Madori Ltd.
5400 Younge Street Fifth Floor
North York, ON M2N 5R5

File No. 23-050 REV2
February 24, 2026

Attention: Nick Karakis

Subject: Hydrogeological Assessment
Northwest Corner of Elm Road and Ninth Line,
Whitchurch- Stouffville, Ontario

Grounded Engineering Inc. ("Grounded") is pleased to provide you with this Hydrogeological Assessment for the site known as Northwest Corner of Elm Road and Ninth Line, in Whitchurch- Stouffville, Ontario.

Grounded Engineering Inc. ("Grounded") was originally retained to complete a Hydrogeological Assessment for the site known as Northwest Corner of Elm Road and Ninth Line (File No. 23-050, dated July 9, 2025). Grounded received comments from The Biglieri Group (Biglieri) for the project. We have been asked provide response to comments received from the first submission for ZBA25.011 (19T[W]25.001). This revision provides additional information as requested.

1 Introduction

Madori Limited proposes to construct a new residential development consisting of three (3) buildings containing nine (9), three (3), and eight (8) townhouses, and a public laneway. Grounded has been asked to prepare an updated Hydrogeological Assessment to support the development.

The site is located north of Elm Road and west of Ninth Line in Whitchurch-Stouffville. The site is rectangular in shape, with a total area of approximately 0.36 ha. The proposed residential development will be serviced with municipal services. The site location is presented on Figure 1.

2 Previous Investigations

The following previous environmental reports were provided for review as part of this hydrogeological assessment, a summary of the previous reports is provided below:

- *Terraprobe Inc., Hydrogeologic Study Proposed Residential Subdivision (Madori Property), Stouffville, Ontario, July 8, 2004*
- *Terraprobe Inc., Hydrogeological Study Northwest Stouffville, Town of Whitchurch-Stouffville, December 18, 2015*
- *WSP Canada Inc., 5731 Bethesda Sideroad, Stouffville, Ontario Hydrogeological Investigation, March 3, 2022*

- *Grounded Engineering Inc., 5731 Bethesda Sideroad, Stouffville, Ontario Hydrogeological Assessment, March 3, 2025*

Terraprobe Inc., Hydrogeologic Study Proposed Residential Subdivision (Madori Property), Stouffville, Ontario, July 8, 2004

The investigation was carried out for an adjacent property. The hydrogeological characteristics of the adjacent property are applicable to the property at the corner of Elm Road and Ninth Line. The purpose of this investigation was to provide information regarding the hydrogeological conditions and provide considerations for the development of the property. Specifically, the following summarizes the results of the hydrogeological assessment.

- The stratigraphy consists of surficial deposits of low permeability native glacial till soils.
- Based on the information provided in the Terraprobe report, the direction of groundwater flow is to the southwest.
- The previous report by Terraprobe indicates that the hydraulic conductivity of the shallow soil at the site is very low (approximately 10^{-6} to 10^{-9} m/s). This results in a very slow groundwater flow rate with limited infiltration and recharge.
- The results of the water balance identified a deficit. However, engineered infiltration measures were not recommended due to the low permeability of the soil.
- Based on the shallow groundwater depths at the property, most shallow excavations will be below the observed shallow groundwater level. However, seepage was expected to be limited because of the low permeability glacial till. Deeper excavations in proximity of the underlying pressurized aquifer, if required, would result in significant flows and active dewatering and depressurization would be needed. A detailed assessment and a dewatering plan including a PTTW and monitoring program would be required in this situation.

Terraprobe Inc., Hydrogeological Study Northwest Stouffville, Town of Whitchurch-Stouffville, December 18, 2015

The investigation was carried out for a property to the east of Highway 48 (Markham Road), north of Main Street and to the south of Bethesda Sideroad; however, the hydrogeological characteristics of the subject property and study area are applicable to the property at the corner of Elm Road and Ninth Line. The purpose of the investigation was to provide information regarding the hydrogeological conditions. Specifically, the following summarizes the results of the Terraprobe hydrogeological study:

- The stratigraphy consists of silty clay to clayey silt till forming a till cap overlying sandy deposits typically under artesian ground conditions. Thickness of till deposits across the site vary, and sand seams were encountered within till deposits at various boreholes completed across the site.
- Shallow groundwater levels across the site were observed to be within one to two meters below ground level, with seasonal high groundwater levels at or near ground surface. Deeper groundwater levels were observed to be artesian.

- Based on the information provided in the Terraprobe report, the direction of regional groundwater flow at the site is to the south towards Lake Ontario. Local groundwater flow was noted to be expected to follow topography and be directed to a tributary to the Little Rouge Creek.
- The hydraulic conductivity of the shallow soil at the site is very low (approximately 10^{-5} to 10^{-9} m/s). This results in a very slow groundwater flow rate with limited infiltration and recharge.
- The results of the water balance identified a deficit.

WSP Canada Inc., 5731 Bethesda Sideroad, Stouffville, Ontario Hydrogeological Investigation, March 3, 2022

The investigation was carried out for a property located 500 m west of the intersection of Bethesda Sideroad and Ninth Line in Stouffville, Ontario; however, the hydrogeological characteristics of the subject property are applicable to property at the corner of Elm Road and Ninth Line. The purpose of the investigation was to provide information regarding the site-specific hydrogeological conditions. Specifically, the following summarizes the WSP hydrogeological investigation:

- The stratigraphy consists of surficial deposits of low permeability native glacial till soils. Silt and clay were found overlying the glacial till along the north side of the property. Silt and sand layers were found sparingly within the glacial till across the property.
- The hydraulic conductivity of clayey glacial till is in the order of 10^{-9} to 10^{-10} m/s.
- Shallow groundwater was measured between 0.01 mbgs (elev. 271.53 masl) and 1.67 mbgs (271.37 masl) except in the southwest corner where levels measured between 0.16 mbgs (elev. 269.35 masl) to 0.37 mbgs (elev. 269. 40 masl).
- Based on the information provided in the WSP report, the direction of shallow groundwater flow is to the southwest.
- The results of the water budget indicated 37% of the roof run off would need to be infiltrated to match the pre-development infiltration rates without mitigation measures. Engineered infiltration measures were not recommended. Passive LID measures such as increased topsoil thickness, bioretention and promotion of residential stormwater landscaping would be more appropriate. This is due to the high groundwater levels, upward gradient across the site, and low hydraulic conductivity.

Grounded Engineering Inc., 5731 Bethesda Sideroad, Stouffville, Ontario Hydrogeological Assessment, March 3, 2025

The investigation was carried out for a property located 500 m west of the intersection of Bethesda Side Road and Ninth Line in Stouffville, Ontario; however, the hydrogeological characteristics of the subject property are applicable to property at the corner of Elm Road and Ninth Line. The purpose of the investigation was to provide information regarding the hydrogeological considerations for the development of the property. Specifically, the following summarizes the Grounded Hydrogeological Assessment:

- The stratigraphy consists of surficial deposits of low permeability native glacial till soils. Silt and clay soil was found overlying the glacial till along the north side of the property. Silt and sand layers were

found sparingly within the glacial till across the property. Bedrock lies approximately 100 mbgs at the Site.

- The hydraulic conductivity of the till was reported to be in the order of 10^{-7} to 10^{-10} m/s.
- Shallow groundwater was measured between 267.52 masl and 271.86 masl.
- Based on the information provided in the Grounded report, the direction of shallow groundwater flow is to the southwest.
- The results of the water budget indicate that approximately 23% of the roof runoff would need to be infiltrated in order to match the pre-development infiltration rates without mitigation measures. Engineered infiltration measures are not recommended. Passive LID measures are more appropriate for this site (such as increased topsoil thickness, bioretention, and promotion of residential stormwater landscaping). This is a result of the high groundwater levels, upward gradient across the Site, and low hydraulic conductivity. These measures were agreed to be suitable as part of the draft plan approval of the subdivision.

3 Physical Setting

3.1 Site Description and Location

The site is located north of Elm Road and west of Ninth Line in Whitchurch-Stouffville. The site is rectangular in shape, with a total area of approximately 0.36 ha. The property was vacant with some tree cover. The surrounding area consists of residential, community and commercial uses. A residential development is proposed for the site. The proposed development will be serviced with municipal services. The site location is presented on Figure 1.

3.2 Physiography

The site is located within the Markham Pickering Till Plain physiographic region as defined by Chapman and Putnam (1984). The till plain slopes southward from the edge of the Oak Ridges Moraine. The overburden in the area consists primarily of surficial deposits of glacial till. This glacial till is known as the Halton Till. The Halton Till is comprised of silt to clayey silt with occasional boulders. This soil typically has low permeability.

3.3 Site Topography and Drainage

Regionally, the surrounding area is characterized by gently rolling hills. The area is drained by several creeks which generally flow south to Lake Ontario. The Oak Ridges Moraine forms a regional topographic high to the north of the Site. The moraine is a regionally extensive deposit of sand and gravel extending from the Niagara Escarpment at Caledon to the west and Trenton to the east. In the area of Whitchurch-Stouffville and Uxbridge Townships the moraine is up to 10 km wide and forms a highland area approximately 300 m to 400 m in elevation.

The site is largely flat lying with a raised area along the east property boundary. The site is at an elevation of approximately 271 masl. Due to the low permeability till across the site, surface water will tend to flow overland to the west and be directed to ditches and catch basins along the roadway.

3.4 Site Topography and Drainage

The Following climate data were compiled from the TRCA water balance tool:

Precipitation:	869 mm/a
Evapotranspiration:	662 mm/a
Water surplus:	207 mm/a

The climate data is typical for Southern Ontario, with rainfall exceeding evapotranspiration.

3.5 Regional Geology

Based on a review of published information, the site is located within the Markham-Pickering Till Plain. The till plain slopes southward from the edge of the Oak Ridges Morain. The site is located within the Oak Ridges Moraine Planning Area. Sand and gravel, which form the southern extent of the Oak Ridges Moraine Complex, underlies the surficial till unit across the area.

The near surface overburden soil in the area consists of Halton Till, consisting of glaciolacustrine deposits of silt and clay with minor sand due to basin and quiet water deposits. Underlying the till unit are sands and gravels which have been identified at depths of 10 to 20 m below grade. The sand and gravel deposits form a confined artesian aquifer. Beneath the soil deposits on the site is bedrock of the Whitby Formation consisting of grey and black shale.

3.6 Water Resources

Through the review process, a comment from York Region recommended that geotechnical and hydrogeological investigations consider that groundwater levels may currently be artificially depressed at the site due to third party permanent dewatering systems in the area.

The Access Environment web portal was utilized to review nearby water taking activities registered with the Ministry of the Environment, Conservation and Parks (MECP). The following Environmental Activity and Sector Registrations (EASR) and Permit to take Water (PTTW) registrations were noted within a 500 m radius of the Site and are presented on Figure 2.

Address / Location	Approx. Distance from Site (m)	Permissions	Date	Status	Approval Number	Comments
Lot 2, Concession 8	0	PTTW	August 5, 2004	Expired	8205-63LJMV	- Purpose of water taking was for a pumping test on two wells. - The Permit expired October 31, 2004. No water was approved after the expiry date. - No effect to the subject site is anticipated presently based on this PTTW.
117 Fairview Avenue	56	EASR	April 25, 2022	Registered	R-004-8114115274	- EASR is for waste transportation system, not water taking. - No effect to the subject site is anticipated presently based on this EASR.

There were two entries for the Lot 2, Concession 8 PTTW, with identical details. These PTTW records have been summarized in one row, above. There are no active significant water taking activities within 500 of the subject site. It is therefore assumed that the groundwater in the vicinity of the site has not been influenced by nearby third-party dewatering systems.

4 Results of Subsurface Investigation

4.1 Drilling

Two (2) boreholes were advanced by others on March 17, 2023. A monitoring well was installed in one of the boreholes. The boreholes were advanced to a depth of approximately 6.7 m. Borehole and monitoring well locations are shown on Figure 3.

The results of the drilling program are recorded in detail on the borehole logs in Appendix A.

4.2 Site Soil Profile

The information collected during the drilling program by others, is summarized below:

- A layer of topsoil was observed in both boreholes. The topsoil was approximately 150 mm thick.
- Underlying the topsoil layer was a layer of fill which extended to a range of approximately 0.7 to 0.8 ± mbgs (Elev. 270.1 to 270.3 ± masl).
- Fill is underlain by a clayey silt to silty sand glacial till layer, with trace to some clay, and trace gravel that extends up to a depth of 2.3 mbgs ± (Elev. 268.8 masl ±). This layer is described as brown, moist to wet and loose to compact.
- Below the clayey silt glacial till layer, is a layer of sand to silty sand which contains trace to some silt, brown, saturated and dense. The top of the underlying sand unit ranges from 268.8 masl in the east to 266.3 masl in the west. This layer extends to depths ranging from 4.6 mbgs to 6.7 mbgs ± (Elev. 264.2 to 264.4 masl ±).

5 Groundwater

5.1 Monitoring Well Installation

A monitoring well was installed in BH23-1 and screened between 4.6 and 6.1 mbgs (Elev. 266.3 to 264.8 masl). The monitoring well was installed in the underlying silty sand unit. The monitoring well was installed to permit the installation of a datalogger at the site to measure groundwater levels. The details of the monitoring well installation can be found on the borehole log in Appendix A. The location of the monitoring well is noted in Figure 3.

5.2 Summary of Groundwater Level Monitoring

The following summarizes the groundwater level monitoring at the site.

- Dataloggers were installed in BH23-1 in April of 2023 and were removed in August of 2023, collecting hourly data regarding groundwater levels.
- Seasonal groundwater measurements have been obtained and plotted in a hydrograph (Figures 4) along with daily precipitation in mm.
- The data shows that the seasonally high water levels were reached in April 2023, with a piezometric head of 1.50 mbgs (Elev. 269.3 masl).
- The data shows that the seasonally low water levels were reached in August 2023, with a piezometric head of 2.76 mbgs (Elev. 268.4 masl), until the reading in June 2025, which recorded a piezometric head of 2.61 mbgs (Elev. 268.3 masl).

The monitoring well on the property was screened in the underlying confined sand layer and is measuring a piezometric response within this zone. Based on the Sabourin Kimble & Associates Ltd. Site Grading Plan (February 2026), on the western portion of the property, the lowest underside footing elevation was 269.7 mASL. On the eastern portion, the lowest underside footing elevation was 270.0 mASL. The highest piezometric head observed was 269.3 mASL, which was not observed to intersect the elevation of the lowest underside of footings. The basements are all above the underlying sand unit (about 1.2 to 1.7 m separation in the east to 3.4 to 3.7 m in the west). The basements are also above the piezometric head measured (about 0.7 to 1.2 m separation in the east to 0.3 to 0.6 m in the west). The piezometric levels and approximate lowest underside footing elevation are shown on Figure 5.

Based on the DS Consultants boreholes, basements will be completed within the fill and unsaturated low permeability glacial till soils. The low permeability glacial till soils at the surface will preclude any significant groundwater seepage into footing drains. The DS Consultants borehole logs described the glacial till as brown with a relatively lower moisture content percentage. If the glacial till were grey in colour, this would be indicative of long-term saturated, oxygen-deprived (anaerobic) conditions. It is therefore assumed that a long-term water table would not be present in the upper portions of the glacial till. It is also likely that the foundations are above the piezometric head in this area. Given the low permeability of the soils, low moisture content in the till, observed brown colour, and that the basements are constructed above the maximum anticipated water table level, groundwater seepage into footing drains will not occur. The Town of Whitchurch-

Stouffville generally requires 0.6 m separation between the basement footings and the shallow groundwater table. Based on the above, and because the basements are all within the glacial till, it is our opinion that this condition would be satisfied.

6 Water Balance

6.1 Thornthwaite Model

It is currently proposed to develop the subject Site for a residential development consisting of three (3) buildings containing nine (9), three (3), and eight (8) townhouses, and a public laneway.

The following summarizes the currently proposed land coverage areas for the development:

Area Covered by Buildings	1,275 m^2	0.13 ha
Area Covered by Hard Surface Parking	1,525 m^2	0.15 ha
Area Covered by Landscape/Greenspace	833 m^2	0.08 ha
	3,633 m^2	0.36 ha

The above-noted proposed land coverage is based upon the Sabourin Kimble & Associates Ltd. Site Grading Plan dated February 2026 (Figure 6).

The surface deposits of low permeability soils at the Site allow only a low volume of groundwater recharge into the shallow groundwater system. It should be noted that the site is a very small infill, and the water balance would not be considered significant within the regional context. A water balance is normally conducted during the plan of subdivision stage which would be more meaningful with respect to the water balance and would allow for various stormwater management practices and low impact development techniques (LIDs) to be implemented.

Notwithstanding the above, a water balance for the development was prepared to assess the distribution of rainfall, runoff, and infiltration for existing (pre-development) conditions. The Thornthwaite method was used to calculate the relative budget between rainfall, evaporation, and evapotranspiration in a shallow soil zone. Based on this calculation, a conceptual model of ground water flow and water balance was developed and is attached as Table 1.

In summary, the total shallow groundwater pre-development recharge component for the site is approximately 124 mm/a. The post-development water balance was calculated and is appended as Table 1.

The water balance (pre- and post-development) is summarized below:

	Precipitation (m^3)	Evapotranspiration (m^3)	Evaporation (m^3)	Infiltration (m^3)	Run-Off (m^3)
Pre-Development	3,157	2,405	-	451	301
Post-Development	3,157	551	243	103	2,259

The percentage of roof run-off (building additions roof) required to match pre-development infiltration is 35% (348 m^3). Based on the low permeability of the soil and the small size of the development, engineered infiltration measures are not recommended. LIDs can be implemented where possible and it is not anticipated that the development will have an effect on the overall regional recharge and water balance.

6.2 CTC Source Protection Plan REC-1 Policy

The CTC Source Protection Plan's REC-1 Policy is a land use planning policy that manages activities that reduce recharge to an aquifer. The intent is to ensure that the Planning Approval Authority can make decisions that do not result in recharge reduction from new development from becoming a significant drinking water threat. This policy requires that all site plan and subdivision applications for new residential, commercial, industrial and institutional uses provide a water balance for the proposed development which addresses the following requirements:

a. Maintain pre-development recharge to the greatest extent feasible through best management practices such as LID, minimizing impervious surfaces, and lot level infiltration.

b. Where pre-development recharge cannot be maintained on site, implement and maximize off-site recharge enhancement (within the same WHPA-Q2) to compensate for any predicted loss of recharge from the development.

c. For new development within the WHPA-Q2 and within an Issue Contributing Area (for sodium, chloride or nitrates), the water balance assessment shall consider water quality when recommending best management practices and address how recharge will be maintained and water quality will be protected.

Due to the limited size of the site, there is not sufficient space to add LID components to account for the recharge deficit. However, a residential development within Whitchurch Stouffville and in the same WHPA-Q2 also operated by Fieldgate (5731 Bethesda Road, File No.: 19T[W]-22.002) has been draft approved and currently has an infiltration surplus. The 5731 Bethesda Road LID concept plan detailing locations of bioswales and the wetland planting deck has been included in Appendix B.

Following point b. above, and in consultation with the TRCA, the 348 m^3 deficit on this Site has been mitigated with the infiltration measures at the 5731 Bethesda Site, for which there is an infiltration surplus of 35,781 m^3. The water balance for 5731 Bethesda Road has been appended herein highlighting this surplus and has been included in Table 2. By compensating for the predicted loss of recharge from this development with the surplus at 5731 Bethesda Road, which is in the same WHPA-Q2, this site would now be in compliance with CTC Source Protection Plan REC-1.

7 Summary and Conclusions

Based on the review of the available site information, the hydrogeologic conditions of the Property is summarized as follows:

- The overburden in the area consists primarily of surficial deposits of glacial till. This glacial till is known as the Halton Till. Based on a review of published information, the site is located within the Markham-Pickering Till Plain.
- Based on a review of available information groundwater flow is anticipated to be to the south/southwest.
- The site is largely flat lying with a raised area along the east property boundary. The site is at an elevation of approximately 271 masl.
- No hydrogeologic features were noted on site.
- Due to the low permeability till across the site, surface water will tend to flow overland to the west and be directed to ditches and catch basins along the roadway.
- Beneath the soil deposits on the site is bedrock of the Whitby Formation consisting of grey and black shale.
- Two (2) boreholes were advanced by others on March 17, 2023. A monitoring well was installed in one of the boreholes (BH23-1). The boreholes were advanced to a depth of approximately 6.7 m.
- A monitoring well was installed in BH23-1 and screened between 4.6 and 6.1 mbgs (Elev. 266.3 to 264.8 masl). The monitoring well was installed to permit the installation of a datalogger at the site to measure groundwater levels. The data shows that the seasonally piezometric head was reached in April 2023, with a depth of 1.5 mbgs (Elev. 269.3 masl). The data shows that the seasonally low piezometric head was reached in August 2023, with a depth of 2.76 mbgs (Elev. 268.4 masl).
- The basements will all be completed within the fill and low permeability glacial till and above the maximum anticipated piezometric head. Basements drainage into footing drains are not anticipated. It is our opinion that the separation intent of Whitchurch-Stouffville for basements has been achieved.
- Groundwater controls are likely not required during the construction of the storm and sanitary sewers. The Sabourin Kimble & Associates Ltd dated February 2026 labelled “PP” showed the lowest point of the sewers to be approximately 268.8 to 267.8, extending to the top of the underlying sand (elevation ranging 268.8 - 266.3 masl). Groundwater seepage can be limited by conducting excavation in stages.
- Engineered infiltration measures are not proposed due to the small size of the development and the low permeability of the surface soil. The water balance requirement under CTC REC-1 Policy has been achieved using additional recharge from another Site (5731 Bethesda Road, File No.: 19T[W]-22.002).
- In general, site design measures should incorporate the following: carrying out excavation or trench backfilling operations with materials that are like the materials that have been excavated.
- The monitoring well installed in BH23-1 needs to be maintained in accordance with the Ontario Water Resources Act, O. Reg. 903, Wells. Once the well is no longer required for monitoring or sampling purposes it will need to be appropriately decommissioned by a licensed well contractor as required by O. Reg. 903.

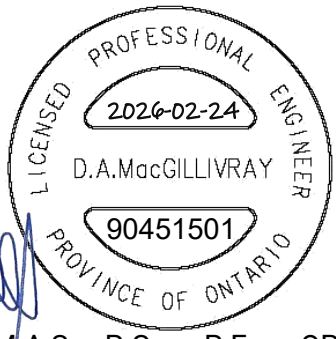
8 Closure

This report has been prepared for the use of Madori Ltd. This report is copyright of Grounded Engineering Inc.

We trust that the information contained in this letter is sufficient for your present requirements. If we can be of further assistance, please do not hesitate to contact us.

GROUNDED ENGINEERING

Kristen Shaver, M.Sc., P.Geo., QP$_{ESA}$
Project Geoscientist



David MacGillivray, M.A.Sc., P.Geo., P.Eng., QP$_{RA-ESA}$
Principal

FIGURES

GROUNDED ENGINEERING
49 MOBILE DRIVE, TORONTO, ONT., M4A 1H5
www.groundedeng.ca

LEGEND

APPROXIMATE PROPERTY BOUNDARY

Note

Reference

Google Earth, 2023

Project

ELM ROAD AND NINTH LINE, WHITCHURCH-STOUFFVILLE

Figure Title

SITE LOCATION PLAN

North

TRUE
PROJECT

Date

FEBRUARY 2026

Scale

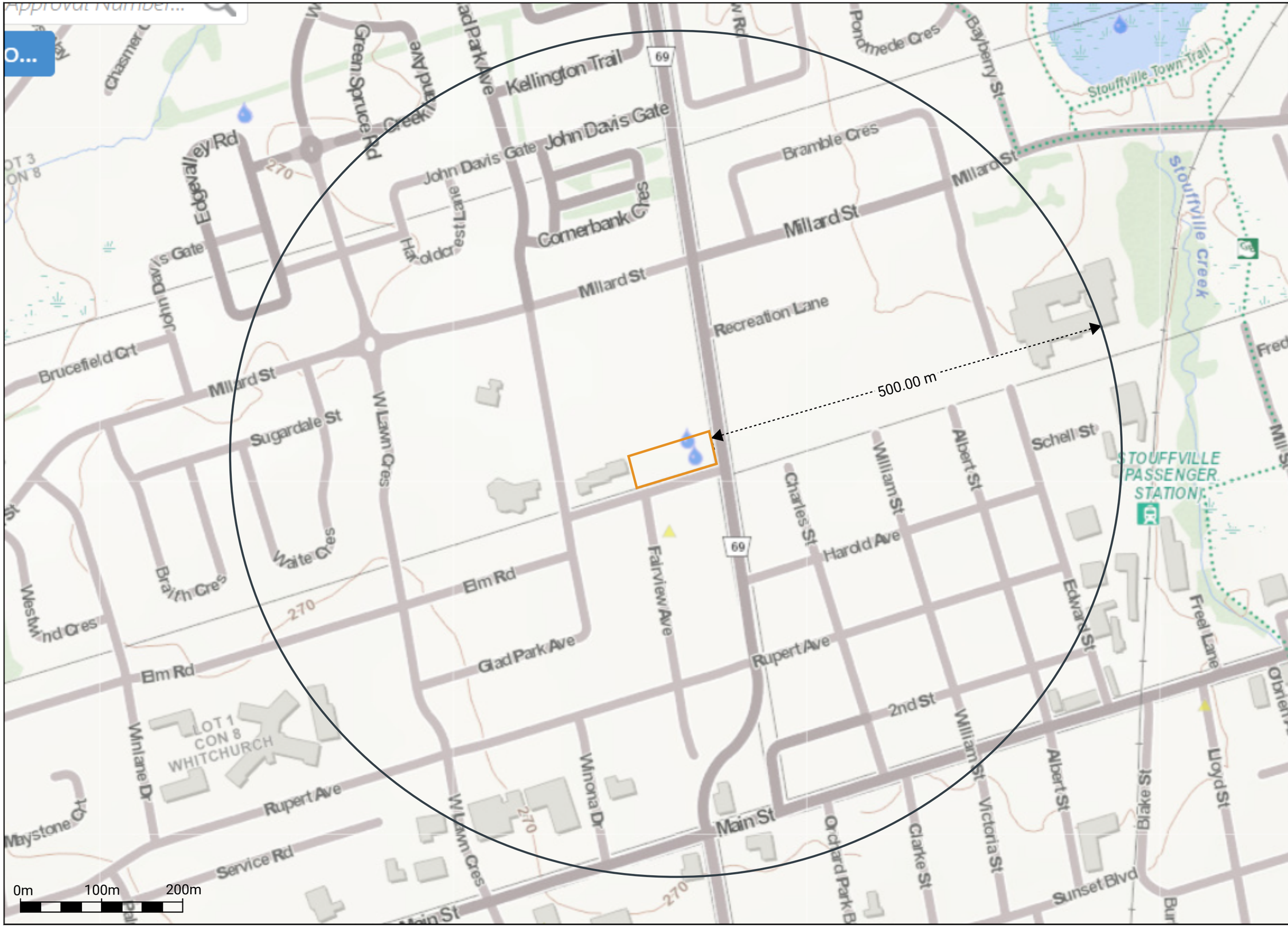
AS INDICATED

Job No

23-050

Figure No

FIGURE 1



GROUNDED ENGINEERING

49 MOBILE DRIVE, TORONTO, ONT., M4A 1H5
www.groundedeng.ca

LEGEND

- PROPERTY BOUNDARY
- 500 m RADIUS
- PERMIT TO TAKE WATER
- ENVIRONMENTAL ACTIVITY AND SECTOR REGISTRATIONS

Note

Reference

Project
ELM ROAD AND NINTH LINE, WHITCHURCH-STOUFFVILLE

Figure Title
WATER TAKING ACTIVITIES NEAR SITE

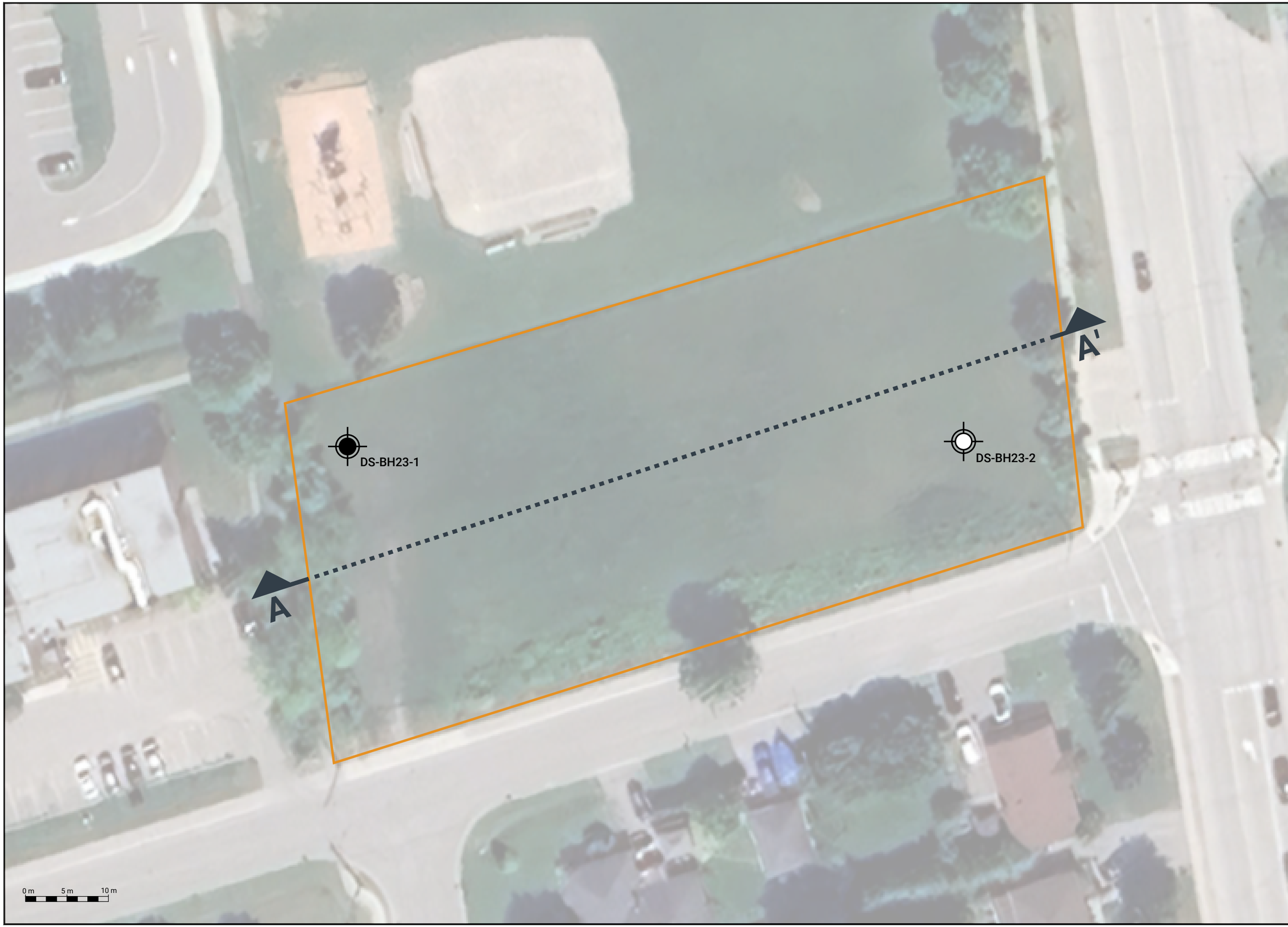
North

Date
FEBRUARY 2026

Scale
AS INDICATED

Job No
23-050

Figure No
FIGURE 2



GROUNDED ENGINEERING

49 MOBILE DRIVE, TORONTO, ONT., M4A 1H5
www.groundedeng.ca

LEGEND

- PROPERTY BOUNDARY
- MONITORING WELL/BOREHOLE BY OTHERS
- CROSS SECTION LINE

Note

Reference

Project

ELM ROAD AND NINTH LINE, WHITCHURCH-STOUFFVILLE

Figure Title

BOREHOLE LOCATION PLAN

North

TRUE
PROJECT

Date

FEBRUARY 2026

Scale

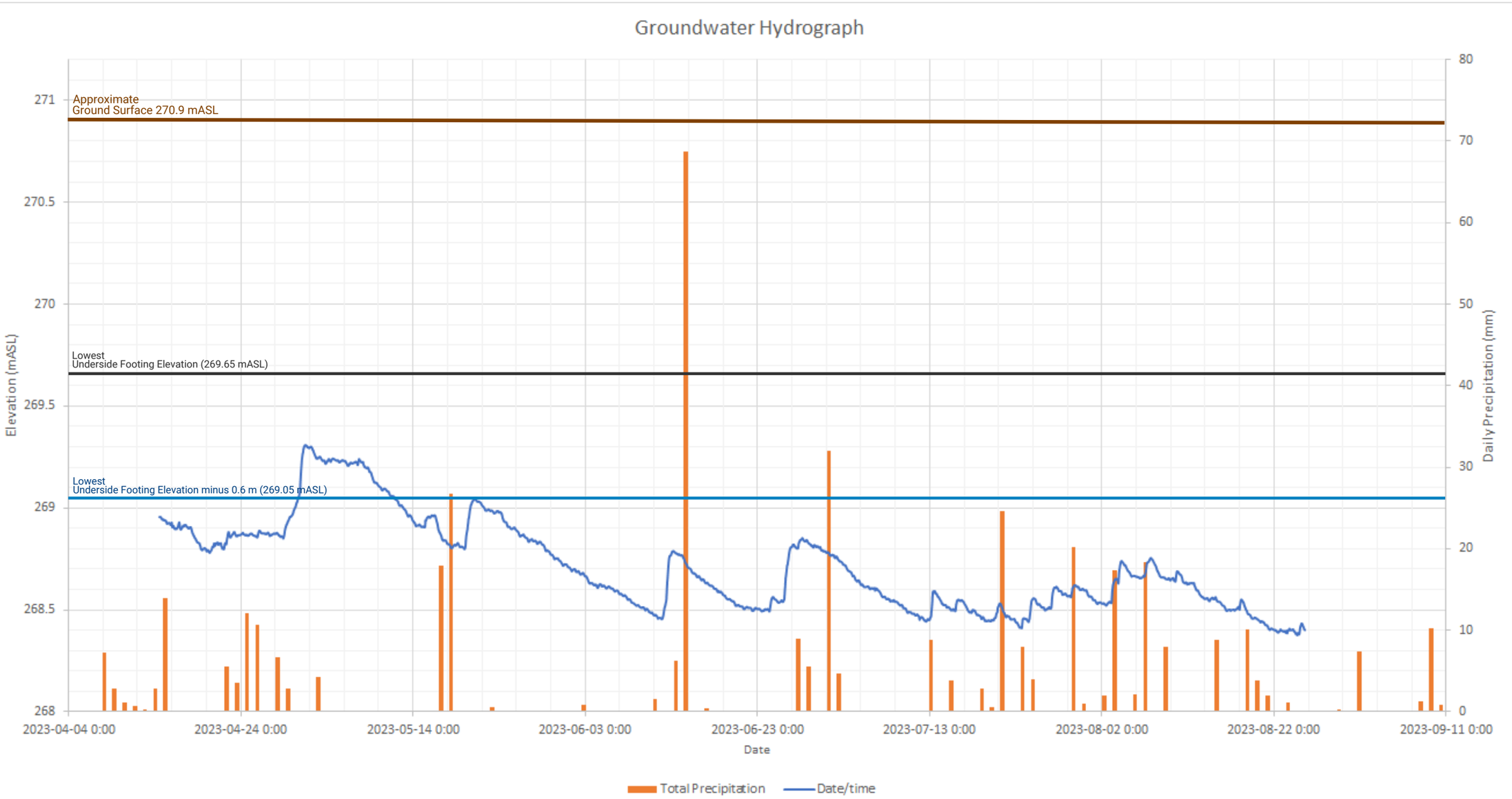
AS INDICATED

Job No

23-050

Figure No

FIGURE 3



GROUNDED ENGINEERING
49 MOBILE DRIVE, TORONTO, ONT., M4A 1H5
www.groundedeng.ca

LEGEND

- PIEZOMETRIC ELEVATIONS (mASL)
- PRECIPITATION (mm)

Note

Reference

Project

ELM ROAD AND NINTH LINE, WHITCHURCH-STOUFFVILLE

Figure Title

HYDROGRAPH

North

Date

FEBRUARY 2026

Scale

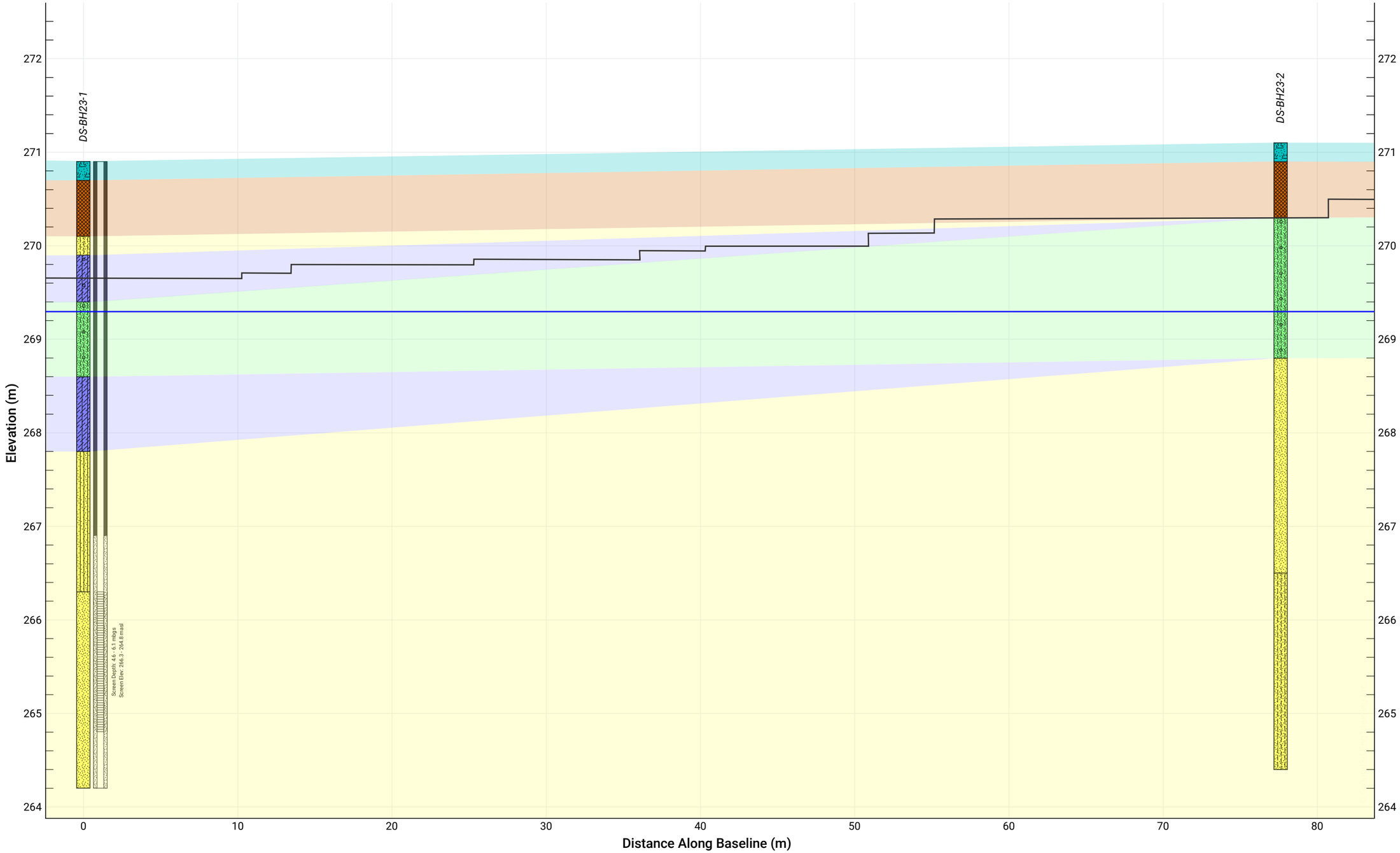
AS INDICATED

Job No

23-050

Figure No

FIGURE 4



GROUNDED ENGINEERING

49 MOBILE DRIVE, TORONTO, ONT., M4A 1H5
www.groundedeng.ca

LEGEND

- APPROXIMATE LOWEST UNDERSIDE OF FOOTING ELEVATION
- SEASONALLY HIGH PIEZOMETRIC ELEVATION
- TOPSOIL
- EARTH FILL
- SANDS
- COHESIONLESS TILL
- COHESIVE TILL

Topsoil · Silty Sand Till · Fill · Clayey Silt · Silty Sand · Sandy Silt · Clayey Silt Till · Sand

Note

The soil/rock stratigraphy shown on the cross section between borehole locations is interpreted. The actual soil/rock conditions may vary.

Reference

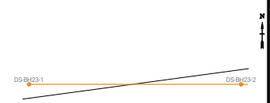
Project

ELM ROAD AND NINTH LINE, WHITCHURCH-STOUFFVILLE

Figure Title

CROSS SECTION A-A'

North



Date

FEBRUARY 2026

Scale

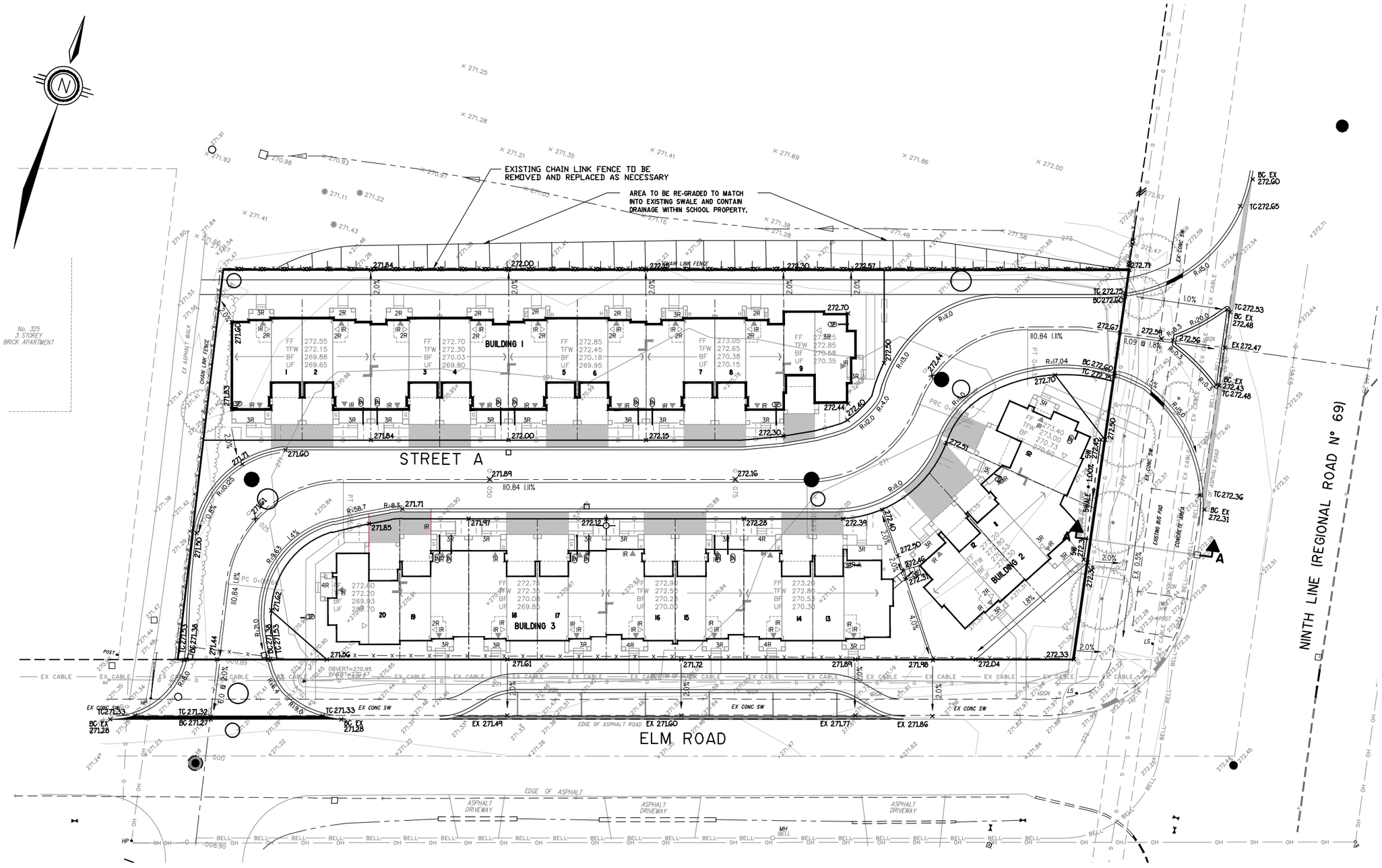
AS INDICATED

Job No

23-050

Figure No

FIGURE 5



GROUNDED ENGINEERING

49 MOBILE DRIVE, TORONTO, ONT., M4A 1H5
www.groundedeng.ca

LEGEND

Note

Reference

Sabourin Kimble & Associates Ltd., June 2025

Project

ELM ROAD AND NINTH LINE, WHITCHURCH-STOUFFVILLE

Figure Title

SITE SERVICING PLAN

North

TRUE

PROJECT

Date

FEBRUARY 2026

Scale

AS INDICATED

Job No

23-050

Figure No

FIGURE 6

TABLE 1

Water Balance - Elm Road and Ninth Line

1. Climate Information

Climate data from TRCA Water Balance

Precipitation	869	mm/a	0.87	m/a *
Evapotranspiration	662	mm/a	0.66	m/a *
Water Surplus	207	mm/a	0.21	m/a

2. Infiltration Rates

Selected Approach **Table 2**

Table 2 Approach - Infiltration Factors

Topography - (Flat land, rolling land, hilly land)	0.3	*
Soil - (Tight impervious clay, etc...)	0.2	*
Cover - (Cultivated lands, woodland)	0.1	*
TOTAL:	0.6	

Infiltration (Infiltration Factor x Water Surplus)	124	mm/a	0.1242	m/a
Run-off (Water Surplus - Infiltration)	83	mm/a	0.0828	m/a

Table 3 Approach - Typical Recharge Rates

coarse sand and gravel	250+	mm/a *
fine to medium sand	200 - 250	mm/a *
silty sand to sandy silt	150 - 200	mm/a *
silt	125 - 150	mm/a *
clayey silt	100 - 125	mm/a *
clay	< 100	mm/a *

The site development area is underlain by clayey silt to silty sand.

Based on the above, the recharge rate is	150	mm/a	0.150	m/a
with runoff of	57	mm/a	0.057	m/a

3. Property Statistics - Pre-development

Area Covered by Existing Building	0	m^2	0.00	ha
Area Covered by Existing Hard Surface Paving	0	m^2	0.00	ha
Area Covered by Existing Landscaped area	3,633	m^2	0.36	ha
TOTAL	3,633	m^2	0.36	ha

4. Property Statistics - Post-development

Area Covered by Building with Additions	1,275	m^2	0.13	ha
Area Covered by Hard Surface Paving	1,525	m^2	0.15	ha
Area Covered by Landscaped Area	833	m^2	0.08	ha
TOTAL:	3,633	m^2	0.36	ha

*Based on published information

Water Balance - Elm Road and Ninth Line

5. Annual Water Balance Before Building Additions

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Evaporation (m^3)	Infiltration (m^3)	Run-Off (m^3)
Building (entire site)	0	0	-	-	-	0
Hard Surface Paving	0	0	-	-	-	0
Landscape Area (entire site)	3,633	3,157	2,405	-	451	301
TOTAL	**3,633**	**3,157**	**2,405**	**0**	**451**	**301**

6. Annual Water Balance After Building Additions

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Evaporation (m^3)	Infiltration (m^3)	Run-Off (m^3)
Building (entire site)	1,275	1,108	-	111	-	997
Hard Surface Paving	1,525	1,325	-	133	-	1,193
Landscape Area (entire site)	833	724	551	-	103	69
TOTAL	**3,633**	**3,157**	**551**	**243**	**103**	**2,259**

7. Comparison of Pre-Development (before building additions) and Post-Development (after building additions)

	Precipitation (m^3)	Evapotranspiration (m^3)	Evaporation (m^3)	Infiltration (m^3)	Run-Off (m^3)
Pre-Development	3,157	2,405	-	451	301
Post-Development	3,157	551	243	103	2,259
Difference (No Mitigation)	0	-1,854	243	-348	1,958

8. Mitigation

	Precipitation (m^3)	Evapotranspiration (m^3)	Evaporation (m^3)	Infiltration (m^3)	Run-Off (m^3)
Volume of Infiltration Surplus Taken From 5731 Bethesda Road (File No.: 19T[W]-22.002)	-	-	-	348	-
Difference After Mitigation	0	-1,854	243	0	1,958

TABLE 2

Water Balance - Bethesda Sideroad

1. Climate Information

Precipitation	853	mm/a	0.85 m/a *
Evapotranspiration	550	mm/a	0.55 m/a *
Water Surplus	303	mm/a	0.30 m/a

2. Infiltration Rates

Selected Approach **Table 3**

Table 2 Approach - Infiltration Factors

Topography - rolling land	0.2 *
Soil - Medium combinations of clay and loam	0.2 *
Cover - Cultivated lands	0.1 *
TOTAL:	0.5

Infiltration (Infiltration Factor x Water Surplus)	151.5	mm/a	0.1515 m/a
Run-off (Water Surplus - Infiltration)	152	mm/a	0.1515 m/a

Table 3 Approach - Typical Recharge Rates

coarse sand and gravel	250+	mm/a *
fine to medium sand	200 - 250	mm/a *
silty sand to sandy silt	150 - 200	mm/a *
silt	125 - 150	mm/a *
clayey silt	100 - 125	mm/a *
clay	< 100	mm/a *

The site development area is underlain by clayey silt till = 125 mm/a

Based on the above, the recharge rate is	125	mm/a	0.125 m/a
with runoff of	178	mm/a	0.178 m/a

3. Property Statistics - Pre-development

Area Covered by Existing Building	0	m^2	0.00 ha
Area Covered by Existing Hard Surface/Paving	0	m^2	0.00 ha
Area Covered by Existing Landscape/Open	215,200	m^2	21.52 ha
TOTAL	215,200	m^2	21.52 ha

4. Property Statistics - Post-development

Area Covered by Building (Roofs)	120,100	m^2	12.01 ha
Area Covered by Hard Surface Paving	55,300	m^2	5.53 ha
SWMP	11,100	m^2	1.11 ha
Area Covered by Landscape/Greenspace	28,700	m^2	2.87 ha
TOTAL:	215,200	m^2	21.52 ha

*Based on published information

Water Balance - Bethesda Sideroad

5. Annual Water Balance Before Development

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Building	0	0	-	-	0
Hard Surfaces Paving		0	-	-	0
Landscape Area	215,200	183,566	118,360	26,900	38,306
TOTAL	**215,200**	**183,566**	**118,360**	**26,900**	**38,306**

6. Annual Water Balance Post-Development - No Mitigation

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Building (Roofs)	120,100	102,445	-	-	102,445
Hard Surface/ Paving	55,300	47,171	-	-	47,171
Landscape/ Greenscape Areas	28,700	24,481	15,785	3,588	5,109
SWMP	11,100	9,468	6,105	-	3,363
TOTAL	**215,200**	**183,566**	**21,890**	**3,588**	**158,088**

Percentage of roof run-off needed to match pre-development infiltration 23%

7. Mitigation

Amended Topsoil 25% reduction in runoff (TRCA - Evaluation of Residential Lot Level Stormwater Management Practices, 2013)

Runoff reduction	26,888	m^3
Increased ET	17,337	m^3
Increased Infiltration	3,940	m^3

Infiltration Opportunities

Land Use	Area (m^2)	Contributing Area (m^2)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
LID#1 - Pond Block Bioswale	70	1,055	39	681	180
LID#2 - Rear Yard Bioswale	109	1,308	60	833	223
LID#3 - School Block Bioswale	440	10,209	242	6,202	2,264
LID#4 - Parking Lot Bioswale	208	2,570	114	1,727	351
LID#5 - Park Block Bioswale	165	10,828	91	7,114	2,032
Wetland Planting Deck	202	141,806	111	38,596	82,253
TOTAL	**1,194**	**167,776**	**657**	**55,153**	**87,303**

8. Comparison of Pre- to Post-Development

	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Pre-Development	183,566	118,360	26,900	38,306
Post-Development	183,566	21,890	3,588	158,088
Post-Development Mitigated	183,566	39,884	62,681	81,001
Difference (No Mitigation)	0	-96,470	-23,313	119,783
Difference (With Mitigation)	0	-78,476	35,781	42,695

APPENDIX A

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH23-1

PROJECT: Geotechnical Investigation
CLIENT: Fieldgate Developments
PROJECT LOCATION: Elm Road & 9th Line, Whitchurch-Stouffville, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4870382.55 E 639726.12

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Mar-17-2023

REF. NO.: 23-072-100
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION	GR	SA	SI	CL
270.9									
270.8	**TOPSOIL:** 150mm								
0.2	**FILL:** silty sand, trace organics, trace gravel, brown, moist, loose	1	SS	5					
270.1									
269.9	**SILTY SAND:** trace clay, trace gravel, brown, very moist, compact	2	SS	17	270	6	32	43	19
1.0									
269.4	**CLAYEY SILT TILL:** sandy, trace gravel, brown, moist, very stiff								
1.5		3	SS	18		10	38	39	13
2	**SILTY SAND TILL:** some clay, some gravel, occasional cobble, brown, moist, compact				269				
268.6					W. L. 269.0 m Mar 22, 2023				
2.3	**CLAYEY SILT:** trace sand, brown, moist, very stiff	4	SS	20			3	78	19
3					268				
267.8									
3.1	**SANDY SILT:** some clay, trace gravel, brown, wet, dense	5	SS	42		1	25	61	13
4					267				
266.3									
4.6	**SAND:** trace silt, trace clay, trace gravel, brown, saturated, compact	6	SS	13	266	1	90		(9)
5									
6					265				
		7	SS	12					
264.2									
6.7	**END OF BOREHOLE:**								

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Mar. 22, 2023	1.95

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH23-2

PROJECT: Geotechnical Investigation
CLIENT: Fieldgate Developments
PROJECT LOCATION: Elm Road & 9th Line, Whitchurch-Stouffville, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4870382.64 E 639803.75

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Mar-17-2023

REF. NO.: 23-072-100
ENCL NO.: 3

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
271.1												
271.0 / 0.0	**TOPSOIL:** 150mm						271					
270.8 / 0.2	**FILL:** silty sand, trace gravel, brown, moist, loose		1	SS	4							
270.3												
1 0.8	**SILTY SAND TILL:** some clay, trace gravel, brown, moist to wet, loose to compact		2	SS	9		270					
			3	SS	13							4 30 51 15
2 268.8							269					
2.3	**SAND:** trace to some silt, brown, saturated, dense		4	SS	30							
3			5	SS	30		268					
4 266.5							267					
4.6	**SILTY SAND:** trace clay, brown, saturated, compact		6	SS	10							0 73 25 2
5							266					
6			7	SS	18		265					
264.4												
6.7	**END OF BOREHOLE:** Notes: 1) Water observed at 2.3m during drilling.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

APPENDIX B

BETHESDA SIDEROAD

BETHESDA SIDEROAD

HARJONES AVENUE

HIGHWOOD STREET

FIELDSTONE AVENUE

SANDPIPER CRESCENT

SANDPIPER LANE

SANDPIPER CRESCENT

HARJONES AVENUE

FIELDSTONE AVENUE

PLUMBTREE LANE

DANE STREET

PARKVALE CRESCENT

PARKVALE CRESCENT

STREET B

JADESTONE DRIVE

CEDARBUSH LANE

GRAND MAPLE LANE

JADESTONE DRIVE

ELMER AVENUE

MAGGIES WAY

HARJONES AVENUE

FIELDSTONE AVENUE

BAKER HILL BLVD

SCHOOL BUILDING

LID 3:
2.0m WIDE x 0.5m DEEP x 222m LONG
TOTAL RETENTION: 88m³

LID 5:
1.0m WIDE x 0.5m DEEP x 159m LONG
TOTAL RETENTION: 33m³

LID 2:
0.6m WIDE x 0.4m DEEP x 182m LONG
TOTAL RETENTION: 16m³

1.02
78%

1.08
25%

0.26
90%

LID SPILL ELEV.
273.82

LID SPILL ELEV.
274.08

LID SPILL ELEV.
273.20

0.14
100%

LID SPILL ELEV.
272.44

0.12
100%

LID 4:
2.0m WIDE x 0.42m DEEP x 104m LONG
TOTAL RETENTION: 35m³

LID 1:
0.5m WIDE x 0.5m DEEP x 140m LONG
TOTAL RETENTION: 13m³

WETLAND PLANTING DECK
TOTAL RETENTION: 234m³

SCALE 1:2000

LEGEND:

- 2.20 / 90% — DRAINAGE AREA (ha) / % IMPERVIOUS
- STORM DRAINAGE BOUNDARY
- BIORETENTION SWALE
- MEANDERBELT
- MEANDERBELT +30m
- EXISTING REGIONAL FLOODLINE
- PROPOSED REGIONAL FLOODLINE
- TRCA STAKED DRIPLINE
- TRCA STAKED DRIPLINE BUFFER
- OVERLAND FLOW ROUTE
- CONTRIBUTING DRAINAGE AREA TO LID 1
- CONTRIBUTING DRAINAGE AREA TO LID 2
- CONTRIBUTING DRAINAGE AREA TO LID 3
- CONTRIBUTING DRAINAGE AREA TO LID 4
- CONTRIBUTING DRAINAGE AREA TO LID 5

FIELDGATE DEVELOPMENTS
BONA LANDS
LID CONCEPT PLAN

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NO.
12.264	5

CAD FILE: P:\12\264\Drawing Files\Phase 1\Figures\SWM Brief\264 Figure 05 LID Strategy.dwg