 | 20 | | |
| 7247789 | Total Chromium (Cr) | 2021/03/16 | 91 | 80 - 120 | 90 | 80 - 120 | <5.0 | ug/L | NC | 20 | | |
| 7247789 | Total Cobalt (Co) | 2021/03/16 | 93 | 80 - 120 | 93 | 80 - 120 | <0.50 | ug/L | NC | 20 | | |
| 7247789 | Total Copper (Cu) | 2021/03/16 | 94 | 80 - 120 | 95 | 80 - 120 | <0.90 | ug/L | 5.6 | 20 | | |
| 7247789 | Total Iron (Fe) | 2021/03/16 | 96 | 80 - 120 | 94 | 80 - 120 | <100 | ug/L | 4.5 | 20 | | |
| 7247789 | Total Lead (Pb) | 2021/03/16 | 93 | 80 - 120 | 92 | 80 - 120 | <0.50 | ug/L | 1.9 | 20 | | |
| 7247789 | Total Magnesium (Mg) | 2021/03/16 | 98 | 80 - 120 | 95 | 80 - 120 | <50 | ug/L | 1.0 | 20 | | |



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## QUALITY ASSURANCE REPORT(CONT'D)



| | | | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | | QC Standard | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits | % Recovery | QC Limits |
| 7247789 | Total Manganese (Mn) | 2021/03/16 | 94 | 80 - 120 | 93 | 80 - 120 | <2.0 | ug/L | 2.2 | 20 | | |
| 7247789 | Total Molybdenum (Mo) | 2021/03/16 | 98 | 80 - 120 | 95 | 80 - 120 | <0.50 | ug/L | NC | 20 | | |
| 7247789 | Total Nickel (Ni) | 2021/03/16 | 92 | 80 - 120 | 93 | 80 - 120 | <1.0 | ug/L | 6.2 | 20 | | |
| 7247789 | Total Potassium (K) | 2021/03/16 | 98 | 80 - 120 | 93 | 80 - 120 | <200 | ug/L | 2.8 | 20 | | |
| 7247789 | Total Selenium (Se) | 2021/03/16 | 97 | 80 - 120 | 95 | 80 - 120 | <2.0 | ug/L | NC | 20 | | |
| 7247789 | Total Silicon (Si) | 2021/03/16 | 95 | 80 - 120 | 91 | 80 - 120 | <50 | ug/L | 6.4 | 20 | | |
| 7247789 | Total Silver (Ag) | 2021/03/16 | 95 | 80 - 120 | 93 | 80 - 120 | <0.090 | ug/L | NC | 20 | | |
| 7247789 | Total Sodium (Na) | 2021/03/16 | 95 | 80 - 120 | 94 | 80 - 120 | <100 | ug/L | 2.5 | 20 | | |
| 7247789 | Total Strontium (Sr) | 2021/03/16 | 93 | 80 - 120 | 90 | 80 - 120 | <1.0 | ug/L | 1.2 | 20 | | |
| 7247789 | Total Thallium (Tl) | 2021/03/16 | 96 | 80 - 120 | 92 | 80 - 120 | <0.050 | ug/L | NC | 20 | | |
| 7247789 | Total Titanium (Ti) | 2021/03/16 | 87 | 80 - 120 | 89 | 80 - 120 | <5.0 | ug/L | NC | 20 | | |
| 7247789 | Total Vanadium (V) | 2021/03/16 | 94 | 80 - 120 | 93 | 80 - 120 | <0.50 | ug/L | 2.3 | 20 | | |
| 7247789 | Total Zinc (Zn) | 2021/03/16 | 97 | 80 - 120 | 96 | 80 - 120 | <5.0 | ug/L | 7.2 | 20 | | |
| 7247857 | Total Organic Carbon (TOC) | 2021/03/16 | 95 | 80 - 120 | 97 | 80 - 120 | <0.40 | mg/L | 0.18 | 20 | | |
| 7249088 | Total Phosphorus | 2021/03/17 | NC | 80 - 120 | 99 | 80 - 120 | <0.004 | mg/L | 3.3 | 20 | 95 | 80 - 120 |
| 7250081 | Dissolved Sulphate (SO4) | 2021/03/17 | 95 | 75 - 125 | 104 | 80 - 120 | <1.0 | mg/L | 1.2 | 20 | | |
| 7258493 | Alkalinity (Total as CaCO3) | 2021/03/22 | | | 93 | 85 - 115 | <1.0 | mg/L | 1.5 | 20 | | |

N/A = Not Applicable

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.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

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.

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 <= 2x RDL).

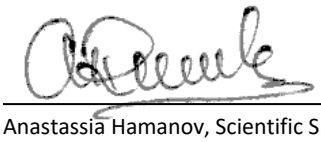
(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

## 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.



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Bureau Veritas Laboratories
109 & 110, 4023 Meadowbrook Drive, London, Ontario Canada N6L 1E7 Tel:(519) 652-9444 Toll-free:800-563-6266 Fax:(519) 652-8189 www.bvlabs.com

REC'D IN LONDON

12-Mar-21 17:16
Christine Gripton
C167405
DSG ENV-748

Page of

| INVOICE TO: | | REPORT TO: | | PROJECT INFORMATION: | |
|---|---|---|---|---|---|
| Company Name: | #28124 exp Services Inc | Company Name: | | Quotation #: | B91718 |
| Attention: | Accounts Payable | Attention: | | P.O. #: | |
| Address: | 15701 Robin's Hill Rd Unit 2 | Address: | | Project: | LON-21002415-A0 |
| | London ON N5V 0A5 | | | Project Name: | |
| Tel: | (519) 963-3000 Fax: (519) 963-1152 | Tel: | Fax: | Site #: | Arva Medway Creek Development |
| Email: | AP@exp.com, karen.Burke@exp.com, Lo-Ellen.Mitton | Email: | | Sampled By: | M. Berkens |

Bottle Order #: 817231
COC #: C#817231-01-01
Project Manager: Christine Gripton

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)**
- ☐ Table 1 ☐ Res/Park ☐ Medium/Fine
- ☐ Table 2 ☐ Ind/Comm ☐ Coarse
- ☐ Table 3 ☐ Agri/Other ☐ For RSC
- ☐ Table ___

**Other Regulations**
- ☐ CCME ☐ Sanitary Sewer Bylaw
- ☐ Reg 558 ☐ Storm Sewer Bylaw
- ☐ MISA Municipality ___
- ☒ PWQO ☐ Reg 406 Table ___
- ☐ Other ___

**Special Instructions**

*Include Criteria on Certificate of Analysis (Y/N)?* ___

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

**Regular (Standard) TAT:** ☒
*(will be applied if Rush TAT is not specified):*
*Standard TAT = 5-7 Working days for most tests.*
*Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.*

**Job Specific Rush TAT (if applies to entire submission)**
Date Required: ___ Time Required: ___ ☐
Rush Confirmation Number: ___ *(call lab for #)*

| | Sample Barcode Label | Sample (Location) Identification | Date Sampled | Time Sampled | Matrix | Field Filtered (please circle): Metals / Hg / Cr VI | RCAp - Comprehensive (Lab Filtered) | RCAP - Surface Water | Dissolved Metals | # of Bottles | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | MW5A | Mar 12/21 | PM | GW | | X | | | 3 | |
| 2 | | MW5B | ↓ | ↓ | GW | | X | | | 3 | |
| 3 | | MW7 | | | GW | | X | | | 3 | |
| 4 | | MW8B | | | GW | | X | | | 3 | |
| 5 | | SW#1 | | | SW | | | X | X | 4 | |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | On Ice |

| * RELINQUISHED BY: (Signature/Print) | Date: (YY/MM/DD) | Time | RECEIVED BY: (Signature/Print) | Date: (YY/MM/DD) | Time | # jars used and not submitted |
|---|---|---|---|---|---|---|
| Mark Berkens | 21/03/12 | 5:15 | LU BAI | 2021/3/12 | 17:16 | |
| | | | [illegible] | 21/03/13 | 10:47 | |

**Laboratory Use Only**

| Time Sensitive | Temperature (°C) on Recei | Custody Seal | Yes | No |
|---|---|---|---|---|
| | 7, 9, 11 | Present | | |
| | | Intact | | |

* 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.

SAMPLES MUST BE KEPT COOL ( < 10° C ) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

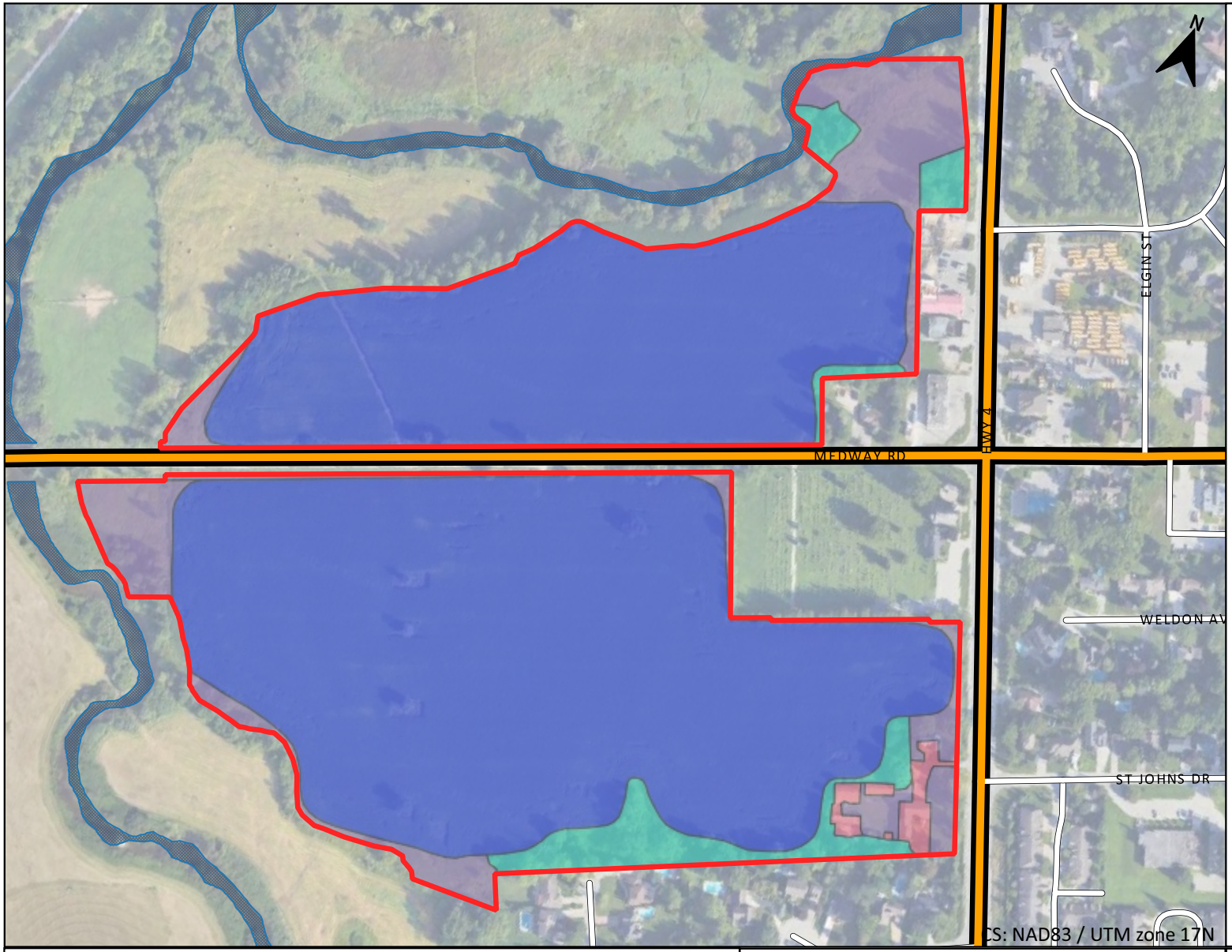
White: BV Labs Yellow: Client

6/0/3

Bureau Veritas Canada (2019) Inc.

# Appendix K – Water Balance Assessments

6-405 Maple Grove Road | Cambridge, Ontario | Canada
t: +1.519.650.4918 | f: +1.519.650.4603 | exp.com




-LEGEND-

- Subject Lands
- Watercourse (Medway Creek)

Pre-Development Ground Cover

- Impervious
- Moderately Rooted Crops
- Mature Forest
- Pasture and Shrubs

Notes:

Data Sources:
Contains information licensed under the Open Government License - Ontario
Google Earth Imagery (c) 2022 City of London, First Base Solutions, Maxar Technologies

Hydrogeological Assessment

**Bridle Path Subdivision**

Medway Creek, Arva, ON

| | |
|---|---|
| CLIENT | Bridle Path North Arva Inc. |
| TITLE | Pre-Development Land Cover - Site-Wide |
| Prepared By: K.W. | Reviewed By: H.J./H.B. |

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

| DATE | SCALE | PROJECT NO. | FIG. |
|---|---|---|---|
| Nov. 2024 | 1:4,500 | KCH-21002415 | K-1 |

**Project Name: Medway Creek (Bridle Path Subdivision)**
**Project Number: KCH-21002415-A0**
**Client: York Developments**

**Pre-Development Site-Wide Monthly Water Balance**

**PRE-DEVELOPMENT WATER BALANCE CALCULATIONS**

| Total Area | Impervious Area ($m^2$) | Pervious Area ($m^2$) | Total Area ($m^2$) | Soil Type | Soil Group | Water Holding Capacity (mm) | Infiltration Factor | $T_{rain}$ (°C) | $T_{snow}$ (°C) | Meltmax (%/100) |
|---|---|---|---|---|---|---|---|---|---|---|
| Agricultural Land/Moderately Rooted Crops- Type A-B | - | 180,613 | **235,170** | Sand/Sand and Gravel/Silty Sand/Silt | A-B | 113 (rounded) | 0.6 | 3.3 | -10.0 | 1 |
| Agricultural Land/Moderately Rooted Crops- Type D | - | 12,718 | | Clayey Silt Till | D | 150 | 0.3 | | | |
| Pasture and Shrubs | - | 26,849 | | Silt/Silt Loam with some Sand and Gravel | B | 150 | 0.5 | | | |
| Mature Forest | - | 12,536 | | Silt/Silt Loam with some Sand and Gravel | B | 300 | 0.6 | | | |
| Impervious - Buildings & Paved Surfaces | 2,454 | - | | | | | | | | |

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Temperature (°C) | -5.6 | -4.5 | -0.1 | 6.8 | 13.1 | 18.3 | 20.8 | 19.7 | 15.5 | 9.2 | 3.4 | -2.6 | |
| Total Precipitation (mm/month) | 74.2 | 65.5 | 71.5 | 83.4 | 89.8 | 91.7 | 82.7 | 82.9 | 103.0 | 81.3 | 98.0 | 87.5 | 1011.5 |
| Precipitation as rain (mm/month) | 24.5 | 27.1 | 53.2 | 83.4 | 89.8 | 91.7 | 82.7 | 82.9 | 103.0 | 81.3 | 98.0 | 48.7 | |
| Precipitation as snow (mm/month) | 49.7 | 38.4 | 18.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 38.8 | |
| Potential Snow Melt (mm/month) | 22.1 | 34.4 | 49.9 | 21.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.6 | |
| Actual Snow Melt (mm/month) | 22.1 | 34.4 | 49.9 | 17.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.6 | |
| Snow Storage (mm/month) | 44.7 | 48.8 | 17.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 17.2 | |
| ***Agricultural Land - A-B type soils*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.9 | 10.8 | 20.3 | 38.4 | 70.3 | 102.6 | 115.3 | 90.2 | 56.3 | 30.5 | 16.0 | 10.0 | 569.6 |
| Surplus (mm/month) | 37.8 | 50.7 | 82.8 | 62.1 | 19.5 | -10.9 | -32.6 | -7.3 | 46.7 | 50.8 | 82.0 | 60.3 | 441.9 |
| Estimated Runoff (mm/month) | 37.8 | 50.7 | 58.0 | 24.9 | 7.8 | 0.0 | 0.0 | 0.0 | 18.7 | 20.3 | 32.8 | 60.3 | 311.2 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 24.8 | 37.3 | 11.7 | 0.0 | 0.0 | 0.0 | 28.0 | 30.5 | 49.2 | 0.0 | 181.5 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **1607** | **1951** | **3666** | **6936** | **12697** | **18531** | **20825** | **16291** | **10169** | **5509** | **2890** | **1806** | **102877** |
| **Estimated Runoff ($m^3$/month)** | **6822** | **9153** | **10472** | **4489** | **1409** | **0** | **0** | **0** | **3374** | **3670** | **5924** | **10888** | **56201** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **4488** | **6734** | **2113** | **0** | **0** | **0** | **5061** | **5505** | **8886** | **0** | **32787** |
| ***Agricultural Land - D type soils*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.9 | 10.8 | 20.3 | 38.4 | 70.3 | 102.6 | 116.1 | 91.3 | 56.3 | 30.5 | 16.0 | 10.0 | 571.5 |
| Surplus (mm/month) | 37.8 | 50.7 | 82.8 | 62.1 | 19.5 | -10.9 | -33.4 | -8.4 | 46.7 | 50.8 | 82.0 | 60.3 | 440.0 |
| Estimated Runoff (mm/month) | 37.8 | 50.7 | 70.4 | 43.5 | 13.7 | 0.0 | 0.0 | 0.0 | 32.7 | 35.6 | 57.4 | 60.3 | 401.9 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 12.4 | 18.6 | 5.9 | 0.0 | 0.0 | 0.0 | 14.0 | 15.2 | 24.6 | 0.0 | 90.8 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **113** | **137** | **258** | **488** | **894** | **1305** | **1477** | **1161** | **716** | **388** | **203** | **127** | **7268** |
| **Estimated Runoff ($m^3$/month)** | **480** | **645** | **895** | **553** | **174** | **0** | **0** | **0** | **416** | **452** | **730** | **767** | **5112** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **158** | **237** | **74** | **0** | **0** | **0** | **178** | **194** | **313** | **0** | **1154** |
| ***Pasture and Shrubs*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.9 | 10.8 | 20.3 | 38.4 | 70.3 | 102.6 | 116.1 | 91.3 | 56.3 | 30.5 | 16.0 | 10.0 | 571.5 |
| Surplus (mm/month) | 37.8 | 50.7 | 82.8 | 62.1 | 19.5 | -10.9 | -33.4 | -8.4 | 46.7 | 50.8 | 82.0 | 60.3 | 440.0 |
| Estimated Runoff (mm/month) | 37.8 | 50.7 | 62.1 | 31.1 | 9.8 | 0.0 | 0.0 | 0.0 | 23.4 | 25.4 | 41.0 | 60.3 | 341.4 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 20.7 | 31.1 | 9.8 | 0.0 | 0.0 | 0.0 | 23.4 | 25.4 | 41.0 | 0.0 | 151.3 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **239** | **290** | **545** | **1031** | **1887** | **2755** | **3117** | **2451** | **1512** | **819** | **430** | **268** | **15344** |
| **Estimated Runoff ($m^3$/month)** | **1014** | **1361** | **1668** | **834** | **262** | **0** | **0** | **0** | **627** | **682** | **1101** | **1618** | **9167** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **556** | **834** | **262** | **0** | **0** | **0** | **627** | **682** | **1101** | **0** | **4062** |
| ***Mature Forest*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.9 | 10.8 | 20.3 | 38.4 | 70.3 | 102.6 | 117.4 | 93.0 | 56.3 | 30.5 | 16.0 | 10.0 | 574.5 |
| Surplus (mm/month) | 37.8 | 50.7 | 82.8 | 62.1 | 19.5 | -10.9 | -34.7 | -10.1 | 46.7 | 50.8 | 82.0 | 60.3 | 437.0 |
| Estimated Runoff (mm/month) | 37.8 | 50.7 | 58.0 | 24.9 | 7.8 | 0.0 | 0.0 | 0.0 | 18.7 | 20.3 | 32.8 | 60.3 | 311.2 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 24.8 | 37.3 | 11.7 | 0.0 | 0.0 | 0.0 | 28.0 | 30.5 | 49.2 | 0.0 | 181.5 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **112** | **135** | **254** | **481** | **881** | **1286** | **1472** | **1166** | **706** | **382** | **201** | **125** | **7202** |
| **Estimated Runoff ($m^3$/month)** | **473** | **635** | **727** | **312** | **98** | **0** | **0** | **0** | **234** | **255** | **411** | **756** | **3901** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **312** | **467** | **147** | **0** | **0** | **0** | **351** | **382** | **617** | **0** | **2276** |
| ***Impervious Surfaces*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.4 | 11.1 | 18.6 | 18.1 | 16.2 | 16.5 | 14.9 | 14.9 | 18.5 | 14.6 | 17.6 | 12.7 | 182.1 |
| Surplus (mm/month) | 38.3 | 50.4 | 84.6 | 82.4 | 73.6 | 75.2 | 67.8 | 68.0 | 84.5 | 66.7 | 80.4 | 57.6 | 829.4 |
| Estimated Runoff (mm/month) | 38.3 | 50.4 | 84.6 | 82.4 | 73.6 | 75.2 | 67.8 | 68.0 | 84.5 | 66.7 | 80.4 | 57.6 | 829.4 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **21** | **27** | **46** | **44** | **40** | **41** | **37** | **37** | **45** | **36** | **43** | **31** | **447** |
| **Estimated Runoff ($m^3$/month)** | **94** | **124** | **208** | **202** | **181** | **185** | **166** | **167** | **207** | **164** | **197** | **141** | **2035** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| ***Totals*** | | | | | | | | | | | | | |
| **Estimated Runoff ($m^3$/month)** | **8884** | **11917** | **13970** | **6391** | **2123** | **185** | **166** | **167** | **4858** | **5223** | **8363** | **14170** | **76415** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **5514** | **8273** | **2596** | **0** | **0** | **0** | **6217** | **6763** | **10917** | **0** | **40279** |

**Project Name: Medway Creek (Bridle Path Subdivision)**
**Project Number: KCH-21002415-A0**
**Client: York Developments**

**Post-Development Site-Wide Monthly Water Balance**

**POST-DEVELOPMENT WATER BALANCE CALCULATIONS**

| Total Area | Impervious Area ($m^2$) | Pervious Area ($m^2$) | Total Area ($m^2$) | Soil Type | Soil Group | Water Holding Capacity (mm) | Infiltration Factor | $T_{rain}$ (°C) | $T_{snow}$ (°C) | Meltmax (%/100) |
|---|---|---|---|---|---|---|---|---|---|---|
| Urban Lawn-Type A-B | 79,542 | 79,812 | **235,170** | Sand/Sand and Gravel/Silty Sand/Silt | A-B | 63 | 0.6 | 3.3 | -10.0 | 1 |
| Urban Lawn- Type D | 8,838 | 8,868 | | Clayey Silt Till | D | 75 | 0.3 | | | |
| Mature Forest | - | 1,369 | | Sand and Gravel / Silty Sand | B | 300 | 0.6 | | | |
| Pasture and Shrubs | 6,375 | 6,375 | | Silt/Silt Loam with some Sand and Gravel | B | 150 | 0.5 | | | |
| Impervious - Roadways, Road Widenings, | 43,990 | - | | Silt/Silt Loam with some Sand and Gravel | B | 300 | | | | |

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Temperature (°C) | -5.6 | -4.5 | -0.1 | 6.8 | 13.1 | 18.3 | 20.8 | 19.7 | 15.5 | 9.2 | 3.4 | -2.6 | |
| Total Precipitation (mm/month) | 74.2 | 65.5 | 71.5 | 83.4 | 89.8 | 91.7 | 82.7 | 82.9 | 103.0 | 81.3 | 98.0 | 87.5 | 1011.5 |
| Precipitation as rain (mm/month) | 24.5 | 27.1 | 53.2 | 83.4 | 89.8 | 91.7 | 82.7 | 82.9 | 103.0 | 81.3 | 98.0 | 48.7 | |
| Precipitation as snow (mm/month) | 49.7 | 38.4 | 18.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 38.8 | |
| Potential Snow Melt (mm/month) | 22.1 | 34.4 | 49.9 | 21.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.6 | |
| Actual Snow Melt (mm/month) | 22.1 | 34.4 | 49.9 | 17.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.6 | |
| Snow Storage (mm/month) | 44.7 | 48.8 | 17.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 17.2 | |
| ***Urban Lawn - A-B type soils*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.9 | 10.8 | 20.3 | 38.4 | 70.3 | 102.6 | 112.5 | 87.1 | 56.3 | 30.5 | 16.0 | 10.0 | 563.7 |
| Surplus (mm/month) | 37.8 | 50.7 | 82.8 | 62.1 | 19.5 | -10.9 | -29.8 | -4.2 | 46.7 | 50.8 | 82.0 | 60.3 | 447.8 |
| Estimated Runoff (mm/month) | 37.8 | 50.7 | 58.0 | 24.9 | 7.8 | 0.0 | 0.0 | 0.0 | 18.7 | 20.3 | 32.8 | 60.3 | 311.2 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 24.8 | 37.3 | 11.7 | 0.0 | 0.0 | 0.0 | 28.0 | 30.5 | 49.2 | 0.0 | 181.5 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **710** | **862** | **1620** | **3065** | **5611** | **8189** | **8979** | **6952** | **4493** | **2434** | **1277** | **798** | **44990** |
| **Estimated Runoff ($m^3$/month)** | **3015** | **4045** | **4628** | **1984** | **623** | **0** | **0** | **0** | **1491** | **1622** | **2618** | **4811** | **24835** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **1983** | **2976** | **934** | **0** | **0** | **0** | **2236** | **2433** | **3927** | **0** | **14489** |
| ***Urban Lawn - D type soils*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.9 | 10.8 | 20.3 | 38.4 | 70.3 | 102.6 | 113.5 | 88.2 | 56.3 | 30.5 | 16.0 | 10.0 | 565.8 |
| Surplus (mm/month) | 37.8 | 50.7 | 82.8 | 62.1 | 19.5 | -10.9 | -30.8 | -5.3 | 46.7 | 50.8 | 82.0 | 60.3 | 445.7 |
| Estimated Runoff (mm/month) | 37.8 | 50.7 | 70.4 | 43.5 | 13.7 | 0.0 | 0.0 | 0.0 | 32.7 | 35.6 | 57.4 | 60.3 | 401.9 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 12.4 | 18.6 | 5.9 | 0.0 | 0.0 | 0.0 | 14.0 | 15.2 | 24.6 | 0.0 | 90.8 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **79** | **96** | **180** | **341** | **623** | **910** | **1007** | **782** | **499** | **270** | **142** | **89** | **5018** |
| **Estimated Runoff ($m^3$/month)** | **335** | **449** | **624** | **386** | **121** | **0** | **0** | **0** | **290** | **315** | **509** | **535** | **3564** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **110** | **165** | **52** | **0** | **0** | **0** | **124** | **135** | **218** | **0** | **805** |
| ***Pasture and Shrubs*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.9 | 10.8 | 20.3 | 38.4 | 70.3 | 102.6 | 116.1 | 91.3 | 56.3 | 30.5 | 16.0 | 10.0 | 571.5 |
| Surplus (mm/month) | 37.8 | 50.7 | 82.8 | 62.1 | 19.5 | -10.9 | -33.4 | -8.4 | 46.7 | 50.8 | 82.0 | 60.3 | 440.0 |
| Estimated Runoff (mm/month) | 37.8 | 50.7 | 62.1 | 31.1 | 9.8 | 0.0 | 0.0 | 0.0 | 23.4 | 25.4 | 41.0 | 60.3 | 341.4 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 20.7 | 31.1 | 9.8 | 0.0 | 0.0 | 0.0 | 23.4 | 25.4 | 41.0 | 0.0 | 151.3 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **57** | **69** | **129** | **245** | **448** | **654** | **740** | **582** | **359** | **194** | **102** | **64** | **3643** |
| **Estimated Runoff ($m^3$/month)** | **241** | **323** | **396** | **198** | **62** | **0** | **0** | **0** | **149** | **162** | **261** | **384** | **2177** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **132** | **198** | **62** | **0** | **0** | **0** | **149** | **162** | **261** | **0** | **964** |
| ***Mature Forest*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.9 | 10.8 | 20.3 | 38.4 | 70.3 | 102.6 | 117.4 | 93.0 | 56.3 | 30.5 | 16.0 | 10.0 | 574.5 |
| Surplus (mm/month) | 37.8 | 50.7 | 82.8 | 62.1 | 19.5 | -10.9 | -34.7 | -10.1 | 46.7 | 50.8 | 82.0 | 60.3 | 437.0 |
| Estimated Runoff (mm/month) | 37.8 | 50.7 | 58.0 | 24.9 | 7.8 | 0.0 | 0.0 | 0.0 | 18.7 | 20.3 | 32.8 | 60.3 | 311.2 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 24.8 | 37.3 | 11.7 | 0.0 | 0.0 | 0.0 | 28.0 | 30.5 | 49.2 | 0.0 | 181.5 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **12** | **15** | **28** | **53** | **96** | **140** | **161** | **127** | **77** | **42** | **22** | **14** | **786** |
| **Estimated Runoff ($m^3$/month)** | **52** | **69** | **79** | **34** | **11** | **0** | **0** | **0** | **26** | **28** | **45** | **83** | **426** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **34** | **51** | **16** | **0** | **0** | **0** | **38** | **42** | **67** | **0** | **249** |
| ***Impervious Surfaces*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.4 | 11.1 | 18.6 | 18.1 | 16.2 | 16.5 | 14.9 | 14.9 | 18.5 | 14.6 | 17.6 | 12.7 | 182.1 |
| Surplus (mm/month) | 38.3 | 50.4 | 84.6 | 82.4 | 73.6 | 75.2 | 67.8 | 68.0 | 84.5 | 66.7 | 80.4 | 57.6 | 829.4 |
| Estimated Runoff (mm/month) | 38.3 | 50.4 | 84.6 | 82.4 | 73.6 | 75.2 | 67.8 | 68.0 | 84.5 | 66.7 | 80.4 | 57.6 | 829.4 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **1166** | **1535** | **2576** | **2511** | **2243** | **2290** | **2065** | **2070** | **2572** | **2030** | **2447** | **1755** | **25261** |
| **Estimated Runoff ($m^3$/month)** | **5310** | **6994** | **11733** | **11439** | **10217** | **10433** | **9409** | **9432** | **11718** | **9250** | **11150** | **7996** | **115080** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| ***Totals*** | | | | | | | | | | | | | |
| **Estimated Runoff ($m^3$/month)** | **8900** | **11811** | **17381** | **14006** | **11022** | **10433** | **9409** | **9432** | **13648** | **11349** | **14538** | **13726** | **145656** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **2225** | **3339** | **1048** | **0** | **0** | **0** | **2509** | **2730** | **4406** | **0** | **16258** |

**Project Name: Medway Creek (Bridle Path Subdivision)**
**Project Number: KCH-21002415-A0**
**Client: York Developments**

**Post-Development Site-Wide Monthly Water Balance**

**WATER BALANCE SUMMARY**

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Totals (Pre-Development)*** | | | | | | | | | | | | | |
| **Estimated Runoff ($m^3$/month)** | **8884** | **11917** | **13970** | **6391** | **2123** | **185** | **166** | **167** | **4858** | **5223** | **8363** | **14170** | **76415** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **5514** | **8273** | **2596** | **0** | **0** | **0** | **6217** | **6763** | **10917** | **0** | **40279** |
| ***TOTALS (Post Development)*** | | | | | | | | | | | | | |
| **Estimated Runoff ($m^3$/month)** | **8900** | **11811** | **17381** | **14006** | **11022** | **10433** | **9409** | **9432** | **13648** | **11349** | **14538** | **13726** | **145656** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **2225** | **3339** | **1048** | **0** | **0** | **0** | **2509** | **2730** | **4406** | **0** | **16258** |

| **Total Area** | PRE | POST | VOL CHANGE | % Maintained | Post with Mitigation (without increased topsoil thickness) | % Difference with Mitigation |
|---|---|---|---|---|---|---|
| **Estimated Runoff ($m^3$/year)** | **76,415** | **145,656** | **69,240** | **191%** | **129,633** | **170%** |
| **Estimated Infiltration ($m^3$/year)** | **40,279** | **16,258** | **(24,021)** | **40%** | **32,280** | **80%** |

| **With Mitigation:** | | |
|---|---|---|
| Runoff reduction | % | 11% |
| Runoff Reduction | $m^3$/year | 16,022 |
| Estimated Runoff with Reduction | $m^3$/year | 129,633 |
| Estimated Infiltration with Runoff Reduction | $m^3$/year | 32,280 |

**Increased Topsoil Thickness - at least 300 mm**

5% Reduction in Runoff / Increase in Infiltration ($m^3$/yr) (TRCA, 2014) 7283

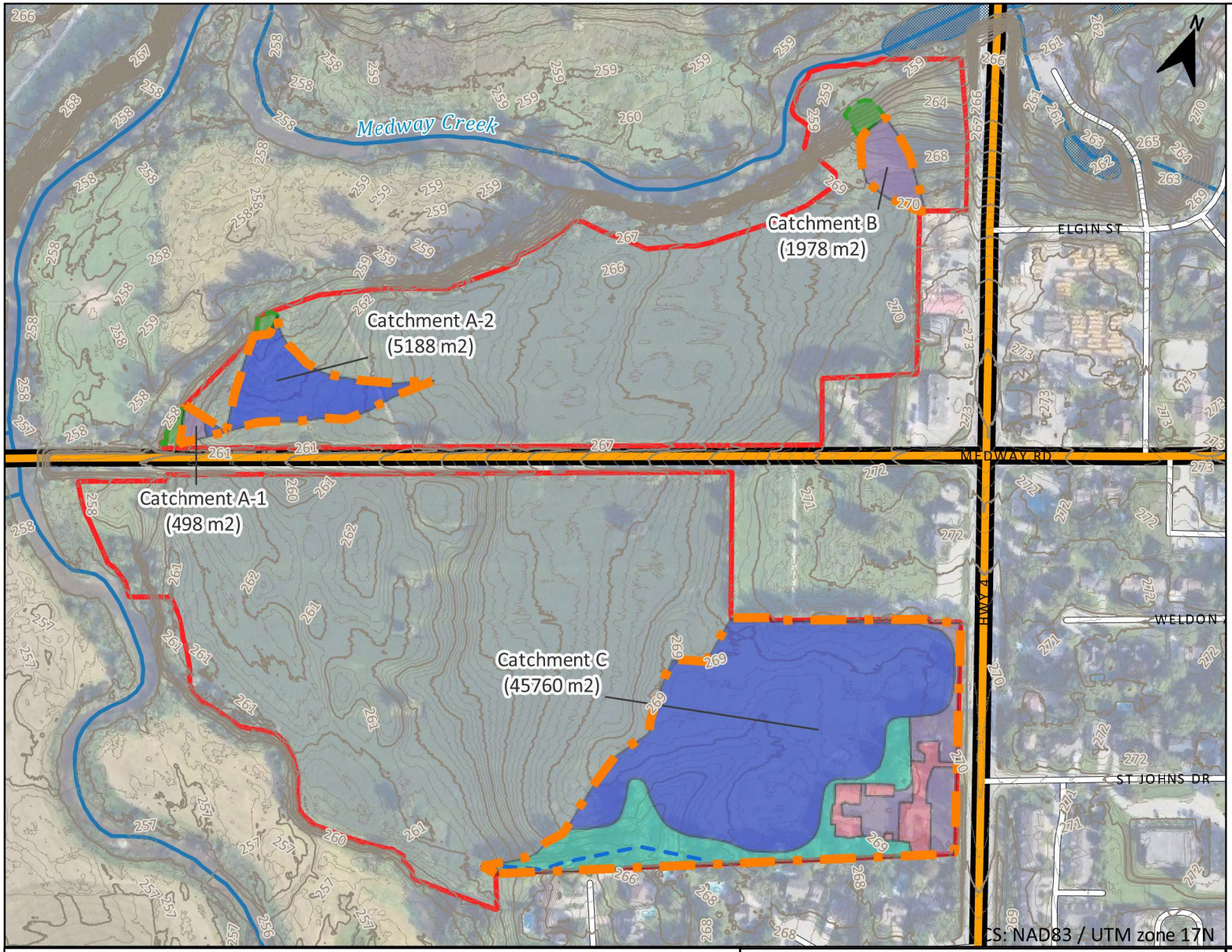
With Increased Topsoil Thickness (No Additional Mitigation)

| **Total Area** | PRE | POST | VOL CHANGE | % Maintained | Post with Mitigation - Increased Topsoil | % Difference with Mitigation |
|---|---|---|---|---|---|---|
| **Estimated Runoff ($m^3$/year)** | **76,415** | **145,656** | **69,240** | **191%** | **138,373** | **181%** |
| **Estimated Infiltration ($m^3$/year)** | **40,279** | **16,258** | **(24,021)** | **40%** | **23,541** | **58%** |

With Increased Topsoil Thickness and Additional Mitigation

| **Total Area** | PRE | POST with topsoil | VOL CHANGE | % Maintained | Post with Mitigation - Increased Topsoil | % Difference with Mitigation |
|---|---|---|---|---|---|---|
| **Estimated Runoff ($m^3$/year)** | **76,415** | **138,373** | **61,957** | **181%** | **129,693** | **170%** |
| **Estimated Infiltration ($m^3$/year)** | **40,279** | **23,541** | **(16,738)** | **58%** | **32,220** | **80%** |

| **With Mitigation:** | | |
|---|---|---|
| Runoff reduction | % | 6% |
| Runoff Reduction | $m^3$/year | 8,680 |
| Estimated Runoff with Reduction | $m^3$/year | 129,693 |
| Estimated Infiltration with Runoff Reduction | $m^3$/year | 32,220 |




-LEGEND-

- Subject Lands
- Watercourse (Medway Creek)
- Headwater Drainage Feature
- Catchment Areas

Pre-Development Ground Cover

- Impervious
- Moderately Rooted Crops
- Mature Forest
- Pasture and Shrubs

Notes:

Data Sources:
Contains information licensed under the Open Government License - Ontario
Google Earth Imagery (c) 2022 City of London, First Base Solutions, Maxar Technologies

Hydrogeological Assessment

**Bridle Path Subdivision**

Medway Creek, Arva, ON

| | |
|---|---|
| CLIENT | Bridle Path North Arva Inc. |
| TITLE | Pre-Development Catchments & Land Cover - Feature Based |
| Prepared By: K.W. | Reviewed By: H.J./H.B. |

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

| DATE | SCALE | PROJECT NO. | FIG. |
|---|---|---|---|
| Nov. 2024 | 1:4,500 | KCH-21002415 | K-2 |

**Project Name: Medway Creek (Bridle Path Subdivision)**
**Project Number: KCH-21002415-A0**
**Client: York Developments**

**Pre-Development Monthly Water Balance - Feature Based**

**CATCHMENT A-1 PRE-DEVELOPMENT WATER BALANCE CALCULATIONS**

| Total Area | Impervious Area ($m^2$) | Pervious Area ($m^2$) | Total Area ($m^2$) | Soil Type | Soil Group | Water Holding Capacity (mm) | Infiltration Factor | $T_{rain}$ (°C) | $T_{snow}$ (°C) | Meltmax (%/100) |
|---|---|---|---|---|---|---|---|---|---|---|
| Agricultural Land/Moderately Rooted Crops- Type A-B | - | 105 | **498** | Sand/Sand and Gravel/Silty Sand/Silt | A-B | 113 (rounded) | 0.6 | 3.3 | -10.0 | 1 |
| Pasture and Shrubs | - | 393 | | Silt/Silt Loam with some Sand and Gravel | B | 150 | 0.5 | | | |

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Temperature (°C) | -5.6 | -4.5 | -0.1 | 6.8 | 13.1 | 18.3 | 20.8 | 19.7 | 15.5 | 9.2 | 3.4 | -2.6 | |
| Total Precipitation (mm/month) | 74.2 | 65.5 | 71.5 | 83.4 | 89.8 | 91.7 | 82.7 | 82.9 | 103.0 | 81.3 | 98.0 | 87.5 | 1011.5 |
| Precipitation as rain (mm/month) | 24.5 | 27.1 | 53.2 | 83.4 | 89.8 | 91.7 | 82.7 | 82.9 | 103.0 | 81.3 | 98.0 | 48.7 | |
| Precipitation as snow (mm/month) | 49.7 | 38.4 | 18.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 38.8 | |
| Potential Snow Melt (mm/month) | 22.1 | 34.4 | 49.9 | 21.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.6 | |
| Actual Snow Melt (mm/month) | 22.1 | 34.4 | 49.9 | 17.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.6 | |
| Snow Storage (mm/month) | 44.7 | 48.8 | 17.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 17.2 | |
| ***Agricultural Land - A-B type soils*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.9 | 10.8 | 20.3 | 38.4 | 70.3 | 102.6 | 115.3 | 90.2 | 56.3 | 30.5 | 16.0 | 10.0 | 569.6 |
| Surplus (mm/month) | 37.8 | 50.7 | 82.8 | 62.1 | 19.5 | -10.9 | -32.6 | -7.3 | 46.7 | 50.8 | 82.0 | 60.3 | 441.9 |
| Estimated Runoff (mm/month) | 37.8 | 50.7 | 58.0 | 24.9 | 7.8 | 0.0 | 0.0 | 0.0 | 18.7 | 20.3 | 32.8 | 60.3 | 311.2 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 24.8 | 37.3 | 11.7 | 0.0 | 0.0 | 0.0 | 28.0 | 30.5 | 49.2 | 0.0 | 181.5 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **1** | **1** | **2** | **4** | **7** | **11** | **12** | **9** | **6** | **3** | **2** | **1** | **60** |
| **Estimated Runoff ($m^3$/month)** | **4** | **5** | **6** | **3** | **1** | **0** | **0** | **0** | **2** | **2** | **3** | **6** | **33** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **3** | **4** | **1** | **0** | **0** | **0** | **3** | **3** | **5** | **0** | **19** |
| ***Pasture and Shrubs*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.9 | 10.8 | 20.3 | 38.4 | 70.3 | 102.6 | 116.1 | 91.3 | 56.3 | 30.5 | 16.0 | 10.0 | 571.5 |
| Surplus (mm/month) | 37.8 | 50.7 | 82.8 | 62.1 | 19.5 | -10.9 | -33.4 | -8.4 | 46.7 | 50.8 | 82.0 | 60.3 | 440.0 |
| Estimated Runoff (mm/month) | 37.8 | 50.7 | 62.1 | 31.1 | 9.8 | 0.0 | 0.0 | 0.0 | 23.4 | 25.4 | 41.0 | 60.3 | 341.4 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 20.7 | 31.1 | 9.8 | 0.0 | 0.0 | 0.0 | 23.4 | 25.4 | 41.0 | 0.0 | 151.3 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **3** | **4** | **8** | **15** | **28** | **40** | **46** | **36** | **22** | **12** | **6** | **4** | **225** |
| **Estimated Runoff ($m^3$/month)** | **15** | **20** | **24** | **12** | **4** | **0** | **0** | **0** | **9** | **10** | **16** | **24** | **134** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **8** | **12** | **4** | **0** | **0** | **0** | **9** | **10** | **16** | **0** | **59** |
| ***Totals*** | | | | | | | | | | | | | |
| **Estimated Runoff ($m^3$/month)** | **19** | **25** | **31** | **15** | **5** | **0** | **0** | **0** | **11** | **12** | **20** | **30** | **167** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **11** | **16** | **5** | **0** | **0** | **0** | **12** | **13** | **21** | **0** | **79** |

**Project Name: Medway Creek (Bridle Path Subdivision)**
**Project Number: KCH-21002415-A0**
**Client: York Developments**

**Pre-Development Monthly Water Balance - Feature Based**

**CATCHMENT A-2 PRE-DEVELOPMENT WATER BALANCE CALCULATIONS**

| Total Area | Impervious Area ($m^2$) | Pervious Area ($m^2$) | Total Area ($m^2$) | Soil Type | Soil Group | Water Holding Capacity (mm) | Infiltration Factor | $T_{rain}$ (°C) | $T_{snow}$ (°C) | Meltmax (%/100) |
|---|---|---|---|---|---|---|---|---|---|---|
| Agricultural Land/Moderately Rooted Crops- Type A-B | - | 5,187 | **5,187** | Sand/Sand and Gravel/Silty Sand/Silt | A-B | 113 (rounded) | 0.6 | 3.3 | -10.0 | 1 |

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Temperature (°C) | -5.6 | -4.5 | -0.1 | 6.8 | 13.1 | 18.3 | 20.8 | 19.7 | 15.5 | 9.2 | 3.4 | -2.6 | |
| Total Precipitation (mm/month) | 74.2 | 65.5 | 71.5 | 83.4 | 89.8 | 91.7 | 82.7 | 82.9 | 103.0 | 81.3 | 98.0 | 87.5 | 1011.5 |
| Precipitation as rain (mm/month) | 24.5 | 27.1 | 53.2 | 83.4 | 89.8 | 91.7 | 82.7 | 82.9 | 103.0 | 81.3 | 98.0 | 48.7 | |
| Precipitation as snow (mm/month) | 49.7 | 38.4 | 18.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 38.8 | |
| Potential Snow Melt (mm/month) | 22.1 | 34.4 | 49.9 | 21.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.6 | |
| Actual Snow Melt (mm/month) | 22.1 | 34.4 | 49.9 | 17.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.6 | |
| Snow Storage (mm/month) | 44.7 | 48.8 | 17.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 17.2 | |
| ***Agricultural Land - A-B type soils*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.9 | 10.8 | 20.3 | 38.4 | 70.3 | 102.6 | 115.3 | 90.2 | 56.3 | 30.5 | 16.0 | 10.0 | 569.6 |
| Surplus (mm/month) | 37.8 | 50.7 | 82.8 | 62.1 | 19.5 | -10.9 | -32.6 | -7.3 | 46.7 | 50.8 | 82.0 | 60.3 | 441.9 |
| Estimated Runoff (mm/month) | 37.8 | 50.7 | 58.0 | 24.9 | 7.8 | 0.0 | 0.0 | 0.0 | 18.7 | 20.3 | 32.8 | 60.3 | 311.2 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 24.8 | 37.3 | 11.7 | 0.0 | 0.0 | 0.0 | 28.0 | 30.5 | 49.2 | 0.0 | 181.5 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **46** | **56** | **105** | **199** | **365** | **532** | **598** | **468** | **292** | **158** | **83** | **52** | **2955** |
| **Estimated Runoff ($m^3$/month)** | **196** | **263** | **301** | **129** | **40** | **0** | **0** | **0** | **97** | **105** | **170** | **313** | **1614** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **129** | **193** | **61** | **0** | **0** | **0** | **145** | **158** | **255** | **0** | **942** |

| ***Totals*** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Estimated Runoff ($m^3$/month)** | **196** | **263** | **301** | **129** | **40** | **0** | **0** | **0** | **97** | **105** | **170** | **313** | **1614** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **129** | **193** | **61** | **0** | **0** | **0** | **145** | **158** | **255** | **0** | **942** |

**Project Name: Medway Creek (Bridle Path Subdivision)**
**Project Number: KCH-21002415-A0**
**Client: York Developments**

**Pre-Development Monthly Water Balance - Feature Based**

**CATCHMENT B PRE-DEVELOPMENT WATER BALANCE CALCULATIONS**

| Total Area | Impervious Area ($m^2$) | Pervious Area ($m^2$) | Total Area ($m^2$) | Soil Type | Soil Group | Water Holding Capacity (mm) | Infiltration Factor | $T_{rain}$ (°C) | $T_{snow}$ (°C) | Meltmax (%/100) |
|---|---|---|---|---|---|---|---|---|---|---|
| Pasture and Shrubs | - | 1,978 | **1,978** | Silt/Silt Loam with some Sand and Gravel | B | 150 | 0.5 | 3.3 | -10.0 | 1 |

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Temperature (°C) | -5.6 | -4.5 | -0.1 | 6.8 | 13.1 | 18.3 | 20.8 | 19.7 | 15.5 | 9.2 | 3.4 | -2.6 | |
| Total Precipitation (mm/month) | 74.2 | 65.5 | 71.5 | 83.4 | 89.8 | 91.7 | 82.7 | 82.9 | 103.0 | 81.3 | 98.0 | 87.5 | 1011.5 |
| Precipitation as rain (mm/month) | 24.5 | 27.1 | 53.2 | 83.4 | 89.8 | 91.7 | 82.7 | 82.9 | 103.0 | 81.3 | 98.0 | 48.7 | |
| Precipitation as snow (mm/month) | 49.7 | 38.4 | 18.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 38.8 | |
| Potential Snow Melt (mm/month) | 22.1 | 34.4 | 49.9 | 21.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.6 | |
| Actual Snow Melt (mm/month) | 22.1 | 34.4 | 49.9 | 17.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.6 | |
| Snow Storage (mm/month) | 44.7 | 48.8 | 17.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 17.2 | |
| ***Pasture and Shrubs*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.9 | 10.8 | 20.3 | 38.4 | 70.3 | 102.6 | 115.3 | 90.2 | 56.3 | 30.5 | 16.0 | 10.0 | 569.6 |
| Surplus (mm/month) | 37.8 | 50.7 | 82.8 | 62.1 | 19.5 | -10.9 | -32.6 | -7.3 | 46.7 | 50.8 | 82.0 | 60.3 | 441.9 |
| Estimated Runoff (mm/month) | 37.8 | 50.7 | 62.1 | 31.1 | 9.8 | 0.0 | 0.0 | 0.0 | 23.4 | 25.4 | 41.0 | 60.3 | 341.4 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 20.7 | 31.1 | 9.8 | 0.0 | 0.0 | 0.0 | 23.4 | 25.4 | 41.0 | 0.0 | 151.3 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **18** | **21** | **40** | **76** | **139** | **203** | **228** | **178** | **111** | **60** | **32** | **20** | **1127** |
| **Estimated Runoff ($m^3$/month)** | **75** | **100** | **123** | **61** | **19** | **0** | **0** | **0** | **46** | **50** | **81** | **119** | **675** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **41** | **61** | **19** | **0** | **0** | **0** | **46** | **50** | **81** | **0** | **299** |

| ***Totals*** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Estimated Runoff ($m^3$/month)** | **75** | **100** | **123** | **61** | **19** | **0** | **0** | **0** | **46** | **50** | **81** | **119** | **675** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **41** | **61** | **19** | **0** | **0** | **0** | **46** | **50** | **81** | **0** | **299** |

**Project Name: Medway Creek (Bridle Path Subdivision)**
**Project Number: KCH-21002415-A0**
**Client: York Developments**

**Pre-Development Monthly Water Balance - Feature Based**

**CATCHMENT C PRE-DEVELOPMENT WATER BALANCE CALCULATIONS**

| Total Area | Impervious Area ($m^2$) | Pervious Area ($m^2$) | Total Area ($m^2$) | Soil Type | Soil Group | Water Holding Capacity (mm) | Infiltration Factor | $T_{rain}$ (°C) | $T_{snow}$ (°C) | Meltmax (%/100) |
|---|---|---|---|---|---|---|---|---|---|---|
| Agricultural Land/Moderately Rooted Crops- Type A-B | - | 20,687 | **45,759** | Sand/Sand and Gravel/Silty Sand/Silt | A-B | 113 (rounded) | 0.6 | 3.3 | -10.0 | 1 |
| Agricultural Land/Moderately Rooted Crops- Type D | - | 9,817 | | Clayey Silt Till | D | 150 | 0.3 | | | |
| Pasture and Shrubs | - | 4,213 | | Silt/Silt Loam with some Sand and Gravel | B | 150 | 0.5 | | | |
| Mature Forest | - | 8,588 | | Silt/Silt Loam with some Sand and Gravel | B | 300 | 0.6 | | | |
| Impervious - Buildings & Paved Surfaces | 2,454 | - | | | | | | | | |

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Temperature (°C) | -5.6 | -4.5 | -0.1 | 6.8 | 13.1 | 18.3 | 20.8 | 19.7 | 15.5 | 9.2 | 3.4 | -2.6 | |
| Total Precipitation (mm/month) | 74.2 | 65.5 | 71.5 | 83.4 | 89.8 | 91.7 | 82.7 | 82.9 | 103.0 | 81.3 | 98.0 | 87.5 | 1011.5 |
| Precipitation as rain (mm/month) | 24.5 | 27.1 | 53.2 | 83.4 | 89.8 | 91.7 | 82.7 | 82.9 | 103.0 | 81.3 | 98.0 | 48.7 | |
| Precipitation as snow (mm/month) | 49.7 | 38.4 | 18.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 38.8 | |
| Potential Snow Melt (mm/month) | 22.1 | 34.4 | 49.9 | 21.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.6 | |
| Actual Snow Melt (mm/month) | 22.1 | 34.4 | 49.9 | 17.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.6 | |
| Snow Storage (mm/month) | 44.7 | 48.8 | 17.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 17.2 | |
| ***Agricultural Land - A-B type soils*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.9 | 10.8 | 20.3 | 38.4 | 70.3 | 102.6 | 115.3 | 90.2 | 56.3 | 30.5 | 16.0 | 10.0 | 569.6 |
| Surplus (mm/month) | 37.8 | 50.7 | 82.8 | 62.1 | 19.5 | -10.9 | -32.6 | -7.3 | 46.7 | 50.8 | 82.0 | 60.3 | 441.9 |
| Estimated Runoff (mm/month) | 37.8 | 50.7 | 58.0 | 24.9 | 7.8 | 0.0 | 0.0 | 0.0 | 18.7 | 20.3 | 32.8 | 60.3 | 311.2 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 24.8 | 37.3 | 11.7 | 0.0 | 0.0 | 0.0 | 28.0 | 30.5 | 49.2 | 0.0 | 181.5 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **184** | **223** | **420** | **794** | **1454** | **2122** | **2385** | **1866** | **1165** | **631** | **331** | **207** | **11783** |
| **Estimated Runoff ($m^3$/month)** | **781** | **1048** | **1199** | **514** | **161** | **0** | **0** | **0** | **386** | **420** | **679** | **1247** | **6437** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **514** | **771** | **242** | **0** | **0** | **0** | **580** | **631** | **1018** | **0** | **3755** |
| ***Agricultural Land - D type soils*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.9 | 10.8 | 20.3 | 38.4 | 70.3 | 102.6 | 116.1 | 91.3 | 56.3 | 30.5 | 16.0 | 10.0 | 571.5 |
| Surplus (mm/month) | 37.8 | 50.7 | 82.8 | 62.1 | 19.5 | -10.9 | -33.4 | -8.4 | 46.7 | 50.8 | 82.0 | 60.3 | 440.0 |
| Estimated Runoff (mm/month) | 37.8 | 50.7 | 70.4 | 43.5 | 13.7 | 0.0 | 0.0 | 0.0 | 32.7 | 35.6 | 57.4 | 60.3 | 401.9 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 12.4 | 18.6 | 5.9 | 0.0 | 0.0 | 0.0 | 14.0 | 15.2 | 24.6 | 0.0 | 90.8 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **87** | **106** | **199** | **377** | **690** | **1007** | **1140** | **896** | **553** | **299** | **157** | **98** | **5610** |
| **Estimated Runoff ($m^3$/month)** | **371** | **497** | **691** | **427** | **134** | **0** | **0** | **0** | **321** | **349** | **563** | **592** | **3946** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **122** | **183** | **57** | **0** | **0** | **0** | **138** | **150** | **241** | **0** | **891** |
| ***Pasture and Shrubs*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.9 | 10.8 | 20.3 | 38.4 | 70.3 | 102.6 | 116.1 | 91.3 | 56.3 | 30.5 | 16.0 | 10.0 | 571.5 |
| Surplus (mm/month) | 37.8 | 50.7 | 82.8 | 62.1 | 19.5 | -10.9 | -33.4 | -8.4 | 46.7 | 50.8 | 82.0 | 60.3 | 440.0 |
| Estimated Runoff (mm/month) | 37.8 | 50.7 | 62.1 | 31.1 | 9.8 | 0.0 | 0.0 | 0.0 | 23.4 | 25.4 | 41.0 | 60.3 | 341.4 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 20.7 | 31.1 | 9.8 | 0.0 | 0.0 | 0.0 | 23.4 | 25.4 | 41.0 | 0.0 | 151.3 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **37** | **46** | **86** | **162** | **296** | **432** | **489** | **385** | **237** | **128** | **67** | **42** | **2408** |
| **Estimated Runoff ($m^3$/month)** | **159** | **214** | **262** | **131** | **41** | **0** | **0** | **0** | **98** | **107** | **173** | **254** | **1438** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **87** | **131** | **41** | **0** | **0** | **0** | **98** | **107** | **173** | **0** | **637** |
| ***Mature Forest*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.9 | 10.8 | 20.3 | 38.4 | 70.3 | 102.6 | 117.4 | 93.0 | 56.3 | 30.5 | 16.0 | 10.0 | 574.5 |
| Surplus (mm/month) | 37.8 | 50.7 | 82.8 | 62.1 | 19.5 | -10.9 | -34.7 | -10.1 | 46.7 | 50.8 | 82.0 | 60.3 | 437.0 |
| Estimated Runoff (mm/month) | 37.8 | 50.7 | 58.0 | 24.9 | 7.8 | 0.0 | 0.0 | 0.0 | 18.7 | 20.3 | 32.8 | 60.3 | 311.2 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 24.8 | 37.3 | 11.7 | 0.0 | 0.0 | 0.0 | 28.0 | 30.5 | 49.2 | 0.0 | 181.5 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **76** | **93** | **174** | **330** | **604** | **881** | **1008** | **799** | **484** | **262** | **137** | **86** | **4934** |
| **Estimated Runoff ($m^3$/month)** | **324** | **435** | **498** | **213** | **67** | **0** | **0** | **0** | **160** | **175** | **282** | **518** | **2672** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **213** | **320** | **100** | **0** | **0** | **0** | **241** | **262** | **423** | **0** | **1559** |
| ***Impervious Surfaces*** | | | | | | | | | | | | | |
| Estimated Actual Evapotranspiration (mm/month) | 8.4 | 11.1 | 18.6 | 18.1 | 16.2 | 16.5 | 14.9 | 14.9 | 18.5 | 14.6 | 17.6 | 12.7 | 182.1 |
| Surplus (mm/month) | 38.3 | 50.4 | 84.6 | 82.4 | 73.6 | 75.2 | 67.8 | 68.0 | 84.5 | 66.7 | 80.4 | 57.6 | 829.4 |
| Estimated Runoff (mm/month) | 38.3 | 50.4 | 84.6 | 82.4 | 73.6 | 75.2 | 67.8 | 68.0 | 84.5 | 66.7 | 80.4 | 57.6 | 829.4 |
| Estimated Infiltration (mm/month) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Estimated Actual Evapotranspiration ($m^3$/month)** | **21** | **27** | **46** | **44** | **40** | **41** | **37** | **37** | **45** | **36** | **43** | **31** | **447** |
| **Estimated Runoff ($m^3$/month)** | **94** | **124** | **208** | **202** | **181** | **185** | **166** | **167** | **207** | **164** | **197** | **141** | **2035** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| ***Totals*** | | | | | | | | | | | | | |
| **Estimated Runoff ($m^3$/month)** | **1730** | **2318** | **2858** | **1488** | **584** | **185** | **166** | **167** | **1173** | **1215** | **1894** | **2752** | **16529** |
| **Estimated Infiltration ($m^3$/month)** | **0** | **0** | **937** | **1405** | **441** | **0** | **0** | **0** | **1056** | **1149** | **1855** | **0** | **6843** |

Project Name: Medway Creek (Bridle Path Subdivision)
Project Number: KCH-21002415-A0
Client: York Developments

Pre-Development Monthly Water Balance - Feature Based

PRE-DEVELOPMENT WATER BALANCE SUMMARY

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *TOTALS - CATCHMENT A-1* | | | | | | | | | | | | | |
| Estimated Runoff (m3/month) | 19 | 25 | 31 | 15 | 5 | 0 | 0 | 0 | 11 | 12 | 20 | 30 | 167 |
| Estimated Infiltration (m3/month) | 0 | 0 | 11 | 16 | 5 | 0 | 0 | 0 | 12 | 13 | 21 | 0 | 79 |
| *TOTALS - CATCHMENT A-2* | | | | | | | | | | | | | |
| Estimated Runoff (m3/month) | 196 | 263 | 301 | 129 | 40 | 0 | 0 | 0 | 97 | 105 | 170 | 313 | 1614 |
| Estimated Infiltration (m3/month) | 0 | 0 | 129 | 193 | 61 | 0 | 0 | 0 | 145 | 158 | 255 | 0 | 942 |
| *TOTALS - CATCHMENT B* | | | | | | | | | | | | | |
| Estimated Runoff (m3/month) | 75 | 100 | 123 | 61 | 19 | 0 | 0 | 0 | 46 | 50 | 81 | 119 | 675 |
| Estimated Infiltration (m3/month) | 0 | 0 | 41 | 61 | 19 | 0 | 0 | 0 | 46 | 50 | 81 | 0 | 299 |
| *TOTALS - CATCHMENT B* | | | | | | | | | | | | | |
| Estimated Runoff (m3/month) | 1730 | 2318 | 2858 | 1488 | 584 | 185 | 166 | 167 | 1173 | 1215 | 1894 | 2752 | 16529 |
| Estimated Infiltration (m3/month) | 0 | 0 | 937 | 1405 | 441 | 0 | 0 | 0 | 1056 | 1149 | 1855 | 0 | 6843 |

**WATER BALANCE ASSUMPTIONS**

1. AET occurs year round. Although the average temperature is below 0°C in the winter months, fluctuation above and below the freezing temperature of water occurs. The Thornthwaite model used assumes $T_{rain}$ = 3.3°C and $T_{snow}$ = -10.0°C. When the average monthly temperature falls between these values, the monthly precipitation as rain and snow is derived by assuming a linear interpolation between these values, consistent with the methodology used in the accepted USGS reference material (McCabe, G.J., and Markstrom, S.L., 2007, A monthly water-balance model driven by a graphical use interface: U.S. Geological Survey Open-File report 2007-1088, 6 p.). Values of AET were taken from the Thornthwaite model and are considered to be representative of actual site conditions.

2. Monthly surplus is calculated by summing the precipitation as rain and actual snow melt, less estimated evapotranspiration.

3. Negative surplus values can be achieved during the summer months as water storage is the vadose zone of the soil is subject to evapotranspiration and depleted.

4. Infiltration is assumed not to occur between December and February as frost is typically present throughout those months.

5. Infiltration in March (Average temperature of -0.1°C), is assumed to occur during half of the month.

6. No net infiltration or runoff occur in the summer as the rainfall accumulation is stored on site and infiltration was not assigned a negative value. See Assumption 3.

7. Evapotranspiration in impervious areas is the sum of precipitation as rain and snow melt multiplied by a factor of 0.18.

8. The post-development park block, stormwater management block, and pump station block are assumed to be 10%, 50%, and 50% impervious, respectively.

# Appendix L – Limitations and Use of Report

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## LIMITATIONS AND USE OF REPORT

### BASIS OF REPORT

This report ("Report") is based on site conditions known or inferred by the geotechnical investigation undertaken as of the date of the Report. Should changes occur which potentially impact the geotechnical condition of the site, or if construction is implemented more than one year following the date of the Report, the recommendations of EXP may require re-evaluation.

The Report is provided solely for the guidance of design engineers and on the assumption that the design will be in accordance with applicable codes and standards. Any changes in the design features which potentially impact the geotechnical analyses or issues concerning the geotechnical aspects of applicable codes and standards will necessitate a review of the design by EXP. Additional field work and reporting may also be required.

Where applicable, recommended field services are the minimum necessary to ascertain that construction is being carried out in general conformity with building code guidelines, generally accepted practices and EXP's recommendations. Any reduction in the level of services recommended will result in EXP providing qualified opinions regarding the adequacy of the work. EXP can assist design professionals or contractors retained by the Client to review applicable plans, drawings, and specifications as they relate to the Report or to conduct field reviews during construction.

Contractors contemplating work on the site are responsible for conducting an independent investigation and interpretation of the test pit results contained in the Report. The number of test pits necessary to determine the localized underground conditions as they impact construction costs, techniques, sequencing, equipment and scheduling may be greater than those carried out for the purpose of the Report.

Classification and identification of soils, rocks, geological units, contaminant materials, building envelopment assessments, and engineering estimates are based on investigations performed in accordance with the standard of care set out below and require the exercise of judgment. As a result, even comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations or building envelope descriptions involve an inherent risk that some conditions will not be detected. All documents or records summarizing investigations are based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated. Some conditions are subject to change over time. The Report presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, these should be disclosed to EXP to allow for additional or special investigations to be undertaken not otherwise within the scope of investigation conducted for the purpose of the Report.

**RELIANCE ON INFORMATION PROVIDED**

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