

**FUNCTIONAL SERVICING AND PRELIMINARY
STORMWATER MANAGEMENT REPORT**

4243 SIXTH LINE

**TOWN OF OAKVILLE
HALTON REGION**

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1.0 Introduction

C.F. Crozier & Associates Inc. (Crozier) was retained by East & West Inc. to prepare a Functional Servicing and Preliminary Stormwater Management Report to support the Zoning By-Law Amendment (ZBA) application for the proposed development of 4243 Sixth Line, Town of Oakville, Halton Region (subject lands).

The subject lands are located within Subcatchment SM1 according to the North Oakville Creek's Subwatershed Study (NOCCS) Implementation Report dated August 2006. In April 2018, an Environmental Implementation Report and Functional Servicing Study for Sixteen Mile Creek (existing EIR/FSS) was prepared for Subcatchment SM1 as part of the development approvals for the lands owned by Star Oaks Developments Limited located immediately south and east of the subject lands. The Star Oaks Developments Limited lands are subject of the draft plan of subdivision 24T-13002. The existing EIR/FSS report became the basis for the overall servicing, stormwater management, and environmental strategy of Subcatchment SM1 where any development within Subcatchment SM1 requires an addendum to the existing EIR/FSS.

Consequently, this report acts as an addendum to the existing EIR/FSS. The Red-lined Terms of Reference for the EIR/FSS addendum is provided in Appendix A. The purpose of this report is to demonstrate that the proposed development can be developed in accordance with the Town of Oakville (Town) and Halton Region (Region) guidelines and standards and meet the applicable requirements outlined in the existing EIR/FSS from a water, wastewater, and stormwater management perspective.

1.1 Subject Lands Description

The subject lands are approximately 3.89 ha and located within the North Oakville East Secondary Planning area. The subject lands currently consist of an existing heritage building, gravel driveway, pond, cell tower and associated steel buildings. The subject lands are bounded by Highway 407 to the north, Sixth Line to the west, and two (2) active developments subject to draft plan of subdivision 24T-13002 to the south and east.

According to the Site Plan prepared by n Architecture Inc. (February 2026), the elements envisioned for the proposed development include:

- Two (2) one-storey industrial buildings
- Conversion of the existing heritage building to an office space
- Associated internal road and parking areas
- Maintaining the use of the cell tower

Refer to the Site Plan provided in Appendix A for further information regarding the elements of the proposed development.

1.2 Background Information

The following drawings, design standards, and documents were referenced during the preparation of this report:

- Red-lined Terms of Reference for the EIR/FSS addendum (Crozier, December 2025).
- Site Plan prepared by n Architecture Inc. (February 2026)
- Geotechnical Investigation prepared by Soil Engineers Ltd. (Ref. No. 2306-S222, September 2023)
- Topographic Survey of Part of Lot 15, Concession 2 North of Dundas Street (Mauro Group Inc., August 25, 2023)
- As-Constructed Drawing No. W1 – Watermain & Sanitary Sewer Sixth Line, prepared by Stantec Consulting Ltd. (December 12, 2020)
- As-Constructed Drawing No. W2 – Watermain & Sanitary Sewer William Halton Parkway (Reg. RD. 40), prepared by Stantec Consulting Ltd. (December 12, 2020)
- As-Constructed Drawing No. 20 & 21 – Proposed Construction William Halton Parkway (Reg. RD.40), prepared by Stantec Consulting Ltd. (December 12, 2020)
- Existing EIR/FSS - Environmental Implementation Report and Functional Servicing Study for Sixteen Mile Creek, prepared for the lands owned by Star Oaks Developments Limited by R.J. Burnside & Associates Limited, GeoProcess Research Associates, KLM Planning Partners Inc., STLA, Savanta, Stonybrook, RAND Engineering Corporation, and Geomorphix (April 2018)
- Draft Plan of Subdivision 24T-13002 Stormwater Management Implementation Report, prepared by RAND Engineering Corporation (April 2019)
- Town of Oakville Development Engineering Procedures and Guidelines (Version 2.0, September 2023)
- Halton Region Water & Wastewater Linear Design Manual (Version 7, December 2025)
- MTO Stormwater Management Requirements for Land Development Proposals (April 2022)

Relevant excerpts are provided in Appendix A.

2.0 Water Servicing

The Region is responsible for the operation and maintenance of the municipal water and treatment system in the Town of Oakville. The existing and proposed water servicing is discussed in the following sections.

2.1 Existing Water Servicing

A review of the as-constructed drawings provided in Appendix A identified the following water servicing infrastructure in proximity to the proposed development:

- A 300 mm diameter polyvinyl chloride (PVC) municipal watermain located within William Halton Parkway.

Under existing conditions, the subject lands are not connected to municipal services. According to the Source Protection Information Atlas, the domestic well that presumably serviced the existing heritage building was abandoned in February 1997. The associated Water Well Record is provided in Appendix A.

2.2 Design Water Demand

The water demand was estimated for the proposed development in accordance with Halton Region Water and Wastewater Linear Design Manual. Subsequently, an average daily demand of 190 L/cap/day was used for both office and industrial uses. An equivalent population was determined for the proposed development using an equivalent population density of 37.4 m² of building floor area/employee for commercial uses and 129 m² of building floor area/employee for industrial uses.

Table 1 below outlines the estimated domestic water demand generated by the proposed development with supporting calculations in Appendix B.

Table 1: Estimated Domestic Design Water Demand

Building Type	Building Floor Area (m ²)	Population	Average Daily Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Office	335	9	0.26	0.49	0.77
Industrial	13,924	108			

Note: Building floor area is based on Site Plan prepared by n Architecture Inc.

As presented in Table 1, a domestic water service will be required to provide a peak hour water demand of 0.77 L/s.

2.3 Fire Flow Demand

The Fire Underwriters Survey method was used to estimate the fire flow demand for each proposed building of the proposed development.

This calculation is based on the following assumptions per email correspondence with n Architecture Inc. provided in Appendix B (Choi to Fletcher, February 23, 2026):

- Buildings will use Type 2 Non-Combustible Construction, with a coefficient of 0.8 applied to the fire flow calculations.
- Proposed building will be equipped with an automatic sprinkler system which reduces the initial fire flow demand of the building by up to 50%. The automated sprinkler system is to be designed by the Mechanical Engineer at subsequent design stages.

Table 2 summarizes the estimated fire flow requirements and durations necessary to meet fire protection for the proposed development with supporting calculations in Appendix B.

Table 2: Estimated Fire Flow Demand

Fire Flow Requirement (L/s)	Fire Flow Duration (hours)
133	2.00

It should be noted that the fire flows determined from the Fire Underwriters Survey method is a conservative estimate for comparison purposes only. At the detailed design stage, the Mechanical Engineer will confirm the required fire flow rates and the Architect will design fire separation methods per the determined fire flow rate to meet municipally available flows and pressures. It is understood that the Region will complete their own modelling to confirm there is sufficient capacity in the existing municipal water distribution system to service the proposed development.

2.4 Proposed Water Servicing

To service the proposed development, a 200 mm diameter watermain is proposed to be extended approximately 240 m north within Sixth Line from the existing 300 mm diameter watermain within William Halton Parkway. The 200 mm diameter watermain within Sixth Line will then split at the subject lands' property line into a 200 mm diameter fire service and a 100 mm diameter domestic service according to Halton Region Drawing RH 409.010. Design of the watermain extension will be completed as part of the detailed design stage.

To service the proposed industrial buildings, the internal fire and domestic services are proposed to be routed to each industrial building's mechanical room for water metering, backflow prevention, and distribution throughout the building. The fire line will also service two (2) hydrants located within 45 m of the proposed building's Siamese connections. To service the heritage building, a 50 mm diameter water service is proposed off the 100 mm diameter watermain.

Refer to the Servicing Figures (Fig. 4 and 5) for an illustration of the proposed water servicing infrastructure. The water distribution systems within each building will be designed by the Mechanical Engineer at the detailed design stage.

3.0 Sanitary Servicing

Halton Region is responsible for the operation and maintenance of the municipal sanitary sewer network in the Town of Oakville. The existing and proposed sanitary servicing is outlined in the following sections.

3.1 Existing Sanitary Servicing

A review of the as-constructed drawings provided in Appendix A identified the following sanitary servicing infrastructure in proximity to the proposed development:

- A 300 mm diameter polyvinyl chloride (PVC) sanitary sewer located within William Halton Parkway.
- A 375 mm diameter polyvinyl chloride (PVC) sanitary sewer located within Sixth Line to the south of the William Halton Parkway roundabout.

Under existing conditions, the subject lands are not connected to municipal services.

3.2 Design Sanitary Flow

The design sanitary flows and equivalent population for the proposed development were calculated with reference to the Halton Region Water and Wastewater Linear Design Manual. Subsequently, an average daily flow rate of 185 L/employee/day was used for both office and industrial uses. Infiltration flow into the sanitary sewer and a peaking factor were applied to the unit sewage flow to obtain the total estimated design sewage flow.

A summary of the sanitary design flows is presented in Table 3 with supporting calculations in Appendix C.

Table 3: Estimated Sanitary Design Flows

Building Type	Building Floor Area (m ²)	Population	Average Daily Flow (L/s)	Peak Flow (L/s)	Infiltration Flow (L/s)	Total Sanitary Flow (L/s)
Office	335	9	0.25	1.00	1.09	2.09
Industrial	13,924	108				

Note: Total sanitary flow includes infiltration flow and peak flow.

As presented in Table 3, a sanitary service is to be sized to convey 2.09 L/s to service the proposed development. It is understood that the Region will complete their own modelling to confirm there is sufficient capacity in the existing municipal wastewater system to service the proposed development.

3.3 Proposed Sanitary Servicing

To service the proposed development, a 250 mm diameter sanitary sewer is proposed to be extended approximately 210 m north within Sixth Line from an existing sanitary maintenance hole located south of the William Halton Parkway roundabout. The internal sanitary sewers will connect to the sanitary sewer within Sixth Line via a property line maintenance hole. Design of the sanitary extension will be completed as part of the detailed design stage.

To service the proposed industrial buildings, sanitary sewer stubs are proposed adjacent to each mechanical room. A forcemain is proposed to service the heritage building due to the low elevation of the building with respect to the sanitary sewer infrastructure. An associated grinder pump, or equivalent, within the heritage building will be designed by the Mechanical Engineer during detailed design.

Refer to the Servicing Figures (Fig. 4 and 5) for an illustration of the proposed sanitary servicing infrastructure. The sanitary collection system within each building will be designed by the Mechanical Engineer at the detailed design stage.

4.0 Storm Servicing

The storm servicing for the proposed development is outlined in the following sections.

4.1 Existing Storm Servicing

There is no existing municipal storm sewer within Sixth Line along the frontage of the subject lands based on the review of the Topographic Survey and available as-constructed drawings provided in Appendix A.

4.2 Existing Drainage Conditions

There are two (2) culverts that drain east to west within Sixth Line in proximity of the subject lands. The southern culvert is identified as an 800 mm diameter in the Topographic Survey and the northern culvert is identified as a 1500 mm diameter in Drawing C-1 of the Stormwater Management Implementation Report for the Draft Plan of Subdivision 24T-13002 (RAND Engineering Corporation, April 2019) provided in Appendix A. Both culverts convey runoff towards a Highway 407 stormwater management pond located west of Sixth Line. The Highway 407 stormwater management pond outlets via a culvert to a tributary of Sixteen Mile Creek and is understood to be the outlet for Subcatchment SM1 according to the existing EIR/FSS.

The subject lands generally drain west towards the existing Sixth Line municipal ditch with the majority directed to the northern culvert. Figure 2.1 – Natural Heritage System Framework of the existing EIR/FSS identify two (2) existing Hydrologic Feature B depressions on the subject lands (provided in Appendix A). The associated drainage areas directed to these depressions have been illustrated on the Storm Drainage Plan (ST-1) prepared as part of the Stormwater Management Implementation Report for the Draft Plan of Subdivision 24T-13002 (RAND Engineering Corporation, April 2019) and provided in Appendix D.

Refer to the Pre-Development Storm Drainage Figure (Fig. 1) for an illustration of the existing drainage conditions.

4.3 Proposed Drainage Conditions and Storm Servicing

Based on the Site Plan the proposed development will consist of two (2) industrial buildings, a heritage building and associated internal road and parking areas. The proposed development has two accesses to the Sixth Line Right-of-Way. Based on the proposed grading and servicing strategy there is one proposed catchment, Catchment 201, in post-development conditions.

The proposed internal storm servicing infrastructure and grading maintains the existing outlet of the subject lands by capturing and conveying runoff to the Sixth Line ditch as in existing conditions. The minor storm sewer system has been sized to convey the 5-year design storm according to Town of Oakville Development Engineering Procedures and Guidelines. As further described in Section 5.0, since quantity control is required for the major system, a capture analysis will be completed at detailed design to confirm the major system is captured and conveyed through the proposed stormwater management infrastructure.

Refer to the Post-Development Drainage Figure (Fig. 2) and Preliminary Servicing Figure (Fig. 4) for an illustration of the proposed drainage patterns and servicing infrastructure.

5.0 Stormwater Management

Stormwater management design criteria were established in accordance with the existing EIR/FSS and Red-lined Terms of Reference provided in Appendix A. The SWM criteria applicable to the proposed development area are as follows:

Water Quantity Control

The stormwater management system for the proposed development will be designed to meet the unitary flow rates for Subcatchment SM1 outlined in the North Oakville Creek's Subwatershed Study Addendum (NOCCS) dated September 2007. The unitary flow rates are on a per hectare basis and are presented in Table 7.2 of the existing EIR/FSS provided in Appendix A and Table 4 in Section 5.1 of this report. Note, according to the existing EIR/FSS, the Regional Storm's unitary flow rate is based on the capacity of the Highway 407 outlet culvert.

Additionally, according to the Red-lined Terms of Reference, the stormwater storage volume is to be compared with the pre-development runoff attenuated by the existing Hydrologic Feature B depressions because they are proposed to be removed. The relevant criteria are as follows:

- 2-year event: The extended detention and permanent pool volume in the SWM Facility is to be greater than or equal to the volume attenuated in the depressions during the 2-year storm event. Note, since the stormwater management design proposes underground storage tanks, the intent of this criterion will be satisfied by comparing the total 2-year attenuation volume in the depressions with the combined retention volume provided through infiltration.
- 100-year event: The total storage volume (permanent and active) is to be greater than or equal to the volume attenuated in the depressions during the 100-year or Regional (whichever is applicable) storm events.

Water Quality Control

As outlined in the Red-lined Terms of Reference, the water quality control target for the proposed development is Enhanced Level of protection (80% total suspended solids (TSS) removal) as defined by the MECP. Additionally, pre- and post-development phosphorus loading calculations are required to be completed in accordance with Section 7.4.4.4 of the NOCCS Implementation Report (August 2006) to confirm no-net increase in phosphorus loadings as a result of the development.

Erosion Control

Erosion control will be achieved through providing the same or better level of erosion control than proposed in the existing EIR/FSS. The existing EIR/FSS proposes a 7-day extended detention for the 25 mm, 4-hour Chicago storm event.

Water Balance

As outlined in the Red-lined Terms of Reference, a water balance analysis is required to be completed using Thornthwaite and Mather methodology.

MTO Guidelines

The details of stormwater management infrastructure must be designed in accordance with MTO Stormwater Management Requirements for Land Development Proposals (April 2022). This will be demonstrated during the detailed design stage as the requirements pertain to the specifics of the infrastructure beyond the scope of functional level design.

5.1 Stormwater Quantity Control

The Ministry of Transportation guidelines were referenced to determine the hydrologic parameters for the subject lands. The Geotechnical Investigation and Ontario's AgMaps was reviewed to determine the on-site soil conditions. Based on these sources, the hydrologic parameters for the post-development conditions were determined and are provided in the hydrologic parameter sheets in Appendix D.

Visual OTTHYMO (VO) was used to simulate post-development runoff conditions. The Town of Oakville's intensity-duration frequency (IDF) curves were used to derive the 24-hour Chicago design storms as outlined in Town of Oakville Engineering Procedures and Guidelines. The Hurricane Hazel 12-hour design storm was used for the Regional event. As outlined in Section 5.0, pre-development hydrologic modelling was not required as the unitary flow rates from the existing EIR/FSS were used to determine the post-development peak flow targets.

As illustrated on the Post-development Drainage Figure (Fig. 2), Catchment 201 has an area of 3.89 ha, is 89% impervious and was therefore modelled as a STANDHYD. Table 4 summarizes the results of hydrologic modelling results of Catchment 201 for the post-development scenario.

Table 4: Catchment 201 Hydrologic Modelling Results (24-hour Chicago Design Storm)

Return Period	Unitary Flow Rate ¹ (m ³ /s/ha)	Post-Development Target Peak Flow Rates (m ³ /s)	Required Storage Volume (m ³)
2-Year	0.004	0.016	1,000
5-Year	0.007	0.027	1,555
10-Year	0.009	0.035	1,750
25-Year	0.012	0.047	2,070
50-Year	0.014	0.055	2,300
100-Year	0.016	0.062	2,540
Regional	0.130	0.51	900

Note: 1. Unitary flow rates per Table 7.2 of the existing EIR/FSS provided in Appendix D. The Regional Storm's unitary flow rate is based on Highway 407's outlet culvert design capacity according to the existing EIR/FSS addendum.

It is assumed that the Regional control volume required is in addition to the incremental storage volume for the 100-year design storm event (i.e., stacked). Therefore, to achieve the target post-development peak flow rates a maximum water quantity storage volume of 3,440 m³ (2,540 m³ + 900 m³) is required. As presented on the Preliminary Servicing Figure (Fig. 4), an underground stormwater tank is proposed to provide 3,600 m³ of active storage volume. The peak flow leaving the tank will be controlled to meet the post-development peak flow rate targets using an orifice or vortex valve, to be specified at the detailed design stage of the proposed development.

Strategies can be explored during detailed design to reduce the size of the stormwater management tank while still meeting the required stormwater management criteria such as accounting for storm sewer and/or surface storage or incorporating other types of infrastructure like superpipe or linear chambers.

5.2 Erosion Control

As outlined in Section 5.0, erosion control will be achieved through providing the same or better level of erosion control than proposed in the existing EIR/FSS. The existing EIR/FSS proposes a 7-day drawdown time for the 25 mm, 4-hour Chicago storm event.

A different erosion control strategy is recommended for the subject lands because of the relatively small size of Catchment 201 (3.89 ha) which would make it difficult to propose an extended detention system over a 7-day period. Therefore, erosion control for the proposed development is proposed to be achieved through retention of the runoff generated during the 25 mm, 4-hour Chicago Storm event.

A VO model scenario was prepared to estimate the runoff generated within Catchment 201 during the 25 mm, 4-hour Chicago Storm event with the results summarized in Table 5.

Table 5: Catchment 201 Hydrologic Modelling Results (25 mm, 4-hour Chicago Storm)

Drainage Area (ha)	Runoff Volume (mm)	Erosion Control Volume Retention Target (m ³)
3.89	22.05	858

An erosion control retention volume target of 858 m³ is required for the proposed development. As illustrated on the Preliminary Servicing Figure (Fig. 4), this target is achieved by proposing a total of 930 m³ of retention volume in three (3) different infiltration chambers. Chambers A and B have been conservatively sized to capture the 25 mm runoff generated on the roofs of Buildings A and B. The remaining retention volume is provided as infiltration volume within the proposed quantity control underground stormwater tank.

Drawdown calculations for the infiltration chambers are provided in Appendix D. The Geotechnical Investigation identified silty clay native soils on the subject lands which are not conducive to infiltration. Therefore, it is proposed that the native soil within the infiltration infrastructure be replaced with soils conducive to infiltration (i.e. coarse silty, sandy, or gravel material) that have a grain size distribution to allow for a minimum infiltration rate of 32 mm/hr. If the infiltration features are located where fill will be placed for earthworks purposes, it is proposed that the fill material within the infiltration features meet the minimum infiltration rate. Details of the soil requirements will be provided at detailed design.

Additionally, the Geotechnical Investigation found that no groundwater was encountered upon the completion of drilling the boreholes, however, it is recommended that further groundwater monitoring is undertaken during detailed design to confirm the seasonally high groundwater elevations across the subject lands to ensure proper separation with the infiltration chambers.

5.3 Hydrologic Feature B Depressions

As outlined in Section 5.0, the runoff directed to Hydrologic Feature B depressions under pre-development conditions are required to be compared with the stormwater storage volumes provided as follows:

- The provided retention storage volume is required to be greater than or equal to the volume of runoff attenuated in the Hydrologic Feature B depressions during the 2-year storm event.
- The total storage volume provided is required to be greater than or equal to the volume of runoff attenuated in the Hydrologic Feature B depressions during the 100-year or Regional (whichever is applicable) storm events.

Another VO model scenario was prepared for the Hydrologic Feature B depressions based on the drainage areas illustrated on the Storm Drainage Plan (ST-1) prepared as part of the Stormwater Management Implementation Report for the Draft Plan of Subdivision 24T-13002 (RAND Engineering Corporation, April 2019) provided in Appendix D. Pond 1 was modelled as a STANDHYD as the drainage area was 39% impervious whereas, Pond 2 was modelled as a NASHYD as the catchment was less than 20% impervious. The depression storage volumes were calculated by multiplying the estimated runoff volume with the total drainage area for each depression area.

Table 6 summarizes the results of hydrologic modelling results and 2-year, 100-year, and Regional attenuated storage volumes in the depression areas.

**Table 6: Hydrologic Feature B Depressions Hydrologic Modelling Results
(2-Year and 100-Year, 24-hour Chicago Design Storms and Regional Event)**

Return Period	Drainage ID	Drainage Area (ha)	CN Value or % Impervious	Runoff Volume (mm)	Attenuated Runoff Volume (m ³)
2-year	Pond 1	0.20	36%	25.05	51
	Pond 2	0.21	CN* = 80.7	12.95	27
100-year	Pond 1	0.20	36%	67.30	142
	Pond 2	0.21	CN* = 80.7	44.50	94
Regional	Pond 1	0.20	36%	192.19	383
	Pond 2	0.21	CNIII = 86.0	171.36	360

A total of 78 m³, 236 m³ and 743 m³ of runoff is estimated to be attenuated by the Hydrologic Feature B depressions during the 2-year, 100-year and Regional storm events respectively. As presented in Section 5.1 and 5.2, the proposed stormwater management system provides a retention volume of 930 m³ and total storage of 4,530 m³ (930 m³ + 3,600 m³). Since these volumes are greater than the runoff attenuated by the Hydrologic Feature B depressions, these criteria are met.

5.4 Stormwater Quality Control

As outlined in Section 5.0, stormwater quality controls include achieving an Enhanced Level of protection (80% total suspended solids (TSS) removal) as defined by the MECP and completing phosphorus loading calculations to confirm there is no-net increase as a result of the development.

As illustrated on the Preliminary Servicing Figure (Fig. 4), a Jellyfish or approved equivalent is proposed to achieve an Enhanced Level of protection in post-development conditions (80% TSS removal). The specific model of the Jellyfish or equivalent infrastructure will be determined during detailed design.

Phosphorus loading calculations were completed in accordance with Section 7.4.4.4 of the NOCCS Implementation Report and are included in Appendix D. Table 7 summarizes the phosphorus loading calculation results.

Table 7: Phosphorus Loading Calculation Summary

Scenario	Phosphorus Load (kg/yr)	Mitigation Measures
Pre-Development	4.75	/
Post-Development without Mitigation	8.04	/
Post-Development with Mitigation	1.93	Jellyfish or equivalent & Infiltration Tanks

Through the proposed implementation of a Jellyfish or approved equivalent and infiltration tanks in post-development conditions, a phosphorus loading reduction of 2.82 kg/year is anticipated in post-development conditions satisfying the water quality criterion.

5.5 Water Balance

A water balance assessment was conducted to assess potential impacts of the proposed development on the local groundwater conditions. The water balance was conducted under existing (pre-development) and proposed (post-development) conditions. The water balance assessment was conducted in accordance with accepted site condition values from Table 6.3 of the Urban Storm Drainage Criteria Manual: Volume 1 (Urban Drainage and Flood Control District, 2016) and Table 3.1 of the MECP Stormwater Management Planning and Design Manual (MECP, 2003). The appropriate reference tables are provided in Appendix E.

The results of the water balance assessment are presented in Table 8.

Table 8: Summary of Water Balance

Pre-Development Infiltration (mm/yr)	Post-Development Infiltration without Mitigation (mm/yr)	Infiltration Deficit without Mitigation (mm/yr)
94	18	77

5.5.1 Methodology

The water balance on a site can be estimated from the following equation described in Thornthwaite and Mather 1957:

$$P = S + R + I + ET$$

Where: P = precipitation

S = change in groundwater storage

R = surface water runoff

I = infiltration

ET = evapotranspiration/evaporation

The components of the water balance equation can be estimated using field observations of drainage conditions, land cover, soil types, groundwater conditions and local climate records.

5.5.2 Precipitation (P)

The nearest climate station with available 1991–2020 data is the Toronto Pearson (Airport) Climate Station (Climate ID 6158731), located approximately 22.10 km from the Site at 43°27'00.000" N, 80°23'00.000" W, with an elevation of 173.4 masl. As noted, long-term monthly average precipitation and climate data from 1991–2020 were used to support the subject lands' water balance calculations. The long-term monthly averages are presented in Table 9.

Table 9: Climate Data (1991 – 2020) for Kitchener/Waterloo Climate Station

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Precipitation (mm)	61.6	50.2	50.5	76.7	77.6	80.7	74	68.5	69.4	67.2	71.8	58.6	806.8¹
Temperature (°C)	-5	-4.4	0.6	7	13.7	19.2	22.1	21.1	16.9	10	4.1	-1.6	8.6²

Notes: 1. Total average annual precipitation from 1991-2020.
2. Average annual temperature from 1991-2020.

Therefore, based on the data above, the long-term annual average precipitation for the area is 806.8 mm/year and the long-term average temperature for the Site area is 8.6 °C.

5.5.3 Storage (S)

Long-term groundwater storage (S) is assumed to be negligible as no evidence of groundwater impact on significant groundwater pumping or withdrawal is noted in regional studies of the area. The seasonal changes in water levels are expected to balance annually.

5.5.4 Evapotranspiration (ET)

The rate of evapotranspiration is a function of the water holding capacity of the soil, soil and vegetation type and land cover. Through the Thornthwaite and Mather method or a soil moisture balance approach and local climate data, the Potential Evapotranspiration (PET) and the Actual Evapotranspiration (AET) can be calculated (see Appendix E) using the following equations:

$$PET = 16 \times \left(\frac{10Ta}{Hi} \right)^\alpha$$

Where: Ta = average daily temperature, 0 degrees for negative temperature months

Hi = heat index value, assuming 12 hours per day, 30 days a month of daylight

The average heat index value is estimated using the following equation:

$$Hi = \sum_{i=1}^{12} \left(\frac{10Ta}{5} \right)^{1.514}$$

The evapotranspiration factor (α) is determined using the following equation:

$$\alpha = 0.49 + (0.0179 \times Hi) - (0.0000771 \times Hi^2) + (0.000000675 \times Hi^3)$$

PET is adjusted to account for the average number of hours of daylight per month for a given location. The adjustment factor is dependent on the subject property's latitude and is presented in Appendix E (Thornthwaite and Mather, 1957). The PET is multiplied by the adjustment factor per month to determine the Adjusted Potential Evapotranspiration (PET_{adj}).

The Actual Evapotranspiration (AET) is determined using the following equation:

$$AET = PET_{adj} - \Delta S$$

The Change in Soil Storage (ΔS) is depended on the types of soil on the property and the Accumulated Potential Water Loss (APWL) per month. The Change in Soil Storage and Accumulated Potential Water Loss can be calculated using the following equations:

$$\Delta S = S_{mc} \times$$

Where: S_{mc} = soil moisture capacity

APWL = accumulated potential water loss

$$\text{For } \Delta P < 0: APWL = -\sum_{i=0}^{12} PET_i$$

$$\text{For } \Delta P < 0: APWL = \frac{\ln\left(\frac{|AET - PET|}{S_{mc}}\right)}{S_{mc}}$$

The soils on the subject lands were determined to be clay loam soils, referred to as Hydrologic Soil Group CD. Using the Ministry Environment, Conservation and Parks (MECP) Stormwater Management and Design Manual Table 3.1. (2003), the soil moisture capacity was estimated to be 100 mm for clay loam soils in urban lawn environments.

5.5.5 Water Surplus (R+I)

The difference between mean annual P and mean annual ET outputs the amount of water surplus for the subject lands. The water surplus either infiltrates (I) into the soil or travels across the subject lands as runoff (R).

The distribution of water that infiltrates into the soil is a function of an infiltration factor as described in Table 3.1 of the MECP Stormwater Management Planning and Design Manual (MECP, 2003). The infiltration factor for the subject lands is assumed to be 0.6 based on topographic factor of 0.3 for flat land, a soils factor of 0.2 for medium combinations of clay and loam and a land cover factor of 0.1 for open area.

The water balance components were used to estimate the pre-development and post-development water balance scenarios. Detailed water balance calculations for the subject property are provided in Appendix E.

5.5.6 Pre-Development Infiltration

The pre-development water balance calculations are presented in Appendix E. Under existing conditions, the infiltration for the subject lands is calculated to be 94 mm/yr.

5.5.7 Post-Development Infiltration without Mitigation

To complete the post-development infiltration calculation, the proposed development was separated by land use and assigned a percent imperviousness. Based on the water balance components, the calculated post-development infiltration volumes are estimated to be 18 mm/yr. In comparing the pre- and post-development infiltration volumes, the proposed development has the potential to decrease infiltration by 77 mm/yr (81% reduction) without mitigation.

5.5.8 Water Balance Impact Assessment

To address the identified infiltration deficit, the following LID measures have been proposed: one open-bottom stormwater tank and two (2) infiltration chambers. Together, these measures provide a total storage volume of 930 m³.

Based on the mitigation calculations provided in Appendix E, the annual pre-development infiltration volume is equal to 3,659 m³/year based on an annual infiltration of 94 mm/yr. Based on an estimated 40 runoff-producing rainfall events per year as referenced in the 1994 MOE Stormwater Management Manual approximately 91 m³ of runoff is infiltrated on the subject lands on average during each runoff-producing rainfall event.

Given that the proposed LID measures provide 930 m³ of storage, which significantly exceeds the required 91 m³, the proposed LID measures provide a substantial surplus in infiltration capacity and satisfies all applicable water balance criteria.

6.0 Impacts to the Existing EIR/FSS

As outlined in the Red-lined Terms of Reference for the EIR/FSS addendum, this report has been scoped to address how the drainage and stormwater management strategy for the subject lands (4243 Sixth Line) will be incorporated into the overall stormwater management strategy for Subcatchment SM1. Section 5.0 of this report presents how the proposed private stormwater management strategy for the subject lands can meet the required stormwater management criteria for Subcatchment SM1. However, the current proposed stormwater management approach for the subject lands will result in minor changes being required to the findings in the existing EIR/FSS related to conceptual Pond 15.

The existing EIR/FSS assumed that the subject lands would be serviced by a conceptual Pond 15 located southwest of the subject lands. However, as outlined in Section 5.0 of this report, the subject lands will be serviced by a private stormwater management system. Therefore, the drainage area and impervious coverage included in Table 7.5 – *Summary of Pond 15 Characteristics* in the existing EIR/FSS should be revised to exclude the subject lands. The Pre-Development Drainage Figure (Fig. 1) can be used as a reference when Pond 15's characteristics are revised during the development studies of the other lands within Subcatchment SM1. Additional modelling should then be conducted based on these new characteristics to update the operating values of the pond presented in Table 7.6 – *Pond 15 Inflow/Volume Characteristics* and any other applicable recommendations contained within the existing EIR/FSS report.

7.0 Monitoring Program

Similar to the existing EIR/FSS, a monitoring program will be required for the proposed stormwater management infrastructure on the subject lands and is as follows:

7.1 Erosion and Sediment Control Planning, Inspection and Monitoring

Erosion and sediment controls will be installed prior to the commencement of any construction activities and will be maintained until the subject lands are stabilized or as directed by the Site Engineer and/or the Town. Controls will be inspected after each significant rainfall event and maintained in proper working condition. The design of the temporary erosion and sediment control infrastructure will be prepared during detailed design.

7.2 Performance Assessment Monitoring of Stormwater Management Facilities

The proposed stormwater management facilities on the subject lands are to be assessed to determine whether the performance of the facilities meets their design objectives. As outlined in the existing EIR/FSS and NOCSS, a three-year monitoring period is recommended. The details of the monitoring requirements will be prepared prior to construction through the preparation of an Operation, Maintenance, and Monitoring Plan.

No baseline monitoring or geomorphic monitoring is required as they have been included as part of the existing EIR/FSS and monitoring prepared for the development of the Star Oaks Development Lands.

8.0 Conclusion and Recommendations

The proposed development will consist of two (2) industrial buildings, the conversion of the heritage building into an office, and associated internal road and parking areas. The existing cell tower will continue to function as in existing conditions.

Based on details contained in this report, conclusions for the proposed development include:

- Water servicing is proposed to be provided by extending a 200 mm diameter watermain approximately 240 m along Sixth Line to the 300 mm municipal diameter watermain located within William Halton Parkway.
- The 200 mm watermain is proposed to split at the property line into a 200 mm diameter fire line and a 100 mm diameter domestic service and be routed towards each building and fire hydrants. The building's internal water distribution system will be designed by the Mechanical Engineer at the detailed design stage.
- Sanitary servicing is proposed to be provided by extending a 250 mm diameter PVC sanitary sewer approximately 210 m along Sixth Line to an existing sanitary maintenance hole located south of the William Halton Parkway roundabout.
- 250 mm diameter PVC sanitary sewer stubs will be provided adjacent to each industrial building. The sanitary collection system within each building will be designed by the Mechanical Engineer at the detailed design stage.
- A private forcemain is required for the heritage building connection with an associated grinder pump or equivalent to be designed by the Mechanical Engineer during detailed design.

- The required quantity control for the proposed development was determined based on the unitary flow rates provided in the existing EIR/FSS. Quantity control will be provided via an underground stormwater tank with a storage volume requirement of 3,440 m³.
- Erosion control is achieved by proposing the retention and infiltration of the runoff generated within the proposed development during the 25 mm, 4-hour Chicago Storm event. Infiltration is proposed through underground infiltration tanks.
- The provided retention and total stormwater storage volumes within the proposed stormwater management system is greater than the runoff attenuated by the Hydrologic Feature B depressions during the 2-year, 100-year, and Regional events.
- The Enhanced Level of quality control (80% TSS removal) as defined by the MECP is proposed to be achieved through a Jellyfish or approved equivalent.
- A reduction in phosphorus loading is anticipated in the post-development scenario through the proposed implementation of a Jellyfish or approved equivalent and infiltration tanks.
- A site wide water balance was completed for the subject lands. Using the Thornthwaite and Mather method the pre-development infiltration was determined to be 94 mm/yr and post-development infiltration without mitigation was determined to be 18 mm/yr. Therefore, the infiltration deficit without mitigation was calculated to be 77 mm/yr, however, the proposed infiltration galleries is anticipated to provide a surplus in infiltration during post-development conditions and satisfies all applicable water balance criteria.

Based on the above conclusions and requirements outlined in the existing EIR/FSS, we recommend the approval of the Zoning By-Law Amendment for the proposed mixed-use development from a water, wastewater, and stormwater management perspective.

Respectfully submitted,

C.F. CROZIER & ASSOCIATES INC.


James Fletcher
Engineering Intern, Land Development

MPH/tc

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C.F. CROZIER & ASSOCIATES INC.


Jayesh Boily, P.Eng.
Project Engineer, Land Development



APPENDIX A

Background Information

C.F. Crozier & Associates Inc. (Crozier) has been retained to complete an addendum to the existing Environmental Implementation Report/Functional Servicing Study for Sixteen Mile Creek (EIR/FSS) prepared for the lands owned by Star Oak Developments Limited, dated April 2018. The addendum will be scoped to address how the drainage and stormwater management strategy for the proposed development located at 4243 Sixth Line (subject lands) will be incorporated into the overall stormwater management strategy for the Sixteen Mile Creek subcatchment. This subcatchment is known as “SM1” according to the North Oakville Creeks Subwatershed Study (NOCSS).

This document in its original form is the existing and approved Terms of Reference for an EIR/FSS report in the Town. The Town has requested this Terms of Reference be red-lined to outline the scope of work required for the EIR/FSS Addendum that will support the zoning approvals of the subject lands.

These red-lines have been prepared based on the below discussions with the Town of Oakville and background documents:

- Email correspondence (Yao to Fletcher, November 6, 2025 & November 24, 2025)
- Meeting (MS TEAMS, November 13, 2025)
- Email correspondence (Khorshid to Fletcher, November 19, 2025)
- Environmental Implementation Report/Functional Servicing Study for Sixteen Mile Creek (April 2018)
- North Oakville Creeks Subwatershed Study (August 2006)

Appendix A-1

EIR/FSS Terms of Reference

TOWN OF OAKVILLE

NORTH OAKVILLE

**ENVIRONMENTAL IMPLEMENTATION REPORT and
FUNCTIONAL SERVICING STUDY**

TERMS OF REFERENCE

AUGUST 2, 2007 Revised on December 1, 2025 to outline scope of 4243 Sixth
Line's EIR/FSS Addendum

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**NORTH OAKVILLE
ENVIRONMENTAL IMPLEMENTATION REPORT AND
FUNCTIONAL SERVICING STUDY
TERMS OF REFERENCE**

1.0 INTRODUCTION

1.1 Background

The North Oakville Creeks Subwatershed Study, including addenda (NOCSS) provides the Management Strategy for the North Oakville Secondary Plan area. The limits of this area are illustrated in Figure 1.1.1, and include the lands north of Dundas Street to the Highway 407 corridor and from Tremaine Road east to Ninth Line. The Management Strategy and associated North Oakville Secondary Plan provide direction for land development within the North Oakville lands.

Integral to these documents is the goal of preserving a sustainable Natural Heritage System (NHS) for maintaining landscape diversity within an urban context. In accordance with this goal, the NOCSS was completed, providing recommendations with respect to the management approach for natural heritage/open space and stream systems. There are certain lands, including watercourses, that are restricted from development and others that have specified limitations or constraints. The Management Strategy and associated North Oakville Secondary Plan also outline requirements with regard to stormwater management, land use policies and servicing.

The NOCSS is divided into four sections, which follow the four phases of a subwatershed management approach:

- i) Characterization
- ii) Analysis
- iii) Management Strategy
- iv) Implementation

The Management Strategy for North Oakville is outlined in the last two NOCSS sections: Management Report and Implementation. In the Implementation Report, the processes to be followed as well as implementation details are outlined including the need for an Environmental Implementation Report (EIR) and a Functional Servicing Study (FSS) in support of future Draft Plans of subdivision (Draft Plans). A general overview of the planning/implementation framework is illustrated in Figure 1.1.2, which indicates how the EIR/FSS fits within this process.

1.2 Purpose

The purpose of the EIR is to characterize and analyse the natural heritage features and functions and to determine and address the potential impacts of a proposed development application, including servicing requirements, on the NHS. The purpose of the FSS is to identify servicing requirements related to sanitary, water, stormwater, roads and site grading.

Further, the purpose of both the EIR and FSS is to provide a link between the Management Report, Implementation Report, the Secondary Plan, and the Draft Plan submissions for future development applications.

It is recognized that the approach to servicing will, in large part, be guided by conditions within the NHS, including cores, linkages and stream corridors. In addition, the characteristics of these areas may require

the use of measures to protect the function of the NHS from impacts (i.e., prevention of changes to the surface water and groundwater systems to maintain flows to the NHS). As a result, the EIR and FSS must be integrated and may be produced as a joint document.

It is intended that this document provides the Terms of Reference for completion of an EIR and FSS. The EIR/FSS document sets out the study requirements and obligations, including monitoring, for works installed in the secondary plan area, including the NHS. These are the obligation of the landowner proponent who proposes the development or proposes to install the works. In some cases, the Town or the Region may be the proponent of certain works in the secondary plan area or in the NHS. In this latter instance, the study requirements and obligations, including monitoring, are the proponent Town's or the proponent Region's as the case may be and the obligations are not the landowner's obligation.

The preparation of an EIR/FSS is to assist in the development of a Draft Plan. It is to ensure that the requirements of the Subwatershed Strategy and Secondary Plan are met and that the site characteristics are understood in sufficient detail to provide the information necessary for processing of the Draft Plan and to provide conditions of approval. These studies also will support agencies' approvals.

If the Draft Plan does not conform to the Secondary Plan, other planning approvals may be required.

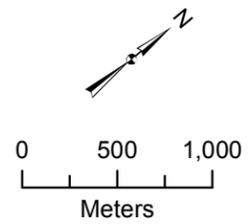
The objectives to be fulfilled by the EIR and FSS are to:

- Demonstrate how the subwatershed requirements set out in the NOCSS Management Report (including targets), the Implementation Report, and Secondary Plan are being fulfilled in all proposed Draft Plans;
- Provide sufficient level of conceptual design to ensure that the various components of NHS and infrastructure can be implemented as envisaged in the NOCSS and Secondary Plan and to ensure that the Draft Plans are consistent with this conceptual design;
- Ensure servicing requirements as determined in the FSS for the areas external to the Draft Plan are adequate;
- Identify details regarding any potential development constraints or conflicts and how they are to be resolved;
- Provide any further implementation details as needed;
- Streamline the Draft Plan approval process; and,
- Facilitate the development of Draft Plan conditions.

The EIR/FSS Terms of Reference are broken down into sections to discuss the overall approach, and details of the studies needed, including monitoring.



NORTH OAKVILLE CREEKS SUBWATERSHED STUDY



Legend

- Road
- Watercourse
- Secondary Plan Boundary
- EIR Nodes
- EIR Subcatchments

EIR Subcatchment Plan

Figure 23.11.1



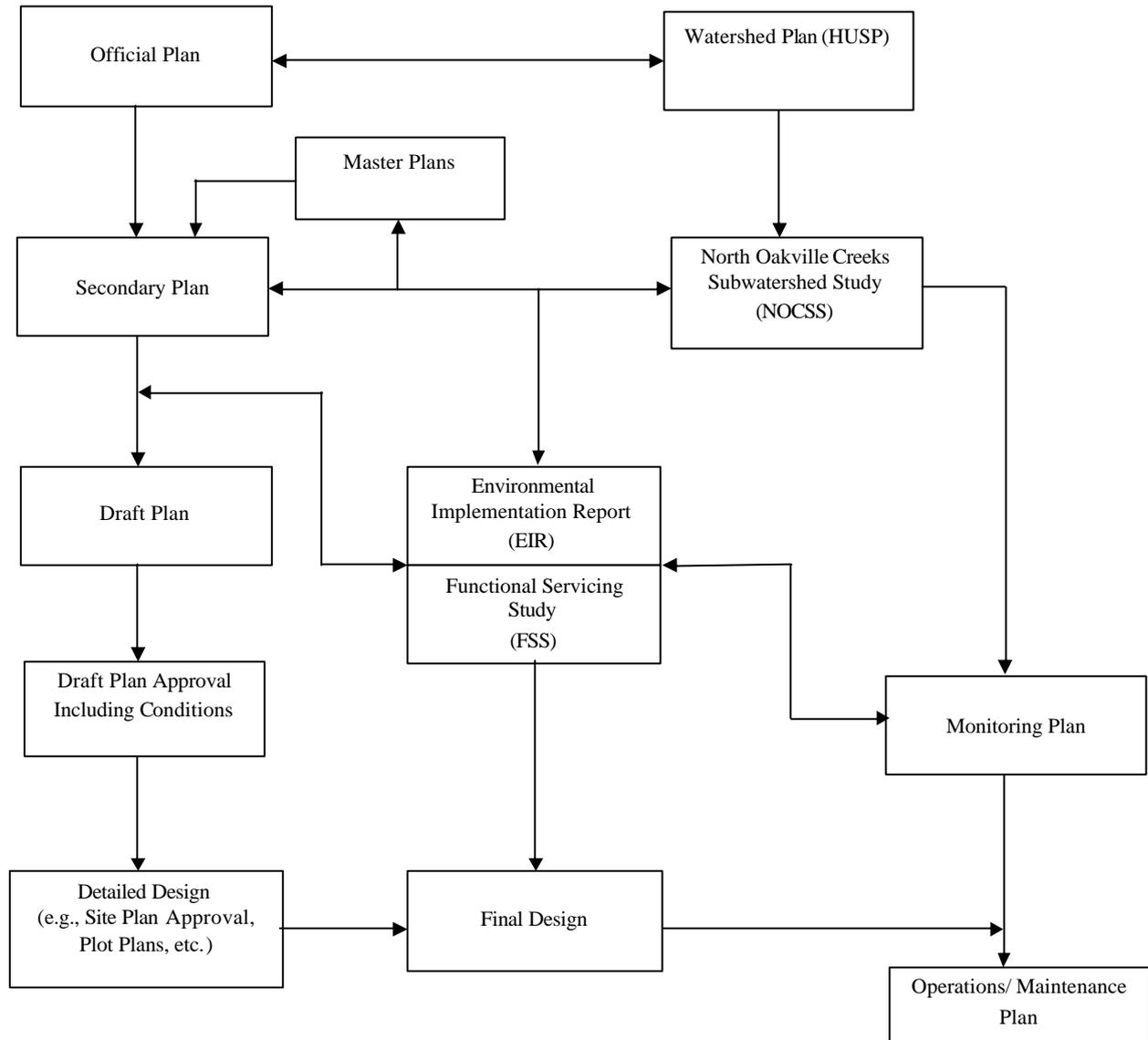
August 2006

Figure 1.1.2

OVERVIEW OF SUBWATERSHED PLANNING IMPLEMENTATION FRAMEWORK

Planning Steps

Supporting Analysis and Design



2.0 APPROACH

2.1 Overview

The EIR/FSS is to demonstrate how the proposed development will meet the requirements set out in the Management Strategy and Secondary Plan. To do this, comprehensive technical analyses and design concepts will be necessary as part of the EIR/FSS. It is the intention of these Terms of Reference to indicate how the analyses, design concepts and related reports are to be prepared.

2.2 Agencies

It is intended that the EIR/FSS, and subsequent Draft Plans, will be reviewed by the following agencies as related to their respective jurisdictions:

- Town of Oakville
- Region of Halton
- Conservation Halton

The above noted agencies will be the primary contact groups for the EIR/FSS submissions. Depending upon the conditions related to the EIR subcatchment area, it may be decided by one or more of the agencies, primarily Conservation Halton and the Town of Oakville, that input and approval will be needed from the Ministry of Natural Resources (MNR) and/or Department of Fisheries and Oceans (DFO). This input will be coordinated by the Town and Conservation Halton. It is understood that proponents can liaise with the agencies as necessary as part of this process. Input from DFO is anticipated in the review of conceptual and final design on any sections of streams where fish habitat compensation is required.

2.3 Study Areas

It is intended that the EIR be carried out on a subcatchment basis, which forms the study area for the EIR. The EIR subcatchments are illustrated on Figure 1.1.1. The study area for the FSS will focus on the proposed development area for the intended Draft Plans (referred to as “proposed development area” in subsequent sections of this document). It is recognized that consideration will likely be required beyond the FSS study area to ensure that servicing can be provided for neighbouring areas.

Each EIR/FSS will be evaluated to ensure that the flows outletting from each area are managed in a manner that will properly protect the receiving stream(s), in accordance with the NOCSS Management Strategy. Carrying out the EIR based on the specified subcatchments will address the following:

- Preservation of drainage areas to the various stream branches within the subwatersheds; and,
- Provide for meeting target flows, water quality and erosion targets for the various receiving points along the streams.

In some cases, the study area for the NHS system (cores and linkages, and streams) may extend beyond the subcatchment, as discussed in Sections 3.2 and 3.3.

It is recognized that the EIR subcatchment areas do not correspond to land ownership boundaries and that it may be difficult to ensure the cooperation of landowners to carry out an EIR/FSS within the specific

study subcatchment. Every effort should be made to facilitate cooperation between landowners to carry out the EIR/FSS within the EIR subcatchment. If more than one landowner within an EIR subcatchment is active in the EIR/FSS process, only one EIR study will be permitted (i.e., no concurrent EIR studies for the same area). Subsequent development in the EIR subcatchment area will require the preparation of a separate FSS and an update of the EIR, to conform to the findings and recommendations of all previous EIR/FSS studies. In the event that this concurrent joint report cannot be accomplished, it is recognized that consideration will be given to permitting a modified approach. In that event, certain conditions will need to be met to ensure that the requirements of the Management Strategy and Secondary Plan are met and that any proposed development does not place any undue restrictions on other lands within the EIR subcatchment area not included in the study.

Various scenarios could arise where the proposed development (Draft Plan areas of participating owners) does not correspond to the EIR subcatchment area boundary. Anticipated scenarios and the approach that should be used for each are outlined in the following items. These are presented as examples and do not include all potential scenarios:

- i) The proposed development is in the upstream portion of the EIR subcatchment.
 - EIR/FSS will need to indicate how land will be serviced on an interim and final basis;
 - If the existing receiving watercourse is used as an outlet, assumptions as to the final outlet conditions are to be indicated. The submission must demonstrate how drainage from upstream lands including stormwater management systems, will be conveyed to a suitable outlet without placing undue restrictions on the serviceability of adjacent lands;
 - If a proposed stormwater management (SWM) facility is downstream of the proposed development, an interim facility may be provided, with a long-term approach indicated, in the event that a permanent facility is not constructed;
 - If stream modifications extend beyond the limits of the proposed development area (e.g., lowering or relocations), they also must be addressed conceptually;
 - Conceptual design of trunk services within the EIR subcatchment must be prepared, including appropriate allowances for connections to areas external to the Draft Plan and/or EIR subcatchment, demonstrating servicing viability without placing undue restrictions on external areas (e.g., considering sewer depths and grading); and,
 - Street and land use patterns outside of the proposed Draft Plan are to be provided as per the Secondary Plan with input from the Town of Oakville.

- ii) The proposed development is in the downstream portion of the EIR subcatchment.
 - EIR/FSS will need to indicate how land will be serviced/graded on an interim and final basis;
 - If SWM facility is located in the proposed development area and is to service the upstream portion of the subcatchment, the facility is to be sized for the entire upper subcatchment, based on the land use from the Secondary Plan with input from the Town of Oakville;
 - If stream modifications extend beyond the limits of the proposed development area (e.g., lowering or relocations), they also must be addressed conceptually;
 - Conceptual design of trunk services within the EIR subcatchment are to be prepared, including appropriate allowances for connections to areas external to the Draft Plan and/or EIR subcatchment, demonstrating servicing viability without placing undue restrictions on external areas (e.g., considering sewer depths and grading); and,
 - Street and land use patterns outside of the proposed Draft Plan are to be provided as per the Secondary Plan, with input from the Town of Oakville.

- iii) The proposed development is within the majority of the EIR subcatchment with minor portions outside.
- Consideration will be given to minor adjustments in subcatchment boundaries with the conditions that the adjustments would not put undue restrictions on the servicing of adjacent subcatchments and demonstrate no negative impacts to flooding, erosion and the NHS; and,
 - If no change in subcatchment boundary is proposed, consideration is to be given to how development in the adjacent subcatchment is to be serviced. Conceptual drainage patterns are to be developed and profiles generated to ensure that the area can be serviced.

3.0 STUDY REQUIREMENTS

Studies are required for the EIR/FSS in the areas of:

- ~~Land Use~~
- ~~Cores and Linkages~~
- ~~Stream Systems, Fish, and Fish Habitat~~
- Grading, Drainage and SWM
- Hydrogeology
- ~~Sanitary, Water, Roads~~
- ~~Trails~~

EIR/FSS Addendum is scoped to drainage and stormwater management per email correspondence with the Town (Yao to Fletcher, November 6, 2025). Hydrogeology will also be reviewed from a water balance perspective.

The specific study requirements are outlined in the following sections.

~~3.1 Land Use~~

~~The proposed land use, road patterns and servicing layout are to be provided through the EIR/FSS submission. The EIR/FSS submission should reflect the Secondary Plan land uses. Further land use details will be provided in the corresponding Draft Plans. If the EIR subcatchment extends beyond a particular Draft Plan, land use details in those areas must reflect the Secondary Plan, with input from the Town of Oakville.~~

~~The land use map for the portions of the EIR subcatchment area that are outside the limits of the Draft Plan will include details for the following to demonstrate the Draft Plan context with regard to the rest of the subcatchment:~~

- Land use designations
- Natural heritage system (cores, linkages and stream corridors)
- Major roads
- Major services
- SWM Blocks
- Trails

~~Planning input to the EIR/FSS is needed to demonstrate the logical coordination of land uses, road connections and open space linkages and features for the Draft Plan(s), lands extending beyond the limits of the Draft Plan(s), and potentially beyond the limits of EIR subcatchment area.~~

~~Not applicable - see note Section 3.0~~

3.2 Cores and Linkages

3.2.1 Introduction

Not applicable - see note Section 3.0.
Additionally, no Core or Linkages
existing on the subject lands.

The following section summarizes the study requirements for cores and linkages in the EIR/FSS. The NOCSS and current approaches to natural heritage planning strongly recommend that certain study components be completed at a larger ecologically based study area than the proposed development area (i.e. the EIR subcatchment boundaries or beyond). On the other hand, certain impact assessments require details that are only available at the Draft Plan level of detail. As such, the following discussion of the Terms of Reference is divided into two components.

- Study components that must be completed at the EIR subcatchment area level or beyond: This level of study is required since many ecological processes and features extend beyond the limits of a single Draft Plan and require analysis based on ecological study boundaries in order to understand the factors that drive the sustainability of the ecosystem; and
- Study components that require Draft Plan level of detail in order to be completed: This level of study focuses on detailing the potential impacts of proposed land use changes on the natural features and functions. As such, details regarding the proposed undertaking must be available in order to understand the sources of, and potential mitigation of, potential impacts.

In cases where an entire EIR subcatchment area is covered by participating landowners, the two levels of detail can be integrated. In cases where a Draft Plan(s) for only a portion of the lands within a particular EIR subcatchment area is being advanced, it is critical that proponents have regard for the varying levels of detail at each level.

3.2.2 Cores

EIR Subcatchment Area Level of Detail:

- Confirm limits of EIR subcatchment and FSS study area based on overlap of Draft Plan(s) with subcatchments, extent of cores, especially those that extend beyond subcatchment boundary (for linkages see below);
- Delineate core boundaries based on NOCSS and present the boundaries on recent aerial photographs;
- Assemble background information on natural environment features and functions within the core(s) from the NOCSS and other secondary sources, including features, functions and management recommendations;
- Conduct preliminary field review of features to confirm limits and character of vegetation communities (e.g. roadside review or similar using recent aerial photographs); and,
- Identify any effect of other works (i.e. road crossings, servicing, SWM etc.) and associated requirements related to cores and linkages.

Draft Plan Level of Detail:

- Complete appropriate seasonal field surveys of the limits of woodlands, wetlands and other habitats associated with the core(s), generally within 50m of vegetation community boundaries that define the limit of the core;

Not applicable - see note Section 3.0.
Additionally, no Core or Linkages
existing on the subject lands.

- Apply the buffers to the natural features based on the NOCSS recommendations, to define the boundaries of the core;
- Stake and survey the boundaries of core areas including limit of buffers based on guidance provided in NOCSS;
- These staked core boundaries are to be confirmed in the field by staff of Conservation Halton, Town of Oakville and Ministry of Natural Resources (at the discretion of Conservation Halton);
- Identify limits of grading adjacent to a core, and assess the impacts of any grading adjacent to the core(s), and detail mitigative measures and/or management recommendations, where needed;
- Detail the proposed drainage characteristics of lands adjacent to core and assess any impacts associated with drainage to the natural features, functions and management recommendations;
- Detail stormwater management facilities proposed adjacent to the core(s) and assess the impacts of construction and operation of the stormwater management facility on core features, functions and management recommendations;
- Where a SWM pond is permitted within a core, stake and survey the limit of stormwater management pond block overlap with the core boundary (as per NOCSS). This is to be reviewed in the field by agencies as noted above, and the impacts of construction and operation of the stormwater management facility on core features, functions and management recommendations assessed;
- Identify all services, utilities etc. proposed to be located adjacent to or within cores and assess the potential impacts of these facilities on core features and functions;
- In cases where a core is crossed by a road installed by a proponent, provide information respecting the road characteristics and identify potential impacts to features and functions within the core, (including delineation of features) and protective measures;
- Detail location, type and size of crossing structures from a wildlife movement (ecopassage) perspective;
- Detail any restoration measures within the core that may be triggered by proponent proposals to encroach into cores (road crossings, SWM);
- Detail mitigative measures and assess potential residual impacts of proponent works within the cores and any proponent grading or works adjacent to the cores. Provide evidence that alternative methods and measures for minimizing impacts have been considered; and,
- Develop a plan for monitoring the mitigative measures noted above, based on liaison with agency staff (Conservation Halton, Town of Oakville).

3.2.3 *Linkages*

EIR Subcatchment Area Level of Detail:

- Confirm limits of EIR subcatchment and FSS study area based on the overlap of Draft Plan(s) with subcatchments, and extent of linkages (i.e. identify cases in which linkages extend beyond limits of subcatchment and include these areas within study);
- Delineate linkage areas based on NOCSS and present the boundaries on recent aerial photographs;
- Assemble background information on natural environment features within linkages from NOCSS and other secondary sources;
- Conduct a preliminary field review of features to confirm limits and character of vegetation communities within linkages (e.g. roadside review or similar as well as recent aerial photographs);

Not applicable - see note Section 3.0.
Additionally, there are no existing
streams on the subject lands.

- Review stream corridor assessment to ensure that any proposed proponent modifications to stream corridors (locations, widths, etc.) that may influence linkages are identified;
- Show linkage limits in conjunction with conceptual subcatchment-level stream corridor on plans.

Draft Plan Level of Detail:

- Delineate and describe any natural features (e.g., hedgerows, wetlands etc.) that are to be incorporated into the linkage, and stake and survey as necessary;
- Identify means by which these features will be protected during development/construction process;
- Identify the boundaries of linkage areas, and confirm them in the field with staff of Conservation Halton, Town of Oakville and Ministry of Natural Resources (at the discretion of Conservation Halton);
- Identify limits of grading, and assess any impacts of re-grading within linkage and adjacent to the protected features within linkage;
- Detail the drainage characteristics of lands adjacent to natural features within linkages to be retained (if any), and assess any impacts associated with drainage to the natural features;
- In cases where a linkage is crossed by a road(s) installed by a proponent, detail the road characteristics and identify potential impacts to features within the linkage (if any) including delineation of features and protective measures, detail location, type and size of crossing structures from a wildlife movement (ecopassage) perspective;
- Identify the limit to which a stormwater management pond overlaps with linkage boundary (as per NOCSS), to be reviewed in the field by agencies as noted above;
- In linkages which include stream corridors, it may be necessary to stake and survey the linkage (and the SWM pond overlap) at this time;
- Detail any restoration/naturalization measures within the linkage when proponent intrusion has occurred.
- Detail mitigative measures and assess potential residual impacts of proponent works/intrusions; and,
- Develop a monitoring plan of the mitigative measures noted above, based on liaison with agency staff (Conservation Halton, Town of Oakville).

3.3 Stream Systems, Fish Habitat and Fish Communities

3.3.1 Introduction

The Natural Heritage System for North Oakville includes protection and enhancement of high and medium constraint streams, which are identified as red and blue streams respectively in the Secondary Plan. This approach identified the “provision of a corridor system for streams that have been identified as having environmental characteristics or watershed functions that require protection and/or enhancement to meet the watershed goals and objectives” (NOCSS, Management Report Section 6.3.2).

The stream corridors identified in the NOCSS and Secondary Plan were developed using the concept of riparian corridor identification. The classification was based upon the stream characteristics and related processes considering the role of adjacent lands. This approach then identified the streams to be protected as well as the width of neighbouring lands, or corridor widths that need to be protected. This classification was developed in conjunction with the Department of Fisheries and Oceans and

Not applicable - see note Section 3.0.
Additionally, there are no existing
streams on the subject lands.

Conservation Halton, who conducted field surveys with representatives of the Town of Oakville subwatershed team.

The corridors have been identified in the Management Strategy and Secondary Plan as well as the conceptual width requirements. It is the intent that the corridor widths of the red and blue streams, and the end points of the reach delineations are to be refined as part of the EIR/FSS study. The factors to be considered in the refinement of the stream systems and corridor widths include:

- Regulatory floodplain;
- Fluvial geomorphologic requirements;
- Stable slope top of bank;
- Fish and fish habitat protection requirements;
- Preservation of hydrogeologic functions;
- Edge of any identified terrestrial features;
- Hydrologic Features "A"; and
- Setback and buffer requirements.

The following sections present a summary of the EIR/FSS study requirements for the development of North Oakville with respect to the streams component of the NHS.

3.3.2 Existing Conditions and Constraint Mapping

The following tasks must be undertaken by the proponent in order to fulfill the requirements of the EIR/FSS:

- Describe the proposed land use change and associated servicing issues;
- Confirm limits of EIR subcatchment area based on the NOCSS;
- Assemble and review all relevant materials pertaining to the stream system of the NHS including the Secondary Plan and NOCSS and other studies;
- Compile existing conditions and constraints (from existing data) and display on recent aerial photographs to delineate the stream system of the NHS; and,
- Review and summarize factors leading to the identification of the corridor constraint level from a natural heritage perspective.

3.3.3 Detailed Studies

The following sections summarize the detailed study requirements for:

- Corridor Width Delineation
- Fish and Fish Habitat
- Stream Modification and Rehabilitation

3.3.3.1 Corridor Width Delineation

Through the NOCSS, stream corridor widths were developed on a broad scale and, as such, are subject to refinement during the EIR/FSS stage. **Figures 6.3.15a, 6.3.15b and 6.3.15c** in the Management Report of

Not applicable - see note Section 3.0.
Additionally, there are no existing
streams on the subject lands.

NOCSS and an Appendix of the Secondary Plan provide illustrations clarifying the stream corridor delineation process. The corridor is defined considering the factors outlined in Section 3.3.1.

Specifically, the following tasks must be completed by the proponent in order to fulfill the EIR/FSS requirements:

a) Geomorphology:

- Confirm delineation and potential refinement of stream reaches as outlined in the NOCSS;
- On a reach basis, conduct an historic evaluation of changes in land use and channel configuration over time utilizing a series of historic aerial photographs or mapping that extend from the earliest (i.e., 1930's to 1950's) to most recent coverage available;
- Based on the results of the historic evaluation, quantify the 100-year erosion rate on a reach basis;
- Delineate meander belt width on a reach basis, following *Belt Width Delineation Procedures* (PARISH Geomorphic Ltd., 2004). It should be noted that factors affecting the ultimate stream corridor width include degree of channel confinement, type of valley system (i.e., major or minor valley), channel position relative to the valley wall and proposed servicing modifications;
- As per **Figures 6.3.15a** and **6.3.15b**, apply the 100-year erosion rate to each side of the belt width as a factor of safety (in lieu of an historic evaluation, a factor of safety represents 10% of the meander belt width on each side (total of 20%) or as determined through a 100-year erosion rate of channel bends that define the belt width); and,
- Perform field investigations, including rapid geomorphic assessment, to confirm desktop analysis, with respect to the 100-year erosion rate and meander belt width on a reach-by-reach basis.

b) Regulatory Floodplain

- The floodplain will be defined for all medium and high constraints streams, which are identified as red and blue streams respectively in the Secondary Plan;
- The floodplain calculations shall be based on the applicable Provincial Technical Guidelines (i.e., Technical Guide – River & Stream Systems: Erosion Hazard Limit, Ministry of Natural Resources & Watershed Science Centre, 2002). It is intended that the Regulatory Floodplain would be determined through this process. Further the calculations should include consideration of:
 - Flow rates based on Regional Storm (existing or future land use, as appropriate (see Section 3.4.4)) or 100-year flood event, whichever is greater;
 - Stream corridor hydraulic properties (i.e. roughness), based on existing and planned ultimate conditions;
 - Where alteration of any existing floodplains is proposed, demonstrate the preservation of floodplain stage-storage-discharge in accordance with directions in the NOCSS; and
 - Field surveys to provide cross-sections and an invert profile to provide for updated regulatory floodlines to Conservation Halton specifications.
- A full range of return period flood levels will be calculated for the purpose of maintenance of riparian storage calculations, SWM facility and outlet design, etc.

Not applicable - see note Section 3.0.
Additionally, there are no existing
streams on the subject lands.

c) Geotechnical

- As per **Figure 6.3.15a** and in fulfillment of Conservation Halton's *Policies, Procedures and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document* (2006), a site specific study must be completed to determine the toe erosion allowance on a reach basis for confined river systems;
- As per **Figure 6.3.15a** and in fulfillment of Conservation Halton's *Policies, Procedures and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document* (2006), a geotechnical stable slope assessment must be completed to determine the 'stable slope top of bank' in a confined setting. The stable slope line is to be drawn from the limit of the toe allowance;
- As per **Figure 6.3.15b**, if a stream within an unconfined corridor will be lowered for servicing such that the valley depth becomes greater than or equal to 2 metres, then geotechnical stable slope design must be incorporated (refer to **Figure 6.3.15a**);
- The physical (or geographical) 'top of bank' of valley features greater than or equal to 2 metres in height, will be established in the field in conjunction with Conservation Halton and Town of Oakville staff, and the applicant. The top of bank, as staked in the field, will represent the limit of the physical top of bank. When staking the limit of the physical top of bank, staff of Conservation Halton will require that the applicant's surveyor be in attendance during the site walk; and,
- Based on the results of the geotechnical stable slope assessment, identify the greater of the 'stable slope top of bank' and the 'physical top of bank'.

d) Fish Habitat Setback

- Identify any relevant fish habitat setbacks, on a reach basis. These setbacks are to be based on the fisheries buffers recommended in the NOCSS Management Report, and as confirmed through the studies outlined in Section 3.3.3.2;
- With respect to Species at Risk, fish habitat setbacks will be identified on a reach basis with reference to NOCSS, and through discussions with relevant agencies; and,
- As per **Figures 6.3.15a** and **6.3.15b**, these fish habitat setbacks are to be applied to the bankfull channel, or unless otherwise specified in the NOCSS Management Report.

e) Valleylands Setback

- Determine the nature of the valley setting (major or minor) on a reach basis. Major valley system refers to the Sixteen Mile Creek valley system, and the balance of the valley systems in North Oakville are minor systems;
- In confined river systems, a 15 metre setback must be applied to the stable slope top of bank for major valley systems and a 7.5 metre setback must be applied to the stable slope top of bank for minor valley systems;
- In unconfined river systems, a 15 metre setback must be applied on both sides of the meander belt allowance for major valley systems and a 7.5 metre setback must be applied on both sides of the meander belt allowance for minor valley systems; and
- In some cases, the Regulatory Floodline may define the corridor width. Floodplain modifications (subject to the approval of Conservation Halton) may alter the location of the floodline in which case the setback would be applied to the altered floodline.

Not applicable - see note Section 3.0.
Additionally, there are no existing
streams on the subject lands.

It should be noted that, as per **Figure 6.3.15c**, the final corridor width determined on a reach basis for confined river systems represents the greater of the meander belt width plus factor of safety plus major/minor valley system setback OR the stable slope top of bank plus toe erosion allowance plus major/minor valley system setback. If servicing modifications are proposed within the identified land use change, the proponent must be cognizant of the implications of channel deepening which may result in a reclassification of degree of stream confinement.

f) Forested Stands within Stream Corridors

The presence of forested stands within stream corridors was not used as a factor directly affecting stream corridor widths in the NOCSS. However, preservation of forested stands within stream corridors is generally preferred, and recommendations were provided in the NOCSS for forest preservation within stream corridors. For the purposes of an EIR/FSS, the following tasks must be completed:

- Use a combination of aerial photographs, ground-truthing, and ELC mapping to determine the extent of forested cover within potential stream corridor(s) (as defined by other factors discussed in this section of the Terms of Reference);
- Identify the characteristics of forested stands and their relationship to the stream corridor (including potential implications, if any, on stream corridor width/location); and,
- Identify forested stands within the stream corridor(s) and measures to be used to protect and/or manage them as appropriate.

3.3.3.2 Fish and Fish Habitats

Introduction:

The following section summarizes the study requirements for fish and fish habitats in the EIR/FSS. An assessment of fish habitat throughout the EIR subcatchment area will be required. This will provide the context and ensure that connectivity to fish habitats throughout the subcatchment are understood and addressed as required by DFO. On the other hand, certain impact assessments require details that are only available at the Draft Plan level of detail, especially those associated with proposed stream modifications. As such, the following discussion of the Terms of Reference is divided into three components.

- Study components that must be completed at the EIR subcatchment area level or beyond: This level of study is required to assess fish habitats that extend beyond the limits of a single Draft Plan and require analyses based on subcatchment boundaries in order to understand the factors that drive the sustainability of the aquatic ecosystem;
- Study components that require Draft Plan level of detail in order to be completed: This level of study focuses on detailing the potential impacts of proposed land use changes on the fish habitats. As such, details regarding the proposed undertaking must be available in order to understand the sources of, and potential mitigation of, potential impacts; and,
- Study components that focus on cases of proposed modifications to streams.

Not applicable - see note Section 3.0.
Additionally, there are no existing
streams on the subject lands.

EIR Subcatchment Area Level of Detail:

- Carry out the work necessary to refine, map and describe stream reaches on an EIR subcatchment area basis to compare this mapping to mapping done for the NOCSS Characterization Report, and present findings on recent aerial photographs to determine any changes to channel alignment or location relative to the NOCSS;
- Assemble background information on fish and fish habitats from the NOCSS and other secondary sources;
- Conduct a preliminary field review (e.g. roadside review or similar as well as recent aerial photographs) of aquatic habitat factors leading to the classification of aquatic habitat (i.e., critical, important, marginal) as defined in the NOCSS and confirm the aquatic habitat designation of each stream on a reach basis;
- Identify reaches with critical, important or marginal aquatic habitat targeted for rehabilitation measures (to identify compensation opportunities); and,
- Compile aquatic habitat management recommendations on a reach basis as identified in the Management Strategy.

Draft Plan Level of Detail:

- Prepare detailed habitat mapping for all streams that contain fish habitat, which potentially may be impacted by the proposed development (e.g., road crossings, SWM outfalls, compensation reaches, etc.). Confirm location and map important habitat structure including in-stream vegetation, boulders, undercut banks, riffles, pools, runs, and woody debris;
- Identify any habitat features supporting critical life stages of fish or other aquatic biota and describe potential impacts to this habitat. Indicate how impacts to these critical habitats will be mitigated so as not to affect the form or function of these habitats;
- Additional fish sampling may be necessary to fill information gaps, as determined in consultation with Conservation Halton;
- Detail the proposed drainage characteristics of lands adjacent to fish habitats and assess any impacts associated with drainage;
- Detail proposed works (e.g., stormwater management facilities, road crossings, grading) adjacent to the fish habitats and assess/predict the impacts of construction and operation of the works, considering channel length and form, riparian buffers, flow volume and duration, water quality and water temperature;
- Detail mitigative measures and assess potential residual impacts of any works in or adjacent to fish habitats. Provide evidence that alternative methods and measures for minimizing impacts have been considered; and,
- Identify buffers from stream reaches for use in identifying stream corridor widths (see Section 3.3.3.1 d).

Modified Stream Reaches:

- Complete fish and fish habitat studies required for proposed stream modifications (see Section 3.3.3.3 below).

Not applicable - see note Section 3.0.
Additionally, there are no existing
streams on the subject lands.

3.3.3.3 Stream Modification/Rehabilitation Measures

Stream rehabilitation opportunities have been identified in the Management Strategy and are illustrated in **Figure 6.3.13 (NOCSS)**. **Section 6.3.4.2 (Table 6.3.4)** of the Management Report identifies enhancement recommendations for stream rehabilitation and **Section 6.3.4.6 (NOCSS)** outlines considerations for stream relocation.

Stream modification may occur under circumstances such as the following:

- Stream reach rehabilitation
- Stream reach relocation and/or lowering
- Road and infrastructure crossings
- Construction of SWM outfalls

It should be noted that authorization by the DFO will be required for any watercourse alteration resulting in a Harmful Alteration, Disruption or Destruction (HADD) of fish habitat and may be required for rehabilitation and for elimination of some low constraint streams. Consultation with DFO, in conjunction with Conservation Halton is required.

Where modifications are proposed by a proponent for medium constraint streams, it will be necessary to demonstrate that the newly constructed stream will maintain and where possible enhance existing channel form, function and aquatic habitat. The established riparian corridor width must also be maintained on a reach basis. Reconstructed channels should incorporate “natural channel design” elements and should transition effectively with downstream receiving waters. Specifically, the following requirements must be fulfilled as part of the EIR/FSS:

- Perform ‘rapid’ field assessments to determine channel sensitivity and identify dominant processes (e.g., aggradation, widening, planform adjustment). During this assessment any existing erosion sites or infrastructure will be mapped and evaluated for rehabilitation or removal;
- Conduct a detailed field investigation of the reach requiring modification or an appropriate reference reach (channel relocation) in order to determine existing aquatic habitat features, stream geometry and channel morphology;
- Confirm the extent of all fish habitat with DFO during preparation of the EIR/FSS;
- Prepare a fish habitat compensation plan that clearly demonstrates how modified reaches will achieve a net gain in fish habitat and meet the ‘no net loss in fish habitat productivity’ as required by Section 35(2) of the Fisheries Act;
- Illustrate the extent of any features supporting critical life stages of fish or other aquatic biota and clearly demonstrate how the proposed compensation will replace the form and function of this habitat;
- Quantify existing aquatic habitat features (e.g., number and linear extent of pools, riffles, runs) for use in ensuring that the proposed compensation plan adequately replaces the type and extent of existing habitats;
- Use a combination of aerial photographs, ground-truthing, and ELC mapping to determine the extent of wetland cover for each Hydrologic Feature ‘A’;
- Identify the form and function of each Hydrologic Feature ‘A’ and document its ecological and hydrologic relationship to the watercourse (e.g., does the feature represent an online pond or wetland);
- Identify how the ecological and hydrological relationships of the Hydrologic Feature ‘A’ is considered in the proposed stream modification;
- Develop preliminary design concepts based on the principles of “natural channel design”;

Not applicable - see note Section 3.0.
Additionally, there are no existing
streams on the subject lands.

- Review hydraulic modeling to confirm 2-year flow conditions, regulatory flood levels and any potential impacts of modifications on regulatory floodlines;
- Based on the foregoing, identify the recommended modification to the watercourse in the form of conceptual drawings;
- Clearly demonstrate how the proposed modification measures meet the management recommendations identified in the Management Strategy;
- Consider construction approach and timing of conceptual design; and
- Identify and detail mitigation requirements related to road crossings.

Design submission requirements will be specified by the review agencies and generally will include the following:

- Plans and elevations;
- Restoration details including conceptual landscape plans, planform, profile, cross-sections and typical treatments;
- Erosion and sediment control requirements;
- Design brief; and
- Monitoring Plan for proponent modifications, including any DFO requirements.

3.4 Grading, Drainage, Stormwater Management

3.4.1 Introduction

A major element of the EIR/FSS involves the development of a preliminary grading, stormwater servicing and stormwater management plans. This is to address the overall serviceability of the lands, to determine the grading required to service the lands, and to ensure integration with neighbouring lands, cores, linkages and receiving watercourses.

3.4.2 Topography and Grading

The following additional work will be needed to upgrade existing information and provide the additional details required to develop grading and servicing plans:

- Topographic mapping that meets Town of Oakville and Conservation Halton requirements, if any;
- Detailed survey information is to be obtained for any proposed watercourse crossings, core or linkage crossings for services, including roadways; and
- Collection of field information to further delineate and quantify topographic depressions as identified in the NOCSS study.

3.4.3 Preliminary Grading and Drainage Plan

- Use updated topographic mapping and survey work to refine the EIR subcatchment boundaries;
- Prepare a preliminary grading plan for the proposed development area, ~~and a conceptual grading plan for the EIR subcatchment as necessary, to ensure servicing functionality. It is recognized that the level of detail for the EIR subcatchment will be more conceptual than within the proposed development area,~~ Not applicable - proposed subject land grading will not impact EIR subcatchment grading with has already been completed as part of the existing EIR/FSS completed for the Star Oaks lands.

Replace bullet with "The drainage and servicing plan will be limited to illustrating the proposed infrastructure on the subject lands. A discussion will be provided on how the proposed stormwater management system on the subject lands will integrate with the stormwater management strategy outlined in the existing EIR/FSS."

Not applicable as there are no subcatchment NHS areas within or downstream of the subject lands

Not applicable as there is not an existing stream on the subject lands and review of the Dundas Street culverts is not relevant to the proposed development

- A drainage and servicing plan for the EIR subcatchment area is to be developed identifying the storm drainage network, including conceptual designs of storm trunk sizes and profiles, SWM facilities (see Section 3.4.5) and the major and minor system;
- Potential conflicts with the ability to protect the NHS are to be identified and mitigation proposed. Examples include:
 - Any increase or decrease in drainage area to a NHS feature. It is intended that existing drainage characteristics (e.g., flow volumes, form and location) be maintained. Some minor flexibility in this may be possible provided that the feature and its functions are protected;
 - Change in grades adjacent to a NHS feature that could impact surface drainage or groundwater conditions;
 - Location of underground services adjacent to a NHS feature that would influence groundwater levels and impact the feature (i.e., wetland).
- ~~Grading and servicing details in support of stream lowering and/or relocation to be undertaken by a proponent are to be provided.~~
- ~~Lowering of existing culverts at Dundas Street may need to be considered. The lowering of red streams is not permitted, however this may apply to blue streams and any other crossings. If proposed by a proponent, details of any lowering are to be provided, as detailed in Section 3.3.3.3; and,~~
- A conceptual approach to erosion and sediment control is to be provided to the satisfaction of the Town.

3.4.4 Water Resources-Related Analyses

Analysis and/or modeling are required for the following components:

Will be provided for the proposed private storm sewers within the subject lands

- Hydrology and SWM facility analyses:
 - Water quantity
 - Water quality and water balance
 - Erosion control
 - Topographic depressions
- ~~Development or refinement of floodline mapping (see Section 3.3.3.1 b)~~
- Flow analysis for drainage system design (sewer sizing in accordance with municipal standards)

No applicable as there is no watercourse on the subject lands

Guidance to the analysis required to address the hydrology and SWM facility analyses is presented in the following subsections.

a) Water Quantity

Hydrology Modeling

VO is proposed to be used to design the private stormwater management infrastructure to meet the required unitary flow rates based on the size and scope of the subject development

The approach to modeling for hydrology related to SWM sizing for flood and erosion control is to be determined in consultation with the Town of Oakville and Conservation Halton, as an initial step in the EIR/FSS. Consideration of impacts to existing downstream online facilities will need to be addressed in the EIR/FSS. It is intended that flexibility be provided in the selection of a modeling approach; however, the approach is to follow commonly accepted practices.

The modeling of predevelopment conditions to establish unit flow rate targets for quantity (flood) control (2-year through Regional Storm flows) purposes has been completed as part of NOCSS. Further

modeling of predevelopment conditions is not required for this purpose. ~~SWM ponds are~~ to be sized to meet unit flow rate targets.

Regional Storm Control

The NOCSS recommends that stormwater management targets include control of the peak flow to predevelopment levels for the 2-year to 100-year return period events and the Regional Storm. With the exception of Joshua's Creek, where control of the Regional Storm event is required, future land use development applicants may carry out an investigation of the potential increase to flood risk to confirm if Regional Storm controls are necessary. Existing stream crossings and online control structures should be field verified by the proponent and reflected in the modeling as part of the Regional storm control analysis. This analysis is to include the increase in risk to life as well as the potential for flood risk to private, Municipal, Regional, Provincial and Federal property under Regional Storm conditions. If the study finds, and the Town and Conservation Halton concur in that finding, that no increase in risk occurs to downstream landowners or public uses, the Town in conjunction with Conservation Halton will conclude, subject to consideration of any other relevant factor within their respective mandates, that control at the Regional Storm level is not required. Evaluation of risk may include, but is not limited to:

- All development within North Oakville for the watershed under consideration;
- The potential increase in flood risk for the entire downstream watercourse to its outlet at Sixteen Mile Creek;
- The examination of potential increase to flood risk related to the:
 - Potential increase in flood elevations;
 - Potential increase in flood velocities;
 - Potential for the foregoing increases to adversely affect all landowners including individuals, municipal agencies, provincial agencies (MTO, MOE, etc.) and federal agencies;
 - Potential for the foregoing increases to adversely affect all land uses including road crossings, private access road, parks, storm sewer outlets, etc.; and,
 - Potential for the implementation of mitigation measures to address any increase in risk as an alternative to the requirements to control Regional Storm flows.

It is understood that not all increases in flood velocity or flood elevation will necessarily lead to an increase in risk.

The final approach with respect to this issue may have a significant impact on the SWM quantity related results for the EIR/FSS.

If it is determined, by the Town of Oakville, in conjunction with Conservation Halton, that it is not necessary to control peak flow rates, under Regional Storm conditions, to pre-development levels, then post development flow rates for the Regional Storm will need to be calculated through modeling as part of this study. These flow rates will then be used to determine flood elevations and associated flood lines for regulatory purposes. The modeling will be carried out to the satisfaction of the Town of Oakville and Conservation Halton.

b) Water Quality and Water Balance

The NOCSS recommends meeting MOE's Enhanced Level of protection (Level 1) for phosphorus control and fishery protection in sizing stormwater management facilities for water quality control. It is an

Replace with: "proposing a private "treatment train" and will include pre- and post-development phosphorus loading calculations following the steps outlined in Section 7.4.4.3 Water Quality of the NOCSS (Implementation Report & Appendices, August 2006)."

objective of the Town that there be no net increase in phosphorus loadings as a result of development. This objective will be met with the use of enhanced Level SWM ponds and as a result, there is no requirement to further analyze phosphorus loadings during development approvals.

The NOCSS also recommends the use of a hierarchy of stormwater controls with preference for source control (site level), then conveyance system control, followed by end-of-pipe control. In addition, where feasible, the use of infiltration measures, including the diversion of drainage to pervious surfaces as well as designed infiltration facilities, surface retention, and storage is encouraged, to help maintain pre-development water balance conditions (see also Section 3.5 Hydrogeology). The implementation of the foregoing would be subject to best efforts to meet water balance objectives, including reduced runoff volumes and maintenance of groundwater levels, and the hierarchy of SWM controls. The examples presented in NOCSS Appendix AA – Test Catchment Design Case and Appendix LL – Analysis of Treatment-Train Design for Water Quality Control reflect both the hierarchy of measures (treatment-train approach) and the use of infiltration measures in the design.

Replace with "facility" for a more more general statement

Should the proponent wish to further analyze SWM pond sizing to account for the use of a variety of SWM measures (i.e., potential to reduce pond sizes), the above noted appendices present procedures for the following cases:

- In the case where Enhanced Level water quality ponds are to be used, calculations to support a reduced level of imperviousness will be acceptable as a basis for sizing the water quality pond where source or conveyance controls also are used to provide surface storage/retention or infiltration in permanent locations;
- In the case where an Enhanced Level water quality SWM pond is not proposed but rather a combination of source, conveyance system, and/or end-of-pipe facilities are proposed, then calculations of the combined efficiencies of the facilities should be carried out to support the design, with a view to achieve a combined performance of 80% TSS removal and/or 65% TP removal, as required by an Enhanced Level of protection; and,
- For serviced lands with a drainage area of less than 5ha, where the size of drainage area limits the feasibility of end-of-pipe facilities for SWM, the use of lot and/or conveyance type of SWM measures will be needed to meet SWM requirements. It is recognized that it may be difficult to meet the enhanced level of SWM needed to provide for the water quality control target. In that event, it must be demonstrated that every reasonable effort has been made to provide an approach that would meet the water quality target. If it is agreed by the Town of Oakville and Conservation Halton that enhanced level of control cannot be provided for in the serviced area, it must be demonstrated that the enhanced level of control, as well as other SWM targets are being met within the overall EIR subcatchment area that contains this particular serviced area.

c) Erosion Control SWM Facility Sizing

~~In order to ensure that the receiving channels will not experience higher than normal rates of erosion, a threshold flow needs to be incorporated into the design of each SWM facility. Analysis in support of SWM facility sizing must include erosion threshold analysis and continuous hydrologic modeling to ensure that appropriate extended detention storage is provided.~~

~~Erosion thresholds were broadly characterized in Section 5.8 (Table 5.8.5) of the NOCSS Analysis Report. A more detailed determination of erosion thresholds is required at the EIR/FSS stage. These thresholds are meant to be integrated into a stormwater management system design in such a manner that existing channel erosion or aggradation is not exacerbated. Specifically, the following requirements must be fulfilled as part of the EIR/FSS:~~

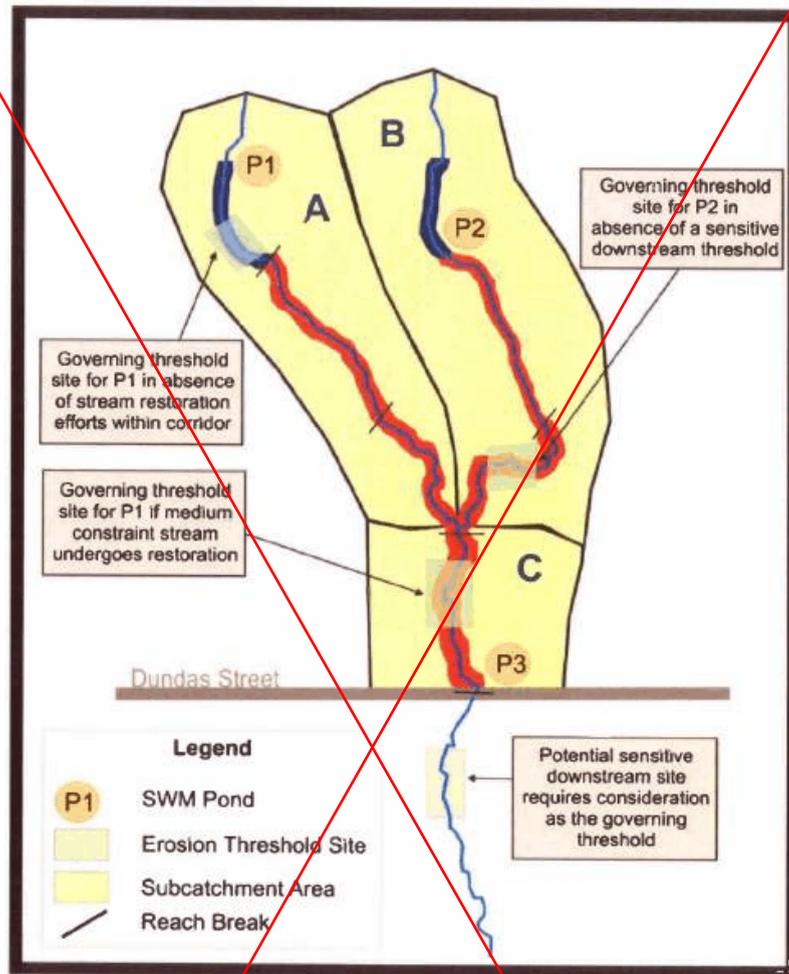
TOWN OF OAKVILLE

- Confirm reach delineation work completed for the NOCSS using best available mapping and aerial photography;
- Determine if erosion thresholds previously identified in the NOCSS apply to the EIR subcatchment area;
- Confirm the location of SWM ponds within and downstream of the identified EIR subcatchment area;
- Conduct rapid geomorphic assessments on a reach basis to verify desktop analyses and identify areas most susceptible to erosion;
- Perform detailed field investigation(s) along the most geomorphologically sensitive reach(es) to quantify channel geometry and identify active geomorphic processes;
- Apply multiple analytical methods (e.g. critical shear, stream power and permissible velocity models) to the field data in order to calculate an erosion threshold in terms of the point at which sustained flows will tend to entrain and transport sediment using data collected during the detailed field investigation(s);
- Select an appropriate defining threshold based on model convergence and compatibility with indicators of active processes (e.g., widening and entrenchment) as identified through the field investigation;
- Perform an analysis of pre and post development conditions using a continuous hydrologic model on a subcatchment area basis to identify erosion control sizing for SWM facilities. Specifically, the frequency and duration of time (expressed as hours) that the erosive threshold flow is exceeded, in the pre-development condition, is to be matched in the post-development condition (i.e., results are within approximately 5% of the pre-development conditions. Before a 5% increase is accepted, work needs to be completed as to the likely effects and implications of this nominal increase to determine whether further mitigation, modeling refinement or monitoring is warranted); and,
- Clearly illustrate how the proposed development scenario meets erosion control criteria as established in the NOCSS.

It should be noted that, while the erosion threshold assessment is conducted on a single subcatchment area basis, the proponent must be aware that areas downstream need to be considered when selecting the most sensitive reach, as depicted in Figure 3.4.1.

Per email correspondence with the Town (Khorshid to Fletcher, November 19, 2025), the erosion control requirements for the subject lands are to be based on the existing threshold analysis for the SM1 catchment completed by Rand Engineering and Geomorphix Limited. Therefore, this section is not applicable.

Figure 3.4.1: A Hypothetical Example Illustrating Relevant Erosion Threshold Procedures in the Context of Subcatchment Areas



Note: The most sensitive reach for SWM P1 is highlighted in the shaded area downstream of the pond. However, an assessment of downstream reaches beyond the subcatchment boundary is required in order to ensure that no additional impacts are created. Moreover, if restoration of the medium constraint stream is anticipated, then an analysis of downstream reaches would be required to determine the governing threshold for SWM P1. As discussed in the previous text, the governing threshold could be located downstream of Dundas Street (beyond the boundary of the EIR Subcatchments), depending on the relative sensitivity of stream conditions. In this example, the shaded area in Subcatchment A would govern as the most sensitive reach for SWM P1. Also, in the event that the shaded area downstream of SWM P1 was so unstable that erosion threshold targets could not be met, this reach could be restored and enhanced and the threshold for Subcatchment C then would apply.

d) Topographic Depressions  Replace instances of "SWM Pond" with "SWM Facility" in this section to make it more general for application to private stormwater management systems (e.g., underground storage)

In North Oakville, there are a number of topographic depression areas that are poorly drained. The characteristics of this topography have an impact on the response characteristics of the area during precipitation and runoff events. Consequently, NOCSS requires, as part of the EIR/FSS, that the storage within the topographic depressions be refined and checked against the storage within proposed SWM ponds in the EIR subcatchment area to verify that the SWM pond storage accounts for the depression storage. Thus, the SWM ponds volume must be equal to or greater than the original depression storage volume.

In general, the NOCSS hydrologic model incorporates depression storage to establish unit area target flow rates. The calculation and comparison of depression storage to SWM storage is intended as a check to ensure that the existing condition peak flow rates do not increase as a result of land development. The principle behind this approach is to ensure that the hydrologic analysis and SWM approach reflects the existing site conditions that include a number of topographic depressions, and the natural depression storage is maintained in the SWM system.

This approach is not to include artificially created storage such as that created by embankments or dug facilities. Although the topographic depressions are illustrated in NOCSS, referred to as pits, ponds and depressions, the existing mapping does not provide for accurate delineation of these depressions.

The more detailed mapping and other relevant investigations of the EIR/FSS are to be used to confirm the existence, nature (natural or artificial), and storage volume of these depressions.

To ensure that the storage volume of the depression storage areas is maintained, the calculated depression volume is to be compared to the SWM pond volume of the proposed SWM facility within the same subcatchment drainage area. If the depression storage volume is less than or equal to the SWM facility volume, no additional analysis or change to the SWM facility design is required. In the event that depression storage is greater than the SWM facility volumes, the SWM facility volume (as noted in the following points) is to be adjusted to be equal to the depression storage volume.

Calculations and volume comparisons shall be done as follows:

- 2-year event: Calculate the 2-year depression storage volume and compare this volume to the water quality (extended detention and permanent pool) volume in the SWM facility.
- 100-year event or Regional Storm (whichever is applicable): Calculate the 100-year or Regional Storm depression storage volume and compare it to the total storage volume (permanent and active storage) in the SWM facility (up to 100-year or Regional Storm event).

3.4.5 SWM Plan

A SWM plan is to be developed as part of the EIR/FSS to demonstrate how the targets as specified in the Management Strategy are to be met. It is intended that SWM is to be provided through a combination of "Best Management Practices" (BMP), which may range from at-source controls to end-of-pipe solutions. The preliminary location of SWM ponds is illustrated in the Management Strategy; however, flexibility on the final location is anticipated.

In developing the overall SWM Plan, a treatment train approach is to be applied in evaluating the effectiveness of BMPs. Consultation with the Town of Oakville and Conservation Halton will be required in the selection of measures and their effectiveness.

Replace instances of "SWM Pond" with "SWM Facility" to make it more general for application to private stormwater management systems (e.g., underground storage)

The use of BMPs for stormwater management (in addition to ~~SWM ponds~~ **facilities**) can reduce the size of the ponds. The measures are to be evaluated in their ability to retain water on-site and thereby maintain existing condition water balance where feasible based on site soil conditions, and protect water quality in relation to the NOCSS recommendations (i.e. phosphorus control, temperature control, suspended solids reduction).

Preliminary design details for the ~~SWM ponds~~ will be required as part of the EIR/FSS including:

- ~~SWM pond~~ block sizing, including preliminary grades, design water levels (~~pond and receiving body outlet~~), storage volumes and maintenance access provisions;
- Cross-section details, **Shop drawings will be provided of the underground storage system**
- ~~Pond profile including inlet and outlet,~~
- ~~Landscaping provisions as per Conservation Halton guidelines; and~~
- Monitoring plan to the satisfaction of the Town.

Excluding "Baseline" or "Geomorphic Monitoring" as they are included as part of existing EIR/FSS report and monitoring prepared for Star Oaks Development Lands

3.5 Hydrogeology

~~3.5.1 Introduction~~

~~The NOCSS prepared in support of the Secondary Plan for the North Oakville area included recommendations for more detailed hydrogeological investigations as part of the EIR/FSS in support of proposed Draft Plans.~~

~~The purpose of the detailed hydrogeological study is to characterize existing hydrogeological conditions, quantify potential groundwater-related impacts and determine the need for, and nature of, any mitigation measures required to protect the hydrogeological features and functions within the EIR subcatchment area.~~

Not applicable - Hydrogeological review for the EIR/FSS Addendum is scoped to providing a site specific pre- and post-development water balance calculations as there is an existing Hydrogeological Assessment completed and included in the existing EIR/FSS.

~~3.5.2 Technical Requirements~~

~~The EIR must address the entire EIR subcatchment area within which the proposed development area is located. Therefore, in addition to site investigations specific to the proposed development area, it may be necessary to secure access to adjacent properties or road allowances to investigate areas of the EIR subcatchment area outside the proposed development area.~~

~~The level of detail must be sufficient to support submission of Draft Plans of subdivision. The methodology to complete the study requirements is at the discretion of the consultant, but must conform to generally accepted groundwater engineering and hydrogeologic practices.~~

~~Boreholes and groundwater observation wells must be distributed such that the groundwater conditions are defined for the proposed development area and the EIR subcatchment area. Any specific on-site features are to be investigated.~~

a) Geology and Hydrogeology

- Provide an overview of the regional geological setting;
- Drill boreholes to determine the site-specific geology (stratigraphy and depth to bedrock). The number of boreholes will depend upon the sizes of the EIR subcatchment area and the proposed development area, the background data available, and the geological complexity of the area;
- Collect soil samples from each borehole and test for grain-size to characterize the soil types and to assist in determining soil hydraulic conductivity;
- Relate the local geological data to the regional geological setting;
- Establish a network of groundwater observation wells to determine the depth to the water table and vertical and horizontal groundwater gradients;
- The number of monitoring wells to be installed will depend upon the EIR subcatchment area and the proposed development area sizes, the complexity of drainage, the number of environmental features, the locations of groundwater divides, and the background data available. Where available, existing observation wells may be used;
- Survey all monitoring locations for coordinates and geodetic elevation;
- Map the groundwater flow conditions (including vertical and horizontal flow components);
- Conduct bail-down, slug, or other appropriate field tests to confirm well function and assess the hydrogeological characteristics of stratigraphic units (e.g. *in situ* hydraulic conductivity);
- Provide estimates of groundwater flux;
- Monitor groundwater levels in all observation wells (data included in the EIR/FSS should be related to the regional groundwater elevation data and be sufficient to document the response of the shallow groundwater to climatic conditions throughout the year). A minimum of one water table observation well should be equipped with a datalogger to continuously record water levels. The data must be corrected for barometric response;
- Monitor surface water baseflows (non-storm event flows; minimum of 3 days post precipitation event) upstream and downstream in all identified watercourses. These data will be used to assist in establishing the groundwater contribution to stream flow and infiltration as part of the water balance assessment;
- Collect a sufficient number of groundwater and surface water samples for laboratory analysis of major ion chemistry to establish the background water quality across the area. These data will be used to assist in the assessment of groundwater/surface water interactions and to establish baseline pre-development conditions;
- Map groundwater discharge areas and identify any areas along stream corridors for recharge/discharge function protection; and,
- Complete a water balance analysis to determine the pre-development (based on existing conditions) and post-development (based on the proposed land use plan) interflow and deep recharge volumes. The water balance should utilize the longest and most continuous local daily climate data and a soil-moisture balance approach (e.g., Thornthwaite and Mather) with daily or monthly calculations reported on an average annual basis. Surface water flow data should be used to validate the existing conditions water balance where possible.

b) Requirements for Proposed Development Plan

- Determine the infiltration deficit (pre to post development) for the proposed development area and the EIR subcatchment area;
- Identify hydrogeological opportunities and constraints to maintaining the water balance (i.e., to reduce the infiltration deficit);

- Identify the type, location and size of infiltration or storage measures that may be feasible for use based on the site specific geological and hydrogeological conditions;
- Evaluate opportunities for augmenting groundwater infiltration through appropriate and practical Best Management Practices (e.g., as outlined in the MOE Stormwater Management Planning and Design Manual 2003) to balance, or at least in part, make up the post-development infiltration deficit;
- If pre-development infiltration cannot be maintained, predict the impact of this change on the flows in local streams and on the local water table and recommend mitigation measures as required;
- Identify areas where hydrogeological conditions may affect construction (e.g., high water table, requirements for dewatering, etc.), and recommend control and mitigation measures, if warranted; and,
- Evaluate the potential for impacts from proposed underground services on shallow groundwater conditions adjacent to cores, linkages and stream corridors. If the potential for negative impact exists, mitigative measures are to be recommended.

~~3.6 Sanitary, Water, Roads~~

~~Analyses and details must be provided for the servicing of a specific development application. In addition, it will be necessary to provide conceptual designs of trunk services within the EIR subcatchment (conceptually only in areas not part of the proposed development area; FSS level of detail in the proposed development area) including appropriate connections to external areas, demonstrating servicing viability without placing undue restrictions on external areas (e.g., considering sewer depths and grading). Sufficient analysis is necessary to ensure that external lands can be serviced to meet Town and Region standards.~~

~~The FSS will build upon and implement, as applicable, recommendations of the Master Servicing Plan for the North Oakville East area, prepared as background to the Secondary Plan, and any applicable Master Servicing Plans prepared by the Region of Halton. The following tasks are to be undertaken.~~

- ~~Compile information from the NOCSS and the Secondary Plan specific to the proposed development area including design criteria, environmental designations, road locations and design levels, etc. and undertake an information gap analysis to determine additional information needs, if any;~~
- ~~Review detailed information on the proposed land uses of the development application, with respect to population, housing form, road pattern, open space components, and hard surfaces to provide input to engineering analysis;~~
- ~~Complete a sanitary servicing assessment to:~~
 - ~~determine the servicing requirements based on future system wastewater flows;~~
 - ~~recommend a preferred sanitary servicing option considering external and internal infrastructure, and potential phasing;~~
 - ~~provide interim servicing solutions where feasible;~~
 - ~~assess site specific infrastructure locations and designs for crossings of streams, linkages and cores;~~
 - ~~make recommendations on preferred crossing locations, construction practices, and mitigative measures to minimize impacts to the NHS; and,~~
 - ~~determine consistency with Region of Halton Master Servicing Plan and explain differences;~~
- ~~Complete a water servicing assessment to:~~
 - ~~determine the servicing requirements based on future system demands;~~

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~~Not Applicable - It is understood that details pertaining to the watermain and sanitary servicing design for the proposed development are outside the scope of the required EIR/FSS Addendum, but still will be included in order to provide a comprehensive report that can be used for both EIR/FSS Addendum and zoning approvals of the subject lands.~~

- identify a preferred water servicing option considering external and internal infrastructure, pressure districts and potential phasing;
 - assess site specific infrastructure locations and designs for crossings of streams, linkages and cores;
 - make recommendations on preferred crossing locations, construction practices, and mitigative measures to minimize impacts to the NHS; and,
 - determine consistency with Region of Halton Master Servicing Plan and explain differences.
- Complete a road design assessment to:
 - compile the road design requirements and road locations as identified in the Master Servicing Plan and the Secondary Plan;
 - identify local road system within the proposed development area;
 - assess site specific road locations and designs for crossings of streams, linkages and cores; and,
 - make recommendations on preferred crossing locations and configurations, road design standards, and mitigative measures to minimize impacts to the NHS (e.g., ecopassages).

~~Not applicable - the subject lands will remain privately owned and approved through Site Plan application process. A discussion regarding the monitoring of the SWM infrastructure will be included in the addendum but a detailed description of requirements is to be deferred to the detailed design/site plan application design stage.~~

~~4.0 MONITORING~~

~~It will be necessary to detail environmental monitoring requirements as part of the EIR/FSS, in support of Draft Plans of subdivision, in accordance with applicable directions in NOCSS.~~

5.0 REPORTING REQUIREMENTS

A detailed report is to be prepared integrating the analysis, findings and recommendations covered in the study Terms of Reference.

James Fletcher

From: Sepideh Khorshid <sepideh.khorshid@oakville.ca>
Sent: December 10, 2025 9:25 AM
To: Lan Yao; James Fletcher
Cc: Delia McPhail; Matt Britton; steph.matveeva@ghd.com
Subject: RE: [EXTERNAL] FSS/EIR - 4243 Sixth Line, Oakville

Hello James,

We have reviewed the EIR and have no further comments. So its approved.

Thanks
Sepi

Sepideh Khorshid
Water Resource Engineer
Planning & Development
Town of Oakville | 905-845-6601, ext. 3025 | www.oakville.ca

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From: Lan Yao <lan.yao@oakville.ca>
Sent: Monday, December 8, 2025 3:23 PM
To: James Fletcher <jfletcher@cfcrozier.ca>; Sepideh Khorshid <sepideh.khorshid@oakville.ca>
Cc: Delia McPhail <delia.mcphail@oakville.ca>; Matt Britton <mbrampton@cfcrozier.ca>; steph.matveeva@ghd.com
Subject: RE: [EXTERNAL] FSS/EIR - 4243 Sixth Line, Oakville

Hi James,

Thanks for the email — we've received the updated TOR.
Sepideh will be reviewing it, so please follow up with her regarding the review timeline.

Thanks,
Lan

Lan Yao
Development Engineer
Planning & Development
Town of Oakville | 905-845-6601, ext. 3738 | www.oakville.ca

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From: James Fletcher <jfletcher@cfcrozier.ca>
Sent: Monday, December 8, 2025 12:59 PM
To: Lan Yao <lan.yao@oakville.ca>; Sepideh Khorshid <sepideh.khorshid@oakville.ca>
Cc: Delia McPhail <delia.mcphail@oakville.ca>; Matt Britton <mbritton@cfcrozier.ca>; steph.matveeva@ghd.com
Subject: RE: [EXTERNAL] FSS/EIR - 4243 Sixth Line, Oakville

Good morning Lan,

Just wanted to check in to confirm that you received the updated Terms of Reference last week and if there is an approximate timeline on when we could receive a response.

Thanks!
James

James Fletcher
Engineering Intern, Land Development
Office: 905.876.7132
Collingwood | Milton | Toronto | Bradford | Guelph

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From: James Fletcher <jfletcher@cfcrozier.ca>
Sent: December 1, 2025 2:48 PM
To: Lan Yao <lan.yao@oakville.ca>; Sepideh Khorshid <sepideh.khorshid@oakville.ca>
Cc: Delia McPhail <delia.mcphail@oakville.ca>; Matt Britton <mbritton@cfcrozier.ca>; steph.matveeva@ghd.com
Subject: RE: [EXTERNAL] FSS/EIR - 4243 Sixth Line, Oakville

Hi Lan,

Thanks again for the call last week. Your input was helpful as we prepared the updated Terms of Reference.

As requested, please see the attached “red-lined” FSS/EIR Terms of Reference for the Town’s review. If your team has any questions or needs additional clarification on any items, please don’t hesitate to reach out.

Thanks,
James

James Fletcher
Engineering Intern, Land Development
Office: 905.876.7132
Collingwood | Milton | Toronto | Bradford | Guelph

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From: James Fletcher <jfletcher@cfcrozier.ca>
Sent: November 27, 2025 10:40 AM
To: Lan Yao <lan.yao@oakville.ca>; Sepideh Khorshid <sepideh.khorshid@oakville.ca>
Cc: Delia McPhail <delia.mcphail@oakville.ca>; Matt Britton <mbritton@cfcrozier.ca>; steph.matveeva@ghd.com
Subject: RE: [EXTERNAL] FSS/EIR - 4243 Sixth Line, Oakville

Hi Lan,

Thanks again for taking my call earlier this week.

As requested, we are in the process of red lining the existing EIR/FSS TOR but are waiting to finalize until we receive the City's preliminary feedback on the TOR we submitted last week. As discussed, we want to ensure we are on the right track to avoid unnecessary re-work after we transfer the information to the redline version of the existing EIR/FSS TOR. Do you know when we can expect to receive this feedback?

Best Regards,
James

James Fletcher
Engineering Intern, Land Development
Office: 905.876.7132
Collingwood | Milton | Toronto | Bradford | Guelph

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From: Lan Yao <lan.yao@oakville.ca>
Sent: November 24, 2025 9:19 AM
To: James Fletcher <jfletcher@cfcrozier.ca>; Sepideh Khorshid <sepideh.khorshid@oakville.ca>
Cc: Delia McPhail <delia.mcphail@oakville.ca>; Matt Britton <mbritton@cfcrozier.ca>; steph.matveeva@ghd.com
Subject: RE: [EXTERNAL] FSS/EIR - 4243 Sixth Line, Oakville

Hi James,

Thanks for sharing the document.

Please note that the Town has a standard NOCSS TOR. The Sixteen Mile Creek SM1 EIR/FSS report includes this TOR in Appendix A-1. It is recommended that you modify the previous SM1 EIR/FSS TOR—add or remove items as needed, or indicate which sections are not applicable to this study. A redlined

markup of the previous TOR would be sufficient. You can then include the updated TOR as an appendix in your future EIR/FSS addendum submission.

Please let me know if you have any questions.

Regards,
Lan

Lan Yao
Development Engineer
Planning & Development
Town of Oakville | 905-845-6601, ext. 3738 | www.oakville.ca

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From: James Fletcher <jfletcher@cfcrozier.ca>
Sent: Friday, November 21, 2025 3:41 PM
To: Sepideh Khorshid <sepideh.khorshid@oakville.ca>; Lan Yao <lan.yao@oakville.ca>
Cc: Delia McPhail <delia.mcphail@oakville.ca>; Matt Britton <mbritton@cfcrozier.ca>; steph.matveeva@ghd.com
Subject: RE: [EXTERNAL] FSS/EIR - 4243 Sixth Line, Oakville

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Hi Sepideh,

Thank you for your input!

As requested, please see the attached Terms of Reference for the EIR/FSS Addendum for the Town's review and approval. Please don't hesitate to reach out with any questions.

Kind regards,
James

James Fletcher
Engineering Intern, Land Development
Office: 905.876.7132
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From: Sepideh Khorshid <sepideh.khorshid@oakville.ca>
Sent: November 19, 2025 10:20 AM
To: James Fletcher <jfletcher@cfcrozier.ca>; Lan Yao <lan.yao@oakville.ca>

Cc: Delia McPhail <delia.mcphail@oakville.ca>; Matt Britton <mbritton@cfcrozier.ca>; steph.matveeva@ghd.com
Subject: RE: [EXTERNAL] FSS/EIR - 4243 Sixth Line, Oakville

Hello James,

I discussed this with my colleague, and since there is already an erosion threshold analysis, we expect you to base your work on that analysis. When calculating the required volume, you can evaluate different alternatives to achieve compliance. I understand the release time may be long, but with a smaller required volume, you may be able to meet the requirement through water balance. The TOR should reference the previous study, and we can evaluate your proposed options when the EIR is submitted.

Thanks
Sepi

Sepideh Khorshid
Water Resource Engineer
Planning & Development
Town of Oakville | 905-845-6601, ext. 3025 | www.oakville.ca

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From: James Fletcher <jfletcher@cfcrozier.ca>
Sent: Tuesday, November 18, 2025 1:08 PM
To: Lan Yao <lan.yao@oakville.ca>; Sepideh Khorshid <sepideh.khorshid@oakville.ca>
Cc: Delia McPhail <delia.mcphail@oakville.ca>; Matt Britton <mbritton@cfcrozier.ca>; steph.matveeva@ghd.com
Subject: RE: [EXTERNAL] FSS/EIR - 4243 Sixth Line, Oakville

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Thank you Lan!

[@Sepideh Khorshid](#) – As discussed, could you provide an update on the Town's expectations regarding the erosion control requirements for the EIR/FSS Addendum? We have drafted the Terms of Reference related to the other stormwater management design criteria where the erosion control piece is the last item we need. Our client is eager to proceed, so your earliest input would be much appreciated.

Please feel free to give me a call with any questions.

Best,
James

James Fletcher
Engineering Intern, Land Development
Office: 905.876.7132
Collingwood | Milton | Toronto | Bradford | Guelph

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From: Lan Yao <lan.yao@oakville.ca>

Sent: November 13, 2025 3:47 PM

To: James Fletcher <jfletcher@cfcrozier.ca>

Cc: Delia McPhail <delia.mcphail@oakville.ca>; Matt Britton <mbritton@cfcrozier.ca>; steph.matveeva@ghd.com;
Sepideh Khorshid <sepideh.khorshid@oakville.ca>

Subject: RE: [EXTERNAL] FSS/EIR - 4243 Sixth Line, Oakville

Hi James,

As discussed in the meeting, please find the attached SWM report for Star Oak Phase 2 for your reference.

Once the Terms of Reference is ready, please send it to @Sepideh Khorshid. She will review it and get back to you at her earliest convenience.

Regards,
Lan

Lan Yao
Development Engineer
Planning & Development
Town of Oakville | 905-845-6601, ext. 3738 | www.oakville.ca

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From: James Fletcher <jfletcher@cfcrozier.ca>

Sent: Monday, November 10, 2025 10:15 AM

To: Lan Yao <lan.yao@oakville.ca>

Cc: Delia McPhail <delia.mcphail@oakville.ca>; Colin Westerhof <colin.westerhof@oakville.ca>; Stephen Pietrangelo <stephen.pietrangelo@oakville.ca>; Matt Britton <mbritton@cfcrozier.ca>; steph.matveeva@ghd.com; Xinjie Ou <xinjie.ou@oakville.ca>

Subject: RE: [EXTERNAL] FSS/EIR - 4243 Sixth Line, Oakville

Thanks Lan! I just sent an invite for 2pm. Feel free to forward it to the water resources engineer.

Looking forward to meeting you and discussing the project.

Best,
James

James Fletcher
Engineering Intern, Land Development

Office: 905.876.7132

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From: Lan Yao <lan.yao@oakville.ca>

Sent: November 10, 2025 9:18 AM

To: James Fletcher <jfletcher@cfcrozier.ca>

Cc: Delia McPhail <delia.mcphail@oakville.ca>; Colin Westerhof <colin.westerhof@oakville.ca>; Stephen Pietrangelo <stephen.pietrangelo@oakville.ca>; Matt Britton <mbritton@cfcrozier.ca>; steph.matveeva@ghd.com; Xinjie Ou <xinjie.ou@oakville.ca>

Subject: RE: [EXTERNAL] FSS/EIR - 4243 Sixth Line, Oakville

Hi James,

Our water resource engineer and I will be available this Thursday afternoon 2pm to 4pm, Nov 13. Please let me know if it works for you.

Thanks,
Lan

Lan Yao
Development Engineer
Planning & Development
Town of Oakville | 905-845-6601, ext. 3738 | www.oakville.ca

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From: James Fletcher <jfletcher@cfcrozier.ca>

Sent: Friday, November 7, 2025 4:15 PM

To: Lan Yao <lan.yao@oakville.ca>

Cc: Delia McPhail <delia.mcphail@oakville.ca>; Colin Westerhof <colin.westerhof@oakville.ca>; Stephen Pietrangelo <stephen.pietrangelo@oakville.ca>; Matt Britton <mbritton@cfcrozier.ca>; steph.matveeva@ghd.com

Subject: RE: [EXTERNAL] FSS/EIR - 4243 Sixth Line, Oakville

Thank you for the quick response, Lan! We've reviewed the EIR/FSS report and have a few questions related to the scope of the addendum. Our client is eager to move forward with this application as soon as possible, so we'd prefer not to wait for the next NOARM meeting.

Would you be available for a half hour call next week to go over our questions? If so, please share your availability and I'll set something up in our calendars.

Thanks again!

James

James Fletcher

Engineering Intern, Land Development
Office: 905.876.7132

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From: Lan Yao <lan.yao@oakville.ca>

Sent: November 6, 2025 3:51 PM

To: James Fletcher <jfletcher@cfcrozier.ca>

Cc: Delia McPhail <delia.mcphail@oakville.ca>; Colin Westerhof <colin.westerhof@oakville.ca>; Stephen Pietrangelo <stephen.pietrangelo@oakville.ca>; Matt Britton <mbritton@cfcrozier.ca>

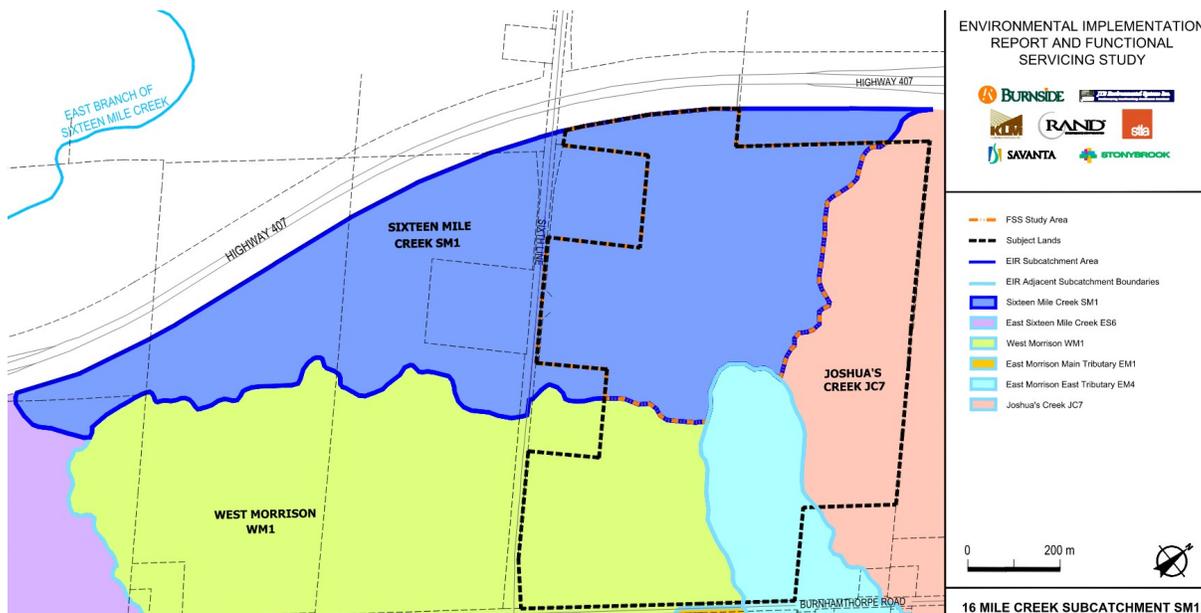
Subject: RE: [EXTERNAL] FSS/EIR - 4243 Sixth Line, Oakville

Hi James,

Please find the approved Sixteen Mile Creek SM1 EIR/FSS report at the link below for reference. I've also included a quick screenshot showing the study area.

[Final Sixteen Mile Creek Star Oak North 2](#)

Please note that this link will expire on November 17th.



These subject lands are part of the SM1 subcatchment. An EIR/FSS addendum will be required to address the drainage and stormwater management concept for these lands, as the post-development conditions were not accounted for in the original SM1 EIR/FSS.

Please feel free to reach out if you have any questions. We also host the North Oakville Agency Review Meeting (NOARM) every month — the next meeting is on November 17 if you would like further information or to discuss this project.

Thanks,
Lan

Lan Yao
Development Engineer
Planning & Development
Town of Oakville | 905-845-6601, ext. 3738 | www.oakville.ca

Vision: A vibrant and livable community for all

Please consider the environment before printing this email.
<http://www.oakville.ca/privacy.html>

From: James Fletcher <jfletcher@cfcrozier.ca>
Sent: Thursday, November 6, 2025 10:31 AM
To: Colin Westerhof <colin.westerhof@oakville.ca>
Cc: Matt Britton <mbritton@cfcrozier.ca>
Subject: [EXTERNAL] FSS/EIR - 4243 Sixth Line, Oakville

You don't often get email from jfletcher@cfcrozier.ca. [Learn why this is important](#)

Hi Colin,

I hope you're doing well!

We received your contact information from Stephanie Matveeva at GHD. We understand that an FSS/EIR report is required by the Town to support the ZBA for the proposed development at the address noted above.

To assist with the preparation of this report, would the Town be able to provide an example FSS/EIR that we could tailor to our site, or a typical terms of reference that we could review?

Thank you in advance for your help.

Best regards,
James

James Fletcher
Engineering Intern, Land Development
Office: 905.876.7132
Collingwood | Milton | Toronto | Bradford | Guelph

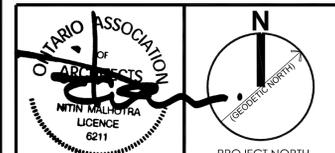
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 9120 Leslie Street, Suite-208
 Richmond Hill, Ontario. L4B 3J9
 T : 4 1 6 . 2 5 6 . 9 7 4 1
 E: info@narchitecture.com
 www.narchitecture.com



26 FEB. 2026

26th FEBRUARY 2026
 PRELIMINARY CONCEPT
 NOT FOR CONSTRUCTION
 MUNICIPAL APPROVAL
 REQUIRED
 RE-ISSUED FOR ZBA

No.	Date	Version	Dwn.
11.	26 FEB. 2026	RE-ISSUED FOR ZBA	NC.
10.	11 AUG 2025	ISSUED FOR COORDINATION	NC.
9.	25 JUNE 2025	ISSUED FOR ZBA	NC.
8.	23 JUNE 2025	ISSUED FOR COORDINATION	NC.
7.	18 JULY 2024	ISSUED FOR REVIEW	NC.
6.	21 FEB 2024	ISSUED FOR PRE-CON	NC.
5.	26 JAN 2024	ISSUED FOR REVIEW	NC.
4.	23 JAN 2024	ISSUED FOR PLANNER REVIEW	NC.
3.	14 DEC 2023	ISSUED FOR COORDINATION	JH.
2.	13 DEC 2023	ISSUED FOR COORDINATION	JH.
1.	22 NOV 2023	ISSUED FOR CLIENT AND PLANNER REVIEW	JH.

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PROJECT:
PROPOSED INDUSTRIAL & WAREHOUSE DEVELOPMENT AT 4243 SIXTH LINE, OAKVILLE, ON

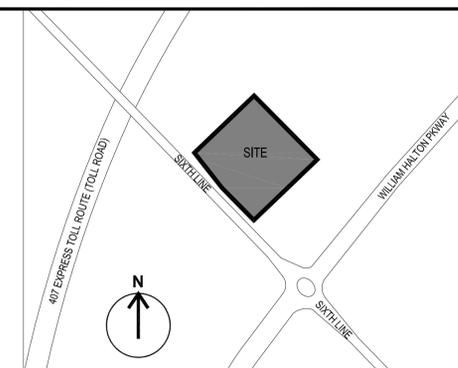
DRAWING TITLE:
SITE PLAN

DRAWN BY: JH DATE: 18 JULY 2023

CHECKED BY: NM SCALE: AS NOTED

PROJECT NO.: DRAWING NO.:

23-32 A-1.0



KEY MAP

PROJECT STATISTICS
 ADDRESS: - 4243 SIXTH LINE, OAKVILLE, ON L6H 7C7
 ZONING: - FUTURE DEVELOPMENT (FD)

	REQUIRED	PROPOSED
MIN. LOT AREA A (SQ.M)	-	38,941.17 SQ.M (9.62 ACRE)
MIN. LOT FRONTAGE	-	201.25 M
EX. BUILDING AREA	-	193,600 SQ.M (2,083.85 SQ.FT.)
PROP. WAREHOUSE BUILDING-A AREA	-	8,048.99 SQ.M (86,638.65 SQ.FT.)
PROP. WAREHOUSE BUILDING-B AREA	-	5,875.24 SQ.M (63,240.55 SQ.FT.)
LOT COVERAGE	-	14,117.83 SQ.M (334,944 SQ.FT.)
EX. BUILDING GFA	-	(3,605.25 SQ.FT.)
PROP. WAREHOUSE BUILDING-A GFA	-	8,048.99 SQ.M (86,638.65 SQ.FT.)
PROP. WAREHOUSE BUILDING-B GFA	-	5,875.24 SQ.M (63,240.55 SQ.FT.)
TOTAL GFA	-	14,259.17 SQ.M (153,484.45 SQ.FT.)
LANDSCAPED AREA (MIN.)	-	10.72%
CONC. PAVED AREA	-	3.25%
PARKING	80	165 (INC. 8 BF)

BUILDING-A SETBACKS

	ALLOWED	PROPOSED
MIN. FRONT YARD (WEST)		21.17 M
INTERIOR SIDE YARD (SOUTH)		16.30 M
INTERIOR SIDE YARD (NORTH)		113.29 M
REAR YARD (EAST)		17.26 M

BUILDING-B SETBACKS

	ALLOWED	PROPOSED
MIN. FRONT YARD (WEST)		50.19 M
INTERIOR SIDE YARD (SOUTH)		111.14 M
INTERIOR SIDE YARD (NORTH)		23.29 M
REAR YARD (EAST)		11.42 M

PARKING REQUIREMENTS

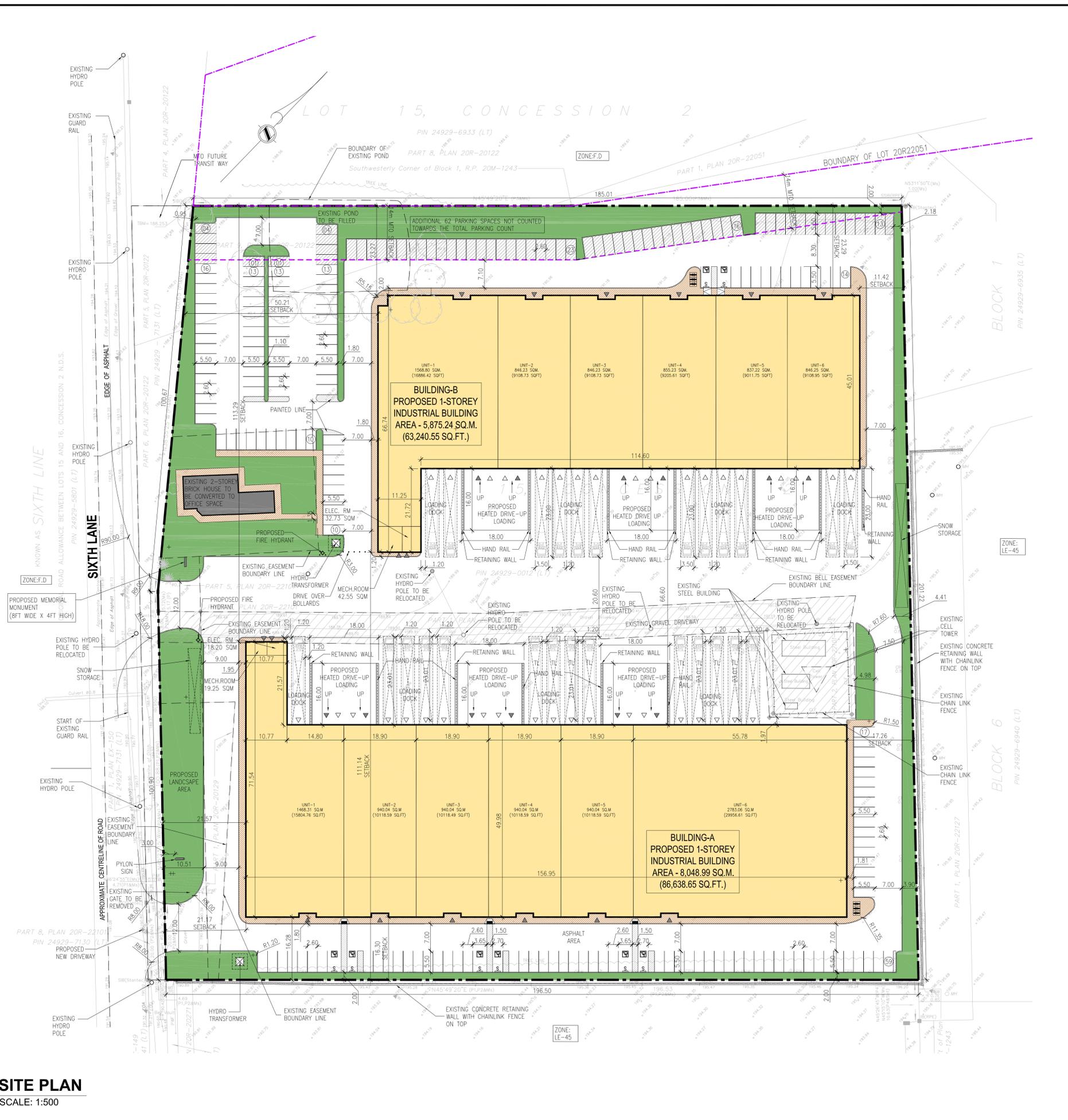
	REQUIRED	PROPOSED
EX. BUILDING - OFFICE 1 SPACE PER 37 SQ.M OF LEASABLE FLOOR AREA	10	10
INDUSTRIAL WAREHOUSE 1 SPACE PER 200 SQ.M OF LEASABLE FLOOR AREA	70	155
TOTAL	80	165 (INC. 8 BF)
ADDITIONAL PARKING SPACES		85
BF PARKING - (3.65mx5.5m)(2.7mx5.5m) REGULAR SPACE - (2.6mx5.5m) (101-150 MIN. 5 SPACES)	5	6

LEGEND

- PROPERTY LINE
- NEW BUILDING
- EXISTING BUILDING
- LANDSCAPE
- CONC. PAVEMENT, 150MM RAISED
- ASPHALT
- ADDITIONAL PARKING
- BARRIER FREE PARKING
- BARRIER CURB
- BARRIER FREE CURB
- MAIN DOOR ENTRANCE
- OVERHEAD DOOR

MUNICIPAL ADDRESS & LEGAL DESCRIPTION
 4243 SIXTH LINE OAKVILLE, ON L6H 7C7
 PLAN OF SURVEY SHOWING TOPOGRAPHIC FEATURES OF PART OF LOT 15, CONCESSION 2 NORTH OF DUNDAS STREET (GEOGRAPHIC TOWNSHIP OF TRAFALGAR) TOWN OF OAKVILLE REGIONAL MUNICIPALITY OF HALTON

SURVEY INFORMATION TAKEN FROM:
 MAURO GROUP INC.
 ONTARIO LAND SURVEYORS
 2 HOLLAND DRIVE, UNIT 5,
 BOLTON, ONTARIO L7E 1E1
 PHONE 905.951.6000
 FAX 905.857.4811
 info@maurogroup.ca



1 SITE PLAN
 A-1.0 SCALE: 1:500

PLAN OF SURVEY
SHOWING TOPOGRAPHIC FEATURES OF
PART OF LOT 15, CONCESSION 2
NORTH OF DUNDAS STREET
(GEOGRAPHIC TOWNSHIP OF TRAFALGAR)

TOWN OF OAKVILLE
REGIONAL MUNICIPALITY OF HALTON

SCALE 1:500
0 10 20 Metres

MAURO GROUP INC.
ONTARIO LAND SURVEYORS
© 2023

METRIC

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

BEARING NOTE

BEARINGS ARE UTM GRID, DERIVED FROM GPS OBSERVATION USING THE "TOPNET" GPS NETWORK OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (2010.0).

LEGEND

- DENOTES FOUND BAR
- DENOTES PLANTED BAR
- SIB DENOTES STANDARD IRON BAR
- IB DENOTES IRON BAR
- PB DENOTES PLASTIC BAR
- CP DENOTES CONCRETE PIN
- Ms DENOTES MEASURED
- WT DENOTES WITNESS
- OU DENOTES ORIGIN UNKNOWN
- (950) DENOTES INSTRUMENT No.783789
- (MGS) DENOTES MINISTRY OF GOVERNMENT SERVICES
- (MMM) DENOTES MMM GEOMATICS ONTARIO LTD., OLS
- (RPE) DENOTES RADY-PENK & EDWARD SURVEYING LTD., OLS
- (Stantec) DENOTES STANTEC GEOMATICS LTD., OLS
- D DENOTES REGISTERED PLAN EX-150
- P1 DENOTES PLAN 20R-22344
- P2 DENOTES PLAN 20R-22101
- P3 DENOTES PLAN 20R-22051
- P4 DENOTES PLAN 20R-22390
- P5 DENOTES PLAN 20M-1243
- (inv) DENOTES CULVERT INVERT
- HP DENOTES HYDRO POLE
- MH DENOTES MANHOLE
- DW DENOTES DRILLED WELL
- WP DENOTES WOOD POLE
- TBM DENOTES TEMPORARY BENCHMARK
- DENOTES CONIFEROUS TREE WITH DIAMETER
- DENOTES DECIDUOUS TREE WITH DIAMETER

SURVEYOR'S CERTIFICATE

- I CERTIFY THAT:
1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT, AND THE REGULATIONS MADE UNDER THEM.
 2. THE SURVEY WAS COMPLETED ON THE 10th DAY OF AUGUST 10, 2023

DATE Aug. 25, 2023

G. Sundar
GANESH SUNDAR B.Eng.
ONTARIO LAND SURVEYOR

ASSOCIATION OF ONTARIO
LAND SURVEYORS
PLAN SUBMISSION FORM
V-51317

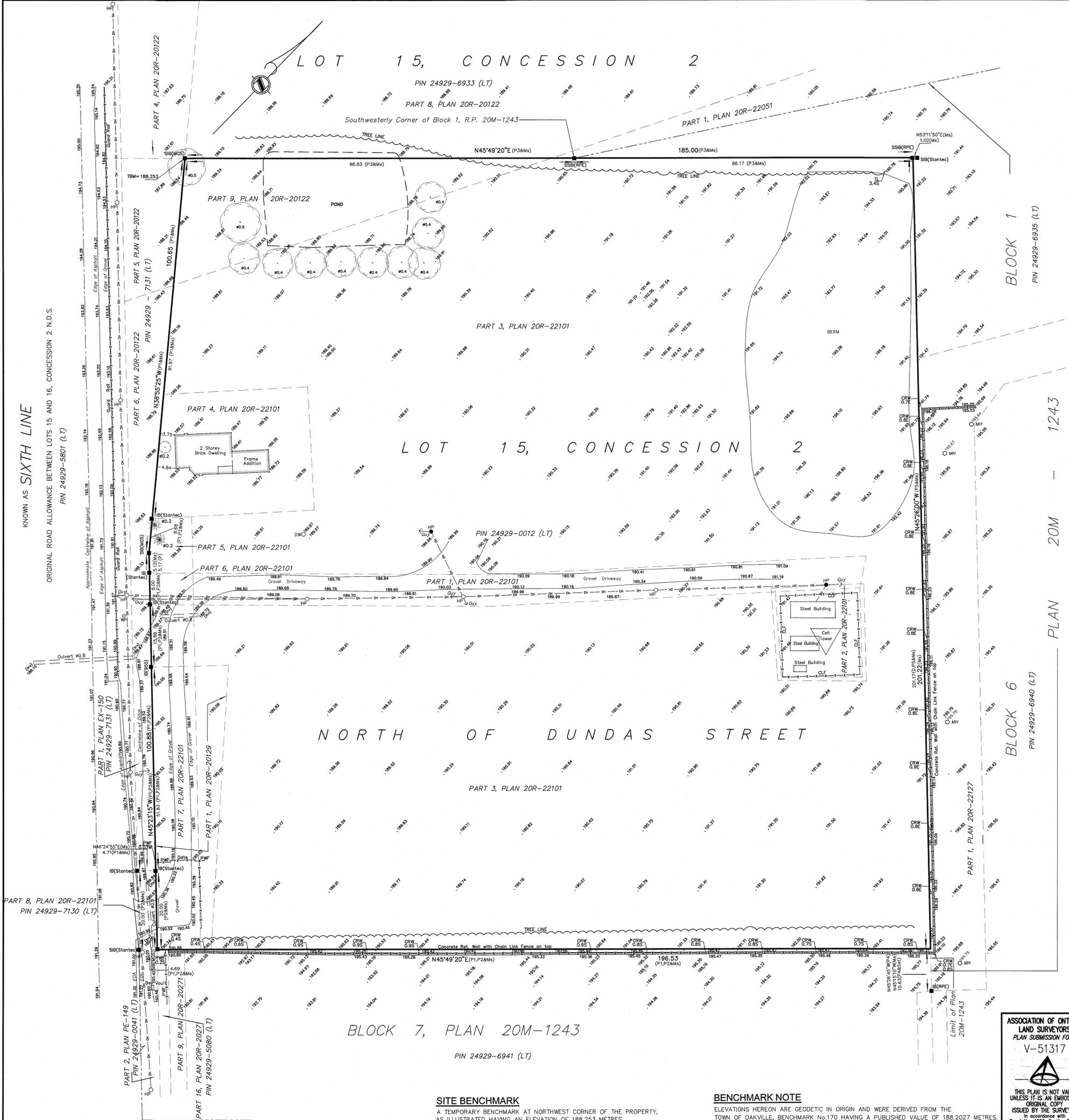
THIS PLAN IS NOT VALID
UNLESS IT IS AN ENCLOSED
ORIGINAL COPY
ISSUED BY THE SURVEYOR
in accordance with
Regulation 1026, Section 29(3).

MAURO GROUP INC.
ONTARIO LAND SURVEYORS

2 HOLLAND DRIVE, UNIT 5, BOLTON, ONTARIO L7E 1E1
PHONE 905.951.8000 - FAX 905.857.4811
www.maurogroup.ca - info@maurogroup.ca

PARTY CHIEF: BP DRAWN BY: IG CHECKED BY: GS
CLIENT: EAST & WEST INC.
PATH=F:\PROJECTS\2023\B8144\MSCAD\B8144_POS_T.DWG

PROJECT No. 23-B8144



SITE BENCHMARK
A TEMPORARY BENCHMARK AT NORTHWEST CORNER OF THE PROPERTY,
AS ILLUSTRATED HAVING AN ELEVATION OF 188.253 METRES.

BENCHMARK NOTE
ELEVATIONS HEREON ARE GEODETIC IN ORIGIN AND WERE DERIVED FROM THE
TOWN OF OAKVILLE, BENCHMARK No.170 HAVING A PUBLISHED VALUE OF 188.2027 METRES.

KNOWN AS SIXTH LINE
ORIGINAL ROAD ALLOWANCE BETWEEN LOTS 15 AND 16, CONCESSION 2 N.D.S.
PIN 24929-5801 (LT)

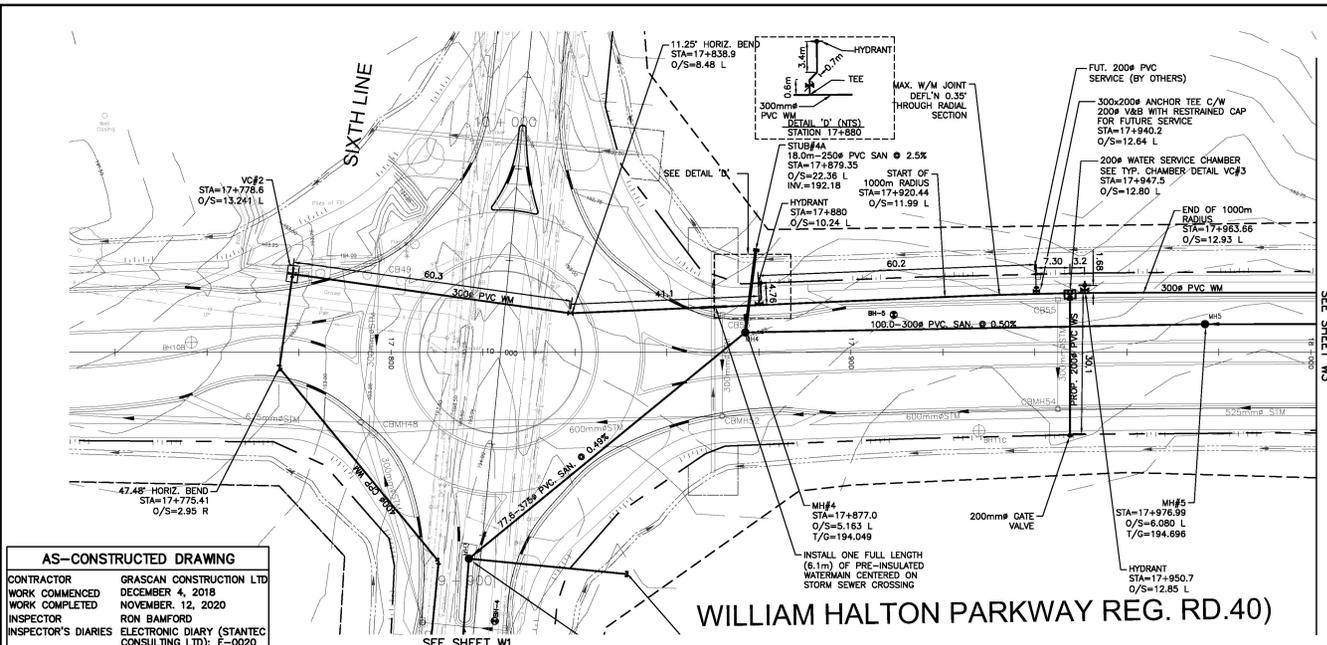
BLOCK 1
PIN 24929-6935 (LT)

BLOCK 6
PIN 24929-6940 (LT)

PLAN 20M-1243

BLOCK 7, PLAN 20M-1243
PIN 24929-6941 (LT)

REGIONAL INFRASTRUCTURE OF HALTON
 ITS REPORTING, OFFICES AND AGENTS
 ARE NOT RESPONSIBLE FOR THE
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 OF THIS DRAWING SHALL BE RESPONSIBLE
 FOR OBTAINING ALL NECESSARY
 ALL INFORMATION SHOULD BE OBTAINED.



AS-CONSTRUCTED DRAWING

CONTRACTOR GRASCAN CONSTRUCTION LTD
 WORK COMMENCED DECEMBER 4, 2018
 WORK COMPLETED NOVEMBER 12, 2020
 INSPECTOR RON BAMFORD
 INSPECTOR'S DIARIES ELECTRONIC DIARY (STANTEC CONSULTING LTD): E-0020

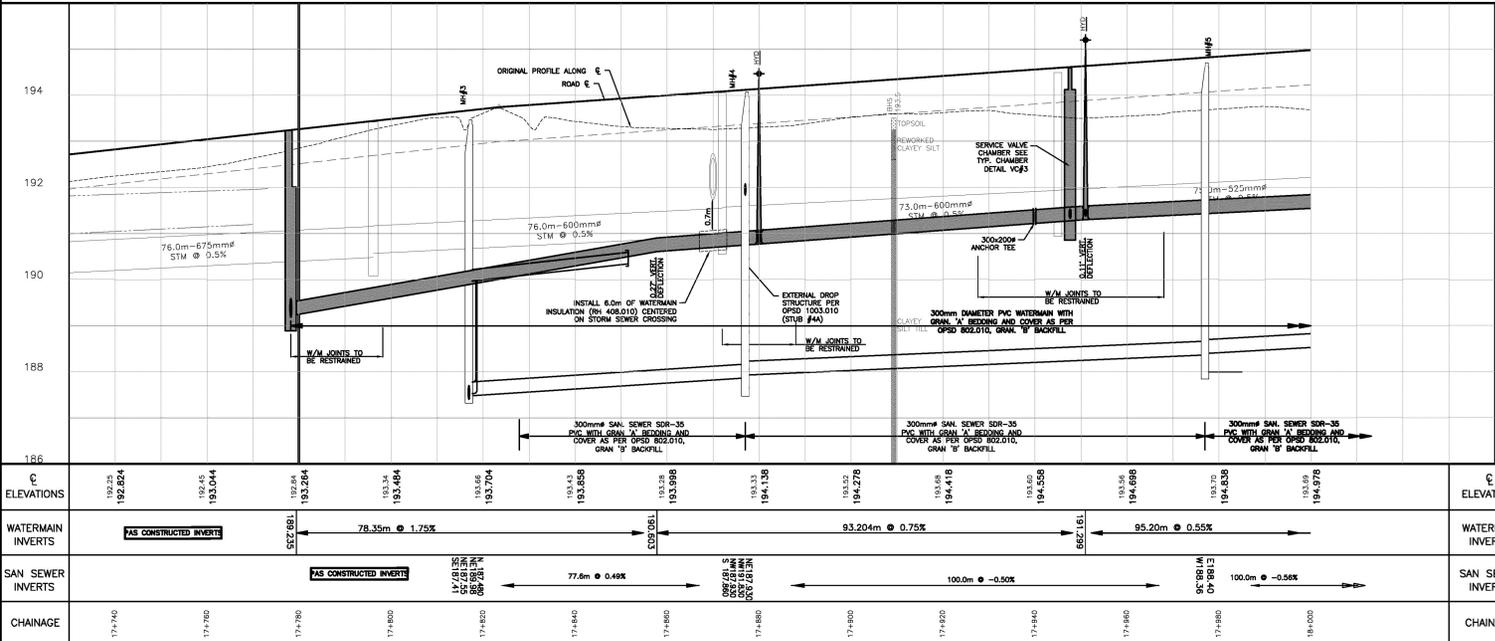
The Regional Municipality of Halton makes no warranties with respect to the accuracy of this drawing and assumed no responsibility for its use. All information should be verified

WILLIAM HALTON PARKWAY REG. RD.40



- GENERAL NOTES**
- ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED
 - EXISTING HYDRO POLES AND GUY WIRES TO BE MAINTAINED AND/OR SUPPORTED TO THE SATISFACTION OF THE UTILITY COMPANIES DURING CONSTRUCTION.
- SANITARY SEWER NOTES**
- ALL SANITARY SEWER INSTALLATION CONFORMED TO THE LATEST REVISIONS OF THE ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD) AND SPECIFICATIONS (OPSS) AS AMENDED BY THE REGIONAL MUNICIPALITY OF HALTON.
 - SANITARY MANHOLES AS PER O.P.S.D. 701.010 WITH FRAMES AND COVERS AS PER O.P.S.D. 401.01 TYPE "A" UNLESS OTHERWISE NOTED ON THE DRAWINGS.
 - BENCHING IN MANHOLES ARE AS PER O.P.S.D. 701.021 AS AMENDED BY THE REGION OF HALTON. BENCHING IN SANITARY MANHOLES ARE TO THE ORBERT OF THE PIPE.
 - SANITARY SEWER PIPE ARE PVC SDR35 CONFORMING TO A.S.T.M. D3034 UNLESS OTHERWISE NOTED.
 - CLASS "B" BEDDING ON ALL SEWERS AND CONNECTIONS ARE AS PER O.P.S.D. 100.02 UNLESS NOTED OTHERWISE.
 - GRANULAR BACKFILL AROUND MANHOLES ARE COMPACTED BY MECHANICAL MEANS TO A MINIMUM OF 95% S.D.P.
- WATERMAIN NOTES**
- 400mm DIA. WATERMAIN MATERIAL IS CONCRETE PRESSURE PIPE AS PER AWWA C303 CLASS 16. 150-300mm WATERMAIN MATERIAL TO BE PVC CL 150 (DR-18). ALL OTHER MATERIALS AS PER REGION OF HALTON APPROVED MANUFACTURERS PRODUCT LIST FOR WATER SYSTEMS.
 - THE CONTRACTOR PROVIDED ALL TEMPORARY CAPS, PLUGS AND BLOW-OFFS REQUIRED FOR TESTING THE NEW WATERMAIN.
 - MAXIMUM ALLOWABLE PIPE JOINT DEFLECTION OF THE WATERMAIN IS LIMITED TO 50% OF MANUFACTURER'S SPECIFICATIONS.
 - CORROSION PROTECTION IS REQUIRED FOR ALL METALLIC PIPE, VALVES, FITTINGS, SERVICES AND HYDRANTS. CATHODIC PROTECTION (ZINC ANODE) AS PER THE REGIONAL SPECIFICATIONS OR PETROLIUM COATINGS MEETING AWWA C427 ARE USED.
 - HYDRANTS INSTALLED SUCH THAT THE LOWER BODY/STEM LENGTH SHALL NOT EXCEED 1.7m MEASURED FROM THE BREAK-OFF FLANGE.
 - REGIONAL MUNICIPALITY OF HALTON APPROVED MECHANICAL RESTRAINTS WERE USED ON ALL STANDARD BENDS, VALVES, FITTINGS AND HYDRANTS. REFER TO CONTRACT DOCUMENTS.
 - RESTRAINT LENGTHS SHOWN ARE FOR BUDGET PURPOSES ONLY. NUMBER AND/OR LENGTH OF JOINTS TO BE RESTRAINED TO BE CONFIRMED BY MANUFACTURER THROUGH SUBMITTAL OF SHOP DRAWINGS. IN ACCORDANCE WITH CONTRACT DOCUMENTS, REVISIONS OR ALTERATIONS TO DEFLECTIONS AND BENDS SHOWN ON THE DRAWINGS DURING INSTALLATION ARE TO BE PROVIDED WITH REVISED SHOP DRAWINGS SHOWING ALTERATIONS TO NUMBER AND LENGTH FOR JOINTS TO BE RESTRAINED.
 - COMMISSIONING AND DISINFECTION OF WATERMANS AS PER REGION OF HALTON DOCUMENT #DS-W98.

MATCH LINE
 SEE SHEET W3



NO	Date	By	REVISIONS	MANH CAD
4	20.12.12	XX	AS CONSTRUCTED (STANTEC)	X
3	19.03.18	AM	SANITARY SEWER REVISED	X
2	18.12.12	GM	ISSUED FOR CONSTRUCTION	X
1	18.07.09	GM	ISSUE FOR TENDER	X

Design	A.M.	Ch'kd	G.M.	Date
Drawn	D.P.	Ch'kd		

Scale
 1:500 Horiz.
 1:50 Vert.

Field Notes
 REGIONAL BOOK

Stamp
 Director, Engineering and Construction
 JPOWELL@HALTON

Manager, Capital Engineering and Construction
 Stantec Consulting Ltd.
 100 Wellington Street West
 Waterloo, ON Canada
 N6L 1A7
 Tel: 519.776.4410
 Fax: 519.776.4291
 www.stantec.com

Halton REGION

**WATERMAIN & SANITARY SEWER
 WILLIAM HALTON PARKWAY (Reg. Rd.40)**
 FROM SIXTH LINE TO 250M EAST OF SIXTH LINE
 STA. 17+750 TO STA. 18+000
 IN THE TOWN OF OAKVILLE

Consultant File No
16510057

Regional Drawing No

CONTRACT NO
PR-2263D(PART 1)-18

Drawing No
W2

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11

2808524

Municipality 28605 Con. DS N 02

County or District [Redacted] Township/Borough/City/Town/Village **OAKVILLE** Con block tract survey, etc. Lot **15**
Address **4243 6TH LINE OAKVILLE** Date completed **23 05 96**

Northing RC Elevation RC Basin Code ii iii iv

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)					
General colour	Most common material	Other materials	General description	Depth - feet	
				From	To
	WELL ABANDONMENT NO RECORDS AVAILABLE FOR INSTALLATION				
	CONCRETE TILE REMOVED				

31 32

41 WATER RECORD

Water found at - feet	Kind of water			
10-13	1 <input type="checkbox"/> Fresh	3 <input type="checkbox"/> Sulphur	4 <input type="checkbox"/> Minerals	14 <input type="checkbox"/> Gas
15-18	1 <input type="checkbox"/> Fresh	3 <input type="checkbox"/> Sulphur	4 <input type="checkbox"/> Minerals	19 <input type="checkbox"/> Gas
20-23	1 <input type="checkbox"/> Fresh	3 <input type="checkbox"/> Sulphur	4 <input type="checkbox"/> Minerals	24 <input type="checkbox"/> Gas
25-28	1 <input type="checkbox"/> Fresh	3 <input type="checkbox"/> Sulphur	4 <input type="checkbox"/> Minerals	29 <input type="checkbox"/> Gas
30-33	1 <input type="checkbox"/> Fresh	3 <input type="checkbox"/> Sulphur	4 <input type="checkbox"/> Minerals	34 <input type="checkbox"/> Gas

51 CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth - feet	
			From	To
36"	1 <input type="checkbox"/> Steel 2 <input type="checkbox"/> Galvanized 3 <input checked="" type="checkbox"/> Concrete 4 <input type="checkbox"/> Open hole 5 <input type="checkbox"/> Plastic	2"	0	9.5 FT
17-18	1 <input type="checkbox"/> Steel 2 <input type="checkbox"/> Galvanized 3 <input type="checkbox"/> Concrete 4 <input type="checkbox"/> Open hole 5 <input type="checkbox"/> Plastic			20-23
24-25	1 <input type="checkbox"/> Steel 2 <input type="checkbox"/> Galvanized 3 <input type="checkbox"/> Concrete 4 <input type="checkbox"/> Open hole 5 <input type="checkbox"/> Plastic			27-30

SCREEN

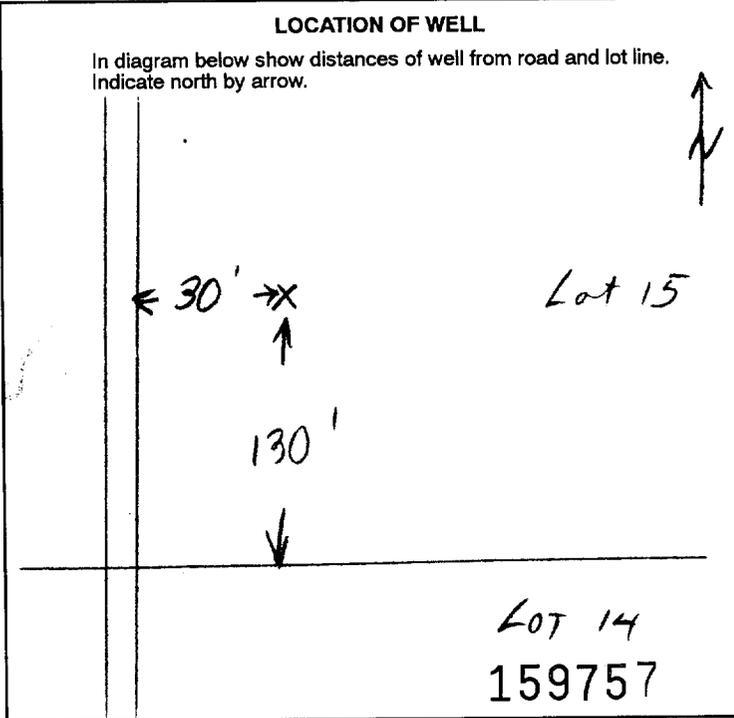
Sizes of opening (Slot No.)	Diameter	Length
NONE	inches	feet
Material and type	Depth at top of screen	
	feet	

61 PLUGGING & SEALING RECORD

<input type="checkbox"/> Annular space		<input checked="" type="checkbox"/> Abandonment
Depth set at - feet		Material and type (Cement grout, bentonite, etc.)
From	To	
9-10-13	8-14-17	MOLE PLUG
8-18-21	2-22-25	BLUE CLAY
2-26-29	0-30-33	BENTONITE & CLAY

71 PUMPING TEST

Pumping test method <input type="checkbox"/> Pump <input checked="" type="checkbox"/> Bailor	Pumping rate GPM	Duration of pumping Hours Mins
Static level feet	Water level end of pumping feet	Water levels during 15 minutes 30 minutes 45 minutes 60 minutes feet feet feet feet feet
If flowing give rate GPM	Pump intake set at feet	Water at end of test <input type="checkbox"/> Clear <input type="checkbox"/> Cloudy
Recommended pump type <input type="checkbox"/> Shallow <input type="checkbox"/> Deep	Recommended pump setting feet	Recommended pump rate GPM



FINAL STATUS OF WELL

1 <input type="checkbox"/> Water supply	5 <input type="checkbox"/> Abandoned, insufficient supply	9 <input type="checkbox"/> Unfinished
2 <input type="checkbox"/> Observation well	6 <input type="checkbox"/> Abandoned, poor quality	10 <input type="checkbox"/> Replacement well
3 <input type="checkbox"/> Test hole	7 <input checked="" type="checkbox"/> Abandoned (Other)	
4 <input type="checkbox"/> Recharge well	8 <input type="checkbox"/> Dewatering	

WATER USE

1 <input type="checkbox"/> Domestic	5 <input type="checkbox"/> Commercial	9 <input type="checkbox"/> Not used
2 <input type="checkbox"/> Stock	6 <input type="checkbox"/> Municipal	10 <input type="checkbox"/> Other
3 <input type="checkbox"/> Irrigation	7 <input type="checkbox"/> Public supply	
4 <input type="checkbox"/> Industrial	8 <input type="checkbox"/> Cooling & air conditioning	

METHOD OF CONSTRUCTION

1 <input type="checkbox"/> Cable tool	5 <input type="checkbox"/> Air percussion	9 <input type="checkbox"/> Driving
2 <input type="checkbox"/> Rotary (conventional)	6 <input type="checkbox"/> Boring	10 <input checked="" type="checkbox"/> Digging
3 <input type="checkbox"/> Rotary (reverse)	7 <input type="checkbox"/> Diamond	11 <input type="checkbox"/> Other
4 <input type="checkbox"/> Rotary (air)	8 <input type="checkbox"/> Jetting	

Name of Well Contractor **FRED CONSTABLE SON LTD** Well Contractor's Licence No. **1663**
Address **3936 MAJOR MACKENZIE DR WOODBRIDGE**
Name of Well Technician **KEN CONSTABLE** Well Technician's Licence No. **T 0228**
Signature of Technician/Contractor *[Signature]* Submission date **28 mo 05 yr 96**

MINISTRY USE ONLY

Data source	Contractor 1663	Date received FEB 27 1997
Date of inspection	Inspector	
Remarks		

CSS. S *[Signature]*

TRIM LINE

FINAL SIXTEEN MILE CREEK ENVIRONMENTAL IMPLEMENTATION REPORT AND FUNCTIONAL SERVICING STUDY

Prepared for STAR OAK DEVELOPMENTS LIMITED

APRIL 2018

FINAL SIXTEEN MILE CREEK ENVIRONMENTAL IMPLEMENTATION REPORT AND FUNCTIONAL SERVICING STUDY



TRIM LINE

Prepared for
STAR OAK DEVELOPMENTS LIMITED

APRIL 2018

Prepared by



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Table 7.2
Subcatchment SM1 Pre-Development Flows at Highway 407

Storm Event	Unit Flow Rate (m ³ /s/ha)	Pre-Development Flow ^a (m ³ /s)	Post-Development Flow ^c (m ³ /s)
2 Year	0.004	0.28	0.22
5 Year	0.007	0.49	0.31
10 Year	0.009	0.63	0.39
25 Year	0.012	0.84	0.64
50 Year	0.014	0.99	0.74
100 Year	0.016	1.13	0.85
Regional Storm	0.130	9.15 ^b	6.69

^aAll unit flow rates from the NOCSS Addendum with the exception of the Regional Storm unit flow rate obtained from Highway 407 culvert design capacity; drainage area = 70.36 ha applied to get return period event pre-development flows

^bbased on Highway 407 culvert capacity

^c Post development flow is based on the addition of outflow from proposed SWM Pond 23 and future SWM Pond 15. This represents the portion of the outflow contributing from the proposed/future development to the 2200mm culvert at Highway 407.

In accordance with the NOCSS, there are two SWM ponds recommended to service the EIR Subcatchment Area to be located on the west and east sides of Sixth Line. They are referred to as Pond 15 to service the EIR West Subarea and the Bell Cellular lands and Pond 23 to service the FSS Study Area. Target flows for each of these ponds are shown in **Tables 7.3 and 7.4** based on unit flow rates. As noted in the MOS (Section 2d), Regional Storm controls are not required in this EIR Subcatchment Area and therefore are not presented in the tables. Rather, Regional Storm flows from the ponds will be governed by the capacity of the Highway 407 culverts.

It should be noted that this EIR/FSS has identified no uncontrolled developed areas in the SM1 subcatchment area, no diversions into the SM1 subcatchment area from other subcatchment and only one minor (1.04 ha) diversion out of the SM1 subcatchment. As a result, there is no need to adjust the allowable release rates shown for the two SWM facilities.

Table 7.3
Allowable Release Rates, Pond 15

Storm Event	Unit Flow Rate ^a (m ³ /s/ha)	Target Release Rate (m ³ /s)
2 Year	0.004	0.174
5 Year	0.007	0.304
10 Year	0.009	0.391
25 Year	0.012	0.521
50 Year	0.014	0.608
100 Year	0.016	0.694
Regional Storm	0.130	5.642 ^b

^aAll unit flow rates from the NOCSS Addendum with the exception of the Regional Storm unit flow rate that was obtained from Highway 407 culvert design capacity; drainage area = 43.4 ha as shown on Figure 7.2 applied to get return period target release rates^b based on Highway 407 culvert capacity

Table 7.4
Allowable Release Rates, Pond 23

Storm Event	Unit Flow Rate ^a (m ³ /s/ha)	Target Release Rate ^b (m ³ /s)
2 Year	0.004	0.042
5 Year	0.007	0.073
10 Year	0.009	0.094
25 Year	0.012	0.126
50 Year	0.014	0.147
100 Year	0.016	0.168
Regional Storm	0.130	1.361 ^c

^aAll unit flow rates from the NOCSS Addendum with the exception of the Regional Storm unit flow rate that were obtained from Highway 407 culvert design capacity;

^b release rates are based on existing drainage area = 10.47 ha at proposed discharge point from the Pond 23 SWM block, applied to get return period event target release rates; see Section 7.4

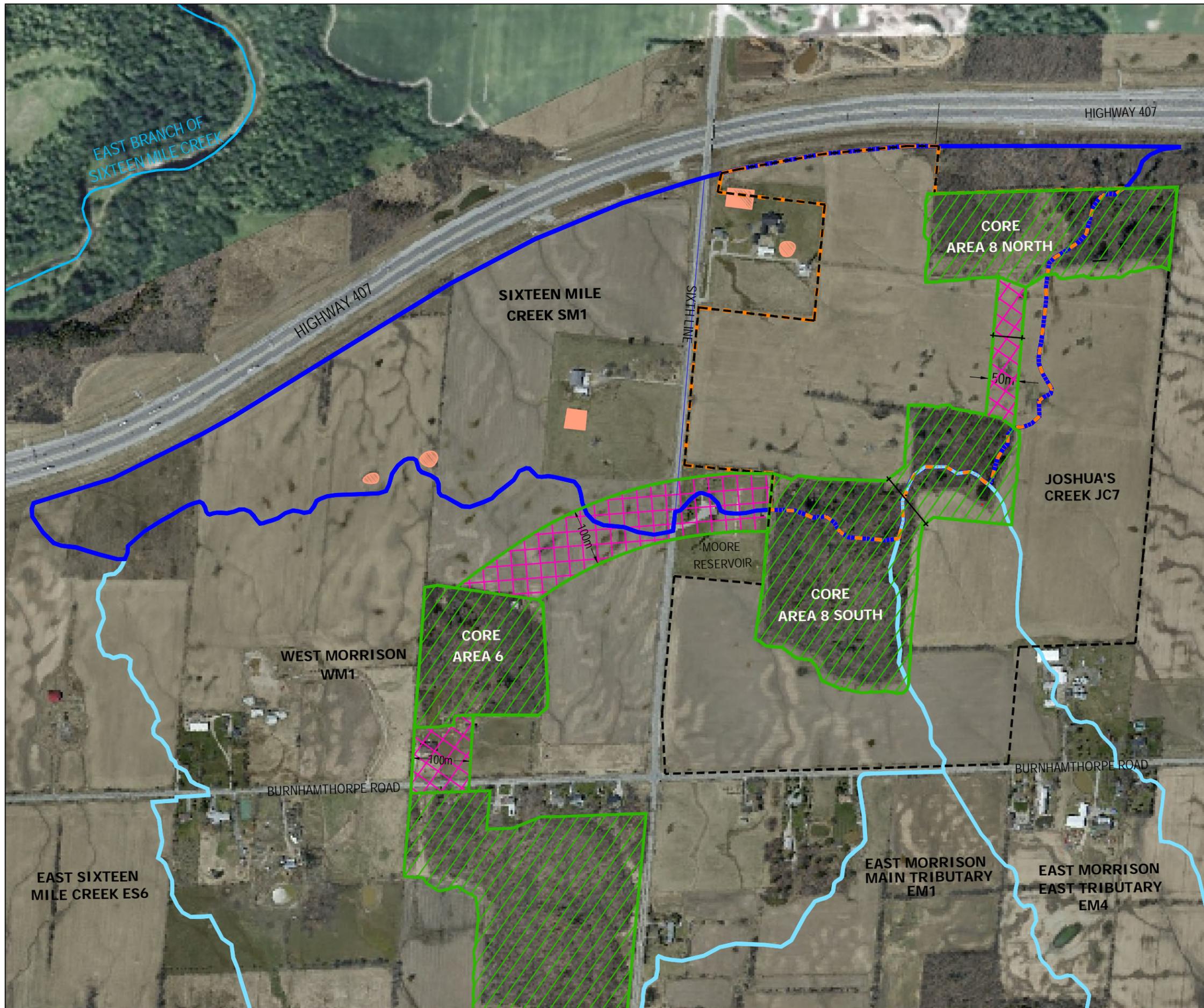
^c based on Highway 407 culvert capacity

7.3.2 Highway 407 ETR Culvert Capacity

Figure 7.1 illustrates the location of the existing 2200 mm diameter CMP culvert crossing Highway 407 (culvert SM-407-2). The design information for the culvert was obtained from the July 1999 “Highway 407 ETR Western Extension, Hydrology, Drainage and Stormwater Management Report”, prepared by Giffels. Based on this information, it was determined that the culvert was sized to convey the Regional Storm flow of 11.13 m³/s from the contributing drainage area (85.24 ha) consisting of the following catchments:

- 13.84 ha - Highway 407 ETR right-of-way; and,
- 71.40 ha - Drainage Area south of Highway 407 ETR

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ENVIRONMENTAL IMPLEMENTATION
REPORT AND FUNCTIONAL
SERVICING STUDY



- FSS Study Area
- Subject Lands
- EIR Subcatchment Area
- EIR Adjacent Subcatchment Boundaries
- NHS Boundary
- Hydrologic Feature B
- Linkage Preserve Area
- Core Preserve Area

Note: There are no High, Medium or Low Constraint Stream Corridors, Optional Linkage Preserve Areas or Hydrologic Feature A in EIR Subcatchment Area.



16 MILE CREEK SUBCATCHMENT SM1

FIGURE 2.1
Natural Heritage System
Framework

REVISED: Sep 17, 2010 - 1:45pm



STORMWATER MANAGEMENT IMPLEMENTATION REPORT

STAR OAK NORTH 2

**STAR OAK DEVELOPMENTS LIMITED
PHASE 2
DRAFT PLAN OF SUBDIVISION 24T-13002**

**TOWN OF OAKVILLE
REGIONAL MUNICIPALITY OF HALTON**

PROJECT NO. 16987-2

Revised APRIL 2019

**RAND ENGINEERING CORPORATION
5285 SOLAR DRIVE
MISSISSAUGA, ONTARIO
L4W 5B8**



LEGEND

- 26.96 Ha. DRAINAGE AREA TO POND 23 IN HECTARES (Ha.)
- DENOTES SINGLE CATCHBASIN
- DENOTES DOUBLE CATCHBASIN
- DENOTES STORM MANHOLE
- DENOTES SINGLE CATCHBASIN STORM MANHOLE
- DENOTES DOUBLE CATCHBASIN STORM MANHOLE
- STAR OAK DEVELOPMENT LIMITED PROPERTY
- DRAINAGE BOUNDARY TO POND 23
- SUBCATCHMENT DRAINAGE BOUNDARY
- NHS BOUNDARY
- POTENTIAL 4M WIDE BIOSWALE LOCATION

0 50 m 100 m
SCALE 1:4,500



16 MILE CREEK SUBCATCHMENT SM1

**Drawing C-1
Storm Drainage System Design with
4m Wide Bioswale/Landscape Area
and Pre-Treatment for Roof + Parking**

REVISED: Apr 02, 2019 - 2:15pm

FILE: R:\060870576_Figures_2018\March 13 10:57_2_Drawing C-1.dwg



Soil Engineers Ltd.

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**A REPORT TO
LIVESPACE INTERIORS CANADA LTD. AND EAST & WEST INC.**

**A GEOTECHNICAL INVESTIGATION FOR
PROPOSED COMMERCIAL/INDUSTRIAL DEVELOPMENT**

**4243 SIXTH LINE
TOWN OF OAKVILLE**

REFERENCE NO. 2306-S222

SEPTEMBER 2023

DISTRIBUTION

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Subsurface Profiles Drawing No. 2



1.0 **INTRODUCTION**

In accordance with a written authorization from Ms. Preeti Dhall of Livespace Interiors Canada Ltd. and East & West Inc., dated June 26, 2023, and our revised proposal dated July 12, 2023, a geotechnical investigation was carried out at 4243 Sixth Line in the Town of Oakville.

The purpose of the investigation was to reveal the subsurface conditions and determine the engineering properties of the disclosed soils for the proposed commercial/industrial development. The geotechnical findings and recommendations for the proposed development are presented in this report.

Soil Engineers Ltd. confirms that the geotechnical report has been completed in compliance with Ontario Building Code 2012 Subsection 4.2.4.

2.0 **SITE AND PROJECT DESCRIPTION**

The site is situated on Halton till plain overlying a shale bedrock of Queenston Formation which occurs at a shallow to moderate depth.

The subject property, approximately 3.8 hectares in area, has a municipal address of 4243 Sixth Line, located in the northeast quadrant of William Halton Parkway East and Sixth Line in the Town of Oakville. At the time of investigation, the site is occupied by a vacant two-storey dwelling and a Bell Canada cellular tower. The balance of the site is generally vacant, with a pond at the northwest corner of the property and soil stockpiles along the northern limit of the property. The existing site gradient is relatively flat, generally level with Sixth Line.

A review of the site plan provided by Candevcon Inc. indicates that the property will be developed into two commercial/industrial buildings. It will be provided with municipal services and access roadway to Sixth Line.

3.0 **FIELD WORK**

The field work, consisted of ten (10) boreholes extending to depths of 4.7 m, 5.0 m and 6.6 m below grade, was carried out on August 10 and 11, 2023, at the locations specified by Candevcon Inc. and adjusted by Soil Engineers Ltd. The borehole locations are shown on the Borehole Location Plan, Drawing No. 1.



The boreholes were advanced at intervals to the sampling depths by a track-mounted machine equipped with solid stem augers and split spoons for soil sampling. Standard Penetration Tests, using the procedures described on the enclosed “List of Abbreviations and Terms”, were performed at the sampling depths. The results are recorded as the Standard Penetration Resistance (or ‘N’ values) of the subsoil. Split-spoon samples were recovered for soil classification and laboratory testing.

Upon completion of borehole drilling, monitoring wells were installed in Boreholes 1, 7 and 9 to facilitate future groundwater level measurements and hydrogeological assessment. Details of the monitoring wells are presented in the borehole logs.

The field work was supervised and the findings were recorded by a Geotechnical Technician. The ground elevation at each of the borehole location was obtained using the Global Navigation Satellite System (GNSS).

4.0 **SUBSURFACE CONDITIONS**

Detailed descriptions of the subsurface conditions are presented on the Borehole Logs, comprising Figures 1 to 10, inclusive. The revealed stratigraphy is plotted in the Subsurface Profiles, Drawing No. 2. The engineering properties of the disclosed soils are discussed herein.

The investigation has disclosed that beneath a topsoil veneer and a layer of earth fill generally in the north half portion of the site, the property is generally underlain by a stratum of silty clay till.

4.1 **Topsoil**

The revealed topsoil ranges from 20 to 36 cm in thickness. Thicker topsoil layers can be anticipated in places, especially in low-lying areas.

4.2 **Earth Fill**

A layer of earth fill, extending to depths ranging from 1.4 to 3.0 m, was encountered in Boreholes 1 to 5, inclusive, generally in the north half of the property. It consists of silty clay, with a variable amount of topsoil inclusions and layers, and rootlets.

The natural water content of the samples was determined and the results are plotted on the Borehole Logs; the values range from 14% to 32%, with a median of 19%, indicating that the



fill is in a moist to very moist condition. The high water content value indicates the presence of topsoil inclusions.

The obtained 'N' values range from 5 to 32, with a median of 9 blows per 30 cm of penetration, indicating that the fill was likely placed with non-uniformly compaction.

Due to its unknown history, the earth fill is not suitable to support any structures sensitive to settlement. It must be subexcavated, sorted free of deleterious material and organics and properly recompacted in layers.

4.3 **Silty Clay Till**

The silty clay till was encountered in all boreholes, with a weathered zone extending to a depth of up to 1.0 m below the prevailing ground surface. It consists of a random mixture of particle sizes ranging from clay to gravel, with the silt and clay being the dominant fraction. Intermittent high resistance to augering was encountered, indicating the presence of cobbles, boulders and shale fragments. Grain size analyses were performed on 2 representative samples; the results are plotted on Figure 11.

The obtained 'N' values range from 4 to over 100 blows per 30 cm of penetration, with a median of 31 blows per 30 cm of penetration, indicating the clay till is firm to hard, being generally very stiff in consistency. The firm clay till was contacted in the weathered zone near the ground surface.

Atterberg Limits on 2 samples were completed; having liquid limits of 23% and 25%, and plastic limit of 16%, indicating the clay till is low in plasticity.

The natural water content of the soil samples ranges between 10% and 27%, with a median of 12%, showing a generally moist condition.

The engineering properties of the clay till deposit are given below:

- High frost susceptibility and low water erodibility.
- The clay till will be stable in relatively steep slopes; however, prolonged exposure will allow the sand seams to slough, which may lead to local sliding.



5.0 **GROUNDWATER CONDITION**

All boreholes remained dry upon completion of the field work.

During wet seasons, shallower groundwater may be encountered and will be subjected to seasonal fluctuations.

6.0 **DISCUSSION AND RECOMMENDATIONS**

The investigation has disclosed that beneath a topsoil veneer and a layer of earth fill within the north half of the property, the site is underlain by a stratum of silty clay till, firm to hard in consistency.

All boreholes remained dry upon completion of the field work.

The proposed development will consist of two commercial/industrial buildings, with municipal services and access road. The geotechnical findings warranting special consideration for the proposed project are presented below:

1. The topsoil must be removed for site development. It can only be re-used for landscaping in designated areas only.
2. The existing earth fill is not suitable to support structures sensitive to settlement. It must be subexcavated and replaced with properly compacted engineered fill unless other soil improvement technique is being considered for the proposed development.
3. Existing structures on site should be demolished. After demolition and removal of structures, the debris must be disposed of off-site. The cavities and trenches should be backfilled with selected on-site material, free of organics, compacted to 98% Standard Proctor Dry Density (SPDD).
4. The pond should be properly decommissioned prior to re-development. Any wet material in the pond must be removed and the subgrade should be inspected prior to backfilling with engineered fill for future development.
5. The site can be re-graded with an engineered fill for development. The weathered soils must be sub-excavated, sorted free of topsoil and organics before reuse for engineered fill or structural backfill.
6. The engineered fill and sound native soils are suitable for supporting the proposed structures, underground services and road pavement.



The recommendations appropriate for the design of the development are presented herein. One must be aware that the subsurface conditions may vary between boreholes. Should subsurface variances become apparent during construction, a geotechnical engineer must be consulted.

6.1 **Site Preparation**

After demolition of the existing dwelling and structures, the debris and underground utilities must be removed and disposed of off-site. The cavities should be backfilled according to engineered fill standards. Existing water wells, monitoring wells and septic system, if any, should be removed and properly decommissioned.

Any decommissioned ponds previously backfilled should be identified and assessed. The remaining pond on site should be properly decommissioned prior to development. Any wet material in the pond must be removed and the subgrade should be inspected prior to backfilling to engineered fill standards.

Prior to site grading, the vegetation and topsoil must be removed. The topsoil can be stockpiled on site for reuse in landscaped areas.

The engineering requirements for a certifiable fill for building foundations, municipal services, slab-on-grade, and pavement construction are presented below:

1. The topsoil must be removed; the disturbed soils, earth fill and weathered soils must be subexcavated and further assessed of their suitability for engineered fill.
2. The native soil subgrade must be inspected and proof-rolled prior to any fill placement.
3. Inorganic soils must be used for the fill, and they must be uniformly compacted in lifts 20 cm thick to 98% or + of the maximum Standard Proctor dry density up to the proposed pre-grade or finished grade. The soil moisture must be properly controlled near the optimum. If the foundations are to be built soon after the fill placement, the densification process for the engineered fill must be increased to 100% of the maximum Standard Proctor compaction.
4. If the engineered fill is compacted with the moisture content on the wet side of the optimum, the underground services and pavement construction should not begin until the pore pressure within the fill mantle has completely dissipated. This must be further assessed at the time of the engineered fill construction.
5. If imported fill is to be used, it should be inorganic soils, free of any deleterious material with environmental issue (contamination). Any potential imported earth fill from off-site must be reviewed for geotechnical and environmental quality by the appropriate personnel as authorized by the developer or agency, before it is hauled to the site.



6. The engineered fill must not be placed during the period where freezing ambient temperatures occur either persistently or intermittently. This is to ensure that the fill is free of frozen soils, ice and snow.
7. The fill operation must be supervised on a full time basis and monitored by a technician under the direction of a geotechnical engineer.
8. The engineered fill envelope and finished elevations must be clearly and accurately defined in the field, and they must be precisely documented.
9. Foundations founded on engineered fill must be reinforced and should be designed by a structural engineer to properly distribute the stress induced by the abrupt differential settlement (about 20 mm) in engineered fill.
10. Any excavation carried out in the certified engineered fill must be reported to the geotechnical consultant who supervised the fill placement in order to document the locations of excavation and/or to supervise reinstatement of the excavated areas to engineered fill status. If construction on the engineered fill does not commence within a period of 2 years from the date of certification, the condition of the engineered fill must be assessed for re-certification.
11. The footing and underground services subgrade must be inspected by the geotechnical consulting firm that supervised the engineered fill placement. This is to ensure that the foundations and service pipes are placed within the engineered fill envelope, and the integrity of the fill has not been compromised by interim construction, environmental degradation and/or disturbance by the footing excavation.

6.2 **Foundation**

The proposed structures can be supported on conventional spread and strip footings, founded on the undisturbed native soil or engineered fill. The recommended soil bearing pressures for the design of conventional footings are provided below:

- Maximum Bearing Pressure at Serviceability Limit State (SLS) = 150 kPa
- Factored Bearing Pressure at Ultimate Limit State (ULS) = 240 kPa

The total and differential settlements of structures designing for the bearing pressure at SLS are estimated within 25 mm and 20 mm, respectively.

During construction, the foundation subgrade should be inspected by the geotechnical engineer or a senior geotechnical technician to ensure that the revealed conditions are compatible with the foundation design requirements.



The perimeter footings exposed to the weather should have at least 1.2 m of earth cover for protection against frost action, unless they are properly insulated. In order to alleviate the risk of frost damage, the foundation walls must be constructed of concrete and either backfilled with non-frost susceptible granular material, or shielded with a polyethylene slip-membrane. The membrane will allow vertical movement of the heaving soil (due to frost) without imposing structural distress on the foundation.

Where water seepage is encountered during footing excavations, or where the subgrade of the foundations is found to be wet, the subgrade should be protected by a concrete mud-slab immediately after exposure. This will prevent construction disturbance and costly rectification.

The foundations should meet the requirements specified in the latest Ontario Building Code, and the structure should be designed to resist an earthquake force using Site Classification 'D' (stiff soil).

6.3 **Slab-On-Grade Construction**

The subgrade for slab-on-grade construction must consist of sound native soils, or engineered fill.

In preparation of the subgrade, the subgrade should be inspected and assessed by proof-rolling. Any weathered and/or loose soil should be subexcavated, sorted free of any deleterious material, aerated and uniformly compacted to at least 98% SPDD.

The concrete slab must be constructed on a 20 cm thick granular bedding, consisting of 19-mm Crusher-Run Limestone (CRL), compacted to 100% SPDD. A Modulus of Subgrade Reaction (k_s) of 25 MPa/m can be used for slab design.

The floor slab at the entrances into the buildings should be insulated with 50-mm Styrofoam, or equivalent, extending 1.2 m internally. This measure is to prevent cold drafts in the winter from inducing frost action in the subgrade and causing damage to the floor slab.

The grading around the building structure must be such that it directs runoff away from the structure.



6.4 **Underground Services**

The underground services should be founded on sound native soil or properly compacted inorganic earth fill. Where weathered soil is encountered, it should be subexcavated and replaced with the bedding material, compacted to at least 98% SPDD.

A Class 'B' bedding is recommended for the underground services construction. It should consist of compacted 19-mm Crusher-Run Limestone, or equivalent, as approved by a geotechnical engineer.

The pipe joints into the manholes and catch basins must be leak-proof to prevent the migration of fines through the joints. Openings to subdrains and catch basins should be shielded with a fabric filter to prevent blockage by silting.

A soil cover having a thickness at least equal to the diameter of the pipe should be in place at all times after pipe installation, to prevent pipe floatation when the trench is deluged with water derived from precipitation.

The on-site soils are considered corrosive to ductile iron pipes and metal fittings; therefore, the underground services should be protected against soil corrosion. For estimation for the anode weight requirements, the electrical resistivities of the disclosed soils can be used. The proposed anode weight must meet the minimum requirements as specified by the Town of Oakville and Peel Region Standard.

6.5 **Backfilling in Trenches and Excavated Areas**

The backfill in service trenches should be compacted to at least 98% SPDD, particularly below concrete floor subgrade and in the zone within 1.0 m below the pavement. The material should be compacted with the water content at 2% to 3% drier than the optimum.

The obtainable degree of compaction is primarily dependent on the soil moisture and, to a lesser extent, on the type of compactor used and the effort applied. As a general guide, the typical water content values of the revealed soils for Standard Proctor compaction are presented in Table 1.

**Table 1 - Estimated Water Content for Compaction of On-Site Material**

Soil Type	Determined Natural Water Content (%)	Water Content (%) for Standard Proctor Compaction	
		100% (optimum)	Range for 95% or +
Earth Fill	14 to 32 (median 19)	16	12 to 20
Silty Clay Till	10 to 27 (median 12)	16	12 to 20

The above values show the in-situ native till is mostly suitable for 95% or + Standard Proctor compaction.

The weathered till and existing fill must be sorted free of topsoil inclusions and deleterious materials, if any, prior to its use as structural backfill.

When compacting the till on the dry side of the optimum, the compactive energy will frequently bridge over the chunks in the soil and be transmitted laterally into the soil mantle. Therefore, the lifts must be limited to 20 cm or less (before compaction). Boulders over 15 cm in size must be sorted and removed from the backfill.

In normal construction practice, the problem areas of pavement settlement largely occur adjacent to manholes, catch basins, services crossings, foundation walls and columns, it is recommended that a sand backfill should be used.

The narrow trenches for services crossings should be cut at 1 vertical:2 horizontal so that the backfill in the trenches can be effectively compacted. Otherwise, soil arching in the trenches will prevent achievement of the proper compaction. In confined areas where the desired slope cannot be achieved or the operation of a proper kneading-type roller cannot be facilitated, imported sand fill, which can be appropriately compacted by using a smaller vibratory compactor, must be used.

6.6 **Pavement Design**

The pavement design for the proposed development is presented in Table 2.

**Table 2 - Pavement Design**

Course	Thickness (mm)	OPS Specifications
Asphalt Surface	40	HL3
Asphalt Binder	50	HL8
Granular Base	150	Granular 'A' or equivalent
Granular Sub-base Light-Duty Heavy-Duty/Fire Route	300 450	Granular 'B' or equivalent

In preparation of pavement subgrade, all topsoil and compressible material should be removed. The final subgrade must be proof-rolled using a heavy roller or loaded dump truck. Any soft spot identified must be rectified by subexcavation and replacing with selected dry inorganic material. The subgrade within 1.0 m below the underside of the granular sub-base must be compacted to at least 98% SPDD, with the water content at 2% to 3% drier than its optimum.

All the granular bases should be compacted in 150 to 200 mm lifts to 100% SPDD.

For the parking area, swales or an intercept subdrain system should be installed along the perimeter where surface runoff may drain onto the pavement. In paved areas, catch basins with stub drains in all four directions should be provided. The stub drains and subdrains should drain into the catch basin through filter-sleeved weepers. The invert of the subdrains should be at least 0.4 m beneath the underside of the granular sub-base and should be backfilled with free-draining granular material.

6.7 Soil Parameters

The recommended soil parameters for the project design are given in Table 3.

Table 3 - Soil Parameters

<u>Unit Weight and Bulk Factor</u>	Bulk Unit Weight γ (kN/m ³)	Estimated Bulk Factor	
		Loose	Compacted
Silty Clay Till	22.0	1.30	1.05
Earth Fill	21.5	1.25	1.00



Table 3 - Soil Parameters (Cont'd)

<u>Lateral Earth Pressure Coefficients</u>	Active K_a	At Rest K_o	Passive K_p
Silty Clay Till	0.33	0.50	3.00
<u>Effective Shear Strength Parameters</u>	Cohesion c' (kPa)	Angle of Internal Friction, φ'	
Silty Clay Till	5	30°	
<u>Coefficient of Permeability (K) and Percolation Time (T)</u>			
	K (cm/sec)	T (min/cm)	
Silty Clay Till	10 ⁻⁶ to 10 ⁻⁷	More than 50	
<u>Estimated Electrical Resistivity</u>			
Silty Clay Till	3500 ohm·cm		
<u>Coefficients of Friction</u>			
Between Concrete and Granular Base			0.50
Between Concrete and Sound Native Soils			0.35
<u>Maximum Allowable Soil Pressure (SLS) For Thrust Block Design</u>			
Engineered Fill and Sound Native Soils			75 kPa

6.8 Excavation

Excavation should be carried out in accordance with Ontario Regulation 213/91. The types of soils are classified in Table 4.

Table 4 - Classification of Soils for Excavation

Material	Type
Silty Clay Till	2
Weathered Till and Earth Fill	3

In the silty clay till deposit, any perched groundwater yield can be collected and removed by conventional pumping from sumps.

Excavation into the sound till with boulders and shale fragments will require extra effort and the use of properly equipped heavy-duty excavator.



7.0 LIMITATIONS OF REPORT

This report was prepared by Soil Engineers Ltd. for the account of Livespace Interiors Canada Ltd. and East & West Inc., for review by the designated consultants, financial institutions, government agencies and contractors. The material in the report reflects the judgment of Kelvin Hung, P.Eng., and Bernard Lee, P.Eng., in light of the information available to it at the time of preparation.

Use of the report is subject to the conditions and limitations of the contractual agreement. Any use which a Third Party makes of this report, and/or any reliance on decisions to be made based on it is the responsibility of such Third Parties. Soil Engineers Ltd. accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

SOIL ENGINEERS LTD.

Kelvin Hung, P.Eng.

Bernard Lee, P.Eng.
KH/BL



LIST OF ABBREVIATIONS AND DESCRIPTION OF TERMS

The abbreviations and terms commonly employed on the borehole logs and figures, and in the text of the report, are as follows:

SAMPLE TYPES

AS	Auger sample
CS	Chunk sample
DO	Drive open (split spoon)
DS	Denison type sample
FS	Foil sample
RC	Rock core (with size and percentage recovery)
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

PENETRATION RESISTANCE

Standard Penetration Resistance or 'N' Value:

The number of blows of a 63.5 kg hammer falling from a height of 76 cm required to advance a 51 mm outer diameter drive open sampler 30 cm into undisturbed soil, after an initial penetration of 15 cm.

Plotted as '○'

Dynamic Cone Penetration Resistance:

A continuous profile showing the number of blows per each 30 cm of penetration of a 51 mm diameter, 90° point cone driven by a 63.5 kg hammer falling from a height of 76 cm.

Plotted as '—●—'

WH	Sampler advanced by static weight
PH	Sampler advanced by hydraulic pressure
PM	Sampler advanced by manual pressure
NP	No penetration

SOIL DESCRIPTION

Cohesionless Soils:

<u>'N' (blows/30 cm)</u>		<u>Relative Density</u>
0	to 4	very loose
4	to 10	loose
10	to 30	compact
30	to 50	dense
	>50	very dense

Cohesive Soils:

<u>Undrained Shear Strength (kPa)</u>	<u>'N' (blows/30 cm)</u>	<u>Consistency</u>
<12	<2	very soft
12 to <25	2 to <4	soft
25 to <50	4 to <8	firm
50 to <100	8 to <15	stiff
100 to 200	15 to 30	very stiff
>200	>30	hard

Method of Determination of Undrained Shear Strength of Cohesive Soils:

x 0.0 Field vane test in borehole; the number denotes the sensitivity to remoulding

△ Laboratory vane test

METRIC CONVERSION FACTORS

1 ft	= 0.3048 m
1 inch	= 25.4 mm
1 lb	= 0.454 kg
1 ksf	= 47.88 kPa



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CONSULTING ENGINEERS

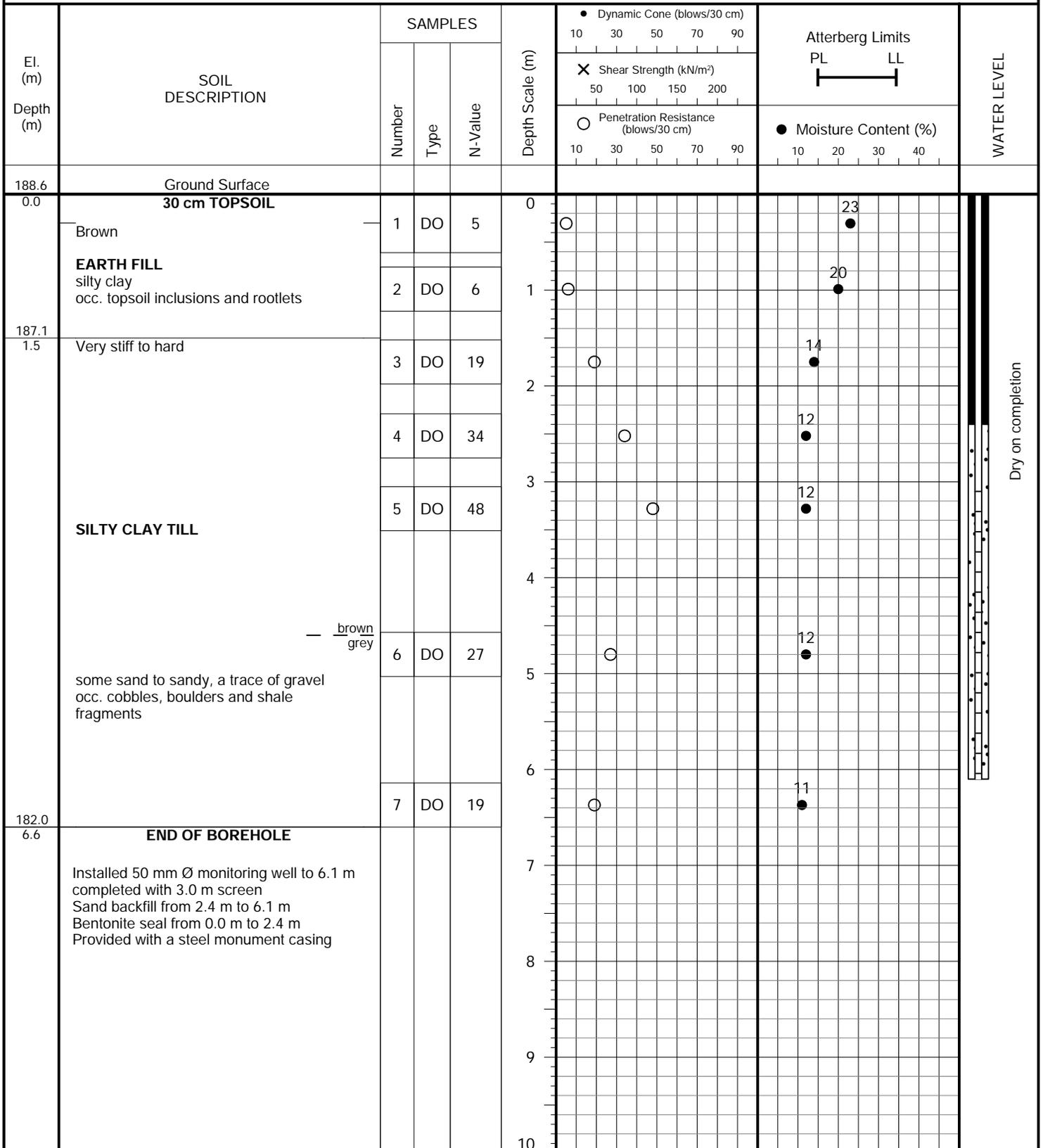
GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE

PROJECT DESCRIPTION: Proposed Commercial/Industrial Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 4243 Sixth Line, Town of Oakville

DRILLING DATE: August 11, 2023

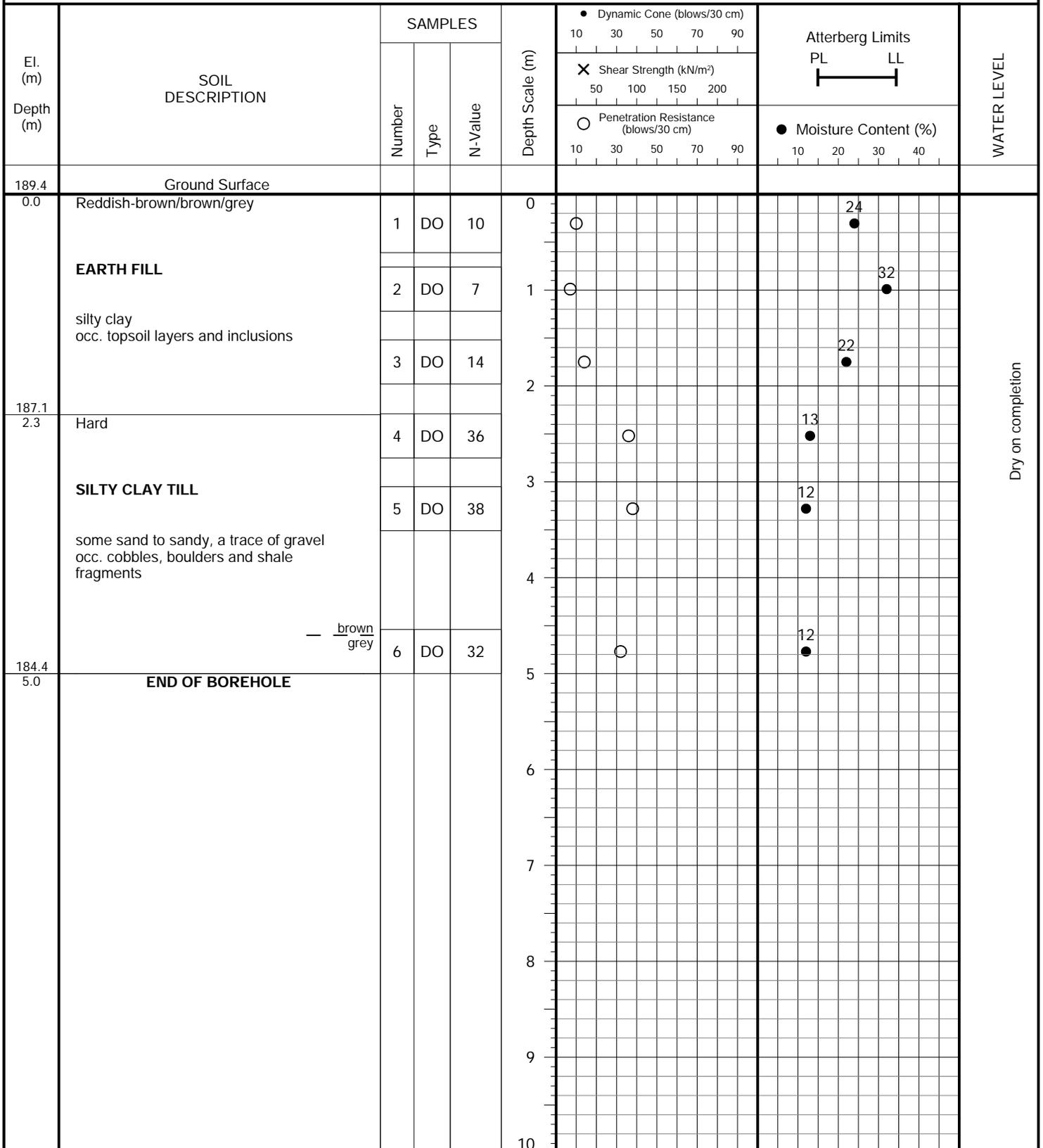


PROJECT DESCRIPTION: Proposed Commercial/Industrial Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 4243 Sixth Line, Town of Oakville

DRILLING DATE: August 10, 2023



Dry on completion

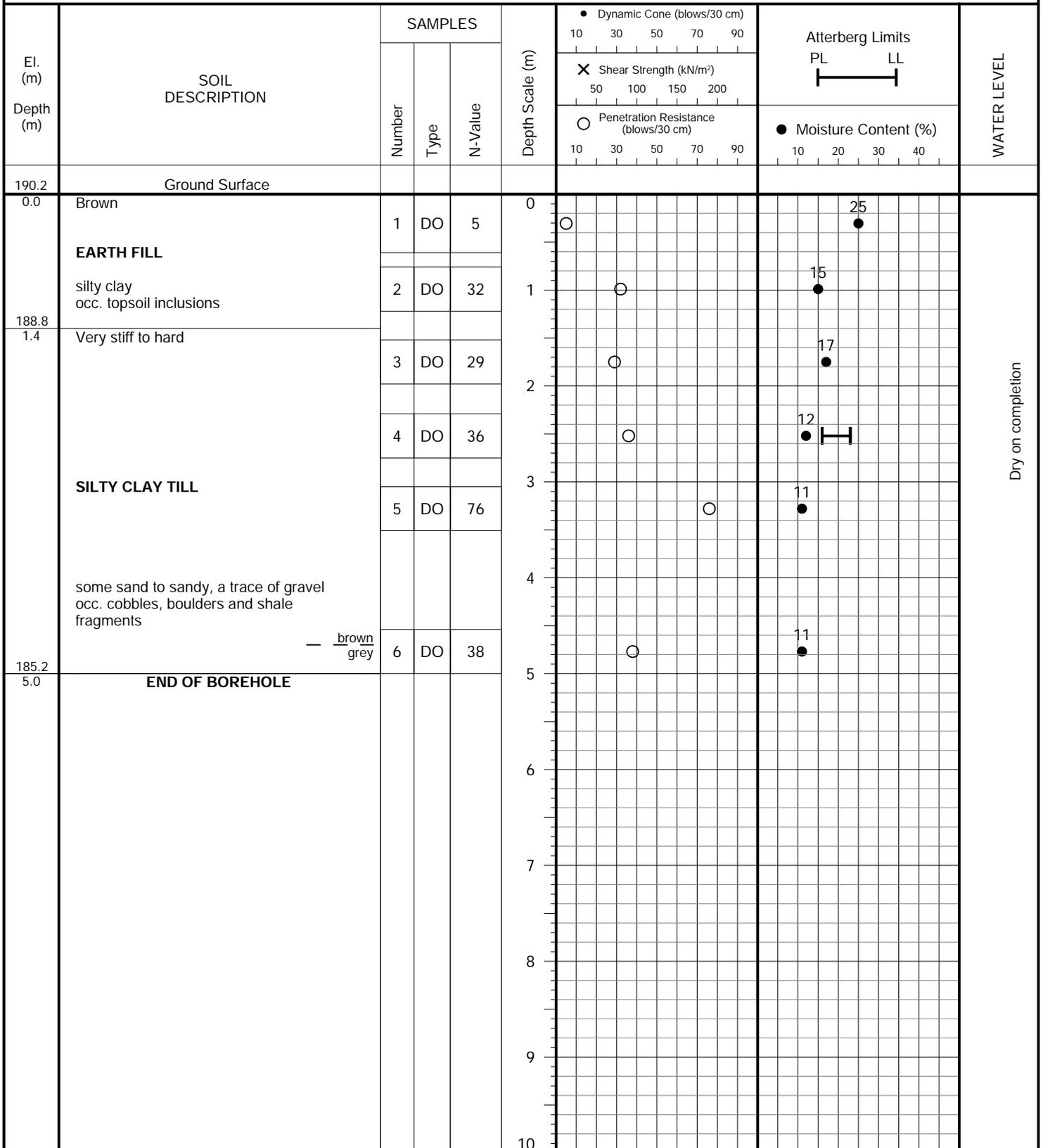


PROJECT DESCRIPTION: Proposed Commercial/Industrial Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 4243 Sixth Line, Town of Oakville

DRILLING DATE: August 10, 2023

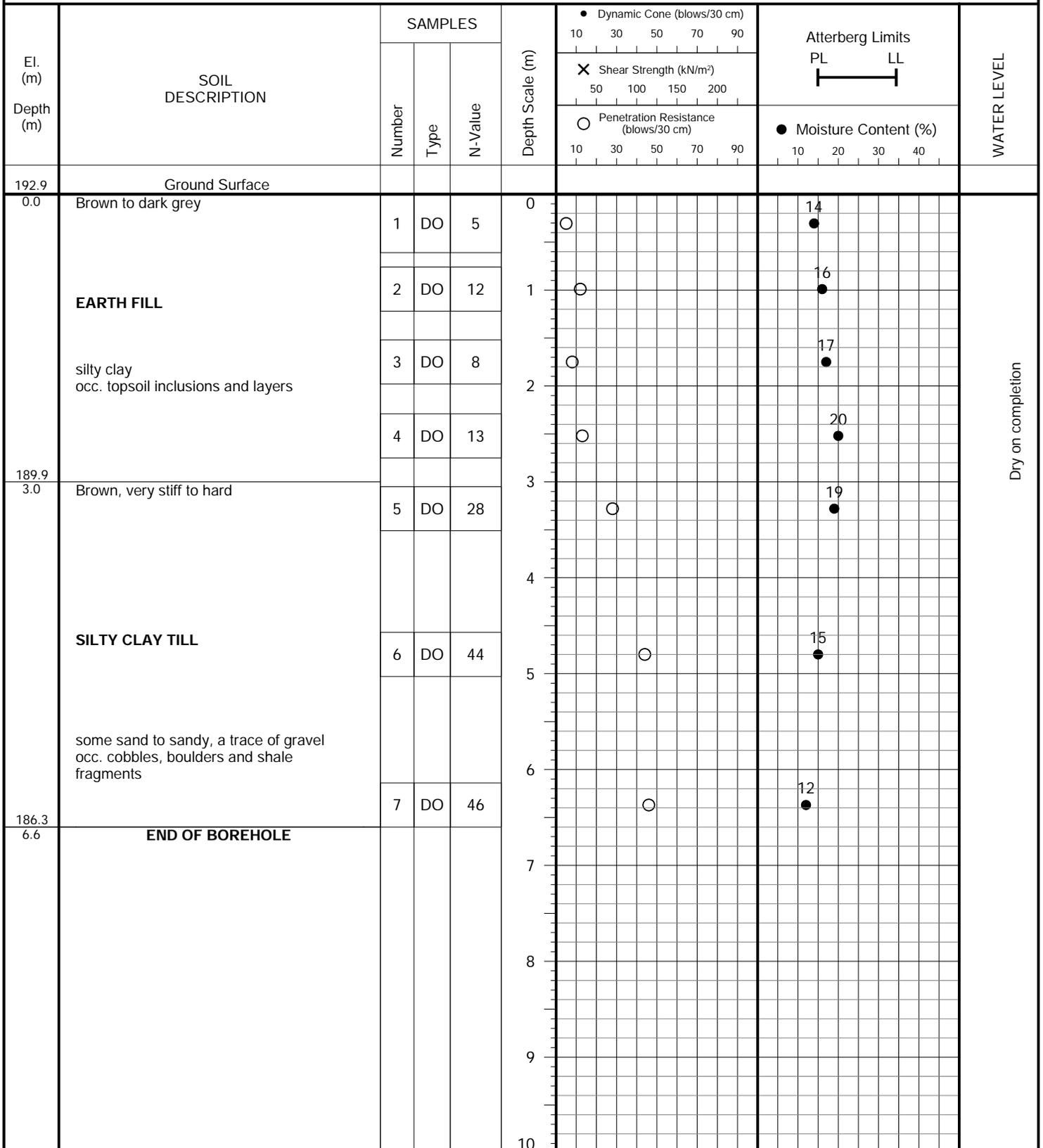


PROJECT DESCRIPTION: Proposed Commercial/Industrial Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 4243 Sixth Line, Town of Oakville

DRILLING DATE: August 10, 2023

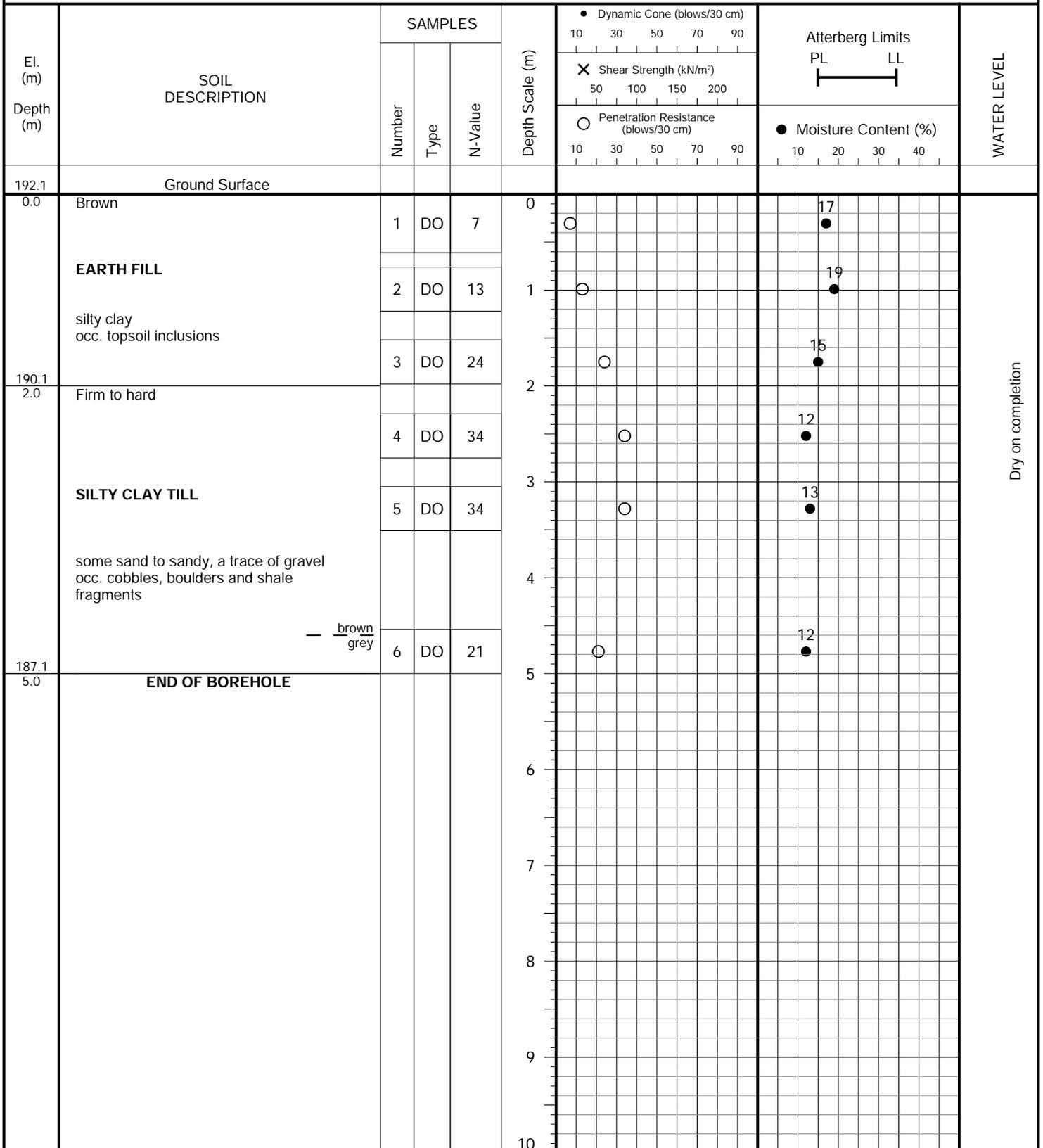


PROJECT DESCRIPTION: Proposed Commercial/Industrial Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 4243 Sixth Line, Town of Oakville

DRILLING DATE: August 10, 2023



JOB NO.: 2306-S222

LOG OF BOREHOLE: 6

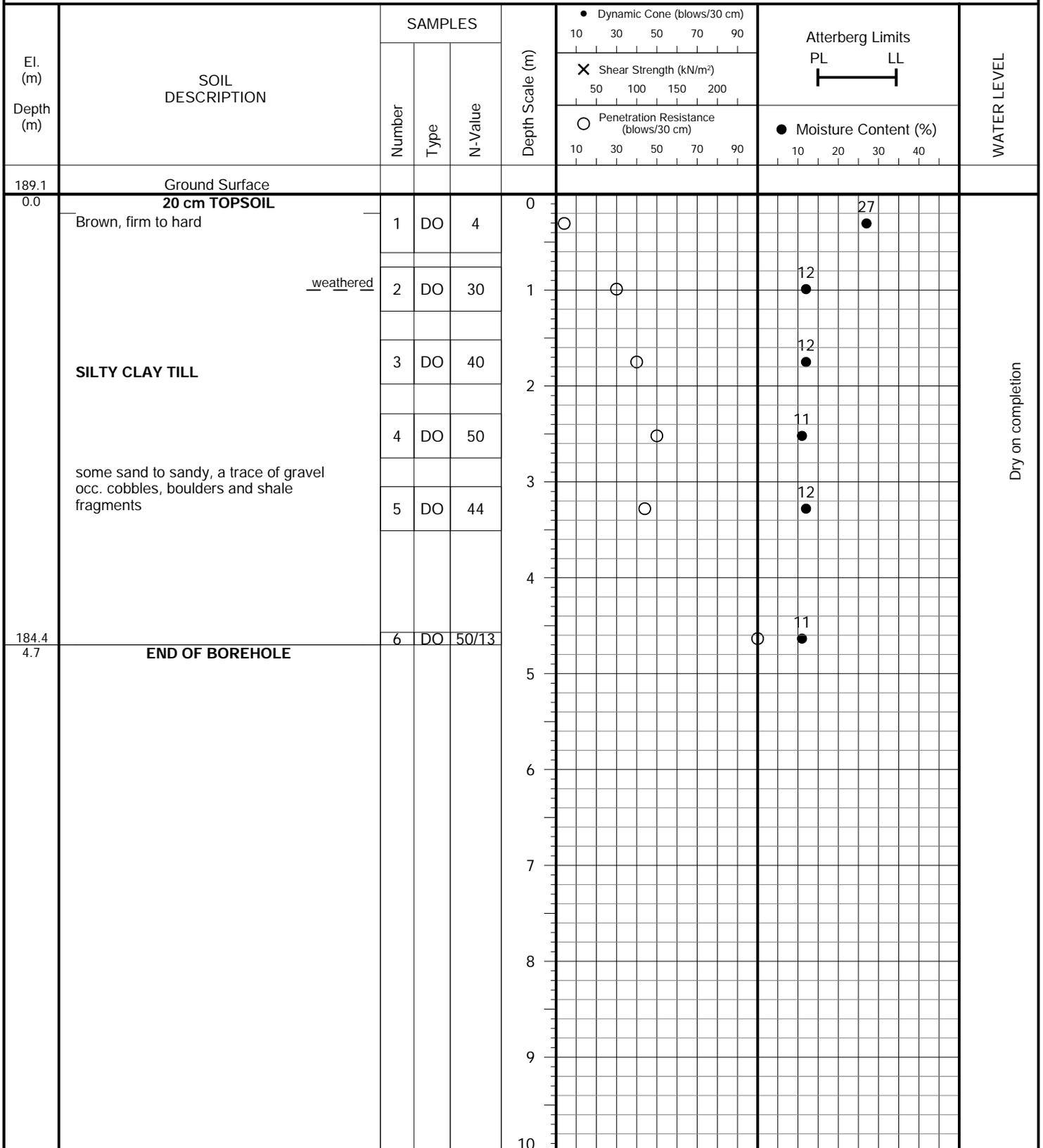
FIGURE NO.: 6

PROJECT DESCRIPTION: Proposed Commercial/Industrial Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 4243 Sixth Line, Town of Oakville

DRILLING DATE: August 10, 2023



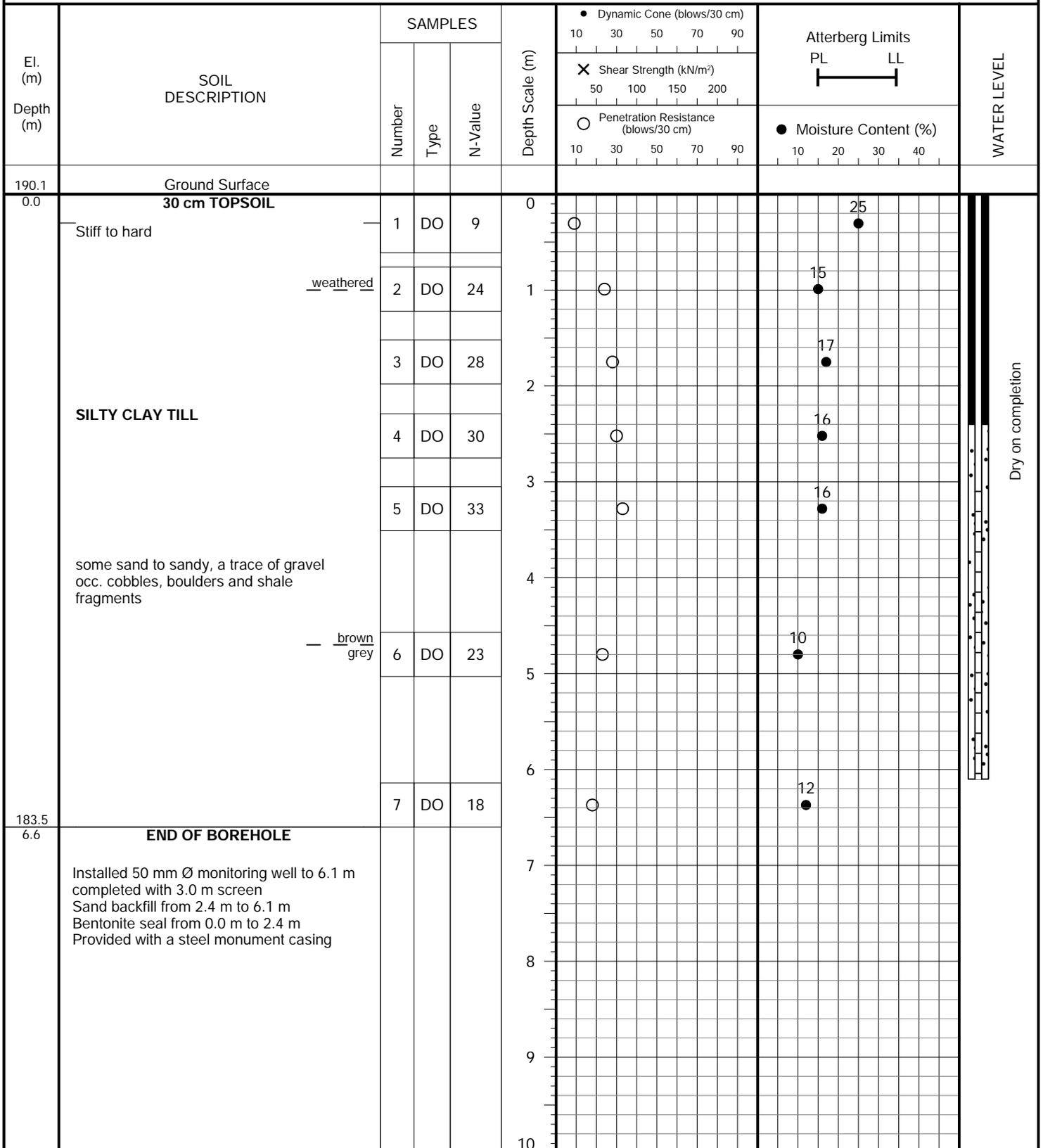
Soil Engineers Ltd.

PROJECT DESCRIPTION: Proposed Commercial/Industrial Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 4243 Sixth Line, Town of Oakville

DRILLING DATE: August 11, 2023

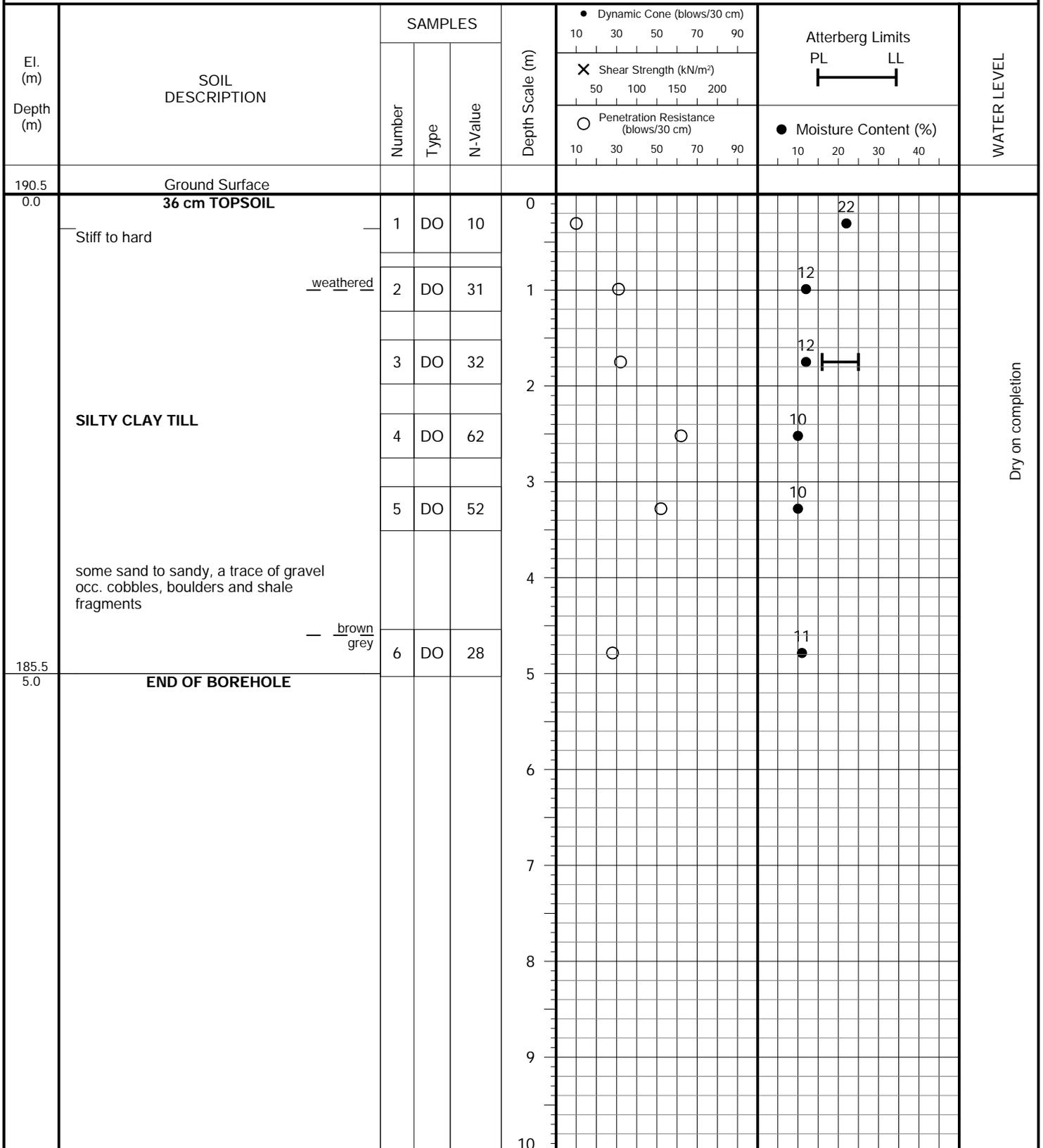


PROJECT DESCRIPTION: Proposed Commercial/Industrial Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 4243 Sixth Line, Town of Oakville

DRILLING DATE: August 11, 2023

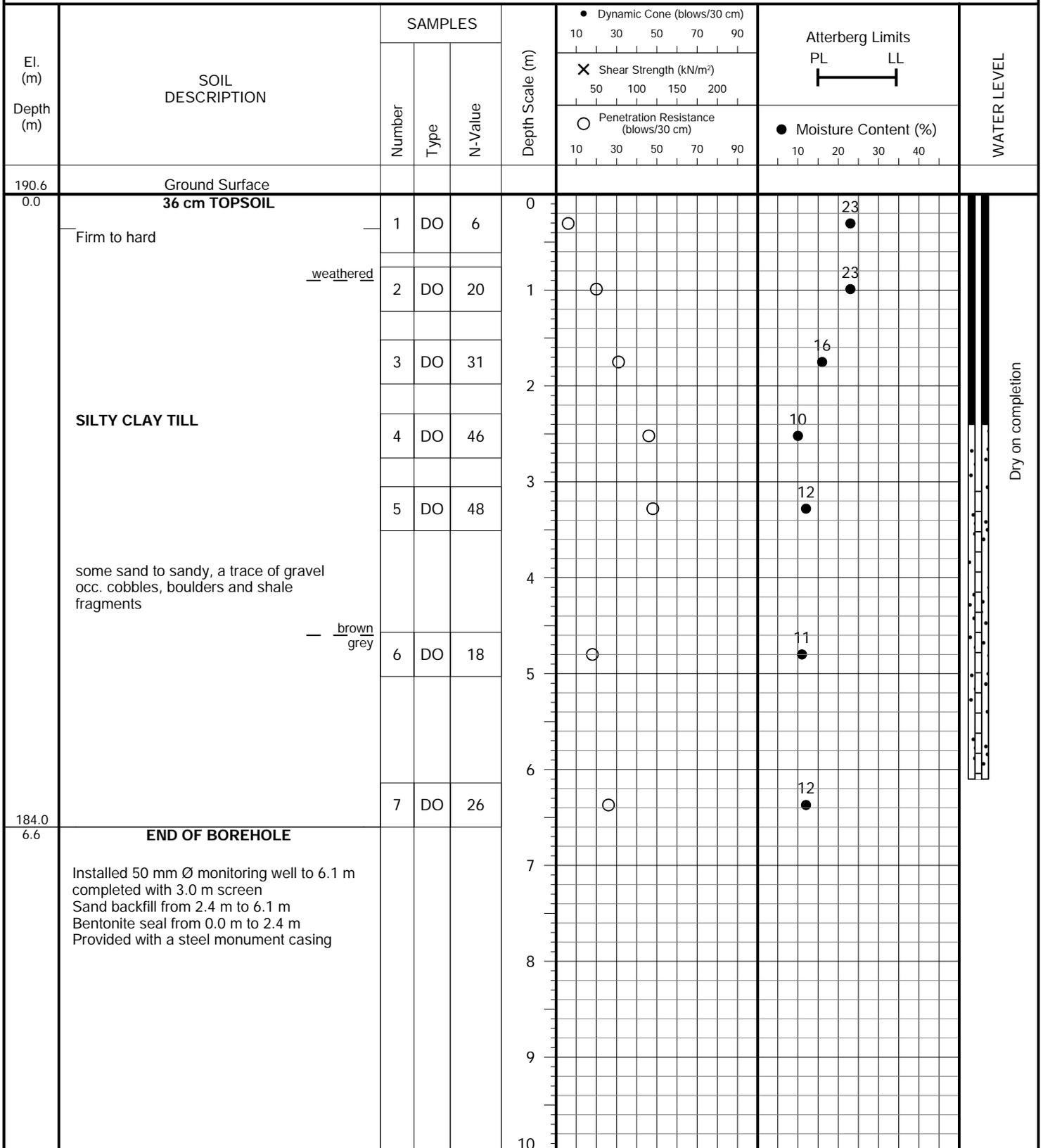


PROJECT DESCRIPTION: Proposed Commercial/Industrial Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 4243 Sixth Line, Town of Oakville

DRILLING DATE: August 11, 2023

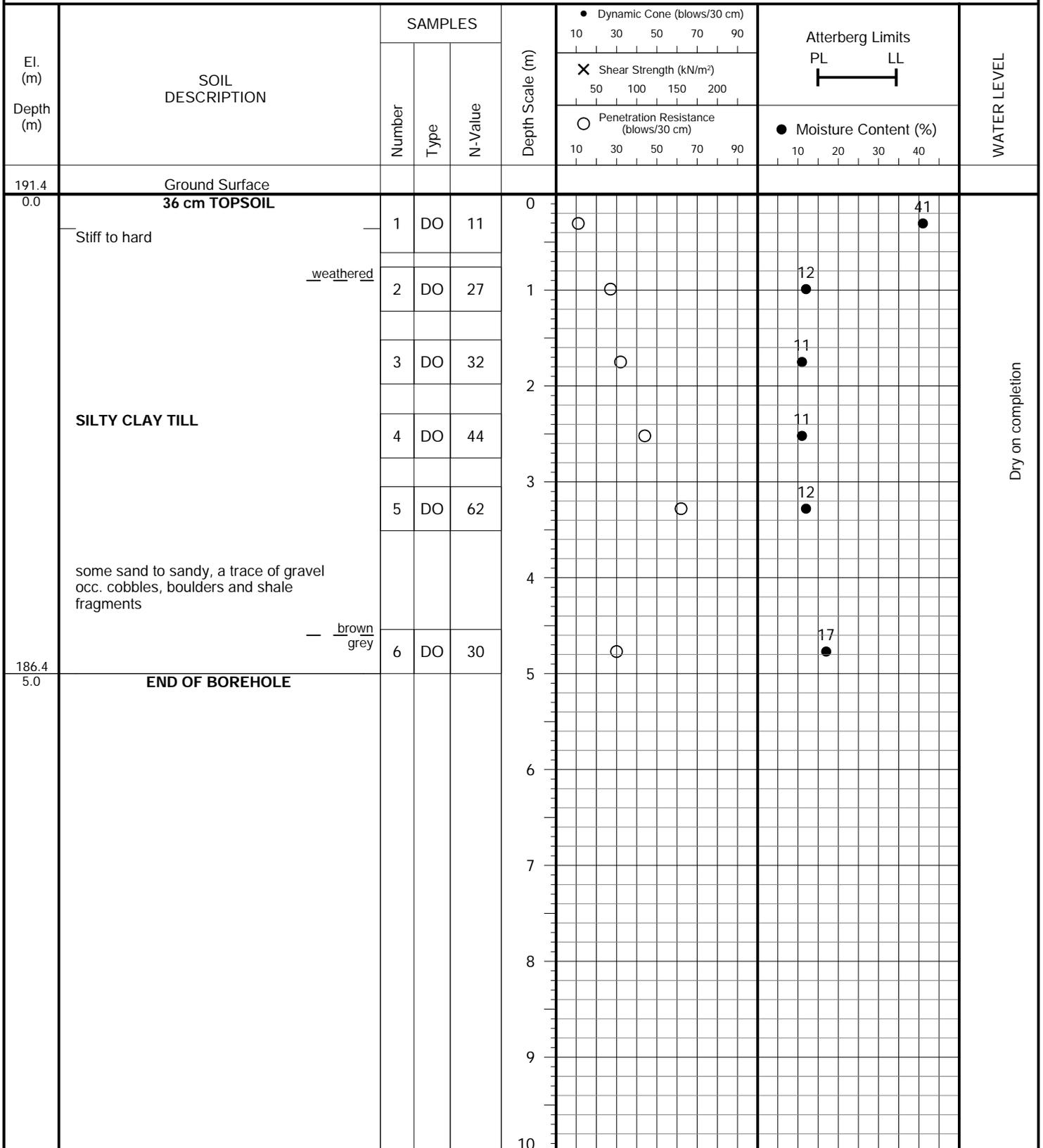


PROJECT DESCRIPTION: Proposed Commercial/Industrial Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 4243 Sixth Line, Town of Oakville

DRILLING DATE: August 11, 2023



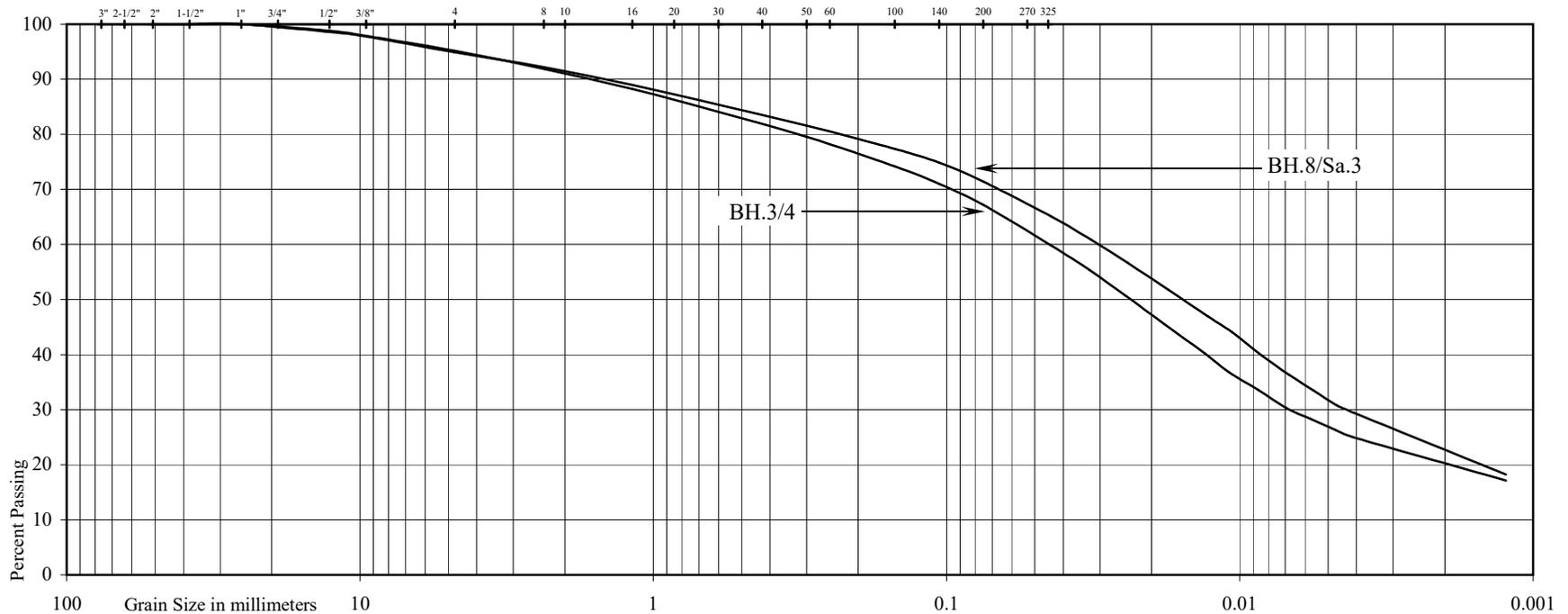


U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL			SAND				SILT	CLAY
COARSE		FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Commercial/Industrial Development
 Location: 4243 Sixth Line, Town of Oakville

Borehole No: 3 8
 Sample No: 4 3
 Depth (m): 2.5 1.8
 Elevation (m): 187.7 188.7

BH./Sa.	3/4	8/3
Liquid Limit (%) =	23	25
Plastic Limit (%) =	16	16
Plasticity Index (%) =	7	9
Moisture Content (%) =	12	12
Estimated Permeability		
(cm./sec.) =	10 ⁻⁷	10 ⁻⁷

Classification of Sample [& Group Symbol]:	SILTY CLAY TILL sandy, a trace of gravel
--	---

Figure: 11



KEY PLAN
(N.T.S.)



LEGEND

-  - Borehole
-  - Borehole with Monitoring Well

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 90 WEST BEAVER CREEK ROAD, SUITE #100, RICHMOND HILL, ONTARIO L4B 1E7 TEL: (416) 754-8515 FAX: (905) 881-8335

BOREHOLE AND MONITORING WELL LOCATION PLAN

SITE: 4243 Sixth Line, Town of Oakville

DESIGNED BY: -	CHECKED BY: -	DWG NO.: 1
SCALE: 1:1250	REF. NO.: 2306-S222	DATE: September 2023
		REV 2



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SUBSURFACE PROFILE

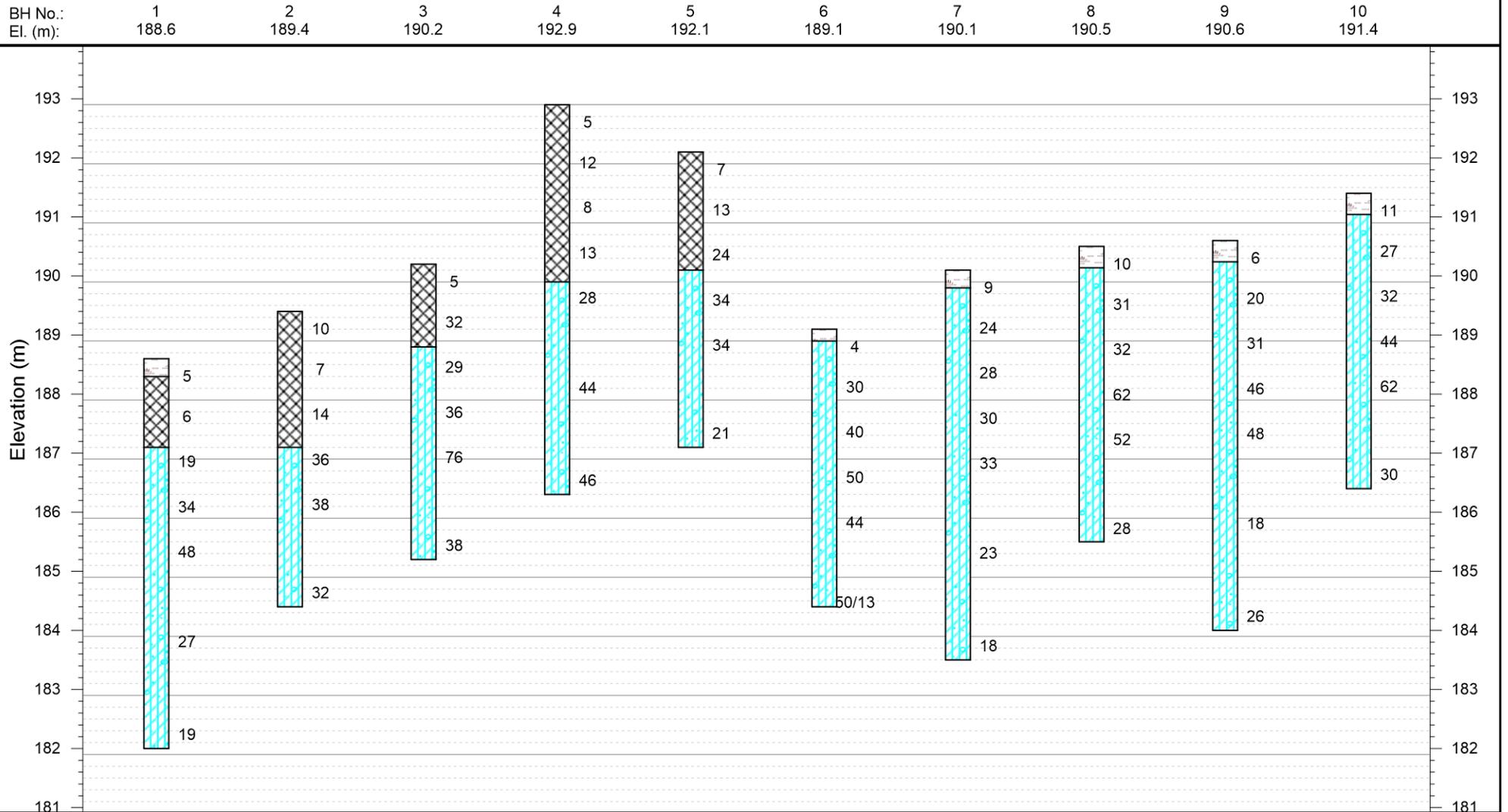
DRAWING NO. 2

SCALE: AS SHOWN

JOB NO.: 2306-S222
REPORT DATE: September 2023
PROJECT DESCRIPTION: Proposed Commercial/Industrial Development
PROJECT LOCATION: 4243 Sixth Line, Town of Oakville

LEGEND

TOPSOIL FILL SILTY CLAY TILL



APPENDIX B

Water Demand Calculations



File: 3023-7688
Date: 2026.02.27
By: MPH
Check By: JKF

4243 Sixth Line Proposed Water Demand

Land Usage

1) Office GFA	335 m2
2) Industrial GFA	13924 m2

Per Site Plan prepared by n Architecture Inc.

Person Per Land Usage

1) Office	37.40 m2/Employee
2) Industrial	129.00 m2/Employee

Per Region of Halton Water and Wastewater Linear Design Manual (2025)

Total Employment Population 117.00 Employees

Domestic Water Design Flows

Employment **190.00** L/emp-day

Total Domestic Water Design Flows

Average Daily Employment Flow 0.26 L/sec

Max Daily Demand Factor **1.90**

Max Daily Demand Flow **0.49** L/sec

Peak Hour Demand Factor **3.00**

Peak Hour Demand Flow **0.77** L/sec

Fire Flow Determination Per Fire Underwriters Survey (2020)

STEP E: Automatic Sprinkler Protection

Sprinklers - The required fire flow may be reduced by up to 50% for complete automatic sprinkler protection depending upon adequacy of system.

	Yes/No/Unknown	*Possible Reduction Available	Actual Reduction Provided
Automatic sprinkler protection designed and installed in accordance with NFPA 13?	Yes	-30%	-30%
Water supply is standard for both the system and Fire Department hose lines?	Yes	-10%	-10%
Fully supervised system?	Yes	-10%	-10%

*Reduction available assumes complete building coverage
 *30% reduction typical for building requiring sprinkler system

Total Reduction % -50% (reduction)
Total Reduced Flow -8,000 L/min (reduction, not rounded)

STEP F: Exposure Adjustment Charge

Exposure - A percentage of water for the exposures should be added to the required fire flow for the subject building to provide adequate flow rates for hose streams used to reduce the spreading of fire from the subject building to exposed risks. The required fire flow of a subject building may be increased depending on the severity of exposed risks to the subject building and the distance between the exposed risks and the subject building. This charge considers the usage of water supplies to prevent exposed risks from igniting or being damaged during a major fire incident in the subject building.

Separation Distance	Maximum Exposure Adjustment Charge
0 to 3m	25%
3.1 to 10m	20%
10.1 to 20m	15%
20.1 to 30m	10%
Greater than 30m	0%

*If a vertical fire wall is properly constructed and has a rating of no less than 2 hours, then the boundary can be treated as protected with no exposure charge
 *The maximum exposure adjustment charge to be applied to a subject building is 75%
 *The distance in metres from the subject building facing wall to the exposed building facing wall, measured to the nearest metre, between the nearest points of the buildings. Where either the subject building or the exposed building is at a diagonal to the other building, the shortest distance should be increased by 3 metres and this adjusted value used as exposure distance.

Exposed buildings	Distance	Surcharge Factor	Surcharge (L/min)
North	N/A	0%	0
East	Office 33	0%	0
South	N/A	0%	0
West	N/A	0%	0

Total Reduced Flow 0 L/min Surcharge (not rounded)

STEP G: Final Required Fire Flow

Step D - Occupancy Adjusted Fire Flow Demand 16,000 L/min
 Step E - Sprinkler (Reduction) -8,000 L/min
 Step F - Exposure Charge 0 L/min

Final Fire Flow: 8,000 L/min
8,000 L/min (rounded to nearest 1000L/min)
 or 133 L/s
 or 2,113 USGPM
Required duration: 2.00 hours
 *Refer to Table 1 for Duration

Table 1 - FUS 2020

Required Duration of Fire Flow	
Flow Required (L/min)	Duration (hours)
2,000 or less	1.00
3,000	1.25
4,000	1.50
5,000	1.75
6,000	2.00
8,000	2.00
10,000	2.00
12,000	2.50
14,000	3.00
16,000	3.50
18,000	4.00
20,000	4.50
22,000	5.00
24,000	5.50
26,000	6.00
28,000	6.50
30,000	7.00
32,000	7.50
34,000	8.00
36,000	8.50
38,000	9.00
40,000 and over	9.50

*Interpolate for intermediate figures

James Fletcher

From: Nuri Choi | nArchitecture Inc. <nc@narchitecture.com>
Sent: February 23, 2026 3:19 PM
To: James Fletcher
Cc: Matt Britton; Jayesh Boily; Madeleine Hooper; Nitin Malhotra
Subject: n2332 | RE: Fire Underwriter Survey Assumptions - 4243 Sixth Line

Good afternoon James,

The proposed warehouse buildings will be constructed with non-combustible construction with sprinklers. The current proposed openings are allowed to be unprotected the OBC requirement.

Let me know if you have any questions or concerns. Thank you.

Regards,



n Architecture Inc



nuri choi Adv. Diploma Architectural Technology | Architectural Technologist
9120 Leslie Street, Suite-208, Richmond Hill, Ontario. L4B 3J9 T: 416-256-9741
<http://narchitecture.com/> | <https://www.facebook.com/nArchitectureInc>

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From: James Fletcher [mailto:jfletcher@cfcrozier.ca]
Sent: February 23, 2026 1:27 PM
To: Nuri Choi | nArchitecture Inc.

Cc: Matt Britton; Jayesh Boily; Madeleine Hooper
Subject: Fire Underwriter Survey Assumptions - 4243 Sixth Line

Hi Nuri,

As discussed, we are finalizing our Fire Underwriter's Survey (FUS) calculations as required by the Region to support the water servicing calculations for the industrial buildings at 4243 Sixth Line and are hoping you could confirm some assumptions:

1. What is the proposed construction type of the buildings? (See pages 20-21 of the attached for further descriptions)
 - a. Ordinary construction - brick or other masonry walls, combustible floor and interior
 - b. Non-combustible construction – unprotected metal structural components, masonry or metal walls.
 - c. Fire-resistive construction – fully protected frame floors, roof
2. Will the vertical openings and exterior vertical communications be protected in accordance with the National Building Code? (See page 22 of the attached for further information)
3. Will the sprinkler systems in the buildings be designed to meet all or some of the below standards? (See page 27-28 of the attached for further information)
 - d. Automatic sprinkler protection designed and installed in accordance with NFPA 13
 - e. Water supply is standard for both the systems and Fire Department hose lines
 - f. Fully supervised system

Thanks again for your help with this!

Best,

James

James Fletcher
Engineering Intern, Land Development
Office: 905.876.7132
Collingwood | Burlington | Toronto | Bradford | Guelph

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APPENDIX C

Sanitary Flow Calculations

4243 Sixth Line Proposed Sanitary Flow

Developed Site Area 3.89 ha
 Per Plan of Survey dated August 25, 2023 (Mauro Group Inc.)

Land Usage

1) Office GFA 335 m2
 2) Industrial GFA 13924 m2

Person Per Residential Unit and Land Usage

1) Office 37.40 m2/employee
 2) Industrial 129.00 m2/employee

Per Region of Halton Water and Wastewater Linear Design Manual (2025)

Total Employment Population 117.00 Employees

Unit Sewage Flows

Employment 185.00 L/emp-day

Infiltration 0.28 L/s/ha

Total Design Sewage Flows

Infiltration/Inflow Residential 1.09 L/sec

Average Daily Employment Flow 0.25 L/sec

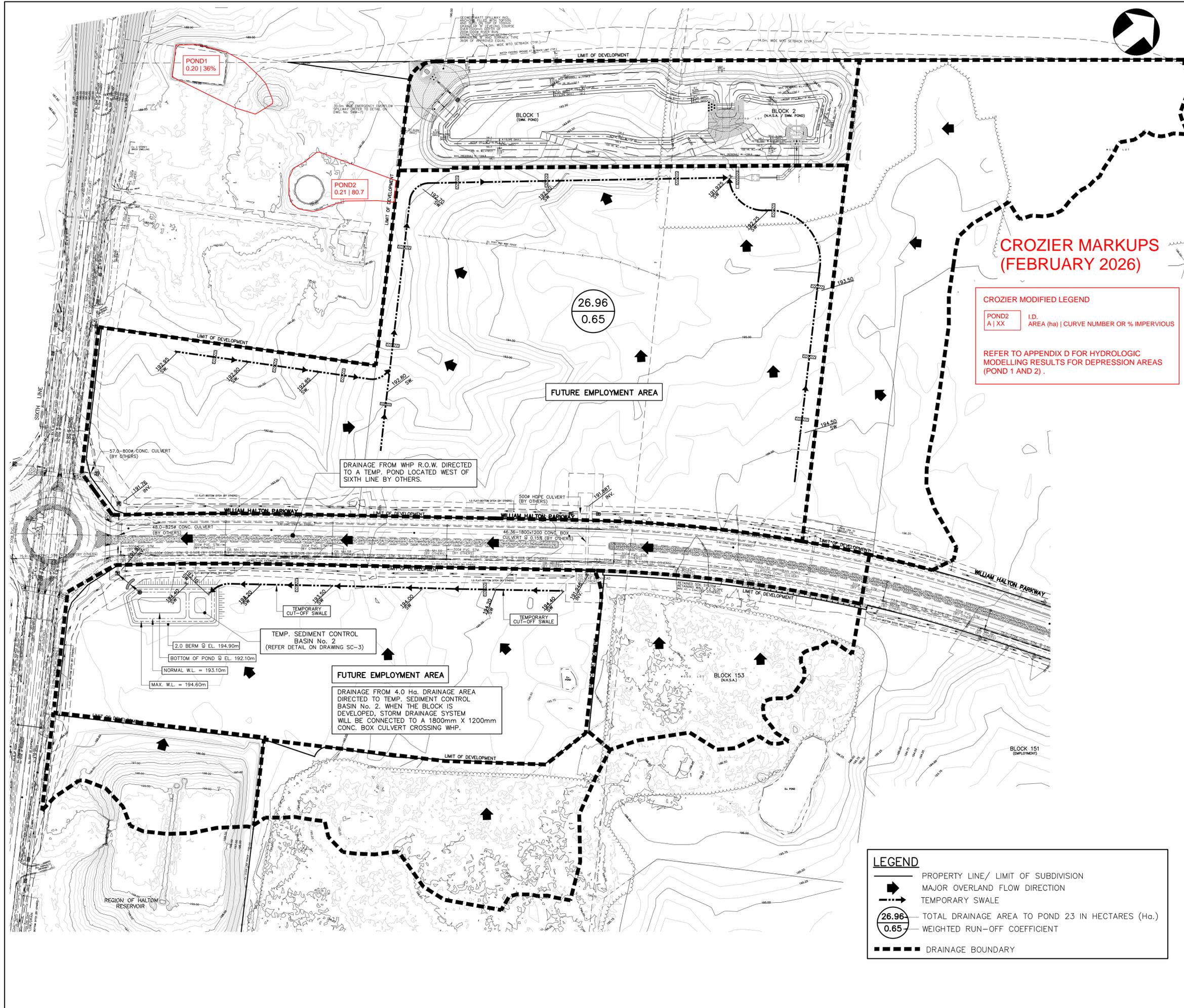
Commercial Peak Factor 4.00

Total Peak Daily Flow 2.09 L/sec

Sewage System Requirements

APPENDIX D

Stormwater Management Calculations



KEY PLAN SCALE N.T.S.
FOR GENERAL NOTES REFER TO DWG. No. GN-1

**CROZIER MARKUPS
(FEBRUARY 2026)**

CROZIER MODIFIED LEGEND

POND2 A | XX I.D. AREA (ha) | CURVE NUMBER OR % IMPERVIOUS

REFER TO APPENDIX D FOR HYDROLOGIC MODELLING RESULTS FOR DEPRESSION AREAS (POND 1 AND 2).

BENCHMARK:
ELEVATIONS ARE GEODETIC AND ARE REFERRED TO THE TOWN OF OAKVILLE BENCHMARK No. 00819818114 HAVING AN ELEVATION OF 188.594 METRES. STEEL ROD WITH BRASS CAP. BENCHMARK IS LOCATED ON NORTH SIDE OF BURNHAMTHORPE ROAD, 138.7m EAST OF THE JCT OF BURNHAMTHORPE ROAD AND SIXTH LINE ROAD IN OAKVILLE, AND 9.2m NORTH OF CENTRELINE OF BURNHAMTHORPE ROAD. BENCHMARK IS SET 1.1m SOUTH OF NORTH RIGHT-OF-WAY FENCE OF BURNHAMTHORPE ROAD AND IS MARKED BY A STEEL MARKER 46cm EAST OF BENCHMARK.

NO.	DATE	BY	REVISION
2.	APR. 1, 2019	P.S.	SECOND ENGINEERING SUBMISSION
1.	DEC. 20, 2017	P.S.	FIRST ENGINEERING SUBMISSION

DESIGN	M.M.	CHECKED	V.C.	DATE
DRAWN	ACAD	CHECKED	M.M.	

SCALE 0 10 20 40 60 80
1:1250

STAMP

APPROVALS

MUNICIPAL
APPROVED IN PRINCIPLE SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO TOWN OF OAKVILLE STANDARDS AND SPECIFICATIONS.

SIGNED: _____ DATE: _____
Manager of Development Engineering, Town of Oakville

REGIONAL
DESIGN OF SANITARY AND WATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO HALTON REGION STANDARDS AND SPECIFICATIONS AND LOCATION APPROVAL FROM AREA MUNICIPALITY.

SIGNED: _____ DATE: _____
Legislative & Planning Services Department, Halton Region

CONSULTANT
RAND ENGINEERING CORPORATION
5285 Solar Drive
Mississauga, ON
Canada, L4W 5S8
Tel: 905.625.9500

MUNICIPALITY
THE REGIONAL MUNICIPALITY OF HALTON
OAKVILLE TOWN OF OAKVILLE
DEVELOPMENT ENGINEERING

STAR OAK DEVELOPMENTS LIMITED
STAR OAK NORTH 2
STORM DRAINAGE PLAN
24T-13002

MUNICIPAL FILE NO. SD-605	REGIONAL FILE NO. DO-000
CONTRACT NO. 16987-2	SHEET ST-1

LEGEND

- PROPERTY LINE/ LIMIT OF SUBDIVISION
- MAJOR OVERLAND FLOW DIRECTION
- TEMPORARY SWALE
- 26.96 TOTAL DRAINAGE AREA TO POND 23 IN HECTARES (Ha.)
- 0.65 WEIGHTED RUN-OFF COEFFICIENT
- DRAINAGE BOUNDARY

R:\16\16987\0-PHASE 2\987PH2-STM-01.dwg | Apr 04, 2019 - 2:04pm



Project: Sixth Line
 Project No.: 3023-7688
 Created By: MPH
 Checked By: JKF
 Date: 2026.02.27

Post-Development Hydrograph Determination

Catchment ID	Hydrologic Soil Group	Pervious Areas (ha)					Impervious Areas (ha)							Catchment Details			
		Woodland	SWMF (Landscaped)	Meadow	Crops	Lawn / Landscape	Gravel		Paved / Concrete		Building		SWMF (Permanent pool)	Subtotal Area (ha)	TIMP (Fraction)	XIMP (Fraction)	Hydrograph in VO Model
		N/A	N/A	N/A	N/A	N/A	To Outlet	To Pervious	To Outlet	To Pervious	To Outlet	To Pervious	To Outlet				
201	C					0.16			0.95		0.58			1.69	0.89	0.89	STANDHYD
	D					0.26			1.11		0.83		2.20				
	Total	0.00	0.00	0.00	0.00	0.42	0.00	0.00	2.06	0.00	1.41	0.00	0.00	3.89			



**Post-Development
 STANDHYD - TIMP, XIMP & CN Values**

Parameter	Hydrologic Soil Group	Landuse				
		Woodland	SWMF / Wetland	Meadow	Cultivated/ Crops	Lawn / Landscape
CN Values	C	71	50	71	82	76
	D	77	50	78	86	81
IA Values		10	10	8	7	5

*Note these values are taken from the MTO manual.

Catchment ID	Hydrologic Soil Group	Pervious Areas (ha)						Impervious Areas (ha)							Results						
		Woodland	SWMF (Landscaped)	Meadow	Crops	Lawn / Landscape	Pervious Total Area (ha)	Gravel		Paved / Concrete		Building		SWMF (Permanent pool)	Impervious Total Area (ha)	Subtotal Area (ha)	Hydrograph in VO Model	TIMP (Fraction)	XIMP (Fraction)	Weighted CN	Weighted IA
								To Outlet	To Pervious	To Outlet	To Pervious	To Outlet	To Pervious	To Outlet							
201	C	0.00	0.00	0.00	0.00	0.16	0.16	0.00	0.00	0.95	0.00	0.58	0.00	0.00	1.53	1.69	STANDHYD	0.893	0.893	79.1	5
	D	0.00	0.00	0.00	0.00	0.26	0.26	0.00	0.00	1.11	0.00	0.83	0.00	0.00	1.94	2.20					
	Total	0.00	0.00	0.00	0.00	0.42	0.42	0.00	0.00	2.06	0.00	1.41	0.00	0.00	3.47	3.89					



Project: Sixth Line
Project No.: 3023-7688
Created By: MPH
Checked By: JKF
Date: 2026.02.27

**Post-Development
 STANDHYD Summary**

Catchment ID	Area (ha)	DT (min)	TIMP	XIMP	Pervious Area							Impervious Area			
					CN Value	CN*	CN(III)	IA (mm)	SLPP (%)	LGP (m)	MNI	DPSI	SLPI (%)	LGI (m)	MNI
201	3.89	5	0.893	0.893	79.1	80	90	5	2.0	5	0.25	1	1	AUTO	0.013



Project #: 3023-7688
Project Name: 4243 6th Line
February 27, 2026
Post-Development

Schematic





Results

```

=====
V V I SSSSS U U A L (v 6.2.2015)
V V I SS U U A A L
V V I SS U U AAAAA L
V V I SS U U A A L
VV I SSSSS UUUUU A A LLLLL

OOO TTTT TTTT H H Y Y M M OOO TM
O O T T H H Y Y MM MM O O
O O T T H H Y Y M M O O
OOO T T H H Y Y M M OOO
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***** DETAILED OUTPUT*****

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DATE: 02-27-2026 TIME: 09:55:57

USER:

COMMENTS: _____

 ** SIMULATION : 25mm, 4-hour **

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| | 21106e93-0562-4077-be08-a4ff5d436d13\3e72293c
| Ptotal= 25.11 mm | Comments: 25mm, 4-hour

```

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.00	1.39	1.00	6.56	2.00	4.07	3.00	1.88
0.08	1.48	1.08	10.33	2.08	3.68	3.08	1.80
0.17	1.58	1.17	25.04	2.17	3.37	3.17	1.73
0.25	1.70	1.25	84.53	2.25	3.11	3.25	1.67
0.33	1.84	1.33	32.66	2.33	2.89	3.33	1.61
0.42	2.00	1.42	17.46	2.42	2.70	3.42	1.56
0.50	2.21	1.50	11.79	2.50	2.54	3.50	1.51
0.58	2.46	1.58	8.89	2.58	2.39	3.58	1.46
0.67	2.79	1.67	7.15	2.67	2.27	3.67	1.41
0.75	3.24	1.75	5.99	2.75	2.15	3.75	1.37
0.83	3.87	1.83	5.16	2.83	2.05	3.83	1.34
0.92	4.85	1.92	4.54	2.92	1.96	3.92	1.30

 | CALIB |

| STANDHYD (0201) | Area (ha)= 3.89
 |ID= 1 DT= 5.0 min | Total Imp(%)= 89.30 Dir. Conn.(%)= 89.30

```

=====
IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 3.47 0.42
Dep. Storage (mm)= 1.00 5.00
Average Slope (%)= 1.00 2.00
Length (m)= 161.04 5.00
Mannings n = 0.013 0.250

Max.Eff.Inten.(mm/hr)= 84.53 9.19
over (min) 5.00 5.00
Storage Coeff. (min)= 3.64 (ii) 4.56 (ii)
Unit Hyd. Tpeak (min)= 5.00 5.00
Unit Hyd. peak (cms)= 0.25 0.23

*TOTALS*
PEAK FLOW (cms)= 0.66 0.01 0.669 (iii)
TIME TO PEAK (hrs)= 1.33 1.42 1.33
RUNOFF VOLUME (mm)= 24.11 4.84 22.05
TOTAL RAINFALL (mm)= 25.11 25.11 25.11
RUNOFF COEFFICIENT = 0.96 0.19 0.88

```

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

=====
| RESERVOIR( 0006) | OVERFLOW IS OFF
| IN= 2--> OUT= 1 |
| DT= 5.0 min |
-----
(cms) (ha.m.) | (cms) (ha.m.)
0.0000 0.0000 | 0.0470 0.2070
0.0160 0.1000 | 0.0550 0.2300
0.0270 0.1550 | 0.0620 0.2540
0.0350 0.1750 | 0.5100 0.3330

```

```

AREA QPEAK TPEAK R.V.
(ha) (cms) (hrs) (mm)
INFLOW : ID= 2 ( 0201) 3.890 0.669 1.33 22.05
OUTFLOW: ID= 1 ( 0006) 3.890 0.012 4.00 21.64

```

```

PEAK FLOW REDUCTION [Qout/ Qin](%)= 1.79
TIME SHIFT OF PEAK FLOW (min)=160.00
MAXIMUM STORAGE USED (ha.m.)= 0.0748

```

FINISH
 =====



```

=====
*****
V V I SSSS U U A L (v 6.2.2015)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A L
V V I SSSS UUUU A A LLLL

OOO TTTT TTTT H H Y Y M M OOO TM
O O T T H H Y Y M M O O O
O O T T H H Y Y M M O O O
OOO T T H H Y Y M M OOO

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```

***** DETAILED OUTPUT*****

```

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\rhoooper\AppData\Local\Civica\VH5\3b3ad3-62bc-4ae0-beb1-12b5e54ace95\7ba28067-0e91-476d-89a2-d1bc0a7661aa\scen
Summary filename: C:\Users\rhoooper\AppData\Local\Civica\VH5\3b3ad3-62bc-4ae0-beb1-12b5e54ace95\7ba28067-0e91-476d-89a2-d1bc0a7661aa\scen

```

DATE: 02-27-2026 TIME: 09:55:56

USER:

COMMENTS: _____

```

*****
** SIMULATION : 2yr 24hr 5min Chicago **
*****

```

```

| CHICAGO STORM | IDF curve parameters: A= 725,000
| Ptotal= 48.69 mm | B= 4.800
| C= 0.808
used in: INTENSITY = A / (t + B)^C

```

```

Duration of storm = 24.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

```

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.00	0.40	6.00	1.30	12.00	1.23	18.00	0.58
0.08	0.40	6.08	1.35	12.08	1.20	18.08	0.57
0.17	0.41	6.17	1.41	12.17	1.18	18.17	0.57
0.25	0.41	6.25	1.47	12.25	1.17	18.25	0.57
0.33	0.41	6.33	1.54	12.33	1.15	18.33	0.56
0.42	0.42	6.42	1.61	12.42	1.13	18.42	0.56
0.50	0.42	6.50	1.69	12.50	1.11	18.50	0.55
0.58	0.42	6.58	1.78	12.58	1.09	18.58	0.55
0.67	0.43	6.67	1.89	12.67	1.08	18.67	0.55
0.75	0.43	6.75	2.01	12.75	1.06	18.75	0.54
0.83	0.44	6.83	2.14	12.83	1.05	18.83	0.54
0.92	0.44	6.92	2.30	12.92	1.03	18.92	0.54
1.00	0.45	7.00	2.49	13.00	1.02	19.00	0.53
1.08	0.45	7.08	2.72	13.08	1.01	19.08	0.53
1.17	0.45	7.17	2.99	13.17	0.99	19.17	0.53
1.25	0.46	7.25	3.34	13.25	0.98	19.25	0.52

1.33	0.46	7.33	3.79	13.33	0.97	19.33	0.52
1.42	0.47	7.42	4.39	13.42	0.95	19.42	0.52
1.50	0.47	7.50	5.25	13.50	0.94	19.50	0.51
1.58	0.48	7.58	6.57	13.58	0.93	19.58	0.51
1.67	0.48	7.67	8.89	13.67	0.92	19.67	0.51
1.75	0.49	7.75	14.00	13.75	0.91	19.75	0.51
1.83	0.50	7.83	33.97	13.83	0.90	19.83	0.50
1.92	0.50	7.92	114.66	13.92	0.89	19.92	0.50
2.00	0.51	8.00	44.30	14.00	0.88	20.00	0.50
2.08	0.51	8.08	23.68	14.08	0.87	20.08	0.49
2.17	0.52	8.17	15.99	14.17	0.86	20.17	0.49
2.25	0.52	8.25	12.06	14.25	0.85	20.25	0.49
2.33	0.53	8.33	9.69	14.33	0.84	20.33	0.49
2.42	0.54	8.42	8.12	14.42	0.83	20.42	0.48
2.50	0.54	8.50	7.00	14.50	0.82	20.50	0.48
2.58	0.55	8.58	6.16	14.58	0.81	20.58	0.48
2.67	0.56	8.67	5.51	14.67	0.80	20.67	0.48
2.75	0.57	8.75	5.00	14.75	0.80	20.75	0.47
2.83	0.57	8.83	4.57	14.83	0.79	20.83	0.47
2.92	0.58	8.92	4.22	14.92	0.78	20.92	0.47
3.00	0.59	9.00	3.92	15.00	0.77	21.00	0.47
3.08	0.60	9.08	3.66	15.08	0.77	21.08	0.46
3.17	0.61	9.17	3.44	15.17	0.76	21.17	0.46
3.25	0.62	9.25	3.25	15.25	0.75	21.25	0.46
3.33	0.63	9.33	3.07	15.33	0.74	21.33	0.46
3.42	0.64	9.42	2.92	15.42	0.74	21.42	0.45
3.50	0.65	9.50	2.78	15.50	0.73	21.50	0.45
3.58	0.66	9.58	2.66	15.58	0.72	21.58	0.45
3.67	0.67	9.67	2.55	15.67	0.72	21.67	0.45
3.75	0.68	9.75	2.44	15.75	0.71	21.75	0.44
3.83	0.69	9.83	2.35	15.83	0.70	21.83	0.44
3.92	0.70	9.92	2.26	15.92	0.70	21.92	0.44
4.00	0.71	10.00	2.18	16.00	0.69	22.00	0.44
4.08	0.73	10.08	2.11	16.08	0.69	22.08	0.44
4.17	0.74	10.17	2.04	16.17	0.68	22.17	0.43
4.25	0.75	10.25	1.98	16.25	0.68	22.25	0.43
4.33	0.77	10.33	1.92	16.33	0.67	22.33	0.43
4.42	0.78	10.42	1.86	16.42	0.66	22.42	0.43
4.50	0.80	10.50	1.81	16.50	0.66	22.50	0.43
4.58	0.82	10.58	1.76	16.58	0.65	22.58	0.42
4.67	0.83	10.67	1.72	16.67	0.65	22.67	0.42
4.75	0.85	10.75	1.67	16.75	0.64	22.75	0.42
4.83	0.87	10.83	1.63	16.83	0.64	22.83	0.42
4.92	0.89	10.92	1.59	16.92	0.63	22.92	0.42
5.00	0.91	11.00	1.56	17.00	0.63	23.00	0.41
5.08	0.93	11.08	1.52	17.08	0.62	23.08	0.41
5.17	0.96	11.17	1.49	17.17	0.62	23.17	0.41
5.25	0.98	11.25	1.46	17.25	0.61	23.25	0.41
5.33	1.01	11.33	1.43	17.33	0.61	23.33	0.41
5.42	1.04	11.42	1.40	17.42	0.61	23.42	0.41
5.50	1.07	11.50	1.37	17.50	0.60	23.50	0.40
5.58	1.10	11.58	1.34	17.58	0.60	23.58	0.40
5.67	1.14	11.67	1.32	17.67	0.59	23.67	0.40
5.75	1.17	11.75	1.29	17.75	0.59	23.75	0.40
5.83	1.21	11.83	1.27	17.83	0.58	23.83	0.40
5.92	1.26	11.92	1.25	17.92	0.58	23.92	0.39

```

| CALIB |
| STANDHYD ( 0201) | Area (ha)= 3.89
| ID= 1 DT= 5.0 min | Total Imp(%)= 89.30 Dir. Conn.(%)= 89.30

```

```

IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 3.47 0.42
Dep. Storage (mm)= 1.00 5.00
Average Slope (%)= 1.00 2.00
Length (m)= 161.04 5.00
Mannings n = 0.013 0.250

```



Max.Eff.Inten.(mm/hr)= 114.66 26.61
 over (min) 5.00 5.00
 Storage Coeff. (min)= 3.22 (ii) 4.04 (ii)
 Unit Hyd. Tpeak (min)= 5.00 5.00
 Unit Hyd. peak (cms)= 0.27 0.24
 TOTALS
 PEAK FLOW (cms)= 0.93 0.03 0.963 (iii)
 TIME TO PEAK (hrs)= 8.00 8.00 8.00
 RUNOFF VOLUME (mm)= 47.69 17.81 44.49
 TOTAL RAINFALL (mm)= 48.69 48.69 48.69
 RUNOFF COEFFICIENT = 0.98 0.37 0.91

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| RESERVOIR(0006) | OVERFLOW IS OFF
 | IN= 2--> OUT= 1 |
 | DT= 5.0 min | OUTFLOW STORAGE | OUTFLOW STORAGE
 ----- | (cms) (ha.m.) | (cms) (ha.m.)
 0.0000 0.0000 | 0.0470 0.2070
 0.0160 0.1000 | 0.0550 0.2300
 0.0270 0.1550 | 0.0620 0.2540
 0.0350 0.1750 | 0.5100 0.3330

AREA QPEAK TPEAK R.V.
 (ha) (cms) (hrs) (mm)
 INFLOW : ID= 2 (0201) 3.890 0.963 8.00 44.49
 OUTFLOW: ID= 1 (0006) 3.890 0.019 10.50 44.08

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.01
 TIME SHIFT OF PEAK FLOW (min)=150.00
 MAXIMUM STORAGE USED (ha.m.)= 0.1166



```

=====
*****
V V I SSSS U U A L (v 6.2.2015)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A L
VV I SSSS UUUU A A LLLL

OOO TTTT TTTT H H Y Y M M OOO TM
O O T T H H Y Y M M M M O O
O O T T H H Y Y M M O O
OOO T T H H Y Y M M OOO
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```

***** DETAILED OUTPUT*****

```

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\mhoooper\AppData\Local\Civica\VH5\3b3ad3-62bc-4ae0-beb1-12b5e54ace95\5d8a4a40-8969-42bc-8388-2a41e4071973\scen
Summary filename: C:\Users\mhoooper\AppData\Local\Civica\VH5\3b3ad3-62bc-4ae0-beb1-12b5e54ace95\5d8a4a40-8969-42bc-8388-2a41e4071973\scen

```

DATE: 02-27-2026 TIME: 09:55:56

USER:

COMMENTS: _____

```

*****
** SIMULATION : 5yr 24hr 5min Chicago **
*****

```

```

| CHICAGO STORM | IDF curve parameters: A=1170.000
| Ptotal= 60.87 mm | B= 5.800
| C= 0.843
used in: INTENSITY = A / (t + B)^C

```

```

Duration of storm = 24.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

```

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.00	0.41	6.00	1.44	12.00	1.35	18.00	0.61
0.08	0.41	6.08	1.50	12.08	1.32	18.08	0.60
0.17	0.42	6.17	1.56	12.17	1.30	18.17	0.60
0.25	0.42	6.25	1.64	12.25	1.28	18.25	0.59
0.33	0.43	6.33	1.72	12.33	1.26	18.33	0.59
0.42	0.43	6.42	1.81	12.42	1.23	18.42	0.59
0.50	0.43	6.50	1.90	12.50	1.21	18.50	0.58
0.58	0.44	6.58	2.02	12.58	1.20	18.58	0.58
0.67	0.44	6.67	2.14	12.67	1.18	18.67	0.57
0.75	0.45	6.75	2.29	12.75	1.16	18.75	0.57
0.83	0.45	6.83	2.46	12.83	1.14	18.83	0.57
0.92	0.46	6.92	2.66	12.92	1.12	18.92	0.56
1.00	0.46	7.00	2.89	13.00	1.11	19.00	0.56
1.08	0.47	7.08	3.18	13.08	1.09	19.08	0.55
1.17	0.47	7.17	3.53	13.17	1.08	19.17	0.55
1.25	0.48	7.25	3.98	13.25	1.06	19.25	0.55

1.33	0.48	7.33	4.56	13.33	1.05	19.33	0.54
1.42	0.49	7.42	5.36	13.42	1.03	19.42	0.54
1.50	0.49	7.50	6.52	13.50	1.02	19.50	0.54
1.58	0.50	7.58	8.35	13.58	1.01	19.58	0.53
1.67	0.50	7.67	11.63	13.67	0.99	19.67	0.53
1.75	0.51	7.75	19.04	13.75	0.98	19.75	0.53
1.83	0.52	7.83	48.23	13.83	0.97	19.83	0.52
1.92	0.52	7.92	157.40	13.92	0.96	19.92	0.52
2.00	0.53	8.00	63.26	14.00	0.94	20.00	0.52
2.08	0.54	8.08	33.27	14.08	0.93	20.08	0.51
2.17	0.54	8.17	21.94	14.17	0.92	20.17	0.51
2.25	0.55	8.25	16.19	14.25	0.91	20.25	0.51
2.33	0.56	8.33	12.77	14.33	0.90	20.33	0.51
2.42	0.56	8.42	10.52	14.42	0.89	20.42	0.50
2.50	0.57	8.50	8.94	14.50	0.88	20.50	0.50
2.58	0.58	8.58	7.78	14.58	0.87	20.58	0.50
2.67	0.59	8.67	6.89	14.67	0.86	20.67	0.49
2.75	0.59	8.75	6.18	14.75	0.85	20.75	0.49
2.83	0.60	8.83	5.61	14.83	0.84	20.83	0.49
2.92	0.61	8.92	5.13	14.92	0.83	20.92	0.49
3.00	0.62	9.00	4.74	15.00	0.83	21.00	0.48
3.08	0.63	9.08	4.40	15.08	0.82	21.08	0.48
3.17	0.64	9.17	4.11	15.17	0.81	21.17	0.48
3.25	0.65	9.25	3.85	15.25	0.80	21.25	0.48
3.33	0.66	9.33	3.63	15.33	0.79	21.33	0.47
3.42	0.67	9.42	3.44	15.42	0.78	21.42	0.47
3.50	0.68	9.50	3.26	15.50	0.78	21.50	0.47
3.58	0.69	9.58	3.10	15.58	0.77	21.58	0.47
3.67	0.71	9.67	2.96	15.67	0.76	21.67	0.46
3.75	0.72	9.75	2.83	15.75	0.76	21.75	0.46
3.83	0.73	9.83	2.71	15.83	0.75	21.83	0.46
3.92	0.74	9.92	2.61	15.92	0.74	21.92	0.46
4.00	0.76	10.00	2.51	16.00	0.73	22.00	0.45
4.08	0.77	10.08	2.42	16.08	0.73	22.08	0.45
4.17	0.79	10.17	2.33	16.17	0.72	22.17	0.45
4.25	0.80	10.25	2.25	16.25	0.72	22.25	0.45
4.33	0.82	10.33	2.18	16.33	0.71	22.33	0.44
4.42	0.84	10.42	2.11	16.42	0.70	22.42	0.44
4.50	0.86	10.50	2.05	16.50	0.70	22.50	0.44
4.58	0.87	10.58	1.99	16.58	0.69	22.58	0.44
4.67	0.89	10.67	1.93	16.67	0.69	22.67	0.44
4.75	0.91	10.75	1.88	16.75	0.68	22.75	0.43
4.83	0.94	10.83	1.83	16.83	0.67	22.83	0.43
4.92	0.96	10.92	1.78	16.92	0.67	22.92	0.43
5.00	0.98	11.00	1.74	17.00	0.66	23.00	0.43
5.08	1.01	11.08	1.70	17.08	0.66	23.08	0.43
5.17	1.04	11.17	1.66	17.17	0.65	23.17	0.42
5.25	1.07	11.25	1.62	17.25	0.65	23.25	0.42
5.33	1.10	11.33	1.58	17.33	0.64	23.33	0.42
5.42	1.13	11.42	1.55	17.42	0.64	23.42	0.42
5.50	1.17	11.50	1.52	17.50	0.63	23.50	0.42
5.58	1.20	11.58	1.49	17.58	0.63	23.58	0.41
5.67	1.24	11.67	1.46	17.67	0.62	23.67	0.41
5.75	1.29	11.75	1.43	17.75	0.62	23.75	0.41
5.83	1.33	11.83	1.40	17.83	0.61	23.83	0.41
5.92	1.38	11.92	1.37	17.92	0.61	23.92	0.41

```

| CALIB |
| STANDHYD ( 0201) | Area (ha)= 3.89
| ID= 1 DT= 5.0 min | Total Imp(%)= 89.30 Dir. Conn.(%)= 89.30

```

```

IMPERVIOUS PVIOUS (i)
Surface Area (ha)= 3.47 0.42
Dep. Storage (mm)= 1.00 5.00
Average Slope (%)= 1.00 2.00
Length (m)= 161.04 5.00
Mannings n = 0.013 0.250

```



Max.Eff.Inten.(mm/hr)= 157.40 45.86
 over (min) 5.00 5.00
 Storage Coeff. (min)= 2.84 (ii) 3.56 (ii)
 Unit Hyd. Tpeak (min)= 5.00 5.00
 Unit Hyd. peak (cms)= 0.28 0.26
 TOTALS
 PEAK FLOW (cms)= 1.33 0.05 1.384 (iii)
 TIME TO PEAK (hrs)= 8.00 8.00 8.00
 RUNOFF VOLUME (mm)= 59.87 26.15 56.26
 TOTAL RAINFALL (mm)= 60.87 60.87 60.87
 RUNOFF COEFFICIENT = 0.98 0.43 0.92

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 | RESERVOIR(0006) | OVERFLOW IS OFF
 | IN= 2--> OUT= 1 |
DT= 5.0 min

	(cms)	(ha.m.)	(cms)	(ha.m.)
	0.0000	0.0000	0.0470	0.2070
	0.0160	0.1000	0.0550	0.2300
	0.0270	0.1550	0.0620	0.2540
	0.0350	0.1750	0.5100	0.3330

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0201)	3.890	1.384	8.00	56.26
OUTFLOW: ID= 1 (0006)	3.890	0.027	10.08	55.86

PEAK FLOW REDUCTION [Qout/Qin](%)= 1.92
 TIME SHIFT OF PEAK FLOW (min)=125.00
 MAXIMUM STORAGE USED (ha.m.)= 0.1530



```

=====
*****
V V I SSSS U U A L (v 6.2.2015)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A L
V V I SSSS UUUU A A LLLL

OOO TTTT TTTT H H Y Y M M OOO TM
O O T T H H Y Y M M M M O O
O O T T H H Y Y M M O O
OOO T T H H Y Y M M OOO
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```

***** DETAILED OUTPUT*****

```

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\rhoooper\AppData\Local\Civica\VH5\3b3ad3-62bc-4ae0-beb1-12b5e54ace95\5c575b74-6c43-45ed-a0dc-c98c0df0f6c1\scen
Summary filename: C:\Users\rhoooper\AppData\Local\Civica\VH5\3b3ad3-62bc-4ae0-beb1-12b5e54ace95\5c575b74-6c43-45ed-a0dc-c98c0df0f6c1\scen

```

DATE: 02-27-2026 TIME: 09:55:56

USER:

COMMENTS: _____

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*****
** SIMULATION : 10yr 24hr 5min Chicago **
*****

```

```

| CHICAGO STORM | IDF curve parameters: A=1400,000
| Ptotal= 70.24 mm | B= 5.800
| C= 0.848
used in: INTENSITY = A / (t + B)^C

```

Duration of storm = 24.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.00	0.46	6.00	1.62	12.00	1.52	18.00	0.68
0.08	0.46	6.08	1.69	12.08	1.49	18.08	0.67
0.17	0.47	6.17	1.77	12.17	1.47	18.17	0.67
0.25	0.47	6.25	1.85	12.25	1.44	18.25	0.67
0.33	0.48	6.33	1.94	12.33	1.42	18.33	0.66
0.42	0.48	6.42	2.04	12.42	1.39	18.42	0.66
0.50	0.49	6.50	2.16	12.50	1.37	18.50	0.65
0.58	0.49	6.58	2.28	12.58	1.35	18.58	0.65
0.67	0.50	6.67	2.43	12.67	1.33	18.67	0.64
0.75	0.50	6.75	2.59	12.75	1.30	18.75	0.64
0.83	0.51	6.83	2.79	12.83	1.28	18.83	0.63
0.92	0.51	6.92	3.01	12.92	1.27	18.92	0.63
1.00	0.52	7.00	3.28	13.00	1.25	19.00	0.63
1.08	0.52	7.08	3.61	13.08	1.23	19.08	0.62
1.17	0.53	7.17	4.02	13.17	1.21	19.17	0.62
1.25	0.53	7.25	4.53	13.25	1.19	19.25	0.61

1.33	0.54	7.33	5.21	13.33	1.18	19.33	0.61
1.42	0.55	7.42	6.13	13.42	1.16	19.42	0.61
1.50	0.55	7.50	7.48	13.50	1.15	19.50	0.60
1.58	0.56	7.58	9.60	13.58	1.13	19.58	0.60
1.67	0.56	7.67	13.42	13.67	1.12	19.67	0.59
1.75	0.57	7.75	22.09	13.75	1.10	19.75	0.59
1.83	0.58	7.83	56.52	13.83	1.09	19.83	0.59
1.92	0.58	7.92	186.12	13.92	1.07	19.92	0.58
2.00	0.59	8.00	74.28	14.00	1.06	20.00	0.58
2.08	0.60	8.08	38.83	14.08	1.05	20.08	0.58
2.17	0.61	8.17	25.49	14.17	1.04	20.17	0.57
2.25	0.61	8.25	18.75	14.25	1.02	20.25	0.57
2.33	0.62	8.33	14.75	14.33	1.01	20.33	0.57
2.42	0.63	8.42	12.13	14.42	1.00	20.42	0.56
2.50	0.64	8.50	10.29	14.50	0.99	20.50	0.56
2.58	0.65	8.58	8.93	14.58	0.98	20.58	0.56
2.67	0.66	8.67	7.90	14.67	0.97	20.67	0.55
2.75	0.67	8.75	7.08	14.75	0.96	20.75	0.55
2.83	0.68	8.83	6.41	14.83	0.95	20.83	0.55
2.92	0.69	8.92	5.87	14.92	0.94	20.92	0.54
3.00	0.70	9.00	5.41	15.00	0.93	21.00	0.54
3.08	0.71	9.08	5.02	15.08	0.92	21.08	0.54
3.17	0.72	9.17	4.68	15.17	0.91	21.17	0.54
3.25	0.73	9.25	4.39	15.25	0.90	21.25	0.53
3.33	0.74	9.33	4.14	15.33	0.89	21.33	0.53
3.42	0.75	9.42	3.91	15.42	0.88	21.42	0.53
3.50	0.77	9.50	3.71	15.50	0.87	21.50	0.52
3.58	0.78	9.58	3.53	15.58	0.86	21.58	0.52
3.67	0.79	9.67	3.36	15.67	0.86	21.67	0.52
3.75	0.81	9.75	3.22	15.75	0.85	21.75	0.52
3.83	0.82	9.83	3.08	15.83	0.84	21.83	0.51
3.92	0.84	9.92	2.96	15.92	0.83	21.92	0.51
4.00	0.85	10.00	2.84	16.00	0.83	22.00	0.51
4.08	0.87	10.08	2.74	16.08	0.82	22.08	0.51
4.17	0.88	10.17	2.64	16.17	0.81	22.17	0.50
4.25	0.90	10.25	2.55	16.25	0.80	22.25	0.50
4.33	0.92	10.33	2.47	16.33	0.80	22.33	0.50
4.42	0.94	10.42	2.39	16.42	0.79	22.42	0.50
4.50	0.96	10.50	2.32	16.50	0.78	22.50	0.49
4.58	0.98	10.58	2.25	16.58	0.78	22.58	0.49
4.67	1.01	10.67	2.19	16.67	0.77	22.67	0.49
4.75	1.03	10.75	2.13	16.75	0.76	22.75	0.49
4.83	1.05	10.83	2.07	16.83	0.76	22.83	0.48
4.92	1.08	10.92	2.02	16.92	0.75	22.92	0.48
5.00	1.11	11.00	1.97	17.00	0.74	23.00	0.48
5.08	1.14	11.08	1.92	17.08	0.74	23.08	0.48
5.17	1.17	11.17	1.87	17.17	0.73	23.17	0.47
5.25	1.20	11.25	1.83	17.25	0.73	23.25	0.47
5.33	1.24	11.33	1.79	17.33	0.72	23.33	0.47
5.42	1.27	11.42	1.75	17.42	0.72	23.42	0.47
5.50	1.31	11.50	1.71	17.50	0.71	23.50	0.47
5.58	1.36	11.58	1.68	17.58	0.71	23.58	0.46
5.67	1.40	11.67	1.64	17.67	0.70	23.67	0.46
5.75	1.45	11.75	1.61	17.75	0.69	23.75	0.46
5.83	1.50	11.83	1.58	17.83	0.69	23.83	0.46
5.92	1.56	11.92	1.55	17.92	0.68	23.92	0.45

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| CALIB |
| STANDHYD ( 0201) | Area (ha)= 3.89
| ID= 1 DT= 5.0 min | Total Imp(%)= 89.30 Dir. Conn.(%)= 89.30

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IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 3.47 0.42
Dep. Storage (mm)= 1.00 5.00
Average Slope (%)= 1.00 2.00
Length (m)= 161.04 5.00
Mannings n = 0.013 0.250

```



Max.Eff.Inten.(mm/hr)= 186.12 60.64
 over (min) 5.00 5.00
 Storage Coeff. (min)= 2.65 (ii) 3.33 (ii)
 Unit Hyd. Tpeak (min)= 5.00 5.00
 Unit Hyd. peak (cms)= 0.29 0.26
 TOTALS
 PEAK FLOW (cms)= 1.60 0.08 1.673 (iii)
 TIME TO PEAK (hrs)= 8.00 8.00 8.00
 RUNOFF VOLUME (mm)= 69.24 33.06 65.37
 TOTAL RAINFALL (mm)= 70.24 70.24 70.24
 RUNOFF COEFFICIENT = 0.99 0.47 0.93

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 | RESERVOIR(0006) | OVERFLOW IS OFF
 | IN= 2--> OUT= 1 |
 | DT= 5.0 min | OUTFLOW STORAGE | OUTFLOW STORAGE

 (cms) (ha.m.) | (cms) (ha.m.)
 0.0000 0.0000 | 0.0470 0.2070
 0.0160 0.1000 | 0.0550 0.2300
 0.0270 0.1550 | 0.0620 0.2540
 0.0350 0.1750 | 0.5100 0.3330

 AREA QPEAK TPEAK R.V.
 (ha) (cms) (hrs) (mm)
 INFLOW : ID= 2 (0201) 3.890 1.673 8.00 65.37
 OUTFLOW: ID= 1 (0006) 3.890 0.036 9.75 64.96

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.13
 TIME SHIFT OF PEAK FLOW (min)=105.00
 MAXIMUM STORAGE USED (ha.m.)= 0.1767



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*****
V V I SSSS U U A L (v 6.2.2015)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A L
V V I SSSS UUUU A A LLLL

OOO TTTT TTTT H H Y Y M M OOO TM
O O T T H H Y Y M M M M O O
O O T T H H Y Y M M O O
OOO T T H H Y Y M M OOO
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***** DETAILED OUTPUT*****

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Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\rhoooper\AppData\Local\Civica\VH5\3b3ad3-62bc-4ae0-beb1-12b5e54ace95\ae24537d-6a88-4da9-af3b-868120a4afc1\scen
Summary filename: C:\Users\rhoooper\AppData\Local\Civica\VH5\3b3ad3-62bc-4ae0-beb1-12b5e54ace95\ae24537d-6a88-4da9-af3b-868120a4afc1\scen

```

DATE: 02-27-2026 TIME: 09:55:56

USER:

COMMENTS: _____

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*****
** SIMULATION : 25yr 24hr 5min Chicago **
*****

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| CHICAGO STORM | IDF curve parameters: A=1680,000
| Ptotal= 82.47 mm | B= 5.600
| C= 0.851
used in: INTENSITY = A / (t + B)^C

```

Duration of storm = 24.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.00	0.53	6.00	1.88	12.00	1.76	18.00	0.78
0.08	0.53	6.08	1.96	12.08	1.72	18.08	0.78
0.17	0.54	6.17	2.04	12.17	1.69	18.17	0.77
0.25	0.54	6.25	2.14	12.25	1.66	18.25	0.77
0.33	0.55	6.33	2.24	12.33	1.63	18.33	0.76
0.42	0.55	6.42	2.36	12.42	1.61	18.42	0.76
0.50	0.56	6.50	2.49	12.50	1.58	18.50	0.75
0.58	0.56	6.58	2.64	12.58	1.55	18.58	0.75
0.67	0.57	6.67	2.81	12.67	1.53	18.67	0.74
0.75	0.58	6.75	3.00	12.75	1.51	18.75	0.74
0.83	0.58	6.83	3.23	12.83	1.48	18.83	0.73
0.92	0.59	6.92	3.49	12.92	1.46	18.92	0.73
1.00	0.59	7.00	3.80	13.00	1.44	19.00	0.72
1.08	0.60	7.08	4.18	13.08	1.42	19.08	0.72
1.17	0.61	7.17	4.65	13.17	1.40	19.17	0.71
1.25	0.61	7.25	5.25	13.25	1.38	19.25	0.71

1.33	0.62	7.33	6.04	13.33	1.36	19.33	0.70
1.42	0.63	7.42	7.11	13.42	1.34	19.42	0.70
1.50	0.63	7.50	8.68	13.50	1.32	19.50	0.69
1.58	0.64	7.58	11.15	13.58	1.31	19.58	0.69
1.67	0.65	7.67	15.61	13.67	1.29	19.67	0.68
1.75	0.66	7.75	25.79	13.75	1.27	19.75	0.68
1.83	0.67	7.83	66.72	13.83	1.26	19.83	0.68
1.92	0.67	7.92	225.31	13.92	1.24	19.92	0.67
2.00	0.68	8.00	87.97	14.00	1.22	20.00	0.67
2.08	0.69	8.08	45.56	14.08	1.21	20.08	0.66
2.17	0.70	8.17	29.79	14.17	1.20	20.17	0.66
2.25	0.71	8.25	21.85	14.25	1.18	20.25	0.66
2.33	0.72	8.33	17.17	14.33	1.17	20.33	0.65
2.42	0.73	8.42	14.10	14.42	1.15	20.42	0.65
2.50	0.74	8.50	11.96	14.50	1.14	20.50	0.64
2.58	0.75	8.58	10.37	14.58	1.13	20.58	0.64
2.67	0.76	8.67	9.17	14.67	1.12	20.67	0.64
2.75	0.77	8.75	8.21	14.75	1.10	20.75	0.63
2.83	0.78	8.83	7.44	14.83	1.09	20.83	0.63
2.92	0.79	8.92	6.80	14.92	1.08	20.92	0.63
3.00	0.80	9.00	6.27	15.00	1.07	21.00	0.62
3.08	0.81	9.08	5.82	15.08	1.06	21.08	0.62
3.17	0.83	9.17	5.43	15.17	1.05	21.17	0.62
3.25	0.84	9.25	5.09	15.25	1.04	21.25	0.61
3.33	0.85	9.33	4.79	15.33	1.03	21.33	0.61
3.42	0.87	9.42	4.53	15.42	1.02	21.42	0.61
3.50	0.88	9.50	4.29	15.50	1.01	21.50	0.60
3.58	0.90	9.58	4.08	15.58	1.00	21.58	0.60
3.67	0.91	9.67	3.89	15.67	0.99	21.67	0.60
3.75	0.93	9.75	3.72	15.75	0.98	21.75	0.59
3.83	0.95	9.83	3.57	15.83	0.97	21.83	0.59
3.92	0.96	9.92	3.42	15.92	0.96	21.92	0.59
4.00	0.98	10.00	3.29	16.00	0.95	22.00	0.58
4.08	1.00	10.08	3.17	16.08	0.94	22.08	0.58
4.17	1.02	10.17	3.06	16.17	0.93	22.17	0.58
4.25	1.04	10.25	2.95	16.25	0.93	22.25	0.58
4.33	1.06	10.33	2.86	16.33	0.92	22.33	0.57
4.42	1.09	10.42	2.77	16.42	0.91	22.42	0.57
4.50	1.11	10.50	2.68	16.50	0.90	22.50	0.57
4.58	1.13	10.58	2.60	16.58	0.89	22.58	0.56
4.67	1.16	10.67	2.53	16.67	0.89	22.67	0.56
4.75	1.19	10.75	2.46	16.75	0.88	22.75	0.56
4.83	1.22	10.83	2.39	16.83	0.87	22.83	0.56
4.92	1.25	10.92	2.33	16.92	0.87	22.92	0.55
5.00	1.28	11.00	2.27	17.00	0.86	23.00	0.55
5.08	1.31	11.08	2.22	17.08	0.85	23.08	0.55
5.17	1.35	11.17	2.17	17.17	0.84	23.17	0.55
5.25	1.39	11.25	2.12	17.25	0.84	23.25	0.54
5.33	1.43	11.33	2.07	17.33	0.83	23.33	0.54
5.42	1.47	11.42	2.02	17.42	0.83	23.42	0.54
5.50	1.52	11.50	1.98	17.50	0.82	23.50	0.54
5.58	1.57	11.58	1.94	17.58	0.81	23.58	0.53
5.67	1.62	11.67	1.90	17.67	0.81	23.67	0.53
5.75	1.68	11.75	1.86	17.75	0.80	23.75	0.53
5.83	1.74	11.83	1.82	17.83	0.79	23.83	0.53
5.92	1.80	11.92	1.79	17.92	0.79	23.92	0.52

```

| CALIB |
| STANDHYD ( 0201) | Area (ha)= 3.89
| ID= 1 DT= 5.0 min | Total Imp(%)= 89.30 Dir. Conn.(%)= 89.30

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```

IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 3.47 0.42
Dep. Storage (mm)= 1.00 5.00
Average Slope (%)= 1.00 2.00
Length (m)= 161.04 5.00
Mannings n = 0.013 0.250

```



Max.Eff.Inten.(mm/hr)= 225.31 81.72
 over (min) 5.00 5.00
 Storage Coeff. (min)= 2.46 (ii) 3.08 (ii)
 Unit Hyd. Tpeak (min)= 5.00 5.00
 Unit Hyd. peak (cms)= 0.30 0.27
 TOTALS
 PEAK FLOW (cms)= 1.97 0.11 2.073 (iii)
 TIME TO PEAK (hrs)= 8.00 8.00 8.00
 RUNOFF VOLUME (mm)= 81.47 42.58 77.31
 TOTAL RAINFALL (mm)= 82.47 82.47 82.47
 RUNOFF COEFFICIENT = 0.99 0.52 0.94

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| RESERVOIR(0006) | OVERFLOW IS OFF
 | IN= 2--> OUT= 1 |
 | DT= 5.0 min |

OUTFLOW		STORAGE		OUTFLOW		STORAGE	
(cms)	(ha.m.)	(cms)	(ha.m.)	(cms)	(ha.m.)	(cms)	(ha.m.)
0.0000	0.0000	0.0470	0.2070				
0.0160	0.1000	0.0550	0.2300				
0.0270	0.1550	0.0620	0.2540				
0.0350	0.1750	0.5100	0.3330				

AREA	QPEAK	TPEAK	R.V.
(ha)	(cms)	(hrs)	(mm)
INFLOW : ID= 2 (0201)	3.890	2.073	8.00 77.31
OUTFLOW: ID= 1 (0006)	3.890	0.047	9.50 76.90

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.27
 TIME SHIFT OF PEAK FLOW (min)= 90.00
 MAXIMUM STORAGE USED (ha.m.)= 0.2073



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*****
V V I SSSS U U A L (v 6.2.2015)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A L
V V I SSSS UUUU A A LLLL

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OOO TTTT TTTT H H Y Y M M OOO TM
O O T T H H Y Y M M M M O O
O O T T H H Y Y M M O O
OOO T T H H Y Y M M OOO

```

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***** DETAILED OUTPUT*****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
 Output filename: C:\Users\rhoooper\AppData\Local\Civica\VH5\3b3ad3-62bc-4ae0-beb1-12b5e54ace95\0fad03c6-9b5b-48a7-8daf-dc80380821f7\scen
 Summary filename: C:\Users\rhoooper\AppData\Local\Civica\VH5\3b3ad3-62bc-4ae0-beb1-12b5e54ace95\0fad03c6-9b5b-48a7-8daf-dc80380821f7\scen

DATE: 02-27-2026 TIME: 09:55:55

USER:

COMMENTS: _____

 ** SIMULATION : 50yr 24hr 5min Chicago **

| CHICAGO STORM | IDF curve parameters: A=1960.000
 | Ptotal= 89.46 mm | B= 5.800
 C= 0.861

used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
 Storm time step = 5.00 min
 Time to peak ratio = 0.33

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.00	0.54	6.00	1.95	12.00	1.82	18.00	0.80
0.08	0.54	6.08	2.03	12.08	1.78	18.08	0.79
0.17	0.55	6.17	2.12	12.17	1.75	18.17	0.79
0.25	0.55	6.25	2.22	12.25	1.72	18.25	0.78
0.33	0.56	6.33	2.33	12.33	1.69	18.33	0.78
0.42	0.56	6.42	2.46	12.42	1.66	18.42	0.77
0.50	0.57	6.50	2.60	12.50	1.63	18.50	0.77
0.58	0.57	6.58	2.76	12.58	1.61	18.58	0.76
0.67	0.58	6.67	2.94	12.67	1.58	18.67	0.75
0.75	0.59	6.75	3.14	12.75	1.55	18.75	0.75
0.83	0.59	6.83	3.38	12.83	1.53	18.83	0.74
0.92	0.60	6.92	3.67	12.92	1.51	18.92	0.74
1.00	0.60	7.00	4.00	13.00	1.48	19.00	0.73
1.08	0.61	7.08	4.42	13.08	1.46	19.08	0.73
1.17	0.62	7.17	4.92	13.17	1.44	19.17	0.72
1.25	0.62	7.25	5.57	13.25	1.42	19.25	0.72

1.33	0.63	7.33	6.43	13.33	1.40	19.33	0.72
1.42	0.64	7.42	7.61	13.42	1.38	19.42	0.71
1.50	0.65	7.50	9.34	13.50	1.36	19.50	0.71
1.58	0.65	7.58	12.08	13.58	1.34	19.58	0.70
1.67	0.66	7.67	17.06	13.67	1.33	19.67	0.70
1.75	0.67	7.75	28.53	13.75	1.31	19.75	0.69
1.83	0.68	7.83	74.90	13.83	1.29	19.83	0.69
1.92	0.69	7.92	252.63	13.92	1.28	19.92	0.68
2.00	0.69	8.00	98.98	14.00	1.26	20.00	0.68
2.08	0.70	8.08	50.92	14.08	1.24	20.08	0.68
2.17	0.71	8.17	33.05	14.17	1.23	20.17	0.67
2.25	0.72	8.25	24.08	14.25	1.21	20.25	0.67
2.33	0.73	8.33	18.81	14.33	1.20	20.33	0.66
2.42	0.74	8.42	15.37	14.42	1.19	20.42	0.66
2.50	0.75	8.50	12.98	14.50	1.17	20.50	0.66
2.58	0.76	8.58	11.22	14.58	1.16	20.58	0.65
2.67	0.77	8.67	9.88	14.67	1.15	20.67	0.65
2.75	0.78	8.75	8.82	14.75	1.13	20.75	0.64
2.83	0.80	8.83	7.97	14.83	1.12	20.83	0.64
2.92	0.81	8.92	7.27	14.92	1.11	20.92	0.64
3.00	0.82	9.00	6.69	15.00	1.10	21.00	0.63
3.08	0.83	9.08	6.19	15.08	1.09	21.08	0.63
3.17	0.84	9.17	5.77	15.17	1.07	21.17	0.63
3.25	0.86	9.25	5.40	15.25	1.06	21.25	0.62
3.33	0.87	9.33	5.08	15.33	1.05	21.33	0.62
3.42	0.89	9.42	4.79	15.42	1.04	21.42	0.62
3.50	0.90	9.50	4.54	15.50	1.03	21.50	0.61
3.58	0.92	9.58	4.31	15.58	1.02	21.58	0.61
3.67	0.93	9.67	4.10	15.67	1.01	21.67	0.61
3.75	0.95	9.75	3.92	15.75	1.00	21.75	0.60
3.83	0.97	9.83	3.75	15.83	0.99	21.83	0.60
3.92	0.99	9.92	3.59	15.92	0.98	21.92	0.60
4.00	1.01	10.00	3.45	16.00	0.97	22.00	0.59
4.08	1.03	10.08	3.32	16.08	0.97	22.08	0.59
4.17	1.05	10.17	3.20	16.17	0.96	22.17	0.59
4.25	1.07	10.25	3.09	16.25	0.95	22.25	0.58
4.33	1.09	10.33	2.99	16.33	0.94	22.33	0.58
4.42	1.11	10.42	2.89	16.42	0.93	22.42	0.58
4.50	1.14	10.50	2.80	16.50	0.92	22.50	0.58
4.58	1.16	10.58	2.72	16.58	0.91	22.58	0.57
4.67	1.19	10.67	2.64	16.67	0.91	22.67	0.57
4.75	1.22	10.75	2.56	16.75	0.90	22.75	0.57
4.83	1.25	10.83	2.49	16.83	0.89	22.83	0.56
4.92	1.28	10.92	2.43	16.92	0.88	22.92	0.56
5.00	1.32	11.00	2.37	17.00	0.88	23.00	0.56
5.08	1.35	11.08	2.31	17.08	0.87	23.08	0.56
5.17	1.39	11.17	2.25	17.17	0.86	23.17	0.55
5.25	1.43	11.25	2.20	17.25	0.86	23.25	0.55
5.33	1.47	11.33	2.15	17.33	0.85	23.33	0.55
5.42	1.52	11.42	2.10	17.42	0.84	23.42	0.55
5.50	1.57	11.50	2.05	17.50	0.84	23.50	0.54
5.58	1.62	11.58	2.01	17.58	0.83	23.58	0.54
5.67	1.67	11.67	1.97	17.67	0.82	23.67	0.54
5.75	1.73	11.75	1.93	17.75	0.82	23.75	0.54
5.83	1.80	11.83	1.89	17.83	0.81	23.83	0.53
5.92	1.87	11.92	1.85	17.92	0.80	23.92	0.53

 | CALIB |
 | STANDHYD (0201) | Area (ha)= 3.89
 | ID= 1 DT= 5.0 min | Total Imp(%)= 89.30 Dir. Conn.(%)= 89.30

IMPERVIOUS PERVIOUS (i)
 Surface Area (ha)= 3.47 0.42
 Dep. Storage (mm)= 1.00 5.00
 Average Slope (%)= 1.00 2.00
 Length (m)= 161.04 5.00
 Mannings n = 0.013 0.250



Max.Eff.Inten.(mm/hr)= 252.63 96.89
 over (min) 5.00 5.00
 Storage Coeff. (min)= 2.35 (ii) 2.95 (ii)
 Unit Hyd. Tpeak (min)= 5.00 5.00
 Unit Hyd. peak (cms)= 0.30 0.28
 TOTALS
 PEAK FLOW (cms)= 2.23 0.13 2.355 (iii)
 TIME TO PEAK (hrs)= 8.00 8.00 8.00
 RUNOFF VOLUME (mm)= 88.46 48.21 84.15
 TOTAL RAINFALL (mm)= 89.46 89.46 89.46
 RUNOFF COEFFICIENT = 0.99 0.54 0.94

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 | RESERVOIR(0006) | OVERFLOW IS OFF
 | IN= 2--> OUT= 1 |
 | DT= 5.0 min | OUTFLOW STORAGE | OUTFLOW STORAGE

 (cms) (ha.m.) | (cms) (ha.m.)
 0.0000 0.0000 | 0.0470 0.2070
 0.0160 0.1000 | 0.0550 0.2300
 0.0270 0.1550 | 0.0620 0.2540
 0.0350 0.1750 | 0.5100 0.3330

 AREA QPEAK TPEAK R.V.
 (ha) (cms) (hrs) (mm)
 INFLOW : ID= 2 (0201) 3.890 2.355 8.00 84.15
 OUTFLOW: ID= 1 (0006) 3.890 0.054 9.42 83.74

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.30
 TIME SHIFT OF PEAK FLOW (min)= 85.00
 MAXIMUM STORAGE USED (ha.m.)= 0.2276



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*****
V V I SSSS U U A L (v 6.2.2015)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A L
V V I SSSS UUUU A A LLLL

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OOO TTTT TTTT H H Y Y M M OOO TM
O O T T H H Y Y M M O O
O O T T H H Y Y M M O O
OOO T T H H Y Y M M OOO

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***** DETAILED OUTPUT*****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
 Output filename: C:\Users\rhoooper\AppData\Local\Civica\WH5\3b3ad3-62bc-4ae0-beb1-12b5e54ace95\4b8a30a-8e75-462c-bc0c-9b2e17628cc6\scen
 Summary filename: C:\Users\rhoooper\AppData\Local\Civica\WH5\3b3ad3-62bc-4ae0-beb1-12b5e54ace95\4b8a30a-8e75-462c-bc0c-9b2e17628cc6\scen

DATE: 02-27-2026 TIME: 09:55:56

USER:

COMMENTS: _____

 ** SIMULATION : 100yr 24hr 5min Chicago **

| CHICAGO STORM | IDF curve parameters: A=2150,000
 | Ptotal= 98.13 mm | B= 5.700
 C= 0.861

used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
 Storm time step = 5.00 min
 Time to peak ratio = 0.33

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.00	0.59	6.00	2.13	12.00	1.99	18.00	0.88
0.08	0.59	6.08	2.22	12.08	1.95	18.08	0.87
0.17	0.60	6.17	2.32	12.17	1.92	18.17	0.86
0.25	0.60	6.25	2.43	12.25	1.88	18.25	0.86
0.33	0.61	6.33	2.56	12.33	1.85	18.33	0.85
0.42	0.62	6.42	2.69	12.42	1.82	18.42	0.85
0.50	0.62	6.50	2.85	12.50	1.79	18.50	0.84
0.58	0.63	6.58	3.02	12.58	1.76	18.58	0.83
0.67	0.64	6.67	3.21	12.67	1.73	18.67	0.83
0.75	0.64	6.75	3.44	12.75	1.70	18.75	0.82
0.83	0.65	6.83	3.70	12.83	1.68	18.83	0.82
0.92	0.66	6.92	4.01	12.92	1.65	18.92	0.81
1.00	0.66	7.00	4.38	13.00	1.63	19.00	0.81
1.08	0.67	7.08	4.83	13.08	1.60	19.08	0.80
1.17	0.68	7.17	5.39	13.17	1.58	19.17	0.79
1.25	0.68	7.25	6.10	13.25	1.56	19.25	0.79

1.33	0.69	7.33	7.03	13.33	1.53	19.33	0.78
1.42	0.70	7.42	8.32	13.42	1.51	19.42	0.78
1.50	0.71	7.50	10.20	13.50	1.49	19.50	0.77
1.58	0.72	7.58	13.19	13.58	1.47	19.58	0.77
1.67	0.73	7.67	18.63	13.67	1.45	19.67	0.76
1.75	0.73	7.75	31.14	13.75	1.43	19.75	0.76
1.83	0.74	7.83	82.00	13.83	1.42	19.83	0.76
1.92	0.75	7.92	279.34	13.92	1.40	19.92	0.75
2.00	0.76	8.00	108.48	14.00	1.38	20.00	0.75
2.08	0.77	8.08	55.64	14.08	1.36	20.08	0.74
2.17	0.78	8.17	36.08	14.17	1.35	20.17	0.74
2.25	0.79	8.25	26.29	14.25	1.33	20.25	0.73
2.33	0.80	8.33	20.53	14.33	1.32	20.33	0.73
2.42	0.81	8.42	16.79	14.42	1.30	20.42	0.72
2.50	0.82	8.50	14.17	14.50	1.28	20.50	0.72
2.58	0.84	8.58	12.25	14.58	1.27	20.58	0.72
2.67	0.85	8.67	10.79	14.67	1.26	20.67	0.71
2.75	0.86	8.75	9.64	14.75	1.24	20.75	0.71
2.83	0.87	8.83	8.71	14.83	1.23	20.83	0.70
2.92	0.88	8.92	7.95	14.92	1.22	20.92	0.70
3.00	0.90	9.00	7.31	15.00	1.20	21.00	0.70
3.08	0.91	9.08	6.77	15.08	1.19	21.08	0.69
3.17	0.93	9.17	6.31	15.17	1.18	21.17	0.69
3.25	0.94	9.25	5.90	15.25	1.17	21.25	0.68
3.33	0.96	9.33	5.55	15.33	1.15	21.33	0.68
3.42	0.97	9.42	5.24	15.42	1.14	21.42	0.68
3.50	0.99	9.50	4.96	15.50	1.13	21.50	0.67
3.58	1.01	9.58	4.71	15.58	1.12	21.58	0.67
3.67	1.02	9.67	4.49	15.67	1.11	21.67	0.67
3.75	1.04	9.75	4.29	15.75	1.10	21.75	0.66
3.83	1.06	9.83	4.10	15.83	1.09	21.83	0.66
3.92	1.08	9.92	3.93	15.92	1.08	21.92	0.65
4.00	1.10	10.00	3.78	16.00	1.07	22.00	0.65
4.08	1.12	10.08	3.64	16.08	1.06	22.08	0.65
4.17	1.15	10.17	3.51	16.17	1.05	22.17	0.64
4.25	1.17	10.25	3.39	16.25	1.04	22.25	0.64
4.33	1.19	10.33	3.27	16.33	1.03	22.33	0.64
4.42	1.22	10.42	3.17	16.42	1.02	22.42	0.63
4.50	1.25	10.50	3.07	16.50	1.01	22.50	0.63
4.58	1.28	10.58	2.98	16.58	1.00	22.58	0.63
4.67	1.31	10.67	2.89	16.67	0.99	22.67	0.63
4.75	1.34	10.75	2.81	16.75	0.99	22.75	0.62
4.83	1.37	10.83	2.73	16.83	0.98	22.83	0.62
4.92	1.40	10.92	2.66	16.92	0.97	22.92	0.62
5.00	1.44	11.00	2.59	17.00	0.96	23.00	0.61
5.08	1.48	11.08	2.53	17.08	0.95	23.08	0.61
5.17	1.52	11.17	2.47	17.17	0.95	23.17	0.61
5.25	1.57	11.25	2.41	17.25	0.94	23.25	0.60
5.33	1.61	11.33	2.35	17.33	0.93	23.33	0.60
5.42	1.66	11.42	2.30	17.42	0.92	23.42	0.60
5.50	1.71	11.50	2.25	17.50	0.92	23.50	0.60
5.58	1.77	11.58	2.20	17.58	0.91	23.58	0.59
5.67	1.83	11.67	2.16	17.67	0.90	23.67	0.59
5.75	1.90	11.75	2.11	17.75	0.90	23.75	0.59
5.83	1.97	11.83	2.07	17.83	0.89	23.83	0.58
5.92	2.05	11.92	2.03	17.92	0.88	23.92	0.58

 | CALIB |
 | STANDHYD (0201) | Area (ha)= 3.89
 | ID= 1 DT= 5.0 min | Total Imp(%)= 89.30 Dir. Conn.(%)= 89.30

 IMPERVIOUS PERVIOUS (i)
 Surface Area (ha)= 3.47 0.42
 Dep. Storage (mm)= 1.00 5.00
 Average Slope (%)= 1.00 2.00
 Length (m)= 161.04 5.00
 Mannings n = 0.013 0.250



Max.Eff.Inten.(mm/hr)= 279.34 112.89
 over (min) 5.00 5.00
 Storage Coeff. (min)= 2.25 (ii) 2.83 (ii)
 Unit Hyd. Tpeak (min)= 5.00 5.00
 Unit Hyd. peak (cms)= 0.30 0.28
 TOTALS
 PEAK FLOW (cms)= 2.48 0.15 2.634 (iii)
 TIME TO PEAK (hrs)= 8.00 8.00 8.00
 RUNOFF VOLUME (mm)= 97.13 55.38 92.67
 TOTAL RAINFALL (mm)= 98.13 98.13 98.13
 RUNOFF COEFFICIENT = 0.99 0.56 0.94

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 | RESERVOIR(0006) | OVERFLOW IS OFF
 | IN= 2--> OUT= 1 |
DT= 5.0 min

	(cms)	(ha.m.)	(cms)	(ha.m.)
	0.0000	0.0000	0.0470	0.2070
	0.0160	0.1000	0.0550	0.2300
	0.0270	0.1550	0.0620	0.2540
	0.0350	0.1750	0.5100	0.3330

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0201)	3.890	2.634	8.00	92.67
OUTFLOW: ID= 1 (0006)	3.890	0.061	9.42	92.26

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.31
 TIME SHIFT OF PEAK FLOW (min)= 85.00
 MAXIMUM STORAGE USED (ha.m.)= 0.2498



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V V I SSSS U U A L (v 6.2.2015)
 V V I SS U U A A L
 V V I SS U U A A A A L
 V V I SS U U A A L
 V V I SSSS UUUU A A LLLL

OOO TTTT TTTT H H Y Y M M OOO TM
 O O T T H H Y Y M M O O
 O O T T H H Y Y M M O O
 OOO T T H H Y Y M M OOO

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***** DETAILED OUTPUT*****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
 Output filename: C:\Users\rhoooper\AppData\Local\Civica\VH5\3bf3ad3-62bc-4ae0-beb1-12b5e54ace95\7a94c599-
 de4c-4f62-bfaf-8affe1529451\scen
 Summary filename: C:\Users\rhoooper\AppData\Local\Civica\VH5\3bf3ad3-62bc-4ae0-beb1-12b5e54ace95\7a94c599-
 de4c-4f62-bfaf-8affe1529451\scen

DATE: 02-27-2026 TIME: 09:59:28

USER:

COMMENTS: _____

 ** SIMULATION : 12 Hour Hazel **

 | READ STORM | Filename: C:\Users\rhoooper\AppData
 | | ata\Local\Temp\
 | | 156df1d3-8aa6-4f8c-8350-182a83573fd0\99ef6c6c
 | Ptotal=212.00 mm | Comments: Hazel 12-hour

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN	
hrs	mm/hr	hrs	mm/hr	'	hrs	mm/hr	hrs	mm/hr
0.00	6.00	3.00	13.00	6.00	23.00	9.00	53.00	
1.00	4.00	4.00	17.00	7.00	13.00	10.00	38.00	
2.00	6.00	5.00	13.00	8.00	13.00	11.00	13.00	

 | CALIB |
 | STANDHYD (0201) | Area (ha)= 3.89
 | ID= 1 DT= 5.0 min | Total Imp.(%)= 89.30 Dir. Conn.(%)= 89.30

IMPERVIOUS PERVIOUS (i)
 Surface Area (ha)= 3.47 0.42
 Dep. Storage (mm)= 1.00 5.00
 Average Slope (%)= 1.00 2.00
 Length (m)= 161.04 5.00
 Mannings n = 0.013 0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN	
hrs	mm/hr	hrs	mm/hr	'	hrs	mm/hr	hrs	mm/hr
0.083	6.00	3.083	13.00	6.083	23.00	9.08	53.00	
0.167	6.00	3.167	13.00	6.167	23.00	9.17	53.00	
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00	
0.333	6.00	3.333	13.00	6.333	23.00	9.33	53.00	
0.417	6.00	3.417	13.00	6.417	23.00	9.42	53.00	
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00	
0.583	6.00	3.583	13.00	6.583	23.00	9.58	53.00	
0.667	6.00	3.667	13.00	6.667	23.00	9.67	53.00	
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00	
0.833	6.00	3.833	13.00	6.833	23.00	9.83	53.00	
0.917	6.00	3.917	13.00	6.917	23.00	9.92	53.00	
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00	
1.083	4.00	4.083	17.00	7.083	13.00	10.08	38.00	
1.167	4.00	4.167	17.00	7.167	13.00	10.17	38.00	
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00	
1.333	4.00	4.333	17.00	7.333	13.00	10.33	38.00	
1.417	4.00	4.417	17.00	7.417	13.00	10.42	38.00	
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00	
1.583	4.00	4.583	17.00	7.583	13.00	10.58	38.00	
1.667	4.00	4.667	17.00	7.667	13.00	10.67	38.00	
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00	
1.833	4.00	4.833	17.00	7.833	13.00	10.83	38.00	
1.917	4.00	4.917	17.00	7.917	13.00	10.92	38.00	
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00	
2.083	6.00	5.083	13.00	8.083	13.00	11.08	13.00	
2.167	6.00	5.167	13.00	8.167	13.00	11.17	13.00	
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00	
2.333	6.00	5.333	13.00	8.333	13.00	11.33	13.00	
2.417	6.00	5.417	13.00	8.417	13.00	11.42	13.00	
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00	
2.583	6.00	5.583	13.00	8.583	13.00	11.58	13.00	
2.667	6.00	5.667	13.00	8.667	13.00	11.67	13.00	
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00	
2.833	6.00	5.833	13.00	8.833	13.00	11.83	13.00	
2.917	6.00	5.917	13.00	8.917	13.00	11.92	13.00	
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00	

Max.Eff.Inten.(mm/hr)= 53.00 51.69
 over (min) 5.00 10.00
 Storage Coeff. (min)= 4.38 (ii) 5.50 (ii)
 Unit Hyd. Tpeak (min)= 5.00 10.00
 Unit Hyd. peak (cms)= 0.23 0.16
 TOTALS
 PEAK FLOW (cms)= 0.51 0.06 0.571 (iii)
 TIME TO PEAK (hrs)= 10.00 10.00 10.00
 RUNOFF VOLUME (mm)= 211.00 182.16 207.91
 TOTAL RAINFALL (mm)= 212.00 212.00 212.00
 RUNOFF COEFFICIENT = 1.00 0.86 0.98

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 90.0 la = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 | RESERVOIR(0006) | OVERFLOW IS OFF
 | IN= 2--> OUT= 1 |
DT= 5.0 min
(cms) (ha.m.)
 0.0000 0.0000 | 0.5100 0.0900



	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
INFLOW: ID= 2 (0201)	3.890	0.571	10.00	207.91
OUTFLOW: ID= 1 (0006)	3.890	0.506	10.08	207.90

PEAK FLOW REDUCTION [Qout/Qin](%)= 88.55
TIME SHIFT OF PEAK FLOW (min)= 5.00
MAXIMUM STORAGE USED (ha.m.)= 0.0898

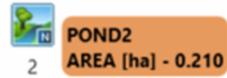
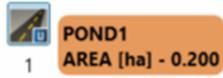
FINISH

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Project #: 3023-7688
Project Name: 4243 6th Line
February 27, 2026
Existing Depressions

Schematic





Results

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V V I SSSSS U U A A L (v 6.2.2015)
V V I SS U U A A L
V V I SS U U AAAAA L
V V I SS U U A A L
V V I SSSSS UUUUU A A LLLLL

OOO TTTT TTTT H H Y Y M M OOO TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
OOO T T H H Y M M OOO

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***** DETAILED OUTPUT*****

```

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\mhoooper\AppData\Local\Civica\XH5\3bf3ad3-62bc-4ae0-beb1-12b5e54ace95\c81fa86b-
bda6-4580-92dd-45bc4b101ae2\scen
Summary filename: C:\Users\mhoooper\AppData\Local\Civica\XH5\3bf3ad3-62bc-4ae0-beb1-12b5e54ace95\c81fa86b-
bda6-4580-92dd-45bc4b101ae2\scen
  
```

DATE: 02-27-2026 TIME: 10:01:12

USER:

COMMENTS: _____

```

*****
** SIMULATION : 2yr 24hr 5min Chicago **
*****
  
```

```

| CHICAGO STORM | IDF curve parameters: A= 725.000
| Ptotal= 48.69 mm | B= 4.800
| C= 0.808
used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33
  
```

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.00	0.40	6.00	1.30	12.00	1.23	18.00	0.58
0.08	0.40	6.08	1.35	12.08	1.20	18.08	0.57
0.17	0.41	6.17	1.41	12.17	1.18	18.17	0.57
0.25	0.41	6.25	1.47	12.25	1.17	18.25	0.57
0.33	0.41	6.33	1.54	12.33	1.15	18.33	0.56
0.42	0.42	6.42	1.61	12.42	1.13	18.42	0.56
0.50	0.42	6.50	1.69	12.50	1.11	18.50	0.55
0.58	0.42	6.58	1.78	12.58	1.09	18.58	0.55
0.67	0.43	6.67	1.89	12.67	1.08	18.67	0.55
0.75	0.43	6.75	2.01	12.75	1.06	18.75	0.54
0.83	0.44	6.83	2.14	12.83	1.05	18.83	0.54
0.92	0.44	6.92	2.30	12.92	1.03	18.92	0.54
1.00	0.45	7.00	2.49	13.00	1.02	19.00	0.53
1.08	0.45	7.08	2.72	13.08	1.01	19.08	0.53

1.17	0.45	7.17	2.99	13.17	0.99	19.17	0.53
1.25	0.46	7.25	3.34	13.25	0.98	19.25	0.52
1.33	0.46	7.33	3.79	13.33	0.97	19.33	0.52
1.42	0.47	7.42	4.39	13.42	0.95	19.42	0.52
1.50	0.47	7.50	5.25	13.50	0.94	19.50	0.51
1.58	0.48	7.58	6.57	13.58	0.93	19.58	0.51
1.67	0.48	7.67	8.89	13.67	0.92	19.67	0.51
1.75	0.49	7.75	14.00	13.75	0.91	19.75	0.51
1.83	0.50	7.83	33.97	13.83	0.90	19.83	0.50
1.92	0.50	7.92	114.66	13.92	0.89	19.92	0.50
2.00	0.51	8.00	44.30	14.00	0.88	20.00	0.50
2.08	0.51	8.08	23.68	14.08	0.87	20.08	0.49
2.17	0.52	8.17	15.99	14.17	0.86	20.17	0.49
2.25	0.52	8.25	12.06	14.25	0.85	20.25	0.49
2.33	0.53	8.33	9.69	14.33	0.84	20.33	0.49
2.42	0.54	8.42	8.12	14.42	0.83	20.42	0.48
2.50	0.54	8.50	7.00	14.50	0.82	20.50	0.48
2.58	0.55	8.58	6.16	14.58	0.81	20.58	0.48
2.67	0.56	8.67	5.51	14.67	0.80	20.67	0.48
2.75	0.57	8.75	5.00	14.75	0.80	20.75	0.47
2.83	0.57	8.83	4.57	14.83	0.79	20.83	0.47
2.92	0.58	8.92	4.22	14.92	0.78	20.92	0.47
3.00	0.59	9.00	3.92	15.00	0.77	21.00	0.47
3.08	0.60	9.08	3.66	15.08	0.77	21.08	0.46
3.17	0.61	9.17	3.44	15.17	0.76	21.17	0.46
3.25	0.62	9.25	3.25	15.25	0.75	21.25	0.46
3.33	0.63	9.33	3.07	15.33	0.74	21.33	0.46
3.42	0.64	9.42	2.92	15.42	0.74	21.42	0.45
3.50	0.65	9.50	2.78	15.50	0.73	21.50	0.45
3.58	0.66	9.58	2.66	15.58	0.72	21.58	0.45
3.67	0.67	9.67	2.55	15.67	0.72	21.67	0.45
3.75	0.68	9.75	2.44	15.75	0.71	21.75	0.44
3.83	0.69	9.83	2.35	15.83	0.70	21.83	0.44
3.92	0.70	9.92	2.26	15.92	0.70	21.92	0.44
4.00	0.71	10.00	2.18	16.00	0.69	22.00	0.44
4.08	0.73	10.08	2.11	16.08	0.69	22.08	0.44
4.17	0.74	10.17	2.04	16.17	0.68	22.17	0.43
4.25	0.75	10.25	1.98	16.25	0.68	22.25	0.43
4.33	0.77	10.33	1.92	16.33	0.67	22.33	0.43
4.42	0.78	10.42	1.86	16.42	0.66	22.42	0.43
4.50	0.80	10.50	1.81	16.50	0.66	22.50	0.43
4.58	0.82	10.58	1.76	16.58	0.65	22.58	0.42
4.67	0.83	10.67	1.72	16.67	0.65	22.67	0.42
4.75	0.85	10.75	1.67	16.75	0.64	22.75	0.42
4.83	0.87	10.83	1.63	16.83	0.64	22.83	0.42
4.92	0.89	10.92	1.59	16.92	0.63	22.92	0.42
5.00	0.91	11.00	1.56	17.00	0.63	23.00	0.41
5.08	0.93	11.08	1.52	17.08	0.62	23.08	0.41
5.17	0.96	11.17	1.49	17.17	0.62	23.17	0.41
5.25	0.98	11.25	1.46	17.25	0.61	23.25	0.41
5.33	1.01	11.33	1.43	17.33	0.61	23.33	0.41
5.42	1.04	11.42	1.40	17.42	0.61	23.42	0.41
5.50	1.07	11.50	1.37	17.50	0.60	23.50	0.40
5.58	1.10	11.58	1.34	17.58	0.60	23.58	0.40
5.67	1.14	11.67	1.32	17.67	0.59	23.67	0.40
5.75	1.17	11.75	1.29	17.75	0.59	23.75	0.40
5.83	1.21	11.83	1.27	17.83	0.58	23.83	0.40
5.92	1.26	11.92	1.25	17.92	0.58	23.92	0.39

```

| CALIB |
| NASHYD [ 0002] | Area [ha]= 0.21 Curve Number [CN]= 72.0
| ID= 1 DT= 5.0 min | la [mm]= 5.80 # of Linear Res.[N]= 3.00
| U.H. Tp[hrs]= 0.19
  
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Unit Hyd Qpeak [cms]= 0.042
PEAK FLOW [cms]= 0.006 [i]
  
```



TIME TO PEAK (hrs)= 8.167
 RUNOFF VOLUME (mm)= 12.951
 TOTAL RAINFALL (mm)= 48.688
 RUNOFF COEFFICIENT = 0.266

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 | CALIB |
 | STANDHYD (0001) | Area (ha)= 0.20
 | ID= 1 DT= 5.0 min | Total Imp(%)= 36.00 Dir. Conn.(%)= 10.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.07	0.13
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	36.51	40.00
Mannings n =	0.013	0.250

Max.Eff.Inten.(mm/hr)=	114.66	50.28
over (min)	5.00	15.00
Storage Coeff. (min)=	1.32 (ii)	10.61 (ii)
Unit Hyd. Tpeak (min)=	5.00	15.00
Unit Hyd. peak (cms)=	0.33	0.09

	TOTALS		
PEAK FLOW (cms)=	0.01	0.01	0.012 (iii)
TIME TO PEAK (hrs)=	8.00	8.17	8.17
RUNOFF VOLUME (mm)=	47.69	22.56	25.05
TOTAL RAINFALL (mm)=	48.69	48.69	48.69
RUNOFF COEFFICIENT =	0.98	0.46	0.51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
 ***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 80.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 FINISH
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V V I SSSS U U A L (v 6.2.2015)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A L
V V I SSSS UUUU A A LLLL
```

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OOO TTTT TTTT H H Y Y M M OOO TM
O O T T H H Y Y M M O O
O O T T H H Y Y M M O O
OOO T T H H Y Y M M OOO
```

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***** DETAILED OUTPUT*****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
 Output filename: C:\Users\mhooper\AppData\Local\Civica\WH5\3b3ad3-62bc-4ae0-beb1-12b5e54ace95\94bae3c-1699-4ef2-b6ce-2a5c7e811ba1\scen
 Summary filename: C:\Users\mhooper\AppData\Local\Civica\WH5\3b3ad3-62bc-4ae0-beb1-12b5e54ace95\94bae3c-1699-4ef2-b6ce-2a5c7e811ba1\scen

DATE: 02-27-2026 TIME: 10:01:12

USER:

COMMENTS: _____

 ** SIMULATION : 100yr 24hr 5min Chicago **

| CHICAGO STORM | IDF curve parameters: A=2150,000
 | Ptotal= 98.13 mm | B= 5.700
 C= 0.861
 used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
 Storm time step = 5.00 min
 Time to peak ratio = 0.33

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.00	0.59	6.00	2.13	12.00	1.99	18.00	0.88
0.08	0.59	6.08	2.22	12.08	1.95	18.08	0.87
0.17	0.60	6.17	2.32	12.17	1.92	18.17	0.86
0.25	0.60	6.25	2.43	12.25	1.88	18.25	0.86
0.33	0.61	6.33	2.56	12.33	1.85	18.33	0.85
0.42	0.62	6.42	2.69	12.42	1.82	18.42	0.85
0.50	0.62	6.50	2.85	12.50	1.79	18.50	0.84
0.58	0.63	6.58	3.02	12.58	1.76	18.58	0.83
0.67	0.64	6.67	3.21	12.67	1.73	18.67	0.83
0.75	0.64	6.75	3.44	12.75	1.70	18.75	0.82
0.83	0.65	6.83	3.70	12.83	1.68	18.83	0.82
0.92	0.66	6.92	4.01	12.92	1.65	18.92	0.81
1.00	0.66	7.00	4.38	13.00	1.63	19.00	0.81
1.08	0.67	7.08	4.83	13.08	1.60	19.08	0.80
1.17	0.68	7.17	5.39	13.17	1.58	19.17	0.79
1.25	0.68	7.25	6.10	13.25	1.56	19.25	0.79

1.33	0.69	7.33	7.03	13.33	1.53	19.33	0.78
1.42	0.70	7.42	8.32	13.42	1.51	19.42	0.78
1.50	0.71	7.50	10.20	13.50	1.49	19.50	0.77
1.58	0.72	7.58	13.19	13.58	1.47	19.58	0.77
1.67	0.73	7.67	18.63	13.67	1.45	19.67	0.76
1.75	0.73	7.75	31.14	13.75	1.43	19.75	0.76
1.83	0.74	7.83	82.00	13.83	1.42	19.83	0.76
1.92	0.75	7.92	279.34	13.92	1.40	19.92	0.75
2.00	0.76	8.00	108.48	14.00	1.38	20.00	0.75
2.08	0.77	8.08	55.64	14.08	1.36	20.08	0.74
2.17	0.78	8.17	36.08	14.17	1.35	20.17	0.74
2.25	0.79	8.25	26.29	14.25	1.33	20.25	0.73
2.33	0.80	8.33	20.53	14.33	1.32	20.33	0.73
2.42	0.81	8.42	16.79	14.42	1.30	20.42	0.72
2.50	0.82	8.50	14.17	14.50	1.28	20.50	0.72
2.58	0.84	8.58	12.25	14.58	1.27	20.58	0.72
2.67	0.85	8.67	10.79	14.67	1.26	20.67	0.71
2.75	0.86	8.75	9.64	14.75	1.24	20.75	0.71
2.83	0.87	8.83	8.71	14.83	1.23	20.83	0.70
2.92	0.88	8.92	7.95	14.92	1.22	20.92	0.70
3.00	0.90	9.00	7.31	15.00	1.20	21.00	0.70
3.08	0.91	9.08	6.77	15.08	1.19	21.08	0.69
3.17	0.93	9.17	6.31	15.17	1.18	21.17	0.69
3.25	0.94	9.25	5.90	15.25	1.17	21.25	0.68
3.33	0.96	9.33	5.55	15.33	1.15	21.33	0.68
3.42	0.97	9.42	5.24	15.42	1.14	21.42	0.68
3.50	0.99	9.50	4.96	15.50	1.13	21.50	0.67
3.58	1.01	9.58	4.71	15.58	1.12	21.58	0.67
3.67	1.02	9.67	4.49	15.67	1.11	21.67	0.67
3.75	1.04	9.75	4.29	15.75	1.10	21.75	0.66
3.83	1.06	9.83	4.10	15.83	1.09	21.83	0.66
3.92	1.08	9.92	3.93	15.92	1.08	21.92	0.65
4.00	1.10	10.00	3.78	16.00	1.07	22.00	0.65
4.08	1.12	10.08	3.64	16.08	1.06	22.08	0.65
4.17	1.15	10.17	3.51	16.17	1.05	22.17	0.64
4.25	1.17	10.25	3.39	16.25	1.04	22.25	0.64
4.33	1.19	10.33	3.27	16.33	1.03	22.33	0.64
4.42	1.22	10.42	3.17	16.42	1.02	22.42	0.63
4.50	1.25	10.50	3.07	16.50	1.01	22.50	0.63
4.58	1.28	10.58	2.98	16.58	1.00	22.58	0.63
4.67	1.31	10.67	2.89	16.67	0.99	22.67	0.63
4.75	1.34	10.75	2.81	16.75	0.99	22.75	0.62
4.83	1.37	10.83	2.73	16.83	0.98	22.83	0.62
4.92	1.40	10.92	2.66	16.92	0.97	22.92	0.62
5.00	1.44	11.00	2.59	17.00	0.96	23.00	0.61
5.08	1.48	11.08	2.53	17.08	0.95	23.08	0.61
5.17	1.52	11.17	2.47	17.17	0.95	23.17	0.61
5.25	1.57	11.25	2.41	17.25	0.94	23.25	0.60
5.33	1.61	11.33	2.35	17.33	0.93	23.33	0.60
5.42	1.66	11.42	2.30	17.42	0.92	23.42	0.60
5.50	1.71	11.50	2.25	17.50	0.92	23.50	0.60
5.58	1.77	11.58	2.20	17.58	0.91	23.58	0.59
5.67	1.83	11.67	2.16	17.67	0.90	23.67	0.59
5.75	1.90	11.75	2.11	17.75	0.90	23.75	0.59
5.83	1.97	11.83	2.07	17.83	0.89	23.83	0.58
5.92	2.05	11.92	2.03	17.92	0.88	23.92	0.58

 | CALIB |
 | NASHYD [0002] | Area (ha)= 0.21 Curve Number (CN)= 72.0
 | ID= 1 DT= 5.0 min | la (mm)= 5.80 # of Linear Res.(N)= 3.00
 ----- U.H. Tp(hrs)= 0.19

Unit Hyd Qpeak (cms)= 0.042

PEAK FLOW (cms)= 0.028 (i)
 TIME TO PEAK (hrs)= 8.167
 RUNOFF VOLUME (mm)= 44.504



TOTAL RAINFALL (mm)= 98.135
 RUNOFF COEFFICIENT = 0.454

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB |
 | STANDHYD (0001) | Area (ha)= 0.20
 | ID= 1 DT= 5.0 min | Total Imp(%)= 36.00 Dir. Conn.(%)= 10.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.07	0.13
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	36.51	40.00
Mannings n =	0.013	0.250

Max.Eff.Inten.(mm/hr)=	279.34	188.08
over (min)	5.00	10.00

Storage Coeff. (min)=	0.93 (ii)	6.41 (ii)
Unit Hyd. Tpeak (min)=	5.00	10.00
Unit Hyd. peak (cms)=	0.34	0.14

	TOTALS		
PEAK FLOW (cms)=	0.02	0.05	0.059 (iii)
TIME TO PEAK (hrs)=	8.00	8.08	8.08
RUNOFF VOLUME (mm)=	97.13	64.02	67.30
TOTAL RAINFALL (mm)=	98.13	98.13	98.13
RUNOFF COEFFICIENT =	0.99	0.65	0.69

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
 ***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 80.0 Ia = Dep. Storage (Above)
 - (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
 THAN THE STORAGE COEFFICIENT.
 - (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
-



```

=====
*****
V V I SSSS U U A L (v 6.2.2020)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A L
V V I SSSS UUUU A A LLLL

OOO TTTT TTTT H H Y Y M M OOO TM
O O T T H H Y Y M M M O O
O O T T H H Y Y M M O O
OOO T T H H Y Y M M OOO
Developed and Distributed by Smart City Water Inc
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```

***** DETAILED OUTPUT*****

```

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\jfitcher\AppData\Local\Civica\XH5\af3bf3ad3-62bc-4ae0-beb1-12b5e54ace95\35dfb904-f996-4613-be49-a4865128a919\sc
Summary filename: C:\Users\jfitcher\AppData\Local\Civica\XH5\af3bf3ad3-62bc-4ae0-beb1-12b5e54ace95\35dfb904-f996-4613-be49-a4865128a919\sc

```

DATE: 02-26-2026 TIME: 09:40:02

USER:

COMMENTS: _____

```

*****
** SIMULATION : 12 Hour Hazel **
*****

```

```

| READ STORM | Filename: C:\Users\jfitcher\AppData
| | ata\Local\Temp\
| | fef06282-82e6-47ac-b26b-2136a3f18c6e\99ef6c6c
| Ptotal=212.00 mm | Comments: Hazel 12-hour

```

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN	
hrs	mm/hr	hrs	mm/hr	'	hrs	mm/hr	hrs	mm/hr
0.00	6.00	3.00	13.00	6.00	23.00	9.00	53.00	
1.00	4.00	4.00	17.00	7.00	13.00	10.00	38.00	
2.00	6.00	5.00	13.00	8.00	13.00	11.00	13.00	

```

| CALIB |
| NASHYD ( 0002) | Area (ha)= 0.21 Curve Number (CN)= 86.0
| ID= 1 DT= 5.0 min | la (mm)= 5.80 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 0.19

```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

--- TRANSFORMED HYETOGRAPH ---

TIME	RAIN	TIME	RAIN	'	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	'	hrs	mm/hr	hrs	mm/hr
0.083	6.00	3.083	13.00	6.083	23.00	9.08	53.00	

0.167	6.00	3.167	13.00	6.167	23.00	9.17	53.00
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00
0.333	6.00	3.333	13.00	6.333	23.00	9.33	53.00
0.417	6.00	3.417	13.00	6.417	23.00	9.42	53.00
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.583	6.00	3.583	13.00	6.583	23.00	9.58	53.00
0.667	6.00	3.667	13.00	6.667	23.00	9.67	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00
0.833	6.00	3.833	13.00	6.833	23.00	9.83	53.00
0.917	6.00	3.917	13.00	6.917	23.00	9.92	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.083	4.00	4.083	17.00	7.083	13.00	10.08	38.00
1.167	4.00	4.167	17.00	7.167	13.00	10.17	38.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.333	4.00	4.333	17.00	7.333	13.00	10.33	38.00
1.417	4.00	4.417	17.00	7.417	13.00	10.42	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00
1.583	4.00	4.583	17.00	7.583	13.00	10.58	38.00
1.667	4.00	4.667	17.00	7.667	13.00	10.67	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
1.833	4.00	4.833	17.00	7.833	13.00	10.83	38.00
1.917	4.00	4.917	17.00	7.917	13.00	10.92	38.00
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.083	6.00	5.083	13.00	8.083	13.00	11.08	13.00
2.167	6.00	5.167	13.00	8.167	13.00	11.17	13.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.333	6.00	5.333	13.00	8.333	13.00	11.33	13.00
2.417	6.00	5.417	13.00	8.417	13.00	11.42	13.00
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.583	6.00	5.583	13.00	8.583	13.00	11.58	13.00
2.667	6.00	5.667	13.00	8.667	13.00	11.67	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00
2.833	6.00	5.833	13.00	8.833	13.00	11.83	13.00
2.917	6.00	5.917	13.00	8.917	13.00	11.92	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

Unit Hyd Qpeak (cms)= 0.042

```

PEAK FLOW (cms)= 0.029 (j)
TIME TO PEAK (hrs)= 10.000
RUNOFF VOLUME (mm)= 171.356
TOTAL RAINFALL (mm)= 212.000
RUNOFF COEFFICIENT = 0.808

```

(j) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

| CALIB |
| STANDHYD ( 0001) | Area (ha)= 0.20
| ID= 1 DT= 5.0 min | Total Imp(%)= 36.00 Dir. Conn.(%)= 10.00

```

```

IMPERVIOUS PERVIOUS (j)
Surface Area (ha)= 0.07 0.13
Dep. Storage (mm)= 1.00 5.00
Average Slope (%)= 1.00 2.00
Length (m)= 36.51 40.00
Mannings n = 0.013 0.250

```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

--- TRANSFORMED HYETOGRAPH ---

TIME	RAIN	TIME	RAIN	'	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	'	hrs	mm/hr	hrs	mm/hr
0.083	6.00	3.083	13.00	6.083	23.00	9.08	53.00	
0.167	6.00	3.167	13.00	6.167	23.00	9.17	53.00	
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00	
0.333	6.00	3.333	13.00	6.333	23.00	9.33	53.00	
0.417	6.00	3.417	13.00	6.417	23.00	9.42	53.00	



0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.583	6.00	3.583	13.00	6.583	23.00	9.58	53.00
0.667	6.00	3.667	13.00	6.667	23.00	9.67	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00
0.833	6.00	3.833	13.00	6.833	23.00	9.83	53.00
0.917	6.00	3.917	13.00	6.917	23.00	9.92	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.083	4.00	4.083	17.00	7.083	13.00	10.08	38.00
1.167	4.00	4.167	17.00	7.167	13.00	10.17	38.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.333	4.00	4.333	17.00	7.333	13.00	10.33	38.00
1.417	4.00	4.417	17.00	7.417	13.00	10.42	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00
1.583	4.00	4.583	17.00	7.583	13.00	10.58	38.00
1.667	4.00	4.667	17.00	7.667	13.00	10.67	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
1.833	4.00	4.833	17.00	7.833	13.00	10.83	38.00
1.917	4.00	4.917	17.00	7.917	13.00	10.92	38.00
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.083	6.00	5.083	13.00	8.083	13.00	11.08	13.00
2.167	6.00	5.167	13.00	8.167	13.00	11.17	13.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.333	6.00	5.333	13.00	8.333	13.00	11.33	13.00
2.417	6.00	5.417	13.00	8.417	13.00	11.42	13.00
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.583	6.00	5.583	13.00	8.583	13.00	11.58	13.00
2.667	6.00	5.667	13.00	8.667	13.00	11.67	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00
2.833	6.00	5.833	13.00	8.833	13.00	11.83	13.00
2.917	6.00	5.917	13.00	8.917	13.00	11.92	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

Max.Eff.Inten.(mm/hr)= 53.00 73.53
 over (min) 5.00 10.00
 Storage Coeff. (min)= 1.80 (ii) 9.78 (ii)
 Unit Hyd. Tpeak (min)= 5.00 10.00
 Unit Hyd. peak (cms)= 0.32 0.11

TOTALS
 PEAK FLOW (cms)= 0.00 0.03 0.029 (iii)
 TIME TO PEAK (hrs)= 9.42 10.00 10.00
 RUNOFF VOLUME (mm)= 211.00 190.14 192.19
 TOTAL RAINFALL (mm)= 212.00 212.00 212.00
 RUNOFF COEFFICIENT = 1.00 0.90 0.91

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
 ***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
 YOU SHOULD CONSIDER SPLITTING THE AREA.

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 90.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 FINISH
 =====
 =====



Project: Sixth Line
 Project No.: 3023-7688
 Created By: MPH
 Checked By: JKF
 Date: 2026.02.27

Depression Areas Hydrograph Determination

Catchment ID	Hydrologic Soil Group	Pervious Areas (ha)					Impervious Areas (ha)							Catchment Details			
		Woodland	SWMF (Landscaped)	Meadow	Crops	Lawn / Landscape	Gravel		Paved / Concrete		Building		SWMF (Permanent pool)	Subtotal Area (ha)	TIMP (Fraction)	XIMP (Fraction)	Hydrograph in VO Model
		N/A	N/A	N/A	N/A	N/A	To Outlet	To Pervious	To Outlet	To Pervious	To Outlet	To Pervious	To Outlet				
POND1	C					0.01							0.02	0.03	0.36	0.00	STANDHYD
	D					0.12						0.00	0.05	0.18			
	Total	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.20			
POND2	C					0.18							0.03	0.21	0.15	N/A	NASHYD
	D												0.00	0.00			
	Total	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.21			



Project: Sixth Line
 Project No.: 3023-7688
 Created By: MPH
 Checked By: JKF
 Date: 2026.02.27

Depression Areas NASHYD - CN & IA Values

Parameter	Hydrologic Soil Group	Soil Category	Landuse							
			Woodland	SWMF / Wetland	Meadow	Cultivated/ Crops	Lawn / Landscape	Gravel	Paved / Concrete	Building
CN Values	C	Clay Loam/Clay	71	50	71	82	76	98	98	98
	D	Clay Loam/Clay	77	50	78	86	81	98	98	98
IA Values			10	10	8	7	5	2	2	2

*Note these values are taken from the MTO manual.

Catchment ID	Hydrologic Soil Group	Soil Category	Area (ha) for each land use and soil group							Subtotal Area (ha)	Weighted CN	Weighted IA	
			Woodland	SWMF / Wetland	Meadow	Cultivated/ Crops	Lawn / Landscape	Gravel	Paved / Concrete				Building
POND2	C	Clay Loam/Clay	0.00	0.03	0.00	0.00	0.18	0.00	0.00	0.00	0.21	72.1	5.8
	D	Clay Loam/Clay	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	Total		0.00	0.03	0.00	0.00	0.18	0.00	0.00	0.00	0.21		



Project: Sixth Line
 Project No.: 3023-7688
 Created By: MPH
 Checked By: JKF
 Date: 2026.02.27

Depression Areas Time to Peak - Bransby Williams & Airport Methods

Airport Method

Bransby William

$$T_c = \frac{3.26 * (1.1 - C) * L^{0.5}}{S_w^{0.33}}$$

$$T_c = \frac{0.057 * L}{S_w^{0.2} * A^{0.1}}$$

Equation from MTO Drainage Management Manual 1997

Catchment ID	Subtotal Area (ha)	Runoff Coefficient	Method	Flow Path Length (m)	US Elev	DS Elev	Flow Path Drop (m)	Slope (%)	Tc (hr)	Tp (hr)
POND2	0.21	0.15	AIRPORT	76.46	192.00	189.00	3.00	3.92	0.29	0.19

*Note: A minimum Tp of 0.17hrs (10 minutes) has been applied.

Catchment ID	Hydrologic Soil Group	Catchment Slope	RC by Landuse								Weighted RC by Soil Group	Overall Weighted RC Value
			Woodland	SWMF/Wetland	Meadow	Cultivated /Crops	Lawn / Landscape	Gravel (loose)	Paved / Concrete	Building		
POND2	Clay Loam/Clay	0-5%	0.35	0.05	0.40	0.55	0.17	0.60	0.95	0.95	0.15	0.15
			0.00	0.03	0.00	0.00	0.18	0.00	0.00	0.00		
	Clay Loam/Clay	0-5%	0.35	0.05	0.40	0.55	0.17	0.60	0.95	0.95	0.00	
			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
		0-5%	0	0	0	0	0	0	0	0	0.00	
			0	0	0	0	0	0	0	0		
		0-5%	0	0	0	0	0	0	0	0	0.00	
			0	0	0	0	0	0	0	0		



Project: Sixth Line
Project No.: 3023-7688
Created By: MPH
Checked By: JKF
Date: 2026.02.27

Depression Areas NASHYD Summary

Catchment ID	Area (ha)	DT (min)	CN Value	CN*	CN(III)	IA (mm)	N	Tp (hr)
POND2	0.21	5	72.1	72	86	5.8	3	0.19



**Depression Areas
 STANDHYD - TIMP, XIMP & CN Values**

Parameter	Hydrologic Soil Group	Landuse				
		Woodland	SWMF / Wetland	Meadow	Cultivated/ Crops	Lawn / Landscape
CN Values	C	71	50	71	82	76
	D	77	50	78	86	81
IA Values		10	10	8	7	5

*Note these values are taken from the MTO manual.

Catchment ID	Hydrologic Soil Group	Pervious Areas (ha)						Impervious Areas (ha)							Results						
		Woodland	SWMF (Landscaped)	Meadow	Crops	Lawn / Landscape	Pervious Total Area (ha)	Gravel		Paved / Concrete		Building		SWMF (Permanent pool)	Impervious Total Area (ha)	Subtotal Area (ha)	Hydrograph in VO Model	TIMP (Fraction)	XIMP (Fraction)	Weighted CN	Weighted IA
								To Outlet	To Pervious	To Outlet	To Pervious	To Outlet	To Pervious	To Outlet							
POND1	C	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.03	STANDHYD	0.36	0.000	80.7	5
	D	0.00	0.00	0.00	0.00	0.12	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.18					
	Total	0.00	0.00	0.00	0.00	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.20					



Project: Sixth Line
Project No.: 3023-7688
Created By: MPH
Checked By: JKF
Date: 2026.02.27

**Depression Areas
 STANDHYD Summary**

Catchment ID	Area (ha)	DT (min)	TIMP	XIMP	Pervious Area							Impervious Area			
					CN Value	CN*	CN(III)	IA (mm)	SLPP (%)	LGP (m)	MNI	DPSI	SLPI (%)	LGI (m)	MNI
POND1	0.20	5	0.36	0.00	80.7	80	90	5	2.0	40	0.25	1	1	AUTO	0.013



PROJECT: 4243 Sixth Line
PROJECT No.: 3023-7688
DATE: 2026.02.27
DESIGN: MPH
CHECK: JKF

Infiltration Chamber Drawdown Calculations

Notes & References

Assume: Full Infiltration

Open Bottom Stormwater Tank 1

P = Required Design Soil Percolation Rate	6.25	mm/hr
n = Porosity of Chamber	1	
Footprint Area	1800	m ²
Depth	0.30	m
Storage Volume	540	m³
Detention Time	48.0	hr

$$T = \frac{1000V}{PnA}$$

Infiltration Chamber A

P = Required Design Soil Percolation Rate	31.25	mm/hr
n = Porosity of Chamber	1	
Footprint Area	150	m ²
Depth	1.50	m
Storage Volume	225	m³
Detention Time	48.0	hr

$$T = \frac{1000V}{PnA}$$

Infiltration Chamber A

P = Required Design Soil Percolation Rate	31.25	mm/hr
n = Porosity of Chamber	1	
Footprint Area	110	m ²
Depth	1.50	m
Storage Volume	165	m³
Detention Time	48.0	hr

$$T = \frac{1000V}{PnA}$$



Project: 4243 Sixth Line
Project No.: 3023-7688
Created By: MPH
Checked By: JKJF
Date: 2026.02.27

Pre-Development Phosphorus Loading

Existing Development Conditions

Catchment	Land Use	Total Phosphorus Concentration ¹ (mg/L)	Annual Precipitation (mm/year)	Fraction of Precipitation Producing Runoff	Impervious Fraction	Runoff Coefficient for Impervious Surfaces	Area (ha)	Total Phosphorus Export (kg/year)
101	Residential/Commercial	0.36	800.00	1.00	0.41	0.42	3.89	4.75
Total								4.75

Note:

¹ Total Phosphorus Concentration coefficient from North Oakville Creeks Subwatershed Study (Town of Oakville, August 2006).

² 100% of rainfall assumed to produce runoff as a conservative approach.

³ 800mm annual precipitation per North Oakville Creeks Subwatershed Study (Town of Oakville, August 2006).



Project: 4243 Sixth Line
Project No.: 3023-7688
Created By: MPH
Checked By: JKF
Date: 2026.02.27

Post-Development Phosphorus Loading

Existing Development Conditions

Catchment	Land Use	Total Phosphorus Concentration ¹ (mg/L)	Annual Precipitation (mm/year)	Fraction of Precipitation Producing Runoff ²	Impervious Fraction	Runoff Coefficient	Area (ha)	Total Phosphorus Export (kg/year)
201	Industrial	0.30	800.00	1.00	0.89	0.86	3.89	8.04
Total								8.04

Note:

¹ Total Phosphorus Concentration coefficient from North Oakville Creeks Subwatershed Study (Town of Oakville, August 2006).

² 100% of rainfall assumed to produce runoff as a conservative approach.

³ 800mm total rainfall for Oakville per North Oakville Creeks Subwatershed Study (Town of Oakville, August 2006).



Project: 4243 Sixth Line
 Project No.: 3023-7688
 Created By: MPH
 Checked By: JKF
 Date: 2026.02.27

Post-Development Phosphorus Loading With Mitigation

Post - Development Conditions

Catchment	Land Use	Total Pre-Development Phosphorus Export (kg/year)	Total Post-Development Phosphorus Export Without BMPs (kg/year)	% of Area Treated with BMPs
201	Industrial	4.75	8.04	100%
Total Annual Phosphorus Loading:			8.04	

Note:

Phosphorus reduction factors per the MOE Lake Simcoe Phosphorus Loading Development Tool (2012), including the supporting report titled "Phosphorus Budget Tool in Support of Sustainable Development for the Lake Simcoe Watershed" (Hutchinson, March 2012).

Treatment Train Calculation:

$$R = A + B - [(A \times B) / 100] \quad (\text{Equation 4-1})$$

Where:

R = Total TSS Removal Rate

A = TSS Removal Rate of the First or Upstream BMP

B = TSS Removal Rate of the Second or Downstream BMP

Catchment 201		
Mitigation Methods Applied	Reduction Factor	P Load Reduction (kg/yr)
Jellyfish	40%	3.21
Infiltration Tank	60%	2.89
Total:		6.11

Summary	
Mitigation	Total Load Reduction (kg/yr)
Jellyfish	3.21
Infiltration Tank	2.89
Total	6.11

*As per Equation 4-1 of the 'New Jersey Stormwater Best Management Practices Manual' (February 2004)

Phosphorus Removal:

Jellyfish (Rate A) = 40 %

Infiltration Tank (Rate B) = 60 %

Removal at Infiltration:

$$R_{inf} = Rate 1 + Rate 2 - [(Rate 1 \times Rate 2) / 100]$$

$R_{inf} = 76.0 \%$

Total Existing Load	4.75		kg/yr
Total Post-Development Load Without BMPs	8.04		kg/yr
Total Post-Development Load With BMPs	1.93		kg/yr
Difference in Post-Development and Existing Load	-2.82		kg/yr

APPENDIX E

Water Balance Assessment



Project Information

Thornthwaite & Mather Method

Project: 4243 Sixth Line

Project No.: 3023-7688

Created By: VM

Checked By: EF

Date: 2026.02.27

Project Name: **4243 Sixth Line**

Location: **Town of Oakville**

Pre-Development Conditions

Catchment ID	101				
Catchment Area (m ²)	38900				
Pervious Area (m ²)	22951				
Impervious Area (m ²)	15949				
Percent Imperviousness (%)	41%				
Infiltration Factors					
Topography - Description	Flat				
Topography - Infiltration Factor	0.30				
Soil - Description	Clay Loam				
Soil - Infiltration Factor	0.20				
Cover - Description	Shallow Rooted Crops				
Cover - Infiltration Factor	0.10				
Total Infiltration Factor	0.60				
Soil Moisture Capacity (mm)	100				

Post-Development Conditions

Catchment ID	201				
Catchment Area (m ²)	38900				
Pervious Area (m ²)	4279				
Impervious Area (m ²)	34621				
Percent Imperviousness (%)	89%				
Infiltration Factors					
Topography - Description	Flat				
Topography - Infiltration Factor	0.30				
Soil - Description	Clay Loam				
Soil - Infiltration Factor	0.20				
Cover - Description	Urban Lawns				
Cover - Infiltration Factor	0.10				
Total Infiltration Factor	0.60				
Soil Moisture Capacity (mm)	100				



Climate Parameters

Thornthwaite & Mather Method

Project: 4243 Sixth Line
 Project No.: 3023-7688
 Created By: VM
 Checked By: EF
 Date: 2026.02.27

PROJECT LOCATION OAKVILLE, ON
 PROJECT LATITUDE ° **43**

Month	Mean Temperature (C°) ¹	Heat Index [i = (t/5) ^{1.514}]	α	Potential Evapotranspiration (PET) (mm)	Correction Factor ²	Adjusted Potential Evapotranspiration (APET) (mm)	Precipitation (P) (mm) ¹
January	-5.0	0.00		0.0	1.37	0.0	61.6
February	-4.4	0.00		0.0	0.82	0.0	50.2
March	0.6	0.04		1.7	1.02	1.7	50.5
April	7.0	1.66		28.8	1.12	32.3	76.7
May	13.7	4.60		62.8	1.26	79.2	77.6
June	19.2	7.67		93.0	1.28	119.1	80.7
July	22.1	9.49		109.6	1.29	141.3	74.0
August	21.1	8.85		103.8	1.2	124.6	68.5
September	16.9	6.32		80.2	1.04	83.4	69.4
October	10.0	2.86		43.6	0.95	41.4	67.2
November	4.1	0.74		15.5	0.81	12.5	71.8
December	-1.6	0.00		0.0	0.77	0.0	58.6
TOTAL	8.6	42.2	1.2	539.0		635.5	806.8

NOTES: 1. Precipitation and temperature data referenced from Environment Canada (Toronto Buttonville (Airport) Weather Station).
 2. Latitude adjustment/correction factors determined based on site location assuming 12 hours of sunlight per day for 30 days



Pre-Development Water Balance
Thornthwaite & Mather Method

Project: 4243 Sixth Line
Project No.: 3023-7688
Created By: VM
Checked By: EF
Date: 2026.02.27

Project Name: **4243 Sixth Line**
Location: **Town of Oakville**

Catchment ID	101												
Catchment Parameters	Pervious Area	2.30 ha			Impervious Area	1.59 ha			Total Area	3.89 ha			
	Soil Moisture Holding Capacity	100 mm			Infiltration Factor	0.60			% Impervious Evaporation	15%			
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation	62	50	51	77	78	81	74	69	69	67	72	59	807
<i>Pervious Area Water Balance</i>													
Evapotranspiration (mm)	0	0	2	32	79	112	107	83	72	41	13	0	541
Storage (mm)	100	100	100	100	98	67	34	20	17	43	100	100	
Water Surplus (mm)	62	50	49	44	0	0	0	0	0	0	2	59	266
Infiltration (mm)	37	30	29	27	0	0	0	0	0	0	1	35	159
Surface Water Runoff (mm)	25	20	20	18	0	0	0	0	0	0	1	23	106
<i>Impervious Area Water Balance</i>													
Evaporation (mm)	9	8	8	12	12	12	11	10	10	10	11	9	121
Surface Water Runoff (mm)	52	43	43	65	66	69	63	58	59	57	61	50	686
<i>Combined Water Balance</i>													
Pervious ET (m³)	0	0	39	740	1,817	2,572	2,452	1,909	1,651	950	287	0	12,419
Impervious ET (m³)	147	120	121	183	186	193	177	164	166	161	172	140	1,930
Pervious Infiltration (m³)	848	691	672	612	0	0	0	0	0	0	28	807	3,659
Impervious Infiltration (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0
Pervious Runoff (m³)	566	461	448	408	0	0	0	0	0	0	19	538	2,439
Impervious Runoff (m³)	835	681	685	1,040	1,052	1,094	1,003	929	941	911	973	794	10,938

Pre-Development Water Balance Summary: Catchment 101				
Pre-Development Evapotranspiration	14349	m ³ /yr	368.9	mm/yr
Pre-Development Infiltration	3659	m ³ /yr	94.1	mm/yr
Pre-Development Runoff	13377	m ³ /yr	343.9	mm/yr

- NOTES: 1.The infiltration factor is determined using the MECP methodology outlined in the Stormwater Management Planning and Design Manual 2003.
2. Assumptions:
- Evapotranspiration does not occur when average temperature is below zero.
 - Infiltration does not occur when average temperature is below zero.
 - Approximately 15% of the precipitation on impervious surfaces will evaporate.
 - When calculating the water balance, evaporation is subtracted from precipitation, then soil storage is replenished. If any precipitation remains it is considered surplus and divided between infiltration and runoff



Post-Development Water Balance without Mitigation
 Thornthwaite & Mather Method

Project: 4243 Sixth Line
 Project No.: 3023-7688
 Created By: VM
 Checked By: EF
 Date: 2026.02.27

Project Name: **4243 Sixth Line**
 Location: **Town of Oakville**

Catchment ID													
201													
Catchment Parameters													
Pervious Area		0.43 ha		Impervious Area		3.46 ha		Total Area		3.89 ha			
Soil Moisture Holding Capacity		100 mm		Infiltration Factor		0.60		% Impervious Evaporation		15%			
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation	62	50	51	77	78	81	74	69	69	67	72	59	807
<i>Pervious Area Water Balance</i>													
Evapotranspiration (mm)	0	0	2	32	79	112	107	83	72	41	13	0	541
Storage	100	100	100	100	98	67	34	20	17	43	100	100	
Water Surplus (mm)	62	50	49	44	0	0	0	0	0	0	2	59	266
Infiltration (mm)	37	30	29	27	0	0	0	0	0	0	1	35	159
Surface Water Runoff (mm)	25	20	20	18	0	0	0	0	0	0	1	23	106
<i>Impervious Area Water Balance</i>													
Evaporation (mm)	9	8	8	12	12	12	11	10	10	10	11	9	121
Surface Water Runoff (mm)	52	43	43	65	66	69	63	58	59	57	61	50	686
<i>Combined Water Balance</i>													
Pervious ET (m ³)	0	0	7	138	339	480	457	356	308	177	54	0	2315
Impervious ET (m ³)	320	261	262	398	403	419	384	356	360	349	373	304	4190
Pervious Infiltration (m ³)	158	129	125	114	0	0	0	0	0	0	5	150	682
Impervious Infiltration (m ³)	0	0	0	0	0	0	0	0	0	0	0	0	0
Pervious Runoff (m ³)	105	86	84	76	0	0	0	0	0	0	3	100	455
Impervious Runoff (m ³)	1813	1477	1486	2257	2284	2375	2178	2016	2042	1978	2113	1724	23742

Post-Development Water Balance Summary: Catchment 201				
Post-Development Evapotranspiration	6505.3	m ³ /yr	167.2	mm/yr
Post-Development Infiltration	682.1	m ³ /yr	17.5	mm/yr
Post-Development Runoff	24197.1	m ³ /yr	622.0	mm/yr

NOTES: 1.The infiltration factor is determined using the MECF methodology outlined in the Stormwater Management Planning and Design Manual 2003.
 2. Assumptions:
 - Surplus water is unavailable for runoff and recharge in months where water losses from APET exceed precipitation inputs.
 - Evapotranspiration does not occur when average temperature is below zero.
 - Approximately 15% of the precipitation on impervious surfaces will evaporate.
 - When calculating the water balance, evaporation is subtracted from precipitation, then soil storage is replenished. If any precipitation remains it is considered surplus and divided between infiltration and runoff



Water Balance Mitigation Analysis

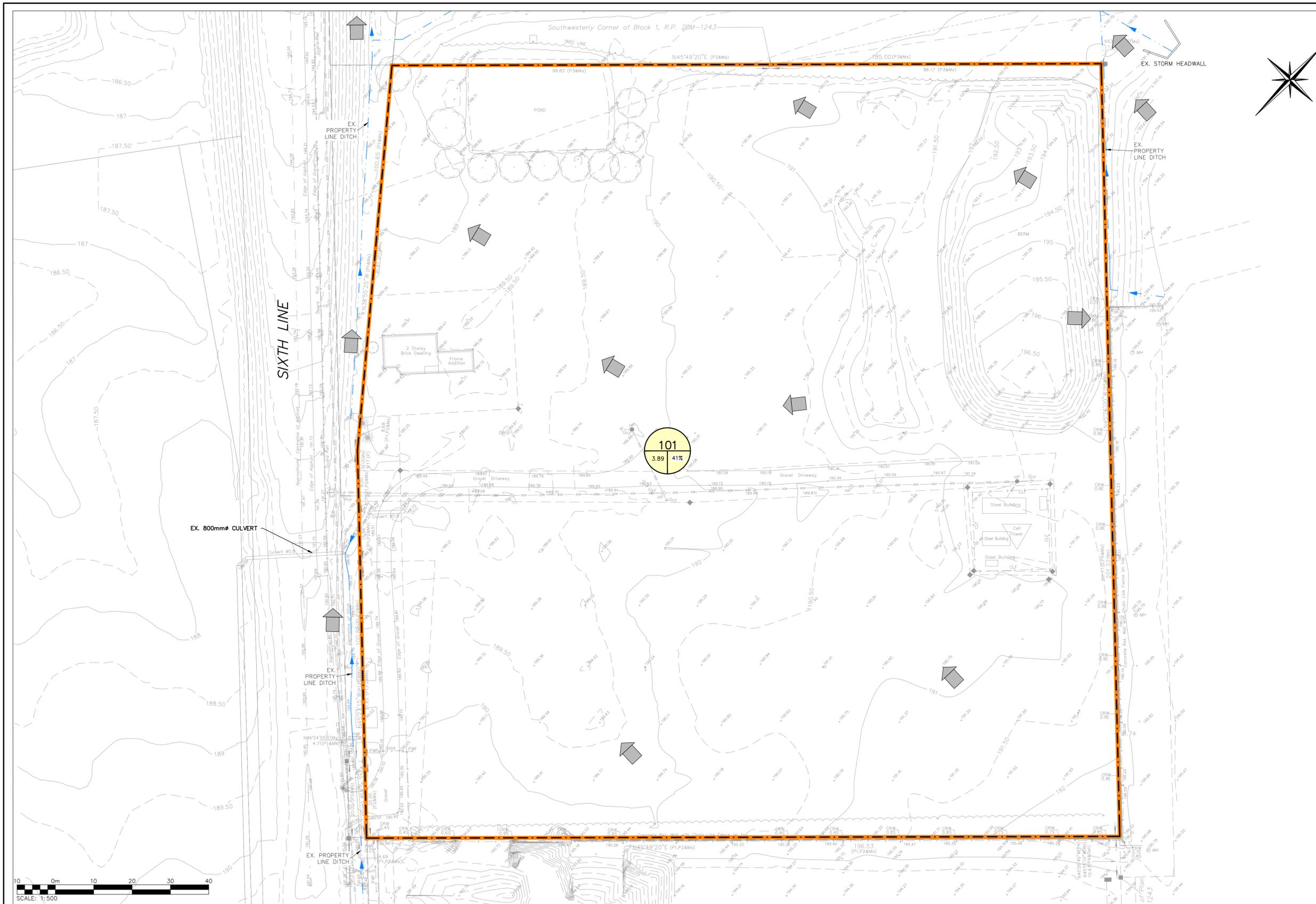
Project: 4243 Sixth Line
 Project No: 3023-7688
 Date: 2026.02.27
 Created by: VM
 Checked by: JKF

DESIGN PARAMETERS			
Catchment	Approximate Land Area (m ²)	Annual Pre-Development Infiltration (mm/yr)	Annual Pre-Development Infiltration Volume (m ³ /yr)
Catchment 101	38,900	94	3,659
REQUIRED STORAGE			
Annual Pre-Development Infiltration Volume (m ³ /yr)	Annual Events Producing Runoff ¹	Storage Required (m ³)	
3,659	40	91	
UNDERGROUND STORAGE VOLUME OF PROPOSED LIDS			
LID Identity	Total Infiltration Volume (m ³)	Void Ratio	Underground Storage Volume (m ³)
Chamber A	225	1	225
Chamber B	165	1	165
Stormwater Tank	540	1	540
Storage Required (m ³)			91
Underground Storage Provided (m ³)			930

1. LID should be sized to capture 90% of rainfall events or 25mm storm event. There are approximately 40 events per year that produce runoff (1994 MOE SWM Manual)

FIGURES

- Figure 1:** Pre-Development Drainage Figure
- Figure 2:** Post-Development Drainage Figure
- Figure 3:** Preliminary Grading Figure
- Figure 4:** Preliminary Servicing Figure
- Figure 5:** Preliminary External Servicing Figure



LEGEND

- PROPERTY LINE
- EX. DITCH
- EX. CONTOUR (0.5m)
- EX. CONTOUR (1.0m)
- EX. DRAINAGE CATCHMENT
- CATCHMENT I.D.
- AREA (ha) | % IMPERVIOUS
- EX. OVERLAND FLOW DIRECTION



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No.	ISSUE	DATE: YYYY/MM/DD
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Town	Engineer	Project

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

4243 SIXTH LINE
TOWN OF OAKVILLE

PRE-DEVELOPMENT DRAINAGE FIGURE

CROZIER

Drawn By	M.P.H.	Design By	J.K.F.	Project	3023-7688
Check By	J.B.	Check By	M.E.	Figure	FIG.1



LEGEND

- PROPERTY LINE
- EX. DITCH
- 14m MTO SETBACK
- EX. CONTOUR (0.5m)
- EX. CONTOUR (1.0m)
- POST-DEVELOPMENT DRAINAGE CATCHMENT
- CATCHMENT I.D.
- AREA (ha) | PERCENT IMPERVIOUS
- EX. OVERLAND FLOW DIRECTION
- PR. OVERLAND FLOW DIRECTION
- PR. MINOR FLOW DIRECTION
- PR. STORM MANHOLE
- PR. STORM CATCH BASIN MANHOLE
- PR. SINGLE CATCH BASIN
- PR. DOUBLE CATCH BASIN
- PR. STORM SEWER

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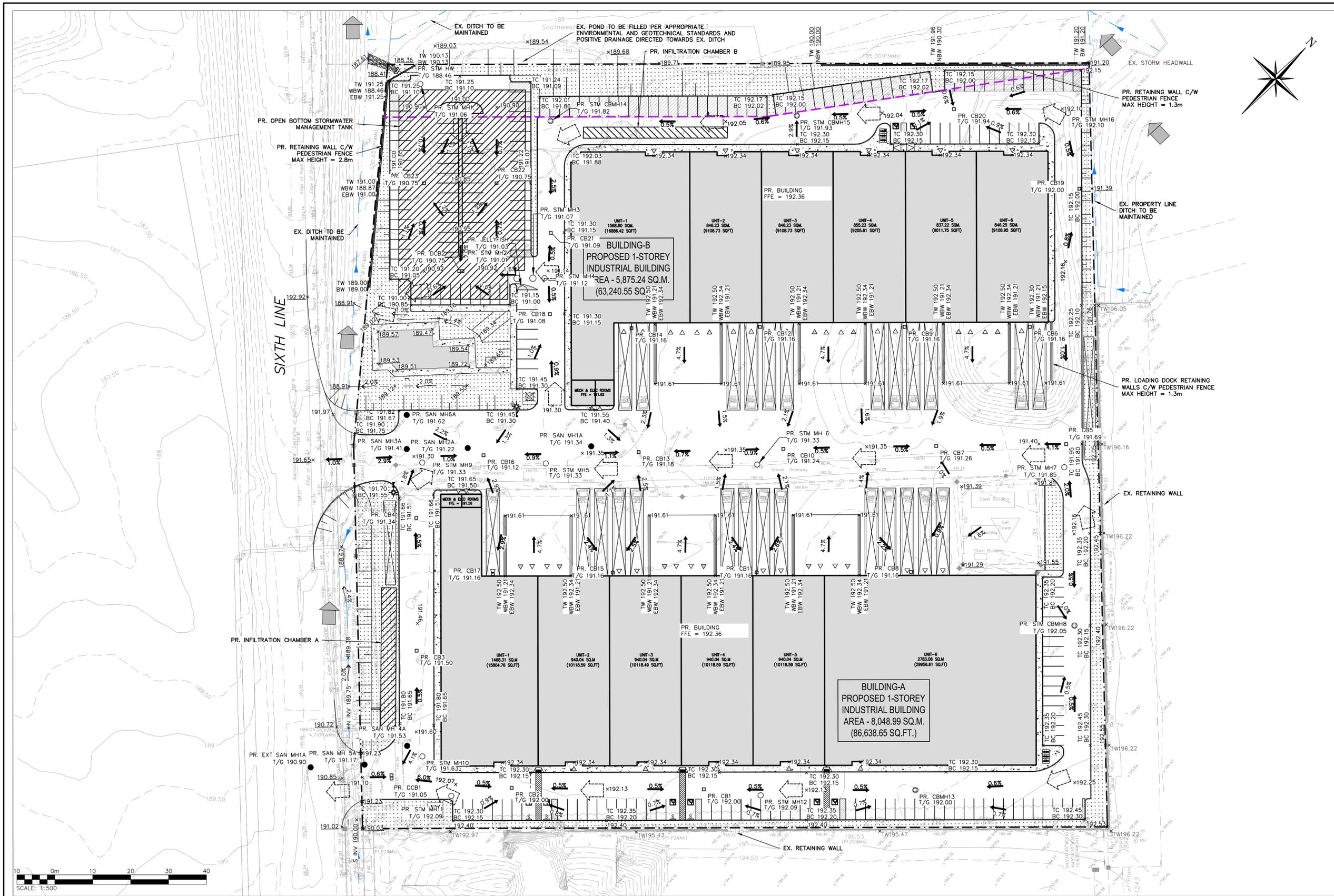
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4243 SIXTH LINE
TOWN OF OAKVILLE

POST-DEVELOPMENT DRAINAGE FIGURE

CROZIER

Drawn By	M.P.H.	Design By	J.K.F.	Project	3023-7688
Check By	J.B.	Check By	M.B.	Figure	FIG.2



LEGEND

- PROPERTY LINE
- 14m MTO SETBACK
- EX. DITCH
- EX. CONTOUR (0.5m)
- EX. CONTOUR (1.0m)
- EX. GRADE
- EX. OVERLAND FLOW DIRECTION
- EX. MANHOLE
- PR. GRADE (TO MATCH EXISTING)
- PR. MINOR FLOW DIRECTION
- PR. STORM MANHOLE
- PR. STORM CATCH BASIN MANHOLE
- PR. SINGLE CATCH BASIN
- PR. DOUBLE CATCH BASIN
- PR. SANITARY MANHOLE
- PR. HYDRANT
- PR. OVERLAND FLOW DIRECTION
- 3:1 MAX SLOPE
- PR. RETAINING WALL
- PR. LOADING DOCK RETAINING WALL



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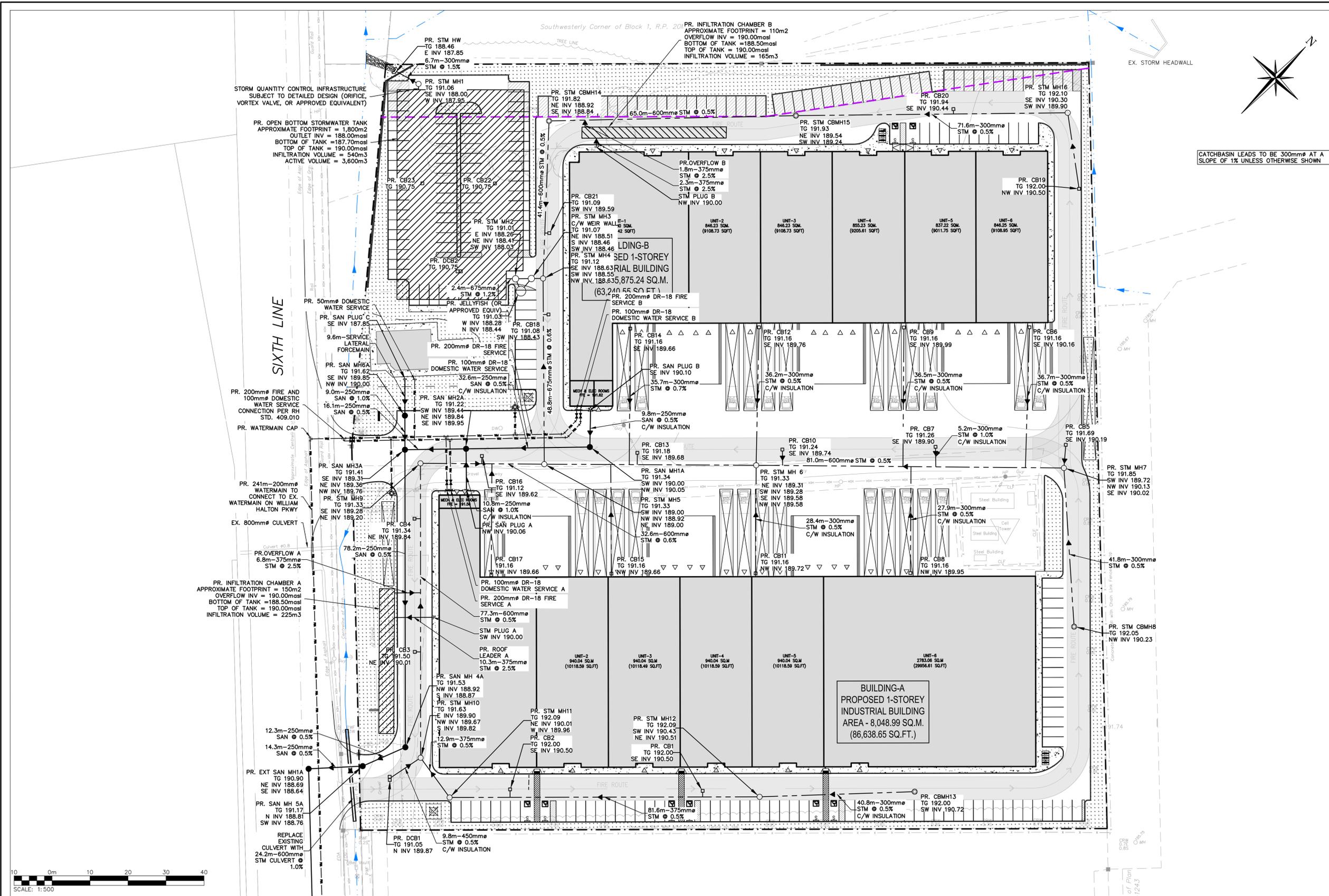
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4243 SIXTH LINE
TOWN OF OAKVILLE

PRELIMINARY GRADING FIGURE

CROZIER

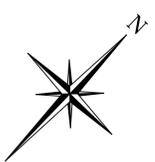
Drawn By	M.P.H.	Design By	J.K.F.	Project	3023-7688
Check By	J.B.	Check By	M.B.	Figure	FIG.3



LEGEND

- PROPERTY LINE
- - - EX. DITCH
- - - 14m MTO SETBACK
- EX. MANHOLE
- PR. STORM SEWER
- PR. STORM MANHOLE
- PR. STORM CATCH BASIN MANHOLE
- PR. SINGLE CATCH BASIN
- PR. DOUBLE CATCH BASIN
- ⊕ PR. HYDRANT
- PR. WATERMAIN
- PR. SANITARY MANHOLE
- PR. SANITARY SEWER

CATCHBASIN LEADS TO BE 300mm AT A SLOPE OF 1% UNLESS OTHERWISE SHOWN



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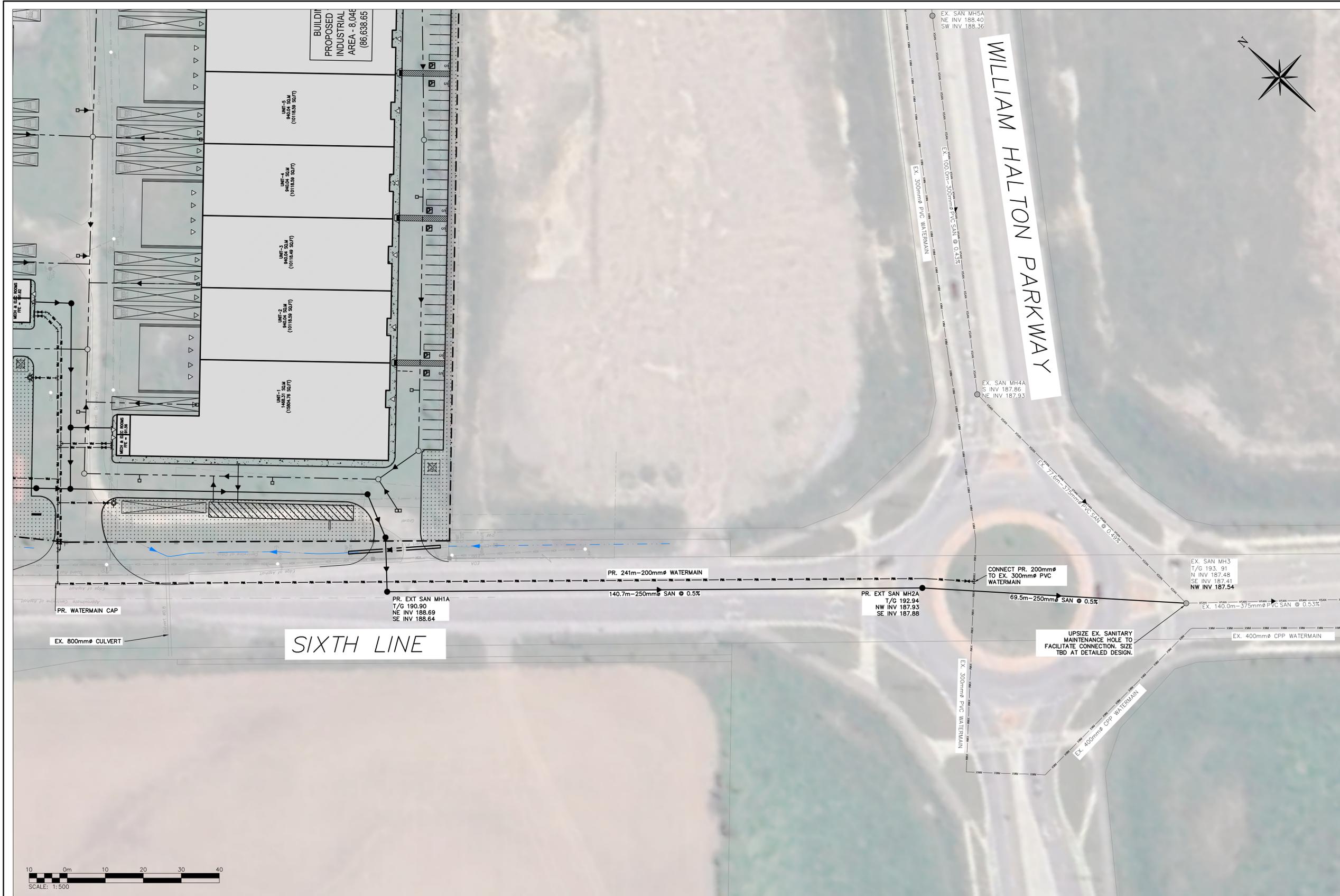
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4243 SIXTH LINE
TOWN OF OAKVILLE

PRELIMINARY SERVICING FIGURE

CROZIER

Drawn By: M.P.H. Design By: J.K.F. Project: **3023-7688**
 Check By: J.B. Check By: M.B. Figure: **FIG. 4**



LEGEND

---	PROPERTY LINE
- - -	EX. DITCH
○	EX. SANITARY MANHOLE
—○—	EX. SANITARY SEWER
—○—	EX. WATERMAIN
○	PR. STORM MANHOLE
○	PR. STORM CATCH BASIN MANHOLE
□	PR. SINGLE CATCH BASIN
□	PR. DOUBLE CATCH BASIN
—○—	PR. STORM SEWER
—○—	PR. HYDRANT
—○—	PR. WATERMAIN
○	PR. SANITARY MANHOLE
—○—	PR. SANITARY SEWER

NOTE: EX. WATERMAIN AND SANITARY SEWER BENEATH WILLIAM HALTON PARKWAY AND SIXTH LINE OBTAINED FROM AS-CONSTRUCTED DRAWING NO. 20 & 21 - PROPOSED CONSTRUCTION WILLIAM HALTON PARKWAY (REG. RD.40), PREPARED BY STANTEC CONSULTING LTD. (DECEMBER 12, 2020)



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Drawing	

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4243 SIXTH LINE
TOWN OF OAKVILLE

PRELIMINARY EXTERNAL SERVICING FIGURE

CROZIER

Drawn By	M.P.H.	Design By	J.K.F.	Project	3023-7688
Check By	J.B.	Check By	M.B.	Figure	FIG.5