FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

10249 HUNSDEN SIDEROAD ESTATE RESIDENTIAL DEVELOPMENT

TOWN OF CALEDON

PREPARED FOR:

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PREPARED BY:

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Revision Number	Date	Comments
Rev. 0	June 2022	Issued for First Submission (ZBA)
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1.0 Introduction

C.F. Crozier & Associates Inc. (Crozier) was retained by Carringwood Homes (Owner) to prepare a Functional Servicing and Stormwater Management Report in support of the Zoning By-Law Amendment Application for the estate residential development located at 10249 Hunsden Sideroad (the Site) in the Town of Caledon. The purpose of this report is to demonstrate that the proposed development is feasible from a functional servicing and stormwater management perspective and conforms with the requirements of the Town of Caledon (Town), Region of Peel (Region), and the Nottawasaga Valley Conservation Authority (NVCA).

This report has been completed in accordance with the guidelines and Development Application Review Team meeting notes dated October 21, 2021. The relevant background studies and reports include:

- Region of Peel 2020 Water Master Plan
- Region of Peel Watermain Design Criteria (June 2010)
- Region of Peel Linear Wastewater Standards (March 2023)
- Region of Peel As-Constructed Drawings (Drawing No. 61336-D) (October 2016)
- Town of Caledon As-Constructed Drawings (Drawing No. 70320-D & 70321-D) (August 2017)
- Flato Developments Inc. Residential Subdivision, Mount Pleasant Road Functional Servicing Report and Drawings prepared by Urbantech (January 2017)
- Geotechnical Report prepared by Soil Engineers Ltd. (April 2022)
- Ministry of Transportation Drainage Management Manual (1997)
- Ministry of Environment Stormwater Management Planning and Design Manual (March 2003)
- Nottawasaga Valley Conservation Authority Stormwater Technical Design (December 2013)
- Oak Ridges Moraine Conservation Plan (2017)
- CVC/TRCA Low Impact Development SWM Planning Design Guide (Version 1.0, 2010)

This report has been prepared to support the second submission of the Zoning By-Law Amendment Application and Planning Justification Report prepared by GSAI (November 2023) for the proposed estate residential development.

2.0 Site Description

The Site encompasses an area of 20.37 ha with a developable area of approximately 9.97 ha. The Site currently consists of an existing detached residential building and accessory buildings, vacant grassed agricultural fields, and forested areas. The Site, located in an agricultural area within the Oak Ridges Moraine in the Town of Caledon, is bounded by Hunsden Sideroad to the north, natural heritage woodlot to the south, agricultural lands to the east, and detached residential dwellings to the west.

According to the Draft Plan of Subdivision (Mackitecture, dated October 26, 2023), it is understood that the Site will consist of the following elements:

- Fourteen (14) single detached residential lots with associated on-site sewage systems.
- Internal 18.0 m municipal right-of-way with access to Hunsden Sideroad and the future residential development along Stinson Street to the west of the Site.
- Designated Natural Heritage System Lands, Open Space, and a 20.0 m Natural Heritage System buffer.

3.0 Water Servicing

The Region of Peel is responsible for the operation and maintenance of the public watermain system surrounding the property. The existing and proposed water servicing are discussed in the following sections.

3.1 Existing Water Servicing

The existing water servicing infrastructure close to the Site include:

- A 300 mm diameter polyvinyl chloride (PVC) municipal watermain located on the east side of Mount Pleasant Road which reduces to a 200 mm diameter PVC municipal watermain at the Mount Pleasant Road and Hunsden Sideroad intersection (Region of Peel As-Constructed Drawing (61336-D), October 2016).
- A 300 mm diameter PVC municipal watermain located on the east side of Stinson Street (Flato Palgrave Mansions Inc. As-Constructed Drawing (Sheet 70320-D), August 2017).
- One (1) municipal hydrant located west of the Site within the cul-de-sac at northern extent of Stinson Street (Flato Palgrave Mansions Inc. As-Constructed Drawing (Sheet 70321-D), August 2017).
- The proposed development is located within the Water Pressure Zone 8 supply system.

The existing residential dwelling at 10249 Hunsden Sideroad is assumed to be serviced by a private well based on the Ministry of Environment, Conservation, and Parks Well Mapping Records. The as-constructed drawings for the water servicing infrastructure are provided in Appendix A.

3.2 Domestic Water Demand Calculations

The domestic water demand for the proposed residential development was calculated with reference to the Region of Peel 2020 Water Master Plan and the Region of Peel Linear Watermain Design Criteria (March 2023). The Region of Peel design criteria requires an average daily water demand of 270 L/capita/day for residential uses. A unit-based population density of six (6) persons per unit, based on similar developments in the Town of Caledon, was used along with the peaking factors outlined in the Region of Peel 2020 Water Master Plan to obtain the estimated maximum daily demand and peak hourly demand for the proposed development.

Table 1 summarizes the overall domestic water demand for the Site. Appendix B contains the detailed domestic water demand calculations.

Table 1: Proposed Domestic Water Demand

Standard	Type	Average Daily Water Demand (L/s)	Maximum Daily Water Demand (L/s)	Peak Hourly Water Demand (L/s)
Region of Peel	Residential	0.3	0.5	0.8

Note: References to design guidelines are provided in the detailed domestic water demand calculations in Appendix B.

Using the Region of Peel design criteria for domestic water demand, the estimated average daily demand, maximum daily demand, and peak hourly demand for the proposed development are 0.3 L/s, 0.5 L/s, and 0.8 L/s, respectively.

3.3 Fire Flow Calculations

The Fire Underwriters Survey (FUS) method was used to estimate the preliminary fire flow requirements for the proposed residential development. This calculation is based on the building type assumption of wood frame construction. The estimated fire flow requirement is used to estimate the watermain size required to service the development.

Table 2 summarizes the estimated fire flow demand and duration necessary to meet fire protection for the proposed development. Appendix B contains the Fire Underwriters Survey calculations.

Table 2: Proposed Fire Flow Demand

Method	Total Effective Floor Area (m^2)	Fire Flow (L/s)	Duration (hrs)
Fire Underwriters Survey	886	183	2.25

Note: Proposed Fire Flow Demand is based on the building located in Lot 2 due to the building's proximity to adjacent lot structures.

Based on the fire flow calculations and total effective floor area of 886 m^2, the required fire flow for the development was calculated to be 183 L/s for a duration of 2.25 hours.

It should be noted that the fire flows determined from the FUS method is a conservative estimate for comparison purposes only. The Mechanical Engineer for the development will complete the required analysis for fire protection and the Architect will design fire separation methods per the determined fire flow rate to meet municipally available flows and pressures. Based on the estimated peak hourly domestic water demand (0.8 L/s) and fire flow demand (183 L/s) summarized in Table 1 and Table 2, the total design flow for the internal water distribution system is approximately 184 L/s.

A contractor has been retained to conduct a hydrant flow test to determine the existing available pressures and flows within the municipal watermain on Stinson Street. These results will be used to confirm that the existing system has the capacity to service the proposed development.

3.4 Proposed Water Servicing

A 150 mm diameter PVC watermain is proposed to service the Site with a 50 mm diameter copper watermain looped at the cul-de-sac, with opportunities to extend further east for future residential development. The proposed watermain is located within the proposed municipal right-of-way and will connect to the existing 300 mm PVC watermain along Stinson Street, southwest of the Site. All residential lots will be serviced with domestic water services connecting to the proposed internal watermain. The Preliminary Grading and Servicing Plan (Drawing C102) illustrates the location and design of the proposed watermain.

As shown on the Preliminary Site Grading and Servicing Plan (Drawing C102), the proposed 150 mm PVC watermain will be extended along Hunsden Sideroad to provide municipal water to Block 14. A flushing hydrant is proposed at Block 14 to ensure water does not become stagnant in the watermain.

Hydrants are proposed throughout the development with a maximum spacing of 150 m in accordance with Region of Peel Watermain Design Criteria (June 2010) and a maximum distance of 90 m to the perimeter of each building in accordance with the Ontario Building Code.

4.0 Sanitary Servicing

The Site is in a rural area that does not currently have sanitary services available, and the surrounding properties are serviced via private septic systems. Similarly, private septic systems are proposed to provide sanitary servicing for the development as the Town of Caledon does not have plans to provide sanitary servicing in this area in the near future.

4.1 Sanitary Design Calculations

The Ontario Building Code (OBC) was referenced to estimate the sanitary design flows generated by the proposed estate residential development. The proposed development will consist of fourteen (14) residential dwellings per the Draft Plan of Subdivision (Mackitecture, dated October 26, 2023). A daily unit flow rate of 2,000 L/d day was utilized to determine the total daily design sanitary sewage flow of 28,000 L/d from the proposed development.

Table 3 summarizes the design parameters and estimated design flows for the Site with supporting calculations provided in Appendix B.

Table 3: Sanitary Design Parameters and Daily Design Sewage Flow

Zoning/Use	Classification (per OBC 8.2.1.3.B.)	Units	Daily Unit Flow (L/d)	Total Flow (L/d)
Residential Dwellings	Table 8.2.1.3.A "OBC 2016, Four-bedroom Dwelling"	14	2,000	28,000

4.2 Proposed Sanitary Servicing

All fourteen (14) lots located within the development will be serviced with private on-site sewage systems. The details, size, and location of the on-site sewage systems will be determined once individual house designs and building permits are prepared.

The individual lot design and Site grading have conservatively allowed an on-site sewage footprint area of 600 m^2 for a conventional on-site sewage absorption bed and minimum setback requirements, as shown on the Preliminary Site Grading and Servicing Plan (Drawing C102). The size and layout of each on-site sewage system will be completed during the building permit application phase for each lot to demonstrate that the proper separations are met.

5.0 Drainage Conditions

The drainage conditions for the Site in both pre-development and post-development conditions are outlined in the following sections.

5.1 Existing Drainage Conditions

According to the topographic survey (J.D. Barnes Limited, April 4, 2022), the Site currently consists of an existing detached residential dwelling and accessory buildings, vacant grassed agricultural fields, and forested areas. The Site generally slopes from east to west, drains from back to front, and is separated into three (3) catchments as shown on the Pre-development Drainage Plan (Figure 1).

Most of the runoff from the Site drains towards the Hunsden Sideroad ditch where it is directed to an existing 1000 mm CSP culvert beneath Hunsden Sideroad (Outlet A). Under existing conditions, the catchment areas that are directed towards Outlet A consist of primarily woodlot and cultivated lands (Catchments 101 and 102). The southwestern portion of the Site also consists primarily of woodlot and cultivated lands (Catchment 103) and drains uncontrolled to Flato Development Inc.'s (Flato's) residential subdivision to the southwest via sheet flow (Outlet B). The receiver of most of the runoff from the Site is the tributary of Beeton Creek located approximately 150 m north of Hunsden Sideroad.

Within Catchment 101, there is an existing ditch that runs south to north which directs runoff to Outlet A. According to a Scoped Environmental Impact Study (EIS) prepared by GEI (November 2023), the existing ditch on the Site is not classified as a Headwater Drainage Feature.

Table 4 describes the pre-development catchment areas and Figure 1 illustrates their configuration and the overall drainage direction.

Table 4: Pre-Development Catchment Areas' Imperviousness and Drainage Outlet

Catchment ID	**Land-Use Description**	**Impervious Area** (ha)	**Pervious Area** (ha)	**Percent Impervious** (%)	**Outlet**
101	Existing residential dwelling, woodlot, and cultivated lands	0.04	10.93	0.3	Outlet A - Hunsden Sideroad Culvert (Beeton Creek Tributary)
102	Existing cultivated lands and woodlot	-	4.83	0.0	
103	Existing cultivated lands and woodlot	-	4.57	0.0	Outlet B - Neighbouring Residential Properties (Southwest)
	Total Area (ha) =	**20.37**			

5.2 Proposed Drainage Conditions

Based on the Draft Plan of Subdivision (Mackitecture, dated October 26, 2023), the proposed development will consist of fourteen (14) single detached residential lots, a paved internal roadway, landscaped, and natural heritage areas. Access to the Site will be provided from the proposed entrances on Hunsden Sideroad and Stinson Street.

5.2.1 Grading Compliance with Town of Caledon Official Plan Policies 7.1.9.3 and 7.1.9.37

According to the Town of Caledon Official Plan Policies 7.1.9.3 and 7.1.9.37, the Site has been graded to accommodate the proposed buildings, associated driveways, sufficient area for individual leaching beds, and amenity space. Lot Grading will be accommodated within the Structure Envelope but some grading outside of the envelope (e.g., along the lot line) is necessary for stormwater management purposes. This grading will ensure that runoff from multiple lots is adequately conveyed to a proper outlet.

5.2.2 Post-development Drainage Catchment Areas

The proposed Site grading divides the Site into five (5) post-development drainage catchment areas with two outlets, as shown on the Post-Development Drainage Plan (Figure 2):

- Catchment 201 (A = 12.40 ha) consists of uncontrolled drainage from proposed building footprints, rear yards, and natural heritage woodlots. Runoff generated within this catchment is directed to the existing ditch upstream of Hunsden Sideroad and eventually to the 1000 mm CSP culvert on Hunsden Sideroad, mimicking the pre-development drainage conditions (Outlet A).

  A portion of Catchment 201 and a small external drainage area is directed towards a low area to the south of Lot 8 illustrated on Figure 2. Conveying these flows through the proposed development (via a ditch) would present conflicts with the proposed infrastructure, so it is proposed to route these flows around the proposed development via a 600 mm diameter storm sewer as illustrated on the Preliminary Grading and Servicing Plan (C102). The storm sewer outlets at the limits of the Natural Heritage System and will be directed to the existing ditch within the catchment. Flow modelling and pipe capacity calculations to convey these flows around the proposed development are provided in Appendix C.

- Catchment 202 (A = 3.47 ha) consists of drainage from the internal roadway (Street ‘A’) and proposed residential lots. Runoff within the roadway and front yards are directed to roadside bioswales prior to being directed to the Hunsden Sideroad ditch. Runoff generated in the rear yards of Blocks 1-5 is directed to rear yard swales which will direct the runoff to the Hunsden Sideroad ditch and eventually the 1000 mm CSP culvert on Hunsden Sideroad. (Outlet A)

- Catchment 203 (A = 1.73 ha) consists of drainage from the internal roadway (Street ‘A’ cul-de-sac and Street ‘B’) and proposed residential lots. Runoff generated within this catchment is conveyed to roadside bioswales prior to being directed through Block 18 to Catchment 201. The runoff will then drain to the existing ditch within Catchment 201 and towards the Hunsden Sideroad 1000 mm CSP culvert. (Outlet A)

- Catchment 204 (A = 0.62 ha) consists of drainage from the internal roadway (Street ‘B’) and proposed residential lots. Runoff generated within this catchment is conveyed to roadside bioswales prior to being directed to the existing residential development and Stinson Street to the southwest. (Outlet B)

- Catchment 205 (A = 2.15 ha) consists of uncontrolled drainage from natural heritage woodlots and landscaped areas. Runoff generated within this catchment drains overland to Flato's residential development southwest of the development, mimicking the pre-development drainage conditions. (Outlet B)

The drainage from Catchments 204 and 205 have been accounted for in External Catchments 2, 3, and 4 identified in the Functional Servicing Report and Drawing 302 prepared by Urbantech for Flato's residential subdivision (January 2017). Since the post-development peak flows directed to Outlet B will be controlled to match, or be less than pre-development conditions, it is assumed that the existing subdivision infrastructure has sufficient capacity to receive the drainage from the proposed development. Excerpts from the adjacent Functional Servicing Report and Drawing 302 are provided in Appendix A for reference. Table 5 provides details of the catchment areas and runoff coefficients for the post-development conditions.

Table 5: Post-Development Catchment Areas' Imperviousness and Drainage Outlet

Catchment ID	**Description**	**Impervious Area** (ha)	**Pervious Area** (ha)	**Percent Impervious** (%)	**Outlet**
201	Woodlot and residential lots	0.36	12.04	2.9	Outlet A - Hunsden Sideroad Culvert (Beeton Creek Tributary)
202	Internal roadway and residential lots	0.53	2.94	15.4	
203	Internal roadway and residential lots	0.33	1.40	19.2	
204	Internal roadway and residential lot	0.09	0.53	14.0	Outlet B – Flato's Residential Subdivision
205	Woodlot and landscaped areas	-	2.15	0.0	
	Total Area (ha) =	**20.37**			

6.0 Stormwater Management

Stormwater management and Site drainage for the proposed development must adhere to the policies and standards of the Town of Caledon, Nottawasaga Valley Conservation Authority (NVCA), Oak Ridges Moraine Conservation Plan, and Ministry of Environment, Conservation and Parks (MOE). It is important to note that efforts have been made to preserve and maintain the rural character of the property and passive stormwater management practices have been incorporated throughout the design.

The stormwater management criteria for the development have been summarized below:

<u>Water Quality Control</u>

Provide at least 80% removal of Total Suspended Solids in accordance with "Enhanced Protection" in Table 3.2 (Ministry of the Environment, Planning, and Stormwater Management Manual, 2003).

Water Balance and Erosion Control

Retain stormwater on-site to achieve an equivalent annual volume of infiltration as pre-development conditions, according to Section 3.2 of the MOE Stormwater Management Planning and Design Manual (March 2003).

Retain the stormwater volume of a 5 mm rainwater event over the area of the proposed development, according to NVCA Stormwater Technical Guide (December 2013).

Water Quantity Control

According to the Town of Caledon Development Standards Manual (2019), water quantity controls are required for the Site. The water quantity requirements include controlling the post-development peak flow event to the pre-development peak flow event for design storms up to and including the 100-year event.

Upon development, all runoff generated within the internal roadway or runoff that mixes with the roadway runoff will be conveyed to proposed roadside bioswales for quantity and quality control. The bioswales have been designed based on a hydraulic conductivity of 18 mm/hr which was derived from:

- The percolation rate of 10^{-4} cm/sec provided in the Geotechnical Report prepared by Soil Engineers Ltd. (April 2022).

- Figure C1 of CVC/TRCA Low Impact Development SWM Planning Design Guide (Version 1.0, 2010).

- A conservative safety factor of 2.5.

Details of the bioswale design are outlined in Section 6.2 with calculations provided in Appendix C.

6.1 Visual OTTHYMO (VO) Model Set-up and Hydrologic Parameters

The NVCA, Town of Caledon, and Ministry of Transportation guidelines were referenced to determine the hydrologic parameters for the various catchment areas within the Site. The topographic survey (J.D. Barnes Limited, April 4, 2022) for the Site was referenced to review the land cover and drainage patterns under the existing Site conditions. The Geotechnical Investigation prepared by Soil Engineers Ltd. (April 2022) was reviewed to determine the on-site soil conditions.

Based on the above, the hydrologic parameters for the pre-development and post-development conditions were determined and are summarized in Tables 6 and 7. The detailed hydrologic parameter sheets for each catchment area are provided in Appendix C.

Visual OTTHYMO (VO) was used to simulate pre-development and post-development runoff conditions. The Town of Caledon's intensity-duration frequency (IDF) curves were used to derive a 25 mm, 4-hour Chicago, and 24-hour SCS Type II design storms. The 25 mm deign storm was used to size the quality controls for the Site and the 4-hour Chicago and 24-hour SCS Type II design storms were used to model the stormwater quantity controls for the Site.

Table 6: Pre-Development Hydrologic Parameters

Catchment Characteristics	101	102	103
Drainage Area (ha), Total Area = 20.37 ha	10.97	4.83	4.57
Total Imperviousness (%)	0.32	0	0
Hydrologic Soil Type	Sandy Silt - B		
Composite Curve Number (CN)[1]	56.1	57.8	57.0
Initial Abstraction (mm)	8.99	7.25	8.00
Time to peak (hrs)	0.38	0.27	0.14

1. Composite Curve Numbers (CN) have been adjusted using the Modified Curve Number (CN*) method in VO and the total 100-year precipitation volume.

Table 7: Post-Development Hydrologic Parameters

Catchment Characteristics	201	202	203	204	205
Drainage Area (ha) Total Area = 20.37 ha	12.40	3.47	1.73	0.62	2.15
Total Imperviousness (%)	2.88	15.39	19.25	13.98	0
Hydrologic Soil Type	Sandy Silt - B				
Composite Curve Number (CN)[1]	57.9	66.7	68.1	66.2	61.0
Initial Abstraction (mm)	8.39	4.54	4.42	4.58	5.00
Time to peak (hrs)	0.53	0.54	0.40	0.21	0.16

1. Composite Curve Numbers (CN) have been adjusted using the Modified Curve Number (CN*) method in VO and the total 100-year precipitation volume.

6.2 Stormwater Quality Control

Stormwater quality controls for the proposed development will be achieved by retaining, treating, and infiltrating runoff in roadside bioswale systems. The bioswale systems will capture road runoff and water that mixes with the road runoff (e.g., front lot drainage). Runoff from the remainder of the site consists of natural heritage and landscaped areas and is therefore not subject to water quality treatment requirements.

The bioswale systems were sized based on the more conservative of the following 2 conditions:

- the runoff generated during the 25 mm design storm; or
- Table 3.2 of the MOE Stormwater Management Planning and Design Manual to achieve "Enhanced Protection".

The 25 mm design storm was extrapolated from the Town of Caledon's 2-year design storm IDF parameters and used in the VO model.

Table 8 summarizes the water quality storage requirements generated by each condition and the storage provided within the bioswale systems on each side of the roadway.

Table 8: Provided Water Quality Storage to Achieve Enhanced Water Quality Protection

Catchment	**25 mm Runoff Required Treatment Volume** (m^3)	**MOE Table 3.2 Enhanced Water Quality Storage Requirements** (m^3)	**Provided Treatment Volume**[2] (m^3)		**Total Provided Treatment Volume** (m^3)
			Street 'A' East Ditch	**Street 'A' West Ditch**	
201	N/A – Uncontrolled Natural Heritage Area				
202[1]	46	**47**	39.5	39.5	**79**
203	**47**	43	27	27	**54**
			Street 'B' North Ditch	**Street 'B' South Ditch**	
204	15	**16**	11	11	**22**
205	N/A – Uncontrolled Natural Heritage Area				
Total	**110 m^3**				**155 m^3**

1. Catchment 202's treatment only includes road and front lot runoff draining to the roadside bioswales. Runoff generated in the rear lot areas in Catchment 202 are clean and do not require treatment.
2. The provided treatment volume is assumed to be equally distributed between the roadside ditches on either side of the proposed internal roadway.

At a minimum, a total of 110 m^3 of runoff is required to be treated and infiltrated to remove 80% of TSS and achieve "Enhanced Protection". The proposed bioswale systems exceed this requirement and will have the capacity to treat and infiltrate a total of 155 m^3 of runoff.

The roadside bioswale systems consists of five (5) main elements including:

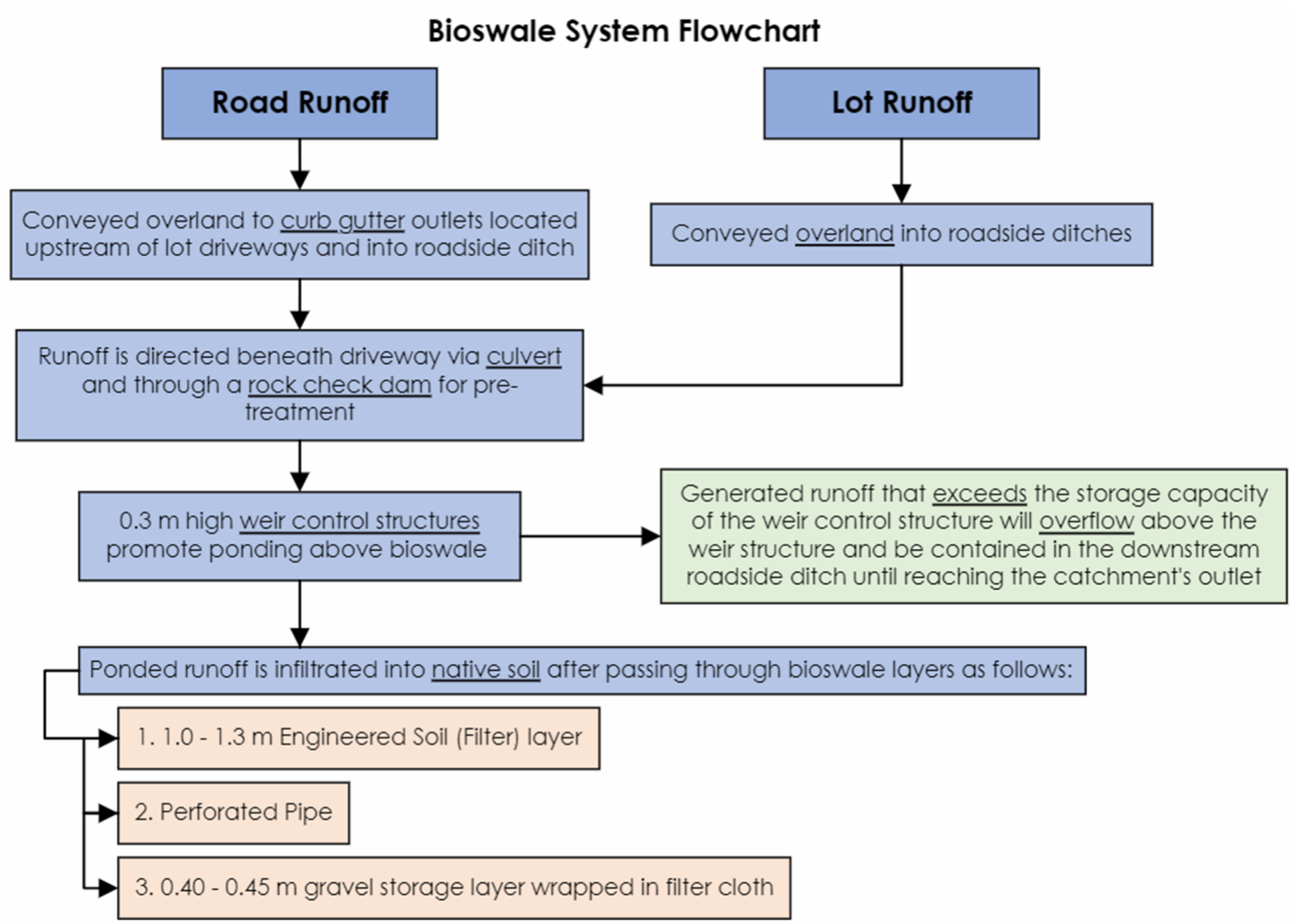
- Curb gutter outlets;
- Roadside ditches;
- Rock check dams;
- Weir control structures;
- Filter media and gravel storage;

The bioswale systems will accept road runoff via curb gutter outlets located upstream of each lot driveway. From each curb gutter outlet, the runoff will be collected by roadside ditches and conveyed via a culvert beneath each driveway. From the culvert, the runoff will pass through a rock check dam for pre-treatment and to reduce the runoff velocity.

To allow for the runoff to infiltrate into the bioswale filter media located beneath the roadside ditches, the runoff will be retained behind small weir control structures spaced according to the slope of the swale. The ponded runoff behind the weir control structures will infiltrate into the bioswale filter media in accordance with the CVC/TRCA Low Impact Development SWM Planning Design Guide (Version 1.0, 2010).

The bioswale systems' treatment capacity is governed by the surface ponding volume created by the weir control structures. The gravel storage layer has been conservatively sized to provide storage that is greater than, or equal to, the surface storage provided by the weir control structures. Design calculations for the bioswale, weir control structure storage, and drawdown are provided in Appendix C. A flowchart summarizing the bioswale function is provided on Page 12 and additional details are provided on Drawing C102, C103, and C104.

Water quality controls are not provided for Catchments 201 or 205. Catchment 201 will remain relatively unchanged between pre-development and post-development conditions with no directly connected impervious areas. Catchment 205 will remain unchanged between pre-development and post-development conditions producing only clean runoff from landscaped and woodlot areas.



6.3 Water Balance and Erosion Control

According to the NVCA Stormwater Technical Guide, the runoff generated during a 5 mm rainwater event over the area of the proposed development is required to be retained to achieve erosion control. As presented in Section 6.2, the roadside bioswales will provide water quality storage that exceeds the volume necessary to retain, treat, and infiltrate the 25 mm rainfall event, far exceeding the minimum erosion requirement.

Additionally, it is assumed that the water balance requirements will be met since the stormwater management design relies so heavily on infiltration and because so much of the Site will remain pervious (large natural heritage area with buffer, and large residential lots). A detailed water balance calculation according to Oak Ridges Moraine and MOE requirements will be provided following zoning approvals.

6.4 Stormwater Quantity Controls

Governing Design Storm – 4-hour Chicago vs. 24-hour SCS Type II Storm

The 4-hour Chicago and 24-hour SCS Type II storm distributions were simulated in VO where the storm distribution that produced the greatest storage requirement would be the governing storm for the quantity control design. For this exercise, the bioswale storage volumes were not included and the preliminary storage requirements were calculated for each design storm frequency individually (i.e., a stage-storage system was not used).

The results of flow modelling and preliminary storage volumes are presented in Table 9.

Table 9: Preliminary Storage Volume Requirements (4-hour Chicago vs. 24-hour SCS Type II Design Storms)

Storm	Pre-Dev. Peak Flow Rate[1] (L/s)	Post-Dev. Uncontrolled Peak Flow Rate[2] (L/s)	Total Preliminary Storage Volume Required (m^3)
2-year 4-hour Chicago	101	113	65
5-year 4-hour Chicago	241	255	106
10-year 4-hour Chicago	369	379	75
25-year 4-hour Chicago	566	572	75
50-year 4-hour Chicago	726	725	No Control Required
100-year 4-hour Chicago	915	905	No Control Required
2-year 24-hour SCS Type II	129	134	30
5-year 24-hour SCS Type II	304	301	No Control Required
10-year 24-hour SCS Type II	391	384	No Control Required
25-year 24-hour SCS Type II	547	528	No Control Required
50-year 24-hour SCS Type II	653	626	No Control Required
100-year 24-hour SCS Type II	781	743	No Control Required

1. Includes runoff directed to Outlet A – Hunsden Sideroad Culvert (Catchments 101 and 102). Runoff directed to Outlet B (Catchment 103) did not require quantity controls.
2. Includes runoff from Catchments 201, 202, and 203 directed to Outlet A. Runoff directed to Outlet B from Catchments 204 and 205 did not require quantity controls.

The maximum storage required for the 4-hour Chicago storm distribution was 106 m^3 during the 5-year storm event whereas, the maximum storage required for the 24-hour SCS Type II storm distribution was 30 m^3 during the 2-year storm event. Therefore, **the 4-hour Chicago storm distribution** was determined to be the governing storm to complete the quantity control design.

6.4.1 Drainage Outlet A – Hunsden Sideroad Culvert

The VO model was run using the 2-year to 100-year 4-hour Chicago design storms to determine the water quantity controls required for the catchments draining to the 1000 mm CSP culvert beneath Hunsden Sideroad (Outlet A). A total of 133 m^3 of water quality storage was included in the model as active storage from Catchments 202 (79 m^3) and 203 (54 m^3) as presented in Table 8.

The results of the model, including the pre-development and post-development flow rates and storage requirements, are presented in Table 10. The VO model schematics, full modelling results, and output files are provided in Appendix C.

Table 10: Peak Flows and Water Quantity Storage Requirements (Discharge towards Outlet A – Hunsden Sideroad Culvert)

Storm	**Pre-Dev. Peak Flow Rate**[1] (L/s)	**Post-Dev. Peak Flow Rate**[2] (L/s)	**Water Quality Storage Provided**[3] (m^3)	**Water Quantity Storage Required** (m^3)
2-yr	101	84	133	0
5-yr	241	218		
10-yr	369	326		
25-yr	566	495		
50-yr	726	629		
100-yr	915	786		

1. Includes runoff from Catchments 101 and 102.
2. Includes runoff from Catchments 201 (Uncontrolled), 202, and 203 with Catchments 202 and 203 subject to full-buildout conditions with weir control structures.
3. Water quality storage provided in Catchments 202 and 203. Table 8 provides the water quality storage breakdown within each catchment.

The VO results summarized in Table 10 indicate that for the 2-year to 100-year 4-hour Chicago design storms, the post-development peak flow rates are less than the pre-development peak flow rates directed to Outlet A, when accounting the storage volumes provided in the bioswale system. Therefore, no quantity controls are required in Catchments 201, 202, and 203 beyond the 133 m^3 of water quality storage provided.

As mentioned in Section 6.2, water quality storage will be provided in the bioswale systems by retaining runoff behind weir control structures in Catchments 202 and 203. The water quality storage volumes for each catchment have been designed to retain the runoff volume equal to, or greater than, what is generated during the 25 mm rainfall event. During storms where the runoff volume exceeds that of the weir control structures, the runoff will overflow the weirs and be conveyed towards Outlet A. In the roadside ditches, overflow will be directed over the weir control structures and be directed downstream within the roadside ditch as shown on the Preliminary Grading and Servicing Plan (C102).

The 450 mm diameter driveway culverts and roadside ditches within the proposed development were sized based on the estimated 100-year peak flows within Catchments 202 and 203. For simplicity, the peak flows within each roadside ditch were assumed to be half of the 100-year peak flows from Catchments 202 and 203. Supporting calculations showing the capacity of the driveway culverts and roadside ditches above the weir control structures are provided in Appendix C.

Two (2) new culverts are proposed to maintain the flow conveyance within the Hunsden Sideroad ditch beneath Street ‘A’ and the driveway of Lot 14. Additionally, an investigation will be completed into the conveyance capacity of the existing 1000 mm CSP culvert located beneath Hunsden Sideroad at Outlet A and the 400 mm diameter driveway culvert at 10201 Hunsden Sideroad. However, we expect the culverts’ conveyance conditions to be the same, or improved, from the pre-development conditions as the post-development peak flows are less than the pre-development peak flows. Hydraulic calculations will be provided following zoning approvals.

6.4.2 Drainage Outlet B – Flato’s Residential Subdivision

Catchments 204 and 205 are directed towards Flato’s residential subdivision (Outlet B) and consist of residential lots, internal roadway, landscape, and woodlot runoff from the southwestern extents of the proposed development. Catchment 205 will remain unchanged under post development conditions and will continue to drain uncontrolled.

The VO model was used to determine the pre-development and post-development peak flows directed to Flato’s residential subdivision and the required flood storage required for Catchment 204. A total of 22 m^3 of water quality storage was included in the model as active storage from Catchment 204 as presented in Table 8.

The results of the model, including the pre-development and post-development flow rates and storage requirements, are presented in Table 11. The VO model schematics, full modelling results, and output files are provided in Appendix C.

The VO results in Table 11 indicate that for the 2-year to 100-year design storms the post-development peak flow rates are less than the pre-development peak flow rates directed to Outlet B. Therefore, no additional water quantity controls are required in Catchment 204 beyond the 22 m^3 of water quality storage provided.

As mentioned in Section 6.2, water quality storage will be provided in the bioswale systems by retaining runoff behind weir control structures in Catchment 204. During storms where the runoff volume exceeds what is provided in the weir control structures, the runoff will overflow the weirs and be conveyed downstream within the roadside ditch towards Outlet B. The roadside ditches have been designed to have the capacity to convey the 100-year post-development peak flow within Catchment 204. Supporting Flowmaster calculations presenting the modelled capacity of the roadside ditches are provided in Appendix C.

**Table 11: Peak Flows and Water Quantity Storage Requirements
(Discharge towards Outlet B – Flato's Residential Subdivision)**

Storm	Pre-Dev. Peak Flow Rate[1] (L/s)	Post-Dev. Peak Flow Rate[2] (L/s)	Water Quality Storage Provided[3] (m^3)	Additional Flood Storage Volume Provided[3] (m^3)
2-yr	50	34	22	0
5-yr	116	70		
10-yr	177	104		
25-yr	267	151		
50-yr	341	190		
100-yr	428	235		

1. Includes runoff from Catchment 103.
2. Includes runoff from Catchments 204 and 205 with Catchment 204 subject to full-buildout conditions with weir control structures.
3. Water quality storage provided in Catchment 204. Table 8 provides the water quality storage breakdown within each catchment of the Site.

7.0 Erosion and Sediment Controls During Construction

Erosion and sediment controls will be implemented prior to the commencement of any site servicing works for the development and will be maintained throughout construction until the Site is stabilized or as directed by the Site Engineer and/or Town of Caledon.

Controls will be inspected after each significant rainfall event and maintained in proper working condition. A Preliminary Erosion and Sediment Control Plan (Drawing C101) has been prepared for the development outlining the site-specific erosion and sediment controls. This plan includes silt fencing, a mud mat, and more robust measures, such as check dams, in areas of concentrated flow.

Further details on the erosion and control measures have been summarized below:

<u>Sediment Control Silt Fence</u>

Sediment Control Silt Fence will be installed on the perimeter of the Site to intercept sheet flow. Additional Sediment Control Silt Fence may be added based on field decisions by the Site Engineer and Owner prior to, during, and following construction.

<u>Mud Mat</u>

A rock mud mat will be installed at the entrance to the Site off Hunsden Sideroad. The rock mud mat will help to prevent mud tracking. All construction traffic will be restricted to the construction entrance as indicated on the Preliminary Erosion and Sediment Control Plan (Drawing C101).

Rock Check Dams

Rock check dams installed according to OPSD 219.210 should be installed in the proposed swale to protect from erosion conveyance during construction.

8.0 Compatibility with Sub-consultant Designs

8.1 Environmental Impact Study (GEI Consultants)

The servicing and stormwater management design for the proposed development has been designed considering the recommendations outlined in EIS prepared by GEI (November 2023) including:

- The confirmation that the existing ditch to the south of the Hunsden Sideroad is not classified as a Headwater Drainage Feature and no environmental management recommendations are required (Page 15).
- The finding that no negative impacts to potential fish habitats are anticipated (Page 18).
- The recommendation that there is no EZ2 designation present on the Subject Lands (Page 22).
- Providing erosion and sedimentation controls during construction (Page 28).
- Providing water quality, quantity, and erosion control to minimize potential post-construction impacts on the surrounding environment (Page 29).

8.2 Landscape (BTi Landscape Architecture)

The Landscape Plan prepared by BTi (November 2023) has been incorporated into the proposed civil design to accommodate the proposed tree preservation and planting areas. Most of trees identified for preservation can be saved. In some cases, additional tree hoarding measures may be necessary to compensate for proposed changes to grades.

8.3 Streetlighting System (RTG Systems Inc.)

The Streetlighting System Plan prepared by RTG has been incorporated into the proposed civil design including the streetlight poles and preliminary joint utility trench locations. Access to transformers can be accommodated using small driveways, with no appreciable impact to the bioswale design.

9.0 Conclusions & Recommendations

This report was prepared in support of the Zoning By-Law Amendment Application for the property located at 10249 Hunsden Sideroad in the Town of Caledon. The proposed development can be serviced for water, sanitary, and stormwater management in accordance with the Town of Caledon, Region of Peel, and Nottawasaga Valley Conservation Authority requirements and standards. Our conclusions and recommendations include:

<u>Proposed Water Services</u>

1. The domestic peak hourly water demand for the proposed development is 0.8 L/s. The design fire flow is 183 L/s for 2.25 hours.

2. Water servicing for the proposed development will be met by installing and connecting a 150 mm diameter PVC watermain to the existing 300 mm diameter PVC watermain on Stinson Street. The proposed 150 mm diameter PVC watermain will be looped throughout the development and provide municipal water servicing to each residential lot including an extension along Hunsden Sideroad to service Lot 14.

<u>Proposed Sanitary Services</u>

1. Peak sanitary flow for each unit is 2,000 L/d, totaling 28,000 L/d for the fourteen (14) units in the proposed development.

2. Sanitary servicing for the proposed development will consist of private individual lot on-site sewage systems.

<u>Stormwater Management</u>

1. A passive stormwater management approach is proposed to preserve and maintain the rural character of the property using bioswale systems.

2. Water quality controls, erosion protection, and water balance for the proposed development will be provided by roadside bioswale systems. The roadside bioswale systems will provide water quality treatment that exceeds the "Enhanced Protection" criteria by retaining, treating, and infiltrating runoff volume equal to, or greater than, the runoff volume generated during a 25 mm rainfall event. The water quality storage provided in the bioswale systems provides active storage to simultaneously provide the necessary quantity controls for the Site.

3. No additional water quantity storage is required beyond what is provided in the roadside bioswale systems. The post-development peak flows are less than pre-development peak flows at both Outlet A and B for the 2-year to 100-year design storm events when accounting the storage in the bioswale system.

4. A portion of runoff generated in Catchment 201 and a small external drainage area directed towards a low area to the south of Lots 7 and 8 will be conveyed with a proposed storm sewer around the proposed development. This flow routing will maintain the existing drainage outlet for the captured flows within Catchment 201.

Compatibility with Sub-Consultant Designs

Sub-consultant plans (landscape, ecology and electrical) have been reviewed and confirmed to be compatible with the civil design. Some minor refinement may be necessary following zoning approvals, but all grading, servicing, and stormwater management practices may be implemented in conjunction with the sub-consultant designs.

Based on the above conclusions, we recommend the approval of the Zoning By-Law Amendment Application from the perspective of functional servicing and stormwater management.

Respectfully submitted,

C.F. CROZIER & ASSOCIATES INC.

James Fletcher
Engineering Intern, Land Development

C.F. CROZIER & ASSOCIATES INC.

Tony Elias, P.Eng.
Senior Project Manager

JKF/dd

I:\900\952 - Harwood\6305- 10249 Hunsden Sdrd\Reports\2nd Submission_FSRSWM\2023.11.15_(0952-6305)_ FSRSWM_.docx

APPENDIX A

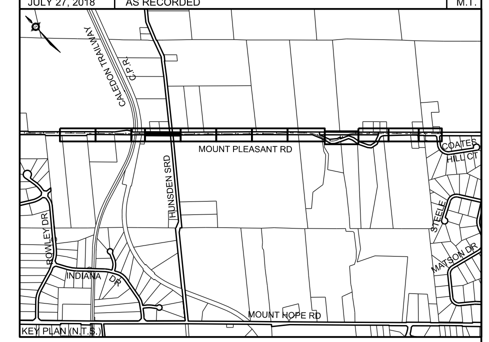
As-Constructed Drawings & Background Material

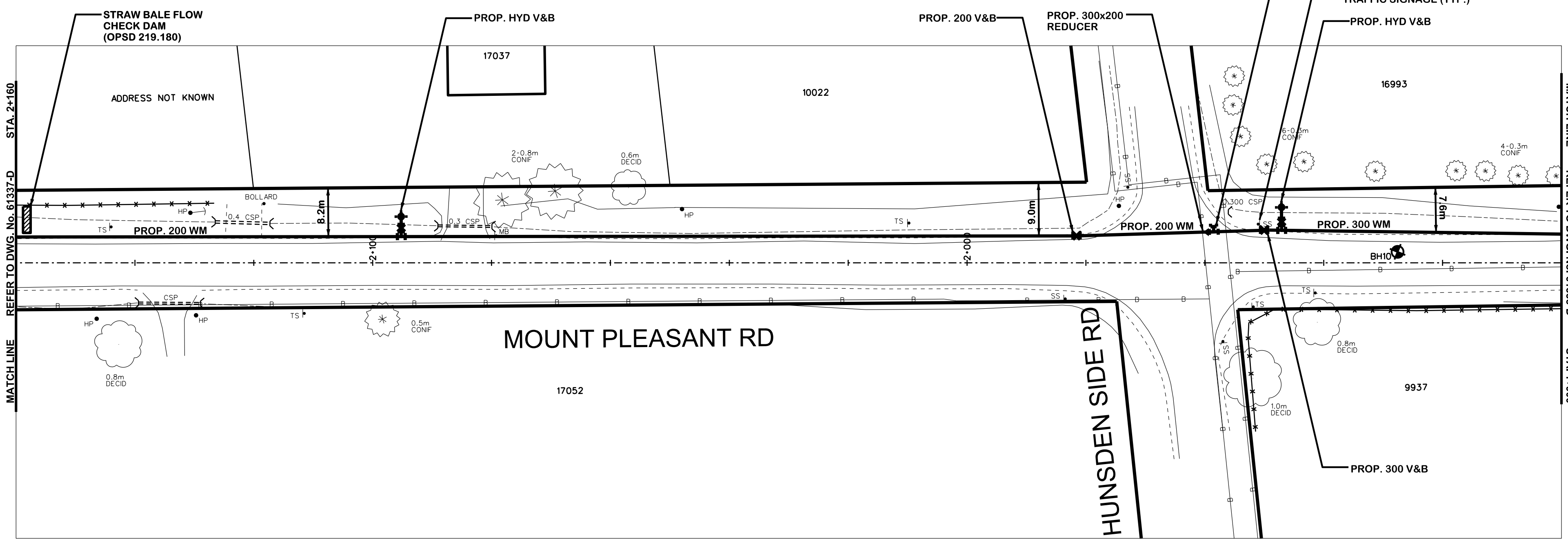
SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS	OCT. 01, 2016	M.T.	GAS MAINS	MAY 13, 2016	M.T.
STORM SEWERS	OCT. 01, 2016	M.T.	BELL U/G CABLE	MAY 26, 2016	M.T.
WATERMAINS	OCT. 01, 2016	M.T.	HYDRO U/G CABLE		
TRANSIT			HYDRO ONE	MAY 25, 2016	M.T.
PARKS & REC.			CTV	MAY 30, 2016	M.T.
ONT. CLEAN WATER			COMMUNIC. CABLES		

REVISIONS

DATE	DETAILS	INIT.
DEC. 09, 2016	ISSUED FOR 60% REVIEW	M.T.
MAR. 27, 2017	ISSUED FOR PUCC	M.T.
MAY 05, 2017	ISSUED FOR 90% REVIEW	M.T.
MAY 24, 2017	ISSUED FOR TENDER	M.T.
JUNE 28, 2017	ISSUED FOR CONSTRUCTION	M.T.
JULY 27, 2018	AS RECORDED	M.T.



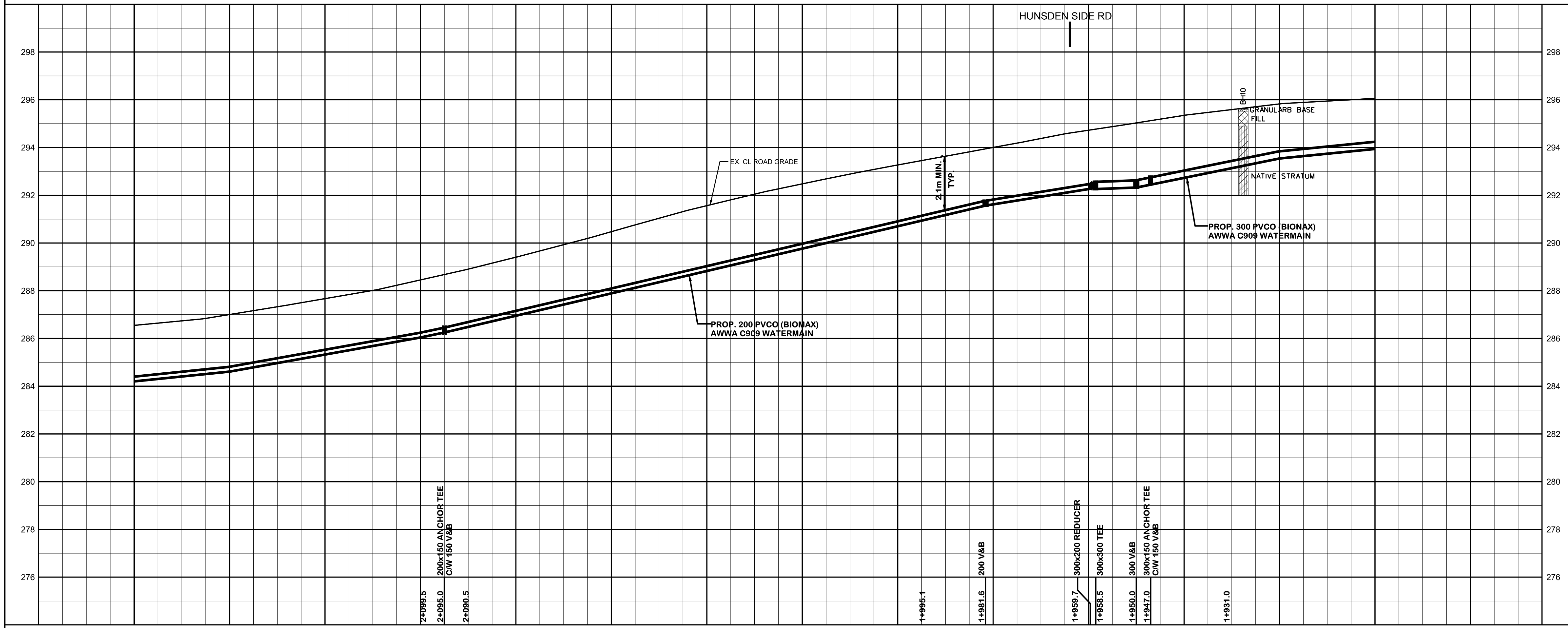


NOTE:

1. FOR GENERAL NOTES, DETAILS AND LEGEND SEE DWG. 61340-D

WATERMAIN
VALVES - CLOW CANADA 2639
HYDRANTS - MCAVITY, M67B
WATERMAIN - PVCO IPEX BIONAX

THIS DRAWING TO BE USED FOR WATERMAIN CONSTRUCTION ONLY



BOT.EL. OF WM.	284.20	284.61	285.33	286.04	286.95	287.89	288.83	289.76	290.70	291.62	292.26
EX. ROAD ELEV.	286.55	287.00	287.67	288.45	289.40	290.47	291.56	292.48	293.27	294.00	294.73
ROAD CHAINAGE	2+160	2+140	2+120	2+100	2+080	2+060	2+040	2+020	2+000	1+980	1+960

BOT.EL. OF WM.	292.73	293.54	293.94
EX. ROAD ELEV.	295.35	295.83	296.06
ROAD CHAINAGE	1+940	1+920	1+900

General Notes

All Driveways Are ASPHALT Unless Otherwise Noted

All Water And Sanitary Service Locations Are Approximate And Must Be Located Accurately In The Field

All Horizontal And Vertical Bends Are In Degrees

All Pipes Size In mm

20C Existing Water Service, Size In mm

WS25 Proposed Water Service, Size In mm

B.M. No. Elev.
Description
Location

The Contractor Is Responsible For Locating And Protecting All Existing Utilities Prior To And During Construction. Location Of Existing Utilities Approximate Only, To Be Verified In Field By Contractor.

Designed by ______ Chkd. ______ Approved by ______

NOTICE TO CONTRACTOR

48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING

THE REGIONAL MUNICIPALITY OF PEEL
CITY OF MISSISSAUGA WORKS DEPT.
CITY OF BRAMPTON WORKS DEPT.
TOWN OF CALEDON WORKS DEPT.
BELL CANADA
ENBRIDGE INCORPORATED-GAS DISTRIBUTION
ONTARIO MINISTRY OF TRANSPORTATION
ONTARIO CLEAN WATER AGENCY
HYDRO ONE NETWORKS
ENERSOURCE, HYDRO MISSISSAUGA
HYDRO ONE BRAMPTON

CABLE TELEVISION/FIBREOPTIC PROVIDERS:
BELL CANADA
ENERSOURCE TELECOM
HYDRO ONE TELECOM
ROGERS CABLE
ALLSTREAM
PSN (PUBLIC SECTOR NETWORK)
FUTUREWAY (FCI BROADBAND)

10m 0 10 20 30m HORIZONTAL SCALE

2m 0 2 4 6m VERTICAL SCALE

Region of Peel
Working for you

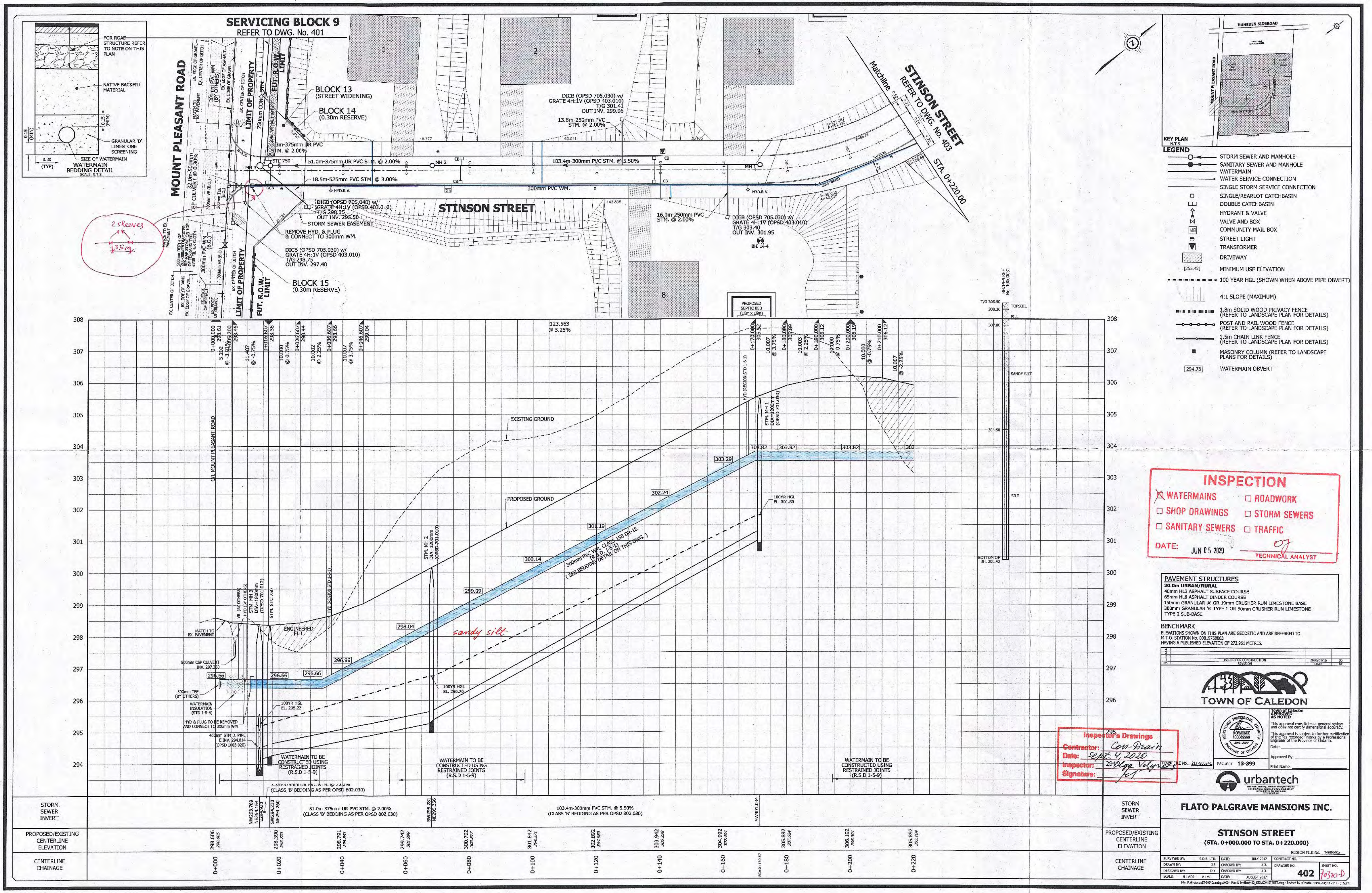
MOUNT PLEASANT ROAD

(FROM COATES HILL CRT TO 17294 MT. PLEASANT RD)

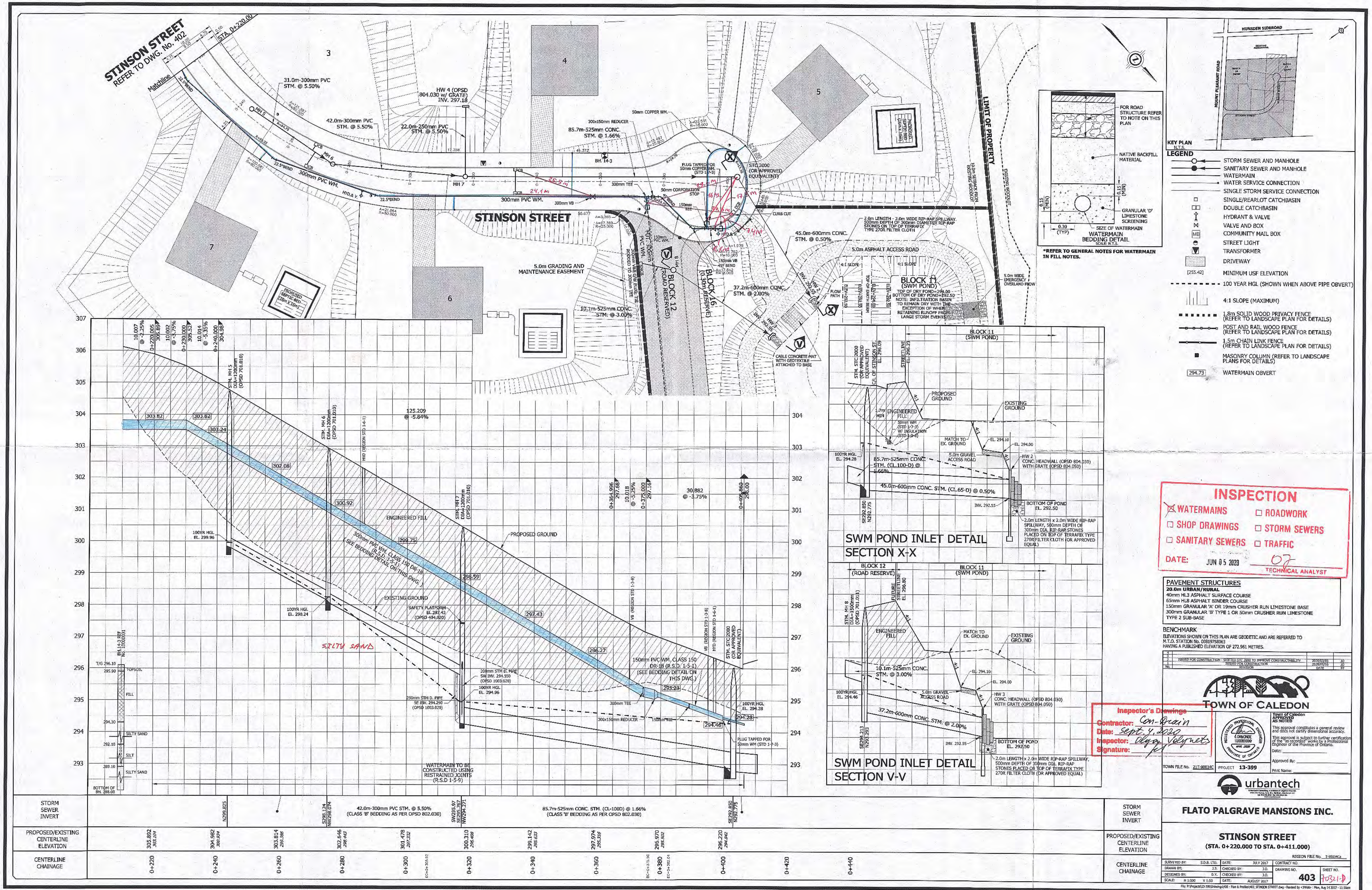
PROP. 200/300mm WATERMAIN

STA. 1+900 TO STA. 2+160

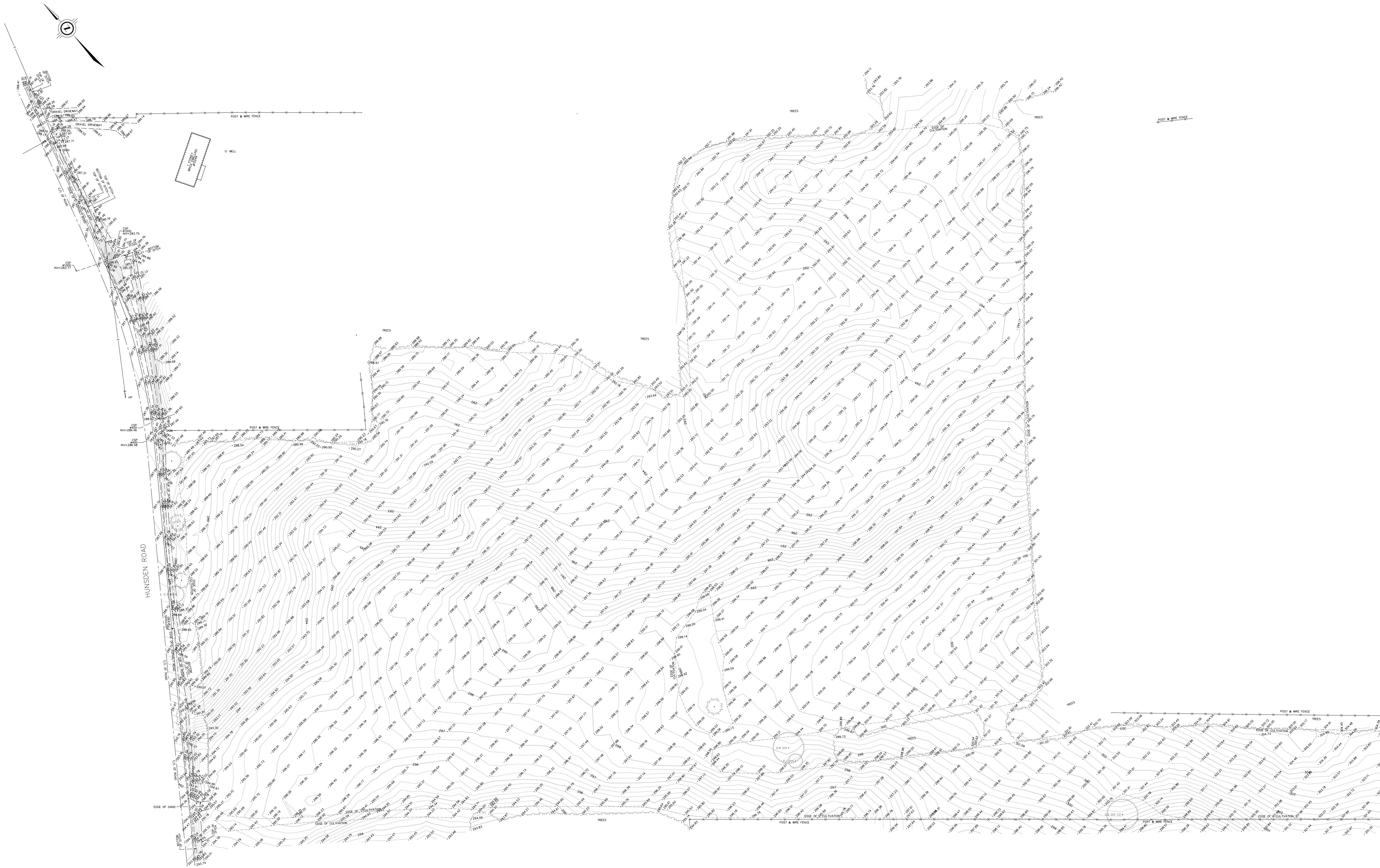
CAD Area		Area	C-44/C-55	Project No.	17-1381-S
Checked by		Drawn by	M.T.		
Date	OCT. 2016	Sheet	9 of 12	Plan No.	61336-D



SERVICING BLOCK 9
REFER TO DWG. No. 401
WATERMAIN BEDDING DETAIL
FOR ROAD STRUCTURE REFER TO NOTE ON THIS PLAN
NATIVE BACKFILL MATERIAL
GRANULAR 'D' LIMESTONE SCREENING
SIZE OF WATERMAIN
MOUNT PLEASANT ROAD
LIMIT OF PROPERTY
FUT. R.O.W. LIMIT
BLOCK 13 (STREET WIDENING)
BLOCK 14 (0.30m RESERVE)
BLOCK 15 (0.30m RESERVE)
STINSON STREET
STINSON STREET REFER TO DWG. No. 403
Matchline
STA. 0+220.00
51.0m-375mm UR PVC STM. @ 2.00%
103.4m-300mm PVC STM. @ 5.50%
18.5m-525mm PVC STM @ 3.00%
300mm PVC WM.
DICB (OPSD 705.030) w/ GRATE 4H:1V (OPSD 403.010) T/G 301.41 OUT INV. 299.96
13.8m-250mm PVC STM. @ 2.00%
16.0m-250mm PVC STM. @ 2.00%
DICB (OPSD 705.030) w/ GRATE 4H:1V (OPSD 403.010) T/G 303.40 OUT INV. 301.95
DICB (OPSD 705.040) w/ GRATE 4H:1V (OPSD 403.010) T/G 298.35 OUT INV. 293.50
STORM SEWER EASEMENT
REMOVE HYD. & PLUG & CONNECT TO 300mm WM.
DICB (OPSD 705.030) w/ GRATE 4H:1V (OPSD 403.010) T/G 298.75 OUT INV. 297.40
MH 1
MH 2
MH 3
PROPOSED SEPTIC BED
2 sleeves
3.5m
EXISTING GROUND
PROPOSED GROUND
ENGINEERED FILL
sandy silt
300mm PVC WM. CLASS 150 DR-18 (R.S.D. 1-5-1) (SEE BEDDING DETAIL ON THIS DWG.)
WATERMAIN TO BE CONSTRUCTED USING RESTRAINED JOINTS (R.S.D 1-5-9)
100YR HGL EL. 301.80
100YR HGL EL. 296.76
100YR HGL EL. 295.22
500mm CSP CULVERT
300mm TEE (BY OTHERS)
WATERMAIN INSULATION (STD 1-5-8)
HYD & PLUG TO BE REMOVED AND CONNECT TO 300mm WM
MATCH TO EX. PAVEMENT
C/L MOUNT PLEASANT ROAD
STM. MH 1 DIA=1200mm (OPSD 701.010)
STM. MH 2 DIA=1200mm (OPSD 701.010)
KEY PLAN
HUNSDEN SIDEROAD
LEGEND
STORM SEWER AND MANHOLE
SANITARY SEWER AND MANHOLE
WATERMAIN
WATER SERVICE CONNECTION
SINGLE STORM SERVICE CONNECTION
SINGLE/REARLOT CATCHBASIN
DOUBLE CATCHBASIN
HYDRANT & VALVE
VALVE AND BOX
COMMUNITY MAIL BOX
STREET LIGHT
TRANSFORMER
DRIVEWAY
MINIMUM USF ELEVATION
100 YEAR HGL (SHOWN WHEN ABOVE PIPE OBVERT)
4:1 SLOPE (MAXIMUM)
1.8m SOLID WOOD PRIVACY FENCE (REFER TO LANDSCAPE PLAN FOR DETAILS)
POST AND RAIL WOOD FENCE (REFER TO LANDSCAPE PLAN FOR DETAILS)
1.5m CHAIN LINK FENCE (REFER TO LANDSCAPE PLAN FOR DETAILS)
MASONRY COLUMN (REFER TO LANDSCAPE PLANS FOR DETAILS)
WATERMAIN OBVERT
INSPECTION
WATERMAINS
ROADWORK
SHOP DRAWINGS
STORM SEWERS
SANITARY SEWERS
TRAFFIC
DATE: JUN 05 2020
TECHNICAL ANALYST
PAVEMENT STRUCTURES
20.0m URBAN/RURAL
40mm HL3 ASPHALT SURFACE COURSE
65mm HL8 ASPHALT BINDER COURSE
150mm GRANULAR 'A' OR 19mm CRUSHER RUN LIMESTONE BASE
300mm GRANULAR 'B' TYPE 1 OR 50mm CRUSHER RUN LIMESTONE TYPE 2 SUB-BASE
BENCHMARK
ELEVATIONS SHOWN ON THIS PLAN ARE GEODETIC AND ARE REFERRED TO M.T.O. STATION No. 00819758063 HAVING A PUBLISHED ELEVATION OF 272.961 METRES.
ISSUED FOR CONSTRUCTION
Inspector's Drawings
Contractor: Con-Drain
Date: Sept. 4, 2020
Inspector:
Signature:
TOWN OF CALEDON
PROJECT 13-399
urbantech
FLATO PALGRAVE MANSIONS INC.
STINSON STREET
(STA. 0+000.000 TO STA. 0+220.000)
STORM SEWER INVERT
PROPOSED/EXISTING CENTERLINE ELEVATION
CENTERLINE CHAINAGE
0+000
0+020
0+040
0+060
0+080
0+100
0+120
0+140
0+160
0+180
0+200
0+220
402



STINSON STREET
REFER TO DWG. No. 402
STINSON STREET
LIMIT OF PROPERTY
BLOCK 12 (ROAD RESERVE)
BLOCK 16 (0.30m RESERVE)
BLOCK 11 (SWM POND)
5.0m GRADING AND MAINTENANCE EASEMENT
5.0m ASPHALT ACCESS ROAD
WATERMAIN BEDDING DETAIL
*REFER TO GENERAL NOTES FOR WATERMAIN IN FILL NOTES.
KEY PLAN
N.T.S.
LEGEND
STORM SEWER AND MANHOLE
SANITARY SEWER AND MANHOLE
WATERMAIN
WATER SERVICE CONNECTION
SINGLE STORM SERVICE CONNECTION
SINGLE/REARLOT CATCHBASIN
DOUBLE CATCHBASIN
HYDRANT & VALVE
VALVE AND BOX
COMMUNITY MAIL BOX
STREET LIGHT
TRANSFORMER
DRIVEWAY
[255.42] MINIMUM USF ELEVATION
100 YEAR HGL (SHOWN WHEN ABOVE PIPE OBVERT)
4:1 SLOPE (MAXIMUM)
1.8m SOLID WOOD PRIVACY FENCE (REFER TO LANDSCAPE PLAN FOR DETAILS)
POST AND RAIL WOOD FENCE (REFER TO LANDSCAPE PLAN FOR DETAILS)
1.5m CHAIN LINK FENCE (REFER TO LANDSCAPE PLAN FOR DETAILS)
MASONRY COLUMN (REFER TO LANDSCAPE PLANS FOR DETAILS)
294.73 WATERMAIN OBVERT
SWM POND INLET DETAIL SECTION X-X
SWM POND INLET DETAIL SECTION V-V
SILTY SAND
INSPECTION
WATERMAINS
ROADWORK
SHOP DRAWINGS
STORM SEWERS
SANITARY SEWERS
TRAFFIC
DATE: JUN 05 2020
TECHNICAL ANALYST
PAVEMENT STRUCTURES
20.0m URBAN/RURAL
40mm HL3 ASPHALT SURFACE COURSE
65mm HL8 ASPHALT BINDER COURSE
150mm GRANULAR 'A' OR 19mm CRUSHER RUN LIMESTONE BASE
300mm GRANULAR 'B' TYPE 1 OR 50mm CRUSHER RUN LIMESTONE TYPE 2 SUB-BASE
BENCHMARK
ELEVATIONS SHOWN ON THIS PLAN ARE GEODETIC AND ARE REFERRED TO M.T.O. STATION No. 00819758063 HAVING A PUBLISHED ELEVATION OF 272.961 METRES.
2 ISSUED FOR CONSTRUCTION - SHIFTED STC 2000 TO IMPROVE CONSTRUCTABILITY 2020/03/03 JO
1 ISSUED FOR CONSTRUCTION 2020/01/16 JO
No. REVISION DATE BY
TOWN OF CALEDON
Inspector's Drawings
Contractor: Con-Drain
Date: Sept. 4, 2020
Inspector: Olgay Volynets
Signature:
Town of Caledon APPROVED AS NOTED
This approval constitutes a general review and does not certify dimensional accuracy.
This approval is subject to further certification of the "as recorded" works by a Professional Engineer of the Province of Ontario.
Date:
Approved By:
Print Name:
TOWN FILE No. 21T-90034C
PROJECT 13-399
urbantech
FLATO PALGRAVE MANSIONS INC.
STINSON STREET
(STA. 0+220.000 TO STA. 0+411.000)
REGION FILE No. T-90034Ca
SURVEYED BY: S.D.B. LTD.
DATE: JULY 2017
DRAWN BY: J.S.
CHECKED BY: J.O.
DESIGNED BY: D.Y.
CHECKED BY: J.O.
SCALE: H 1:500 V 1:50
DATE: AUGUST 2017
CONTRACT NO.
DRAWING NO. 403
SHEET NO. 70321-D
STORM SEWER INVERT
PROPOSED/EXISTING CENTERLINE ELEVATION
CENTERLINE CHAINAGE
42.0m-300mm PVC STM. @ 5.50% (CLASS 'B' BEDDING AS PER OPSD 802.030)
85.7m-525mm CONC. STM. (CL-100D) @ 1.66% (CLASS 'B' BEDDING AS PER OPSD 802.030)



TOPOGRAPHIC SKETCH OF

PART OF LOTS 25 AND 26 CONCESSION 9

AND

PART OF ROAD ALLOWANCE BETWEEN LOTS 25 AND 26 CONCESSION 9

(GEOGRAPHIC TOWNSHIP OF ALBION)

CITY OF CALEDON

REGIONAL MUNICIPALITY OF PEEL

SCALE 1 : 500

10 0 10 20 30 metres

J.D. BARNES LIMITED

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

ELEVATION NOTE

ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE MINISTRY OF NATURAL RESOURCES BENCHMARKS:

No. 00820108111
ELEVATION=286.833m

No. 00820108113
ELEVATION=290.087m

LEGEND

HP	DENOTES HYDRO POLE
PED	DENOTES TELEPHONE PEDESTAL
WELL	DENOTES WELL
CSP	DENOTES CORRUGATED STEEL PIPE
E	DENOTES OVERHEAD HYDRO CABLE
	DENOTES CONIFEROUS TREE DIA=DIAMETER OF TRUNK IN METRES
	DENOTES DECIDUOUS TREE DIA=DIAMETER OF TRUNK IN METRES

BEFORE DIGGING, UNDERGROUND SERVICES SHOULD BE LOCATED ON SITE BY THE RESPECTIVE AGENCIES.

IT IS THE RESPONSIBILTITY OF THE CONTRACTOR TO VERIFY THAT LOCAL BENCHMARKS HAVE NOT BEEN ALTERED OR DISTURBED AND THAT THE RELATIVE ELEVATIONS AGREE WITH THE INFORMATION SHOWN ON THIS PLAN.

PRIMARY CONTOURS ARE AT 1.00m INTERVALS.
SECONDARY CONTOURS ARE AT 0.25m INTERVALS.

SURVEY COMPLETED ON THE 22 DAY OF MARCH, 2022.

J.D.BARNES LIMITED
SURVEYING MAPPING GIS
LAND INFORMATION SPECIALISTS
401 WHEELABRATOR WAY, SUITE A, MILTON, ON L9T 3C1
T: (905) 875-9955 F: (905) 875-9956 www.jdbarnes.com

DRAWN BY: AA	CHECKED BY: GS	REFERENCE NO.: 22-30-839-00
FILE: G:\22-30-839\00\Drawing\22-30-839-00-B.dgn		DATED: 04/04/2022

PLOTTED: 4/4/2022

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE
90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

BARRIE	MISSISSAUGA	OSHAWA	NEWMARKET	GRAVENHURST	HAMILTON
TEL: (705) 721-7863	TEL: (905) 542-7605	TEL: (905) 440-2040	TEL: (905) 853-0647	TEL: (705) 684-4242	TEL: (905) 777-7956
FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

A REPORT TO
CARRINGWOOD HOMES

A GEOTECHNICAL INVESTIGATION FOR PROPOSED RESIDENTIAL DEVELOPMENT

HUNSDEN SIDEROAD

TOWN OF CALEDON

REFERENCE NO. 2202-S079

APRIL 2022

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ENCLOSURES

1.0 INTRODUCTION

In accordance with written authorization dated February 17, 2022 from Mr. Robert Fernicola, President of Woodbridge Crossing Ltd., on behalf of Carringwood Homes, a geotechnical investigation was conducted on a parcel of land on the south side of Hunsden Sideroad, approximately 350 m east of Mount Pleasant Road in the Town of Caledon, for a proposed Residential Development.

The purpose of the investigation was to reveal the subsurface conditions and determine the engineering properties of the disclosed soils. The geotechnical findings and resulting recommendations are presented in this Report.

2.0 SITE AND PROJECT DESCRIPTION

The Town of Caledon is situated on Peel-Markham till plain where the drift dominates the soil stratigraphy. In places, lacustrine sand, silt, clay and drift which have been reworked by the water action of Peel Ponding (glacial lake) have modified the drift stratigraphy.

The property, approximately 20 hectares in area, consists of a residential lot fronting Hundsden Sideroad, farm field and a wood lot. The grading within the property is relatively flat, generally descends towards Hunsden Sideroad.

At the time of the report preparation, detailed design for the proposed development is not available, however, it is understood that the property will be developed into a residential subdivision with a block reserved for a stormwater management facility.

3.0 FIELD WORK

The field work, consisting of six (6) sampled boreholes extending to a depth of 6.6 to 9.6 m from the prevailing ground surface, was performed on March 9 and 10, 2022, at the locations shown on the Borehole and Monitoring Well Location Plan, Drawing No. 1.

The boreholes were advanced at intervals to the sampling depths by a track-mounted, continuous-flight power-auger machine equipped 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. The relative density of the non-cohesive strata and the consistency of the cohesive strata are inferred from the ‘N’ values. Split-spoon samples were recovered for soil classification and laboratory testing.

Monitoring wells, 50 mm in diameter, were installed at all borehole locations to facilitate a a hydrogeological assessment by others. The depth and details of wells are shown on the corresponding Borehole Logs.

The fieldwork was supervised and the findings were recorded by a Geotechnical Technician. The ground elevation at each borehole location was obtained using a hand-held Global Navigation Satellite System (GNSS) equipment.

4.0 SUBSURFACE CONDITIONS

The boreholes were completed in the farm field. The investigation has disclosed that beneath the topsoil, the site is generally underlain by a deposit of silt, with strata of sand in places.

Detailed descriptions of the subsurface conditions are presented on the Borehole Logs, comprising Figures 1 to 6, inclusive. The revealed stratigraphy is plotted on the Subsurface Profile, Drawing No. 2. The engineering properties of the disclosed soils are discussed herein.

4.1 **Topsoil** (All Boreholes)

The revealed topsoil is 15 cm to 30 cm in thickness. Thicker topsoil layer may be contacted in areas beyond the borehole locations, especially near the treed or low-lying areas.

4.2 **Silt** (All Boreholes)

A silt deposit was contacted throughout the property, with sand deposit either above or beneath the silt. It consists of some sand to being sandy, with a trace of gravel. Grain size analyses were performed on three representative samples of the silt; the result is illustrated on Figure 7.

The recorded ‘N’ values of the silt ranges from 5 to 64 blows per 30 cm of penetration, indicating that the deposit is loose to very dense in relative density. The loose condition is generally restricted to the weathered zone, extending to a depth of up to 1.2 m from grade.

The silt is generally moist, as disclosed by the natural water content values ranging from 10% to 25%. The silt deposit is wet in Boreholes 5 and 6, likely derived from perched groundwater. The engineering properties of the silt deposit are presented below:

- High frost susceptibility and high soil adfreezing potential.
- High water erodibility. In excavation, the fine particles are susceptible to migration through small openings under seepage pressure.
- Relatively low permeability, with estimated permeability of 10^{-4} to 10^{-5} cm/sec, or percolation time of 12 to 20 min/cm.
- In excavation, the silt will run with water seepage and boil under a piezometric head of 0.3 m.
- Poor pavement-supportive material, with an estimated CBR value of 3% to 7%.
- Moderate corrosivity to buried metal, with an estimated electrical resistivity of 5000 ohm·cm.

4.3 **Sand** (Boreholes 1, 4 and 6)

The sand was encountered in Boreholes 1, 4 and 6. It is fine-grained to well-graded, with a variable amount of silt and gravel. Grain size analysis was performed on two representative samples of the sand. The results are plotted on Figures 8 and 9.

The obtained 'N' values ranges from 12 to 76 blows per 30 cm of penetration, indicating the sand is compact to very dense in relative density. The moisture contents of the sand ranges from 1% to 16%, indicating dry to very moist condition. The high-water content value is likely due to the higher silt content in the sand, as sample examination indicates that the sand is generally in a dry to moist condition.

The engineering properties of the sand deposit are listed below:

- Moderate to moderately high frost susceptibility.
- High water erodibility, it is susceptible to migration through small opening under seepage pressure.
- Pervious to relatively pervious, with an estimated coefficient of permeability and percolation times of 10^{-2} to 10^{-4} cm/sec and 4 to 12 min/cm, respectively.
- In excavation, the sand will slough to its angle of repose, run with water seepage and boil under a piezometric head of 0.4 m.
- Fair pavement-supportive material, with an estimated CBR value of 8%.
- Low to moderately low corrosivity to buried metal, with an estimated electrical resistivity of 5000 to 6000 ohm·cm.

4.4 Compaction Characteristics of the Revealed Soils

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 +
Sand	1 to 16 (median 6)	10	7 to 13
Silt	10 to 25 (median 19)	12	8 to 15

The above values show that the in-situ soils are either too dry or too wet for 95% or + Standard Proctor compaction. The weathered soils near the ground surface and portions of the sand and silt are on the wet side of the optimum or too wet and will require aeration prior to compaction. Aeration can be achieved by spreading the wet soil thinly on the ground in the dry and warm weather. The weathered soil must also be screened, segregated the topsoil and organics, before aeration for reuse as structural backfill.

When compacting the tills 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).

5.0 GROUNDWATER CONDITION

All boreholes remained dry upon completion of the fieldwork. Water seepage was encountered in Boreholes 1, 5 and 6, at a depth of 9.1 m, 1.4 m and 3.0 m from grade, respectively, or El. 300.1 to 286.9 m.

Groundwater yield, if encountered, from the silt and sand will likely, be moderate to appreciable. Perched groundwater may occur at shallow depths during wet seasons.

6.0 DISCUSSION AND RECOMMENDATIONS

The investigation revealed that beneath the topsoil, the site is underlain by a loose to very dense, generally compact silt deposit. In places, compact to very dense sand was also contacted. The upper zone of the soil, extending to 1.2 m from grade, is generally weathered.

All boreholes remained dry and upon completion of borehole drilling with groundwater seepage detected in 3 of the boreholes. During wet seasons, perched groundwater may occur at shallow depths and will be subject to seasonal fluctuation. If encountered, the groundwater yield from the silt and sand will be moderate appreciable. Additional water level in the monitoring wells will be recorded by others.

The conceptual site plan indicates that the site will be developed into a residential subdivision provided with municipal road. The lots will be serviced privately with individual septic systems for sewage. 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 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.
3. The engineered fill and sound native soils are suitable for supporting the proposed structures, underground services and road pavement.
4. The footing subgrade must be inspected by a geotechnical engineer or a senior geotechnical technician to assess its suitability for supporting the structures at the designed bearing pressures.
5. Backfill of any trenches and house foundation should consist of on-site excavated material, free of organics, or imported granular material or inorganic earth fill.
6. If the proposed stormwater management pond is a retention pond, an impermeable clay liner must be provided.

The recommendations appropriate for the project described in Section 2.0 are presented herein. One must be aware that the subsurface conditions may vary between boreholes. Should any subsurface variance become apparent during construction, a geotechnical engineer must be consulted to determine whether the following recommendations require revision.

6.1 Site Preparation

The site can be re-graded with an engineered fill for development. The requirements for the engineered fill are presented below:

1. The topsoil must be removed; any disturbed soils 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 (SPDD) up to the proposed 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% SPDD.
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 fully supervised 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 in the footings and in the upper section of the foundation walls. It 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 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 **Foundations**

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

- 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.

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.

Foundations exposed to weathering or in unheated areas should have at least 1.4 m of earth cover for protection against frost action.

If groundwater seepage is encountered in excavation, the foundation must be poured immediately after subgrade inspection or the subgrade should be protected by a mud-slab of lean concrete immediately after exposure. This will prevent construction disturbance and costly rectification of the bearing subsoil.

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

6.3 **Basement Structures**

The basement structure should be provided with a drainage system (Drawing No. 3) at the wall base and damp-proofing of the perimeter walls. The subdrains should be encased in a fabric filter to protect them against blockage by silting.

The perimeter walls should be designed to sustain a lateral earth pressure calculated using the soil parameters stated in Section 6.10. Any applicable surcharge loads adjacent to the basement must also be considered in the wall design.

The basement floor subgrade should consist of sound native soil or well compacted inorganic earth fill. The floor slab should be constructed on a granular base, at least 15 cm thick, consisting of 19-mm Crusher-Run Clearstone, or equivalent.

The exterior gradient beside the basement structure must be graded to direct runoff away from the structures.

6.4 Garages and Driveways

The on-site soils are mostly frost susceptible and the ground will be subject to frost heaving during cold weather.

The driveway at the entrance to the garage must be backfilled with non-frost-susceptible granular material, with a frost taper at a slope flatter than 1 vertical:1 horizontal. In areas where frost susceptible material is present beneath the garage floor slab, the subgrade should be insulated with 50-mm Styrofoam, or its thermal equivalent.

6.5 Underground Services

The underground services should be founded on sound native soil or properly compacted inorganic earth fill. Where incompetent or 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.

A soil cover of at least two times 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.

6.6 Backfilling in Trenches and Excavated Areas

The backfill in service trenches should be compacted to at least 98% SPDD, particularly 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.

Selected on site inorganic soils are suitable for use as trench backfill. Wet soils will require aeration prior to its use as structural backfill.

In normal construction practice, the problem areas of pavement settlement largely occur adjacent to manholes, 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.

One must be aware of the possible consequences during trench backfilling and exercise caution as described below:

- To backfill a trench, one must be aware that future settlement is to be expected, unless the sides is flattened to 2 Horizontal (H):1 vertical (V), and the lifts of the fill and its moisture content are stringently controlled; i.e., lifts should be no more than 20 cm (or less if the backfilling conditions dictate) and uniformly compacted to achieve at least 98% SPDD, with the moisture content on the wet side of the optimum.
- It is often difficult to achieve uniform compaction of the backfill in the lower vertical section of a trench which is an open cut or is stabilized by a trench box, particularly in the sector close to the trench walls or the sides of the box. These sectors must be backfilled with sand and the compaction must be carried out diligently prior to the placement of the backfill above this sector, i.e., in the upper sloped trench section. This measure is necessary in order to prevent consolidation of inadvertent voids and loose backfill which will compromise the compaction of the backfill in the upper section.
- In areas where groundwater movement is expected in the pipe bedding or trench backfill mantle, anti-seepage collars (OPSS 802.095) should be provided.
- When construction is carried out in freezing weather, frozen soil layers may inadvertently be mixed with the structural trench backfill. Should the in situ soils have a water content on the dry side of the optimum, it would be impossible to wet the soils due to the freezing condition, rendering difficulties in obtaining uniform and proper compaction. Furthermore, the freezing condition will prevent wetting of the backfill or when it is required, such as when the trench box is removed. The above will invariably cause backfill settlement in the next few years.
- In areas where the underground services construction is carried out during winter months, prolonged exposure of the trench walls will result in frost heave within the soil mantle of the walls. This may result in some settlement as the frost recedes, and repair costs will be incurred prior to final surfacing of the new pavement.

6.7 Septic System

For normal in-ground septic tile bed construction, the limitations are that the bottom of the absorption trenches, or the surface of a filter medium be located a minimum of 0.5 m above the highest groundwater level, and 0.9 m above rock or soils with a percolation time exceeding 50 min/cm. The soil in the treatment zone should possess acceptable effluent absorption properties expressed in a percolation time of between 1 min/cm and 50 min/cm.

As shown in the soil report, the predominant *in situ* soils consist of silt and sand which are relatively pervious and suitable for in-ground septic tile bed construction.

The estimated percolation time ('T') for the design of the septic tile bed is presented in Section 4.2 and 4.3 of this report. A detailed design of the septic tile bed system can be obtained from the 1997 Ontario Building Code, published by the Ontario Ministry of Municipal Affairs and Housing.

In order to enhance an efficient bed operation, the following requirements should be incorporated in the septic tile bed construction:

1. Grading of the surrounding areas should be such that it directs surface runoff away from the tile bed area.
2. The bed should be located in an unshaded area.
3. The fissured pattern of the underlying soil should not be disturbed, as this would reduce its capacity for in-ground effluent absorption.
4. In the low areas, the septic tile bed should be elevated so that surface runoff will not pond.

6.8 Pavement Design

The pavement design for local road meeting the Town of Caledon standards is presented in Table 2.

Table 2 - Pavement Design

Course	Thickness (mm)	Specifications
Asphalt Surface	40	OPSS HL3
Asphalt Binder	80	OPSS HL-8
Granular Base	150	20-mm Crusher-Run Limestone
Granular Sub-base	300	50-mm Crusher-Run Limestone

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.

The pavement subgrade will suffer a strength regression if water is allowed to saturate the mantle. The following measures should, therefore, be incorporated in the construction procedures and road design:

- The subgrade should be properly crowned and smooth-rolled to allow interim precipitation to be properly drained prior to pavement construction.
- Lot areas adjacent to the roads should be properly graded to prevent ponding of large amounts of water. Otherwise, the water will seep into the subgrade mantle and induce a regression of the subgrade strength, with costly consequences for the pavement construction.

The roadside ditches should be at least 1.5 m below the crown of the finished pavement, and the sides should be graded to 2.5H:1V or flatter for stability.

In order to prevent rainwash erosion, the sides must be sodded. The wet perimeter of the open ditches should be protected against flow erosion by using the measures given in Table 3.

Table 3 - Protection Against Flow Erosion

Drainage Flow (m/sec)	**Protective Measures Against Flow Erosion**
0.6 or less	Not Required
0.6 to 1.5	Sodded Gutter
1.5 to 2.1	Cobbled Gutter
2.1 to 4.5	30 cm Paving Stone
4.5 +	Gabion Mat on Geotextile Backing

6.9 **Stormwater Management Facility** (Borehole 6)

A stormwater management facility is proposed in the vicinity of Borehole 6. Based on the borehole findings, the subsoil consists of silt overlying sand. Due to the relatively previous nature of the sand and silt, a clay liner will be necessary if the facility is to consist of a retention pond. The liner thickness will depend on the invert of the facilities and the groundwater conditions in the vicinity. The thickness of the liner must be further assessed once the stormwater management design is available.

The side slopes of the stormwater management facility should be maintained at a stable slope not steeper than 3H to 1V above the wet perimeter, and flatter than 4H to 1V below the wet perimeter. The final slopes must be vegetated and/or sodded to prevent runoff erosion.

If an earth berm is to be constructed in the retention facility, topsoil and badly weathered soils must be removed and the subgrade must be proof-rolled. The berm should consist of inorganic clayey soils, compacted to 98% SPDD. The final surface of the berm should be graded and vegetated properly as recommended above.

The foundation of control structures should extend into the sound native soils below the frost depth or scouring depth, whichever is greater. A Maximum Allowable Soil Pressure (SLS) of 150 kPa and a Factored Ultimate Soil Bearing Pressure (ULS) of 240 kPa are recommended for the design of control structures.

6.10 **Soil Parameters**

The recommended soil parameters for the project design are given in Table 4.

Table 4 - Soil Parameters

Unit Weight and Bulk Factor	**Bulk Unit Weight γ (kN/m^3)**	**Estimated Bulk Factor**	
		Loose	**Compacted**
Silt	21.0	1.25	1.00
Sand	20.0	1.25	1.00
Lateral Earth Pressure Coefficients	**Active K_a**	**At Rest K_0**	**Passive K_p**
Silt	0.33	0.43	3.00
Sand	0.30	0.46	3.39

Table 4 - Soil Parameters (Cont'd)

Coefficients of Friction	
Between Concrete and Granular Base	0.50
Between Concrete and Sound Native Soils	0.35
Maximum Allowable Soil Pressure (SLS) For Thrust Block Design	
Engineered Fill and Sound Native Soils	75 kPa

6.11 Excavation

Excavation should be carried out in accordance with Ontario Regulation 213/91. The types of soils are classified in Table 5.

Table 5 - Classification of Soils for Excavation

Material	Type
Weathered soils, drained Sand and Silt	3
Wet Sand and Silt	4

In open excavation, the sides of excavation may suffer localized sloughing or side collapse; therefore, a stable backing slope or excavation protection will be required for stability.

Continuous groundwater is not anticipated within the depth of the investigation. Any excavation extending into the wet sand and silt, if any, will require extensive dewatering from closely spaced sump wells or well points.

Prospective contractors may be asked to assess the subsurface conditions by digging test pits to the intended depth of trench excavation. These test pits should be allowed to remain open for a few hours to assess the trenching conditions and the dewatering scheme for excavation.

7.0 LIMITATIONS OF REPORT

This report was prepared by Soil Engineers Ltd. for the account of Carringwood Homes and for review by the designated consultants, contractors, financial institutions, and government agencies. 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.

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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

Dynamic Cone Penetration Resistance:

A continuous profile showing the number of blows for each foot of penetration of a 2-inch diameter, 90° point cone driven by a 140-pound hammer falling 30 inches.

Plotted as '—•—'

Standard Penetration Resistance or 'N' Value:

The number of blows of a 140-pound hammer falling 30 inches required to advance a 2-inch O.D. drive open sampler one foot into undisturbed soil.

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:

'N' (blows/ft)	Relative Density
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

Cohesive Soils:

Undrained Shear Strength (ksf)	'N' (blows/ft)	Consistency
less than 0.25	0 to 2	very soft
0.25 to 0.50	2 to 4	soft
0.50 to 1.0	4 to 8	firm
1.0 to 2.0	8 to 16	stiff
2.0 to 4.0	16 to 32	very stiff
over 4.0	over 32	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

□ Compression test in laboratory

For a saturated cohesive soil, the undrained shear strength is taken as one half of the undrained compressive strength

METRIC CONVERSION FACTORS

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

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JOB NO.: 2202-S079

LOG OF BOREHOLE NO.: 1

FIGURE NO.: 1

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: Hunsden Sideroad, Town of Caledon (Bolton)

DRILLING DATE: March 9, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	Sample Number	Type	N-Value	Depth Scale (m)	Penetration Resistance (blows/30 cm)	Moisture Content (%)	WATER LEVEL
296.0	Ground Surface							
0.0	**15 cm TOPSOIL**				0			
	Brown, loose **SAND** fine grained, some silt, weathered	1	DO	9		○	6	
		2	DO	8	1	○	15	
294.6 / 1.4	Brown, compact to dense **SAND** well-graded, gravelly some silt to silty occ. silt layers	3	DO	15		○	10	
		4	DO	12	2	○	9	
		5	DO	18	3	○	16	
		6	DO	33	4–5	○	9	Dry on completion
		7	DO	34	6	○	6	
288.9 / 7.1	Brown, dense **SILT** some sand to sandy, a trace of fine gravel occ. sand seams; water seepage at 9.1 m	8	DO	48	7–8	○	12	
		9	DO	37	9	○	15	
286.4 / 9.6	**END OF BOREHOLE**				10			

Legend: ● Dynamic Cone (blows/30 cm) 10 30 50 70 90; × Shear Strength (kN/m²) 50 100 150 200; ○ Penetration Resistance (blows/30 cm) 10 30 50 70 90; Atterberg Limits PL — LL; ● Moisture Content (%) 10 20 30 40

Installed 51 mm Ø monitoring well to 9.1 m
completed with 3.0 m screen
Sand backfill from 5.5 to 9.1 m
Bentonite seal from 0.0 m to 5.5 m
Provided with a monument steel casing.

Soil Engineers Ltd.

JOB NO.: 2202-S079

LOG OF BOREHOLE NO.: 2

FIGURE NO.: 2

PROJECT DESCRIPTION: Proposed Residential Development

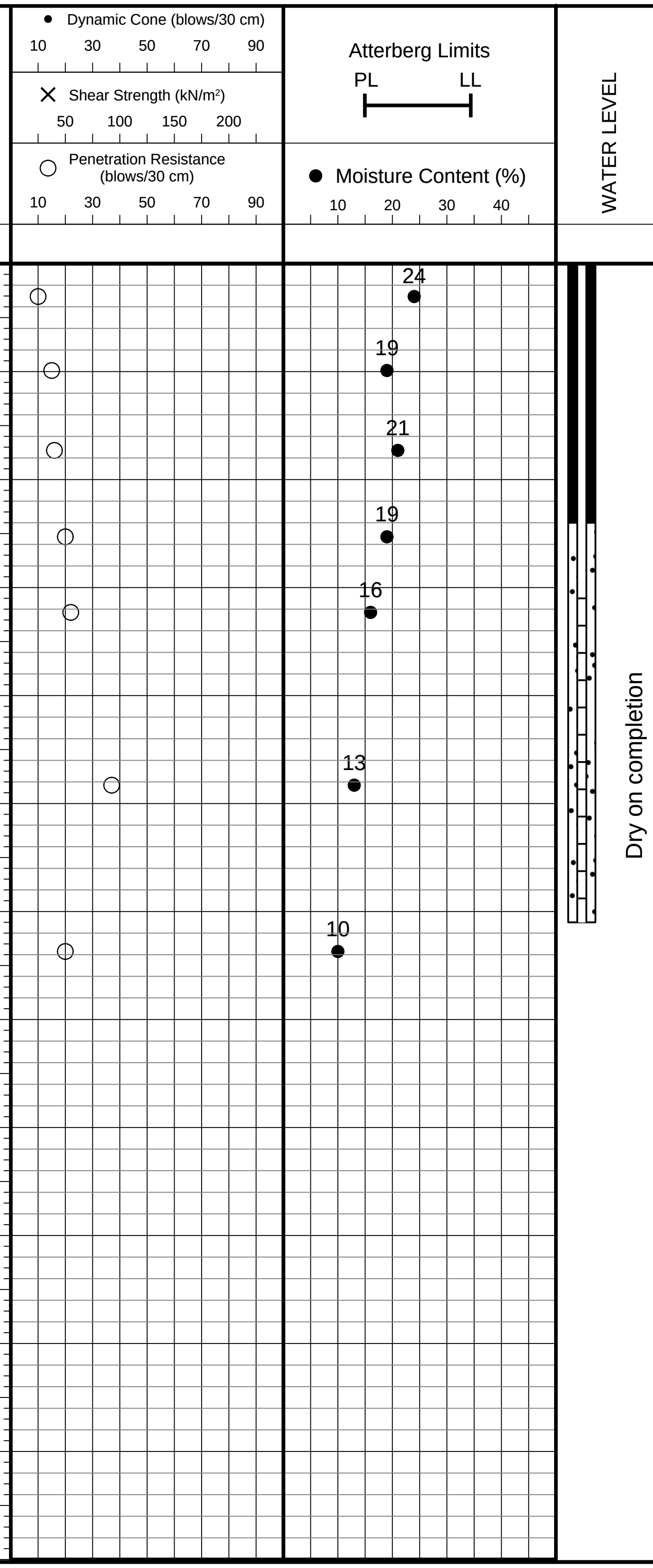
METHOD OF BORING: Flight-Auger

PROJECT LOCATION: Hunsden Sideroad, Town of Caledon (Bolton)

DRILLING DATE: March 10, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
295.9	Ground Surface				
0.0	**18 cm TOPSOIL**				0
	Brown, compact to dense	1	DO	10	
	weathered	2	DO	15	1
		3	DO	16	2
	SILT	4	DO	20	
		5	DO	22	3
	some sand to sandy				4
		6	DO	37	5
					6
289.3		7	DO	20	
6.6	**END OF BOREHOLE**				7

Installed 51 mm Ø monitoring well to 6.1 m
completed with 3.0 m screen
Sand backfill from 2.4 to 6.1 m
Bentonite seal from 0.0 m to 2.4 m
Provided with a monument steel casing.



Soil Engineers Ltd.

LOG OF BOREHOLE NO.: 3

JOB NO.: 2202-S079 **FIGURE NO.:** 3

PROJECT DESCRIPTION: Proposed Residential Development **METHOD OF BORING:** Flight-Auger

PROJECT LOCATION: Hunsden Sideroad, Town of Caledon (Bolton) **DRILLING DATE:** March 9, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	Sample Number	Type	N-Value	Depth Scale (m)	Penetration Resistance (blows/30 cm)	Moisture Content (%)	WATER LEVEL
298.2	Ground Surface							
0.0	**23 cm TOPSOIL**				0			
	Brown, loose to very dense	1	DO	14		○	25	
	weathered	2	DO	6	1	○	10	
		3	DO	18	2	○	19	
	SILT	4	DO	22		○	16	
		5	DO	48	3	○	19	
	some sand to sandy, a trace of fine gravel below 7.6 m	6	DO	18	4, 5	○	14	Dry on completion
		7	DO	41	6	○	11	
290.1 / 8.1		8	DO	64	7, 8	○	17	
	END OF BOREHOLE				9–12			

Legend: ● Dynamic Cone (blows/30 cm) 10 30 50 70 90; × Shear Strength (kN/m²) 50 100 150 200; ○ Penetration Resistance (blows/30 cm) 10 30 50 70 90; Atterberg Limits PL LL; ● Moisture Content (%) 10 20 30 40

Installed 51 mm Ø monitoring well to 7.6 m
completed with 3.0 m screen
Sand backfill from 4.0 to 7.6 m
Bentonite seal from 0.0 m to 4.0 m
Provided with a monument steel casing.

Soil Engineers Ltd.

JOB NO.: 2202-S079

LOG OF BOREHOLE NO.: 4

FIGURE NO.: 4

PROJECT DESCRIPTION: Proposed Residential Development

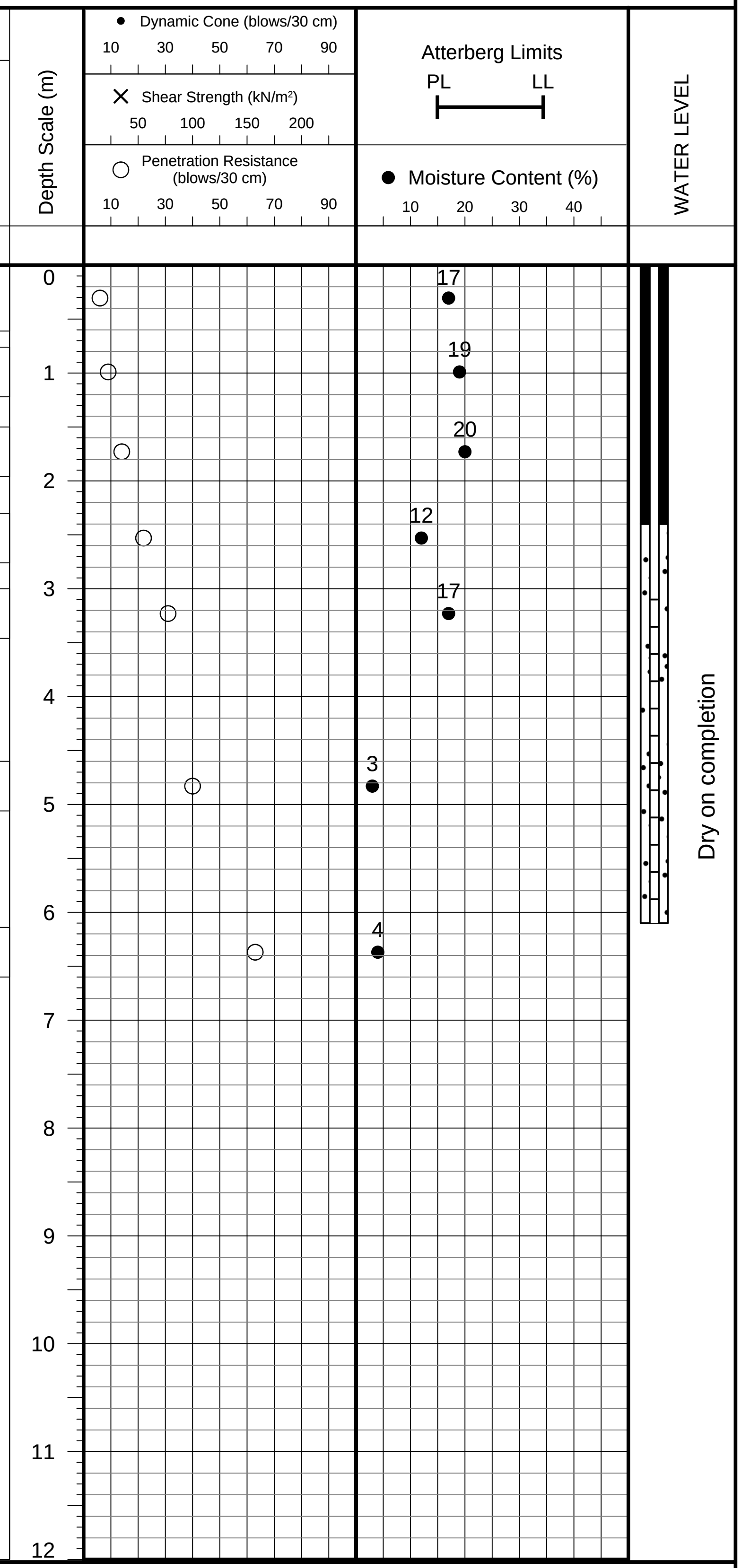
METHOD OF BORING: Flight-Auger

PROJECT LOCATION: Hunsden Sideroad, Town of Caledon (Bolton)

DRILLING DATE: March 10, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	Sample Number	Type	N-Value	Moisture Content (%)
293.2 / 0.0	Ground Surface **30 cm TOPSOIL**				
	Brown, loose to very dense **SILT**, some sand to sandy, weathered	1	DO	6	17
		2	DO	9	19
		3	DO	14	20
		4	DO	22	12
		5	DO	31	17
289.2 / 4.0	Brown, dense to very dense **SAND**, fine grained, some silt	6	DO	40	3
		7	DO	63	4
286.6 / 6.6	**END OF BOREHOLE**				

Installed 51 mm Ø monitoring well to 6.1 m completed with 3.0 m screen
Sand backfill from 2.4 to 6.1 m
Bentonite seal from 0.0 m to 2.4 m
Provided with a monument steel casing.



Soil Engineers Ltd.

JOB NO.: 2202-S079

LOG OF BOREHOLE NO.: 5

FIGURE NO.: 5

PROJECT DESCRIPTION: Proposed Residential Development

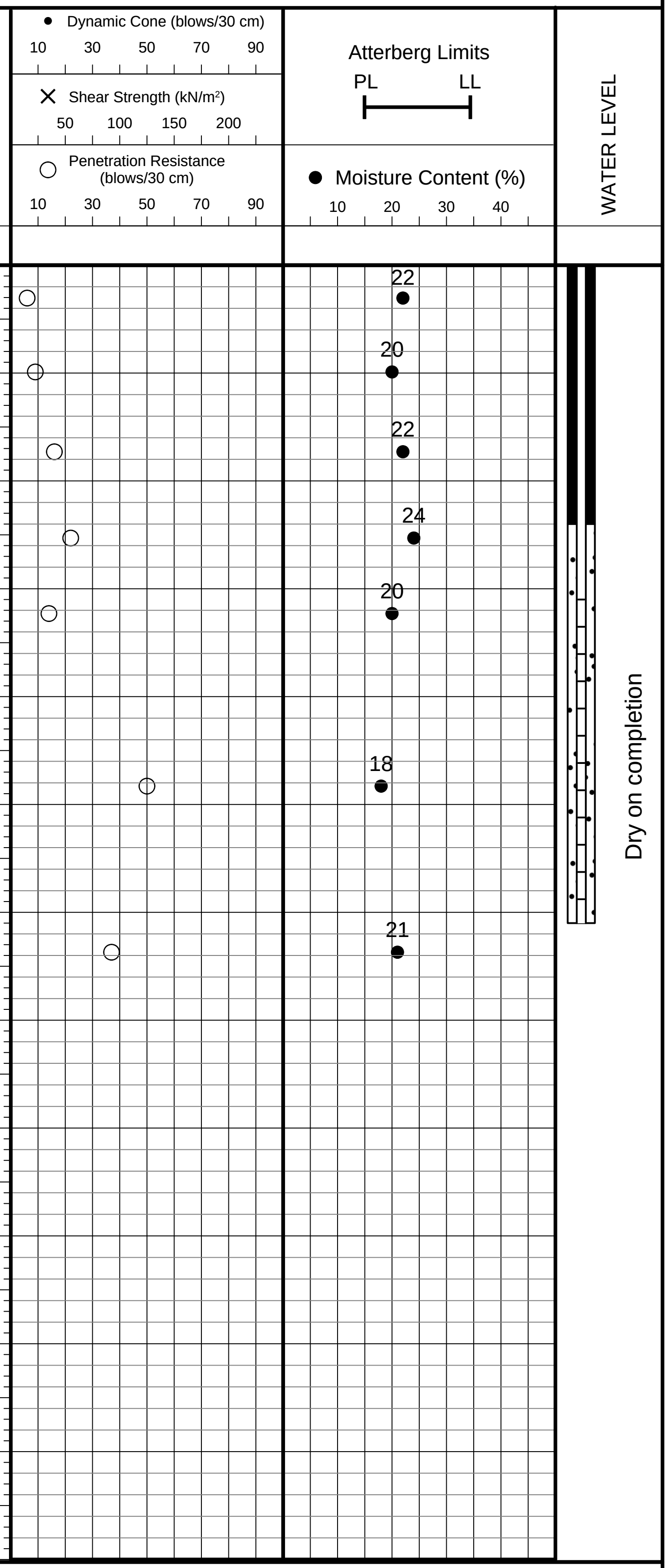
METHOD OF BORING: Flight-Auger

PROJECT LOCATION: Hunsden Sideroad, Town of Caledon (Bolton)

DRILLING DATE: March 10, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Moisture Content (%)
301.5	Ground Surface					
0.0	**23 cm TOPSOIL**				0	
	Brown, loose to very dense	1	DO	6		22
	weathered	2	DO	9	1	20
		3	DO	16	2	22
	SILT	4	DO	22		24
		5	DO	14	3	20
	some sand to sandy occ. clay layers	6	DO	50	4 / 5	18
	seepages below 1.4 m					
294.9		7	DO	37	6	21
6.6	**END OF BOREHOLE**					

Installed 51 mm Ø monitoring well to 6.1 m
completed with 3.0 m screen
Sand backfill from 2.4 to 6.1 m
Bentonite seal from 0.0 m to 2.4 m
Provided with a monument steel casing.



Soil Engineers Ltd.

JOB NO.: 2202-S079

LOG OF BOREHOLE NO.: 6

FIGURE NO.: 6

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: Hunsden Sideroad, Town of Caledon (Bolton)

DRILLING DATE: March 10, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Moisture Content (%)
294.4	Ground Surface					
0.0	**23 cm TOPSOIL**				0	
	Brown, loose to very dense	1	DO	5		19
	weathered	2	DO	13	1	15
		3	DO	23		13
	SILT	4	DO	21	2	19
		5	DO	46	3	20
	some sand to sandy occ. clay layers seepage at 3.0 m				4	
		6	DO	34	5	17
288.8 5.6	Brown, very dense **SAND** fine grained some silt	7	DO	76	6	1
287.8 6.6	**END OF BOREHOLE**				7	

Installed 51 mm Ø monitoring well to 6.1 m
completed with 3.0 m screen
Sand backfill from 2.4 to 6.1 m
Bentonite seal from 0.0 m to 2.4 m
Provided with a monument steel casing.

● Dynamic Cone (blows/30 cm) 10 30 50 70 90

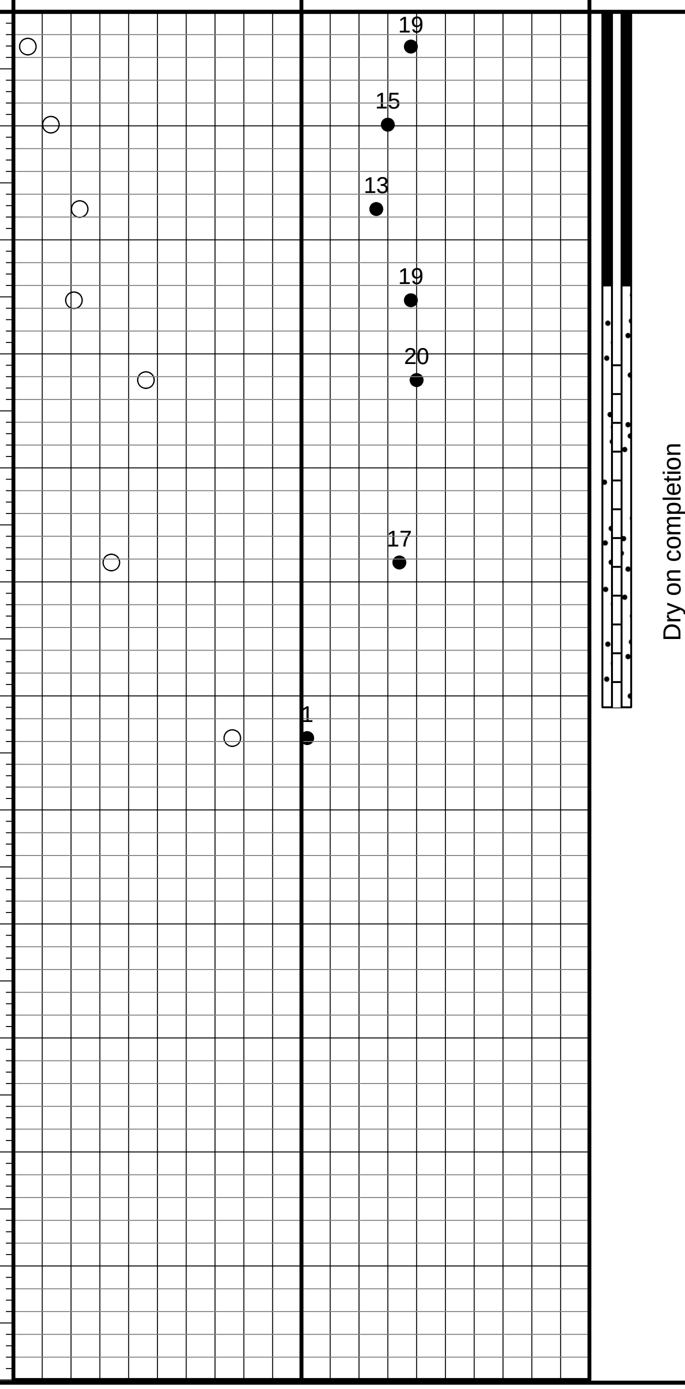
× Shear Strength (kN/m²) 50 100 150 200

○ Penetration Resistance (blows/30 cm) 10 30 50 70 90

Atterberg Limits PL LL

● Moisture Content (%) 10 20 30 40

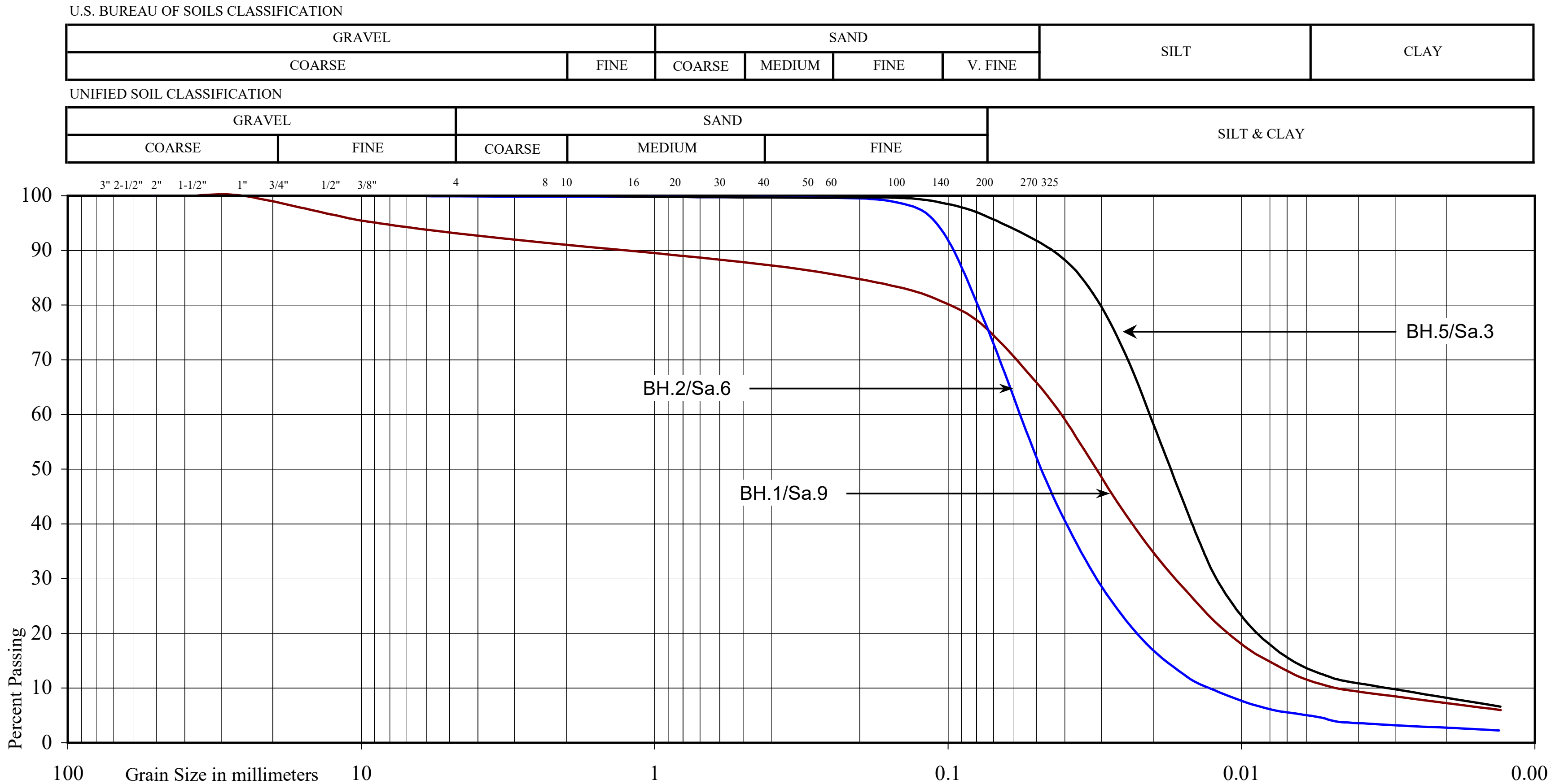
WATER LEVEL



Soil Engineers Ltd.

Soil Engineers Ltd. GRAIN SIZE DISTRIBUTION

Reference No: 0310-S142



Project: Proposed Residential Development

Location: Hunsden Sideroad, Town of Caledon (Bolton)

Borehole No:	1	2	5
Sample No:	9	6	3
Depth (m):	1.0	4.8	1.8
Elevation (m):	295.0	291.1	299.7

BH./Sa.	1/9	2/6	5/3
Liquid Limit (%) =	-	-	-
Plastic Limit (%) =	-	-	-
Plasticity Index (%) =	-	-	-
Moisture Content (%) =	15	13	22
Estimated Permeability (cm./sec.) =	10^{-5}	10^{-4}	10^{-5}

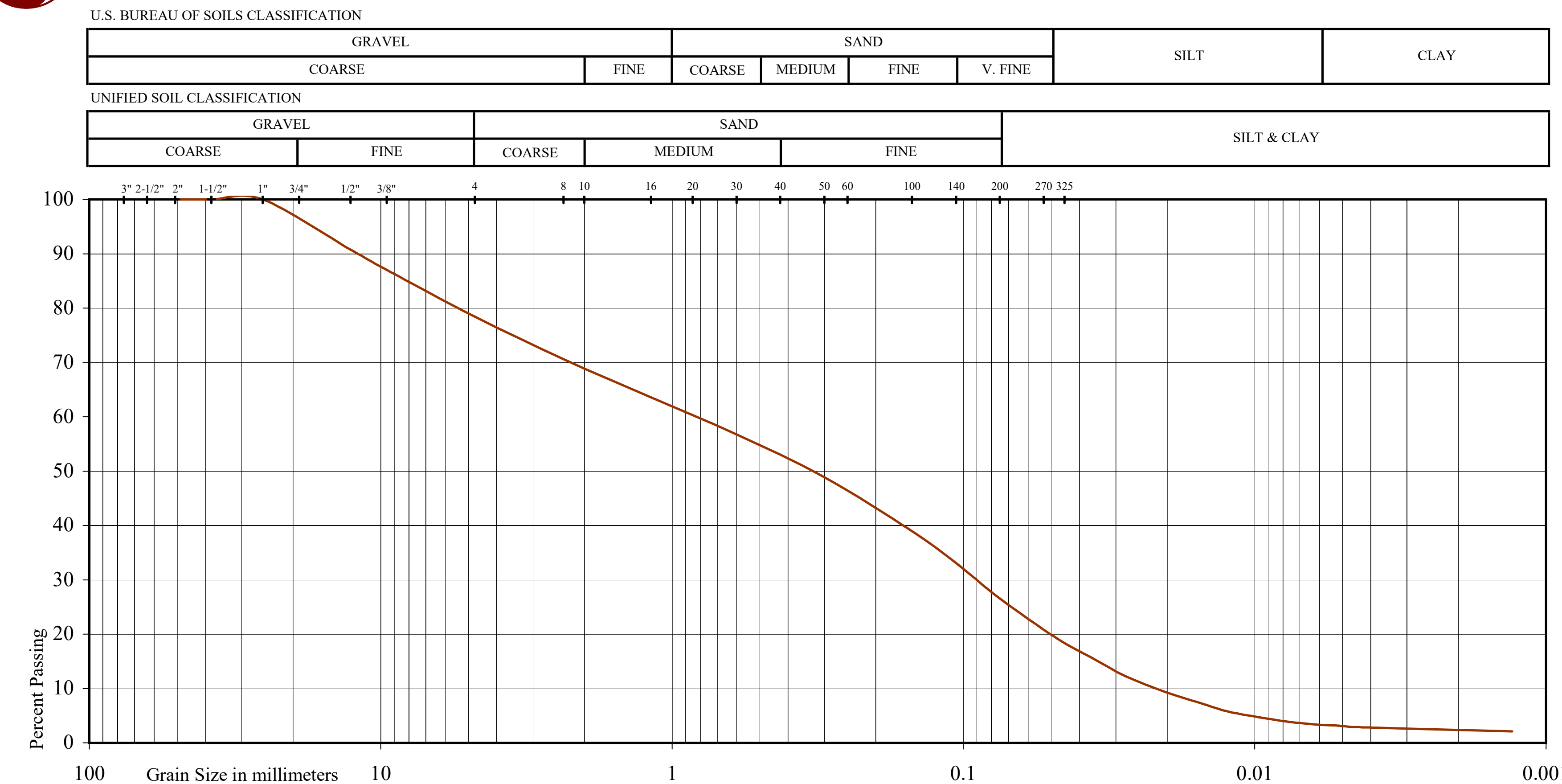
Classification of Sample [& Group Symbol]: SILT
some sand to sandy, a trace of fine gravel

Figure: 7

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2202-S079



Project: Proposed Residential Development

Location: Hunsden Sideroad, Town of Caledon (Bolton)

Borehole No: 1	Liquid Limit (%) = -
Sample No: 5	Plastic Limit (%) = -
Depth (m): 3.2	Plasticity Index (%) = -
Elevation (m): 292.8	Moisture Content (%) = 16
	Estimated Permeability (cm./sec.) = 10^{-4}

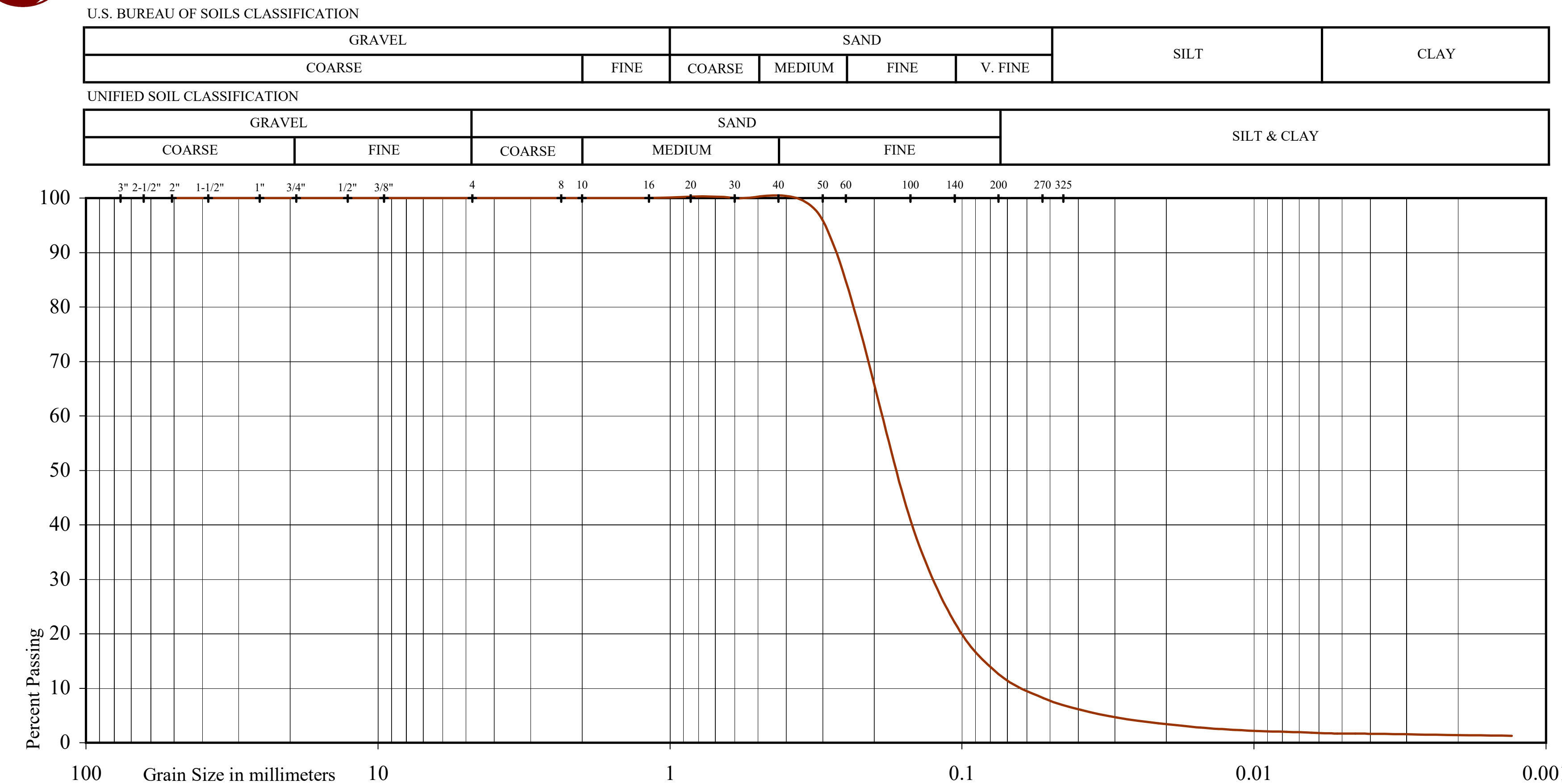
Classification of Sample [& Group Symbol]: SAND
well-graded, gravelly, some silt to silty

Figure: 8

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2202-S079



Project: Proposed Residential Development

Location: Hunsden Sideroad, Town of Caledon (Bolton)

Borehole No: 4

Sample No: 6

Depth (m): 4.8

Elevation (m): 288.4

Liquid Limit (%) = -

Plastic Limit (%) = -

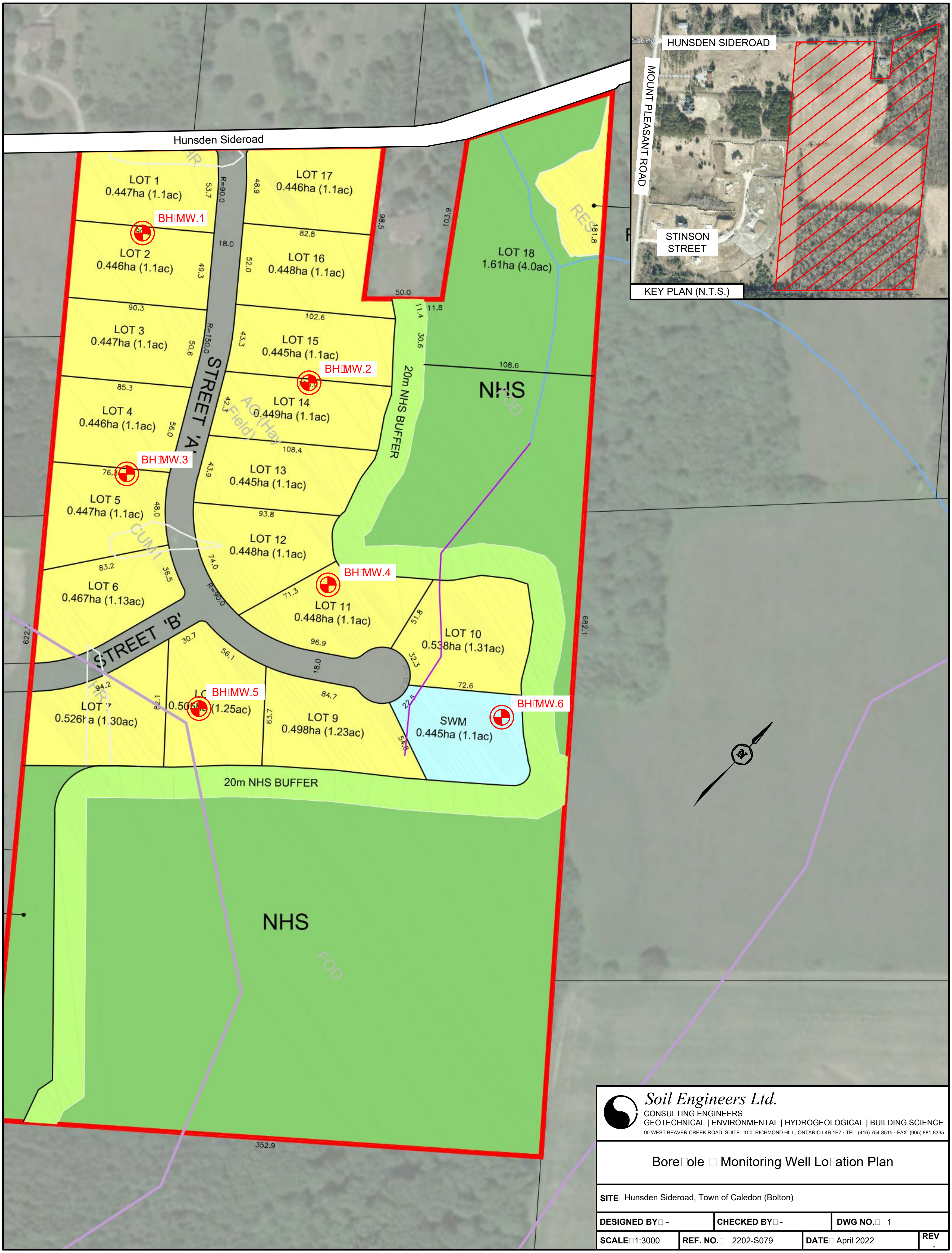
Plasticity Index (%) = -

Moisture Content (%) = 3

Estimated Permeability (cm./sec.) = 10^{-2}

Classification of Sample [& Group Symbol]: SAND
fine-grained, some silt

Figure: 9



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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 / Monitoring Well Location Plan

SITE: Hunsden Sideroad, Town of Caledon (Bolton)

DESIGNED BY: -	CHECKED BY: -	DWG NO.: 1	
SCALE: 1:3000	REF. NO.: 2202-S079	DATE: April 2022	REV -

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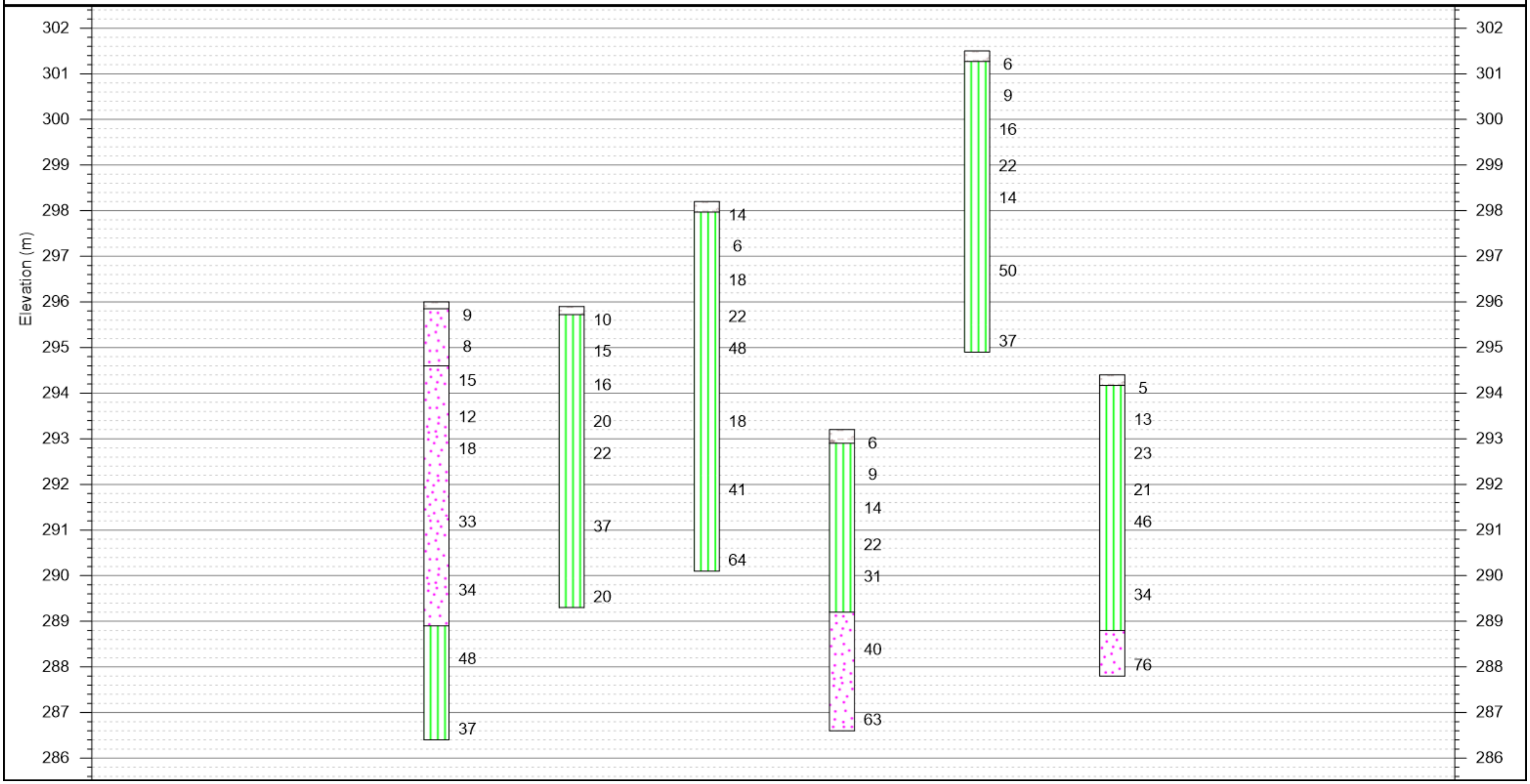
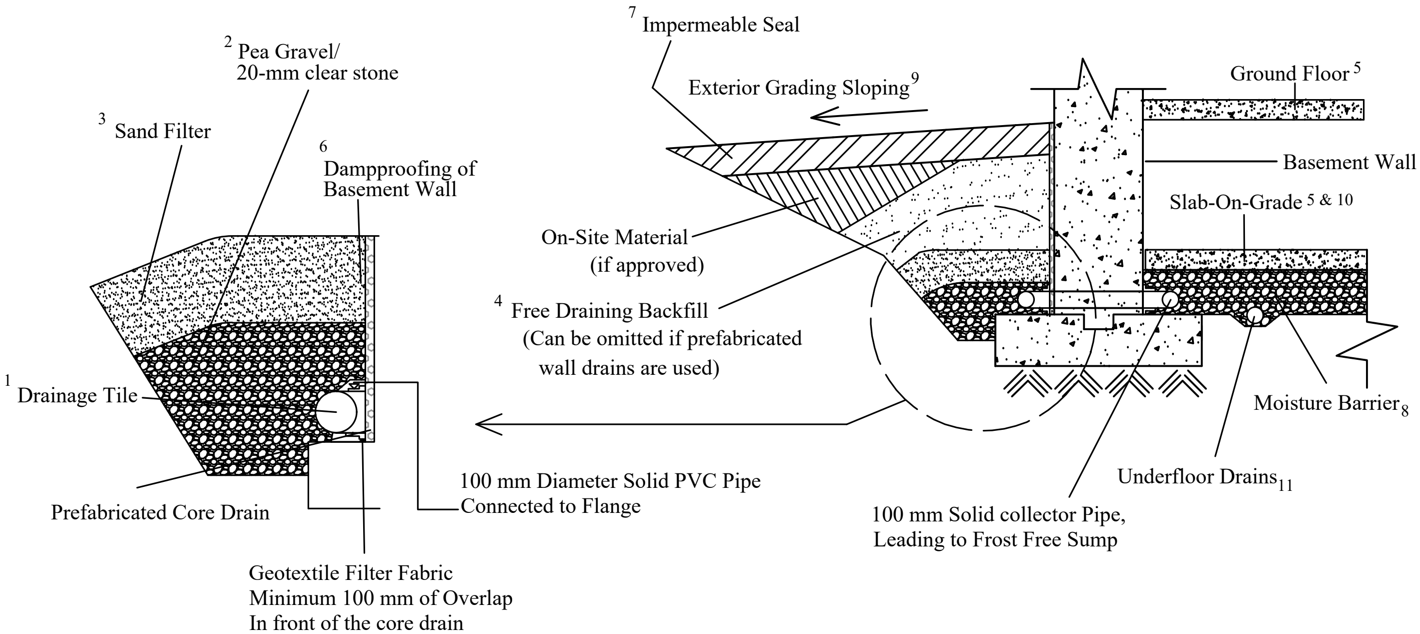
SUBSURFACE PROFILE
DRAWING NO. 2
SCALE: AS SHOWN

JOB NO.: 2202-S079
REPORT DATE: April 2022
PROJECT DESCRIPTION: Proposed Residential Development
PROJECT LOCATION: Hunsden Sideroad, Town of Caledon (Bolton)

LEGEND
TOPSOIL SAND SILT

BH No.:	1	2	3	4	5	6
El. (m):	296	295.9	298.2	293.2	301.5	294.4





NOTES:

1. **Drainage tile**: consists of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet. Invert to be at minimum of 150 mm (6") below underside of basement floor slab.

2. **Pea gravel**: at 150 mm (6") on the top and sides of drain. If drain is not placed on concrete footing, provide 100 mm (4") of pea gravel below drain. The pea gravel may be replaced by 19 mm clear stone provided that the drain is covered by a porous geotextile membrane of Terrafix 270R or equivalent.

3. **Filter material**: consists of C.S.A. fine concrete aggregate. A minimum of 300 mm (12") on the top and sides of gravel. This may be replaced by an approved porous geotextile membrane of Terrafix 270R or equivalent.

4. **Free-draining backfill**: OPSS Granular 'B' or equivalent, compacted to 95% to 98% (maximum) Standard Proctor dry density. Do not compact closer than 1.8 m (6') from wall with heavy equipment. This may be replaced by on-site material if prefabricated wall drains (Miradrain) extending from the finished grade to the bottom of the basement wall are used.

5. **Do not backfill** until the wall is supported by the basement floor slab and ground floor framing, or adquate bracing.

6. **Dampproofing** of the basement wall is required before backfilling

7. **Impermeable backfill seal** of compacted clay, clayey silt or equivalent. If the original soil in the vicinity is a free-draining sand, the seal may be omitted.

8. **Moisture barrier**: 19-mm clear stone or compacted OPSS Granular 'A', or equivalent. The thickness of this layer should be 150 mm (6") minimum.

9. **Exterior Grade**: slope away from basement wall on all the sides of the building.

10. **Slab-On-Grade** should not be structurally connected to walls or foundations.

11. **Underfloor drains*** should be placed in parallel rows at 6 to 8 m (20'-25') centre, on 100 mm (4") of pea gravel with 150 mm (6") of pea gravel on top and sides. The invert should be at least 300 mm (12") below the underside of the floor slab. The drains should be connected to positive sumps or outlets. Do not connect the underfloor drains to the perimeter drains.

* Underfloor drains can be deleted where not required.

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Details of Perimeter Drainage System

SITE Hunsden Sideroad, Town of Caledon (Bolton)

DESIGNED BY K.L.	**CHECKED BY** B.S.	**DWG NO.** 3	
SCALE N.T.S.	**REF. NO.** 2202-S079	**DATE** April 2022	**REV** -

FUNCTIONAL SERVICING REPORT

Including:
Landform Conservation Plan (Section 2)
Soil and Drainage Map (Section 3)
Slope Map (Section 2 & 4)
Stormwater Management and Grading Plans (Sections 4 & 5)

Flato Developments Inc.
Residential Subdivision
Mount Pleasant Road

Town of Caledon

Regional Municipality of Peel

Prepared for

Flato Developments Inc.

Project #: 13-399

January 2017

Urbantech Consulting, A Division of Leighton-Zec Ltd.
25 Royal Crest Court, Suite 201 Markham, Ontario L3R 9X4
TEL: 905.946.9461 FAX: 905.946.9595
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subside over 24 hours prior to the following peak; therefore there is no "overlapping" of peaks.

Although control of the Regulatory storm is not required by NVCA or the Town, the Timmins storm distribution was simulated (Regional event).

As requested by the agencies, a back-to-back 100-year event was generated using both the Chicago and SCS distributions with consecutive rainfall information (i.e. no gap between the events). It is noted that the back-to-back 100-year event is very conservative, as it has a low frequency of occurrence and typical facilities / infrastructure are not required to accommodate a back-to-back event. The Town and NVCA criteria only require control of the 2-year to 100-year storm with respect to quantity control. Therefore, this storm is not intended for use as a design storm, but for analysis only.

Detailed model parameters for the existing and proposed simulations are included in **Appendix B**.

5.2 EXISTING DRAINAGE

The subject site is located within the Nottawasaga Watershed (Innisfill Creek Subwatershed) within Region of Peel. There is no watercourse located near the subject lands.

The site is generally defined as a rectangular shaped parcel that slopes from the south to the north. From the ridgeline, drainage is split towards the east and west. Based on existing topography, an external drainage area of 14.67ha from the southeast area drains through the east parcel of the subject site (drainage area of 6.71ha), and ultimately drains to the northeast direction. An external drainage area of 20.35ha from the southwest area drains into the west parcel of the subject site (drainage area of 6.07ha). To the north of the site, there is an external drainage area of 0.44ha that drains into the site. A portion of the adjacent Mt. Pleasant Road west of the site (approximately 0.80ha) drains eastwardly into the subject lands.

The existing drainage details are presented on **DWG. STM-1**. For modelling purposes, the site has been discretized into the drainage areas indicated in **Table 5-2**.

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Table 5-2 Existing Drainage Areas

Area ID	Outlet ID	Drainage Area [ha]
EXT1 (external to site)	Outlet 1	20.35
EXT3 (external to site)	Outlet 1	0.80
EXT4 (external to site)	Outlet 1	0.44
INT1 (internal to site)	Outlet 1	6.07
EXT2 (external to site)	Outlet 2	14.67
INT2 (internal to site)	Outlet 2	6.71
Total Area		**49.04**

At the northwest corner of the site, there is a natural depression area (kame) with a ponding depth of approximately 1.56m that receives runoff from the west external drainage area and the internal drainage from the west parcel of the site (refer to Outlet 1 on **DWG. STM-1**). There is no defined outlet for the depression, aside from the adjacent Mount Pleasant Road ROW, which would only overtop in the event that the existing ponding area overflows. No standing water was observed in this location during site visits and no records of overtopping have been recorded by Town of Caledon Works Staff.

The ponding area is assumed to drain via infiltration / evapotranspiration. For modelling purposes, a 90m long spillway weir was placed at the top of pond to represent the low-point in the ROW along the depression area. The existing depression has a capacity of approximately 5352^3.

Drainage from the east parcels of the subject site is not contained and drains as sheet flow toward the existing ditch south of Caledon Trailway Path.

Table 5-3 Stage-Storage-Discharge Relationship for Existing Depression at Outlet 1

Elevation (m)	Area (m^2)	Cumulative Volume (m^3)	Discharge (m^3/s)	
291.50	317	0	0	No discharge below elevation 293.00m
291.75	866	148	0	
292.00	1470	440	0	
292.25	3243	1029	0	
292.50	4386	1983	0	
292.75	5719	3246	0	
293.00	7165	4857	0	

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293.01	8358	4934	0.14	Discharge based on broad-crested weir equation $Q=1.5Lh^{3/2}$ with L=90m*
293.02	8358	5018	0.38	
293.03	8358	5101	0.70	
293.04	8358	5185	1.08	
293.05	8358	5268	1.51	
293.06	8358	5352	1.98	

* For modelling purposes only – no flow is released from the existing depression under the 2-year to 100-year and Timmins events.

The following table indicates the existing Chicago storm and SCS storm results for the 2-100-year events, as well as a comparison to the Innisfil Creeks watershed flow equations / linear regression parameters provided in Table 2.1 of the NVCA Development Review Guidelines (2006). It is noted that the infiltration rates on site are such that the runoff from frequent events is completely infiltrated prior to arriving at the site outlets. A conservative value for the infiltration rate of 60mm/hr was selected for the model simulation, which is considerably lower than the observed values in excess of 100mm/hr to 200mm/hr (geometric mean of 176 mm/hour).

To verify that model results were representative of the site, the Innisfil Creeks subwatershed flows from the NVCA regression analysis were calculated for each return period event. The subwatershed unit flow rates have fairly good agreement with the modelled existing conditions SCS and Chicago storm flows for the frequent return period events, however the less frequent modelled events result in higher flows that the linear regression predictions. This discrepancy is likely due to the following:

- Use of event-based modelling / defined storm distributions in the SSA model versus continuous simulation of Innisfil Creek watershed – typically, event based models arrive at higher flow estimates than continuous models

- Position within the watershed and size relative to watershed – the Innisfil Creek linear regression equation may not be accurate for all locations within the watershed, nor representative of smaller areas with shorter times to peak.

- The subject lands are relatively steep and may not be representative of "typical" / average slope parameters within the watershed.

As further verification of results, the total runoff volume results vs. total site area were computed to confirm if the fraction of runoff volume is consistent with typical ranges of runoff coefficient ('C'). It was found that the computed C values range from 0.04 to 0.10, which is close to the lowest typical values recommended by NVCA. Given the high infiltration rates characteristic of the Oak Ridges Moraine, it follows that the resulting C values are lower than typical C values.

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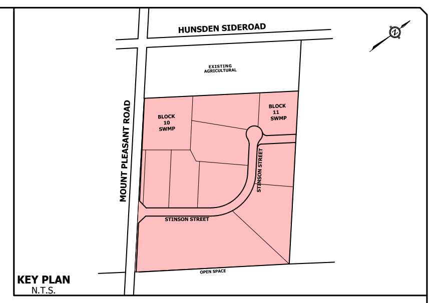
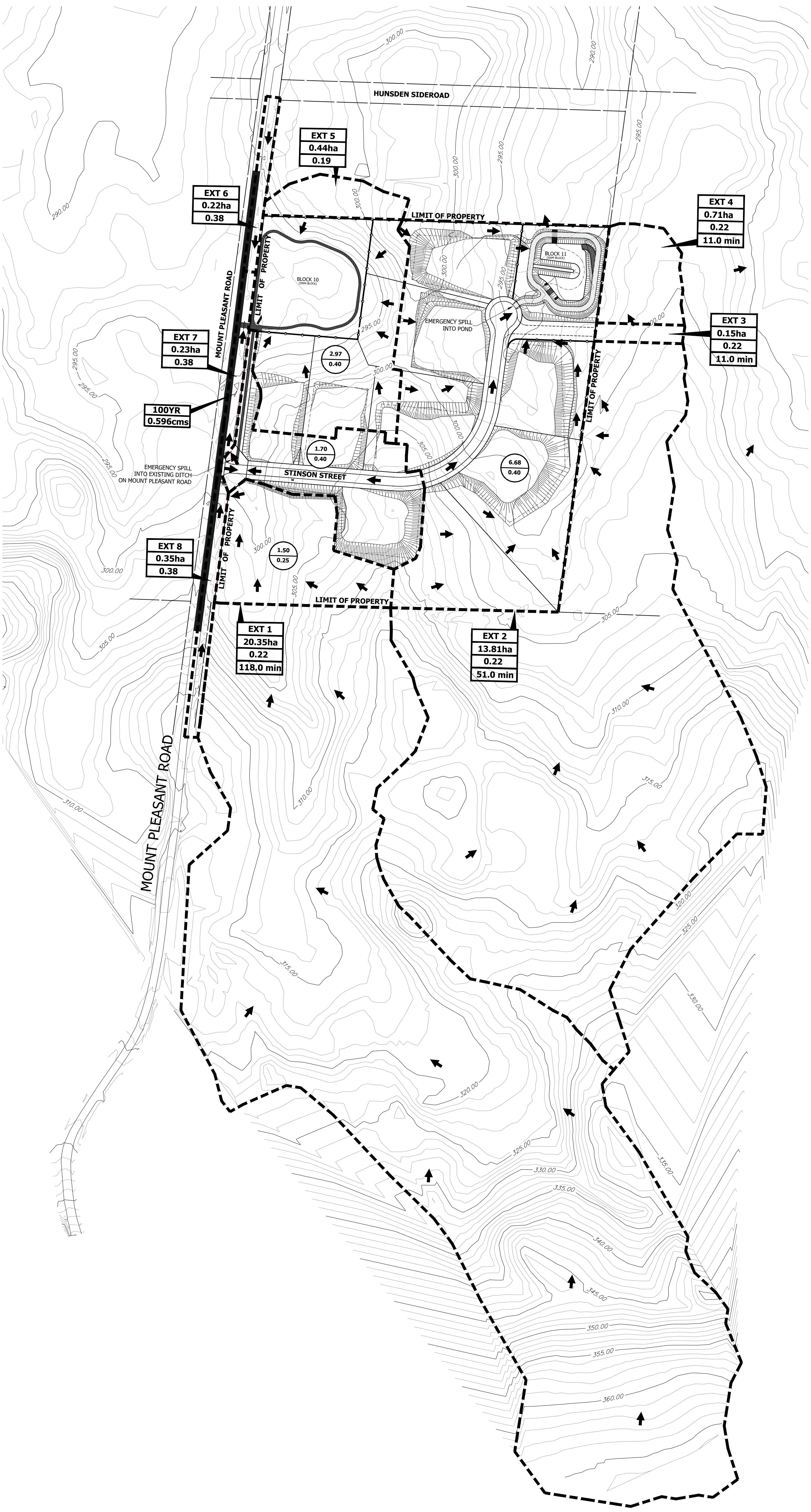


KEY PLAN
N.T.S.



LEGEND

- MAJOR SYSTEM DRAINAGE AREA BOUNDARY
- OVERLAND FLOW ROUTE

EXT. 1	EXTERNAL AREA CAPTURE ID
3.36 ha	CONTRIBUTING DRAINAGE AREA
0.38	RUNOFF COEFFICIENT

EXT 1	EXTERNAL AREA CAPTURE ID
20.35ha	CONTRIBUTING DRAINAGE AREA
0.19	RUNOFF COEFFICIENT
118.0 min	TIME OF CONCENTRATION

6.68	INTERNAL CONTRIBUTING DRAINAGE AREA
0.40	RUNOFF COEFFICIENT

100YR	100 YEAR FLOW
0.596cms	FLOW (m^3/s)

BENCHMARK
ELEVATIONS SHOWN ON THIS PLAN ARE GEODETIC AND ARE REFERRED TO M.T.O. STATION No. 00819758063 HAVING A PUBLISHED ELEVATION OF 272.961 METRES.

No.	REVISION	DATE	BY
4			
3			
2			
1			

TOWN OF CALEDON

REGISTERED PROFESSIONAL ENGINEER J.ORMONDE 100089999 MAR. 2020 PROVINCE OF ONTARIO

Town of Caledon APPROVED AS NOTED

This approval constitutes a general review and does not certify dimensional accuracy.

This approval is subject to further certification of the "as recorded" works by a Professional Engineer of the Province of Ontario.

Date: ____________

Approved By: ____________

Print Name: ____________

TOWN FILE No. 21T-90034C

PROJECT 13-399

urbantech
Urbantech Consulting, A Division of Leighton-Zec Ltd.
3760 14th Avenue, Suite 301, Markham, Ontario L3R 3T7
tel: 905.946.9461 fax: 905.946.9595
www.urbantech.com

FLATO PALGRAVE MANSIONS INC.

STORM DRAINAGE PLAN MAJOR SYSTEM

REGION FILE No. T-90034Ca

SURVEYED BY:	S.D.B. LTD.	DATE:	JULY 2017	CONTRACT NO.	
DRAWN BY:	D.Y.	CHECKED BY:	J.O.	DRAWING NO. 302	SHEET NO.
DESIGNED BY:	D.Y.	CHECKED BY:	J.O.		
SCALE:	1:2000	DATE:	NOVEMBER 2017		

File: P:\Projects\13-399\Drawings\300 - Drainage\302_STM-Major.dwg - Revised by <JORMONDE> : Thu, Jan 04 2018 - 4:45pm

APPENDIX B

Water and Sanitary Servicing Calculations

CROZIER CONSULTING ENGINEERS

Project Name: 10249 Hunsden Sideroad
Project No.: 952-6305

Created By: JF
Checked By: HL/TE

Date: 2022-06-23
Updated: 2023-11-01

Domestic Water Demand

Total Site Area:	20.37	ha	
Developable Site Area:	9.97	ha	
Number of units:	14		
Unit Population Density:	6	persons/unit	
Population	84	persons	(unit based)

Design Parameters

Average Demand (L/capita/d)
270

Water Demand:

Average Daily Demand =	22,680	L/day
	0.3	**L/s**
Peaking Factors		
Max Day =	1.8	
Peak Hour =	3.0	
Average Day =	0.3	L/s
Max Day =	**0.5**	L/s
Peak Hour =	**0.8**	L/s

Municipality	Average Daily Water Demand (L/s)	Max Day Demand (L/s)	Peak Hourly Demand (L/s)
Region of Peel	0.3	0.5	0.8

Notes & References

Site areas and unit numbers obtained from Draft Plan of Subdivision prepared by Mackitecture dated October 26, 2023

Population Density per unit assumed based on size of houses and past jobs of similar subdivision design.
Note: this assumption is more conservative than the Single Detached Population density (4.2 persons/unit) shown in Table 2-2 of the Region of Peel Linear Wastewater Standards dated March 29, 2023.

Region of Peel 2020 Water Master Plan, Section 2.2 - Design Criteria – Demands Projections

Region of Peel 2020 Water Master Plan, Section 2.2 - Design Criteria – Demands Projections

*Max Day = Average Day Demand * Max Day*
*Peak Hour = Average Day Demand * Peak Hour*

Project Name: 10249 Hunsden Road
Project Number: 952-6305
Prepared by: JF
Checked by: HL/TE
Date: 2023.11.01

Fire Flow Determination Per Fire Underwriters Survey (2020)

Water Supply for Public Fire Protection - 2020
Fire Underwriters Survey
Part II - Guide for Determination of Fire Flows for Public Fire Protection in Canada

An estimate of fire flow required for a given area may be determined by the formula:

RFF = 220 * C * sqrt A

where:

RFF = the required fire flow in litres per minute (L/min)
C = the construction coefficient is related to the type of construction of the building
= 1.5 for Type V Wood Frame Construction
= 0.8 for Type IV-A Mass Timber Construction
= 0.9 for Type IV-B Mass Timber Construction
= 1.0 for Type IV-C Mass Timber Construction
= 1.5 for Type IV-D Mass Timber Construction
= 1.0 for Type III Ordinary Construction
= 0.8 for Type II Non-combustible Construction
= 0.6 for Type I Fire Resistive Construction
A = the total effective floor area (effective building area) in square metres (excluding basements at least 50 percent below grade) in the building considered

STEP A: Construction Coefficient (C) 1.5 Type V Wood Frame Construction Assumed

STEP B: Total Effective Floor Area
Proposed Building

Residential Estate Lots; Floor Area = 443 m^2; assumed two (2) above ground floors and one (1) basement below grade
Builiding on Lot 2 taken as the critical building to determine fire flow due to the building's proximity to adjacent lot structures.

	Yes/No/Unknown	
Is basement at least 50% below grade?	Yes	If yes, basement floor area excluded
Vertical openings protected?	No	*For consideration for effective area calculations

Calculate Effective Floor Area based on the highlighted cell
-C value from 1.0 to 1.5: 100% of all floor areas are used
-C value below 1 and vertical openings are not protected: Consider two largest floors plus 50% of all floor above to a max of eight
-C value below 1 and vertical openings are protected: Consider single largest floor plus 25% of the two immediately adjoining floors

*A building may be subdivided if there is a vertical firewall with a fire-resistance rating greater than 2 hours, and meets the requirements of the National Building Code.

Floors Above Grade	Total Floor Area (m^2)	% of Area Considered	Effective Floor Area (m^2)
Basement	443	0%	0.0
Ground Floor	443	100%	443.0
Level 2	443	100%	443.0
Total	**11,000**		**886.0**

Total Effective Floor Area **886** m^2

STEP C: **Therefore RFF =** **10,000** **L/min (rounded to nearest 1000 L/min)**

STEP D: Occupancy Contents Adjustment Factor

The required fire flow may be reduced by as much as -25% for occupancies having contents with very low fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard.

Occupancy and Contents Adjustment Factor	
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

*Refer to Table 3 for recommended Occupancy and Contents Charges by major occupancy examples.

Type of Occupancy	**Adjustment Factor**	
Residential Occupancy	Limited Combustible	-15%

Total Reduction % **-1,500** **L/min (reduction)**

RFF = **8,500** **L/min (not rounded)**

Note: The RFF flow 8500 L/min is used in Step E and F.

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Project Name: 10249 Hunsden Road
Project Number: 952-6305
Prepared by: JF
Checked by: HL/TE
Date: 2023.11.01

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?	No	-30%	0%
Water supply is standard for both the system and Fire Department hose lines?	No	-10%	0%
Fully supervised system?	No	-10%	0%

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

Total Reduction % **0%** **(reduction)**

Total Reduced Flow **0** **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	Lot 12 & 13	101.5	0%	0
East	Lot 3	20.8	10%	850
South	None	N/A	0%	0
West	Lot 1	17.8	15%	1275

Total Reduced Flow **2,125** **L/min Surcharge (not rounded)**

STEP G: Final Required Fire Flow

Step D - Occupancy Adjusted Fire Flow Demand	8,500	L/min
Step E - Sprinkler (Reduction)	0	L/min
Step F - Exposure Charge	2,125	L/min
Final Fire Flow:	**10,625**	**L/min**
	11,000	**L/min (rounded to nearest 1000L/min)**
or	**183**	**L/s**
or	**2,906**	**USGPM**
Required duration:	**2.25**	**hours**

Interpolated from 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

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ONSITE SEWAGE SYSTEM CALCULATION SHEET

Project Name: 10249 Hunsden Sideroad 2023-11-01
Project Number: 952-6305 **Designed By:** BP/JF
Checked By: TE/HL

Name	Area m^2	BUILDING OCCUPANCY	Establishment Per Table 8.2.1.3.A. of OBC	Unit Flow (L/day)	Number of Units	Total Flow (L/day)
Residential Estate Dwelling	-	Dwelling	Per bedrooms (assumed 4 bedroom)	2000	1	2,000
				Total Daily Sewage Design Flow:		**2,000**

Soils Information
Based on Geotechnical Investigation prepared by Soil Engineers Ltd. dated April 2022

Native Percolation time, T = 20 min/cm (4 min/cm - 20 min/cm)

Conventional System - Filter Bed

Surface Area = 26.7 m^2 (Q/75)

Base Area = 47.1 m^2 (QT/850)

Minimum Septic Tank Size

6,000 L

APPENDIX C

Stormwater Servicing Calculations

Worksheet for Storm Sewer Bypass

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00400	m/m
Diameter	0.60	m
Discharge	0.263	m³/s

Results

Normal Depth	0.362	m
Flow Area	0.18	m²
Wetted Perimeter	1.07	m
Hydraulic Radius	0.167	m
Top Width	0.59	m
Critical Depth	0.33	m
Percent Full	60.3	%
Critical Slope	0.00517	m/m
Velocity	1.48	m/s
Velocity Head	0.11	m
Specific Energy	0.47	m
Froude Number	0.86	
Maximum Discharge	0.42	m³/s
Discharge Full	0.39	m³/s
Slope Full	0.00183	m/m
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.000	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.000	m
Profile Description		
Profile Headloss	0.00	m
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	60.32	%
Downstream Velocity	Infinity	m/s

Worksheet for Storm Sewer Bypass

GVF Output Data

Upstream Velocity	Infinity	m/s
Normal Depth	0.362	m
Critical Depth	0.33	m
Channel Slope	0.00400	m/m
Critical Slope	0.00517	m/m

CROZIER CONSULTING ENGINEERS

Project Name: 10249 Hunsden Sideroad
Project Number: 0952-6305
Created By: JF/HL
Reviewed By: TE

D.A. NAME Portion of Catchment 201 & External Area
D.A. AREA 4.08

Hydrologic Parameters: CALIB NASHYD Command
Post Development Drainage Area: Portion of Catchment 201 & External Area
Modelled in VO for Storm Sewer Bypass Sizing

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Sandy Silt	B	B	100	4.08
				0
				0
				0
Total Area				4.08

Impervious Landuses Present:												
	Roadway		Sidewalk		Driveway		House		SWMF		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B											0.00	0.00
Subtotal												

Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B	4.08	55									4.08	224.27
Subtotal	4.08											

Composite Area Calculations	Total Pervious Area	4.08
	Total Impervious Area	0.00
	% Impervious	0.00%
	Composite Curve Number	55.0
	Total Area Check	4.08

Initial Abstraction and Tp Calculations

Initial Abstraction				Composite Runoff Coefficient								
				Sandy Silt		0		0		0		
Landuse	IA (mm)	Area (ha)	A * IA	RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	4.08	40.78	0.21	4.08		0		0		0	0.86
Meadow	8	0	0		0		0		0		0	0
Wetland	16	0	0		0		0		0		0	0
Lawn	5	0.00	0.00	0.12	0.00		0		0		0	0.00
Cultivated	7	0	0		0		0		0		0	0
Impervious	2	0.00	0.00	0.90	0.00		0		0		0	0.00
Composite		4.0777	10.00	Composite Runoff Coefficient								0.21

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
Overland	259.0	19.73	7.62%	2.3	0.63	0.11	0.08	0.08	0.14	0.10	0.40	0.27

Appropriate calculated time to peak:	0.27	Appropriate Method:	Airport

```
*************************************************************
** SIMULATION:6 - 100yr 4hr 10min Chicago (Caledon IDF) **
*************************************************************
--------------------
| CALIB             |
| NASHYD   (  0206)|   Area     (ha)=   4.08   Curve Number   (CN)= 56.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.27

         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     2.89 | 1.083    62.12 | 2.083    12.48 |  3.08     3.91
                  0.167     2.89 | 1.167    62.12 | 2.167    12.48 |  3.17     3.91
                  0.250     3.67 | 1.250   196.54 | 2.250     9.60 |  3.25     3.44
                  0.333     3.67 | 1.333   196.54 | 2.333     9.60 |  3.33     3.44
                  0.417     4.88 | 1.417    83.09 | 2.417     7.66 |  3.42     3.05
                  0.500     4.88 | 1.500    83.09 | 2.500     7.66 |  3.50     3.05
                  0.583     6.96 | 1.583    41.25 | 2.583     6.29 |  3.58     2.73
                  0.667     6.96 | 1.667    41.25 | 2.667     6.29 |  3.67     2.73
                  0.750    11.02 | 1.750    25.07 | 2.750     5.28 |  3.75     2.47
                  0.833    11.02 | 1.833    25.07 | 2.833     5.28 |  3.83     2.47
                  0.917    21.03 | 1.917    17.06 | 2.917     4.51 |  3.92     2.24
                  1.000    21.03 | 2.000    17.06 | 3.000     4.51 |  4.00     2.24

     Unit Hyd Qpeak  (cms)=   0.577

     PEAK FLOW       (cms)=   0.263 (i)
     TIME TO PEAK    (hrs)=   1.667
     RUNOFF VOLUME    (mm)=  22.815
     TOTAL RAINFALL   (mm)=  89.870
     RUNOFF COEFFICIENT   =   0.254

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

-------------------------------------------------------------------------------
```

Portion of Catchment 201 & External Area is represented by 206




LOW IMPACT DEVELOPMENT STORMWATER MANAGEMENT PLANNING AND DESIGN GUIDE

Version 1.0

2010

CVC
CREDIT VALLEY CONSERVATION

TORONTO AND REGION Conservation
for The Living City

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APPENDIX C – SITE EVALUATION AND SOIL TESTING PROTOCOL FOR STORMWATER INFILTRATION

For the purpose of designing the infiltration BMP, hydraulic conductivity values (typically in centimetres per second) generated from permeameter or infiltrometer tests must be converted into infiltration rates (typically in millimetres per hour). **It is critical to note that hydraulic conductivity and infiltration rate are two different concepts and that conversion from one parameter to another cannot be done through unit conversion**. Particularly for fine grained soils, there is no consistent relationship due to the many factors involved. Table C1 and Figure C1 describes approximate relationships between hydraulic conductivity, percolation time and infiltration rate. Measured hydraulic conductivity values can be converted to infiltration rates using the approximate relationship described in Figure C1.

Table C1: Approximate relationships between hydraulic conductivity, percolation time and infiltration rate

Hydraulic Conductivity, K_{fs} (centimetres/second)	Percolation Time, T (minutes/centimetre)	Infiltration Rate, 1/T (millimetres/hour)
0.1	2	300
0.01	4	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12

Source: Ontario Ministry of Municipal Affairs and Housing (OMMAH). 1997. Supplementary Guidelines to the Ontario Building Code 1997. SG-6 Percolation Time and Soil Descriptions. Toronto, Ontario.

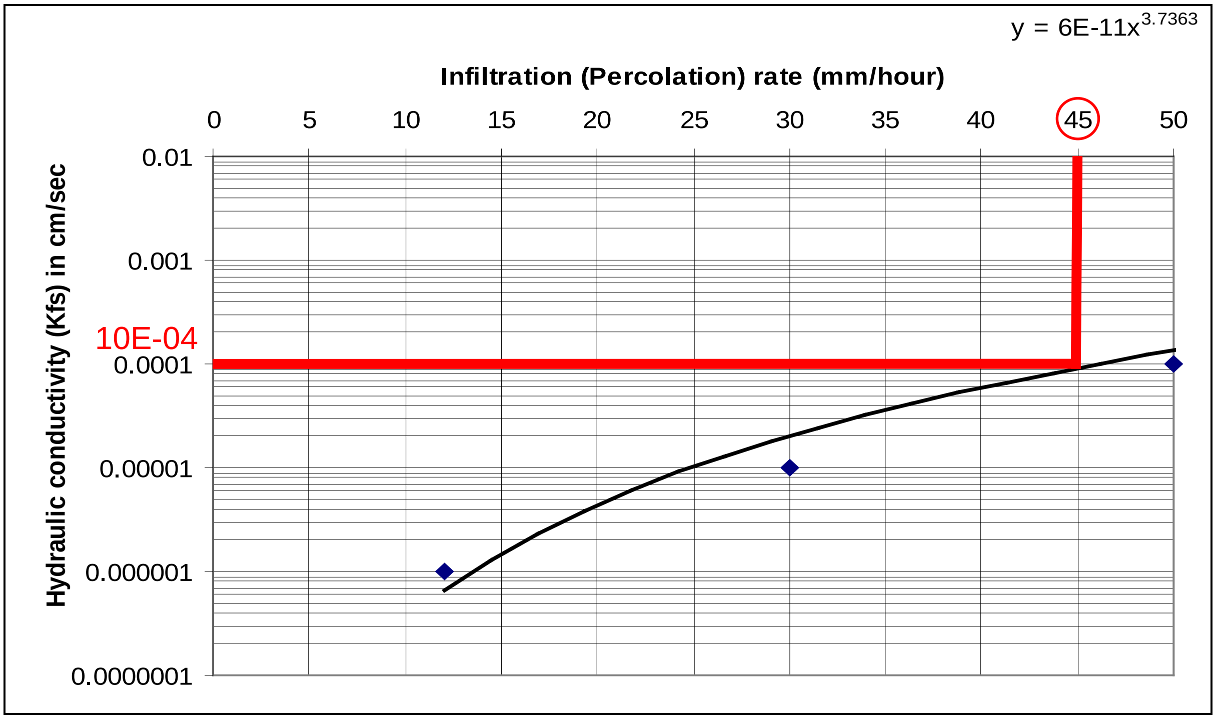
Following testing, the test pits should be refilled with the original soil and the surface replaced with the original topsoil.

The results and locations of all test pits, soil borings and infiltration tests should be included in documents submitted to commenting and approval agencies in support of the development proposal.

C2.4 Step 4. Design Considerations

The infiltration rate used to design an infiltration BMP must incorporate a safety correction factor that compensates for potential reductions in soil permeability due to compaction or smearing during construction, gradual accumulation of fine sediments over the lifespan of the BMP and uncertainty in measured values when less permeable soil horizons exist within 1.5 metres below the proposed bottom elevation of the BMP.

Figure C1: Approximate relationship between infiltration rate and hydraulic conductivity



Source: Ontario Ministry of Municipal Affairs and Housing (OMMAH). 1997. Supplementary Guidelines to the Ontario Building Code 1997. SG-6 Percolation Time and Soil Descriptions. Toronto, Ontario.

The measured infiltration rate (in millimetres per hour) at the proposed bottom elevation of the BMP must be divided by a safety correction factor selected from Table C2 to calculate the design infiltration rate. To select a safety correction factor from Table C2, calculate the ratio of the mean (geometric) measured infiltration rate at the proposed bottom elevation of the BMP to the rate in the least permeable soil horizon within 1.5 metres below the bottom of the BMP. Based on this ratio, a safety correction factor is selected from Table C2. For example, where the mean infiltration rate measured at the proposed bottom elevation of the BMP is 30 mm/h, and the mean infiltration rate measured in an underlying soil horizon within 1.5 metres of the bottom is 12 mm/h, the ratio would be 2.5, the safety correction factor would be 3.5, and the design infiltration rate would be 8.6 mm/h. Where the soil horizon is continuous within 1.5 metres below the proposed bottom of the BMP, the mean infiltration rate measured at the bottom elevation of the BMP should be divided by a safety correction factor of 2.5 to calculate the design infiltration rate.

Table C2: Safety correction factors for calculating design infiltration rates

Ratio of Mean Measured Infiltration Rates[1]	Safety Correction Factor[2]
≤ 1	2.5
1.1 to 4.0	3.5
4.1 to 8.0	4.5
8.1 to 16.0	6.5
16.1 or greater	8.5

Source: Wisconsin Department of Natural Resources. 2004. Conservation Practice Standards. Site Evaluation for Stormwater Infiltration (1002). Madison, WI.

Notes:

1. Ratio is determined by dividing the geometric mean measured infiltration rate at the proposed bottom elevation of the BMP by the geometric mean measured infiltration rate of the least permeable soil horizon within 1.5 metres below the proposed bottom elevation of the BMP.
2. The design infiltration rate is calculated by dividing the geometric mean measured infiltration rate at the proposed bottom elevation of the BMP by the safety correction factor.

The design infiltration rate should be used to determine the maximum depth of the water storage component of the BMP, based on the desired drawdown period (typically 48 hours to fully drain the BMP; see Chapter 4 for guidance regarding the design of specific infiltration BMP types). Based on the calculated design infiltration rate, assumptions regarding the bottom elevation of the BMP may need to be reconsidered and further infiltration testing may be warranted.

Project Name: 10249 Hunsden Sideroad
Project Number: 0952-6305
Created By: JF/HL
Reviewed By: TE

D.A. NAME 101
D.A. AREA 10.97

Hydrologic Parameters: CALIB NASHYD Command
Pre Development Drainage Area: Catchment 101

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Sandy Silt	B	B	100	10.97
				0
				0
				0
Total Area				10.97

Impervious Landuses Present:												
	Roadway		Sidewalk		Driveway		Building		SWMF		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B					0.01	98	0.02	98			0.04	3.49
Subtotal					0.01		0.02					

Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B	7.35	55							3.59	58	10.93	612.16
Subtotal	7.35								3.59			

	Composite Area Calculations	Total Pervious Area	10.93
		Total Impervious Area	0.04
		% Impervious	0.32%
		Composite Curve Number	56.1
		Total Area Check	10.97

Initial Abstraction and Tp Calculations

Initial Abstraction				Composite Runoff Coefficient								
Landuse	IA (mm)	Area (ha)	A * IA	Sandy Silt		0		0		0		
				RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	7.35	73.47	0.21	7.35		0		0		0	1.54
Meadow	8	0	0		0		0		0		0	0
Wetland	16	0	0		0		0		0		0	0
Lawn	5	0	0		0		0		0		0	0
Cultivated	7	3.59	25.11	0.25	3.59		0		0		0	0.90
Impervious	2	0.04	0.07	0.90	0.04		0		0		0	0.03
Composite		10.97	8.99	Composite Runoff Coefficient								0.23

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
Overland	356.3	14.5	4.07%	2.3	0.46	0.21	0.14	0.14	0.20	0.13	0.56	0.38

Appropriate calculated time to peak:	0.38	Appropriate Method:	Airport

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Project Name: 10249 Hunsden Sideroad
Project Number: 0952-6305
Created By: JF/HL
Reviewed By: TE

D.A. NAME 102
D.A. AREA 4.83

Hydrologic Parameters: CALIB NASHYD Command
Pre Development Drainage Area: Catchment 102

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Sandy Silt	B	B	100	4.83
				0
				0
				0
Total Area				4.83

Impervious Landuses Present:	Roadway		Sidewalk		Driveway		Building		SWMF		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B											0	0
Subtotal												

Pervious Landuses Present:	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B	0.40	55							4.43	58	4.83	278.93
Subtotal	0.40								4.43			

Composite Area Calculations		
	Total Pervious Area	4.83
	Total Impervious Area	0
	% Impervious	0.00%
	Composite Curve Number	57.8
	Total Area Check	4.83

Initial Abstraction and Tp Calculations

Initial Abstraction				Composite Runoff Coefficient								
				Sandy Silt		0		0		0		
Landuse	IA (mm)	Area (ha)	A * IA	RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	0.40	4.02	0.21	0.40		0		0		0	0.08
Meadow	8	0	0		0		0		0		0	0
Wetland	16	0	0		0		0		0		0	0
Lawn	5	0	0		0		0		0		0	0
Cultivated	7	4.43	31.00	0.25	4.43		0		0		0	1.11
Impervious	2	0	0		0		0		0		0	0
Composite		4.83	7.25	Composite Runoff Coefficient								0.25

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
Overland	184.1	7.5	4.07%	2.3	0.46	0.11	0.07	0.07	0.11	0.08	0.40	0.27

Appropriate calculated time to peak:	0.27	Appropriate Method:	Airport

Project Name: 10249 Hunsden Sideroad
Project Number: 0952-6305
Created By: JF/HL
Reviewed By: TE

D.A. NAME 103
D.A. AREA 4.57

Hydrologic Parameters: CALIB NASHYD Command
Pre Development Drainage Area: Catchment 103

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Sandy Silt	B	B	100	4.57
				0
				0
				0
Total Area				4.57

Impervious Landuses Present:												
	Roadway		Sidewalk		Driveway		Building		SWMF		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B											0	0
Subtotal												

Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B	1.52	55							3.05	58	4.57	260.49
Subtotal	1.52								3.05			

	Composite Area Calculations	Total Pervious Area	4.57
		Total Impervious Area	0
		% Impervious	0.00%
		Composite Curve Number	57.0
		Total Area Check	4.57

Initial Abstraction and Tp Calculations

Initial Abstraction				Composite Runoff Coefficient								
Landuse	IA (mm)	Area (ha)	A * IA	Sandy Silt		0		0		0		
				RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	1.52	15.23	0.21	1.52		0		0		0	0.32
Meadow	8	0	0		0		0		0		0	0
Wetland	16	0	0		0		0		0		0	0
Lawn	5	0	0		0		0		0		0	0
Cultivated	7	3.05	21.33	0.25	3.05		0		0		0	0.76
Impervious	2	0	0		0		0		0		0	0
Composite		4.57	8.00	Composite Runoff Coefficient								0.24

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
Overland	90	9	10.00%	2.3	0.73	0.03	0.02	0.02	0.05	0.03	0.21	0.14

Appropriate calculated time to peak:	0.14	Appropriate Method:	Airport

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Project Name: 10249 Hunsden Sideroad
Project Number: 0952-6305
Created By: JF/HL
Reviewed By: TE

D.A. NAME 201
D.A. AREA 12.40

Hydrologic Parameters: CALIB NASHYD Command
Post Development Drainage Area: Catchment 201

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Sandy Silt	B	B	100	12.40
				0
				0
				0
Total Area				12.40

Impervious Landuses Present:												
	Roadway		Sidewalk		Driveway		House		SWMF		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B					0.09	98	0.27	98			0.36	34.98
Subtotal					0.09		0.27					

Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B	8.62	55					3.43	61			12.04	682.93
Subtotal	8.62						3.43					

Composite Area Calculations		
	Total Pervious Area	12.04
	Total Impervious Area	0.36
	% Impervious	2.88%
	Composite Curve Number	57.9
	Total Area Check	12.40

Initial Abstraction and Tp Calculations

Initial Abstraction				Composite Runoff Coefficient								
				Sandy Silt		0		0		0		
Landuse	IA (mm)	Area (ha)	A * IA	RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	8.62	86.16	0.21	8.62		0		0		0	1.81
Meadow	8	0	0		0		0		0		0	0
Wetland	16	0	0		0		0		0		0	0
Lawn	5	3.43	17.14	0.12	3.43		0		0		0	0.41
Cultivated	7	0	0		0		0		0		0	0
Impervious	2	0.36	0.71	0.90	0.36		0		0		0	0.32
Composite		12.4	8.39	Composite Runoff Coefficient								0.20

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
Overland	420.0	8.33	1.98%	2.3	0.32	0.36	0.24	0.24	0.27	0.18	0.80	0.53

Appropriate calculated time to peak:	0.53	Appropriate Method:	Airport

Project Name: 10249 Hunsden Sideroad
Project Number: 0952-6305
Created By: JF/HL
Reviewed By: TE

D.A. NAME 202
D.A. AREA 3.47

Hydrologic Parameters: CALIB NASHYD Command
Post Development Drainage Area: Catchment 202

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Sandy Silt	B	B	100	3.47
				0
				0
				0
Total Area				3.47

Impervious Landuses Present:												
	Roadway		Sidewalk		Driveway		House		SWMF		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B	0.21	98			0.11	98	0.22	98			0.53	52.32
Subtotal	0.21				0.11		0.22					
Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B							2.94	61			2.94	179.10
Subtotal							2.94					

Composite Area Calculations		
	Total Pervious Area	2.94
	Total Impervious Area	0.53
	% Impervious	15.39%
	Composite Curve Number	66.7
	Total Area Check	3.47

Initial Abstraction and Tp Calculations

Initial Abstraction				Composite Runoff Coefficient								
				Sandy Silt		0		0		0		
Landuse	IA (mm)	Area (ha)	A * IA	RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	0	0		0		0		0		0	0
Meadow	8	0	0		0		0		0		0	0
Wetland	16	0	0		0		0		0		0	0
Lawn	5	2.94	14.68	0.12	2.94		0		0		0	0.35
Cultivated	7	0	0		0		0		0		0	0
Impervious	2	0.53	1.07	0.90	0.53		0		0		0	0.48
Composite		3.47	4.54	Composite Runoff Coefficient								0.24

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
Overland	420	7	1.67%	2.3	0.30	0.39	0.26	0.26	0.32	0.21	0.81	0.54

Appropriate calculated time to peak:	0.54	Appropriate Method:	Airport

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Project Name: 10249 Hunsden Sideroad
Project Number: 0952-6305
Created By: JF/HL
Reviewed By: TE

D.A. NAME 203
D.A. AREA 1.73

Hydrologic Parameters: CALIB NASHYD Command
Post Development Drainage Area: Catchment 203

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Sandy Silt	B	B	100	1.73
				0
				0
				0
Total Area				1.73

Impervious Landuses Present:												
	Roadway		Sidewalk		Driveway		House		SWMF		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B	0.20	98			0.04	98	0.10	98			0.33	32.64
Subtotal	0.20				0.04		0.10					

Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B							1.40	61			1.40	85.21
Subtotal							1.40					

Composite Area Calculations	Total Pervious Area	1.40
	Total Impervious Area	0.33
	% Impervious	19.25%
	Composite Curve Number	68.1
	Total Area Check	1.73

Initial Abstraction and Tp Calculations

Initial Abstraction				Composite Runoff Coefficient								
Landuse	IA (mm)	Area (ha)	A * IA	Sandy Silt		0		0		0		
				RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	0	0		0		0		0		0	0
Meadow	8	0	0		0		0		0		0	0
Wetland	16	0	0		0		0		0		0	0
Lawn	5	1.40	6.98	0.12	1.40		0		0		0	0.17
Cultivated	7	0	0		0		0		0		0	0
Impervious	2	0.33	0.67	0.90	0.33		0		0		0	0.30
Composite		1.73	4.42	Composite Runoff Coefficient								0.27

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
Overland	220	3.08	1.40%	2.3	0.27	0.22	0.15	0.15	0.18	0.12	0.60	0.40

Appropriate calculated time to peak:	0.40	Appropriate Method:	Airport

Project Name: 10249 Hunsden Sideroad
Project Number: 0952-6305
Created By: JF/HL
Reviewed By: TE

D.A. NAME 204
D.A. AREA 0.62

Hydrologic Parameters: CALIB NASHYD Command
Post Development Drainage Area: Catchment 204

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Sandy Silt	B	B	100	0.62
				0
				0
				0
Total Area				0.62

Impervious Landuses Present:												
	Roadway		Sidewalk		Driveway		House		SWMF		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B	0.05	98					0.03	98			0.09	8.49
Subtotal	0.05						0.03					
Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B							0.53	61			0.53	32.53
Subtotal							0.53					

Composite Area Calculations	Total Pervious Area	0.53
	Total Impervious Area	0.09
	% Impervious	13.98%
	Composite Curve Number	66.2
	Total Area Check	0.62

Initial Abstraction and Tp Calculations

Initial Abstraction				Composite Runoff Coefficient								
Landuse	IA (mm)	Area (ha)	A * IA	Sandy Silt		0		0		0		
				RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	0	0		0		0		0		0	0
Meadow	8	0	0		0		0		0		0	0
Wetland	16	0	0		0		0		0		0	0
Lawn	5	0.53	2.67	0.12	0.53		0		0		0	0.06
Cultivated	7	0	0		0		0		0		0	0
Impervious	2	0.09	0.17	0.90	0.09		0		0		0	0.08
Composite		0.62	4.58	Composite Runoff Coefficient								0.23

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
Overland	91.88	2.77	3.01%	2.3	0.40	0.06	0.04	0.04	0.07	0.05	0.32	0.21

Appropriate calculated time to peak:	0.21	Appropriate Method:	Airport

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Project Name: 10249 Hunsden Sideroad
Project Number: 0952-6305
Created By: JF/HL
Reviewed By: TE

D.A. NAME 205
D.A. AREA 2.15

Hydrologic Parameters: CALIB NASHYD Command
Pre Development Drainage Area: Catchment 205

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Sandy Silt	B	B	100	2.15
				0
				0
				0
Total Area				2.15

Impervious Landuses Present:												
	Roadway		Sidewalk		Driveway		House		SWMF		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B											0.00	0.00
Subtotal												

Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
B							2.15	61			2.15	131.17
Subtotal							2.15					

Composite Area Calculations	Total Pervious Area	2.15
	Total Impervious Area	0.00
	% Impervious	0.00%
	Composite Curve Number	61.0
	Total Area Check	2.15

Initial Abstraction and Tp Calculations

Initial Abstraction				Composite Runoff Coefficient								
Landuse	IA (mm)	Area (ha)	A * IA	Sandy Silt		0		0		0		
				RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	0.00	0.00	0.21	0.00		0		0		0	0
Meadow	8	0	0		0		0		0		0	0
Wetland	16	0	0		0		0		0		0	0
Lawn	5	2.15	10.75	0.12	2.15		0		0		0	0.26
Cultivated	7	0	0		0		0		0		0	0
Impervious	2	0	0		0		0		0		0	0
Composite		2.15	5.00	Composite Runoff Coefficient								0.12

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
Overland	90	9	10.00%	2.3	0.73	0.03	0.02	0.02	0.05	0.03	0.24	0.16

Appropriate calculated time to peak:	0.16	Appropriate Method:	Airport

Project:	10249 Hunsden Sideroad	**Date:**	2023-11-01
Project No.:	0952-6305	**Revised:**	/
Description:	Catchment 202 Water Quality Storage Requirements	**Designed By:**	JF
		Checked By:	HL/TE

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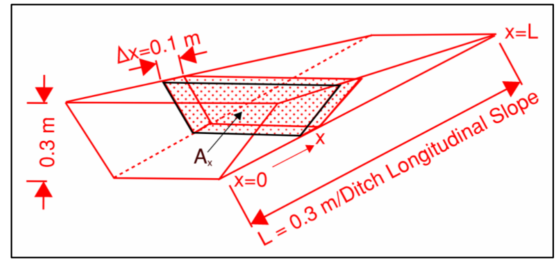
Catchment 202 Water Quality Storage Requirements

Bioswale Catchment Area (ha):	1.88	Portion of Catchment 202 (Front yards of Lots 1-5 & 12-13 and Street A)
Imperviousness Level (%):	23	
MOE Table 3.2		
Storage Volume for enhanced 80% long term SS removal (m^3/ha):	25	
Design Storage Volume per MOE Table 3.2 (m^3):	47	= Bioswale Catchment Area * 25
VO Results Volume:		
25 mm Runoff (mm):	2.47	
Design Storage Volume per VO Results (m^3):	46	
Design Storage Required (m^3):	**47**	
Design Storage Provided (m^3):	**79**	See Weir Control Sizing Calculation Sheet

Project:	10249 Hunsden Sideroad
Project No.:	0952-6305
Description:	Bioswale Control Weir Sizing
Date:	2023-11-01
Revised:	/
Designed By:	JF
Checked By:	HL/TE

Bioswale Weir Control Sizing - Street 'A' Catchment 202

Ditch Bottom Width =	0.5	m
Ditch Top Width =	3.75	m
Roadside Ditch Side Slope =	3:1	
Lot Line Ditch Slope =	2:1	
Ditch Height =	0.65	m
Proposed Control Weir Height =	0.30	m
Road Segment Length =	260	m
Proposed Longitudinal Ditch Slope =	3%	
Control Weir Spacing =	10	m
Number of Control Weir Ponding Areas =	51	
Weir Control Ponding Storage per Area (V) =	1.55	m^3/area
Surface Ponding Volume Provided =	**79**	**m^3**



$$V = \int_{x=0}^{x=L} dV \cong A_{x=\Delta x}\Delta x + A_{x=2\Delta x}\Delta x + A_{x=3\Delta x}\Delta x + \ldots + A_{x=L}\Delta x$$

where $\Delta x = 0.1$ m and A_x = *Cross sectional area of retained water @ x*

> Required Storage = **47** **m^3**

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Project:	10249 Hunsden Sideroad	**Date:**	2023-11-01
Project No.:	0952-6305	**Revised:**	/
Description:	Bioswale Sizing	**Designed By:**	JF
		Checked By:	HL/TE

Roadside Bioswale Sizing - Steet 'A' Catchment 202

Provided Bioswale Design Parameters

Parameter	Value	Units	Comment
Surface Ponding Volume Provided Behind Weir Control Structures =	**79**	**m^3**	
Percolation Rate =	45.0	mm/hr	Percolation rate based on percolation rate of 10^{-4} cm/sec per Geotechnical Report (Soil Engineers Ltd., April 2022) and Figure C1 of CVC & TRCA's Low Impact Development Stormwater Management Planning and Design Guide (Version 1.0, 2010)
Safety Correction Factor =	2.50		
Design Percolation Rate **(P)** =	18.00	mm/hr	
LID Length =	**499**	**m**	Road is 260 m long with Bioswales proposed on both sides minus 7 proposed driveway entrances (3 m wide ea.), Length = 2 * 260 m - 7 * 3 m
LID Width =	**1.0**	**m**	
Provided footprint **(A)** =	**499**	**m^2**	= Length * width
Gravel Storage Depth =	0.40	m	**A = 1000 * V / [P*n* t]** Equation 4.3 (MOE SWM Planning and Design Manual, 2003)
Void Space Ratio **(n)** =	0.40		
Total Bioswale Gravel Storage Volume Provided (V) =	**80**	m^3	≥ Surface Ponding Storage = **79** **m^3**
Infiltration Rate =	**3.6**	m^3/hr	
Retention Time (t) =	**22**	hours	

NOTES:

1. Surface storage and filter media storage not included in bioswale volume calculation to be conservative.

Project:	Hunsden Rd, Caledon
Project No.:	1273-4435
Designed By:	HL/JF
Checked By:	TE
Date:	2023-11-01

DRAWDOWN TIME CALCULATIONS - Catchment 202

Known Parameters

Parameter	Value	Comments
Surface Area of the Filter (m^2) - **A**:	499	See Bioswale Sizing Sheet for Area Calculation
Depth of the controlling filter medium (m) - **d**:	1.0	
Coefficient of permeability of the controlling filter media (mm/hr) - **k**:	45	
Safety Factor -**SF**:	2.5	
Operating head of water on the filter (m) - **h**:	0.15	Average depth in Weir Wall Storage Areas
Design Storage Required (m^3):	**47**	See Water Quality Storage Requirement Sheet
Design Storage Provided (m^3) - V:	**79**	See Weir Control Sizing Calculation Sheet

Drawdown Time Calculations

Design drawdown time (hr): 7.6

Typical Values for k		
Sand	45	mm/hr
Peat	25	mm/hr
Leaf Compost	110	mm/hr

$A = 1000 * V * d / [k / SF * (h + d) * t]$

Equation 4.12 Drainage Manual (MOE, 2003)

Project:	10249 Hunsden Sideroad	**Date:**	2023-11-01
Project No.:	0952-6305	**Revised:**	/
Description:	Catchment 203 Water Quality Storage Requirements	**Designed By:**	JF
		Checked By:	HL/TE

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Catchment 203 Water Quality Storage Requirements

Bioswale Catchment Area (ha):	1.73	Catchment 203
Imperviousness Level (%):	19	
MOE Table 3.2		
Storage Volume for enhanced 80% long term SS removal (m^3/ha):	25	
Design Storage Volume per MOE Table 3.2 (m^3):	43	= Bioswale Catchment Area * 25
VO Results Volume:		
25 mm Runoff (mm):	2.69	
Design Storage Volume per VO Results (m^3):	47	
Design Storage Required (m^3):	**47**	
Design Storage Provided (m^3):	**54**	See Weir Control Sizing Calculation Sheet

Project:	10249 Hunsden Sideroad	**Date:**	2023-11-01
Project No.:	0952-6305	**Revised:**	/
Description:	Bioswale Control Weir Sizing	**Designed By:**	JF
		Checked By:	HL/TE

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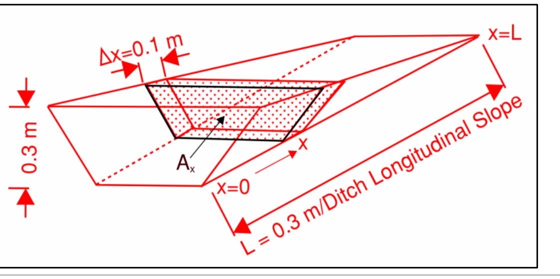
Bioswale Weir Control Sizing - Steet 'A' Catchment 203

Ditch Bottom Width =	0.5	m
Ditch Top Width =	3.75	m
Roadside Ditch Side Slope =	3:1	
Lot Line Ditch Slope =	2:1	
Ditch Height =	0.65	m
Proposed Control Weir Height =	0.30	m
Road Segment Length =	180	
Proposed Longitudinal Ditch Slope =	2%	
Control Weir Spacing =	15	m
Number of Control Weir Ponding Areas =	24	
Weir Control Ponding Storage per Area (V) =	2.27	m^3/area
Surface Ponding Volume Provided =	**54**	**m^3**



$$V = \int_{x=0}^{x=L} dV \cong A_{x=\Delta x}\Delta x + A_{x=2\Delta x}\Delta x + A_{x=3\Delta x}\Delta x + \ldots + A_{x=L}\Delta x$$

where $\Delta x = 0.1$ m and $A_x = Cross\ sectional\ area\ of\ retained\ water\ @\ x$

> Required Storage = **47** **m^3**

Project:	10249 Hunsden Sideroad	**Date:**	2023-11-01
Project No.:	0952-6305	**Revised:**	/
Description:	Bioswale Sizing	**Designed By:**	JF
		Checked By:	HL/TE

Roadside Bioswale Sizing - Steet 'A' Catchment 203

Provided Bioswale Design Parameters

Parameter	Value	Units	Comment
Surface Ponding Volume Provided Behind Weir Control Structures =	**54**	**m^3**	
Percolation Rate =	45.0	mm/hr	Percolation rate based on percolation rate of 10^{-4} cm/sec per Geotechnical Report (Soil Engineers Ltd., April 2022) and Figure C1 of CVC & TRCA's Low Impact Development Stormwater Management Planning and Design Guide (Version 1.0, 2010)
Safety Correction Factor =	2.50		
Design Percolation Rate **(P)** =	18.00	mm/hr	
LID Length =	**405**	**m**	Road is 210 m long with Bioswales proposed on both sides minus 5 proposed driveway entrances (3 m wide ea.), Length = 2 * 210 m - 5 * 3 m
LID Width =	**1.0**	**m**	
Provided footprint **(A)** =	**405**	**m^2**	= Length * width
Gravel Storage Depth =	0.40	m	**A = 1000 * V / [P*n* t]** Equation 4.3 (MOE SWM Planning and Design Manual, 2003)
Void Space Ratio **(n)** =	0.40		
Total Bioswale Gravel Storage Volume Provided (V) =	**65**	m^3	≥ Surface Ponding Storage = **54** **m^3**
Infiltration Rate =	**2.9**	m^3/hr	
Retention Time (t) =	**22**	hours	

NOTES:

1. Surface storage and filter media storage not included in bioswale volume calculation to be conservative.

CROZIER CONSULTING ENGINEERS

Project: Hunsden Rd, Caledon
Project No.: 1273-4435
Designed By: HL/JF
Checked By: TE
Date: 2023-11-01

DRAWDOWN TIME CALCULATIONS - Catchment 203

Known Parameters

Parameter	Value	Comments
Surface Area of the Filter (m^2) - **A**:	405	See Bioswale Sizing Sheet for Area Calculation
Depth of the controlling filter medium (m) - **d**:	1.0	
Coefficient of permeability of the controlling filter media (mm/hr) - **k**:	45	
Safety Factor -**SF**:	2.5	
Operating head of water on the filter (m) - **h**:	0.15	Average depth in Weir Wall Storage Areas
Design Storage Required (m^3):	**47**	See Water Quality Storage Requirement Sheet
Design Storage Provided (m^3) - V:	**54**	See Weir Control Sizing Calculation Sheet

Drawdown Time Calculations

Design drawdown time (hr): 6.4

Typical Values for k

Sand	45	mm/hr
Peat	25	mm/hr
Leaf Compost	110	mm/hr

$$A = 1000 * V * d / [k / SF * (h + d) * t]$$

Equation 4.12 Drainage Manual (MOE, 2003)

CROZIER CONSULTING ENGINEERS	**Project:** 10249 Hunsden Sideroad	**Date:** 2023-11-01	
	Project No.: 0952-6305	**Revised:** /	
	Description: Catchment 204 Water Quality Storage Requirements	**Designed By:** JF	
		Checked By: HL/TE	

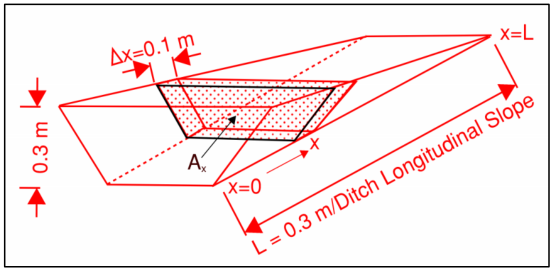
Catchment 204 Water Quality Storage Requirements

Bioswale Catchment Area (ha):	0.62	Catchment 204
Imperviousness Level (%):	14	
MOE Table 3.2		
Storage Volume for enhanced 80% long term SS removal (m^3/ha):	25	
Design Storage Volume per MOE Table 3.2 (m^3):	16	= Bioswale Catchment Area * 25
VO Results Volume:		
25 mm Runoff (mm):	2.45	
Design Storage Volume per VO Results (m^3):	15	
Design Storage Required (m^3):	**16**	
Design Storage Provided (m^3):	**22**	See Weir Control Sizing Calculation Sheet

Project:	10249 Hunsden Sideroad	Date:	2023-11-01
Project No.:	0952-6305	Revised:	/
Description:	Bioswale Control Weir Sizing	Designed By:	JF
		Checked By:	HL/TE

Bioswale Weir Control Sizing - Steet 'A' Catchment 204

Ditch Bottom Width =	0.5	m
Ditch Top Width =	3.75	m
Roadside Ditch Side Slope =	3:1	
Lot Line Ditch Slope =	2:1	
Ditch Height =	0.65	m
Proposed Control Weir Height =	0.30	m
Road Segment Length =	64	
Proposed Longitudinal Ditch Slope =	1%	
Control Weir Spacing =	25	m
Number of Control Weir Ponding Areas =	5	
Weir Control Ponding Storage per Area (V) =	4.44	m^3/area
Surface Ponding Volume Provided =	**22**	**m^3**



$$V = \int_{x=0}^{x=L} dV \cong A_{x=\Delta x}\Delta x + A_{x=2\Delta x}\Delta x + A_{x=3\Delta x}\Delta x + \ldots + A_{x=L}\Delta x$$

where $\Delta x = 0.1$ m and A_x = *Cross sectional area of retained water @ x*

> Required Storage = **16** **m^3**

CROZIER CONSULTING ENGINEERS

Project:	10249 Hunsden Sideroad	**Date:**	2023-11-01
Project No.:	0952-6305	**Revised:**	/
Description:	Bioswale Sizing	**Designed By:**	JF
		Checked By:	HL/TE

Roadside Bioswale Sizing - Steet 'A' Catchment 204

Provided Bioswale Design Parameters

Parameter	Value	Units	Comment
Surface Ponding Volume Provided Behind Weir Control Structures =	**22**	**m^3**	
Percolation Rate =	45.0	mm/hr	Percolation rate based on percolation rate of 10^{-4} cm/sec per Geotechnical Report (Soil Engineers Ltd., April 2022) and Figure C1 of CVC & TRCA's Low Impact Development Stormwater Management Planning and Design Guide (Version 1.0, 2010)
Safety Correction Factor =	2.50		
Design Percolation Rate **(P)** =	18.00	mm/hr	
LID Length =	**128**	**m**	Road is 64 m long with Bioswales proposed on both sides. No driveways are proposed within Catchment 204, Length = 2 * 64 m
LID Width =	**1.0**	**m**	
Provided footprint **(A)** =	**128**	**m^2**	= Length * width
Gravel Storage Depth =	0.45	m	**A = 1000 * V / [P*n* t]** Equation 4.3 (MOE SWM Planning and Design Manual, 2003)
Void Space Ratio **(n)** =	0.40		
Total Bioswale Gravel Storage Volume Provided (V) =	**23**	m^3	≥ Surface Ponding Storage = **22** **m^3**
Infiltration Rate =	**0.9**	m^3/hr	
Retention Time (t) =	**25**	hours	

NOTES:

1. Surface storage and filter media storage not included in bioswale volume calculation to be conservative.

Project:	Hunsden Rd, Caledon
Project No.:	1273-4435
Designed By:	HL/JF
Checked By:	TE
Date:	2023-11-01

DRAWDOWN TIME CALCULATIONS - Catchment 204

Known Parameters

Parameter	Value	Comments
Surface Area of the Filter (m^2) - **A**:	128	See Bioswale Sizing Sheet for Area Calculation
Depth of the controlling filter medium (m) - **d**:	1.0	
Coefficient of permeability of the controlling filter media (mm/hr) - **k**:	45	
Safety Factor -**SF**:	2.5	
Operating head of water on the filter (m) - **h**:	0.15	Average depth in Weir Wall Storage Areas
Design Storage Required (m^3):	**17**	See Water Quality Storage Requirement Sheet
Design Storage Provided (m^3) - V:	**22**	See Weir Control Sizing Calculation Sheet

Drawdown Time Calculations

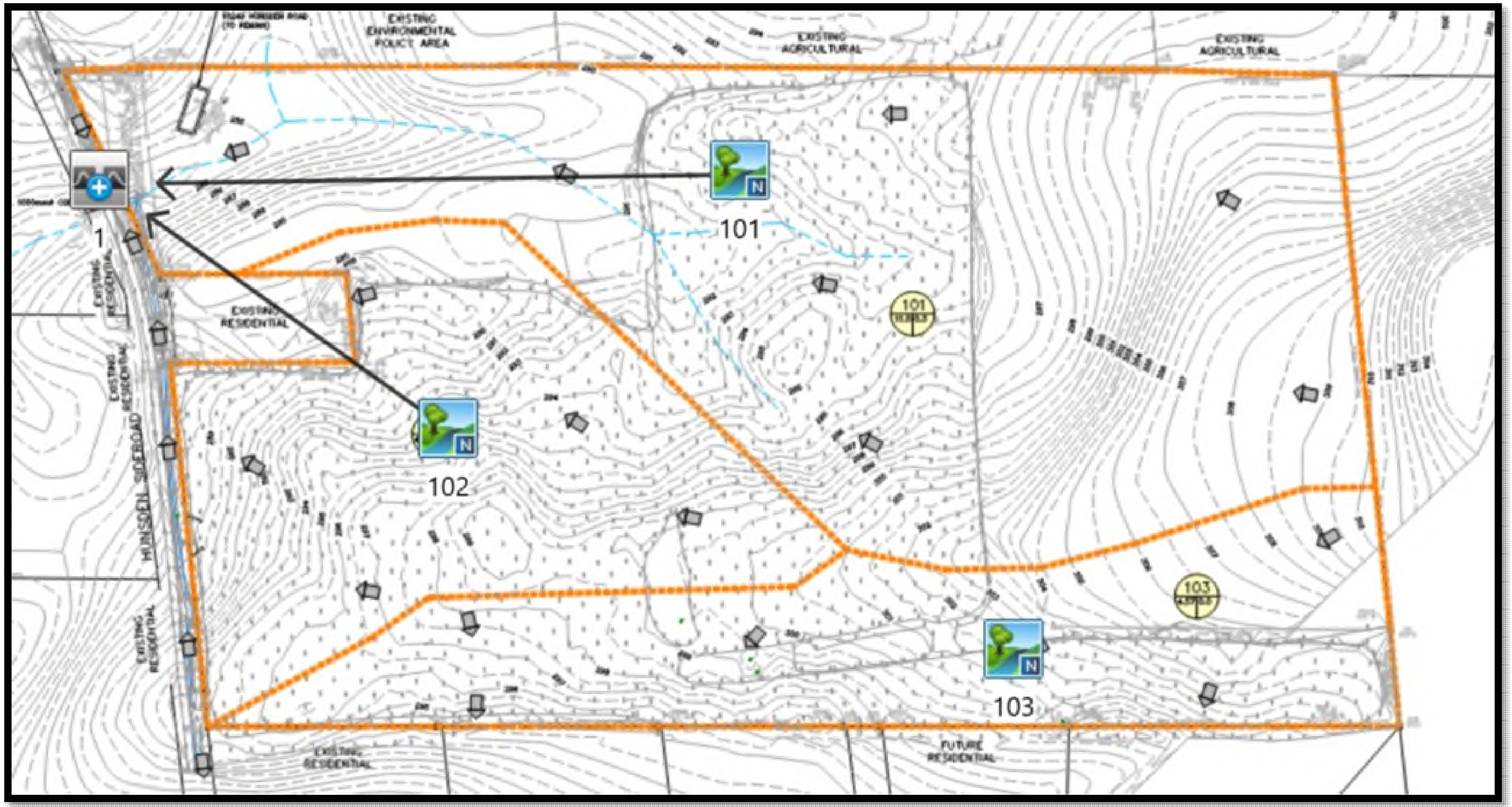
Design drawdown time (hr): 8.3

Typical Values for k		
Sand	45	mm/hr
Peat	25	mm/hr
Leaf Compost	110	mm/hr

$A = 1000 * V * d / [k / SF * (h + d) * t]$

Equation 4.12 Drainage Manual (MOE, 2003)

Pre-development VO Modelling 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   TTTTT  TTTTT  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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                  *****  D E T A I L E D   O U T P U T *****


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  Summary filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\ed4345e1-


DATE: 11-13-2023                           TIME: 09:14:59

USER:



COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 1- 2yr 4hr 10min Chicago (Cal **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1070.000
| Ptotal= 34.22 mm |                          B=   7.850
--------------------                          C=   0.876
                    used in:   INTENSITY =  A / (t + B)^C

                    Duration of storm  =  4.00 hrs
                    Storm time step    = 10.00 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    1.53 |  1.00   19.60 |  2.00    4.48 |  3.00    1.89
                0.17    1.81 |  1.17   85.72 |  2.17    3.65 |  3.17    1.73
                0.33    2.22 |  1.33   26.59 |  2.33    3.08 |  3.33    1.59
                0.50    2.87 |  1.50   12.64 |  2.50    2.66 |  3.50    1.47
                0.67    4.06 |  1.67    7.99 |  2.67    2.34 |  3.67    1.37
                0.83    6.86 |  1.83    5.76 |  2.83    2.10 |  3.83    1.29


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0103)|   Area    (ha)=   4.57   Curve Number   (CN)= 57.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.14

         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    1.53 | 1.083   19.60 | 2.083    4.48 |  3.08    1.89
               0.167    1.53 | 1.167   19.60 | 2.167    4.48 |  3.17    1.89
               0.250    1.81 | 1.250   85.72 | 2.250    3.65 |  3.25    1.73
               0.333    1.81 | 1.333   85.72 | 2.333    3.65 |  3.33    1.73
               0.417    2.22 | 1.417   26.59 | 2.417    3.08 |  3.42    1.59
               0.500    2.22 | 1.500   26.59 | 2.500    3.08 |  3.50    1.59
               0.583    2.87 | 1.583   12.64 | 2.583    2.66 |  3.58    1.47
               0.667    2.87 | 1.667   12.64 | 2.667    2.66 |  3.67    1.47
               0.750    4.06 | 1.750    7.99 | 2.750    2.34 |  3.75    1.37
               0.833    4.06 | 1.833    7.99 | 2.833    2.34 |  3.83    1.37
               0.917    6.86 | 1.917    5.76 | 2.917    2.10 |  3.92    1.29
               1.000    6.86 | 2.000    5.76 | 3.000    2.10 |  4.00    1.29
```

```
     Unit Hyd Qpeak  (cms)=   1.247

     PEAK FLOW       (cms)=   0.050 (i)
     TIME TO PEAK    (hrs)=   1.500
     RUNOFF VOLUME    (mm)=   3.132
     TOTAL RAINFALL   (mm)=  34.218
     RUNOFF COEFFICIENT   =   0.092

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0101)|   Area    (ha)=  10.97   Curve Number   (CN)= 56.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.99   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.38

         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    1.53 | 1.083   19.60 | 2.083    4.48 |  3.08    1.89
                 0.167    1.53 | 1.167   19.60 | 2.167    4.48 |  3.17    1.89
                 0.250    1.81 | 1.250   85.72 | 2.250    3.65 |  3.25    1.73
                 0.333    1.81 | 1.333   85.72 | 2.333    3.65 |  3.33    1.73
                 0.417    2.22 | 1.417   26.59 | 2.417    3.08 |  3.42    1.59
                 0.500    2.22 | 1.500   26.59 | 2.500    3.08 |  3.50    1.59
                 0.583    2.87 | 1.583   12.64 | 2.583    2.66 |  3.58    1.47
                 0.667    2.87 | 1.667   12.64 | 2.667    2.66 |  3.67    1.47
                 0.750    4.06 | 1.750    7.99 | 2.750    2.34 |  3.75    1.37
                 0.833    4.06 | 1.833    7.99 | 2.833    2.34 |  3.83    1.37
                 0.917    6.86 | 1.917    5.76 | 2.917    2.10 |  3.92    1.29
                 1.000    6.86 | 2.000    5.76 | 3.000    2.10 |  4.00    1.29

     Unit Hyd Qpeak  (cms)=   1.103

     PEAK FLOW       (cms)=   0.063 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=   2.831
     TOTAL RAINFALL   (mm)=  34.218
     RUNOFF COEFFICIENT   =   0.083

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0102)|   Area    (ha)=   4.83   Curve Number   (CN)= 57.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.25   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.27

         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    1.53 | 1.083   19.60 | 2.083    4.48 |  3.08    1.89
                 0.167    1.53 | 1.167   19.60 | 2.167    4.48 |  3.17    1.89
                 0.250    1.81 | 1.250   85.72 | 2.250    3.65 |  3.25    1.73
                 0.333    1.81 | 1.333   85.72 | 2.333    3.65 |  3.33    1.73
                 0.417    2.22 | 1.417   26.59 | 2.417    3.08 |  3.42    1.59
                 0.500    2.22 | 1.500   26.59 | 2.500    3.08 |  3.50    1.59
                 0.583    2.87 | 1.583   12.64 | 2.583    2.66 |  3.58    1.47
                 0.667    2.87 | 1.667   12.64 | 2.667    2.66 |  3.67    1.47
                 0.750    4.06 | 1.750    7.99 | 2.750    2.34 |  3.75    1.37
                 0.833    4.06 | 1.833    7.99 | 2.833    2.34 |  3.83    1.37
                 0.917    6.86 | 1.917    5.76 | 2.917    2.10 |  3.92    1.29
                 1.000    6.86 | 2.000    5.76 | 3.000    2.10 |  4.00    1.29

     Unit Hyd Qpeak  (cms)=   0.683

     PEAK FLOW       (cms)=   0.041 (i)
     TIME TO PEAK    (hrs)=   1.667
     RUNOFF VOLUME    (mm)=   3.325
     TOTAL RAINFALL   (mm)=  34.218
     RUNOFF COEFFICIENT   =   0.097

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

--------------------------------------------------------------------------------
```

```
--------------------
| ADD HYD  (  0001)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):     10.97   0.063     1.83     2.83
      + ID2= 2 (  0102):      4.83   0.041     1.67     3.33
        ===================================================
        ID = 3 (  0001):     15.80   0.101     1.75     2.98

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
==============================================================================================================

       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   TTTTT  TTTTT  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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DATE: 11-13-2023                          TIME: 09:14:59

USER:



COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 2 - 5yr 4hr 10min Chicago (Ca **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1593.000
| Ptotal= 49.55 mm |                          B=  11.000
--------------------                          C=   0.879
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    = 10.00 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    2.35 |  1.00   30.47 |  2.00    7.17 |  3.00    2.93
                 0.17    2.80 |  1.17  109.68 |  2.17    5.81 |  3.17    2.67
                 0.33    3.46 |  1.33   40.71 |  2.33    4.87 |  3.33    2.45
                 0.50    4.52 |  1.50   20.28 |  2.50    4.19 |  3.50    2.26
                 0.67    6.48 |  1.67   12.91 |  2.67    3.67 |  3.67    2.10
                 0.83   11.07 |  1.83    9.28 |  2.83    3.26 |  3.83    1.96


-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0103)|   Area    (ha)=   4.57   Curve Number   (CN)= 57.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.14

         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	2.35	1.083	30.47	2.083	7.17	3.08	2.93
0.167	2.35	1.167	30.47	2.167	7.17	3.17	2.93
0.250	2.80	1.250	109.68	2.250	5.81	3.25	2.67
0.333	2.80	1.333	109.68	2.333	5.81	3.33	2.67
0.417	3.46	1.417	40.71	2.417	4.87	3.42	2.45
0.500	3.46	1.500	40.71	2.500	4.87	3.50	2.45
0.583	4.52	1.583	20.28	2.583	4.19	3.58	2.26
0.667	4.52	1.667	20.28	2.667	4.19	3.67	2.26
0.750	6.48	1.750	12.91	2.750	3.67	3.75	2.10
0.833	6.48	1.833	12.91	2.833	3.67	3.83	2.10
0.917	11.07	1.917	9.28	2.917	3.26	3.92	1.96
1.000	11.07	2.000	9.28	3.000	3.26	4.00	1.96

```
    Unit Hyd Qpeak  (cms)=   1.247

    PEAK FLOW       (cms)=   0.116 (i)
    TIME TO PEAK    (hrs)=   1.500
    RUNOFF VOLUME    (mm)=   7.350
    TOTAL RAINFALL   (mm)=  49.553
    RUNOFF COEFFICIENT   =   0.148

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0101)|   Area    (ha)=  10.97   Curve Number   (CN)= 56.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.99   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.38

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.35	1.083	30.47	2.083	7.17	3.08	2.93
0.167	2.35	1.167	30.47	2.167	7.17	3.17	2.93
0.250	2.80	1.250	109.68	2.250	5.81	3.25	2.67
0.333	2.80	1.333	109.68	2.333	5.81	3.33	2.67
0.417	3.46	1.417	40.71	2.417	4.87	3.42	2.45
0.500	3.46	1.500	40.71	2.500	4.87	3.50	2.45
0.583	4.52	1.583	20.28	2.583	4.19	3.58	2.26
0.667	4.52	1.667	20.28	2.667	4.19	3.67	2.26
0.750	6.48	1.750	12.91	2.750	3.67	3.75	2.10
0.833	6.48	1.833	12.91	2.833	3.67	3.83	2.10
0.917	11.07	1.917	9.28	2.917	3.26	3.92	1.96
1.000	11.07	2.000	9.28	3.000	3.26	4.00	1.96

```
    Unit Hyd Qpeak  (cms)=   1.103

    PEAK FLOW       (cms)=   0.154 (i)
    TIME TO PEAK    (hrs)=   1.833
    RUNOFF VOLUME    (mm)=   6.851
    TOTAL RAINFALL   (mm)=  49.553
    RUNOFF COEFFICIENT   =   0.138

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0102)|   Area    (ha)=   4.83   Curve Number   (CN)= 57.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.25   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.27

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.35	1.083	30.47	2.083	7.17	3.08	2.93
0.167	2.35	1.167	30.47	2.167	7.17	3.17	2.93
0.250	2.80	1.250	109.68	2.250	5.81	3.25	2.67
0.333	2.80	1.333	109.68	2.333	5.81	3.33	2.67
0.417	3.46	1.417	40.71	2.417	4.87	3.42	2.45
0.500	3.46	1.500	40.71	2.500	4.87	3.50	2.45
0.583	4.52	1.583	20.28	2.583	4.19	3.58	2.26
0.667	4.52	1.667	20.28	2.667	4.19	3.67	2.26
0.750	6.48	1.750	12.91	2.750	3.67	3.75	2.10
0.833	6.48	1.833	12.91	2.833	3.67	3.83	2.10
0.917	11.07	1.917	9.28	2.917	3.26	3.92	1.96
1.000	11.07	2.000	9.28	3.000	3.26	4.00	1.96

```
     Unit Hyd Qpeak  (cms)=   0.683

     PEAK FLOW       (cms)=   0.094 (i)
     TIME TO PEAK    (hrs)=   1.667
     RUNOFF VOLUME    (mm)=   7.646
     TOTAL RAINFALL   (mm)=  49.553
     RUNOFF COEFFICIENT   =   0.154

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0001)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0101):    10.97   0.154     1.83     6.85
       + ID2= 2 (  0102):     4.83   0.094     1.67     7.65
         ==================================================
         ID = 3 (  0001):    15.80   0.241     1.75     7.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
============================================================================================================

       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   TTTTT  TTTTT  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
Developed and Distributed by Smart City Water Inc
```

```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\4f45401a-
  Summary filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\4f45401a-


DATE: 11-13-2023                            TIME: 09:14:59

USER:


COMMENTS: ____________________________________________________________


------------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 3 - 10yr 4hr 10min Chicago (C **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=2221.000
| Ptotal= 58.62 mm |                          B=  12.000
--------------------                          C=   0.908
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    = 10.00 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    2.39 |  1.00   37.17 |  2.00     8.06 |  3.00    3.05
                 0.17    2.89 |  1.17  134.16 |  2.17     6.42 |  3.17    2.75
                 0.33    3.65 |  1.33   50.03 |  2.33     5.30 |  3.33    2.50
                 0.50    4.89 |  1.50   24.37 |  2.50     4.50 |  3.50    2.29
                 0.67    7.23 |  1.67   15.14 |  2.67     3.89 |  3.67    2.11
                 0.83   12.87 |  1.83   10.64 |  2.83     3.42 |  3.83    1.96

--------------------------------------------------------------------------------
```

```
--------------------
| CALIB             |
| NASHYD   (  0103)|   Area    (ha)=   4.57   Curve Number   (CN)= 57.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.14

         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    2.39 | 1.083   37.17 | 2.083    8.06 |  3.08    3.05
                   0.167    2.39 | 1.167   37.17 | 2.167    8.06 |  3.17    3.05
                   0.250    2.89 | 1.250  134.16 | 2.250    6.42 |  3.25    2.75
                   0.333    2.89 | 1.333  134.16 | 2.333    6.42 |  3.33    2.75
                   0.417    3.65 | 1.417   50.03 | 2.417    5.30 |  3.42    2.50
                   0.500    3.65 | 1.500   50.03 | 2.500    5.30 |  3.50    2.50
                   0.583    4.89 | 1.583   24.37 | 2.583    4.50 |  3.58    2.29
                   0.667    4.89 | 1.667   24.37 | 2.667    4.50 |  3.67    2.29
                   0.750    7.23 | 1.750   15.14 | 2.750    3.89 |  3.75    2.11
                   0.833    7.23 | 1.833   15.14 | 2.833    3.89 |  3.83    2.11
                   0.917   12.87 | 1.917   10.64 | 2.917    3.42 |  3.92    1.96
                   1.000   12.87 | 2.000   10.64 | 3.000    3.42 |  4.00    1.96

     Unit Hyd Qpeak  (cms)=   1.247

     PEAK FLOW       (cms)=   0.177 (i)
     TIME TO PEAK    (hrs)=   1.500
     RUNOFF VOLUME    (mm)=  10.497
     TOTAL RAINFALL   (mm)=  58.616
     RUNOFF COEFFICIENT   =   0.179

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0101)|   Area    (ha)=  10.97   Curve Number   (CN)= 56.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.99   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.38

         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    2.39 | 1.083   37.17 | 2.083    8.06 |  3.08    3.05
                   0.167    2.39 | 1.167   37.17 | 2.167    8.06 |  3.17    3.05
                   0.250    2.89 | 1.250  134.16 | 2.250    6.42 |  3.25    2.75
                   0.333    2.89 | 1.333  134.16 | 2.333    6.42 |  3.33    2.75
                   0.417    3.65 | 1.417   50.03 | 2.417    5.30 |  3.42    2.50
                   0.500    3.65 | 1.500   50.03 | 2.500    5.30 |  3.50    2.50
                   0.583    4.89 | 1.583   24.37 | 2.583    4.50 |  3.58    2.29
                   0.667    4.89 | 1.667   24.37 | 2.667    4.50 |  3.67    2.29
                   0.750    7.23 | 1.750   15.14 | 2.750    3.89 |  3.75    2.11
                   0.833    7.23 | 1.833   15.14 | 2.833    3.89 |  3.83    2.11
                   0.917   12.87 | 1.917   10.64 | 2.917    3.42 |  3.92    1.96
                   1.000   12.87 | 2.000   10.64 | 3.000    3.42 |  4.00    1.96

     Unit Hyd Qpeak  (cms)=   1.103

     PEAK FLOW       (cms)=   0.236 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=   9.881
     TOTAL RAINFALL   (mm)=  58.616
     RUNOFF COEFFICIENT   =   0.169

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0102)|   Area    (ha)=   4.83   Curve Number   (CN)= 57.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.25   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.27

         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    2.39 | 1.083   37.17 | 2.083    8.06 |  3.08    3.05
                0.167    2.39 | 1.167   37.17 | 2.167    8.06 |  3.17    3.05
                0.250    2.89 | 1.250  134.16 | 2.250    6.42 |  3.25    2.75
                0.333    2.89 | 1.333  134.16 | 2.333    6.42 |  3.33    2.75
                0.417    3.65 | 1.417   50.03 | 2.417    5.30 |  3.42    2.50
                0.500    3.65 | 1.500   50.03 | 2.500    5.30 |  3.50    2.50
                0.583    4.89 | 1.583   24.37 | 2.583    4.50 |  3.58    2.29
                0.667    4.89 | 1.667   24.37 | 2.667    4.50 |  3.67    2.29
                0.750    7.23 | 1.750   15.14 | 2.750    3.89 |  3.75    2.11
                0.833    7.23 | 1.833   15.14 | 2.833    3.89 |  3.83    2.11
                0.917   12.87 | 1.917   10.64 | 2.917    3.42 |  3.92    1.96
                1.000   12.87 | 2.000   10.64 | 3.000    3.42 |  4.00    1.96

     Unit Hyd Qpeak  (cms)=   0.683

     PEAK FLOW       (cms)=   0.142 (i)
     TIME TO PEAK    (hrs)=   1.667
     RUNOFF VOLUME    (mm)=  10.852
     TOTAL RAINFALL   (mm)=  58.616
     RUNOFF COEFFICIENT   =   0.185

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

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0001)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):    10.97   0.236     1.83     9.88
      + ID2= 2 (  0102):     4.83   0.142     1.67    10.85
        ===================================================
        ID = 3 (  0001):    15.80   0.369     1.75    10.18

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
==============================================================================================================

       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   TTTTT  TTTTT  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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                    *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\f8eda0d9-
  Summary filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\f8eda0d9-


DATE: 11-13-2023                           TIME: 09:14:59

USER:



COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 4 - 25yr 4hr 10min Chicago (C **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=3158.000
| Ptotal= 71.59 mm |                          B=  15.000
--------------------                          C=   0.933
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    = 10.00 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    2.68 |  1.00   47.76 |  2.00   10.11 |  3.00    3.51
              0.17    3.31 |  1.17  156.47 |  2.17    7.92 |  3.17    3.13
              0.33    4.28 |  1.33   63.86 |  2.33    6.44 |  3.33    2.81
              0.50    5.90 |  1.50   31.72 |  2.50    5.38 |  3.50    2.55
              0.67    9.00 |  1.67   19.56 |  2.67    4.59 |  3.67    2.33
              0.83   16.53 |  1.83   13.56 |  2.83    3.99 |  3.83    2.15


--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0103)|   Area    (ha)=   4.57   Curve Number   (CN)= 57.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.14

         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    2.68 | 1.083   47.76 | 2.083   10.11 |  3.08    3.51
             0.167    2.68 | 1.167   47.76 | 2.167   10.11 |  3.17    3.51
             0.250    3.31 | 1.250  156.47 | 2.250    7.92 |  3.25    3.13
             0.333    3.31 | 1.333  156.47 | 2.333    7.92 |  3.33    3.13
             0.417    4.28 | 1.417   63.86 | 2.417    6.44 |  3.42    2.81
             0.500    4.28 | 1.500   63.86 | 2.500    6.44 |  3.50    2.81
             0.583    5.90 | 1.583   31.72 | 2.583    5.38 |  3.58    2.55
             0.667    5.90 | 1.667   31.72 | 2.667    5.38 |  3.67    2.55
             0.750    9.00 | 1.750   19.56 | 2.750    4.59 |  3.75    2.33
             0.833    9.00 | 1.833   19.56 | 2.833    4.59 |  3.83    2.33
             0.917   16.53 | 1.917   13.56 | 2.917    3.99 |  3.92    2.15
             1.000   16.53 | 2.000   13.56 | 3.000    3.99 |  4.00    2.15

     Unit Hyd Qpeak  (cms)=   1.247

     PEAK FLOW       (cms)=   0.267 (i)
     TIME TO PEAK    (hrs)=   1.500
     RUNOFF VOLUME    (mm)=  15.726
     TOTAL RAINFALL   (mm)=  71.589
     RUNOFF COEFFICIENT   =   0.220

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0101)|   Area    (ha)=  10.97   Curve Number   (CN)= 56.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.99   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.38

         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    2.68 | 1.083   47.76 | 2.083   10.11 |  3.08    3.51
             0.167    2.68 | 1.167   47.76 | 2.167   10.11 |  3.17    3.51
             0.250    3.31 | 1.250  156.47 | 2.250    7.92 |  3.25    3.13
             0.333    3.31 | 1.333  156.47 | 2.333    7.92 |  3.33    3.13
             0.417    4.28 | 1.417   63.86 | 2.417    6.44 |  3.42    2.81
             0.500    4.28 | 1.500   63.86 | 2.500    6.44 |  3.50    2.81
             0.583    5.90 | 1.583   31.72 | 2.583    5.38 |  3.58    2.55
             0.667    5.90 | 1.667   31.72 | 2.667    5.38 |  3.67    2.55
             0.750    9.00 | 1.750   19.56 | 2.750    4.59 |  3.75    2.33
             0.833    9.00 | 1.833   19.56 | 2.833    4.59 |  3.83    2.33
             0.917   16.53 | 1.917   13.56 | 2.917    3.99 |  3.92    2.15
             1.000   16.53 | 2.000   13.56 | 3.000    3.99 |  4.00    2.15

     Unit Hyd Qpeak  (cms)=   1.103

     PEAK FLOW       (cms)=   0.365 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=  14.945
     TOTAL RAINFALL   (mm)=  71.589
     RUNOFF COEFFICIENT   =   0.209

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

--------------------------------------------------------------------------------
```

```
--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   4.83   Curve Number   (CN)= 57.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.25   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.27

         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    2.68 | 1.083   47.76 | 2.083   10.11 |  3.08    3.51
                   0.167    2.68 | 1.167   47.76 | 2.167   10.11 |  3.17    3.51
                   0.250    3.31 | 1.250  156.47 | 2.250    7.92 |  3.25    3.13
                   0.333    3.31 | 1.333  156.47 | 2.333    7.92 |  3.33    3.13
                   0.417    4.28 | 1.417   63.86 | 2.417    6.44 |  3.42    2.81
                   0.500    4.28 | 1.500   63.86 | 2.500    6.44 |  3.50    2.81
                   0.583    5.90 | 1.583   31.72 | 2.583    5.38 |  3.58    2.55
                   0.667    5.90 | 1.667   31.72 | 2.667    5.38 |  3.67    2.55
                   0.750    9.00 | 1.750   19.56 | 2.750    4.59 |  3.75    2.33
                   0.833    9.00 | 1.833   19.56 | 2.833    4.59 |  3.83    2.33
                   0.917   16.53 | 1.917   13.56 | 2.917    3.99 |  3.92    2.15
                   1.000   16.53 | 2.000   13.56 | 3.000    3.99 |  4.00    2.15

     Unit Hyd Qpeak  (cms)=   0.683

     PEAK FLOW       (cms)=   0.214 (i)
     TIME TO PEAK    (hrs)=   1.667
     RUNOFF VOLUME    (mm)=  16.163
     TOTAL RAINFALL   (mm)=  71.589
     RUNOFF COEFFICIENT   =   0.226

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

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0001)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):    10.97   0.365     1.83    14.94
      + ID2= 2 (  0102):     4.83   0.214     1.67    16.16
        ====================================================
        ID = 3 (  0001):    15.80   0.566     1.75    15.32

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
=============================================================================================

       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   TTTTT  TTTTT  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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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\45082d52-
  Summary filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\45082d52-


DATE: 11-13-2023                            TIME: 09:14:59

USER:


COMMENTS: ____________________________________________________________


---------------------------------------------------------------------------------------------
  ************************************************
```

```
  ** SIMULATION : 5 - 50yr 4hr 10min Chicago (C **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=3886.000
| Ptotal= 80.32 mm |                          B=  16.000
--------------------                          C=   0.950
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    = 10.00 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    2.76 |  1.00   54.62 |  2.00   11.20 |  3.00    3.68
                  0.17    3.46 |  1.17  176.19 |  2.17    8.68 |  3.17    3.25
                  0.33    4.54 |  1.33   73.10 |  2.33    6.99 |  3.33    2.91
                  0.50    6.37 |  1.50   36.22 |  2.50    5.78 |  3.50    2.62
                  0.67    9.92 |  1.67   22.14 |  2.67    4.89 |  3.67    2.38
                  0.83   18.63 |  1.83   15.18 |  2.83    4.21 |  3.83    2.18


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0103)|   Area    (ha)=   4.57   Curve Number   (CN)= 57.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.14

         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    2.76 | 1.083   54.62 | 2.083   11.20 |  3.08    3.68
                 0.167    2.76 | 1.167   54.62 | 2.167   11.20 |  3.17    3.68
                 0.250    3.46 | 1.250  176.19 | 2.250    8.68 |  3.25    3.25
                 0.333    3.46 | 1.333  176.19 | 2.333    8.68 |  3.33    3.25
                 0.417    4.54 | 1.417   73.10 | 2.417    6.99 |  3.42    2.91
                 0.500    4.54 | 1.500   73.10 | 2.500    6.99 |  3.50    2.91
                 0.583    6.37 | 1.583   36.22 | 2.583    5.78 |  3.58    2.62
                 0.667    6.37 | 1.667   36.22 | 2.667    5.78 |  3.67    2.62
                 0.750    9.92 | 1.750   22.14 | 2.750    4.89 |  3.75    2.38
                 0.833    9.92 | 1.833   22.14 | 2.833    4.89 |  3.83    2.38
                 0.917   18.63 | 1.917   15.18 | 2.917    4.21 |  3.92    2.18
                 1.000   18.63 | 2.000   15.18 | 3.000    4.21 |  4.00    2.18

     Unit Hyd Qpeak  (cms)=   1.247

     PEAK FLOW       (cms)=   0.341 (i)
     TIME TO PEAK    (hrs)=   1.500
     RUNOFF VOLUME    (mm)=  19.668
     TOTAL RAINFALL   (mm)=  80.320
     RUNOFF COEFFICIENT   =   0.245

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=  10.97   Curve Number   (CN)= 56.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.99   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.38

         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    2.76 | 1.083   54.62 | 2.083   11.20 |  3.08    3.68
                 0.167    2.76 | 1.167   54.62 | 2.167   11.20 |  3.17    3.68
                 0.250    3.46 | 1.250  176.19 | 2.250    8.68 |  3.25    3.25
                 0.333    3.46 | 1.333  176.19 | 2.333    8.68 |  3.33    3.25
                 0.417    4.54 | 1.417   73.10 | 2.417    6.99 |  3.42    2.91
                 0.500    4.54 | 1.500   73.10 | 2.500    6.99 |  3.50    2.91
                 0.583    6.37 | 1.583   36.22 | 2.583    5.78 |  3.58    2.62
                 0.667    6.37 | 1.667   36.22 | 2.667    5.78 |  3.67    2.62
                 0.750    9.92 | 1.750   22.14 | 2.750    4.89 |  3.75    2.38
                 0.833    9.92 | 1.833   22.14 | 2.833    4.89 |  3.83    2.38
                 0.917   18.63 | 1.917   15.18 | 2.917    4.21 |  3.92    2.18
                 1.000   18.63 | 2.000   15.18 | 3.000    4.21 |  4.00    2.18
```

```
     Unit Hyd Qpeak  (cms)=   1.103

     PEAK FLOW       (cms)=   0.469 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=  18.779
     TOTAL RAINFALL   (mm)=  80.320
     RUNOFF COEFFICIENT   =   0.234

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0102)|   Area    (ha)=   4.83   Curve Number   (CN)= 57.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.25   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.27

         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    2.76 | 1.083   54.62 | 2.083   11.20 |  3.08    3.68
                   0.167    2.76 | 1.167   54.62 | 2.167   11.20 |  3.17    3.68
                   0.250    3.46 | 1.250  176.19 | 2.250    8.68 |  3.25    3.25
                   0.333    3.46 | 1.333  176.19 | 2.333    8.68 |  3.33    3.25
                   0.417    4.54 | 1.417   73.10 | 2.417    6.99 |  3.42    2.91
                   0.500    4.54 | 1.500   73.10 | 2.500    6.99 |  3.50    2.91
                   0.583    6.37 | 1.583   36.22 | 2.583    5.78 |  3.58    2.62
                   0.667    6.37 | 1.667   36.22 | 2.667    5.78 |  3.67    2.62
                   0.750    9.92 | 1.750   22.14 | 2.750    4.89 |  3.75    2.38
                   0.833    9.92 | 1.833   22.14 | 2.833    4.89 |  3.83    2.38
                   0.917   18.63 | 1.917   15.18 | 2.917    4.21 |  3.92    2.18
                   1.000   18.63 | 2.000   15.18 | 3.000    4.21 |  4.00    2.18

     Unit Hyd Qpeak  (cms)=   0.683

     PEAK FLOW       (cms)=   0.274 (i)
     TIME TO PEAK    (hrs)=   1.667
     RUNOFF VOLUME    (mm)=  20.160
     TOTAL RAINFALL   (mm)=  80.320
     RUNOFF COEFFICIENT   =   0.251

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

--------------------------------------------------------------------------------


--------------------
| ADD HYD  (  0001)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (  0101):    10.97   0.469     1.83    18.78
        + ID2= 2 (  0102):     4.83   0.274     1.67    20.16
          ===================================================
          ID = 3 (  0001):    15.80   0.726     1.75    19.20

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
============================================================================================================

       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   TTTTT  TTTTT  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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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\17292c27-
  Summary filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\17292c27-
```
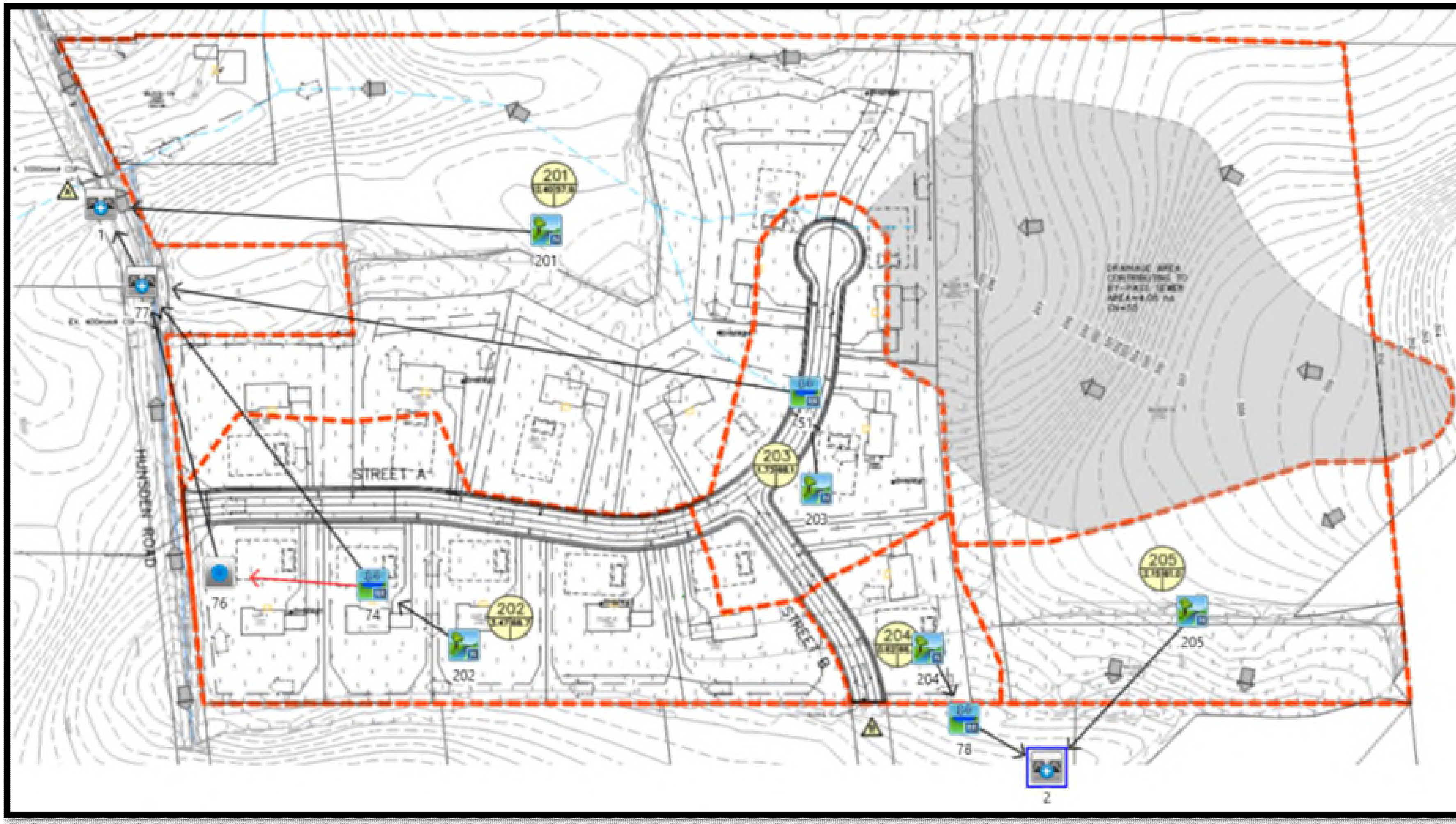

```
DATE: 11-13-2023                         TIME: 09:14:59

USER:


COMMENTS: ____________________________________________________________

--------------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 6 - 100yr 4hr 10min Chicago ( **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=4688.000
| Ptotal= 89.87 mm |                          B=  17.000
--------------------                          C=   0.962
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    = 10.00 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    2.89 |  1.00   62.12 |  2.00   12.48 |  3.00    3.91
                 0.17    3.67 |  1.17  196.54 |  2.17    9.60 |  3.17    3.44
                 0.33    4.88 |  1.33   83.09 |  2.33    7.66 |  3.33    3.05
                 0.50    6.96 |  1.50   41.25 |  2.50    6.29 |  3.50    2.73
                 0.67   11.02 |  1.67   25.07 |  2.67    5.28 |  3.67    2.47
                 0.83   21.03 |  1.83   17.06 |  2.83    4.51 |  3.83    2.24


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0103)|   Area    (ha)=   4.57   Curve Number   (CN)= 57.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.14

         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    2.89 | 1.083   62.12 | 2.083   12.48 |  3.08    3.91
                0.167    2.89 | 1.167   62.12 | 2.167   12.48 |  3.17    3.91
                0.250    3.67 | 1.250  196.54 | 2.250    9.60 |  3.25    3.44
                0.333    3.67 | 1.333  196.54 | 2.333    9.60 |  3.33    3.44
                0.417    4.88 | 1.417   83.09 | 2.417    7.66 |  3.42    3.05
                0.500    4.88 | 1.500   83.09 | 2.500    7.66 |  3.50    3.05
                0.583    6.96 | 1.583   41.25 | 2.583    6.29 |  3.58    2.73
                0.667    6.96 | 1.667   41.25 | 2.667    6.29 |  3.67    2.73
                0.750   11.02 | 1.750   25.07 | 2.750    5.28 |  3.75    2.47
                0.833   11.02 | 1.833   25.07 | 2.833    5.28 |  3.83    2.47
                0.917   21.03 | 1.917   17.06 | 2.917    4.51 |  3.92    2.24
                1.000   21.03 | 2.000   17.06 | 3.000    4.51 |  4.00    2.24

     Unit Hyd Qpeak  (cms)=   1.247

     PEAK FLOW       (cms)=   0.428 (i)
     TIME TO PEAK    (hrs)=   1.500
     RUNOFF VOLUME    (mm)=  24.325
     TOTAL RAINFALL   (mm)=  89.870
     RUNOFF COEFFICIENT   =   0.271

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=  10.97   Curve Number   (CN)= 56.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.99   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.38

         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    2.89 | 1.083   62.12 | 2.083   12.48 |  3.08    3.91
              0.167    2.89 | 1.167   62.12 | 2.167   12.48 |  3.17    3.91
              0.250    3.67 | 1.250  196.54 | 2.250    9.60 |  3.25    3.44
              0.333    3.67 | 1.333  196.54 | 2.333    9.60 |  3.33    3.44
              0.417    4.88 | 1.417   83.09 | 2.417    7.66 |  3.42    3.05
              0.500    4.88 | 1.500   83.09 | 2.500    7.66 |  3.50    3.05
              0.583    6.96 | 1.583   41.25 | 2.583    6.29 |  3.58    2.73
              0.667    6.96 | 1.667   41.25 | 2.667    6.29 |  3.67    2.73
              0.750   11.02 | 1.750   25.07 | 2.750    5.28 |  3.75    2.47
              0.833   11.02 | 1.833   25.07 | 2.833    5.28 |  3.83    2.47
              0.917   21.03 | 1.917   17.06 | 2.917    4.51 |  3.92    2.24
              1.000   21.03 | 2.000   17.06 | 3.000    4.51 |  4.00    2.24

     Unit Hyd Qpeak  (cms)=   1.103

     PEAK FLOW       (cms)=   0.592 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=  23.321
     TOTAL RAINFALL   (mm)=  89.870
     RUNOFF COEFFICIENT   =   0.260

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   4.83   Curve Number   (CN)= 57.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.25   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.27

         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    2.89 | 1.083   62.12 | 2.083   12.48 |  3.08    3.91
              0.167    2.89 | 1.167   62.12 | 2.167   12.48 |  3.17    3.91
              0.250    3.67 | 1.250  196.54 | 2.250    9.60 |  3.25    3.44
              0.333    3.67 | 1.333  196.54 | 2.333    9.60 |  3.33    3.44
              0.417    4.88 | 1.417   83.09 | 2.417    7.66 |  3.42    3.05
              0.500    4.88 | 1.500   83.09 | 2.500    7.66 |  3.50    3.05
              0.583    6.96 | 1.583   41.25 | 2.583    6.29 |  3.58    2.73
              0.667    6.96 | 1.667   41.25 | 2.667    6.29 |  3.67    2.73
              0.750   11.02 | 1.750   25.07 | 2.750    5.28 |  3.75    2.47
              0.833   11.02 | 1.833   25.07 | 2.833    5.28 |  3.83    2.47
              0.917   21.03 | 1.917   17.06 | 2.917    4.51 |  3.92    2.24
              1.000   21.03 | 2.000   17.06 | 3.000    4.51 |  4.00    2.24

     Unit Hyd Qpeak  (cms)=   0.683

     PEAK FLOW       (cms)=   0.343 (i)
     TIME TO PEAK    (hrs)=   1.667
     RUNOFF VOLUME    (mm)=  24.876
     TOTAL RAINFALL   (mm)=  89.870
     RUNOFF COEFFICIENT   =   0.277

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0001)|
|   1 +  2 =  3    |           AREA    QPEAK    TPEAK     R.V.
--------------------           (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):    10.97   0.592     1.83    23.32
      + ID2= 2 (  0102):     4.83   0.343     1.67    24.88
        ==================================================
        ID = 3 (  0001):    15.80   0.915     1.75    23.80

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

 FINISH
===========================================================================================================
```

Post-development VO Modelling 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   TTTTT  TTTTT  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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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\160ca4b0-
  Summary filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\160ca4b0-


DATE: 11-13-2023                          TIME: 09:09:01

USER:



COMMENTS: ____________________________________________________________


-----------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 0 - 25mm Design Storm (Caledo **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\jfletcher\AppD
|                  |              ata\Local\Temp\
|                  |              c844526a-88fb-45d7-95f6-5b3c033c9171\4096aaff
| Ptotal= 25.00 mm |    Comments: 25mm 4hr 10min Chicago (Caledon IDF)
--------------------
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.00    1.12 |  1.00   14.32 |  2.00    3.27 |  3.00    1.38
                  0.17    1.32 |  1.17   62.63 |  2.17    2.67 |  3.17    1.26
                  0.33    1.62 |  1.33   19.43 |  2.33    2.25 |  3.33    1.16
                  0.50    2.09 |  1.50    9.24 |  2.50    1.95 |  3.50    1.08
                  0.67    2.96 |  1.67    5.84 |  2.67    1.71 |  3.67    1.00
                  0.83    5.02 |  1.83    4.21 |  2.83    1.53 |  3.83    0.94

--------------------------------------------------------------------------------


--------------------
| CALIB            |
| NASHYD   (  0201)|   Area    (ha)=  12.40   Curve Number   (CN)= 58.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.39   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.53

         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    1.12 | 1.083   14.32 | 2.083    3.27 |  3.08    1.38
                 0.167    1.12 | 1.167   14.32 | 2.167    3.27 |  3.17    1.38
                 0.250    1.32 | 1.250   62.63 | 2.250    2.67 |  3.25    1.26
                 0.333    1.32 | 1.333   62.63 | 2.333    2.67 |  3.33    1.26
                 0.417    1.62 | 1.417   19.43 | 2.417    2.25 |  3.42    1.16
                 0.500    1.62 | 1.500   19.43 | 2.500    2.25 |  3.50    1.16
                 0.583    2.09 | 1.583    9.24 | 2.583    1.95 |  3.58    1.08
                 0.667    2.09 | 1.667    9.24 | 2.667    1.95 |  3.67    1.08
                 0.750    2.96 | 1.750    5.84 | 2.750    1.71 |  3.75    1.00
                 0.833    2.96 | 1.833    5.84 | 2.833    1.71 |  3.83    1.00
                 0.917    5.02 | 1.917    4.21 | 2.917    1.53 |  3.92    0.94
                 1.000    5.02 | 2.000    4.21 | 3.000    1.53 |  4.00    0.94

    Unit Hyd Qpeak  (cms)=   0.894
```

```
     PEAK FLOW       (cms)=   0.027 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=   1.376
     TOTAL RAINFALL   (mm)=  25.000
     RUNOFF COEFFICIENT   =   0.055

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (  0202)|   Area     (ha)=    3.47   Curve Number   (CN)= 63.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=    4.54   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.54

         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     1.12 | 1.083    14.32 | 2.083     3.27 |  3.08     1.38
                  0.167     1.12 | 1.167    14.32 | 2.167     3.27 |  3.17     1.38
                  0.250     1.32 | 1.250    62.63 | 2.250     2.67 |  3.25     1.26
                  0.333     1.32 | 1.333    62.63 | 2.333     2.67 |  3.33     1.26
                  0.417     1.62 | 1.417    19.43 | 2.417     2.25 |  3.42     1.16
                  0.500     1.62 | 1.500    19.43 | 2.500     2.25 |  3.50     1.16
                  0.583     2.09 | 1.583     9.24 | 2.583     1.95 |  3.58     1.08
                  0.667     2.09 | 1.667     9.24 | 2.667     1.95 |  3.67     1.08
                  0.750     2.96 | 1.750     5.84 | 2.750     1.71 |  3.75     1.00
                  0.833     2.96 | 1.833     5.84 | 2.833     1.71 |  3.83     1.00
                  0.917     5.02 | 1.917     4.21 | 2.917     1.53 |  3.92     0.94
                  1.000     5.02 | 2.000     4.21 | 3.000     1.53 |  4.00     0.94

     Unit Hyd Qpeak  (cms)=   0.245

     PEAK FLOW       (cms)=   0.014 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=   2.467
     TOTAL RAINFALL   (mm)=  25.000
     RUNOFF COEFFICIENT   =   0.099

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0074)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)    |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.0001      0.0079

                                  AREA      QPEAK     TPEAK       R.V.
                                  (ha)      (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)       3.470       0.014       2.00        2.47
   OUTFLOW: ID= 1 (  0074)       0.762       0.000       4.17        0.20
   OVERFLOW:ID= 3 (  0003)       2.708       0.003       4.17        0.20

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =    19
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  1.58
                   PERCENTAGE OF TIME OVERFLOWING   (%) = 23.75

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.69
                   TIME SHIFT OF PEAK FLOW         (min)=130.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0079

--------------------------------------------------------------------------------


  --------------------------
  | Junction Command(0076) |
  --------------------------

                             AREA     QPEAK    TPEAK     R.V.
                             (ha)     (cms)    (hrs)     (mm)
  INFLOW : ID= 3(  0074)     2.71      0.00     4.17     0.20
  OUTFLOW: ID= 2(  0076)     2.71      0.00     4.17     0.20

  --------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (  0203)|   Area     (ha)=    1.73   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=    4.42   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.40
```

```
        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    1.12 | 1.083   14.32 | 2.083    3.27 |  3.08    1.38
                0.167    1.12 | 1.167   14.32 | 2.167    3.27 |  3.17    1.38
                0.250    1.32 | 1.250   62.63 | 2.250    2.67 |  3.25    1.26
                0.333    1.32 | 1.333   62.63 | 2.333    2.67 |  3.33    1.26
                0.417    1.62 | 1.417   19.43 | 2.417    2.25 |  3.42    1.16
                0.500    1.62 | 1.500   19.43 | 2.500    2.25 |  3.50    1.16
                0.583    2.09 | 1.583    9.24 | 2.583    1.95 |  3.58    1.08
                0.667    2.09 | 1.667    9.24 | 2.667    1.95 |  3.67    1.08
                0.750    2.96 | 1.750    5.84 | 2.750    1.71 |  3.75    1.00
                0.833    2.96 | 1.833    5.84 | 2.833    1.71 |  3.83    1.00
                0.917    5.02 | 1.917    4.21 | 2.917    1.53 |  3.92    0.94
                1.000    5.02 | 2.000    4.21 | 3.000    1.53 |  4.00    0.94

    Unit Hyd Qpeak  (cms)=   0.165

    PEAK FLOW       (cms)=   0.010 (i)
    TIME TO PEAK    (hrs)=   1.833
    RUNOFF VOLUME     (mm)=   2.691
    TOTAL RAINFALL    (mm)=  25.000
    RUNOFF COEFFICIENT    =   0.108

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0051)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)    |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.0001      0.0054

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 (  0203)        1.730      0.010      1.83        2.69
  OUTFLOW: ID= 1 (  0051)        1.730      0.000      5.08        0.06
  OVERFLOW:ID= 3 (  0003)        0.000      0.000      0.00        0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.88
                   TIME SHIFT OF PEAK FLOW         (min)=195.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0046

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0077)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0051):      1.73   0.000     5.08     0.06
     + ID2= 2 (  0074):      0.76   0.000     4.17     0.20
       ===================================================
       ID = 3 (  0077):      2.49   0.000     5.08     0.10

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0077)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 3 (  0077):      2.49   0.000     5.08     0.10
     + ID2= 2 (  0076):      2.71   0.003     4.17     0.20
       ===================================================
       ID = 1 (  0077):      5.20   0.003     4.17     0.15

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0001)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0201):     12.40   0.027     2.08     1.38
     + ID2= 2 (  0077):      5.20   0.003     4.17     0.15
       ===================================================
```

```
       ID = 3 (  0001):    17.60   0.027     2.08     1.01

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0204)|    Area    (ha)=   0.62   Curve Number   (CN)= 63.0
|ID= 1 DT= 5.0 min |    Ia      (mm)=   4.58   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=   0.21

        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    1.12 | 1.083   14.32 | 2.083    3.27 |  3.08    1.38
                  0.167    1.12 | 1.167   14.32 | 2.167    3.27 |  3.17    1.38
                  0.250    1.32 | 1.250   62.63 | 2.250    2.67 |  3.25    1.26
                  0.333    1.32 | 1.333   62.63 | 2.333    2.67 |  3.33    1.26
                  0.417    1.62 | 1.417   19.43 | 2.417    2.25 |  3.42    1.16
                  0.500    1.62 | 1.500   19.43 | 2.500    2.25 |  3.50    1.16
                  0.583    2.09 | 1.583    9.24 | 2.583    1.95 |  3.58    1.08
                  0.667    2.09 | 1.667    9.24 | 2.667    1.95 |  3.67    1.08
                  0.750    2.96 | 1.750    5.84 | 2.750    1.71 |  3.75    1.00
                  0.833    2.96 | 1.833    5.84 | 2.833    1.71 |  3.83    1.00
                  0.917    5.02 | 1.917    4.21 | 2.917    1.53 |  3.92    0.94
                  1.000    5.02 | 2.000    4.21 | 3.000    1.53 |  4.00    0.94

    Unit Hyd Qpeak  (cms)=   0.113

    PEAK FLOW       (cms)=   0.005 (i)
    TIME TO PEAK    (hrs)=   1.583
    RUNOFF VOLUME    (mm)=   2.454
    TOTAL RAINFALL   (mm)=  25.000
    RUNOFF COEFFICIENT   =   0.098

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0078)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)    |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.0001      0.0022

                                   AREA      QPEAK      TPEAK       R.V.
                                   (ha)      (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  0204)        0.620      0.005       1.58       2.45
   OUTFLOW: ID= 1 (  0078)        0.620      0.000       4.42       0.10
   OVERFLOW:ID= 3 (  0003)        0.000      0.000       0.00       0.00

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                  PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.46
                  TIME SHIFT OF PEAK FLOW         (min)=170.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0015

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0205)|    Area    (ha)=   2.15   Curve Number   (CN)= 59.0
|ID= 1 DT= 5.0 min |    Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=   0.13

        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    1.12 | 1.083   14.32 | 2.083    3.27 |  3.08    1.38
                  0.167    1.12 | 1.167   14.32 | 2.167    3.27 |  3.17    1.38
                  0.250    1.32 | 1.250   62.63 | 2.250    2.67 |  3.25    1.26
                  0.333    1.32 | 1.333   62.63 | 2.333    2.67 |  3.33    1.26
                  0.417    1.62 | 1.417   19.43 | 2.417    2.25 |  3.42    1.16
                  0.500    1.62 | 1.500   19.43 | 2.500    2.25 |  3.50    1.16
                  0.583    2.09 | 1.583    9.24 | 2.583    1.95 |  3.58    1.08
                  0.667    2.09 | 1.667    9.24 | 2.667    1.95 |  3.67    1.08
                  0.750    2.96 | 1.750    5.84 | 2.750    1.71 |  3.75    1.00
                  0.833    2.96 | 1.833    5.84 | 2.833    1.71 |  3.83    1.00
```

```
               0.917    5.02 | 1.917    4.21 | 2.917    1.53 |  3.92    0.94
               1.000    5.02 | 2.000    4.21 | 3.000    1.53 |  4.00    0.94

     Unit Hyd Qpeak  (cms)=   0.632

     PEAK FLOW       (cms)=   0.016 (i)
     TIME TO PEAK    (hrs)=   1.500
     RUNOFF VOLUME    (mm)=   2.015
     TOTAL RAINFALL   (mm)=  25.000
     RUNOFF COEFFICIENT   =   0.081

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0002)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0205):      2.15   0.016     1.50     2.02
      + ID2= 2 (  0078):      0.62   0.000     4.42     0.10
        ===================================================
        ID = 3 (  0002):      2.77   0.016     1.50     1.59

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

 FINISH
===========================================================================================================

===========================================================================================================

       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   TTTTT  TTTTT  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
Developed and Distributed by Smart City Water Inc
```



```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\4a71a45f-
  Summary filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\4a71a45f-


DATE: 11-13-2023                          TIME: 09:09:01

USER:


COMMENTS: ____________________________________________________________


-----------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 1- 2yr 4hr 10min Chicago (Cal **
  ************************************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A=1070.000
| Ptotal= 34.22 mm |                           B=   7.850
--------------------                           C=   0.876
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  4.00 hrs
                         Storm time step    = 10.00 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    1.53 |  1.00   19.60 |  2.00    4.48 |  3.00    1.89
                   0.17    1.81 |  1.17   85.72 |  2.17    3.65 |  3.17    1.73
                   0.33    2.22 |  1.33   26.59 |  2.33    3.08 |  3.33    1.59
```

```
              0.50    2.87 |  1.50   12.64 |  2.50    2.66 |  3.50    1.47
              0.67    4.06 |  1.67    7.99 |  2.67    2.34 |  3.67    1.37
              0.83    6.86 |  1.83    5.76 |  2.83    2.10 |  3.83    1.29

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0201)|   Area    (ha)=  12.40   Curve Number   (CN)= 58.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.39   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.53

         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    1.53 | 1.083   19.60 | 2.083    4.48 |  3.08    1.89
              0.167    1.53 | 1.167   19.60 | 2.167    4.48 |  3.17    1.89
              0.250    1.81 | 1.250   85.72 | 2.250    3.65 |  3.25    1.73
              0.333    1.81 | 1.333   85.72 | 2.333    3.65 |  3.33    1.73
              0.417    2.22 | 1.417   26.59 | 2.417    3.08 |  3.42    1.59
              0.500    2.22 | 1.500   26.59 | 2.500    3.08 |  3.50    1.59
              0.583    2.87 | 1.583   12.64 | 2.583    2.66 |  3.58    1.47
              0.667    2.87 | 1.667   12.64 | 2.667    2.66 |  3.67    1.47
              0.750    4.06 | 1.750    7.99 | 2.750    2.34 |  3.75    1.37
              0.833    4.06 | 1.833    7.99 | 2.833    2.34 |  3.83    1.37
              0.917    6.86 | 1.917    5.76 | 2.917    2.10 |  3.92    1.29
              1.000    6.86 | 2.000    5.76 | 3.000    2.10 |  4.00    1.29

     Unit Hyd Qpeak  (cms)=   0.894

     PEAK FLOW       (cms)=   0.065 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=   3.180
     TOTAL RAINFALL   (mm)=  34.218
     RUNOFF COEFFICIENT   =   0.093

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0202)|   Area    (ha)=   3.47   Curve Number   (CN)= 63.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   4.54   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.54

         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    1.53 | 1.083   19.60 | 2.083    4.48 |  3.08    1.89
              0.167    1.53 | 1.167   19.60 | 2.167    4.48 |  3.17    1.89
              0.250    1.81 | 1.250   85.72 | 2.250    3.65 |  3.25    1.73
              0.333    1.81 | 1.333   85.72 | 2.333    3.65 |  3.33    1.73
              0.417    2.22 | 1.417   26.59 | 2.417    3.08 |  3.42    1.59
              0.500    2.22 | 1.500   26.59 | 2.500    3.08 |  3.50    1.59
              0.583    2.87 | 1.583   12.64 | 2.583    2.66 |  3.58    1.47
              0.667    2.87 | 1.667   12.64 | 2.667    2.66 |  3.67    1.47
              0.750    4.06 | 1.750    7.99 | 2.750    2.34 |  3.75    1.37
              0.833    4.06 | 1.833    7.99 | 2.833    2.34 |  3.83    1.37
              0.917    6.86 | 1.917    5.76 | 2.917    2.10 |  3.92    1.29
              1.000    6.86 | 2.000    5.76 | 3.000    2.10 |  4.00    1.29

     Unit Hyd Qpeak  (cms)=   0.245

     PEAK FLOW       (cms)=   0.030 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=   4.924
     TOTAL RAINFALL   (mm)=  34.218
     RUNOFF COEFFICIENT   =   0.144

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0074)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)    |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.0001      0.0079
```

```
                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)       3.470      0.030      2.00        4.92
   OUTFLOW: ID= 1 (  0074)       0.066      0.000      2.33        2.67
   OVERFLOW:ID= 3 (  0003)       3.404      0.025      2.33        2.67

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =    44
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  3.67
                   PERCENTAGE OF TIME OVERFLOWING   (%) = 53.66

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.34
                   TIME SHIFT OF PEAK FLOW         (min)= 20.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0078

--------------------------------------------------------------------------------

  --------------------------
  | Junction Command(0076) |
  --------------------------

                             AREA     QPEAK   TPEAK     R.V.
                             (ha)     (cms)    (hrs)    (mm)
  INFLOW : ID= 3(  0074)      3.40      0.03    2.33     2.67
  OUTFLOW: ID= 2(  0076)      3.40      0.03    2.33     2.67

  --------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0203)|   Area    (ha)=   1.73   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   4.42   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.40

         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    1.53 | 1.083   19.60 | 2.083    4.48 |  3.08    1.89
                 0.167    1.53 | 1.167   19.60 | 2.167    4.48 |  3.17    1.89
                 0.250    1.81 | 1.250   85.72 | 2.250    3.65 |  3.25    1.73
                 0.333    1.81 | 1.333   85.72 | 2.333    3.65 |  3.33    1.73
                 0.417    2.22 | 1.417   26.59 | 2.417    3.08 |  3.42    1.59
                 0.500    2.22 | 1.500   26.59 | 2.500    3.08 |  3.50    1.59
                 0.583    2.87 | 1.583   12.64 | 2.583    2.66 |  3.58    1.47
                 0.667    2.87 | 1.667   12.64 | 2.667    2.66 |  3.67    1.47
                 0.750    4.06 | 1.750    7.99 | 2.750    2.34 |  3.75    1.37
                 0.833    4.06 | 1.833    7.99 | 2.833    2.34 |  3.83    1.37
                 0.917    6.86 | 1.917    5.76 | 2.917    2.10 |  3.92    1.29
                 1.000    6.86 | 2.000    5.76 | 3.000    2.10 |  4.00    1.29

     Unit Hyd Qpeak  (cms)=   0.165

     PEAK FLOW       (cms)=   0.020 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=   5.329
     TOTAL RAINFALL   (mm)=  34.218
     RUNOFF COEFFICIENT   =   0.156

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0051)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0001      0.0054

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0203)       1.730      0.020      1.83        5.33
   OUTFLOW: ID= 1 (  0051)       0.065      0.000      2.33        2.23
   OVERFLOW:ID= 3 (  0003)       1.665      0.012      2.33        2.23

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =    35
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  2.92
                   PERCENTAGE OF TIME OVERFLOWING   (%) = 49.30

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.51
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0054
```

```
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0077)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0051):     0.07   0.000     2.33     2.23
      + ID2= 2 (  0074):     0.07   0.000     2.33     2.67
        ====================================================
        ID = 3 (  0077):     0.13   0.000     2.33     2.45

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0077)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0077):     0.13   0.000     2.33     2.45
      + ID2= 2 (  0076):     3.40   0.025     2.33     2.67
        ====================================================
        ID = 1 (  0077):     3.54   0.025     2.33     2.66

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0001)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):    12.40   0.065     2.00     3.18
      + ID2= 2 (  0077):     3.54   0.025     2.33     2.66
        ====================================================
        ID = 3 (  0001):    15.94   0.084     2.33     3.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   0.62   Curve Number   (CN)= 63.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   4.58   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.21

         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    1.53 | 1.083   19.60 | 2.083    4.48 |  3.08    1.89
                  0.167    1.53 | 1.167   19.60 | 2.167    4.48 |  3.17    1.89
                  0.250    1.81 | 1.250   85.72 | 2.250    3.65 |  3.25    1.73
                  0.333    1.81 | 1.333   85.72 | 2.333    3.65 |  3.33    1.73
                  0.417    2.22 | 1.417   26.59 | 2.417    3.08 |  3.42    1.59
                  0.500    2.22 | 1.500   26.59 | 2.500    3.08 |  3.50    1.59
                  0.583    2.87 | 1.583   12.64 | 2.583    2.66 |  3.58    1.47
                  0.667    2.87 | 1.667   12.64 | 2.667    2.66 |  3.67    1.47
                  0.750    4.06 | 1.750    7.99 | 2.750    2.34 |  3.75    1.37
                  0.833    4.06 | 1.833    7.99 | 2.833    2.34 |  3.83    1.37
                  0.917    6.86 | 1.917    5.76 | 2.917    2.10 |  3.92    1.29
                  1.000    6.86 | 2.000    5.76 | 3.000    2.10 |  4.00    1.29

     Unit Hyd Qpeak  (cms)=   0.113

     PEAK FLOW       (cms)=   0.009 (i)
     TIME TO PEAK    (hrs)=   1.583
     RUNOFF VOLUME    (mm)=   4.904
     TOTAL RAINFALL   (mm)=  34.218
     RUNOFF COEFFICIENT   =   0.143

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0078)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0001      0.0022

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0204)       0.620      0.009      1.58        4.90
   OUTFLOW: ID= 1 (  0078)       0.082      0.000      2.33        1.39
```

```
   OVERFLOW:ID= 3 (  0003)      0.538      0.002      2.33       1.39

                    TOTAL NUMBER OF SIMULATION OVERFLOW  =    26
                    CUMULATIVE TIME OF OVERFLOW  (HOURS) =  2.17
                    PERCENTAGE OF TIME OVERFLOWING   (%) = 44.07

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.06
                    TIME SHIFT OF PEAK FLOW        (min)= 45.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0022

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0205)|   Area    (ha)=   2.15   Curve Number   (CN)= 59.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.13

         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    1.53 | 1.083   19.60 | 2.083    4.48 |  3.08    1.89
                0.167    1.53 | 1.167   19.60 | 2.167    4.48 |  3.17    1.89
                0.250    1.81 | 1.250   85.72 | 2.250    3.65 |  3.25    1.73
                0.333    1.81 | 1.333   85.72 | 2.333    3.65 |  3.33    1.73
                0.417    2.22 | 1.417   26.59 | 2.417    3.08 |  3.42    1.59
                0.500    2.22 | 1.500   26.59 | 2.500    3.08 |  3.50    1.59
                0.583    2.87 | 1.583   12.64 | 2.583    2.66 |  3.58    1.47
                0.667    2.87 | 1.667   12.64 | 2.667    2.66 |  3.67    1.47
                0.750    4.06 | 1.750    7.99 | 2.750    2.34 |  3.75    1.37
                0.833    4.06 | 1.833    7.99 | 2.833    2.34 |  3.83    1.37
                0.917    6.86 | 1.917    5.76 | 2.917    2.10 |  3.92    1.29
                1.000    6.86 | 2.000    5.76 | 3.000    2.10 |  4.00    1.29

     Unit Hyd Qpeak  (cms)=   0.632

     PEAK FLOW       (cms)=   0.034 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=   4.108
     TOTAL RAINFALL   (mm)=  34.218
     RUNOFF COEFFICIENT   =   0.120

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

--------------------------------------------------------------------------------


--------------------
| ADD HYD  (  0002)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (  0205):     2.15   0.034     1.42     4.11
        + ID2= 2 (  0078):     0.08   0.000     2.33     1.39
          ===================================================
          ID = 3 (  0002):     2.23   0.034     1.42     4.01

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
================================================================================================================

       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   TTTTT  TTTTT  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
Developed and Distributed by Smart City Water Inc
```


```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\65abffec-
  Summary filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\65abffec-
```

```
DATE: 11-13-2023                            TIME: 09:09:01

USER:



COMMENTS: ____________________________________________________________

--------------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 2 - 5yr 4hr 10min Chicago (Ca **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1593.000
| Ptotal= 49.55 mm |                          B=  11.000
--------------------                          C=   0.879
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    = 10.00 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    2.35 |  1.00   30.47 |  2.00    7.17 |  3.00    2.93
                  0.17    2.80 |  1.17  109.68 |  2.17    5.81 |  3.17    2.67
                  0.33    3.46 |  1.33   40.71 |  2.33    4.87 |  3.33    2.45
                  0.50    4.52 |  1.50   20.28 |  2.50    4.19 |  3.50    2.26
                  0.67    6.48 |  1.67   12.91 |  2.67    3.67 |  3.67    2.10
                  0.83   11.07 |  1.83    9.28 |  2.83    3.26 |  3.83    1.96


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0201)|   Area    (ha)=  12.40   Curve Number   (CN)= 58.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.39   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.53

         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    2.35 | 1.083   30.47 | 2.083    7.17 |  3.08    2.93
                 0.167    2.35 | 1.167   30.47 | 2.167    7.17 |  3.17    2.93
                 0.250    2.80 | 1.250  109.68 | 2.250    5.81 |  3.25    2.67
                 0.333    2.80 | 1.333  109.68 | 2.333    5.81 |  3.33    2.67
                 0.417    3.46 | 1.417   40.71 | 2.417    4.87 |  3.42    2.45
                 0.500    3.46 | 1.500   40.71 | 2.500    4.87 |  3.50    2.45
                 0.583    4.52 | 1.583   20.28 | 2.583    4.19 |  3.58    2.26
                 0.667    4.52 | 1.667   20.28 | 2.667    4.19 |  3.67    2.26
                 0.750    6.48 | 1.750   12.91 | 2.750    3.67 |  3.75    2.10
                 0.833    6.48 | 1.833   12.91 | 2.833    3.67 |  3.83    2.10
                 0.917   11.07 | 1.917    9.28 | 2.917    3.26 |  3.92    1.96
                 1.000   11.07 | 2.000    9.28 | 3.000    3.26 |  4.00    1.96

     Unit Hyd Qpeak  (cms)=   0.894

     PEAK FLOW       (cms)=   0.156 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=   7.527
     TOTAL RAINFALL   (mm)=  49.553
     RUNOFF COEFFICIENT   =   0.152

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0202)|   Area    (ha)=   3.47   Curve Number   (CN)= 63.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   4.54   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.54

         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    2.35 | 1.083   30.47 | 2.083    7.17 |  3.08    2.93
```

```
               0.167    2.35 | 1.167   30.47 | 2.167    7.17 |  3.17    2.93
               0.250    2.80 | 1.250  109.68 | 2.250    5.81 |  3.25    2.67
               0.333    2.80 | 1.333  109.68 | 2.333    5.81 |  3.33    2.67
               0.417    3.46 | 1.417   40.71 | 2.417    4.87 |  3.42    2.45
               0.500    3.46 | 1.500   40.71 | 2.500    4.87 |  3.50    2.45
               0.583    4.52 | 1.583   20.28 | 2.583    4.19 |  3.58    2.26
               0.667    4.52 | 1.667   20.28 | 2.667    4.19 |  3.67    2.26
               0.750    6.48 | 1.750   12.91 | 2.750    3.67 |  3.75    2.10
               0.833    6.48 | 1.833   12.91 | 2.833    3.67 |  3.83    2.10
               0.917   11.07 | 1.917    9.28 | 2.917    3.26 |  3.92    1.96
               1.000   11.07 | 2.000    9.28 | 3.000    3.26 |  4.00    1.96

     Unit Hyd Qpeak  (cms)=   0.245

     PEAK FLOW       (cms)=   0.062 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  10.433
     TOTAL RAINFALL   (mm)=  49.553
     RUNOFF COEFFICIENT   =   0.211

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

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0074)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0001      0.0079

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)      3.470      0.062      2.00      10.43
   OUTFLOW: ID= 1 (  0074)      0.023      0.000      1.92       8.26
   OVERFLOW:ID= 3 (  0003)      3.447      0.062      2.00       8.26

                 TOTAL NUMBER OF SIMULATION OVERFLOW  =    52
                 CUMULATIVE TIME OF OVERFLOW  (HOURS) =  4.33
                 PERCENTAGE OF TIME OVERFLOWING   (%) = 61.18

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.16
                 TIME SHIFT OF PEAK FLOW         (min)= -5.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.0076

-------------------------------------------------------------------------------

  --------------------------
  | Junction Command(0076) |
  --------------------------

                           AREA     QPEAK   TPEAK     R.V.
                           (ha)     (cms)    (hrs)    (mm)
  INFLOW : ID= 3(  0074)    3.45     0.06    2.00     8.26
  OUTFLOW: ID= 2(  0076)    3.45     0.06    2.00     8.26

  -------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   1.73   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   4.42   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.40

        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    2.35 | 1.083   30.47 | 2.083    7.17 |  3.08    2.93
               0.167    2.35 | 1.167   30.47 | 2.167    7.17 |  3.17    2.93
               0.250    2.80 | 1.250  109.68 | 2.250    5.81 |  3.25    2.67
               0.333    2.80 | 1.333  109.68 | 2.333    5.81 |  3.33    2.67
               0.417    3.46 | 1.417   40.71 | 2.417    4.87 |  3.42    2.45
               0.500    3.46 | 1.500   40.71 | 2.500    4.87 |  3.50    2.45
               0.583    4.52 | 1.583   20.28 | 2.583    4.19 |  3.58    2.26
               0.667    4.52 | 1.667   20.28 | 2.667    4.19 |  3.67    2.26
               0.750    6.48 | 1.750   12.91 | 2.750    3.67 |  3.75    2.10
               0.833    6.48 | 1.833   12.91 | 2.833    3.67 |  3.83    2.10
               0.917   11.07 | 1.917    9.28 | 2.917    3.26 |  3.92    1.96
               1.000   11.07 | 2.000    9.28 | 3.000    3.26 |  4.00    1.96

     Unit Hyd Qpeak  (cms)=   0.165

     PEAK FLOW       (cms)=   0.040 (i)
```

```
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=  11.197
     TOTAL RAINFALL   (mm)=  49.553
     RUNOFF COEFFICIENT   =   0.226

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0051)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0001      0.0054

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0203)      1.730      0.040      1.83      11.20
   OUTFLOW: ID= 1 (  0051)      0.019      0.000      1.83       8.57
   OVERFLOW:ID= 3 (  0003)      1.711      0.054      1.83       8.57

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =    44
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  3.67
                   PERCENTAGE OF TIME OVERFLOWING   (%) = 59.46

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.25
                   TIME SHIFT OF PEAK FLOW         (min)=  0.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0054

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0077)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0051):      0.02   0.000     1.83     8.57
      + ID2= 2 (  0074):      0.02   0.000     1.92     8.26
        ==================================================
        ID = 3 (  0077):      0.04   0.000     1.92     8.40

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0077)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0077):      0.04   0.000     1.92     8.40
      + ID2= 2 (  0076):      3.45   0.062     2.00     8.26
        ==================================================
        ID = 1 (  0077):      3.49   0.062     2.00     8.26

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0001)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     12.40   0.156     2.00     7.53
      + ID2= 2 (  0077):      3.49   0.062     2.00     8.26
        ==================================================
        ID = 3 (  0001):     15.89   0.218     2.00     7.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   0.62   Curve Number   (CN)= 63.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   4.58   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.21

         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    2.35 | 1.083   30.47 | 2.083    7.17 |  3.08    2.93
                 0.167    2.35 | 1.167   30.47 | 2.167    7.17 |  3.17    2.93
                 0.250    2.80 | 1.250  109.68 | 2.250    5.81 |  3.25    2.67
                 0.333    2.80 | 1.333  109.68 | 2.333    5.81 |  3.33    2.67
                 0.417    3.46 | 1.417   40.71 | 2.417    4.87 |  3.42    2.45
                 0.500    3.46 | 1.500   40.71 | 2.500    4.87 |  3.50    2.45
```

```
             0.583    4.52 | 1.583   20.28 | 2.583    4.19 |  3.58    2.26
             0.667    4.52 | 1.667   20.28 | 2.667    4.19 |  3.67    2.26
             0.750    6.48 | 1.750   12.91 | 2.750    3.67 |  3.75    2.10
             0.833    6.48 | 1.833   12.91 | 2.833    3.67 |  3.83    2.10
             0.917   11.07 | 1.917    9.28 | 2.917    3.26 |  3.92    1.96
             1.000   11.07 | 2.000    9.28 | 3.000    3.26 |  4.00    1.96

    Unit Hyd Qpeak  (cms)=   0.113

    PEAK FLOW       (cms)=   0.019 (i)
    TIME TO PEAK    (hrs)=   1.583
    RUNOFF VOLUME    (mm)=  10.401
    TOTAL RAINFALL   (mm)=  49.553
    RUNOFF COEFFICIENT   =   0.210

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0078)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0001      0.0022

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0204)      0.620      0.019      1.58      10.40
   OUTFLOW: ID= 1 (  0078)      0.018      0.000      1.67       7.10
   OVERFLOW:ID= 3 (  0003)      0.602      0.018      1.67       7.10

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =    35
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  2.92
                  PERCENTAGE OF TIME OVERFLOWING   (%) = 58.33

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.52
                  TIME SHIFT OF PEAK FLOW         (min)=  5.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0021

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0205)|   Area    (ha)=   2.15   Curve Number   (CN)= 59.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.13

        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    2.35 | 1.083   30.47 | 2.083    7.17 |  3.08    2.93
             0.167    2.35 | 1.167   30.47 | 2.167    7.17 |  3.17    2.93
             0.250    2.80 | 1.250  109.68 | 2.250    5.81 |  3.25    2.67
             0.333    2.80 | 1.333  109.68 | 2.333    5.81 |  3.33    2.67
             0.417    3.46 | 1.417   40.71 | 2.417    4.87 |  3.42    2.45
             0.500    3.46 | 1.500   40.71 | 2.500    4.87 |  3.50    2.45
             0.583    4.52 | 1.583   20.28 | 2.583    4.19 |  3.58    2.26
             0.667    4.52 | 1.667   20.28 | 2.667    4.19 |  3.67    2.26
             0.750    6.48 | 1.750   12.91 | 2.750    3.67 |  3.75    2.10
             0.833    6.48 | 1.833   12.91 | 2.833    3.67 |  3.83    2.10
             0.917   11.07 | 1.917    9.28 | 2.917    3.26 |  3.92    1.96
             1.000   11.07 | 2.000    9.28 | 3.000    3.26 |  4.00    1.96

    Unit Hyd Qpeak  (cms)=   0.632

    PEAK FLOW       (cms)=   0.070 (i)
    TIME TO PEAK    (hrs)=   1.417
    RUNOFF VOLUME    (mm)=   8.890
    TOTAL RAINFALL   (mm)=  49.553
    RUNOFF COEFFICIENT   =   0.179

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0002)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0205):     2.15   0.070     1.42     8.89
       + ID2= 2 (  0078):     0.02   0.000     1.67     7.10
         ====================================================
```

```
       ID = 3 (  0002):      2.17   0.070     1.42     8.88

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
================================================================================

      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   TTTTT  TTTTT  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
Developed and Distributed by Smart City Water Inc
```



```
                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\65b384f3-
  Summary filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\65b384f3-


DATE: 11-13-2023                           TIME: 09:09:01

USER:



COMMENTS: ____________________________________________________________


---------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 3 - 10yr 4hr 10min Chicago (C **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=2221.000
| Ptotal= 58.62 mm |                          B=  12.000
--------------------                          C=   0.908
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    = 10.00 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    2.39 |  1.00   37.17 |  2.00    8.06 |  3.00    3.05
                  0.17    2.89 |  1.17  134.16 |  2.17    6.42 |  3.17    2.75
                  0.33    3.65 |  1.33   50.03 |  2.33    5.30 |  3.33    2.50
                  0.50    4.89 |  1.50   24.37 |  2.50    4.50 |  3.50    2.29
                  0.67    7.23 |  1.67   15.14 |  2.67    3.89 |  3.67    2.11
                  0.83   12.87 |  1.83   10.64 |  2.83    3.42 |  3.83    1.96


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0201)|   Area    (ha)=  12.40   Curve Number   (CN)= 58.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.39   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.53

           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    2.39 | 1.083   37.17 | 2.083    8.06 |  3.08    3.05
                 0.167    2.39 | 1.167   37.17 | 2.167    8.06 |  3.17    3.05
                 0.250    2.89 | 1.250  134.16 | 2.250    6.42 |  3.25    2.75
                 0.333    2.89 | 1.333  134.16 | 2.333    6.42 |  3.33    2.75
                 0.417    3.65 | 1.417   50.03 | 2.417    5.30 |  3.42    2.50
                 0.500    3.65 | 1.500   50.03 | 2.500    5.30 |  3.50    2.50
                 0.583    4.89 | 1.583   24.37 | 2.583    4.50 |  3.58    2.29
                 0.667    4.89 | 1.667   24.37 | 2.667    4.50 |  3.67    2.29
```

```
              0.750    7.23 | 1.750   15.14 | 2.750    3.89 |  3.75    2.11
              0.833    7.23 | 1.833   15.14 | 2.833    3.89 |  3.83    2.11
              0.917   12.87 | 1.917   10.64 | 2.917    3.42 |  3.92    1.96
              1.000   12.87 | 2.000   10.64 | 3.000    3.42 |  4.00    1.96

     Unit Hyd Qpeak  (cms)=   0.894

     PEAK FLOW       (cms)=   0.237 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  10.773
     TOTAL RAINFALL   (mm)=  58.616
     RUNOFF COEFFICIENT   =   0.184

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0202)|   Area    (ha)=   3.47   Curve Number   (CN)= 63.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   4.54   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.54

        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    2.39 | 1.083   37.17 | 2.083    8.06 |  3.08    3.05
              0.167    2.39 | 1.167   37.17 | 2.167    8.06 |  3.17    3.05
              0.250    2.89 | 1.250  134.16 | 2.250    6.42 |  3.25    2.75
              0.333    2.89 | 1.333  134.16 | 2.333    6.42 |  3.33    2.75
              0.417    3.65 | 1.417   50.03 | 2.417    5.30 |  3.42    2.50
              0.500    3.65 | 1.500   50.03 | 2.500    5.30 |  3.50    2.50
              0.583    4.89 | 1.583   24.37 | 2.583    4.50 |  3.58    2.29
              0.667    4.89 | 1.667   24.37 | 2.667    4.50 |  3.67    2.29
              0.750    7.23 | 1.750   15.14 | 2.750    3.89 |  3.75    2.11
              0.833    7.23 | 1.833   15.14 | 2.833    3.89 |  3.83    2.11
              0.917   12.87 | 1.917   10.64 | 2.917    3.42 |  3.92    1.96
              1.000   12.87 | 2.000   10.64 | 3.000    3.42 |  4.00    1.96

     Unit Hyd Qpeak  (cms)=   0.245

     PEAK FLOW       (cms)=   0.090 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  14.386
     TOTAL RAINFALL   (mm)=  58.616
     RUNOFF COEFFICIENT   =   0.245

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0074)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0001      0.0079

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)       3.470      0.090      2.00      14.39
   OUTFLOW: ID= 1 (  0074)       0.016      0.000      1.83      12.12
   OVERFLOW:ID= 3 (  0003)       3.454      0.090      2.00      12.12

                     TOTAL NUMBER OF SIMULATION OVERFLOW  =    53
                     CUMULATIVE TIME OF OVERFLOW  (HOURS) =  4.42
                     PERCENTAGE OF TIME OVERFLOWING   (%) = 62.35

                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.11
                     TIME SHIFT OF PEAK FLOW        (min)=-10.00
                     MAXIMUM  STORAGE   USED       (ha.m.)=  0.0079

--------------------------------------------------------------------------------

  --------------------------
  | Junction Command(0076) |
  --------------------------

                             AREA     QPEAK   TPEAK     R.V.
                             (ha)     (cms)    (hrs)    (mm)
  INFLOW : ID= 3(  0074)     3.45      0.09    2.00    12.12
  OUTFLOW: ID= 2(  0076)     3.45      0.09    2.00    12.12
```

```
  ----------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0203)|   Area    (ha)=   1.73   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   4.42   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.40

         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    2.39 | 1.083   37.17 | 2.083    8.06 |  3.08    3.05
                  0.167    2.39 | 1.167   37.17 | 2.167    8.06 |  3.17    3.05
                  0.250    2.89 | 1.250  134.16 | 2.250    6.42 |  3.25    2.75
                  0.333    2.89 | 1.333  134.16 | 2.333    6.42 |  3.33    2.75
                  0.417    3.65 | 1.417   50.03 | 2.417    5.30 |  3.42    2.50
                  0.500    3.65 | 1.500   50.03 | 2.500    5.30 |  3.50    2.50
                  0.583    4.89 | 1.583   24.37 | 2.583    4.50 |  3.58    2.29
                  0.667    4.89 | 1.667   24.37 | 2.667    4.50 |  3.67    2.29
                  0.750    7.23 | 1.750   15.14 | 2.750    3.89 |  3.75    2.11
                  0.833    7.23 | 1.833   15.14 | 2.833    3.89 |  3.83    2.11
                  0.917   12.87 | 1.917   10.64 | 2.917    3.42 |  3.92    1.96
                  1.000   12.87 | 2.000   10.64 | 3.000    3.42 |  4.00    1.96

     Unit Hyd Qpeak  (cms)=   0.165

     PEAK FLOW       (cms)=   0.058 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=  15.378
     TOTAL RAINFALL   (mm)=  58.616
     RUNOFF COEFFICIENT   =   0.262

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

----------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0051)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0001      0.0054

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0203)      1.730      0.058      1.83      15.38
   OUTFLOW: ID= 1 (  0051)      0.013      0.000      1.75      12.27
   OVERFLOW:ID= 3 (  0003)      1.717      0.058      1.83      12.27

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =    45
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  3.75
                   PERCENTAGE OF TIME OVERFLOWING   (%) = 60.81

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.17
                   TIME SHIFT OF PEAK FLOW         (min)= -5.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0054

----------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0077)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0051):     0.01   0.000     1.75    12.27
      + ID2= 2 (  0074):     0.02   0.000     1.83    12.12
        ==================================================
        ID = 3 (  0077):     0.03   0.000     1.83    12.18

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
----------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0077)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0077):     0.03   0.000     1.83    12.18
      + ID2= 2 (  0076):     3.45   0.090     2.00    12.12
        ==================================================
        ID = 1 (  0077):     3.48   0.090     2.00    12.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
----------------------------------------------------------------------------------
```

```
--------------------
| ADD HYD  (  0001)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):    12.40   0.237     2.00    10.77
      + ID2= 2 (  0077):     3.48   0.090     2.00    12.12
        ====================================================
        ID = 3 (  0001):    15.88   0.326     2.00    11.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   0.62   Curve Number   (CN)= 63.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   4.58   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.21

         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    2.39 | 1.083   37.17 | 2.083    8.06 |  3.08    3.05
                0.167    2.39 | 1.167   37.17 | 2.167    8.06 |  3.17    3.05
                0.250    2.89 | 1.250  134.16 | 2.250    6.42 |  3.25    2.75
                0.333    2.89 | 1.333  134.16 | 2.333    6.42 |  3.33    2.75
                0.417    3.65 | 1.417   50.03 | 2.417    5.30 |  3.42    2.50
                0.500    3.65 | 1.500   50.03 | 2.500    5.30 |  3.50    2.50
                0.583    4.89 | 1.583   24.37 | 2.583    4.50 |  3.58    2.29
                0.667    4.89 | 1.667   24.37 | 2.667    4.50 |  3.67    2.29
                0.750    7.23 | 1.750   15.14 | 2.750    3.89 |  3.75    2.11
                0.833    7.23 | 1.833   15.14 | 2.833    3.89 |  3.83    2.11
                0.917   12.87 | 1.917   10.64 | 2.917    3.42 |  3.92    1.96
                1.000   12.87 | 2.000   10.64 | 3.000    3.42 |  4.00    1.96

     Unit Hyd Qpeak  (cms)=   0.113

     PEAK FLOW       (cms)=   0.028 (i)
     TIME TO PEAK    (hrs)=   1.583
     RUNOFF VOLUME    (mm)=  14.345
     TOTAL RAINFALL   (mm)=  58.616
     RUNOFF COEFFICIENT   =   0.245

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0078)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0001      0.0022

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0204)       0.620      0.028      1.58      14.35
   OUTFLOW: ID= 1 (  0078)       0.012      0.000      1.58      10.81
   OVERFLOW:ID= 3 (  0003)       0.608      0.028      1.58      10.81

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =    37
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  3.08
                   PERCENTAGE OF TIME OVERFLOWING   (%) = 61.67

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.35
                   TIME SHIFT OF PEAK FLOW         (min)=  0.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0022

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0205)|   Area    (ha)=   2.15   Curve Number   (CN)= 59.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.13

         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    2.39 | 1.083   37.17 | 2.083    8.06 |  3.08    3.05
                0.167    2.39 | 1.167   37.17 | 2.167    8.06 |  3.17    3.05
                0.250    2.89 | 1.250  134.16 | 2.250    6.42 |  3.25    2.75
```

```
               0.333    2.89 | 1.333  134.16 | 2.333    6.42 |  3.33    2.75
               0.417    3.65 | 1.417   50.03 | 2.417    5.30 |  3.42    2.50
               0.500    3.65 | 1.500   50.03 | 2.500    5.30 |  3.50    2.50
               0.583    4.89 | 1.583   24.37 | 2.583    4.50 |  3.58    2.29
               0.667    4.89 | 1.667   24.37 | 2.667    4.50 |  3.67    2.29
               0.750    7.23 | 1.750   15.14 | 2.750    3.89 |  3.75    2.11
               0.833    7.23 | 1.833   15.14 | 2.833    3.89 |  3.83    2.11
               0.917   12.87 | 1.917   10.64 | 2.917    3.42 |  3.92    1.96
               1.000   12.87 | 2.000   10.64 | 3.000    3.42 |  4.00    1.96

     Unit Hyd Qpeak  (cms)=   0.632

     PEAK FLOW       (cms)=   0.104 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=  12.368
     TOTAL RAINFALL   (mm)=  58.616
     RUNOFF COEFFICIENT   =   0.211

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

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0002)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0205):      2.15   0.104     1.42    12.37
      + ID2= 2 (  0078):      0.01   0.000     1.58    10.81
        ===================================================
        ID = 3 (  0002):      2.16   0.104     1.42    12.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
===============================================================================================================

       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   TTTTT  TTTTT  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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                      *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\6d4af7f3-
  Summary filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\6d4af7f3-


DATE: 11-13-2023                           TIME: 09:09:01

USER:



COMMENTS: ____________________________________________________________


---------------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 4 - 25yr 4hr 10min Chicago (C **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=3158.000
| Ptotal= 71.59 mm |                          B=  15.000
--------------------                          C=   0.933
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    = 10.00 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    2.68 |  1.00   47.76 |  2.00   10.11 |  3.00    3.51
                 0.17    3.31 |  1.17  156.47 |  2.17    7.92 |  3.17    3.13
                 0.33    4.28 |  1.33   63.86 |  2.33    6.44 |  3.33    2.81
                 0.50    5.90 |  1.50   31.72 |  2.50    5.38 |  3.50    2.55
                 0.67    9.00 |  1.67   19.56 |  2.67    4.59 |  3.67    2.33
                 0.83   16.53 |  1.83   13.56 |  2.83    3.99 |  3.83    2.15


--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0201)|   Area    (ha)=  12.40   Curve Number   (CN)= 58.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.39   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.53

         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    2.68 | 1.083   47.76 | 2.083   10.11 |  3.08    3.51
                0.167    2.68 | 1.167   47.76 | 2.167   10.11 |  3.17    3.51
                0.250    3.31 | 1.250  156.47 | 2.250    7.92 |  3.25    3.13
                0.333    3.31 | 1.333  156.47 | 2.333    7.92 |  3.33    3.13
                0.417    4.28 | 1.417   63.86 | 2.417    6.44 |  3.42    2.81
                0.500    4.28 | 1.500   63.86 | 2.500    6.44 |  3.50    2.81
                0.583    5.90 | 1.583   31.72 | 2.583    5.38 |  3.58    2.55
                0.667    5.90 | 1.667   31.72 | 2.667    5.38 |  3.67    2.55
                0.750    9.00 | 1.750   19.56 | 2.750    4.59 |  3.75    2.33
                0.833    9.00 | 1.833   19.56 | 2.833    4.59 |  3.83    2.33
                0.917   16.53 | 1.917   13.56 | 2.917    3.99 |  3.92    2.15
                1.000   16.53 | 2.000   13.56 | 3.000    3.99 |  4.00    2.15

     Unit Hyd Qpeak  (cms)=   0.894

     PEAK FLOW       (cms)=   0.363 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  16.161
     TOTAL RAINFALL   (mm)=  71.589
     RUNOFF COEFFICIENT   =   0.226

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0202)|   Area    (ha)=   3.47   Curve Number   (CN)= 63.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   4.54   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.54

         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    2.68 | 1.083   47.76 | 2.083   10.11 |  3.08    3.51
                0.167    2.68 | 1.167   47.76 | 2.167   10.11 |  3.17    3.51
                0.250    3.31 | 1.250  156.47 | 2.250    7.92 |  3.25    3.13
                0.333    3.31 | 1.333  156.47 | 2.333    7.92 |  3.33    3.13
                0.417    4.28 | 1.417   63.86 | 2.417    6.44 |  3.42    2.81
                0.500    4.28 | 1.500   63.86 | 2.500    6.44 |  3.50    2.81
                0.583    5.90 | 1.583   31.72 | 2.583    5.38 |  3.58    2.55
                0.667    5.90 | 1.667   31.72 | 2.667    5.38 |  3.67    2.55
                0.750    9.00 | 1.750   19.56 | 2.750    4.59 |  3.75    2.33
                0.833    9.00 | 1.833   19.56 | 2.833    4.59 |  3.83    2.33
                0.917   16.53 | 1.917   13.56 | 2.917    3.99 |  3.92    2.15
                1.000   16.53 | 2.000   13.56 | 3.000    3.99 |  4.00    2.15

     Unit Hyd Qpeak  (cms)=   0.245

     PEAK FLOW       (cms)=   0.132 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  20.790
     TOTAL RAINFALL   (mm)=  71.589
     RUNOFF COEFFICIENT   =   0.290

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0074)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
```

```
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0001      0.0079

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)      3.470      0.132      2.00      20.79
   OUTFLOW: ID= 1 (  0074)      0.011      0.000      1.75      18.52
   OVERFLOW:ID= 3 (  0003)      3.459      0.132      2.00      18.52

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =    55
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  4.58
                  PERCENTAGE OF TIME OVERFLOWING   (%) = 63.95

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.08
                  TIME SHIFT OF PEAK FLOW         (min)=-15.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0079

--------------------------------------------------------------------------------

  --------------------------
  | Junction Command(0076) |
  --------------------------

                           AREA     QPEAK   TPEAK     R.V.
                           (ha)     (cms)    (hrs)    (mm)
  INFLOW : ID= 3(  0074)    3.46     0.13    2.00    18.52
  OUTFLOW: ID= 2(  0076)    3.46     0.13    2.00    18.52

  --------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   1.73   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   4.42   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.40

         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    2.68 | 1.083   47.76 | 2.083   10.11 |  3.08    3.51
                0.167    2.68 | 1.167   47.76 | 2.167   10.11 |  3.17    3.51
                0.250    3.31 | 1.250  156.47 | 2.250    7.92 |  3.25    3.13
                0.333    3.31 | 1.333  156.47 | 2.333    7.92 |  3.33    3.13
                0.417    4.28 | 1.417   63.86 | 2.417    6.44 |  3.42    2.81
                0.500    4.28 | 1.500   63.86 | 2.500    6.44 |  3.50    2.81
                0.583    5.90 | 1.583   31.72 | 2.583    5.38 |  3.58    2.55
                0.667    5.90 | 1.667   31.72 | 2.667    5.38 |  3.67    2.55
                0.750    9.00 | 1.750   19.56 | 2.750    4.59 |  3.75    2.33
                0.833    9.00 | 1.833   19.56 | 2.833    4.59 |  3.83    2.33
                0.917   16.53 | 1.917   13.56 | 2.917    3.99 |  3.92    2.15
                1.000   16.53 | 2.000   13.56 | 3.000    3.99 |  4.00    2.15

     Unit Hyd Qpeak  (cms)=   0.165

     PEAK FLOW       (cms)=   0.085 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=  22.120
     TOTAL RAINFALL   (mm)=  71.589
     RUNOFF COEFFICIENT   =   0.309

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0051)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0001      0.0054

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0203)      1.730      0.085      1.83      22.12
   OUTFLOW: ID= 1 (  0051)      0.009      0.000      1.67      19.01
   OVERFLOW:ID= 3 (  0003)      1.721      0.085      1.83      19.01

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =    47
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  3.92
                  PERCENTAGE OF TIME OVERFLOWING   (%) = 62.67

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.12
```

```
                  TIME SHIFT OF PEAK FLOW         (min)=-10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0054

 ------------------------------------------------------------------------------

 --------------------
 | ADD HYD  (  0077)|
 |   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
 --------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0051):      0.01   0.000     1.67    19.01
       + ID2= 2 (  0074):      0.01   0.000     1.75    18.52
         ====================================================
         ID = 3 (  0077):      0.02   0.000     1.75    18.74

      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 ------------------------------------------------------------------------------

 --------------------
 | ADD HYD  (  0077)|
 |   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
 --------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 3 (  0077):      0.02   0.000     1.75    18.74
       + ID2= 2 (  0076):      3.46   0.132     2.00    18.52
         ====================================================
         ID = 1 (  0077):      3.48   0.132     2.00    18.52

      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 ------------------------------------------------------------------------------

 --------------------
 | ADD HYD  (  0001)|
 |   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
 --------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0201):     12.40   0.363     2.00    16.16
       + ID2= 2 (  0077):      3.48   0.132     2.00    18.52
         ====================================================
         ID = 3 (  0001):     15.88   0.495     2.00    16.68

      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 ------------------------------------------------------------------------------
 --------------------
 | CALIB            |
 | NASHYD   (  0204)|   Area    (ha)=   0.62   Curve Number   (CN)= 63.0
 |ID= 1 DT= 5.0 min |   Ia      (mm)=   4.58   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   0.21

          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    2.68 | 1.083   47.76 | 2.083   10.11 |  3.08    3.51
                 0.167    2.68 | 1.167   47.76 | 2.167   10.11 |  3.17    3.51
                 0.250    3.31 | 1.250  156.47 | 2.250    7.92 |  3.25    3.13
                 0.333    3.31 | 1.333  156.47 | 2.333    7.92 |  3.33    3.13
                 0.417    4.28 | 1.417   63.86 | 2.417    6.44 |  3.42    2.81
                 0.500    4.28 | 1.500   63.86 | 2.500    6.44 |  3.50    2.81
                 0.583    5.90 | 1.583   31.72 | 2.583    5.38 |  3.58    2.55
                 0.667    5.90 | 1.667   31.72 | 2.667    5.38 |  3.67    2.55
                 0.750    9.00 | 1.750   19.56 | 2.750    4.59 |  3.75    2.33
                 0.833    9.00 | 1.833   19.56 | 2.833    4.59 |  3.83    2.33
                 0.917   16.53 | 1.917   13.56 | 2.917    3.99 |  3.92    2.15
                 1.000   16.53 | 2.000   13.56 | 3.000    3.99 |  4.00    2.15

      Unit Hyd Qpeak  (cms)=   0.113

      PEAK FLOW       (cms)=   0.041 (i)
      TIME TO PEAK    (hrs)=   1.583
      RUNOFF VOLUME    (mm)=  20.737
      TOTAL RAINFALL   (mm)=  71.589
      RUNOFF COEFFICIENT   =   0.290

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

 ------------------------------------------------------------------------------
 --------------------
 | RESERVOIR(  0078)|     OVERFLOW IS ON
 | IN= 2---> OUT= 1 |
 | DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.0001      0.0022

                                AREA     QPEAK     TPEAK       R.V.
```

```
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0204)      0.620      0.041      1.58      20.74
   OUTFLOW: ID= 1 (  0078)      0.008      0.000      1.50      17.46
   OVERFLOW:ID= 3 (  0003)      0.612      0.041      1.58      17.46

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =    38
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  3.17
                   PERCENTAGE OF TIME OVERFLOWING   (%) = 62.30

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.24
                   TIME SHIFT OF PEAK FLOW         (min)= -5.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0020

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0205)|   Area    (ha)=   2.15   Curve Number   (CN)= 59.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.13

         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    2.68 | 1.083   47.76 | 2.083   10.11 |  3.08    3.51
                  0.167    2.68 | 1.167   47.76 | 2.167   10.11 |  3.17    3.51
                  0.250    3.31 | 1.250  156.47 | 2.250    7.92 |  3.25    3.13
                  0.333    3.31 | 1.333  156.47 | 2.333    7.92 |  3.33    3.13
                  0.417    4.28 | 1.417   63.86 | 2.417    6.44 |  3.42    2.81
                  0.500    4.28 | 1.500   63.86 | 2.500    6.44 |  3.50    2.81
                  0.583    5.90 | 1.583   31.72 | 2.583    5.38 |  3.58    2.55
                  0.667    5.90 | 1.667   31.72 | 2.667    5.38 |  3.67    2.55
                  0.750    9.00 | 1.750   19.56 | 2.750    4.59 |  3.75    2.33
                  0.833    9.00 | 1.833   19.56 | 2.833    4.59 |  3.83    2.33
                  0.917   16.53 | 1.917   13.56 | 2.917    3.99 |  3.92    2.15
                  1.000   16.53 | 2.000   13.56 | 3.000    3.99 |  4.00    2.15

     Unit Hyd Qpeak  (cms)=   0.632

     PEAK FLOW       (cms)=   0.150 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=  18.059
     TOTAL RAINFALL   (mm)=  71.589
     RUNOFF COEFFICIENT   =   0.252

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

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0002)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0205):     2.15   0.150     1.42    18.06
      + ID2= 2 (  0078):     0.01   0.000     1.50    17.46
        ==================================================
        ID = 3 (  0002):     2.16   0.150     1.42    18.06

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
================================================================================================

       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   TTTTT  TTTTT  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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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\147914be-
```

```
  Summary filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\147914be-

DATE: 11-13-2023                          TIME: 09:09:00

USER:


COMMENTS: ____________________________________________________________


---------------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 5 - 50yr 4hr 10min Chicago (C **
  ************************************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A=3886.000
| Ptotal= 80.32 mm |                           B=  16.000
--------------------                           C=   0.950
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  4.00 hrs
                         Storm time step    = 10.00 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    2.76 |  1.00   54.62 |  2.00   11.20 |  3.00    3.68
                 0.17    3.46 |  1.17  176.19 |  2.17    8.68 |  3.17    3.25
                 0.33    4.54 |  1.33   73.10 |  2.33    6.99 |  3.33    2.91
                 0.50    6.37 |  1.50   36.22 |  2.50    5.78 |  3.50    2.62
                 0.67    9.92 |  1.67   22.14 |  2.67    4.89 |  3.67    2.38
                 0.83   18.63 |  1.83   15.18 |  2.83    4.21 |  3.83    2.18


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0201)|   Area    (ha)=  12.40   Curve Number   (CN)= 58.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.39   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.53

         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    2.76 | 1.083   54.62 | 2.083   11.20 |  3.08    3.68
                0.167    2.76 | 1.167   54.62 | 2.167   11.20 |  3.17    3.68
                0.250    3.46 | 1.250  176.19 | 2.250    8.68 |  3.25    3.25
                0.333    3.46 | 1.333  176.19 | 2.333    8.68 |  3.33    3.25
                0.417    4.54 | 1.417   73.10 | 2.417    6.99 |  3.42    2.91
                0.500    4.54 | 1.500   73.10 | 2.500    6.99 |  3.50    2.91
                0.583    6.37 | 1.583   36.22 | 2.583    5.78 |  3.58    2.62
                0.667    6.37 | 1.667   36.22 | 2.667    5.78 |  3.67    2.62
                0.750    9.92 | 1.750   22.14 | 2.750    4.89 |  3.75    2.38
                0.833    9.92 | 1.833   22.14 | 2.833    4.89 |  3.83    2.38
                0.917   18.63 | 1.917   15.18 | 2.917    4.21 |  3.92    2.18
                1.000   18.63 | 2.000   15.18 | 3.000    4.21 |  4.00    2.18

     Unit Hyd Qpeak  (cms)=   0.894

     PEAK FLOW       (cms)=   0.464 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  20.221
     TOTAL RAINFALL   (mm)=  80.320
     RUNOFF COEFFICIENT   =   0.252

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0202)|   Area    (ha)=   3.47   Curve Number   (CN)= 63.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   4.54   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.54

         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    2.76 | 1.083   54.62 | 2.083   11.20 |  3.08    3.68
             0.167    2.76 | 1.167   54.62 | 2.167   11.20 |  3.17    3.68
             0.250    3.46 | 1.250  176.19 | 2.250    8.68 |  3.25    3.25
             0.333    3.46 | 1.333  176.19 | 2.333    8.68 |  3.33    3.25
             0.417    4.54 | 1.417   73.10 | 2.417    6.99 |  3.42    2.91
             0.500    4.54 | 1.500   73.10 | 2.500    6.99 |  3.50    2.91
             0.583    6.37 | 1.583   36.22 | 2.583    5.78 |  3.58    2.62
             0.667    6.37 | 1.667   36.22 | 2.667    5.78 |  3.67    2.62
             0.750    9.92 | 1.750   22.14 | 2.750    4.89 |  3.75    2.38
             0.833    9.92 | 1.833   22.14 | 2.833    4.89 |  3.83    2.38
             0.917   18.63 | 1.917   15.18 | 2.917    4.21 |  3.92    2.18
             1.000   18.63 | 2.000   15.18 | 3.000    4.21 |  4.00    2.18

     Unit Hyd Qpeak  (cms)=   0.245

     PEAK FLOW       (cms)=   0.165 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  25.526
     TOTAL RAINFALL   (mm)=  80.320
     RUNOFF COEFFICIENT   =   0.318

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0074)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0001      0.0079

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)      3.470      0.165      2.00      25.53
   OUTFLOW: ID= 1 (  0074)      0.009      0.000      1.67      23.26
   OVERFLOW:ID= 3 (  0003)      3.461      0.165      2.00      23.26

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =    57
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  4.75
                   PERCENTAGE OF TIME OVERFLOWING   (%) = 65.52

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.06
                   TIME SHIFT OF PEAK FLOW         (min)=-20.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0079

--------------------------------------------------------------------------------

  --------------------------
  | Junction Command(0076) |
  --------------------------

                           AREA     QPEAK   TPEAK     R.V.
                           (ha)     (cms)    (hrs)    (mm)
  INFLOW : ID= 3(  0074)    3.46     0.16    2.00    23.26
  OUTFLOW: ID= 2(  0076)    3.46     0.16    2.00    23.26

  --------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   1.73   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   4.42   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.40

         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    2.76 | 1.083   54.62 | 2.083   11.20 |  3.08    3.68
             0.167    2.76 | 1.167   54.62 | 2.167   11.20 |  3.17    3.68
             0.250    3.46 | 1.250  176.19 | 2.250    8.68 |  3.25    3.25
             0.333    3.46 | 1.333  176.19 | 2.333    8.68 |  3.33    3.25
             0.417    4.54 | 1.417   73.10 | 2.417    6.99 |  3.42    2.91
             0.500    4.54 | 1.500   73.10 | 2.500    6.99 |  3.50    2.91
             0.583    6.37 | 1.583   36.22 | 2.583    5.78 |  3.58    2.62
             0.667    6.37 | 1.667   36.22 | 2.667    5.78 |  3.67    2.62
             0.750    9.92 | 1.750   22.14 | 2.750    4.89 |  3.75    2.38
             0.833    9.92 | 1.833   22.14 | 2.833    4.89 |  3.83    2.38
             0.917   18.63 | 1.917   15.18 | 2.917    4.21 |  3.92    2.18
             1.000   18.63 | 2.000   15.18 | 3.000    4.21 |  4.00    2.18
```

```
     Unit Hyd Qpeak  (cms)=   0.165

     PEAK FLOW       (cms)=   0.106 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=  27.084
     TOTAL RAINFALL   (mm)=  80.320
     RUNOFF COEFFICIENT   =   0.337

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0051)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0001      0.0054

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0203)      1.730      0.106      1.83      27.08
   OUTFLOW: ID= 1 (  0051)      0.007      0.000      1.58      24.46
   OVERFLOW:ID= 3 (  0003)      1.723      0.106      1.83      24.46

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =    48
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  4.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) = 64.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.09
                   TIME SHIFT OF PEAK FLOW         (min)=-15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0054

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0077)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0051):     0.01   0.000     1.58    24.46
      + ID2= 2 (  0074):     0.01   0.000     1.67    23.26
        ===================================================
        ID = 3 (  0077):     0.02   0.000     1.67    23.79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0077)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0077):     0.02   0.000     1.67    23.79
      + ID2= 2 (  0076):     3.46   0.165     2.00    23.26
        ===================================================
        ID = 1 (  0077):     3.48   0.165     2.00    23.26

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0001)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):    12.40   0.464     2.00    20.22
      + ID2= 2 (  0077):     3.48   0.165     2.00    23.26
        ===================================================
        ID = 3 (  0001):    15.88   0.629     2.00    20.89

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   0.62   Curve Number   (CN)= 63.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   4.58   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.21

         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    2.76 | 1.083   54.62 | 2.083   11.20 |  3.08    3.68
                  0.167    2.76 | 1.167   54.62 | 2.167   11.20 |  3.17    3.68
                  0.250    3.46 | 1.250  176.19 | 2.250    8.68 |  3.25    3.25
```

```
               0.333    3.46 | 1.333  176.19 | 2.333    8.68 |  3.33    3.25
               0.417    4.54 | 1.417   73.10 | 2.417    6.99 |  3.42    2.91
               0.500    4.54 | 1.500   73.10 | 2.500    6.99 |  3.50    2.91
               0.583    6.37 | 1.583   36.22 | 2.583    5.78 |  3.58    2.62
               0.667    6.37 | 1.667   36.22 | 2.667    5.78 |  3.67    2.62
               0.750    9.92 | 1.750   22.14 | 2.750    4.89 |  3.75    2.38
               0.833    9.92 | 1.833   22.14 | 2.833    4.89 |  3.83    2.38
               0.917   18.63 | 1.917   15.18 | 2.917    4.21 |  3.92    2.18
               1.000   18.63 | 2.000   15.18 | 3.000    4.21 |  4.00    2.18

     Unit Hyd Qpeak  (cms)=   0.113

     PEAK FLOW       (cms)=   0.051 (i)
     TIME TO PEAK    (hrs)=   1.583
     RUNOFF VOLUME    (mm)=  25.464
     TOTAL RAINFALL   (mm)=  80.320
     RUNOFF COEFFICIENT   =   0.317

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0078)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0001      0.0022

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0204)      0.620      0.051      1.58      25.46
   OUTFLOW: ID= 1 (  0078)      0.006      0.000      1.50      21.93
   OVERFLOW:ID= 3 (  0003)      0.614      0.051      1.58      21.93

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =    38
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  3.17
                   PERCENTAGE OF TIME OVERFLOWING   (%) = 62.30

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.19
                   TIME SHIFT OF PEAK FLOW         (min)= -5.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0022

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0205)|   Area    (ha)=   2.15   Curve Number   (CN)= 59.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.13

         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    2.76 | 1.083   54.62 | 2.083   11.20 |  3.08    3.68
               0.167    2.76 | 1.167   54.62 | 2.167   11.20 |  3.17    3.68
               0.250    3.46 | 1.250  176.19 | 2.250    8.68 |  3.25    3.25
               0.333    3.46 | 1.333  176.19 | 2.333    8.68 |  3.33    3.25
               0.417    4.54 | 1.417   73.10 | 2.417    6.99 |  3.42    2.91
               0.500    4.54 | 1.500   73.10 | 2.500    6.99 |  3.50    2.91
               0.583    6.37 | 1.583   36.22 | 2.583    5.78 |  3.58    2.62
               0.667    6.37 | 1.667   36.22 | 2.667    5.78 |  3.67    2.62
               0.750    9.92 | 1.750   22.14 | 2.750    4.89 |  3.75    2.38
               0.833    9.92 | 1.833   22.14 | 2.833    4.89 |  3.83    2.38
               0.917   18.63 | 1.917   15.18 | 2.917    4.21 |  3.92    2.18
               1.000   18.63 | 2.000   15.18 | 3.000    4.21 |  4.00    2.18

     Unit Hyd Qpeak  (cms)=   0.632

     PEAK FLOW       (cms)=   0.190 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=  22.304
     TOTAL RAINFALL   (mm)=  80.320
     RUNOFF COEFFICIENT   =   0.278

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0002)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
           ID1= 1 (  0205):     2.15   0.190     1.42    22.30
         + ID2= 2 (  0078):     0.01   0.000     1.50    21.93
           =================================================
           ID = 3 (  0002):     2.16   0.190     1.42    22.30

        NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
  --------------------------------------------------------------------------------
  ============================================================================================================

        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   TTTTT  TTTTT  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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                      *****  D E T A I L E D   O U T P U T *****


    Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
    Output  filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\7e9698eb-
    Summary filename: C:\Users\jfletcher\AppData\Local\Civica\VH5\62082276-f617-4be2-807a-c20b5723c417\7e9698eb-


  DATE: 11-13-2023                            TIME: 09:09:01

  USER:



  COMMENTS: ____________________________________________________________


  ------------------------------------------------------------------------------------------------------------
    ************************************************
    ** SIMULATION : 6 - 100yr 4hr 10min Chicago ( **
    ************************************************

  --------------------
  | CHICAGO STORM    |     IDF curve parameters: A=4688.000
  | Ptotal= 89.87 mm |                           B=  17.000
  --------------------                           C=   0.962
                           used in:   INTENSITY =  A / (t + B)^C

                           Duration of storm  =  4.00 hrs
                           Storm time step    = 10.00 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    2.89 |  1.00   62.12 |  2.00   12.48 |  3.00    3.91
                   0.17    3.67 |  1.17  196.54 |  2.17    9.60 |  3.17    3.44
                   0.33    4.88 |  1.33   83.09 |  2.33    7.66 |  3.33    3.05
                   0.50    6.96 |  1.50   41.25 |  2.50    6.29 |  3.50    2.73
                   0.67   11.02 |  1.67   25.07 |  2.67    5.28 |  3.67    2.47
                   0.83   21.03 |  1.83   17.06 |  2.83    4.51 |  3.83    2.24


  --------------------------------------------------------------------------------
  --------------------
  | CALIB            |
  | NASHYD   (  0201)|   Area    (ha)=  12.40   Curve Number   (CN)= 58.0
  |ID= 1 DT= 5.0 min |   Ia      (mm)=   8.39   # of Linear Res.(N)= 3.00
  --------------------   U.H. Tp(hrs)=   0.53

            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    2.89 | 1.083   62.12 | 2.083   12.48 |  3.08    3.91
                  0.167    2.89 | 1.167   62.12 | 2.167   12.48 |  3.17    3.91
                  0.250    3.67 | 1.250  196.54 | 2.250    9.60 |  3.25    3.44
                  0.333    3.67 | 1.333  196.54 | 2.333    9.60 |  3.33    3.44
                  0.417    4.88 | 1.417   83.09 | 2.417    7.66 |  3.42    3.05
```

```
              0.500    4.88 | 1.500   83.09 | 2.500    7.66 |  3.50    3.05
              0.583    6.96 | 1.583   41.25 | 2.583    6.29 |  3.58    2.73
              0.667    6.96 | 1.667   41.25 | 2.667    6.29 |  3.67    2.73
              0.750   11.02 | 1.750   25.07 | 2.750    5.28 |  3.75    2.47
              0.833   11.02 | 1.833   25.07 | 2.833    5.28 |  3.83    2.47
              0.917   21.03 | 1.917   17.06 | 2.917    4.51 |  3.92    2.24
              1.000   21.03 | 2.000   17.06 | 3.000    4.51 |  4.00    2.24

     Unit Hyd Qpeak  (cms)=   0.894

     PEAK FLOW       (cms)=   0.583 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  25.013
     TOTAL RAINFALL   (mm)=  89.870
     RUNOFF COEFFICIENT   =   0.278

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0202)|   Area     (ha)=   3.47   Curve Number   (CN)= 63.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   4.54   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.54

         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    2.89 | 1.083   62.12 | 2.083   12.48 |  3.08    3.91
              0.167    2.89 | 1.167   62.12 | 2.167   12.48 |  3.17    3.91
              0.250    3.67 | 1.250  196.54 | 2.250    9.60 |  3.25    3.44
              0.333    3.67 | 1.333  196.54 | 2.333    9.60 |  3.33    3.44
              0.417    4.88 | 1.417   83.09 | 2.417    7.66 |  3.42    3.05
              0.500    4.88 | 1.500   83.09 | 2.500    7.66 |  3.50    3.05
              0.583    6.96 | 1.583   41.25 | 2.583    6.29 |  3.58    2.73
              0.667    6.96 | 1.667   41.25 | 2.667    6.29 |  3.67    2.73
              0.750   11.02 | 1.750   25.07 | 2.750    5.28 |  3.75    2.47
              0.833   11.02 | 1.833   25.07 | 2.833    5.28 |  3.83    2.47
              0.917   21.03 | 1.917   17.06 | 2.917    4.51 |  3.92    2.24
              1.000   21.03 | 2.000   17.06 | 3.000    4.51 |  4.00    2.24

     Unit Hyd Qpeak  (cms)=   0.245

     PEAK FLOW       (cms)=   0.203 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  31.048
     TOTAL RAINFALL   (mm)=  89.870
     RUNOFF COEFFICIENT   =   0.345

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0074)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)    |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.0001      0.0079

                                   AREA      QPEAK      TPEAK       R.V.
                                   (ha)      (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  0202)         3.470       0.203       2.00       31.05
   OUTFLOW: ID= 1 (  0074)         0.007       0.000       1.58       29.75
   OVERFLOW:ID= 3 (  0003)         3.463       0.203       2.00       29.75

                     TOTAL NUMBER OF SIMULATION OVERFLOW   =    58
                     CUMULATIVE TIME OF OVERFLOW  (HOURS) =  4.83
                     PERCENTAGE OF TIME OVERFLOWING   (%) = 66.67

                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.05
                     TIME SHIFT OF PEAK FLOW         (min)=-25.00
                     MAXIMUM  STORAGE   USED       (ha.m.)=  0.0079

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  --------------------------
  | Junction Command(0076) |
  --------------------------

                              AREA     QPEAK    TPEAK     R.V.
                              (ha)     (cms)     (hrs)     (mm)
```

```
  INFLOW : ID= 3(  0074)    3.46     0.20    2.00    29.75
  OUTFLOW: ID= 2(  0076)    3.46     0.20    2.00    29.75

  ---------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (  0203)|   Area     (ha)=   1.73   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   4.42   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.40

         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    2.89 | 1.083   62.12 | 2.083   12.48 |  3.08    3.91
                   0.167    2.89 | 1.167   62.12 | 2.167   12.48 |  3.17    3.91
                   0.250    3.67 | 1.250  196.54 | 2.250    9.60 |  3.25    3.44
                   0.333    3.67 | 1.333  196.54 | 2.333    9.60 |  3.33    3.44
                   0.417    4.88 | 1.417   83.09 | 2.417    7.66 |  3.42    3.05
                   0.500    4.88 | 1.500   83.09 | 2.500    7.66 |  3.50    3.05
                   0.583    6.96 | 1.583   41.25 | 2.583    6.29 |  3.58    2.73
                   0.667    6.96 | 1.667   41.25 | 2.667    6.29 |  3.67    2.73
                   0.750   11.02 | 1.750   25.07 | 2.750    5.28 |  3.75    2.47
                   0.833   11.02 | 1.833   25.07 | 2.833    5.28 |  3.83    2.47
                   0.917   21.03 | 1.917   17.06 | 2.917    4.51 |  3.92    2.24
                   1.000   21.03 | 2.000   17.06 | 3.000    4.51 |  4.00    2.24

     Unit Hyd Qpeak  (cms)=   0.165

     PEAK FLOW       (cms)=   0.131 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=  32.853
     TOTAL RAINFALL   (mm)=  89.870
     RUNOFF COEFFICIENT   =   0.366

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

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0051)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)    |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.0001      0.0054

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0203)         1.730       0.131      1.83       32.85
   OUTFLOW: ID= 1 (  0051)         0.006       0.000      1.58       29.74
   OVERFLOW:ID= 3 (  0003)         1.724       0.131      1.83       29.74

                      TOTAL NUMBER OF SIMULATION OVERFLOW  =    48
                      CUMULATIVE TIME OF OVERFLOW  (HOURS) =  4.00
                      PERCENTAGE OF TIME OVERFLOWING   (%) = 64.00

                      PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.08
                      TIME SHIFT OF PEAK FLOW         (min)=-15.00
                      MAXIMUM  STORAGE   USED       (ha.m.)=  0.0054

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (  0077)|
|   1 +  2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (  0051):     0.01   0.000     1.58    29.74
        + ID2= 2 (  0074):     0.01   0.000     1.58    29.75
          ===================================================
          ID = 3 (  0077):     0.01   0.000     1.58    29.75

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------

--------------------
| ADD HYD   (  0077)|
|   3 +  2 =  1     |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (  0077):     0.01   0.000     1.58    29.75
        + ID2= 2 (  0076):     3.46   0.203     2.00    29.75
          ===================================================
          ID = 1 (  0077):     3.48   0.203     2.00    29.75
```

```
     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0001)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0201):    12.40   0.583     2.00    25.01
       + ID2= 2 (  0077):     3.48   0.203     2.00    29.75
         ===============================================
         ID = 3 (  0001):    15.88   0.786     2.00    26.05

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0204)|   Area     (ha)=   0.62   Curve Number   (CN)= 63.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   4.58   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.21

         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    2.89 | 1.083   62.12 | 2.083   12.48 |  3.08    3.91
                 0.167    2.89 | 1.167   62.12 | 2.167   12.48 |  3.17    3.91
                 0.250    3.67 | 1.250  196.54 | 2.250    9.60 |  3.25    3.44
                 0.333    3.67 | 1.333  196.54 | 2.333    9.60 |  3.33    3.44
                 0.417    4.88 | 1.417   83.09 | 2.417    7.66 |  3.42    3.05
                 0.500    4.88 | 1.500   83.09 | 2.500    7.66 |  3.50    3.05
                 0.583    6.96 | 1.583   41.25 | 2.583    6.29 |  3.58    2.73
                 0.667    6.96 | 1.667   41.25 | 2.667    6.29 |  3.67    2.73
                 0.750   11.02 | 1.750   25.07 | 2.750    5.28 |  3.75    2.47
                 0.833   11.02 | 1.833   25.07 | 2.833    5.28 |  3.83    2.47
                 0.917   21.03 | 1.917   17.06 | 2.917    4.51 |  3.92    2.24
                 1.000   21.03 | 2.000   17.06 | 3.000    4.51 |  4.00    2.24

     Unit Hyd Qpeak  (cms)=   0.113

     PEAK FLOW       (cms)=   0.063 (i)
     TIME TO PEAK    (hrs)=   1.583
     RUNOFF VOLUME    (mm)=  30.976
     TOTAL RAINFALL   (mm)=  89.870
     RUNOFF COEFFICIENT   =   0.345

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0078)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)    |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.0001      0.0022

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0204)     0.620      0.063      1.58      30.98
   OUTFLOW: ID= 1 (  0078)     0.005      0.000      1.42      28.81
   OVERFLOW:ID= 3 (  0003)     0.615      0.064      1.42      28.81

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =    39
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  3.25
                  PERCENTAGE OF TIME OVERFLOWING   (%) = 63.93

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.16
                  TIME SHIFT OF PEAK FLOW         (min)=-10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0022

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0205)|   Area     (ha)=   2.15   Curve Number   (CN)= 59.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.13

         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    2.89 | 1.083   62.12 | 2.083   12.48 |  3.08    3.91
               0.167    2.89 | 1.167   62.12 | 2.167   12.48 |  3.17    3.91
               0.250    3.67 | 1.250  196.54 | 2.250    9.60 |  3.25    3.44
               0.333    3.67 | 1.333  196.54 | 2.333    9.60 |  3.33    3.44
               0.417    4.88 | 1.417   83.09 | 2.417    7.66 |  3.42    3.05
               0.500    4.88 | 1.500   83.09 | 2.500    7.66 |  3.50    3.05
               0.583    6.96 | 1.583   41.25 | 2.583    6.29 |  3.58    2.73
               0.667    6.96 | 1.667   41.25 | 2.667    6.29 |  3.67    2.73
               0.750   11.02 | 1.750   25.07 | 2.750    5.28 |  3.75    2.47
               0.833   11.02 | 1.833   25.07 | 2.833    5.28 |  3.83    2.47
               0.917   21.03 | 1.917   17.06 | 2.917    4.51 |  3.92    2.24
               1.000   21.03 | 2.000   17.06 | 3.000    4.51 |  4.00    2.24

     Unit Hyd Qpeak  (cms)=   0.632

     PEAK FLOW       (cms)=   0.235 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=  27.284
     TOTAL RAINFALL   (mm)=  89.870
     RUNOFF COEFFICIENT   =   0.304

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

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0002)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0205):     2.15   0.235     1.42    27.28
      + ID2= 2 (  0078):     0.00   0.000     1.42    28.81
        ====================================================
        ID = 3 (  0002):     2.15   0.235     1.42    27.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
```

Worksheet for Catchment 202 Driveway Culverts

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.03000	m/m
Diameter	0.45	m
Discharge	0.102	m³/s

=1/2 of 100-year Peak Flow = 1/2*0.203 = 0.102 m3/s

Assumed drainage within catchment is split 50/50 into each roadside ditch.

Note: Maximum Discharge is still greater than total 100-year peak flow within the catchment (0.530 > 0.203 m3/s)

Results

Normal Depth	0.139	m
Flow Area	0.04	m²
Wetted Perimeter	0.53	m
Hydraulic Radius	0.079	m
Top Width	0.42	m
Critical Depth	0.22	m
Percent Full	30.8	%
Critical Slope	0.00536	m/m
Velocity	2.45	m/s
Velocity Head	0.31	m
Specific Energy	0.44	m
Froude Number	2.47	
Maximum Discharge	0.53	m³/s
Discharge Full	0.49	m³/s
Slope Full	0.00128	m/m
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.000	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.000	m
Profile Description		
Profile Headloss	0.00	m
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	30.84	%
Downstream Velocity	Infinity	m/s

Worksheet for Catchment 202 Driveway Culverts

GVF Output Data

Upstream Velocity	Infinity	m/s
Normal Depth	0.139	m
Critical Depth	0.22	m
Channel Slope	0.03000	m/m
Critical Slope	0.00536	m/m

Worksheet for Catchment 203 Driveway Culverts

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02000	m/m
Diameter	0.45	m
Discharge	0.065	m³/s

=1/2 of 100-year Peak Flow = 1/2*0.131 = 0.065 m3/s

Assumed drainage within catchment is split 50/50 into each roadside ditch.

Note: Maximum Discharge is still greater than total 100-year peak flow within the catchment (0.430 > 0.131 m3/s)

Results

Normal Depth	0.122	m
Flow Area	0.03	m²
Wetted Perimeter	0.49	m
Hydraulic Radius	0.071	m
Top Width	0.40	m
Critical Depth	0.18	m
Percent Full	27.2	%
Critical Slope	0.00503	m/m
Velocity	1.86	m/s
Velocity Head	0.18	m
Specific Energy	0.30	m
Froude Number	2.01	
Maximum Discharge	0.43	m³/s
Discharge Full	0.40	m³/s
Slope Full	0.00052	m/m
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.000	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.000	m
Profile Description		
Profile Headloss	0.00	m
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	27.15	%
Downstream Velocity	Infinity	m/s

Worksheet for Catchment 203 Driveway Culverts

GVF Output Data

Upstream Velocity	Infinity	m/s
Normal Depth	0.122	m
Critical Depth	0.18	m
Channel Slope	0.02000	m/m
Critical Slope	0.00503	m/m

Worksheet for Trapezoidal Swale Above Weir Control Structure

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.01000	m/m
Normal Depth	0.350	m
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	2.00	m/m (H:V)
Bottom Width	2.00	m

Results

Discharge	1.167	m³/s
Flow Area	1.01	m²
Wetted Perimeter	3.89	m
Hydraulic Radius	0.259	m
Top Width	3.75	m
Critical Depth	0.29	m
Critical Slope	0.02056	m/m
Velocity	1.16	m/s
Velocity Head	0.07	m
Specific Energy	0.42	m
Froude Number	0.72	
Flow Type	Subcritical	

>> 100-year Peak Flows for each catchment

Peak Flows for each Catchment:
Catchment 202 = 0.203 m3/s
Catchment 203 = 0.131 m3/s
Catchment 204 = 0.063 m3/s

GVF Input Data

Downstream Depth	0.000	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

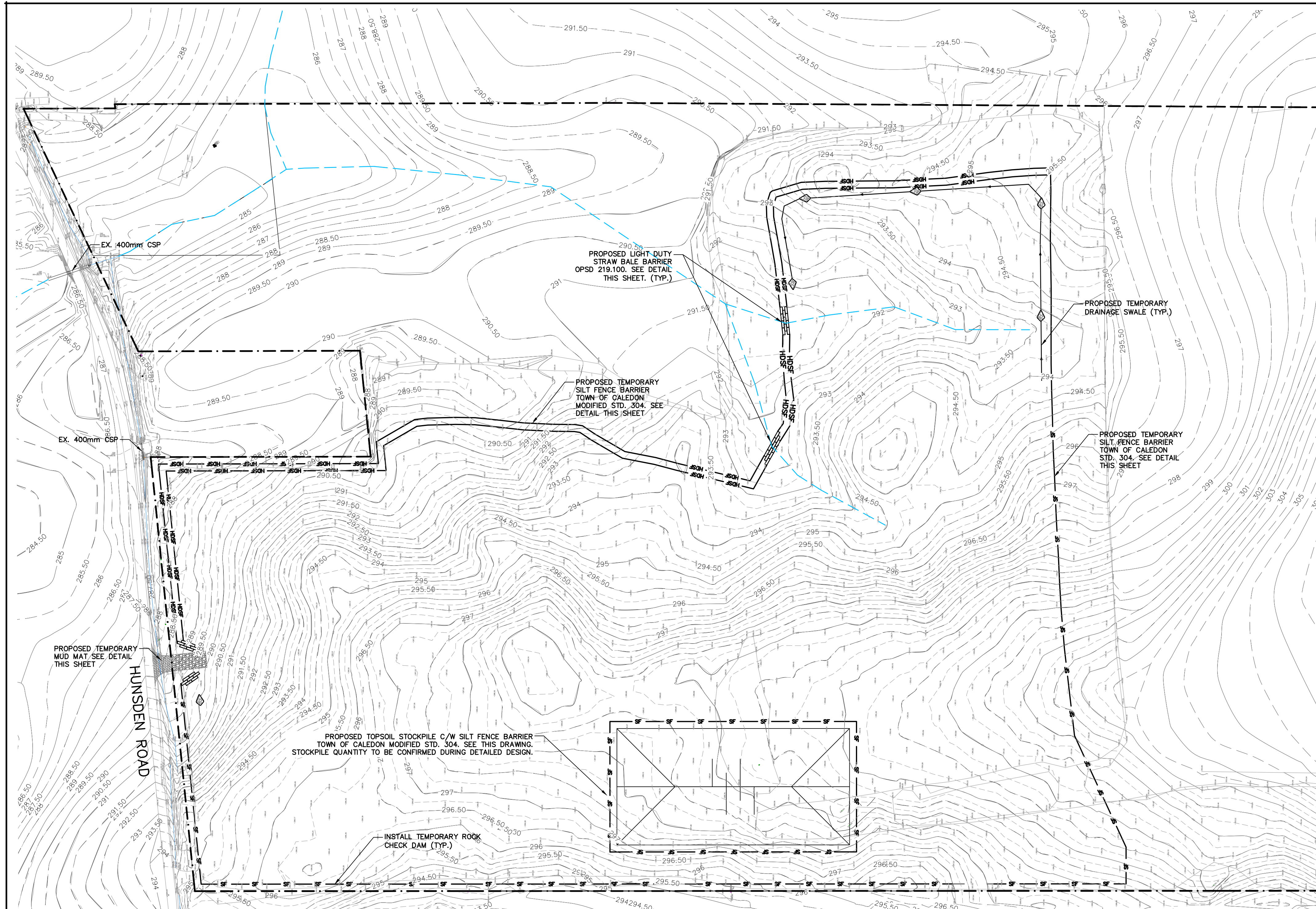
Upstream Depth	0.000	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.350	m
Critical Depth	0.29	m
Channel Slope	0.01000	m/m

Worksheet for Trapezoidal Swale Above Weir Control Structure

GVF Output Data

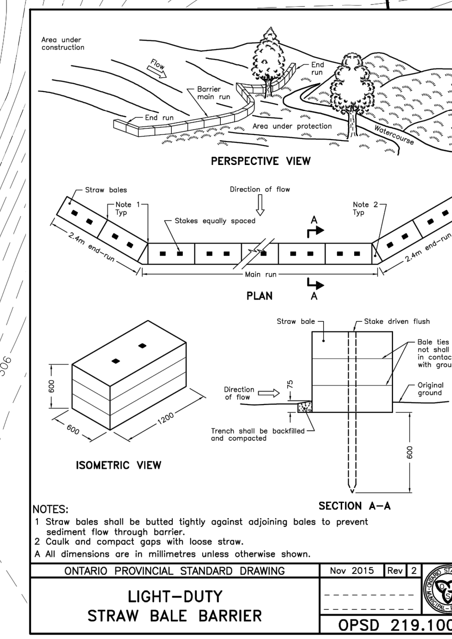
Critical Slope	0.02056	m/m

DRAWINGS



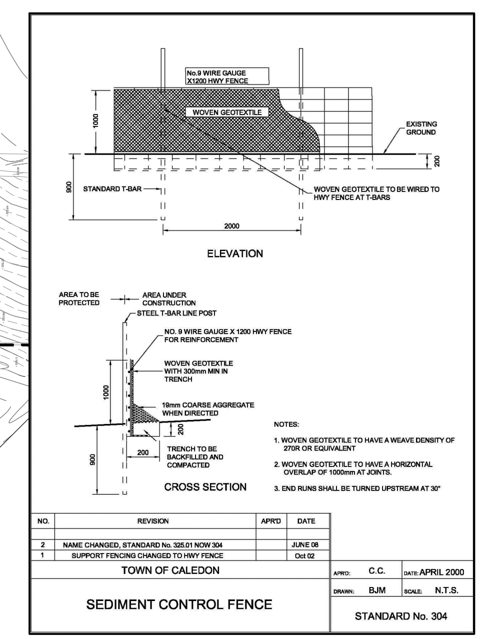
LEGEND

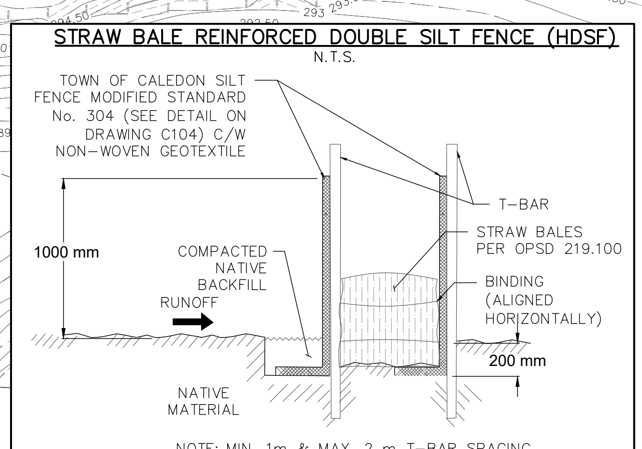
	PROPERTY LINE
	EXISTING CONTOUR (0.5m)
	EXISTING CONTOUR (1.0m)
	EXISTING DITCH
	EXISTING GRADE
	MUD-MAT; SEE DETAIL MODIFIED
SF	SILT FENCE (T.O.C. STD. DWG. No. 304) – SEE DETAIL ON C104
HDSF	HEAVY DUTY SILT FENCE (STRAW BALE REINFORCED DOUBLE SILT FENCE) – SEE DETAIL ON THIS DRAWING
	ROCK FLOW CHECK DAM; OPSD 219.210

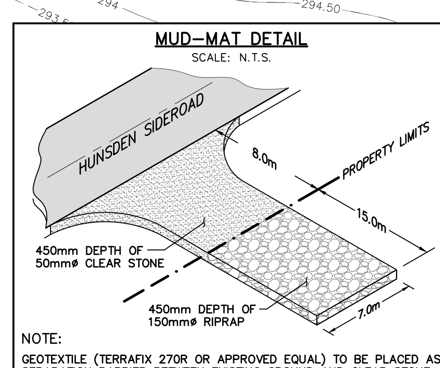


NOTE:

ESC MEASURES TO RESPECT EXISTING VEGETATION AND AVOID IMPACTS WHERE POSSIBLE. SEE ARBORIST/TREE PRESERVATION AND PROTECTION PLAN FOR DETAILS ON TREES TO BE PRESERVED.







NOT FOR CONSTRUCTION

No.	ISSUE / REVISION	YYYY/MMM/DD
1	ISSUED FOR SECOND SUBMISSION (ZBA)	2023/NOV/07
0	ISSUED FOR FIRST SUBMISSION (ZBA)	2022/JUNE/30

ELEVATION NOTE:

ELEVATIONS SHOWN HEREON ARE GEODETIC DATUM AND ARE DERIVED FROM THE MINISTRY OF NATURAL RESOURCES BENCHMARKS.

SITE BENCHMARK:

No. 00820108111
ELEVATION = 286.833m
No. 00820108113
ELEVATION = 290.087

SURVEY NOTES:

THIS TOPOGRAPHIC SURVEY WAS COMPLETED BY J.D. BARNES LIMITED ON MARCH 22, 2022. REF. No: 22-30-839-00

DRAWING NOTES:

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ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

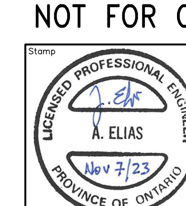
Project

10249 HUNSDEN SIDEROAD
TOWN OF CALEDON

Drawing

PRELIMINARY EROSION AND SEDIMENT CONTROL PLAN

Stamp

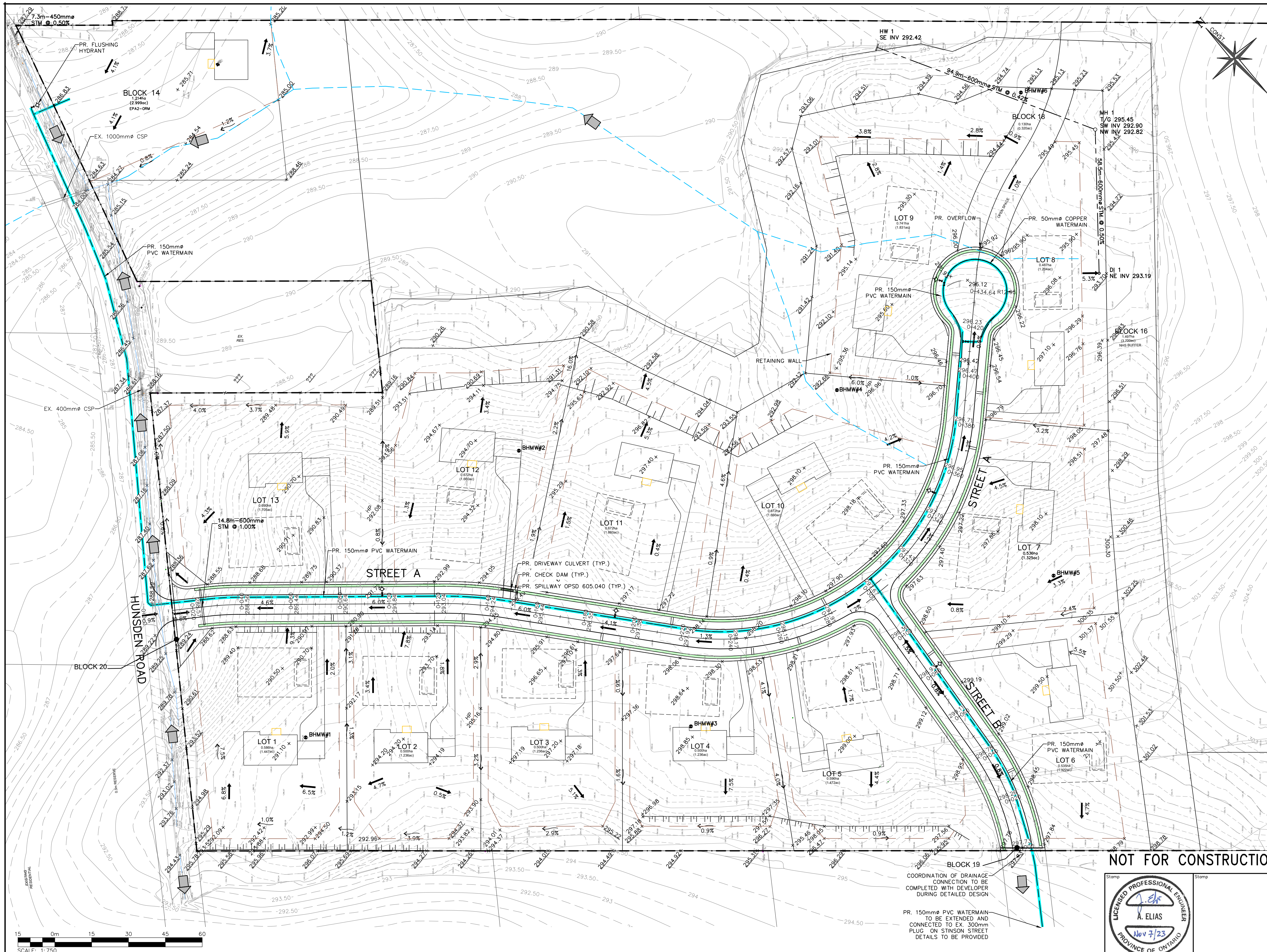


Stamp

CROZIER CONSULTING ENGINEERS

2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905.875.0026 T
905.875.4915 F
WWW.CFCROZIER.CA

Drawn	D.G.	Design	T.E.	Project No.	952–6305
Check	J.F.	Check	T.E.	Scale 1:1000	Dwg. C101



KEY PLAN
SCALE: N.T.S.

LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (0.5m)
- EXISTING CONTOUR (1.0m)
- EXISTING DITCH
- EXISTING FENCE
- 215.00 EXISTING GRADE
- 215.00 PROPOSED GRADE
- 215.00 PROPOSED GRADE (TO MATCH EXISTING)
- 2.0% PROPOSED MINOR FLOW DIRECTION
- 2.0% PROPOSED GRASSED SWALE
- BHMW# BOREHOLE MONITORING WELL
- PROPOSED SLOPE (3:1 MAX.)
- EXISTING OVERLAND FLOW DIRECTION
- PROPOSED FIRE HYDRANT & GATE VALVE
- PROPOSED WATERMAIN & GATE VALVE
- PR. BIOSWALE
- PR. BUILDING ENVELOPE
- SANITARY SEPTIC BED TO BE DESIGNED BY OTHERS
- LOT STRUCTURAL ENVELOPE

No.	ISSUE / REVISION	YYYY/MMM/DD
1	ISSUED FOR SECOND SUBMISSION (ZBA)	2023/NOV/07
0	ISSUED FOR FIRST SUBMISSION (ZBA)	2022/JUNE/30

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No. 00820108111
ELEVATION = 286.833m
No. 00820108113
ELEVATION = 290.087

SURVEY NOTES:

THIS TOPOGRAPHIC SURVEY WAS COMPLETED BY J.D. BARNES LIMITED ON MARCH 22, 2022. REF. No: 22-30-839-00

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Project

10249 HUNSDEN SIDEROAD
TOWN OF CALEDON

Drawing

PRELIMINARY SITE GRADING & SERVICING PLAN

NOT FOR CONSTRUCTION

Stamp: LICENSED PROFESSIONAL ENGINEER — A. ELIAS — Nov 7/23 — PROVINCE OF ONTARIO

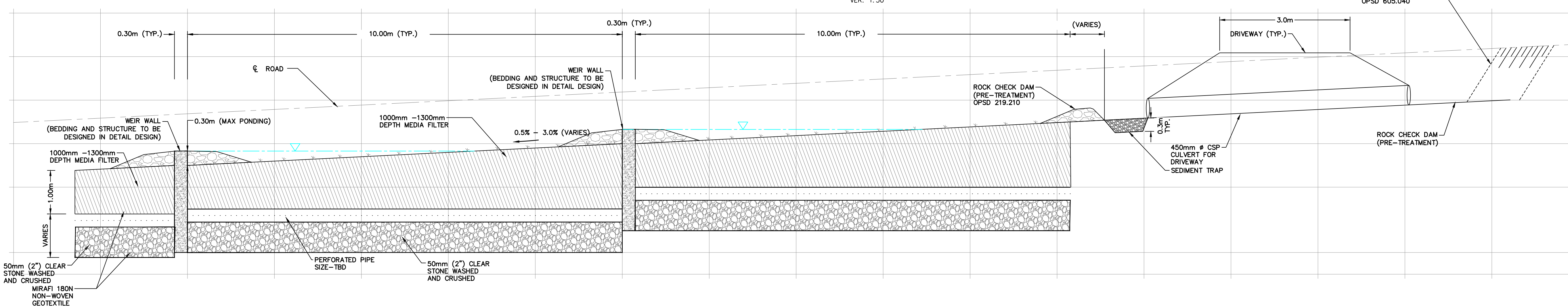
Stamp

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA

Drawn	D.G.	Design	T.E.	Project No.	952–6305
Check	J.F.	Check	T.E.	Scale 1:750	Dwg. C 102

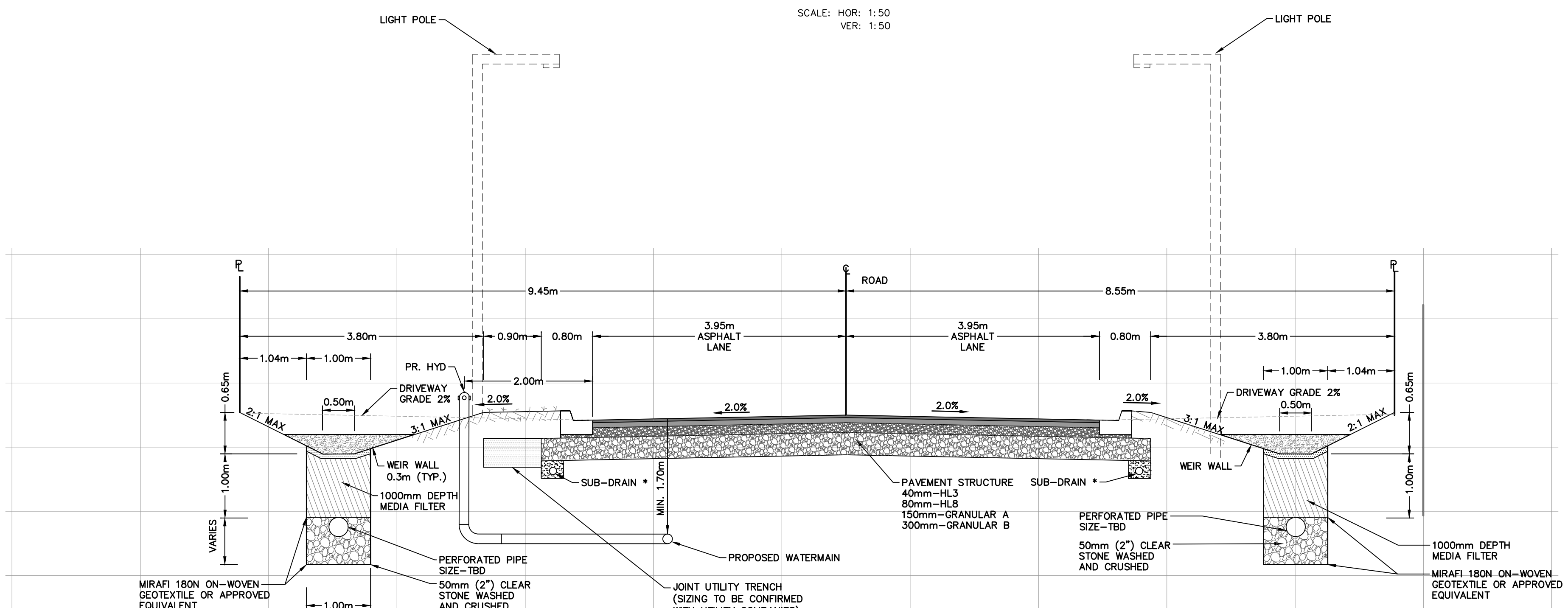
TYPICAL ROADSIDE BIOSWALE SECTION

SCALE: HOR: 1:50
VER: 1:50



TYPICAL 18.0m R.OW. ROAD SECTION

SCALE: HOR: 1:50
VER: 1:50



* SUB-DRAIN MAY OUTLET TO PERFORATED PIPE IN BIOSWALE

No.	ISSUE / REVISION	YYYY/MMM/DD
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0	ISSUED FOR FIRST SUBMISSION (ZBA)	2022/JUNE/30

ELEVATION NOTE:

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SITE BENCHMARK:

No. 00820108111
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No. 00820108113
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Project

10249 HUNSDEN SIDEROAD
TOWN OF CALEDON

Drawing

SECTIONS AND DETAILS

NOT FOR CONSTRUCTION

Stamp

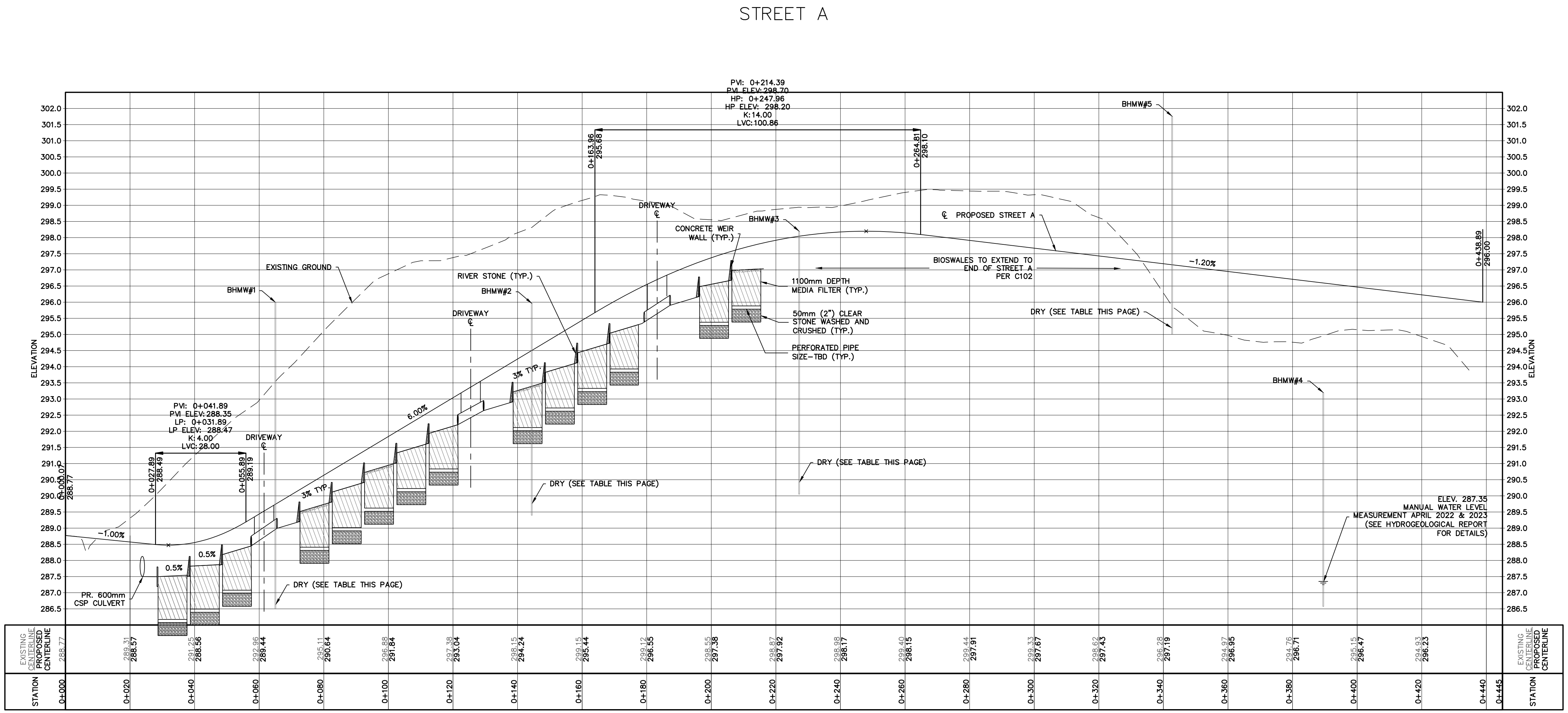
LICENSED PROFESSIONAL ENGINEER
A. ELIAS
Nov 7/23
PROVINCE OF ONTARIO

Stamp

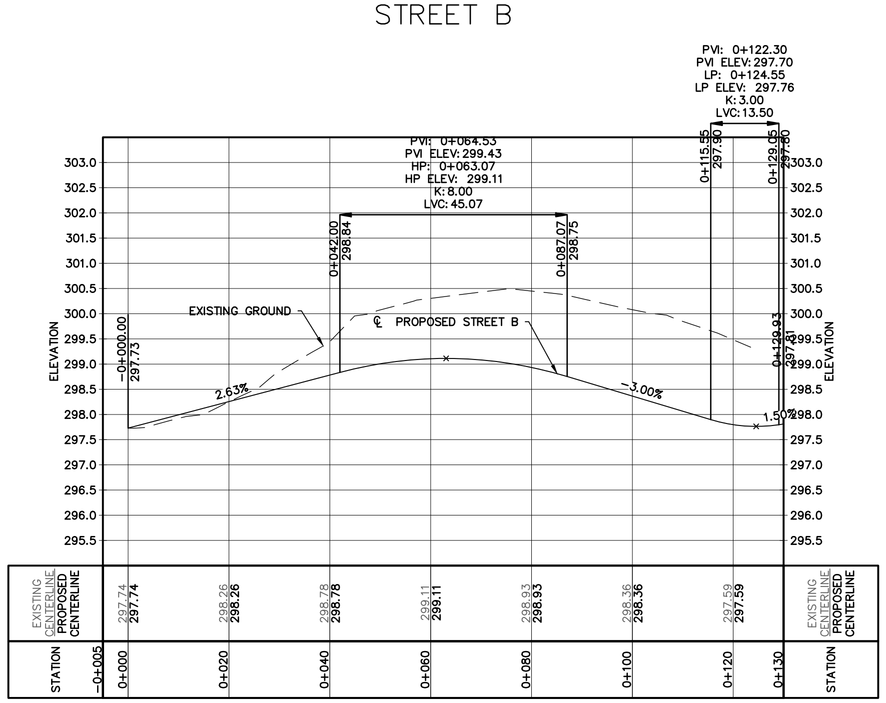
CROZIER
CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905.875.0026 T
905.875.4915 F
WWW.CFCROZIER.CA

Drawn	D.G.	Design	T.E.	Project No.	952-6305
Check	J.F.	Check	T.E.	Scale AS SHOWN	Dwg. C 103

STREET A



STREET B



SCALE: 1: 750

Monitoring Well	06-Apr-22			28-Apr-23			11-Oct-23		
	Measured Level (m)	Corrected Water Level (mbgs)	Groundwater Elevation (masl)	Measured Level (m)	Corrected Water Level (mbgs)	Groundwater Elevation (masl)	Measured Level (m)2	Corrected Water Level (mbgs)2	Groundwater Elevation (masl)2
MW1	DRY	-	-	DRY	-	-	DRY	-	-
MW2	DRY	-	-	DRY	-	-	DRY	-	-
MW3	DRY	-	-	DRY	-	-	DRY	-	-
MW4	6.55	5.85	287.35	6.55	5.85	287.35	6.67	5.97	287.23
MW5	DRY	-	-	DRY	-	-	DRY	-	-
MW6	DRY	-	-	6.71	6.01	288.39	DRY	-	-
MIN	6.55	5.85	287.35	6.55	5.85	287.35	6.67	5.97	287.23
MAX	6.55	5.85	287.35	6.71	6.01	288.39	6.67	5.97	287.23
AVG	6.55	5.85	287.35	6.63	5.93	287.87	6.67	5.97	287.23

Caption: Monitoring Well Levels

No.	ISSUE / REVISION	YYYY/MMM/DD
1	ISSUED FOR SECOND SUBMISSION (ZBA)	2023/NOV/07
0	ISSUED FOR FIRST SUBMISSION (ZBA)	2022/JUNE/30

ELEVATION NOTE:

ELEVATIONS SHOWN HEREON ARE GEODETIC DATUM AND ARE DERIVED FROM THE MINISTRY OF NATURAL RESOURCES BENCHMARKS.

SITE BENCHMARK:

No. 00820108111
ELEVATION = 286.833m
No. 00820108113
ELEVATION = 290.087

SURVEY NOTES:

THIS TOPOGRAPHIC SURVEY WAS COMPLETED BY J.D. BARNES LIMITED ON MARCH 22, 2022. REF. No: 22-30-839-00

DRAWING NOTES:

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, LEVELS, AND DATUMS ON SITE AND REPORT ANY DISCREPANCIES OR OMISSIONS TO THIS OFFICE PRIOR TO CONSTRUCTION.

THIS DRAWING IS TO BE READ AND UNDERSTOOD IN CONJUNCTION WITH ALL OTHER PLANS AND DOCUMENTS APPLICABLE TO THIS PROJECT. DO NOT SCALE THIS DRAWING.

ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

Project

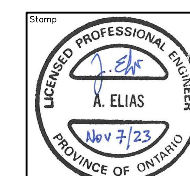
10249 HUNSDEN SIDEROAD
TOWN OF CALEDON

Drawing

PRELIMINARY SITE
ROAD & BIO-SWALE PROFILES

NOT FOR CONSTRUCTION

Stamp



Stamp

CROZIER
CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA

Drawn D.G.	Design T.E.	Project No. 952-6305
Check J.F.	Check T.E.	Scale 1: 750 — Dwg. C 104

FIGURES

LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (0.5m)
- EXISTING CONTOUR (1.0m)
- EXISTING DITCH
- EXISTING GRADE
- EXISTING OVERLAND FLOW DIRECTION
- EXISTING STORM DRAINAGE CATCHMENT
- CATCHMENT I.D. — AREA (ha) | CURVE NUMBER
- STORMWATER OUTLET ID

No.	ISSUE / REVISION	YYYY/MMM/DD
1	ISSUED FOR SECOND SUBMISSION (ZBA)	2023/NOV/07
0	ISSUED FOR FIRST SUBMISSION (ZBA)	2022/JUNE/30

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SITE BENCHMARK:

No. 00820108111
ELEVATION = 286.833m
No. 00820108113
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SURVEY NOTES:

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Project

10249 HUNSDEN SIDEROAD
TOWN OF CALEDON

Drawing

PRE-DEVELOPMENT DRAINAGE PLAN

NOT FOR CONSTRUCTION

Stamp: LICENSED PROFESSIONAL ENGINEER — A. ELIAS — Nov 7/23 — PROVINCE OF ONTARIO

Stamp

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA

Drawn	D.G.	Design	T.E.	Project No.	952-6305
Check	J.F.	Check	T.E.	Scale 1:1250	Dwg. FIG1

LEGEND

Symbol	Description
	PROPERTY LINE
	EXISTING CONTOUR (0.5m)
	EXISTING CONTOUR (1.0m)
	EXISTING DITCH
× 215.00	EXISTING GRADE
	PROPOSED MAJOR OVERLAND FLOW DIRECTION
	BOREHOLE MONITORING WELL
	EXISTING MAJOR OVERLAND FLOW DIRECTION
	MODELED CATCHMENT AREA
ID / A | CN	CATCHMENT I.D. / AREA (ha) | CURVE NUMBER (CN)
#	STORMWATER OUTLET ID
	PR. BUILDING ENVELOPE

No.	ISSUE / REVISION	YYYY/MMM/DD
1	ISSUED FOR SECOND SUBMISSION (ZBA)	2023/NOV/07
0	ISSUED FOR FIRST SUBMISSION (ZBA)	2022/JUNE/30

ELEVATION NOTE:

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SITE BENCHMARK:

No. 00820108111
ELEVATION = 286.833m
No. 00820108113
ELEVATION = 290.087

SURVEY NOTES:

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Project

10249 HUNSDEN SIDEROAD
TOWN OF CALEDON

Drawing

POST DEVELOPMENT DRAINAGE PLAN

NOT FOR CONSTRUCTION

Stamp: LICENSED PROFESSIONAL ENGINEER — A. ELIAS — Nov 7/23 — PROVINCE OF ONTARIO

Stamp

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SUITE 100
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905.875.4915 F
WWW.CFCROZIER.CA

Drawn	D.G.	Design	T.E.	Project No.	952-6305
Check	J.F.	Check	T.E.	Scale 1:1250	Dwg. FIG2

SCALE: 1:1250 (25 0m 25 50 75 100)