Robinson
Land Development

Carroll Subdivision
3160 Carp Road
City of Ottawa, ON
Servicing & Stormwater Management Report

Prepared For:

T & L Carroll Holdings Inc.

Prepared By:

Robinson Land Development

Project No. 24104
Revision 1
March 2025

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LEGAL NOTIFICATION

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1.0 INTRODUCTION

Robinson Land Development have been retained by T & L Carroll Holdings Inc. to prepare a Servicing & Stormwater Management Report for a proposed rural industrial/commercial subdivision located at 3160 Carp Road in the City of Ottawa. The subject site (herein referred to as the Carroll Subdivision) is 21.5 hectares in area and will be accessed from a new road connection to Carp Road (refer to **Figure 1 – Key Plan** following page 1). In support of achieving draft plan approval, this report will provide sufficient details to demonstrate that the Carroll Subdivision can be developed in accordance with current City of Ottawa guidelines and overarching studies to the satisfaction of the approval authorities.

2.0 GUIDELINES, STUDIES AND REPORTS

The designs for the proposed Carroll Subdivision have been prepared in keeping with the following documents:

- **Sewer Design Guidelines**, City of Ottawa, Second Edition, October 2012 (herein referred to as the OSDG).
  - **Technical Bulletin ISD-2010-1,** City of Ottawa, September 28, 2010.
  - **Technical Bulletin ISD-2011-2,** City of Ottawa, October 6, 2011.
  - **Technical Bulletin ISD-2012-1,** City of Ottawa, January 31, 2012.
  - **Technical Bulletin ISD-2012-4,** City of Ottawa, June 20, 2012.
  - **Technical Bulletin ISD-2012-6,** City of Ottawa, October 31, 2012.
  - **Technical Bulletin ISDTB-2014-01,** City of Ottawa, February 5, 2014.
  - **Technical Bulletin PIEDTB-2016-01,** City of Ottawa, September 6, 2016.
  - **Technical Bulletin ISTB-2018-**01, City of Ottawa, March 21, 2018.
  - **Technical Bulletin ISTB-2018-03,** City of Ottawa, March 21, 2018.
  - **Technical Bulletin ISTB-2018**-04, City of Ottawa, June 27, 2018.
  - **Technical Bulletin ISTB-2019-02,** City of Ottawa, July 08, 2019.

- **Ottawa Design Guidelines, Water Distribution**, City of Ottawa, First Edition, July 2010 (herein referred to as OWDG).
  - **Technical Bulletin ISD-2010-2,** City of Ottawa, December 15, 2010.
  - **Technical Bulletin ISDTB-2014-02,** City of Ottawa, May 27, 2014.
  - **Technical Bulletin ISTB-2018-02,** City of Ottawa, March 21, 2018.
  - **Technical Bulletin ISTB-2021-03,** City of Ottawa, August 18, 2021.
  - **Technical Bulletin IWSTB-2024-05,** City of Ottawa, November 18, 2024.

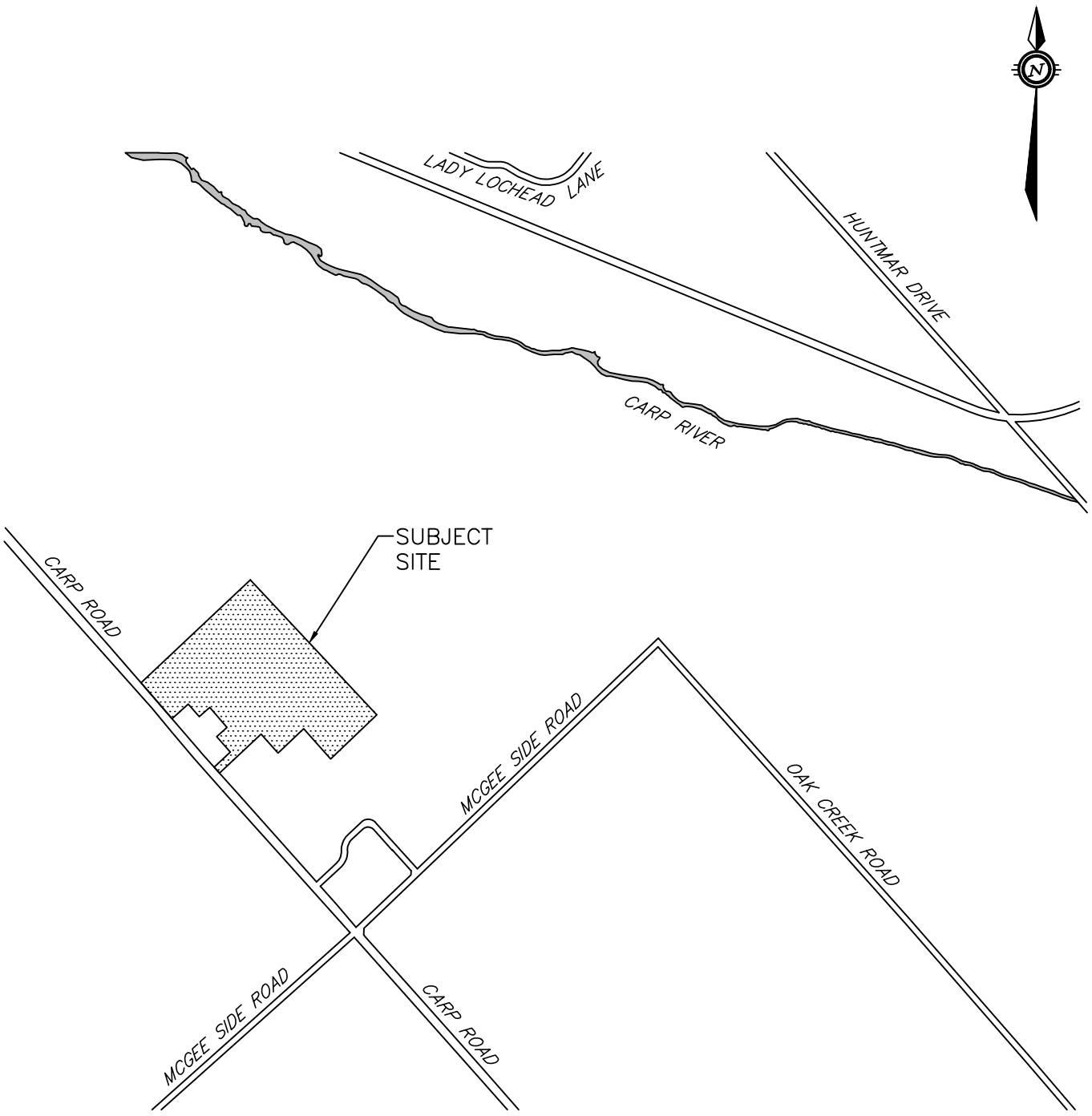
- **Stormwater Management Planning and Design Manual,** Ministry of the Environment, 2003 (herein referred to as MECP SWM Manual).

- **Carp River Watershed/ Subwatershed Study Volume I – Main Report**, Robinson Consultants Inc., December 2004 (herein referred to as the CRWSS).

- **Low Impact Development Stormwater Management Planning and Design Guide,** CVC, TRCA, 2010 (herein referred to as LID Design Guide).

- **Water Supply for Public Fire Protection,** Fire Underwriters Survey, 2020 (herein referred to as FUS Guidelines).

- **Geotechnical Investigation, Proposed Industrial Development, 3160 Carp Road**, GEMTEC, September 13, 2023.



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scale N.T.S.	CARROLL SUBDIVISION	project no. 24104
date 06/03/25		
drawn by BLM	KEY PLAN	FIG 1.0

- **Environmental Impact Statement, Proposed Plan of Subdivision, 3160 Carp Road**, GEMTEC.

- **Hydrogeological Investigation & Terrain Analysis, Proposed Industrial Subdivision, 3160 Carp Road**, GEMTEC, August 9, 2024.

A pre-consultation was held with the City of Ottawa and Rideau Valley Conservation Authority (RVCA) on September 9th, 2022 to discuss requirements for the proposed development. The pre-consultation meeting notes have been provided under **Appendix A** for reference.

3.0 EXISTING CONDITIONS

The subject site is 21.5 hectares in area and is zoned rural commercial subzone 9 (RC9 – Highway Commercial). The site is bound by Carp Road and highway commercial properties to the west, highway commercial properties to the north and south, and agricultural land to the east. The subject site is currently undeveloped with limited tree coverage. The topography of the property slopes from west to east. The site contains multiple drainage features (refer to **Section 7.6** for more details) which capture and convey surface runoff from the property. An existing watercourse is located at the easternmost corner of the site. The existing watercourse conveys stormwater runoff in a northeast direction, ultimately discharging into the Carp River approximately 1550 metres downstream of the subject site. The site is located within the Carp River Watershed and within the Mississippi Valley Source Protection Area. Approximately half of the site falls within the boundary of a highly vulnerable aquifer (as per source protection mapping). Refer to the Draft Plan of Subdivision, prepared by Egis Surveying Inc., in **Appendix A**. Refer also to **Figure 2** below for an aerial view of the subject site under its current development state.

Figure 2: Existing Conditions

4.0 DEVELOPMENT PROPOSAL

The proposed Carroll Subdivision will provide a total of (11) rural industrial/commercial use blocks. The blocks will range from 1.14 hectares up to 4.74 hectares in area. The blocks will be accessed by a new municipal roadway with two connections to Carp Road. The southerly connection will coincide with the existing entrance connection to the 3108 Carp Road property. As part of the development works, a new entrance connection for the 3108 Carp Road property will be provided off the new municipal roadway. The new municipal roadway will have a rural cross-section and will be contained within a 20.0 metre right-of-way. The total length of the proposed roadway is approximately 890 metres.

Development of the subject site will be constrained by a 30 metre Blanding's Turtle Habitat setback measured from the existing watercourse as identified in the Environmental Impact Statement (EIS) prepared by GEMTEC.

The proposed blocks will be serviced by individual well and septic systems as discussed under **Section 5.0** and **Section 6.0** below. Detailed development plans for the blocks will require individual Site Plan Applications (SPAs) with the City of Ottawa as they become developed.

5.0 WATER SERVICING

5.1 Existing System

There are no municipal watermain systems available in proximity to the subject site. Existing developments in the area receive water supply via private drilled wells.

5.2 Domestic Water Supply

Domestic water supply for the individual blocks will be provided by private drilled wells. GEMTEC completed a groundwater supply investigation to determine the quantity and quality of groundwater available for domestic water supply. The investigation required the drilling of four test wells on the subject site to characterize the hydrogeology and meet MECP D-5-5 minimum test well requirements. The field procedures included 8-hour constant rate pumping tests and simultaneously pumping of two test wells to assess well interference. The test wells were pumped at a constant flow rate of 21 L/min. A flow rate of 21 L/min over an 8-hour period (≈10,000 L) is considered to be representative of the water usage expected for the future uses on the site. Water level measurements and groundwater sampling were also completed. Based on the investigations completed to date, GEMTEC has provided the following conclusions regarding the use of drilled wells for domestic water supply:

- The water quality available from the drilled wells on the site is safe for consumption based on the absence of health-related exceedances.
- The quality of groundwater meets MECP regulations, standards, guidelines and objectives with the exception of hardness, sodium, and sulphide.
    - The levels of hardness are considered to be reasonably treatable using a conventional water softener.
    - The levels of sodium remain well below the 200 mg/L aesthetic objective; however, three of the test wells exceed the 20 mg/L warning limit for persons on sodium restricted diets.
    - The levels of hydrogen sulphide exceed the ODWS aesthetic objective of 0.05 mg/L. An unofficial addendum to Procedure D-5-5 (July 6, 1995) indicates that sulphide

concentrations of up to 2.5 mg/L can be reasonably treated with manganese greensand filters.

- No negative water quality impacts from neighbouring properties have been identified.
- The trace metals (associated with neighbouring cemeteries) tested from TW2 and TW4 reported non-detectable concentrations or concentrations well below the applicable maximum acceptable concentration, aesthetic objective or operational guideline.
- The water quality determined in the course of the investigation is representative of long-term water quality from which future lot owners are likely to obtain from their wells constructed in accordance with the well construction recommendations.
- The quantity of groundwater available from the proposed water supply aquifer is more than sufficient for the proposed development and will sustain repeated pumping at the test rate and duration at 24-hour intervals over the long term.
- The well yields determined in the course of this investigation are representative of the long-term yields which future lot owners are likely to obtain from their wells constructed in accordance with the well construction recommendations.
- Additional water quantity testing is recommended should future lot owners require groundwater in excess of the maximum allowable septic flows (e.g. processing waters).
- Interference between drinking water wells is expected to be acceptable under typical usage for commercial/industrial developments.

The exact locations of the proposed drilled wells will be determined at the SPA stage as the individual blocks become developed. Proposed drilled wells must maintain a minimum setback of 15 metres from any proposed septic systems. The minimum setback is increased to 18 metres if fully raised septic beds are used. A conceptual well location has been shown on **Figure 3 – Conceptual Lot Development Plan** provided under **Appendix B** to demonstrate that minimum separations can be achieved. GEMTEC has provided the following well construction recommendations to assist in the future development of the subject site:

- Any original test wells which are not located in suitable locations for future development use and any other existing wells located on the property should be abandoned by a licensed well driller in accordance with MECP regulations following draft plan approval of the subdivision.
- Wells should be located so that they meet the minimum setback distances from septic systems, property lines and any other sources of contamination, as required in the Ontario Building Code and/or Ontario Reg. 903. If possible, the setback distance for the location of drinking water wells should be maximized.
- All wells shall remain accessible for future inspection and testing and large equipment for future maintenance, repair, and replacement.
- All wells that are drilled in the subdivision should be constructed in accordance with MECP regulations (Ontario Reg. 903).
- All wells that are drilled in the subdivision should be maintained in accordance with the document entitled 'Water Supply Wells – Requirements and Best Management Practices' (MECP December 2009).
- Well casings should be extended at least 11.6 metres below ground surface. The entire annular space between the steel casing and the overburden/bedrock should be filled with a suitable cement or bentonite grout.
- In addition to the minimum recommended well casing lengths specified in the preceding recommendation, all well casings should be completed a minimum of 4.57 metres into sound, competent bedrock.
- Multi-day well development may be required to reduce turbidity levels in newly drilled wells on the site. If a newly drilled well is required at the time of Site Plan Control for the Site, a qualified professional should be retained to confirm that turbidity levels are at acceptable levels after well development.

- A well grouting certification inspection should be conducted during the installation and grouting of the well casing for all future wells installed on the subject site. The well grouting certification inspection should be conducted under the supervision of a professional engineer or professional geoscientist.
- Hydrofracturing of all four on-site test wells was required to obtain the minimum pumping requirements of MECP Procedure D-5-5. Future lot owners should be aware that additional well development such as hydrofracturing, surging and/or additional pumping may be required to reach the well yields demonstrated in the Hydrogeological Investigation & Terrain Analysis report.
- The test wells completed for the study were completed at depths of 61 metres below ground surface. Future drinking water wells completed on the site at depths greater than 61 metres may encounter different hydrogeological conditions and the quality and quantity of water available from drilled wells may differ than that presented in the study.

The findings of GEMTEC's testing are detailed in the Hydrogeological Investigation and Terrain Analysis report (available under a separate cover); relevant excerpts have been provided under **Appendix C**.

5.3 Water Supply for Fire Protection

Since there are no existing pressurized watermain distribution systems in proximity to the subject site, water supply for fire protection will need to be provided in accordance with City of Ottawa IWSTB-2024-05 (rural fire flow calculation process provided under **Appendix D**). Sample calculations have been provided below for Block 9 which is the smallest lot by area. The following parameters have been used in the calculations:

- Building Area — 20% Lot Coverage (Max. 25% as per RC9 Zoning)
- Building Height — 4.0 m (Max. 11.0m as per RC9 Zoning)
- Occupancy — F2 – Medium Hazard Industrial Occupancies
- Type of Construction — Non-combustible
- Sprinkler Protection — None

Using the process outlined in IWSTB-2024-05, the minimum water supply for fire protection shall be first calculated using the equation below from the Ontario Building Code (OBC):

$Q = KVS_{tot}$

Where:

Q = minimum supply of water (L)
K = water supply coefficient (derived from OBC Table 1)
V = total building volume (m^3)
S_{tot} = total of spatial coefficient (derived from OBC Figure 1)

Water Supply Coefficient

The water supply coefficient (K) is derived from OBC *Table 1* which provides a coefficient based on the building group/division classification (in accordance with OBC *Table 3.1.2.1*) and the type of construction. Given that the blocks will be developed for rural industrial/commercial uses, an F2 classification (medium hazard industrial occupancy) and non-combustible construction type have been assumed. Using OBC *Table 1*, a water supply coefficient of 17 has been selected.

Total Building Volume

V = (Block Area) x (Maximum Lot Coverage) x (Building Height)
V = (11,400 m^2) x (0.20) x (4.0 m)
V = 9,120 m^3

Total of Spatial Coefficient

The total of spatial coefficient (S_{tot}) is calculated using the following equation:

$S_{tot} = 1.0 + [(S_{side1}) + (S_{side2}) + (S_{side3}) + \ldots etc.]$

Where:

S_{side} = values obtained from OBC *Figure 1*
S_{tot} shall not exceed 2.0

Exposure distances from a new building are measured from the exterior building faces to the property lines. When facing a street, the property line shall be deemed to be the centre of the street. For all new buildings (excluding F1 occupancies), if the exposure distance is 10 m or greater, the spatial coefficient for that side is zero. Given the size of the proposed blocks, it is feasible that a minimum setback of 10 metres from the property lines can be achieved and therefore the total of spatial coefficient has been assumed to be 1.0, however, this will need to be verified at the SPA stage once building locations are known.

Minimum Supply of Water and Flow Rate

Using the values derived above, the minimum supply of water has been calculated as follows:

$Q = KVS_{tot}$
Q = (17) x (9,120 m^3) x (1.0)
Q = 155,040 L

From OBC *Table 2*, the required minimum water supply flow rate for a minimum water supply between 135,000 L and 162,000 L is 4500 L/min. Following the procedure outlined in IWSTB-2024-05, a water supply flow rate of 4500 L/min does not require special evaluation and further calculations using FUS and NFPA 1142 methods are not required. Since the water supply flow rate does not exceed 4500 L/min, the site qualifies for a 57,000 L reduction in the required storage volume. Therefore, the minimum supply of water would be reduced as follows:

Q = (155,040 L) – (57,000 L) = 98,040 L

A final review would then be completed by Ottawa Fire Services and Development Review to determine appropriate water storage requirements for the site.

If the building volume is increased, the required water storage and flow rate will also increase. If the building were constructed to maximum dimensions permitted by zoning the minimum water supply could exceed 530,000 L on the smallest block. If a future developer wants to reduce the minimum water supply requirements, the following measures could be considered:

- Reduce the overall building area and height.
- Implementation of a site use which conforms to low hazard industrial occupancy (i.e. F3) thus reducing the water supply coefficient (K).
- Implementation of an automatic sprinkler system. Additional analysis would be required in accordance with NFPA 13.

- Implementation of fire walls within the proposed building to reduce the effective fire area.

Sample required water storage calculations for the individual blocks have been shown in **Table D1** provided under **Appendix D**. However, detailed fire flow calculations will need to be completed for each block at the SPA stage once future building plans are known. The footprint for a single prefabricated underground water storage tank (largest model available) with a capacity of 151,000 L has been shown on **Figure 3** (provided under **Appendix B**) to demonstrate a reasonable amount of space which may need to be allocated for fire protection. Note that the minimum storage tank volume permitted for fire fighting purposes, regardless of building dimensions, is 38,000 L.

6.0 SANITARY SERVICING

6.1 Existing System

There are no municipal sanitary sewer systems available in proximity to the subject site. Existing developments in the area utilize private septic systems to discharge sanitary flows.

6.2 Proposed Septic Systems

Sanitary flows generated by the individual blocks within the Carroll Subdivision will be conveyed to on-site private septic systems. It has been assumed that advanced treatment is being proposed for this development. Advanced treatment is capable of treating effluent to a notable degree prior to the effluent being disposed to a Class IV leaching bed (Type A or Type B).

GEMTEC completed an impact assessment in accordance with MECP Procedure D-5-4 to assess the potential impact on groundwater and surface water resources due to wastewater treatment and disposal by individual septic systems on the subject site. The impact assessment was completed on a lot-by-lot basis to determine the nitrate concentrations at the boundaries of each block. The maximum allowable concentration of nitrate in the groundwater at the lot boundaries is 10 milligrams per litre as per MECP Procedure D-5-4. The supporting calculations completed by GEMTEC were based on a maximum post-development hard surface area of 40%. Based on the results of the impact assessment, allowable daily design sanitary sewage flow (DDSSF) for the proposed blocks ranges from 472 L/day to 2,304 L/day for conventional systems, and 1,416 L/day to 6,912 L/day for advanced treatment systems. The maximum allowable flows for each block were calculated by GEMTEC and have been provided under **Appendix C** for reference.

GEMTEC has provided the following septic system recommendations for the subject site:

- The proposed blocks will be serviced by advanced treatment septic sewage disposal systems that achieve a minimum of 50% reduction in nitrogen, approved under the Ontario Building Code, prior to the effluent being disposed to a Class IV leaching bed (Type A or Type B).
- A site-specific investigation should be conducted on each block for the design of the septic system.
- It is required that the property owners enter a maintenance agreement with authorized agents of the advanced treatment septic system manufacturer for the service life of the system.
- It is recommended that the advanced treatment septic systems be Bureau de normalisation du Québec (BNQ) certified at 50% nitrate reduction.

- In review of the percolation time of the native soils, a sand mantle and partially to fully raised leaching beds should be allowed for on some the proposed blocks. The suitability of the native soils should be assessed on a lot-by-lot basis by a qualified septic designer.
- It should be noted that when determining hard surface coverage for the future blocks, that gravel surfaces are included. Gravel surface are considered impermeable, as they are likely to be compacted over time.
- The maximum allowable daily design sanitary sewage flow (DDSF) for the proposed commercial blocks ranges from 585 L/day to 2,211 L/day for conventional systems, and 1,754 L/day to 6,663 L/day for advanced systems. If during the site plan approval process, the proposed septic system design flow exceeds the preliminary septic flow recommendation for a specific block, then it is recommended that a detailed groundwater impact assessment be conducted. If the detailed groundwater impact assessment demonstrates that additional septic flow can be accommodated on the block, then the preliminary septic flow recommendation for that block should be amended accordingly.
- If the proposed septic flow for a site development application is less than the preliminary septic flow recommendation, then no additional groundwater impact assessment work is required for that block.

All septic systems shall be designed on a lot-by-lot basis at the SPA stage for the individual blocks. As recommended by GEMTEC, test holes should be advanced during the block development to identify the subsurface conditions at the location of the proposed septic system. In all cases, the septic system design must conform to the OBC requirements. A conceptual septic footprint has been shown on **Figure 3** (provided under **Appendix B**) to demonstrate a reasonable amount of space which may need to be allocated for the septic system.

7.0 GRADING & DRAINAGE

7.1 Municipal Right-of-Way

Stormwater runoff from the proposed municipal right-of-way will be captured and conveyed by roadside ditches. Stormwater from the roadside ditches will converge to an outlet ditch located on the northside of Block 7 which will be contained within a 15 metre easement. The stormwater will then be conveyed northeast to a linear stormwater management (SWM) facility located along the eastern boundary of Block 7. The proposed SWM facility will discharge to the existing watercourse located at the easternmost property corner of the subject site. The existing watercourse conveys stormwater runoff in a northeast direction, ultimately discharging into the Carp River approximately 1550 metres downstream of the subject site. The SWM facility will be designed to provide stormwater quantity and quality controls as discussed further under **Section 8.0** below.

7.2 Individual Blocks

Based on topography, stormwater runoff from the individual blocks will be discharged to the municipal right-of-way and/or drainage easements located at the rear of the blocks. Stormwater runoff from the individual blocks will need to be attenuated in accordance with the overall stormwater management design for the Carroll Subdivision (as discussed under **Section 8.0**). Proposed grades for the block corners and drainage slopes along the shared lot lines have been provided on the Grading and Drainage Plans (DWG. 24104-GR1-GR3) to demonstrate the proposed drainage patterns for the subject site. Detailed grading and drainage plans will be required for each individual block at the SPA stage as they become developed.

7.3 External Drainage

Under pre-development conditions, runoff from external lands is conveyed into the subject site. To not cause adverse impacts to the abutting properties, all external drainage patterns have been accommodated in the overall grading and drainage design for the Carroll Subdivision. Runoff from the external lands located between Blocks 8, 11-12 and Carp Road will be captured by drainage swales and conveyed to the municipal roadside ditch system before discharging to the SWM facility on Block 7. Runoff from the external lands located immediately south of Block 7 will be captured by a cut-off swale located on the south side of Block 7. The cut-off swale will convey the external drainage directly to the existing watercourse, bypassing the proposed SWM facility.

7.4 Drainage Areas

Stormwater runoff from Blocks 9-12 and the adjacent external lands (denoted as area STM1) will outlet to the Street A roadside ditch and be conveyed by a road crossing culvert to the outlet channel and SWM facility on Block 7.

Stormwater runoff from the frontages of Blocks 2-6 (denoted as area STM2) will outlet to the Street A roadside ditch and also be conveyed to the outlet channel and SWM facility on Block 7.

Stormwater runoff from the rears of Blocks 2-6 (denoted as area STM3) will outlet to a drainage easement located along the rear property line and be conveyed to the SWM facility on Block 7.

Stormwater runoff from Blocks 7-8 and a large portion of the adjacent external lands (denoted as area STM4) will be conveyed to the outlet channel and SWM facility on Block 7 via the Street A roadside ditch system.

Stormwater runoff from a small portion of Block 7 (strip of undeveloped land outside of proposed berm) and adjacent external lands (denoted as area STM5) will be conveyed by a cut-off swale directly to the existing watercourse, bypassing the proposed SWM facility. Refer to the Post-Development Drainage Area Plan (DWG. 24104-STM1) under **Appendix B** for more details.

7.5 Culverts

New road crossing culverts will be required within the municipal right-of-way to convey roadside drainage. The culverts will be sized at the detailed design stage using the following parameters in accordance with current City of Ottawa guidelines:

- Minimum Culvert Diameter 500 mm
- Design Event for Road Crossing Culverts 10 Years
- Design Event for Entrance Culverts 5 Years

Entrance culverts will also be required as the individual blocks become developed. Refer to the Grading and Drainage Plans (DWG. 24104-GR1-GR3) provided under **Appendix B** for more details.

7.6 Headwater Drainage Features

Under pre-development conditions, runoff from the subject site and portions of the abutting external lands are conveyed by overland flow in west-to-east direction. Some of the runoff is

intercepted by existing drainage features located within the limits of subject site. Based on topographic survey data, the existing on-site drainage features do not have positive draining outlets and do not have direct connectivity to the existing watercourse located at the easternmost property corner. The on-site drainage features have been identified as headwater drainage features (HDFs) in the EIS. As recommended in the EIS, the HDFs will be relocated to the perimeter drainage ditches/swales to maintain feature functions. The relocation of the HDFs is anticipated to improve connectivity with the existing watercourse. The location of the HDFs is shown on *Figure A4* from the EIS (provided under **Appendix C**).

8.0 STORMWATER MANAGEMENT

8.1 Design Criteria

Through review of the pre-consultation meeting notes (provided under **Appendix A**) and overarching studies and reports, the following stormwater management design criteria are proposed for the subject site:

- Control post-development stormwater runoff to pre-development levels for the 2-year through 100-year design events.
- Provide enhanced level (80% TSS removal) quality control of stormwater runoff.
- Provide a water budget assessment to demonstrate a maximum 15% reduction in groundwater recharge from pre-development to post-development conditions.
- Achieve a post-development infiltration target of 104 mm/year.
- Incorporate low impact development (LID) measures where possible to do so.

The sections below will provide detailed discussions and calculations to demonstrate how the above design criteria will be achieved.

8.2 Pre-Development Flows

Under pre-development conditions, stormwater runoff from the majority of the subject site and portions of the abutting external lands (denoted as area PRE1) is conveyed by overland flow in a west-to-east direction towards the existing agricultural lands to the east. Of the total 26.59 ha drainage area, approximately 9.3 ha (35%) is comprised of external lands.

Stormwater runoff from a portion of the subject site (denoted as area PRE2) is conveyed by overland sheet flow through the adjacent agricultural lands before being intercepted by the existing watercourse.

Stormwater runoff from a smaller area to the south (denoted as area PRE3) is conveyed by overland sheet flow directly to the existing watercourse located adjacent to the easternmost property corner of the subject site. Of the total 2.43 ha drainage area, approximately 1.85 ha (76%) is comprised of external lands.

Stormwater runoff from the total 32.61 ha drainage area is generally conveyed in a northeast direction where it is intercepted by existing tributaries and ultimately discharges into the Carp River, approximately 1550 metres downstream of the subject site.

A pre-development stormwater model has been developed using PCSWMM. The model takes into consideration the pre-development land use, land cover, and subsurface conditions from the Geotechnical Investigation. The model has been used to determine the peak flows which discharge from the subject site under pre-development conditions. Pre-development peak

flows for the 2-year, 5-year, and 100-year design events have been summarized in the table below.

Table 8.1: Pre-Development Peak Flows

Drainage Area ID	Area (ha)	Pre-Development Peak Flow*[1,2] (L/s)		
		2-Year	5-Year	100-Year
PRE-1	26.59	329	546	1,250
PRE-2	3.59	301	444	861
PRE-3	2.43	91	147	322
Total	**32.61**	**444**	**700**	**1,507**

Notes:
1. Peak flows calculated using PCSWMM.
2. Total pre-development flow is a summation of flows from the pre-development areas taken at the first time to peak. These flows are not coincidental (i.e. peaks do not occur simultaneously) and therefore the individual peak flows cannot be directly summed.

As demonstrated in the table above, the pre-development peak flows range from 444 L/s during the 2-year design event up to 1,507 L/s during the 100-year design event. Refer to the Pre-Development Drainage Area Plan (DWG. 24104-PRE1) provided under **Appendix B** for more details.

8.3 Quantity Control

Under post-development conditions, stormwater runoff will be captured by a system of ditches/swales and conveyed to the proposed SWM facility on Block 7 before discharging to the existing watercourse located at the easternmost corner of the subject site. As outlined under **Section 8.1**, post-development runoff must be controlled to pre-development levels for the 2-year through 100-year design events.

A post-development stormwater model has been developed using PCSWMM. The model has been developed using the following design parameters:

- CN values as per soil groups identified in the Hydrogeological Investigation (refer to *Figure 6* under **Appendix C**).
- Each block will have an imperviousness of 40% as per the Hydrogeological Investigation.
- Each block will have to provide stormwater attenuation for the 100-year design storm, ensuring to match the 5-year peak flow calculated using the Rational Method, corresponding to a runoff coefficient of 0.48 and IDF curve equations for the 5-year return period as outlined in the City of Ottawa Sewer Design Guidelines (OSDG).
- Roadside ditches will have the capacity to convey the 5-year design event as a minimum, without spillage over future entrances.
- The proposed SWM facility will provide stormwater attenuation to less than pre-development levels for the 2-year through 100-year design events.

8.3.1 Individual Block Controls

As mentioned above, the post-development stormwater model assumes that each block will attenuate the 100-year design storm event to the allocated allowable release rate. The allowable release rate corresponds to the 5-year peak flow rate calculated using the Rational Method, City of Ottawa IDF curve equations, an assumed site imperviousness level of 40% (equating to a runoff coefficient of 0.48), and a time of concentration of 10 minutes. Attenuating

the 100-year storm runoff will require on-site storage to control the outflow to the prescribed release rate and prevent any overflow from the site during this event.

The allowable release rates and required 100-year storage volumes for each block are summarized in the table below.

Table 8.2: Quantity Controls for Individual Blocks

Block No.	Area (ha)	Allowable Release Rate[*1] (L/s)	100-Year Required Storage Volume[*2] (m^3/ha)
2	1.29	166	50
3	1.30	166	60
4	3.00	379	70
5	1.43	189	70
6	1.37	180	70
7	4.74	372	50
8	1.28	178	50
9	1.14	159	70
10	1.20	167	70
11	1.36	193	50
12	1.46	203	50

Notes:
1. Allowable release rates are based on 5-year peak flow calculated using the Rational Method.
2. Required storage volume to attenuate 100-year design storm event to 5-year peak flow.

The required storage volumes provided in the table above are based on each block having an imperviousness of 40% (as per the Hydrogeological Investigation). If the blocks are developed to less than the maximum allowable hard surface coverage, then the required storage volumes will be reduced. Required storage volumes will need to be calculated for each block at the SPA stage once development plans are finalized.

8.3.2 SWM Facility Quantity Controls

Stormwater runoff from the proposed municipal right-of-way will be directed to the proposed SWM facility. As outlined in **Section 8.3.1**, stormwater runoff from the individual blocks will be controlled to the allowable release rate before being discharged into the ditch/swale system and conveyed to the SWM facility. The proposed SWM facility must provide stormwater attenuation to pre-development levels for design events ranging from the 2-year to the 100-year, considering the uncontrolled flow from the tributary area of approximately 2.3 ha (STM5) that bypasses the SWM facility. The following table summarizes the simulation results:

Table 8.3: Quantity Controls for SWM Facility

Design Event	Pre-Development Flow Rate (L/s)	Required Storage Volume (m^3)	Pond Water Surface Elevation (m)	Pond Release Rate (L/s)	ByPass Flow*1 (L/s)	Total Post-Development Flow*2 (L/s)
2-Year	444	3,463	110.75	216	39	233
5-Year	700	4,394	110.85	408	96	442
100-Year	1,507	8,022	111.14	1,346	314	1,440

Notes:
1. Peak flows from the area of approximately 2.3 ha (STM5) that bypasses the SWM Facility.
2. Total post development flow is a summation of flows from the pond and bypass area taken at the time to peak for the pond outlet structure. These flows are not coincidental (i.e. peaks do not occur simultaneously) and therefore the individual peak flows cannot be directly summed.

As shown in the table above, the proposed SWM facility has been designed with adequate storage volume to detain flows exceeding pre-development levels for up to and including the 100-year design storm event. During the detailed design stage, the SWM facility outlet control structure will need to be properly sized to optimize the use of the available pond storage volume, ensuring that release rates for more frequent storm events (i.e. 2-year and 5-year) are closer to pre-development flow rates. Refer to **Table D2: SWM Facility Stage-Storage** under **Appendix D** for more details.

8.4 Downstream Capacity Assessment

The existing watercourse immediately downstream of the subject site has been assessed to verify if it has adequate capacity to convey the attenuated peak flows from the proposed SWM facility. Using topographic survey information, the existing channel dimensions and longitudinal slope have been approximated. Using the Manning's Equation, the capacity of the existing channel has been calculated to be approximately 2198 L/s when flowing full, which exceeds the 100-year attenuated peak flow from the proposed SWM facility. Therefore, it has been demonstrated that the existing watercourse downstream of the proposed outlet has sufficient capacity to convey the attenuated peak flow for up to and including the 100-year design event. Refer to **Table D3: Downstream Channel Capacity** provided under **Appendix D** for more details.

8.5 Quality Control

As outlined under **Section 8.1**, enhanced level (80% TSS removal) quality control of stormwater runoff is the recommended target for the subject site. However, it should be noted that the overarching Carp River Watershed Subwatershed Study (CRWSS) only requires normal level (70% TSS removal) quality control.

8.5.1 Individual Block Controls

The development of each block within the Carroll Subdivision will need to provide on-site quality controls for stormwater runoff. Each block shall implement quality controls to achieve a minimum target of 70% TSS removal (i.e. normal level protection). At the SPA stage, detailed designs will need to be prepared for each block to demonstrate that the target level is being achieved. Although the block specific quality controls will ultimately be determined at the SPA stage, the following stormwater management practices or a combination thereof may be considered:

- Dry ponds
- Infiltration trenches
- Enhanced grass swales
- Vegetated filter strips
- Bioretention cells
- Sand filters
- Oil/grit separators (sized as per ETV protocols)

Table 1.3 from the MECP SWM Manual lists various stormwater management practices (SWMP) and their suitability for mitigating the impacts of development. Physical site constraints such as bedrock and groundwater may limit the ability of certain SWMPs to function as intended. *Table 4.1* from the MECP SWM Manual summarizes the physical constraints which can be associated with various SWMPs. Both tables (provided under **Appendix D** for reference) can be used as guidance to select the appropriate measure(s) based on the physical constraints associated with each respective block.

Table 3.2 from the MECP SWM Manual provides water quality storage requirements based on the desired protection level, the SWMP type, and the impervious level. Sample calculations have been completed to demonstrate how much quality storage volume may be required on each block. Assuming a normal level of protection (70% TSS removal) and 40% impervious (maximum allowable as per Hydrogeological Investigation) the required quality storage volume for an infiltration SWMP ranges from 23 m^3 on the smallest block up to 60 m^3 on the largest block. To achieve a basic level of protection (60% TSS removal) with a dry pond SWMP, the required quality storage volume ranges from 120 m^3 on the smallest block up to 315 m^3 on the largest block (refer to **Table D4** under **Appendix D**). Since a typical dry pond can only provide up to 60% TSS removal, additional on-site quality control measures would need to be implemented to meet the 70% TSS removal target established for the blocks. At the SPA stage, the available space to implement SWMPs based on development plans will also need to be considered in selecting the appropriate quality control measures for each block.

Based on the inferred surficial geology of the subject site (refer to *Figure 6* from the Hydrogeological Investigation under **Appendix C**), the blocks best suited for infiltration measures are Blocks 2-3, 11-12, and 7-8 since they're founded on native silty sand material. The remaining blocks are founded on native silty clay material and therefore the infiltration potential could be limited. The estimated infiltration rates of the native soils (from field testing) ranges from 26 mm/hr up to 163 mm/hr. It should be noted that the native soil conditions are inferred from available geotechnical testing and could vary throughout the site.

8.5.2 SWM Facility Quality Controls

The proposed SWM facility will be designed as a dry pond to provide quality control for stormwater runoff from the municipal right-of-way and additional quality treatment for runoff from the individual blocks which will have already received treatment from on-site controls (refer to **Section 8.5.1**). The required water quality storage volume to achieve basic level protection (60% TSS removal) with a dry pond SWMP has been calculated using *Table 3.2* from the MECP Manual and summarized in the table below.

Table 8.4: Water Quality Storage Volume for SWM Facility

Drainage Area[*1] (ha)	Imp. Level[*2] (%)	Storage Volume for Imp. Level[*3] (m^3/ha)	Required Storage Volume (m^3)
31.2	30	90	2808

Notes:
1. Drainage area includes total area tributary to SWM facility including external lands.
2. Based on tributary area land cover and assuming 40% impervious on blocks.
3. Interpolated using Table 3.2 from the MECP SWM Manual.

As shown in the table above, a total water quality storage volume of 2808 m^3 will be required to provide basic level protection (60% TSS removal). Based on **Table D2** (provided under **Appendix D**), the water quality storage volume can be achieved within the dry pond at approximate ponding elevation of 110.70 m.

In accordance with the MECP SWM Manual, the water quality storage volume should have an extended detention time of 24 to 48 hours. Due to the proximity of the subject site to the Carp Airport, standing water is undesirable as it may attract birds which poses a safety risk to air traffic. Therefore, a 24-hour detention time will be targeted. An orifice which can provide the desired detention time for the quality storage volume will be appropriately sized during detailed design.

8.5.3 Additional Controls

The outlet channel located on the northside of Block 7 will convey stormwater runoff from the municipal right-of-way to the proposed SWM facility. The outlet channel will provide pretreatment for runoff prior to discharging into the SWM facility. The outlet channel will be designed in keeping with the recommendations for an enhanced grass swale. Enhanced grass swales are vegetated, open channels designed to convey, treat and attenuate runoff. According to *Section 4.8 – Enhanced Grass Swale* of the LID Design Guide, the median pollutant removal rates of swales from available performance studies are 76% for total suspended solids (TSS), 55% for total phosphorus and 50% for total nitrogen. The vegetation in the swale slows the runoff allowing for sedimentation, filtration through the root zone and soil matrix, evapotranspiration, and infiltration into the underlying native soil. The low longitudinal slope and flat bottom design promote shallower flows and enhanced water quality treatment. The total length of the outlet channel is approximately 155 metres.

Stormwater runoff from the municipal right-of-way and individual blocks will receive quality pre-treatment through over 1800 m of vegetated roadside and rear yard ditches/swales, respectively. The vegetation and low slopes promote sedimentation, filtration, evapotranspiration, and infiltration into the native soil.

The EIS (prepared by GEMTEC) recommends a minimum 15 m setback from the existing watercourse to provide sufficient protection for mitigating water quality impacts and human disturbances. The setback is consistent with the recommendations of the CRWSS. As noted under **Section 4.0**, a 30 m setback from the existing watercourse will be provided due to the presence of Blanding's turtle habitat.

The implementation of vegetated roadside ditches and rear yard ditches/swales, a flat bottom outlet channel, a dry pond, on-site block level quality controls, and 30 m buffer, will provide a reasonable amount of quality control for stormwater runoff generated from the municipal right-of-way and future development blocks.

8.6 SWM Facility Design

As discussed under **Section 8.3.2 and Section 8.5.2**, the proposed SWM facility will be designed as a dry pond to provide stormwater quantity and quality controls. In addition to providing the required quantity and quality storage volumes, other design parameters must be considered. In review of *Table 4.1* from the MECP SWM Manual, there are no physical constraints associated with a dry pond SWMP and therefore it can be considered suitable for the subject site. *Table 4.8* from the MECP SWM Manual summarizes the design guidelines recommended for the implementation of dry ponds. The recommended and provided design criteria have been summarized in the table below.

Table 8.5: Dry Pond Design Criteria

Design Element	Recommended Criteria	Provided Criteria
Drainage Area	5 ha	31.2 ha
Treatment Volume	Table 3.2	Table 3.2
Detention Time	24 hrs	24 hrs[*2]
Pre-Treatment	Forebay	Outlet Channel; ditches
Length-to-Width Ratio	3:1	3:1
Depth	3 m Max.	1.19 m
Side Slopes	4:1	3:1
Inlet	450 mm	450 mm[*2]
Outlet	450 mm	450 mm[*2]
Maintenance Access	Per Municipality Approval	3.0 m Access Road
Buffer	3 m beyond max. water level	3 m

Notes:
1. Recommended criteria as per *Table 4.8* from the MECP SWM Manual.
2. Design details to be determined at detailed design stage.

As shown in the table above, the proposed SWM facility design generally meets or exceeds the recommended criteria from the MECP SWM Manual. The proposed outlet channel and/or drainage ditches will provide adequate pre-treatment and due to the low longitudinal slopes, excessive flow velocities are not anticipated to be of concern. The side slopes of the facility have been designed at a 3H:1V slope to maximize the available storage volume and to minimize the footprint of the facility. Since the facility will be located within a rural industrial/commercial subdivision, the side slopes are considered satisfactory from a safety perspective. A 3.0 m wide access road is proposed along the northside of the outlet channel and along the east side of the SWM facility to provide maintenance access.

The Hydrogeological Investigation has indicated that the soil conditions encountered at Block 7 are considered to be hydrogeologically sensitive due to thin soil cover to bedrock. Therefore, it is anticipated that an impermeable liner will be required for the SWM facility. Details for the proposed liner will be provided at the detailed design stage.

8.7 Low Impact Development (LID)

As outlined under **Section 8.1**, low impact development (LID) measures should be implemented where possible to do so. LID is a stormwater management strategy that seeks

to mitigate the impacts of increased runoff and stormwater pollution by managing runoff as close to its source as possible. Through the processes of infiltration, evapotranspiration, harvesting, filtration and detention of stormwater, LID practices can effectively remove nutrients, pathogens and metals from runoff, and reduce the volume and intensity of stormwater flows.

As discussed under **Section 8.5.3**, the outlet channel on Block 7 will be designed in keeping with the recommendations for an enhanced grass swale which is considered a LID measure since it promotes infiltration and filtration of stormwater. LID measures within the municipal right-of-way are often considered unacceptable by the City's Operations Group due to the increased level of maintenance required to maintain and operate such features. It is anticipated that LID measures will be implemented on the individual blocks as a means of achieving the required quality controls discussed under **Section 8.5.1**. Due to site constraints such as bedrock, high groundwater, and low permeability soils, the implementation of LID measures may not be suitable or may be limited on some blocks.

8.8 Water Budget/ Infiltration Target

As outlined under **Section 8.1**, a maximum 15% reduction in groundwater recharge from pre-development to post-development conditions including a post-development infiltration target of 104 mm/year is recommended for the subject site. A water budget assessment has been prepared by Robinson Consultants and is available under separate cover. The water budget assessment has determined that the post-development infiltration rate for the subject site will be approximately 313 mm/year which well exceeds the target of 104 mm/year. Accounting for LID measures on the individual blocks, further increases the infiltration rate to 352 mm/year. The water budget assessment has also determined that there will be approximately a 7% reduction in groundwater recharge from pre-development to post-development conditions (assuming no LID measures on individual blocks) which meets the 15% target.

9.0 EROSION AND SEDIMENT CONTROL

Prior to construction and until vegetation has been re-established in disturbed areas, erosion and sediment control measures must be implemented to mitigate the impact on receiving watercourses. The following erosion and sediment control (ESC) measures are recommended for the subject site:

- Limit the extent of exposed soils at any given time.
- Erosion and sediment control measures shall be maintained until vegetation has been re-established in all disturbed areas. Re-vegetate disturbed areas as soon as possible.
- Stockpile soil away (15 metres or greater) from watercourses, drainage features and top of steep slopes.
- Silt fence and straw bales to be installed and maintained where indicated on the erosion and sediment control plans.
- For dry weather periods (active and/or inactive construction phases) inspections of ESC measures shall be undertaken on a weekly basis.
- Inspection of ESC measures shall be undertaken immediately after major storm events (>25mm of rain in 24 hour period), significant snowmelt events (melting of snow at a rate which adversely affects the performance and function of the system), and extreme weather events.
- Visual inspections shall also be undertaken in anticipation of large storm events (or a series of rainfall and/or snowmelt days) that could potentially yield significant runoff volumes.

- Identify and rectify any deficiencies and undertake necessary maintenance measures as soon as possible.
- Inspections and maintenance of temporary ESC measures shall continue until they are no longer required.
- The Contractor shall ensure that records of inspection are taken, including at a minimum:
  - the inspector's name;
  - date of inspection;
  - visual observations;
  - any necessary remedial measures taken to maintain the interim ESC measures.
- Care shall be taken to prevent damage to ESC during construction operations.
- In some cases, barriers may be removed temporarily to accommodate construction operations. The affected barriers shall be reinstated immediately after construction operations are completed.
- ESC should be adjusted during construction to adapt to site features as the site becomes developed.
- ESC shall be cleaned of accumulated sedimentation as required and replaced as necessary.
- During the course of construction, if the Engineer believes that additional prevention methods are required to control erosion and sedimentation, the Contractor shall implement additional measures, as required, to the satisfaction of the Engineer.
- Construction and maintenance requirements for erosion and sediment controls are to comply with Ontario Provincial Standard Specification (OPSS) 805.

Refer to the Erosion and Sediment Control Plan (DWG. 24104-ESC1) provided under **Appendix B** for more details.

10.0 CONCLUSIONS

It has been demonstrated that the proposed rural industrial/commercial subdivision (i.e. Carroll Subdivision) located at 3160 Carp Road can be developed in accordance with current City of Ottawa guidelines and overarching studies. Specifically, the proposed development will include the following key design features:

- New municipal roadway with a rural cross-section contained within a 20 metre right-of-way with two connections to Carp Road.
- Water supply for domestic use via individual drilled wells located on the future development blocks.
- Water supply for fire protection via individual storage tanks located on the future development blocks.
- Wastewater will be conveyed to individual septic systems located on the future development blocks.
- On-site stormwater quantity control to the 5-year pre-development level for the future development blocks.
- On-site stormwater quantity storage for up to and including the 100-year design event on the future development blocks.
- On-site stormwater quality controls to achieve normal level protection (70% TSS removal) on the future development blocks.
- A proposed outlet channel and SWM facility on Block 7 to provide stormwater quantity and quality controls for the municipal right-of-way and future development blocks.

- Stormwater attenuation to pre-development levels for the 2-year through 100-year design events.
- Implementation of LID measures on the future development blocks where possible to do so.
- Erosion and sediment control measures will be implemented prior to construction and maintained until vegetation has been re-established in disturbed areas.

Report Prepared By:

Brandon MacKechnie, P.Eng.
Project Engineer

Stormwater Modelling Prepared By:

Ivan Dzeparoski, P.Eng.
Senior Water Resource Engineer

Appendix A

Pre-Consultation Meeting Notes

Draft Plan of Subdivision (prepared by Egis Surveying Inc.)

Pre-Application Consultation Meeting Notes

Property Address: 3160 Carp Road
PC2022-0214
September 9, 2022, Microsoft Teams Meeting

Attendees:
Erica Ogden, Planner II, City of Ottawa
Sean Harrigan, Planner I, City of Ottawa
Stephan Kukkonen, Planner I, City of Ottawa
Derek Kulyk, Project Manager, City of Ottawa
Josiane Gervais, Transportation, City of Ottawa
Ann O'Connor, Urban Design, City of Ottawa
Adiva Saadat, Student Planner, City of Ottawa
Mercedes Liedtke, Environmental Planner, Mississippi Valley Conservation Authority
Claire Milloy, Hydrogeologist, Rideau Valley Conservation Authority

Bridgette Alchawa, McIntosh Perry
Adam O'Connor, Keeper Co. Ltd.
Alex Testa
Lois Carroll, TG Carroll Cartage Ltd.
Thomas Carroll, TG Carroll Cartage Ltd.

Regrets:
Anissa McAlpine, Parks Planner, City of Ottawa
Tessa Di Iorio, Hydrogeologist, City of Ottawa
Sami Rehman, Environmental Planner, City of Ottawa

Subject: 3160 Carp Road

Meeting notes:

Overview of Proposal

- The proposal includes the severance of one (1) commercial/industrial lot and a plan of subdivision for a commercial/industrial subdivision with eleven (11) lots.
- Undecided at this time which lot would be created through a severance application, likely considering Lot 1, 11 or 12, as shown on the concept plan provided.

Preliminary comments and questions from staff and agencies, including follow-up actions:

Planning

- Official Plan
  - The property is designated Rural Employment Area on Schedule A of the current City of Ottawa Official Plan
  - The Rural Employment area permits heavy and light industrial uses, transportation, warehouse and storage operations, uses that are noxious by virtue and new commercial uses that primarily provide services to employees of the rural business park or the travelling public.
  - Development will be subject to Site Plan Control and all new development must be supportable on individual well and septic systems.

- Carp Road Corridor Community Design Plan
  - The property is designated as Highway Commercial Area within the Carp Road Corridor Community Design Plan.
  - Highway commercial uses are generally oriented to attract and serve passing traffic and require direct access to arterial roads. Carp Road is an arterial road that provides easy access to Highway 417 and the Carp Airport.
  - The Carp Road Corridor CDP encourages industrial development primarily in industrial/business parks
  - The following Design Guidelines from Section 7.3 of the CDP apply to Industrial/Business Park/ Subdivisions:
    1. Limit access to Carp Road. Internal roads to the subdivision should provide access to Carp Road.
    2. Locate parking at the rear or side of buildings. Where this is not possible and parking is required at the front or side of the building a greater setback from the property line should be required to permit planting to mitigate the effects of the parking area (e.g. parking screened from view).
    3. Locate storage and service areas at the rear of buildings except on sites where the property backs onto Carp Road or the main entry road.
    4. Site buildings fronting on Carp Road to face, front and feature the road corridor (entry roads and all local roads).
    5. Preserve as many trees as possible on the site.
    6. Compensate for removal of existing trees by extensive planting in the open space corridor, entry features "gateways" and on-site landscape areas.
    7. Plant trees along the corridor - an informal mix of trees and shrubs is preferable, with more coniferous than deciduous species.
    8. Provide landscaping at the front of buildings.
    9. Use landscaping, decorative fences to screen unsightly uses.
    10. Create entry feature ("gateways") for new subdivisions/parks. This should include a sign and landscaping with the name of the development and the park occupants and enhanced lighting for visibility at night.
    11. Provide for turning lanes where warranted.
  - The proposed subdivision is adjacent to residential uses, the CDP includes the following policies related to appropriate transition between existing and future uses:
    1. Locate all unsightly and noise-generating elements, such as service lanes, loading zones, dumpsters and outdoor storage, away from adjacent residential properties;
    2. Separate existing residential and institutional areas which back onto "Carp Road Corridor Rural Employment Area" with a landscaped buffer, located on development lands, designed to mitigate unsightly and noise-generating elements. Construction and maintenance of the landscaped buffer may be required as a condition of subdivision/site plan approval;
    3. The buffer should be formed by a 6m wide, 1.5 to 2 metres high aesthetic berm, predominantly planted with evergreen trees that retain their lower limbs with age. The planting should create a continuous and dense visual screen; and
    4. Where the noise generated by future uses is of concern, the setbacks from residential uses should be increased to allow for densely landscaped buffers.
- New Official Plan
  - The property is designated Rural Industrial and Logistics on Schedule B9 of the Council adopted Official Plan, which is awaiting approval from the Ministry of Municipal Affairs and Housing.

- City Council has approved transition policies for the New Official Plan, which state that in the period between Council approval of the New Official Plan and the Minister's approval of the New Official Plan, City staff will apply whichever provision, as between the Current and New Official Plan, is more restrictive.
- The property is subject to the Area Specific Policies for the Carp Road Corridor which designate the lands Corridor Commercial Area on Schedule 8.A within Volume 2C of the New Official Plan
- Permitted uses include light industrial uses, automotive, recreational and heavy vehicle sales and service. Convenience commercial uses are not permitted.

- Zoning By-law
  - The property is zoned Rural Commercial subzone 9 (RC9), which permits a variety of commercial and industrial uses.
  - The provisions for lots zoned RC9 include:
    - Minimum lot area 4000 sq.m.
    - Minimum lot width 30 m
    - Maximum lot coverage 25%

- Plan of Subdivision Application - Erica Ogden, erica.ogden@ottawa.ca
  - The policies of the Carp Road Corridor CDP, discourages lots fronting on to Carp Road. The internal access road should be the access for the proposed lots.
  - Consideration for existing easements to the neighbouring property 3108 Carp Road for the existing access, as well as access to the landlocked agricultural parcel to the rear, which appears to be accessed through the subject property.
  - The property is within the Airport Area of Influence, see the engineering section below for additional required studies.
  - The site has been identified to have Archaeological Potential and will require an Archaeological Resources Assessment.
  - Many of the proposed uses within the Rural Commercial zone require Site Plan Control approval.
  - Appropriate buffering to any existing residential uses and the proposed new lots will be required.

- Severance Application – Sean Harrigan, sean.harrigan@ottawa.ca
  - The severance application must be reviewed independently from the subdivision application but must also have consideration for the future development.
  - Both the proposed severed and retained lots require appropriate frontages, lot sizes and servicing, regardless of the future subdivision application.
  - Lots 11 or 12, shown on the concept plan provided, likely would not be supported through a severance application as they are located behind existing lots and do not have frontage on to Carp Road.
  - Severing Lot 1 may not maintain the required lot frontage for the retained parcel. The lot frontage is not considered cumulative across the various access points. A minor variance application could be considered for the retained lands. It is the applicant's decision whether to pursue a lot configuration that is zoning complaint or to submit a minor variance application and this decision should be rationalized in accordance with applicable policies and consideration for future development potential. However, when determining an appropriate lot configuration (i.e. whether to leave 20m for the future laneway south of Lot 1 or 30+m such that it is zoning compliant, or any other lot configuration), please consider how much space is required for the future subdivision

lane for engineering and traffic requirements (i.e. will 20m be sufficient for industrial related traffic such as freight?).

- The retained and severed lot must be sufficient sized, primarily related to servicing requirements, to adequately accommodate the uses permitted within the RC9 zone, or other mechanisms must be considered in the interim prior to the plan of subdivision application. This is a requirement of the Official Plan and should be discussed in the Planning Rationale/Cover Letter and accounted for in the Hydrogeological Report which will be required as a condition of approval.
- A Planning Justification will be required with the initial severance application and should include an analysis of current permitted uses, and rationale that the severed and retained lots are sufficiently sized.
- Road widening, if required, will be required as a condition of approval for the severance application. A survey is required to confirm.
- Parkland dedication will be required for the severance, see the comments provided below.
- A Hydrogeological and Terrain Analysis will be required and must demonstrate that both the severed and retain can be serviced, see the comments provided below.
- A condition of approval may require a notice on title related to well water quality, if required.
- Consideration should be given to future access from the internal road of the subdivision to Lot 1, as the CDP discourages direct access from Carp Road. Easements across the retained lands and a 30 cm reserve along the Carp Road frontage of Lot 1 may be required.
- Existing access to the farmlands to the rear of the subject property must be considered, as the existing access is located within the area of Lot 1. There more than likely will be a condition of approval that requires a formal easement agreement for the farmlands. Where exactly the easement should be placed is unknown at this time, but it is suspected the best location is over the retained lands through the proposed future lane (potential 30cm reserve would prevent an easement over the severed lot)
- Please note that other conditions of approval not listed above may be requested for the severance applications. The exact list of conditions will be determined based on the final proposal and after a comprehensive review is completed for a formal application submission.

Urban Design - Ann O'Connor, Ann.OConnor@ottawa.ca

- For a Plan of Subdivision application alone, no Design Brief is required. If a Zoning By-law Amendment application is going to be applied for concurrently with the Plan of Subdivision, a Design Brief may be required. A Terms of Reference can be provided by Design staff if this is considered.
- As the design of the lots move forward, consider retaining as much of the tree canopy/wooded area identified on the perimeter of the site.
- All policies in the Carp Road Corridor Community Design Plan should be adhered to, where possible. In particular, consider:
  - For Lot 1, with frontage on Carp Road, note that:
    - Section 2.1 of the CDP identifies that the properties fronting on the Carp Road are most appropriate for highway commercial and industrial use
    - Section 7 addresses how to enhance the visual appearance of the corridor and maintain the rural landscape.
  - For the Lot 8 and Lot 7, with lot lines that abut residential lots, note that:
    - Section 8 addresses land use compatibility with residences.

- Schedules:
  - Schedule 1 – Land Use Designations identifies the subject site as “Highway Commercial Area”
  - Schedule 2 – Environmental Features identifies portions of the site as having “moderate recharge’

Engineering - Derek Kulyk, derek.kulyk@ottawa.ca

Severance

Groundwater and Water Service

Please see the Hydrogeological comments provided below. While confirming quantity and quality it is important to be aware that the site is situated within 220 m of Highland Park Cemetery to the north-east, within 30 m of Presbyterian Cemetery to the south and Mineral Extraction pits (sand and gravel) are approximately 500 m to the south and approximately 375 m to the south-west.

The site is within Mississippi Rideau Source Water Protection Area. The site has been identified to be within a significant groundwater recharge area and contains a highly vulnerable aquifer. The location is within the area covered by the Carp River Watershed/Subwatershed Study (CRWSS).

If the accepted report recommends specific mitigation measures or design requirements, the Owners shall enter into a Development Agreement with the City, at the expense of the Owners, which is to be registered on the title of the property, which includes those recommendations. In instances where the subject site has sensitive soils, the drilling of a well or the conveyance of a 30-centimetre reserve may be required and also for access to the lot from the proposed road, not driveway from Carp Road. Both the report and any required Development Agreement shall be prepared to the satisfaction of Development Review Manager of the Relevant Branch within Planning, Infrastructure and Economic Development Department, or his/her designate.

Sanitary Service

There are no municipal sanitary sewers adjacent the proposed expansion. An Impact Risk Assessment will be required (as part of Hydrogeological and Terrain Analysis). Please see the Hydrogeology comments below.

Stormwater

There are no municipal storm sewers adjacent the proposed lot and also road ROW ditches with downstream outlets were not identified. Consequently, Stormwater investigation (NOT a report) should be provided to the City, as there is a concern of surface run-off conveyance and legal outlet from the proposed lot.

Site Geotechnical Conditions

Please note that sensitive marine clays are anticipated in the area of the proposed severance and potentially thin soils. Also slope of the site is unknown (Slope Stability study might be required).

In the severance application, if the City identifies any adverse soils conditions such as sensitive marine clays, a notice on title will need to be registered that advises of the potential site specific detailed engineering solutions that may be required to allow for development:

“The City of Ottawa has identified that there are potential sensitive marine clay soils and thin soils within the area that may require site specific detailed geotechnical engineering solutions to allow for development, the City of Ottawa bears no responsibility, financial or otherwise, to provide solutions to the deficiency, such solutions being the sole responsibility of the homeowner.”

Carp Airport Proximity
The proposed land severance is direct proximity to Carp airport, 650 m from the end of runway 28, consequently and landing/taking off aircraft might generate excessive noise and vibration. The proposed severance is also directly adjacent to Carp Road (arterial road), which is also identified as a “full load truck route”.

Noise and Vibration Attenuation Study**,** as per City of Ottawa Environmental Noise Control Guidelines will be required to address these two sources (airport & Carp Road) of noise and vibration and potential impacts and mitigation to the future development proposal. The Owner might have to enter into an agreement with the City that requires the Owner to implement any noise control (and vibration if applicable) attenuation measures recommended in the approved study. The Noise Warning Clauses might need to be registered on title.

Transport Canada, Carp Airport Authority, Navigation Canada, or other aviation authorities, as required, need to be contacted regarding ponds and lighting or other specific considerations and limitations associated with proposed development in direct proximity to Carp Airport. The City Engineering needs to be copied on the communication (the findings resulting from the communication might need to be registered on title). Airport area zoning restrictions imposed by the Airport Vicinity Development Zone need to be considered, as per new OP section 10.2.2.11 (Schedule C14) and current OP, Section 4.8.6.

Easements/ROW
Easements and rights-of-ways must be shown on the plans and information on any existing easements or ROWs, must be provided with the application. 0.3 m reserve along Carp Road might be required (preferred access is from the road proposed as subdivision road not directly from Carp Road). There is a concern of access to the agricultural property to the north. It appears that access to that property is along the north-west side of the severed property. The proposed severance will remove access to the mentioned property. Solution must be presented to the City for review, prior to approval of the severance.

Roads
Carp Road in Rural Road Network is an Arterial Road and ROW protection of 30.0 m is required, as per new Official plan, Schedule C16 (15 m from the road centre line to the property limit).
It appears that the ROW width is sufficient and road widening will not be required.
Please refer to the City of Ottawa Private Approach By-Law (Private Approach (By-law No. 2003-447) | City of Ottawa) The driveway setback needs to be, as minimum 3.0 m from the property line, however, as the proposed severed parcel is part of the proposed commercial/industrial subdivision, access to the lot should be provided along its east property limit, which will become in the future the subdivision access road. 0.3 m reserve along Carp Road might be required. Please refer to Transportation Department comments for more information.

Subdivision

Topographic Plan of Survey

A topographic survey needs to identify all representative elevation points, currently existing features, including all property lines, bodies of water, vegetation, easements etc. It needs to provide a note that references the horizontal and vertical datums that were used and tied into to complete the project, including the local benchmarks. The survey should show the municipal road ROW which is identified as an arterial road with 30m ROW protection.

Groundwater and Water Service

It is understood that there are no municipal water pipes near the application. Please see the Hydrogeological comments provided below. While confirming quantity and quality it is important to be aware that the site is situated within 220 m of Highland Park Cemetery to the north-east, within 30 m of Presbyterian Cemetery to the south and Mineral Extraction pits (sand and gravel) are approximately 500 m to the south and approximately 375 m to the south-west. Proximity and potential impact of the aforementioned facilities should be analyzed.

The site is within Mississippi Rideau Source Water Protection Area. The site has been identified to be within a significant groundwater recharge area and contains a highly vulnerable aquifer. The location is within the area covered by the Carp River Watershed/Subwatershed Study (CRWSS).

The Consultant undertaking the hydrogeological and terrain study needs to refer for more details to Hydrogeological and Terrain Analysis Guidelines (March 2021)and should clearly demonstrate integration with other studies such as, but not limited to, Geotechnical Study, ESA, EIS, etc. Also, all surface features of interest or concern need to be addressed. There is an existing watercourse at the NE corner of the property – Fluvial Geomorphological report will be required.

If a SWM pond or similar stormwater management infrastructure is proposed, it will also need to be included in the Hydrogeological Report and Terrain Analysis.

It is the responsibility of the owner to ensure that adequate water supply for firefighting is provided for each lot by the FUS method and please note that a recently revised FUS exists.

As a condition of approval of plan of subdivision, the developer will be required to dedicate a monitoring well, at no cost, to the City.

Sanitary Service

There are no municipal sanitary sewers adjacent the proposed subdivision. Please see the comments below regarding hydrogeology. An Impact Risk Assessment will be required (as part of Hydrogeological and Terrain Analysis).

Minimum Septic Field Setback from property lines is 3 metres & 5 metres from buildings. Note: if the septic fields are raised beds then these separations distances increase (they increase by 2x the grade raise) – please see Ottawa Septic System Office guidelines for details.

Servicing Study (water/sanitary)
A Subdivision Servicing Study (and Plans) will need to be submitted to the City for review and it needs to demonstrate that all lots can be adequately serviced. It should comprehensively address the available water quality and quantity. It should identify the required projected water demand and the expected well capacities (sustainably to be in excess of demand). It should also address sanitary servicing needs of all individual lots.

The report needs to provide all pertinent calculations and justifications to support any claims made in the report. References to other relevant studies need to be made and clearly stated in order to adequately address the servicing needs and underlying ground conditions.

Proposed septic bed sizing needs to be provided, to demonstrate that each bed will be able to accommodate the generated flows and there is an adequate lot area to accommodate the proposed septic beds and water wells on each of the lots. Since there is a watercourse identified on site, required setbacks, as per City official plan need to be observed- they can be significant.

The study should also contain comprehensive rationale that will allow to conclude that the existing hydrogeological and geotechnical conditions were considered, in order to protect the groundwater, as per latest guidelines and legal requirements.

Fire-fighting considerations should also be included in the report to determine potential surface area requirements if water storage tanks need to be implemented in the future, for each lot. As per the clarification provided in Technical Bulletin ISTB-2021-03 the FUS fire-fighting methodology is to be used in Rural Areas in all cases.

All SWM systems need to be identified on the Servicing Plan (i.e. common SWM pond, multiple ponds, swales, ditches, CB's, underground pipes, etc.), as this will impact future space allocation for individual site designs and septic systems.

Storm Sewers
There are no municipal storm sewers adjacent the proposed subdivision and also road ROW ditches with downstream outlets were not identified. Consequently, the retained consultant will need to review the existing terrain and demonstrate that there is Legal and sufficient storm outlet from site for both release rate and volume and prepare a SWM Report and Plan, as per City of Ottawa Sewer Design Guidelines (Second edition, October 2012, plus bulletins) that will ensure that the post development surface run-off will not adversely affect the downstream drainage system, including culverts, point of proposed site storm sewer system outlet location and the adjacent properties, during construction and in the post-construction condition. SWM pond might be required.

Storm Water Management
SWM Report will be required, as per above-mentioned guidelines. LID is required as per the memo from the former MOECC (now MECP). Any existing stormwater runoff from adjacent site(s) that crosses the property must be accommodated by the proposed stormwater

management design. No adverse effect can be created to the surrounding properties. Since it is a commercial/industrial subdivision proposal, on-site SWM measures need to be applied to minimize impact to downstream storm control systems.

Any stormwater outlet to a watercourse will require treatment and, as such, if there are any new stormwater outlets proposed to the watercourse, as part of the SWM plan, or proposed stormwater systems servicing multiple lots, they will require a direct submission Environmental Compliance Approval (ECA) application to the Ministry of the Environment, Conservation and Parks (MECP). The turnaround time for a direct submission ECA from the MECP can be up to one year.

Please note: Once the development application has been submitted, a request can be made to the City to consider a Transfer of Review (ToR) ECA for SWM works (ponds, ditches, culverts, etc.) for a private property, instead of the direct submission ECA. This is subject to approval by the City and MECP. Note that the ECA requirements are currently in flux. It is recommended to check with the City when the development application is submitted to confirm the ECA process at that time.

Stormwater management quality criteria is provided by Mississippi Valley Conservation Authority below.

Note that oil/grit separators, if used, require Environmental Technology Verification (ETV) protocol for ECA approval.

Capacity of the downstream systems needs to be investigated in detail and concurrence with any existing Drainage Studies or Watershed/Subwatershed Studies needs to be demonstrated. All stormwater management determinations shall have supporting rationale.

The site is located within the area covered by the Carp River Watershed/Subwatershed Study, and it suggests methods promoting infiltration (following sufficient/satisfactory treatment). The Stormwater Management Report must address the applicable requirements of the Carp River Watershed/Subwatershed Study and if such pertains, Master Drainage Plan.

A water budget will need to be developed for the proposal to maintain recharge, as the site is within significant groundwater recharge area. It should provide a 15% reduction in the difference from pre-development to post-development.

The SWM report needs to reference soil hydrogeological and geotechnical conditions and its infiltration capacity clearly and what surface run-off water treatment measures are being applied to protect the highly vulnerable aquifer that was identified on the site.

The stormwater management quantity criteria for the development is that the 100-year post-development stormwater runoff must be controlled to the 2-year pre-development runoff, as per section 8.3.7.3 of the Ottawa Sewer Design Guidelines (SDG).

All stormwater management determinations shall have supporting rationale.

All SWM systems need to be identified on the SWM Plan (i.e. common SWM pond, multiple ponds, swales, ditches, CB's, underground pipes, etc.), to support the analysis and recommendations provided in the SWM Report. All these considerations need to be shown on the SWM Plan. Any SWM ponds will need a sediment drying area.

Geotechnical Investigation

A Geotechnical Investigation Report is required. Please note that sensitive marine clays are anticipated in the area of the proposed subdivision and, therefore, enhanced geotechnical investigation and exhaustive analysis will be necessary. Investigation of clays should be undertaken with vane shear testing, Atterberg limits testing (from a number of depths in each column), shrinkage, grain size, grade raise restriction, consolidation, compaction sensitivity, remolded strength and liquefaction analysis- amongst others. For geotechnical investigation, please refer to "Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa"

It should also include exhaustive infiltration/percolation testing for SWM & septic field design, as a highly vulnerable aquifer is present on the site. Extensive analysis and discussion is required to address LID requirements of the MECP bulletin and the Carp River subwatershed study (CRWSS). The area is within Mississippi-Rideau source water protection area and also within significant groundwater recharge area. Infiltration is required here but also might be of concern (septic systems)

The groundwater level is to be investigated and the level is to be derived from spring-time investigation (there are mineral extraction sites to the south, and their presence might need to be considered in the investigation). Water table level needs to be determined for the proposed design and foundation drainage need to be addressed. The above mentioned CRWSS concerns, and its recommendations need to be considered in the Geotechnical Report. In sensitive marine clays, trees in proximity to foundations can cause foundation damage. The requirements of the City's Tree Planting in Sensitive Marine Clay Soils – 2017 Guidelines should be contemplated.

Earthquake analysis and potential for seismic liquefaction analysis are also required to be undertaken and details provided in the report.

As current site grading is unknown, Slope stability Study may also be required, and potential "Hazard Lands" will need to be identified and safe setbacks are to be specified as per Section 4.8 of the Official Plan, in accordance with the "City Slope Stability Guidelines in the City of Ottawa (Original by Golder Associates, 2004; updated by City of Ottawa, 2012)".

Environmental Site Assessment (ESA).

A Phase 1 Environmental Site Assessment (ESA) is required, completed in accordance with Ontario Regulation (O.Reg.) 153/04.
A Phase 2 ESA may be required, depending on the outcome of the Phase 1 ESA.
A Record of Site Condition, if applicable, will be required as a condition of the Plan of Subdivision approval.

Noise Control Feasibility Study
A study will be required due to the potential of the proposed development to generate noise (Stationary Noise) and close proximity of the proposed commercial/industrial subdivision to the existing buildings nearby (offices/potentially residential)

Noise and Vibration Study
A study will be required, in order to address the noise and vibration generated by the Carp Airport activities, adjacent to the proposed development and also the noise and vibration component of the adjacent Carp Road (arterial road), which is also identified as a "full load truck route", and how, if required, the noise and vibration should be mitigated.

Carp Airport Proximity
Transport Canada, Carp Airport Authority, Navigation Canada, or other aviation authorities, as required, need to be contacted regarding ponds and lighting or other specific considerations and limitations associated with proposed development in direct proximity to Carp Airport. The City Engineering needs to be copied on the communication. Airport area zoning restrictions imposed by the Airport Vicinity Development Zone need to be considered, as per new OP section 10.2.2.11 (Schedule C14) and current OP, Section 4.8.6.

- Noise-sensitive development is not permitted within the 30 NEF/NEP contour lines at the Carp airport.
- Proposed development in the vicinity of Carp airport shall comply with current Transport Canada guidelines.
- Proposed development in the vicinity of Carp airport will comply with TP 312 Aerodrome Standards, and within runway approach surfaces will be subject to the overall building height provisions of the Federal Airport Zoning Regulations and Recommended Practices affecting building heights.
- Prior to Draft Plan of Subdivision approval, exterior lighting specifications need to be defined by a qualified Professional Engineer. Confirmation that the defined criteria comply with the requirements, set by the governing airport authority, will need to be presented to the City prior to the Draft Plan approval.

Easements/ROW
Easements and rights-of-ways must be shown on the plans and information on any existing easements or ROWs, must be provided with the application. There is a concern of access to the agricultural property to the north. It appears that access to that property is along the north-west side of proposed subdivision Lot #1, which is also considered presently as subject to severance. The proposed development will remove access to the mentioned property. Solution needs to be provided.

Roads
Carp Road in Rural Road Network is an Arterial Road and ROW protection of 30.0 m is required, as per new Official plan, Schedule C16 (15 m from the road centre line to the property limit).
Topographic survey needs to confirm the ROW width. If distance between property line and Carp Road centre line is not 15 m, road widening will be required.
Sight line triangles need to be added at the subdivision road intersections with Carp Rad.

As per the Safer Roads initiative (adopted by Council, late 2019), roads must be designed to limit vehicle speeds to 30 km/h (by design, not by signage). Please refer to Transportation Department comments for more information.

Energy conservation
Energy conservation is required to be demonstrated throughout design as per section 4.9 of the Official Plan (reduction of urban heat, renewable energy, mitigation of climate change impacts and others).

Permits and Approvals
The property is within the regulation limit of Mississippi Valley Conservation Authority.

Please contact the Mississippi Valley Conservation Authority (MVCA), amongst other federal and provincial departments/agencies, to identify all the necessary permits and approvals required to facilitate the development. Responsibility rests with the developer and their consultant for determining which approvals are needed and for obtaining all external agency approvals. The address shall be in good standing with all approval agencies. Copies of confirmation of correspondence will be required by the City of Ottawa from all approval agencies that a form of assent is given.
Please note that a stormwater program for multiple lots is understood to be the expanded type of Environmental Compliance Approval (ECA) application with the MECP; please speak with your engineering consultant to understand the impact this has on the application. Note that oil/grit separators require Environmental Technology Verification (ETV) protocol for ECA approval.

If required, an MECP ECA application is not submitted until after City of Ottawa Engineering is satisfied that components directly or indirectly aligned with the ECA process concur with standards, directives, and guidelines of the MECP. No construction shall commence until after a commence work notification is given by Development Review

Hydrogeology
General
Submissions are to be in accordance with the following.

- The City of Ottawa Hydrogeological and Terrain Analysis Guidelines (March, 2021)
- The Carp Road Corridor – Nitrate Impact Assessment Recommendations (City of Ottawa Memorandum, September 2016)
- Ontario's Procedures D-5-4 and D-5-5
- The City of Ottawa Official Plan Section 4.4
- Section 1.6.6.4 of the Provincial Policy Statement

Severance
The hydrogeological and terrain information required to support the proposed single lot severance will be reviewed by City of Ottawa hydrogeological geoscience and other staff. The required information is as follows.

- A hydrogeological and terrain analysis (HGTA) report is required to support the private servicing (well and septic).

- HGTA report must meet the requirement of the City's Hydrogeological and Terrain Analysis Guideline Guidelines (March, 2021); requirements related to severance applications are listed in Section 4.0. Also note that there are special considerations for the septic impact assessment for lots within the Carp Road Corridor (memo dated September 27, 2016), please contact the City planner or hydrogeologist if your hydrogeological consultant does not have a copy of the memo.
- Water quantity and quality: A well must be tested to support the water quantity and water quality. It is recommended that a well be installed onsite, which can be used as the future supply well, however the City Guidelines allow that a near-by technically representative well be used to support severance applications. Note that the supply well must be installed and tested to support an future site plan approval.
    - Support must be provided for the pump test rate; should use the maximum day rate. The rate should consider the actual use (if known), or potential uses permitted through zoning.
    - Must meet the water quality testing requirements outlined in the City Guidelines – i.e. sample for subdivision suite parameters, metals and VOCs. Also consider local existing and historic land use and determine if any additional parameters need to be included (i.e. cemetery, industries, etc.)
- A septic impact assessment is required, as per City Guidelines and the 2016 City memo related to special considerations within the Carp Road Corridor, which includes the use of advance septic treatment (up to 50% nitrate reduction with certified systems). For the severance application, if the use is unknown, then the assessment must be conducted using a proposed reasonable impermeable surface coverage and septic flow, which will be verified at Site Plan Control.
- Note that if the total septic flows for the site will be greater than 10,000 L/day, then an ECA from the MECP will be required for the septic system at Site Plan. If the septic flows are less than 10,000 L/day then a septic assessment is required to ensure that the septic does not impact the local aquifer; the required methodology for the assessment is outlined in the City Guidelines – refer to the predictive assessment for commercial/industrial developments.
- The HGTA report must include a water budget; since the site lies within an area identified as moderate recharge in the Carp Road Corridor CDP; the water budget should show how recharge will be maintained onsite (compared to pre-development conditions).
- The HGTA report should also outline potential onsite activities and risks to existing groundwater users and identify measures that should be implemented to protect the aquifer in the long-term, if needed, to be confirmed at Site Plan.
- The report recommendations section must include clear development recommendations which will be verified at Site Plan Approval, including:
    - Maximum permitted well yield, based on pump test results.
    - Well construction details (if supply well not installed onsite)
    - Maximum septic flow (or maximum employment), maximum impermeable surface and proposed septic system type (if advanced septic treatment is recommended) – based on septic impact assessment calculations
    - Infiltration targets to meet recharge requirements, based on the site-specific water budget
    - Mitigative measures recommended for protection of the aquifer
- At Site Plan Control, additional hydrogeological analyses may be considered if the proposed use exceeds the recommendations. Any additional analyses must meet the requirements of the HGTA Guidelines, to the satisfaction of the City.
- Technical consultation with the hydrogeological reviewer of the severance application is encouraged with the hydrogeological consultant prior to starting field work to help scope report

requirements. Please contact the City hydrogeologist, Tessa Di Iorio (Tessa.diiorio@ottawa.ca) to schedule a technical pre-consultation.

Subdivision

The hydrogeological and terrain information required to support the proposed 11 or 12 lot subdivision will be reviewed by the conservation authority's hydrogeological geoscientist on behalf of the City of Ottawa, as per a formal service agreement. In this way, conservation authority staff are acting on behalf of the City and are not referencing any conservation authority requirements.

High level considerations about the natural hydrogeological and terrain conditions that might impact the proposed subdivision servicing plan and / or scope of investigation include the following.

- The uppermost underlying aquifer is mapped as the Verulam Formation, which is generally considered to be only an inconsistent or marginal producer. Well yield and the acceptability of interference with existing and proposed wells will be especially important to demonstrate.
- There are known issues here and there along the Carp Road Corridor with elevated nitrate and problematic aesthetic parameters. There are also multiple land uses adjacent to the site that should trigger additional chemical analysis of all groundwater samples. The ESA and / or the equivalent work should dictate what additional chemical analyses are needed. If water quality considerations arise, consultation in advance of a formal application is recommended.
- Industrial and commercial development tends to create significant impervious areas, which conflict with the need for rainwater to be able to infiltrate into each lot to dilute septic effluent to acceptable standards. This is to be fully addressed in any submission.
- A water budget assessment will be required to support not only lot sizes, via the nitrate dilution calculations, but also to demonstrate that groundwater recharge is maintained as part of the stormwater management plan. These should be aligned.
- Service locations and design may not be sustainable if only the minimum regulatory requirements from the Wells Regulation and OBC are implemented. The studies that are undertaken to address municipal and provincial planning and development policies should identify what other measures are required to ensure sustainability. In some cases, service location should take precedence over building locations and special well design is needed.

The required investigation and report submission must be respectively supervised and authored by an experienced hydrogeological geoscientist or equivalent engineer. Full information about the required submission is detailed in the City's guideline, to which the link is provided above. In addition, an equivalent summary is provided above in the severance discussion. Note that the severance investigation can be designed to be relevant for and included in the subdivision investigation and submission.

Rather than re-summarizing those requirements then, the following is advised.

Given that there may be well yield and groundwater chemistry / quality issues that arise during the hydrogeological and terrain investigation, it is recommended that the hydrogeological work is phased, and that technical consultation occurs between phases. Technical consultation for the subdivision will be with the designated technical reviewer from the conservation authority. It is recommended that the work proceed as follows.

- A detailed background review and site reconnaissance should be undertaken prior to finalizing the work plan.
- The results of the hydrogeological and terrain work for the severance and the ESA should be used to refine the work plan for the subdivision and integrated into any submission for the subdivision.

- The results of water sample analysis from existing adjacent wells (for all relevant parameters) may be done prior to the main field program as to help gauge the likelihood of existing problems. Otherwise, sampling of adjacent existing water wells would be included in the main field program.
- A work plan should be established which is based on a detailed review of all available background data, rather than generically. It should provide the rationale for test-well and test-pit locations and design and list all methods. Some items that tend to pose issues are elaborated on next.
    - The representative terrain unit investigation should be aligned with any geotechnical work, but the hydrogeologist must be a full participant to all sediment and rock logging work. Further, sediment structure and not just texture and colour should be documented. Photographs are very useful.
    - The work plan should consider if there are existing constraints on service locations, which may dictate testing locations from,
        - non-hydrogeological considerations, such as setbacks from the creek, easements, roads etc.,
        - hydrogeological considerations, such as setbacks from existing services, sources of contamination, outcrops, etc.
    - The work plan should ensure that observation well data can be collected during aquifer tests. Some representative observation well data should be representative of typical separation distances between proposed wells and to existing services from the closest proposed well.
    - Continuous background water level data should be collected prior to and following all aquifer tests to eliminate uncertainties in well recovery datasets and aquifer parameter analysis and to document the baseline interference from existing groundwater users and natural groundwater level fluctuations.
    - Test well construction, purging, disinfection and lithological logging should be fully supervised and documented, and all additional chlorination episodes fully documented, as applicable.
    - Test well design must be representative of future water wells, as to suitably investigate groundwater quality and yield.
    - Well testing must be representative of the greatest water taking (rate and duration) which is permissible by existing zoning, so extended aquifer testing may be required.
    - Residual chlorine measurements must address the level of accuracy and precision needed to ascertain if a groundwater sample is free of chlorine to a level where it is not only undetectable but also non-disinfecting.
    - Sampling plans should be provided, which explain methods:
        - for how required field parameters will be measured, the equipment previously calibrated, the results of calibration and field testing documented to specific levels of accuracy, and what uncertainty is expected
        - Photos of samples and equipment readouts are very useful for considering colour, turbidity, chlorine residual, etc.
        - for filtering and preserving
        - for determining if hydrogen sulphide requires on-site measurement
        - for deciding if and how methane should be measured

- Results should be discussed with the technical reviewer if issues are encountered, prior to application submission.

Please note that following acceptance of the subdivision, each lot will be subject to Site Plan Control. Therefore, the final hydrogeological and terrain analysis, which is submitted with the subdivision application, should provide precise recommendations on a lot-by-lot basis related to the following:

- The types of land use included in the current zoning, which cannot be supported, if applicable.
- The maximum allowable impervious surface area and septic flows, as assessed via the D-5-4 procedure.
- The type of septic treatment that is to be used and that was assessed via the D-5-4 procedure considering the Carp Road Corridor memorandum (i.e., conventional vs. advanced treatment).
- The sustainable and safe water well design
- The maximum sustainable well yield (rate and duration)
- The most suitable service locations to minimize interference but preserve access

These recommendations will become the accepted limitations for private servicing on each lot and will be upheld for each lot at Site Plan Control. Nevertheless, there may be flexibility to amend these limitations if additional investigation is undertaken for the individual lot and that work indicates that a new more intensive private servicing plan is sustainable. The review of such an amended plan would be subject to City review and approval.

Please contact Claire Milloy for questions regarding the subdivision hydrogeological requirements. claire.milloy@rvca.ca

Transportation - Josiane Gervais, josiane.gervais@ottawa.ca

- Follow Traffic Impact Assessment Guidelines
  - Update Screening Form to indicate the anticipated amount of industrial/commercial development. This is required to determine what the impacts will be to Carp Road and should there be any roadway modifications required to support the subdivision.
  - Please submit the revised Screening Form at your earliest convenience to Josiane.gervais@ottawa.ca. The Screening Form will be reviewed to determine if a TIA is required.
  - Start this process asap.
  - The application will not be deemed complete until the submission of the draft step 1-4, including the functional draft RMA package (if applicable), draft functional plans (if applicable) and/or monitoring report (if applicable).
  - Request base mapping asap if RMA is required. Contact Engineering Services (https://ottawa.ca/en/city-hall/planning-and-development/engineering-services)
- Local roadways are to be designed for a 30km/hr operating speed.
- Local roads and collector roads in the rural area must have a 20m and 26m ROW, respectively.
- Geometric Road Design Drawings (GRDD) will be required with the first submission of underground infrastructure and grading drawings. These drawings should include such items as, but are not limited to:
  - Road signage and pavement markings;
  - Location of depressed curbs and tactile walking surface indicators (TWSI);
  - Traffic calming measures aimed at reducing vehicle speed and enhancing pedestrian safety. Measures may include either vertical or horizontal features, however such measures shall not interfere with stormwater management and overland flow routing. Traffic calming measures shall reference best management practices from the Canadian Guide to Neighbourhood Traffic Calming, published by the Transportation Association of Canada, and/or Ontario Traffic Manual, and/or the City of Ottawa's Traffic Calming Design Guidelines;

    - Intersection control measures at new internal intersections;
    - Consideration should be made to include mini roundabouts where feasible throughout the subdivision.
- ROW protection on Carp Road between March and Richardson Side is 30m even.

Environmental - Sami Rehman, Sami.Rehman@ottawa.ca

- It is assumed that lot 1 identified in the draft concept plan for TLC Holdings will be the proposed severance. If so, there are little environmental concern for the single severance. It has been identified as moderate recharge are and may require a groundwater impact assessment (Carp Rd Corridor CDP, Section 3, policy 3).
- For the proposed plan of subdivision, our data indicates a watercourse in the eastern corner of the property. As such, an Environmental Impact Study (EIS) will be required to determine the minimum watercourse setbacks (see OP 4.9). The EIS should also investigate potential significant habitat for threatened or endangered species on or adjacent to the subject property.
- The plan of subdivision will also require a Tree Conservation Report (TCR). This can be combined with the EIS to avoid duplications.
- Here are the links to the Environmental Impact Statement Guidelines and the Tree Conservation Report Guidelines.

Parks

- Severance for commercial or Industrial purposes: As a condition of severance, the General Manager shall require cash-in-lieu of parkland, as well as the fee for appraisal services. Commercial and Industrial uses are expected to convey parkland at a rate of 2 % of the gross land area.
- Industrial Subdivision: Upon subdivision registration, the General Manager shall require cash-in-lieu of parkland, as well as the fee for appraisal services. Commercial and Industrial uses are expected to convey parkland at a rate of 2 % of the gross land area.
- Please address parkland dedication in the planning rationale for each application.
- A property survey will be required to confirm the gross land area being developed with each application.
- Please note that Parks and Facilities Planning has recently undertaken a legislated replacement of the Parkland Dedication By-law, with the new by-law approved by City Council on August 31, 2022. To ensure you are aware of parkland dedication requirements for your proposed development, we encourage you to familiarize yourself with the staff report and By-Law that were approved by Council on August 31, 2022.
- Please contact the Parks and Faculties Planner anissa.mcalpine@ottawa.ca if you have any questions.

City Surveyor

- The determination of property boundaries, minimum setbacks and other regulatory constraints are a critical component of development. An Ontario Land Surveyor (O.L.S.) needs to be consulted at the outset of a project to ensure properties are properly defined and can be used as the geospatial framework for the development.
- Topographic details may also be required for a project and should be either carried out by the O.L.S. that has provided the Legal Survey or done in consultation with the O.L.S. to ensure that the project is integrated to the appropriate control network.

Questions regarding the above requirements can be directed to the City's Surveyor, Bill Harper, at Bill.Harper@ottawa.ca

Conservation Authority - Mercedes Liedtke mliedtke@mvc.on.ca

Severance (Lot 1, 11, or 12)

- The subject property is not regulated by MVCA under Ontario Regulation 153/06.
- If stormwater management is required, MVCA would review the proposal for water quantity and quality impacts on the receiving watercourse.

Subdivision:

- The watercourse on the property is regulated by the Mississippi Valley Conservation Authority (MVCA) under Ontario Regulation 153/06, *Development, Interference with Wetlands and Alterations to Shorelines and Watercourses.* Under Ontario Regulation 153/06, written permission is required from the MVCA prior to the initiation of development (which includes construction, site grading and the placement or removal of fill) within an area regulated by the Conservation Authority as well as straightening, changing, diverting or interfering in any way with the existing channel or the shoreline of a watercourse.
- MVCA recommends that a headwater drainage feature assessment be completed for the identified watercourse on proposed lot 7.
- A stormwater management report will be required with the subdivision submission:
    a. 80% TSS removal, or enhanced level of protection is recommended, but 70%, or normal level of protection is required as per the Carp River Watershed Subwatershed Study.
- The property is within the Carp River Watershed Subwatershed Study area, and was outlined in the Carp Road Corridor Community Design Plan which has an annual infiltration target outlined below. Existing infiltration rates on site should be assessed and maintained post development.
    a. Moderate groundwater recharge area 104 mm/year infiltration

Submission requirements and fees

- Severance
    - Planning Rationale/Cover Letter
    - Hydrogeological and Terrain analysis and report
    - Storm water investigation
        - brief analysis - please see comments above
    - Geotechnical Investigation and Slope Stability Report
        - might be required (please see comments above)
- Subdivision
    - Draft Plan of Subdivision
    - Planning Rationale
    - Archaeological Assessment
    - Private Servicing Plan
    - Preliminary Grading Plan
        - (Provisional Grading Plan can be submitted with application submission and then Grade Control and Drainage Plan as a condition of draft approval)
    - Drainage Plan (SWM Plan to be included)
    - Erosion and Sediment Control Plan
    - Lighting Plan
        - (proximity to Carp Airport – lighting constraints to be defined)
    - Hydrogeological and Terrain analysis and report
    - Baseline Well Water Quality Sampling report
    - Geotechnical Investigation and report
        - (The geotechnical consultant will need to provide full copies of any published and peer reviewed papers relied on, to determine results and conclusions; Earthquake analysis and potential for Seismic liquefaction analysis are also

required to be undertaken and details provided in the report; Slope Stability Study might also be required – grading dependent)
    - Subdivision Servicing Study and Report (Water & Sanitary Private servicing)
    - Storm Water Management Report
    - Noise Control Feasibility Study
        - (to control stationary noise produced by industrial component of the proposed subdivision)
    - Noise and Vibration Study (due to proximity to Carp airport and Carp Road)
    - Phase 1 Environmental Site Assessment (ESA)
    - Phase 2 Environmental Site Assessment (ESA)
        - if required based on outcome of Phase 1 (refer to Environmental Site Assessment comments above)
    - Fluvial Geomorphology Report
        - may be required (identified watercourse on site – NE corner)
    - Environmental Impact Study
    - Transportation Impact Assessment (depending on Screening Form)
- Additional information regarding fees related to planning applications can be found here.
- Guide to preparing City of Ottawa Studies and Plans
- To request City of Ottawa plan(s) or report information please contact the ISD Information Centre: Information Centre (informationcentre@ottawa.ca): (613) 580-2424 ext. 44455

- Plans are to be standard A1 size (594 mm x 841 mm) or Arch D size (609.6 mm x 914.4 mm) sheets, dimensioned in metric and utilizing an appropriate Metric scale (1:200, 1:250, 1:300, 1:400 or 1:500).
- All PDF submitted documents are to be unlocked and flattened.

Next steps

- You are encouraged to discuss the proposal with Councillor, community groups and neighbours.

DRAFT PLAN OF SUBDIVISION
PART OF LOTS 11 AND 12 CONCESSION 2 GEOGRAPHIC TOWNSHIP OF HUNTLEY CITY OF OTTAWA

BLOCKS 2–12 for future industrial use
BLOCKS 1 & 13 for other use
STREET A – 20 metres wide

APPLICANT AND PROPERTY OWNER
T & L CARROLL HOLDINGS INC.
1380 HOWIE ROAD
CARP, ON, K0A 1L0

I HEREBY AUTHORIZE THE PREPARATION AND SUBMISSION OF THIS PLAN TO THE COUNCIL OF THE CITY OF OTTAWA.

DATED ON _______________, 2025.

____
T & L CARROLL HOLDINGS INC.
I HAVE THE AUTHORITY TO BIND THIS CORPORATION

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

____
JOHN GAUTHIER
ONTARIO LAND SURVEYOR

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51 (17) OF THE PLANNING ACT

A. AS SHOWN ON DRAFT PLAN
B. AS SHOWN ON DRAFT PLAN
C. AS SHOWN ON DRAFT PLAN
D. AS DESCRIBED ON THE TITLE BLOCK
E. AS SHOWN ON DRAFT PLAN
F. NOT APPLICABLE
G. AS SHOWN ON DRAFT PLAN
H. INDIVIDUAL PRIVATE WALLS
I. REFER TO SOILS REPORT
J. AS SHOWN ON DRAFT PLAN
K. INDIVIDUAL PRIVATE SEPTIC SYSTEMS
L. AS SHOWN ON DRAFT PLAN

SCHEDULE OF AREAS

LOT/BLOCK	AREA (Ha)	TYPE
BLOCK 1	0.07	OTHER
BLOCK 2	1.29	INDUSTRIAL USE
BLOCK 3	1.30	INDUSTRIAL USE
BLOCK 4	3.00	INDUSTRIAL USE
BLOCK 5	1.43	INDUSTRIAL USE
BLOCK 6	1.37	INDUSTRIAL USE
BLOCK 7	4.74	INDUSTRIAL USE
BLOCK 8	1.28	INDUSTRIAL USE
BLOCK 9	1.14	INDUSTRIAL USE
BLOCK 10	1.20	INDUSTRIAL USE
BLOCK 11	1.36	INDUSTRIAL USE
BLOCK 12	1.46	INDUSTRIAL USE
BLOCK 13	0.04	OTHER
TOTAL LOT/BLOCK AREA (Ha)		19.69
STREET	AREA (Ha)	LENGTH (m)
STREET A	1.81	900.08
TOTAL SUBDIVISION AREA (Ha)		21.50

LEGEND:

○ B	DENOTES	BELL UTILITY POLE
○ H	DENOTES	HYDRO UTILITY POLE
○ B&H	DENOTES	BELL & HYDRO UTILITY POLE
AN	DENOTES	ANCHOR
□ BP	DENOTES	BELL UTILITY PEDESTAL
OHW	DENOTES	OVERHEAD WIRES
BF	DENOTES	BOARD FENCE
PWF	DENOTES	POST & WIRE FENCE
PVC	DENOTES	POLYVINYL CHLORIDE (PLASTIC)
MW	DENOTES	MONITORING WELL
	DENOTES	TREE LINE
	DENOTES	SIGN

DISTANCES:
DISTANCES SHOWN ON THIS PLAN ARE GROUND DISTANCES AND CAN BE USED TO COMPUTE GRID DISTANCES BY MULTIPLYING BY A COMBINED SCALE FACTOR OF 0.999905.

BEARINGS:
BEARINGS ARE MTM GRID BEARINGS, DERIVED BY REAL TIME NETWORK GNSS OBSERVATIONS ON OBSERVED REFERENCE POINTS 'A' AND 'B' SHOWN HEREON, AND ARE REFERRED TO THE NAD83 (ORIGINAL) MTM ZONE 9 COORDINATE SYSTEM.

ELEVATIONS:
ELEVATIONS AND EXISTING TOPOGRAPHIC FEATURES SHOWN ON THIS PLAN WERE PROVIDED BY A SKETCH TO ILLUSTRATE TOPOGRAPHY BY MCINTOSH PERRY SURVEYING INC, FILE 23–1883.

SCALE 1 : 750
0 15 30 45 60 75 Metres

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

REVISIONS

No.	DESCRIPTION	DATE	BY
1	REMOVED SEVERANCE ALREADY COMPLETED. REDUCED ROW TO 20M. ADDED NEW BLOCKS	2025–02–06	MP

JOB No. 23–1883 | DRAWING # 23–1883 Draft Plan of Subdivision_v3

PREPARED FOR: T & L Carroll Holdings Inc.

egis SURVEYING INC.
info.north-america@egis-group.com
www.egis-group.com
3240 Drummond Con. 5A, R.R. #7
Perth, ON K7H 3C9
Tel: 613-267-6524 Fax: 613-267-7992

EXAMINED: JG | CAD: MP

Appendix B

Figure 3: Conceptual Lot Development Plan

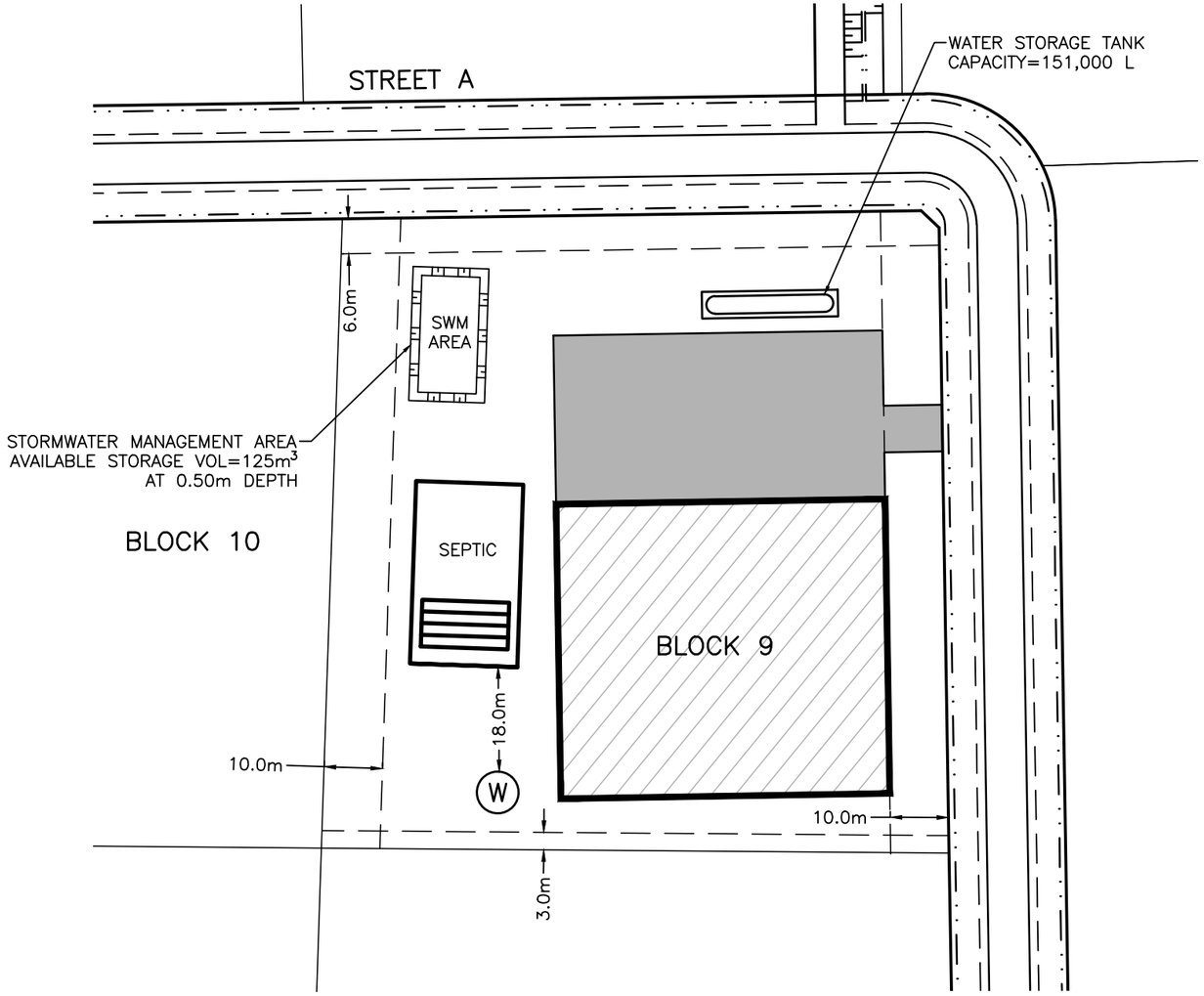
Grading and Drainage Plans (DWG. 24104-GR1-GR3)

Plan and Profiles (DWG. 24104-P1-P5)

Pre-Development Drainage Area Plan (DWG. 24104-PRE1)

Post-Development Drainage Area Plan (DWG. 24104-STM1)

Erosion and Sediment Control Plan (DWG. 24104-ESC1)



LEGEND

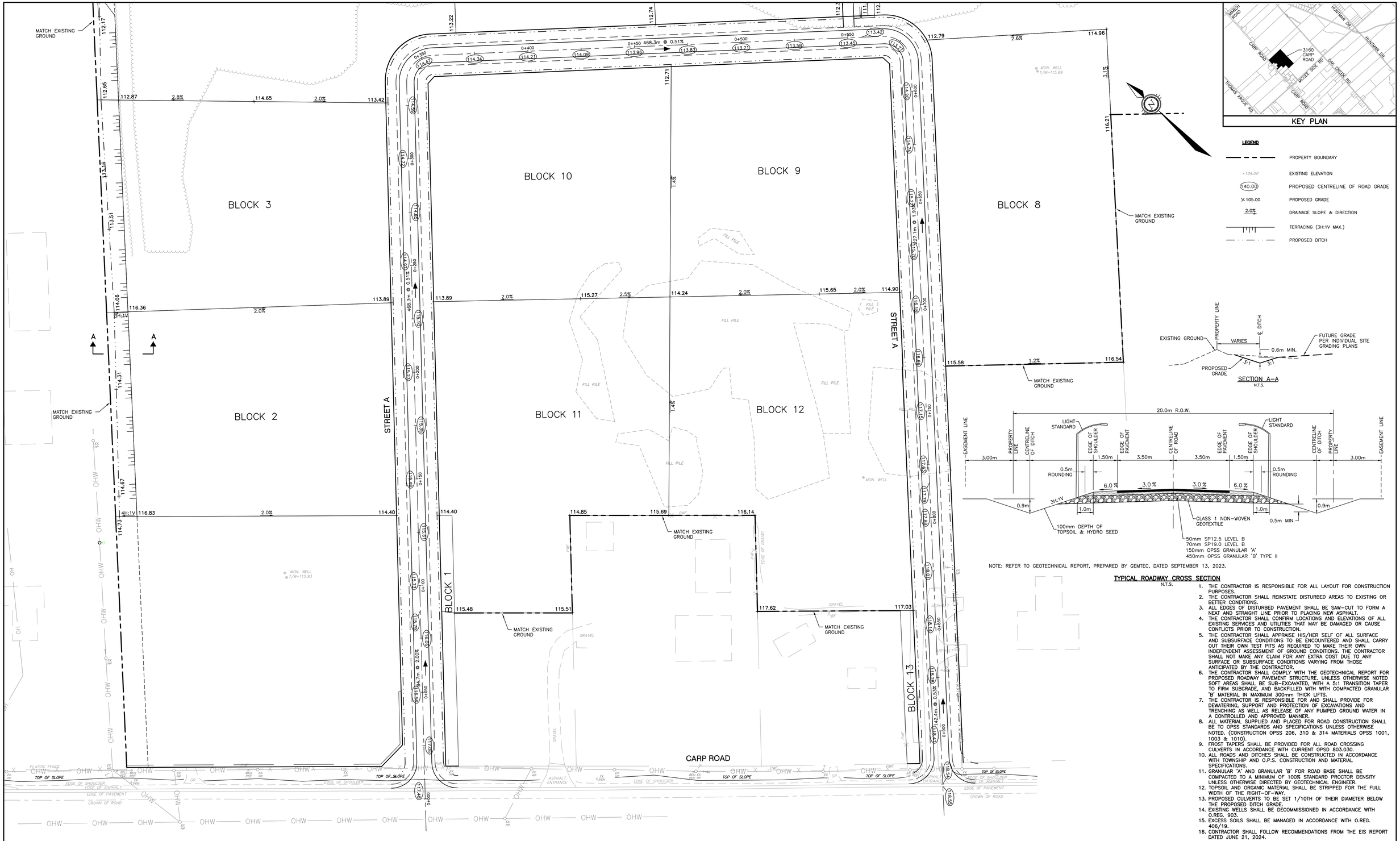
- ZONING SETBACK
- WELL
- WATER STORAGE TANK
- BUILDING FOOTPRINT
- IMPERVIOUS AREA
- SEPTIC FOOTPRINT

BLOCK 9 STATISTICS

BLOCK AREA = 11,400 m^2
MAX. BUILDING AREA = 2,850 m^2
MAX. IMPERVIOUS AREA = 4,560 m^2 (INCLUDES BUILDING)

Robinson
Land Development

scale 1:1000	CARROLL SUBDIVISION	project no. 24104
date 06/03/25	CONCEPTUAL LOT DEVELOPMENT PLAN	FIG. 3
drawn by BLM		



KEY PLAN

LEGEND

- PROPERTY BOUNDARY
- ×104.00 EXISTING ELEVATION
- (40.00) PROPOSED CENTRELINE OF ROAD GRADE
- ×105.00 PROPOSED GRADE
- 2.0% DRAINAGE SLOPE & DIRECTION
- TERRACING (3H:1V MAX.)
- PROPOSED DITCH

SECTION A–A
N.T.S.

NOTE: REFER TO GEOTECHNICAL REPORT, PREPARED BY GEMTEC, DATED SEPTEMBER 13, 2023.

TYPICAL ROADWAY CROSS SECTION
N.T.S.

1. THE CONTRACTOR IS RESPONSIBLE FOR ALL LAYOUT FOR CONSTRUCTION PURPOSES.
2. THE CONTRACTOR SHALL REINSTATE DISTURBED AREAS TO EXISTING OR BETTER CONDITIONS.
3. ALL EDGES OF DISTURBED PAVEMENT SHALL BE SAW–CUT TO FORM A NEAT AND STRAIGHT LINE PRIOR TO PLACING NEW ASPHALT.
4. THE CONTRACTOR SHALL CONFIRM LOCATIONS AND ELEVATIONS OF ALL EXISTING SERVICES AND UTILITIES THAT MAY BE DAMAGED OR CAUSE CONFLICTS PRIOR TO CONSTRUCTION.
5. THE CONTRACTOR SHALL APPRAISE HIS/HER SELF OF ALL SURFACE AND SUBSURFACE CONDITIONS TO BE ENCOUNTERED AND SHALL CARRY OUT THEIR OWN TEST PITS AS REQUIRED TO MAKE THEIR OWN INDEPENDENT ASSESSMENT OF GROUND CONDITIONS. THE CONTRACTOR SHALL NOT MAKE ANY CLAIM FOR ANY EXTRA COST DUE TO ANY SURFACE OR SUBSURFACE CONDITIONS VARYING FROM THOSE ANTICIPATED BY THE CONTRACTOR.
6. THE CONTRACTOR SHALL COMPLY WITH THE GEOTECHNICAL REPORT FOR PROPOSED ROADWAY PAVEMENT STRUCTURE. UNLESS OTHERWISE NOTED SOFT AREAS SHALL BE SUB–EXCAVATED, WITH A 5:1 TRANSITION TAPER TO FIRM SUBGRADE, AND BACKFILLED WITH WITH COMPACTED GRANULAR 'B' MATERIAL IN MAXIMUM 300mm THICK LIFTS.
7. THE CONTRACTOR IS RESPONSIBLE FOR AND SHALL PROVIDE FOR DEWATERING, SUPPORT AND PROTECTION OF EXCAVATIONS AND TRENCHING AS WELL AS RELEASE OF ANY PUMPED GROUND WATER IN A CONTROLLED AND APPROVED MANNER.
8. ALL MATERIAL SUPPLIED AND PLACED FOR ROAD CONSTRUCTION SHALL BE TO OPSS STANDARDS AND SPECIFICATIONS UNLESS OTHERWISE NOTED. (CONSTRUCTION OPSS 206, 310 & 314 MATERIALS OPSS 1001, 1003 & 1010).
9. FROST TAPERS SHALL BE PROVIDED FOR ALL ROAD CROSSING CULVERTS IN ACCORDANCE WITH CURRENT OPSD 803.030.
10. ALL ROADS AND DITCHES SHALL BE CONSTRUCTED IN ACCORDANCE WITH TOWNSHIP AND O.P.S. CONSTRUCTION AND MATERIAL SPECIFICATIONS.
11. GRANULAR 'A' AND GRANULAR 'B' FOR ROAD BASE SHALL BE COMPACTED TO A MINIMUM OF 100% STANDARD PROCTOR DENSITY UNLESS OTHERWISE DIRECTED BY GEOTECHNICAL ENGINEER.
12. TOPSOIL AND ORGANIC MATERIAL SHALL BE STRIPPED FOR THE FULL WIDTH OF THE RIGHT–OF–WAY.
13. PROPOSED CULVERTS TO BE SET 1/10TH OF THEIR DIAMETER BELOW THE PROPOSED DITCH GRADE.
14. EXISTING WELLS SHALL BE DECOMMISSIONED IN ACCORDANCE WITH O.REG. 903.
15. EXCESS SOILS SHALL BE MANAGED IN ACCORDANCE WITH O.REG. 406/19.
16. CONTRACTOR SHALL FOLLOW RECOMMENDATIONS FROM THE EIS REPORT DATED JUNE 21, 2024.

NOTES

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NO.	REVISION DESCRIPTION	DATE	BY
1	ISSUED FOR REVIEW	06/03/25	BLM

SCALE
0 5m 10m 30m
HORIZONTAL 1:750

LICENSED PROFESSIONAL ENGINEER
B.L. MACKECHNIE
100199554
May. 6/25
PROVINCE OF ONTARIO

Robinson Land Development
350 Palladium Drive
Ottawa, ON K2V 1A8
(613) 592-6060 rcii.com

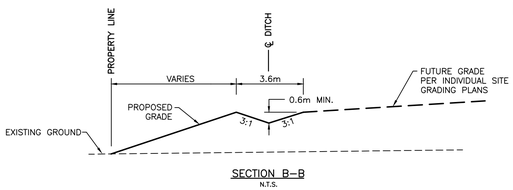
DESIGN	JHB
CHECKED	BLM
DRAWN	JHB
CHECKED	CC
APPROVED	BLM

T & L CARROLL HOLDINGS INC.

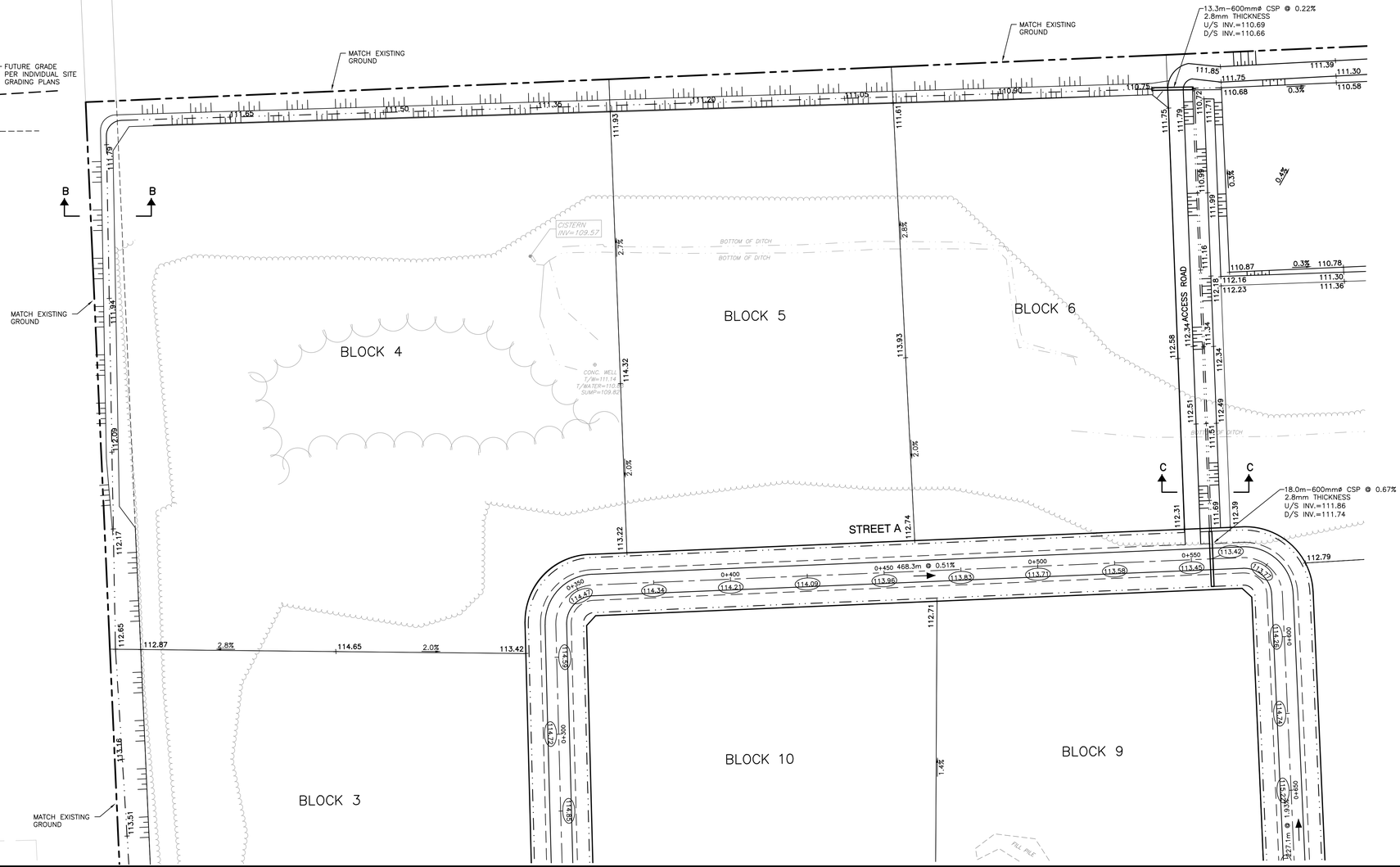
CARROLL INDUSTRIAL SUBDIVISION
3160 CARP ROAD
CITY OF OTTAWA

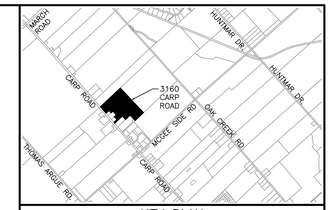
GRADING AND DRAINAGE PLAN

PROJECT No.	24104
SURVEY	LIDAR
DATED	MARCH 2025
DWG. No:	24104-GR1



SECTION B–B
N.T.S.





KEY PLAN

LEGEND

- PROPERTY BOUNDARY
- ×104.00 EXISTING ELEVATION
- (140.00) PROPOSED CENTRELINE OF ROAD GRADE
- ×105.00 PROPOSED GRADE
- 2.0% DRAINAGE SLOPE & DIRECTION
- TERRACING (3H:1V MAX.)
- PROPOSED DITCH

NOTES

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NO.	REVISION DESCRIPTION	DATE	BY
1	ISSUED FOR REVIEW	06/03/25	BLM

SCALE

0 5m 10m 30m

HORIZONTAL 1:750

LICENSED PROFESSIONAL ENGINEER
B. L. MACKECHNIE
100199554
Mar. 6/25
PROVINCE OF ONTARIO

Robinson Land Development
350 Palladium Drive
Ottawa, ON K2V 1A8
(613) 592-6060 rcii.com

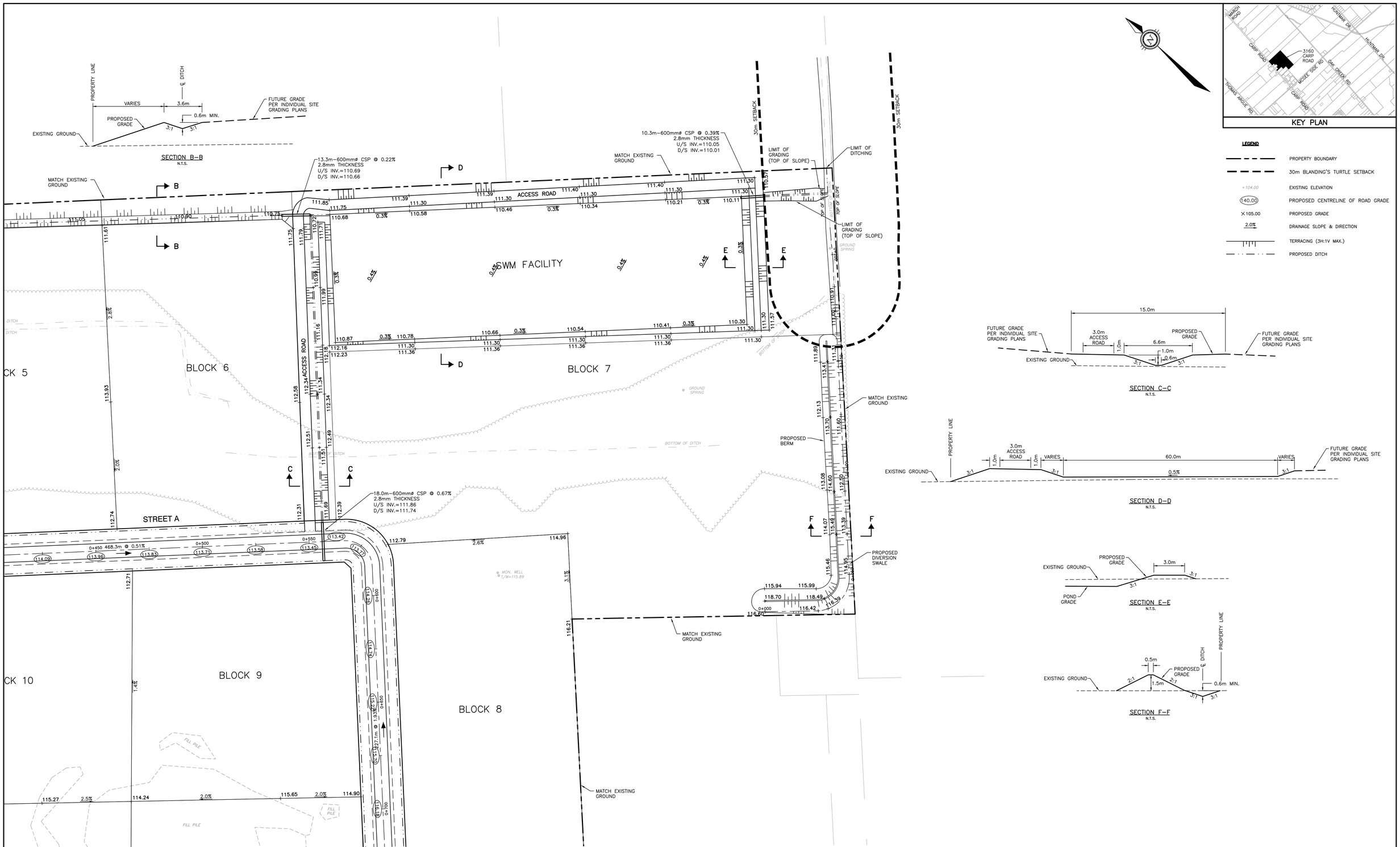
DESIGN	JHB
CHECKED	BLM
DRAWN	JHB
CHECKED	CC
APPROVED	BLM

T & L CARROLL HOLDINGS INC.

CARROLL INDUSTRIAL SUBDIVISION
3160 CARP ROAD
CITY OF OTTAWA

GRADING AND DRAINAGE PLAN

PROJECT No.	24104
SURVEY	LIDAR
DATED	MARCH 2025
DWG. No:	24104-GR2



KEY PLAN

LEGEND

- PROPERTY BOUNDARY
- 30m BLANDING'S TURTLE SETBACK
- ×104.00 EXISTING ELEVATION
- (140.00) PROPOSED CENTRELINE OF ROAD GRADE
- ×105.00 PROPOSED GRADE
- 2.0% DRAINAGE SLOPE & DIRECTION
- TERRACING (3H:1V MAX.)
- PROPOSED DITCH

SECTION C–C
N.T.S.

SECTION D–D
N.T.S.

SECTION E–E
N.T.S.

SECTION F–F
N.T.S.

NOTES

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NO.	REVISION DESCRIPTION	DATE	BY
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SCALE
0 5m 10m 30m
HORIZONTAL 1:750

LICENSED PROFESSIONAL ENGINEER
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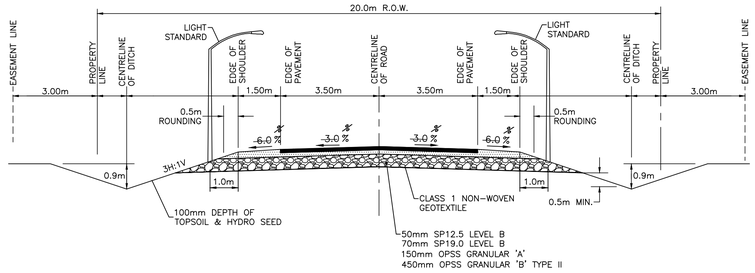
APPROVED	BLM

T & L CARROLL HOLDINGS INC.

CARROLL INDUSTRIAL SUBDIVISION
3160 CARP ROAD
CITY OF OTTAWA

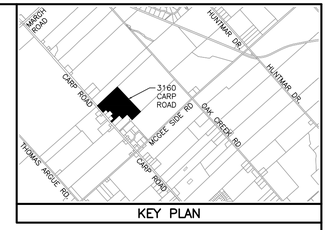
GRADING AND DRAINAGE PLAN

PROJECT No.	24104
SURVEY	LIDAR
DATED	MARCH 2025
DWG. No:	24104-GR3

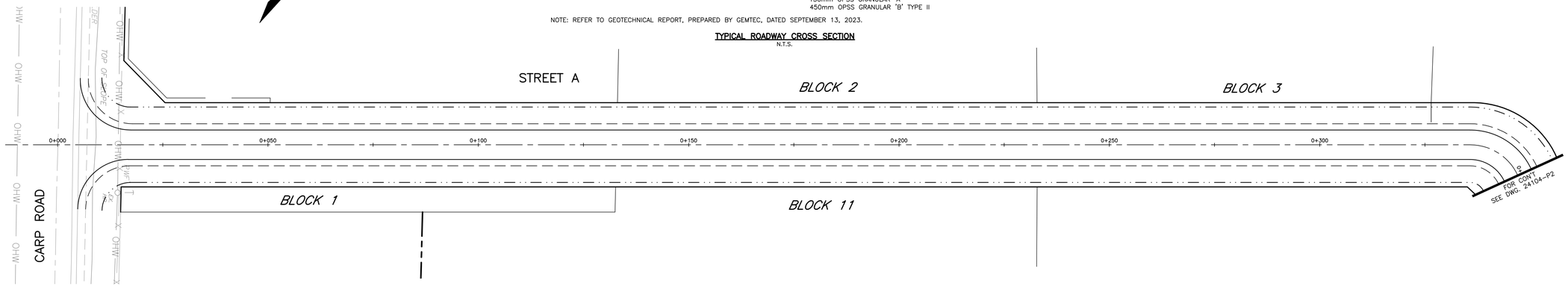


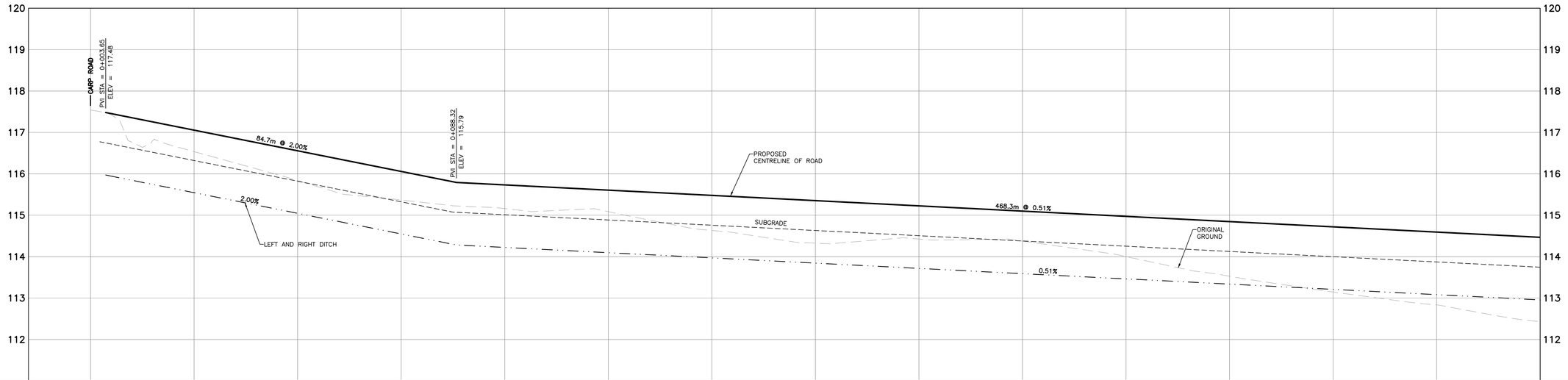
NOTE: REFER TO GEOTECHNICAL REPORT, PREPARED BY GEMTEC, DATED SEPTEMBER 13, 2023.

TYPICAL ROADWAY CROSS SECTION
N.T.S.



KEY PLAN





PROPOSED ROAD ℄ ELEVATION			117.06	116.56	116.06		115.73	115.61	115.48	115.35	115.23	115.10	114.97	114.85	114.72	114.59	114.47	PROPOSED ROAD ℄ ELEVATION
PROPOSED LEFT DITCH GRADE		115.97	115.55	115.05	114.55	114.28	114.22	114.10	113.97	113.84	113.72	113.59	113.46	113.34	113.21	113.08	112.96	PROPOSED LEFT DITCH GRADE
PROPOSED RIGHT DITCH GRADE		115.97	115.55	115.05	114.55	114.28	114.22	114.10	113.97	113.84	113.72	113.59	113.46	113.34	113.21	113.08	112.96	PROPOSED RIGHT DITCH GRADE
EXISTING ℄ R.O.W ELEVATION			*116.54*	*115.84*	*115.37*		*115.16*	*115.09*	*114.63*	*114.33*	*114.43*	*114.38*	*114.00*	*113.53*	*113.15*	*112.84*	*112.43*	EXISTING ℄ R.O.W ELEVATION
CHAINAGE	0+015	0+000	0+025	0+050	0+075		0+100	0+125	0+150	0+175	0+200	0+225	0+250	0+275	0+300	0+325	0+350	CHAINAGE

NOTES

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NO.	REVISION DESCRIPTION	DATE	BY
1	ISSUED FOR REVIEW	06/03/25	BLM

SCALE
HORIZONTAL 1:500 (0, 5m, 10m, 20m)
VERTICAL 1:50 (0, 0.5m, 1m, 2m)

LICENSED PROFESSIONAL ENGINEER
B.L. MACKECHNIE
100199554
Mar. 6/25
PROVINCE OF ONTARIO

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DESIGN	JHB
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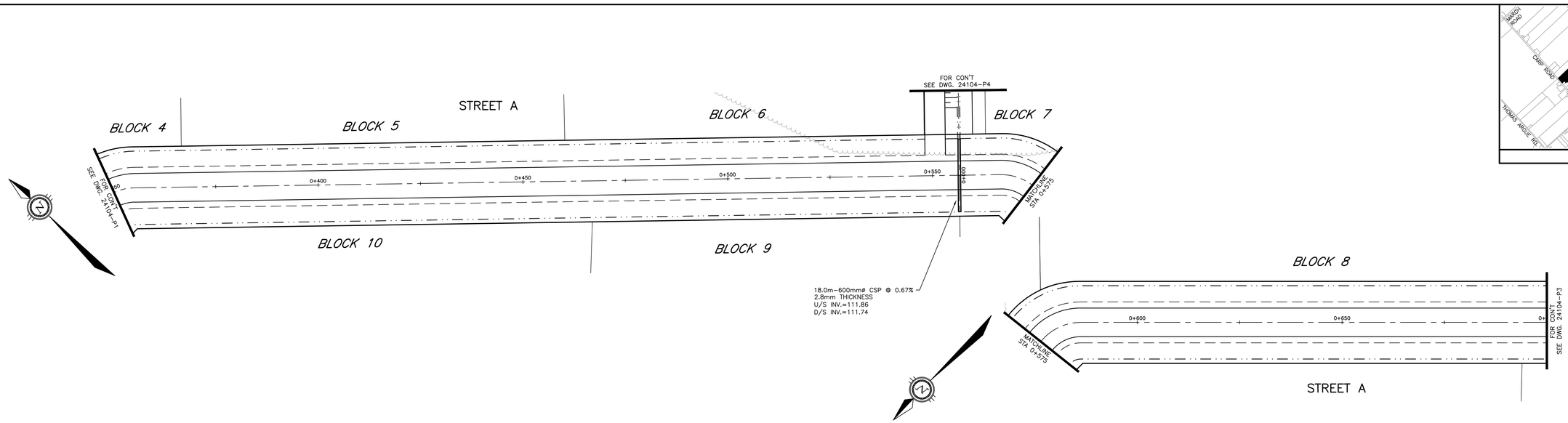
CHECKED	CC
APPROVED	BLM

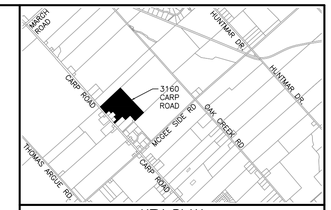
T & L CARROLL HOLDINGS INC.

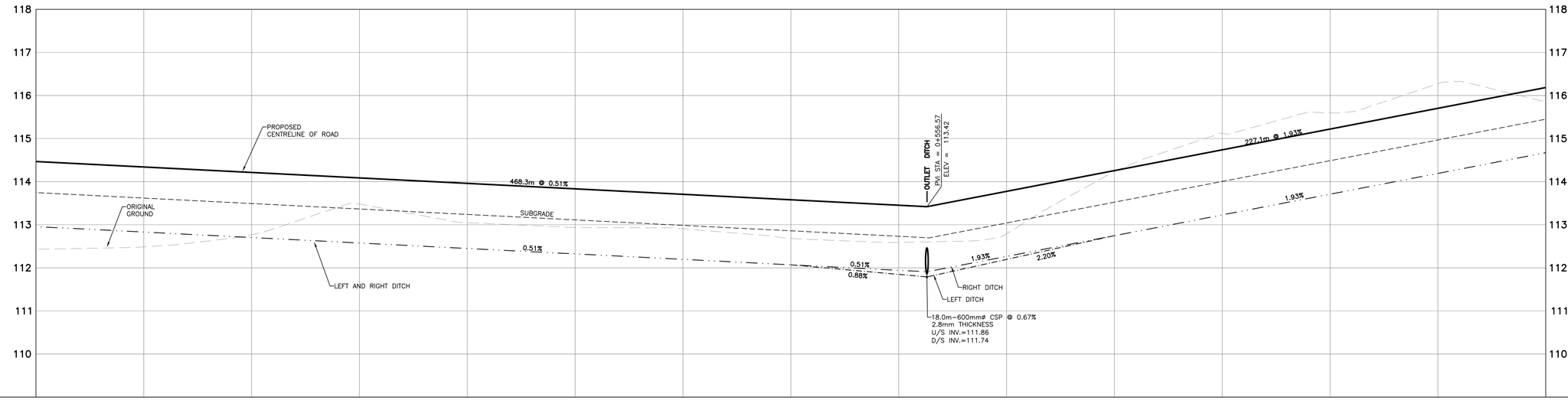
CARROLL INDUSTRIAL SUBDIVISION
3160 CARP ROAD
CITY OF OTTAWA

PLAN AND PROFILE
STA 0+000 TO STA 0+350

PROJECT No.	24104
SURVEY	LIDAR
DATED	MARCH 2025
DWG. No:	24104-P1







PROPOSED ROAD ℄ ELEVATION	114.47	114.34	114.21	114.09	113.96	113.83	113.71	113.58	113.45		113.77	114.26	114.74	115.22	115.70	116.18	PROPOSED ROAD ℄ ELEVATION
PROPOSED LEFT DITCH GRADE	112.86	112.83	112.70	112.58	112.45	112.32	112.20	112.07	111.85	111.79	112.20	112.75	113.23	113.71	114.19	114.67	PROPOSED LEFT DITCH GRADE
PROPOSED RIGHT DITCH GRADE	112.96	112.83	112.70	112.58	112.45	112.32	112.20	112.07	111.94	111.91	112.26	112.75	113.23	113.71	114.19	114.67	PROPOSED RIGHT DITCH GRADE
EXISTING ℄ R.O.W ELEVATION	*112.43*	*112.49*	*112.77*	*113.48*	*113.05*	*112.94*	*112.90*	*112.68*	*112.59*		*112.79*	*114.23*	*115.12*	*115.60*	*116.27*	*115.85*	EXISTING ℄ R.O.W ELEVATION
CHAINAGE	0+350	0+375	0+400	0+425	0+450	0+475	0+500	0+525	0+550		0+575	0+600	0+625	0+650	0+675	0+700	CHAINAGE

NOTES

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NO.	REVISION DESCRIPTION	DATE	BY
1	ISSUED FOR REVIEW	06/03/25	BLM

SCALE

HORIZONTAL 1:500 (0, 5m, 10m, 20m)

VERTICAL 1:50 (0, 0.5m, 1m, 2m)

LICENSED PROFESSIONAL ENGINEER
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100199554
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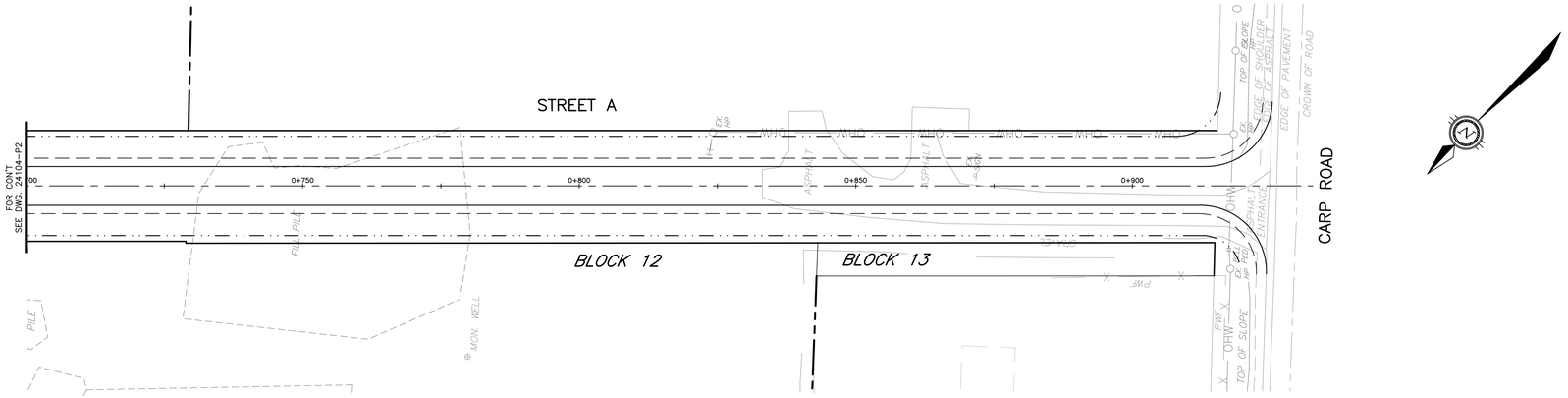
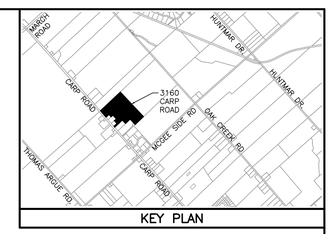
CARROLL INDUSTRIAL SUBDIVISION
3160 CARP ROAD
CITY OF OTTAWA

PLAN AND PROFILE
STA 0+350 TO STA 0+700

PROJECT No.	24104
SURVEY	LIDAR
DATED	MARCH 2025
DWG. No:	24104-P2





PROPOSED ROAD ℄ ELEVATION	116.18	116.66	117.15	117.63		117.88	118.01	118.14	118.28	118.41	118.54
PROPOSED LEFT DITCH GRADE	114.67	115.15	115.64	116.12	116.28	116.37	116.50	116.63	116.77	116.90	117.03 / 117.04
PROPOSED RIGHT DITCH GRADE	114.67	115.15	115.64	116.12	116.28	116.37	116.50	116.63	116.77	116.90	117.03 / 117.04
EXISTING ℄ R.O.W ELEVATION	*115.85*	*115.97*				*117.56*	*117.96*	*118.13*	*118.07*	*117.93*	*118.47*
CHAINAGE	**0+700**	**0+725**	**0+750**	**0+775**		**0+800**	**0+825**	**0+850**	**0+875**	**0+900**	**0+925**	**0+950**

NOTES

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PLAN AND PROFILE
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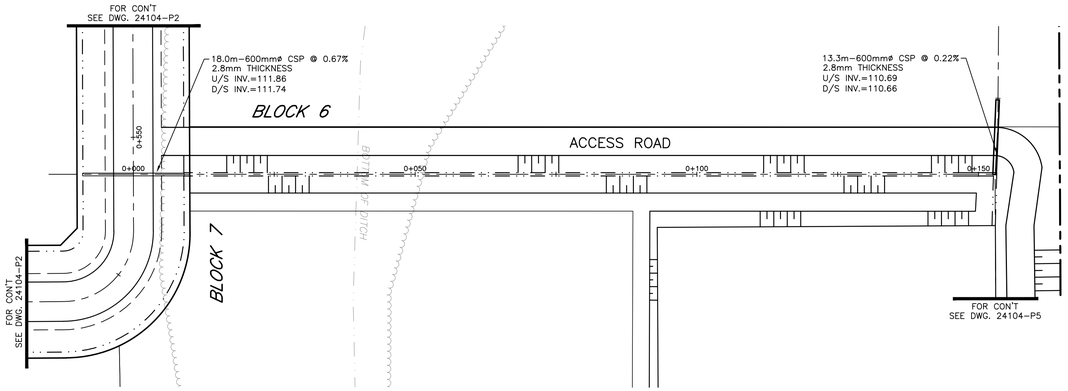
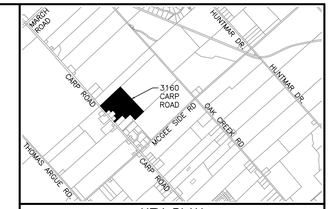
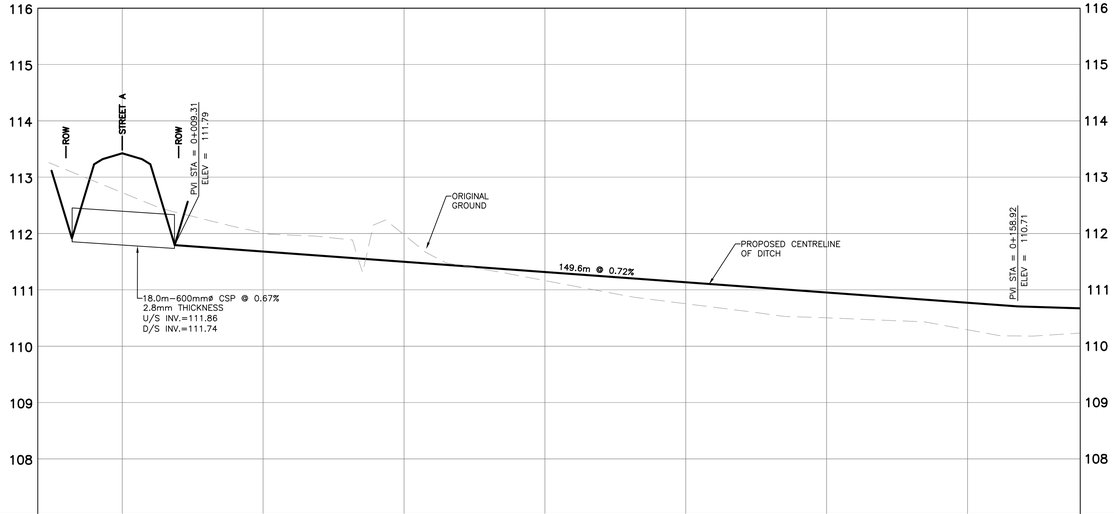
PROJECT No.	24104
SURVEY	LIDAR
DATED	MARCH 2025
DWG. No:	24104-P3





KEY PLAN



PROPOSED ℄ DITCH ELEVATION		111.68	111.50	111.32	111.13	110.95	110.77	PROPOSED ROAD ℄ ELEVATION
PROPOSED LEFT DITCH GRADE								PROPOSED LEFT DITCH GRADE
PROPOSED RIGHT DITCH GRADE								PROPOSED RIGHT DITCH GRADE
EXISTING ℄ R.O.W ELEVATION	*112.73*	*112.01*	*111.98*	*111.16*	*110.75*	*110.50*	*110.29*	EXISTING ℄ R.O.W ELEVATION
CHAINAGE	**0+000**	**0+025**	**0+050**	**0+075**	**0+100**	**0+125**	**0+150**	CHAINAGE

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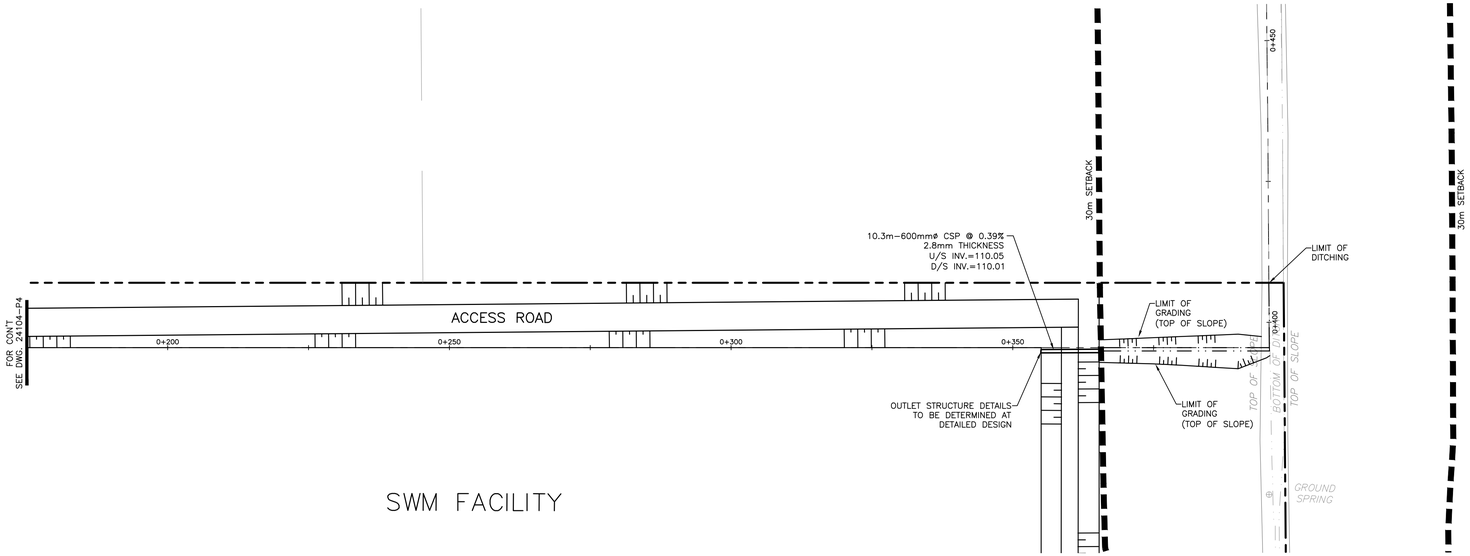
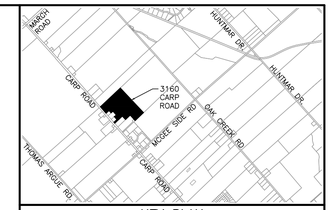
3160 CARP ROAD
CITY OF OTTAWA

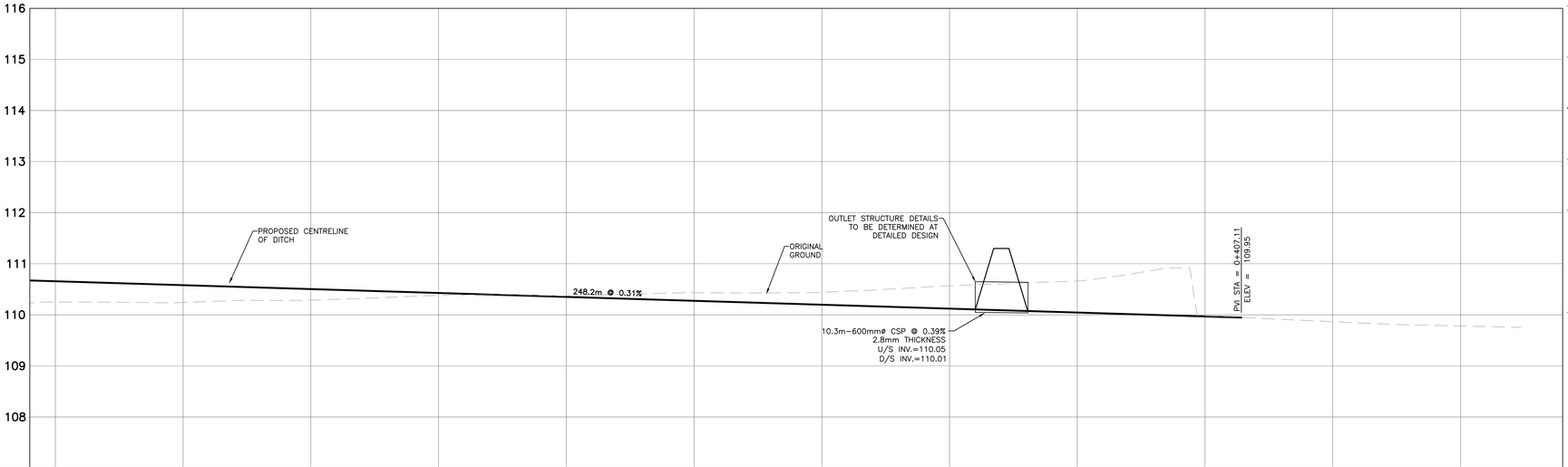
PLAN AND PROFILE
STA 0+000 TO STA 0+175

PROJECT No.	24104
SURVEY	LIDAR
DATED	MARCH 2025
DWG. No:	24104-P4





KEY PLAN



PROPOSED ROAD ℄ ELEVATION	110.66	110.58	110.50	110.43	110.35	110.27	110.20	110.12	110.05	109.97			PROPOSED ROAD ℄ ELEVATION
PROPOSED LEFT DITCH GRADE													PROPOSED LEFT DITCH GRADE
PROPOSED RIGHT DITCH GRADE													PROPOSED RIGHT DITCH GRADE
EXISTING ℄ R.O.W ELEVATION	*110.25*	*110.24*	*110.29*	*110.38*	*110.17*	*110.43*	*110.44*	*110.57*	*110.66*	*109.98*	*109.87*	*109.78*	EXISTING ℄ R.O.W ELEVATION
CHAINAGE	**0+175**	**0+200**	**0+225**	**0+250**	**0+275**	**0+300**	**0+325**	**0+350**	**0+375**	**0+400**	**0+425**	**0+450**	CHAINAGE

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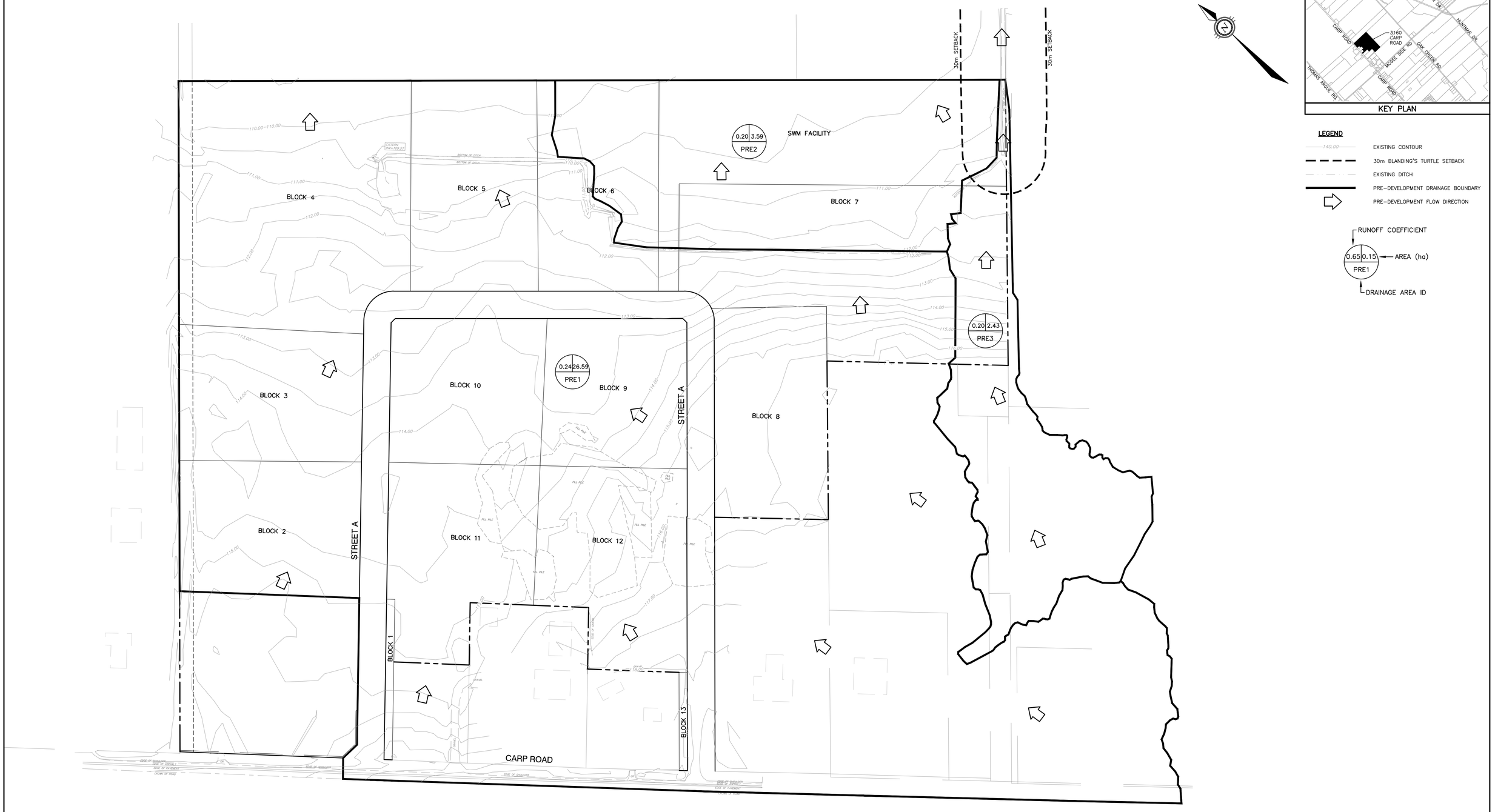
CITY OF OTTAWA

PLAN AND PROFILE
STA 0+175 TO STA 0+350

PROJECT No.	24104
SURVEY	LIDAR
DATED	MARCH 2025
DWG. No:	24104-P5



KEY PLAN

LEGEND

- EXISTING CONTOUR
- 30m BLANDING'S TURTLE SETBACK
- EXISTING DITCH
- PRE-DEVELOPMENT DRAINAGE BOUNDARY
- PRE-DEVELOPMENT FLOW DIRECTION

RUNOFF COEFFICIENT
0.65 0.15 — AREA (ha)
PRE1
DRAINAGE AREA ID

NOTES

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SCALE
0 10m 20m 50m
HORIZONTAL 1:1250

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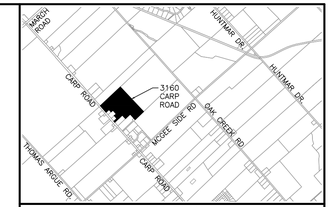
CITY OF OTTAWA

PRE-DEVELOPMENT
DRAINAGE AREA PLAN

PROJECT No.	24104
SURVEY	LIDAR
DATED	MARCH 2025
DWG. No:	24104-PRE1



LEGEND

- 140.00 — EXISTING CONTOUR
- 30m BLANDING'S TURTLE SETBACK
- EXISTING DITCH
- PROPOSED DITCH
- STORM DRAINAGE AREA BOUNDARY
- POST-DEVELOPMENT FLOW DIRECTION

RUNOFF COEFFICIENT
0.65 0.15 ← AREA (ha)
STM1
DRAINAGE AREA ID

NOTES

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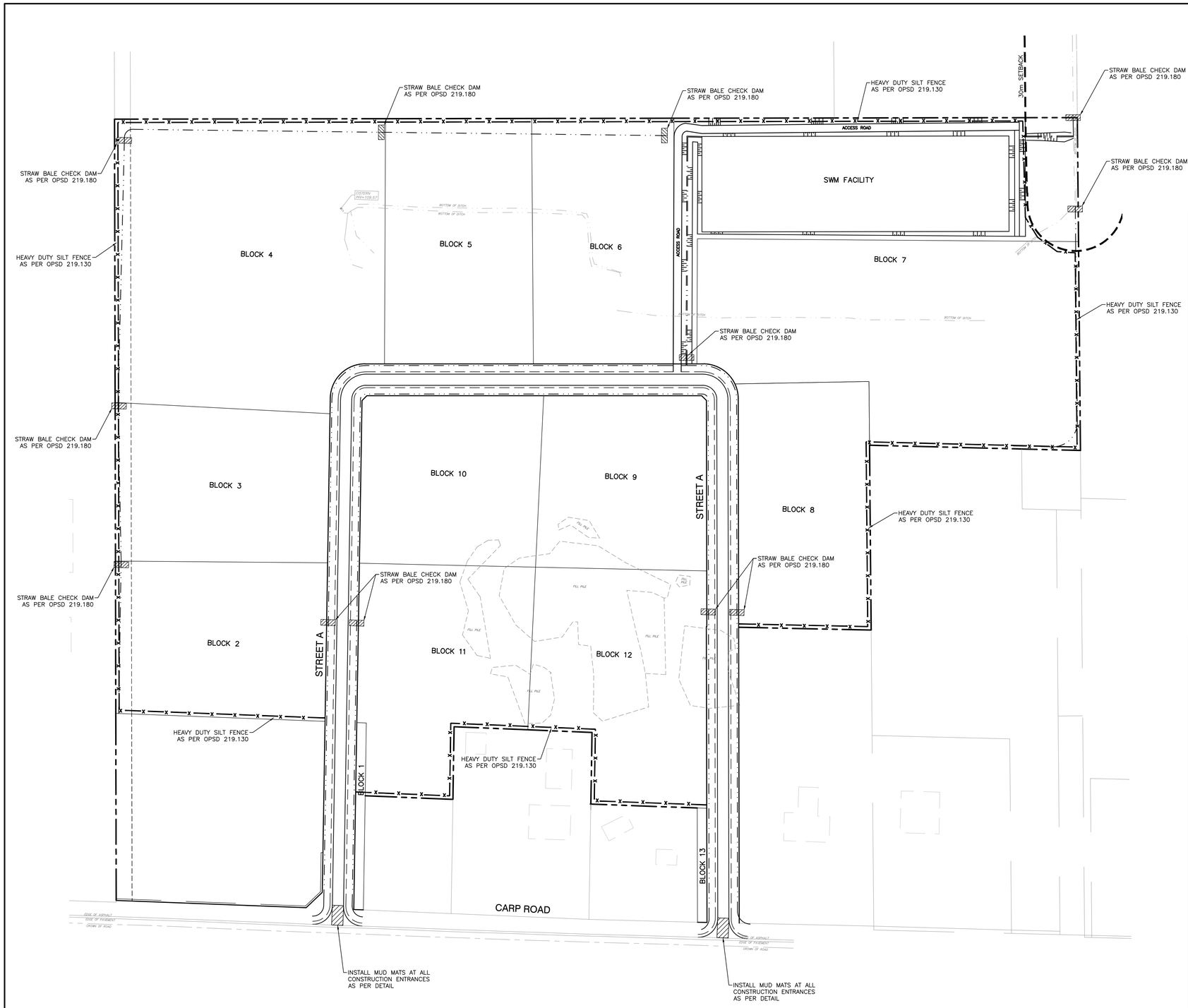
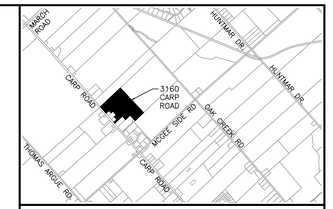
3160 CARP ROAD
CITY OF OTTAWA

POST-DEVELOPMENT DRAINAGE AREA PLAN

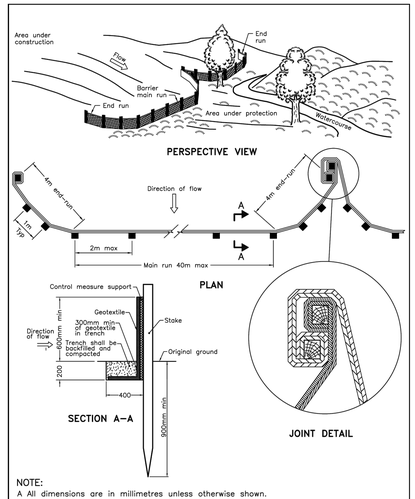
PROJECT No.	24104
SURVEY	LIDAR
DATED	MARCH 2025
DWG. No:	24104-STM1





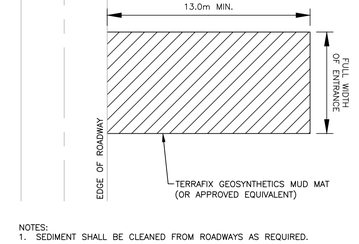
LEGEND

- PROPERTY BOUNDARY
- 30m BLANDING'S TURTLE SETBACK
- EXISTING DITCH
- PROPOSED DITCH
- HEAVY DUTY SILT FENCE
- STRAW BALE CHECK DAM



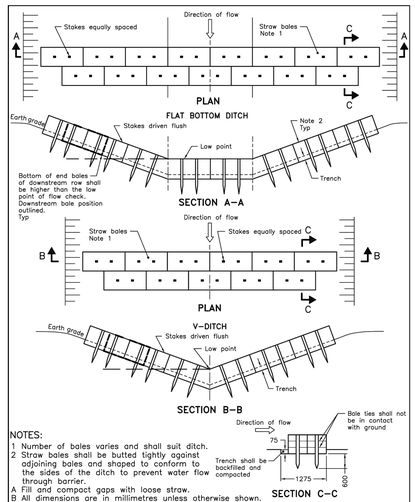
NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2021	Rev 3
HEAVY-DUTY SILT FENCE BARRIER		OPSD 219.130



NOTES:
1. SEDIMENT SHALL BE CLEANED FROM ROADWAYS AS REQUIRED.

MUD MAT DETAIL
N.T.S.



NOTES:
1 Number of bales varies and shall suit ditch.
2 Straw bales shall be butted tightly against adjoining bales and shaped to conform to the sides of the ditch to prevent water flow through barrier.
A Fill and compact gaps with loose straw.
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2021	Rev 3
STRAW BALE FLOW CHECK DAM		OPSD 219.180

NOTES:

1. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE ULTIMATE RECEIVING WATERCOURSE DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.
2. LIMIT THE EXTENT OF EXPOSED SOILS AT ANY GIVEN TIME.
3. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE MAINTAINED UNTIL VEGETATION HAS BEEN RE-ESTABLISHED IN ALL DISTURBED AREAS. RE-VEGETATE DISTURBED AREAS AS SOON AS POSSIBLE.
4. STOCKPILE SOIL AWAY (15 METRES OR GREATER) FROM WATERCOURSES, DRAINAGE FEATURES AND TOP OF STEEP SLOPES.
5. A HEAVY DUTY SILT FENCE BARRIER SHALL BE INSTALLED AS PER OPSD 219.130 WHERE INDICATED AND MAINTAINED AS REQUIRED.
6. STRAW BALE CHECK DAMS TO BE INSTALLED AS PER OPSD 219.180 WHERE INDICATED AND MAINTAINED AS REQUIRED.
7. DURING ACTIVE CONSTRUCTION PERIODS, VISUAL INSPECTIONS SHALL BE UNDERTAKEN ON A WEEKLY BASIS AND AFTER MAJOR STORM EVENTS (>25MM RAIN IN 24 HOUR PERIOD) ON SEDIMENT CONTROL BARRIERS AND ANY DAMAGE REPAIRED IMMEDIATELY.
8. EROSION AND SEDIMENT CONTROL BARRIERS SHALL ALSO BE ASSESSED (AND REPAIRED AS REQUIRED) FOLLOWING SIGNIFICANT SNOWMELT EVENTS.
9. VISUAL INSPECTIONS SHALL ALSO BE UNDERTAKEN IN ANTICIPATION OF LARGE STORM EVENTS (OR A SERIES OF RAINFALL AND/OR SNOWMELT DAYS) THAT COULD POTENTIALLY YIELD SIGNIFICANT RUNOFF VOLUMES.
10. CARE SHALL BE TAKEN TO PREVENT DAMAGE TO EROSION AND SEDIMENT CONTROLS DURING CONSTRUCTION OPERATIONS.
11. IN SOME CASES, BARRIERS MAY BE REMOVED TEMPORARILY TO ACCOMMODATE THE CONSTRUCTION OPERATIONS. THE AFFECTED BARRIERS SHALL BE REINSTATED IMMEDIATELY AFTER CONSTRUCTION OPERATIONS ARE COMPLETED.
12. SEDIMENT CONTROL DEVICES SHALL BE CLEANED OF ACCUMULATED SEDIMENTATION AS REQUIRED AND REPLACED AS NECESSARY.
13. DURING THE COURSE OF CONSTRUCTION, IF THE ENGINEER BELIEVES THAT ADDITIONAL PREVENTION METHODS ARE REQUIRED TO CONTROL EROSION AND SEDIMENTATION, THE CONTRACTOR SHALL IMPLEMENT ADDITIONAL MEASURES, AS REQUIRED, TO THE SATISFACTION OF THE ENGINEER.
14. CONSTRUCTION AND MAINTENANCE REQUIREMENTS FOR EROSION AND SEDIMENT CONTROLS ARE TO COMPLY WITH OPSS 805.
15. CONTRACTOR SHALL FOLLOW RECOMMENDATIONS FROM EIS REPORT DATED JUNE 21, 2024.
16. CONSTRUCTION EQUIPMENT SHALL BE PROPERLY MAINTAINED. MAINTENANCE ON CONSTRUCTION EQUIPMENT WITH RESPECT TO REFUELING, WASHING AND FLUID CHANGES SHOULD NOT TAKE PLACE WITHIN 30 METRES OF ANY SURFACE WATER FEATURES.
17. EMERGENCY SPILL KITS SHALL BE LOCATED ON-SITE AND CONSTRUCTION CREWS SHALL BE FULLY TRAINED ON THE USE OF CLEAN-UP MATERIALS IN ORDER TO MINIMIZE IMPACTS OF ANY ACCIDENTAL SPILLS. THE AREA SHALL BE MONITORED FOR LEAKAGE AND IN THE EVENT OF A MINOR SPILL, ACTIVITY SHOULD BE HALTED AND CORRECTIVE MEASURES SHALL BE IMPLEMENTED. ANY SPILLS SHALL BE IMMEDIATELY REPORTED TO THE MECP SPILLS ACTION CENTRE.

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0 10m 20m 50m
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APPROVED	BLM

T & L CARROLL HOLDINGS INC.

CARROLL INDUSTRIAL SUBDIVISION
3160 CARP ROAD
CITY OF OTTAWA

EROSION AND SEDIMENT CONTROL PLAN

PROJECT No.	24104
SURVEY	LIDAR
DATED	MARCH 2025
DWG. No:	24104-ESC

Appendix C

Hydrogeological Investigation Excerpts

- Bedrock Depths and Elevations
- Groundwater Levels
- Soil Infiltration Testing
- Groundwater Impacts
- Recommendations
- Figure 1: Borehole Location Plan
- Figure 6: Inferred Surficial Geology
- Borehole Logs
- Guelph Permeameter Infiltration Testing
- Maximum Allowable Septic Flows

Figure A4: Natural Heritage Features

GEMTEC
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Hydrogeological Investigation & Terrain Analysis
Proposed Industrial Subdivision
3160 Carp Road
Ottawa, Ontario

The results of a grain size distribution testing carried out on one sample of the glacial till are provided in Appendix E and summarized in Table 4.3. The water contents of 29 samples of the glacial till range between about 4 and 35 percent.

Table 4.3 – Summary of Grain Size Distribution Testing (Glacial Till)

Borehole ID	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
23-06	10B	7.0 to 7.5	21	46	22	10
23-08	5	3.1 to 3.2	2	27	35	35

4.2.7 Auger Refusal and Bedrock

Boreholes 23-06, 23-07, 23-08, 23-10, 23-14, and 23-15, from the GEMTEC 2023 investigations encountered practical auger refusal at depths ranging from about 2.6 to 8.5 metres below the existing ground surface. Boreholes 19-1D, 19-3D, and 19-4S from GEMTEC 2021 investigations encountered practical auger refusal at depths ranging from about 5.6 to 9.1 metres below the existing ground surface. Auger refusal may occur on cobbles and boulders within the glacial till or on the bedrock surface.

Practical refusal to excavating was encountered in test pits 18-2, 18-3, 18-6, 18-9, 18-10, 18-11, 18-12, 18-13, and 18-14 at depths ranging from about 1.8 to 3.1 metres below the existing ground surface.

Bedrock was encountered in the test wells at depths ranging from about 7.0 to 8.2 metres below the existing ground surface. The depth to bedrock at the test well locations was inferred from the drilling resistance and the drill cuttings.

A summary of the refusal depths and elevations from the GEMTEC 2019 and 2023 investigations are summarized in Table 4.4.

Table 4.4 – Summary of Auger Refusal and Bedrock Depths and Elevations

Test hole ID	Ground Surface Elevation (metres)	Depth to Refusal (metres)	Refusal/Bedrock Elevation (metres)
BH 23-06	110.3	8.5[1]	101.8[1]
BH 23-07	112.8	3.3	109.6
BH 23-08	110.3	4.4	105.8
BH 23-10	114.1	4.2	109.9
BH 23-13	111.7	4.0[2]	107.6[2]

Test hole ID	Ground Surface Elevation (metres)	Depth to Refusal (metres)	Refusal/Bedrock Elevation (metres)
BH 23-14	116.3	2.6	113.8
BH 23-15	111.5	5.0	106.4
BH 19-1D	115.8	9.2	106.6
BH 19-3D	115.2	6.5	108.7
BH 19-4S	117.1	5.6	111.5
TW-1	115.8	7.9[3]	107.9[3]
TW-2	112.8	7.6[3]	105.2[3]
TW-3	115.3	7.0[3]	108.3[3]
TW-4	117.3	8.2[3]	109.1[3]
TP 18-2	114.7	2.9	111.8
TP 18-3	113.1	2.4	110.7
TP 18-6	114.5	2.9[4]	111.6[4]
TP 18-9	116.2	3.1[4]	113.2[4]
TP 18-10	114.1	3.1[4]	111.0[4]
TP 18-11	111.6	2.3[4]	109.4[4]
TP 18-12	116.3	2.9[4]	113.4[4]
TP 18-13	111.8	3.1[4]	108.8[4]
TP 18-14	115.5	1.8	113.6

Notes:

1. Practical auger refusal was encountered in borehole 23-06 at a depth of about 8.5 metres below the ground surface, however, an SPT advanced past auger refusal to a depth of about 9.0 metres below the existing ground surface.
2. Borehole 23-13 encountered SPT refusal (not auger refusal). SPT refusal likely represents cobbles and boulders, rather than the bedrock surface.
3. The depth to bedrock in the test wells is inferred from the drilling resistance and the drill cuttings.
4. Refusal to excavator advancement was encountered in test pits 18-6 and 18-9 to 18-13 on possible cobbles and boulders within the glacial till.

4.3 Groundwater Levels

Monitoring wells were installed in borehole 23-07 from the GEMTEC 2023 investigations and boreholes 19-1D, 19-1S, 19-3D, 19-3S, and 19-4S from the GEMTEC 2019 investigations to measure the groundwater levels. Four test wells were advanced at the site for pumping testing and groundwater level measurements during the previous investigation.

The measured groundwater levels in the monitoring wells and test wells installed in the boreholes are presented in Appendix D and the highest recorded groundwater levels in each monitoring well are summarized in Table 4.5. The groundwater levels may be higher during wet periods of the year such as the early spring or following periods of precipitation.

Table 4.5 – Summary of Groundwater Levels

Borehole ID	Ground Surface Elevation (metres)	Groundwater Depth (metres below ground surface)	Groundwater Level Elevation (metres)	Date
BH 23-07	112.8	2.8	110.0	Apr 23, 2023
TW 19-1	115.8	4.2	111.6	Aug 8, 2019
TW 19-2	112.8	1.5	111.3	Aug 8, 2019
TW 19-3	115.3	3.0	112.3	Apr 23, 2023
TW 19-4	117.3	3.9	113.4	Apr 23, 2023
BH 19-1D	115.8	4.6	111.2	Aug 8, 2019
BH 19-1S	115.8	Dry (3.05)	Dry (112.8)	Aug 6, 2019
BH 19-3D	115.2	2.9	112.3	Apr 23, 2023
BH 19-3S	115.3	3.0	112.3	Apr 23, 2023
BH 19-4S	117.1	4.6	112.5	Apr 23, 2023

4.4 Soil Infiltration Testing

As part of GEMTEC (2023a) field infiltration tests were carried out at seven (7) locations across the site in order to estimate infiltration rates. Shallow hand-auger holes were advanced 0.4 to 1.2 metres below ground surface in the immediate vicinity of test pits 18-1, 18-3, 18-5, 18-9, 18-10 and 18-14. The soils conditions above the depth of infiltration testing consists of grey to brown sands with varying amounts of silt/clay and gravel. The hand auger and infiltration testing depths are summarized in Appendix F.

A Guelph Permeameter was used to estimate the saturated hydraulic conductivity in the vadose zone (ASTM D5126 – 90: Standard Guide for Comparison of Field Methods for Determining Hydraulic Conductivity in the Vadose Zone). The field saturated hydraulic conductivity (K_{fs}) was calculated using the single head method, following Soil Moisture's K_{fs} calculation (refer to Appendix F). The single head method was conducted using hydraulic head heights of 5 to 15 cm.

The field measurements of saturated hydraulic conductivity were converted to infiltration rates based on the relationship between field saturated hydraulic conductivity and infiltration rates

presented in “Ontario Ministry of Municipal Affairs and Housing (OMMAH), 1997, Supplementary Guidelines to Ontario Building Code 1997, SG-6 Percolation Times and Soil Descriptions, Toronto, Ontario”.

The calculated saturated field hydraulic conductvities range from 1.1 x 10^{-2} to 1.1 x 10^{-5} cm/s. The corresponding estimated infiltration rates, based on K_{fs}, ranged from 26 to 163 mm/hour.

Soil samples were collected from the bottom 15 cm of each hand auger hole and submitted for grain size analyses (Appendix E). Soil classifications are variable ranging from sand with a trace of silt and clay to sandy clayey silt.

Calculated saturated field hydraulic conductivities were also estimated based on grain size analysis and soil texture classification of samples from the hand auger holes, which ranged from 5.3 x 10^{-6} to 3.6 x 10^{-2} cm/s. The infiltration rates based on the soil texture classification for the hand auger samples are presented in Appendix F.

5.0 IMPACT ASSESSMENT

The potential impact on groundwater and surface water resources due to wastewater treatment and disposal by individual onsite sewage disposal systems on the subject site are assessed in the following sections.

5.1 Sewage Disposal Systems

It is understood that the use of advanced technologies for the treatment of septic effluent (advanced treatment) is being proposed for the development. Advanced treatment is permitted under the Ontario Building Code (OBC) and these technologies are capable of treating effluent to a notable degree prior to the effluent being disposed to a Class IV leaching bed (Type A or Type B), including a reduction in the nitrate concentration. This section discusses the results of the terrain evaluation as they relate to the feasibility of installing advanced type sewage disposal systems on the subject site for onsite wastewater treatment and disposal.

CoO (2016) provides additional guidance for the application of the MECP D-5-4 guidelines within the Carp Road Corridor. The memo allows proponents to undertake a modified nitrate attenuation predictive assessment using nitrogen reduction treatment systems. Available systems are able to achieve a minimum of 50% reduction in nitrogen and as a result, the modified minimum concentration of nitrate used in the nitrate attenuation assessment can be reduced to 20 mg/L.

It should be noted that the following information is provided for general guidance purposes only. All septic systems installed at the Site should be designed on a lot-by-lot basis. Test holes should be advanced during the lot development to identify the subsurface conditions at the location of the proposed septic system. In all cases, the septic system design must conform to the OBC requirements.

- Additional water quantity testing is recommended should future lot owners require groundwater in excess of the maximum allowable septic flows (e.g., processing waters).
  - The current zoning of the Site is Rural Commercial, Subzone 9 (RC9). The permitted uses of the Site should be consulted at Site Plan to confirm that the tested water quantity of approximately 10,000 litres per day is sufficient for the proposed Site usage.
  - Potential Site usages that may require additional water quantity testing include: car wash, hotel, campground, etc.

- Interference between drinking water wells is expected to be acceptable under typical usage for commercial/industrial developments.
  - No significant drawdown was observed in the bedrock monitoring wells during the individual pumping tests, or the muti well pumping test (pumping TW1 and TW4 simlutaneously), with a maximum observed drawdown of 0.84 metres in the bedrock monitoring wells.
  - Long term water level monitoring in the bedrock test wells reported drawdown of less than 0.2 metres over a two-week period. Negligible drawdown related to off-site pumping or precipitation events was observed.
  - Background studies along Carp Road that were reviewed as part of the investigation (CoO, 2004 & Dillon, 2004) do not indicate water quantity concerns in the area.

- Based on the water balance calculations, the percentage decrease in infiltration will decrease by approximately 67% % from pre- to post-development conditions on the proposed severance lot, depending on the hard surface coverage after development.
  - Consideration should be given to maintaining the pre-development infiltration volumes for each lot post-development to sustain groundwater levels and protect groundwater users. This can be supported through the placement through the use of Low Impact Development (LID) measures.

10.0 RECOMMENDATIONS

The following provides general recommendations and recommendations regarding well construction specifications, water quality and septic system design:

10.1 General Recommendations

The accepted GEMTEC hydrogeological report entitled “Hydrogeological Assessment and Terrain Analysis, Proposed Commercial/Industrial Subdivision, 3160 Carp Road, Township of Huntley, Ottawa, Ontario”, dated August 9, 2024 shall be made available to lot purchasers as a guide to development.

10.2 Groundwater Impact Mitigation Recommendations

- Low Impact Development (LID) and stormwater management measures are recommended to maintain pre-development infiltration rates of 155 mm/year. The post-development infiltration rates are calculated to be 128 mm/year.

- The post-development water balance indicates significant increase in runoff, which will need to be addressed as part of the stormwater for the Site. Potential impacts from the runoff from a contaminant perspective include winter maintenance (road salting) and fuel spills from potential fuel storage / parking lots. It is recommended that BMP for road salting and fuel storage/spills be followed.

    - It is recommended that the best management practices for the application of road salts should follow the City of Ottawa's "Material Application Policy, Revision 3.2, October 31, 2011" Salt Management Plan.

    - It is recommended that the best management practices for fuel storage follow the Liquid Fuels Handling Code and the Ontario Water Resources Act.

10.3 Well Construction Recommendations

- Any original test wells which are not located in suitable locations for future development use and any other existing wells located on the property should be abandoned by a licensed well driller in accordance with MECP regulations following draft plan approval of the subdivision;
- Wells should be located so that they meet the minimum setback distances from septic systems, property lines and any other sources of contamination, as required in the Ontario Building Code and/or Ontario Reg. 903. If possible, the setback distance for the location of drinking water wells should be maximized.
- All wells shall remain accessible for future inspection and testing and to large equipment for future maintenance, repair, and replacement;
- All wells that are drilled in the subdivision should be constructed in accordance with MECP regulations (Ontario Reg. 903);
- All wells that are drilled in the subdivision should be maintained in accordance with the document entitled 'Water Supply Wells – Requirements and Best Management Practices' (MECP December 2009);
- Well casings should be extended at least 11.6 metres below ground surface. The entire annular space between the steel casing and the overburden/bedrock should be filled with a suitable cement or bentonite grout.

- In addition to the minimum recommended well casing lengths specified in the preceding recommendation, all well casings should be completed a minimum of 4.57 metres into sound, competent bedrock;

- A well grouting certification inspection should be conducted during the installation and grouting of the well casing for all future wells installed on the subject site. The well grouting certification inspection should be conducted under the supervision of a professional engineer or professional geoscientist;
- Hydrofracturing of all four on-site test wells was required to obtain the minimum pumping requirements of MECP Procedure D-5-5. Future lot owners should be aware that additional well development such as hydrofracturing, surging and/or additional pumping may be required to reach the well yields demonstrated in this report;
    - Muti-day well development may be required to reduce turbidity levels in newly drilled wells on the Site. If a newly drilled well is required at the time of Site Plan Control for the Site, a qualified professional should be retained to confirm that turbidity levels are at acceptable levels after well development.
- The test wells completed for this study were completed at depths of 61 metres below ground surface. Future drinking water wells completed on the Site at depths greater than 61 metres may encounter different hydrogeological conditions and the quality and quantity of water available from drilled wells may differ than that presented in this study.

10.4 Septic System Recommendations

- The proposed lots will be serviced by advanced treatment septic sewage disposal systems that achieve a minimum of 50% reduction in nitrogen, approved under the Ontario Building Code, prior to the effluent being disposed to a Class IV leaching bed (Type A or Type B). A site-specific investigation should be conducted on each lot for the design of the septic system;
    - It is required that the property owners enter a maintenance agreement with authorized agents of the advanced treatment septic system manufacturer for the service life of the system.
    - It is recommended that the advanced treatment septic systems be Bureau de normalisation du Québec (BNQ) certified at 50% nitrate reduction.
- In view of the percolation time of the native soils, a sand mantle and partially to fully raised leaching beds should be allowed for on some the proposed lots. The suitability of the native soils should be assessed on a lot by lot basis by a qualified septic designer;
- It should be noted that when determining hard surface coverage for the future lots, that gravel surfaces are included. Gravel surface are considered impermeable, as they are likely to be compacted over time; and,

- The maximum allowable daily design sanitary sewage flow (DDSF) for the proposed commercial lots ranges from 585 L/day to 2,211 L/day for conventional systems, and 1,754 L/day to 6,663 L/day for advanced systems
  - If during the site plan approval process, the proposed septic system design flow exceeds the preliminary septic flow recommendation for a specific lot, then it is recommended that a detailed groundwater impact assessment be conducted. If the detailed groundwater impact assessment demonstrates that additional septic flow can be accommodated on the lot, then the preliminary septic flow recommendation for that lot should be amended accordingly.
  - If the proposed septic flow for a site development application is less than the preliminary septic flow recommendation, then no additional groundwater impact assessment work is required for that lot.

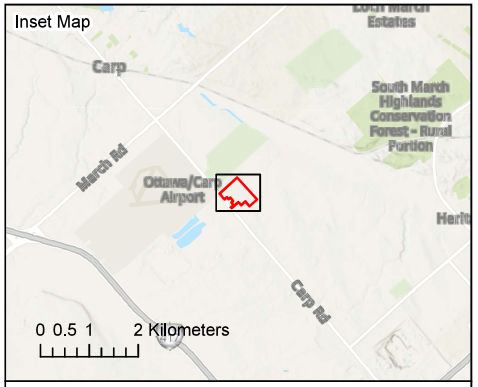
10.5 Drinking Water Supply Recommendations

- It is recommended that the following information be registered on title for the created lots:
  - Background sodium levels in the drinking water wells at the site may exceed the warning level for persons on sodium restricted diets and should be reported to the Local Medical Officer of Health;
  - The following water quality parameters may not meet the ODWS operational guidelines in drinking water wells completed at the subject site:
    - Hardness – Hardness levels in the onsite test wells were greater than the operational guideline for hardness and can be expected in future wells drilled at the property.
  - The following water quality parameters may not meet the ODWQS aesthetic objectives in drinking water wells completed at the subject site:
    - Sulphide – Sulphide levels in all four of the on-site test wells exceeded the ODWQS aesthetic objective for sulphide and may be encountered in future wells drilled on the subject site. Although ingestion of large quantities of sulphide can produce toxic effects on humans, it is unlikely that an individual would consume a harmful dose in drinking water because of the associated unpleasant taste and odour. Sulfide, in association with iron, produces black stains on laundered items and black deposits on pipes and fixtures. Hydrogen sulphide can be effectively treated through the use of activated charcoal filters, chlorination, manganese greensand filters and other forms of oxidizing treatment.
- The maximum groundwater quantity per lot tested as part of this investigation is 10,080 litres per day. Additional pumping tests and well interference assessments are recommended for higher groundwater demands.

Legend

BH/MW # ← BOREHOLE / MONITORING WELL ID
XX.XX ← GROUND SURFACE ELEVATION, IN METERS
GEODETIC DATUM

- Borehole Location (current investigation)
- Test Pit Location (previous investigation by GEMTEC)
- Borehole/ Test Well Location (previous investigation by GEMTEC)
- Approximate Property Boundary
- Proposed Lot



Scale
1:3,000
40 20 0 40 80 120 160 m

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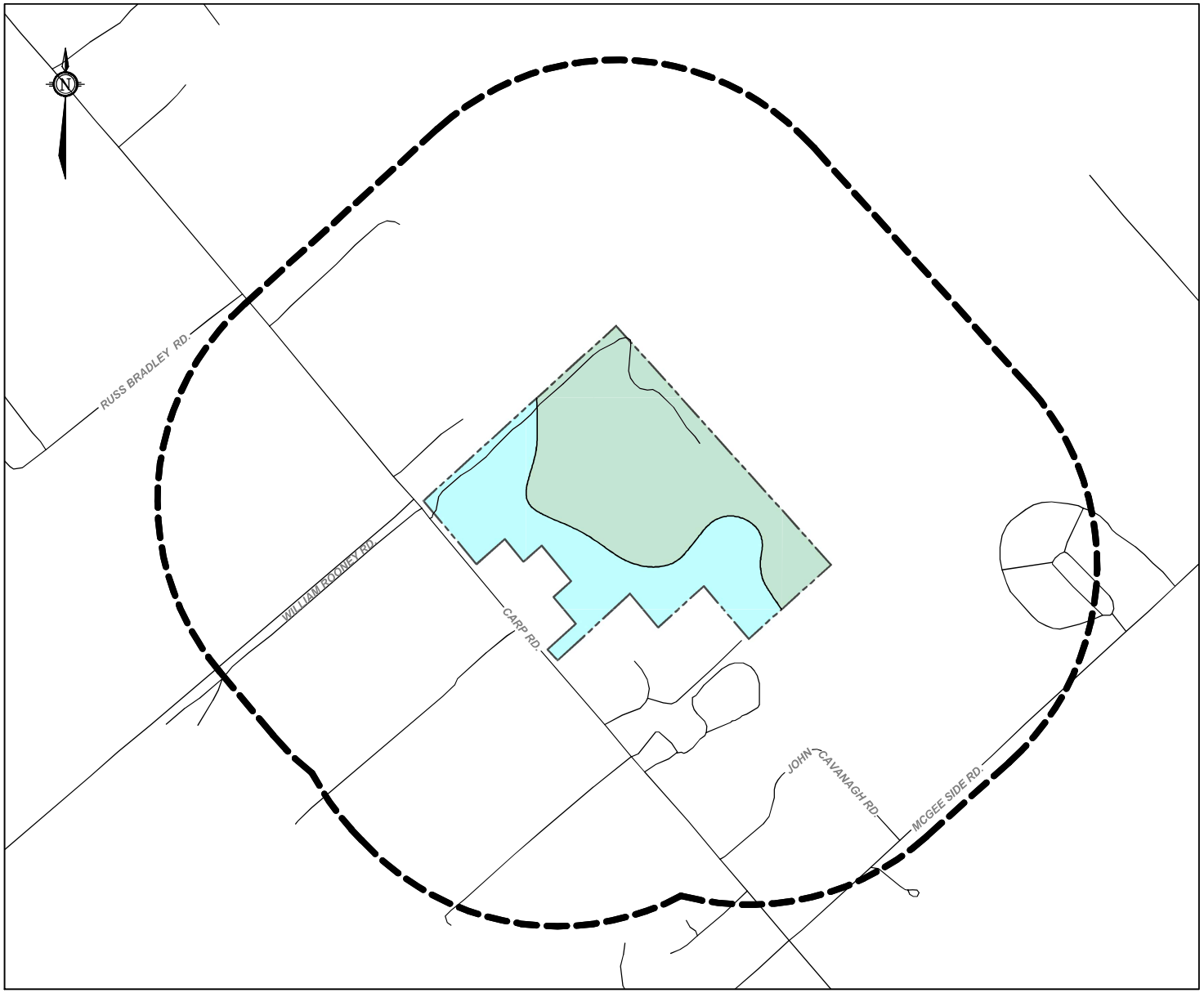
Client:	Project No.:
TLC Holdings LTD.	102151.001

Project
Hydrogeological Investigation & Terrain Analysis
3160 Carp Rd, Ottawa, ON

Drwn By:	Chkd By:	
C.Z./S.L.	B.R.	Detailed Site Plan
Date: August 2024	Rev. 0	Figure: 1

Coordinate System: NAD 1983 UTM Zone 18N
Service Layer Credits: World Topographic Map: City of Ottawa, Province of Ontario, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, NRCan, Parks Canada
Bing Maps Aerial: © 2024 Microsoft Corporation © 2018 DigitalGlobe ©CNES (2018) Distribution Airbus DS



Legend

- Subject Site
- Study Area
  500m around Subject Site
- Silty Sand, Sand and Silt, Till
- Silty Clay, Clayey Silt

Scale 1:7500

0 150 300 450m

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Client: TLC Holdings LTD.

Project No.: 102151.001

Project: Hydrogeological Investigation & Terrain Analysis
3160 Carp Rd, Ottawa, ON

Drwn By: C.Z./S.L.

Chkd By: B.R.

Inferred Surficial Geology

Date: August 2024

Rev. 0

Figure: 6

Coordinate System: NAD 1983 UTM Zone 18N
Service Layer Credits: Hybrid Reference Layer: Esri Community Maps Contributors, City of Ottawa, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

APPENDIX D

Record of Test Pit Sheets, Borehole Logs

RECORD OF BOREHOLE 19-1D

CLIENT: Novatech
PROJECT: Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 9 2019

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface									
		Dark brown silty sand, with organic material (TOPSOIL)		0.20	1	SS	533	5			Above ground protector
		Brown SILTY SAND		0.31							
		Grey brown SILTY CLAY, some sand									
		Brown SILTY SAND, trace clay		0.61	2	SS	610	11			
1		Grey brown SILTY CLAY		0.91							
		Brown SILTY SAND, trace clay		1.04							
		Grey brown SILTY CLAY with silty sand seems		1.22	3	SS	610	10			
		Grey brown silty sand, some gravel, trace to some clay (GLACIAL TILL)		1.65							
2		Grey sandy silt / silty sand, some gravel, cobbles, and boulders (GLACIAL TILL)		1.83	4	SS	610	26			Bentonite
					5	SS	610	33			
3					6	SS	406	89			
					7	SS	200	65			
4					8	SS	100	68			Filter Sand
5					9	SS	279	59			50 mm diameter, 1.52 m length slotted PVC Pipe
					10	SS	483	43			
6					11	SS	381	50			
					12	SS	76	50			
7					13	SS	51	50			
8					14	SS	127	50			Slough
					15	SS	203	90			
9		Auger refusal on inferred bedrock End of borehole		9.17							
10											

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LOGGED: A.N.
CHECKED:

GEO - BOREHOLE LOG 64819.03_BOREHOLE LOGS_GNT_V01_2019-07-10.GPJ GEMTEC 2018.GDT 21/8/19

RECORD OF BOREHOLE 19-1S

CLIENT: Novatech
PROJECT: Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 9 2019

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface							10 20 30 40 50 60 70 80 90		Above ground protector
		Soil conditions not logged									Bentonite
1											
2											Filter Sand
3				3.05							50 mm diameter, 1.52 m length slotted PVC Pipe
4											
5											
6											
7											
8											
9											
10											

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LOGGED: A.N.
CHECKED:

GEO - BOREHOLE LOG 64819.03_BOREHOLE LOGS_GNT_V01_2019-07-10.GPJ GEMTEC 2018.GDT 21/8/19

RECORD OF BOREHOLE 19-3D

CLIENT: Novatech
PROJECT: Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Borehole Location Plan, Figure 1

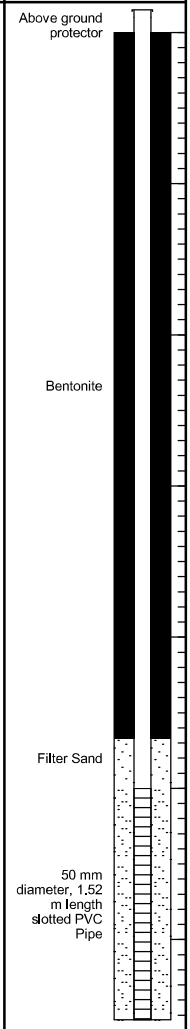
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 10 2019

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface						
		Dark brown silty sand, with organic material (TOPSOIL)		0.13	1	SS	330	16
		Grey brown sandy silt / silty sand, some gravel cobbles boulders (GLACIAL TILL)			2	SS	178	103
1					3	SS	229	85
2					4	SS	150	110
3					5	SS	610	58
					6	SS	381	84
4					7	SS	178	66
5					8	SS	310	92
6					9	SS	53	50
		Auger refusal on inferred bedrock End of borehole		6.53				
7								
8								
9								
10								

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA
NATURAL ⊕ REMOULDED
WATER CONTENT, %
W_P W W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



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LOGGED: A.N.
CHECKED:

GEO - BOREHOLE LOG 64819.03_BOREHOLE LOGS_GNT_V01_2019-07-10.GPJ GEMTEC 2018.GDT 21/8/19

RECORD OF BOREHOLE 19-3S

CLIENT: Novatech
PROJECT: Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 10 2019

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, mm	SAMPLES: BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED); WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface							10 20 30 40 50 60 70 80 90		Above ground protector
		Soil conditions not logged									Bentonite
3											Filter Sand
4											50 mm diameter, 1.52 m length slotted PVC Pipe
				4.57							
5											
6											
7											
8											
9											
10											

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LOGGED: A.N.
CHECKED:

GEO - BOREHOLE LOG 64819.03_BOREHOLE LOGS_GNT_V01_2019-07-10.GPJ GEMTEC 2018.GDT 21/8/19

RECORD OF BOREHOLE 19-4S

CLIENT: Novatech
PROJECT: Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Borehole Location Plan, Figure 1

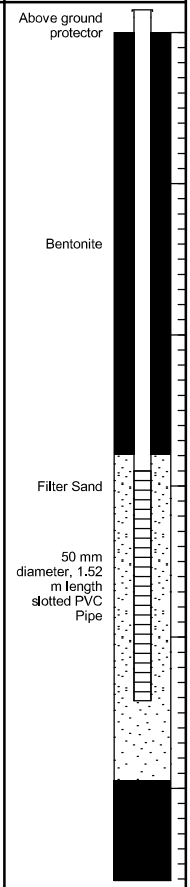
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 10 2019

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface						
		Dark brown silty sand, with organic material (TOPSOIL)		0.20	1	SS	406	9
		Reddish brown SILTY SAND, trace gravel		0.41				
1		Grey brown silty sand, some gravel, cobbles and boulders (GLACIAL TILL)			2	SS	254	8
					3	SS	330	43
2					4	SS	559	77
					5	SS	610	76
3				3.10	6	SS	381	92
		Grey brown silty sand / sandy silt, some gravel cobbles and boulders (GLACIAL TILL)						
4					7	SS	406	83
5					8	SS	356	36
		Auger refusal on boulders End of borehole		5.61				
6								
7								
8								
9								
10								

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P W W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



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LOGGED: A.N.
CHECKED:

GEO - BOREHOLE LOG 64819.03_BOREHOLE LOGS_GNT_V01_2019-07-10.GPJ GEMTEC 2018.GDT 21/8/19

RECORD OF BOREHOLE 18-1

CLIENT: Novatech
PROJECT: Industrial Subdivision Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, mm	SAMPLES BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Excavator CASE CX135 sr	Ground Surface									
		Dark brown silty sand, with organic material (TOPSOIL)			1	GS					Test pit backfilled with excavated material
		Brown, fine to medium grained SAND, trace to some silt		0.23	2	GS					
1		Grey brown, fine to coarse grained SAND, trace silt, trace to some gravel, cobbles and boulders, some sandy silt pockets with depth (GLACIAL TILL)		0.91	3	GS					
2											
3					4	GS					
		End of Test Pit		3.05							No groundwater observed upon completion of test pit
4											
5											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

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LOGGED: A.N.
CHECKED: A.P.

GEO - BOREHOLE LOG 64819.03_TEST PIT LOGS_GNT_V01_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

RECORD OF BOREHOLE 18-2

CLIENT: Novatech
PROJECT: Industrial Subdivision Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface									
		Dark brown silty sand, with organic material (TOPSOIL)									Test pit backfilled with excavated material
		Brown SILTY SAND, some roots		0.18	1	GS					
1		Grey brown SILTY SAND		0.61	2	GS					
	Excavator CASE CX135 sr	Grey SANDY SILT / SILTY SAND, some gravel cobbles and boulders (GLACIAL TILL)		1.14	3	GS					
2											
					4	GS					
3		Practical shovel refusal on possible bedrock End of Test Pit		2.90							No groundwater observed upon completion of test pit
4											
5											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P W W_L
10 20 30 40 50 60 70 80 90

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LOGGED: A.N.
CHECKED: A.P.

GEO - BOREHOLE LOG 64819.03_TEST PIT LOGS_GNT_V01_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

RECORD OF BOREHOLE 18-3

CLIENT: Novatech
PROJECT: Industrial Subdivision Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface										
		Dark brown silty sand, with organic material (TOPSOIL)										
		Grey brown SILTY SAND		0.15	1	GS						
		Grey brown SILTY CLAY (WEATHERED CRUST)		0.41	2	GS						
1	Excavator CASE CX135 sr	Grey brown, silty sand, some gravel, cobbles and boulders (GLACIAL TILL)		0.94	3	GS						
2		Practical shovel refusal at 1.52 m on possible bedrock at two locations within test pit End of Test Pit		2.44								Test pit backfilled with excavated material No groundwater observed upon completion of test pit
3												
4												
5												

10 20 30 40 50 60 70 80 90

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Consulting Engineers and Scientists

LOGGED: A.N.
CHECKED: A.P.

GEO - BOREHOLE LOG 64819.03_TEST PIT LOGS_GNT_V01_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

RECORD OF BOREHOLE 18-4

CLIENT: Novatech
PROJECT: Industrial Subdivision Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface							10 20 30 40 50 60 70 80 90		
		Dark brown silty sand, with organic material (TOPSOIL)									Test pit backfilled with excavated material
		Grey brown SILTY CLAY (WEATHERED CRUST)		0.18	1	GS					
1		Grey brown silty sand, trace clay, some gravel, cobbles and boulders (GLACIAL TILL)		0.53	2	GS					
	Excavator CASE CX135 sr	Grey brown silty sand, trace clay, some gravel, cobbles and boulders, with pockets of grey SILTY CLAY on one side of test pit (GLACIAL TILL)		1.17	3	GS					
2					4	GS					
3		End of Test Pit		3.05							Groundwater seepage at 0.91 m below ground surface
4											
5											

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Consulting Engineers and Scientists

LOGGED: A.N.
CHECKED: A.P.

GEO - BOREHOLE LOG 64819.03_TEST PIT LOGS_GNT_V01_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

RECORD OF BOREHOLE 18-5

CLIENT: Novatech
PROJECT: Industrial Subdivision Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED); WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Excavator CASE CX135 sr	Ground Surface							10 20 30 40 50 60 70 80 90		
		Dark brown silty sand, with organic material (TOPSOIL)									Test pit backfilled with excavated material
		Brown SILTY SAND		0.23							
1		Grey silty sand, some gravel, cobbles, and boulders (GLACIAL TILL)		0.97							
2											
3		End of Test Pit		3.05							No groundwater observed upon completion of test pit
4											
5											

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CHECKED: A.P.

GEO - BOREHOLE LOG 64819.03_TEST PIT LOGS_GNT_V01_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

RECORD OF BOREHOLE 18-6

CLIENT: Novatech
PROJECT: Industrial Subdivision Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Excavator CASE CX135 sr	Ground Surface							10 20 30 40 50 60 70 80 90		
		Dark brown silty sand, with organic material (TOPSOIL)									Test pit backfilled with excavated material
		Brown SILTY SAND		0.36	1	GS					
1		Grey brown SILTY CLAY (WEATHERED CRUST)		0.61	2	GS					
		Grey silty sand, some gravel, cobbles and boulders (GLACIAL TILL)		1.02	3	GS					
2											
3		Practical shovel refusal within Glacial Till End of Test Pit		2.90							No groundwater observed upon completion of test pit
4											
5											

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LOGGED: A.N.
CHECKED: A.P.

GEO - BOREHOLE LOG 64819.03_TEST PIT LOGS_GNT_V01_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

RECORD OF BOREHOLE 18-7

CLIENT: Novatech
PROJECT: Industrial Subdivision Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Excavator CASE CX135 sr	Ground Surface							10 20 30 40 50 60 70 80 90		
		Dark brown silty sand, with organic material (TOPSOIL)									Test pit backfilled with excavated material
		Brown SILTY SAND		0.20							
1		Grey silty sand, some gravel, cobbles and boulders (GLACIAL TILL)		0.76							
2											
3		End of Test Pit		3.05							No groundwater observed upon completion of test pit
4											
5											

GEO - BOREHOLE LOG 64819.03_TEST PIT LOGS_GNT_V01_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

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Consulting Engineers and Scientists

LOGGED: A.N.
CHECKED: A.P.

RECORD OF BOREHOLE 18-8

CLIENT: Novatech
PROJECT: Industrial Subdivision Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Excavator CASE CX135 sr	Ground Surface									
		Dark brown clayey silt, with organic material (TOPSOIL)									Test pit backfilled with excavated material
		Grey brown SILTY CLAY, trace sand (WEATHERED CRUST)		0.23							
1		Grey brown SILTY SAND, trace clay		1.70	1	GS					
2		Boulder encountered underlain by grey SILTY CLAY Note: Unable to determine depth of SILTY CLAY due to side wall shearing		1.98	2	GS					Groundwater seepage at 1.52 metres below ground surface
3		Test pit lost due to side wall shearing End of Test Pit		3.05							
4											
5											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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LOGGED: A.N.
CHECKED: A.P.

GEO - BOREHOLE LOG 64819.03_TEST PIT LOGS_GNT_V01_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

RECORD OF BOREHOLE 18-9

CLIENT: Novatech
PROJECT: Industrial Subdivision Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Excavator CASE CX135 sr	Ground Surface							10 20 30 40 50 60 70 80 90		
		Dark brown silty sand, with organic material (TOPSOIL)									Test pit backfilled with excavated material
		Grey brown SILTY SAND		0.20							
1		Grey brown silty sand, some gravel, cobbles, and boulders (GLACIAL TILL)		0.48							
2											
3		Practical shovel refusal within Glacial Till End of Test Pit		3.05							No groundwater observed upon completion of test pit
4											
5											

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Consulting Engineers and Scientists

LOGGED: A.N.
CHECKED: A.P.

GEO - BOREHOLE LOG 64819.03_TEST PIT LOGS_GNT_V01_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

RECORD OF BOREHOLE 18-10

CLIENT: Novatech
PROJECT: Industrial Subdivision Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface							10 20 30 40 50 60 70 80 90		
		Dark brown silty sand, with organic material (TOPSOIL)									
		Grey brown SILTY CLAY (WEATHERED CRUST)		0.15							
1	Excavator CASE CX135 sr	Grey brown silty sand, trace clay, some gravel, cobbles and boulders (GLACIAL TILL)		0.94							
2											
3		Practical shovel refusal within Glacial Till End of Test Pit		3.05							
4											
5											

Test pit backfilled with excavated material

No groundwater observed upon completion of test pit

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Consulting Engineers and Scientists

LOGGED: A.N.
CHECKED: A.P.

GEO - BOREHOLE LOG 64819.03_TEST PIT LOGS_GNT_V01_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

RECORD OF BOREHOLE 18-11

CLIENT: Novatech
PROJECT: Industrial Subdivision Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface									
		Dark brown clayey silt, with organic material (TOPSOIL)									Test pit backfilled with excavated material
				0.23							
1	Excavator CASE CX135 sr	Grey brown SILTY CLAY (WEATHERED CRUST)									
				1.32							
2		Grey silty sand, some gravel, cobbles and boulders (GLACIAL TILL)									
		Practical shovel refusal within Glacial Till		2.29							No groundwater observed upon completion of test pit
3		End of Test Pit									
4											
5											

GEMTEC
Consulting Engineers and Scientists

LOGGED: A.N.
CHECKED: A.P.

GEO - BOREHOLE LOG 64819.03_TEST PIT LOGS_GNT_V01_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

RECORD OF BOREHOLE 18-12

CLIENT: Novatech
PROJECT: Industrial Subdivision Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Excavator CASE CX135 sr	Ground Surface							10 20 30 40 50 60 70 80 90		
		Dark brown silty sand, with organic material (TOPSOIL)									Test pit backfilled with excavated material
		Brown SILTY SAND		0.23							
1		Grey brown, silty sand, some gravel cobbles and boulders (GLACIAL TILL)		0.76							
2											
3		Practical shovel refusal within Glacial Till End of Test Pit		2.90							No groundwater observed upon completion of test pit
4											
5											

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Consulting Engineers and Scientists

LOGGED: A.N.
CHECKED: A.P.

GEO - BOREHOLE LOG 64819.03_TEST PIT LOGS_GNT_V01_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

RECORD OF BOREHOLE 18-13

CLIENT: Novatech
PROJECT: Industrial Subdivision Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface							10 20 30 40 50 60 70 80 90		
		Dark brown clayey silt, with organic material (TOPSOIL)									Test pit backfilled with excavated material
1		Grey brown SILTY SAND, some gravel and cobbles		0.31							
		Grey brown SILTY CLAY (WEATHERED CRUST)		1.14							
	Excavator CASE CX135 sr	Grey brown SILTY SAND		1.27							
2		Grey brown SILTY CLAY (WEATHERED CRUST)		1.32							
		Grey silty sand, some gravel, cobbles and boulders (GLACIAL TILL)		2.59							
3		Practical shovel refusal within Glacial Till End of Test Pit		3.05							Groundwater seepage at 1.27 metres below ground surface
4											
5											

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LOGGED: A.N.
CHECKED: A.P.

GEO - BOREHOLE LOG 64819.03_TEST PIT LOGS_GNT_V01_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

RECORD OF BOREHOLE 18-14

CLIENT: Novatech
PROJECT: Industrial Subdivision Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface									
	Excavator CASE CX135 sr	Dark brown silty sand, with organic material (TOPSOIL)			1	GS					Test pit backfilled with excavated material
		Brown SANDY SILT		0.23	2	GS					
1		Grey brown sandy silt, trace to some gravel, cobbles and boulders (GLACIAL TILL)		0.79	3	GS					
2		Practical shovel refusal on possible bedrock End of Test Pit		1.83							No groundwater observed upon completion of test pit
3											
4											
5											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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Consulting Engineers and Scientists

LOGGED: A.N.
CHECKED: A.P.

GEO - BOREHOLE LOG 64819.03_TEST PIT LOGS_GNT_V01_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

RECORD OF BOREHOLE 18-15

CLIENT: Novatech
PROJECT: Industrial Subdivision Hydrogeological Investigation
JOB#: 64819.03
LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface									
		Dark brown clayey silt, with organic material (TOPSOIL)									Test pit backfilled with excavated material
		Grey brown SILTY CLAY, some sand (WEATHERED CRUST)		0.53							
1		Grey brown SILTY SAND		1.07							
2	Excavator CASE CX135 sr										
		Grey SILTY CLAY		2.57							
3											
		Grey silty clay, some gravel cobbles and boulders (GLACIAL TILL)		3.66							
4											Groundwater seepage at about 2.57 metres below ground surface
		Test pit lost due to side walls shearing End of Test Pit		4.27							
5											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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LOGGED: A.N.
CHECKED: A.P.

GEO - BOREHOLE LOG 64819.03_TEST PIT LOGS_GNT_V01_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

RECORD OF BOREHOLE 23-01

CLIENT: TLC Holdings Ltd.
PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario
JOB#: 102151.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 18 2023

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		115.75							
		TOPSOIL		115.50							
		Loose, brown SILTY SAND, with rootlets		0.25	1	SS	405	7			
				114.99							
1		Grey brown SILTY SAND, trace to some clay		0.76 / 114.79							
		Stiff to very stiff, grey brown SILTY CLAY, with sand seams (WEATHERED CRUST)		0.96	2	SS	535	7			
				114.23							
2		Compact to very dense, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		1.52	3	SS	155	27			Auger Cuttings
					4	SS	430	26			
3					5	SS	155	87			
				111.94							
4		Dense, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		3.81	6	SS	405	46			
				111.33							
		End of Borehole		4.42							
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

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LOGGED: CC
CHECKED: TM

GEO - BOREHOLE LOG 102151.001_BH_LOGS_2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23

RECORD OF BOREHOLE 23-03

CLIENT: TLC Holdings Ltd.
PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario
JOB#: 102151.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 18 2023

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		112.76							
		TOPSOIL		112.61							
		Very loose, grey brown SILTY SAND, trace to some clay		0.15	1	SS	380	WH			
				112.00							
1		Compact, grey brown SILTY SAND, some clay		0.76	2	SS	585	21			
				111.24							
2		Stiff to very stiff, grey brown SILTY CLAY, trace sand (WEATHERED CRUST)		1.52	3	SS	610	8			Auger Cuttings
				110.48							
		Loose to compact, grey brown SILTY SAND to SANDY SILT, some gravel, with cobbles and boulders (GLACIAL TILL)		2.28	4	SS	380	8			
3					5	SS	535	20			
				109.11							
		End of Borehole		3.65							
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

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LOGGED: CC
CHECKED: TM

GEO - BOREHOLE LOG 102151.001_BH_LOGS_2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23

RECORD OF BOREHOLE 23-04

CLIENT: TLC Holdings Ltd.
PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario
JOB#: 102151.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 18 2023

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		110.49						
		TOPSOIL		110.29						
		Loose, grey brown SILTY SAND, with rootlets		0.20	1	SS	510	4		
				109.73						
1		Loose to compact, grey brown SAND, some silt, with silty clay seams		0.76	2	SS	510	9		
2					3	SS	460	12	MH	Auger Cuttings
				108.21						
		Dense to very dense, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		2.28	4	SS	405	51		
3					5	SS	430	57		
4					6	SS	205	49		
				106.07						
		End of Borehole		4.42						
5										
6										
7										
8										
9										
10										

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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LOGGED: CC
CHECKED: TM

GEO - BOREHOLE LOG 102151.001_BH_LOGS_2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23

RECORD OF BOREHOLE 23-06

CLIENT: TLC Holdings Ltd.
PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario
JOB#: 102151.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 20 2023

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		110.29							
		TOPSOIL		109.99	1	SS	355	5			
		Grey brown SILTY SAND, trace clay, with rootlets		0.30 / 109.53							
1	Power Auger / Hollow Stem Auger (210mm OD)	Loose to very dense, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		0.76	2	SS	560	6			
					3	SS	305	46			
2					4	SS	610	41			
3					5	SS	305	50			
4					6	SS	405	>50			Auger Cuttings
5					7	SS	510	72			
					8	SS	305	62			
6					9	SS	480	36			
7					10	SS	480	82		MH	
					11	SS	330	77			
8					12	SS	330	59			
9		End of Borehole Note: Auger refusal occured at 8.53 metres depth		101.30 / 8.99							
10											

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CHECKED: TM

GEO - BOREHOLE LOG 102151.001_BH_LOGS_2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23

RECORD OF BOREHOLE 23-07

CLIENT: TLC Holdings Ltd.
PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario
JOB#: 102151.001
LOCATION: See Site Plan, Figure 1

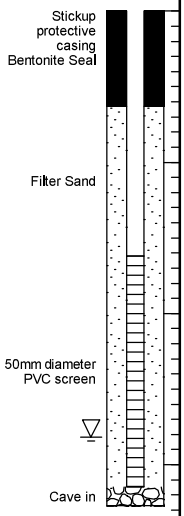
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 20 2023

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		112.82				
		TOPSOIL		112.52	1	SS	355	1
		Brown SILTY SAND, with rootlets		0.30				
				112.06				
1		Loose, grey brown SILTY SAND, some gravel, trace clay		0.76	2	SS	405	7
				111.30				
2		Dense, grey brown SILTY SAND, trace to some gravel, with cobbles and boulders (GLACIAL TILL)		1.52	3	SS	460	43
					4	SS	330	>50
3					5	SS	50	> 50
				109.55				
		End of Borehole Auger Refusal		3.27				

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
23/04/27	2.8 ▽	110.0

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GEO - BOREHOLE LOG 102151.001_BH_LOGS_2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23

RECORD OF BOREHOLE 23-08

CLIENT: TLC Holdings Ltd.
PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario
JOB#: 102151.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 18 2023

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		110.28						
		TOPSOIL		110.08						
		Brown SILTY SAND, trace clay, with rootlets		0.20	1	SS	430	7		
				109.52						
1		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)		0.76	2	SS	610	5	MH	
					3	SS	610	3		
2				108.15						Auger Cuttings
		Very loose, grey SILT and SAND		2.13	4	SS	175	WH		
				107.39						
3		Very loose, grey sandy SILT and CLAY, with cobbles and boulders (GLACIAL TILL)		2.89	5	SS	380	WH	MH	
				105.84						
4		End of Borehole Auger Refusal		4.44						
5										
6										
7										
8										
9										
10										

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

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LOGGED: CC
CHECKED: TM

GEO - BOREHOLE LOG 102151.001_BH_LOGS_2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23

RECORD OF BOREHOLE 23-10

CLIENT: TLC Holdings Ltd.
PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario
JOB#: 102151.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 19 2023

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		114.14							
		TOPSOIL		113.99 / 0.15							
		Grey SAND and GRAVEL, with cobbles and boulders (GLACIAL TILL)			1	SS	205	17			
				113.38 / 0.76							
1		Loose, grey brown, SILTY SAND, trace gravel (GLACIAL TILL)			2	SS	405	4			
				112.62 / 1.52							
2		Very dense, grey brown, SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)			3	SS	75	>50			
					4	SS	180	>50			
3					5	SS	0	>50			
4					6	SS	355	>50			
				109.90 / 4.24							
		End of Borehole Auger Refusal									
5											
6											
7											
8											
9											
10											

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LOGGED: CC
CHECKED: TM

GEO - BOREHOLE LOG 102151.001_BH_LOGS_2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23

RECORD OF BOREHOLE 23-11

CLIENT: TLC Holdings Ltd.
PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario
JOB#: 102151.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 18 2023

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		111.49							
		TOPSOIL		111.29							
		Loose to compact, grey brown SILTY SAND, trace to some clay		0.20	1	SS	510	11			
1					2	SS	510	11			
2					3	SS	610	5			Auger Cuttings
				109.21							
		Dense to very dense, grey brown SILTY SAND and GRAVEL, with cobbles and boulders (GLACIAL TILL)		2.28	4	SS	205	32			
3					5	SS	510	72			
4					6	SS	305	102	>>		
				107.07							
		End of Borehole		4.42							
5											
6											
7											
8											
9											
10											

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CHECKED: TM

GEO - BOREHOLE LOG 102151.001_BH_LOGS_2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23

RECORD OF BOREHOLE 23-13

CLIENT: TLC Holdings Ltd.
PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario
JOB#: 102151.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 19 2023

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		111.69							
		TOPSOIL		111.41							
		Loose to compact, grey brown SILTY SAND, trace to some gravel		0.28	1	SS	405	4			
1					2	SS	330	10			
		Still to very stiff, grey brown SILTY CLAY, with silty sand seams (WEATHERED CRUST)		110.17 1.52	3	SS	610	2			Auger Cuttings
2				109.41	4	SS	50	>50			
		Very dense, grey SILTY SAND and GRAVEL, with cobbles and boulders (GLACIAL TILL)		2.28	5	SS	405	100			
3											
4					6	SS	205	>50			
		End of Borehole Spoon Refusal		107.63 4.06							
5											
6											
7											
8											
9											
10											

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LOGGED: CC
CHECKED: TM

GEO - BOREHOLE LOG 102151.001_BH_LOGS_2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23

RECORD OF BOREHOLE 23-14

CLIENT: TLC Holdings Ltd.
PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario
JOB#: 102151.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 19 2023

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		116.33							
		TOPSOIL		116.05							
		Loose, grey brown SILTY SAND		0.28	1	SS	50	6			
1					2	SS	380	7			Auger Cuttings
				114.96							
		Very dense, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		1.37	3	SS	25	>50			
2					4	SS	180	>50			
				113.77							
		End of Borehole Auger Refusal		2.56							
3											
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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CHECKED: TM

GEO - BOREHOLE LOG 102151.001_BH_LOGS_2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23

RECORD OF BOREHOLE 23-15

CLIENT: TLC Holdings Ltd.
PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario
JOB#: 102151.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 19 2023

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		111.47							
		TOPSOIL		111.27							
		Loose, brown SILTY SAND, with rootlets		0.20 / 110.71	1	SS	330	7			
1		Compact, grey brown SILTY SAND, trace clay		0.76 / 109.95	2	SS	460	11			
		Compact, brown SILTY SAND		1.52 / 109.19	3	SS	355	17			
2		Very loose, grey SANDY SILT		2.28 / 108.42	4	SS	560	1			Auger Cuttings
		Grey brown SAND, some silt		3.05 / 108.12	5	SS	430	20			
3		Grey brown SILTY CLAY with sand seams (WEATHERED CRUST)		3.35 / 107.66							
		Dense to very dense, grey brown SILTY SAND and GRAVEL, trace clay, with cobbles and boulders (GLACIAL TILL)		3.81 / 106.44	6	SS	330	38			
4					7	SS	230	>50			
		End of Borehole Auger Refusal		5.03							
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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LOGGED: CC
CHECKED: TM

GEO - BOREHOLE LOG 102151.001_BH_LOGS_2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23

APPENDIX F

Guelph Permeameter Infiltration Testing

Table E1: Comparison of infiltration rates based on field saturated hydraulic conductivity (using Guelph Permeameter) and soil texture / grain size analysis (lab testing). Refer to Figure 1 for infiltration test locations.

		Field Testing		Infiltration Rates[2] (mm/hr)		
Test ID	Depth m bgs	Guelph Permeameter K_{fs} (cm/s)	Soil Class. (GSA)	Guelph Permeameter $*K_{fs}$	Soil Texture	Hazen Method $*K_{fs}$
GP 18-1S	0.30 – 0.45	1.3×10^{-3}	4.0×10^{-4}	92	61.2	197
GP 18-1D	1.00 – 1.15	1.1×10^{-2}	3.6×10^{-2}	163	210	230
GP 18-3S	0.50 – 0.65	1.1×10^{-5}	-	26	-	-
GP 18-5S	0.25 – 0.40	5.0×10^{-5}	-	38	-	-
GP 18-9S	0.25 - 0.40	8.5×10^{-4}	-	82	-	-
GP 18-10S	0.40 - 0.55	1.1×10^{-5}	-	26	-	-
GP 18-14S	0.30 – 0.45	2.1×10^{-4}	5.3×10^{-6}	56	13.2	20

Notes:
1. Appendix C – Site Evaluation and Soil Testing Protocol for Stormwater Infiltration (Low Impact Development Stormwater Management Planning and Design Guide, Credit Valley Conservation Authority, Version 1.0, 2011)
2. The estimated infiltration rates do not include a safety factor and do not represent design infiltration rates.

Abbreviations:
K_{fs} = Field saturated hydraulic conductivity;
GSA = Grain Size Analysis, Hazen D_{10}; **Soil Texture** = US Maryland Stormwater Design Manual – Table D.13.1 Hydrologic Soil Properties Classified by Soil Texture (revised May 2009);
$*K_{fs}$ converted to infiltration rate based on K_{fs}-infiltration relationship found in OMMAH;
OMMAH = Ontario Ministry of Municipal Affairs and Housing (OMMAH). 1997. Supplementary Guidelines to Ontario Building Code 1997. SG-6 Percolation Times and Soil Descriptions, Toronto, Ontario

APPENDIX H

Nitrate Dilution Calculations

Maximum Allowable Septic Flows
3160 Carp Road, Ottawa, ON

Lot	Available Infiltration [1] (litres per day)	Maximum Septic Flow-Conventional[2] (litres per day)	Maximum Number of Users[3]	Maximum Septic Flow-Advanced[2] (litres per day)	Maximum Number of Users[3]
Lot 1	1955	652	9	1955	26
Lot 2	2505	835	11	2505	33
Lot 3	1982	661	9	1982	26
Lot 4	3685	1228	16	3685	49
Lot 5	1780	593	8	1780	24
Lot 6	1416	472	6	1416	19
Lot 7	6912	2304	31	6912	92
Lot 8	2555	852	11	2555	34
Lot 9	1604	535	7	1604	21
Lot 10	1511	504	7	1511	20
Lot 11	2429	810	11	2429	32
Lot 12	2141	714	10	2141	29

Notes:

1. Available infiltration (litres per day) = Infiltration volume (m3/year) x (1000 litres/m3) / (365 days/year) x (1 - hard surface area) x Infiltration Factor. Assumes a hard surface coverage of 40%.
2. Incorporates a value of 20 mg/L nitrate in the discharged effluent from the tertiary treatment system. The calculated maximum allowable flow is based on a simplification of the formula provided in Section 5.6.3, utilizing a concentration of 20 mg/L of Nitrate in the effluent discharging from the tertiary treatment unit.
3. Assumes 75 litres per day per person.

Legend

- Property Boundary
- Study Area
- Watercourse
- Headwater Drainage Feature
- Candidate Blanding's Turtle Habitat 2 (30 m)
- Candidate Blanding's Turtle Habitat 3 (250 m)

Scale
1:5,250
0 50 100 200 300 400 Meters

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Client: TLC Holdings Ltd.

Project: 102151.001

Location: 3160 Carp Road
Ottawa, Ontario

Drwn By: EP | Chkd By: TW

Natural Heritage Features

Date: June 2024

Rev. 0

Figure: A.4

Coordinate System: NAD 1983 UTM Zone 18N
Service Layer Credits: Hybrid Reference Layer: Esri Community Maps Contributors, City of Ottawa, Province of Ontario, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada
World Imagery: Maxar

Appendix D

Rural Fire Flow Calculation Process

Table D1: Required Water Storage for Fire Protection

Table D2: SWM Facility Stage-Storage

Table D3: Downstream Channel Capacity

Table D4: Water Quality Storage Requirements for Individual Blocks

MECP *Table 1.3*

MECP *Table 4.1*

Appendix J RURAL FIRE FLOW CALCULATION PROCESS

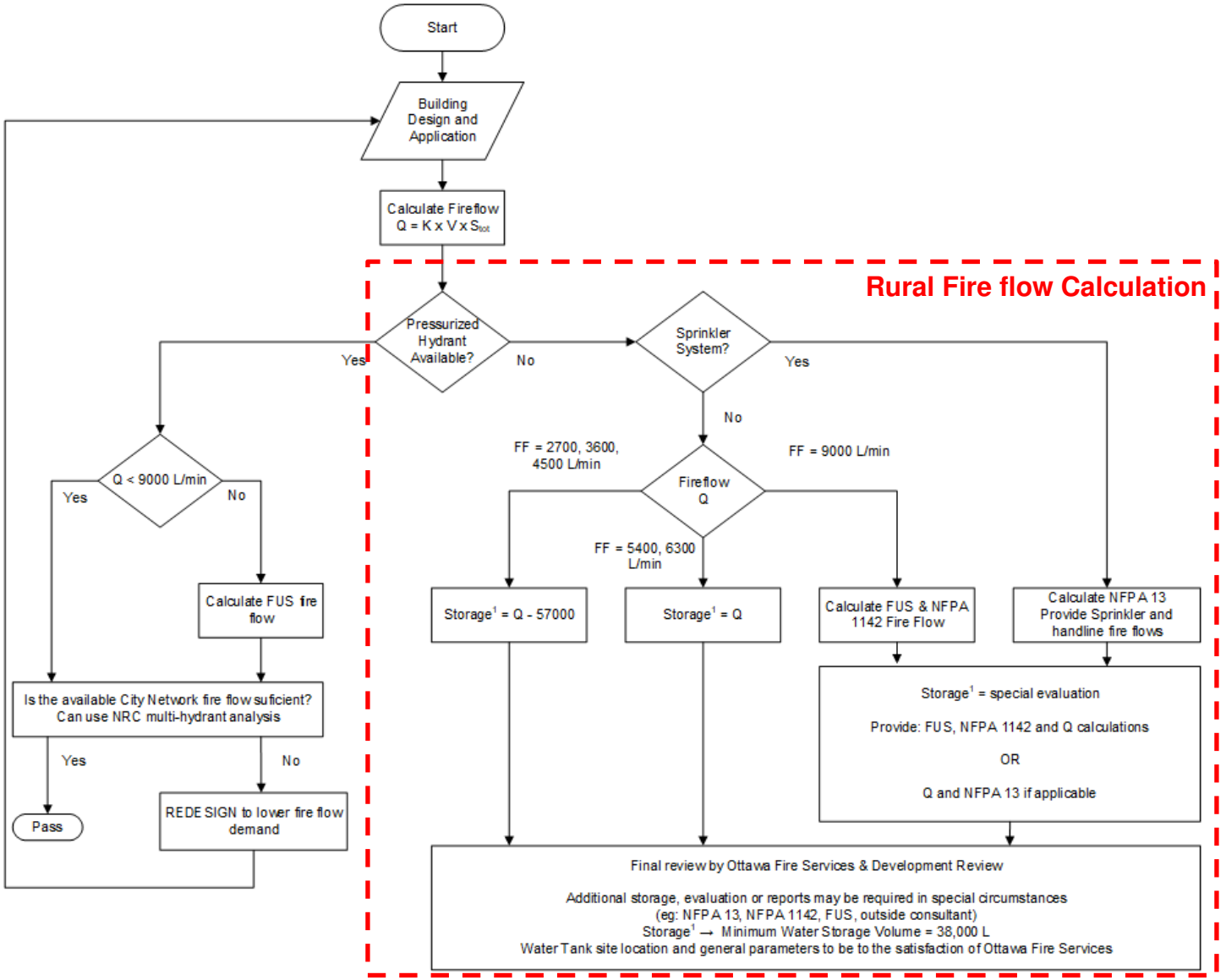

Figure J.1: Rural Fire Flow Calculation Process.

Table D1: Required Water Storage for Fire Protection

Block No.	Block Area (ha)	BLDG Area (m^2)	BLDG Height (m)	BLDG Volume, V (m^3)	Water Supply Coefficient [*1], K	S_{TOT} [*2]	Min. Water Supply [*3], Q (L)	Required Water Supply Flow Rate [*4] (L/min)	Min. Required Water Storage [*5] (L)
2	1.29	2,580	4.0	10,320	17	1.0	175,440	5,400	175,440
3	1.30	2,600	4.0	10,400	17	1.0	176,800	5,400	176,800
4	3.00	6,000	4.0	24,000	17	1.0	408,000	9,000	FUS & NFPA Required
5	1.43	2,860	4.0	11,440	17	1.0	194,480	6,300	194,480
6	1.37	2,740	4.0	10,960	17	1.0	186,320	5,400	186,320
7 [*6]	2.67	5,340	4.0	21,360	17	1.0	363,120	9,000	FUS & NFPA Required
8	1.28	2,560	4.0	10,240	17	1.0	174,080	5,400	174,080
9	1.14	2,280	4.0	9,120	17	1.0	155,040	4,500	98,040
10	1.20	2,400	4.0	9,600	17	1.0	163,200	5,400	163,200
11	1.36	2,720	4.0	10,880	17	1.0	184,960	5,400	184,960
12	1.46	2,920	4.0	11,680	17	1.0	198,560	6,300	198,560

Parameters

20%	Building Lot Coverage (Max. 25% as per RC9 Zoning)
4.0	Building Height (Max. 11.0 as per RC9 Zoning)
17	Water Supply Coefficient (F2 Occupancy; Non-combustible)

Notes:

1	Water supply coefficient as per OBC Table 1 for F2 occupancy
2	Total spatial coefficient as per OBC Figure 1
3	$Q = K \times V \times S_{TOT}$
4	Required water supply flow rate as per OBC Table 2
5	If Flow Rate = 2700, 3600 or 4500 L/min then Storage = Q - 57000, if Flow Rate = 5400 or 6300 L/min then Storage = Q
6	Area of Block 7 reduced to remove SWM facility and outlet channel footprint.

Table D2: SWM Facility Stage-Storage

Ponding Elevation (m)	Ponding Area (m^2)	Available Storage Volume (m^3)
110.20	536	17
110.30	2,195	145
110.40	4,260	468
110.50	6,346	998
110.60	8,452	1,738
110.70	10,555	2,689
110.80	11,916	3,821
110.90	12,280	5,037
111.00	12,464	6,274
111.10	12,657	7,530
111.20	12,857	8,806
111.30	13,065	10,102

Notes:

1. Available storage volumes calculated using Civil3D by Autodesk.

Table D3: Downstream Channel Capacity

Side Slope,z (H:1V)	Channel Slope (m/m)	Channel Bottom Width[*2], b (m)	Channel Depth, h[*2] (m)	Manning n Value[*1]	Flow Area, A (m^2)	Wetted Perimeter, WP (m)	Hydraulic Radius, R (m)	Velocity, V (m/s)	Capacity, Q (m^3/s)	Capacity, Q (L/s)
3.0	0.0029	1.00	0.760	0.035	2.49	5.81	0.43	0.88	2.198	2198.1

Notes:

1. Manning n value for natural stream channel; fairly regular section (OSDG Appendix 6-C)
2. Channel dimensions interpolated from survey data.

Sample Calculations for Trapezoidal Ditch:

b - bottom width of channel

h - height of channel

z - horizontal to vertical ratio of channel side slope

$A = bh + zh^2$ $\quad R = A/WP$ $\quad Q = A \times V$

$WP = b + 2h(1 + z^2)^{1/2}$ $\quad V = \frac{1}{n} R^{2/3} S^{1/2}$

Table D4: Water Quality Storage Requirements for Individual Blocks

Block No.	Area (ha)	Imp. Level[*4] (%)	Storage Volume for Imp. Level[*2] (m^3/ha)		Required Storage Volume (m^3)	
			Infiltration	Dry Pond	Infiltration	Dry Pond
2	1.29	40	20	105	26	135
3	1.30	40	20	105	26	137
4	3.00	40	20	105	60	315
5	1.43	40	20	105	29	150
6	1.37	40	20	105	27	144
7[*3]	2.67	40	20	105	53	280
8	1.28	40	20	105	26	134
9	1.14	40	20	105	23	120
10	1.20	40	20	105	24	126
11	1.36	40	20	105	27	143
12	1.46	40	20	105	29	153

Notes:

1. Infiltration Protection Level: Normal; Dry Pond Protection Level: Basic
2. Storage volume for impervious level interpolated from Table 3.2 (MECP SWM Manual).
3. Area of Block 7 reduced to remove SWM facility and outlet channel footprint.
4. Maximum allowable impervious level as per Hydrogeological Investigation.

Table 3.2 Water Quality Storage Requirements based on Receiving Waters[1, 2]

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level			
		35%	55%	70%	85%
Enhanced 80% long-term S.S. removal	Infiltration	25	30	35	40
	Wetlands	80	105	120	140
	Hybrid Wet Pond/Wetland	110	150	175	195
	Wet Pond	140	190	225	250
Normal 70% long-term S.S. removal	Infiltration	20	20	25	30
	Wetlands	60	70	80	90
	Hybrid Wet Pond/Wetland	75	90	105	120
	Wet Pond	90	110	130	150
Basic 60% long-term S.S. removal	Infiltration	20	20	20	20
	Wetlands	60	60	60	60
	Hybrid Wet Pond/Wetland	60	70	75	80
	Wet Pond	60	75	85	95
	Dry Pond (Continuous Flow)	90	150	200	240

Table 1.3: Stormwater Management Practices

SWMP	Water Balance	Water Quality	Erosion	Water Quantity
Lot Level and Conveyance Controls				
Rooftop storage	F	F	F	M
Parking lot storage	F	F	F	M
Superpipe storage	F	F	F	M
Reduced lot grading	M	•	•	F
Roof leader to ponding area	M	•	•	F
Roof leader to soakaway pit	M	•	•	F
Infiltration trench	M	M	•	F
Grassed swales	M	•	•	•
Pervious pipes	M	M	•	F
Pervious catchbasins	M	•	•	F
Vegetated filter strips	M	•	•	F
Natural buffer strips	•	•	•	F
Rooftop gardens	F	•	•	F
End-of-Pipe Controls				
Wet pond	F	M	M	M
Artificial Wetland	F	M	M	M
Dry pond	F	•	M	M
Infiltration basin	•	M	•	F
Filters*	F	M	F	F
Oil/grit separators*	F	•	F	F

M High Suitability • Medium Suitability F Low Suitability

* *Water Quality suitability is highly dependent on sizing and by-pass design.*

Source: Aquafor Beech Ltd., Wet Weather Discharges to the Metropolitan Toronto Waterfront, prepared for the Metropolitan Toronto & Region Remedial Action Plan, 1993

- The SWMPs must not affect the fluvial processes in the floodplain; and
- The outlet invert elevation of the SWMP should be higher than the 2 year floodline and the overflow elevation must be above the 25 year floodline.

Table 4.1: Physical Constraints for SWMP Types

SWMP	Topography	Soils	Bedrock	Groundwater	Area
wet pond	none	none	none	none	> 5 ha
dry pond	none	none	none	none	> 5 ha
wetland	none	none	none	none	> 5 ha
infiltration basin	none	loam (min. inf. rate ≥ 60 mm/h)	> 1 m below bottom	> 1 m below bottom	< 5 ha
infiltration trench	none	loam (min. inf. rate ≥ 15 mm/h)	> 1 m below bottom	> 1 m below bottom	< 2 ha
reduced lot grading	< 5%	loam (min. inf. rate ≥ 15 mm/h)	none	none	none
soakaway pit	none	loam (min. inf. rate ≥ 15 mm/h)	> 1 m below bottom	> 1 m below bottom	< 0.5 ha
rear yard ponding	< 2%	loam (min. inf. rate ≥ 15 mm/h)	> 1 m below bottom	> 1 m below bottom	< 0.5 ha
grassed swales	< 5%	none	none	none	< 2 ha
pervious pipes	none	loam (min. inf. rate ≥ 15 mm/h)	> 1 m below bottom	> 1 m below bottom	none
vegetated filter strips	< 10%	none	none	> 0.5 m below bottom	< 2 ha
sand filters	none	none	none	> 0.5 m below bottom	< 5 ha
oil/grit separators	none	none	none	none	< 2 ha