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Redford Pit Expansion

COMBINED LEVEL 1 AND 2 HYDROGEOLOGICAL ASSESSMENT

Walker Aggregates Inc.

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Issue	Date	Description
1	June 21, 2024	Combined Level 1 and 2 Hydrogeological Assessment Report
2	July 17, 2024	Combined Level 1 and 2 Hydrogeological Assessment Report – Revised
3	July 22, 2025	Combined Level 1 and 2 Hydrogeological Assessment Report – Revision 2

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1 Introduction

Tatham Engineering Limited (Tatham) has been retained by Walker Aggregates Inc. (Walker) to complete a Combined Level 1 and 2 Hydrogeological Investigation to support the proposed expansion of the Redford Pit in Hanover. Walker is preparing an application with the Ministry of Natural Resources and Forestry (MNRF) for an Aggregate Resources Act (ARA) Class A Pit Above Water licence for the proposed expansion of the existing Walker Redford Pit. The proposed expansion lands are located on north ½ of Lot 20, Concession 5 NDR, Geographic Township of Bentinck, Municipality of West Grey, County of Grey (hereafter referred to as the 'site' or 'subject property'). The site location and borehole/monitoring well location plan are presented on Figures 1 and 2, respectively.

Tatham has prepared this Combined Level 1 and 2 Hydrogeological Assessment for the proposed aggregate operation in accordance with the relevant *Provincial Standards including Aggregate Resources of Ontario Technical Reports and Information Standards, dated August 2020*. The standards outline the technical requirements for various aggregate applications. For a Class A Pit Above Water licence the hydrogeological requirement is to predict the maximum water table in metres above sea level, relative to the proposed depth of excavation at the site.

1.1 SITE DESCRIPTION

Walker currently owns and operates the Redford Pit (license No. 624883) located on Lot 19 Concession 5, Township of Bentinck, Municipality of West Grey, County of Grey. The proposed expansion is located east of and adjacent to the current pit and consists of an approximate plan area of 20.8 hectares (ha) of which approximately 13.8 ha is proposed for extraction.

The site is primarily used for agricultural purposes with a single residential dwelling located near the central west portion the property. The surrounding properties are primarily used for agricultural purposes, and/or rural residential properties. Properties within the vicinity of the site are serviced by individual private water supply wells. A water supply well is present on the site and on adjacent properties, which are discussed further in section 2.4.2.

Further, the site is located between several licensed and/or proposed aggregate operations.

The topography across the site consists of gentle hills, with lower lying areas in the southeast, central west, northwest and east. Generally, the elevation slopes to the east towards the Saugeen River located approximately 80 to 100 m east of the eastern site boundary. Elevations on site range between approximately 289 to 301 m asl. Runoff is expected to follow local topography to lower lying areas and ultimately flow towards the east to a roadside ditch before being conveyed to the Saugeen River.

Locally, there is a small unevaluated wetland to the south of the proposed expansion which receives a portion of the site runoff under existing conditions before runoff is conveyed to the Saugeen River to the east.

1.2 SITE DEVELOPMENT

The expansion proposed is considering a Class A Above Water Pit, with an extractable area of 13.8 ha. The proposed pit will be an extension to the east of the existing Redford Pit. The proposed expansion will consist of a 2-phase approach. Currently one lift is being considered; however, in operation multiple lifts may be considered depending on the conditions encountered. Phase 1 will extend from the southwest corner of the site towards the northeast, extending to the center of the site. Phase 2 continues from the center of the site to the northeast extraction boundary. Extraction will remain at least 1.5 m above the maximum predicted water table as established in this assessment.

The main site access and scales will be maintained at the existing Redford Pit; however, site access from Allan Park Road will be available if required. Processing will be initially completed on the existing Redford Pit but a processing area on the expansion lands has been included in the site plans, if needed.

Annual extraction is expected at a rate greater than 20,000 tonnes annually; however, will not exceed 300,000 tonnes.

On-site drainage of undisturbed areas will continue as per the existing features plan and drainage of the extracted areas will be contained within the proposed extraction limits to ultimately infiltrate through the pit floor.

Berms will be constructed along the south/southeast boundaries and along the east boundary north of the site access at Allan Park Road from striped topsoil and overburden prior to extraction operations commencing. Optional berms may be constructed along the east and/or north property boundary if deemed necessary. Once the berms are established, remaining topsoil and overburden shall be used for progressive rehabilitation or if areas are not available for rehabilitation topsoil will be temporary stockpiled. No topsoil will be removed from the site.

A copy of the current concept plan is provided in Appendix A.

1.3 PURPOSE AND SCOPE OF WORK

The main objective of this Hydrogeological Investigation is to:

- Establish local and regional geology and hydrogeology.
- Establish the maximum water table in meters above sea level at the site.

- Assess the baseline natural chemical signature of the groundwater system at the site and the aquifers response to climatic conditions.

To achieve the above objectives, Tatham completed the following scope of work:

- A desktop review of the pertinent geological and hydrogeological resources, Ministry of Environment, Conservation and Parks (MECP) water well records, previous environmental reports, and proposed site plan drawings.
- A site visit to note existing site conditions, topography, drainage, water features, neighboring land uses and/or existing water supply or monitoring wells.
- The advancement of five boreholes completed with monitoring wells to assess the soil conditions and groundwater levels at the site.
- Water quality sampling to determine baseline groundwater quality at five monitoring wells in the spring and fall.
- A door-to-door well survey for neighboring properties within a 500 m radius of the site.
- A domestic water well level monitoring and water quality analysis of the neighboring properties interested in participating.
- Groundwater level monitoring of all accessible and functional wells on the site for a minimum of 1-year, to establish the high groundwater table.
- A site-specific water balance.
- An assessment of the operations of an above water pit to establish the potential impacts (if any) on the groundwater and surface systems.
- The preparation of a Hydrogeological Investigation Report.

2 Site Setting

The proposed expansion lands are located on north ½ of Lot 20, Concession 5 NDR, Geographic Township of Bentinck, Municipality of West Grey, County of Grey (hereafter referred to as the 'site' or 'subject property'). The site location and borehole/monitoring well location plan are presented on Figures 1 and 2, respectively.

2.1 SURFICIAL GEOLOGY

The subject property lies within the physiographic region known as the Horseshoe Moraines comprised of physiographic landforms such as drumlinized till plains, Kame Moraines, and large meltwater spillways (Chapman and Putnam, 2007). The site is located within the spillway landform characterized as glaciofluvial outwash sand and gravel deposits with higher hydraulic conductivities due to their coarse texture (Waterloo Hydrogeologic Inc., 2003).

Ontario Geological Survey quaternary geology mapping indicates the site and surrounding study area is located within Pleistocene Glaciofluvial outwash deposits characterized by gravel and sand including proglacial river and deltaic deposits (OGS, 2000). Ontario Geological Survey surficial geology indicates the site and surrounding study area is located within Glaciofluvial deposits including river deposits and delta topset facies (OGS, 2003).

2.2 BEDROCK GEOLOGY

The bedrock geology within the study area is comprised of the Salina formation and the Guelph formation (Armstrong and Dodge, 2007). The Salina Formation of the Upper Silurian period consists of interbedded grey-brown limestone and bituminous shale (Waterloo Hydrogeologic, 2003). The Guelph Formation of the Middle Silurian period consists of buff to brown medium-bedded dolostone. The Salina Formation is characterized by poor natural water quality, due to elevated hardness, sulphate and chloride (Waterloo Hydrogeologic Inc., 2003). The site itself lies within the Salina formation, bordering the Salina and Guelph formation divide.

2.3 TOPOGRAPHY, DRAINAGE, AND SURFACE WATER FEATURES

The topography of the site consists of gentle hills, with lower lying areas in the southeast, central west, northwest and east. Generally, the elevation slopes to the east towards the Saugeen River located approximately 80 to 100 m east of the eastern site boundary. Elevations on site range between approximately 289 to 301 m asl.

Under existing conditions, runoff from the area of the proposed expansion flows east to a roadside ditch along Allan Park Road before being conveyed to the main branch of the Saugeen

River. There is a small unevaluated wetland to the south of the proposed expansion which receives a portion of the site runoff under existing conditions before being conveyed to the Saugeen River to the east.

The topography and drainage contours of the site is presented on Figure 3.

2.4 HYDROGEOLOGY

2.4.1 Regional Hydrogeology

The regional hydrogeology of an area is controlled by the geometry of the geological features which influence the distribution and movement of groundwater. Groundwater is the water found underground in the voids of geological units (both consolidated and unconsolidated materials). Geological units, which store and transmit groundwater are called aquifers and are relied upon as a source of potable drinking water in many areas across the province, including the Town of Hanover.

Based on the Grey and Bruce Counties Groundwater Study completed in 2003, 15% of wells in the county of Grey obtain water from the overburden and the remaining are supplied by bedrock aquifers. The significant overburden aquifers are comprised of outwash, gravels of beach, lacustrine, ice-contact and glaciofluvial deposits, including spillways. Well yields in the overburden commonly range between 0.2 to 3.8 L/s. The site lies within the Salina bedrock formation, in which wells yield is commonly 0.8 to 3.8 L/s (Waterloo Hydrogeologic Inc., 2003).

2.4.2 MECP Water Wells

To assess the nature of groundwater resources as well as the history of the well usage in the area, MECP water well records were reviewed for a 500 m radius surrounding the site. The approximate MECP water well locations are shown on Figure 4, and a summary of the MECP water well records are provided in Appendix B.

A total of eight MECP well records were reviewed. Of the eight records, five wells indicated domestic water well usage, two records indicated livestock and domestic water well usage and one indicated monitoring well usage.

In general, stratigraphy noted from the well records indicate layers of sand or sand and gravel overlying limestone bedrock. Bedrock was encountered at depths ranging between 16 to 26 m bgs. Domestic water wells are anticipated to be screened within the sand and gravel aquifer with fresh water first encountered at depths of 12 to 30 m bgs. Pumping test details were provided for six of the well records. Pumping tests were carried out for 1 to 4 hours at rates of 3 to 25 Gal/min (11.3 to 94.6 L/min), and static water levels ranging from 4.0 to 12 m bgs were drawn down 0 to 9 m.

2.4.3 Regulated Groundwater Use: Permit To Take Water

Water takings in the province are governed by the Ontario Water Resource Act (OWRA) and Water Taking Regulation O.Reg. 387/04. A Permit to Take Water (PTTW) is required by the regulation, if the total water takings exceed 50,000 L of water per day.

A review of the permitted water takings within a 5 km radius of the site was completed, which included water takings for industrial, commercial, municipal, and agricultural properties. The results indicated there were four PTTW in the study area for primarily industrial or commercial uses (Access Environment, 2023). No active municipal water PTTW were within a 5 km radius of the subject property; however, the PTTW for the closest municipal water supply (the Corporation of the Town of Hanover) was included in the assessment for completeness.

Industrial/Commercial Groundwater

A summary of the industrial/commercial PTTWs within a 5 km radius of the subject property are defined below:

- PTTW 5154-97AQAT: Issued to E.C. King Contracting, a Division of Miller Paving Limited for industrial manufacturing purposes, located at Lot 52, Concession 3 West of Garafraxa Road, Township of Bentinck, West Grey, County of Grey, approximately 3.2 km southwest of the subject property. The PTTW was issued for manufacturing purposes and the takings are from a drilled well with a maximum rate of 230 L/min for a period of 12 hours per day, or 160,000 L/day, for 365 days per year. The PTTW expired May 31, 2023.
- PTTW 3116-C5DHW6: Issued to Cedarwell Excavating Ltd. for water taking from a recirculating pond and the Saugeen River for aggregate washing at Lot 19, 20, 21, 22 and 23 Concession 2, Geographic Township of Bentinck, West Grey, County of Grey, approximately 5 km southwest of the subject property. The PTTW was issued for a maximum taking of 5,727,960 L/day from the recirculating pond and 681,900 L/day from the Saugeen River for 220 days per year. However, the taking is restricted to ensuring the withdrawal rate may not exceed 10% of the available streamflow at the taking location. The PTTW expires July 29, 2031.
- PTTW 3057-7F3RJ4: Issued to Jim Taylor for water taking for commercial aquaculture purposes from camp creek, well 2, well 3 and well 4 at 1 Rural Rte #133241, Hanover, Ontario, approximately 4.5 km southeast of the subject property. The PTTW was issued for a maximum total taking of 24,221,088 L/day from the combined sources for 365 days per year. The permit expired on May 28, 2010.
- PTTW 0868-6MEJ75: Issued to Ducks Unlimited Canada for water taking from an unnamed tributary of the Styx River into an enhanced on-stream storage depression/wetland at Lot

13, Concession 9, Bentick, West Grey, County of Grey, approximately 4 km northwest of the subject property. The PTTW was issued for a maximum taking of 47,400,000 L/day for 365 days per year. The PTTW expired on December 31, 2015.

Municipal Groundwater Use

The Township of Hanover holds a PTTW (#4777-CK5SAT dated October 13, 2022) for the municipal water supply system servicing the Town of Hanover. The water supply system is comprised of two wells (Well No.1 and Well No.2). The PTTW permits the maximum combined daily taking of 9,128,368 L/day. Both the Hanover Well No.1 (ID 1400668) and Well No.2 (ID Unknown) were installed in the sand and gravel aquifer at a termination depth of approximately 33.5 and 55.5 m bgs. It is noted Hanover Well No. 1 has been identified as a Groundwater Under Direct Influence (GUDI) well, whereas Hanover Well No. 2 has not.

2.5 SOURCE WATER PROTECTION

The Clean Water Act (CWA S.O. 2006, Chapter 22) was established to provide a basis of how drinking water source protection is to be conducted. The Act is a law enacted by the Legislative Assembly of Ontario. The Act focused on sources of water designated by a municipality as being a current or future source of residential municipal drinking water for a community; and is not designated to protect all of the province's water resources. The OWRA and the Environmental Protection Act and other provincial and federal laws remain the main legislation for protecting the quality and quantity of Ontario's water resources.

To assess the potential impacts associated with the extraction of aggregate on municipal water supplies in the study area, a review of Source Water Protection Mapping was completed and outlined in sections 2.5.1 to 2.5.3, below.

2.5.1 Source Water Protection Area

The proposed Redford Pit expansion is located in the Saugeen Valley Source Protection Area (SPA). The Saugeen Valley SPA is under the jurisdiction of the Saugeen Conservation Authority and encompasses about 4,632 km^2 of plan area. The Saugeen River is the major watershed within the SPA and the sub-major watersheds include the North Saugeen River, Rocky Saugeen River, Beatty Saugeen River, South Saugeen River and the Teeswater River. Smaller watersheds such as the Penetangore River and Pine River are also included within the Saugeen Valley SPA. The watersheds drain directly to Lake Huron (Watershed Characterization, 2015).

The closest municipal drinking water supply is located in the Town of Hanover, which is located approximately 9 km southwest of the site. The proposed Redford expansion is located approximately 9 km from the delineated Hanover Wellhead Protection Area (WHPA). In addition,

the municipal drinking water supply for the Town of Durham and the delineated Durham Wellhead Protection Area is located approximately 11 km southeast of the site (Ministry of Environment, Conservation and Parks, 2023). The WHPAs are presented on Figure 5.

The site is not located within an identified Intake Protection Area (IPZ) as shown on Figure 6.

2.5.2 Significant Groundwater Recharge Areas and Highly Vulnerable Aquifers

A significant groundwater recharge area (SGRA) is subject to the rules outlined in the Clean Water Act 2006, Technical Rules for Development of an Assessment Report and the MNRF in the form of a Technical Bulletin. The determination of the SGRAs within the Saugeen Valley SPA are outlined in Chapter 3 Water Quantity Stress Assessment of the Approved Assessment Report for the Saugeen Valley Source Protection Area dated October 15, 2015. In general, the determination of the SGRAs uses hydrogeological modelling and data from Tier I, II and III water budgets, which account for the geology, soils, land cover and topography of the Region.

Due to the sand and gravel overburden, the site lies within a SGRA with an average score of 6 and is identified as a highly vulnerable aquifer (HVA) with an average score of 6, as presented on Figures 7 and 8, respectively.

The proposed change in land use from agricultural to aggregate extraction may increase vulnerability; therefore, it is important to assess the threats (if any) associated with an aggregate operation, as outlined in Sections 2.5.3 and 6.

2.5.3 Source Water Protection and Aggregate Industry

In response to the Clean Water Act regarding Source Water Protection, the Ontario Stone, Sand and Gravel Association (OSSGA) supported a literature review study by the MNRF to assess the role of the aggregate industry and associated lands in the context of source water programs. The MNRF Study, known as the Applied Research on Source Water Protection Issues in the Aggregate Industry prepared by Blackport Hydrogeology Inc., and Golder in 2006, did not document scientific evidence linking the aggregate industry activities such as extraction and processing of stone, sand or gravel as a threat to drinking water sources.

Specifically, the document indicated the effects of the aggregate extraction during above or below water table are found to be very minor or localized and result in low impacts to the yield of any nearby drinking water supplies. In addition, the research indicated little evidence of water quality effects related to normal aggregate extraction and processing activities. No documented cases of contamination of a municipal water supply well were found as a result of normal aggregate extraction activities (Blackport Hydrogeology Inc., & Golder Associates, 2006).

Under the Clean Water Act, 21 prescribed drinking water threats were identified. Of these threats, the current land use of the proposed Redford Pit is considered rural residential and agricultural, resulting in the following prescribed drinking water threats (Ministry of Environment, Conservation and Parks, 2021).

- The application of agricultural source material to land.
- The application of commercial fertilizer to land.
- The application of non-agricultural source material to land.
- The application of pesticide to land.
- The application of road salt.
- The handling and storage of commercial fertilizer.
- The handling and storage of non-agricultural source material.
- The handling and storage of pesticides.
- The handling and storage of road salts.
- The storage of agricultural source material.
- The management of agricultural source material.

The proposed change in land use to a pit, will temporarily reduce the number of prescribed drinking water threats to only the handling and storage of fuel. Given the proposed crushing, screening and washing areas will remain on the already licensed Redford pit, the storage of fuel within the proposed expansion lands is minimal. Further, aggregate extraction is an interim land-use.

The proposed final rehabilitation plan for the site is to be returned to agricultural lands and improved best management practices for the use of pesticides and fertilizers may be available at this time and overall threats to water quality will be reduced.

3 Procedures and Methodology

This scope of work was designed to build upon the regional geological and hydrogeological setting (refer to Section 2) to provide a comprehensive characterization of the site. This comprehensive characterization of the site provides the foundation to our assessment and ultimately guides the recommended long-term groundwater monitoring program.

3.1 DOOR-TO-DOOR WATER WELL SURVEY

A door-to-door well survey was completed on March 21, 2023. A total of five well users were interested in participating. A summary of the completed water well survey is provided in Table 1, below.

Table 1: Summary of Completed Domestic Water Well Survey

WELL IDENTIFIER / MECP WELL RECORD ID	TYPE OF WELL	DEPTH OF WELL (m)	STRATA SCREENED	ANY WATER QUALITY / QUANTITY CONCERNS?	TREATMENT
DW1/ 2516963	Drilled Well	41.5	Limestone	No concerns, mild hardness	Water softener and reverse osmosis
DW2/ 2516469	Drilled Well	29.8	Limestone	No concerns	Water softener and UV filter
DW3/ unknown	Dug Well	Unknown	Overburden	No concerns	No treatment
DW4/ unknown	Dug Well	Unknown	Overburden	Poor water quality, does not drink, low yield	Unknown
DW5/ 2508016	Drilled Well	17	Bedrock	Strong sulfur odour	Installing UV treatment

3.2 BOREHOLE DRILLING AND MONITORING WELL INSTALLATION

As part of the hydrogeological assessment, five boreholes were advanced at the subject property. Groundwater monitoring wells were installed in each borehole (OW1 through OW5). The drilling program was carried out by InSitu Groundwater Contractors under the general

supervision of Tatham on February 27, 28, March 2 and 3, 2023. The boreholes were drilled to a maximum depth of 19.8 m below existing grade.

Boreholes were advanced by a track mounted Sonic Drill Rig using hollow stems and 3.0 m sampling barrels. Monitoring wells were constructed with 50 mm PVC riser pipe and 3.0 m length slotted screens. Annular space was filled with filter sand surrounding the well screen and 0.6 m above the well screen. The remaining annular space was backfilled with bentonite and soil cuttings. The monitoring wells were finished with concrete and monument casings at the surface.

The monitoring wells were surveyed on June 2023, to identify the elevations of the monitoring wells. A Trimble R12i GNSS receiver, connected to the CANNET GNSS network via built in GNSS integrated antenna was used. The receiver is connected to a TSC7 controller, using Trimble Access software for data collection. Traditional survey techniques were used, and data was processed using Trimble Business center and AutoCAD Civil3D. This equipment provides an accuracy of 8 mm horizontally and 15 mm vertically. Elevations provided reference the CGVD28 datum.

The groundwater monitoring well locations are presented on Figure 2 and the well construction details are provided in Table 2, below. Borehole logs are presented in Appendix C.

Table 2: Groundwater Monitoring Well Construction Details

MONITORING WELL ID	GROUND SURFACE (m asl)	SCREEN INTERVAL (m asl)	UTM COORDINATES
OW1	297.84	278.03 – 281.08	17T 504311E, 4895171N
OW2	289.25	277.06 – 280.11	17T 504484E, 4895069N
OW3	292.75	274.47 – 277.51	17T 504426E, 4895493N
OW4	301.1	282.82 – 285.86	17T 504057E, 4898340N
OW5	302.09	283.81 – 286.85	17T 504143E, 4894918N

3.3 GROUNDWATER LEVEL MONITORING

3.3.1 On-site Monitoring Wells

Manual groundwater level measurements were collected on a monthly basis following the installation of the monitoring wells in March 2023.

Dataloggers were installed in all five monitoring wells to facilitate continuous water level monitoring. A barometric pressure transducer and datalogger was installed on-site to correct the groundwater level monitoring dataloggers for changes due to fluctuations in barometric pressures. The dataloggers were set at a 4 hour frequency. The results of the continuous water level monitoring are provided on individual hydrographs for each monitoring well location in Appendix D and are discussed further in Section 4.2.

The continuous water level data has been used to assess the aquifers response to precipitation events, establish the seasonal high water table elevations and to determine the local groundwater flow direction.

3.3.2 Private Water Wells

Manual water level measurements were recorded at DW1 to DW5 on a quarterly basis following the completion of the door-to-door water well survey.

Dataloggers were installed in all five domestic water supply wells to facilitate continuous water level monitoring. The dataloggers were set at a 4 hour frequency. The results of the continuous water level monitoring are provided on individual hydrographs for each monitoring well location in Appendix E and are discussed further in Section 4.2.

3.4 GROUNDWATER QUALITY MONITORING

3.4.1 On-Site Monitoring Wells

Groundwater quality monitoring was conducted during the spring (April 4, 2023) and fall (September 20, 2023) of 2023. The water quality program completed provides a baseline of the natural chemical signature of the groundwater on-site and provides details regarding potential seasonal water quality variabilities. Groundwater samples were collected from all five monitoring wells on-site.

Prior to sampling, monitoring wells (OW1 through OW5) were developed using low density polyethene (LDPE) tubing and a foot valve, by the removal of at least three well volumes of groundwater or the well going dry three times. Samples were collected using the LDPE tubing and directly placed into pre-cleaned laboratory supplied bottles, with analytical test group specific preservatives. Dedicated nitrile gloves were used during sampling and non-dedicated equipment was sanitized between monitoring wells. Samples were field filtered for select parameters and submitted for analysis of dissolved metals, major anions and general chemistry. Samples were analyzed by Caduceon Environmental Laboratories, a CALA accredited lab. Laboratory results are presented in Appendix F and are discussed further in Section 4.4.

3.4.2 Private Water Wells

A groundwater sample was collected from an outdoor tap in the spring (June 2023) and fall (September 2023) at DW1 to 5. The tap was flushed for approximately 5 minutes prior to collecting water samples directly into pre-cleaned laboratory supplied bottles, with analytical test group specific preservatives. Dedicated nitrile gloves were used during sampling. Samples were analyzed by Caduceon Environmental Laboratories, a CALA accredited lab. Laboratory results are presented in Appendix F and are discussed further in Section 4.4.

Summary letters were provided to homeowners summarizing the results of the analysis following receipt of the laboratory results.

4 Field Findings

The field program outlined in Section 3.0 was implemented to assess the on-site stratigraphy and groundwater conditions including seasonal high groundwater levels, direction of groundwater flow, and baseline groundwater quality.

4.1 STRATIGRAPHY

Stratigraphy at the site was generally described as topsoil (approximately 0.76 m thick) over coarse- and fine-grained sands, with varying contents of silt and gravel, cobbles and boulders, and traces of clay to termination depths of approximately 19.8 m. A localized silty sand unit was encountered underlying the topsoil overlying the sand unit at OW1.

Locally at OW2 dolostone bedrock was encountered at a depth of approximately 12.2 m.

Details of the ground conditions are further presented in the borehole logs in Appendix C and Cross-Section A-A' (northwest-southeast) and Cross-Section B-B' (southwest-northeast) are provided on Figures 9 and 10.

4.2 GROUNDWATER LEVELS

4.2.1 On-Site Monitoring Wells

Continuous groundwater level data measured at OW1 through OW5 are compared to recorded precipitation events and are presented as hydrographs in Appendix D.

Groundwater levels were monitored between March 2023 and March 2024. Seasonal fluctuations in the groundwater levels are noted at all five on-site monitoring wells illustrating higher groundwater levels during the spring and fall months, and lower groundwater levels during the fall and winter months.

Further, as shown on the hydrographs, an increase of groundwater levels can be observed at OW1, OW2 and OW3 immediately following large rainfall events.

The manual groundwater depths and elevations for OW1 through OW5 are presented in Table 3, below. The high groundwater table elevation for each monitoring well location is presented in Table 4. The high groundwater table was established at each monitoring well ranging between 288.4 to 289.8 m asl.

Groundwater Flow

In an aquifer, groundwater flows from points of higher pressure to points of lower pressure, and the direction of groundwater flow typically has both a horizontal and vertical component. The

horizontal hydraulic gradient is dependent on the rate at which water is added to and removed from the aquifer and permeability of the material. It is commonly known as the slope of the water table and reflects the surface relief due to the capillary effect in soils, sediments and other porous media.

Based on the groundwater monitoring program completed on-site, the local groundwater flow direction is interpreted to be to the southeast. Groundwater contour figures for the spring, summer, fall and winter seasons are presented on Figure 11 through 14.

4.2.2 Private Water Wells

Groundwater levels were monitored in five off-site domestic water wells (DW1 through DW5) for due diligence purposes. Ground surface elevations were estimated based on the MNRF LIDAR survey and are considered an approximation.

Continuous groundwater level data measured at DW1 through DW5 are compared to recorded precipitation events and are presented as hydrographs in Appendix E.

Groundwater levels were monitored between May 2023 and March 2024. Seasonal fluctuations in the groundwater levels are noted at all five domestic water wells illustrating higher groundwater levels during the spring and fall months, and lower groundwater levels during the fall and winter months.

Further, as shown on the hydrographs, an increase of groundwater levels can be observed at DW1 through DW4 immediately following large rainfall events.

The manual groundwater depths and elevations for DW1 through DW5 are presented in Table 5.

Table 3: Measured Monthly Groundwater Levels

MONITORING DATE	ON-SITE MONITORING WELLS GROUNDWATER DEPTH (m) / ELEVATION (m asl)				
	OW1	OW2	OW3	OW4	OW5
March 21, 2023	9.1 / 288.8	1.6 / 287.7	4.1 / 288.7	11.7 / 289.4	13.4 / 288.7
April 4, 2023	8.8 / 289.1	1.1 / 288.2	3.7 / 289.1	11.6 / 289.5	13.3 / 288.8
May 11, 2023	8.8 / 289.0	1.4 / 287.8	4.0 / 288.8	11.4 / 289.7	12.9 / 289.2
June 20, 2023	9.2 / 288.7	1.9 / 287.4	4.2 / 288.5	11.6 / 289.5	13.2 / 288.9
July 13, 2023	9.3 / 288.5	1.9 / 287.3	4.3 / 288.5	11.8 / 289.3	13.4 / 288.7
August 17, 2023	9.2 / 288.6	2.0 / 287.3	4.4 / 288.4	11.9 / 289.2	13.5 / 288.6
September 20, 2023	9.5 / 288.4	2.0 / 287.2	4.4 / 288.4	12.0 / 289.1	13.7 / 288.4
October 30, 2023	9.5 / 288.4	1.9 / 287.3	4.3 / 288.4	12.1 / 289.0	13.8 / 288.3
December 5, 2023	9.5 / 288.4	1.9 / 287.4	4.3 / 288.4	12.1 / 289.0	13.9 / 288.2
December 15, 2023	9.5 / 288.4	1.8 / 287.4	4.3 / 288.4	12.2 / 289.0	14.0 / 288.1
January 17, 2024	9.3 / 288.6	1.7 / 287.5	4.2 / 288.6	11.9 / 289.2	13.8 / 288.3
February 16, 2024	9.2 / 288.6	1.7 / 287.6	4.1 / 288.6	11.8 / 289.3	13.8 / 288.3
March 24, 2024	9.0 / 288.8	1.5 / 287.7	4.0 / 288.7	11.7 / 289.4	13.6 / 288.5

Table 4: Highest Groundwater Elevation

WELL ID	HIGHEST GROUNDWATER ELEVATION (m asl)
OW1	289.3
OW2	288.4
OW3	289.3
OW4	289.8
OW5	289.3

Table 5: Measured Groundwater Levels

MONITORING DATE	DOMESTIC WATER WELLS GROUNDWATER DEPTH (m) / ELEVATION (m asl)				
	DW1	DW2	DW3	DW4	DW5
May 11, 2023	3.7/287.9	3.0/287.6	4.1/288.1	1.1/287.2	4.2/289.9
August 17, 2023	4.3/287.3	3.6/287.0	4.6/287.6	1.7/286.6	4.7/289.4
September 20, 2023	4.2/287.3	3.6/287.0	4.6/287.6	1.7/286.6	4.7/289.4
December 5, 2023	4.1/287.4	3.5/287.2	4.5/287.6	1.5/286.8	4.7/289.4
March 24, 2024	NM	3.1/287.5	4.2/288.0	NM	4.4/289.7

Notes:
1. Ground surface elevations were estimated based on publicly available MNRF LIDAR survey and are considered an approximation.
2. NM = Not measured

4.3 GROUNDWATER QUALITY

4.3.1 On-Site Monitoring Wells

Groundwater sampling was conducted at the five monitoring well locations (OW1 through OW5) during the spring and fall of 2023. Groundwater samples were analyzed for dissolved metals, major anions, and general water quality parameters (pH, conductivity, hardness, etc.).

Groundwater samples were collected on April 4, 2023, and September 20, 2023. Groundwater samples were compared to the Ontario Drinking Water Quality Standards (ODWQS). Results of the April and September sampling events indicated all analyzed parameters met the ODWQS with the exception of the following parameters:

- Hardness ($CaCO_3$) exceeded the operational guidelines in both spring and fall 2023 at each monitoring well.
- Nitrate exceeded the maximum acceptable concentration in the spring at OW1 (10.1 mg/L versus 10 mg/L) and in the spring and fall at OW2 (13.6 mg/L and 10.4 mg/L versus 10 mg/L).
- Manganese exceeded the aesthetic objective in the spring and fall at OW4 (0.056 mg/L and 0.069 mg/L versus 0.05 mg/L) and in the spring at OW5 (0.264 mg/L versus 0.05 mg/L).
- Iron exceeded the aesthetic objectives (0.18 mg/L versus 0.1 mg/L) in the fall at OW1.
- Aluminum exceeded the operational guidelines (0.348 mg/L versus 0.3 mg/L) in the fall at OW1.

Generally, the water quality is typical of groundwater from overburden aquifers in Southern Ontario. Hardness is naturally occurring and commonly elevated in groundwater throughout Southern Ontario, and elevated nitrate concentrations are typical of agricultural areas in which fertilizers are applied. Elevated concentrations of manganese, iron and aluminum are all relatively close to the aesthetic objectives and operational guidelines and are likely attributed to naturally occurring minerals.

Discussion regarding the cause and affects of the exceeding compounds are further discussed in section 4.3.2.

Copies of the certificates of analysis are provided in Appendix F.

4.3.2 Private Water Wells

Baseline groundwater samples were collected from five off-site domestic water supply wells referred to as DW1 to DW5.

The groundwater samples were collected on June 20, 2023, and September 20, 2023 at DW1 through DW5. Samples were analyzed for dissolved metals, major anions, and general water quality parameters (pH, conductivity, hardness, etc.), and compared to the ODWQS. Results of the June and September sampling events indicated all analyzed parameters met the ODWQS with the exception of the following:

- Hardness was exceeded at DW1 through DW5 during both the June and September visit with concentrations ranging from 156 to 415 mg/L compared to an ODWQS Operational Guideline of 80 to 100 mg/L (ODWQS, 2006). Hardness is caused by dissolved calcium and magnesium and is expressed as the equivalent quantity of calcium carbonate. When heated, hard water tends to form scale deposits and can form excessive scum with regular soaps. However, there are certain detergents, which are largely unaffected by hardness. Conversely, water too soft may result in accelerated corrosion of water pipes. Hardness levels between 80 and 100 mg/L as calcium carbonate (CaCO3) are considered an acceptable balance between corrosion and incrustation. Water supplies with hardness greater then 200 mg/L are considered poor but tolerable. Hardness more than 500 mg/L in drinking water is unacceptable for most domestic purposes. All concentrations of hardness were below 500 mg/L.
- Sodium was exceeded at DW4 and DW5 during the June 2023 visit with measured concentrations of 308 and 25.1 mg/L, respectively, compared to an ODWQS Aesthetic Objective of 200 mg/L and trigger warning level of 20 mg/L (ODWQS, 2006). Sodium is non-toxic and has no maximum acceptable concentration in drinking water. The aesthetic objective for sodium in drinking water is 200 mg/L due to any exceedances causing a salty taste. A normal adult consuming more than 10 grams per day of sodium will not lead to any adverse health effects. On average, water should be a small fraction of the total sodium consumed in a normal diet. Sodium levels exceeding the 20 mg/L limit within drinking water can affect citizens with sodium-restricted diets. People who suffer from hypertension or congestive heart disease should include sodium level monitoring within their water monitoring programs to be aware of any sodium limit exceedances. These exceedances should be notified to the local Medical Officer of Health to ensure local physicians are informed. Using a domestic water softener will increase sodium levels within the water and is not advised for consumers with sodium-restricted diets. It is recommended a separate unsoftened supply of water be used for cooking and drinking purposes and to inquire about sodium-reduction treatment options.
- Manganese exceeded the Aesthetic Objective at DW5 during the June 2023 visit with a measured concentration of 0.069 mg/L compared to an ODWQS Aesthetic Objective of 0.05 mg/L (ODWQS, 2006). The aesthetic objective is recommended to ensure the water is

visually appealing. Exceedances of this limit can cause the water to become poor tasting and coloured, staining laundry and fixtures black. If concerns arise, there are manganese-reduction treatment options available.

- Iron exceeded the Aesthetic Objective at DW5 during the September 2023 visit with a measured concentration of 3.66 mg/L compared to an ODWQS Aesthetic Objective of 0.3 mg/L (ODWQS, 2006). The aesthetic objective is recommended to ensure the water is visually appealing. Exceedances of this limit can cause the water to become bitter and astringent tasting with a brownish colour, staining laundry and plumbing fixtures. The iron precipitates from exceedances can cause iron bacteria growth in water mains and service pipes. If concerns arise, there are iron-reduction treatment options available, such as iron-based coagulants. These treatments effectively remove the particles from the water while leaving trace amounts of residual iron (ODWQS, 2006).

Copies of the certificates of analysis are provided in Appendix F.

5 Water Balance

A water balance was completed for the site to establish a reasonable estimate of the current infiltration rates at the site compared to the future infiltration rates for the proposed aggregate pit (i.e., existing, extraction and rehabilitation conditions). If a decrease in infiltration and groundwater recharge is expected, mitigation measures may be required to maintain or enhance the groundwater recharge at the site.

Using historical precipitation and climate data from the Hanover weather station (climate normal between 1981-2010) and using the Thornwaite and Mather 1957 water balance method, the potential and actual evapotranspiration and the water surplus were calculated. Based on the water balance, the mean annual precipitation for the area is 1,087 mm, with a mean water surplus of 489.4 mm. A copy of the water balance is presented in Appendix G.

The infiltration factors for the three anticipated conditions (i.e. existing, extraction and rehabilitation) were selected from the Stormwater Management Planning and Design Manual and were selected based on the site topography, vegetation cover and soil type. The following infiltration factors were selected:

Table 6: Infiltration Factors

	INFILTRATION FACTOR		
	EXISTING CONDITION	EXTRACTION CONDITION	REHABILITATION CONDITION
Topography	Rolling Land 0.2	Flat Land 0.3	Flat Land 0.3
Soils	Open Sandy Loam 0.4	Open Sandy Loam 0.4	Open Sandy Loam 0.4
Cover	Cultivated Land 0.1	Cultivated Land 0.1	Cultivated Land 0.1
Total	0.7	0.8	0.8

Since the pit operations will generally not decrease the amount of pervious land use, the pre and post extraction pervious land use space remains the same. Further the slope during the extraction and rehabilitation phases will likely be engineered to be gentle to flat slopes compared to the rolling land observed in the existing phase. As such, the infiltration factor during the extraction and rehabilitation phases will be increased in comparison to the existing phase as a result of the anticipated flattening of the grades on-site.

The rehabilitation condition will remain similar to the extraction phase. Topsoil stockpiled in berms during extraction will be used to establish 3:1 slopes towards the base of the pit floor. As such, infiltration will remain similar to the extraction phase, as incidental waters will drain towards the lower lying pit floor.

The estimated water surplus, infiltration and runoff for the existing, extraction and rehabilitation conditions are summarized in Table 7 based on the infiltration factor details discussed above.

Table 7: Water Balance Summary

	WATER BALANCE SUMMARY		
	EXISTING CONDITION	EXTRACTION CONDITION	REHABILITATION CONDITION
Water Surplus (m^3)	67,534	67,534	67,534
Infiltration (m^3)	47,274	54,027	54,027
Runoff (m^3)	20,260	13,507	13,507

Based on the above it is anticipated infiltration will increase on-site during the aggregate operations and after rehabilitation, and runoff will decrease. If imported soils are required during rehabilitation, impermeable soils should not be used, such as clay soils. It is recommended topsoil from the site be re-used during rehabilitation.

6 Assessment of Potential Impacts of Proposed Pit

A comprehensive assessment was completed for the site through the completion of the on-site groundwater monitoring program and domestic water well assessment as outlined in sections above. To determine potential impacts to the groundwater system, a water balance was completed for existing, extraction and rehabilitation conditions. The water balance is detailed in Section 5. Changes to the water balance at the site can alter groundwater levels and its interaction with surface water features, such as streams and wetlands.

As the site is situated between several licensed and/or proposed aggregate operations the cumulative impacts of the proposed extraction as well as the surrounding operations on the local groundwater and/or surface water regimes were also considered as part of this assessment.

6.1 POTENTIAL INTERFERENCE WITH LOCAL GROUNDWATER REGIME

The proposed aggregate pit and associated aggregate extraction will occur at an elevation at least 1.5 m above the established high water table elevation.

As discussed in Section 5, infiltration is anticipated to increase on-site during extraction conditions. As per the site plans, all drainage of the extracted areas will be contained on-site and will infiltrate into the pit floor. As such, potential interference with the local groundwater regime is considered low risk during the extraction condition.

During the rehabilitation condition, it is recommended imported fill and/or topsoil be required to satisfy a 3:1 slope, the materials to be used are permeable materials to promote infiltration. Less permeable materials such as clays should not be used.

6.2 POTENTIAL INTERFERENCE WITH GROUNDWATER RESOURCES: DOMESTIC WATER WELLS

Similar to the potential interference with the local groundwater regime, the proposed aggregate pit extraction will occur at an elevation at least 1.5 m above the established high water table elevation and generally infiltration will remain the same and/or slightly increase during extraction conditions and rehabilitation conditions.

Based on a review of the MECP domestic water wells within 500 m of the proposed extraction limits, the domestic water wells are situated within the overburden unit, with static water levels ranging between 4 to 12 m bgs. Although the potential impact to domestic water wells is anticipated to be negligible for due diligence purposes long-term groundwater level monitoring is recommended.

6.3 POTENTIAL INTERFERENCE WITH SURFACE WATER FEATURES

Under existing conditions, the majority of the proposed expansion area drains east to the Saugeen River as sheet flow. The drainage area of the Saugeen River at this location is 690.2 km^2 while the drainage area of the proposed expansion area is 0.14 km^2. The overall reduction in drainage area to the Saugeen River as a result of the proposed expansion is 0.02% and is expected to have negligible impacts to the watercourse.

Approximately 1.3 ha of the proposed expansion area currently drains south to a tributary of the Saugeen River which has four small online, unevaluated wetland features before connecting to the main branch of the river. The total catchment area of this tributary is 87.4 ha and as such the proposed expansion will result in a decrease in drainage area of 1.5%. Based on this, the impact on the tributary is expected to be minimal.

With respect to potential impacts to water quality in the surface water features, as per the site plans, where necessary a low earth berm will be installed to prevent siltation of the adjacent lands including a low earth berm at the southeast corner of the site, around the wetland.

7 Complaints Response Program

A comprehensive complaints response program has been established for the site for the purpose of responding to water well interference complaints for water well users in the vicinity of the proposed pit. The proposed pit is an above-water pit and it is anticipated no groundwater interference will occur; however, the program has been prepared for due diligence purposes. The program includes the following:

- Following receipt of a complaint from a water well user, Walker will provide a representative and/or an agent to visit the property within 24 hours and assess the complaint.
- If deemed applicable, a licensed water well technician will be hired to complete a well inspection including a review of the pump, well condition, pump depth and condition, etc.
- If deemed applicable, a hydrogeologist may be obtained to review the water well inspection data and supporting information, water level data and on-going operations at the pit to provide an assessment of the cause of the complaint. The hydrogeologist will prepare an opinion as to the likelihood the well compliant is related to the pit operation.
- If the well interference is attributed to the pit operations and activities and the water supply is at risk, a temporary water supply should be made available to the water well user. In addition, if deemed necessary a water supply restoration program should be implemented.
- The water supply restoration program includes:
  - Step 1: Well system rehabilitation: this includes the replacement or lowering of pumps, flushing the pump lines, well deepening, etc.
  - Step 2: Well Replacements: if system rehabilitation is not an option, the well could be replaced with a new well further from the pit.
  - Step 3: Water treatment considerations: appropriate water treatment will be incorporated into any restored water supply.

8 Mitigation Measures

Due to low risks associated with the proposed aggregate extraction to the groundwater and surface water network, mitigation measures are not proposed. However, the following best practices are recommended:

- Refueling of machinery should not be conducted in areas of excavation within 5 m of the water table.
- No chemical sprays should be used in the areas of the excavation.
- An access/egress route/road should be maintained greater than 1.0 m above the maximum proposed depth in the excavation areas.
- Operator training should include understanding and implementing the preventative measures provided above, in addition to any on-site corporate Spill Contingency Plan.

9 Recommended Compliance Monitoring Program

It is recommended long-term groundwater level monitoring continue, and future compliance monitoring be combined with the existing Redford Pit monitoring program.

Recommended compliance monitoring includes:

- The continuation of monitoring the on-site monitoring wells OW1 through OW5. The monitoring includes continuous water level monitoring and quarterly manual groundwater levels for the first two years of operations. After the first two years, it is recommended the monitoring be reduced to semi-annually. Automatic dataloggers should be used to record continuous data.
- The continuation of monitoring the domestic water wells DW1 through DW5. The monitoring includes continuous water level monitoring and quarterly manual groundwater levels for the first two years of operations. After the first two years, it is recommended the monitoring be reduced to semi-annually. Automatic dataloggers should be used to record continuous data.
- The results of the monitoring program will be summarized in the Annual Compliance Report which is currently prepared for the existing Redford Pit, and submitted to the MNRF on an annual basis.

10 Summary and Conclusions

This Combined Level I and 2 Hydrogeological Assessment was completed to support the proposed expansion of the Redford Pit in Hanover. The proposed expansion lands are located on north ½ of Lot 20, Concession 5 NDR, Geographic Township of Bentinck, Municipality of West Grey, County of Grey. The proposed expansion will comprise of a Class A Pit Above Water licence. This investigation was primarily completed to predict the maximum water table in metres above sea level, relative to the proposed depth of excavation at the site. The conclusions are presented below:

- The subject property lies within the physiographic region known as the Horseshoe Moraines comprised of physiographic landforms such as drumlinized till plains, Kame Moraines, and large meltwater spillways (Chapman and Putnam, 2007). Ontario Geological Survey quaternary geology mapping indicates the site and surrounding study area is located within Pleistocene Glaciofluvial outwash deposits characterized by gravel and sand including proglacial river and deltaic deposits (OGS, 2000). Ontario Geological Survey surficial geology indicates the site and surrounding study area is located within Glaciofluvial deposits including river deposits and delta topset facies (OGS, 2003).
- The study area borders the Salina and Guelph formation bedrock divide (Armstrong and Dodge, 2007); however, the site itself lies within the Salina bedrock formation consisting of interbedded grey-brown limestone and bituminous shale (waterloo Hydrogeologic, 2003).
- The topography across the site consists of gentle hills, with lower lying areas in the southeast, central west, northwest and east. Generally, the elevation slopes to the east towards the Saugeen River located approximately 80 to 100 m east of the eastern site boundary. Elevations on site range between approximately 289 to 301 m asl. Runoff is expected to follow local topography to lower lying areas and ultimately flow towards the east to a roadside ditch before being conveyed to the Saugeen River. Locally, there is a small unevaluated wetland to the south of the proposed expansion which receives a portion of the site runoff under existing conditions before runoff is conveyed to the Saugeen River to the east.
- Based on a review of MECP well records within the vicinity of the site, stratigraphy noted from the well records indicated layers of sand or sand and gravel overlying limestone bedrock. Bedrock was encountered at depths ranging between 16 to 26 m bgs. Domestic water wells are anticipated to be screened within the sand and gravel aquifer with fresh water first encountered at depths of 12 to 30 m bgs. Pumping test details were provided for six of the well records. Pumping tests were carried out for 1 to 4 hours at rates of 3 to 25

Gal/min (11.3 to 94.6 L/min), and static water levels ranging from 4.0 to 12 m bgs were drawn down 0 to 9 m.

- The proposed Redford Pit expansion is located in the Saugeen Valley SPA. The proposed Redford expansion is located approximately 9 km outside of the delineated Hanover WHPA and does not lie within an IPZ. The site lies within a SGRA with an average score of 6 and is considered to be a HVA with an average score of 6.
- An intrusive investigation was carried out at the proposed expansion site and included the advancement of five boreholes/monitoring wells to depths ranging between 15.2 to 19.2 m. The investigation included logging of the borehole stratigraphy, long-term monitoring of groundwater levels, and two rounds of groundwater quality monitoring (fall and spring).
- A water well survey was completed for all properties within a 500 m radius of the site. Five domestic water well users were interested in participating in a long-term groundwater level monitoring program. As part of the program, two rounds of groundwater quality monitoring was collected from the domestic water supply wells (spring and fall) to determine baseline groundwater conditions.
- The stratigraphy within the proposed expansion site primarily consists of a sand and gravel overburden unit extending to the depths of exploration ranging between at 15.2 to 19.2 m. Dolostone bedrock was encountered at one borehole location at the site at a depth of 15.2 m.
- Groundwater quality results from the on-site monitoring wells and off-site private water wells were consistent with general water quality and background conditions in Southern Ontario.
- The high groundwater table was established at each monitoring well ranging between 288.4 to 289.8 m asl. Seasonal variations were noted at all monitoring well locations with highs in the spring and lows in the summer and winter months.
- Groundwater is interpreted to flow to the southeast towards the Saugeen River.
- A water balance was completed for the existing, extraction and rehabilitation conditions. The results indicated infiltration will generally stay the same, with potential for slight increase in infiltration due to less runoff off-site during extraction and rehabilitation when compared to existing conditions.
- Under existing conditions, the majority of the proposed expansion area drains east to the Saugeen River as sheet flow. The drainage area of the Saugeen River at this location is 690.2 km^2 while the drainage area of the proposed expansion area is 0.14 km^2. The overall reduction in drainage area to the Saugeen River as a result of the proposed expansion is

0.02% and is expected to have negligible impacts to the watercourse. Approximately 1.3 ha of the proposed expansion area currently drains south to a tributary of the Saugeen River which has four small online, unevaluated wetland features before connecting to the main branch of the river. The total catchment area of this tributary is 87.4 ha and as such the proposed expansion will result in a decrease in drainage area of 1.5%. Based on this, the impact on the tributary is expected to be minimal. With respect to potential impacts to water quality in the surface water features, as per the site plans, where necessary a low earth berm will be installed to prevent siltation of the adjacent lands including a low earth berm at the southeast corner of the site, around the wetland.

Based on the findings of this assessment, no adverse effects to the groundwater and surface water resources and their users are anticipated as a result of the operation and rehabilitation of the proposed Reford Pit Expansion.

11 Site Plan Recommendations

The following recommendations are suggested for the site:

- Long-term groundwater level monitoring program including continuous monitoring and quarterly manual groundwater level measurements of the on-site monitoring wells (OW1 through OW5) for the first two years of operation and semi-annually, thereafter.
- Long-term groundwater level monitoring program including continuous monitoring and quarterly groundwater level measurements of the off-site domestic water supply wells DW1 through DW5) for the first two years of operation and semi-annually, thereafter.
- Implement the complaints response program as detailed in section 7, if needed.
- During the rehabilitation phase, if imported fill and/or topsoil materials are required to achieve 3:1 slopes, permeable materials should be used to promote infiltration. Less permeable materials such as clays should not be used.

12 References

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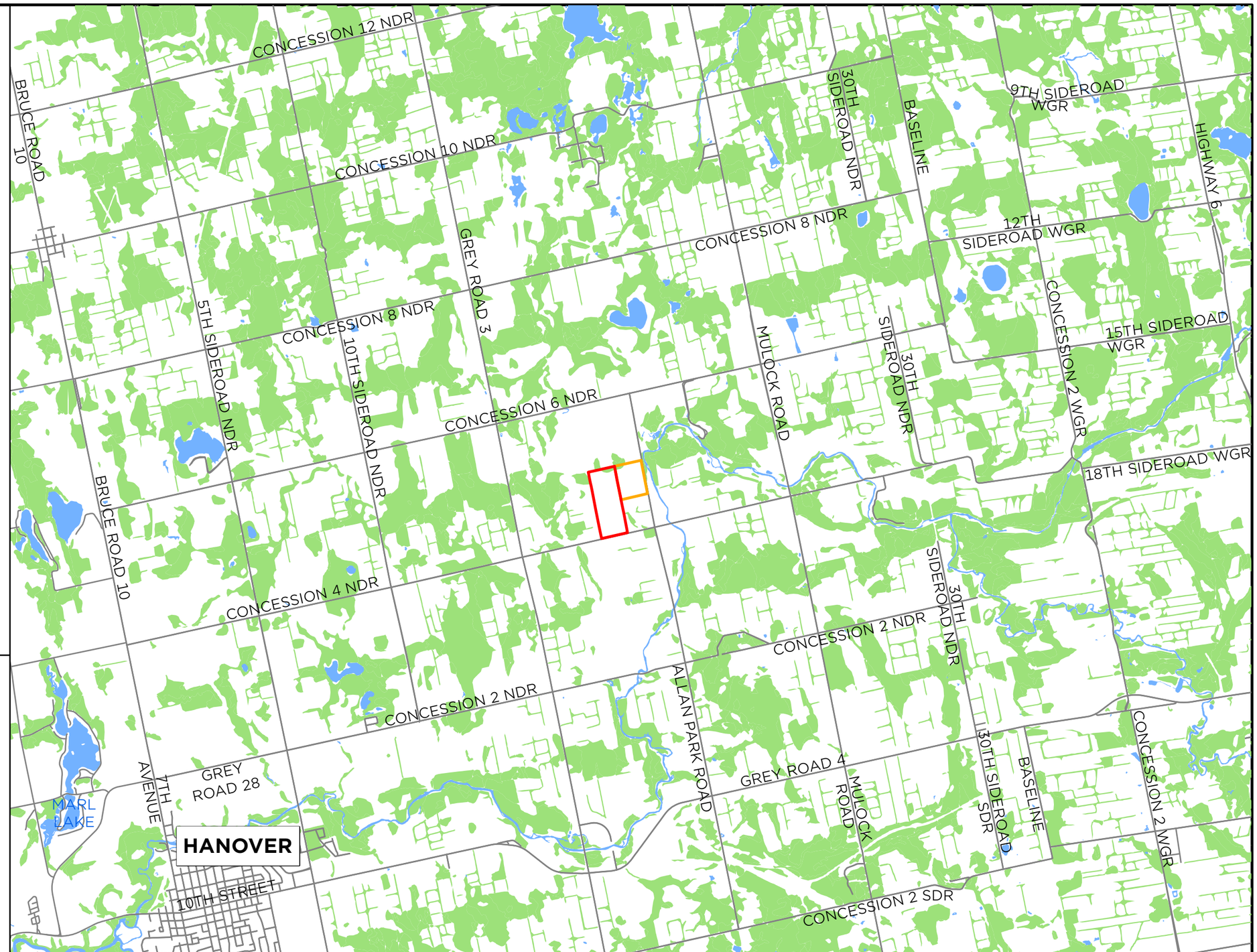
NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- SITE
- PROPOSED EXPANSION LANDS
- ROAD
- WATERCOURSE
- WATERBODY
- WOODED AREA



0 1 2 4 KILOMETERS

TATHAM ENGINEERING

REDFORD PIT EXPANSION
COMBINED LEVEL 1 & 2
HYDROGEOLOGICAL ASSESSMENT
SITE LOCATION PLAN

DWG. No. **FIG-1**

SCALE: 1:60,000 | DRAWN: AO | DATE: JUL. 2025 | JOB NO. 123039

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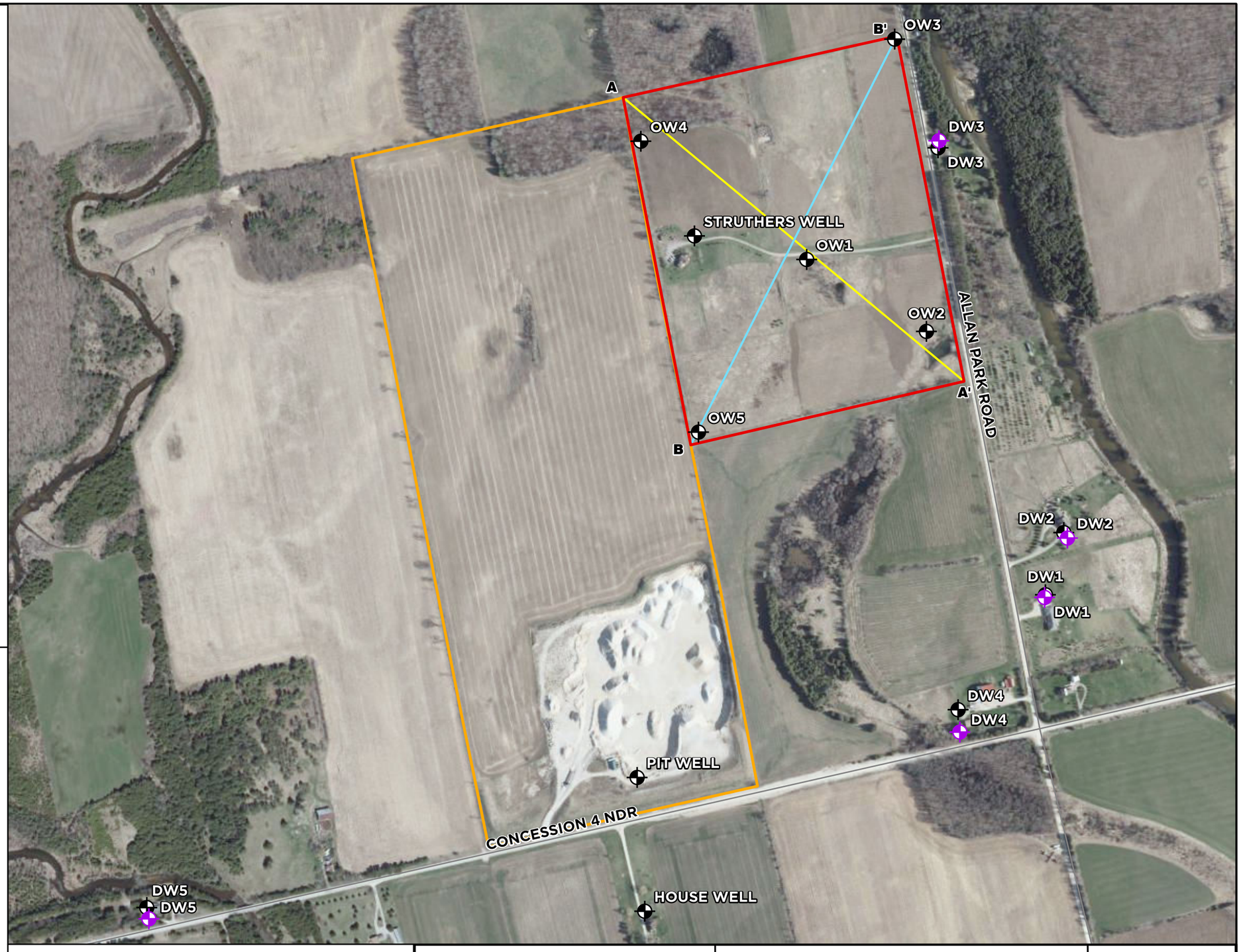
NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- SITE
- EXISTING REDFORD PIT
- ROAD
- BOREHOLE/MONITORING WELL
- DOMESTIC WATER SUPPLY WELLS
- CROSS SECTION A-A'
- CROSS SECTION B-B'



0 75 150 300 450 600
METERS

TATHAM ENGINEERING

REDFORD PIT EXPANSION
COMBINED LEVEL 1 & 2
HYDROGEOLOGICAL ASSESSMENT
BOREHOLE/MONITORING WELL LOCATION PLAN

DWG. No. **FIG-2**

SCALE: 1:8,000 | DRAWN: AO | DATE: JUL. 2025 | JOB NO. 123039

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N

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- SITE
- EXISTING REDFORD PIT
- FLOW ARROW

0 0.25 0.5 1 KILOMETERS

TATHAM ENGINEERING

REDFORD PIT EXPANSION
COMBINED LEVEL 1 & 2
HYDROGEOLOGICAL ASSESSMENT
TOPOGRAPHY & DRAINAGE

DWG. No. **FIG-3**

SCALE: 1:20,000 | DRAWN: AO | DATE: JUL. 2025 | JOB NO. 123039

O:\Collingwood\Digital Mapping\HydroG Figure Template

N

CONCESSION 6 NDR

RIVER ROAD

ALLAN PARK ROAD

CONCESSION 4 NDR

ID: 2502709

ID: 2516404

ID: 2516461

ID: 7383294

ID: 2516469

ID: 2516963

ID: 2503437

ID: 2500174

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- SITE
- SITE BUFFER (500m)
- MECP WATER WELL
- ROAD
- WATERCOURSE
- WATERBODY
- WOODED AREA

0 0.25 0.5 KILOMETERS

TATHAM ENGINEERING

REDFORD PIT EXPANSION
COMBINED LEVEL 1 & 2
HYDROGEOLOGICAL ASSESSMENT
MECP WELLS

DWG. No. **FIG-4**

SCALE: 1:10,000	DRAWN: AO	DATE: JUL. 2025	JOB NO. 123039

O:\Collingwood\Digital Mapping\HydroG Figure Template

N

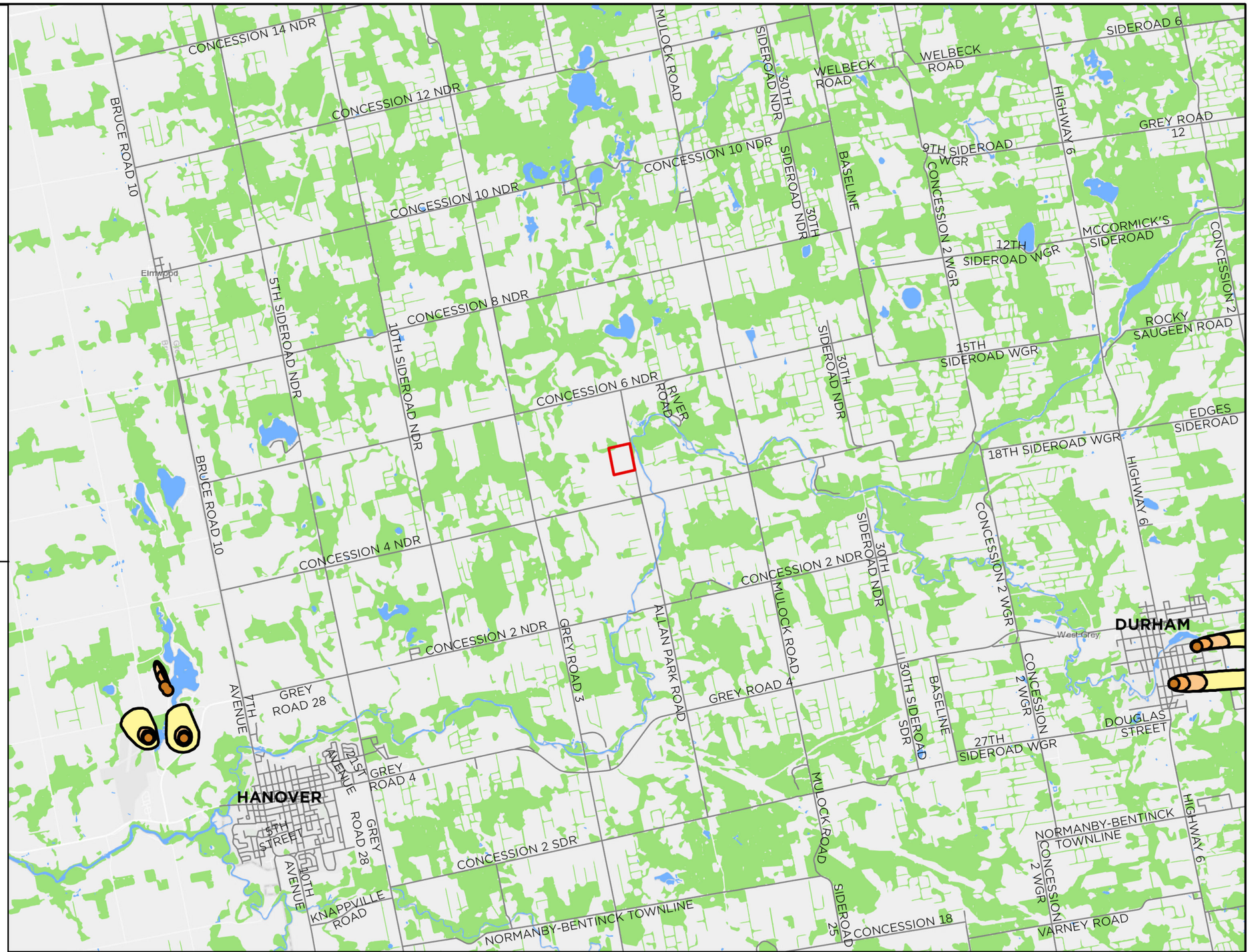
NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.
3. CONTAINS INFORMATION MADE AVAILABLE UNDER LAKE SIMCOE REGION CONSERVATION AUTHORITY OPEN DATA LICENSE V1.0.
4. SITE IS NOT IN A WELLHEAD PROTECTION AREA

LEGEND

- SITE
- ROAD
- WATERCOURSE
- WATERBODY
- WOODED AREA

WELLHEAD PROTECTION AREA

- A
- B
- C
- D



0 0.5 1 2 3 4 5 KILOMETERS

TATHAM ENGINEERING

REDFORD PIT EXPANSION
COMBINED LEVEL 1 & 2
HYDROGEOLOGICAL ASSESSMENT
WELLHEAD PROTECTION AREA

DWG. No. **FIG-5**

SCALE: 1:75,000 | DRAWN: AO | DATE: JUL. 2025 | JOB NO. 123039

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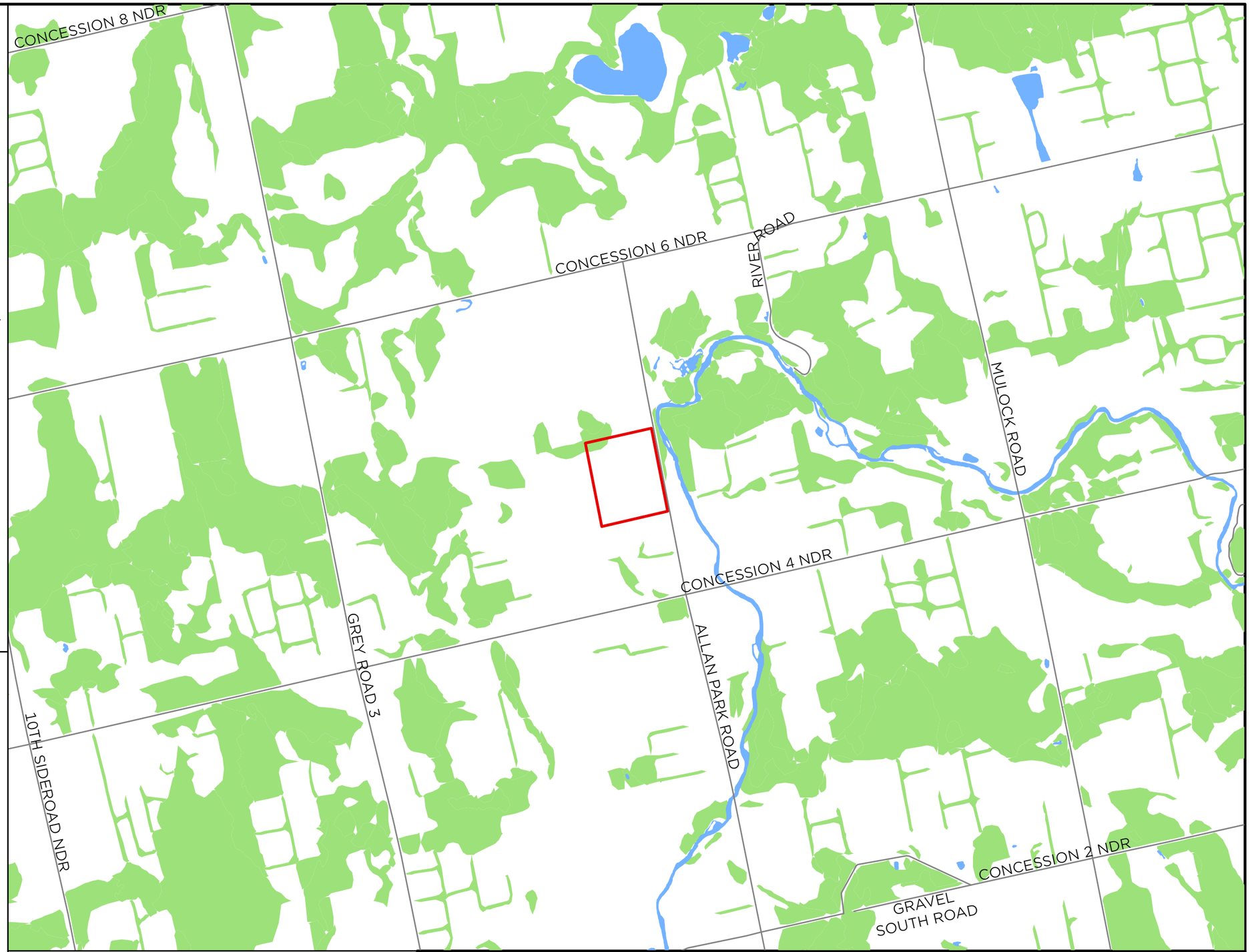
NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO
3. CONTAINS INFORMATION MADE AVAILABLE UNDER LAKE SIMCOE REGION CONSERVATION AUTHORITY OPEN DATA LICENSE V1.0.
4. SITE IS NOT WITHIN A INTAKE PROTECTION ZONE.

LEGEND

- SITE
- INTAKE PROTECTION ZONES (LSRCA 2022)
  - 1
  - 2
  - 3
- ROAD
- WATERCOURSE
- WATERBODY
- WOODED AREA



0 0.25 0.5 1 1.5 KILOMETERS

TATHAM ENGINEERING

REDFORD PIT EXPANSION
COMBINED LEVEL 1 & 2
HYDROGEOLOGICAL ASSESSMENT
INTAKE PROTECTION ZONE

DWG. No. **FIG-6**

SCALE: 1:24,000	DRAWN: AO	DATE: JUL. 2025	JOB NO. 123039

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N

CONCESSION 6 NDR

RIVER ROAD

ALLAN PARK ROAD

CONCESSION 4 NDR

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO
3. CONTAINS INFORMATION MADE AVAILABLE UNDER LAKE SIMCOE REGION CONSERVATION AUTHORITY OPEN DATA LICENSE V1.0.
4. SITE IS NOT WITHIN A SIGNIFICANT GROUNDWATER RECHARGE AREA

LEGEND

- SITE
- ROAD
- WATERCOURSE
- WATERBODY

SIGNIFICANT GROUNDWATER RECHARGE AREA

- N/A
- 0
- 2
- 4
- 6

0 0.25 0.5 KILOMETERS

TATHAM ENGINEERING

REDFORD PIT EXPANSION
COMBINED LEVEL 1 & 2
HYDROGEOLOGICAL ASSESSMENT
SIGNIFICANT GROUNDWATER RECHARGE AREA

DWG. No. **FIG-7**

SCALE: 1:10,000 | DRAWN: AO | DATE: JUL. 2025 | JOB NO. 123039

O:\Collingwood\Digital Mapping\HydroG Figure Template

N

CONCESSION 6 NDR

RIVER ROAD

ALLAN PARK ROAD

CONCESSION 4 NDR

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO
3. CONTAINS INFORMATION MADE AVAILABLE UNDER LAKE SIMCOE REGION CONSERVATION AUTHORITY OPEN DATA LICENSE V1.0.
4. SITE IS WITHIN A HIGHLY VULNERABLE AQUIFER.

LEGEND

- SITE
- HIGHLY VULNERABLE AQUIFERS
- ROAD
- WATERCOURSE
- WATERBODY
- WOODED AREA

0 0.25 0.5 KILOMETERS

TATHAM ENGINEERING

REDFORD PIT EXPANSION
COMBINED LEVEL 1 & 2
HYDROGEOLOGICAL ASSESSMENT
HIGHLY VULNERABLE AQUIFER

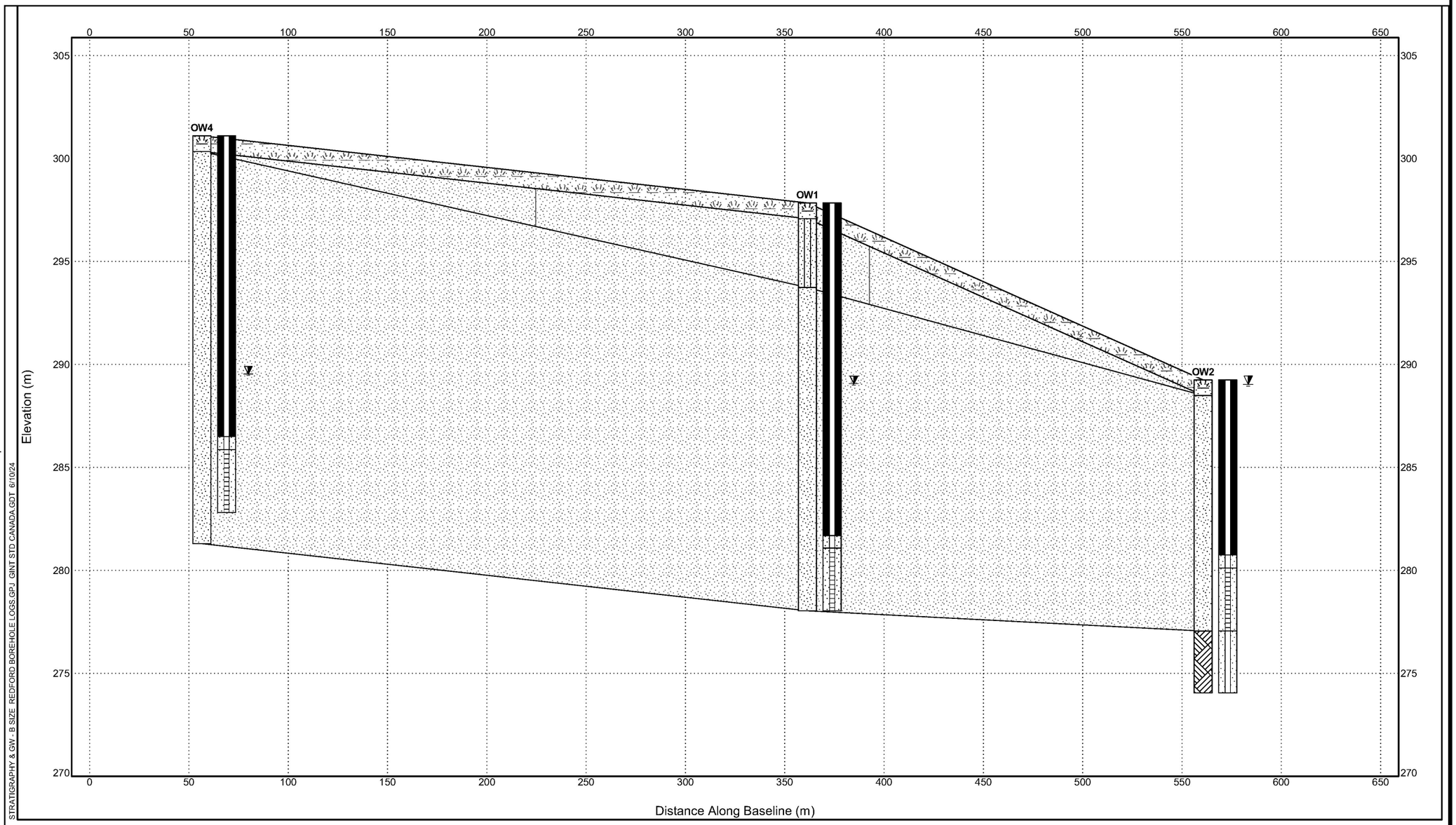
DWG. No. **FIG-8**

SCALE: 1:10,000 | DRAWN: AO | DATE: JUL. 2025 | JOB NO. 123039

G:\Collingwood\Digital Mapping\HydroG Figure Template

LEGEND

- TOPSOIL
- BEDROCK
- SILTY SAND
- SAND
- PREDICTED HIGHEST GROUNDWATER LEVEL



NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.
3. GROUNDWATER ELEVATIONS MEASURED APRIL 4, 2023

TATHAM ENGINEERING

REDFORD PIT EXPANSION
COMBINED LEVEL 1 & 2
HYDROGEOLOGICAL ASSESSMENT
GEOLOGICAL CROSS SECTION A-A'

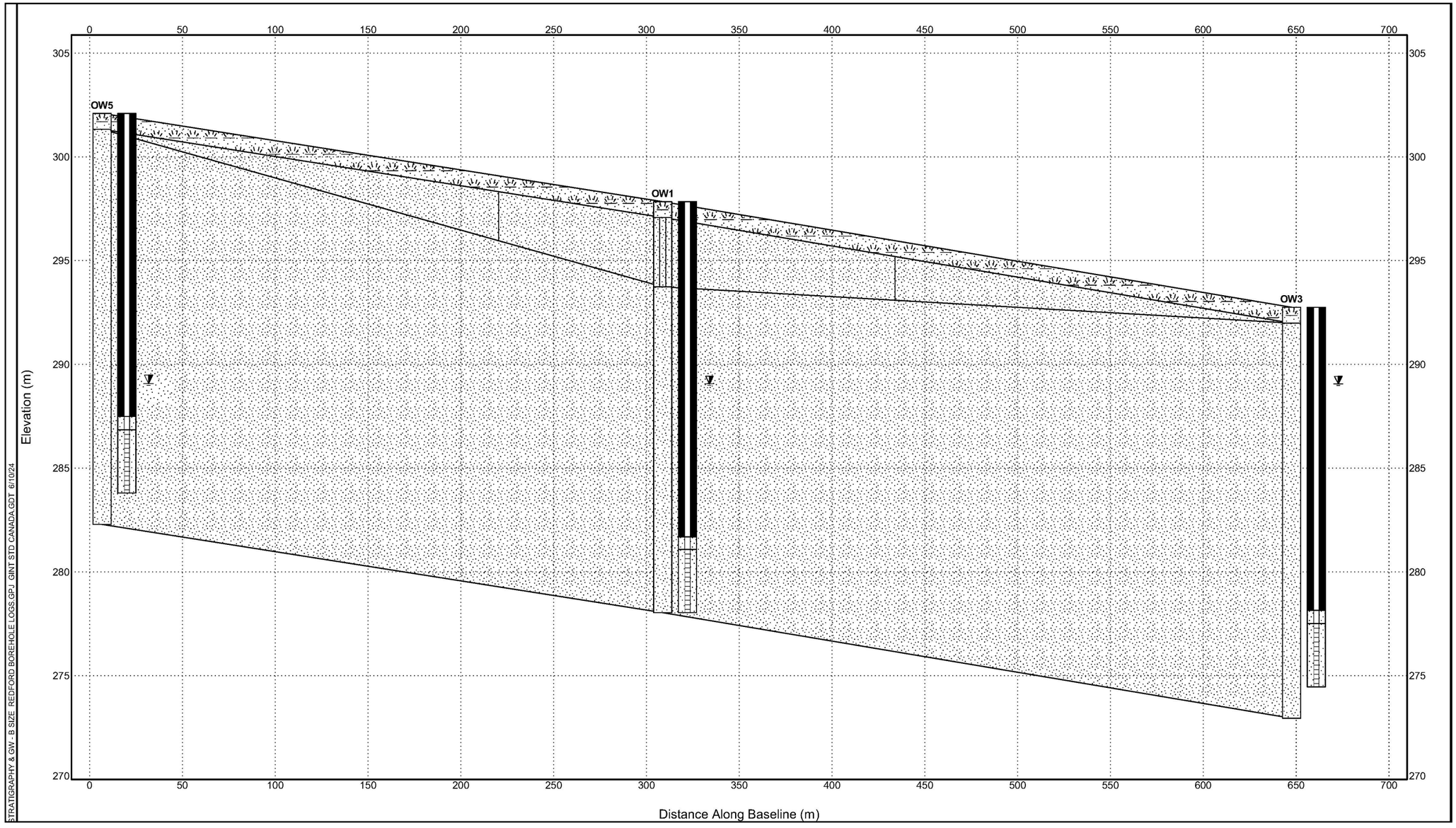
DRAWN: AO | DATE: JUL. 2025 | JOB NO. 123039

DWG. No. **FIG-9**

O:\Collingwood\Digital Mapping\HydroG Figure Template

LEGEND

- TOPSOIL
- SILTY SAND
- SAND
- PREDICTED HIGHEST GROUNDWATER LEVEL



NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.
3. GROUNDWATER ELEVATIONS MEASURED APRIL 4, 2023

TATHAM ENGINEERING

REDFORD PIT EXPANSION
COMBINED LEVEL 1 & 2
HYDROGEOLOGICAL ASSESSMENT
GEOLOGICAL CROSS SECTION B-B'

DWG. No. **FIG-10**

DRAWN: AO | DATE: JUL. 2025 | JOB NO. 123039

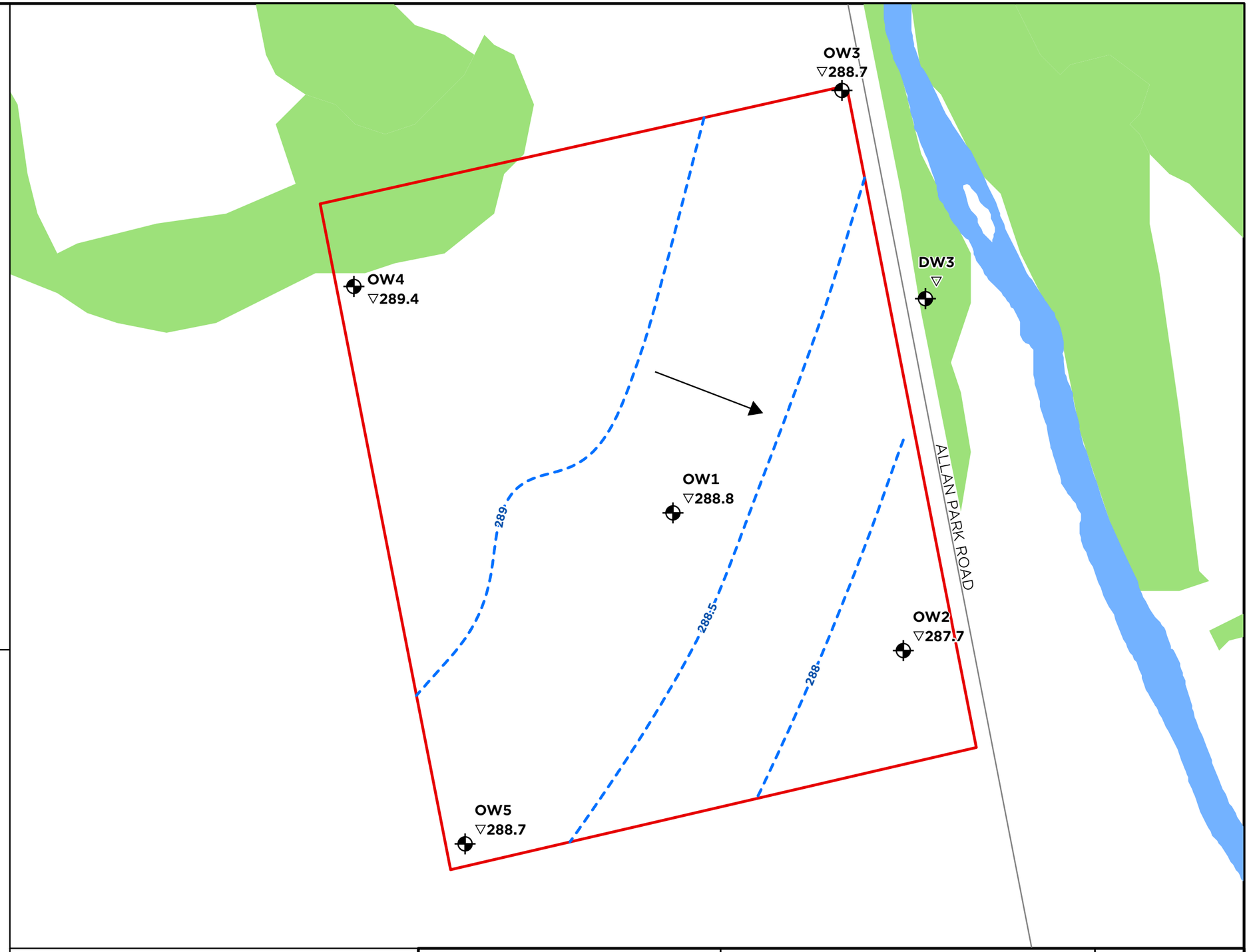
O:\Collingwood\Digital Mapping\HydroG Figure Template

N

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- SITE
- BOREHOLE/MONITORING WELLS, 2023
- GROUNDWATER CONTOURS
- ROAD
- WATERCOURSE
- WATERBODY
- WOODED AREA
- GROUNDWATER ELEVATION (MEASURED MARCH 21, 2023)
- GROUNDWATER FLOW DIRECTION



0 60 120 240 METERS

TATHAM ENGINEERING

REDFORD PIT EXPANSION
COMBINED LEVEL 1 & 2
HYDROGEOLOGICAL ASSESSMENT
GROUNDWATER CONTOURS SPRING (MARCH 2023)

DWG. No. **FIG-11**

SCALE: 1:3,000 | DRAWN: AO | DATE: JUL. 2025 | JOB NO. 123039

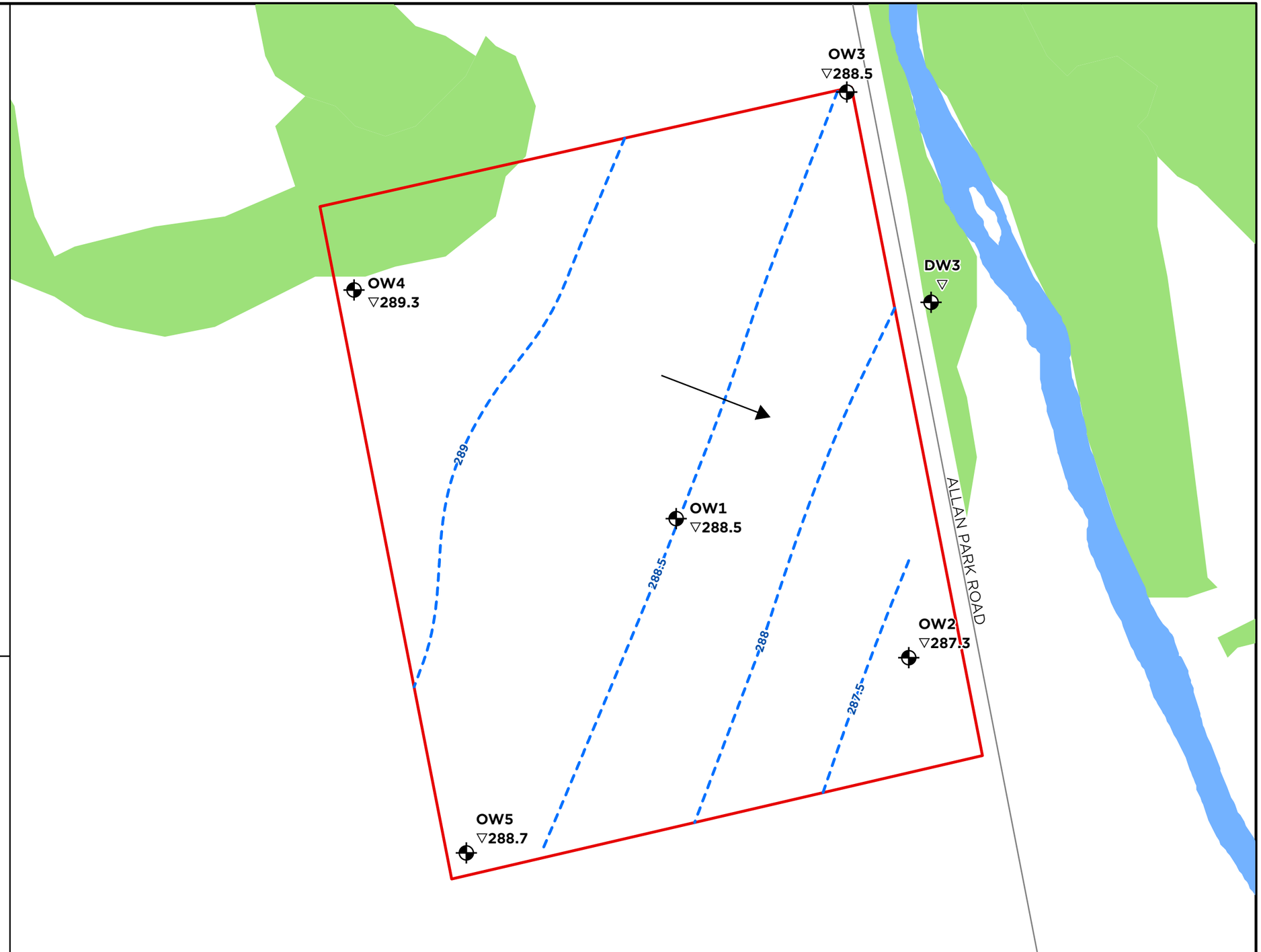
D:\Collingwood\Digital Mapping\HydroG Figure Template

N

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- SITE
- BOREHOLE/MONITORING WELLS, 2023
- GROUNDWATER CONTOURS
- ROAD
- WATERCOURSE
- WATERBODY
- WOODED AREA
- GROUNDWATER ELEVATION (MEASURED JULY 13, 2023)
- GROUNDWATER FLOW DIRECTION



0 60 120 240 METERS

TATHAM ENGINEERING

REDFORD PIT EXPANSION
COMBINED LEVEL 1 & 2
HYDROGEOLOGICAL ASSESSMENT
GROUNDWATER CONTOURS SUMMER (JULY 2023)

DWG. No. **FIG-12**

SCALE: 1:3,000 | DRAWN: AO | DATE: JUL. 2025 | JOB NO. 123039

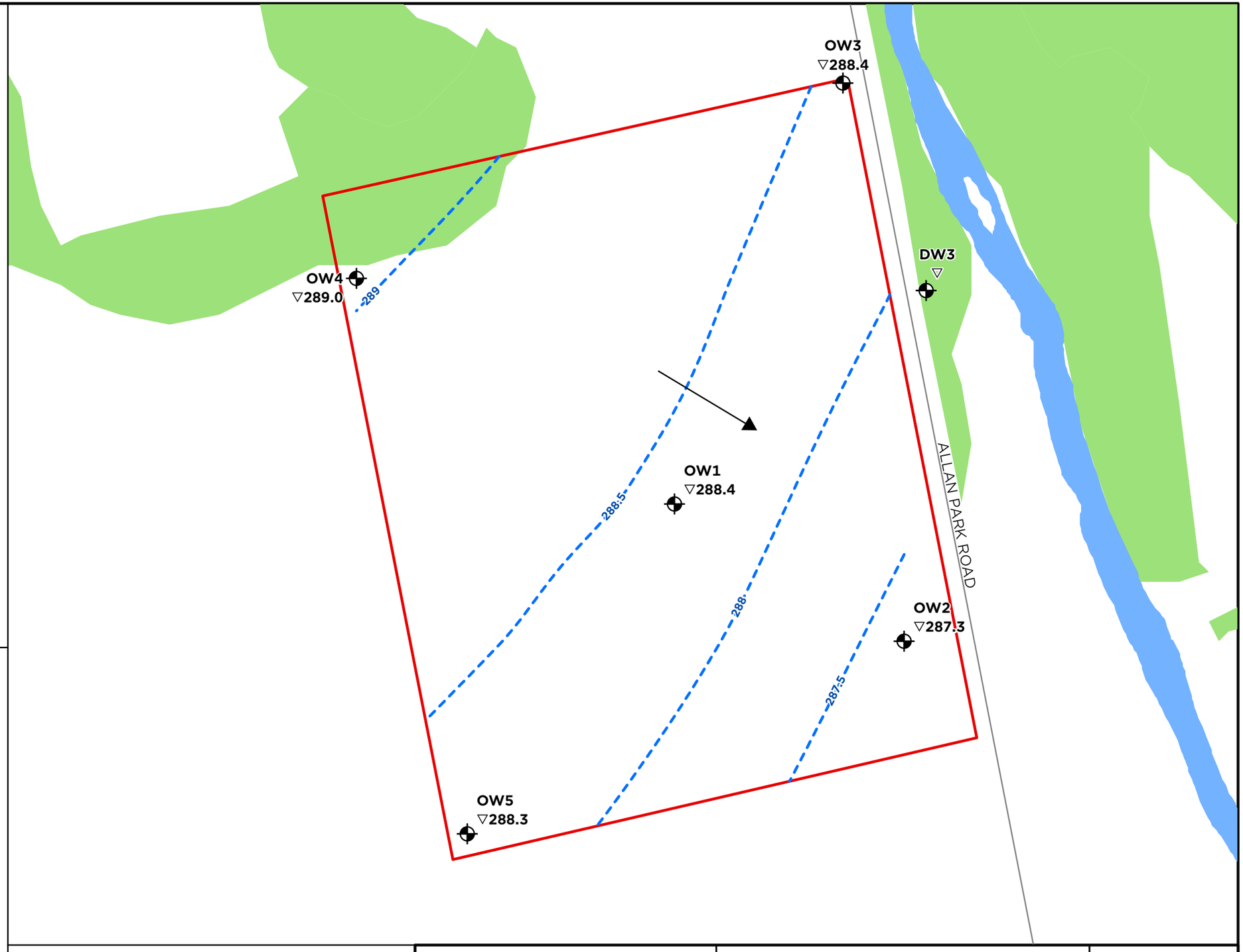
O:\Collingwood\Digital Mapping\HydroG Figure Template

N

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- SITE
- BOREHOLE/MONITORING WELLS, 2023
- GROUNDWATER CONTOURS
- ROAD
- WATERCOURSE
- WATERBODY
- WOODED AREA
- GROUNDWATER ELEVATION (MEASURED OCTOBER 30, 2023)
- GROUNDWATER FLOW DIRECTION



0 60 120 240 METERS

TATHAM ENGINEERING

REDFORD PIT EXPANSION
COMBINED LEVEL 1 & 2
HYDROGEOLOGICAL ASSESSMENT
GROUNDWATER CONTOURS FALL (OCTOBER 2023)

DWG. No. **FIG-13**

SCALE: 1:3,000 | DRAWN: AO | DATE: JUL. 2025 | JOB NO. 123039

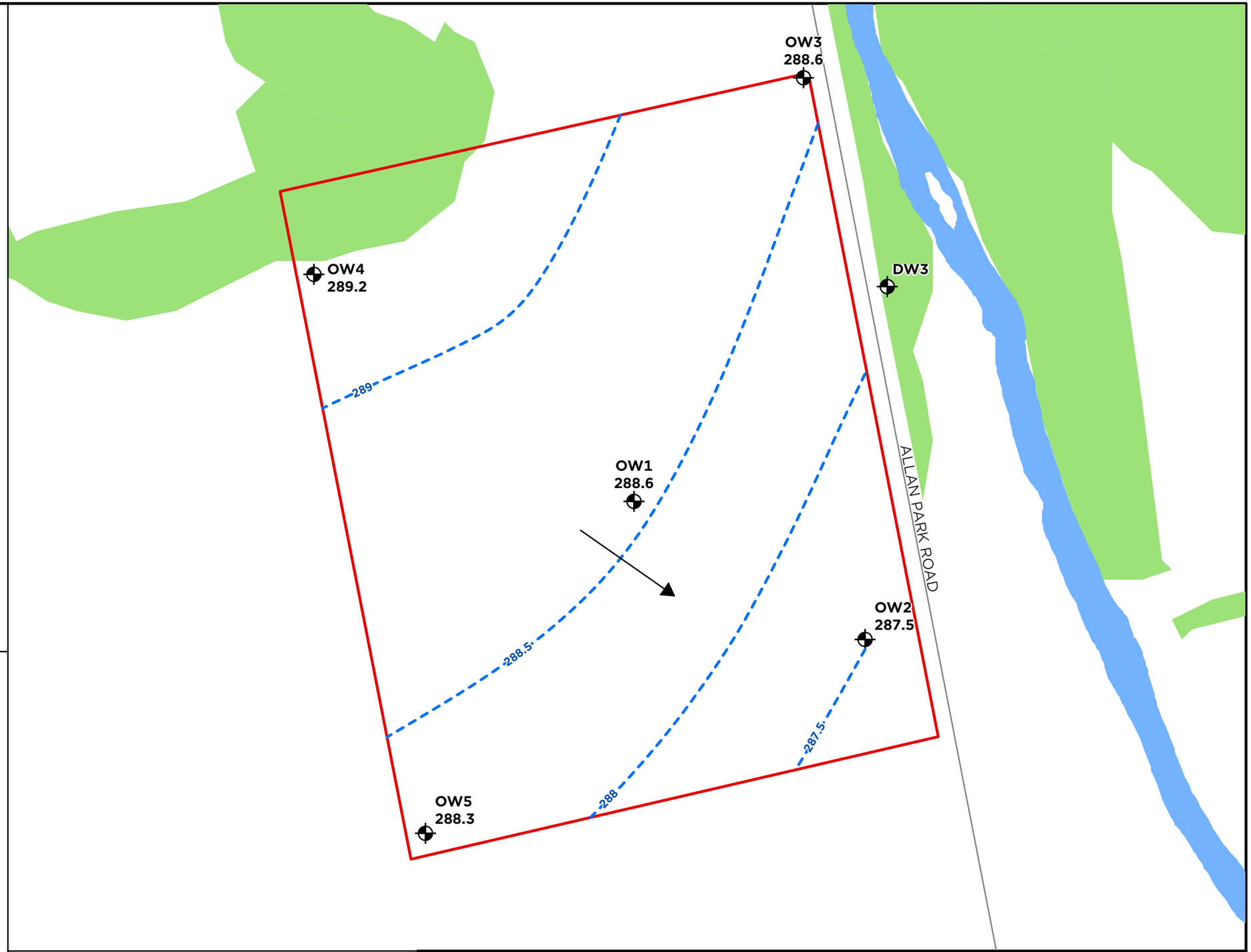
O:\Collingwood\Digital Mapping\HydroG Figure Template

N

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- SITE
- BOREHOLE/MONITORING WELLS, 2023
- GROUNDWATER CONTOURS
- ROAD
- WATERCOURSE
- WATERBODY
- WOODED AREA
- GROUNDWATER ELEVATION (MEASURED JANUARY 17, 2024)
- GROUNDWATER FLOW DIRECTION



0 60 120 240 METERS

TATHAM ENGINEERING

REDFORD PIT EXPANSION
COMBINED LEVEL 1 & 2
HYDROGEOLOGICAL ASSESSMENT
GROUNDWATER CONTOURS WINTER (JANUARY 2024)

DWG. No. **FIG-14**

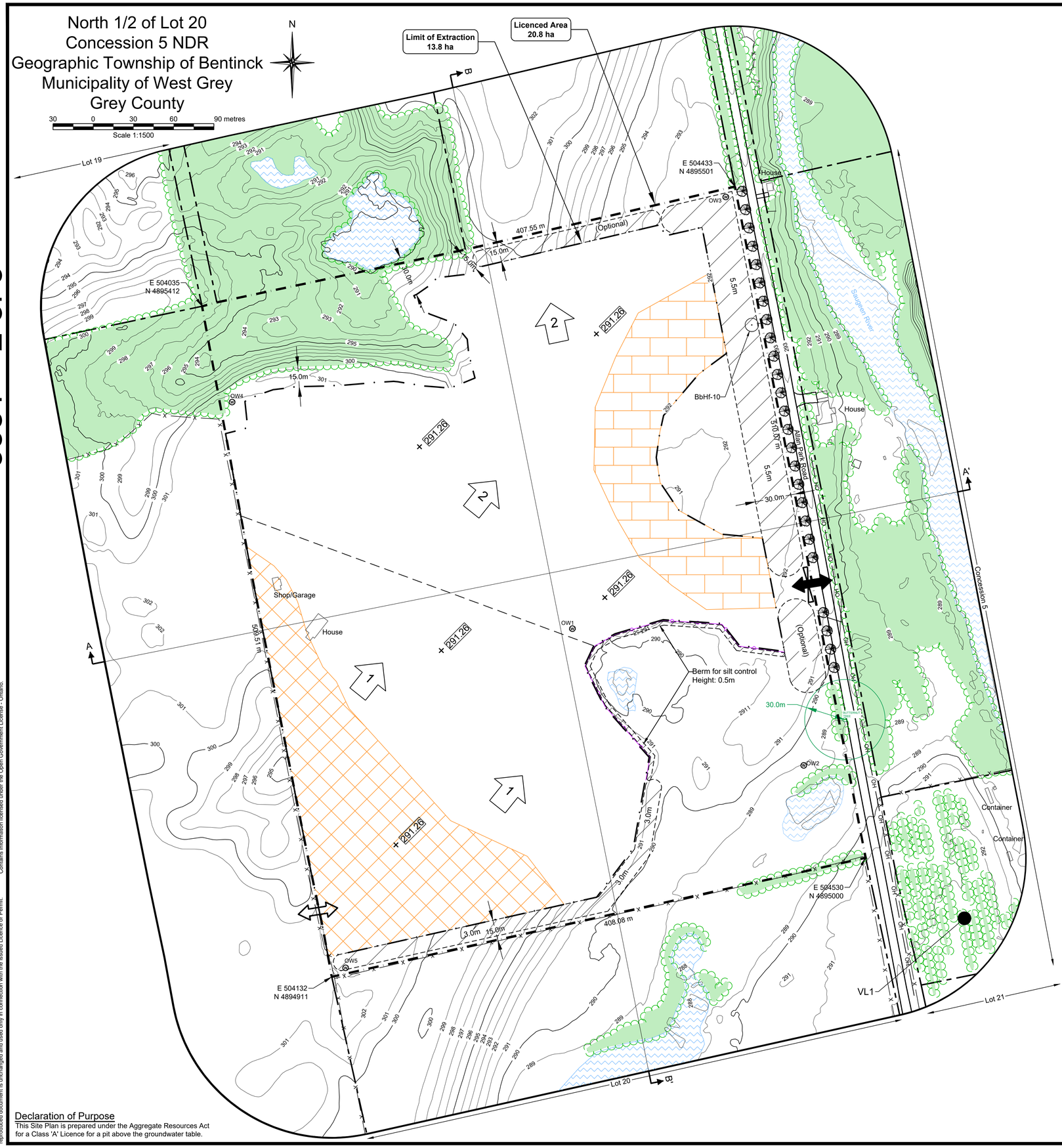
SCALE: 1:3,000 | DRAWN: AO | DATE: JUL. 2025 | JOB NO. 123039

O:\Collingwood\Digital Mapping\HydroG Figure Template

Appendix A:
Concept Plan

North 1/2 of Lot 20
Concession 5 NDR
Geographic Township of Bentinck
Municipality of West Grey
Grey County

3581 - 2 of 5



A. General

1. Licenced area 20.8 ha

   Area to be extracted 13.8 ha

2. The established maximum predicted water table is at an elevation of 289.76 masl on the site based on the Maximum Predicted Water Table Report by Tatham Engineering (July 2024).

3. Depth of extraction shall not exceed 1.5 m above the maximum predicted water table as shown on this plan.

4. The licensee shall obtain a Permit to Take Water (PTTW) under the *Ontario Water Resources Act* where required to carry out operations at the pit.

5. The licensee shall obtain an Environmental Compliance Approval (ECA) under the *Environmental Protection Act* where required to carry out operations at the pit.

6. The site is located within the Saugeen Valley Source Protection Area. Any potential mitigation measures are as outlined in the Technical Recommendations (Drawing 3 of 5) .

7. Annual extraction shall not exceed 300,000 tonnes.

8. The existing shop and house on site in Phase 1 will be re-purposed to onsite office and maintenance use. If the house and shop are not required for these future purposes, they will be demolished before extraction in that portion of Phase 1 occurs.

B. Hours of Operation

1. The permitted hours of operation for site activities are as follows:

   - All pit activities are permitted Monday to Saturday between 07:00 and 19:00.
   - No operations are permitted on Sundays or statutory holidays.

2. Despite B.1, a person may operate a pit or quarry at any time to respond to an emergency.

C. Drainage and Siltation Control

1. Drainage of undisturbed areas shall continue as shown and described on the Existing Features plan view.

2. Drainage of extracted areas shall be contained on-site and will infiltrate into the pit floor.

3. Where necessary, a silt barrier shall be installed to prevent siltation of the setback and adjacent lands. The silt barrier shall be maintained until the stripped area is extracted to an elevation that retains all runoff from the disturbed area.

4. A silt control berm shall be established along the southeast extraction boundary of Phase 1, as shown on the plan view, prior to disturbance of the adjacent extraction area. This berm shall be seeded immediately following construction. A silt barrier shall be installed prior to construction of the berm and may be removed after vegetation is established on the berm.

D. Fencing

1. Post and wire fencing is currently located along the west and south licensed boundaries of the site.

2. Fencing shall be installed along the remaining licensed boundaries within six (6) months of licencing. The minimum height of fencing shall be 1.2 m.

3. A gate shall be installed at the entrance/exit of the site at Allan Park Road and shall be kept closed at all times.

4. Fencing shall be maintained and/or replaced as necessary along the north, east, and south licenced boundaries until the licence is surrendered. Refer to Section N. Variations from Ontario Regulation 244/97 for details on maintenance of fencing along the west licenced boundary.

E. Tree Screens and Setbacks

1. A tree screen shall be planted along the eastern boundary, in the location shown on this plan within six (6) months of licencing. Planting shall consist of one (1) row of coniferous trees. The minimum height of trees at planting shall be one (1.0) metre.

2. The tree screen will be monitored for die-off and trees will be replaced as necessary to ensure an effective screen until the licence is surrendered.

3. Setbacks may be disturbed for the creation of berms and/or installation and maintenance of fencing.

F. Site Preparation

1. Trees, brush and stumps shall be removed from site, disposed of by burying or burning with applicable permits, or stockpiled and/or chipped for use in rehabilitation.

2. All trees within 5 m of the excavation face and within the area to be excavated shall be removed.

G. Berms

1. Topsoil and overburden shall be stripped and stored separately and used for construction of berms located along the south/southeast boundaries, and along the east boundary north of the site access at Allan Park Road. Berms are to be established prior to extraction operations commencing.

2. Optional berms may be constructed at any time along the east licenced boundary, south of the site access from Allan Park Road, and along the norht licensed boundary, if deemed necessary by the licensee for topsoil management.

3. Once berms are established, any additional stripped topsoil and overburden shall be used for progressive rehabilitation, or if areas are not available for rehabilitation, temporarily stockpiled.

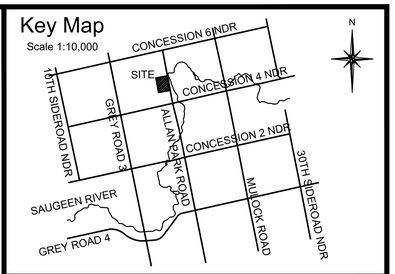
4. Berms and stockpiles shall be seeded and maintained to control erosion as necessary.

5. No topsoil shall be removed from the site.

REFER TO DRAWING 3 OF 5 FOR CONTINUED OPERATIONAL PLAN NOTES

Key Map

Scale 1:10,000



Legend

- Licenced Boundary
- Limit of Extraction
- Line indicating all points within 120m (minimum) of licenced boundary
- Property Line
- Post and Page Wire Fence (unless otherwise noted)
- Silt Fence
- Public Road
- Internal Road
- Water Course - Permanent
- Overhead Hydro Line
- Buildings and Structures
- Contours and Spot Elevations
- Existing Pit Entrance / Exit
- Proposed Pit Entrance / Exit
- Gate
- Wooded Areas
- Pond / Surface Water
- Well
- Processing Area (see Note J.2)
- Restricted Noise Area (see Note J.3)
- Maximum Depth of Extraction
- Section Arrows
- Proposed Topsoil and / or Overburden Berm (Minimum Height)
- Direction / Sequence of Extraction
- Extraction Phase Boundary
- Tree Screen (Coniferous, 1.0 m Height)

Schedule of Revisions (Pre-Licencing)

No.	Date	Description	Approved

Schedule of Amendments

No.	Date	Description	Approved

PRELIMINARY ONLY

Client Date

Walker Aggregates
Redford Pit Expansion
Municipality of West Grey, Grey County

Licensee: Walker Aggregates
323545 East Linton Side Road West
RR #2 Kemble, ON
N0H 1S0

Operational Plan

Project No.	23 - 3581	Drwg. No.	3581 - 2 of 5
Date:	November 2023	Scale:	1:1500
Drawn: KAH	Checked: MJB	Approved:	MJB

Skelton Brumwell & Associates Inc.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS

125 Bell Farm Road, Suite 203
Barrie, Ontario L4M 6L2

Telephone (705) 726-1141
www.skeltonbrumwell.ca

Declaration of Purpose

This Site Plan is prepared under the Aggregate Resources Act for a Class 'A' Licence for a pit above the groundwater table.

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Appendix B:
MECP Well Records

TATHAM ENGINEERING

Ministry of the Environment, Conservation and Parks
Water Well Records

Township Con Lot	UTM	Date Centr	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
BENTINCK TOWNSHIP 05 021	17 504615 4895026 W	2005/07 2576	6	FR 0085 FR 0095	15//25/1:30	DO		2516461 (Z25412) A025024	BRWN SAND BLDR 0021 BRWN SAND 0058 GREY GRVL SAND 0064 GREY LMSN 0098
BENTINCK TOWNSHIP 05 021	17 504647 4894688 W	2006/07 2576	6	FR 0100 FR 0125	13/13/10/1:	DO	0075 61	2516963 (Z25363) A043695	LOAM 0001 BRWN SAND GRVL 0020 BRWN SAND 0065 GREY LMSN CLAY 0070 GREY LMSN LYRD 0136
BENTINCK TOWNSHIP 05 021	17 504685 4894777 W	2005/08 2576	6	FR 0090 FR 0093	39//3/1:30	DO		2516469 (Z25420) A025018	BRWN SAND BLDR 0031 BRWN SAND 0053 GREY LMSN 0098
BENTINCK TOWNSHIP 20 005	17 504137 4895208 W	2005/05 3030	48 36 36	FR 0041		DO		2516404 (Z23388) A023132	BRWN LOAM 0001 BRWN SAND GRVL 0016 BRWN SAND 0018 BRWN SAND 0040 BRWN SAND 0055
BENTINCK TOWNSHIP CON 05 019	17 504064 4894424 W	1960/07 5426	4 4	SU 0114	30/60/4/2:0	ST DO		2500174 ()	MSND STNS CLAY 0020 YLLW MSND 0050 GRVL MSND 0055 MSND STNS 0080 MSND GRVL 0085 GREY ROCK 0114
BENTINCK TOWNSHIP CON 05 019	17 504054 4894424 W	1971/02 1804	4	FR 0100	35/42/10/4:0	ST DO		2503437 ()	BLCK LOAM 0002 BRWN MSND STNS 0083 BRWN ROCK 0147
BENTINCK TOWNSHIP CON 05 022	17 504965 4895064 W	2021/02 7190	2 4		0///:	MO	0005 10	7383294 (3JVY3JQR) A316388	BRWN SAND GRVL 0015
BENTINCK TOWNSHIP CON 06 021	17 504464 4895674 W	1968/11 1804	4 4	FR 0075	15/25/20/2:0	DO		2502709 ()	BLDR 0020 GRVL BLDR 0040 GRVL 0055 FSND 0063 GREY LMSN 0080

UTM: UTM in Zone, Easting, Northing and Datum is NAD83; L: UTM estimated from Centroid of Lot; W: UTM not from Lot Centroid
DATE CNTR: Date Work Completed and Well Contractor Licence Number
CASING DIA: Casing diameter in inches
WATER: Unit of Depth in Feet. See Table 4 for meanign of code.
PUMP TEST: Static Water Level in Feet / Water Level After Pumping in Feet / Pump Test Rate in GPM / Pump Test Duration in Hr : Min
WELL USE: See Table 3 for Meaning of Code
SCREEN: Screen Depth and Length in feet
WELL: WEL (AUDIT #) Well Tag. A: Abandonment; P: Partial Data Entry Only
FORMATION: See Table 1 and 2 for Meaning of Code

Table 1: Core Material and Descriptive Terms

BLDR BOULDERS	FCRD FRACTURED	IRFM IRON FORMATION	PORS POROUS	SOFT SOFT
BSLT BASALT	FGRD FINE-GRAINED	LIMY LIMY	PRDG PREVIOUSLY DUG	SPST SOAPSTONE
CGRD COARSE-GRAINED	FGVL FINE GRAVEL	LMSN LIMESTONE	PRDR PREV. DRILLED	STKY STICKY
CGVL COARSE GRAVEL	FILL FILL	LOAM TOPSOIL	QRTZ QUARTZITE	STNS STONES
CHRT CHERT	FLDS FELDSPAR	LOOS LOOSE	QSND QUICKSAND	STNY STONEY
CLAY CLAY	FLNT FLINT	LTCL LIGHT-COLOURED	QTZ QUARTZ	THIK THICK
CLN CLEAN	FOSS FOSILIFEROUS	LYRD LAYERED	ROCK ROCK	THIN THIN
CLYY CLAYEY	FSND FINE SAND	MARL MARL	SAND SAND	TILL TILL
CMTD CEMENTED	GNIS GNEISS	MGRD MEDIUM-GRAINED	SHLE SHALE	UNKN UNKNOWN TYPE
CONG CONGLOMERATE	GRNT GRANITE	MGVL MEDIUM GRAVEL	SHLY SHALY	VERY VERY
CRYS CRYSTALLINE	GRSN GREENSTONE	MRBL MARBLE	SHRP SHARP	WBRG WATER-BEARING
CSND COARSE SAND	GRVL GRAVEL	MSND MEDIUM SAND	SHST SCHIST	WDFR WOOD FRAGMENTS
DKCL DARK-COLOURED	GRWK GREYWACKE	MUCK MUCK	SILT SILT	WTHD WEATHERED
DLMT DOLOMITE	GVLY GRAVELLY	OBDN OVERBURDEN	SLTE SLATE	
DNSE DENSE	GYPS GYPSUM	PCKD PACKED	SLTY SILTY	
DRTY DIRTY	HARD HARD	PEAT PEAT	SNDS SANDSTONE	
DRY DRY	HPAN HARDPAN	PGVL PEA GRAVEL	SNDY SANDYOAPSTONE	

Table 2: Core Color

WHIT WHITE
GREY GREY
BLUE BLUE
GREN GREEN
YLLW YELLOW
BRWN BROWN
RED RED
BLCK BLACK
BLGY BLUE-GREY

Table 3: Well Use

DO Domestic	OT Other
ST Livestock	TH Test Hole
IR Irrigation	DE Dewatering
IN Industrial	MO Monitoring
CO Commercial	MT Monitoring TestHole
MN Municipal	
PS Public	
AC Cooling And A/C	
NU Not Used	

Table 4:Water Detail

FR Fresh	GS Gas
SA Salty	IR Iron
SU Sulphur	
MN Mineral	
UK Unknown	

Appendix C:
Borehole Logs

Tatham Engineering Limited
41 King Street
Barrie/Ontario L4N 6B5
Telephone: 7057339037

BORING NUMBER OW1

CLIENT Walker Aggregrates
PROJECT NAME Redford Pit Expansion
PROJECT NUMBER 123039
PROJECT LOCATION North 1/2 of Lot 20, Conc 5 NDR, West Grey
DATE STARTED 2/27/23 **COMPLETED** 2/27/23
GROUND ELEVATION 297.84 m **HOLE SIZE**
DRILLING CONTRACTOR InSitu Groundwater Contractors
GROUND WATER LEVELS:
DRILLING METHOD Sonic
AT TIME OF DRILLING ---
LOGGED BY NT/JM **CHECKED BY** AK
AT END OF DRILLING ---
NOTES
AFTER DRILLING 8.77 m / Elev 289.07 m

DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
						Casing Top Elev: 298.69 (m) Casing Type: Monument
	1				TOPSOIL: dark brown, silty clay, trace to some gravel, trace sand, trace organics, wet/frozen	
					0.76 297.08	
	2				SILTY SAND: dark brown to brown, silty sand, moist to wet	
	3				4.10 293.74	
5	4				SAND: brown, coarse to fine grained sand, trace silt, trace gravel, moist to wet	
	5					
	6					Bentonite and Soil Cuttings
10	7					
	8					
	9					
	10					
15	11					Filter sand
	12					Filter sand and 50 mm diameter slotted pipe
	13				19.80 278.04	

Test hole terminated at 19.8 m

Tatham Engineering Limited
41 King Street
Barrie/Ontario L4N 6B5
Telephone: 7057339037

BORING NUMBER OW2

CLIENT Walker Aggregrates
PROJECT NAME Redford Pit Expansion
PROJECT NUMBER 123039
PROJECT LOCATION North 1/2 of Lot 20, Conc 5 NDR, West Grey
DATE STARTED 2/28/23 **COMPLETED** 2/28/23
GROUND ELEVATION 289.25 m **HOLE SIZE**
DRILLING CONTRACTOR InSitu Groundwater Contractors
GROUND WATER LEVELS:
DRILLING METHOD Sonic
AT TIME OF DRILLING ---
LOGGED BY NT/JM **CHECKED BY** AK
AT END OF DRILLING ---
NOTES
AFTER DRILLING 1.10 m / Elev 288.15 m

DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
						Casing Top Elev: 289.92 (m) Casing Type: Monument
	1				TOPSOIL: light brown, sandy silt, trace to some gravel, trace to some clay, trace organics, cobbles and boulders, moist — 0.76 — 288.49	
	2				SAND: dark brown to light brown, coarse to fine sand, some gravel to gravelly, trace to some silt, trace clay, cobbles and boulders, moist to wet	
	3					Bentonite and Soil Cuttings
5	4					
	5					
	6					Filter sand
10	7					
	8					Filter sand and 50 mm diameter slotted pipe
					12.20 — 277.05	
	9				DOLOSTONE BEDROCK: grey, weathered, wet	
	10					
15					15.20 — 274.05	

Test hole terminated at 15.2 m

Tatham Engineering Limited
41 King Street
Barrie/Ontario L4N 6B5
Telephone: 7057339037

BORING NUMBER OW3

CLIENT Walker Aggregrates
PROJECT NAME Redford Pit Expansion
PROJECT NUMBER 123039
PROJECT LOCATION North 1/2 of Lot 20, Conc 5 NDR, West Grey
DATE STARTED 3/2/23 **COMPLETED** 3/2/23
GROUND ELEVATION 292.75 m **HOLE SIZE**
DRILLING CONTRACTOR InSitu Groundwater Contractors
GROUND WATER LEVELS:
DRILLING METHOD Sonic
AT TIME OF DRILLING ---
LOGGED BY NT/JM **CHECKED BY** AK
AT END OF DRILLING ---
NOTES
AFTER DRILLING 3.69 m / Elev 289.06 m

DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
						Casing Top Elev: 293.58 (m) Casing Type: Monument
	1				TOPSOIL: dark brown, silty clay, trace gravel, trace sand, trace organics, wet	
					0.76 291.99	
	2				SAND: brown to light brown, coarse to fine grained sand, trace silt, trace to some gravel, trace clay, cobbles and boulders, moist to wet	
	3					
5	4					
	5					Bentonite and Soil Cuttings
	6					
10	7					
	8					
	9					
	10					Filter sand
15	11					Filter sand and 50 mm diameter slotted pipe
	12					
	13				19.80 272.95	

Test hole terminated at 19.8 m

Tatham Engineering Limited
41 King Street
Barrie/Ontario L4N 6B5
Telephone: 7057339037

BORING NUMBER OW4

CLIENT Walker Aggregrates
PROJECT NAME Redford Pit Expansion
PROJECT NUMBER 123039
PROJECT LOCATION North 1/2 of Lot 20, Conc 5 NDR, West Grey
DATE STARTED 3/2/23 **COMPLETED** 3/2/23
GROUND ELEVATION 301.1 m **HOLE SIZE**
DRILLING CONTRACTOR InSitu Groundwater Contractors
GROUND WATER LEVELS:
DRILLING METHOD Sonic
AT TIME OF DRILLING ---
LOGGED BY NT/JM **CHECKED BY** AK
AT END OF DRILLING ---
NOTES
AFTER DRILLING 11.56 m / Elev 289.54 m

DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
						Casing Top Elev: 301.87 (m) Casing Type: Monument
	1				TOPSOIL: dark brown, silty clay, trace gravel, trace sand, trace organics, cobbles and boulders, wet — 0.76 / 300.34	
	2				SAND: brown to light brown and grey, coarse to fine grained sand, trace to some silt to silty, trace to some gravel, trace clay, moist to wet	
	3					
5	4					
	5					Bentonite and Soil Cuttings
	6					
10	7					
	8					
	9					
	10					Filter sand
15	11					Filter sand and 50 mm diameter slotted pipe
	12					
	13				19.80 / 281.30	

Test hole terminated at 19.8 m

Tatham Engineering Limited
41 King Street
Barrie/Ontario L4N 6B5
Telephone: 7057339037

BORING NUMBER OW5

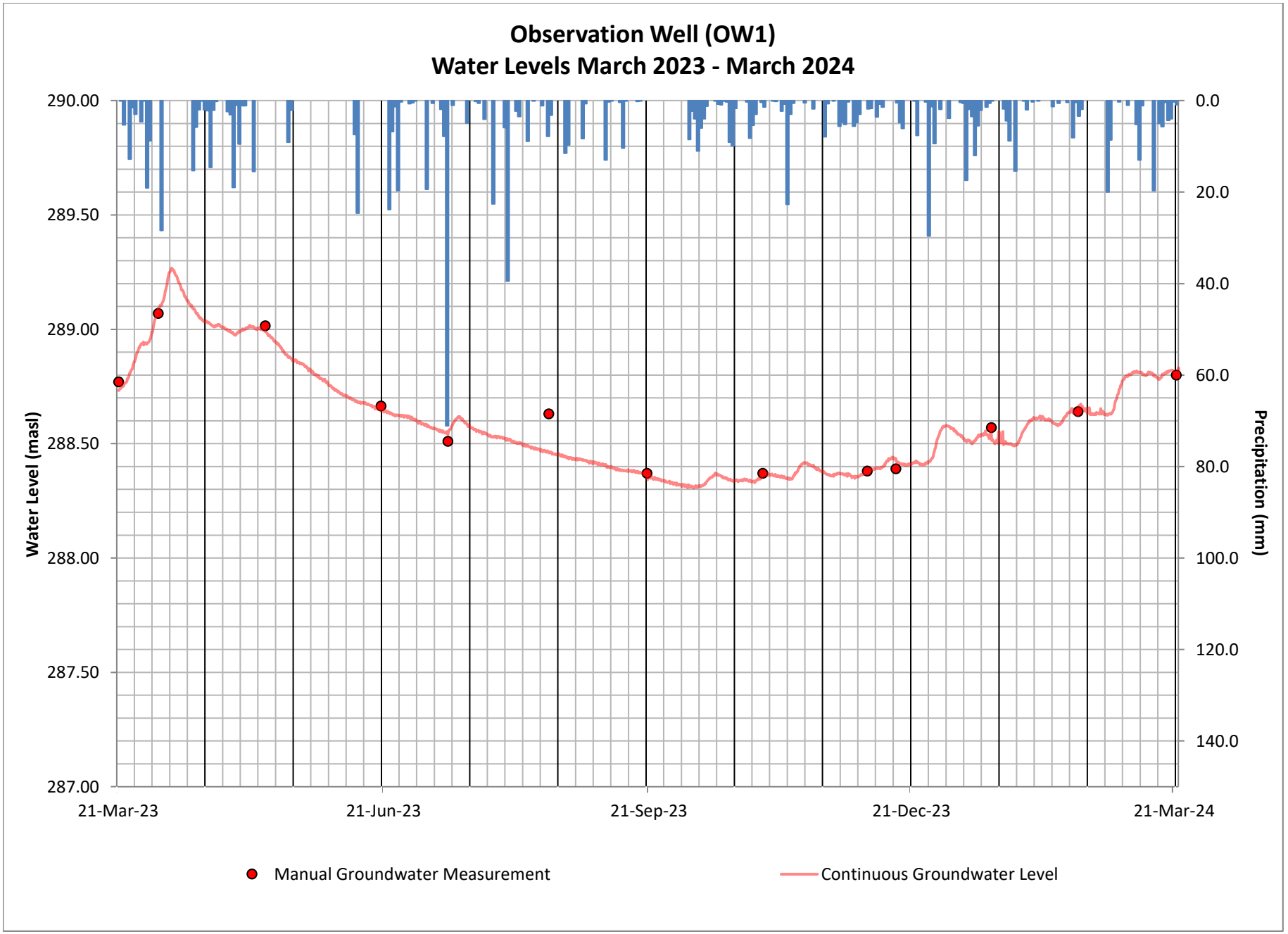
CLIENT Walker Aggregrates
PROJECT NAME Redford Pit Expansion
PROJECT NUMBER 123039
PROJECT LOCATION North 1/2 of Lot 20, Conc 5 NDR, West Grey
DATE STARTED 3/3/23 **COMPLETED** 3/3/23
GROUND ELEVATION 302.09 m **HOLE SIZE**
DRILLING CONTRACTOR InSitu Groundwater Contractors
GROUND WATER LEVELS:
DRILLING METHOD Sonic
AT TIME OF DRILLING ---
LOGGED BY NT/JM **CHECKED BY** AK
AT END OF DRILLING ---
NOTES
AFTER DRILLING 13.32 m / Elev 288.77 m

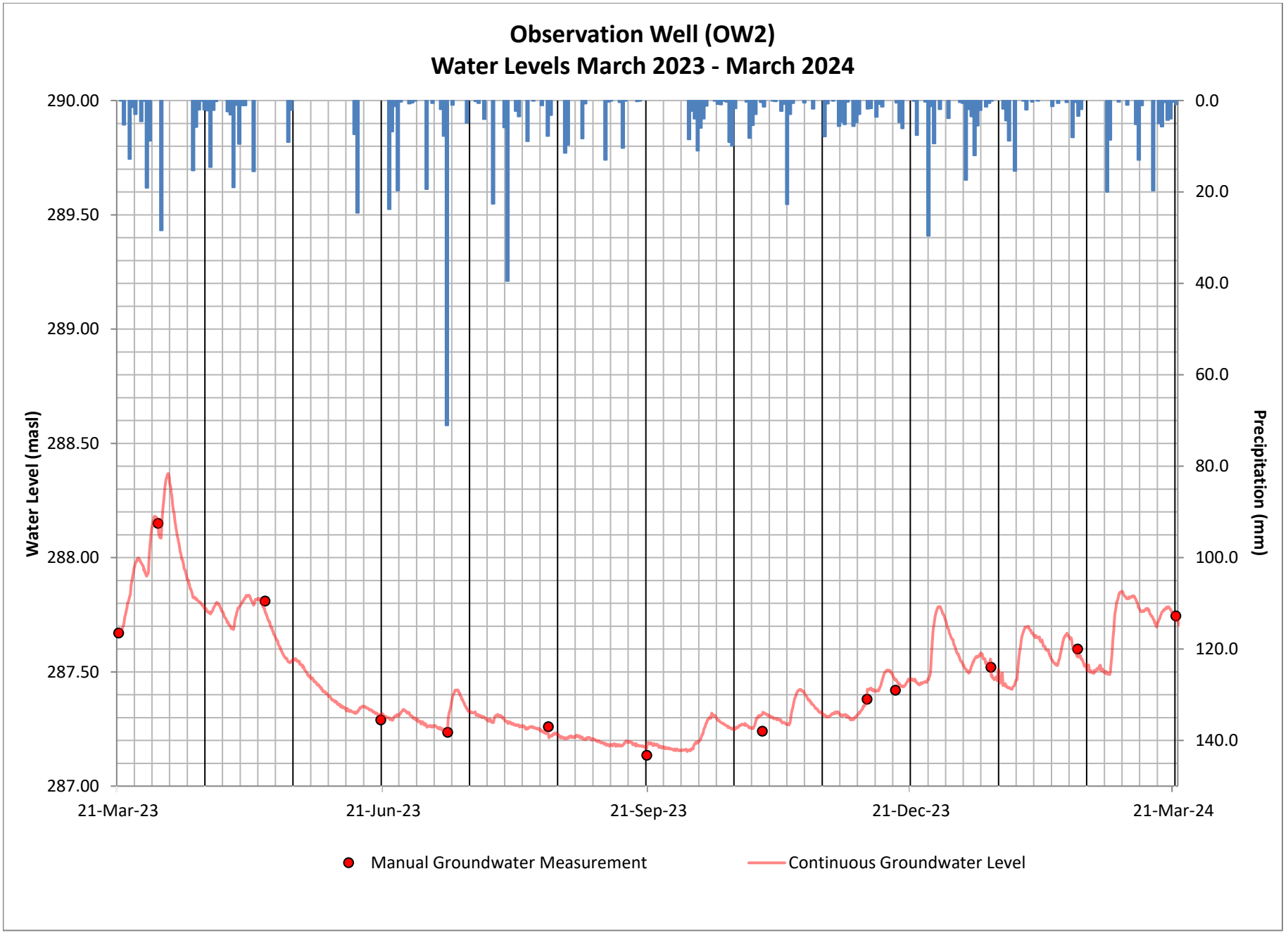
DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
						Casing Top Elev: 302.86 (m) Casing Type: Monument
	1				TOPSOIL: dark brown, silty clay, trace gravel, trace sand, trace organics, wet — 0.76 — 301.33	
	2				SAND: brown to light brown and grey, coarse to fine grained sand, trace to some silt to silty, trace to some gravel, trace clay, moist to wet	
	3					
5	4					
	5					Bentonite and Soil Cuttings
	6					
10	7					
	8				First water strike at 12.2 m	
	9					
	10					Filter sand
15	11					Filter sand and 50 mm diameter slotted pipe
	12					
	13				19.80 — 282.29	

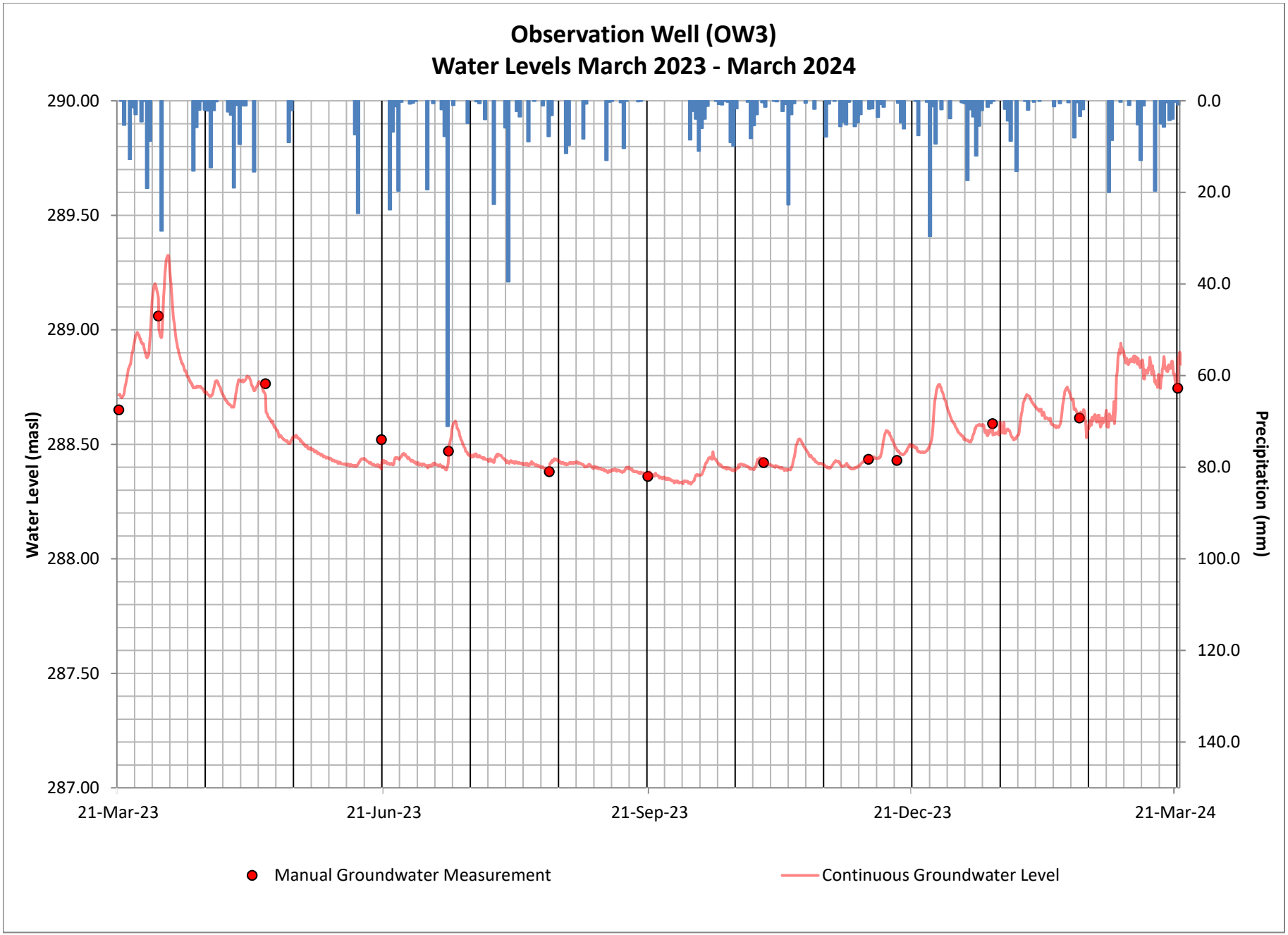
Test hole terminated at 19.8 m

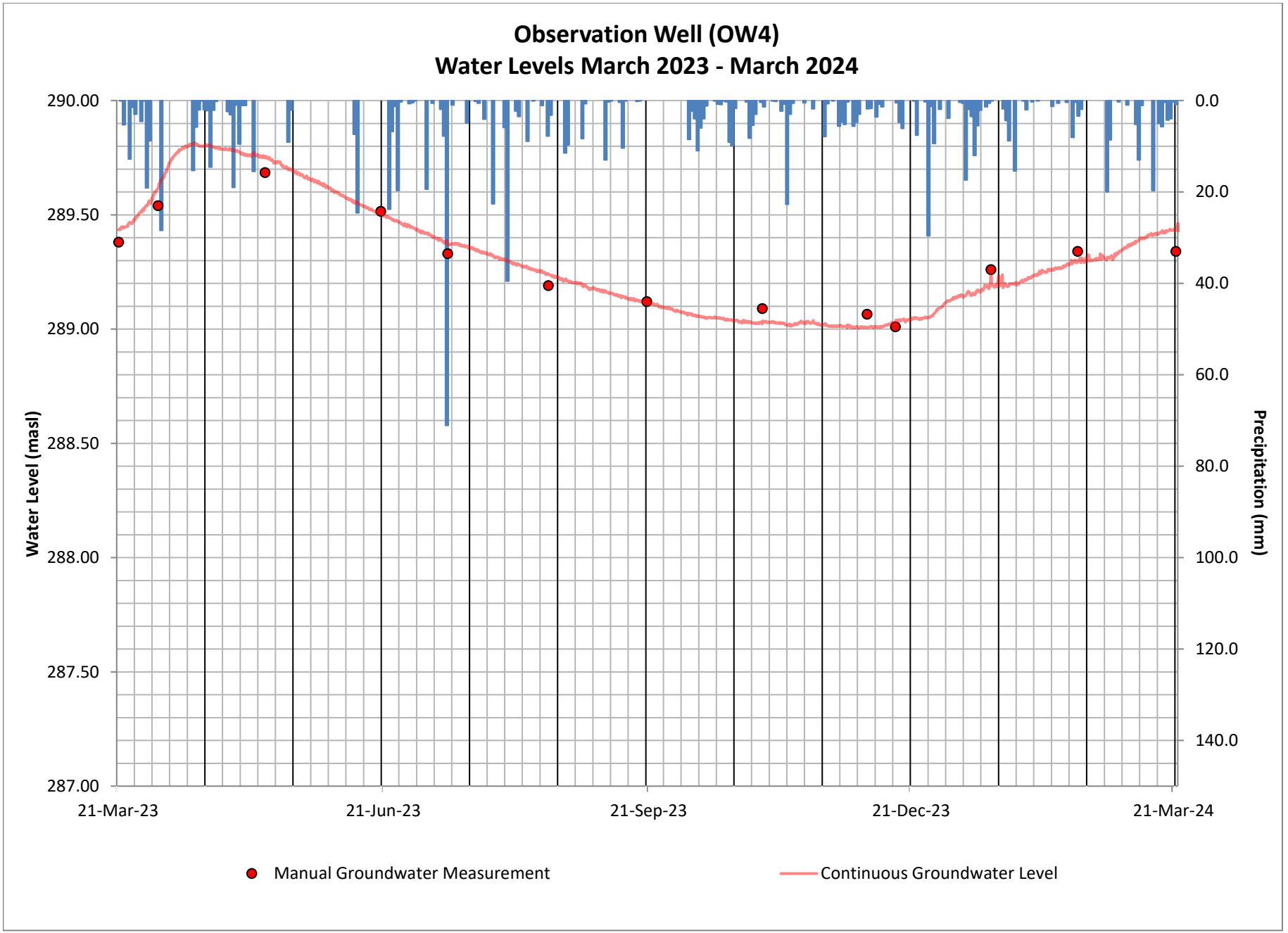
ENVIRONMENTAL BH REDFORD BOREHOLE LOGS.GPJ GINT STD CANADA.GDT 6/10/24

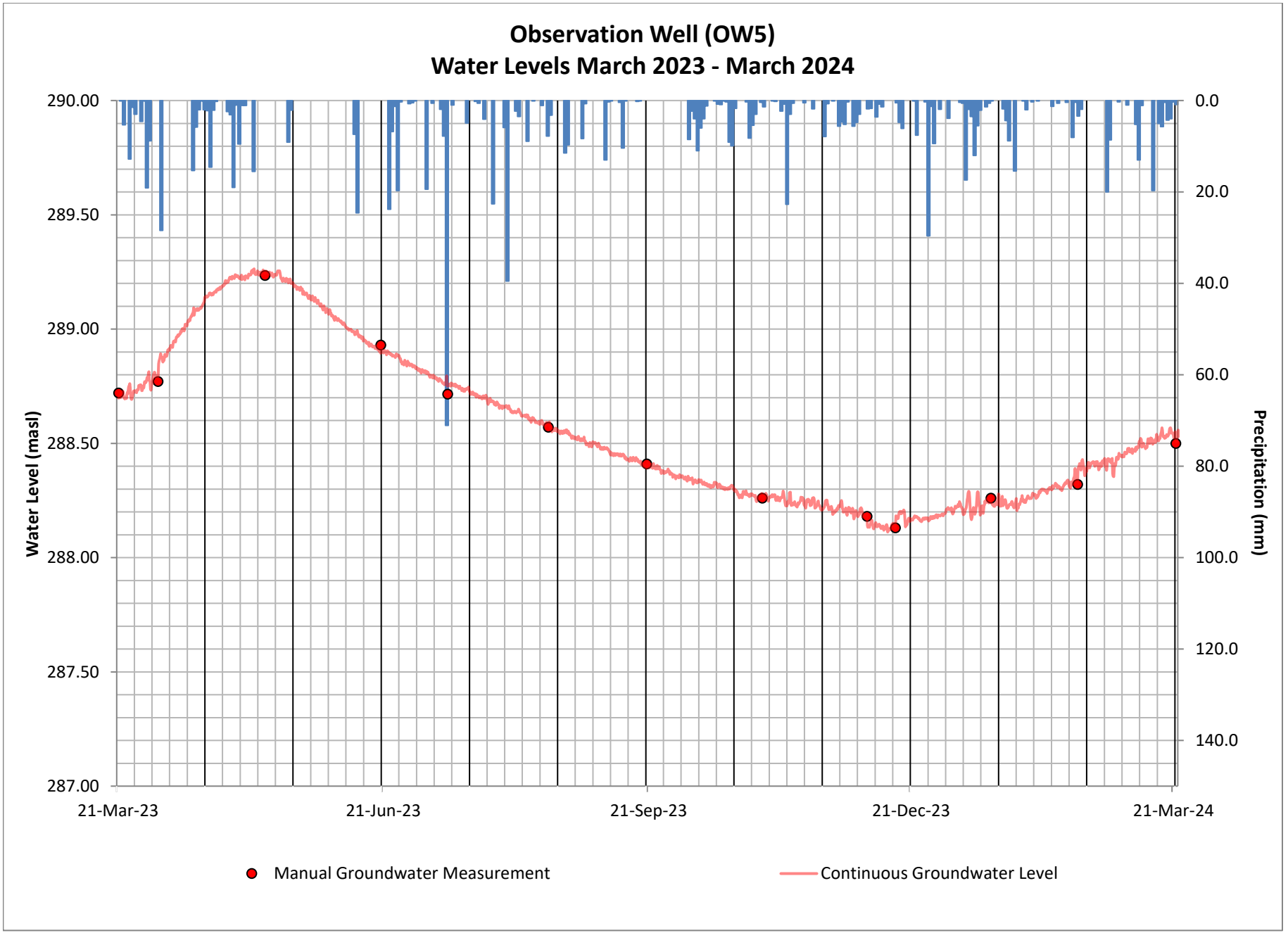
Appendix D:
Hydrographs – Monitoring Wells


Observation Well (OW1)
Water Levels March 2023 - March 2024
290.00
289.50
289.00
288.50
288.00
287.50
287.00
Water Level (masl)
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
Precipitation (mm)
21-Mar-23
21-Jun-23
21-Sep-23
21-Dec-23
21-Mar-24
Manual Groundwater Measurement
Continuous Groundwater Level

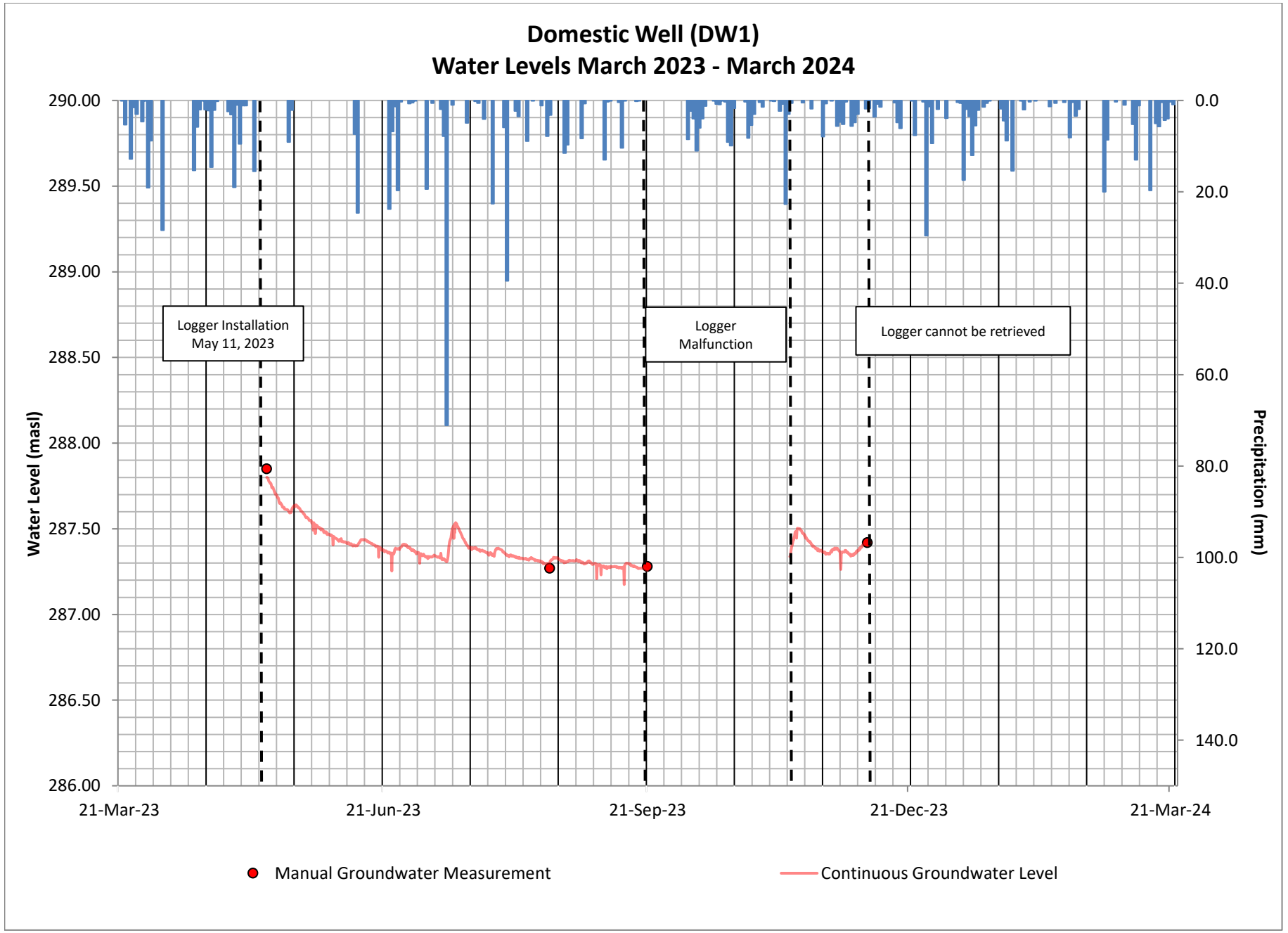

Observation Well (OW2)
Water Levels March 2023 - March 2024
290.00
289.50
289.00
288.50
288.00
287.50
287.00
Water Level (masl)
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
Precipitation (mm)
21-Mar-23
21-Jun-23
21-Sep-23
21-Dec-23
21-Mar-24
Manual Groundwater Measurement
Continuous Groundwater Level

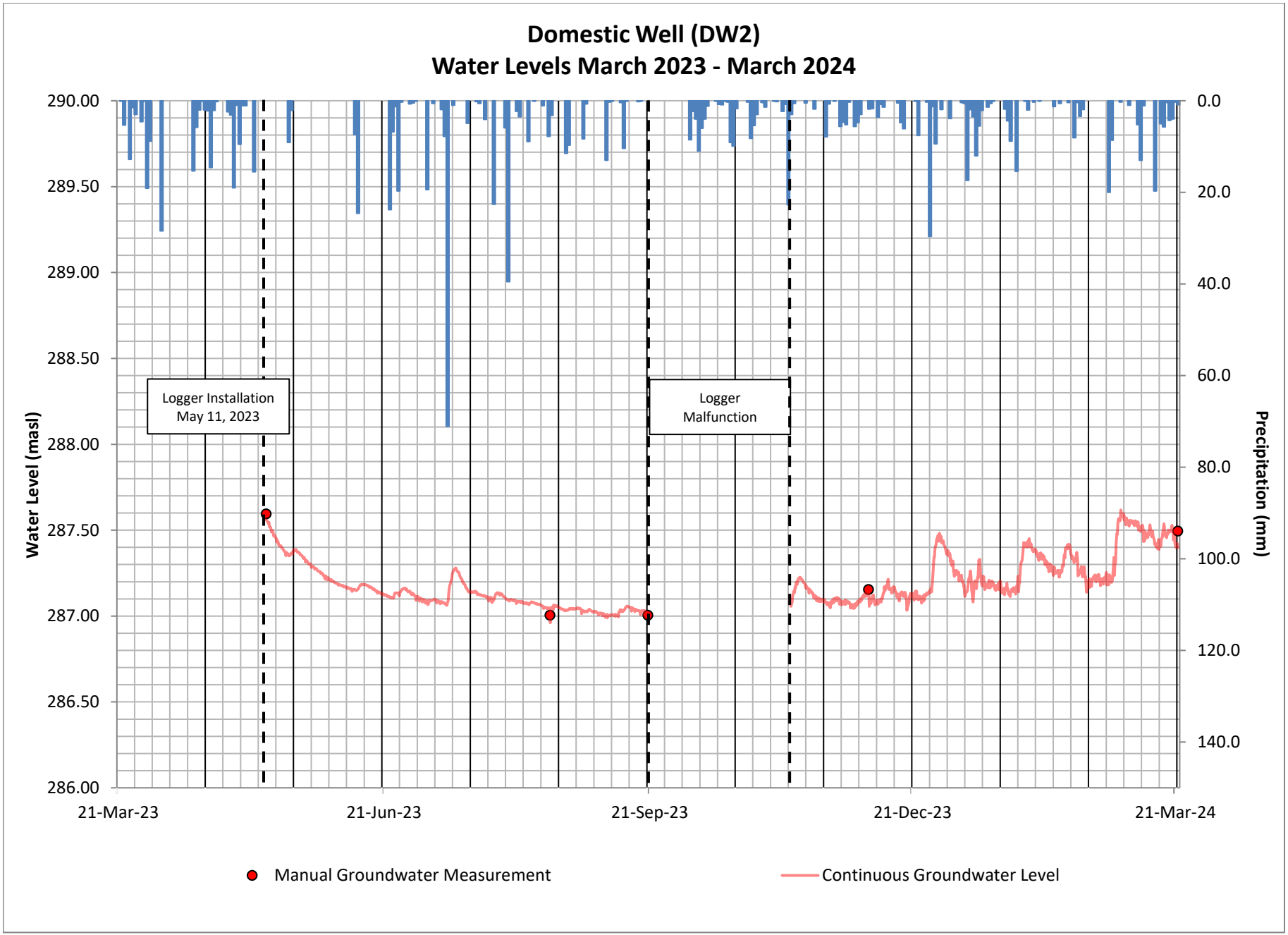

Observation Well (OW3)
Water Levels March 2023 - March 2024
290.00
289.50
289.00
288.50
288.00
287.50
287.00
Water Level (masl)
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
Precipitation (mm)
21-Mar-23
21-Jun-23
21-Sep-23
21-Dec-23
21-Mar-24
Manual Groundwater Measurement
Continuous Groundwater Level

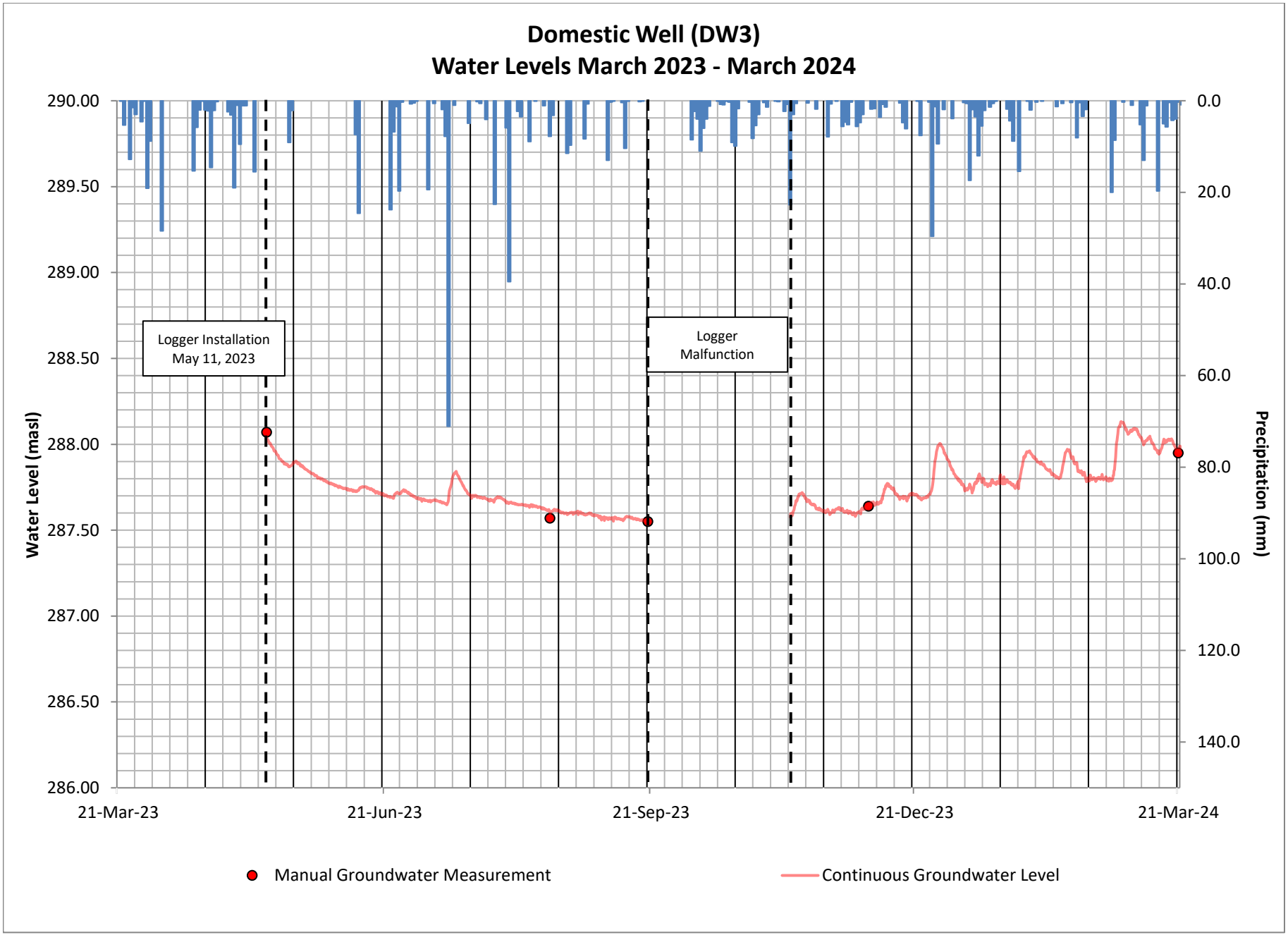

Observation Well (OW4)
Water Levels March 2023 - March 2024
Water Level (masl)
290.00
289.50
289.00
288.50
288.00
287.50
287.00
Precipitation (mm)
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
21-Mar-23
21-Jun-23
21-Sep-23
21-Dec-23
21-Mar-24
Manual Groundwater Measurement
Continuous Groundwater Level

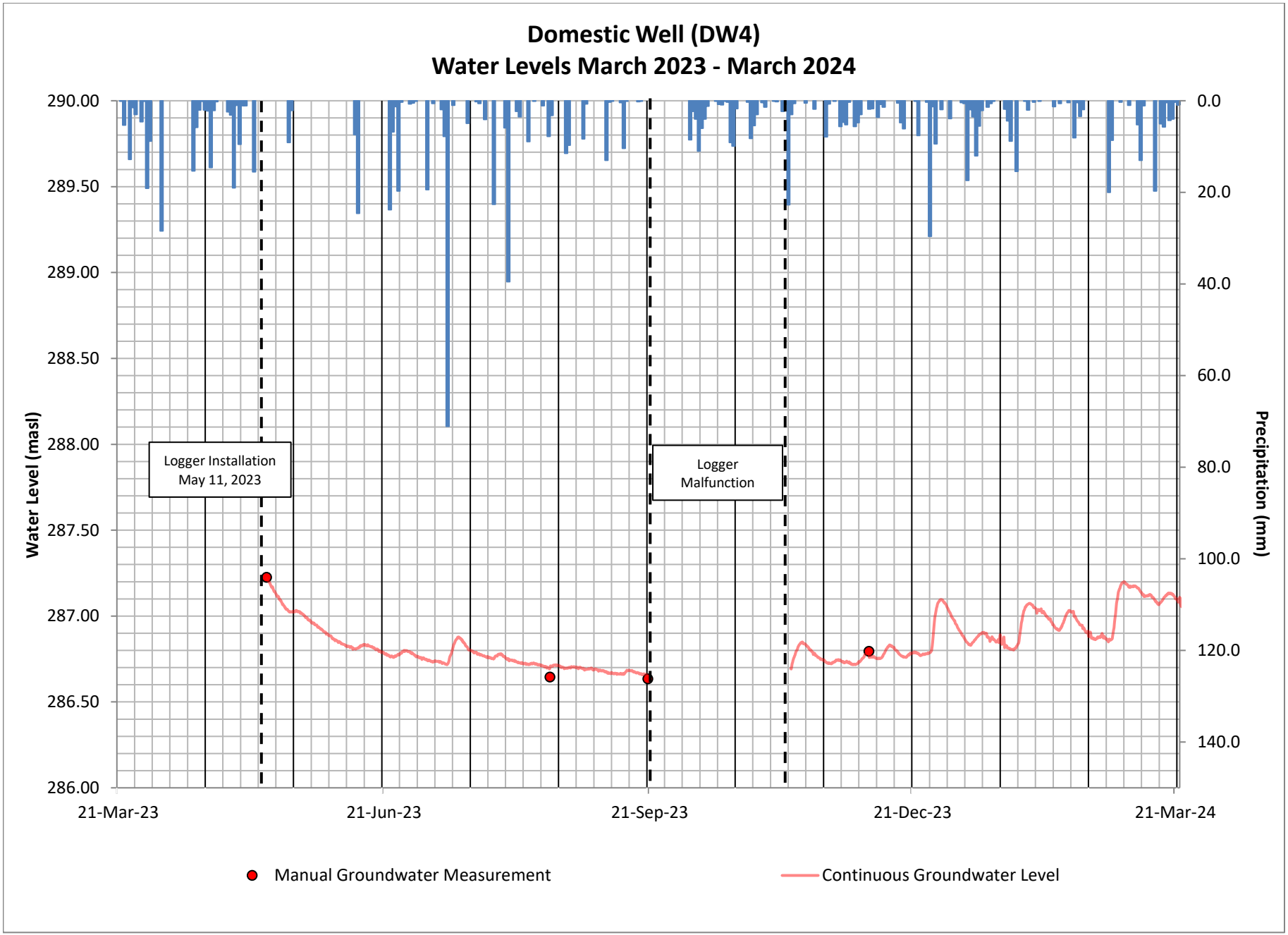

Observation Well (OW5)
Water Levels March 2023 - March 2024
Water Level (masl)
290.00
289.50
289.00
288.50
288.00
287.50
287.00
Precipitation (mm)
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
21-Mar-23
21-Jun-23
21-Sep-23
21-Dec-23
21-Mar-24
Manual Groundwater Measurement
Continuous Groundwater Level

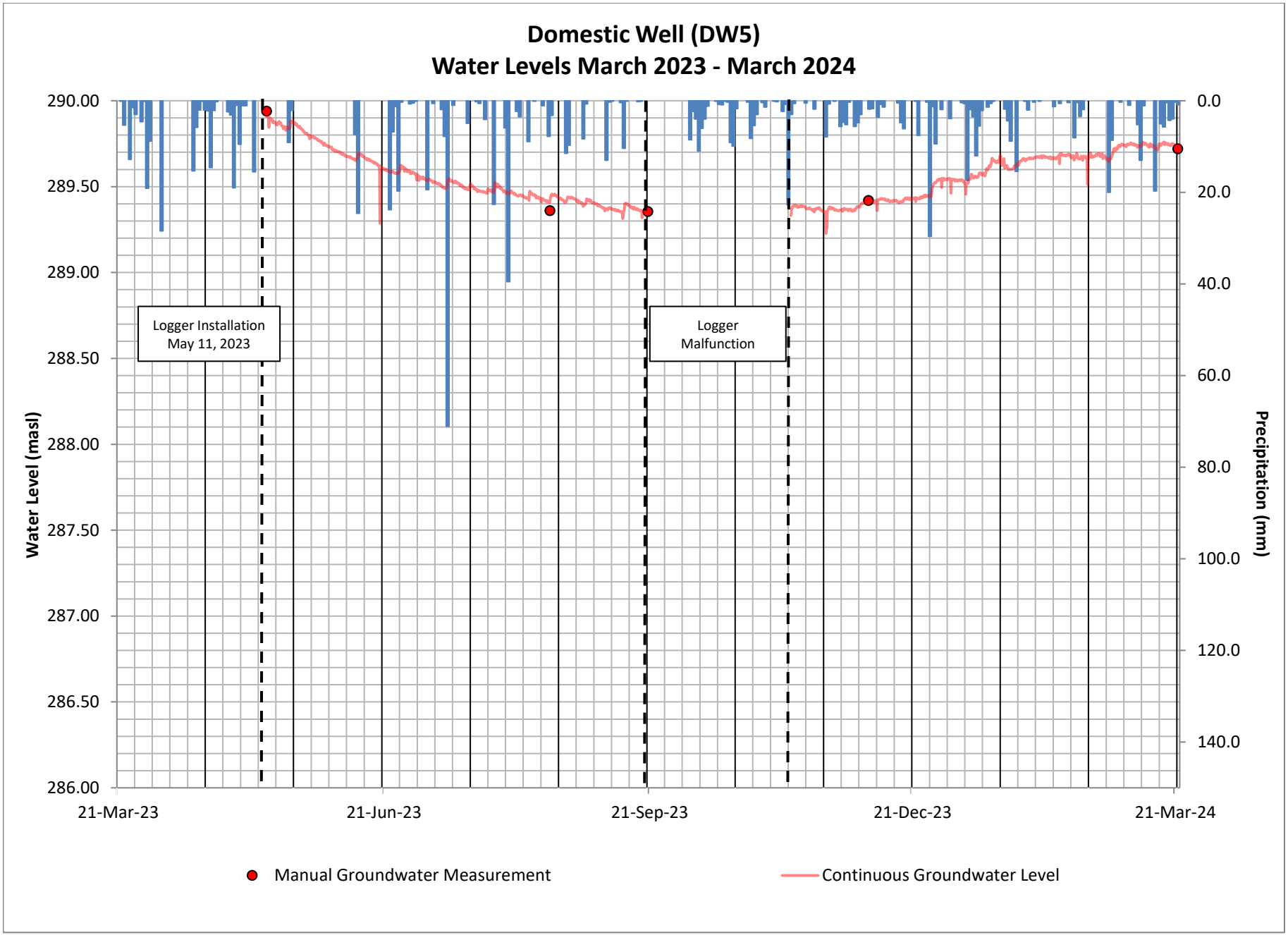
Appendix E: Hydrographs – Domestic Water Wells


Domestic Well (DW1)
Water Levels March 2023 - March 2024
Water Level (masl)
Precipitation (mm)
290.00
289.50
289.00
288.50
288.00
287.50
287.00
286.50
286.00
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
Logger Installation
May 11, 2023
Logger
Malfunction
Logger cannot be retrieved
21-Mar-23
21-Jun-23
21-Sep-23
21-Dec-23
21-Mar-24
Manual Groundwater Measurement
Continuous Groundwater Level


Domestic Well (DW2)
Water Levels March 2023 - March 2024
Water Level (masl)
Precipitation (mm)
290.00
289.50
289.00
288.50
288.00
287.50
287.00
286.50
286.00
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
Logger Installation
May 11, 2023
Logger
Malfunction
21-Mar-23
21-Jun-23
21-Sep-23
21-Dec-23
21-Mar-24
Manual Groundwater Measurement
Continuous Groundwater Level


Domestic Well (DW3)
Water Levels March 2023 - March 2024
Water Level (masl)
Precipitation (mm)
290.00
289.50
289.00
288.50
288.00
287.50
287.00
286.50
286.00
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
Logger Installation
May 11, 2023
Logger
Malfunction
21-Mar-23
21-Jun-23
21-Sep-23
21-Dec-23
21-Mar-24
Manual Groundwater Measurement
Continuous Groundwater Level


Domestic Well (DW4)
Water Levels March 2023 - March 2024
Water Level (masl)
Precipitation (mm)
290.00
289.50
289.00
288.50
288.00
287.50
287.00
286.50
286.00
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
Logger Installation
May 11, 2023
Logger
Malfunction
21-Mar-23
21-Jun-23
21-Sep-23
21-Dec-23
21-Mar-24
Manual Groundwater Measurement
Continuous Groundwater Level


Domestic Well (DW5)
Water Levels March 2023 - March 2024
Water Level (masl)
Precipitation (mm)
290.00
289.50
289.00
288.50
288.00
287.50
287.00
286.50
286.00
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
Logger Installation
May 11, 2023
Logger
Malfunction
21-Mar-23
21-Jun-23
21-Sep-23
21-Dec-23
21-Mar-24
Manual Groundwater Measurement
Continuous Groundwater Level

Appendix F:
Water Quality Results

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured. Canadian owned.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G106147 **REPORT No: 23-006251 - Rev. 0**

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

Attention: Jordon Miller

DATE RECEIVED: 2023-Apr-04
DATE REPORTED: 2023-Apr-12
SAMPLE MATRIX: Ground Water

CUSTOMER PROJECT: 123039
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	5	OTTAWA	VKASYAN	2023-Apr-06	A-IC-01	SM 4110B
Cond/pH/Alk Auto (Liquid)	5	OTTAWA	SBOUDREAU	2023-Apr-06	COND-02/PH-02/ALK-02	SM 2510B/4500H/2320B
ICP/MS (Liquid)	5	OTTAWA	TPRICE	2023-Apr-10	D-ICPMS-01	EPA 200.8
ICP/OES (Liquid)	5	OTTAWA	NHOGAN	2023-Apr-06	D-ICP-01	SM 3120B

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

Christine Burke
Laboratory Manager

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

Parameter	Units	R.L.	Limits	DWG	Client I.D.	OW 1	OW 2	OW 3	OW 4
					Sample I.D.	23-006251-1	23-006251-2	23-006251-3	23-006251-4
					Date Collected	2023-Apr-04	2023-Apr-04	2023-Apr-04	2023-Apr-04
						-	-	-	-
Alkalinity(CaCO3) to pH4.5	mg/L	5	500	OG		211	244	257	259
Bicarbonate (as CaCO3)	mg/L	5				211	244	257	259
pH @25°C	pH units	-	8.5	OG		7.81	7.80	7.82	7.88
Conductivity @25°C	µmho/cm	1				514	589	602	549
Chloride	mg/L	0.5	250	AO		6.2	4.5	5.5	4.0
Nitrate (N)	mg/L	0.05	10.0	MAC		10.1	13.6	5.13	3.76
Nitrite (N)	mg/L	0.05	1.0	MAC		<0.05	<0.05	<0.05	0.15
Sulphate	mg/L	1	500	AO		5	18	33	8
Hardness (as CaCO3)	mg/L as CaCO3	0.02	100	OG		269	311	329	300
Aluminum	mg/L	0.01	0.1	OG		0.04	0.05	0.06	0.04
Barium	mg/L	0.001	1.0	MAC		0.020	0.022	0.022	0.041
Bismuth	mg/L	0.02				<0.02	<0.02	<0.02	<0.02
Boron	mg/L	0.005	5.0	MAC		<0.005	0.007	0.010	0.010
Calcium	mg/L	0.02				64.3	73.6	76.6	71.4
Iron	mg/L	0.005	0.3	AO		<0.005	0.009	0.006	<0.005
Lithium	mg/L	0.005				<0.005	<0.005	<0.005	<0.005
Magnesium	mg/L	0.02				26.4	31.0	33.4	29.5
Manganese	mg/L	0.001	0.05	AO		0.007	0.001	0.004	0.056
Phosphorus	mg/L	0.1				<0.1	<0.1	<0.1	<0.1
Potassium	mg/L	0.1				0.5	0.8	1.0	1.2
Silicon	mg/L	0.01				2.57	2.58	2.64	2.43

Christine Burke
Laboratory Manager

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

Parameter	Units	R.L.	Limits	DWG	Client I.D.	OW 1	OW 2	OW 3	OW 4
					Sample I.D.	23-006251-1	23-006251-2	23-006251-3	23-006251-4
					Date Collected	2023-Apr-04	2023-Apr-04	2023-Apr-04	2023-Apr-04
						-	-	-	-
Silica	mg/L	0.02				5.50	5.52	5.65	5.20
Sodium	mg/L	0.2	200, 20	AO, MAC		0.9	4.8	2.3	1.8
Strontium	mg/L	0.001				0.052	0.186	0.333	0.114
Tin	mg/L	0.05				<0.05	<0.05	<0.05	<0.05
Titanium	mg/L	0.005				<0.005	<0.005	<0.005	<0.005
Tungsten	mg/L	0.01				<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	0.005	5	AO		<0.005	<0.005	<0.005	<0.005
Zirconium	mg/L	0.003				<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0001	0.006	MAC		<0.0001	0.0002	<0.0001	0.0001
Arsenic	mg/L	0.0001	0.01	MAC		<0.0001	0.0001	<0.0001	0.0002
Beryllium	mg/L	0.0001				<0.0001	<0.0001	<0.0001	<0.0001
Cadmium	mg/L	0.000015	0.005	MAC		<0.000015	<0.000015	<0.000015	<0.000015
Chromium	mg/L	0.001	0.05	MAC		<0.001	<0.001	0.001	<0.001
Cobalt	mg/L	0.0001				<0.0001	<0.0001	0.0003	0.0002
Copper	mg/L	0.0001	1.0	AO		0.0010	0.0012	0.0012	0.0010
Lead	mg/L	0.00002	0.01	MAC		<0.00002	<0.00002	<0.00002	<0.00002
Molybdenum	mg/L	0.0001				0.0003	0.0003	0.0003	0.0066
Nickel	mg/L	0.0002				0.0006	0.0006	0.0009	0.0013
Selenium	mg/L	0.001	0.05	MAC		<0.001	<0.001	<0.001	<0.001
Silver	mg/L	0.0001				<0.0001	<0.0001	<0.0001	<0.0001
Thallium	mg/L	0.00005				<0.00005	<0.00005	<0.00005	<0.00005

Christine Burke
Laboratory Manager

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

Final Report

REPORT No: 23-006251 - Rev. 0

				Client I.D.	OW 1	OW 2	OW 3	OW 4
				Sample I.D.	23-006251-1	23-006251-2	23-006251-3	23-006251-4
				Date Collected	2023-Apr-04	2023-Apr-04	2023-Apr-04	2023-Apr-04
Parameter	**Units**	**R.L.**	**Limits**	**DWG**	-	-	-	-
Uranium	mg/L	0.00005	0.02	MAC	0.00012	0.00029	0.00020	0.00026
Vanadium	mg/L	0.0001			<0.0001	0.0001	0.0001	<0.0001

Christine Burke
Laboratory Manager

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

Parameter	Units	R.L.	Limits	DWG	Client I.D.: OW 5 Sample I.D.: 23-006251-5 Date Collected: 2023-Apr-04
					-
Alkalinity(CaCO3) to pH4.5	mg/L	5	500	OG	228
Bicarbonate (as CaCO3)	mg/L	5			228
pH @25°C	pH units	-	8.5	OG	7.83
Conductivity @25°C	µmho/cm	1			490
Chloride	mg/L	0.5	250	AO	4.3
Nitrate (N)	mg/L	0.05	10.0	MAC	4.71
Nitrite (N)	mg/L	0.05	1.0	MAC	<0.05
Sulphate	mg/L	1	500	AO	4
Hardness (as CaCO3)	mg/L as CaCO3	0.02	100	OG	**268**
Aluminum	mg/L	0.01	0.1	OG	0.05
Barium	mg/L	0.001	1.0	MAC	0.027
Bismuth	mg/L	0.02			<0.02
Boron	mg/L	0.005	5.0	MAC	0.006
Calcium	mg/L	0.02			62.5
Iron	mg/L	0.005	0.3	AO	<0.005
Lithium	mg/L	0.005			<0.005
Magnesium	mg/L	0.02			27.3
Manganese	mg/L	0.001	0.05	AO	**0.264**
Phosphorus	mg/L	0.1			<0.1
Potassium	mg/L	0.1			0.9
Silicon	mg/L	0.01			2.29

Christine Burke
Laboratory Manager

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

Parameter	Units	R.L.	Limits	DWG	Client I.D.: OW 5 Sample I.D.: 23-006251-5 Date Collected: 2023-Apr-04
					-
Silica	mg/L	0.02			4.90
Sodium	mg/L	0.2	200, 20	AO, MAC	1.4
Strontium	mg/L	0.001			0.069
Tin	mg/L	0.05			<0.05
Titanium	mg/L	0.005			<0.005
Tungsten	mg/L	0.01			<0.01
Zinc	mg/L	0.005	5	AO	<0.005
Zirconium	mg/L	0.003			<0.003
Antimony	mg/L	0.0001	0.006	MAC	0.0008
Arsenic	mg/L	0.0001	0.01	MAC	0.0004
Beryllium	mg/L	0.0001			<0.0001
Cadmium	mg/L	0.000015	0.005	MAC	0.000016
Chromium	mg/L	0.001	0.05	MAC	<0.001
Cobalt	mg/L	0.0001			0.0003
Copper	mg/L	0.0001	1.0	AO	0.0012
Lead	mg/L	0.00002	0.01	MAC	<0.00002
Molybdenum	mg/L	0.0001			0.0084
Nickel	mg/L	0.0002			0.0010
Selenium	mg/L	0.001	0.05	MAC	<0.001
Silver	mg/L	0.0001			<0.0001
Thallium	mg/L	0.00005			<0.00005

Christine Burke
Laboratory Manager

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

Parameter	Units	R.L.	Limits	DWG	Client I.D.: OW 5 Sample I.D.: 23-006251-5 Date Collected: 2023-Apr-04
					-
Uranium	mg/L	0.00005	0.02	MAC	0.00038
Vanadium	mg/L	0.0001			0.0003

DWG - Drinking Water Guidelines
ODWS - Ontario Drinking Water Standards
AO - Aesthetic Objectives
IMAC - Interim Maximum Acceptable Concentration
MAC - Maximum Acceptable Concentration
ODWO - D-5-5 Objective
OG - Operational Guidelines
WL - Warning Level - Sodium Restricted Diets

Summary of Exceedances		
Aesthetic Objectives		
OW 4	**Found Value**	**Limit**
Manganese	0.056	0.05
OW 5	**Found Value**	**Limit**
Manganese	0.264	0.05
Maximum Acceptable Concentration		
OW 1	**Found Value**	**Limit**
Nitrate (N)	10.1	10.0
OW 2	**Found Value**	**Limit**
Nitrate (N)	13.6	10.0
Operational Guidelines		
OW 1	**Found Value**	**Limit**
Hardness (as CaCO3)	269	100
OW 2	**Found Value**	**Limit**
Hardness (as CaCO3)	311	100
OW 3	**Found Value**	**Limit**
Hardness (as CaCO3)	329	100
OW 4	**Found Value**	**Limit**
Hardness (as CaCO3)	300	100
OW 5	**Found Value**	**Limit**
Hardness (as CaCO3)	268	100

Christine Burke
Laboratory Manager

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G115197 **REPORT No: 23-025496 - Rev. 0**

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

Attention: Jordon Miller

DATE RECEIVED: 2023-Sep-21
DATE REPORTED: 2023-Oct-16
SAMPLE MATRIX: Ground Water

CUSTOMER PROJECT: 123039
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	5	OTTAWA	PCURIEL	2023-Sep-22	A-IC-01	SM 4110B
Cond/pH/Alk Auto (Liquid)	5	OTTAWA	SBOUDREAU	2023-Sep-22	COND-02/PH-02/ALK-02	SM 2510B/4500H/2320B
ICP/MS (Liquid)	5	OTTAWA	AOZKAYMAK	2023-Sep-25	D-ICPMS-01	EPA 200.8
ICP/OES (Liquid)	5	OTTAWA	NHOGAN	2023-Sep-22	D-ICP-01	SM 3120B

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

Christine Burke
Laboratory Manager

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Final Report

REPORT No: 23-025496 - Rev. 0

Parameter	Units	R.L.	Limits	DWG	Client I.D.	OW 1	OW 2	OW 3	OW 4
					Sample I.D.	23-025496-1	23-025496-2	23-025496-3	23-025496-4
					Date Collected	2023-Sep-20	2023-Sep-20	2023-Sep-20	2023-Sep-20
						-	-	-	-
Alkalinity(CaCO3) to pH4.5	mg/L	5	500	OG		228	267	276	290
Bicarbonate (as CaCO3)	mg/L	5				228	267	276	290
pH @25°C	pH units	-	8.5	OG		7.97	7.99	8.04	8.04
Conductivity @25°C	uS/cm	1				498	581	590	532
Chloride	mg/L	0.5	250	AO		6.3	4.9	6.0	4.1
Nitrate (N)	mg/L	0.05	10.0	MAC		9.99	**10.4**	5.18	1.87
Nitrite (N)	mg/L	0.05	1.0	MAC		<0.05	<0.05	<0.05	0.15
Sulphate	mg/L	1	500	AO		4	19	35	8
Hardness (as CaCO3)	mg/L as CaCO3	0.02	100	OG		**310**	**302**	**313**	**294**
Aluminum	mg/L	0.01	0.1	OG		**0.18**	0.06	0.06	0.06
Barium	mg/L	0.001	1	MAC		0.033	0.010	0.030	0.047
Bismuth	mg/L	0.02				<0.02	<0.02	<0.02	<0.02
Boron	mg/L	0.005	5	MAC		0.005	0.006	0.008	0.007
Calcium	mg/L	0.02				75.5	72.8	73.5	72.6
Iron	mg/L	0.005	0.3	AO		**0.348**	<0.005	0.011	0.005
Lithium	mg/L	0.005				<0.005	<0.005	<0.005	0.006
Magnesium	mg/L	0.02				29.6	29.3	31.5	27.4
Manganese	mg/L	0.001	0.05	AO		0.042	<0.001	<0.001	**0.069**
Phosphorus	mg/L	0.1				<0.1	<0.1	<0.1	<0.1
Potassium	mg/L	0.1				0.6	0.8	1.0	1.0
Silicon	mg/L	0.01				3.56	3.29	3.42	2.99

Christine Burke
Laboratory Manager

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Parameter	Units	R.L.	Limits	DWG	Client I.D.	OW 1	OW 2	OW 3	OW 4
					Sample I.D.	23-025496-1	23-025496-2	23-025496-3	23-025496-4
					Date Collected	2023-Sep-20	2023-Sep-20	2023-Sep-20	2023-Sep-20
						-	-	-	-
Silica	mg/L	0.02				7.62	7.04	7.32	6.40
Sodium	mg/L	0.2	200, 20, 20	AO, WL, MAC		0.9	3.5	2.2	1.3
Strontium	mg/L	0.001				0.055	0.181	0.321	0.091
Tin	mg/L	0.05				<0.05	<0.05	<0.05	<0.05
Titanium	mg/L	0.005				0.006	<0.005	<0.005	<0.005
Tungsten	mg/L	0.01				<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	0.005	5	AO		0.005	<0.005	<0.005	<0.005
Zirconium	mg/L	0.003				<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0001	0.006	MAC		<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	0.0001	0.01	MAC		0.0002	<0.0001	<0.0001	0.0001
Beryllium	mg/L	0.0001				<0.0001	<0.0001	<0.0001	<0.0001
Cadmium	mg/L	0.000015	0.005	MAC		<0.000015	<0.000015	<0.000015	<0.000015
Chromium	mg/L	0.001	0.05	MAC		0.002	<0.001	<0.001	<0.001
Cobalt	mg/L	0.0001				0.0004	<0.0001	0.0002	0.0004
Copper	mg/L	0.0001	1	AO		0.0025	0.0003	0.0018	0.0016
Lead	mg/L	0.00002	0.010	MAC		0.00043	<0.00002	0.00003	0.00003
Molybdenum	mg/L	0.0001				0.0004	0.0004	0.0002	0.0043
Nickel	mg/L	0.0002				0.0008	<0.0002	0.0004	0.0017
Selenium	mg/L	0.001	0.05	MAC		<0.001	<0.001	<0.001	<0.001
Silver	mg/L	0.0001				<0.0001	<0.0001	<0.0001	<0.0001
Thallium	mg/L	0.00005				<0.00005	<0.00005	<0.00005	<0.00005

Christine Burke
Laboratory Manager

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				Client I.D.	OW 1	OW 2	OW 3	OW 4
				Sample I.D.	23-025496-1	23-025496-2	23-025496-3	23-025496-4
				Date Collected	2023-Sep-20	2023-Sep-20	2023-Sep-20	2023-Sep-20
Parameter	**Units**	**R.L.**	**Limits**	**DWG**	-	-	-	-
Uranium	mg/L	0.00005	0.02	MAC	0.00015	0.00031	0.00021	0.00023
Vanadium	mg/L	0.0001			0.0003	0.0001	<0.0001	<0.0001

Christine Burke
Laboratory Manager

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Parameter	Units	R.L.	Limits	Client I.D. / Sample I.D. / Date Collected / DWG	OW 5 23-025496-5 2023-Sep-20 -
Alkalinity(CaCO3) to pH4.5	mg/L	5	500	OG	256
Bicarbonate (as CaCO3)	mg/L	5			256
pH @25°C	pH units	-	8.5	OG	8.01
Conductivity @25°C	uS/cm	1			480
Chloride	mg/L	0.5	250	AO	4.3
Nitrate (N)	mg/L	0.05	10.0	MAC	4.51
Nitrite (N)	mg/L	0.05	1.0	MAC	<0.05
Sulphate	mg/L	1	500	AO	3
Hardness (as CaCO3)	mg/L as CaCO3	0.02	100	OG	256
Aluminum	mg/L	0.01	0.1	OG	0.04
Barium	mg/L	0.001	1	MAC	0.012
Bismuth	mg/L	0.02			<0.02
Boron	mg/L	0.005	5	MAC	<0.005
Calcium	mg/L	0.02			60.8
Iron	mg/L	0.005	0.3	AO	0.012
Lithium	mg/L	0.005			<0.005
Magnesium	mg/L	0.02			25.4
Manganese	mg/L	0.001	0.05	AO	0.005
Phosphorus	mg/L	0.1			<0.1
Potassium	mg/L	0.1			0.4
Silicon	mg/L	0.01			2.76

Christine Burke
Laboratory Manager

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Parameter	Units	R.L.	Limits	DWG	Client I.D.: OW 5 Sample I.D.: 23-025496-5 Date Collected: 2023-Sep-20
					-
Silica	mg/L	0.02			5.91
Sodium	mg/L	0.2	200, 20, 20	AO, WL, MAC	0.8
Strontium	mg/L	0.001			0.043
Tin	mg/L	0.05			<0.05
Titanium	mg/L	0.005			<0.005
Tungsten	mg/L	0.01			<0.01
Zinc	mg/L	0.005	5	AO	<0.005
Zirconium	mg/L	0.003			<0.003
Antimony	mg/L	0.0001	0.006	MAC	<0.0001
Arsenic	mg/L	0.0001	0.01	MAC	0.0002
Beryllium	mg/L	0.0001			<0.0001
Cadmium	mg/L	0.000015	0.005	MAC	<0.000015
Chromium	mg/L	0.001	0.05	MAC	<0.001
Cobalt	mg/L	0.0001			0.0011
Copper	mg/L	0.0001	1	AO	0.0019
Lead	mg/L	0.00002	0.010	MAC	<0.00002
Molybdenum	mg/L	0.0001			0.0008
Nickel	mg/L	0.0002			<0.0002
Selenium	mg/L	0.001	0.05	MAC	<0.001
Silver	mg/L	0.0001			<0.0001
Thallium	mg/L	0.00005			<0.00005

Christine Burke
Laboratory Manager

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Parameter	Units	R.L.	Limits	DWG	Client I.D.	OW 5
					Sample I.D.	23-025496-5
					Date Collected	2023-Sep-20
					DWG	-
Uranium	mg/L	0.00005	0.02	MAC		0.00017
Vanadium	mg/L	0.0001				0.0002

DWG - Drinking Water Guidelines
ODWS - Ontario Drinking Water Standards
AO - Aesthetic Objectives
IMAC - Interim Maximum Acceptable Concentration
MAC - Maximum Acceptable Concentration
ODWO - D-5-5 Objective
OG - Operational Guidelines
WL - Warning Level - Sodium Restricted Diets

Summary of Exceedances		
Aesthetic Objectives		
OW 1	**Found Value**	**Limit**
Iron	0.348	0.3
OW 4	**Found Value**	**Limit**
Manganese	0.069	0.05
Maximum Acceptable Concentration		
OW 2	**Found Value**	**Limit**
Nitrate (N)	10.4	10.0
Operational Guidelines		
OW 1	**Found Value**	**Limit**
Hardness (as CaCO3)	310	100
Aluminum	0.18	0.1
OW 2	**Found Value**	**Limit**
Hardness (as CaCO3)	302	100
OW 3	**Found Value**	**Limit**
Hardness (as CaCO3)	313	100
OW 4	**Found Value**	**Limit**
Hardness (as CaCO3)	294	100
OW 5	**Found Value**	**Limit**
Hardness (as CaCO3)	256	100

Christine Burke
Laboratory Manager

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: DWTE230621B **REPORT No: 23-014918 - Rev. 0**

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

Attention: Jordon Miller

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

DATE RECEIVED: 2023-Jun-21
DATE REPORTED: 2023-Jun-29
SAMPLE MATRIX: Drinking Water

CUSTOMER PROJECT: 123039
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	1	OTTAWA	PCURIEL	2023-Jun-23	A-IC-01	SM 4110B
Cond/pH/Alk Auto (Liquid)	1	OTTAWA	SBOUDREAU	2023-Jun-23	COND-02/PH-02/ALK-02	SM 2510B/4500H/2320B
ICP/OES (Liquid)	1	OTTAWA	NHOGAN	2023-Jun-23	D-ICP-01	SM 3120B
TP & TKN (Liquid)	1	KINGSTON	KDIBBITS	2023-Jun-28	TPTKN-001	MECP E3516.2

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

Shelly Lozo
Shelly Lozo
Microbiology Supervisor

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Final Report

REPORT No: 23-014918 - Rev. 0

Parameter	Units	R.L.	Limits	DWG	Client I.D.: DW1 Sample I.D.: 23-014918-1 Date Collected: 2023-Jun-20
					-
Alkalinity(CaCO3) to pH4.5	mg/L	5	500	OG	267
Bicarbonate (as CaCO3)	mg/L	5			267
Carbonate (as CaCO3)	mg/L	5			<5
pH @25°C	pH units	-	8.5	OG	7.94
Conductivity @25°C	uS/cm	1			830
TDS (Calc. from Cond.)	mg/L	3	500	AO	437
Chloride	mg/L	0.5	250	AO	9.5
Nitrate (N)	mg/L	0.05	10.0	MAC	2.33
Nitrite (N)	mg/L	0.05	1.0	MAC	<0.05
Sulphate	mg/L	1	500	AO	187
Phosphorus (Total)	mg/L	0.01			<0.01
Total Kjeldahl Nitrogen	mg/L	0.1			0.1
Hardness (as CaCO3)	mg/L as CaCO3	0.02	100	OG	415
Aluminum	mg/L	0.01	0.1	OG	0.05
Arsenic	mg/L	0.02			<0.02
Barium	mg/L	0.001	1.0	MAC	0.010
Beryllium	mg/L	0.001			<0.001
Bismuth	mg/L	0.02			<0.02
Boron	mg/L	0.005	5.0	MAC	0.017
Cadmium	mg/L	0.005			<0.005
Calcium	mg/L	0.02			97.6

Shelly Lozo

Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	DWG	Client I.D.: DW1 Sample I.D.: 23-014918-1 Date Collected: 2023-Jun-20 -
Chromium	mg/L	0.002			<0.002
Cobalt	mg/L	0.005			<0.005
Copper	mg/L	0.002			0.013
Iron	mg/L	0.005	0.3	AO	0.039
Lead	mg/L	0.02			<0.02
Lithium	mg/L	0.005			<0.005
Magnesium	mg/L	0.02			41.7
Manganese	mg/L	0.001	0.05	AO	0.001
Molybdenum	mg/L	0.01			<0.01
Nickel	mg/L	0.01			<0.01
Phosphorus	mg/L	0.1			<0.1
Potassium	mg/L	0.1			1.1
Silicon	mg/L	0.01			2.73
Silica	mg/L	2			6
Silver	mg/L	0.005			<0.005
Sodium	mg/L	0.2	200, 20, 20	AO, WL, MAC	4.1
Strontium	mg/L	0.001			1.43
Tin	mg/L	0.05			<0.05
Titanium	mg/L	0.005			<0.005
Tungsten	mg/L	0.01			<0.01
Vanadium	mg/L	0.005			<0.005

Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	DWG	Client I.D.: DW1
					Sample I.D.: 23-014918-1
					Date Collected: 2023-Jun-20
					-
Yttrium	mg/L	0.005			<0.005
Zinc	mg/L	0.005	5	AO	0.007
Zirconium	mg/L	0.003			<0.003

DWG - Drinking Water Guidelines
ODWS - Ontario Drinking Water Standards
AO - Aesthetic Objectives
IMAC - Interim Maximum Acceptable Concentration
MAC - Maximum Acceptable Concentration
ODWO - D-5-5 Objective
OG - Operational Guidelines
WL - Warning Level - Sodium Restricted Diets

Summary of Exceedances

Operational Guidelines

DW1	Found Value	Limit
Hardness (as CaCO3)	415	100

Shelly Lozo
Shelly Lozo
Microbiology Supervisor

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CADUCEON ENVIRONMENTAL LABORATORIES
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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: DWTE230621C **REPORT No: 23-014923 - Rev. 0**

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

Attention: Jordon Miller

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

DATE RECEIVED: 2023-Jun-21
DATE REPORTED: 2023-Jun-29
SAMPLE MATRIX: Drinking Water

CUSTOMER PROJECT: 123039
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	1	OTTAWA	PCURIEL	2023-Jun-23	A-IC-01	SM 4110B
Cond/pH/Alk Auto (Liquid)	1	OTTAWA	SBOUDREAU	2023-Jun-23	COND-02/PH-02/ALK-02	SM 2510B/4500H/2320B
ICP/OES (Liquid)	1	OTTAWA	NHOGAN	2023-Jun-27	D-ICP-01	SM 3120B
TP & TKN (Liquid)	1	KINGSTON	KDIBBITS	2023-Jun-28	TPTKN-001	MECP E3516.2

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

Shelly Lozo
Shelly Lozo
Microbiology Supervisor

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Final Report

REPORT No: 23-014923 - Rev. 0

Parameter	Units	R.L.	Limits	Client I.D. / DWG	DW2
				Sample I.D.	23-014923-1
				Date Collected	2023-Jun-20
				DWG	-
Alkalinity(CaCO3) to pH4.5	mg/L	5	500	OG	273
Bicarbonate (as CaCO3)	mg/L	5			273
Carbonate (as CaCO3)	mg/L	5			<5
pH @25°C	pH units	-	8.5	OG	7.95
Conductivity @25°C	uS/cm	1			597
TDS (Calc. from Cond.)	mg/L	3	500	AO	310
Chloride	mg/L	0.5	250	AO	6.8
Nitrate (N)	mg/L	0.05	10.0	MAC	2.44
Nitrite (N)	mg/L	0.05	1.0	MAC	<0.05
Sulphate	mg/L	1	500	AO	42
Phosphorus (Total)	mg/L	0.01			<0.01
Total Kjeldahl Nitrogen	mg/L	0.1			0.1
Hardness (as CaCO3)	mg/L as CaCO3	0.02	100	OG	317
Aluminum	mg/L	0.01	0.1	OG	0.04
Arsenic	mg/L	0.02			<0.02
Barium	mg/L	0.001	1.0	MAC	0.010
Beryllium	mg/L	0.001			<0.001
Bismuth	mg/L	0.02			<0.02
Boron	mg/L	0.005	5.0	MAC	0.011
Calcium	mg/L	0.02			75.9
Chromium	mg/L	0.002			<0.002

Shelly Lozo

Shelly Lozo
Microbiology Supervisor

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

Parameter	Units	R.L.	Limits	DWG	Client I.D.: DW2 Sample I.D.: 23-014923-1 Date Collected: 2023-Jun-20 -
Cobalt	mg/L	0.005			<0.005
Copper	mg/L	0.002			0.029
Iron	mg/L	0.005	0.3	AO	0.005
Lead	mg/L	0.02			<0.02
Lithium	mg/L	0.005			<0.005
Magnesium	mg/L	0.02			31.0
Manganese	mg/L	0.001	0.05	AO	<0.001
Molybdenum	mg/L	0.01			<0.01
Nickel	mg/L	0.01			<0.01
Phosphorus	mg/L	0.1			<0.1
Potassium	mg/L	0.1			1.0
Silicon	mg/L	0.01			2.75
Silica	mg/L	2			6
Silver	mg/L	0.005			<0.005
Sodium	mg/L	0.2	200, 20, 20	AO, WL, MAC	3.2
Strontium	mg/L	0.001			0.417
Tin	mg/L	0.05			<0.05
Titanium	mg/L	0.005			<0.005
Tungsten	mg/L	0.01			<0.01
Vanadium	mg/L	0.005			<0.005
Yttrium	mg/L	0.005			<0.005

Shelly Lozo

Shelly Lozo
Microbiology Supervisor

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				Client I.D.	DW2
				Sample I.D.	23-014923-1
				Date Collected	2023-Jun-20
Parameter	Units	R.L.	Limits	DWG	-
Zinc	mg/L	0.005	5	AO	0.005
Zirconium	mg/L	0.003			<0.003

DWG - Drinking Water Guidelines
ODWS - Ontario Drinking Water Standards
AO - Aesthetic Objectives
IMAC - Interim Maximum Acceptable Concentration
MAC - Maximum Acceptable Concentration
ODWO - D-5-5 Objective
OG - Operational Guidelines
WL - Warning Level - Sodium Restricted Diets

Summary of Exceedances

Operational Guidelines

DW2	Found Value	Limit
Hardness (as CaCO3)	317	100

Shelly Lozo

Shelly Lozo
Microbiology Supervisor

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CADUCEON ENVIRONMENTAL LABORATORIES
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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: DWTE230621D **REPORT No: 23-014927 - Rev. 0**

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

Attention: Jordon Miller

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

DATE RECEIVED: 2023-Jun-21
DATE REPORTED: 2023-Jun-29
SAMPLE MATRIX: Drinking Water

CUSTOMER PROJECT: 123039
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	1	OTTAWA	PCURIEL	2023-Jun-23	A-IC-01	SM 4110B
Cond/pH/Alk Auto (Liquid)	1	OTTAWA	SBOUDREAU	2023-Jun-23	COND-02/PH-02/ALK-02	SM 2510B/4500H/2320B
ICP/OES (Liquid)	1	OTTAWA	NHOGAN	2023-Jun-27	D-ICP-01	SM 3120B
TP & TKN (Liquid)	1	KINGSTON	KDIBBITS	2023-Jun-28	TPTKN-001	MECP E3516.2

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

Shelly Lozo
Shelly Lozo
Microbiology Supervisor

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

Final Report

REPORT No: 23-014927 - Rev. 0

				Client I.D.	DW3
				Sample I.D.	23-014927-1
				Date Collected	2023-Jun-20
Parameter	**Units**	**R.L.**	**Limits**	**DWG**	-
Alkalinity(CaCO3) to pH4.5	mg/L	5	500	OG	274
Bicarbonate (as CaCO3)	mg/L	5			274
Carbonate (as CaCO3)	mg/L	5			<5
pH @25°C	pH units	-	8.5	OG	7.94
Conductivity @25°C	uS/cm	1			600
TDS (Calc. from Cond.)	mg/L	3	500	AO	311
Chloride	mg/L	0.5	250	AO	7.3
Nitrate (N)	mg/L	0.05	10.0	MAC	8.10
Nitrite (N)	mg/L	0.05	1.0	MAC	<0.05
Sulphate	mg/L	1	500	AO	22
Phosphorus (Total)	mg/L	0.01			<0.01
Total Kjeldahl Nitrogen	mg/L	0.1			0.1
Hardness (as CaCO3)	mg/L as CaCO3	0.02	100	OG	320
Aluminum	mg/L	0.01	0.1	OG	0.04
Arsenic	mg/L	0.02			<0.02
Barium	mg/L	0.001	1.0	MAC	0.010
Beryllium	mg/L	0.001			<0.001
Bismuth	mg/L	0.02			<0.02
Boron	mg/L	0.005	5.0	MAC	0.011
Cadmium	mg/L	0.005			<0.005
Calcium	mg/L	0.02			77.7

Shelly Lozo

Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	DWG	Client I.D.: DW3 Sample I.D.: 23-014927-1 Date Collected: 2023-Jun-20
Chromium	mg/L	0.002			0.002
Cobalt	mg/L	0.005			<0.005
Copper	mg/L	0.002			0.008
Iron	mg/L	0.005	0.3	AO	0.010
Lead	mg/L	0.02			<0.02
Lithium	mg/L	0.005			<0.005
Magnesium	mg/L	0.02			30.5
Manganese	mg/L	0.001	0.05	AO	0.001
Molybdenum	mg/L	0.01			<0.01
Nickel	mg/L	0.01			<0.01
Phosphorus	mg/L	0.1			<0.1
Potassium	mg/L	0.1			1.1
Silicon	mg/L	0.01			2.58
Silica	mg/L	2			6
Sodium	mg/L	0.2	200, 20, 20	AO, WL, MAC	1.9
Strontium	mg/L	0.001			0.184
Tin	mg/L	0.05			<0.05
Titanium	mg/L	0.005			<0.005
Tungsten	mg/L	0.01			<0.01
Vanadium	mg/L	0.005			<0.005
Yttrium	mg/L	0.005			<0.005

Shelly Lozo

Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	Client I.D. / Sample I.D. / Date Collected / DWG	DW3 / 23-014927-1 / 2023-Jun-20 / -
Zinc	mg/L	0.005	5	AO	0.027
Zirconium	mg/L	0.003			<0.003

DWG - Drinking Water Guidelines
ODWS - Ontario Drinking Water Standards
AO - Aesthetic Objectives
IMAC - Interim Maximum Acceptable Concentration
MAC - Maximum Acceptable Concentration
ODWO - D-5-5 Objective
OG - Operational Guidelines
WL - Warning Level - Sodium Restricted Diets

Summary of Exceedances

Operational Guidelines

DW3	Found Value	Limit
Hardness (as CaCO3)	320	100

Shelly Lozo
Shelly Lozo
Microbiology Supervisor

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: DWTE230621E **REPORT No: 23-014929 - Rev. 0**

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

Attention: Jordon Miller

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

DATE RECEIVED: 2023-Jun-21
DATE REPORTED: 2023-Jun-29
SAMPLE MATRIX: Drinking Water

CUSTOMER PROJECT: 123039
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	1	OTTAWA	PCURIEL	2023-Jun-23	A-IC-01	SM 4110B
Cond/pH/Alk Auto (Liquid)	1	OTTAWA	SBOUDREAU	2023-Jun-23	COND-02/PH-02/ALK-02	SM 2510B/4500H/2320B
ICP/OES (Liquid)	1	OTTAWA	NHOGAN	2023-Jun-27	D-ICP-01	SM 3120B
TP & TKN (Liquid)	1	KINGSTON	KDIBBITS	2023-Jun-28	TPTKN-001	MECP E3516.2

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

Shelly Lozo
Shelly Lozo
Microbiology Supervisor

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Final Report

REPORT No: 23-014929 - Rev. 0

				Client I.D.	DW4
				Sample I.D.	23-014929-1
				Date Collected	2023-Jun-20
Parameter	**Units**	**R.L.**	**Limits**	**DWG**	-
Alkalinity(CaCO3) to pH4.5	mg/L	5	500	OG	274
Bicarbonate (as CaCO3)	mg/L	5			274
Carbonate (as CaCO3)	mg/L	5			<5
pH @25°C	pH units	-	8.5	OG	7.96
Conductivity @25°C	uS/cm	1			617
TDS (Calc. from Cond.)	mg/L	3	500	AO	320
Chloride	mg/L	0.5	250	AO	11.3
Nitrate (N)	mg/L	0.05	10.0	MAC	6.57
Nitrite (N)	mg/L	0.05	1.0	MAC	<0.05
Sulphate	mg/L	1	500	AO	30
Phosphorus (Total)	mg/L	0.01			0.06
Total Kjeldahl Nitrogen	mg/L	0.1			0.5
Hardness (as CaCO3)	mg/L as CaCO3	0.02	100	OG	156
Aluminum	mg/L	0.01	0.1	OG	0.10
Arsenic	mg/L	0.02			<0.02
Barium	mg/L	0.001	1.0	MAC	0.024
Beryllium	mg/L	0.001			<0.001
Bismuth	mg/L	0.02			<0.02
Boron	mg/L	0.005	5.0	MAC	0.080
Cadmium	mg/L	0.005			<0.005
Calcium	mg/L	0.02			46.5

Shelly Lozo

Shelly Lozo
Microbiology Supervisor

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

Parameter	Units	R.L.	Limits	DWG	Client I.D.: DW4 Sample I.D.: 23-014929-1 Date Collected: 2023-Jun-20
Chromium	mg/L	0.002			<0.002
Cobalt	mg/L	0.005			<0.005
Copper	mg/L	0.002			<0.002
Iron	mg/L	0.005	0.3	AO	0.204
Lead	mg/L	0.02			<0.02
Lithium	mg/L	0.005			0.006
Magnesium	mg/L	0.02			9.70
Manganese	mg/L	0.001	0.05	AO	0.050
Molybdenum	mg/L	0.01			0.10
Nickel	mg/L	0.01			<0.01
Phosphorus	mg/L	0.1			2.5
Potassium	mg/L	0.1			58.8
Silicon	mg/L	0.01			3.27
Silica	mg/L	2			7
Silver	mg/L	0.005			<0.005
Sodium	mg/L	0.2	200, 20, 20	AO, WL, MAC	308
Strontium	mg/L	0.001			0.380
Tin	mg/L	0.05			<0.05
Titanium	mg/L	0.005			<0.005
Tungsten	mg/L	0.01			<0.01
Vanadium	mg/L	0.005			<0.005

Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	DWG	Client I.D.: DW4
					Sample I.D.: 23-014929-1
					Date Collected: 2023-Jun-20
					-
Yttrium	mg/L	0.005			<0.005
Zinc	mg/L	0.005	5	AO	0.009
Zirconium	mg/L	0.003			<0.003

DWG - Drinking Water Guidelines
ODWS - Ontario Drinking Water Standards
AO - Aesthetic Objectives
IMAC - Interim Maximum Acceptable Concentration
MAC - Maximum Acceptable Concentration
ODWO - D-5-5 Objective
OG - Operational Guidelines
WL - Warning Level - Sodium Restricted Diets

Summary of Exceedances

Aesthetic Objectives

DW4	Found Value	Limit
Sodium	308	200

Maximum Acceptable Concentration

DW4	Found Value	Limit
Sodium	308	20

Operational Guidelines

DW4	Found Value	Limit
Hardness (as CaCO3)	156	100

Warning Level - Sodium Restricted Diets

DW4	Found Value	Limit
Sodium	308	20

Shelly Lozo
Microbiology Supervisor

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: DWTE230621A **REPORT No: 23-014913 - Rev. 0**

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

Attention: Jordon Miller

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

DATE RECEIVED: 2023-Jun-21
DATE REPORTED: 2023-Jun-29
SAMPLE MATRIX: Drinking Water

CUSTOMER PROJECT: 123039
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	1	OTTAWA	PCURIEL	2023-Jun-23	A-IC-01	SM 4110B
Cond/pH/Alk Auto (Liquid)	1	OTTAWA	SBOUDREAU	2023-Jun-23	COND-02/PH-02/ALK-02	SM 2510B/4500H/2320B
ICP/OES (Liquid)	1	OTTAWA	NHOGAN	2023-Jun-23	D-ICP-01	SM 3120B
TP & TKN (Liquid)	1	KINGSTON	KDIBBITS	2023-Jun-28	TPTKN-001	MECP E3516.2

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

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Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	DWG	Client I.D.: DW5 Sample I.D.: 23-014913-1 Date Collected: 2023-Jun-20
					-
Alkalinity(CaCO3) to pH4.5	mg/L	5	500	OG	313
Bicarbonate (as CaCO3)	mg/L	5			313
Carbonate (as CaCO3)	mg/L	5			<5
pH @25°C	pH units	-	8.5	OG	7.92
Conductivity @25°C	uS/cm	1			615
TDS (Calc. from Cond.)	mg/L	3	500	AO	319
Chloride	mg/L	0.5	250	AO	5.4
Nitrate (N)	mg/L	0.05	10.0	MAC	<0.05
Nitrite (N)	mg/L	0.05	1.0	MAC	<0.05
Sulphate	mg/L	1	500	AO	38
Phosphorus (Total)	mg/L	0.01			<0.01
Total Kjeldahl Nitrogen	mg/L	0.1			0.1
Hardness (as CaCO3)	mg/L as CaCO3	0.02	100	OG	172
Aluminum	mg/L	0.01	0.1	OG	0.03
Arsenic	mg/L	0.02			<0.02
Barium	mg/L	0.001	1.0	MAC	0.024
Beryllium	mg/L	0.001			<0.001
Bismuth	mg/L	0.02			<0.02
Boron	mg/L	0.005	5.0	MAC	0.033
Cadmium	mg/L	0.005			<0.005
Calcium	mg/L	0.02			48.2

Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	DWG	Client I.D.: DW5 Sample I.D.: 23-014913-1 Date Collected: 2023-Jun-20
Chromium	mg/L	0.002			<0.002
Cobalt	mg/L	0.005			<0.005
Copper	mg/L	0.002			0.002
Iron	mg/L	0.005	0.3	AO	0.075
Lead	mg/L	0.02			<0.02
Lithium	mg/L	0.005			<0.005
Magnesium	mg/L	0.02			12.6
Manganese	mg/L	0.001	0.05	AO	**0.069**
Molybdenum	mg/L	0.01			<0.01
Nickel	mg/L	0.01			<0.01
Phosphorus	mg/L	0.1			<0.1
Potassium	mg/L	0.1			2.2
Silicon	mg/L	0.01			0.94
Silica	mg/L	2			2
Silver	mg/L	0.005			<0.005
Sodium	mg/L	0.2	200, 20, 20	AO, WL, MAC	**25.1**
Strontium	mg/L	0.001			0.217
Tin	mg/L	0.05			<0.05
Titanium	mg/L	0.005			<0.005
Tungsten	mg/L	0.01			<0.01
Vanadium	mg/L	0.005			<0.005

Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	DWG	Client I.D.: DW5 Sample I.D.: 23-014913-1 Date Collected: 2023-Jun-20 -
Yttrium	mg/L	0.005			<0.005
Zinc	mg/L	0.005	5	AO	<0.005
Zirconium	mg/L	0.003			<0.003

DWG - Drinking Water Guidelines
ODWS - Ontario Drinking Water Standards
AO - Aesthetic Objectives
IMAC - Interim Maximum Acceptable Concentration
MAC - Maximum Acceptable Concentration
ODWO - D-5-5 Objective
OG - Operational Guidelines
WL - Warning Level - Sodium Restricted Diets

Summary of Exceedances

Aesthetic Objectives

DW5	Found Value	Limit
Manganese	0.069	0.05
Sodium	25.1	200

Maximum Acceptable Concentration

DW5	Found Value	Limit
Sodium	25.1	20

Operational Guidelines

DW5	Found Value	Limit
Hardness (as CaCO3)	172	100

Warning Level - Sodium Restricted Diets

DW5	Found Value	Limit
Sodium	25.1	20

Shelly Lozo
Microbiology Supervisor

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: DW121140

REPORT No: 23-025491 - Rev. 0

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

Attention: Jordon Miller

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

DATE RECEIVED: 2023-Sep-21
DATE REPORTED: 2023-Sep-28
SAMPLE MATRIX: Drinking Water

CUSTOMER PROJECT: 123039 Strada Domestic
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	1	OTTAWA	PCURIEL	2023-Sep-22	A-IC-01	SM 4110B
Cond/pH/Alk Auto (Liquid)	1	OTTAWA	SBOUDREAU	2023-Sep-22	COND-02/PH-02/ALK-02	SM 2510B/4500H/2320B
ICP/MS (Liquid)	1	OTTAWA	AOZKAYMAK	2023-Sep-25	D-ICPMS-01	EPA 200.8
ICP/OES (Liquid)	1	OTTAWA	NHOGAN	2023-Sep-22	D-ICP-01	SM 3120B
TP & TKN (Liquid)	1	KINGSTON	KDIBBITS	2023-Sep-26	TPTKN-001	MECP E3516.2

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

Shelly Lozo
Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	Client I.D. / Sample I.D. / Date Collected / DWG	DW1 / 23-025491-1 / 2023-Sep-20 / -
Alkalinity(CaCO3) to pH4.5	mg/L	5	500	OG	268
pH @25°C	pH units	-	8.5	OG	7.60
Conductivity @25°C	uS/cm	1			694
Chloride	mg/L	0.5	250	AO	8.2
Nitrate (N)	mg/L	0.05	10.0	MAC	2.65
Nitrite (N)	mg/L	0.05	1.0	MAC	<0.05
Sulphate	mg/L	1	500	AO	98
Phosphorus (Total)	mg/L	0.01			0.03
Hardness (as CaCO3)	mg/L as CaCO3	0.02	100	OG	358
Aluminum	mg/L	0.01	0.1	OG	0.07
Barium	mg/L	0.001	1	MAC	0.010
Bismuth	mg/L	0.02			<0.02
Boron	mg/L	0.005	5	MAC	0.013
Calcium	mg/L	0.02			83.2
Iron	mg/L	0.005	0.3	AO	0.031
Lithium	mg/L	0.005			<0.005
Magnesium	mg/L	0.02			36.6
Manganese	mg/L	0.001	0.05	AO	<0.001
Potassium	mg/L	0.1			1.2
Silicon	mg/L	0.01			2.79
Silica	mg/L	2			6

Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	Client I.D. / Sample I.D. / Date Collected / DWG	DW1 / 23-025491-1 / 2023-Sep-20 / -
Sodium	mg/L	0.2	200, 20, 20	AO, WL, MAC	3.9
Strontium	mg/L	0.001			1.00
Tin	mg/L	0.05			<0.05
Titanium	mg/L	0.005			<0.005
Tungsten	mg/L	0.01			<0.01
Zinc	mg/L	0.005	5	AO	0.065
Zirconium	mg/L	0.003			<0.003
Antimony	mg/L	0.0001	0.006	MAC	<0.0001
Arsenic	mg/L	0.0001	0.01	MAC	0.0001
Beryllium	mg/L	0.0001			<0.0001
Cadmium	mg/L	0.000015	0.005	MAC	<0.000015
Chromium	mg/L	0.001	0.05	MAC	<0.0010
Cobalt	mg/L	0.0001			<0.0001
Copper	mg/L	0.0001	1	AO	0.0562
Lead	mg/L	0.00002	0.010	MAC	0.00056
Molybdenum	mg/L	0.0001			0.0002
Nickel	mg/L	0.0002			0.0012
Selenium	mg/L	0.001	0.05	MAC	<0.001
Silver	mg/L	0.0001			<0.0001
Thallium	mg/L	0.00005			<0.00005
Uranium	mg/L	0.00005	0.02	MAC	0.00026

Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	DWG	Client I.D.: DW1	Sample I.D.: 23-025491-1	Date Collected: 2023-Sep-20
							DWG: -
Vanadium	mg/L	0.0001					<0.0001

DWG - Drinking Water Guidelines
ODWS - Ontario Drinking Water Standards
AO - Aesthetic Objectives
IMAC - Interim Maximum Acceptable Concentration
MAC - Maximum Acceptable Concentration
ODWO - D-5-5 Objective
OG - Operational Guidelines
WL - Warning Level - Sodium Restricted Diets

Summary of Exceedances

Operational Guidelines

DW1	Found Value	Limit
Hardness (as CaCO3)	358	100

Shelly Lozo
Shelly Lozo
Microbiology Supervisor

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CADUCEON ENVIRONMENTAL LABORATORIES
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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: DW121139 **REPORT No: 23-025494 - Rev. 0**

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

Attention: Jordon Miller

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

DATE RECEIVED: 2023-Sep-21
DATE REPORTED: 2023-Sep-28
SAMPLE MATRIX: Drinking Water

CUSTOMER PROJECT: 123039 Strada Domestic
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	1	OTTAWA	PCURIEL	2023-Sep-22	A-IC-01	SM 4110B
Cond/pH/Alk Auto (Liquid)	1	OTTAWA	SBOUDREAU	2023-Sep-22	COND-02/PH-02/ALK-02	SM 2510B/4500H/2320B
ICP/MS (Liquid)	1	OTTAWA	AOZKAYMAK	2023-Sep-25	D-ICPMS-01	EPA 200.8
ICP/OES (Liquid)	1	OTTAWA	NHOGAN	2023-Sep-22	D-ICP-01	SM 3120B
TP & TKN (Liquid)	1	KINGSTON	KDIBBITS	2023-Sep-26	TPTKN-001	MECP E3516.2

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

Shelly Lozo
Shelly Lozo
Microbiology Supervisor

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

Parameter	Units	R.L.	Limits	Client I.D. / Sample I.D. / Date Collected / DWG	DW2 23-025494-1 2023-Sep-20 -
Alkalinity(CaCO3) to pH4.5	mg/L	5	500	OG	270
pH @25°C	pH units	-	8.5	OG	7.68
Conductivity @25°C	uS/cm	1			599
Chloride	mg/L	0.5	250	AO	7.5
Nitrate (N)	mg/L	0.05	10.0	MAC	2.63
Nitrite (N)	mg/L	0.05	1.0	MAC	<0.05
Sulphate	mg/L	1	500	AO	45
Phosphorus (Total)	mg/L	0.01			0.03
Hardness (as CaCO3)	mg/L as CaCO3	0.02	100	OG	275
Aluminum	mg/L	0.01	0.1	OG	0.04
Barium	mg/L	0.001	1	MAC	0.006
Bismuth	mg/L	0.02			<0.02
Boron	mg/L	0.005	5	MAC	0.008
Calcium	mg/L	0.02			61.1
Iron	mg/L	0.005	0.3	AO	<0.005
Lithium	mg/L	0.005			<0.005
Magnesium	mg/L	0.02			29.7
Manganese	mg/L	0.001	0.05	AO	0.001
Potassium	mg/L	0.1			1.0
Silicon	mg/L	0.01			2.56
Silica	mg/L	2			5

Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	Client I.D. / DWG	DW2
				Sample I.D.	23-025494-1
				Date Collected	2023-Sep-20
				DWG	-
Sodium	mg/L	0.2	200, 20, 20	AO, WL, MAC	4.1
Strontium	mg/L	0.001			0.364
Tin	mg/L	0.05			<0.05
Titanium	mg/L	0.005			<0.005
Tungsten	mg/L	0.01			<0.01
Zinc	mg/L	0.005	5	AO	0.215
Zirconium	mg/L	0.003			<0.003
Antimony	mg/L	0.0001	0.006	MAC	0.0021
Arsenic	mg/L	0.0001	0.01	MAC	0.0002
Beryllium	mg/L	0.0001			<0.0001
Cadmium	mg/L	0.000015	0.005	MAC	0.000017
Chromium	mg/L	0.001	0.05	MAC	<0.0010
Cobalt	mg/L	0.0001			<0.0001
Copper	mg/L	0.0001	1	AO	0.315
Lead	mg/L	0.00002	0.010	MAC	0.00119
Molybdenum	mg/L	0.0001			0.0002
Nickel	mg/L	0.0002			0.0221
Selenium	mg/L	0.001	0.05	MAC	0.001
Silver	mg/L	0.0001			<0.0001
Thallium	mg/L	0.00005			<0.00005
Uranium	mg/L	0.00005	0.02	MAC	0.00023

Shelly Lozo

Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	Client I.D.	DW2
				Sample I.D.	23-025494-1
				Date Collected	2023-Sep-20
				DWG	-
Vanadium	mg/L	0.0001			<0.0001

DWG - Drinking Water Guidelines
ODWS - Ontario Drinking Water Standards
AO - Aesthetic Objectives
IMAC - Interim Maximum Acceptable Concentration
MAC - Maximum Acceptable Concentration
ODWO - D-5-5 Objective
OG - Operational Guidelines
WL - Warning Level - Sodium Restricted Diets

Summary of Exceedances

Operational Guidelines

DW2	Found Value	Limit
Hardness (as CaCO3)	275	100

Shelly Lozo
Shelly Lozo
Microbiology Supervisor

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: DW121141 **REPORT No: 23-025488 - Rev. 0**

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

Attention: Jordon Miller

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

DATE RECEIVED: 2023-Sep-21
DATE REPORTED: 2023-Sep-28
SAMPLE MATRIX: Drinking Water

CUSTOMER PROJECT: 123039 Strada Domestic
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	1	OTTAWA	PCURIEL	2023-Sep-22	A-IC-01	SM 4110B
Cond/pH/Alk Auto (Liquid)	1	OTTAWA	SBOUDREAU	2023-Sep-22	COND-02/PH-02/ALK-02	SM 2510B/4500H/2320B
ICP/MS (Liquid)	1	OTTAWA	AOZKAYMAK	2023-Sep-25	D-ICPMS-01	EPA 200.8
ICP/OES (Liquid)	1	OTTAWA	APRUDYVUS	2023-Sep-27	D-ICP-01	SM 3120B
TP & TKN (Liquid)	1	KINGSTON	KDIBBITS	2023-Sep-26	TPTKN-001	MECP E3516.2

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

Shelly Lozo
Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	Client I.D. / Sample I.D. / Date Collected / DWG	DW3 / 23-025488-1 / 2023-Sep-20 / -
Alkalinity(CaCO3) to pH4.5	mg/L	5	500	OG	274
pH @25°C	pH units	-	8.5	OG	7.48
Conductivity @25°C	uS/cm	1			609
Chloride	mg/L	0.5	250	AO	7.6
Nitrate (N)	mg/L	0.05	10.0	MAC	7.61
Nitrite (N)	mg/L	0.05	1.0	MAC	<0.05
Sulphate	mg/L	1	500	AO	20
Phosphorus (Total)	mg/L	0.01			0.02
Hardness (as CaCO3)	mg/L as CaCO3	0.02	100	OG	337
Aluminum	mg/L	0.01	0.1	OG	0.02
Barium	mg/L	0.001	1	MAC	0.011
Bismuth	mg/L	0.02			<0.02
Boron	mg/L	0.005	5	MAC	0.010
Calcium	mg/L	0.02			79.5
Iron	mg/L	0.005	0.3	AO	<0.005
Lithium	mg/L	0.005			<0.005
Magnesium	mg/L	0.02			33.6
Manganese	mg/L	0.001	0.05	AO	<0.001
Potassium	mg/L	0.1			1.3
Silicon	mg/L	0.01			3.10
Silica	mg/L	2			7

Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	Client I.D. / Sample I.D. / Date Collected / DWG	DW3 / 23-025488-1 / 2023-Sep-20 / -
Sodium	mg/L	0.2	200, 20, 20	AO, WL, MAC	2.0
Strontium	mg/L	0.001			0.175
Tin	mg/L	0.05			<0.05
Titanium	mg/L	0.005			<0.005
Tungsten	mg/L	0.01			<0.01
Zinc	mg/L	0.005	5	AO	0.061
Zirconium	mg/L	0.003			<0.003
Antimony	mg/L	0.0001	0.006	MAC	<0.0001
Arsenic	mg/L	0.0001	0.01	MAC	<0.0001
Beryllium	mg/L	0.0001			<0.0001
Cadmium	mg/L	0.000015	0.005	MAC	0.000020
Chromium	mg/L	0.001	0.05	MAC	<0.0010
Cobalt	mg/L	0.0001			<0.0001
Copper	mg/L	0.0001	1	AO	0.0452
Lead	mg/L	0.00002	0.010	MAC	0.00070
Molybdenum	mg/L	0.0001			<0.0001
Nickel	mg/L	0.0002			0.0084
Selenium	mg/L	0.001	0.05	MAC	<0.001
Silver	mg/L	0.0001			<0.0001
Thallium	mg/L	0.00005			<0.00005
Uranium	mg/L	0.00005	0.02	MAC	0.00014

Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	Client I.D. / Sample I.D. / Date Collected / DWG	DW3 / 23-025488-1 / 2023-Sep-20 / -
Vanadium	mg/L	0.0001			<0.0001

DWG - Drinking Water Guidelines
ODWS - Ontario Drinking Water Standards
AO - Aesthetic Objectives
IMAC - Interim Maximum Acceptable Concentration
MAC - Maximum Acceptable Concentration
ODWO - D-5-5 Objective
OG - Operational Guidelines
WL - Warning Level - Sodium Restricted Diets

Summary of Exceedances

Operational Guidelines

DW3	Found Value	Limit
Hardness (as CaCO3)	337	100

Shelly Lozo
Shelly Lozo
Microbiology Supervisor

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: DW121137

REPORT No: 23-025470 - Rev. 0

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

Attention: Jordon Miller

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

DATE RECEIVED: 2023-Sep-21
DATE REPORTED: 2023-Sep-28
SAMPLE MATRIX: Drinking Water

CUSTOMER PROJECT: 123039 Strada Domestic
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	1	OTTAWA	PCURIEL	2023-Sep-22	A-IC-01	SM 4110B
Cond/pH/Alk Auto (Liquid)	1	OTTAWA	SBOUDREAU	2023-Sep-22	COND-02/PH-02/ALK-02	SM 2510B/4500H/2320B
ICP/MS (Liquid)	1	OTTAWA	SISLAM	2023-Sep-27	D-ICPMS-01	EPA 200.8
ICP/OES (Liquid)	1	OTTAWA	APRUDYVUS	2023-Sep-27	D-ICP-01	SM 3120B
TP & TKN (Liquid)	1	KINGSTON	KDIBBITS	2023-Sep-26	TPTKN-001	MECP E3516.2

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

Shelly Lozo
Shelly Lozo
Microbiology Supervisor

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

Parameter	Units	R.L.	Limits	Client I.D. / Sample I.D. / Date Collected / DWG	DW4 / 23-025470-1 / 2023-Sep-20 / -
Alkalinity(CaCO3) to pH4.5	mg/L	5	500	OG	276
pH @25°C	pH units	-	8.5	OG	7.78
Conductivity @25°C	uS/cm	1			642
Chloride	mg/L	0.5	250	AO	0.9
Nitrate (N)	mg/L	0.05	10.0	MAC	<0.05
Nitrite (N)	mg/L	0.05	1.0	MAC	<0.05
Sulphate	mg/L	1	500	AO	<1
Phosphorus (Total)	mg/L	0.01			0.09
Hardness (as CaCO3)	mg/L as CaCO3	0.02	100	OG	354
Aluminum	mg/L	0.01	0.1	OG	0.02
Barium	mg/L	0.001	1	MAC	0.018
Bismuth	mg/L	0.02			<0.02
Boron	mg/L	0.005	5	MAC	0.012
Calcium	mg/L	0.02			82.3
Iron	mg/L	0.005	0.3	AO	0.011
Lithium	mg/L	0.005			<0.005
Magnesium	mg/L	0.02			36.0
Manganese	mg/L	0.001	0.05	AO	0.004
Potassium	mg/L	0.1			1.9
Silicon	mg/L	0.01			3.81
Silica	mg/L	2			8

Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	DWG	Client I.D.: DW4 Sample I.D.: 23-025470-1 Date Collected: 2023-Sep-20 -
Sodium	mg/L	0.2	200, 20, 20	AO, WL, MAC	3.4
Strontium	mg/L	0.001			0.306
Tin	mg/L	0.05			<0.05
Titanium	mg/L	0.005			<0.005
Tungsten	mg/L	0.01			<0.01
Zinc	mg/L	0.005	5	AO	0.047
Zirconium	mg/L	0.003			<0.003
Antimony	mg/L	0.0001	0.006	MAC	0.0005
Arsenic	mg/L	0.0001	0.01	MAC	0.0002
Beryllium	mg/L	0.0001			<0.0001
Cadmium	mg/L	0.000015	0.005	MAC	0.000021
Chromium	mg/L	0.001	0.05	MAC	<0.0010
Cobalt	mg/L	0.0001			0.0002
Copper	mg/L	0.0001	1	AO	0.179
Lead	mg/L	0.00002	0.010	MAC	0.00299
Molybdenum	mg/L	0.0001			0.0001
Selenium	mg/L	0.001	0.05	MAC	<0.001
Silver	mg/L	0.0001			<0.0001
Thallium	mg/L	0.00005			<0.00005
Uranium	mg/L	0.00005	0.02	MAC	0.00022
Vanadium	mg/L	0.0001			<0.0001

Shelly Lozo

Shelly Lozo
Microbiology Supervisor

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DWG - Drinking Water Guidelines
ODWS - Ontario Drinking Water Standards
AO - Aesthetic Objectives
IMAC - Interim Maximum Acceptable Concentration
MAC - Maximum Acceptable Concentration
ODWO - D-5-5 Objective
OG - Operational Guidelines
WL - Warning Level - Sodium Restricted Diets

Summary of Exceedances

Operational Guidelines

DW4	Found Value	Limit
Hardness (as CaCO3)	354	100

Shelly Lozo

Shelly Lozo
Microbiology Supervisor

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CADUCEON ENVIRONMENTAL LABORATORIES
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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: DW121138 **REPORT No: 23-025490 - Rev. 0**

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

Attention: Jordon Miller

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

DATE RECEIVED: 2023-Sep-21
DATE REPORTED: 2023-Sep-28
SAMPLE MATRIX: Drinking Water

CUSTOMER PROJECT: 123039 Strada Domestic
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	1	OTTAWA	PCURIEL	2023-Sep-22	A-IC-01	SM 4110B
Cond/pH/Alk Auto (Liquid)	1	OTTAWA	SBOUDREAU	2023-Sep-22	COND-02/PH-02/ALK-02	SM 2510B/4500H/2320B
ICP/MS (Liquid)	1	OTTAWA	AOZKAYMAK	2023-Sep-25	D-ICPMS-01	EPA 200.8
ICP/OES (Liquid)	1	OTTAWA	NHOGAN	2023-Sep-22	D-ICP-01	SM 3120B
TP & TKN (Liquid)	1	KINGSTON	KDIBBITS	2023-Sep-26	TPTKN-001	MECP E3516.2

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

Shelly Lozo
Shelly Lozo
Microbiology Supervisor

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

Parameter	Units	R.L.	Limits	Client I.D. / Sample I.D. / Date Collected / DWG	DW5 / 23-025490-1 / 2023-Sep-20 / -
Alkalinity(CaCO3) to pH4.5	mg/L	5	500	OG	310
pH @25°C	pH units	-	8.5	OG	7.48
Conductivity @25°C	uS/cm	1			636
Chloride	mg/L	0.5	250	AO	5.4
Nitrate (N)	mg/L	0.05	10.0	MAC	<0.05
Nitrite (N)	mg/L	0.05	1.0	MAC	<0.05
Sulphate	mg/L	1	500	AO	39
Phosphorus (Total)	mg/L	0.01			0.03
Hardness (as CaCO3)	mg/L as CaCO3	0.02	100	OG	336
Aluminum	mg/L	0.01	0.1	OG	0.06
Barium	mg/L	0.001	1	MAC	0.147
Bismuth	mg/L	0.02			<0.02
Boron	mg/L	0.005	5	MAC	0.007
Calcium	mg/L	0.02			77.3
Iron	mg/L	0.005	0.3	AO	3.66
Lithium	mg/L	0.005			<0.005
Magnesium	mg/L	0.02			34.8
Manganese	mg/L	0.001	0.05	AO	0.027
Potassium	mg/L	0.1			0.8
Silicon	mg/L	0.01			4.27
Silica	mg/L	2			9

Shelly Lozo
Microbiology Supervisor

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Parameter	Units	R.L.	Limits	DWG	Client I.D.: DW5 Sample I.D.: 23-025490-1 Date Collected: 2023-Sep-20
					-
Sodium	mg/L	0.2	200, 20, 20	AO, WL, MAC	1.9
Strontium	mg/L	0.001			2.90
Tin	mg/L	0.05			<0.05
Titanium	mg/L	0.005			<0.005
Tungsten	mg/L	0.01			<0.01
Vanadium	mg/L	0.005			<0.005
Zinc	mg/L	0.005	5	AO	0.051
Zirconium	mg/L	0.003			<0.003
Antimony	mg/L	0.0001	0.006	MAC	<0.0001
Arsenic	mg/L	0.0001	0.01	MAC	0.0004
Beryllium	mg/L	0.0001			<0.0001
Cadmium	mg/L	0.000015	0.005	MAC	<0.000015
Chromium	mg/L	0.001	0.05	MAC	<0.0010
Cobalt	mg/L	0.0001			<0.0001
Copper	mg/L	0.0001	1	AO	0.360
Lead	mg/L	0.00002	0.010	MAC	0.00485
Molybdenum	mg/L	0.0001			0.0014
Nickel	mg/L	0.0002			0.0012
Selenium	mg/L	0.001	0.05	MAC	<0.001
Silver	mg/L	0.0001			<0.0001
Thallium	mg/L	0.00005			<0.00005

Shelly Lozo

Shelly Lozo
Microbiology Supervisor

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

Parameter	Units	R.L.	Limits	Client I.D. / DWG	DW5
				Sample I.D.	23-025490-1
				Date Collected	2023-Sep-20
				DWG	-
Uranium	mg/L	0.00005	0.02	MAC	0.00117
Vanadium	mg/L	0.0001			<0.0001

DWG - Drinking Water Guidelines
ODWS - Ontario Drinking Water Standards
AO - Aesthetic Objectives
IMAC - Interim Maximum Acceptable Concentration
MAC - Maximum Acceptable Concentration
ODWO - D-5-5 Objective
OG - Operational Guidelines
WL - Warning Level - Sodium Restricted Diets

Summary of Exceedances

Aesthetic Objectives

DW5	Found Value	Limit
Iron	3.66	0.3

Operational Guidelines

DW5	Found Value	Limit
Hardness (as CaCO3)	336	100

Shelly Lozo

Shelly Lozo
Microbiology Supervisor

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Appendix G:
Water Balance

TATHAM ENGINEERING

Water Budget
Climate Normal Data

Project Details

Redford Pit Expansion	123039

Prepared By

KG/AK	July 10, 2024

Water Budget Details

Methodology	Thornthwaite
Climate Data and Source	Hanover - Climate Normal Data for 1988 to 2007 Environment Canada
Thornthwaite Coefficient	1.044

Month	Year	Temp (°C)	Precip (mm)	Heat Index	PET (mm)	Daylight Factor	Adjusted PET (mm)	WHC (mm)	Surplus (mm)	Deficit (mm)
Jan.	Climate Normal	-6.8	109.6	0.0	0.0	0.77	0.0	100.0	109.6	0.0
Feb.		-5.9	81.3	0.0	0.0	0.87	0.0	100.0	81.3	0.0
Mar.		-1.7	72.0	0.0	0.0	1.00	0.0	100.0	72.0	0.0
Apr.		5.8	73.1	1.3	31.1	1.12	34.9	100.0	38.2	0.0
May		11.9	84.6	3.7	74.7	1.23	92.1	92.5	0.0	0.0
Jun.		17.2	78.3	6.5	111.1	1.29	143.2	27.5	0.0	0.0
Jul.		19.6	83.1	7.9	128.7	1.26	162.4	0.0	0.0	51.8
Aug.		18.6	95.0	7.3	112.6	1.17	131.2	0.0	0.0	36.2
Sep.		14.6	109.1	5.1	75.7	1.04	78.9	30.2	0.0	0.0
Oct.		8.4	89.7	2.2	38.5	0.92	35.3	84.6	0.0	0.0
Nov.		2.6	103.0	0.4	9.6	0.80	7.7	100.0	79.9	0.0
Dec.		-3.3	108.4	0.0	0.0	0.74	0.0	100.0	108.4	0.0
Total		**-**	**1087**	**34.3**	**581.9**	**-**	**685.8**		**489.4**	**88.0**

Additional Notes

PET = Potential Evapotranspiration; WHC = Soil Water Holding Capacity

Equations

$PET = 16\left(\frac{L}{12}\right)\left(\frac{N}{30}\right)\left(\frac{10T_d}{I}\right)^{\alpha}$ Where

PET is the estimated potential evapotranspiration (mm/month)

T_d is the average daily temperature (degrees Celsius; if this is negative, use 0) of the month being calculated

N is the number of days in the month being calculated

L is the average day length (hours) of the month being calculated

$\alpha = (6.75 \times 10^{-7})I^3 - (7.71 \times 10^{-5})I^2 + (1.792 \times 10^{-2})I + 0.49239$

$I = \sum_{i=1}^{12}\left(\frac{T_{m_i}}{5}\right)^{1.514}$ is a heat index which depends on the 12 monthly mean temperatures T_{m_i}.[1]

TATHAM ENGINEERING

Water Budget

Exisiting, Extraction and Rehabiliation Comparison

Project Details

Redford Pit Expansion	123039

Prepared By

KG/AK	Jul-24

Existing Catchment Details

Area (ha)	13.8
Pervious Area (ha)	13.8
Impervious Area (ha)	0.0

Extraction Catchment Details

Area (ha)	13.8
Pervious Area (ha)	13.8
Impervious Area (ha)	0.0

Rehabilitation Catchment Details

Area (ha)	13.8
Pervious Area (ha)	13.8
Impervious Area (ha)	0.0

Infiltration Factor

Infiltration Factor	Existing Condition		Extratction Condition		Rehabilitation Condition	
	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious
Topography	0.200	0.0	0.300	0.0	0.300	0.0
Soil	0.400	0.0	0.400	0.0	0.400	0.0
Land Cover	0.100	0.0	0.100	0.0	0.100	0.0
Infiltration Factor	0.700	0.0	0.800	0.0	0.800	0.0

Water Budget

Water Budget	Existing Condition			Extraction Condition			Rehabilitation Condition		
	Pervious	Impervious	Total	Pervious	Impervious	Total	Pervious	Impervious	Total
Water Surplus (m^3)	67,534	0	67,534	67,534	0	67,534	67,534	0	67,534
Infiltration (m^3)	47,274	0	47,274	54,027	0	54,027	54,027	0	54,027
Runoff (m^3)	20,260	0	20,260	13,507	0	13,507	13,507	0	13,507
Reduction in Infiltration Volume (m^3)						**-6,753**			**-6,753**

Additional Notes

Infiltration Factors

Topography	Flat Land, average slope < 0.6 m/km	0.3
	Rolling Land, average slope 2.8 m to 3.8 m/km	0.2
	Hilly Land, average slope 28 m to 47 m/km	0.1
Soils	Tight impervious clay	0.1
	Medium combinations of clay and loam	0.2
	Open Sandy loam	0.4
Cover	Cultivated Land	0.1
	Woodland	0.2

(Stormwater Planning and Design Manual. MOE, 2003.)