TATHAM ENGINEERING

Enhancing our communities

45 Cindy Lane, Adjala-Tosorontio

FUNCTIONAL SERVICING & STORMWATER MANAGEMENT REPORT

2834556 Ontario Inc.

File 423499 | November 12, 2024

Document Control

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Prepared by:

Tatham Engineering Limited
645 Veterans Drive, Unit D
Barrie, Ontario L4N 9H8

T 705-733-9037
tathameng.com

Prepared for:

2834556 Ontario Inc.
45 Cindy Lane
Lisle, Ontario L0M 1M0

Authored by:	Reviewed by:
	
Dan Brito, P.Eng. Project Manager	Nick Millington, P.Eng. Manager – Land Development Barrie Office Manager

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Issue	Date	Description
1	November 12, 2024	First Engineering Submission

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1 Introduction

Tatham Engineering Limited (Tatham) has been retained by 2834556 Ontario Inc. to complete a combined Functional Servicing & Stormwater Management report (FSSWMR) in support of concurrent Official Plan Amendment (OPA), Zoning By-law Amendment (ZBA), and Draft Plan of Subdivision (Draft Plan) applications for a proposed residential development located at 45 Cindy Lane (Site) in the Township of Adjala-Tosorontio (Township).

1.1 SITE DESCRIPTION & SURROUNDING LAND USE

The subject property is located at 45 Cindy Lane and is currently within the property limits of the Silver Brooke Golf Club. The entire property is approximately 21.8 ha, with 2.96 ha of that proposed for development, and is designated as open recreation area land use. The location of the subject property is illustrated on Figure 1. The property is designated as 'Rural Residential' in the Township's Official Plan, and is currently zoned 'Open Space Recreation Exception 2 (OSR-2), Open Space Conservation (OSC) & NVCA Fill Area'.

The proposed development is located within the Nottawasaga Valley Conservation Authority (NVCA) watershed and is located partially within their regulated area due to a tributary of the Pine River (tributary) and its associated hazards (flood and erosion). A Natural Hazard Study (NHS) was prepared by Tatham under a separate cover in support of the development application.

The proposed development is bound by the Tributary of the Pine River (tributary) to the north, the entrance to Silver Brooke Golf Club to the east, Cindy Lane to the south, and residential property to the west.

1.2 PROPOSED DEVELOPMENT

The proposed development is to consist of 8 new individual residential lots, each with frontage onto the north side of Cindy Lane. Each lot is proposed to be serviced by individual private septic and wells. The Draft Plan of Subdivision is provided in Appendix A.

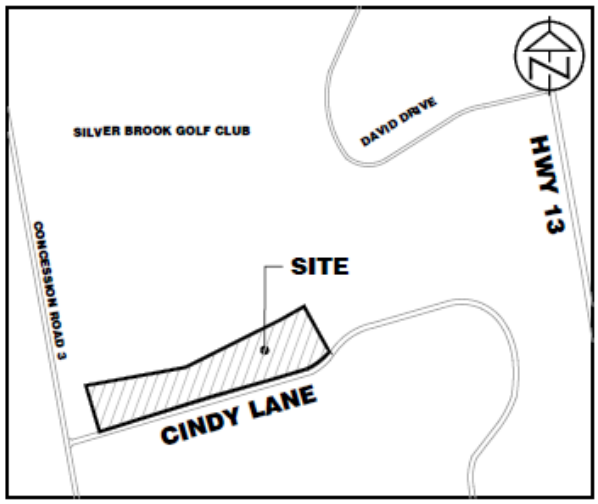


Figure 1: Site Location Plan

1.3 OBJECTIVES

The objective of this report is to present an overall servicing strategy to demonstrate the proposed development can be adequately serviced. This report will also document the preliminary SWM strategy for the site, demonstrating the proposed development will not adversely affect local surface water conditions.

1.4 GUIDELINES & BACKGROUND INFORMATION

This report has been prepared in accordance with local and provincial guidelines, including the following publications:

- The Ministry of the Environment, Conservation, and Parks (MECP, formerly known as Ministry of Environment), *Stormwater Management Practices Planning and Design Manual* (March 2003);
- The MECP, *Design Guidelines for Drinking-Water Systems*, (2003);
- The Ministry of the Environment, Conservation, and Parks (MECP, formerly known as Ministry of Environment), *Source Protection Information Atlas* (accessed August 30, 2024);
- Ministry of Transportation (MTO), *IDF Curve Lookup* (accessed August 30, 2024); and
- Nottawasaga Valley Conservation Authority (NVCA), *NVCA Stormwater Technical Guide* (2013).

This report is prepared in consideration of the following site-specific studies and reports:

- Tatham Engineering Limited (Tatham), *Hydrogeological Assessment* (2024); and
- Tatham Engineering Limited (Tatham), *Natural Hazard Study* (2024).

2 Water Supply & Distribution

2.1 EXISTING WATER SYSTEM

The site is located within an area of the Township not serviced by municipal water. The existing residences along the south side of Cindy Lane are serviced by private individual wells.

2.2 PROPOSED WATER SYSTEM

Each lot is proposed to be serviced by new private individual wells. The conceptual placement of each private well is illustrated on the Preliminary Site Grading and Servicing Plan (Drawing SSG.1) provided in Appendix E.

A private water well feasibility assessment was completed by Tatham in support of the development. The assessment included the installation of three test wells to assess the feasibility of private water supply. Refer to section 5.3 of the Hydrological Assessment completed by Tatham for further details.

2.3 PROPOSED WATER DEMANDS

In accordance with the Water Supply Assessment completed as part of the Hydrogeological Assessment by Tatham (provided under separate cover), MECP D-5-5 guidelines were followed for estimating water demands for the development. In accordance with MECP standards, a minimum daily water demand of 450 L/day/person, and a peak water demand of 3.75 L/min/person for a 120-minute period was assumed. The assessment concluded that a daily water demand of 2,250 L/day (1.56 L/min) and a peak water demand of 18.75 L/min were considered sufficient to yield an adequate water supply for the proposed residential dwellings.

Results of the private water well feasibility assessment considered it feasible that the peak water demand of 18.75 L/min could be achieved by the aquifer on-site. Refer to section 5.3 of the Hydrological Assessment completed by Tatham for further details and calculations.

2.4 FIRE PROTECTION

Consistent with the assumptions made in the Water Supply Assessment as part of the Hydrogeological Assessment by Tatham, a 200 m^2 building footprint was assumed for each lot. Per the Ontario Building Code (OBC) on-site water supply is not required for building areas of 200 m^2 or less. As a result, the fire department will be able to respond with a transportable water supply of sufficient quantity to conduct an effective search and evacuation of a house with the assumed building footprint. Should a revised site plan consist of larger footprint, a dry hydrant complete with firefighting reservoir would be required as per the OBC.

3 Sanitary Sewage System

3.1 EXISTING SANITARY SYSTEM

The site is located within an area of the Township not serviced by municipal wastewater. The existing residences along the south side of Cindy Lane are serviced by private individual septic systems.

3.2 PROPOSED SANITARY SYSTEM

Each lot is proposed to be serviced by new private individual septic systems. The conceptual sizing and placement of each septic bed is illustrated on the Preliminary Site Grading and Servicing Plan (Drawing SSG.1) provide in Appendix E.

3.3 PROPOSED SANITARY DEMANDS

Sanitary sewage design flows were calculated in accordance with the Ontario Building Code (OBC) Section 8.2.1.3. 'Sewage System Design Flows'.

Consistent with the Water Supply Assessment completed as part of the Hydrogeological Assessment by Tatham, demands were calculated based on a four-bedroom five-person dwelling. Preliminary calculations for individual septic sizing is based on a leaching bed (sand filter bed) design. A finished floor area of 200 m^2 was assumed for each dwelling. The estimated sewage generation for each dwelling was calculated to be 2,200 L/day. Assumptions and calculations for individual septic sizing are provided in Appendix C.

The septic system for each lot is to be composed of a septic tank connected to a filter bed and leaching bed. The septic tank has been sized based on the assumed build form and fixtures within, resulting in septic tank volumes equal to 4500 L. Effluent from the septic tank will flow via gravity to the filter bed system. The filter bed system is composed of perforated distribution piping within the filter bed area, and an expanded contact area and loading area based the proposed leaching bed fill percolation time of 10 min/cm. This results in a total leaching bed size required of 220 m^2. As the ground water across the site is high, and the septic systems require 900 mm of separation from the high groundwater level, some units may be required to be raised systems. Detailed calculations are provided in Appendix C.

The septic system design will be confirmed during detailed design.

4 Drainage & Stormwater Management

4.1 TOPOGRAPHY

Information related to existing topography, ground cover, and drainage patterns was obtained through a review of relevant background studies, available plans, base mapping, and topographic surveys, and was confirmed during site visits.

A detailed topographic survey of the site was completed by Rudy Mak Surveying Ltd. in January 2024.

The site generally consists of undeveloped pasture and woodland cover and slopes at approximately 3 - 6% across the delineated catchments (see Appendix D).

4.2 HYDROGEOLOGICAL INVESTIGATION

A hydrogeological investigation was completed by Tatham Engineering under a separate cover. A summary is provided below; refer to the original report for more details.

A test pitting program was conducted in which three test pits were advanced to between 1.5 and 2.0 mbgs. The investigation encountered sandy subsurface conditions which generally reflect those presented in the Ontario Geological Survey (OGS).

Test wells were installed at each test pit location and found shallow groundwater levels which range from 0.2 to 0.5 mbgs (229.4 m to 230.9 m) and is anticipated to flow in a northeastern direction towards the pine river tributary.

Guelph permeameter testing was conducted on site and returned factored infiltration rates of 40.4 and 24.5 mm/hr at TP1 and TP2 respectively.

4.3 EXISTING CONDITIONS

Under existing conditions, the site generally consists of undeveloped pasture and trace woodland. The site has been modelled as two catchments; Catchment 101 and Catchment 102. Refer to the Pre-Development Drainage Plan 1 (DP.1) in Appendix D. Catchment 101 comprises the north portion of the site and is 1.75 ha in size. A runoff coefficient of 0.10 was assigned to this catchment, and runoff from this catchment will drain overland to the tributary (Outlet 1). Catchment 102 comprises the southern portion of the site and is 1.21 ha in size. A runoff coefficient of 0.10 was assigned to this catchment, and runoff will drain overland to the roadside ditch then towards an existing culvert to the southeast of the site (Outlet 2).

In-situ soils are understood to consist of Alliston Sand Loam, which is part of the Hydrologic Soil Group (HSG) AB, as described in the *Soil Map of Simcoe County, Ontario – South Street* from *Soil Survey of Simcoe County, Ontario – Report No. 29 of the Ontario Soil Survey*.

4.4 EXISTING HYDROLOGY

The site has been modelled as per the *Stormwater Management Planning and Design Manual* in accordance with MECP standards, and the NVCA *Stormwater Technical Guide*. The modified-rational method was used to calculate the peak flow under exiting conditions, applying Intensity-Duration-Frequency (IDF) rainfall data obtained from the MTO IDF Curve Lookup.

The Pre-Development Drainage Plan (DP.1) and supporting calculations are enclosed in Appendix D. A summary of the peak flow targets is provided in Table 1 for reference.

Table 1: Existing Condition Peak Flow Rates

STORM EVENT	OUTLET #1 PEAK FLOWS (m^3/s)	OUTLET #2 PEAK FLOWS (m^3/s)
1:2-year	0.03	0.02
1:5-year	0.03	0.03
1:10-year	0.04	0.03
1:25-year	0.05	0.05
1:50-year	0.06	0.05
1:100-year	0.07	0.06

Existing condition peak flows are relatively minor with a maximum of 0.06 m3/s, and 0.07 m^3/s for Catchments 101 and 102 (respectively) under the 1:100-year return frequency design storm.

4.5 PROPOSED CONDITIONS

As a concept plan for the development has not yet been prepared, the preliminary SWM design has been based on a conceptual dwelling size and driveway layout assumed by Tatham for the purposes of this study. Assumptions for conceptual size and layout were based on existing residential dwellings in the immediate vicinity of the property.

Per the draft plan of subdivision, the site is proposed to consist of 8 residential lots. The proposed lots will be sufficiently raised to provide adequate clearance from the groundwater table to allow the use of infiltration-based LIDs across the site. The preliminary grading of the site has been

designed to closely match the existing drainage divide across the property. Under proposed conditions, drainage is split at the approximate midpoint of each lot, with runoff directed towards the tributary (Outlet 1) at the rear of each lots, and to the roadside ditch (Outlet 2) at the front of each lots; mimicking existing drainage patterns.

4.6 PROPOSED HYDROLOGY

The subject property has been split into two drainage catchments under proposed conditions, catchments 201 and 202, as illustrated in the Post-Development Drainage Plan (DP.2) enclosed in Appendix D.

- Catchment 201 is 1.63 ha and contains the rear portion of the lots. Runoff from this catchment is conveyed to Outlet 1 through overland flow and side yard swales. The catchment has been determined to have a percent impervious of 1% and a runoff coefficient of 0.11.
- Catchment 202 is 1.33 ha and contains the front portion of the lots. Runoff from this catchment is conveyed to Outlet 2 through overland flow and side yard swales. The catchment has been determined to have a percent impervious of 20% and a runoff coefficient of 0.27.

4.7 PROPOSED PEAK FLOW RATES

The post-development hydrology was modelled using the modified-rational method to determine the peak flow rates at Outlet 1 and Outlet 2. The MTO lookup tool was utilized to determine the IDF curve values for the site. Peak flow rates have been summarized below in Table 2, with detailed calculations in Appendix D.

Table 2: Proposed Condition Uncontrolled Peak Flow Rates

STORM EVENT	OUTLET #1 PEAK FLOWS (m^3/s)	OUTLET #2 PEAK FLOWS (m^3/s)
1:2-year	0.03 (*0.03*)	0.07 (*0.02*)
1:5-year	0.04 (*0.03*)	0.10 (*0.03*)
1:10-year	0.05 (*0.04*)	0.11 (*0.03*)
1:25-year	0.06 (*0.05*)	0.15 (*0.05*)
1:50-year	0.07 (*0.06*)	0.18 (*0.05*)
1:100-year	0.09 (*0.07*)	0.20 (*0.06*)

Note: Values in *(italics)* denote existing conditions

As shown in Table 2, while flows generated by the site are relatively minor, the post-development peak flow rates are greater than pre-development conditions for both catchments. This increase in peak flow can be attributed to the increase in impervious area across the site.

4.8 WATER QUANTITY

In accordance with NVCA requirements, a best-efforts approach to controlling post-development peak flow rates to corresponding pre-development rates for the 1:2-year, 1:5-year, 1:10-year, 1:25-year, 1:50-year and 1:100-year design storm events was applied to this development as outlined in Section 3.1 of the NVCA Stormwater Technical Guide.

As this site is located along an existing roadway with an existing minor conveyance system (roadside ditch), there is limited area available where the implementation of quantity controls would be feasible. In addition, high groundwater across the site further limits the location, size and types of lot-level LIDs that can be used to provide quantity control. Due to these constraints, the site's proximity to the tributary, and the relatively minor peak flows generated by the site, best efforts have been applied to reduce post-development flows through the use of lot-level LID facilities. Rain gardens are proposed along the mid-point of each lot-line, and will discharge into enhanced swales to convey flows to each respective outlet.

The modified rational method was utilized to approximate the storage volumes required for each catchment as a best efforts approach to reducing post-development flows to pre-development rates. To match peak flows under proposed conditions, 14 m^3 and 95 m^3 would be required within Catchments 201 and 202 respectively. Recognizing that providing this quantity of volume control is not feasible based on the limited available area for controls across the site, the proposed LIDs have been sized to provide a best efforts approach for volume control.

A combination of rain gardens and enhanced swales are proposed between each lot to capture and promote infiltration of runoff from the site. In addition, the site grading will be designed to direct runoff from impervious areas over pervious areas where possible. Each interior lot-line to the development is proposed to contain one rain garden and two enhanced swales as illustrated on the Preliminary Site Grading and Servicing Plan, SSG.1 (Appendix E).

The 16 proposed rain gardens have been sized to provide 4.07 m^3 of storage each (65.1 m^3 across the site), and the 14 proposed enhanced swales have been sized to provide 0.94 m^3 of storage each (13.1 m^3 total across the site). The cumulative storage of these facilities provides a total volume control of 78.2 m^3 across the site. There is expected to be runoff from small areas around the perimeter of the site that are unable to be captured by the proposed LIDs due to grading constraints. The proposed condition hydrology and LID design will be refined during detailed design.

4.9 WATER QUALITY

"Enhanced" Level 1 water quality control (corresponding to 80% TSS removal) is required for the developed areas of the site (driveway & accessory structures). Water quality controls are not required for rooftop areas as runoff generated from these surfaces are generally considered to be clean, and therefore, not subject to water quality controls.

Water quality controls for Catchment 201 (rear of lots) are provided via a treatment train approach comprised of a rain garden and enhanced swale along the side lot-lines. As this catchment is comprised of the back yards and a small portion of the building roofs, it can be assumed that runoff generated in this area is clean and therefore exempt from water quality controls. This assumption will be reviewed during detailed design.

Water quality controls for Catchment 202 (front of lots) are provided via a treatment train approach comprised of enhanced swales along lot lines, rain gardens, and within the Cindy Lane roadside ditch.

The proposed rain gardens have been sized per Section 3.3.2 of the MECP SWM Planning and Design Manual, based on an impervious level of 19.5% within Catchment 202. As the rain gardens individually can only provide basic level of protection, the required storage volume is 27 m^3. The proposed rain gardens will be each sized to hold 4.07 m^3 of runoff volume for a total volume of 65.1 m^3 being provided across the site by these features.

Analysis of the complete treatment train comprised of enhanced swales and rain gardens has been performed. TSS removal efficiencies have been applied based on the median removal rates outlined in the LID SWM Planning and Design Guide published by Sustainable Technologies Evaluation Program (STEP), resulting in 40% TSS removal, 60% TSS removal, and 40% TSS removal for the enhanced swales, rain gardens, and the Cindy Lane roadside ditch respectively. The performed analysis yields an overall TSS removal efficiency of 86% across the controlled area. This level of treatment exceeds the required level of treatment for enhanced water quality control.

Detailed calculations can be found in Appendix F. These calculations will be reviewed and refined during detailed design.

4.10 VOLUME CONTROL

A best-efforts approach for the retention of the first 5 mm of runoff from the impervious area of the site is provided in accordance with the *NVCA Stormwater Technical Guide*. Based on the assumed build-form, this equates 0.45 ha of area and 22.5 m^3 of runoff to be retained. Due to grading constraints, high groundwater and proposed septic bed locations, the location and size

of infiltration LIDs are limited. As such, a best-efforts approach has been taken to maximize the retention of runoff from the impervious areas across the site.

The proposed rain gardens and enhanced swales proposed along each interior lot-line have been sized to capture runoff from the rooftops and as many of the driveways as possible. Runoff will enter these LIDs via sheet flow across the site. The LIDs are each proposed to have cumulative storage volume of 78.2 m^3 total across the site. This is equal to the first 17 mm of runoff across the impervious area of the site, and therefore exceeds the volume generated from the first 5 mm of runoff across the impervious areas of the site. The proposed LID controls will be refined during the detailed design.

4.11 MAJOR AND MINOR FLOW CONVEYANCE

Major and minor flows from Catchment 201 will travel as overland sheet flow or conveyed through the proposed enhanced swales along the interior lot-lines to the tributary at the rear of the property.

Major and minor flows from Catchment 202 will travel as overland sheet flow or conveyed through the proposed enhanced swales along the interior lot-lines to the Cindy Lane roadside ditch. From there flows are conveyed to outlet 2. Further, ditch capacity calculations and review will occur during the detailed design stage as required.

Final grading design of the site will be completed at the detailed design stage to promote desirable drainage conveyance.

4.12 WATER BALANCE

A preliminary water balance has been completed by Tatham as part of a Hydrogeological Assessment. An excerpt of the report is provided in Appendix C for reference. The purpose of the water balance is to assess the potential impact of the development on local groundwater and surface water resources. The annual pre-development infiltration volume for the site was calculated to be 9,129 m^3/year. An increase in impervious area of 13% across the site was assumed for post-development conditions, resulting in approximately 7,943 m^3/year of infiltration, and yielding an infiltration deficit of approximately 1,187 m^3/year.

The proposed LID solutions have been designed to maximize infiltration volumes within the constraints of the site and will be further refined during the detailed design phase. These proposed LIDs result in an annual infiltration volume of 1,078 m^3 from the LID controls. The total post-condition infiltration volume with mitigation measures is 9,021 m^3 across the site which results in a decrease in annual infiltration of 108 m^3 (1% deficit pre to post). The calculations used to determine the level of mitigation of the infiltration deficit determined within the hydrogeological report only consider the storage present in the proposed rain gardens (65.1 m^3

total across the site). As the total storage available across the site is 78.2 m^3, when considering the storage available in both the enhanced swales and rain gardens, the achieved decrease in annual infiltration of 108 m^3 is considered conservative.

Detailed calculations can be found in Appendix F for reference.

Further review of the proposed infiltration measures will occur at detailed design.

4.13 PHOSPHORUS TREATMENT AND MITIGATION

The NVCA requires at a minimum the matching of post-development phosphorous loads to pre-development levels.

A phosphorous budget for the site has been completed using the loading rates and removal efficiencies from the MECP Phosphorus Budget tool (Hutchinson Environmental Sciences Ltd., 2012), utilizing the maximum loading rates, through a spreadsheet method, summarized below in Table 3.

4.13.1 Existing Conditions

Under existing conditions, the 2.96 ha site has been modelled as hay-pasture and forest land uses for the purpose of phosphorus budget calculations. Relevant loading rates of 0.12 kg/ha/year, and 0.10 kg/ha/year for ha for hay-pasture and forest land uses respectively. This results in an annual phosphorous loading of 0.35 kg/year.

4.13.2 Proposed Conditions

Under proposed conditions, the site has been modelled as low intensity development. Runoff from both catchments will be treated by the proposed enhanced side yard swales (55% phosphorous removal efficiency) and rain gardens (60% phosphorous removal efficiency). A summary of the phosphorus loading rates for each scenario is provided in Table 3. Additional details and outputs are provided in Appendix G.

Further review of the phosphorous budget will occur during the detailed design phase.

Table 3: Phosphorus Loading Summary

SCENARIO	AREA (ha)	PHOSPHORUS LOADING (kg/year)
Pre-Development	2.96	0.35
Post-Development (no mitigation)	2.96	0.56
Post-Development (with mitigation)	2.96	0.24

Phosphorous loading to the Pine River tributary from the proposed septic beds has been addressed in the hydrogeological report.

5 Siltation & Erosion Control Plan

Erosion and sediment control will be implemented for all construction activities within the subject site including vegetation clearing, topsoil stripping, stockpiling of materials, site access construction, grading and servicing. The basic principles considered to minimize erosion and sedimentation, and the potential negative environmental impacts include:

- minimize disturbance activities where possible;
- expose the smallest possible land area to erosion for the shortest amount of time;
- institute erosion control measures as required immediately;
- implement sediment control measures before the outset of construction activities; and
- carry out regular inspection of erosion/sediment control measures and repair or maintain them, as necessary.

Erosion and sediment control measures shall be implemented in accordance with the *Erosion & Sediment Control Best Management Practices Guide* and are to include the following:

- sediment control fence;
- construction access mat;
- heavy-duty silt fence surrounding stripping and material stock pile areas;
- catch basin filter screens; and
- sediment traps placed in all existing and proposed catch basins adjacent to the site.

Regular inspection of control measures will be completed through a monitoring and mitigation plan, with regular repairs made as necessary. An erosion and sediment control plan will be developed during the detailed design stage.

6 Grading & Landscaping

The preliminary grading for the site under proposed conditions has been designed to provide split drainage to generally reflect pre-development drainage patterns. The proposed design will match into existing grades along the property lines. In accordance with the SWM design, rain gardens are proposed throughout the development, and assumed to be located at both the front and rear of each lot. Due to the presence of high groundwater in the area the site is proposed to be raised to allow for adequate separation between the groundwater and the building foundations, proposed rain gardens, and proposed septic systems. Refer to the Preliminary Site Grading and Servicing Plan (Drawing SSG.1) provided in Appendix E.

7 Summary

7.1 WATER SERVICING

Each lot is proposed to be serviced by new private individual wells. Based on the assumed build form, a daily water demand of 2,250 L/day (1.56 L/min) and a peak water demand of 18.75 L/min was determined for the proposed residential dwellings. Results of the private water well feasibility assessment considered it feasible that the peak water demand of 18.75 L/min could be achieved by the aquifer on-site.

A building footprint of 200 m^2 was assumed for each lot, in accordance with the assumptions of the Hydrogeological Assessment prepared by Tatham. Per the Ontario Building Code (OBC), on-site water supply is not required for building areas of 200 m^2 or less.

7.2 SANITARY SERVICING

Each lot is proposed to be serviced by new private individual septic systems. Based on the assumed build form, the estimated sewage generation for each dwelling was calculated to be 2,200 L/day. This sewage will be treated by a 4,500 L septic tank and sand filter bed system designed in accordance with the Ontario Building Code. Due to the required separation between the bottom of the distribution system and high groundwater level being 900 mm, some systems may be required to be raised.

7.3 DRAINAGE & STORMWATER MANAGEMENT

The preliminary SWM plan provides a best-effort approach to mitigate negative impacts with respect to the SWM objectives and guidelines of the approving agencies. Peak flow attenuation and water quantity controls for the proposed development will be provided using proposed lot-level LIDs such as enhanced swales and rain gardens. These LIDs will also provide water quality controls in the form of TSS and phosphorus removal and promote infiltration to maintain pre-development annual infiltration volumes and provide volume control across the site. The proposed hydrology and SWM design will be refined during the detailed deign stage once the proposed build-form and lot grading have been finalized to ensure compliance with the Town and NVCA requirements.

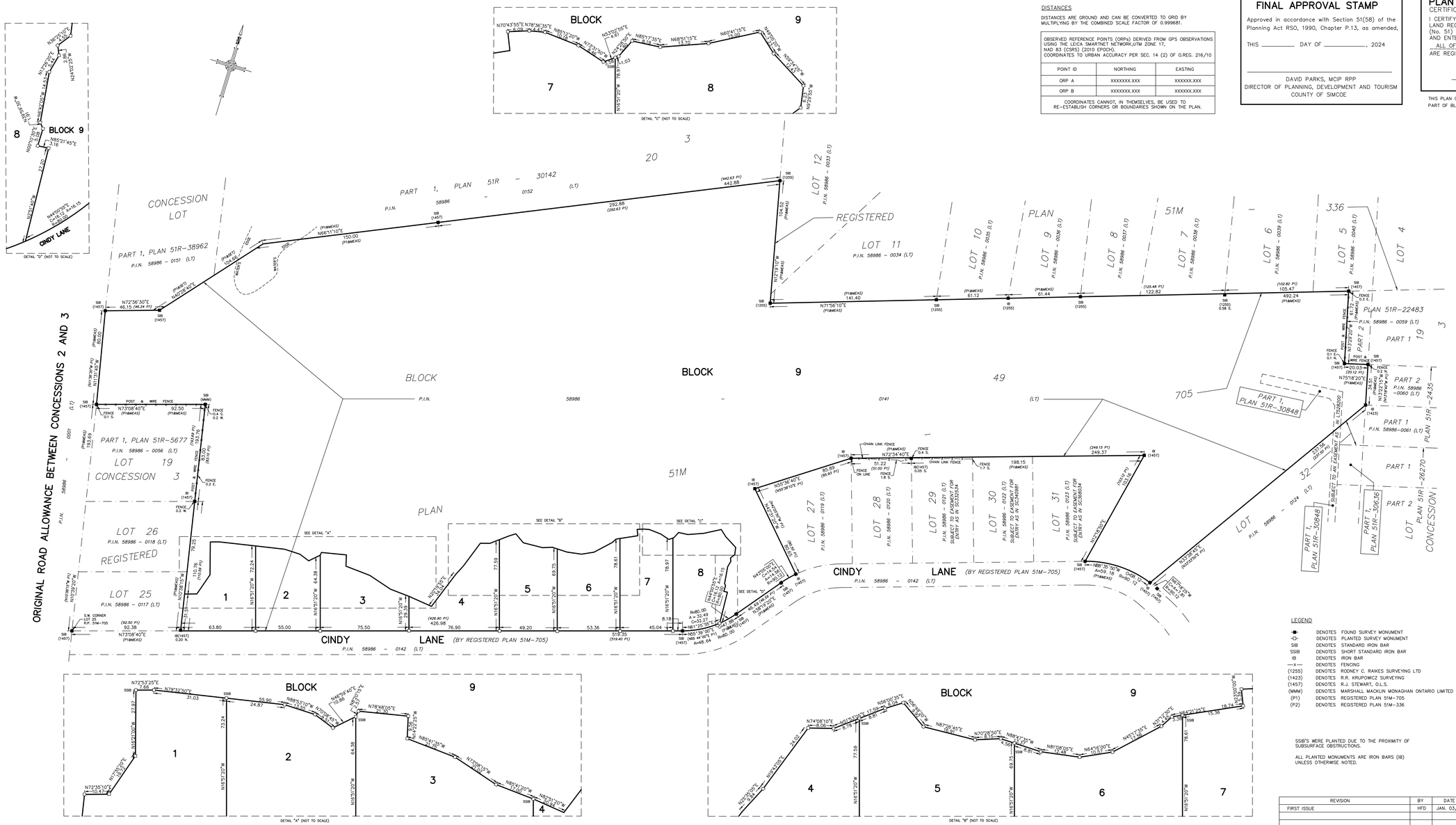
7.4 SILTATION & EROSION CONTROL PLAN

Siltation and erosion controls will be provided with the proper construction mitigation efforts.

7.5 GRADING & LANDSCAPING

The grading of the proposed development will match existing perimeter grades along the limits of the development and generally reflect pre-existing drainage splits. The site is proposed to be raised in order to provide adequate separation from the seasonal high groundwater table and proposed structures, septic systems, and rain gardens.

Appendix A:
Draft Plan of Subdivision



DISTANCES

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999681.

OBSERVED REFERENCE POINTS (ORPs) DERIVED FROM GPS OBSERVATIONS USING THE LEICA SMARTNET NETWORK,UTM ZONE 17, NAD 83 (CSRS) (2010 EPOCH).
COORDINATES TO URBAN ACCURACY PER SEC. 14 (2) OF O.REG. 216/10

POINT ID	NORTHING	EASTING
ORP A	XXXXXXX.XXX	XXXXXX.XXX
ORP B	XXXXXXX.XXX	XXXXXX.XXX

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THE PLAN.

FINAL APPROVAL STAMP

Approved in accordance with Section 51(58) of the Planning Act RSO, 1990, Chapter P.13, as amended,

THIS _____ DAY OF _____, 2024

_____
DAVID PARKS, MCIP RPP
DIRECTOR OF PLANNING, DEVELOPMENT AND TOURISM
COUNTY OF SIMCOE

PLAN 51M–

CERTIFICATE OF REGISTRATION

I CERTIFY THAT THIS PLAN IS REGISTERED IN THE LAND REGISTRY OFFICE FOR THE LAND TITLES DIVISION OF SIMCOE COUNTY (No. 51) AT _____ O'CLOCK ON THE _____ DAY OF _____2024 AND ENTERED IN THE REGISTER FOR PROPERTY IDENTIFIER NUMBERS _____ ALL OF P.I.N. 58986–0141 (LT) _____ AND REQUIRED CONSENTS ARE REGISTERED AS PLAN DOCUMENT No. _____.

_____
REPRESENTATIVE FOR LAND REGISTRAR

THIS PLAN COMPRISES ALL OF P.I.N. 58986–0141 (LT).
PART OF BLOCK 10 IS SUBJECT TO AN EASEMENT AS IN LT528200.

PLAN OF SUBDIVISION OF

ALL OF BLOCK 49 REGISTERED PLAN 51M–705

TOWNSHIP OF ADJALA–TOSORONTIO
COUNTY OF SIMCOE

SCALE 1 : 1250

0 5 10 25 50 75 100 metres

RUDY MAK SURVEYING LTD.

BEARING NOTE

BEARINGS ARE UTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS A TO B, BY REAL TIME NETWORK (RTN) OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (2010 EPOCH).

FOR BEARING COMPARISONS, A ROTATION OF 00°45'50" COUNTER–CLOCKWISE WAS APPLIED TO BEARINGS ON P1.

METRIC

DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

OWNER'S CERTIFICATE

THIS IS TO CERTIFY THAT:

1) LOTS 1 TO 8 INCLUSIVE, AND BLOCK 9, HAVE BEEN LAID OUT ACCORDANCE WITH OUR INSTRUCTIONS.

DATED THE _____ DAY OF _____ 2024.

_____
– PRESIDENT
2834556 ONTARIO INC.
I HAVE THE AUTHORITY TO BIND THE CORPORATION.

LEGEND

■	DENOTES FOUND SURVEY MONUMENT
-O-	DENOTES PLANTED SURVEY MONUMENT
SIB	DENOTES STANDARD IRON BAR
SSIB	DENOTES SHORT STANDARD IRON BAR
IB	DENOTES IRON BAR
—x—	DENOTES FENCING
(1255)	DENOTES RODNEY C. RAIKES SURVEYING LTD
(1423)	DENOTES R.R. KRUPOWICZ SURVEYING
(1457)	DENOTES R.J. STEWART, O.L.S.
(MMM)	DENOTES MARSHALL MACKLIN MONAGHAN ONTARIO LIMITED
(P1)	DENOTES REGISTERED PLAN 51M–705
(P2)	DENOTES REGISTERED PLAN 51M–336

SSIB'S WERE PLANTED DUE TO THE PROXIMITY OF SUBSURFACE OBSTRUCTIONS.

ALL PLANTED MONUMENTS ARE IRON BARS (IB) UNLESS OTHERWISE NOTED.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:

1) THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE LAND TITLES ACT AND THE REGULATIONS MADE UNDER THEM.

2) THE SURVEY WAS COMPLETED ON THE TH DAY OF , 2024.

_____ DATE

_____
RUDY MAK
ONTARIO LAND SURVEYOR

REVISION	BY	DATE
FIRST ISSUE	HFD	JAN. 03/24

THIS PLAN OF SURVEY RELATES TO AOLS PLAN SUBMISSION FORM NUMBER _____

RUDY MAK SURVEYING LTD.
ONTARIO LAND SURVEYORS
732 DUNLOP STREET WEST
BARRIE, ONTARIO L4N 9X1 (705) 722–3845
E–MAIL MAIL@MAKSURVEYING.COM

DRAWN BY: HFD | CHECK BY: | FILE No. 16439_SUB

Appendix B:
Hydrogeological Assessment

TATHAM ENGINEERING

Enhancing our communities

45 Cindy Lane, Adjala-Tosorontio

HYDROGEOLOGICAL ASSESSMENT

2834556 Ontario Inc.

File 423499 | August 26, 2024

Document Control

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Date:

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Prepared by:

Tatham Engineering Limited
645 Veterans Drive, Unit D
Barrie, Ontario L4N 9H8
T 705-733-9037
tathameng.com

Prepared for:

2834556 Ontario Inc.
45 Cindy Lane
New Tecumseth, Ontario L0M 1M0

Authored by:	Reviewed by:
Shane Mariner, B.Sc. (Env) Geoscience Intern	PROFESSIONAL GEOSCIENTIST ONTARIO ALICIA KIMBERLEY PRACTISING MEMBER 2949 August 26, 2024
Kimberly Gardner, B.Eng. EIT Project Manager	Alicia Kimberley, P.Geo Group Leader - Hydrogeology

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Issue	Date	Description
1	August 26, 2024	Final Report

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1 Introduction

Tatham Engineering Limited (Tatham) has been retained by 2834556 Ontario Inc. (the Client) to complete a Hydrogeological Assessment in accordance with the Ministry of Environment, Conservation and Parks (MECP) Guidelines D-5-4 and D-5-5 requirements for the proposed residential development located at 45 Cindy Lane in the Township of Adjala-Tosorontio, hereafter referred to as the "site".

The subject property is comprised of 25.5 hectares (ha) (63.1 acres); however, the developable area of the property is comprised of approximately 3 ha (7.4 acres) of vacant/undeveloped land. For this investigation, the developable area of the property is considered the "site" and is referred to throughout this report. The surrounding lands to the east, west and south are primarily used for residential purposes with agricultural/vacant lands intermixed and the surrounding lands to the north are used for commercial purposes as the Silver Brook Golf Course. The site is bounded by Cindy Lane to the south, a tributary of Pine River to the north, a residential dwelling to the west and the entrance to the Silver Brook Golf Course to the east. A site location plan and monitoring location plan are enclosed as Figure 1 and 2, respectively.

The proposed residential development consists of eight separate lots, each with a private on-site water supply well and septic system. It is our understanding this project will proceed through concurrent Official Plan Amendment (OPA), Zoning By-Law Amendment (ZBA) and Draft Plan of Subdivision (Draft Plan) applications. As part of the on-going site plan development, a hydrogeological assessment was completed to assess the feasibility of the proposed individual on-site sewage systems and private water supply wells in accordance with MECP guidelines D-5-4 and D-5-5. Further, the hydrogeological assessment was also carried out in accordance with typical Nottawasaga Valley Conservation Authority (NVCA) and MECP hydrogeological requirements.

1.1 PURPOSE AND SCOPE OF WORK

The main objectives of the Hydrogeological Assessment were to:

- Establish local and regional geology and hydrogeology;
- Establish the soil and groundwater conditions on-site including infiltration potential and seasonal high groundwater levels;
- Verify the presence of existing water supply wells on-site and within 250-m radius of the site;

- Qualitatively assess the potential impacts to the nearby structures, water bodies and water users, if any, and comment on future regulatory agency involvement;
- Establish a pre and post construction water balance;
- Assess the feasibility of private water and/or septic servicing on-site; and
- Prepare a Hydrogeological Assessment report.

To achieve the above objectives, Tatham has proposed the following scope of work;

- Complete a desktop review of pertinent geological and hydrogeological resources, MECP water well records, previous geotechnical reports completed by others, if any, and proposed site plan drawings;
- Complete a door-to-door water well survey for residences within 250 m of the site to confirm the presence and usage of private water wells;
- Visit the site to note existing site conditions, topography, drainage, water features, neighboring land uses, and/or existing water supply or monitoring wells;
- Advance three test pits up to a depth of 3.0 m to facilitate Guelph Permeameter (GP) testing at approximate depths of 1.5 and 3.0 m in each test pit to evaluate in-situ filtration parameters;
- Install a mini piezometer and automatic dataloggers in each of the test pits and visit the site every 4 months for a 12-month period to facilitate long-term groundwater level monitoring;
- In accordance with MECP Guideline D-5-5 requirements, proposed developments 15 hectares or less in size require the installation and testing of at least three wells to assess the feasibility of private water supply. As such, the scope includes the installation and development of three 6” domestic water supply wells on-site;
- Complete a 6-hr constant rate pumping test in each of the three newly installed/developed residential supply wells;
- Determine baseline groundwater quality within the newly installed/developed residential supply wells to assess groundwater potability;
- Complete a desktop reasonable use assessment (nitrate impact assessment) and phosphorous assessment to confirm the feasibility of individual private septic systems; and
- Prepare a Hydrogeological Assessment Report in general accordance with the applicable MECP guidelines D-5-5 and D-5-4, and NVCA requirements.

1.2 REGULATORY REQUIREMENTS

1.2.1 Private On-Site Servicing

Residential developments to be reliant on private individual water supply wells and/or septic systems are to adhere to the following regulatory requirements:

- MECP D-5-5: Private Wells: Water Supply Assessment
- MECP D-5-4: Individual On-site Sewage Systems

This hydrogeological assessment will generally follow the above noted regulatory requirements; however, additional investigations and/or assessments may be required as part of the on-going OPA, ZBA and/or Draft Plan applications.

2 Site Setting

The site is located at 45 Cindy Lane in the Township of Adjala-Tosorontio, County of Simcoe. The site is approximately 3 hectares (7.4 acres) in size and is currently undeveloped/vacant. The site is bounded to the north and east by Silver Brook Golf Club, to the south by Cindy Lane and to the west by an existing residential property. The surrounding lands are primarily used for residential and commercial (golf course) purposes with agricultural/vacant lands intermixed.

2.1 PHYSIOGRAPHY, SURFICIAL AND BEDROCK GEOLOGY

The site lies within the physiographic region known as the Simcoe Lowlands, comprised of sand plains and beaches (Chapman and Putnam, 1984). Ontario Geological Survey (OGS) quaternary geology mapping indicates the site consists of glaciofluvial outwash deposits comprised of primarily gravel and sand. Bedrock beneath the site consists of Lindsay Formation limestone, dolostone and/or shale of the Simcoe Group.

These findings are consistent with the sandy subsurface conditions encountered during the installation of test wells completed by Highland Water Well Drilling Inc. as part of this hydrogeological assessment.

2.2 TOPOGRAPHY, DRAINAGE AND SURFACE WATER FEATURES

The topography of the site is relatively flat with elevations ranging from approximately 229 metres above sea level (masl) to 232 masl.

No water bodies are present within the site; however, a tributary of the Pine River is located north adjacent to the site and flows in a northeasterly direction. It is assumed on-site drainage will follow local surface topography and flow to the east/northeast, toward the tributary.

2.3 CLIMATE

Climate normal data between 1981 and 2010 was reviewed from the closest Environment Canada Climate Station to the site; Ruskview (Climate ID: 614722), located approximately 12.75 km to the west. The highest daily average temperature occurred in July, at 19.7°C, and the lowest occurred in January, at -7.3°C. The yearly average temperature between 1981 to 2010 was 6.5°C. The average total annual precipitation recorded was 996 mm. Climate data is tabulated in Appendix A.

In accordance with the Thornthwaite and Mather method, a water surplus of 507.2 mm/year was calculated for the site. Detailed calculations are provided in Appendix A for reference.

The infiltration from the annual surplus can be estimated based on infiltration factors from Table 3.1 of the SWM Planning and Design Manual (Ministry of Environment, 2003). Specific infiltration factors are provided for topography, soils, and land cover.

Topography..... 0.3

Soils.....0.2

Land Cover.....0.1

Total.....0.6

For the purpose of this assessment, an infiltration factor of 0.6 was assumed for the site, resulting in an annual infiltration rate of 304.3 mm/year.

2.4 MECP WATER WELL RECORDS

To assess the nature of groundwater resources as well as the history of well usage within the area, MECP water well records were reviewed for a 500 m radius surrounding the site. The approximate locations of the MECP water wells are presented in Figure 3, and a summary of the MECP water wells is provided in Appendix B.

A total of 57 well records were reviewed within a 500 m radius of the site. Of the 57 well records, 53 indicated domestic supply well use, one indicated domestic supply and irrigation use, one indicated public supply well use and one indicated commercial supply well use. The remaining one well record did not indicate its use type.

In general, stratigraphy noted from the well records consisted of sandy silt or silt overlying layers of clay or silt with variable sand contents, overlying sand. Limestone bedrock was encountered at depths of approximately 69 to 70 m below ground surface (m bgs).

The majority of water wells were screened within the overburden sand unit at depths ranging between approximately 16 to 62 m bgs. Fresh water was encountered at depths ranging between approximately 2 to 71 m bgs, and gas was encountered locally at one location at a depth of 70 m bgs. Pumping test details were reviewed for available water wells records and indicated tests were carried out for 30 minutes to 7 hours at rates of 2.5 to 25 US gal/min (9.5 to 95 L/min) with 0.9 to 43 m of drawdown observed.

One well is present on the subject property and appears to be used at the Silver Brook Golf Club, just north of the site. The well record (MECP well record A000725) was reviewed. Based on the water well record the following is noted:

- The well included the installation of a 6.25” diameter steel casing to a depth of 41.1 m and a 5.75” stainless steel 18-slot screen within the confined sand aquifer at a depth of 41.3 to 44.5 m. During drilling, fresh water was encountered at a depth of 35.4 m, and following well

installation the static water level was noted at 7.0 m. A 1-hr and 50 min pumping test was carried out at a pumping rate of 139 L/min and 1.3 m of drawdown was noted at the end of the test. It was recommended the water well pump be installed at a depth of 30 m and a pumping rate of 450 L/min be utilized.

2.5 SOURCE WATER PROTECTION MAPPING

The site lies within the Nottawasaga Valley Source Protection Area (SPA). The site does not lie within a Well Head Protection Area (WHPA) nor Intake Protection Zone (IPZ), as shown on Figures 4 and 5, respectively. Further, the site does not lie within a Highly Vulnerable Aquifer (HVA), as shown on Figure 6, but does lie within a Significant Groundwater Recharge Area (SGRA) as shown on Figure 7.

2.6 SITE INSPECTION

A visual inspection of the site was conducted on May 7, 2024, to assess the site's drainage, topography and surface water features. The site consisted of approximately 3 hectares of undeveloped/vacant land just south of the Silver Brook Golf Club. The site was located in a primarily residential and commercial (golf course) area, with agricultural/undeveloped lands intermixed. No water bodies were present within the site; however, a tributary of Pine River is located north adjacent to the site. It is anticipated surface water runoff on site will follow local surface topography; draining into the Pine River tributary to the north of the Site.

3 Procedures and Methodology

3.1 DOOR TO DOOR WATER WELL SURVEY

Domestic water well surveys were distributed in May 2024 by Tatham representatives to all properties located partially or wholly within 250 m of the site. Based on the proximity to the site, a total of 27 properties were selected and included in the water well survey as summarized in Table 1, below.

Table 1: Summary of Domestic Water Well Survey

MUNICIPAL ADDRESS	RESPONSE TO WELL SURVEY	TYPE OF WELL	TERMINATION DEPTH OF WELL	STRATA SCREENED	ANY WATER QUALITY/ QUANTITY ISSUES?	TREATMENT
31 David Drive	No response at the time of report completion					
35 David Drive	No response at the time of report completion					
7186 Concession 3	No response at the time of report completion					
7121 Concession 3	No response at the time of report completion					
7135 Concession 3	Response provided vial mail	Drilled	37.5 m	Sand	No water quantity concerns. Water is hard and iron rich with slight sulfur odour	Water Softener
7151 Concession 3	No response at the time of report completion					
7191 Concession 3	No response at the time of report completion					
7093 Concession 3	No response at the time of report completion					
7077 Concession 3	No response at the time of report completion					
65 Cindy Lane	Response provided via phone	Assumed Dug	Unknown	Unknown	Utilizing Cistern	Unknown

MUNICIPAL ADDRESS	RESPONSE TO WELL SURVEY	TYPE OF WELL	TERMINATION DEPTH OF WELL	STRATA SCREENED	ANY WATER QUALITY/ QUANTITY ISSUES?	TREATMENT
64 Cindy Lane	No response at the time of report completion					
62 Cindy Lane	No response at the time of report completion					
60 Cindy Lane	No response at the time of report completion					
58 Cindy Lane	No response at the time of report completion					
56 Cindy Lane	No response at the time of report completion					
54 Cindy Lane	No response at the time of report completion					
52 Cindy Lane	No response at the time of report completion					
50 Cindy Lane	No response at the time of report completion					
48 Cindy Lane	No response at the time of report completion					
46 Cindy Lane	No response at the time of report completion					
44 Cindy Lane	Response provided via mail	Drilled	Assumed at approximately 36.6 m	Unknown	High Iron	Reverse osmosis system, iron filter and water softener
43 Cindy Lane	No response at the time of report completion					
41 Cindy Lane	Response provided via mail	Drilled	42.4 m	Sand	Water quality is poor, uses water treatment systems	UV filter and light, Reverse osmosis system, and water softener
39 Cindy Lane	No response at the time of report completion					

MUNICIPAL ADDRESS	RESPONSE TO WELL SURVEY	TYPE OF WELL	TERMINATION DEPTH OF WELL	STRATA SCREENED	ANY WATER QUALITY/ QUANTITY ISSUES?	TREATMENT
37 Cindy Lane	Response provided via mail	Drilled	38.7 m	Sand	Water is hard and iron rich	Water softener
35 Cindy Lane	No response at the time of report completion					
45 Cindy Lane – Clubhouse	No response at the time of report completion					

3.2 TEST PITTING

A test pitting program was carried out on May 7, 2024, following receipt of public and private underground utility service locates. The test pits were dug to depths of approximately 2.0 m bgs by an excavator provided and operated by Morris Shelswell & Sons Excavating. Tatham representatives examined and classified characteristics of the soils encountered in each of the test pits, noted groundwater conditions during and upon completion of the test pits, and reviewed all recovered soil samples.

Upon completion of the test pits, piezometers were installed in Test Pit 1 (TP1), TP2 and TP3 to allow for future groundwater level monitoring during subsequent pumping tests, as well as to facilitate long-term groundwater level monitoring.

3.3 WATER SUPPLY ASSESSMENT

In accordance with MECP guideline D-5-5 requirements, proposed developments which are 15 hectares or less in size require the installation and testing of at least three test wells to assess the feasibility of private water supply.

As such, three test wells (TW1, TW2, and TW3) were installed as part of this investigation. It is Tatham's understanding these three test wells are to be utilized as private domestic supply wells upon completion of the residential dwellings' construction.

3.3.1 Test Well Construction

TW1, TW2 and TW3 were installed by Highland Water Well Drilling Inc. (Highland) (MECP License #dd 2576) on May 1, 6 and 10, 2024, respectively, utilizing standard air rotary drilling methods (Well Tag No. A366563, A366566 and A366565, respectively). A copy of the water well records are provided in Appendix C.

A 6" steel casing water well was installed in all three wells. Wells TW2 and TW3 were installed with 5 ½" stainless-steel 12-slotted screens while TW1 was installed with a 5 ½" stainless-steel 16-slotted screen. All test wells were screened in the overburden sand unit from 39.9 to 41.1, 36.5 to 37.8, and 45.4 to 46.6 m bgs, respectively.

All wells were developed and chlorinated upon completion.

3.3.2 Constant Rate Pumping Test

Highland conducted 6-hour pumping tests concurrently on TW1 and TW3 on May 15, 2024, and TW2 on May 16, 2024, according to the MECP Guideline D-5-5. All test wells were pumped at a constant rate of 8 US gal/min (30.28 L/min) for the duration of the tests.

As part of the pumping tests, groundwater levels were manually measured by a Tatham representative before, during, and after the tests. Automatic dataloggers were used to measure continuous water levels throughout the tests. The results of the pumping tests and groundwater level monitoring are provided in Appendix D and are discussed further in Section 4.4.

3.3.3 Groundwater Sampling

During the 6-hour constant rate pump test, two representative groundwater samples were collected from TW1, TW2 and TW3 for a total of six samples. One sample was collected after the first hour of continuous pumping and another was collected within the final hour of continuous pumping. The samples were collected directly from the discharge pipe and were placed directly into pre-cleaned laboratory-supplied vials and/or bottles with analytical test group specific preservatives. Dedicated nitrile gloves were worn during sample collection and handling. The samples were submitted for chemical analysis of:

- One hour sample: chlorine (field test), E.coli, Total Coliform, Fecal Coliforms, background bacteria, nitrate, nitrite, sodium and turbidity.
- Final hour sample: chlorine (field test), E.coli, Total Coliform, Fecal Coliforms, background bacteria, nitrate, nitrite, sodium, turbidity, alkalinity, ammonia, calcium, chloride, color, conductivity, dissolved organic carbon, hardness, magnesium, manganese, pH, and total dissolved solids.

The analysis was compared to the Ontario Drinking Water Quality Standards (ODWQS). Samples were analyzed by Caduceon Environmental Laboratories, a CALA accredited laboratory in Barrie, Ontario. Groundwater chemistry results are included in the laboratory Certificates of Analysis, provided in Appendix E.

3.4 LONG-TERM GROUNDWATER LEVEL MONITORING

A long-term groundwater level monitoring program is being carried out in which groundwater levels within the three newly installed piezometers will be monitored for a 12-month period between May 2024 and April 2025. Groundwater levels will be continuously recorded by use of an automated datalogger recording device. Additionally, a Tatham representative will visit the site once every four months to confirm groundwater levels, for a total of three site visits.

A supplemental groundwater level letter will be prepared at the end of the long-term groundwater level monitoring program highlighting the seasonal high groundwater levels measured.

4 Subsurface Conditions

4.1 STRATIGRAPHY

A test pitting program was conducted on May 7, 2024, in which three test pits (TP1, TP2, and TP3) were advanced to approximate depths between 1.5 to 2.0 m bgs to facilitate GP testing and the installation of three piezometers. As part of the test pitting program, Tatham representatives examined and classified characteristics of the soils encountered in each of the test pits, noted groundwater conditions during and upon completion of the test pits, and reviewed all recovered soil samples.

In general, the test pits encountered topsoil overlying sand. Bedrock was not encountered in any of the test pits at termination depths.

The subsurface conditions encountered in TP1, TP2 and TP3 are summarized in Table 2, below:

Table 2: Test Pit Stratigraphy

TEST PIT LOCATION	UTM COORDINATES	SOIL STRATIGRAPHY	
TP1	17T 581739 m E 4898180 m N	0 to 0.50 m	Topsoil: dark brown, sand, organics, moist
		0.50 to 1.50 m	Sand: brown, fine sand, some silt, moist.
		1.50 m	Sand: grey, fine sand, wet
		TP Terminated	
TP2	17T 581626 m E 4898136 m N	0 to 0.30 m	Topsoil: dark brown, sand, organics, moist
		0.30 to 0.80 m	Sand: brown/orange/red, fine sand, moist
		0.80 to 1.00 m	Sand: brown/orange/red, fine sand, wet
		1.00 to 1.70 m	Sand: grey, find sand, trace gravel, wet
		TP Terminated	
TP3	17T 581435 m E	0 to 1.00 m	Topsoil: dark brown, sand, organics, moist

TEST PIT LOCATION	UTM COORDINATES	SOIL STRATIGRAPHY	
	4898095 m N	1.00 to 1.30 m	Sand: brown, fine sand, moist
		1.30 to 1.40 m	Sand: grey, fine sand, moist
		1.40 to 2.00 m	Sand: grey, fine sand, trace gravel, wet
			TP Terminated

4.2 GROUNDWATER

4.2.1 Groundwater levels

A piezometer was installed at each test pit location to facilitate long-term groundwater level measurements of the shallow aquifer. The piezometers were installed with a slotted 1.0-meter-long screen.

A summary of the piezometers and on-site test well installation details and stabilized groundwater level measurements are provided below in Table 3 and 4, respectively.

Table 3: Piezometer and Test Well Installation Details

ID	GROUND SURFACE (m asl)	LOCATION OF SCREEN (Depth (m bgs) / Elevation (m asl))	STRATA SCREENED
TP1	229.9	0.5– 1.5 / 228.4 – 229.4	Fine sand
TP2	230.3	0.7 – 1.7 / 228.6 – 229.6	Fine sand, trace gravel
TP3	231.1	1.0 – 2.0 / 229.1 – 230.1	Fine sand, trace gravel
TW1	230.0	39.9 – 41.1 / 188.9 – 190.1	Sand
TW2	231.5	36.5 – 37.8 / 193.4 – 194.7	Sandy silt
TW3	231.5	45.4 – 46.6 / 184.9 – 186.1	Sand

Table 4: Stabilized Groundwater Level Measurements

ID	GROUND SURFACE* (M ASL)	GROUNDWATER LEVELS (m bgs / m asl)		
		MAY 15, 2024	MAY 16, 2024	MAY 22, 2024
TP1	229.9	0.5 / 229.4	0.5 / 229.4	0.4 / 229.5
TP2	230.3	0.3 / 230.0	0.4 / 229.9	0.5 / 229.8
TP3	231.1	0.2 / 230.9	0.3 / 230.8	0.3 / 230.8
TW1	230.0	5.1 / 224.9	5.1 / 224.9	-
TW2	231.5	4.8 / 226.7	4.8 / 226.7	-
TW3	231.5	3.3 / 228.2	3.3 / 228.2	-

Based upon the groundwater elevations to date, shallow groundwater levels range between 0.2 to 0.5 m bgs (elevation 229.4 to 230.9). It is anticipated shallow groundwater will follow surface topography and flow in a northeastern direction, toward the Pine River tributary as shown on Figure 8.

Regional groundwater is anticipated to flow to the northeast, ultimately flowing towards Nottawasaga River and Nottawasaga Bay.

4.3 INFILTRATION TESTING

4.3.1 Gradation Testing

Shallow soils on site are generally comprised of fine to coarse sands. Based on the Ontario Building Code (2012) Supplementary Standards S-6, typical percolation times of sands and silty fine sands range between 8 - 20 mins/cm and are considered to have medium to low permeability.

4.3.2 Guelph Permeameter Testing

Guelph Permeameter (GP) testing was completed to determine the average field saturated hydraulic conductivity (K_{fs}) of the on-site soils to assist in the preliminary design of LID features for the site and septic systems. GP tests were conducted at a depth of 0.5 m at TP1 and 0.7 m at TP2, in the dry conditions. GP tests were not completed at TP3 as the near surface soils were saturated. During each GP test, the water level within the GP chamber was visually monitored and recorded until a steady state infiltration rate was reached.

The field saturated hydraulic conductivity, K_{fs}, was determined using the Zhang et al. (1998) method as follows:

$$K_{fs} = \frac{CQ}{2\pi H^2 + \pi a^2 C + 2\pi \frac{H}{a^*}}$$

where:

C = shape factor

Q = the steady state rate of water level change (cm/s)

H = water head height (cm)

a = borehole radius (cm)

a* = soil texture-structure category (cm^{-1})

The field saturated hydraulic conductivity value was then utilized to determine infiltration rates based on the method outlined in the Toronto Region Conservation Authority (TRCA) Low-Impact Development Stormwater Management Planning and Design Guide as follows:

$$Infiltration\ Rate = \sqrt[3.7363]{\frac{K_{fs}}{6 * 10^{-11}}}$$

The results of the Guelph Permeameter testing completed is summarized in Table 5, below.

Table 5: Guelph Permeameter Testing Results

TEST PIT LOCATION	TEST DEPTH (m)	STRATIGRAPHY TYPE	K_{FS} (cm/sec)	INFILTRATION RATE (mm/hr)	FACTORED INFILTRATION RATE (mm/hr)
TP1	0.5	Fine Sand	1.8×10^{-3}	101	40.4
TP2	0.7	Fine Sand	2.8×10^{-4}	61	24.5

4.4 CONSTANT-RATE PUMPING TEST

The results of the pumping tests and groundwater level monitoring are provided in Appendix D and summarized below.

4.4.1 TW1

The 6-hour constant pumping test was conducted at the same time as the 6-hour pumping test at TW3. The test well is terminated within the overburden sand unit at a depth of 41.1 m bgs. The pumping test was carried out at a rate of 30.3 L/min.

Groundwater Levels

During the pump test, water levels declined from a static level of 5.0 to 5.6 m bgs. The water levels recovered to within 5% of the static water level within 37 minutes.

At the end of the pump test, there was a total of 35.5 m of available drawdown.

Water Quality Results

Water samples were collected during the pumping test completed on TW1. Laboratory results indicated the 1-hour and 5-hour tests exceeded the Maximum Acceptable Concentration (MAC) for Total Coliform (<2 mg/L versus a limit of 0 mg/L). In addition, the 1-hour test exceeded the Aesthetic Objectives (AO) for turbidity (31.2 NTU versus a limit of 5 NTU) and the 5-hour test exceeded the Operational Guideline (OG) for Hardness as CaCO3 (194 mg/L versus a limit of 100mg/L).

4.4.2 TW2

The test well is terminated within the overburden sand unit at a depth of 37.8 m bgs. The pumping test was carried out at a rate of 30.3 L/min.

Groundwater Levels

During the pump test, water levels declined from a static level of 4.8 to 8.2 m bgs. The water levels recovered to within 5% of the static water level within 11 minutes.

At the end of the pumping test, there was a total of 29.5 m of available drawdown

Water Quality Results

Water samples were collected during the pumping test completed on TW2. Laboratory results indicated the 1-hour and 5-hour tests exceeded the AO for turbidity (22.4 NTU and 7.2 NTU versus a limit of 5 NTU) and the MAC for Total Coliform (<2 mg/L and <2 mg/L versus a limit of 0 mg/L). In addition, the 5-hour test exceeded the OG for Hardness as CaCO3 (199 mg/L versus a limit of 100mg/L).

4.4.3 TW3

The 6-hour pumping test was conducted at the same time as the 6-hour pumping test at TW1. The test well is terminated within the overburden sand unit at a depth of 46.6 m bgs. The pumping test was carried out at a rate of 30.3 L/min.

Groundwater Levels

During the pump test, water levels declined from a static water level of 3.3 to 22.0 m bgs. The water levels recovered to within 5% of the static water level within 4 hours.

At the end of the pump test, there was a total of 24.6 m of available drawdown.

Water Quality Results

Water samples were collected during the pumping test completed on TW3. Laboratory results indicated the 1-hour and 5-hour sample exceeded the AO for turbidity (82.7 NTU and 10.1 NTU versus a limit of 5 NTU) and the MAC for Total Coliform (<2 mg/L and 4 mg/L versus a limit of 0 mg/L). In addition, the 5-hour sample exceeded the OG for Hardness as CaCO3 (168 mg/L versus a limit of 100 mg/L).

4.4.4 Calculated Transmissivity Values

The transmissivity was calculated utilizing the constant rate pump test results and the Jacob straight line method where:

$$T = \frac{2.3Q}{4\pi\Delta s}$$

Where,

Q = pumping rate (43.61 m^3/day)

Δs = slope of the observed drawdown versus time for 1 log cycle (1.4 to 1.5 m)

Based on the above calculation, the transmissivity was calculated to be between 3.0 and 210 m^2/day, as shown in Table 6, below.

Table 6: Summary of Transmissivity

ID	CALCULATED TRANSMISSIVITY (m^2/day)
TW1	210
TW2	88
TW3	3

5 Hydrogeological Discussion and Analysis

5.1 WATER BALANCE

An evaluation of the anticipated changes in the water balance between pre-development and post-development conditions has been included to quantify the expected changes to the water balance across the site with and without mitigation.

Using historical precipitation data from the Ruskview Climate Station (Climate ID: 614722) between 1981 and 2010, the pre-development water balance model shows a total of 9, 129 m^3 of annual infiltration volume is provided over the site area (3 ha). Given the current stage of planning, it was assumed the entire site would be developed for residential dwellings. Within each lot, it was assumed 13% of the post-development land cover would be considered impervious. As such, the post-development water balance assessment shows without mitigation, annual infiltration over the site may decrease by as much as 13%, corresponding to an annual infiltration reduction of 1,187 m^3. Water balance calculations are provided in Appendix A for reference.

5.2 LOW IMPACT DEVELOPMENT FEASIBILITY ASSESSMENT

As discussed in previous sections, the site generally consists of sandy loamy topsoil overlying layers of fine sand with trace gravel. Groundwater is expected to be encountered at depths of 0.2 to 0.5 m bgs (elevation 229.4 to 230.9). Based on the groundwater conditions observed, infiltration-based LID features (such as infiltration chambers or soakaway pits) are not considered feasible for this site as the minimum separation distance (1.0 m) between the seasonally high groundwater table and the bottom of a proposed recharge facility cannot be satisfied.

5.3 WATER SUPPLY ASSESSMENT

5.3.1 Water Supply Potential - Quantity

In accordance with the MECPs D-5-5 guideline, a minimum daily water demand of 450 L/day/person, and a peak water demand of 3.75 L/min/person for a 120-minute period is to be assumed. The number of proposed bedrooms for the residences to be constructed on the property have not yet been determined, however, for the purposes of this assessment four bedroom and five persons per dwelling have been assumed. As such, a daily water demand of 2,250 L/day (1.56 L/min) and a peak water demand of 18.75 L/min are considered sufficient to yield an adequate water supply for the proposed residential dwellings.

It is noted, for a 3-hectare property, a minimum of three test wells are required to be constructed on-site and tested for at least 6 hours in accordance with the MECPs Guideline D-5-5.

A constant rate pumping test carried out on TW1 indicated a pumping rate of approximately 30.3 L/min could be sustained for 6-hours with a drawdown of 0.6 m noted. Further, following completion of the pumping test, recovery to within 5% of the original static water level was noted within 37 minutes.

A constant rate pumping test carried out on TW2 indicated a pumping rate of approximately 30.3 L/min could be sustained for 6-hours with a drawdown of 3.4 m noted. Further, following completion of the pumping test, recovery to within 5% of the original static water level was noted within 110 minutes.

A constant rate pumping test carried out on TW3 indicated a pumping rate of approximately 30.3 L/min could be sustained for 6-hours with a drawdown of 18.7 m noted. Further, following completion of the pumping test, recovery to within 5% of the original static water level was noted within 4 hours.

Considering the constant rate pumping tests resulted in 0.6 to 18.7 m of drawdown, corresponding to approximately 1.7% to 43% of the total available drawdown at a pumping rate of 30.3 L/min, it is considered feasible the peak water demand of 18.75 L/min could be achieved by the aquifer on-site.

It is recommended future wells on-site be installed within the same sand aquifer as TW1, TW2, and TW3. Assuming typical water usage and well separation, it is not anticipated the concurrent water taking from two individual water wells would adversely impact the available water supply given such a relatively small percentage of the total available drawdown is actually being utilized. In addition, the pumping tests at TW1 and TW3 were conducted concurrently, and water levels were continuously monitored in TW2 during the test to observe the impacts on neighboring wells. A total drawdown of 0.1 m was observed over the 6-hr pumping test at TW2, indicating minimal impacts to the neighboring wells.

All future water wells on-site should be installed and tested by a licensed water well contractor in accordance with O.Reg.903.

5.3.2 Water Supply Potential – Quality

Water quality samples were collected from TW1, TW2 and TW3 after the first hour of continuous pumping and within the final hour of continuous pumping. The samples indicated generally potable groundwater on-site with minor exceedances of turbidity (7.2 to 10.1 NTU, limit of 5 NTU), total coliform (<2 to 4 CFU/100mL, limit of 0 CFU/100mL), and hardness as $CaCO_3$ (168 to 199 mg/L, limit 100 mg/L).

The Aesthetic Objective (AO) for turbidity is set at 5 NTU (ODWQS, 2006). Turbidity is not a chemical parameter but rather a physical parameter; it is a measurement of the water's light scattering abilities. A high turbidity value would indicate a water sample which is cloudy or murky, while a low turbidity value would indicate a water sample which is clear, or transparent.

Turbidity is an important indicator of water treatment efficiency, especially filters. A significant relationship has been demonstrated between turbidity increases and the number of Giardia cysts and Cryptosporidium oocysts breaking through filters (MECP, 2006). Ontario Regulation 170/03 describes turbidity as posing a potential health risk within a drinking water system if the system is required to provide filtration, but when sampled, exceeds 1.0 NTU. Turbidity concentrations below 5 NTU are considered treatable.

The MAC for Total Coliform is set at 0 CFU/100mL (ODWQS, 2006). Total Coliform represents a group of bacteria which are typically found in soil and water which has been influenced by surface water and/or human/animal waste. The presence of coliform bacteria within drinking water can increase the risk of contracting a water-borne illness. The most common symptoms of contracting a water-borne illness include nausea, vomiting, and diarrhea. Infants, elderly people, and those with compromised immune systems are at the most risk. To kill microorganisms including coliform bacteria, water must be brought to and kept at a boil (100°C) for at least one continuous minute (New Brunswick, n.d.). Chlorination of the water wells prior to use and on a regular basis should be conducted to eliminate bacteria in the well.

The operational guideline for hardness is set between 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 ($CaCO_3$). 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 $CaCO_3$ is 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.

It is considered feasible groundwater found in the test wells on-site terminated between 38.7 and 46.6 m bgs will yield fresh water; however, future homeowners may wish to consider the implementation of conventional water treatment systems including water softeners, reverse osmosis systems and/or UV filters and lights.

Following the construction of future water wells on-site, each water well should be sampled to confirm potability in accordance with industry standards.

5.4 PRIVATE ONSITE SEWAGE ASSESSMENT

It is noted the MECP Guideline D-5-4 only applies to developments where average daily flows of less than 10,000 L/day are anticipated.

For the purposes of this assessment, a nitrate impact assessment (Steps 1 to 3) was carried out in accordance with MECP Guideline D-5-4.

5.4.1 Nitrate Impact Assessment

Step One: Lot Sizing

In accordance with MECP D-5-4, where individual lot sizes within a proposed development exceed 1 hectare (2.5 acre), the MECP considers the dilution of sewage effluent by infiltration precipitation to be adequate to reduce nitrate concentrations to acceptable levels. Assuming the site is not hydrogeologically sensitive, further assessments into the impact of septic systems are generally not required.

Based on the current design details, the lot sizes remain less than 1 hectare; thus, Tatham proceeds to Step Two.

Step Two: System Isolation

Where proposed lot sizes are less than 1 hectare, it is necessary to assess the potential risk of septic effluent on groundwater supplies. Where it can be demonstrated local water supplies are obtained from an aquifer at a depth hydraulically isolated from the sewage effluent in the receiving soil, further assessments are generally not required. The placement and sizing of the septic beds must take into consideration the minimum setback and separation distances outlined in O.Reg. 358 (Sewage Systems), O.Reg. 903 (Ontario Water Resources: Wells) and/or other municipal by-laws.

Where it cannot be demonstrated the sewage effluent is hydraulically isolated from the supply aquifer, Step 3 must be utilized.

Step 3 involves a hydrogeological study to evaluate the impact of infiltration of septic effluent from sewage treatments systems (nitrate loading considerations).

Although the on-site water wells are constructed in a deep confined aquifer, there is the possibility for shallow unconfined water wells to exist downgradient of the property. As such, Tatham proceeds to Step 3.

Step Three: Preliminary Nitrate Impact Assessment

Nitrate in septic effluent is attenuated by dilution with infiltrating water, water discharged into the septic bed, and groundwater seepage from the upstream to the downstream side of the

property (groundwater flux). For the purposes of this assessment, groundwater flux was not considered in the nitrate dilution calculation; as such, the nitrate loading assessment is considered conservative.

The nitrate concentration at the downgradient property line of the 3 ha property, assuming eight proposed residential lots without pre-treatment, was computed to be 9.78 mg/L, which meets the regulatory requirement maximum of 10 mg/L.

Detailed Calculations are provided in Appendix F.

5.4.2 Phosphorous Impact Assessment

In accordance with the MECP D-5-5 and MECP Design Guidelines for Sewage Works (2008): Chapter 11 - Large Subsurface Sewage Disposal Systems, when the discharge of sewage effluent and a surface water feature are within 300 m of each, the potential impact to surface water needs to be evaluated.

Based on the grades on-site, it is anticipated runoff and shallow groundwater will flow to the north to northeast towards the tributary of Pine River located north adjacent to the site which ultimately flows to the Nottawasaga River. As the private septic systems will fall within 300 m of the water body, a phosphorous assessment in addition to the above nitrate assessment was considered applicable.

The phosphorous mass loading from on-site septic systems were calculated assuming:

- Each septic system will generate 1,000 L/day of effluent, for a total of 8,000 L/day for the site (8 private septic systems).
- A 15 mg/L phosphorous loading concentration.

Based on the above the phosphorous loading was estimated to be 5.5 kg/year per individual septic system or 43.8 kg/year for the entire proposed development (8 lots).

Based on the anticipated phosphorous loading as a result of the proposed on-site septic systems it is recommended phosphorous removal be incorporated into the proposed septic system. Conventional clean sand leaching beds can remove between 15 to 35% of phosphorous, and advance treatments can remove up to 95%. Assuming a conventional clean sand leaching bed is utilized (35% reduction in phosphorous concentration) the resultant phosphorous loading is estimated to be 3.6 kg/year per individual septic system or 28.5 kg/year for the entire proposed development (8 lots).

The Nottawasaga Valley Conservation Watershed notes 47 tonnes (47,754 kg/year) of phosphorous enters the Nottawasaga River each year. The estimated phosphorous load 28.5 kg/year resulting from the proposed on-site septic systems represents 0.06% of the total

phosphorous level entering the Nottawasaga River. As such, the proposed development is considered to be a small contributor of phosphorous to the Nottawasaga River and the increased phosphorous loading as a result of the proposed developed is considered negligible.

A further phosphorous assessment has been completed as part of Tatham's Storm Water Management Report for the pre- and post-development land use activities and is reported separately.

5.4.3 Summary and Next Steps

The nitrate impact assessment confirms eight individual residential lots are feasible.

The near surface sandy soils on-site are anticipated to have percolation rates of 8 to 20 min/cm.

Individual septic systems must be constructed above the annual high groundwater table. Groundwater is anticipated at depths as shallow as 0.2 m bgs (229.4 m asl). As such, raised septic systems will need to be considered if the minimum separation distance between the annual high groundwater table and the bottom of the septic system cannot be maintained, typically 0.9 m (OBC, 1997).

To reduce the anticipated phosphorous loadings it is recommended a convention clean sand filter bed be incorporated into the proposed septic system to achieve a 15-35% reduction in phosphorous.

It is noted septic systems will need to be designed by a licensed engineer or septic system designer in accordance with the applicable placement and sizing requirements as outlined in O.Reg. 358, O.Reg. 903, the Ontario Building Code, and other municipal considerations.

6 References

Chapman, L.J. and Putnam, D.F. 2007. The Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release – Data 228.

Ministry of Environment. March 2003. Stormwater Management Planning and Design Manual

New Brunswick Office of the Chief Medical Officer of Health (Public Health). Facts on Drinking Water, Coliform Bacteria – Total Coliforms & E.coli.

Ontario Building Code, O. Reg. 332/12, s.8.4.2.1. (1), 1997

Ontario Ministry of the Environment and Climate Change. Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines. June 2006

Toronto and Region Conservation Authority. Stormwater Management Criteria. August 2012, version 1.0.

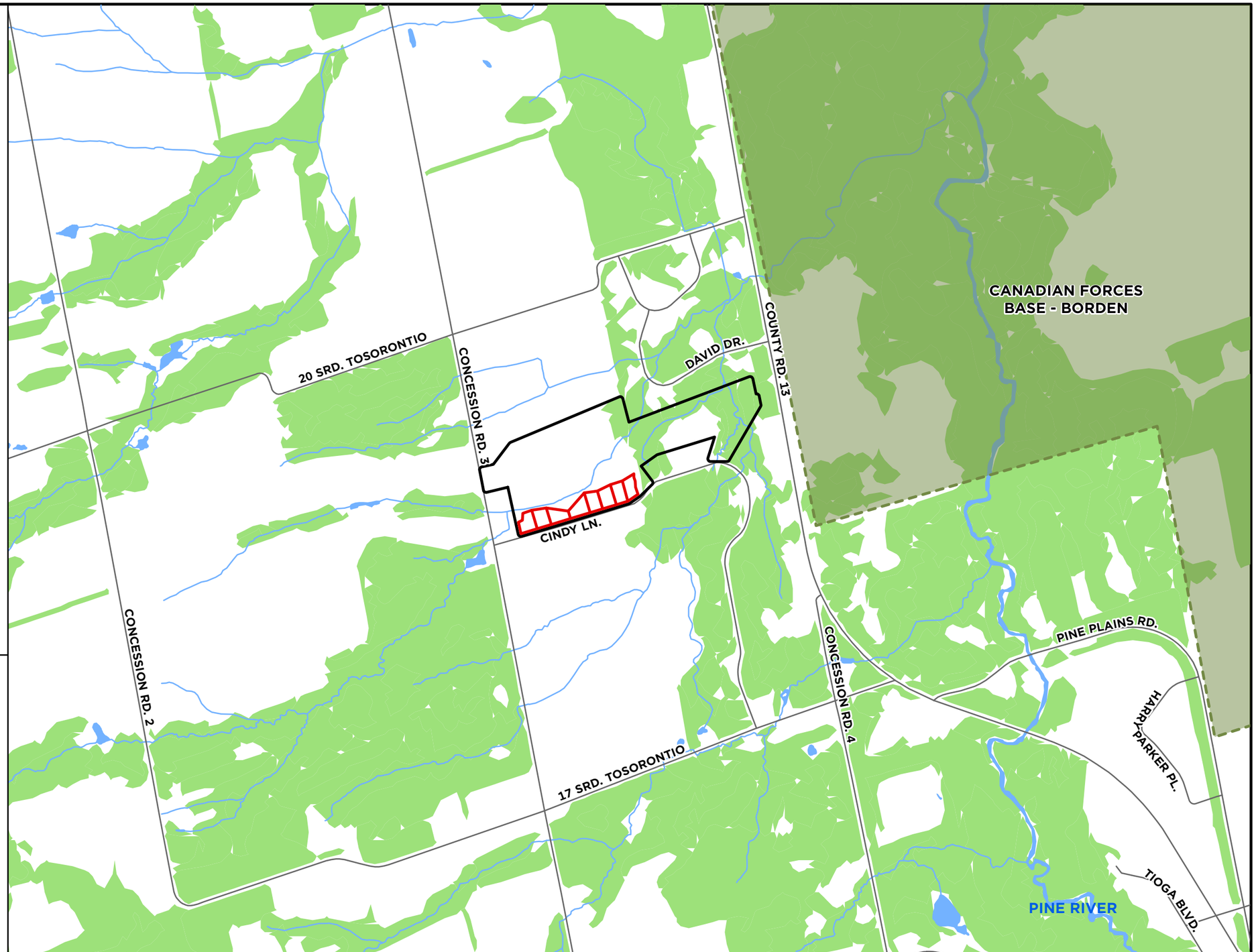
Ministry of Municipal Affairs and Housing Building and Development Branch, Ontario Building Code. MMAH Supplementary Standard SB-6. Percolation Time and Soil Descriptions. September 14, 2012.

N

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

LEGEND

- SITE
- SUBJECT LANDS
- ROAD
- WATERCOURSE
- WATERBODY
- WOODED AREA
- CANADIAN FORCES BASE - BORDEN



0 250 500 1,000 METERS

TATHAM ENGINEERING

45 CINDY LANE, ADJALA-TOSORONTIO
HYDROGEOLOGICAL SITE ASSESSMENT
SITE LOCATION PLAN

DWG. No. **FIG-1**

SCALE: 1:15,000	DRAWN: AO	DATE: AUG. 2024	JOB NO. 423499

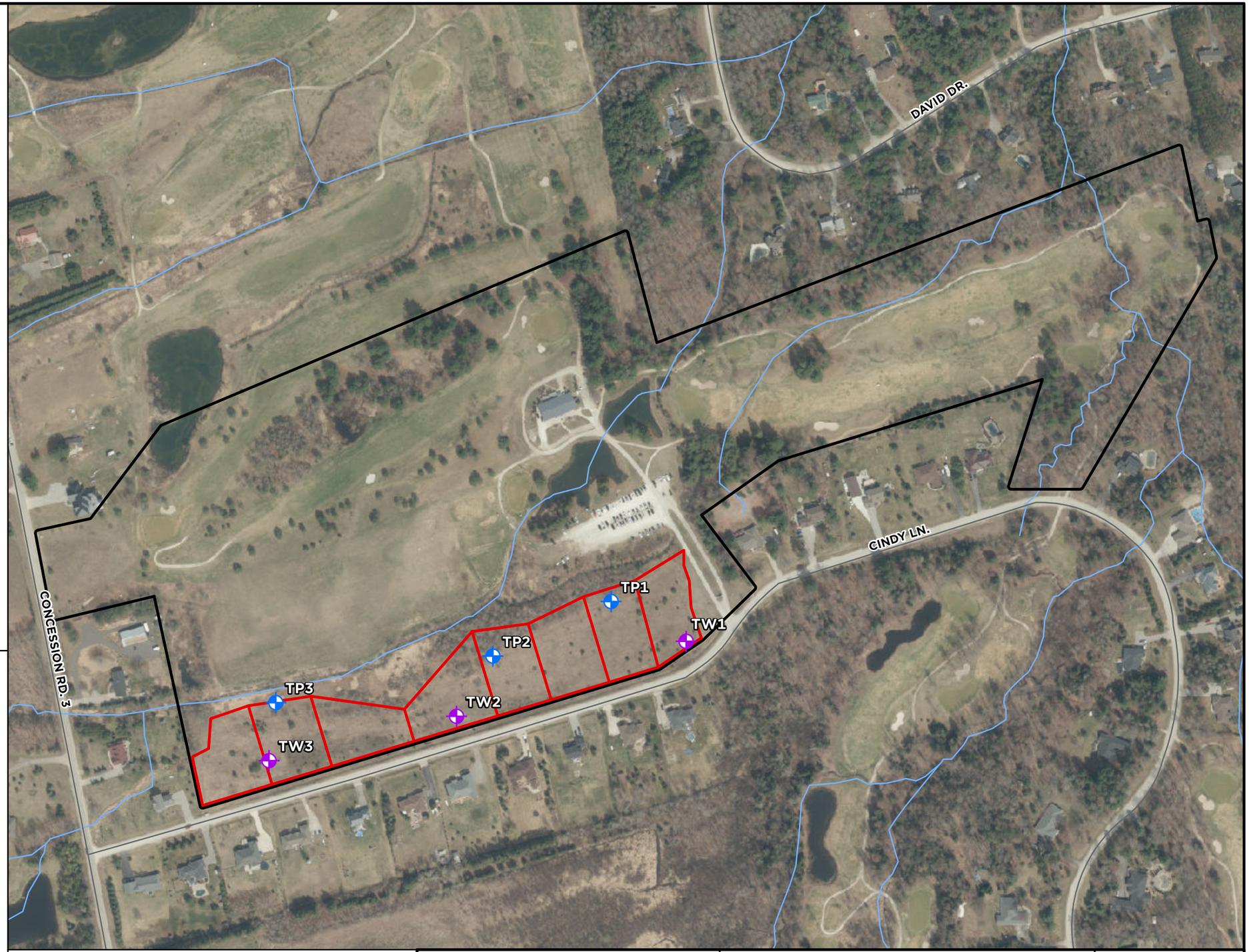
I:\2023 Projects\423499 - 45 Cindy Lane - Adjala-Tosorontio\GIS\423499 - 45 Cindy Lane - Adjala-Tosorontio\423499 - 45 Cindy Lane - Adjala-Tosorontio.aprx

N

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

LEGEND

- SITE
- SUBJECT LANDS
- TEST PIT LOCATIONS
- TEST WELL LOCATIONS
- ROAD
- WATERCOURSE



0 65 130 260 METERS

TATHAM ENGINEERING

45 CINDY LANE, ADJALA-TOSORONTIO
HYDROGEOLOGICAL SITE ASSESSMENT
MONITORING LOCATION PLAN

DWG. No. **FIG-2**

SCALE: 1:3,500 | DRAWN: AO | DATE: AUG. 2024 | JOB NO. 423499

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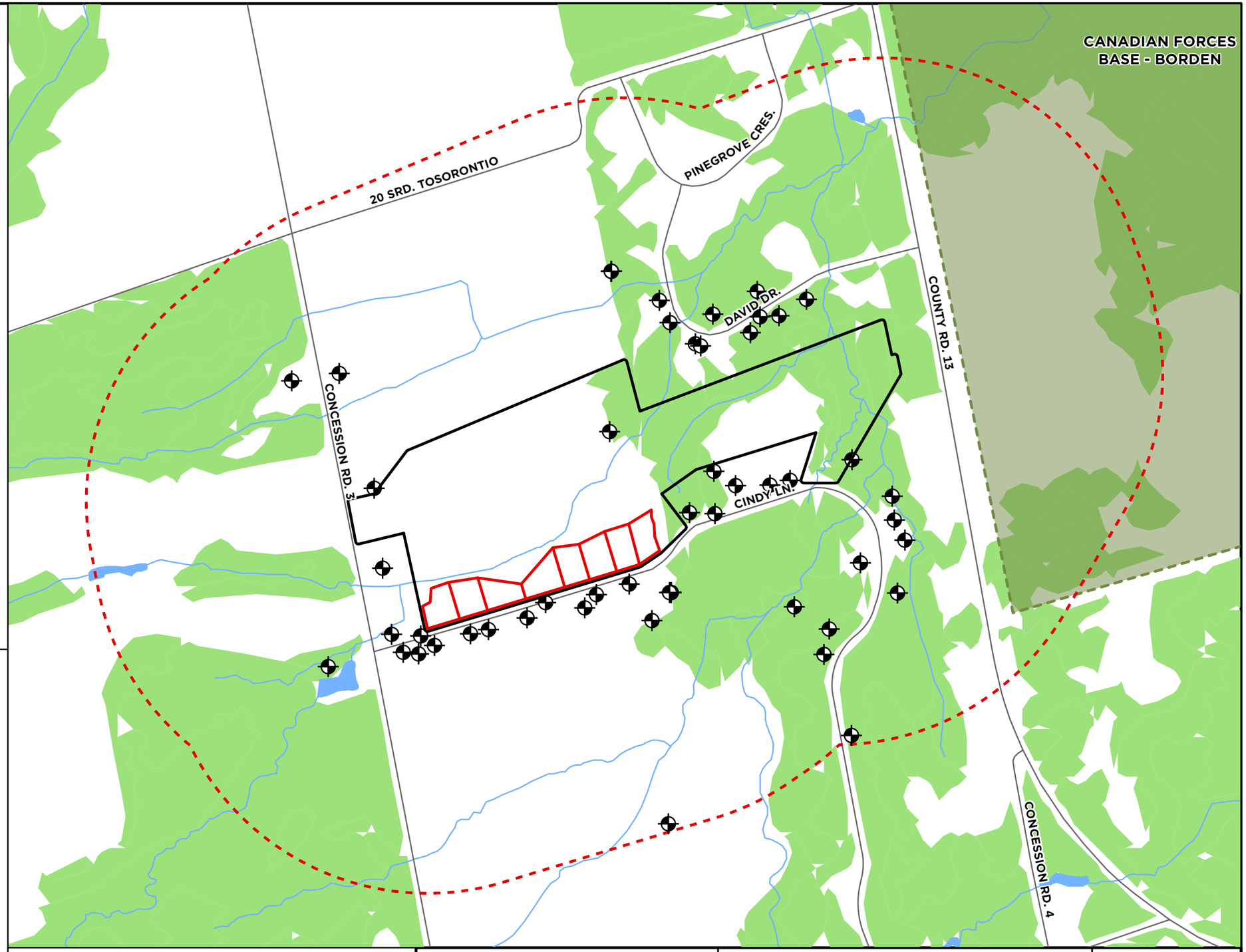
N

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

LEGEND

- SITE
- SUBJECT LANDS
- STUDY AREA (500m)
- MECP WATER WELLS
- ROAD
- WATERCOURSE
- WATERBODY
- WOODED AREA
- CANADIAN FORCES BASE - BORDEN



0 125 250 500 METERS

TATHAM ENGINEERING

45 CINDY LANE, ADJALA-TOSORONTIO
HYDROGEOLOGICAL SITE ASSESSMENT
MECP WATER WELL RECORDS

DWG. No. **FIG-3**

SCALE: 1:7,500 | DRAWN: AO | DATE: AUG. 2024 | JOB NO. 423499

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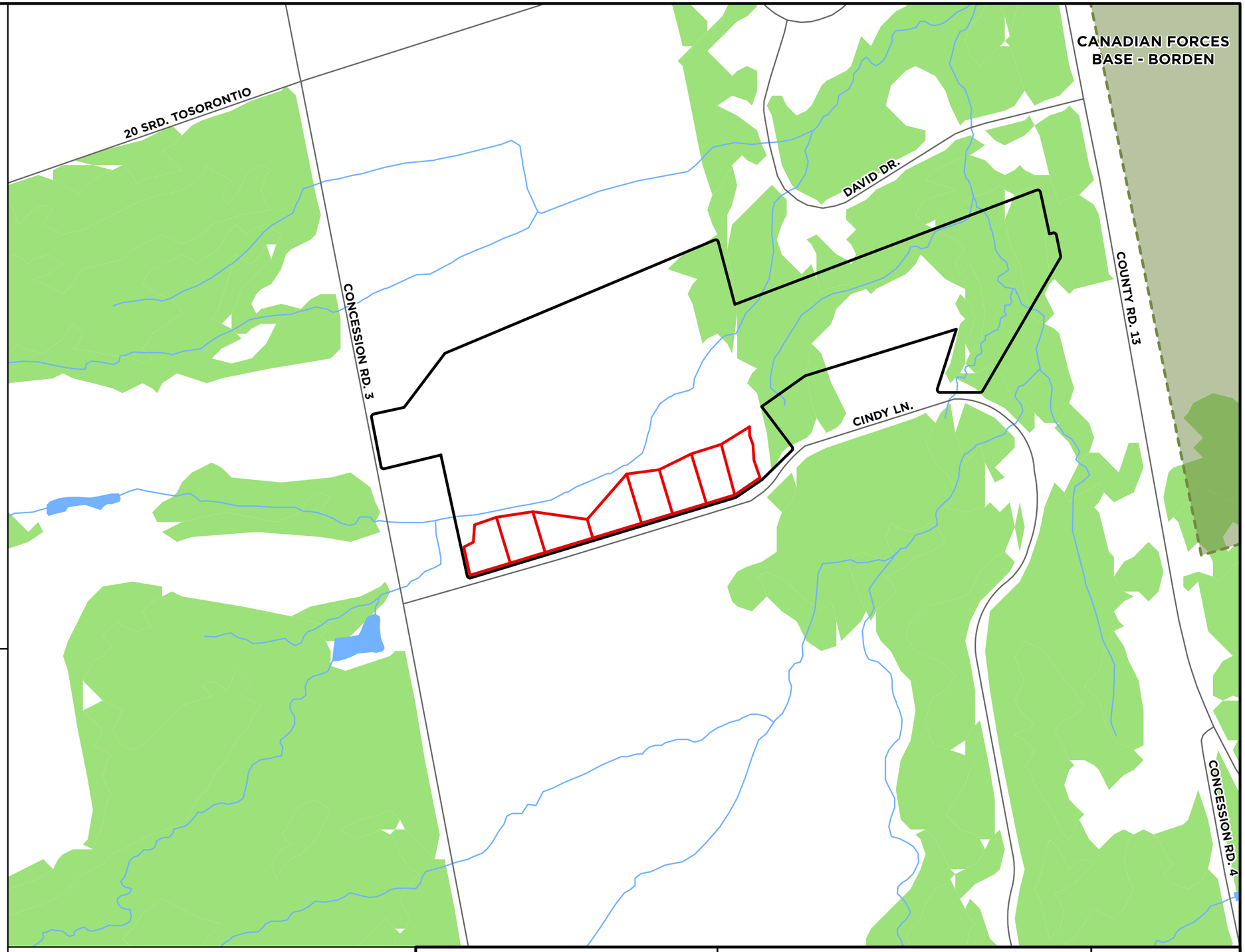
N

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

LEGEND

- SITE
- SUBJECT LANDS
- WELLHEAD PROTECTION AREA
- ROAD
- WATERCOURSE
- WATERBODY
- WOODED AREA
- CANADIAN FORCES BASE - BORDEN



0 100 200 400 METERS

TATHAM ENGINEERING

45 CINDY LANE, ADJALA-TOSORONTIO
HYDROGEOLOGICAL SITE ASSESSMENT
WELLHEAD PROTECTION AREA

DWG. No. **FIG-4**

SCALE: 1:6,000 | DRAWN: AO | DATE: AUG. 2024 | JOB NO. 423499

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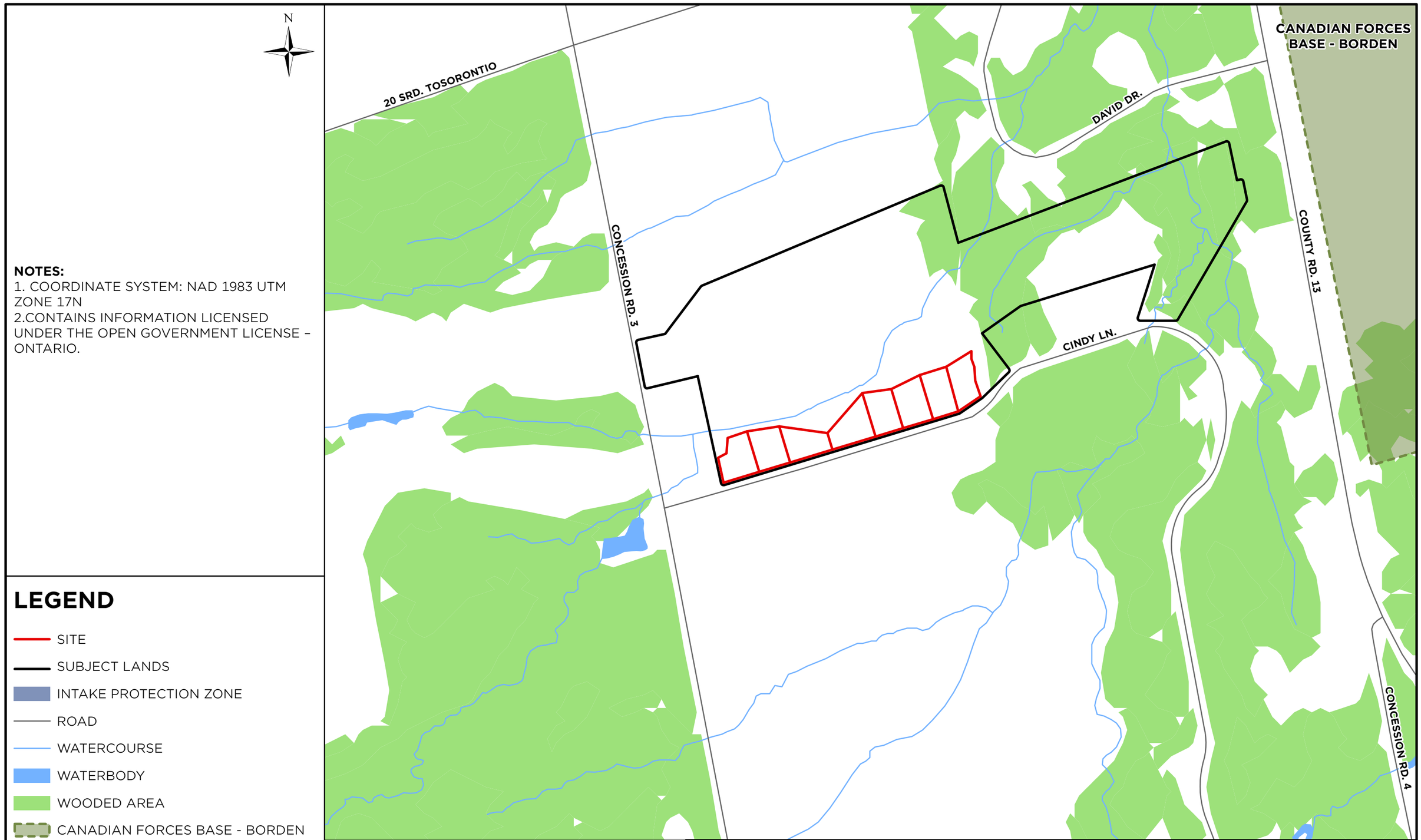

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- SITE
- SUBJECT LANDS
- INTAKE PROTECTION ZONE
- ROAD
- WATERCOURSE
- WATERBODY
- WOODED AREA
- CANADIAN FORCES BASE - BORDEN

0 100 200 400 METERS

TATHAM ENGINEERING

45 CINDY LANE, ADJALA-TOSORONTIO
HYDROGEOLOGICAL SITE ASSESSMENT
INTAKE PROTECTION ZONE

DWG. No. **FIG-5**

SCALE: 1:6,000 | DRAWN: AO | DATE: AUG. 2024 | JOB NO. 423499

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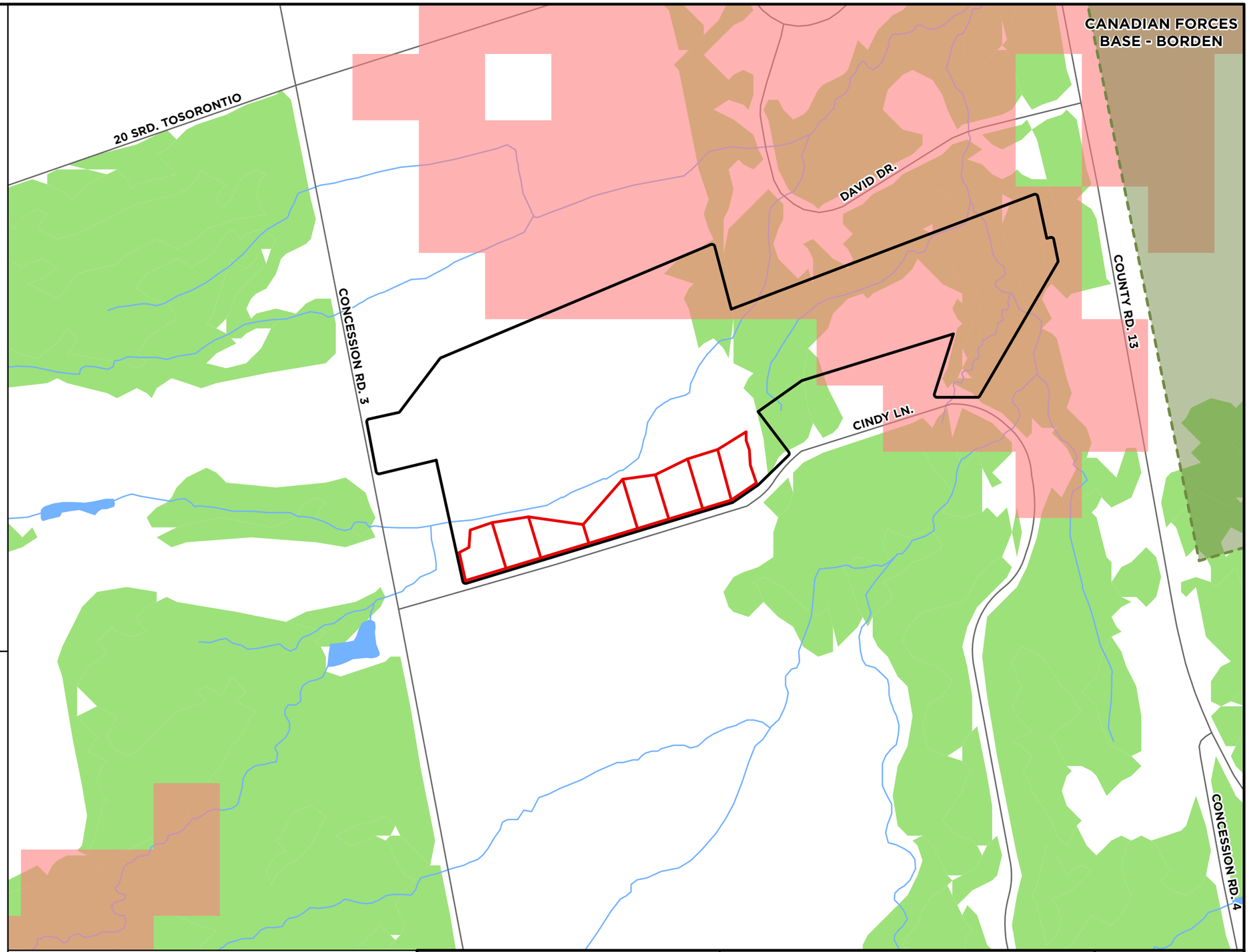
N

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

LEGEND

- SITE
- SUBJECT LANDS
- HIGHLY VULNERABLE AQUIFER
- ROAD
- WATERCOURSE
- WATERBODY
- WOODED AREA
- CANADIAN FORCES BASE - BORDEN



0 100 200 400 METERS

TATHAM ENGINEERING

45 CINDY LANE, ADJALA-TOSORONTIO
HYDROGEOLOGICAL SITE ASSESSMENT
HIGHLY VULNERABLE AQUIFER

DWG. No. **FIG-6**

SCALE: 1:6,000	DRAWN: AO	DATE: AUG. 2024	JOB NO. 423499

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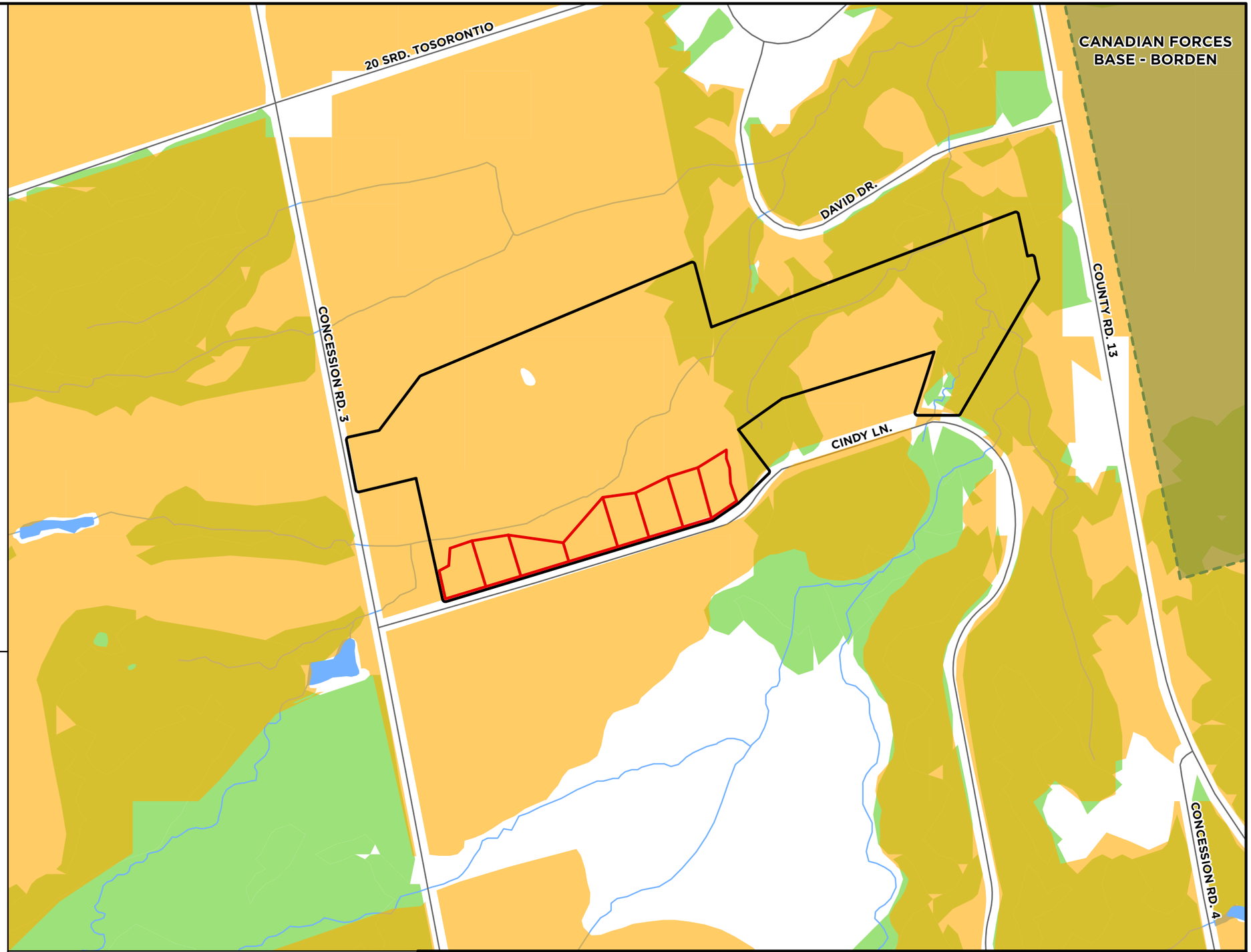
N

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

LEGEND

- SITE
- SUBJECT LANDS
- SIGNIFIGANT GROUNDWATER RECHARGE AREA
- ROAD
- WATERCOURSE
- WATERBODY
- WOODED AREA
- CANADIAN FORCES BASE - BORDEN



0 100 200 400 METERS

TATHAM ENGINEERING

45 CINDY LANE, ADJALA-TOSORONTIO
HYDROGEOLOGICAL SITE ASSESSMENT
SIGNIFICANT GROUNDWATER RECHARGE AREA

DWG. No. **FIG-7**

SCALE: 1:6,000 | DRAWN: AO | DATE: AUG. 2024 | JOB NO. 423499

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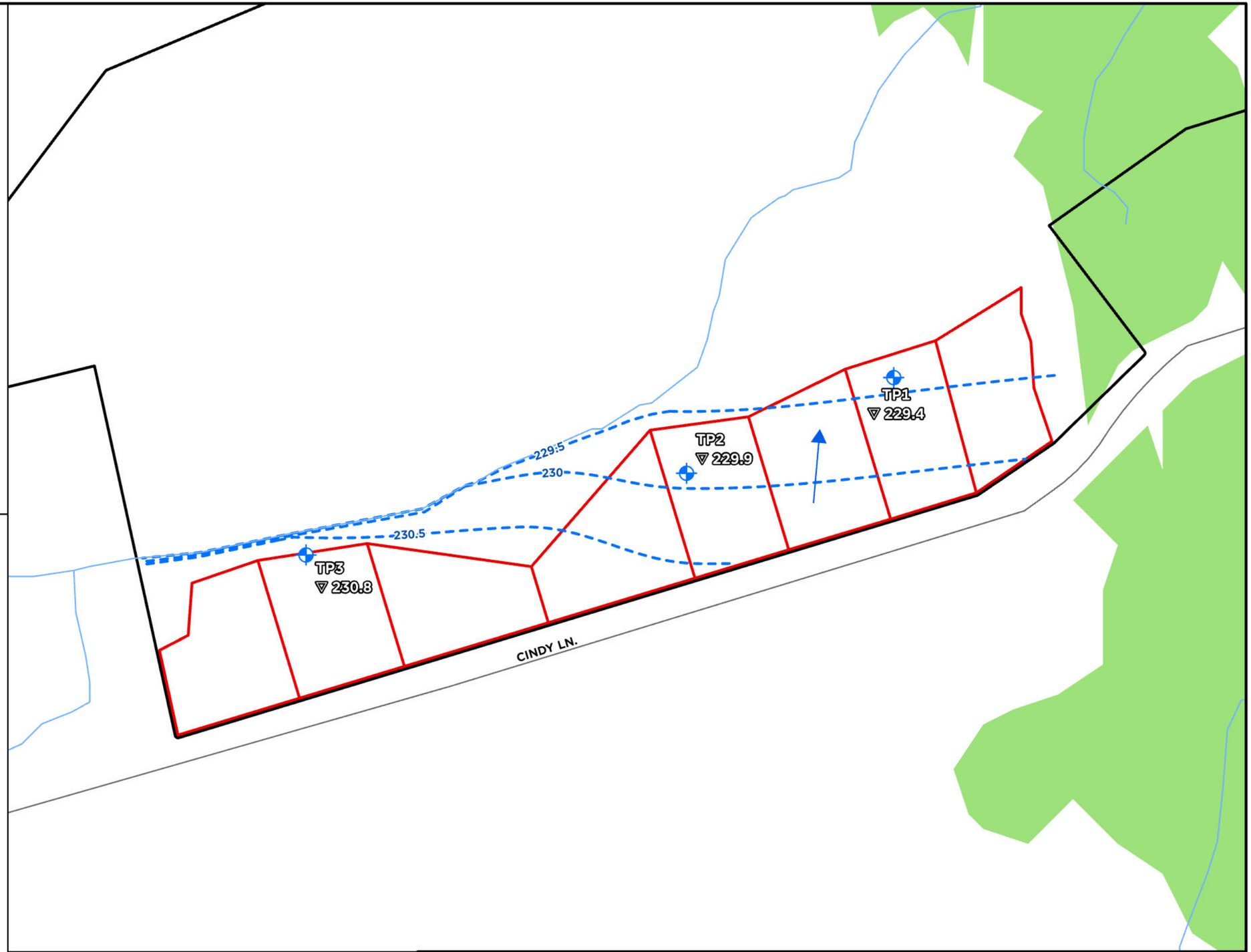
N

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

LEGEND

- SITE
- SUBJECT LANDS
- TEST WELLS
- ROAD
- WATERCOURSE
- WATERBODY
- WOODED AREA
- GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION
- GROUNDWATER ELEVATION (MEASURED MAY, 16, 2024)



0 30 60 120 METERS

TATHAM ENGINEERING

45 CINDY LANE, ADJALA-TOSORONTIO
HYDROGEOLOGICAL SITE ASSESSMENT
SHALLOW GROUNDWATER CONTOUR

DWG. No. **FIG-8**

SCALE: 1:2,000	DRAWN: AO	DATE: AUG. 2024	JOB NO. 423499

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Appendix A:
Water Balance Calculations

TATHAM ENGINEERING

Water Budget

Project Details

45 Cindy Lane	423499

Prepared By

SM	August 26, 2024

Water Balance Detials

Methodology	Thornthwaite Method
Climate Data & Source	Ruskview Climate Station Climate Normal Data for 1981 to 2010 (Environment Canada) 6147229
Thornthwaite Coefficient	1.043

Month	Temp (°C)	Precip (mm)	Heat Index	PET (mm)	Daylight Factor	Days	AET (mm)	Surplus (mm)	Deficit (mm)
Jan.	-7.3	85.6	0.0	0.0	0.77	31	0.0	85.6	0.0
Feb.	-6.8	69.8	0.0	0.0	0.87	28	0.0	69.8	0.0
Mar.	-1.9	68.0	0.0	0.0	1.00	31	0.0	68.0	0.0
Apr.	5.4	73.9	1.1	28.9	1.12	30	32.5	41.4	0.0
May	12.1	86.9	3.8	76.0	1.23	31	93.8	0.0	6.9
Jun.	17.4	90.8	6.6	112.4	1.29	30	145.0	0.0	54.2
Jul.	19.7	81.5	8.0	129.3	1.26	31	163.2	0.0	81.7
Aug.	18.8	79.4	7.4	113.8	1.17	31	132.7	0.0	53.3
Sep.	14.7	95.4	5.1	76.2	1.04	30	79.5	15.9	0.0
Oct.	7.9	83.3	2.0	36.2	0.92	31	33.1	50.2	0.0
Nov.	1.7	100.3	0.2	6.2	0.80	30	5.0	95.3	0.0
Dec.	-4.3	80.9	0.0	0.0	0.74	31	0.0	80.9	0.0
Total	**6.450**	**996**	**34.3**	**579.0**	**-**	**365**	**684.6**	**507.2**	**196.0**

Additional Notes

PET = Potential Evapotranspiration

AET = Actual Evapotranspiration

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

Project Details

45 Cindy Lane	423499

Prepared By

SM	26-Aug-24

Pre-Development Catchment Details

Area (ha)	3.00
Pervious Area (ha)	3.00
Impervious Area (ha)	0.00

Post Development Catchment Details

Area (ha)	3.00
Pervious Area (ha)	2.61
Impervious Area (ha)	0.39

Infiltration Factor	Pre-Development			Post Development		
	Pervious	Impervious	Total	Pervious	Impervious	Total
Topography	0.300	0.0		0.300	0.0	
Soil	0.200	0.0		0.200	0.0	
Land Cover	0.100	0.0		0.100	0.0	
Infiltration Factor	0.600	0.0		0.600	0.0	

Water Budget	Pervious	Impervious	Total	Pervious	Impervious	Total
Water Surplus (m^3)	15,216	0	15,216	13,238	1,978	15,216
Infiltration (m^3)	9,129	0	9,129	7,943	0	7,943
Runoff (m^3)	6,086	0	6,086	5,295	1,978	7,273
Reduction in Infiltration Volume (m^3)						**1,187**
Reduction in Infiltration Volume (%)						**13.0**

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

Appendix B:
MECP Water Well Records

Township Con Lot	UTM	Date Centr	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
ADJALA TOWNSHIP	17 581358 4897991 W	2008/03 7219	6	FR 0151 GS 0230	13/70/2/1:0	PS		7103710 (Z76302) A071841	BRWN FSND SILT 0012 GREY FSND CLAY 0020 GREY FSND SILT 0050 GREY CLAY FSND 0110 GREY CLAY SAND GRVL 0152 GREY GRVL SILT FSND 0154 GREY CLAY GRVL MSND 0230 GREY LMSN 0253
TOSORONTIO TOWNSHIP 03 014	17 581912 4898302 W	2005/10 7178						5740233 (Z38644) A	
TOSORONTIO TOWNSHIP 03 016	17 581994 4898642 W	1986/12 4919	30	UK 0010	10/22//:30	DO		5721682 (NA)	BRWN LOAM HARD 0001 BRWN SAND LOOS 0020 GREY CLAY HARD 0028
TOSORONTIO TOWNSHIP 03 016	17 582035 4898596 W	1986/12 4919	30	UK 0010	10/22//:30	DO		5721681 (NA)	BRWN LOAM 0001 BRWN SAND LOOS 0020 GREY CLAY HARD 0028
TOSORONTIO TOWNSHIP 03 018	17 581594 4898054 W	2007/02 7219	6	FR 0118	17/29/12/3:0	DO		7102539 (Z76195) A071862	BRWN FSND LOOS 0020 GREY FSND SILT 0030 GREY CLAY SILT SOFT 0050 GREY CLAY SILT SOFT 0085 GREY FSND CLAY LYRD 0105 GREY FSND LOOS 0121 BRWN
TOSORONTIO TOWNSHIP 03 019	17 581914 4898222 W	2005/05 7088	6.26	FR 0007 FR 0136 FR 0109	25/70/10/1:5	DO	0140 3	5739749 (Z25974) A025507	SAND 0017 GREY CLAY SILT 0035 GREY SILT CLAY SAND 0088 GREY CLAY 0095 GREY SILT SAND 0102 GREY SILT CLYY 0109 GREY SILT SNDY 0131 GREY CLAY SNDY 0136 BRWN SAND 0143

Township Con Lot	UTM	Date Centr	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
TOSORONTIO TOWNSHIP 03 019	17 581866 4898224 W	2005/04 7088	6.26	FR 0010 FR 0111 FR 0138	17/63/10/1:1 2	DO	0139 3	5739684 (Z25962) A016524	BRWN SAND 0018 GREY SILT 0038 GREY CLAY SILT 0088 GREY SILT SAND 0103 GREY SILT CLAY SAND 0108 BRWN SAND SILT 0129 GREY CLAY SAND 0134 GREY SAND SILT 0138 BRWN SAND 0142
TOSORONTIO TOWNSHIP 03 019	17 581354 4897957 W	2005/10 7088	6.26	FR 0006 FR 0125	8/52/6/1:1	DO	0127 3	5740384 (Z33770) A025519	BRWN SAND 0017 GREY SILT SNDY 0037 GREY SAND SLTY 0044 GREY SILT SAND CLAY 0073 GREY CLAY 0094 GREY SILT CLYY SAND 0107 GREY SAND CLYY 0125 GREY SAND 0130
TOSORONTIO TOWNSHIP 03 019	17 581953 4898275 W	2005/04 7088	6.26	FR 0006 FR 0084 FR 0116	19/37/10/1:0	DO	0123 3	5739683 (Z25963) A016525	BRWN SAND 0006 GREY SAND 0027 GREY SILT SAND 0035 GREY CLAY SILT SAND 0074 GREY SAND SILT 0084 BRWN SAND 0093 GREY SAND SILT 0116 BRWN SAND 0127
TOSORONTIO TOWNSHIP 03 019	17 582189 4898129 W	2005/04 7088	6.26	FR 0010 FR 0292 FR 0109	19/40/10/1:	DO	0110 3	5739748 (Z25960) A016527	YLLW SAND 0016 GREY SAND 0036 GREY CLAY SLTY 0062 GREY SILT 0089 GREY FSND 0096 GREY SLTY SNDY 0109 BRWN SAND 0113
TOSORONTIO TOWNSHIP 03 019	17 582018 4898276 W	2005/04 7088	6.26	FR 0008	18/21/10/1:0	DO	0122 3	5739682 (Z25964) A016526	BRWN SAND 0008 GREY SAND 0016 GREY SILT SAND CLAY 0023 GREY CLAY SILT 0054 GREY SILT SAND 0102 GREY CLAY SILT 0108 GREY SILT CLAY SAND 0112 GREY

Township Con Lot	UTM	Date Centr	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
TOSORONTIO TOWNSHIP 03 019	17 581325 4897960 W	2006/07 7088	6.26	0007 0129	9/53/5/1:21	DO	0129 3	5741080 (Z41701) A031193	BRWN SAND SILT 0015 GREY SAND SLTY 0045 GREY SILT CLAY 0078 GREY CLAY 0097 GREY SILT CLAY SAND 0106 GREY SAND CLYY 0129 GREY SAND 0132
TOSORONTIO TOWNSHIP 03 019	17 582056 4898285 W	2005/09 7088	6.26	FR 0010 0082 0123	25/40/12/1:0	DO	0123 3	5740393 (Z33763) A025515	BRWN SAND 0019 GREY SILT CLYY 0034 GREY CLAY SLTY 0069 GREY SILT SNDY 0081 BRWN SAND 0092 GREY CLAY SLTY SAND 0116 GREY SAND SLTY 0123 GREY SAND 0126
TOSORONTIO TOWNSHIP 03 019	17 581668 4898044 W	2005/04 7088	6.26	FR 0007 FR 0132	14/66/7/1:0	DO	0132 4	5739686 (Z25961) A016523	BRWN SAND SILT 0018 GREY CLAY SILT 0078 GREY SILT CLAY 0083 GREY SILT 0101 GREY SAND SILT 0123 GREY CLAY SAND 0131 GREY SAND 0136
TOSORONTIO TOWNSHIP 03 019	17 581286 4898119 W	2008/07 4645	6.25	FR 0120	19/65/5/2:	DO	0116 4	7111941 (Z82154) A071366	BLCK LOAM SOFT 0001 BRWN SAND CLAY HARD 0008 BRWN SAND SILT SOFT 0014 BRWN SAND SILT LYRD 0115 BRWN SAND GRVL LOOS 0121
TOSORONTIO TOWNSHIP 03 019	17 582249 4898255 W	2006/04 7088	6.26	FR 0007 FR 0080 FR 0118	16/55/10/1:3 7	DO	0120 3	5740925 (Z33778) A031187	BRWN SAND 0013 GREY SAND 0019 GREY SAND 0051 GREY CLAY 0071 GREY SILT SAND 0080 GREY SAND SILT 0084 GREY CLAY SILT 0111 GREY SAND SILT 0118
TOSORONTIO TOWNSHIP 03 019	17 581752 4898089 W	2005/07 7088	6.26	FR 0007 FR 0040	25/48/10/1:1	DO	0135 3	5739951 (Z33761) A025513	BRWN SAND SILT 0025 GREY SILT SNDY 0043 GREY CLAY 0048 GREY SILT SAND 0054 GREY CLAY SAND 0098 GREY SILT SNDY 0105 GREY SAND SLTY CLAY 0117 GREY FSND SILT 0122 GREY SAND 0140

Township Con Lot	UTM	Date Centr	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
TOSORONTIO TOWNSHIP 03 019	17 581452 4897995 W	2006/07 7088	6.26	0007 0089 0170	15/73/5/1:10	DO	0171 3	5740994 (Z41700) A031194	BRWN SAND SILT 0025 GREY SILT SNDY 0034 GREY CLAY SLTY 0089 GREY SILT SNDY 0117 GREY CLAY SAND 0121 BRWN SAND SLTY 0124 GREY SILT SNDY GRVL 0170 GREY SAND 0174
TOSORONTIO TOWNSHIP 03 019	17 581486 4898003 W	2006/07 7088	6.26	0007 0084 FR 0119	14/62/5/1:17	DO	0119 3	5740993 (Z41713) A031195	BRWN SAND SILT 0011 GREY SAND SILT 0023 GREY SILT SAND CLAY 0033 GREY CLAY CLAY SNDY 0039 GREY SILT SNDY SLTY 0049 GREY CLAY SNDY 0079 GREY SAND SLTY SAND 0089 GREY CLAY SLTY
TOSORONTIO TOWNSHIP 03 019	17 581559 4898025 W	2005/05 7088	6.26	FR 0004 FR 0038	13/55/5/1:4	DO	0125 3	5739751 (Z25975) A025504	BRWN SAND 0019 GREY CLAY SLTY 0045 GREY SILT SAND CLAY 0056 GREY CLAY SLTY 0077 GREY SILT 0088 GREY CLAY SLTY 0106 GREY SILT SNDY 0117 GREY SILT CLAY SAND 0125 BRWN SAND 0128
TOSORONTIO TOWNSHIP 03 019	17 581831 4898073 L	1987/07 4919	30	UK 0010	10/26//:30	DO		5722417 (05081)	BRWN LOAM HARD 0001 BRWN SAND LOOS 0028
TOSORONTIO TOWNSHIP 03 019	17 581831 4898073 L	1987/07 4919	30	UK 0010	10/20//1:0	DO		5722415 (05080)	BRWN SAND PCKD 0028

Township Con Lot	UTM	Date Centr	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
TOSORONTIO TOWNSHIP 03 020	17 581718 4898680 L	1985/08 4919	30	UK 0010	10/20//:30	DO		5720643 ()	BRWN LOAM HARD 0001 BRWN SAND LOOS 0020 GREY CLAY PCKD 0024
TOSORONTIO TOWNSHIP CON 02 019	17 581183 4897933 W	2002/09 7088	6	UK 0010 FR 0118	11/105/13/1:0	DO	0119 4	5737261 (252305)	BRWN SAND SLTY 0010 GREY SAND SLTY 0026 GREY CLAY SLTY 0038 GREY SILT FSND CLAY 0074 GREY SILT SNDY GRVL
TOSORONTIO TOWNSHIP CON 02 020	17 581114 4898473 W	1974/08 1830	30 24	FR 0018	13/15//1:0	DO		5711528 ()	LOAM SNDY DNSE 0002 BRWN CLAY SNDY PCKD 0013 BRWN FSND LOOS 0018 GREY CLAY PCKD 0029
TOSORONTIO TOWNSHIP CON 03 017	17 581852 4898753 W	1987/12 1413	6	FR 0135	9/120/5/5:40	DO	0131 4	5722862 (24815)	BRWN SAND LOOS 0017 GREY CLAY SNDY 0115 GREY CLAY DNSE 0128 BRWN GRVL SAND LOOS 0136 GREY CLAY SLTY 0148 BRWN SAND PCKD 0156 GREY CLAY DNSE 0164 GREY HPAN HARD 0180
TOSORONTIO TOWNSHIP CON 03 018	17 581826 4897636 W	2002/03 7088	6	UK 0012 UK 0110 FR 0202	12/93/9/7:0	DO		5736747 (230315)	YLLW SAND 0012 GREY SAND 0021 GREY CLAY SNDY 0035 GREY SILT SNDY 0049 GREY SILT CLYY 0082 GREY SAND SILT
TOSORONTIO TOWNSHIP CON 03 018	17 582072 4897646 W	2001/08 7088	6	UK 0017 UK 0086 FR 0201	14/155/13/2:0	DO	0201 5	5736467 (230302)	BRWN SAND 0017 GREY CLAY SLTY 0043 GREY SAND 0086 BRWN SAND 0104 BRWN SAND SLTY 0118 GREY SILT SNDY 0159 GREY SAND SILT 0164 GREY SAND SLTY
TOSORONTIO TOWNSHIP CON 03 018	17 582172 4897803 W	2003/03 7088	6	FR 0016 FR 0077 FR 0116	13/43/25/1:0	DO	0118 5	5737650 (246071)	YLLW SAND 0016 GREY SAND 0035 GREY SAND CLYY 0043 GREY CLAY SNDY 0059 GREY CLAY SILT 0077 GREY SAND 0079 GREY CLAY 0090 GREY SILT SNDY 0096 GREY FSND SLTY 0116 BRWN SAND 0123

Township Con Lot	UTM	Date Centr	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
TOSORONTIO TOWNSHIP CON 03 019	17 581384 4897973 W	2009/11 7088	6.25	FR 0152	7/21/10/1:0	DO	0152 3	7137336 (Z102991) A089470	BRWN SAND SILT 0018 GREY SILT SAND 0042 GREY CLAY SILT 0078 GREY SILT SAND 0113 GREY CLAY SAND 0122 GREY SILT SAND 0131 GREY SAND SILT CLAY 0152 GREY SAND 0155
TOSORONTIO TOWNSHIP CON 03 019	17 582064 4898046 W	2000/02 2576	6	FR 0196	22/154/4/6:	DO	0191 3	5734946 (214139)	LOAM 0001 BRWN SAND 0010 GREY SAND 0033 GREY CLAY SLTY 0099 GREY SILT 0116 GREY SAND GRVL WBRG 0131 GREY CLAY SLTY 0175 GREY SILT GRVL WBRG 0196
TOSORONTIO TOWNSHIP CON 03 019	17 581828 4898073 L	2001/07 7088	6	FR 0087	7/64/12/1:0	DO	0087 3	5736241 (230297)	BLCK LOAM SAND FILL 0003 BRWN SAND SLTY 0013 GREY CLAY SLTY STNS 0026 GREY FSND SLTY 0067 GREY FSND SILT 0078 GREY FSND SILT CLAY 0087 GREY FSND 0090 GREY SAND SILT CLAY 0092
TOSORONTIO TOWNSHIP CON 03 019	17 581795 4898020 W	2000/02 1663	6	FR 0199	14/21/5/6:	DO IR	0199 7	5735844 (213478)	BRWN PEAT 0004 GREY MSND FSND LOOS 0018 BLUE CLAY SILT SOFT 0093 BRWN FSND 0124 BRWN MSND 0149 BRWN MSND 0154 BLUE CLAY GRVL SAND 0157 BRWN MSND SILT 0185 BLUE CLAY GRVL 0199 GREY GRVL SAND 0218

Township Con Lot	UTM	Date Centr	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
TOSORONTIO TOWNSHIP CON 03 019	17 581303 4897994 W	2001/07 7088	6	FR 0126	3/71/9/1:45	DO	0126 4	5736243 (230298)	BRWN SAND SLTY 0010 GREY SAND SLTY 0020 GREY CLAY 0025 GREY CLAY SLTY 0034 GREY SILT FSND 0044 GREY CLAY SLTY SAND 0087 GREY GRVL CLAY 0125 GREY SAND 0130 GREY SILT 0132
TOSORONTIO TOWNSHIP CON 03 019	17 582130 4898004 W	2003/02 7088	6 6	FR 0013 FR 0083 FR 0132 FR 0232	15/121/15/1: 0	DO		5737651 (252316)	BRWN SAND 0013 GREY SAND 0022 GREY SAND SLTY 0035 GREY SAND CLYY 0064 GREY CLAY SAND GRVL 0083 GREY SAND SILT 0091 GREY SAND SLTY 0132 BRWN SAND 0145 GREY SAND SLTY 0167 GREY GRVL SLTY SNDY 0226 BLUE LMSN 0234
TOSORONTIO TOWNSHIP CON 03 019	17 582120 4897956 W	2003/03 7088	6	FR 0018	18/38/25/1:0	DO	0131 4	5737800 (246070)	YLLW SAND SILT 0016 GREY SAND SILT 0041 GREY CLAY SILT 0076 GREY SILT CLAY 0097 GREY CLAY SLTY 0099 GREY SILT SNDY 0112 GREY FSND SILT 0117 GREY SILT FSND 0121 BRWN SAND 0135
TOSORONTIO TOWNSHIP CON 03 019	17 581831 4898073 L	1990/06 4919	30	UK 0012	12/22/5/1:	DO		5727377 (62591)	BRWN SAND PCKD 0028

Township Con Lot	UTM	Date Centr	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
TOSORONTIO TOWNSHIP CON 03 019	17 581831 4898073 L	1995/09 4645	6	FR 0057	4/40/25/1:0	DO	0053 4	5731988 (163415)	BRWN SAND SILT LOOS 0002 BLCK SAND LOOS 0012 BLCK CLAY SAND SOFT 0022 GREY CLAY SILT LYRD 0045 BLCK SAND LOOS 0057 GREY CLAY SILT DNSE 0062 GREY CLAY SOFT 0080
TOSORONTIO TOWNSHIP CON 03 019	17 581831 4898073 L	1996/09 6915	6	FR 0103	70/85/12/3:0	DO	0097 4	5732512 (163211)	BRWN SAND SILT LOAM 0001 BRWN SAND SILT STNS 0028 BLUE CLAY SAND SOFT 0055 BLUE SILT SAND MSND 0080 BRWN SAND SILT STNS 0088 BRWN FSND SILT SAND 0105
TOSORONTIO TOWNSHIP CON 03 019	17 581690 4898069 W	2005/10 7088	6.26	FR 0013 FR 0112 FR 0130	18/48/5/1:19	DO	0134 3	5740624 (Z33771) A031184	BRWN SAND 0017 GREY SAND SLTY 0021 GREY CLAY SLTY 0076 GREY CLAY SILT 0082 GREY SILT SAND 0103 GREY SAND SILT 0118 GREY SILT 0124 GREY CLAY SLTY
TOSORONTIO TOWNSHIP CON 03 019	17 582273 4898172 W	2004/09 7088	6.26	FR 0160	12/29/10/1:27	DO	0161 4	5739289 (Z16615) A000728	BRWN SAND 0012 GREY SAND 0023 GREY CLAY SLTY 0053 GREY SILT 0065 GREY SILT SNDY SLTY 0081 BRWN SAND 0085 GREY SILT SNDY SLTY 0125 GREY SAND SLTY CLAY 0160 GREY SAND GRVL 0165
TOSORONTIO TOWNSHIP CON 03 019	17 582253 4898210 W	2004/07 7088	6.26	0020 0078 0116	22/39/10/1:5	DO	0120 3	5738956 (Z16603) A016513	BRWN SAND 0012 GREY SAND 0020 GREY SAND SLTY CLAY 0049 GREY CLAY SILT 0073 GREY SILT SNDY 0078 GREY SAND SILT 0084 GREY CLAY SLTY 0098 GREY SILT SNDY 0116 BRWN SAND 0123

Township Con Lot	UTM	Date Centr	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
TOSORONTIO TOWNSHIP CON 03 019	17 582259 4898072 W	2004/08 7088	6.26	0006 0082 0123	19/59/10/1:2 0	DO	0125 3	5739106 (Z16607) A016514	BRWN SAND 0013 GREY SAND 0028 GREY CLAY SLTY SAND 0040 GREY CLAY 0063 GREY SILT SNDY 0073 GREY SAND SLTY 0123 BRWN SAND 0128
TOSORONTIO TOWNSHIP CON 03 019	17 582173 4898324 W	2004/09 7088	6.26	FR 0012 FR 0090 FR 0128	24/53/10/1:2	DO	0131 3	5739286 (Z16612) A016520	BRWN SAND 0012 GREY SAND 0020 GREY SILT SAND CLAY 0034 GREY CLAY SLTY 0058 GREY SILT CLAY 0078 GREY SILT SNDY 0105 GREY SILT CLYY SNDY 0112 GREY SILT FSND 0128 GREY SAND 0134
TOSORONTIO TOWNSHIP CON 03 020	17 581270 4898270 W	1990/10 1583	6 5	FR 0172	30//8/1:0	DO	0169 3	5727430 (90390)	SAND 0014 BRWN CLAY 0020 FSND 0044 SILT CLAY 0080 CLAY GRVL 0145 CLAY 0168 CSND 0172 CLAY 0185
TOSORONTIO TOWNSHIP CON 03 020	17 581718 4898680 L	1991/05 4778	6	FR 0116	22/95/5/3:0	DO	0117 5	5728319 (107549)	BRWN SAND 0014 BLUE CLAY SOFT 0068 BLUE CLAY SILT 0116 BRWN FSND 0122
TOSORONTIO TOWNSHIP CON 03 020	17 581981 4898564 W	1991/05 4778	6	FR 0075	23/50/12/1:0	DO	0077 5	5728320 (107548)	BRWN SAND 0014 BLUE CLAY SOFT 0057 BLUE CLAY SAND LYRD 0075 FSND 0082

Township Con Lot	UTM	Date Centr	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
TOSORONTIO TOWNSHIP CON 03 020	17 581999 4898594 W	4778	6	FR 0066	23/50/10/2:0	DO	0077 6	5728763 (107555)	BRWN SAND 0018 BLUE CLAY SAND 0052 BLUE CLAY SOFT 0066 BRWN SAND CLAY LYRD 0083
TOSORONTIO TOWNSHIP CON 03 020	17 581887 4898539 W	1992/01 4778	6	FR 0113	23/50/20/2:0	DO	0115 5	5728871 (107572)	BRWN LOAM 0002 BRWN SAND 0014 BLUE CLAY SOFT 0052 BLUE SILT CLAY 0067 BLUE CLAY SILT SAND 0087 BLUE CLAY SOFT 0102 BLUE CLAY SAND 0113 BRWN FSND CLN 0120
TOSORONTIO TOWNSHIP CON 03 020	17 581715 4898377 W	2004/06 7088	6.26	FR 0116	23/27/31/1:5 0	CO	0135 5 0141 5	5738906 (Z00828) A000725	BRWN SAND 0006 BRWN CLAY SLTY 0011 GREY CLAY SLTY SAND 0018 GREY SILT CLYY SAND 0047 GREY SILT SNDY 0065 GREY SILT CLYY 0095 GREY SILT SNDY 0116 BRWN SAND 0146
TOSORONTIO TOWNSHIP CON 03 020	17 581718 4898680 L	1990/05 5206			37/46/10/4:0	DO	0123 3	5726684 (70641)	BRWN SAND 0037 BRWN CLAY SNDY 0118 CLAY SAND 0126
TOSORONTIO TOWNSHIP CON 03 020	17 581204 4898487 W	1989/01 4919	30	UK 0020	15/26/5/1:0	DO		5724928 (47149)	BRWN SAND LOOS 0020 GREY CLAY HARD 0030

Township Con Lot	UTM	Date Centr	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
TOSORONTIO TOWNSHIP CON 03 020	17 581718 4898680 L	4778	6	FR 0116	27/35/12/1:0	DO	0119 6	5724841 (55218)	BRWN SAND 0018 BLUE CLAY SOFT 0036 BLUE CLAY SAND SILT 0072 BLUE CLAY SOFT 0090 BLUE CLAY SILT SOFT 0110 FSND CLAY 0116 MSND CLN WBRG 0125
TOSORONTIO TOWNSHIP CON 03 020	17 581877 4898543 W	4778	6	FR 0102	27/80/12/1:0	DO	0107 6	5724844 (55215)	LOAM 0003 BRWN SAND 0021 BLUE CLAY SOFT 0035 BLUE CLAY SILT 0063 BLUE CLAY SOFT 0092 BLUE SILT CLAY HARD 0100 BLUE SILT CLAY SOFT 0102 FSND WBRG 0113
TOSORONTIO TOWNSHIP CON 03 020	17 581809 4898625 W	1989/03 4778	6	FR 0118	24/90/10/1:0	DO	0120 5	5724843 (55214)	LOAM 0002 BRWN SAND 0015 BRWN CLAY SAND 0022 BLUE CLAY SAND 0070 BLUE CLAY SOFT 0111 FSND CMTD 0118 FSND WBRG 0125
TOSORONTIO TOWNSHIP CON 03 020	17 581829 4898583 W	1989/03 4778	6	FR 0118	24/37/12/1:0	DO	0118 5	5724835 (55213)	LOAM 0002 BRWN SAND 0015 BRWN CLAY SAND 0022 BLUE CLAY SAND 0070 BLUE CLAY SOFT 0111 FSND CMTD 0118
TOSORONTIO TOWNSHIP CON 04 020	17 581910 4898599 W	1989/10 4778	6	FR 0132	24/70/10/2:0	DO	0132 5	5726225 (55238)	BRWN SAND 0018 BLUE CLAY 0032 BLUE CLAY SILT 0090 BLUE SILT 0118 BLUE CLAY CMTD SAND 0132 BRWN SAND 0137

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	

Ontario Ministry of the Environment

Well Tag Number (Place sticker and print number below): A000725 / A000725

Well Record

Regulation 903 Ontario Water Resources Act

page 1 of 1

Instructions for Completing Form

- For use in the **Province of Ontario** only. This document is a permanent **legal** document. Please retain for future reference.
- All Sections **must** be completed in full to avoid delays in processing. Further instructions and explanations are available on the back of this form.
- Questions regarding completing this application can be directed to the Water Well Management Coordinator at 416-235-6203.
- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only.

Ministry Use Only

MUN 57015 CON CON 03 LOT 19

Well Owner's Information and Location of Well Information

First Name	Last Name	Mailing Address (Street Number/Name, RR, Lot, Concession)
SILVER BROOKE GOLF CLUB		

County/District/Municipality	Township/City/Town/Village	Province	Postal Code	Telephone Number (include area code)
		Ontario		

Address of Well Location (County/District/Municipality)	Township	Lot	Concession
~~FEEB~~ SIMCOE COUNTY	TOSORONTIO TWP	19	CON 3.

RR#/Street Number/Name	City/Town/Village	Site/Compartment/Block/Tract etc.

GPS Reading: NAD 83 | Zone 17 | Easting 581715 | Northing 4898377 | Unit Make/Model GARMIN ETREX | Mode of Operation: [X] Undifferentiated [ ] Averaged [ ] Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth (ft) From	Depth (ft) To	Depth Metres From	Depth Metres To
BROWN	SAND			0	6	0	1.8
BROWN	CLAY	SILTY		6	11	1.8	3.4
GREY	CLAY	SILTY SAND LAYERS		11	18	3.4	5.5
GREY	SILT	CLAYEY SAND		18	47	5.5	14.3
GREY	SILT	~~CLAYEY~~ SANDY		47	65	14.3	19.8
GREY	SILT	CLAYEY		65	95	19.8	29.0
GREY	SILT	SANDY		95	116	29.0	35.4
BROWN	SAND.			116	146	35.4	44.5

Hole Diameter

Depth From	Metres To	Diameter Centimetres

Water Record

Water found at Metres	Kind of Water		
35.4 m	[X] Fresh	[ ] Sulphur	[ ] Gas
	[ ] Salty	[ ] Minerals	[ ] Other:
m	[ ] Fresh	[ ] Sulphur	[ ] Gas
	[ ] Salty	[ ] Minerals	[ ] Other:
m	[ ] Fresh	[ ] Sulphur	[ ] Gas
	[ ] Salty	[ ] Minerals	[ ] Other:

After test of well yield, water was: [X] Clear and sediment free [ ] Other, specify

Chlorinated [X] Yes [ ] No

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Metres To
	Casing			
15.9	[X] Steel [ ] Fibreglass [ ] Plastic [ ] Concrete [ ] Galvanized	0.48	0.72	41.1
	[ ] Steel [ ] Fibreglass [ ] Plastic [ ] Concrete [ ] Galvanized			
	[ ] Steel [ ] Fibreglass [ ] Plastic [ ] Concrete [ ] Galvanized			
	Screen			
Outside diam	[ ] Steel [ ] Fibreglass [ ] Plastic [ ] Concrete [ ] Galvanized	Slot No.		
14.6	~~STAINLESS~~ STEEL	18	41.3	42.8
		18	43.0	44.5
	No Casing or Screen			
	[ ] Open hole			

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres) 30	Static Level	7.0		
Pumping rate - (litres/min) 139	1	7.7	1	7.3
Duration of pumping 1 hrs + 50 min	2	8.0	2	7.2
Final water level end of pumping 8.2 metres	3	8.0	3	7.2
Recommended pump type. [ ] Shallow [X] Deep	4	8.0	4	7.2
Recommended pump depth. 30 metres	5	8.1	5	7.2
Recommended pump rate. 450 (litres/min)	10	8.0	10	7.1
If flowing give rate - (litres/min)	15	8.1	15	7.1
If pumping discontinued, give reason.	20	8.1	20	7.1
	25	8.2	25	7.1
	30	8.1	30	7.1
	40	8.2	40	7.1
	50	8.3	50	7.0
	60	8.2	60	7.0

Plugging and Sealing Record

[X] Annular space [ ] Abandonment

Depth set at - Metres From	To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	6.1	BENTONITE SLURRY	0.2

Method of Construction

[X] Cable Tool [ ] Rotary (air) [ ] Diamond [ ] Digging
[ ] Rotary (conventional) [ ] Air percussion [ ] Jetting [ ] Other
[ ] Rotary (reverse) [ ] Boring [ ] Driving

Water Use

[ ] Domestic [ ] Industrial [ ] Public Supply [ ] Other
[ ] Stock [X] Commercial [ ] Not used
[ ] Irrigation [ ] Municipal [ ] Cooling & air conditioning

Final Status of Well

[X] Water Supply [ ] Recharge well [ ] Unfinished [ ] Abandoned, (Other)
[ ] Observation well [ ] Abandoned, insufficient supply [ ] Dewatering
[ ] Test Hole [ ] Abandoned, poor quality [ ] Replacement well

Well Contractor/Technician Information

Name of Well Contractor	Well Contractor's Licence No.
COUNTRY WATER SYSTEMS	7088

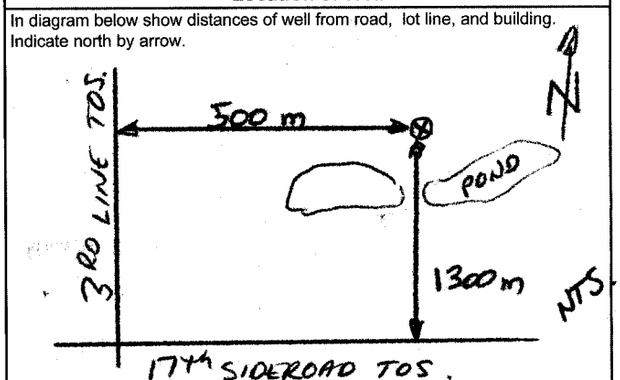
Business Address (street name, number, city etc.): 6995 SIMCOE RD 56, UTOPIA (877) 333-9355.

Name of Well Technician (last name, first name)	Well Technician's Licence No.
SCOTT, PETER	T-1667

Signature of Technician/Contractor: X [signature] Date Submitted YYYY MM DD

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.



Audit No. Z 00828

Date Well Completed YYYY MM DD: 2004 06 25

Was the well owner's information package delivered? [X] Yes [ ] No

Date Delivered YYYY MM DD: 2004 06 30

Ministry Use Only

Data Source	Contractor
	7088
Date Received YYYY MM DD: JUL 13 2004	Date of Inspection YYYY MM DD
Remarks	Well Record Number: 5738906

0506E (09/03) Contractor's Copy [ ] Ministry's Copy [X] Well Owner's Copy [ ]

Cette formule est disponible en français

Appendix C:
Test Well Construction Records

Ontario Ministry of the Environment, Conservation and Parks

Measurements recorded in: ☐ Metric ☑ Imperial

Well Tag No. (Place Sticker and/or Print Below) Tag#:A366563

Well Record

Regulation 903 Ontario Water Resources Act

Page 0 of 1

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
2834556	ONTARIO INC		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
				6473846795

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
45 CINDY LANE	TOSORONTIO TWP	19	3

County/District/Municipality	City/Town/Village	Province	Postal Code
SIMCOE COUNTY		Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	581796	4898149		TWO 1

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
	TOP SOIL			0	1 ft
BROWN	SAND			1	15
GREY	SAND			15	21
GREY	CLAY			21	27
GREY	SILTY CLAY			27	96
GREY	SAND	SILT	WET	96	113
BROWN	SAND		WET, FINE	113	123
BROWN	SAND	GRAVEL	WET, COARSE	123	136 ft

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
0	2 ft	HOLE PLUG	2 BAGS.
2	20	QUICK GROUT	50 LBS

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☐ Air percussion
☑ Other, specify AIR. LIFT

Well Use

☐ Public ☐ Commercial ☐ Not used
☑ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6¼	STEEL	.188	+2	131
	K PACKER		129	129
6¼	STEEL	.188	129	131

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To
6½	S. STEEL	16	131	135

Status of Well

☑ Water Supply
☐ Replacement Well
☑ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Water Details

Water found at Depth	Kind of Water	
131-135 (m/ft)	☐ Gas	☐ Fresh ☑ Untested ☐ Other, specify
(m/ft)	☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify
(m/ft)	☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)
0	20	10 3/8
20	131	6 5/8

Results of Well Yield Testing

After test of well yield, water was:
☑ Clear and sand free
☐ Other, specify

If pumping discontinued, give reason:

Pump intake set at (m/ft): 55 ft

Pumping rate (l/min / GPM): 8 GPM

Duration of pumping: 6 hrs + ____ min

Final water level end of pumping (m/ft): 18.6

If flowing give rate (l/min/GPM)

Recommended pump depth (m/ft): 50 - 50 ft

Recommended pump rate (l/min/GPM): 10-15

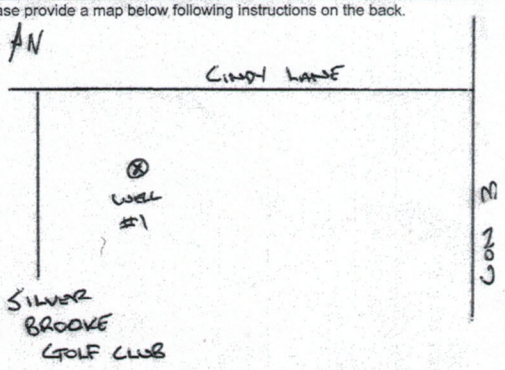
Well production (l/min/GPM): 60 +

Disinfected? ☑ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	16.7		
1	18.1	1	17
2	18.1	2	16.9
3	18.3	3	16.9
4	18.3	4	16.9
5	18.3	5	16.9
10	18.3	10	16.9
15	18.3	15	16.9
20	18.4	20	16.8
25	18.4	25	16.8
30	18.3	30	16.8
40	18.4	40	16.8
50	18.4	50	16.8
60	18.4	60	16.7

Map of Well Location

Please provide a map below following instructions on the back.



Comments: FOR 100 mg/L

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
HIGHLAND WATER WELLS	2576

Business Address (Street Number/Name)	Municipality
BOX 141, DURHAM	WEST GREY

Province	Postal Code	Business E-mail Address
ONT	N0G1R0	highlanddrilling@bmts.com

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
5193696363	POPPLETON, NIGEL

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
2130		20240521

Well owner's information package delivered	Date Package Delivered	Ministry Use Only
☑ Yes ☐ No	20240522	Audit No. Z425750
	Date Work Completed: 20240515	Received

Ontario — Ministry of the Environment, Conservation and Parks

Measurements recorded in: ☐ Metric ☑ Imperial

Well Tag No. (Place Sticker and/or Print Below): Tag#:A366566

Well Record

Regulation 903 Ontario Water Resources Act

Page 0 of 1

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
D834556	ONTARIO INC.		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
				6473846795

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
CINDY LANE	TOSORONTIO TWP	19	3

County/District/Municipality	City/Town/Village	Province	Postal Code
SIMCOE COUNTY		Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	581594	4898083		TWOR

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	To
	TOP SOIL			0	1
BROWN	SAND			1	12
GREY	SAND			12	22
GREY	CLAY	GRAVEL		22	76
GREY	CLAY	SILT / SAND LAYER'S		76	96
GREY	SILT	SAND	BROWN LAYERS	96	124
GREY	CLAY			124	128
BROWN	SAND		WET	128	129
GREY	CLAY	STONES	HARD	129	136

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
0	2	HOLE PLUG	2 BAG'S
2	20	QUICK GROUT	50 GAL'S.

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☐ Air percussion
☑ Other, specify AIR-RT

Well Use

☐ Public ☐ Commercial ☐ Not used
☑ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	To
6¼	STEEL	.188	+2	120
~~5¼~~	K PACKER		118	118
5¼	STEEL		118	120

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To
5½	S. STEEL	12	120	124

Status of Well

☑ Water Supply
☐ Replacement Well
☑ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Water Details

Water found at Depth	Kind of Water	
120-124 (ft) ☐ Gas	☐ Fresh ☑ Untested ☐ Other, specify	
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify	
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify	

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	20	10 5/8
20	120	6 5/8

Results of Well Yield Testing

After test of well yield, water was:
☑ Clear and sand free
☐ Other, specify

If pumping discontinued, give reason:

Pump intake set at (m/ft): 55FT

Pumping rate (l/min / GPM): 8 GPM

Duration of pumping: 6 hrs + min

Final water level end of pumping (m/ft): 26.9

If flowing give rate (l/min/GPM)

Recommended pump depth (m/ft): 50-60 ft

Recommended pump rate (l/min/GPM): 10 GPM

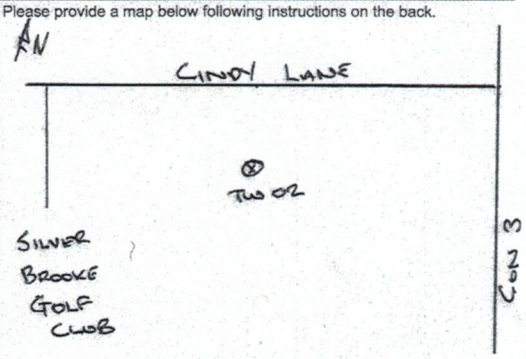
Well production (l/min/GPM): 30

Disinfected? ☑ Yes ☐ No

Draw Down Time (min)	Water Level (m/ft)	Recovery Time (min)	Water Level (m/ft)
Static Level	15.7		
1	20.1	1	21.9
2	22.6	2	19.8
3	24.1	3	18.6
4	25	4	17.8
5	25.4	5	17.4
10	26.3	10	16.6
15	26.4	15	16.4
20	26.4	20	16.4
25	26.4	25	16.3
30	26.3	30	16.3
40	26.3	40	16.2
50	26.3	50	16.2
60	26.3	60	16

Map of Well Location

Please provide a map below following instructions on the back.



Comments: FOR 100 mgh

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
HIGHLAND WATER WELLS	2516

Business Address (Street Number/Name)	Municipality
BOX 141, DURHAM	WEST GREY

Province	Postal Code	Business E-mail Address
ONT	N0G1R0	highlanddrilling@bmts.com

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
5193696363	POPPLETON, NIGEL

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
2130		2024 05 21

Well owner's information package delivered	Date Package Delivered	Ministry Use Only
☑ Yes ☐ No	2024 05 22	Audit No. Z425747
	Date Work Completed: 2024 05 16	Received

Ontario — Ministry of the Environment, Conservation and Parks

Measurements recorded in: ☐ Metric ☑ Imperial

Well Tag No. (Place Sticker and/or Print Below) A366565

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 1

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
2834556	ONTARIO INC		

Mailing Address (Street Number/Name) | Municipality | Province | Postal Code | Telephone No. (inc. area code)
6473846795

Well Location

Address of Well Location (Street Number/Name): 45 CINDY LANE | Township: TOSORONTIO | Lot: 19 | Concession: 3

County/District/Municipality: SIMCOE COUNTY | City/Town/Village | Province: Ontario | Postal Code

UTM Coordinates: NAD 8 3 1 7 5 8 4 2 9 4 8 9 8 0 4 4 | Municipal Plan and Sublot Number | Other: TW03

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	To
	TOP SOIL			0	1 ft
				1	7
BROWN	SAND			7	13
GREY	SAND		SILTY	13	35
GREY	CLAY			35	48
GREY	SAND	BROWN SAND	FINE	48	103
GREY	CLAY		FINE	103	118
GREY	SAND		CEMENTED	118	136
GREY	SAND	GRAVEL		136	156
GREY	SAND	BROWN SAND	FINE → MEDIUM WET		

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
0	2	HOLE PLUG	2 BAGS
2	20	QUICK GROUT	50 GAL'S.

Method of Construction

☐ Cable Tool ☐ Diamond ☐ Rotary (Conventional) ☐ Jetting ☐ Rotary (Reverse) ☐ Driving ☐ Boring ☐ Digging ☐ Air percussion ☑ Other, specify AIR LIFT

Well Use

☐ Public ☐ Commercial ☐ Not used ☑ Domestic ☐ Municipal ☐ Dewatering ☐ Livestock ☐ Test Hole ☐ Monitoring ☐ Irrigation ☐ Cooling & Air Conditioning ☐ Industrial ☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	To
6 1/4	STEEL	.188	+2	149
	K PACKER		147	147
5 1/4	STEEL		147	149

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To
5 1/2	S. STEEL	12	149	153

Status of Well

☑ Water Supply ☐ Replacement Well ☑ Test Hole ☐ Recharge Well ☐ Dewatering Well ☐ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned, Insufficient Supply ☐ Abandoned, Poor Water Quality ☐ Abandoned, other, specify ☐ Other, specify

Water Details

Water found at Depth	Kind of Water	
149-153 (m/ft)	☑ Fresh ☑ Untested ☐ Gas ☐ Other, specify	
(m/ft)	☐ Fresh ☐ Untested ☐ Gas ☐ Other, specify	
(m/ft)	☐ Fresh ☐ Untested ☐ Gas ☐ Other, specify	

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	20	10 5/8
20	149	6 5/8

Results of Well Yield Testing

After test of well yield, water was: ☑ Clear and sand free ☐ Other, specify

If pumping discontinued, give reason:

Pump intake set at (m/ft): 107ft

Pumping rate (l/min / GPM): 8

Duration of pumping: 6 hrs + ____ min

Final water level end of pumping (m/ft): 73.7

If flowing give rate (l/min/GPM):

Recommended pump depth (m/ft): 100ft

Recommended pump rate (l/min/GPM): 8 GPM

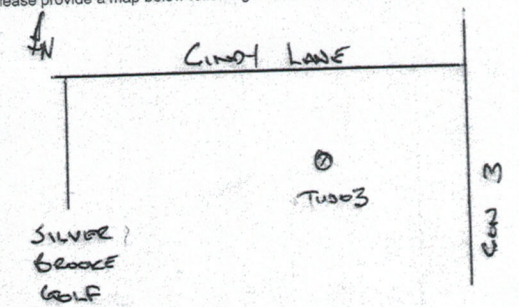
Well production (l/min/GPM): 9 GPM

Disinfected? ☑ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level		108		
1	18		1	67.2
2	19.22		2	63.7
3	22.37		3	60.55
4	25.06		4	57.65
5	27.8		5	54.9
10	37.88		10	43.9
15	46.11		15	36.4
20	50		20	31.2
25	54.05		25	27.55
30	56.65		30	25
40	58		40	21.9
50	59.56		50	20.1
60	62.58		60	19.05

Map of Well Location

Please provide a map below following instructions on the back.



Comments: FOR 150 mg/L

Well Contractor and Well Technician Information

Business Name of Well Contractor: HIGHLAND WATER WELLS | Well Contractor's Licence No.: 2576

Business Address (Street Number/Name): Box 141, QUEHAM | Municipality: WEST GREY

Province: ONT | Postal Code: N0G 1R0 | Business E-mail Address: highlandwaterdrilling@bmts.com

Bus. Telephone No. (inc. area code): 5193696363 | Name of Well Technician (Last Name, First Name): POPPLETON, NIVEN

Well Technician's Licence No.: 2130 | Signature of Technician and/or Contractor | Date Submitted: 2024/05/21

Well owner's information package delivered: ☑ Yes ☐ No | Date Package Delivered: 2024/05/22 | Date Work Completed: 2024/05/15

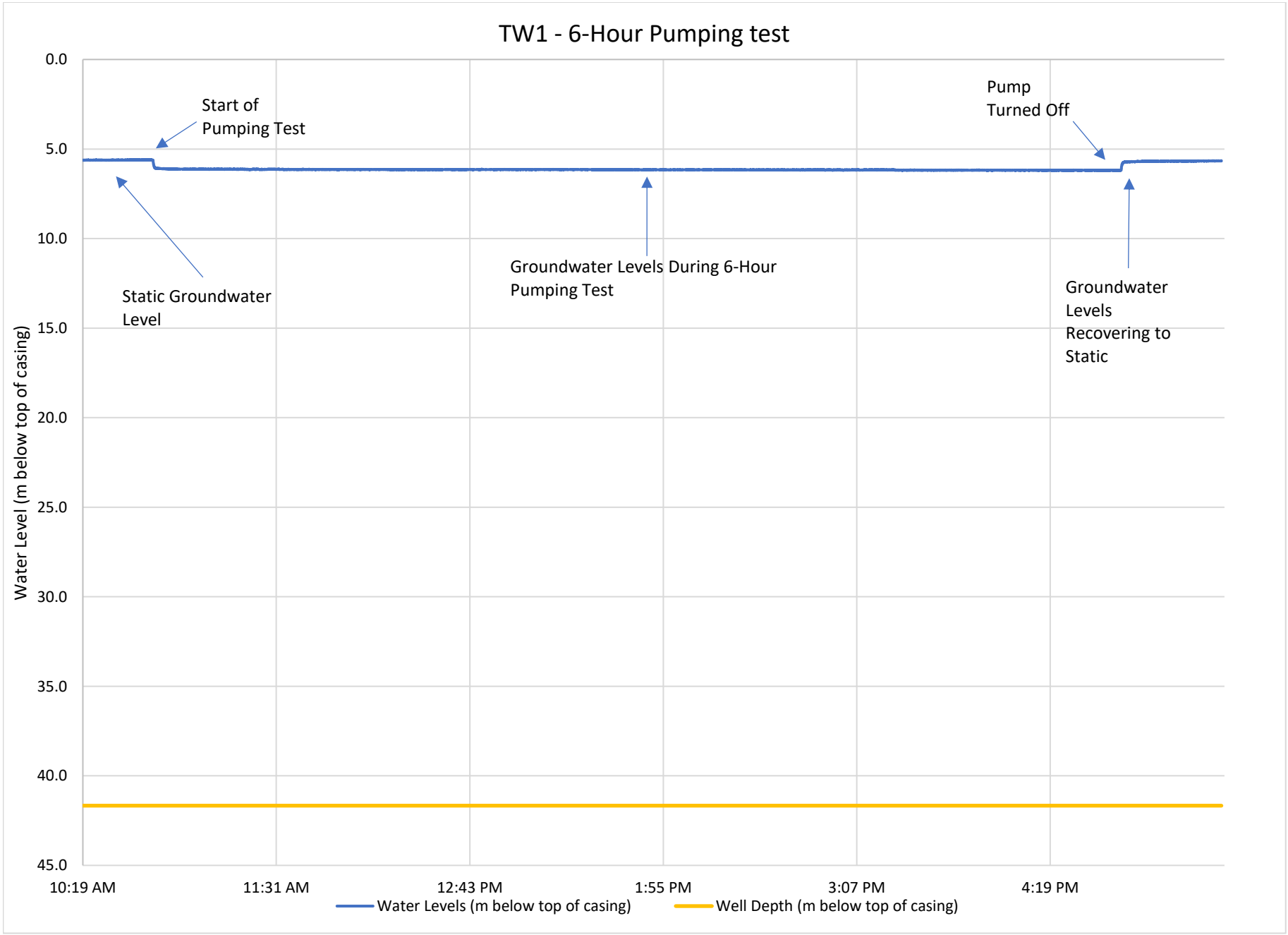
Ministry Use Only

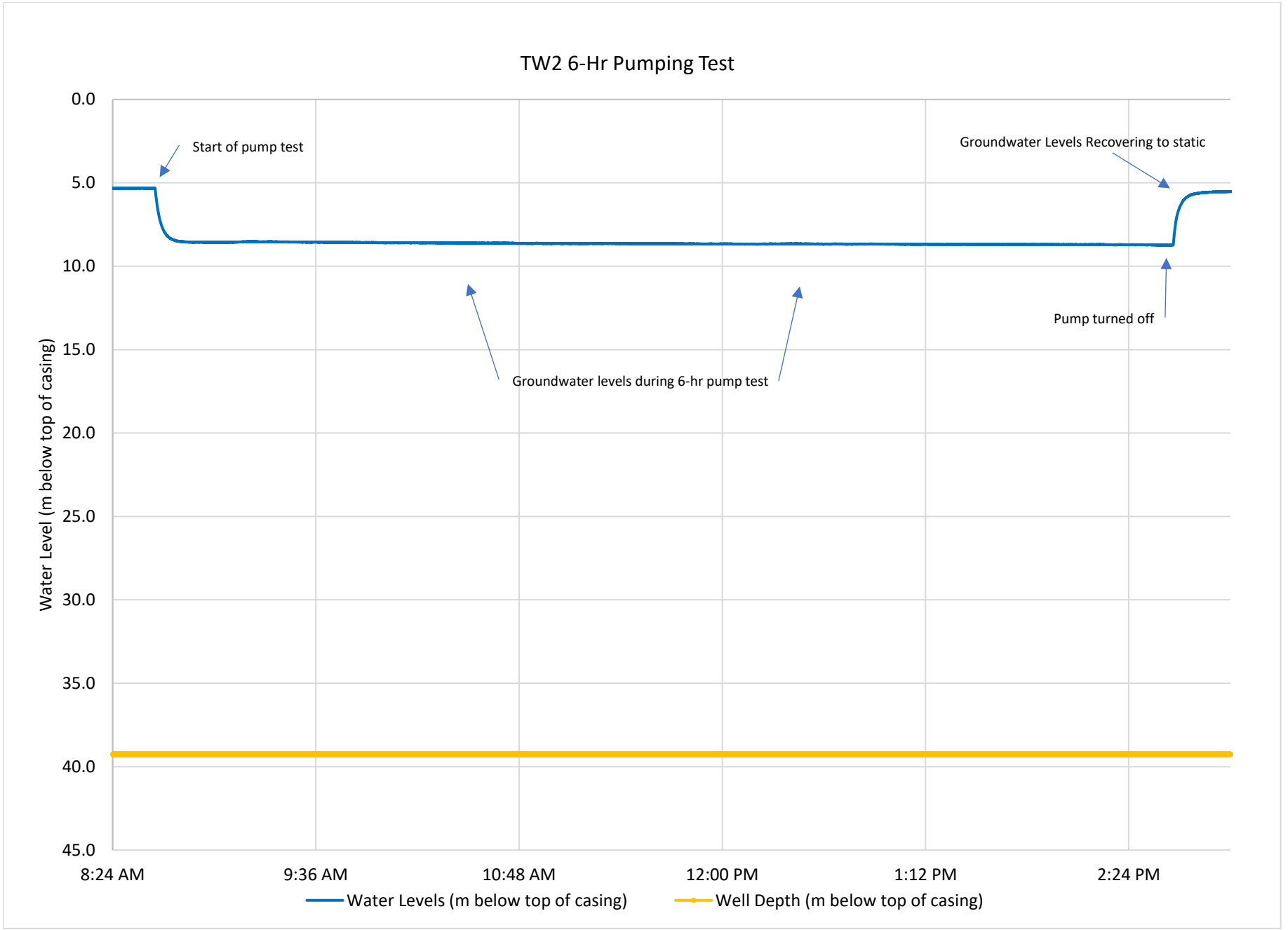
Audit No. Z425749

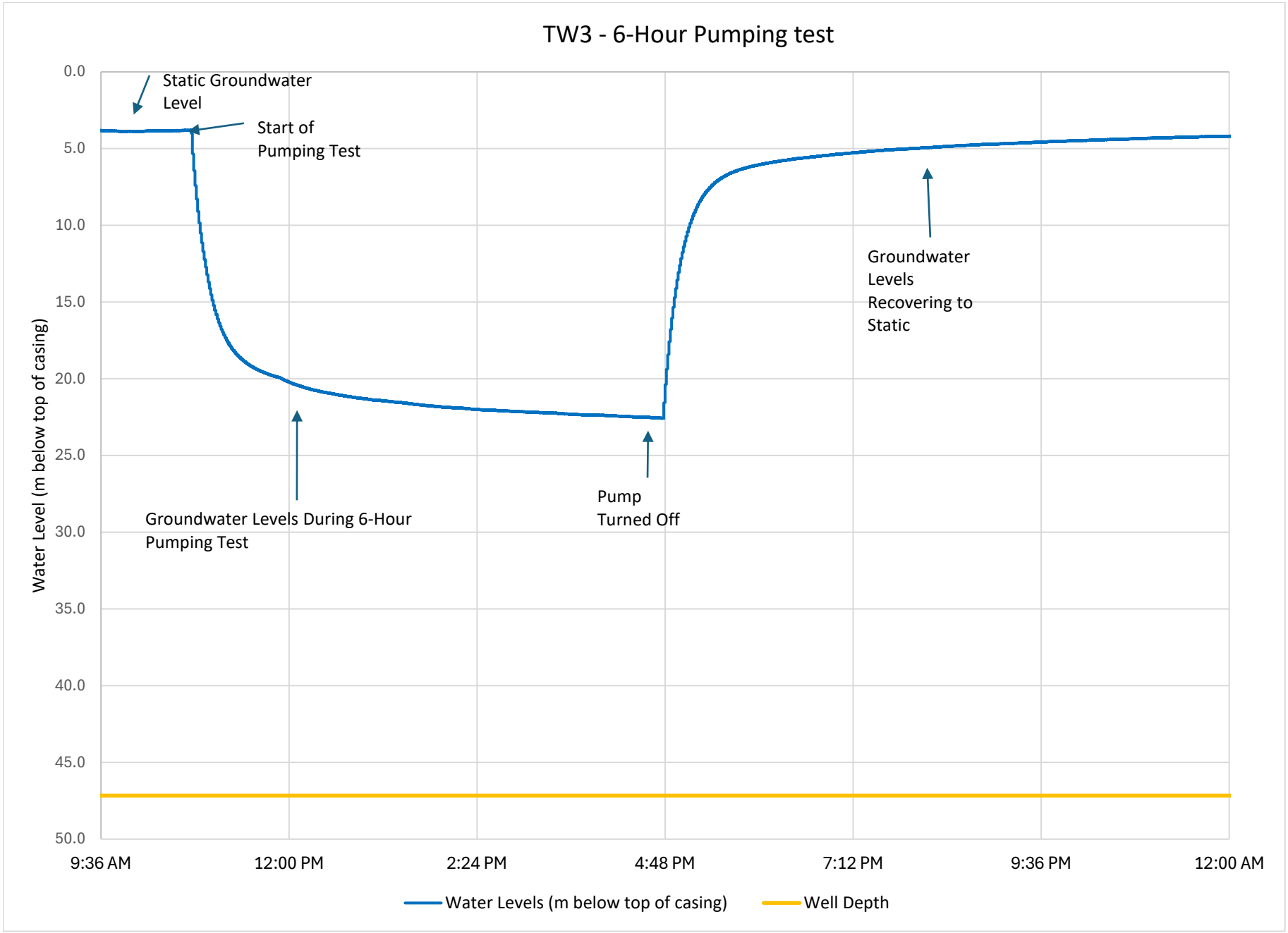
Received

Ministry's Copy

Appendix D:
Pumping Test Results


TW1 - 6-Hour Pumping test
Water Level (m below top of casing)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
10:19 AM
11:31 AM
12:43 PM
1:55 PM
3:07 PM
4:19 PM
Start of Pumping Test
Pump Turned Off
Static Groundwater Level
Groundwater Levels During 6-Hour Pumping Test
Groundwater Levels Recovering to Static
Water Levels (m below top of casing)
Well Depth (m below top of casing)


TW2 6-Hr Pumping Test
Start of pump test
Groundwater Levels Recovering to static
Pump turned off
Groundwater levels during 6-hr pump test
Water Level (m below top of casing)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
8:24 AM
9:36 AM
10:48 AM
12:00 PM
1:12 PM
2:24 PM
Water Levels (m below top of casing)
Well Depth (m below top of casing)


TW3 - 6-Hour Pumping test
Water Level (m below top of casing)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
9:36 AM
12:00 PM
2:24 PM
4:48 PM
7:12 PM
9:36 PM
12:00 AM
Static Groundwater Level
Start of Pumping Test
Groundwater Levels During 6-Hour Pumping Test
Pump Turned Off
Groundwater Levels Recovering to Static
Water Levels (m below top of casing)
Well Depth

Appendix E: Laboratory Certificates of Analysis

CADUCEON ENVIRONMENTAL LABORATORIES
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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: DW136256 **REPORT No: 24-014134 - Rev. 0**

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

Attention: Kimberly Gardner

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

DATE RECEIVED: 2024-May-16
DATE REPORTED: 2024-May-23
SAMPLE MATRIX: Ground Water

CUSTOMER PROJECT: 423499
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	4	OTTAWA	PCURIEL	2024-May-22	A-IC-01	SM 4110B
Colour (Liquid)	2	OTTAWA	STAILLON	2024-May-22	A-COL-01	SM 2120C
Cond/pH/Alk Auto (Liquid)	2	OTTAWA	SBOUDREAU	2024-May-22	COND-02/PH-02/ALK-02	SM 2510B/4500H/2320B
DOC/DIC (Liquid)	2	OTTAWA	VKASYAN	2024-May-22	C-OC-01	EPA 415.2
E.Coli m-TECH Media (Liquid)	4	BARRIE	IPATEL	2024-May-16	EC-001	MECP E3371
ICP/OES (Liquid)	4	OTTAWA	NHOGAN	2024-May-22	D-ICP-01	SM 3120B
Ammonia (Liquid)	2	KINGSTON	JYEARWOOD	2024-May-21	NH3-001	SM 4500NH3
Total Coliforms (m-Endo Media)	4	BARRIE	IPATEL	2024-May-16	TC-001	SM 9222B
Turbidity (Liquid)	4	OTTAWA	PLUSSIER	2024-May-21	A-TURB-01	SM 2130B

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

Michelle Dubien
Data Specialist

Final Report

REPORT No: 24-014134 - Rev. 0

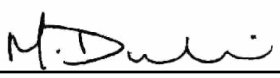
Parameter	Units	R.L.	Limits	DWG	Client I.D.	TW 1 - 1hr	TW 3 - 1hr	TW 1 - 6hr	TW 3 - 6hr
					Sample I.D.	24-014134-1	24-014134-2	24-014134-3	24-014134-4
					Date Collected	2024-May-15	2024-May-15	2024-May-15	2024-May-15
					DWG	-	-	-	-
Total Coliform	CFU/100mL	1	0	MAC		<2	<2	<2	4
Background	CFU/100mL	1				<2	42	12	6
E coli	CFU/100mL	1	0	MAC		0	0	0	0
Alkalinity(CaCO3) to pH4.5	mg/L	5	500	OG				193	190
TDS (Calc. from Cond.)	mg/L	3	500	AO				195	190
Conductivity @25°C	uS/cm	1						379	369
pH @25°C	pH units	-	8.5	OG				7.98	7.94
Colour	TCU	2	5	AO				<2	<2
Turbidity	NTU	0.1	5	AO		31.2	82.7	4.0	10.1
Chloride	mg/L	0.5	250	AO				0.9	3.3
Nitrate (N)	mg/L	0.05	10.0	MAC		0.06	0.11	<0.05	<0.05
Nitrite (N)	mg/L	0.05	1.0	MAC		<0.05	<0.05	<0.05	<0.05
Ammonia (N)-Total (NH3+NH4)	mg/L	0.05						0.06	0.18
Dissolved Organic Carbon	mg/L	0.2	5	AO				1.2	<0.2
Hardness (as CaCO3)	mg/L as CaCO3	0.02	100	OG				194	168
Calcium	mg/L	0.02						45.9	39.6
Magnesium	mg/L	0.02						19.2	16.7
Manganese	mg/L	0.001	0.05	AO				0.024	0.027
Sodium	mg/L	0.2	200, 20, 20	AO, WL, MAC		5.2	14.5	4.9	13.9

Michelle Dubien
Data Specialist

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		
TW 1 - 1hr	**Found Value**	**Limit**
Turbidity	31.2	5
TW 3 - 1hr	**Found Value**	**Limit**
Turbidity	82.7	5
TW 3 - 6hr	**Found Value**	**Limit**
Turbidity	10.1	5
Maximum Acceptable Concentration		
TW 1 - 1hr	**Found Value**	**Limit**
Total Coliform	<2	0
TW 3 - 1hr	**Found Value**	**Limit**
Total Coliform	<2	0
TW 1 - 6hr	**Found Value**	**Limit**
Total Coliform	<2	0
TW 3 - 6hr	**Found Value**	**Limit**
Total Coliform	4	0
Operational Guidelines		
TW 1 - 6hr	**Found Value**	**Limit**
Hardness (as CaCO3)	194	100
TW 3 - 6hr	**Found Value**	**Limit**
Hardness (as CaCO3)	168	100



Michelle Dubien
Data Specialist

CADUCEON ENVIRONMENTAL LABORATORIES
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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: DW112363 **REPORT No: 24-014150 - Rev. 0**

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

Attention: Kimberly Gardner

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

DATE RECEIVED: 2024-May-17
DATE REPORTED: 2024-May-23
SAMPLE MATRIX: Ground Water

CUSTOMER PROJECT: 423499
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	2	OTTAWA	PCURIEL	2024-May-22	A-IC-01	SM 4110B
Colour (Liquid)	1	OTTAWA	STAILLON	2024-May-22	A-COL-01	SM 2120C
Cond/pH/Alk Auto (Liquid)	1	OTTAWA	SBOUDREAU	2024-May-22	COND-02/PH-02/A LK-02	SM 2510B/4500H/ 2320B
DOC/DIC (Liquid)	1	OTTAWA	VKASYAN	2024-May-22	C-OC-01	EPA 415.2
E.Coli m-TECH Media (Liquid)	2	BARRIE	NMUELLER	2024-May-17	EC-001	MECP E3371
ICP/OES (Liquid)	2	OTTAWA	NHOGAN	2024-May-22	D-ICP-01	SM 3120B
Ammonia (Liquid)	1	KINGSTON	JYEARWOOD	2024-May-21	NH3-001	SM 4500NH3
Total Coliforms (m-Endo Media)	2	BARRIE	NMUELLER	2024-May-17	TC-001	SM 9222B
Turbidity (Liquid)	2	OTTAWA	PLUSSIER	2024-May-21	A-TURB-01	SM 2130B

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

Michelle Dubien
Data Specialist

Final Report

REPORT No: 24-014150 - Rev. 0

Parameter	Units	R.L.	Limits	DWG	Client I.D.	TW2 - 1hr	TW2 - 6hr
					Sample I.D.	24-014150-1	24-014150-2
					Date Collected	2024-May-16	2024-May-16
					DWG	-	-
Total Coliform	CFU/100mL	1	0	MAC		<2	<2
Background	CFU/100mL	1				12	6
E coli	CFU/100mL	1	0	MAC		0	0
Alkalinity(CaCO3) to pH4.5	mg/L	5	500	OG			193
TDS (Calc. from Cond.)	mg/L	3	500	AO			202
Conductivity @25°C	uS/cm	1					392
pH @25°C	pH units	-	8.5	OG			7.93
Colour	TCU	2	5	AO			<2
Turbidity	NTU	0.1	5	AO		22.4	7.2
Chloride	mg/L	0.5	250	AO			1.5
Nitrate (N)	mg/L	0.05	10.0	MAC		<0.05	<0.05
Nitrite (N)	mg/L	0.05	1.0	MAC		<0.05	<0.05
Ammonia (N)-Total (NH3+NH4)	mg/L	0.05					0.07
Dissolved Organic Carbon	mg/L	0.2	5	AO			1.2
Hardness (as CaCO3)	mg/L as CaCO3	0.02	100	OG			199
Calcium	mg/L	0.02					47.6
Magnesium	mg/L	0.02					19.4
Manganese	mg/L	0.001	0.05	AO			0.028
Sodium	mg/L	0.2	200, 20, 20	AO, WL, MAC		5.1	4.7
Free Chlorine (Client Data)	mg/L	-				0.5	0

Michelle Dubien
Data Specialist

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		
TW2 - 1hr	**Found Value**	**Limit**
Turbidity	22.4	5
TW2 - 6hr	**Found Value**	**Limit**
Turbidity	7.2	5
Maximum Acceptable Concentration		
TW2 - 1hr	**Found Value**	**Limit**
Total Coliform	<2	0
TW2 - 6hr	**Found Value**	**Limit**
Total Coliform	<2	0
Operational Guidelines		
TW2 - 6hr	**Found Value**	**Limit**
Hardness (as CaCO3)	199	100

Michelle Dubien
Data Specialist

Appendix F:
Nitrate Impact Assessment

TATHAM ENGINEERING

Appendix F

Reasonable Use Assessment - Nitrate

Scenario 1: No Pre-treatment

Number of Proposed Lots:	P	8		
Daily Effluent Flow / Lot:	F	1,000	L/day	Reference is made to MECP D-5-4
Subdivision Area:	A	30,000	m^2	
Infiltration Rate:	I	0.30	m/year	Reference to Section 2.3
Nitrate Loading / Dwelling:	N_s	40	g/day	
Background Nitrate:	N_b	0.11	mg/L	Highest recorded nitrate during pumping test

$$V_i = \frac{A * I}{365}$$

Groundwater Recharge:	V_i	25	m^3/day

$$V_b = PF$$

Daily Sewage Volume:	V_b	**8**	m^3/day

$$RNC = \frac{V_i N_b + V_b N_S}{V_i V_b}$$

Resultant Nitrate Concentration at Site Boundary:	RNC	**9.78**	mg/L

Does the nitrate concentration at the downgradient property boundary meet the ODWS for nitrate (10 mg/L):	**Yes**

Appendix C:
Septic Sizing Calculations

TATHAM ENGINEERING

Leaching Bed Design (Filter Bed)

Project Details		Prepared By	
45 Cindy Lane	423499	JRL	11/12/2024
Municipality		**Checked By**	
Adjala-Tosorontio		DB	11/12/2024

1 Daily Sewage Design Flow

Calculated in accordance with OBC Table 8.2.1.3.A.4.

Description of dwelling: Assumed building to be placed on proposed lots within 45 Cindy Lane development

Description of dwelling based on: Assumptions based on surrounding dwellings

Number of Bedrooms: 4

Finished Floor Area: 200 m^2

Fixture Type	FU / Fixture	No. Fixtures	Total Fixture Units
3 piece bathroom (toilet, sink & shower / bathtub)	6.0	2	12.0
2 piece bathroom (toilet & sink)	5.5	1	5.5
Domestic clothes washer (with 2" trap)	1.5	1	1.5
Domestic sink - single or double with common trap (1½" trap)	1.5	2	3.0
Floor drain - 2" trap	2.0	1	2.0
- - -	- - -		- - -
- - -	- - -		- - -
- - -	- - -		- - -
- - -	- - -		- - -
		Total Fixture Units	**24.0**

Calculations based on hydraulic loads per fixture from OBC Table 7.4.9.3.

DAILY SEWAGE DESIGN FLOW

The number of bedrooms (up to 5) have base minimum flow requirements.

For 4 bedrooms, the base flow is: = 2,000 L/day.

Additional flows must be included for the greatest of:

a)	each bedroom over 5	0	bedrooms @ 500 L / bedroom	=	0 L/day.
b)	each 10 m^2 (or part of it) over 200 m^2 up to 400 m^2	0	parts @ 100 L / part	=	0 L/day.
	each 10 m^2 (or part of it) over 400 m^2 up to 600 m^2	0	parts @ 75 L / part	=	0 L/day.
	each 10 m^2 (or part of it) over 600 m^2	0	parts @ 50 L / part	=	0 L/day.
	Total			=	0 L/day.
c)	each fixture unit over 20 fixture units	4.0	fixture units @ 50 L / unit	=	200 L/day.
			Total daily sewage design flow (Q)	=	**2,200 L/day.**

2. Treatment Units

Septic Tank

V = greater of 2Q and 3,600 L

Sized in accordance with OBC 8.6.2.1.

Where V = 4,400 L — Minimium Septic Tank Volume (calculated value)

Q = 2,200 L/day — Daily sewage design flow (calculated above)

Other Treatment Units

Per OBC Table 8.6.2.2.

Not Applicable

Describe Treatment unit (if Applicable)

TATHAM ENGINEERING

Leaching Bed Design (Filter Bed)

Project Details		Prepared By	
45 Cindy Lane	423499	JRL	11/12/2024
Municipality		**Checked By**	
Adjala-Tosorontio		DB	11/12/2024

3. Leaching Bed

Designed in accordance with OBC 8.7.4. & 8.7.5.

Soil T-Times

Native Soil	T =	20 min/cm	Describe source of information verifying T-time
Leaching Bed Fill	T =	10 min/cm	Specified by designer

Effective Filter Bed Area

$A = \frac{Q}{LR}$ Where

A =	44.0 m^2	Filter bed area
Q =	2,200 L/day	Daily Design Flow (Calculated in Step 1)
LR =	50 L/m^2/day	75 L/m^2/day where Q <= 3,000 L/day 50 L/m^2/day where 3,000 L/day < Q <= 5,000 L/day 100 L/m^2/day where treatment provided by Level II, III or IV treatment unit

Provide:	1 - 44.0 m^2 filter bed(s)	
Filter Bed Dimensions:	8.3 m long	X 5.3 m wide
Distribution Piping:	0.50 m	Distance from CL outer dist. pipe to edge of filter bed.
	5	Number of dist. pipe runs in each filter bed.
	7.30 m	Length of each run of distribution pipe
	1.08 m	Centre line spacing of distribution pipes

Expanded Contact Area

$A = \frac{QT}{850}$ Where

A =	129.4 m^2	
Q =	2,200 L/day	Daily Design Flow (Calculated in Step 1)
T =	50 min/cm	Lesser of T-time of native soil and 50 min/cm.

Provide:	1 - 129.4 m^2 expanded contact area(s)	

Loading Area including Mantle for Fill Based Leaching Bed

$A = \frac{Q}{LR}$ Where

LA =	220 m^2	Minimum required loading area (Calculated Value)
Q =	2,200 L/day	Daily Design Flow (Calculated in Step 1)
LR =	10 L/m^2/day	Loading rates for fill based trenches (from OBC Table 8.7.4.1)

Provide:	1 - 220.0 m^2 loading area(s)	

4. Effluent Pump Chamber

Not Required	Not required because gravity flow to leaching bed is feasible

Appendix D: Drainage and Stormwater Management Calculations

TATHAM ENGINEERING

PROJECT	45 Cindy Lane, Township of Adjala-Tosorontio	FILE	423499
		DATE	11/12/2024
SUBJECT	Pre-Development Runoff Coefficients	NAME	JRL
		PAGE	1 OF 1

Catchment 101

Runoff Coefficient

Land Use Type	Soil Type	Runoff Coefficient	Area (ha)
Woodland	AB	0.08	0.30
Pasture	AB	0.10	1.45
		Total:	1.75

Composite Runoff Coefficient: **0.10**

Source: Design Chart 1.07 - MTO Drainage Manual Part 4

Time of Concentration

Per MTO Drainage Manual, 1997

Catchment Length (m):	62.61	
Maximum Elevation (m):	232.08	
Minimum Elevation (m):	229.83	
Catchment Slope (%):	3.59	%
Runoff Coefficient:	0.10	
Airport:	16.97	min
Bransby Williams:	2.61	min
Time of Concentration Method:	Airport	
Time of Concentration (min):	16.97	min

Where calculated TC is less than MTO standard of 10 minutes, 10 minutes has been used.

Catchment 102

Runoff Coefficient

Land Use Type	Soil Type	Runoff Coefficient	Area (ha)
Woodland	AB	0.08	0.15
Pasture	AB	0.10	1.06
		Total:	1.21

Composite Runoff Coefficient: **0.10**

Source: Design Chart 1.07 - MTO Drainage Manual Part 4

Time of Concentration

Per MTO Drainage Manual, 1997

Catchment Length (m):	40.43	
Maximum Elevation (m):	232.08	
Minimum Elevation (m):	229.63	
Catchment Slope (%):	6.06	%
Runoff Coefficient:	0.10	
Airport:	11.47	min
Bransby Williams:	1.58	min
Time of Concentration Method:	Airport	
Time of Concentration (min):	11.47	min

Where calculated TC is less than MTO standard of 10 minutes, 10 minutes has been used.

TATHAM ENGINEERING

PROJECT	45 Cindy Lane, Township of Adjala-Tosorontio	FILE	423499
		DATE	11/12/2024
SUBJECT	Post-Development Runoff Coefficients	NAME	JRL
		PAGE	1 OF 1

Catchment 201

Runoff Coefficient

Land Use Type	Soil Type	Runoff Coefficient	Area (ha)
Lawn	AB	0.10	1.30
Woodland	AB	0.08	0.31
Proposed Houses	AB	0.95	0.02
		Total:	1.63

Composite Runoff Coefficient: **0.11**

Source: Design Chart 1.07 - MTO Drainage Manual Part 4

Time of Concentration

Per MTO Drainage Manual, 1997

Catchment Length (m):	54.53	
Maximum Elevation (m):	233.35	
Minimum Elevation (m):	229.75	
Catchment Slope (%):	6.60	%
Runoff Coefficient:	0.11	
Airport:	12.85	min
Bransby Williams:	2.03	min
Time of Concentration Method:	Airport	
Time of Concentration (min):	12.85	min

Where calculated TC is less than MTO standard of 10 minutes, 10 minutes has been used

Catchment 202

Runoff Coefficient

Land Use Type	Soil Type	Runoff Coefficient	Area (ha)
Lawn	AB	0.10	0.94
Woodland	AB	0.08	0.13
Proposed Houses	AB	0.95	0.26
		Total:	1.33

Composite Runoff Coefficient: **0.27**

Source: Design Chart 1.07 - MTO Drainage Manual Part 4

Time of Concentration

Per MTO Drainage Manual, 1997

Catchment Length (m):	42.39	
Maximum Elevation (m):	233.35	
Minimum Elevation (m):	229.65	
Catchment Slope (%):	8.73	%
Runoff Coefficient:	0.27	
Airport:	8.67	min
Bransby Williams:	1.52	min
Time of Concentration Method:	Airport	
Time of Concentration (min):	8.67	min

Where calculated TC is less than MTO standard of 10 minutes, 10 minutes has been used

TATHAM ENGINEERING

Modified Rational Method Calculation (Outlet 1)

Project Details

45 Cindy Lane, Adjala-Tosorontio	423499

Prepared By

JRL	11/12/2024

Municipality

MTO - IDF Curve Lookup

Pre-Development Analysis

Catchment ID:	101
Catchment Area (ha):	1.75
1:5-Year Runoff Coef:	0.10
Time of Conc. (min):	17

Post-Development Analysis

Catchment ID:	201	-
Catchment Area (ha):	1.63	0.00
1:5-Year Runoff Coef.:	0.11	0.00
Time of Conc. (min):	13	0

Rational Method Calculations

Design Storm		2	5	10	25	50	100
IDF Curve	A	21	28	33	38	43	47
	B	-0.70	-0.70	-0.70	-0.70	-0.70	-0.70
	C	-	-	-	-	-	-
101	i (mm/hr)	51	68	79	93	103	113
	C	0.10	0.10	0.10	0.11	0.12	0.13
	Q (m^3/s)	0.03	0.03	0.04	0.05	0.06	0.07

Design Storm		2	5	10	25	50	100
201	i (mm/hr)	63	83	96	112	125	137
	C	0.11	0.11	0.11	0.12	0.13	0.14
	Q (m^3/s)	0.03	0.04	0.05	0.06	0.07	0.09
-	i (mm/hr)	####	####	####	####	####	####
	C	0.00	0.00	0.00	0.00	0.00	0.00
	Q (m^3/s)	0.00	0.00	0.00	0.00	0.00	0.00

Peak Flow Summary (m^3/s)

Storm	$Q_{EXISTING}$	$Q_{UNCONTROLLED}$	$Q_{CONTROLLED}$	Q_{TOTAL}	$Q_{EXISTING}$ - $Q_{PROPOSED}$
2	0.025	0.000	0.025	0.025	0.000
5	0.033	0.000	0.033	0.033	0.000
10	0.038	0.000	0.038	0.038	0.000
25	0.049	0.000	0.049	0.049	0.000
50	0.060	0.000	0.060	0.060	0.000
100	0.069	0.000	0.069	0.069	0.000

Required Storage Volume Summary (m^3)

Duration (min)	2	5	10	25	50	100
10	**5**	**7**	**8**	**10**	**12**	**14**
20	3	4	4	5	7	8
30	-1	-2	-2	-2	-3	-3
40	-6	-8	-9	-12	-14	-16
50	-11	-15	-17	-22	-26	-30
60	-16	-22	-25	-33	-40	-45
70	-22	-29	-34	-44	-53	-61
80	-28	-37	-43	-55	-67	-77
90	-34	-45	-52	-67	-82	-93
100	-40	-53	-61	-79	-96	-110
110	-46	-61	-71	-92	-111	-127
120	-53	-69	-81	-104	-126	-144

TATHAM ENGINEERING

Modified Rational Method Calculation (Outlet 2)

Project Details

45 Cindy Lane, Adjala-Tosorontio	423499

Prepared By

JRL	11/12/2024

Municipality

MTO - IDF Curve Lookup

Pre-Development Analysis

Catchment ID:	102
Catchment Area (ha):	1.21
1:5-Year Runoff Coef:	0.10
Time of Conc. (min):	11

Post-Development Analysis

Catchment ID:	202	-
Catchment Area (ha):	1.33	0.00
1:5-Year Runoff Coef.:	0.27	0.00
Time of Conc. (min):	10	0

Rational Method Calculations

Design Storm		2	5	10	25	50	100
IDF Curve	A	21	28	33	38	43	47
	B	-0.70	-0.70	-0.70	-0.70	-0.70	-0.70
	C	-	-	-	-	-	-
	i (mm/hr)	68	89	104	122	135	148
102	C	0.10	0.10	0.10	0.11	0.12	0.13
	Q (m^3/s)	0.02	0.03	0.03	0.05	0.05	0.06

Design Storm		2	5	10	25	50	100
	i (mm/hr)	75	98	114	134	149	163
202	C	0.27	0.27	0.27	0.30	0.32	0.34
	Q (m^3/s)	0.07	0.10	0.11	0.15	0.18	0.20
	i (mm/hr)	####	####	####	####	####	####
-	C	0.00	0.00	0.00	0.00	0.00	0.00
	Q (m^3/s)	0.00	0.00	0.00	0.00	0.00	0.00

Peak Flow Summary (m^3/s)

Storm	$Q_{EXISTING}$	$Q_{UNCONTROLLED}$	$Q_{CONTROLLED}$	Q_{TOTAL}	$Q_{EXISTING}$ - $Q_{PROPOSED}$
2	0.023	0.000	0.023	0.023	0.000
5	0.030	0.000	0.030	0.030	0.000
10	0.035	0.000	0.035	0.035	0.000
25	0.045	0.000	0.045	0.045	0.000
50	0.055	0.000	0.055	0.055	0.000
100	0.062	0.000	0.062	0.062	0.000

Required Storage Volume Summary (m^3)

Duration (min)	2	5	10	25	50	100
10	31	41	47	61	74	85
20	34	45	53	68	83	94
30	**35**	**46**	**53**	**69**	**83**	**95**
40	34	44	51	66	81	92
50	31	41	48	62	75	86
60	29	38	44	57	69	79
70	25	34	39	50	61	70
80	22	29	34	43	53	60
90	18	24	28	36	44	50
100	14	19	22	28	34	39
110	10	13	15	20	24	27
120	5	7	8	11	13	15

Water Quality Requirements

Project Details

45 Cindy Lane	423499

Prepared By

JRL	Nov 12 2024

Water Quality Sizing Criteria

Methodology & Data Source	Volumetric water quality criteria as presented in Table 3.2 in Ministry of Environment, Conservation and Parks (MECP) Stormwater Management Planning & Design Manual (SWMPDM) March 2003.

Contributing Catchments

	Area (ha)	Impervious (%)
Catchment 202	1.33	19.55%
Total	**1.33**	**19.5%**

Treatment Method Details

SWM Facility Type	Infiltration
Target Treatment Leve	Basic Level
Treatment Percentage	60%

Treatment

Water Quality Storage Requirement 27 m^3

Rain garden Cell Storage Provided 65.1 **Provided > Required**

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PROJECT	45 Cindy Lane	FILE	423499
		DATE	11/12/2024
SUBJECT	Proposed LID Design	NAME	JRL
		PAGE	1 OF 1

Enhanced Swale Design Details (Surface Conveyance)

LID Measure	Enhanced Swale
LID Drainage Area (ha)	1.33
Number of LIDs	14
Side Slope (H:V)	3:1
Depth of Swale (m)	0.15
Width of Swale at top (m)	0.90
Length of Swale (Average)	26

Enhanced Swale Design Details (Infiltration Trench)

LID Measure	Enhanced Swale
LID Drainage Area (ha)	1.33
Number of LIDs	14
Void Ratio	0.40
Width of Trench (m)	0.30
Depth of Trench (m)	0.30
Length of Swale (Average)	26
Volume Provided / LID (m^3)	0.94
Volume Provided Across Site (m^3)	13.10

Note: Enhanced swales are to be located along the North-South running lot lines separating the proposed properties

Rain Garden Design Details

LID Measure	Rain Garden
LID Impervious Drainage Area (ha)	0.16
Number of LIDs	16
Void Ratio	0.40
Width of LID (m)	4
Length of LID (m)	5.09
Footprint of LID (m^2)	20.34
Depth of LID (m)	0.50
Volume Provided / LID (m^3)	4.07
Volume Provided Across Site (m^3)	65.09

Total volume provided by LID features across sit 78.19 m^3

PROJECT	45 Cindy Lane	FILE	423499
		DATE	Aug 21 2024
SUBJECT	Water Quality - Treatment Train Calculation	NAME	JRL
		PAGE	1 OF 1

Site Area in Catchment 202

Drainage Area to Controls= 1.33 ha Imperviousness of Drainage Area to Controls= 20%

Device	Target Total Suspended Solids (TSS) Removal	
Primary Treatment	Enhanced Lot-Line Swales	40%
Secondary Treatment	Rain Gardens	60%
Tertiary Treatment	Roadside Ditch	40%

$$\boldsymbol{TSS\ Removal} = \boldsymbol{(1 - ((1 - R_P) * (1 - R_S) * (1 - R_T))}$$

where:

R_P = % TSS Removal provided by Primary Treatment Strategy

R_S = % TSS Removal provided by Secondary Treatment Strategy

R_T = % TSS Removal provided by Tertiary Treatment Strategy

TSS Removal Provided By Controls 86%

Note: Removal rates as per CVC/TRCA LID SWM Planning and Design Guide.

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Water Budget

Mitigation Measures
LID Design

Project Details

45 Cindy Lane	423499

Prepared By

JRL	09/03/2024

LID Design Details

LID Measure	Rain Garden
LID Impervious Drainage Area (ha)	0.16
Number of LIDs	16
Void Ratio	0.4
Footprint of LID (m^2)	20.34
Depth of LID (m)	0.50
Storage Volume Required (m^3)	See notes below
Volume Required / LID (m^3)	-
Volume Provided / LID (m^3)	4.07
Volume Provided (m^3)	65.09
Design Precipitation Depth (mm)	40.7
Annual Volume Captured (mm)	841.8
Annual Volume Captured excluding Evapotransiration (m^3)	1,347
Annual Volume Captured after Evapotranspiration (m^3)	1,078

Additional Notes

Unable to fully offset infiltration volume with the available impervious area to captured by the LIDs

TATHAM ENGINEERING

Water Budget
Summary

Project Details

45 Cindy Lane	423499

Prepared By

JRL	09/03/2024

Summary

Existing Infiltration (m^3)	9,129
Proposed Infiltration (m^3) - No Mitigtation	7,943
Infiltration Deficit Prior to Mitigation (m^3)	1,186
Proposed Infiltration Measures	
[ ] Increase Topsoil Depth	
[x] Infiltration LID	
[ ] Impervious Area Routed Over Pervious Area	
Mitigation - Increase Topsoil Reduction in Pervious Runoff (m^3)	0
Mitigation Measure - Implementing LID (m^3)	1,078
Mitigation Measure - Impervious Area Routed over Pervious Area (m^3)	0
Proposed Infiltration (m^3)	9,021
Infiltration Deficit after Mitigation (m^3)	108

Additional Notes

TATHAM ENGINEERING

Phosphorus Budget Assessment

Project Details

45 Cindy Lane, Adjala-Tosorontio	423499

Prepared By

JRL	11/12/2024

Watershed

Pine River (NVCA)

Treatment Method

Treatment Train

LAND USE CATEGORY	Phosphorus Loading Rate (kg/ha/yr)	Pre-Development		Post-Development		Post-Development	
		Total Area		Treated Area		Untreated Area	
		Area (ha)	Loading (kg/yr)	Area (ha)	Loading (kg/year)	Area (ha)	Loading (kg/year)
Cropland	0.39	0.00	0.00	0.00	0.00	0.00	0.00
Hay-Pasture	0.12	2.51	0.30	0.00	0.00	0.00	0.00
Turf -Sod	0.42	0.00	0.00	0.00	0.00	0.00	0.00
High Intensity Development - C/I	1.82	0.00	0.00	0.00	0.00	0.00	0.00
High Intensity Development - R	1.32	0.00	0.00	0.00	0.00	0.00	0.00
Low Intensity Development	0.19	0.00	0.00	2.75	0.52	0.21	0.04
Quarry	0.15	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Road	0.83	0.00	0.00	0.00	0.00	0.00	0.00
Forest	0.10	0.45	0.05	0.00	0.00	0.00	0.00
Transition	0.16	0.00	0.00	0.00	0.00	0.00	0.00
Wetland	0.10	0.00	0.00	0.00	0.00	0.00	0.00
Open Water	0.26	0.00	0.00	0.00	0.00	0.00	0.00
Total		**2.96**	**0.35**	**2.75**	**0.52**	**0.21**	**0.04**

CONTROLS

Proposed Treatment Method	Removal Efficiency (%)	Area (ha)	Loading (kg/year)
Catchment 201 (Enhanced Grass Swales 55%, Rain Gardens 60%)	58%	1.63	0.13
Catchment 202 (Enhanced Grass Swales 55%, Rain Gardens 60%)	58%	1.12	0.07
Effective Removal Efficiency	**58%**	**2.75**	0.20

SUMMARY

Existing Phosphorous Load	0.35 kg/year
Post Development Phosphorous Load (no controls)	0.56 kg/year
Post Development Phosphorous Load (with controls)	0.24 kg/year
Overall Increase in Phosphorus Load	-0.10 kg/year

Appendix E: Drawings

LEGEND

- 230.00 — EXISTING CONTOUR (0.5m INTERVALS)
- CATCHMENT BOUNDARY
- OVERLAND FLOW DIRECTION
- 101 / 1.75 | 0.10 — CATCHMENT ID; RUNOFF COEFFICIENT; AREA (ha)
- TRIBUTARY OF PINE RIVER

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BENCHMARKS

TBM1 – ELEVATION 231.010 m
SET ON N.E CORNER OF CONCRETE TRANSFORMER

TBM2 – ELEVATION 230.430 m
SET ON N.E CORNER OF CONCRETE TRANSFORMER

TBM3 – ELEVATION 230.15 m
SET ON N.E CORNER OF CONCRETE TRANSFORMER

NOTES

TOPOGRAPHIC INFORMATION SHOWN BASED ON SURVEY COMPLETED BY TATHAM ENGINEERING LIMITED, DATED DECEMBER 5, 2023

DEPICTED HOUSES ARE ASSUMPTIONS AND TO BE REFINED DURING DETAILED DESIGN PHASE

No.	REVISION DESCRIPTION	DATE
1.	FSSWMR – FIRST SUBMISSION	NOV. 12/24

ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER
November 12, 2024
D. BRITO
100521347
PROVINCE OF ONTARIO

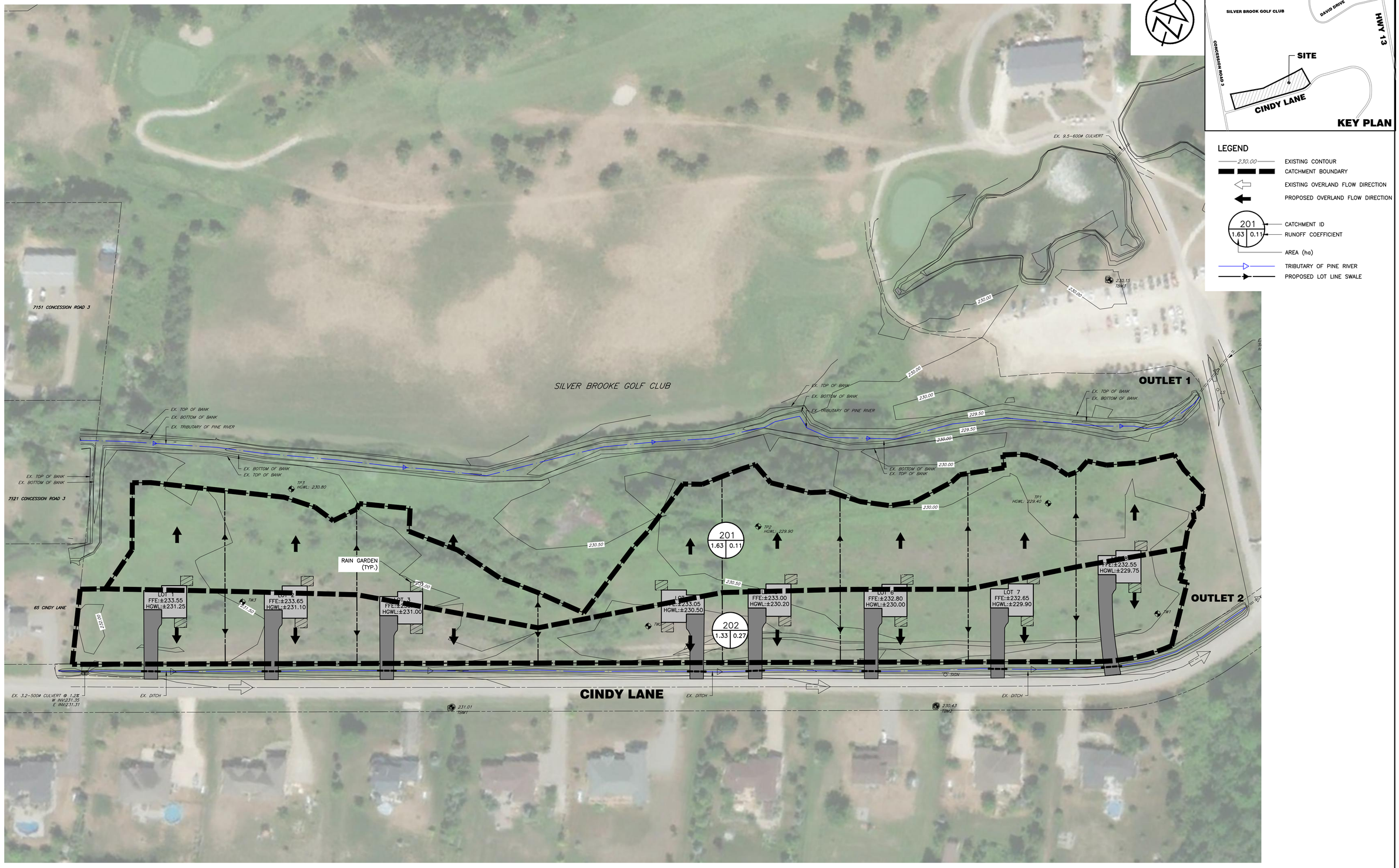
45 CINDY LANE
TOWNSHIP OF ADJALA-TOSORONTIO

TATHAM ENGINEERING

PRE-DEVELOPMENT DRAINAGE PLAN

DESIGN: JG	FILE: 423499	DWG: DP.1
DRAWN: JRL	DATE: NOV. 2023	
CHECK: DB	SCALE: 1:750	

Drawing Name: 423499-DP01.dwg, Plotted: Nov 12, 2024



LEGEND

- 230.00 — EXISTING CONTOUR
- CATCHMENT BOUNDARY
- EXISTING OVERLAND FLOW DIRECTION
- PROPOSED OVERLAND FLOW DIRECTION
- 201 / 1.63 | 0.11 — CATCHMENT ID, RUNOFF COEFFICIENT, AREA (ha)
- TRIBUTARY OF PINE RIVER
- PROPOSED LOT LINE SWALE

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SET ON N.E CORNER OF CONCRETE TRANSFORMER

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No.	REVISION DESCRIPTION	DATE
1.	FSSWMR – FIRST SUBMISSION	NOV. 12/24

ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER
November 12, 2024
D. BRITO
100521347
PROVINCE OF ONTARIO

45 CINDY LANE
TOWNSHIP OF ADJALA-TOSORONTIO

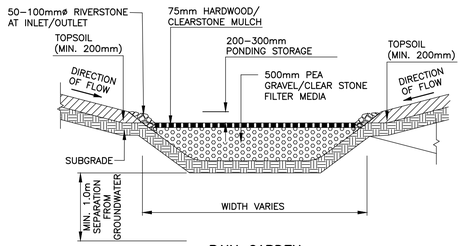
POST–DEVELOPMENT DRAINAGE PLAN

TATHAM ENGINEERING

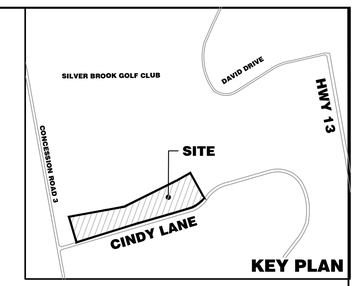
DESIGN: JG	FILE: 423499	DWG: DP.2
DRAWN: JRL	DATE: NOV. 2023	
CHECK: DB	SCALE: 1:750	

Drawing Name: 423499-DP02.dwg, Plotted: Nov 12, 2024

LOT No.	APPROX. SURFACE GRADE OF RAIN GARDEN (m)	DEPTH OF RAIN GARDEN (m)	APPROX. GROUNDWATER ELEVATION (m)	CLEARANCE TO GROUNDWATER (m)
1	233.25	0.50	231.20	1.55
2	233.35	0.50	231.10	1.75
3	233.15	0.50	231.00	1.65
4	232.75	0.50	230.50	1.75
5	232.70	0.50	230.20	2.00
6	232.50	0.50	230.00	2.00
7	232.40	0.50	229.90	2.00
8	232.25	0.50	229.75	2.00

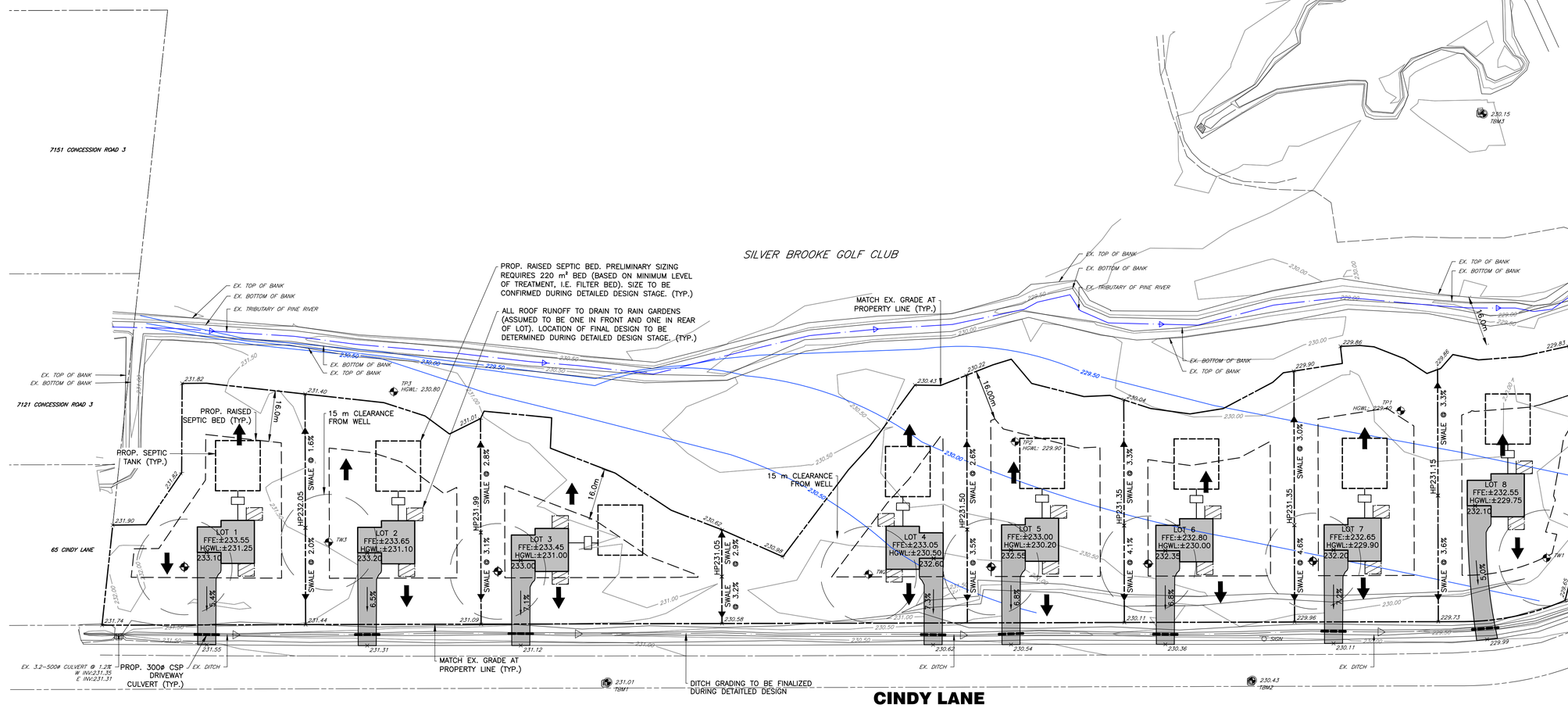


RAIN GARDEN
TYPICAL CROSS SECTION
N.T.S.



LEGEND

- EXISTING PROPERTY LINE
- SUBJECT SITE
- 230.00 EXISTING CONTOUR (0.5m INTERVALS)
- 230.00 EXISTING GROUNDWATER CONTOUR (0.5m INTERVALS)
- PROPOSED SWALE
- PROPOSED DITCH
- EXISTING CULVERT
- PROPOSED DRIVEWAY CULVERT
- PROPOSED SEPTIC BED
- PROPOSED RAIN GARDEN
- ×231.82 EXISTING SPOT ELEVATION
- ×233.00 PROPOSED SPOT ELEVATION
- 5.4% PROPOSED GRADE
- PROPOSED OVERLAND FLOW DIRECTION
- TP1: 229.40 HGWL: 229.40 EXISTING TEST PIT
- TW1 EXISTING TEST WELL
- PROPOSED DOMESTIC WELL



BENCHMARKS

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SET ON N.E CORNER OF CONCRETE TRANSFORMER

TBM2 – ELEVATION 230.430 m
SET ON N.E CORNER OF CONCRETE TRANSFORMER

TBM3 – ELEVATION 230.15 m
SET ON N.E CORNER OF CONCRETE TRANSFORMER

NOTES

TOPOGRAPHIC INFORMATION SHOWN BASED ON SURVEY COMPLETED BY TATHAM ENGINEERING LIMITED, DATED DECEMBER 5, 2023

DEPICTED HOUSES ARE ASSUMPTIONS AND TO BE REFINED DURING DETAILED DESIGN PHASE

No.	REVISION DESCRIPTION	DATE
1.	FSSWMR – FIRST SUBMISSION	NOV. 12/24

ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER
November 12, 2024
D. BRITO
100521347
PROVINCE OF ONTARIO

45 CINDY LANE
TOWNSHIP OF ADJALA-TOSORONTIO

TATHAM ENGINEERING

PRELIMINARY SITE GRADING AND SERVICING PLAN

DESIGN: JG	FILE: 423499	DWG: SSG.1
DRAWN: JRL	DATE: NOV. 2023	
CHECK: DB	SCALE: 1:750	

Drawing Name: 423499-SSG01.dwg, Plotted: Nov 12, 2024