



**BURNSIDE**

**Functional Servicing and Stormwater  
Management Report - 3415 Ninth  
Line, Mississauga, ON**

**St. Mark and St. Demiana Coptic  
Orthodox Church,  
462 Falgarwood Drive  
Oakville, ON L6H 1N3**



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Management Report - 3415 Ninth  
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462 Falgarwood Drive  
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**April 2024  
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**R.J. Burnside & Associates Limited**

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- Appendix B Stormwater Management Calculations
- Appendix C Watermain Calculations

Functional Servicing and Stormwater Management Report - 3415 Ninth Line, Mississauga, ON  
April 2024

## **Disclaimer**

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## 1.0 Introduction and Background

R.J. Burnside & Associates Limited (Burnside) has been retained by St. Mark and St. Demiana Coptic Orthodox Church to complete a Functional Servicing and Stormwater Management Report (FSR) for a Church Development located at Ninth Line, Mississauga. This report will support applications for a Zoning By-law Amendment and Site Plan Approval by demonstrating that the subject lands can be serviced in accordance with applicable regulatory requirements and criteria.

### 1.1 Objectives

The objectives of this report are to:

- Identify any applicable engineering constraints on the subject site.
- Verify the location of existing infrastructure both within and adjacent to the site.
- Confirm feasibility of on-site sanitary treatment.
- Assess and confirm that domestic and fire flow requirements are met for the supply and on-site distribution of municipal water.
- Evaluate options and constraints for stormwater management to:
  - Ensure post development flows from the site are sufficiently controlled.
  - Confirm adequate stormwater quality controls are provided.

### 1.2 Site Description

The proposed St. Mark and St. Demiana Coptic Orthodox Church Development is located on Ninth Line in Mississauga, just south-east of Burnhamthorpe Road. The site is bordered by Ninth Line on the southwest property line and Highway 403 on the northeast property line. The neighboring property to the north has a storage building on site and the property to the south is currently vacant. The site is legally described as RCP 1542 Part of Lot 9, RP 43R37503, Part 6, 7 and 9, City of Mississauga, and is zoned as Employment (E2-93). The existing site is 3.93 ha in size and consists of a grassed area with a small portion of the site covered in gravel. The location plan in Figure 1 shows the property in the context of the surrounding area.



**SITE LOCATION**



KEY MAP OF ONTARIO



Client  
**St. MARK AND St. DEMIANA COPTIC  
 ORTHODOX CHURCH**

Figure Title  
**NINTH LINE MISSISSAUGA**

SITE LOCATION PLAN

Drawn TR	Checked SR	Date 24/04/03	Figure No. <b>1</b>
Scale N.T.S.	Project No. 300044049		



### 1.3 Background Information and Documentation

The current report has been prepared in accordance with, and with consideration to the information and recommendations provided in the following documents:

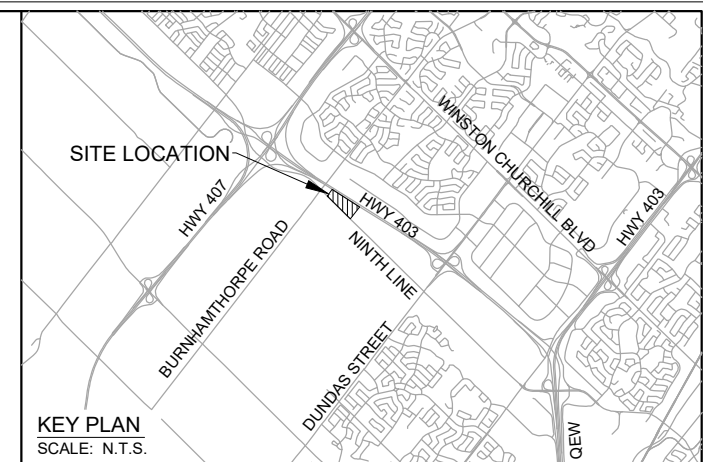
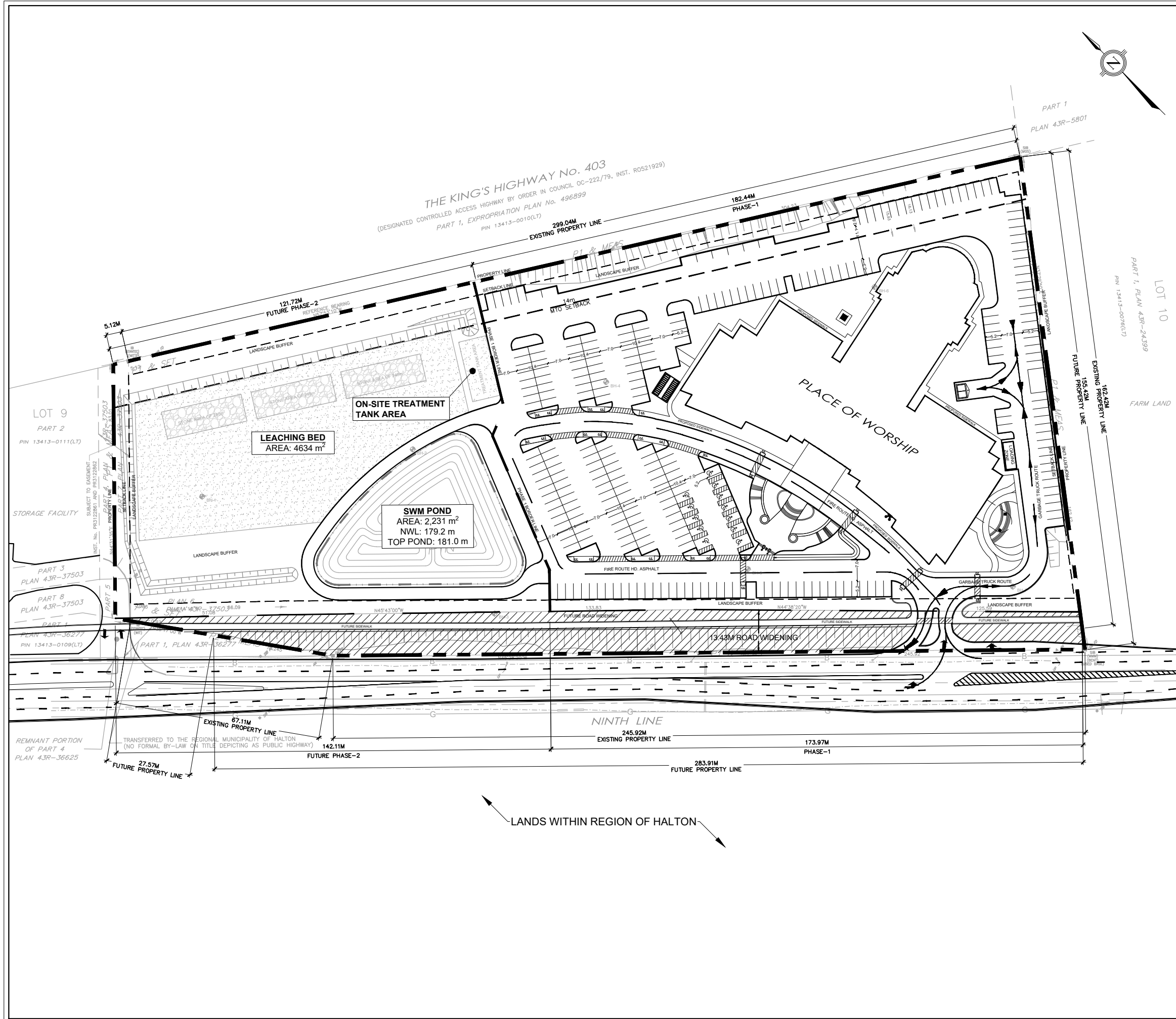
- Public Works Design, Specifications & Procedures Manual – Linear Infrastructure - Functional Servicing and Storm Water Management Report - Region of Peel, July 2009.
- Class Environmental Assessment Study – Ninth Line (Regional Road 13) Transportation Corridor Improvement – Region of Halton, June 22, 2017.
- Topographic Plan of Survey of Part 9, Registrar's Compiled Plan 1542 by Stantec Geomatics Ltd., May 2019.
- Project Status Report DARC 19-164 W8, City of Mississauga, July 2019.
- St. Mark and St. Demiana Church Parking Utilization Study – Stantec Consulting Ltd., January 8th, 2020.
- City of Mississauga Development Requirements - Section 2, January 2020.
- Geotechnical Investigation Report – CMT Engineering Inc., February 20, 2020.
- Application User Guide for Pre-Application Meetings and Site Plan Approval.

### 1.4 Proposed Site Plan

The proposed development on the site has been separated into two phases. The first phase of development proposes a new church building, 4,977 m<sup>2</sup> in size, and accompanying at-grade parking spaces, both located on the eastern portion of the site. A single entrance from Ninth Line, located at the southern end of the site, is proposed. The northern portion of the site will be utilized for a stormwater management (SWM) pond and an on-site sanitary wastewater treatment system.

Phase 2 will introduce additional parking spaces and a Community Centre in the northern portion of the property, replacing the SWM pond and on-site sanitary treatment system constructed as part of Phase 1. Phase 2 will be completed once municipal sanitary services are in place along Ninth Line. The detailed design of Phase 2 will be completed at a future time under separate cover. This report will concentrate only on the Phase 1 design of the proposed development. Refer to Figure 2 for the Phase 1 development plan and Figure 3 for the ultimate overall site plan, which includes the proposed Phase 2 works.

As part of the proposed development, a portion of the existing site will be dedicated to Halton Region in support of the future road widening of Ninth Line. A total of 0.38 ha will be dedicated to the Region, resulting in a proposed development area of 3.55 ha.



**LEGEND**

- PROPERTY BOUNDARY
- PROPERTY SETBACK
- MTO SETBACK
- PROPOSED LANE MARKINGS
- PHASE 1 - BORDER LINE
- POND LIMITS
- EXISTING WATERMAIN
- EXISTING DITCH
- EXISTING BELL
- ROAD WIDENING LANDS TO BE DEDICATED TO THE CITY
- EXISTING STONE AREA
- EXISTING LEACHING BED
- EXISTING BOREHOLE
- PROPOSED RETAINING WALL
- PROPOSED ADA PARKING
- PROPOSED 3:1 MAX GRADING
- PROPOSED CONCRETE CURB
- PROPOSED BIKE RACK
- PROPOSED TRANSFORMER
- PROPOSED GARBAGE STORAGE

0 25 50 75 100  
Metres

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Client  
**St. MARK AND St. DEMIANA COPTIC ORTHODOX CHURCH**

Figure Title  
**NINTH LINE MISSISSAUGA**  
**PROPOSED SITE PLAN - PHASE 1**

Drawn TR	Checked SR	Date 24/04/03	Figure No. <b>2</b>
Scale 1:1250	Project No. 300044049		



## **2.0 Existing Storm Drainage**

### **2.1 Drainage Conditions**

The existing site slopes from north to south with an approximate overall slope of 4% across the site. There is an existing berm at the northeast side of the site that runs parallel to Highway 403. This berm is the high point within the site. A small portion of the site drains to the Highway 403 right-of-way (ROW), while the remainder of the site discharges towards the ditch that runs along the east side of the Ninth Line ROW. Flow that enters this ditch is conveyed under Ninth Line via a 400 mm diameter CSP culvert. The existing culvert ultimately discharges to an area included within the Joshua Creek Watershed, part of Conservation Halton jurisdiction.

### **2.2 Soil Conditions**

In February 2020, CMT Engineering Inc. completed a Geotechnical Investigation for the subject property, which can be found with Appendix A. Based on the preliminary geotechnical investigation, the native soils encountered on the site are generally considered to be suitable for supporting the proposed development. The soil stratigraphy was predominantly sandy clayey silt till. Based on the Geotechnical Investigation the site classification for seismic site response would be considered Site Class D (stiff soils).

As part of the preliminary geotechnical investigation, seven (7) boreholes were advanced to depths ranging from 4.6 to 7.6 m below grade. Boreholes 1, 5 and 6 were equipped with monitoring wells. The monitoring wells recorded groundwater at elevations ranging between 0.15 m and 4.27 m below grade. During the investigation, accumulated groundwater was recorded within open BH2 and BH3, at which the groundwater was roughly 2.74 m and 4.72 m below existing grade, respectively.

### **3.0 Proposed Site Grading**

The proposed site grading takes into consideration the following requirements and constraints:

- Conformance to the City of Mississauga's grading and drainage criteria.
- Optimization of required earthworks.
- Provision for adequate cover on proposed services.
- Provision for overland flow conveyance to the proposed SWM pond.
- Maintain a maximum ponding depth of 0.25 m within the parking lot.

The proposed grading plan is largely driven by the following site constraints:

- The high point within the site is adjacent to the Highway 403 ROW and results in considerably steep slopes within the site.
- The proposed parking lot and drive aisles are to slope towards the proposed SWM pond which, due to site plan constraints, is not located at the natural low point on the site.
- The proposed SWM pond is to discharge into the existing roadside ditch along Ninth Line, which drains towards the existing 400 mm CSP culvert crossing the road at an inlet invert of 178.26 m.

Based on the site constraints outlined above, the proposed grades within the drive aisles range from 0.50% to 5.00%. The proposed grading is shown on Drawing G1.

## 4.0 Stormwater Management

### 4.1 Design Criteria

Based on coordination with the City of Mississauga, the following criteria must be achieved through the stormwater management design for the site:

- Quantity Control: Control the 100-year post development design storm flow to the 2-year pre development design storm flow.
- Quality Control: 80% TSS removal, Enhanced Protection Level (Level 1) quality control as specified in the Ministry of Environment's Stormwater Management Planning and Design Manual (2003).
- Runoff Volume Reduction: The first 5 mm of runoff shall be retained on site.
- Low Impact Development (LID) measures will be evaluated during the Site Plan Application Process.

### 4.2 Pre Development Conditions

The existing site is delineated as two catchments, as demonstrated in Figure 4. Flows from Catchment 101 discharge to the existing ditch along Ninth Line while flows from Catchment 102 are conveyed to the Highway 403 ROW. The peak flows discharged from the site under existing conditions have been calculated using the Visual OTTHYMO hydrologic modelling software. The following table summarizes the parameters for each catchment input into the model. The complete model results and supporting calculations are presented in Appendix B.

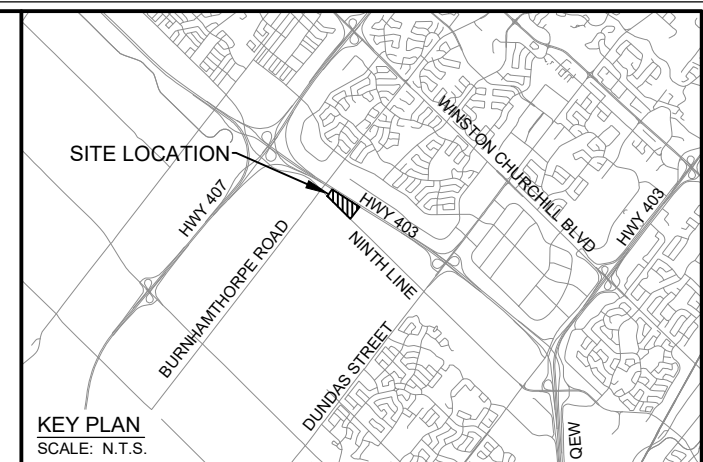
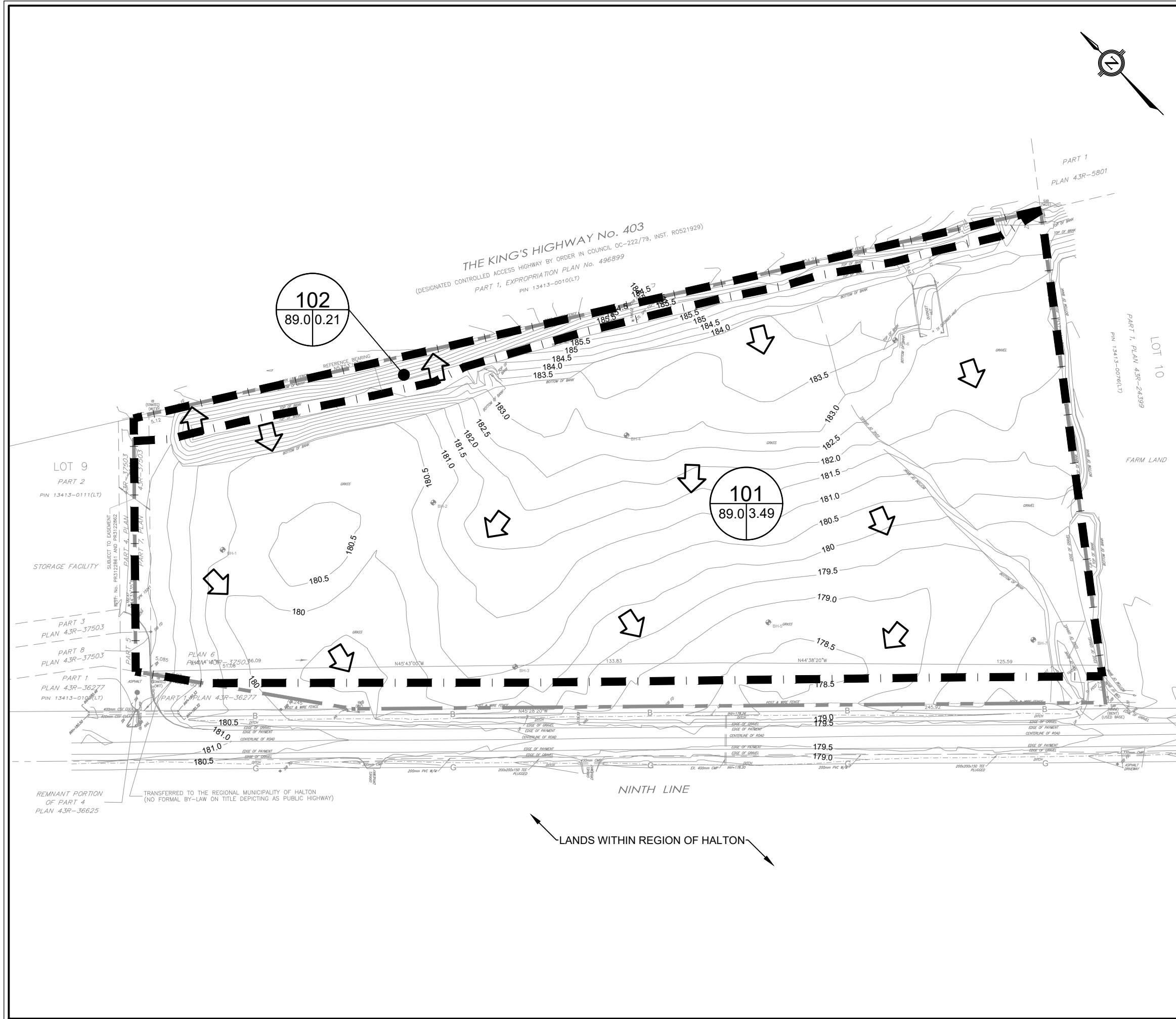
**Table 1: Pre Development Catchment Parameters**

Outlet	Catchment	Area (ha)	SCS Curve Number	Time to Peak (hr)
Ninth Line	101	3.49	89.0	0.19
Highway 403	102	0.21	89.0	0.15*

\* Based on the City of Mississauga criteria for time of concentration (Tc) with a minimum 15 minutes for the first 50 m of flow length plus 2 m/s velocity for additional flow length within the sub-catchment.

Time to peak =  $0.6 \times T_c$ .

Using Ontario Soil Maps, the native soils on the site are considered a mixture of Soil Groups C and D. The site consists of 50% Chinguacousy clay loam and 50% Oneida clay loam. Based on the existing site soils and considering that the existing site is a mixture of grass and gravel, composite curve numbers were derived for each catchment. Appendix B contains further detail regarding the curve numbers and time to peaks for the site. The Visual OTTHYMO model was run using a 4-hour Chicago storm distribution design storms for the 2, 5, 10, 25, 50 and 100-year design storm events. Table 2 summarizes the output from the model. Refer to Appendix B for the Visual OTTHYMO model output.



**LEGEND**

- PROPERTY BOUNDARY
- EXISTING DRAINAGE BOUNDARY
- EXISTING CONTOUR
- EXISTING BOREHOLE
- EXISTING OVERLAND FLOW DIRECTION

**CATCHMENT DATA**

<b>102</b>	89.0	0.21
<b>101</b>	89.0	3.49
<b>101</b>	86.2	1.21

← CATCHMENT No.  
← CATCHMENT AREA (ha)  
← RUNOFF CURVE NUMBER

0 25 50 75 100  
Metres

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Figure Title  
**NINTH LINE MISSISSAUGA**  
PRE-DEVELOPMENT DRAINAGE AREA PLAN

Drawn TR	Checked SR	Date 24/04/03	Figure No. <b>4</b>
Scale 1:1250	Project No. 300044049		

**Table 2: Pre Development Visual OTTHYMO Peak Flows**

Design Storm	Release Rate (L/s)	
	Catchment 101	Catchment 102
2-year	149	10
5-year	263	18
10-year	377	26
25-year	471	33
50-year	560	39
100-year	655	45

As per the City's quantity control criteria the target release rates from the site will be the 2-year pre development flows.

### 4.3 Post Development Conditions

#### 4.3.1 Post Development Catchments

The post development catchments have been delineated based on the proposed grading for the site. Under post development conditions the stormwater runoff from the entire site will drain towards Ninth Line. Flows from Catchment UNC1 will discharge uncontrolled to Ninth Line and flows from Catchment 201 will be directed to the stormwater management (SWM) Pond for attenuation prior to being discharged to the Ninth Line ditch. The proposed site imperviousness was determined based on the pervious and impervious areas shown on the proposed site plan (Figure 2). The following table summarizes the post development catchment parameters. Supporting calculations are included in Appendix B. The proposed catchments are shown on Figure 5.

**Table 3: Post Development Catchment Parameters**

Outlet	Catchment	Area (ha)	Percent Impervious	SCS Curve Number
Ninth Line	201	3.45	58.9%	84.5
	UNC1	0.25	75.4%	81.5





### 4.3.2 Stormwater Management Design

The stormwater management criteria for the site, as outlined above in Section 4.1, will be achieved through the use of a wet pond and an underground infiltration facility.

Section 4.6.2 of the March 2003 MOE (now MECP) SWM Design Manual states that, “*wet ponds require a minimum drainage area of about 5 hectares to sustain the permanent pool*”. While it is recognized that the provided drainage area of 3.45 ha is less than the recommended minimum, it is approaching the approximate 5 ha guideline. The SWM pond has been designed in accordance with the MECP guidelines and incorporates all elements typical of a wet pond, including an appropriately sized forebay and permanent pool. Given that the proposed development is a private facility, the wet pond will be maintained as part of the site plan agreement. An operations and maintenance program will ensure that the permanent pool and other pond operating characteristics are maintained. More frequent cleanout of the pond may be required due to its small size; the cleanout frequency will be addressed through the preparation of the operation and maintenance program, which will be provided at the detailed design stage.

In addition to the above, the SWM facility is proposed as an interim pond only, specifically as part of the Phase 1 development. Once Phase 2 is implemented and the pond is removed, water quality will be achieved using a combination of an oil-grit separator (OGS) unit as well as in isolator rows of on-site underground storage chambers. Further details will be provided at the detailed design stage.

#### 4.3.2.1 Permanent Pool






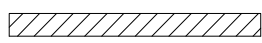





The SWM pond has been designed to provide Enhanced Protection water quality control. This level of quality control will be achieved through the permanent pool volume in the SWM pond, designed in accordance with Table 3.2 from the MOE Stormwater Management Planning and Design Manual (2003). Table 4 shows the permanent pool volume required to achieve the required quality control level. The permanent pool has been calculated using a contributing drainage area of 3.45 ha at a weighted percent impervious of 58.9%.

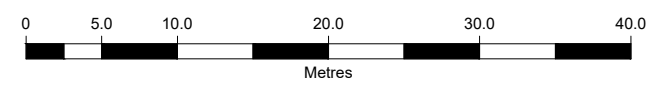
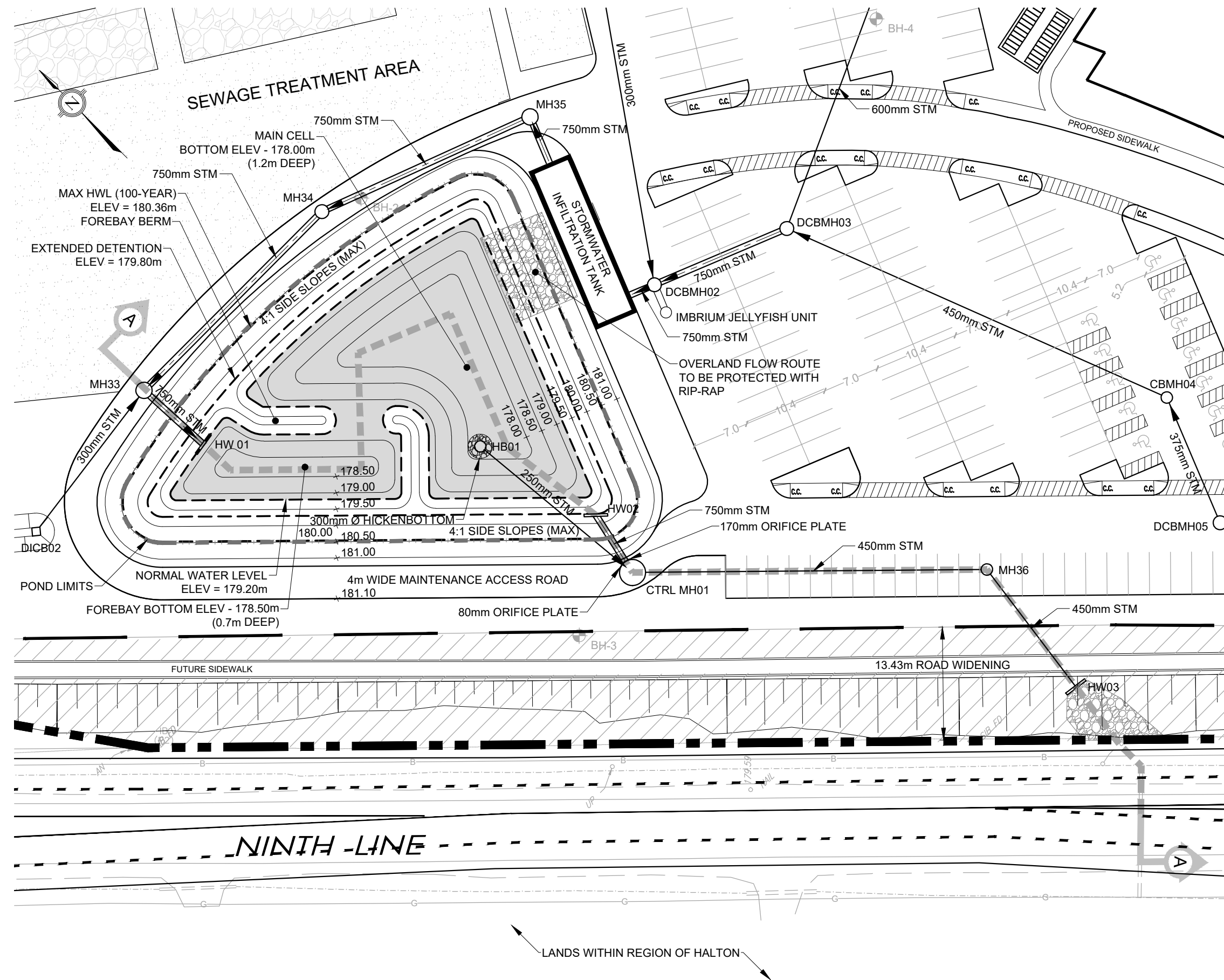
**Table 4: Permanent Pool Volume Summary**


Storage Volume (m <sup>3</sup> /ha)	Volume Required (m <sup>3</sup> )	Volume Provided (m <sup>3</sup> )
160.3	552	676

As shown in the table above, the permanent pool volume provided in the pond exceeds the required volume. This volume is measured from the bottom of the pond (178.0 m) to the normal water level (NWL) for the pond, which is set at 179.20 m. The plan view of the proposed pond is shown in Figure 6.

**LEGEND**

-  PROPERTY BOUNDARY
-  PROPOSED POND LIMITS
-  EXISTING DITCH CENTERLINE
-  PROPOSED STORM SEWER
-  PROPOSED STORM STRUCTURE
-  ROAD WIDENING LANDS TO BE DEDICATED TO THE CITY
-  PROPOSED STONE AREA
-  PROPOSED RIPRAP OVERFLOW
-  PROPOSED LEACHING BED
-  EXISTING BOREHOLE
-  PROPOSED 3:1 MAX GRADING



			
Client <b>St. MARK AND St. DEMIANA COPTIC ORTHODOX CHURCH</b>			
Figure Title <b>NINTH LINE MISSISSAUGA STORMWATER MANAGEMENT POND</b>			
Drawn TR	Checked SR	Date 24/04/03	Figure No. <b>6</b>
Scale 1:1250		Project No. 300044049	

#### 4.3.2.2 Forebay Sizing

The forebay is sized based on the greater of either the settling length or dispersion length required. The forebay is sized to have a maximum allowable average flow velocity of 0.15 m/s. Forebay sizing calculations have been completed in accordance with the MOE Stormwater Management Planning and Design Manual. The following table outlines the forebay sizing requirements. Detailed calculations are included in Appendix B.

**Table 5: Forebay Sizing Summary**

Calculation Method	Design Flow (m <sup>3</sup> /s)	L:W Ratio	Required Dimensions		Provided Dimensions	
			Length (m)	Width (m)	Length (m)	Width (m)
Settling Length	0.013	2	9.3	4.6	26.0	13.0
Dispersion Length	0.673	2	25.8	12.9	26.0	13.0

The design flow for the settling length is based on the extended detention release rate and the design flow for the dispersion length is based on the 10-year flow from the inletting sewer. The table above demonstrates that the size of the designed forebay exceeds the requirements for both settling length and dispersion length.

#### 4.3.2.3 Extended Detention

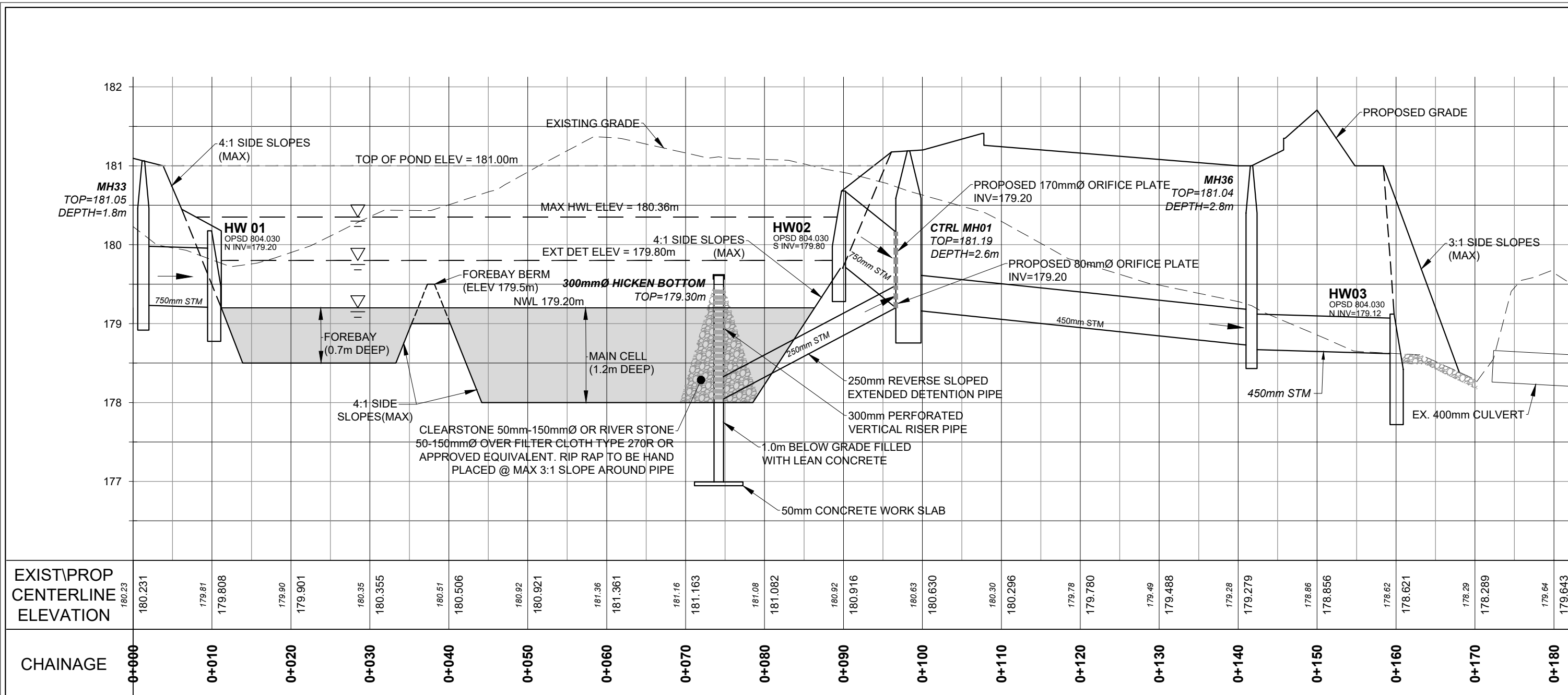
The proposed pond has been designed to include erosion control in the form of extended detention. The required extended detention volume has been calculated based on the 25 mm storm event. Extended detention requirements are summarized in the table below.

**Table 6: Extended Detention Volume Summary**

Volume Required (m <sup>3</sup> )	Volume Provided (m <sup>3</sup> )
486	713


The extended detention volume will pond to a depth of 0.60 m above the NWL. Drawdown of the extended detention volume will occur over a 31-hour period via an 80 mm diameter orifice plate (flow control device) that has been installed on the upstream side of the proposed control manhole. The preliminary schematic of the proposed outlet structure layout is shown in Figure 7.

Extended detention for the Phase 2 condition will be a best-efforts approach to achieve 24-hour drawdown. Further details will be provided at the detailed design stage.



EXIST/PROP CENTERLINE ELEVATION	180.23	180.231	179.81	179.808	179.90	179.901	180.35	180.355	180.51	180.506	180.92	180.921	181.36	181.361	181.16	181.163	181.08	181.082	180.92	180.916	180.63	180.630	180.30	180.296	179.78	179.780	179.49	179.488	179.28	179.279	178.86	178.856	178.62	178.621	178.29	178.289	179.64	179.643
CHAINAGE	0+000	0+010	0+020	0+030	0+040	0+050	0+060	0+070	0+080	0+090	0+100	0+110	0+120	0+130	0+140	0+150	0+160	0+170	0+180																			

**XSECT A-A**  
SCALE H 1:500  
V 1:50

			
<b>Client</b> <b>St. MARK AND St. DEMIANA COPTIC          ORTHODOX CHURCH</b>			
<b>Figure Title</b> <b>NINTH LINE MISSISSAUGA</b> <b>STORMWATER MANAGEMENT POND SECTION</b>			
Drawn	Checked	Date	<b>7</b>
TR	SR	24/04/03	
Scale	Project No.		
AS NOTED	300044049		

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April 2024

#### 4.3.2.4 Quantity Control

Quantity control of the post development flows will be accomplished in the proposed SWM facility. The proposed SWM facility is a wet pond with a drainage area of 3.45 ha and an average imperviousness of 58.9%. Post development catchment areas are shown in Figure 5. The calculations for the post development parameters are included in Appendix B.

The Visual OTTHYMO hydrologic model was used to determine the post development flows and storage volumes required to meet the target flow rates. A 4-hour Chicago storm distribution using the City of Mississauga rainfall data was used to analyze the 2, 5, 10, 25, 50, and 100-year design storm events. Table 3 presents the catchment characteristics of each drainage area used in the Visual OTTHYMO hydrologic model.

The target release rates from the site will be the 2-year pre development flow to the Ninth Line ditch, therefore the overall allowable flow from the site was determined to be 191 L/s.

Catchment 201 will be routed through the SWM pond while Catchment UNC1 will drain uncontrolled to the Ninth Line ditch. To meet the target flow rates, the combination of hydrographs from the SWM pond and the uncontrolled area results in the following stage-storage discharge characteristics in the SWM pond (refer to Table 4). The detailed Visual OTTHYMO model output is provided in Appendix B.

**Table 7: SWM Facility Stage-Storage-Discharge**

Design Storm	Outlet Flow (m <sup>3</sup> /s)	Storage Volume Provided (m <sup>3</sup> )	Water Level Elevation (m)
25 mm	0.010	713	179.80
100-Year	0.140	2,218	180.36

The SWM pond has a storage volume of 2,218 m<sup>3</sup> at an elevation of 180.70 m. This is the maximum high-water level for the pond before spilling through the emergency spill weir, which does not include the 0.3 m of freeboard provided between 180.70 m and 181.00 m. The pond provides a greater volume than required. The above noted stage-storage-discharge curve will be achieved through the proposed outlet control structure. The control structure includes the 80 mm extended detention outlet orifice plate and a 170 mm orifice plate to control flows up to the 100-year storm event. Preliminary outlet control calculations are provided in Appendix B. The preliminary schematic of the proposed outlet structure layout is shown in Figure 7.

Under emergency conditions, the pond will overflow into the roadside ditch along Ninth Line. The overflow will be controlled via a 10 m wide emergency spill weir, built into the side of the pond (at elevation 180.70), which will be designed as a part of detailed design.

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April 2024

As shown in Table 3, Catchment UNC1 flows uncontrolled from the site. This uncontrolled flow has been accounted for when designing a stormwater management plan to ensure the allowable release rates were achieved. The flow from Catchment UNC1 is unable to be captured by the on-site storm sewer system due to restrictions associated with grading requirements to make the driveway in this area feasible. The flow from Catchment UNC1 will discharge directly to the Ninth Line ROW and into the roadside ditch. The following table outlines the post development flows to the Ninth Line outlet, considering the discharge from both Catchments 201 and UNC1.

**Table 8: Post Development to Ninth Line**

Design Storm	Uncontrolled Flow – Catchment UNC1 (L/s) <sup>1</sup>	Release Rate from Pond – Catchment 201 (L/s) <sup>1</sup>	Total Release Rate (L/s) <sup>1</sup>	Allowable Release Rate (L/s) <sup>2</sup>
2-year	50	11	56	-
5-year	70	53	77	-
10-year	90	66	97	-
25-year	105	70	112	-
50-year	118	75	126	-
100-year	132	79	140	149

Note: <sup>1</sup> Flow from the Visual OTTMYO model output. Refer to Appendix B for further details.

<sup>2</sup> 2-Year pre development flow to the Ninth Line Ditch (Catchment 101). Refer to Table 2.

Under Phase 2 conditions, quantity control will be provided via subsurface storage chambers. The design of the chamber system will be addressed at the detailed design stage.

#### 4.3.2.5 Runoff Volume Reduction

Drainage from Catchment 201 will be captured in the on-site storm sewer system. Sewers have been sized to accommodate the 10-year design storm, as specified in the City's criteria. Stormwater discharged in the sewers will ultimately be conveyed to the SWM pond. However, to achieve the City's criteria of retaining the 5 mm event on-site, an infiltration system will be placed upstream of the SWM pond. Stormwater will be pretreated with an offline Imbrium Jellyfish Unit prior to surface runoff being conveyed to the infiltration system. This system will capture and infiltrate the 5 mm rain event. Detailed sizing and drawings from the infiltration system supplier will be provided as part of the detailed design.

Based on the proposed developable site area of 3.55 ha, with an average imperviousness of 59.0%, a storage volume of 105.3 m<sup>3</sup> is required to retain the 5 mm storm event on-site. Detailed calculations are provided in Appendix B.

During storms larger than the 5 mm event, stormwater will overflow from the infiltration system to the downstream sewers which then outlet into the forebay of the proposed

Functional Servicing and Stormwater Management Report - 3415 Ninth Line, Mississauga, ON  
April 2024

SWM pond. During storms greater than the 10-year event, stormwater will be conveyed overland across the site and will discharge into the main cell of the SWM pond.

#### **4.3.2.6 Quality Control**

Quality control for the proposed development will be provided using a combination of Jellyfish Filter unit and the permanent pool in the wet pond, which has been sized to provide enhanced water quality protection as per the March 2003 MECP Stormwater Management Planning and Design Manual.

The uncontrolled flows (catchment UNC1) will drain offsite without quality treatment.

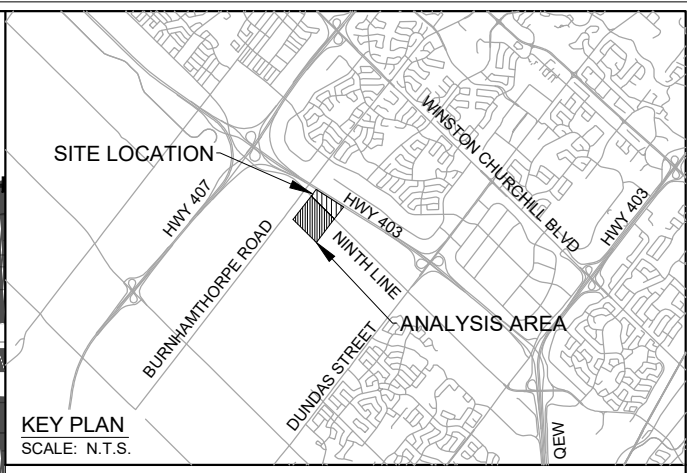
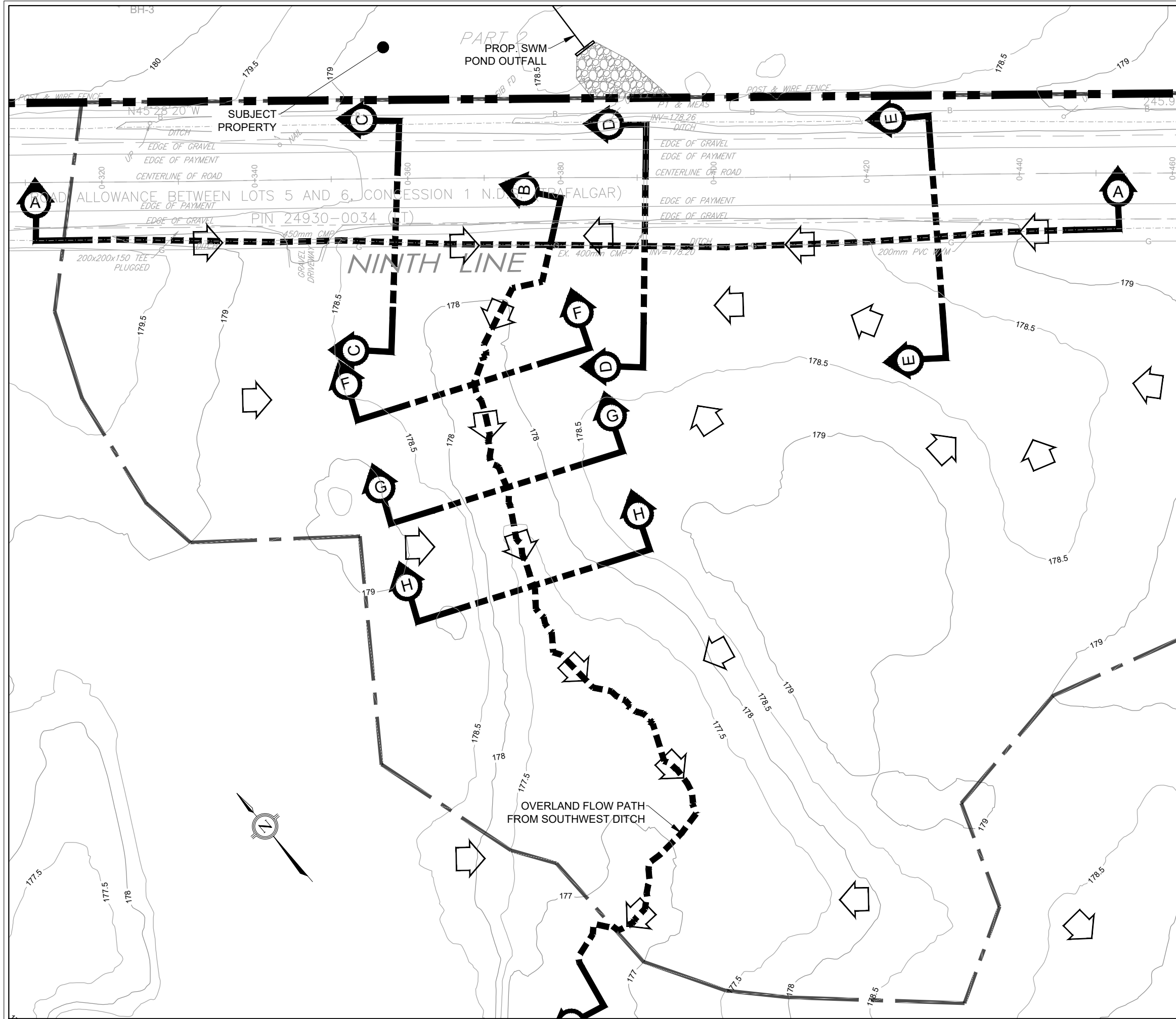
The stormwater quality treatment measures have been provided to achieve an overall minimum 80% TSS removal efficiency for the proposed development. Refer to Appendix B for water quality calculations.

### **4.4 Ninth Line Ditch Analysis**

Under post development conditions, all flows will outlet to a low point along the existing roadside ditch on Ninth Line, where it is conveyed to a downstream tributary via a 400 mm diameter CSP culvert.

The downstream flow path and contributing drainage area were delineated using LIDAR data. The drainage pattern was analysed to ensure that it would remain unchanged under post development conditions. Using three different cross sections, the downstream channel was determined to have sufficient capacity to safely convey the 100-year 4-hour Chicago peak flow of 372 L/s, which includes the proposed outflow from the development site of 140 L/s. Refer to Figures 8 and 9 for the southwest ditch drainage plan and profiles. Conveyance analysis and channel design calculations are included in Appendix B.





### LEGEND

- PROPERTY BOUNDARY
- EXTERNAL DRAINAGE AREA
- EXISTING DITCH CENTERLINE
- EXISTING GRADE (LIDAR)
- EXISTING OVERLAND FLOW PATH

0    5.0    10.0    20.0    30.0    40.0  
Metres

**Client**

**St. MARK AND St. DEMIANA COPTIC  
ORTHODOX CHURCH**

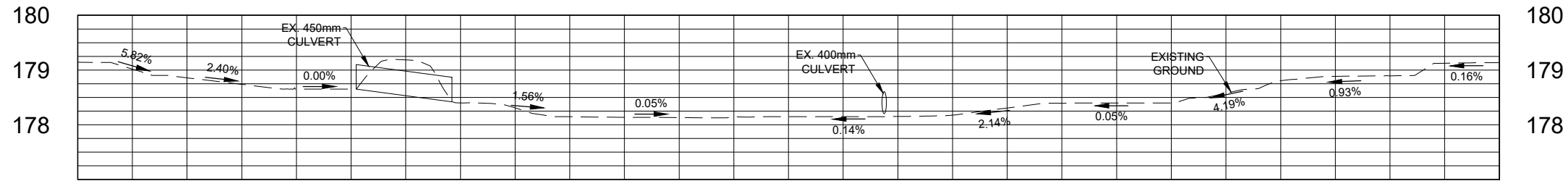
**Figure Title**

**NINTH LINE MISSISSAUGA**

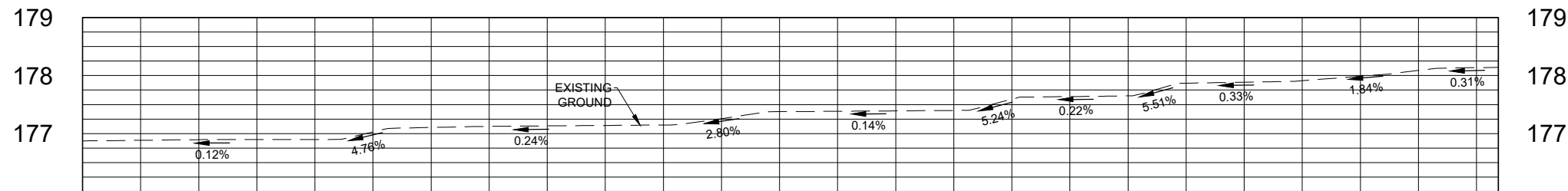
**EXISTING SOUTHWEST DITCH DRAINAGE PLAN**

Drawn DV	Checked SR	Date 24/04/03	Figure No. <b>8</b>
Scale 1:500		Project No. 300044049	

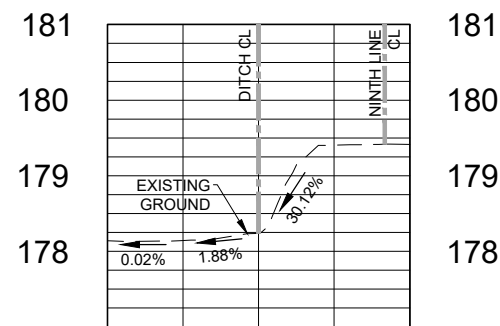
### SECTION A



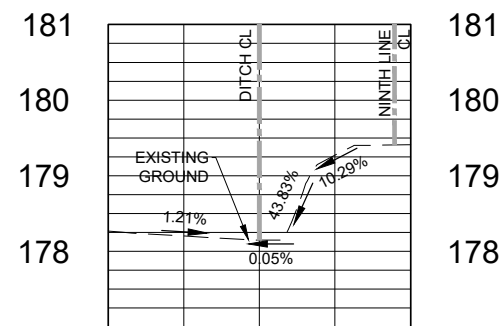
### SECTION B



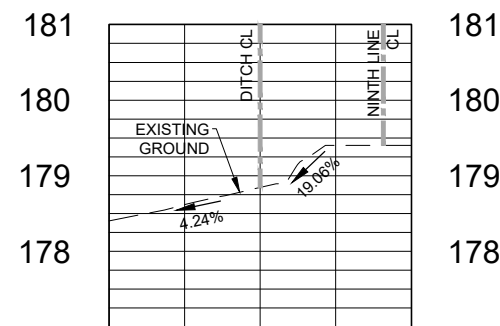
### SECTION C



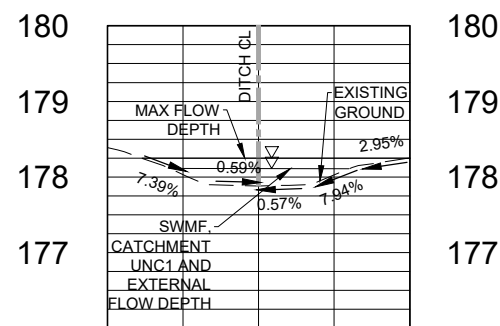
### SECTION D



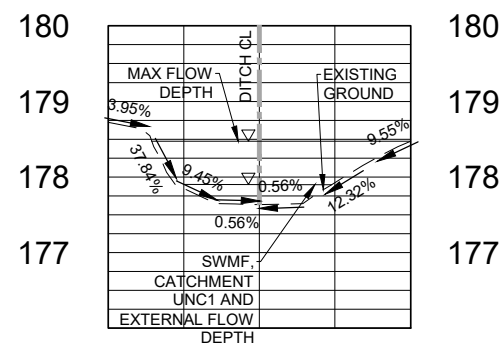
### SECTION E



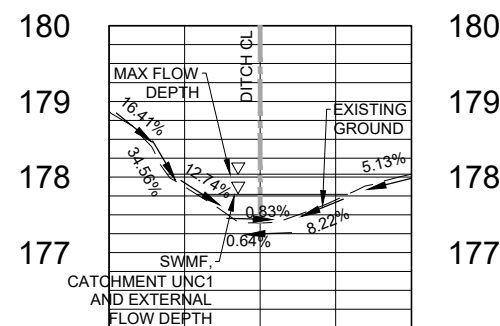
### SECTION F



### SECTION G



### SECTION H



Client  
**St. MARK AND St. DEMIANA COPTIC  
ORTHODOX CHURCH**

Figure Title  
**NINTH LINE MISSISSAUGA**  
EXISTING SOUTHWEST DITCH SECTIONS

Drawn DV	Checked SR	Date 24/04/03	Figure No. <b>9</b>
Scale H 1:500 V 1:100	Project No. 300044049		

## 5.0 Wastewater Servicing

### 5.1 Design Criteria

The onsite sewage system design is based on both the requirements of Part 8 of the Ontario Building Code (OBC) and Ministry of the Environment, Conservation and Parks (MECP) Design Guidelines.

### 5.2 Wastewater Quantity

Daily design sanitary flows for the sewage system have been estimated using building floor plans provided to us, in conjunction with Table 8.2.1.3.B. of the OBC. The proposed development will consist of a church with a sanctuary accommodating up to 800 people, along with associated facilities and uses including administrative offices, a kitchen / cafeteria, and Sunday school classrooms. The lower level contains additional classrooms and office spaces to support church functions, as well as a gym and other activity spaces. The following table summarizes the total daily sanitary sewage flows for this facility.

**Table 9: Maximum Daily Sanitary Sewage Flow**

	OBC Reference	Unit	OBC Flow/Unit	Number of Units	Total Daily Flow (L/day)
<b>Sunday</b>					
Sanctuary	Churches with kitchen facilities	per seat	36	800	28,800
Cafeteria	Food service operation, cafeteria	per meal	12	300	3,600
Sunday School	Churches no kitchen facilities	per seat	8	200	1,600
<b>Total Daily Sewage Flow</b>					<b>34,000 L/day</b>
<b>Rounded Daily Sewage Design Flow</b>					<b>36,000 L/day</b>

The onsite sewage system has been sized to accommodate the estimated maximum daily flow of 36,000 L/day. Based on information provided to us, it is assumed that maximum uses of multiple facilities concurrently would be limited, and that this maximum flow rate is a conservative daily flow estimate, adequate to accommodate the maximum day of use at the facility in the future. We understand that some components of the building may be constructed in phases. During detailed design of the sewage system, options for phasing the construction of the sewage system can be reviewed and considered, as can other design optimization techniques such as flow balancing. For the purposes of this report, the intent is to demonstrate that the proposed building in its entirety can be serviced with the onsite system.

### 5.3 Impact Assessment

The proposed sewage system must meet MECP requirements in terms of the level of treatment provided. A Hydrogeological Assessment (prepared under separate cover by Burnside) has evaluated the site and the potential impact on both groundwater and surface resources from the proposed sewage system. In order to meet MECP requirements, we estimate that the sewage system will need to be capable of providing removal of nitrogen to an effluent concentration of approximately 5.4 mg/L or less.

Conventional septic systems do not provide nitrogen removal; therefore, an advanced wastewater treatment system with additional denitrification equipment will be required to provide sufficient nitrogen removal. Typically, this would include a two-stage process to remove nitrogen from the wastewater. The ammonia will be converted into nitrate in the aerobic treatment process, and then subsequently converted from nitrate to nitrogen gas in an anoxic reactor (i.e., lacking in dissolved oxygen) with a carbon source. The effluent from the anoxic reactor will then be polished and sent to the leaching bed for dispersal into the soil.

The proposed effluent objectives in treated wastewater for the proposed sewage treatment system are as follows:

**Table 10: Proposed Effluent Objectives**

Parameter	Units	Effluent Objective
Total Biochemical Oxygen Demand – 5 days (cBOD5)	mg/L	<10
Total Suspended Solids	mg/L	<10
Total Inorganic Nitrogen	mg/L	<5.4

### 5.4 Proposed Sewage Treatment System

Based on the results of the Hydrogeological Assessment it is our recommendation that the sewage system incorporate a treatment technology capable of Level IV effluent quality as defined by the Ontario Building Code (OBC), as well as supplementary equipment for denitrification to suitable levels. There are several packaged onsite wastewater treatment technologies that are capable of providing high quality treatment as required. The proposed sewage treatment system will in general consist of a septic or pre-settling tanks, a treatment unit for the treatment of organic matter and nitrification / denitrification and a subsurface leaching bed for disposal of treated effluent. Pumping elements will also be incorporated as required, depending on the location and configuration of the treatment tanks. The onsite sewage system will require regular ongoing maintenance and monitoring to ensure a properly functioning system. Specific requirements will be developed in consultation with the Ministry of the Environment, Conservation and Parks during the approval process.

As noted above the existing soil conditions consist of a sandy clayey silt till, which are not conducive to an in-ground leaching bed. Therefore, a fill based (i.e., raised) leaching

Functional Servicing and Stormwater Management Report - 3415 Ninth Line, Mississauga, ON  
April 2024

bed will be required. A design T-time greater than 50 min/cm is assigned to the underlying soils.

The use of an advanced treatment system meeting Level IV effluent quality will allow the use of a reduced size leaching bed as compared to a conventional septic system. The recommended leaching bed is a Type A Dispersal bed, which consists of a 200 mm stone layer protected by geotextile and underlain by a sand layer. The overall size of the bed is dictated by the hydraulic properties of the underlying soil, and the ability to infiltrate the treated effluent into the ground under the bed.

For preliminary sizing purposes, we have used the maximum day flow of 36,000 L/day in order to provide a conservative estimate of the footprint required.

The minimum stone area is calculated according to the following relationship for daily flows (Q) exceeding 3,000 L/day:

$$A_{\text{stone}} = Q/50$$

Therefore, for the design flow of 36,000 L/day, the minimum stone area required is 720 m<sup>2</sup>.

The T-time of the underlying soils is greater than 50 min/cm. The minimum sand area for underlying soil with a T-time that is greater than 15 min/cm is calculated according to the following formula:

$$A_{\text{sand}} = QT/400$$

Where:

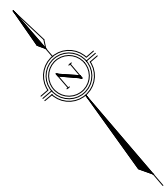
Q = daily design flow (L/day)

T = percolation rate (T-time) of underlying native soil

For the design flow of 36,000 L/day and a T-time of 50 min/cm, the minimum sand area required is 4,500 m<sup>2</sup>. This area represents the minimum total area required for the Type A Dispersal Bed based on the underlying soil properties and regulatory requirements. Figure 10 shows the preliminary layout of the sewage system.

As shown, the site has adequate space to accommodate a sewage treatment system for the proposed changes to the property and to meet all OBC setback distances. The leaching bed should be backfilled with porous material and topsoil to promote grass growth on the finished surface and must be protected from future vehicular traffic and parking. No construction vehicles may be permitted on the leaching bed after it has been constructed, therefore, development of the property will have to be carefully staged to protect this area.

Details of the type of treatment system, leaching bed design, and proposed phasing will be advanced during detailed design.



THE KING'S HIGHWAY No. 403  
 (DESIGNATED CONTROLLED ACCESS HIGHWAY BY ORDER IN COUNCIL OC-222/79, INST. R0521929)  
 PART 1, EXPROPRIATION PLAN No. 496899  
 PIN 13413-0010(LT)

STONE AREA  
 240m<sup>2</sup> EACH

LEACHING BED  
 AREA: 4634 m<sup>2</sup>

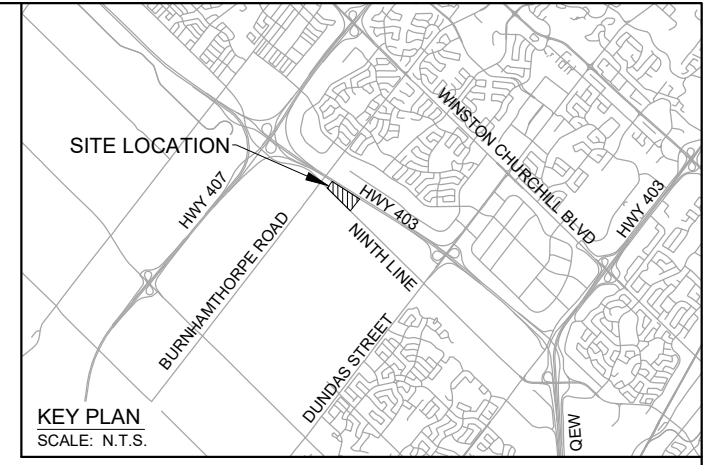
SAN. INV.  
 @ BLDG = 180.65

60.1m - 150mm SAN @ 2.00%

PROPOSED PLACE OF WORSHIP

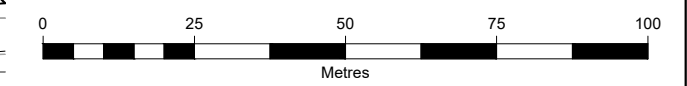
PROPOSED SWM POND

13.43M ROAD WIDENING



**LEGEND**

- PROPERTY BOUNDARY
- PROPERTY SETBACK
- MTO SETBACK
- PHASE 1 - BORDER LINE
- PROPOSED LANE MARKINGS
- PROPOSED SANITARY SEWER
- PROPOSED LEACHING BED
- PROPOSED STONE AREA



Client  
**St. MARK AND St. DEMIANA COPTIC  
 ORTHODOX CHURCH**

Figure Title  
**NINTH LINE MISSISSAUGA  
 PROPOSED SANITARY PLAN**

Drawn TR	Checked SR	Date 24/04/03	Figure No. <b>10</b>
Scale 1:1250	Project No. 300044049		

LANDS WITHIN REGION OF HALTON

LOT 9  
 PART 2  
 PIN 13413-0111(LT)

STORAGE FACILITY

SUBJECT TO EASEMENT  
 INST. Nos. PR3122861 AND PR3122862

PART 4, PLAN 43R-37503

PART 3, PLAN 43R-37503

PART 8, PLAN 43R-37503

PART 1, PLAN 43R-36277  
 PIN 13413-0109(LT)

REMNANT PORTION  
 OF PART 4  
 PLAN 43R-36625

TRANSFERRED TO THE REGIONAL MUNICIPALITY OF HALTON  
 (NO FORMAL BY-LAW ON TITLE DEPICTING AS PUBLIC HIGHWAY)

## **6.0 Water Supply and Distribution**

### **6.1 Design Criteria**

The following Region of Peel criteria have been applied in establishing the sizing of the watermain required to support the proposed institutional development:

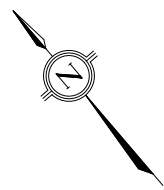
- Average Day Per Capita Flow – 300 L per capita per day.
- Maximum Day Factor – peaking factor of 1.4.
- Peak Hour Factor – peaking factor of 3.0.
- Fire Flow per Fire Underwriters Survey (FUS) requirements - minimum non-fire pressure: 39.9 psi and minimum fire pressure: 20.3 psi.

### **6.2 Proposed Layout and Sizing**

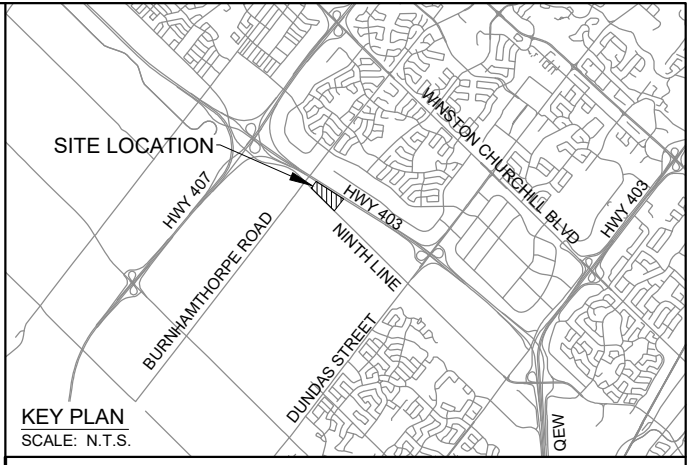
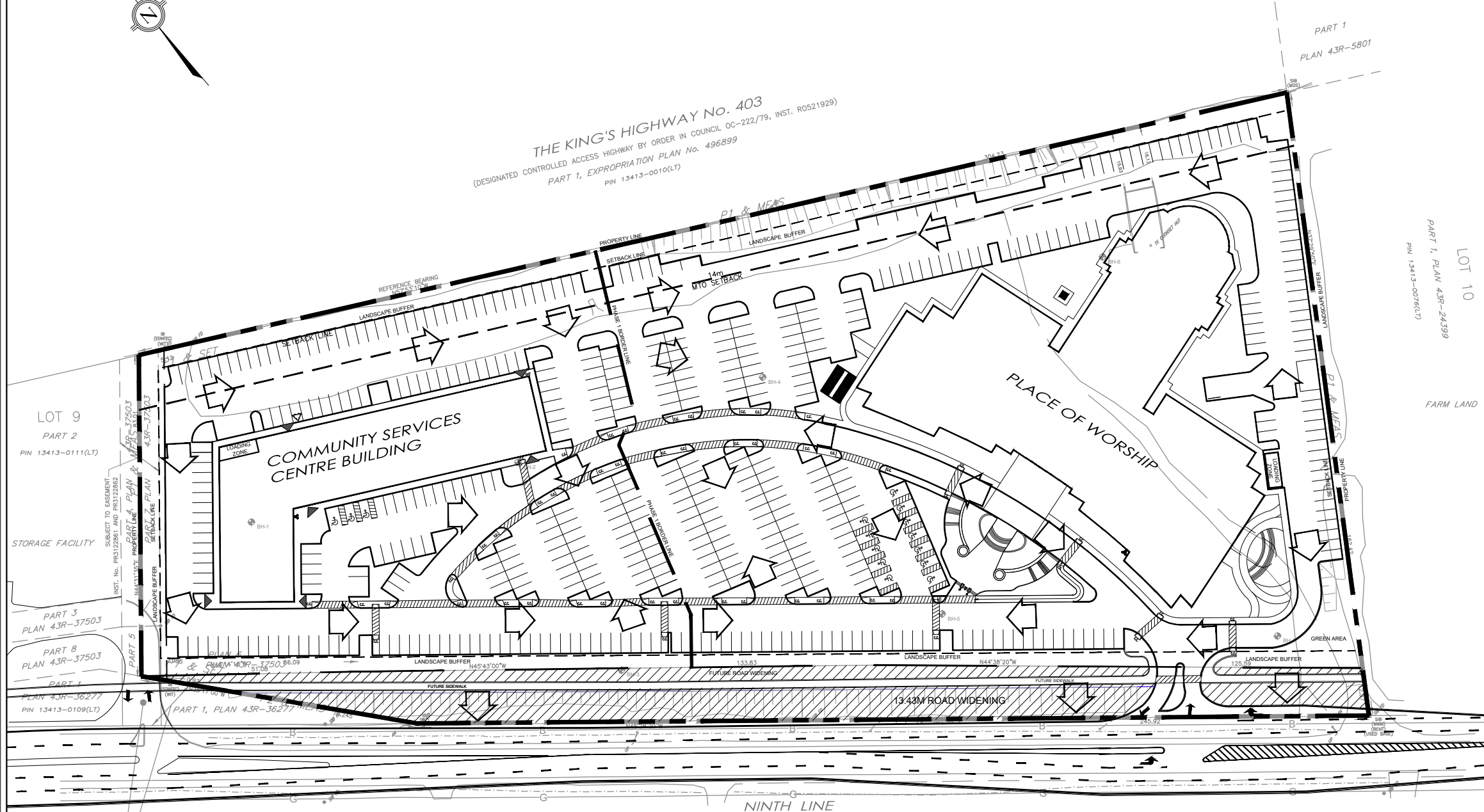
An existing 200 mm watermain is located on the west side of Ninth Line. In early 2019, the City of Mississauga and the Region of Peel modeled two development scenarios for the subject lands. Phase 1 of modeling was for the church and Phase 2 of modeling was for future uses. The modeling exercise determined that the existing 200 mm watermain on Ninth Line does not have sufficient capacity to service the Phase 1 maximum daily demand and fire flow. The Region of Peel design criteria states that a development of this size requires a connection to a minimum municipal watermain size of 300 mm. Therefore, the existing 200 mm watermain on Ninth Line will require an upgrade to a 300 mm watermain prior to servicing any phase of the proposed development. The results of the water modeling and assumed water demand calculations can be found in Appendix C. A proposed water service layout can be seen on Drawings S1 and S2.

## **7.0 Phase Two / Overall Grading Intent**

At the request of the City of Mississauga – Transportation and Works Department, Development Engineering Review, a figure detailing the proposed grading intent of the Phase II development has been prepared. This figure displays the general overland flow direction, noting that the majority of flow will be contained within the Site, and similar to Phase I, will not increase direct runoff to the Highway 403, or Ninth Line right-of-ways. As noted in Section 4.0 above, detailed grading and stormwater management analysis will be included in the Site Plan Application Process. Figure 11 details the proposed grading intent of the Phase II development.



THE KING'S HIGHWAY No. 403  
 (DESIGNATED CONTROLLED ACCESS HIGHWAY BY ORDER IN COUNCIL OC-222/79, INST. R0521929)  
 PART 1, EXPROPRIATION PLAN No. 496899  
 PIN 13413-0010(LT)



**LEGEND**

- PROPERTY BOUNDARY
- PROPERTY SETBACK
- MTO SETBACK
- PROPOSED LANE MARKINGS
- PHASE 1 - BORDER LINE
- EXISTING WATERMAIN
- EXISTING DITCH
- EXISTING BELL
- ROAD WIDENING LANDS TO BE DEDICATED TO THE CITY
- EXISTING BOREHOLE
- PROPOSED ADA PARKING
- PROPOSED 3:1 MAX GRADING
- PROPOSED CONCRETE CURB
- PROPOSED BIKE RACK
- PROPOSED TRANSFORMER
- PROPOSED GARBAGE STORAGE
- PROPOSED OVERLAND FLOW DIRECTION

0 25 50 75 100  
Metres



Client  
**St. MARK AND St. DEMIANA COPTIC  
 ORTHODOX CHURCH**

Figure Title  
**NINTH LINE MISSISSAUGA**  
 GRADING INTENT - OVERALL

Drawn TR	Checked SR	Date 24/04/03	Figure No. <b>11</b>
Scale 1:500	Project No. 300044049		

REMNANT PORTION OF PART 4 PLAN 43R-36625  
 TRANSFERRED TO THE REGIONAL MUNICIPALITY OF HALTON  
 (NO FORMAL BY-LAW ON TITLE DEPICTING AS PUBLIC HIGHWAY)

LANDS WITHIN REGION OF HALTON



## 8.0 Erosion and Sediment Control

During the site grading and servicing works, there is potential for sediment laden runoff to be directed toward the adjoining properties and the municipal street. Therefore, prior to any grading activity, the erosion and sediment control strategies in accordance with the City of Mississauga (Erosion and Sediment Control Design Requirements (Section 2.08) and The Greater Golden Horseshoe Area Conservation Authorities (Erosion and Sediments Control Guidelines for Urban Construction) will be applied as follows:

- All activities on the site shall be conducted in a logical sequence to minimize the area of bare soil exposed at any one time.
- All disturbed ground left inactive shall be stabilized by seeding, sodding, mulching, or covering, or other equivalent control measure. The period of time of inactivity shall not exceed 30 days, unless otherwise authorized by the Commissioner of Transportation and Works.
- Temporary sediment basins shall be constructed for sites having a disturbed drainage area of greater than 2 ha or having an average slope greater than 12%.
- Sediment control fences shall be placed along all downslope sides of a site along the edges of a drainage channel passing through the site, and along the perimeter of all other areas sensitive to sediment accumulation. The sediment control fence shall be constructed in accordance with City Standard Drawing No. 2940.010
- Catch basin sediment traps shall be provided for unpaved areas draining 2 ha or greater and less than 4 ha and shall be constructed in accordance with City Standard Drawing No. 2930.010.
- A minimum 3 m wide undisturbed buffer strip shall be maintained along the limits of the development adjacent to existing road boulevards. Where a sediment control fence is required, it shall be constructed in front of the buffer strip.
- All topsoil stockpiles containing more than 100 m<sup>3</sup> of material shall be located a minimum of 10 m away from a roadway, drainage channel or an occupied residential lot. The maximum side slopes for topsoil stockpiles shall be 1.5 horizontal to 1.0 vertical.
- In order to reduce the tracking of mud onto a paved street, a pad of crushed stone shall be constructed at the site entrance and exit leading onto any existing road. The stone pad shall be a minimum of 300 mm thick, 15 m long and 10 m wide. The first 10 m from the entrance/exit shall be constructed with 50 mm clear stone. The remaining 5 m shall be constructed with 150 mm rip-rap. This stone pad must be maintained as required given the site conditions to ensure mud tracking is kept to a minimum. The Stone Pad Construction Entrance shall be constructed in accordance with City Standard Drawing No. 2970.010
- Rock check dams are to be installed in ditches and swales in accordance with City Standard Drawing No. 2980.010.

Erosion and Sediment control details are provided on Drawing ESC1.

## **9.0 Summary Conclusion**

The preceding report provides investigation of existing servicing capacities and a review of the proposed servicing for the proposed development at Ninth Line in Mississauga. The proposed servicing and grading address the requirements of the City of Mississauga. An external upgrade is required to the existing watermain on Ninth Line, no other upgrades to the existing external municipal infrastructure will be required.

This report addresses the servicing related requirements associated with the Zoning By-law Amendment and Site Plan Approval applications for the subject property. We therefore propose that the preceding Functional Servicing and Stormwater Management Report be accepted for review and approval by the City of Mississauga in order to facilitate the Planning Approvals for the subject property.



# BURNSIDE

[ THE DIFFERENCE IS OUR PEOPLE ]



**Drawings**

**WATERMANS:**

- 1. WATERMAIN SHALL BE POLY(VINYL CHLORIDE) (PVC) CLASS 235 DR-18 PIPE MANUFACTURED TO AWWA C900-89 AND CSA CANS 1317-3 M1986 WITH GASKETED BELL END C/W #14 AWG SOLID COPPER TRACER WIRE.
2. WATERMANS SHALL HAVE A MINIMUM VERTICAL CLEARANCE OF 300mm OVER AND 500mm UNDER SEWERS AND ALL OTHER UTILITIES WHEN CROSSING. ALL WATERMANS AND SERVICES SHALL HAVE 1.80m MINIMUM COVER.
3. BEDDING FOR WATERMANS SHALL BE AS PER OPSD 802.030.
4. ALL WATERMAIN HORIZONTAL AND VERTICAL BENDS, JOINTS AND PUGS TO BE MECHANICALLY RESTRAINED. THRUST BLOCKS/MECHANICAL RESTRAINTS MUST BE INSTALLED ON ALL WATERMAIN BENDS, TEES, AND PUGS AS PER LOCAL MUNICIPAL STANDARDS.
5. ALL WATERMAIN STUBS SHALL BE TERMINATED WITH A PUG AND 50mm BLOW OFF UNLESS OTHERWISE NOTED.
6. HYDRANT AND VALVE TO BE AS PER OPSD 1105.010.
7. ALL HYDRANT FLANGE ELEVATIONS TO BE INSTALLED 0.15m ABOVE PROPOSED FINISHED GRADE AT HYDRANT.
8. BUILDING SERVICE VALVES TO BE 3.0m OFF THE FACE OF THE BUILDING UNLESS OTHERWISE NOTED AND MUST BE RESTRAINED A MINIMUM OF 12m BACK FROM STUB.
9. PROVISIONS FOR FLUSHING WATERMANS MUST BE PROVIDED WITH A MINIMUM 50mm OUTLET FOR MAINS 100mm AND LARGER. FLUSHING POINTS MATCHING THE SIZE OF THE PIPE MUST BE PROVIDED AT THE END OF EACH COPPER MAIN. FIRE MAIN FLUSHING OUTLETS TO BE 100mm DIAMETER MINIMUM OR A HYDRANT. FLUSHING POINTS MUST BE HOSED OR PIPED TO ALLOW THE WATER TO DRAIN.
10. ALL WATERMANS SHALL BE HYDROSTATICALLY TESTED IN ACCORDANCE WITH REGION OF PEEL STANDARDS AND SPECIFICATIONS UNLESS OTHERWISE DIRECTED. PROVISIONS FOR FLUSHING WATER LINE PRIOR TO TESTING, ETC. MUST BE PROVIDED.
11. ALL PROPOSED WATER PIPING MUST BE ISOLATED FROM EXISTING MAINS IN ORDER TO ALLOW INDEPENDENT PRESSURE TESTING AND CHLORINATION AS PER REGION OF PEEL STANDARDS AND SPECIFICATIONS.
12. ALL MATERIALS AND CONSTRUCTION METHODS MUST CORRESPOND TO THE CURRENT PEEL PUBLIC WORKS STANDARDS AND SPECIFICATIONS.
13. WATERMAIN AND /OR WATER SERVICE MATERIALS 100mm (4") AND LARGER MUST BE PVC SDR-18 CLASS 235. SIZE 50mm (2") AND SMALLER MUST BE COPPER TYPE 'K'.
14. ALL CURB STOPS TO BE 3.0m (10') OFF THE FACE OF THE BUILDING UNLESS OTHERWISE NOTED.
15. HYDRANT AND VALVE SET TO REGION STANDARD 1-6-1 DIMENSION A AND B, 0.7m (2') AND 0.9m (3') AND TO HAVE RUBBER NOZZLE.
16. WATERMANS TO BE INSTALLED TO GRADES AS SHOWN ON APPROVED SITE PLAN. COPY OF GRADE SHEET MUST BE SUPPLIED TO INSPECTOR PRIOR TO COMMENCEMENT OF WORK, WHERE REQUESTED BY INSPECTOR.
17. ALL LIVE TAPPING AND OPERATION OF REGION WATER VALVES SHALL BE ARRANGED THROUGH THE REGIONAL INSPECTOR ASSIGNED OR BY CONTACTING THE OPERATIONS AND MAINTENANCE DIVISION.
18. THE CONTRACTOR(S) SHALL BE SOLELY RESPONSIBLE FOR LOCATES, EXPOSING, SUPPORTING AND PROTECTING OF ALL UNDERGROUND AND OVERHEAD UTILITIES AND STRUCTURES EXISTING AT THE TIME OF CONSTRUCTION IN THE AREA OF HIS WORK, WHETHER SHOWN ON THE PLANS OR NOT, AND FOR ALL REPAIRS AND CONSEQUENCES RESULTING FROM DAMAGE TO SAME.
19. THE CONTRACTOR(S) SHALL BE SOLELY RESPONSIBLE TO GIVE 72 HOURS WRITTEN NOTICE TO UTILITIES PRIOR TO CROSSING SUCH UTILITIES. FOR THE PURPOSE OF INSPECTION BY THE CONCERNED UTILITY. THIS INSPECTION WILL BE FOR THE DURATION OF THE CONSTRUCTION, WITH THE CONTRACTOR RESPONSIBLE FOR ALL COSTS ARISING FROM SUCH INSPECTION.
20. ALL PROPOSED WATER PIPING MUST BE ISOLATED THROUGH A TEMPORARY CONNECTION THAT SHALL INCLUDE AN APPROPRIATE CROSS-CONNECTION CONTROL DEVICE, CONSISTENT WITH THE DEGREE OF HAZARD, FOR BACKFLOW PREVENTION OF THE ACTIVE DISTRIBUTION SYSTEM, CONFORMING TO REGION OF PEEL STANDARD 1-7-1 OR 1-7-8.

**STORM AND SANITARY SEWER:**

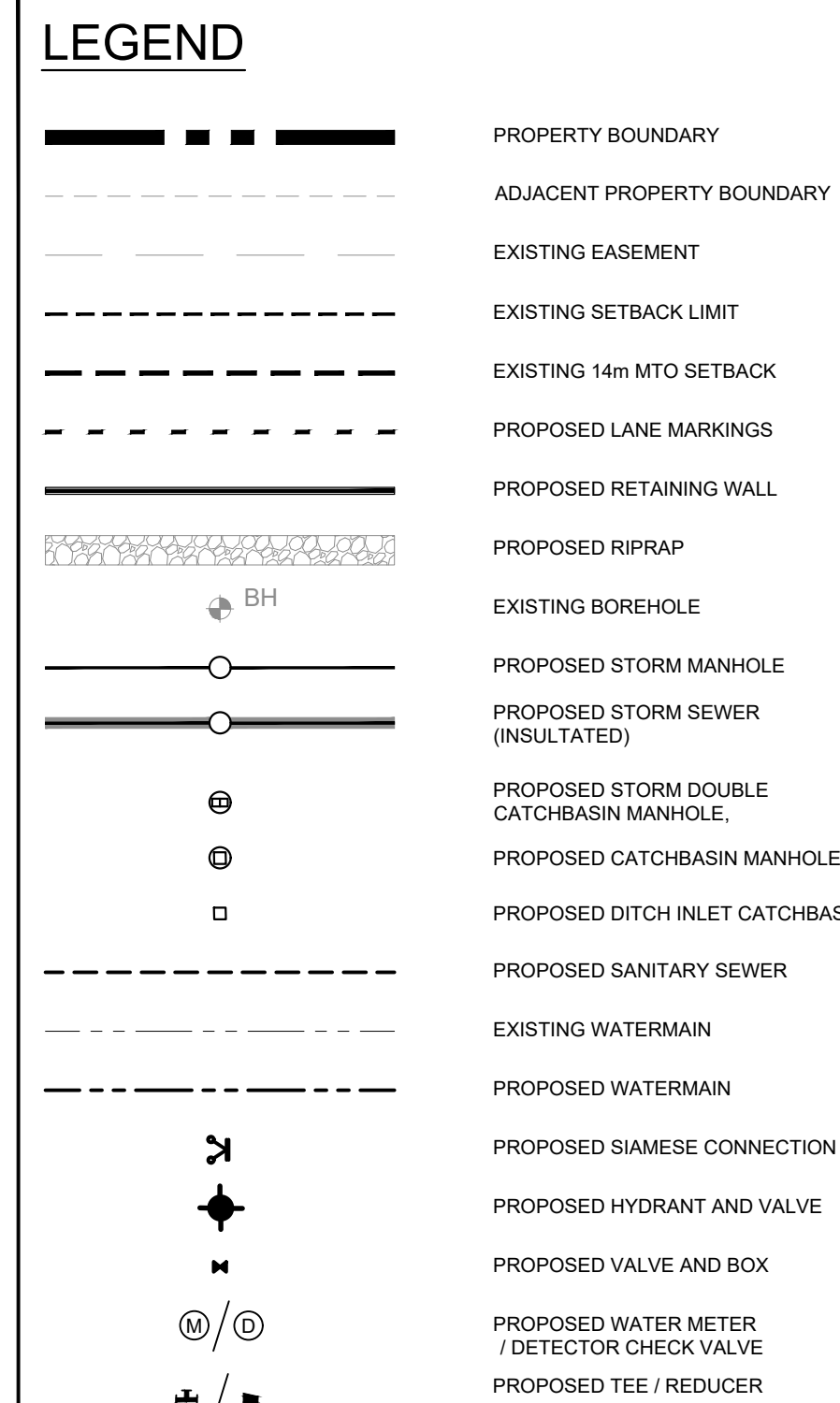
- 1. MANHOLES SHALL BE AS PER OPSD 701.010 AND OPSD 701.011. FRAMES AND COVERS SHALL BE AS PER OPSD 401.010. SAFETY PLATFORMS TO BE INSTALLED AS PER REGION OF PEEL STANDARDS 2-2-12 WHERE DEPTH EXCEEDS 5.0m.
2. SINGLE CATCH BASINS SHALL BE AS PER OPSD 705.010, WITH FRAMES AND COVERS AS PER OPSD 400.020. DOUBLE CATCH BASINS SHALL BE AS PER OPSD 705.020.
3. CONCRETE PIPE SEWER BEDDING SHALL BE AS PER OPSD 802.030. PVC PIPE SEWER BEDDING SHALL BE CLASS 'B' AS PER OPSD 802.030 TO TOP OF SEWER. NATIVE BACKFILL TO BE COMPACTED TO A MIN. 98% STANDARD PROCTOR DENSITY WITH A MINIMUM 300mm SAND COVER OVER PIPE.
4. ALL STORM SEWER PIPES UP TO 450mm DIA. SHALL BE PVC SDR-35 OR APPROVED EQUIVALENT. ALL STORM SEWER PIPES 500mm DIA. AND LARGER SHALL BE CONCRETE AND EQUAL TO C.S.A. SPECIFICATIONS ASST 2 REINFORCED CLASSES AS SPECIFIED (65-D, 100-D, 140-D) OR LATEST AMENDMENT UNLESS OTHERWISE SPECIFIED.
5. ALL SANITARY PVC SEWER PIPES SHALL BE SDR-35 EQUAL CSA SPECIFICATIONS B182.2.19M OR LATEST AMENDMENT UNLESS OTHERWISE NOTED.
6. ALL MANHOLE AND CATCH BASIN EXCAVATIONS TO BE BACKFILLED WITH GRANULAR MATERIAL COMPACTED TO 98% STANDARD PROCTOR DENSITY.
7. ALL BLIND CONNECTIONS TO MATCH THE INVERT OF THE CATCH BASIN LEAD TO THE SPRINGLINE OF THE STORM PIPE. OTHERWISE INSTALL THE CATCH BASIN LEAD AT A MAXIMUM 0.20% AND RCP TO PIPE.
8. UNLESS NOTED OTHERWISE, CATCH BASIN LEADS SHALL BE 250mm@ AT MINIMUM 1.00% SLOPE.
9. THE CONTRACTOR IS TO PROVIDE CCTV CAMERA INSPECTIONS OF ALL SANITARY AND STORM SEWERS, INCLUDING PICTORIAL REPORT AND TWO (2) CD COPIES IN A FORMAT SATISFACTORY TO THE ENGINEER. ALL SEWERS ARE TO BE FLUSHED PRIOR TO CAMERA INSPECTION.

**GENERAL NOTES:**

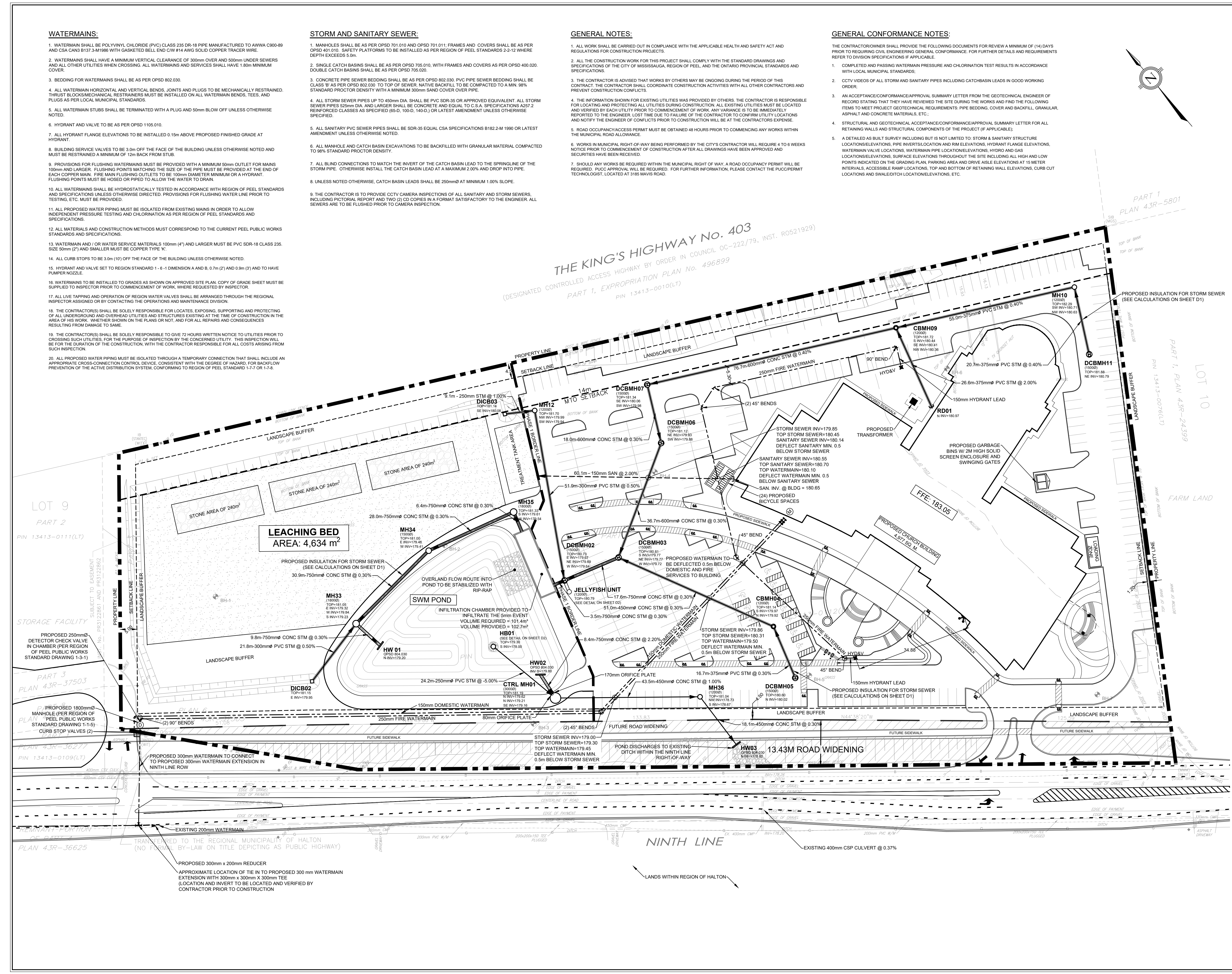
- 1. ALL WORK SHALL BE CARRIED OUT IN COMPLIANCE WITH THE APPLICABLE HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS.
2. ALL THE CONSTRUCTION WORK FOR THIS PROJECT SHALL COMPLY WITH THE STANDARD DRAWINGS AND SPECIFICATIONS OF THE CITY OF MISSISSAUGA, REGION OF PEEL, AND THE ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS.
3. THE CONTRACTOR IS ADVISED THAT WORKS BY OTHERS MAY BE ONGOING DURING THE PERIOD OF THIS CONTRACT. THE CONTRACTOR SHALL COORDINATE CONSTRUCTION ACTIVITIES WITH ALL OTHER CONTRACTORS AND PREVENT CONSTRUCTION CONFLICTS.
4. THE INFORMATION SHOWN FOR EXISTING UTILITIES WAS PROVIDED BY OTHERS. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL UTILITIES DURING CONSTRUCTION. ALL EXISTING UTILITIES MUST BE LOCATED AND VERIFIED BY EACH UTILITY PRIOR TO COMMENCEMENT OF WORK. ANY VARIANCE IS TO BE IMMEDIATELY REPORTED TO THE ENGINEER. LOST TIME DUE TO FAILURE OF THE CONTRACTOR TO CONFIRM UTILITY LOCATIONS AND NOTIFY THE ENGINEER OF CONFLICTS PRIOR TO CONSTRUCTION WILL BE AT THE CONTRACTORS EXPENSE.
5. ROAD OCCUPANCY/ACCESS PERMIT MUST BE OBTAINED 48 HOURS PRIOR TO COMMENCING ANY WORKS WITHIN THE MUNICIPAL ROAD ALLOWANCE.
6. WORKS MUNICIPAL RIGHT-OF-WAY BEING PERFORMED BY THE CITY'S CONTRACTOR WILL REQUIRE 4 TO 6 WEEKS NOTICE PRIOR TO COMMENCEMENT OF CONSTRUCTION AFTER ALL DRAWINGS HAVE BEEN APPROVED AND SECURITIES HAVE BEEN RECEIVED.
7. SHOULD ANY WORKS BE REQUIRED WITHIN THE MUNICIPAL RIGHT OF WAY, A ROAD OCCUPANCY PERMIT WILL BE REQUIRED. P.U.C. APPROVAL WILL BE REQUIRED. FOR FURTHER INFORMATION, PLEASE CONTACT THE P.U.C. PERMIT TECHNOLOGIST, LOCATED AT 3185 MAVIS ROAD.

**GENERAL CONFORMANCE NOTES:**

- 1. COMPLETED AND PASSING WATERMAIN PRESSURE AND CHLORINATION TEST RESULTS IN ACCORDANCE WITH LOCAL MUNICIPAL STANDARDS.
2. CCTV VIDEOS OF ALL STORM AND SANITARY PIPES INCLUDING CATCHBASIN LEADS IN GOOD WORKING ORDER.
3. AN ACCEPTANCE/CONFORMANCE/ APPROVAL SUMMARY LETTER FROM THE GEOTECHNICAL ENGINEER OF RECORD STATING THAT THEY HAVE REVIEWED THE SITE DURING THE WORKS AND FIND THE FOLLOWING ITEMS TO MEET PROJECT GEOTECHNICAL REQUIREMENTS: PIPE BEDDING, COVER AND BACKFILL, GRANULAR ASPHALT AND CONCRETE MATERIALS, ETC.
4. STRUCTURAL AND GEOTECHNICAL ACCEPTANCE/CONFORMANCE/ APPROVAL SUMMARY LETTER FOR ALL RETAINING WALLS AND STRUCTURAL COMPONENTS OF THE PROJECT (IF APPLICABLE).
5. A DETAILED AS BUILT SURVEY INCLUDING BUT IS NOT LIMITED TO: STORM & SANITARY STRUCTURE LOCATIONS/ELEVATIONS, PIPE INVERTS/LOCATION AND RIM ELEVATIONS, HYDRANT FLANGE ELEVATIONS, WATERMAIN VALVE LOCATIONS, WATERMAIN PIPE LOCATION/ELEVATIONS, HYDRO AND GAS LOCATION/ELEVATIONS, SURFACE ELEVATIONS THROUGHOUT THE SITE INCLUDING ALL HIGH AND LOW POINTS INDICATED ON THE GRADING PLAN, PARKING AREA AND DRIVE ABLE ELEVATIONS AT 15 METER INTERVALS, ACCESSIBLE RAMP LOCATIONS, TOP AND BOTTOM OF RETAINING WALL ELEVATIONS, CURB CUT LOCATIONS AND SWALE/EDCH LOCATION/ELEVATIONS, ETC.



THE KING'S HIGHWAY No. 403
DESIGNATED CONTROLLED ACCESS HIGHWAY BY ORDER IN COUNCIL OC-222/79, INST. R0521929)
PART 1, EXPROPRIATION PLAN No. 496899
PIN 13413-0010(LT)



BENCHMARK ELEVATIONS ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928: PRE 1978) AND ARE DERIVED FROM CITY OF MISSISSAUGA BENCHMARK MONUMENT No. 1065, HAVING A PUBLISHED ELEVATION OF 178.912 METRES.

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NOT FOR CONSTRUCTION

Table with 4 columns: No., Issue / Revision, Date, Auth.
1. ISSUED FOR SITE PLAN APPROVAL 20/03/20 DN
2. RE-ISSUED FOR SITE PLAN APPROVAL 22/01/11 DN
3. RE-ISSUED FOR SITE PLAN APPROVAL 23/05/10 TR
4. RE-ISSUED FOR ZONING 24/04/03 TR



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fax (905) 821-1809
web www.rjburnside.com

Client: St. MARK AND ST. DEMIANA COPTIC ORTHODOX CHURCH
462 FALGARWOOD DRIVE
OAKVILLE, ON
L6H 1N3

Drawing Title: NINTH LINE MISSISSAUGA

SERVICING PLAN

Table with 4 columns: Drawn, Checked, Designed, Date.
Drawn: TR, Checked: SR, Designed: TR, Date: 23/07/17
Project No: 300044049, Contract No., Revision No: 0
Scale: 1:500, Drawing No: S1

**SITE GRADING:**

1. ALL DISTURBED GRASSED AREAS SHALL BE RESTORED TO ORIGINAL CONDITION OR BETTER. THE RELOCATION OF TREES AND SHRUBS SHALL BE SUBJECT TO APPROVAL BY THE PROJECT LANDSCAPE ARCHITECT OR ENGINEER.
2. ALL SURFACE DRAINAGE WILL BE SELF-CONTAINED, COLLECTED AND DISCHARGED AT A LOCATION TO BE APPROVED PRIOR TO THE ISSUANCE OF A BUILDING PERMIT.
3. ALL GRANULAR BASE AND SUB-BASE MATERIALS SHALL BE GRADED AND COMPACTED TO 98% STANDARD PROCTOR DENSITY, FREE OF DEPRESSIONS.
4. THE PAVEMENT STRUCTURE SHALL BE CONSTRUCTED OF THE MINIMUM THICKNESSES OF MATERIALS AS PER THE GEOTECHNICAL REPORT PREPARED BY CMT, DATED FEBRUARY 20, 2020.

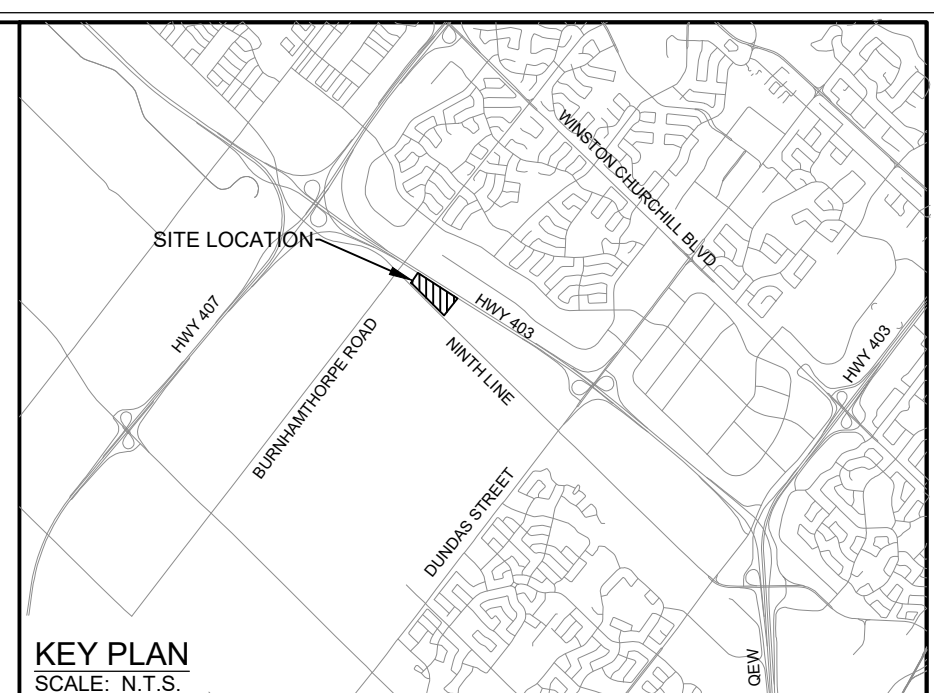
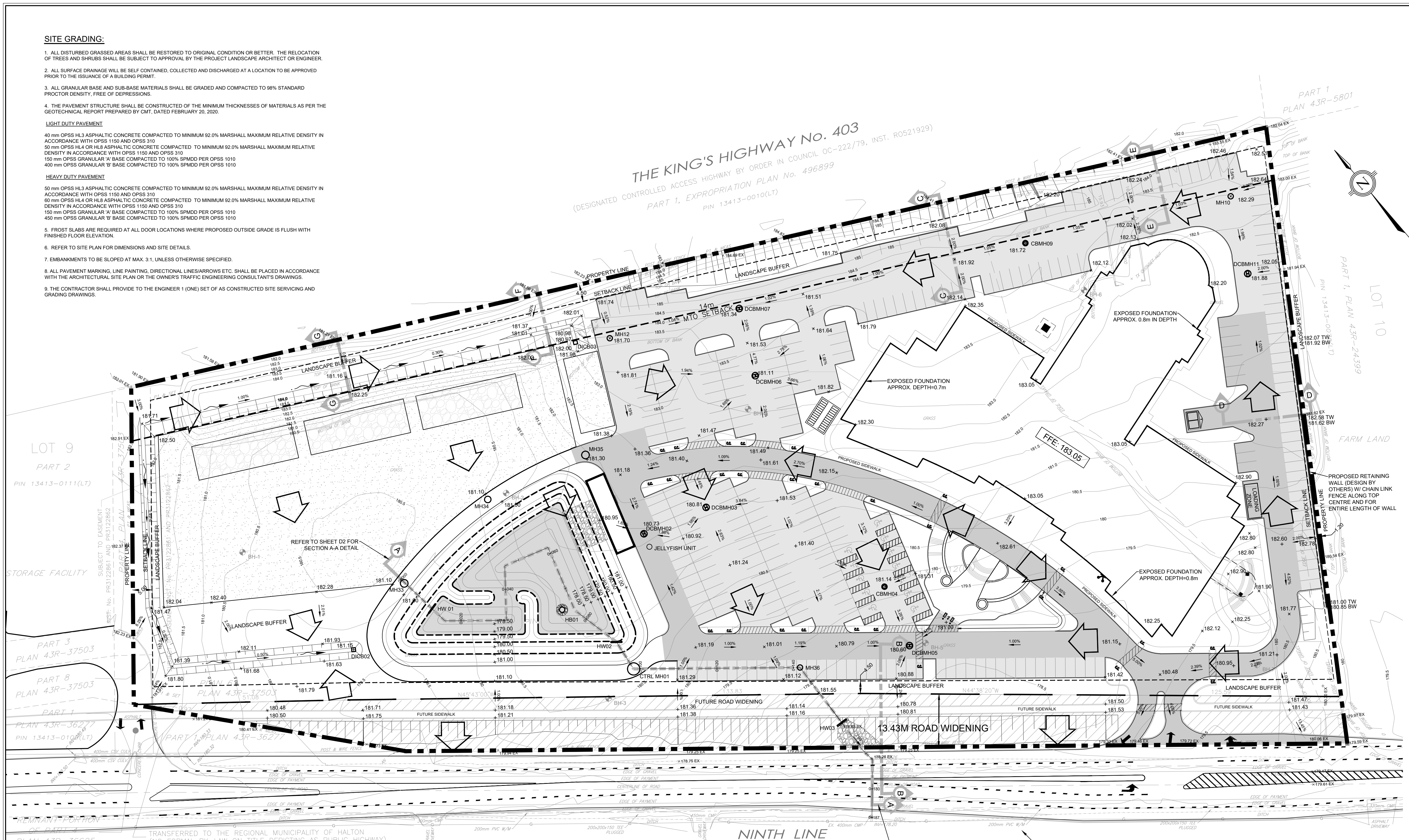
**LIGHT DUTY PAVEMENT**

- 40 mm OPSS HL3 ASPHALTIC CONCRETE COMPACTED TO MINIMUM 92.0% MARSHALL MAXIMUM RELATIVE DENSITY IN ACCORDANCE WITH OPSS 1160 AND OPSS 310
- 50 mm OPSS HL4 OR HL8 ASPHALTIC CONCRETE COMPACTED TO MINIMUM 92.0% MARSHALL MAXIMUM RELATIVE DENSITY IN ACCORDANCE WITH OPSS 1150 AND OPSS 310
- 150 mm OPSS GRANULAR 'A' BASE COMPACTED TO 100% SPMD PER OPSS 1010
- 400 mm OPSS GRANULAR 'B' BASE COMPACTED TO 100% SPMD PER OPSS 1010

**HEAVY DUTY PAVEMENT**

- 50 mm OPSS HL3 ASPHALTIC CONCRETE COMPACTED TO MINIMUM 92.0% MARSHALL MAXIMUM RELATIVE DENSITY IN ACCORDANCE WITH OPSS 1160 AND OPSS 310
- 60 mm OPSS HL4 OR HL8 ASPHALTIC CONCRETE COMPACTED TO MINIMUM 92.0% MARSHALL MAXIMUM RELATIVE DENSITY IN ACCORDANCE WITH OPSS 1150 AND OPSS 310
- 150 mm OPSS GRANULAR 'A' BASE COMPACTED TO 100% SPMD PER OPSS 1010
- 450 mm OPSS GRANULAR 'B' BASE COMPACTED TO 100% SPMD PER OPSS 1010

5. FROST SLABS ARE REQUIRED AT ALL DOOR LOCATIONS WHERE PROPOSED OUTSIDE GRADE IS FLUSH WITH FINISHED FLOOR ELEVATION.
6. REFER TO SITE PLAN FOR DIMENSIONS AND SITE DETAILS.
7. EMBANKMENTS TO BE SLOPED AT MAX. 3:1, UNLESS OTHERWISE SPECIFIED.
8. ALL PAVEMENT MARKING, LINE PAINTING, DIRECTIONAL LINES/ARROWS ETC. SHALL BE PLACED IN ACCORDANCE WITH THE ARCHITECTURAL SITE PLAN OR THE OWNER'S TRAFFIC ENGINEERING CONSULTANT'S DRAWINGS.
9. THE CONTRACTOR SHALL PROVIDE TO THE ENGINEER 1 (ONE) SET OF AS CONSTRUCTED SITE SERVING AND GRADING DRAWINGS.



**LEGEND**

	PROPERTY BOUNDARY
	ADJACENT PROPERTY BOUNDARY
	EXISTING EASEMENT
	EXISTING CONTOUR
	EXISTING SETBACK LIMIT
	EXISTING 14m MTO SETBACK
	PROPOSED LANE MARKINGS
	PROPOSED RETAINING WALL
	PROPOSED HEAVY DUTY ASPHALTIC CONCRETE
	PROPOSED LIGHT DUTY ASPHALTIC CONCRETE
	PROPOSED RIPRAP
	EXISTING BOREHOLE
	PROPOSED GRADE
	PROPOSED STORM MANHOLE
	PROPOSED STORM DOUBLE CATCHBASIN MANHOLE
	PROPOSED CATCHBASIN MANHOLE
	PROPOSED DITCH INLET CATCHBASIN
	PROPOSED SWALE
	PROPOSED GRADING (3:1 MAX.)
	PROPOSED OVERLAND FLOW ARROW

**BENCHMARK**  
ELEVATIONS ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928; PRE 1978) AND ARE DERIVED FROM CITY OF MISSISSAUGA BENCHMARK MONUMENT No. 1065, HAVING A PUBLISHED ELEVATION OF 178.912 METRES.

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No.	Issue / Revision	Date	Auth.
1	ISSUED FOR SITE PLAN APPROVAL	21/04/20	DN
2	RE-ISSUED FOR SITE PLAN APPROVAL	22/01/11	DN
3	RE-ISSUED FOR SITE PLAN APPROVAL	23/05/10	TR
4	RE-ISSUED FOR ZONING	24/03/28	TR



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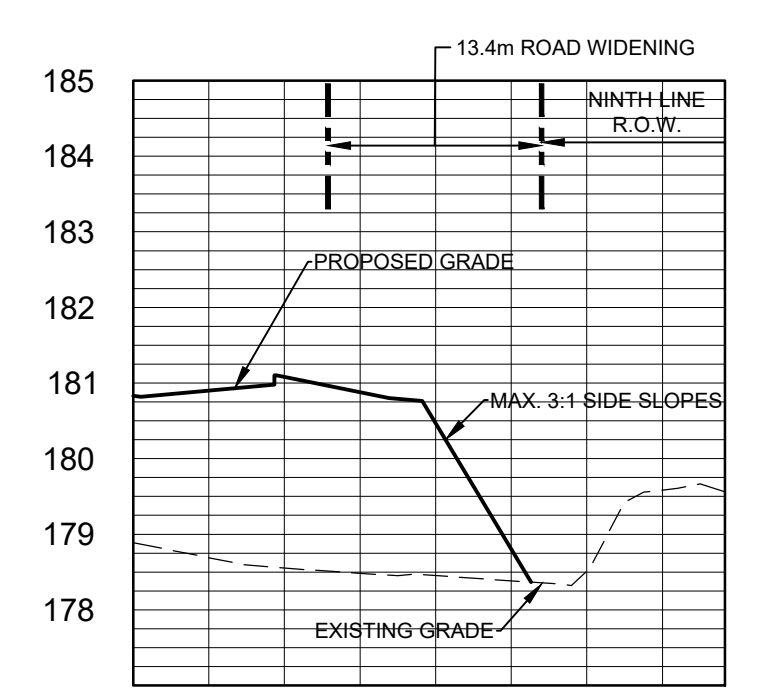
Client:  
**St. Mark and St. Demiana Coptic Orthodox Church**  
462 FALGARWOOD DRIVE  
OAKVILLE, ON  
L6H 1N3

Drawing Title:  
**NINTH LINE MISSISSAUGA**

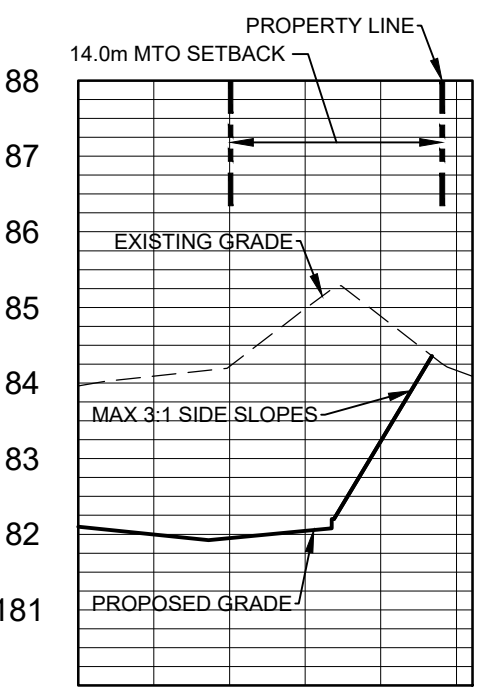
GRADING PLAN

Drawn	Checked	Designed	Checked	Date	Drawing No.
TR	SR	TR	SR	23/05/10	
Project No.	Contract No.	Revision No.	Revision No.	0	
30004049					
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1:500					

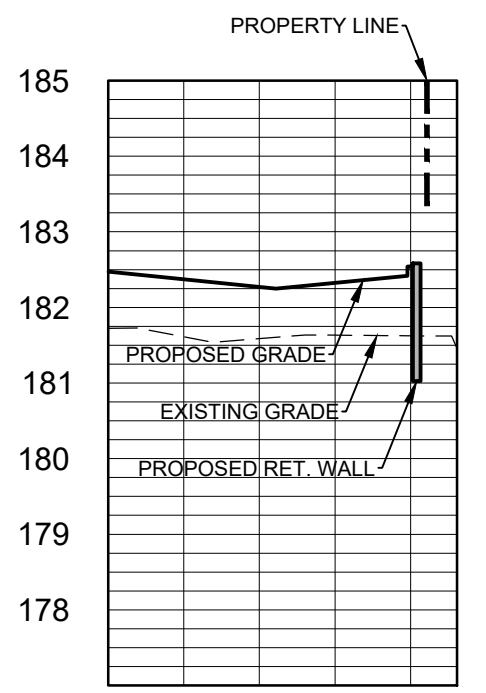
**G1**



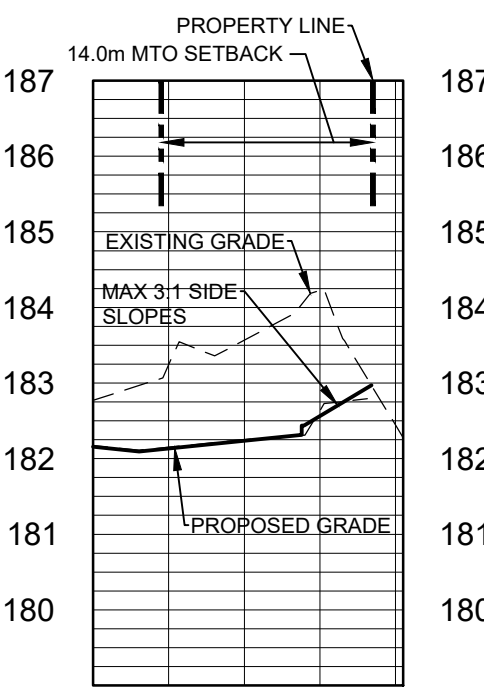
SECTION B-B  
SCALE H1:500 V1:100



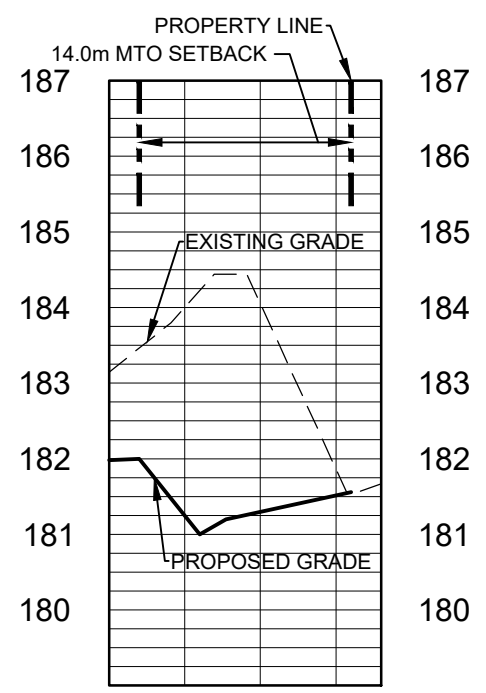
SECTION C-C  
SCALE H1:500 V1:100



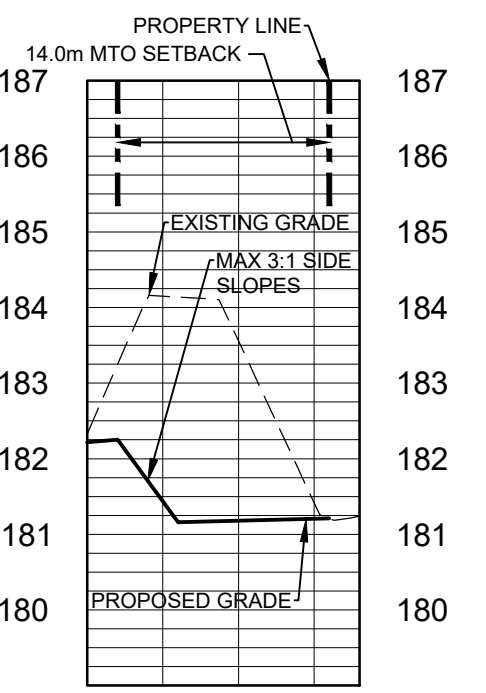
SECTION D-D  
SCALE H1:500 V1:100



SECTION E-E  
SCALE H1:500 V1:100



SECTION F-F  
SCALE H1:500 V1:100



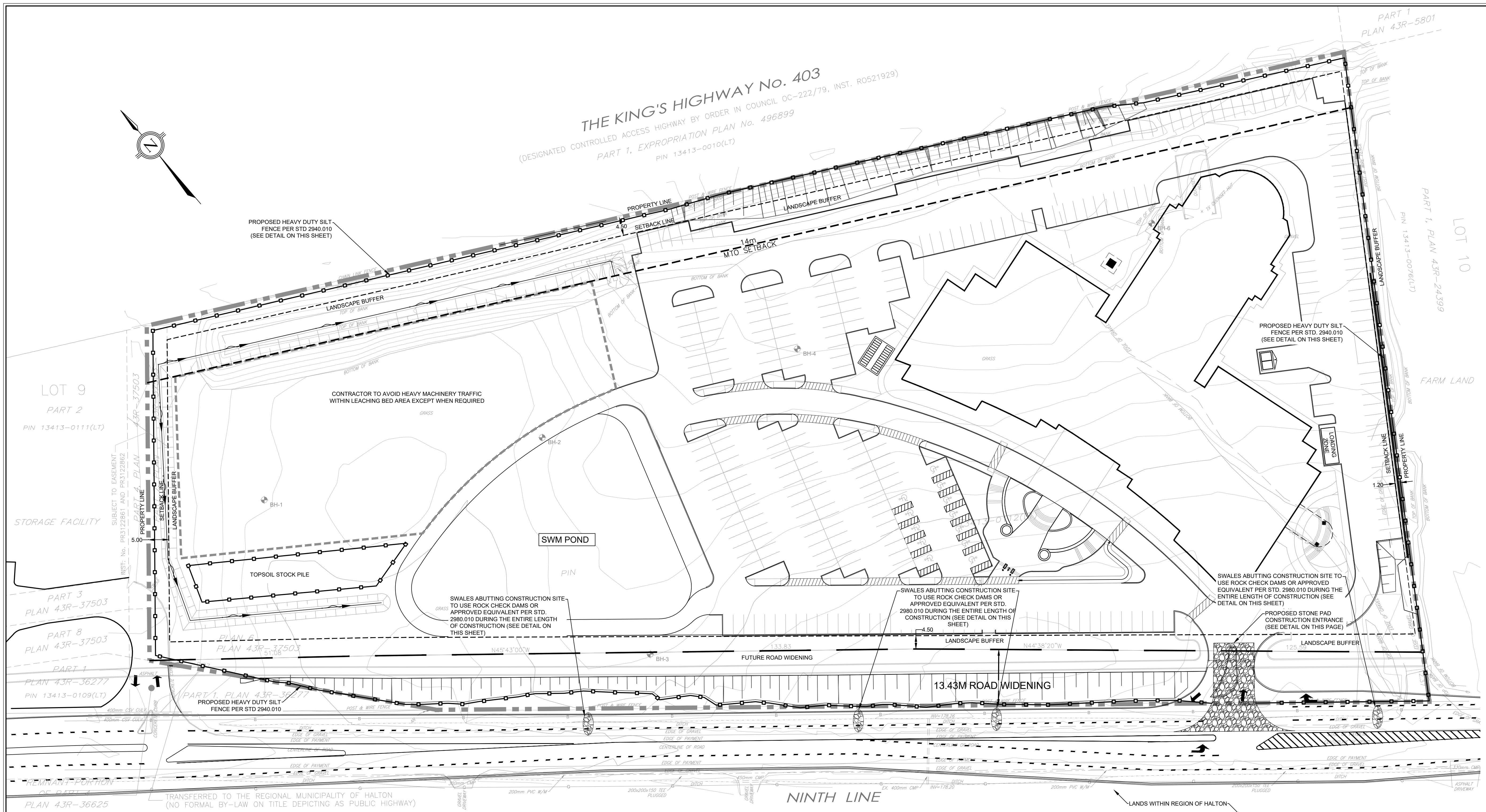
SECTION G-G  
SCALE H1:500 V1:100

**THE KING'S HIGHWAY No. 403**  
 (DESIGNATED CONTROLLED ACCESS HIGHWAY BY ORDER IN COUNCIL OC-222/79, INST. R0521929)  
 PART 1, EXPROPRIATION PLAN No. 496899  
 PIN 13413-0010(LT)

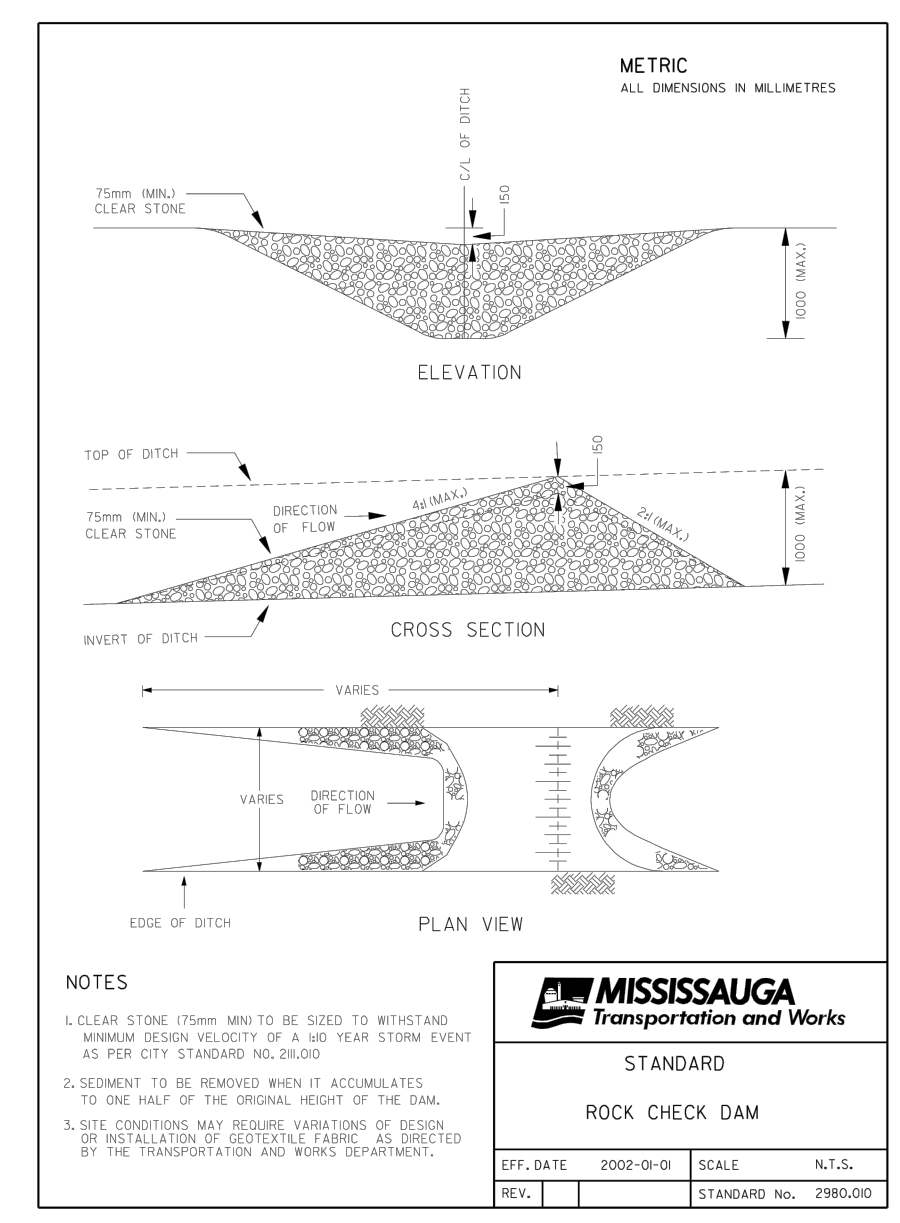
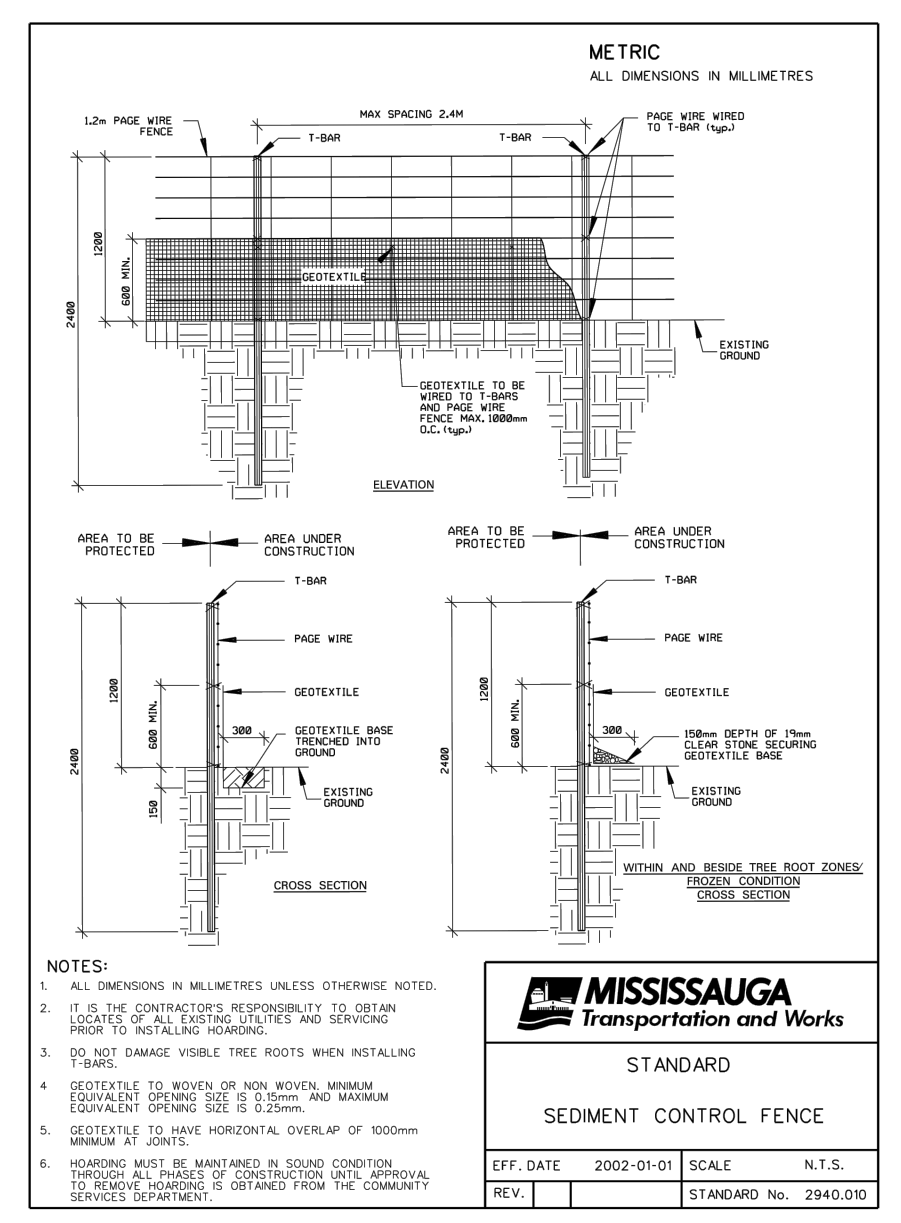
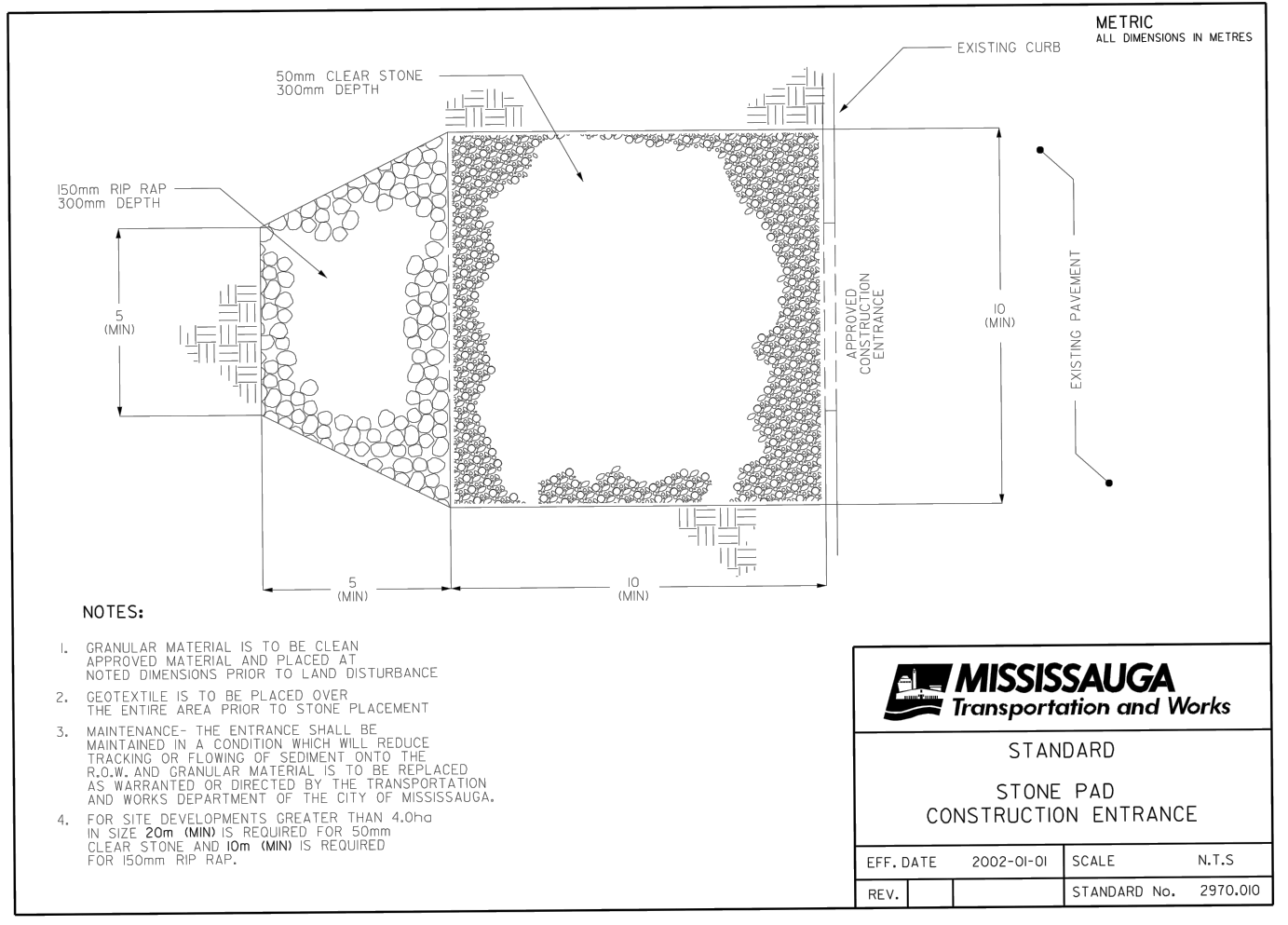
**KEY PLAN**  
 SCALE: N.T.S.

**LEGEND**

	PROPERTY BOUNDARY
	ADJACENT PROPERTY BOUNDARY
	EXISTING EASEMENT
	EXISTING CONTOUR
	EXISTING SETBACK LIMIT
	EXISTING 14m MTO SETBACK
	PROPOSED LANE MARKINGS
	PROPOSED SILT FENCE
	PROPOSED ROCK CHECK DAM
	EXISTING BOREHOLE



- EROSION AND SEDIMENT CONTROL:**
1. ALL EROSION AND SEDIMENT CONTROL MEASURES TO BE INSTALLED PRIOR TO ANY CONSTRUCTION ACTIVITIES.
  2. PRIOR TO CONSTRUCTION TAKING PLACE, ALL REQUIRED HOARDING IN ACCORDANCE WITH THE ONTARIO OCCUPATIONAL HEALTH & SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS MUST BE ERRECTED AND THEN MAINTAINED THROUGHOUT ALL PHASES OF CONSTRUCTION.
  3. THE APPLICANT WILL BE REQUIRED TO CONTACT ALL UTILITY COMPANIES TO OBTAIN ALL REQUIRED LOCATES PRIOR TO THE INSTALLATION OF HOARDING WITHIN THE MUNICIPAL RIGHT OF WAY.
  4. ADDITIONAL SILT FENCING SHOULD BE AVAILABLE IN CASE IMMEDIATE REPAIR IS REQUIRED.
  5. IF NECESSARY, TRUCKS WILL BE WASHED DOWN BEFORE LEAVING THE SITE.
  6. THE SITE WILL BE WET DOWN IF NECESSARY TO CONTROL DUST.
  7. ALL CONSTRUCTION EQUIPMENT MUST BE PARKED ON-SITE.
  8. ALL CONSTRUCTION ACTIVITY WILL COMPLY WITH CITY OF MISSISSAUGA NOISE BY LAW.
  9. ALL CONSTRUCTION VEHICLES TO ENTER AND EXIT SITE FROM TEMPORARY CONSTRUCTION ACCESS.
  10. ALL TOPSOIL STOCKPILES TO BE SURROUNDED WITH SEDIMENT CONTROL FENCING.
  11. FILTER FABRIC TO BE PLACED UNDER GRATES ON ALL CATCHBASINS TO TRAP SEDIMENT. SILT TRAPS ARE TO BE CLEANED REGULARLY AND ARE NOT TO BE REMOVED UNTIL SUCH TIME AS THE CURBS ARE CONSTRUCTED AND THE BOULEVARDS ARE SODDED OR BACKYARDS GRADED AND SODDED. FILTER FABRIC FOR SILT CONTROL TO BE TERRA FIX 270R OR APPROVED EQUIVALENT.
  12. IN CASE OF ANY CONFLICT WITH ANOTHER PLAN, THIS PLAN PREVAILS ONLY IN RESPECT TO CONSTRUCTION MEASURES AND ACTIVITIES SUCH AS THE CONSTRUCTION ACCESS, SILT FENCE, SECURITY FENCING, SEDIMENT CONTROL AND MUD MATS.
  13. STREET SWEEPING, CATCHBASIN CLEANING AND DUST CONTROL ARE THE RESPONSIBILITY OF THE DEVELOPER AND MUST BE KEPT UNDER CONTROL ON ALL ROADWAYS TO THE SATISFACTORY OF THE CITY.
  14. APPROPRIATE SIGNAGE IS TO BE INSTALLED ON THE BOULEVARD TO INDICATE THAT THE SIDEWALK IS NOT ACCESSIBLE.
  15. CONTRACTOR TO STABILIZE THE SITE AS SOON AS POSSIBLE BY REESTABLISHING VEGETATIVE GROUND COVER AND AVOIDING BARE SOIL AREAS. ALL AREAS (INCLUDING STOCKPILES) WHERE SITE IMPROVEMENTS ARE NOT EXPECTED TO OCCUR IMMEDIATELY SHALL BE REVEGETATED WITH 100mm OF TOPSOIL AND HYDROSEED.
  16. ALL DRAINAGE WORKS REQUIRE EROSION / SEDIMENT CONTROL SATISFACTORY TO THE APPROVAL AGENCIES DURING CONSTRUCTION PERIOD AND MUST BE MONITORED AND MAINTAINED ON A REGULAR BASIS TO ENSURE MINIMIZED SILT MIGRATION OFF-SITE.
  17. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE CHECKED AND MAINTAINED ON A REGULAR BASIS AND INSPECTED AFTER EVERY RAINFALL.



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3	RE-ISSUED FOR SITE PLAN APPROVAL	23/05/10	TR
4	RE-ISSUED FOR ZONING	24/04/03	TR



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Client  
**St. Mark and St. Demiana Coptic Orthodox Church**  
 462 Falgarrwood Drive  
 Oakville, ON  
 L6H 1N3

Drawing Title  
**NINTH LINE MISSISSAUGA**

EROSION AND SEDIMENT CONTROL PLAN

Drawn	Checked	Design	Checked	Date	Drawing No.
TR	SR	TR	SR	23/07/17	
Project No. 300044049	Contract No.	Revision No. 0	Contract No.		
Scale 1:500	0	5.0	10.0	20.0	30.0m

**ESC1**

**WATERMANS:**

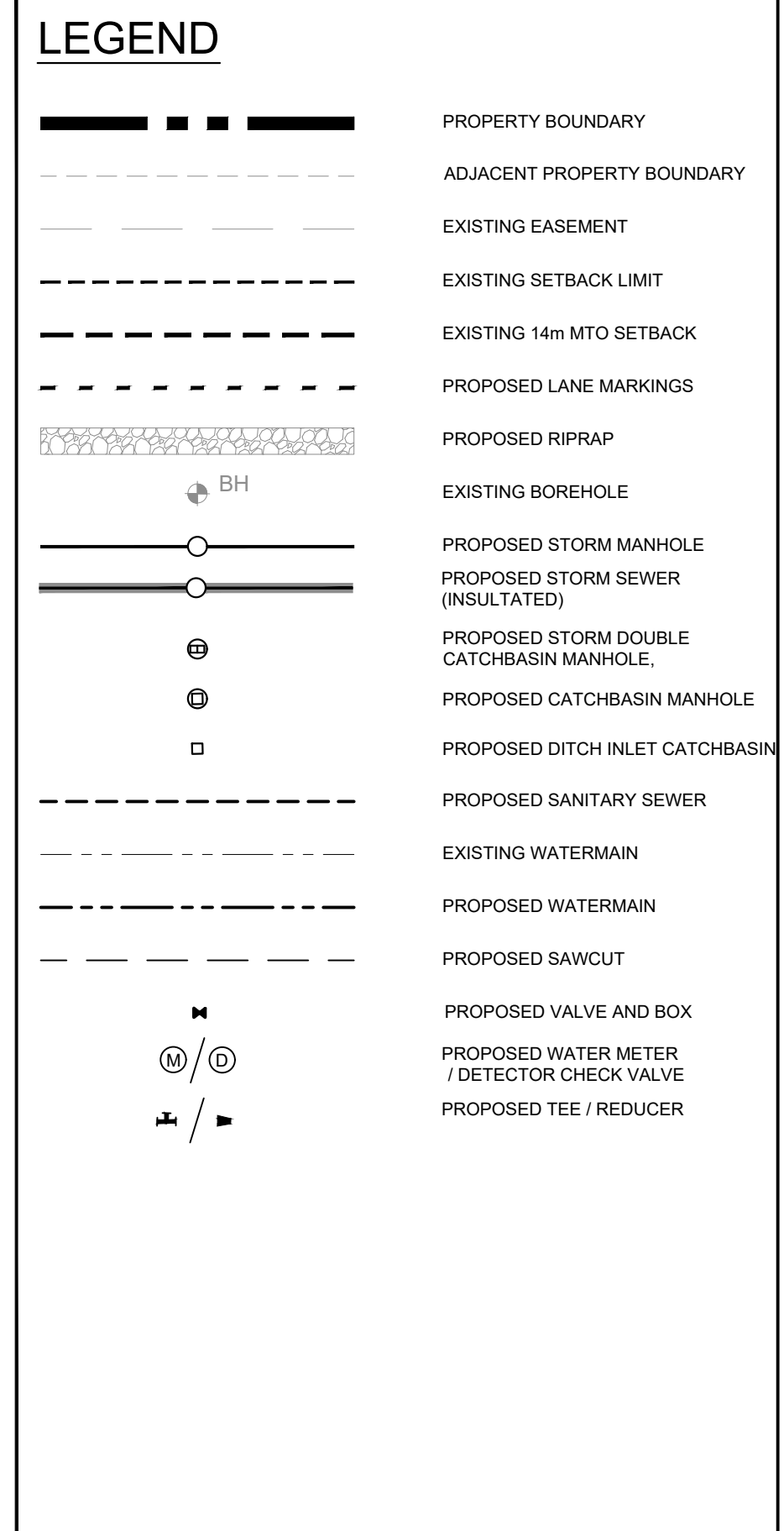
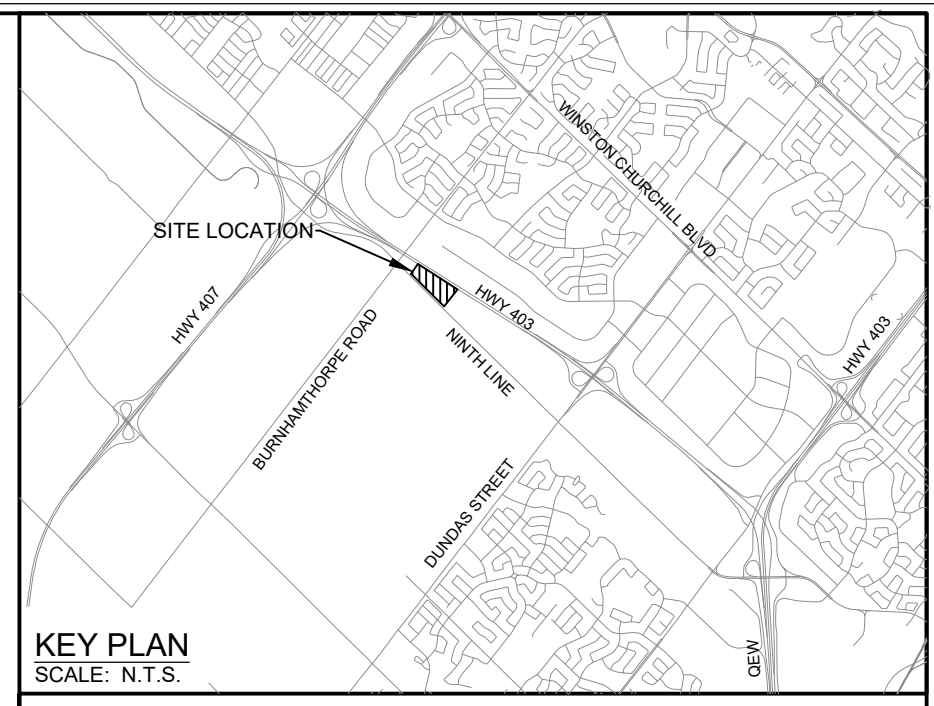
1. WATERMAIN SHALL BE POLY(VINYL CHLORIDE) (PVC) CLASS 235 DR-18 PIPE MANUFACTURED TO AWWA C900-89 AND CSA CANS B137.3-1986 WITH GASKETED BELL END CIV #14 AWG SOLID COPPER TRACER WIRE.
2. WATERMANS SHALL HAVE A MINIMUM VERTICAL CLEARANCE OF 300mm OVER AND 500mm UNDER SEWERS AND ALL OTHER UTILITIES WHEN CROSSING. ALL WATERMANS AND SERVICES SHALL HAVE 1.80m MINIMUM COVER.
3. BEDDING FOR WATERMANS SHALL BE AS PER OPSD 802.030.
4. ALL WATERMAIN HORIZONTAL AND VERTICAL BENDS, JOINTS AND PLOGS TO BE MECHANICALLY RESTRAINED. THRUST BLOCKS/MECHANICAL RESTRAINTERS MUST BE INSTALLED ON ALL WATERMAIN BENDS, TEES, AND PLOGS AS PER LOCAL MUNICIPAL STANDARDS.
5. ALL WATERMAIN STUBS SHALL BE TERMINATED WITH A PLOG AND 50mm BLOW OFF UNLESS OTHERWISE NOTED.
6. HYDRANT AND VALVE TO BE AS PER OPSD 1105.010.
7. ALL HYDRANT FLANGE ELEVATIONS TO BE INSTALLED 0.15m ABOVE PROPOSED FINISHED GRADE AT HYDRANT.
8. BUILDING SERVICE VALVES TO BE 3.0m OFF THE FACE OF THE BUILDING UNLESS OTHERWISE NOTED AND MUST BE RESTRAINED A MINIMUM OF 12m BACK FROM STUB.
9. PROVISIONS FOR FLUSHING WATERMANS MUST BE PROVIDED WITH A MINIMUM 50mm OUTLET FOR MAINS 100mm AND LARGER. FLUSHING POINTS MATCHING THE SIZE OF THE PIPE MUST BE PROVIDED AT THE END OF EACH COPPER MAIN. FIRE MAIN FLUSHING OUTLETS TO BE 100mm DIAMETER MINIMUM OR A HYDRANT. FLUSHING POINTS MUST BE HOSED OR PIPED TO ALLOW THE WATER TO DRAIN.
10. ALL WATERMANS SHALL BE HYDROSTATICALLY TESTED IN ACCORDANCE WITH REGION OF PEEL STANDARDS AND SPECIFICATIONS UNLESS OTHERWISE DIRECTED. PROVISIONS FOR FLUSHING WATER LINE PRIOR TO TESTING, ETC. MUST BE PROVIDED.
11. ALL PROPOSED WATER PIPING MUST BE ISOLATED FROM EXISTING MAINS IN ORDER TO ALLOW INDEPENDENT PRESSURE TESTING AND CHLORINATION AS PER REGION OF PEEL STANDARDS AND SPECIFICATIONS.
12. ALL MATERIALS AND CONSTRUCTION METHODS MUST CORRESPOND TO THE CURRENT PEEL PUBLIC WORKS STANDARDS AND SPECIFICATIONS.
13. WATERMAIN AND / OR WATER SERVICE MATERIALS 100mm (4") AND LARGER MUST BE PVC SDR-18 CLASS 235. SIZE 50mm (2") AND SMALLER MUST BE COPPER TYPE 'K'.
14. ALL CURB STOPS TO BE 3.0m (10') OFF THE FACE OF THE BUILDING UNLESS OTHERWISE NOTED.
15. HYDRANT AND VALVE SET TO REGION STANDARD 1 - 6 - 1 DIMENSION A AND B, 0.7m (2') AND 0.9m (3') AND TO HAVE RUBBER NOZZLE.
16. WATERMANS TO BE INSTALLED TO GRADES AS SHOWN ON APPROVED SITE PLAN. COPY OF GRADE SHEET MUST BE SUPPLIED TO INSPECTOR PRIOR TO COMMENCEMENT OF WORK, WHERE REQUESTED BY INSPECTOR.
17. ALL LIVE TAPPING AND OPERATION OF REGION WATER VALVES SHALL BE ARRANGED THROUGH THE REGIONAL INSPECTOR ASSIGNED OR BY CONTACTING THE OPERATIONS AND MAINTENANCE DIVISION.
18. THE CONTRACTOR(S) SHALL BE SOLELY RESPONSIBLE FOR LOCATES, EXPOSING, SUPPORTING AND PROTECTING OF ALL UNDERGROUND AND OVERHEAD UTILITIES AND STRUCTURES EXISTING AT THE TIME OF CONSTRUCTION IN THE AREA OF HIS WORK. WHETHER SHOWN ON THE PLANS OR NOT, AND FOR ALL REPAIRS AND CONSEQUENCES RESULTING FROM DAMAGE TO SAME.
19. THE CONTRACTOR(S) SHALL BE SOLELY RESPONSIBLE TO GIVE 72 HOURS WRITTEN NOTICE TO UTILITIES PRIOR TO CROSSING SUCH UTILITIES. FOR THE PURPOSE OF INSPECTION BY THE CONCERNED UTILITY. THIS INSPECTION WILL BE FOR THE DURATION OF THE CONSTRUCTION, WITH THE CONTRACTOR RESPONSIBLE FOR ALL COSTS ARISING FROM SUCH INSPECTION.
20. ALL PROPOSED WATER PIPING MUST BE ISOLATED THROUGH A TEMPORARY CONNECTION THAT SHALL INCLUDE AN APPROPRIATE CROSS-CONNECTION CONTROL DEVICE, CONSISTENT WITH THE DEGREE OF HAZARD, FOR BACKFLOW PREVENTION OF THE ACTIVE DISTRIBUTION SYSTEM, CONFORMING TO REGION OF PEEL STANDARD 1-7-7 OR 1-7-8.

**GENERAL NOTES:**

1. ALL WORK SHALL BE CARRIED OUT IN COMPLIANCE WITH THE APPLICABLE HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS.
2. ALL THE CONSTRUCTION WORK FOR THIS PROJECT SHALL COMPLY WITH THE STANDARD DRAWINGS AND SPECIFICATIONS OF THE CITY OF MISSISSAUGA, REGION OF PEEL, AND THE ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS.
3. THE CONTRACTOR IS ADVISED THAT WORKS BY OTHERS MAY BE ONGOING DURING THE PERIOD OF THIS CONTRACT. THE CONTRACTOR SHALL COORDINATE CONSTRUCTION ACTIVITIES WITH ALL OTHER CONTRACTORS AND PREVENT CONSTRUCTION CONFLICTS.
4. THE INFORMATION SHOWN FOR EXISTING UTILITIES WAS PROVIDED BY OTHERS. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL UTILITIES DURING CONSTRUCTION. ALL EXISTING UTILITIES MUST BE LOCATED AND VERIFIED BY EACH UTILITY PRIOR TO COMMENCEMENT OF WORK. ANY VARIANCE IS TO BE IMMEDIATELY REPORTED TO THE ENGINEER. LOST TIME DUE TO FAILURE OF THE CONTRACTOR TO CONFIRM UTILITY LOCATIONS AND NOTIFY THE ENGINEER OF CONFLICTS PRIOR TO CONSTRUCTION WILL BE AT THE CONTRACTORS EXPENSE.
5. ROAD OCCUPANCY/ACCESS PERMIT MUST BE OBTAINED 48 HOURS PRIOR TO COMMENCING ANY WORKS WITHIN THE MUNICIPAL ROAD ALLOWANCE.
6. WORKS IN MUNICIPAL RIGHT-OF-WAY BEING PERFORMED BY THE CITY'S CONTRACTOR WILL REQUIRE 4 TO 6 WEEKS NOTICE PRIOR TO COMMENCEMENT OF CONSTRUCTION AFTER ALL DRAWINGS HAVE BEEN APPROVED AND SECURITIES HAVE BEEN RECEIVED.
7. SHOULD ANY WORKS BE REQUIRED WITHIN THE MUNICIPAL RIGHT OF WAY, A ROAD OCCUPANCY PERMIT WILL BE REQUIRED. P.U.C.C. APPROVAL WILL BE REQUIRED. FOR FURTHER INFORMATION PLEASE CONTACT THE P.U.C.C. PERMIT TECHNOLOGIST, LOCATED AT 3185 MAVIS ROAD.

**GENERAL CONFORMANCE NOTES:**

- THE CONTRACTOR/OWNER SHALL PROVIDE THE FOLLOWING DOCUMENTS FOR REVIEW A MINIMUM OF (14) DAYS PRIOR TO REQUIRING CIVIL ENGINEERING GENERAL CONFORMANCE. FOR FURTHER DETAILS AND REQUIREMENTS REFER TO DIVISION SPECIFICATIONS IF APPLICABLE.
1. COMPLETED AND PASSING WATERMAIN PRESSURE AND CHLORINATION TEST RESULTS IN ACCORDANCE WITH LOCAL MUNICIPAL STANDARDS.
  2. CCTV VIDEOS OF ALL STORM AND SANITARY PIPES INCLUDING CATCHBASIN LEADS IN GOOD WORKING ORDER;
  3. AN ACCEPTANCE/CONFORMANCE/APPROVAL SUMMARY LETTER FROM THE GEOTECHNICAL ENGINEER OF RECORD STATING THAT THEY HAVE REVIEWED THE SITE DURING THE WORKS AND FIND THE FOLLOWING ITEMS TO MEET PROJECT GEOTECHNICAL REQUIREMENTS: PIPE BEDDING, COVER AND BACKFILL, GRANULAR, ASPHALT AND CONCRETE MATERIALS, ETC.;
  4. STRUCTURAL AND GEOTECHNICAL ACCEPTANCE/CONFORMANCE/APPROVAL SUMMARY LETTER FOR ALL RETAINING WALLS AND STRUCTURAL COMPONENTS OF THE PROJECT (IF APPLICABLE);
  5. A DETAILED AS BUILT SURVEY INCLUDING BUT IS NOT LIMITED TO: STORM & SANITARY STRUCTURE LOCATIONS/ELEVATIONS, PIPE INVERTS/LOCATION AND RIM ELEVATIONS, HYDRANT FLANGE ELEVATIONS, WATERMAIN VALVE LOCATIONS, WATERMAIN PIPE LOCATION/ELEVATIONS, HYDRO AND GAS LOCATIONS/ELEVATIONS, SURFACE ELEVATIONS THROUGHOUT THE SITE INCLUDING ALL HIGH AND LOW POINTS INDICATED ON THE GRADING PLAN, PARKING AREA AND DRIVE AISLE ELEVATIONS AT 15 METER INTERVALS, ACCESSIBLE RAMP LOCATIONS, TOP AND BOTTOM OF RETAINING WALL ELEVATIONS, CURB CUT LOCATIONS AND SWALE/DITCH LOCATION/ELEVATIONS, ETC.

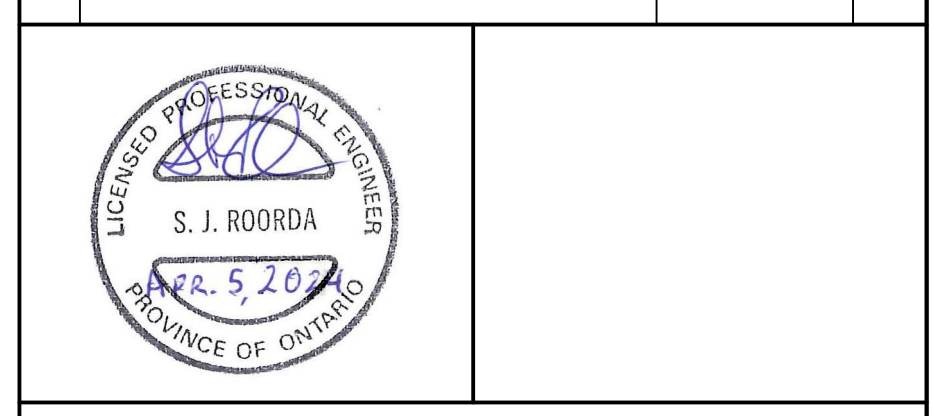


**BENCHMARK**  
ELEVATIONS ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928: PRE 1978) AND ARE DERIVED FROM CITY OF MISSISSAUGA BENCHMARK MONUMENT No. 1065, HAVING A PUBLISHED ELEVATION OF 178.912 METRES.

**Notes**  
1. This drawing is the exclusive property of R. J. Burnside & Associates Limited. The reproduction of any part without prior written consent of this office is strictly prohibited.  
2. The contractor shall verify all dimensions, levels, and datums on site and report any discrepancies or omissions to this office prior to construction.  
3. This drawing is to be read and understood in conjunction with all other plans and documents applicable to this project.

**NOT FOR CONSTRUCTION**

No.	Issue / Revision	Date	Auth.
1	ISSUED FOR SITE PLAN APPROVAL	20/03/20	DN
2	RE-ISSUED FOR SITE PLAN APPROVAL	22/01/11	DN
3	RE-ISSUED FOR SITE PLAN APPROVAL	23/05/10	TR
4	RE-ISSUED FOR ZONING	24/04/03	TR



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Client:  
**ST. MARK AND ST. DEMIANA COPTIC ORTHODOX CHURCH**  
462 FALGARWOOD DRIVE  
OAKVILLE, ON  
L6H 1N3

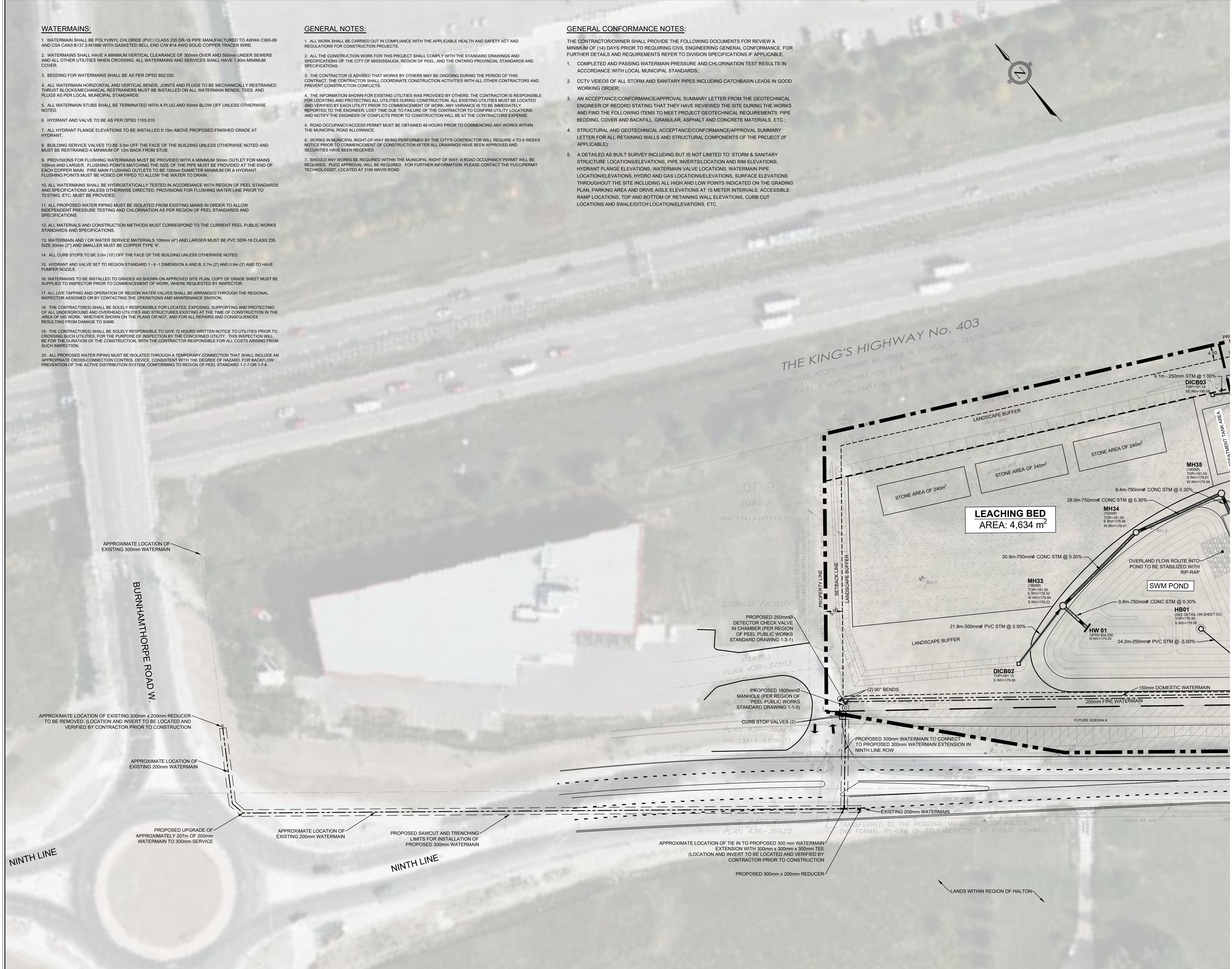
Drawing Title:  
**NINTH LINE MISSISSAUGA**

Project Name:  
**WATERMAIN SERVICING PLAN**

Drawn	Checked	Designed	Checked	Date	Drawing No.
TR	SR	TR	SR	23/07/17	

Project No. 300044049  
Contract No. CONTRACT NO. 0  
Revision No. 0  
Scale 1:500  
0 5.0 10.0 20.0 30.0m

**S2**



**ONTARIO PROVINCIAL STANDARD DRAWING**  
**PRECAST CONCRETE MAINTENANCE HOLE**  
**1200mm DIAMETER**  
**OPSD 701.010**

**NOTES:**  
 1 The sump is measured from the lowest invert.  
 A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.  
 B Precast concrete components shall be according to OPSD 701.030, 701.031, or 701.032.  
 C Structure exceeding 5.0m in depth shall include safety platform according to OPSD 404.020.  
 D Pipe support shall be according to OPSD 708.020.  
 E For benching and pipe opening details, see OPSD 701.021.  
 F For adjustment unit and frame installation, see OPSD 704.010.  
 G All dimensions are nominal.  
 H All dimensions are in millimetres unless otherwise shown.

**ONTARIO PROVINCIAL STANDARD DRAWING**  
**PRECAST CONCRETE MAINTENANCE HOLE**  
**1500mm DIAMETER**  
**OPSD 701.011**

**NOTES:**  
 1 For sump detail, see OPSD 701.010.  
 A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.  
 B Precast concrete components shall be according to OPSD 701.030, 701.031, 701.032, 701.041, 703.011, 703.021, and 708.010.  
 C Structures exceeding 5.0m in depth shall include safety platform according to OPSD 404.020 or 404.021.  
 D Pipe support shall be according to OPSD 708.020.  
 E For benching and pipe opening details, see OPSD 701.021.  
 F For adjustment unit and frame installation, see OPSD 704.010.  
 G All dimensions are nominal.  
 H All dimensions are in millimetres unless otherwise shown.

**ONTARIO PROVINCIAL STANDARD DRAWING**  
**PRECAST CONCRETE MAINTENANCE HOLE**  
**1800mm DIAMETER**  
**OPSD 701.012**

**NOTES:**  
 1 For sump detail, see OPSD 701.010.  
 A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.  
 B Precast concrete components shall be according to OPSD 701.030, 701.031, 701.032, 701.041, 703.011, 703.021, and 708.020.  
 C Structures exceeding 5.0m in depth shall include safety platform according to OPSD 404.020 or 404.021.  
 D Pipe support shall be according to OPSD 708.020.  
 E For benching and pipe opening details, see OPSD 701.021.  
 F For adjustment unit and frame installation, see OPSD 704.010.  
 G All dimensions are nominal.  
 H All dimensions are in millimetres unless otherwise shown.

**ONTARIO PROVINCIAL STANDARD DRAWING**  
**PRECAST CONCRETE MAINTENANCE HOLE**  
**3000mm DIAMETER**  
**OPSD 701.014**

**NOTES:**  
 1 For sump detail, see OPSD 701.010.  
 A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.  
 B Precast concrete components shall be according to OPSD 701.030, 701.031, 701.032, 701.041, 703.011, 703.014, 703.024, 706.040 and 706.041.  
 C Structures exceeding 5.0m in depth shall include safety platform according to OPSD 404.020.  
 D Pipe support shall be according to OPSD 708.020.  
 E For benching and pipe opening details, see OPSD 701.021.  
 F For adjustment unit and frame installation, see OPSD 704.010.  
 G All dimensions are nominal.  
 H All dimensions are in millimetres unless otherwise shown.

**ONTARIO PROVINCIAL STANDARD DRAWING**  
**PRECAST CONCRETE DITCH INLET MAINTENANCE HOLE - TYPE A**  
**1200 x 1200mm**  
**OPSD 702.040**

**NOTES:**  
 1 The sump is measured from the lowest invert. Benching as shown in Benching Detail.  
 2 Lap horizontal 10M rebar 300mm. Lap shall be placed at corners.  
 3 Lap horizontal wire 300mm or weld welds to develop 10% of yield strength of wire. Bars or welds shall be placed at corners.  
 4 End rebar or WWR in base 75mm from outside face of wall.  
 A Where inlet is placed across ditch and is accessible to vehicular traffic, grating slope shall be 6H:1V or flatter.  
 B Granular bedding shall be placed a minimum thickness of 300mm all around the ditch inlet maintenance hole.  
 C Concrete for benching shall be 30Mpa.  
 D Benching slope and height shall be as specified.  
 E Grating shall be according to OPSD 403.010.  
 F Slopes shall be according to OPSD 405.010 or 405.020.  
 G Maximum plate size straight through=1200mm clear, right angle pipes=700mm diameter.  
 H Pipe support shall be according to OPSD 708.020.  
 I Centre reinforcing in walls 335mm. All other reinforcing shall have a minimum cover of 25mm.  
 J All dimensions are nominal.  
 K All dimensions are in millimetres unless otherwise shown.

**Region of Peel** PUBLIC WORKS STANDARD DRAWING  
**SERVICING FOR APARTMENTS, BUILDINGS, SCHOOLS, HOSPITALS, HOTELS, MOTELS AND CHURCHES**  
**REV. DATE: NOVEMBER 2011**  
 APPROVED BY: A.P. DRAWN BY: ANLEY GROUP  
 STD. DWG. NUMBER: 1-8-3 SCALE: N.T.S.

ITEM	DESCRIPTION	TYPE	THICKNESS
1	COVER	PRECAST CONCRETE	100mm
2	CHAMBER WALL	PRECAST CONCRETE	100mm
3	CHAMBER FLOOR	PRECAST CONCRETE	100mm
4	CHAMBER RISE	PRECAST CONCRETE	100mm
5	CHAMBER RISE	PRECAST CONCRETE	100mm

**NOTE:**  
 1. WATERPROOF MEMBRANE TO BE "MEL-K-1" BY W.R. MEADOWS OF MISSISSAUGA OR APPROVED EQUAL. EXTEND COMPLETELY AROUND ALL RISER SECTION JOINTS WITH A MINIMUM 300mm WIDE STRIP.  
 2. ALL INSULATION TO BE READY TIE EXTRUDED POLYSTYRENE FOAM BOARD 40MM OR 50MM OR APPROVED EQUAL. ALL CHAMBER INSULATION TO BE INSTALLED WITH CONSTRUCTION ADHESIVE AND TAPCON ANCHORS AT MAX. 600mm SPACING IN ALL DIRECTIONS WITH 2 ANCHORS PER SHEET OF INSULATION.

**Region of Peel** PUBLIC WORKS STANDARD DRAWING  
**TYPICAL PRECAST CIRCULAR CHAMBER DETAILS FOR NEW WATERMAINS**  
**REV. DATE: APRIL 2014**  
 APPROVED BY: A.P. DRAWN BY: ANLEY GROUP  
 STD. DWG. NUMBER: 1-1-5 SCALE: N.T.S.

ITEM	DESCRIPTION	TYPE	THICKNESS
1	COVER	PRECAST CONCRETE	100mm
2	CHAMBER WALL	PRECAST CONCRETE	100mm
3	CHAMBER FLOOR	PRECAST CONCRETE	100mm
4	CHAMBER RISE	PRECAST CONCRETE	100mm
5	CHAMBER RISE	PRECAST CONCRETE	100mm

**NOTE:**  
 1. INSTALL 50mm GALVANIZED CONDUIT FROM INSIDE CHAMBER WALL TO SUITABLE LOCATION 2000mm MIN. BEYOND TRAFFIC AREA.  
 2. GATE VALVE, FITTINGS AND PIPE SHALL BE RESTRAINED AS PER REGION OF PEEL REQUIREMENTS.  
 3. ALL BELL, FITTINGS, VALVES, APPURTENANCES AND MECHANICAL RESTRAINTS TO BE 10% DENSE PASTE, DENSE MASTIC AND DENSLO TAPE OR APPROVED EQUAL, APPLIED TO MANUFACTURER'S RECOMMENDATIONS.

**Region of Peel** PUBLIC WORKS STANDARD DRAWING  
**DETECTOR CHECK VALVE IN CHAMBER**  
**REV. DATE: APRIL 2014**  
 APPROVED BY: A.P. DRAWN BY: ANLEY GROUP  
 STD. DWG. NUMBER: 1-3-1 SCALE: N.T.S.

**NOTE:**  
 1. WATERPROOF MEMBRANE TO BE "MEL-K-1" BY W.R. MEADOWS OF MISSISSAUGA OR APPROVED EQUAL. EXTEND COMPLETELY AROUND ALL RISER SECTION JOINTS WITH A MINIMUM 300mm WIDE STRIP.  
 2. ALL INSULATION TO BE READY TIE EXTRUDED POLYSTYRENE FOAM BOARD 40MM OR 50MM OR APPROVED EQUAL. ALL CHAMBER INSULATION TO BE INSTALLED WITH CONSTRUCTION ADHESIVE AND TAPCON ANCHORS AT MAX. 600mm SPACING IN ALL DIRECTIONS WITH 2 ANCHORS PER SHEET OF INSULATION.

**FROST PROTECTION INSULATION CALCULATIONS**

PIPE	Diameter (mm)	A (mm)	MIN. WIDTH (mm)	MIN. THICKNESS (mm)	MIN. INSULATION THICKNESS (in)
DCBMH11-MH10	375	565	1545	78	4
MH10-CBMH09	375	785	1105	49	2
RD01-CBMH09	375	830	1015	43	2
CBMH09-DCBMH07	600	605	1690	73	3
DCBMH07-DCBMH06	600	515	1870	85	4
DCBMH06-DCBMH03	600	290	2320	115	5
DCBMH05-CBMH04	375	55	2565	146	6
CBMH04-DCBMH03	450	440	1870	95	4
DCBMH03-DCBMH02	750	250	2590	122	5
DICB03-MH12	250	690	1230	66	3
MH12-DCBMH02	300	640	1320	68	3
DCBMH02-TANK	750	265	2520	118	5
TANK-MH35	750	895	1260	34	2
MH35-MH34	750	715	1620	58	3
MH34-MH33	750	765	1520	52	3
DICB02-MH33	300	800	1000	47	2

**FROST PROTECTION INSULATION DETAIL**  
 SCALE: N.T.S.

**NOTE:**  
 B = FROST PENETRATION DEPTH (cm)  
 D=0 = CELSIUS DEGREE DAYS < 0°  
 D<0 = 523.1 AS PER CLIMATE NORMALS IN ONTARIO  
 A = DEPTH OF PIPE COVER - 150mm  
 THICKNESS = B/A x 0.04 = XXXmm  
 B=1150mm  
 B=174(D<0)/0.67  
 B=115cm = 1150mm

**BENCHMARK ELEVATIONS ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928; PRE 1978) AND ARE DERIVED FROM CITY OF MISSISSAUGA BENCHMARK MONUMENT No. 1065, HAVING A PUBLISHED ELEVATION OF 178.912 METRES.**

**NOT FOR CONSTRUCTION**

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4	RE-ISSUED FOR ZONING	24/04/03	TR

**PROFESSIONAL ENGINEER**  
**S. J. ROORDA**  
**NOV 5 2011**  
**PROVINCE OF ONTARIO**

**R.J. Burnside & Associates Limited**  
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 telephone (905) 821-1800  
 fax (905) 821-1809  
 web www.rjburnside.com

**Client:**  
**St. Mark and St. Demiana Coptic Orthodox Church**  
 462 FALGARDWOOD DRIVE  
 OAKVILLE, ON  
 L6H 1N3

**Drawing Title:**  
**NINTH LINE MISSISSAUGA**

**DETAIL PLAN**

Drawn	Checked	Designed	Checked	Date	Drawing No.
TR	SR	TR	SR	23/03/17	

**Project No.:** 300044049  
**Contract No.:**  
**CONTRACT NO.**  
**Revision No.:** 0  
**Scale:** NOT TO SCALE

**D1**

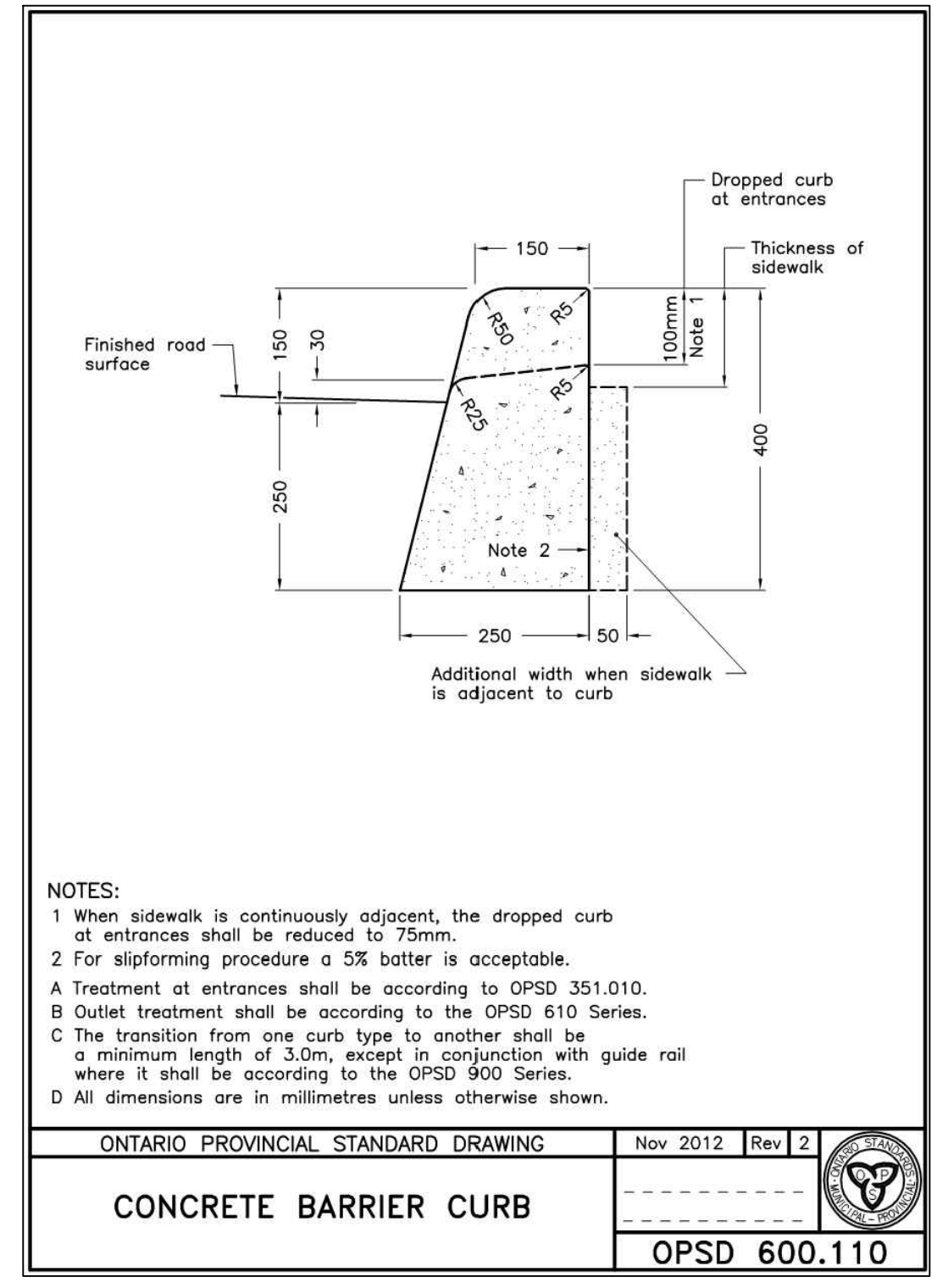
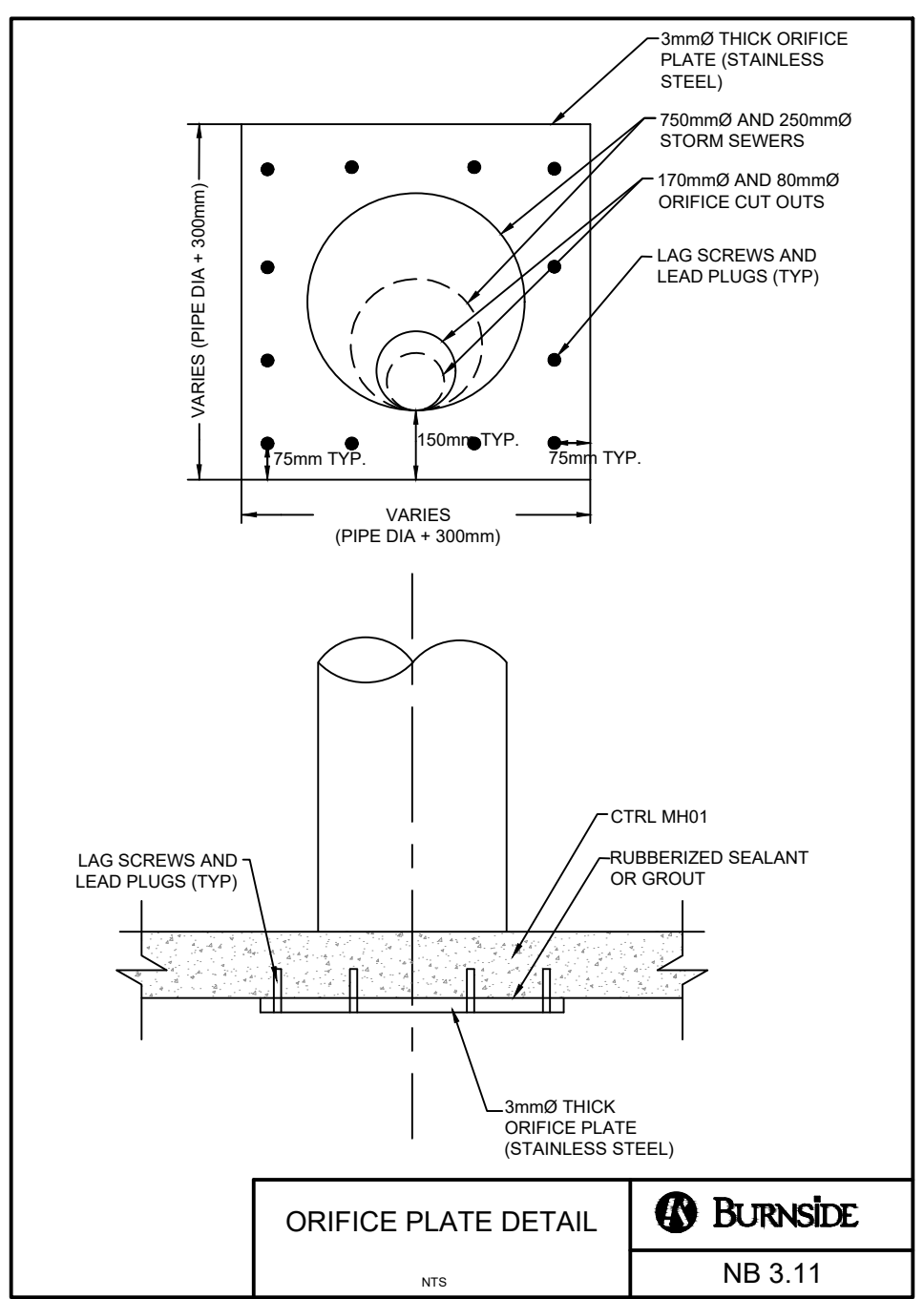
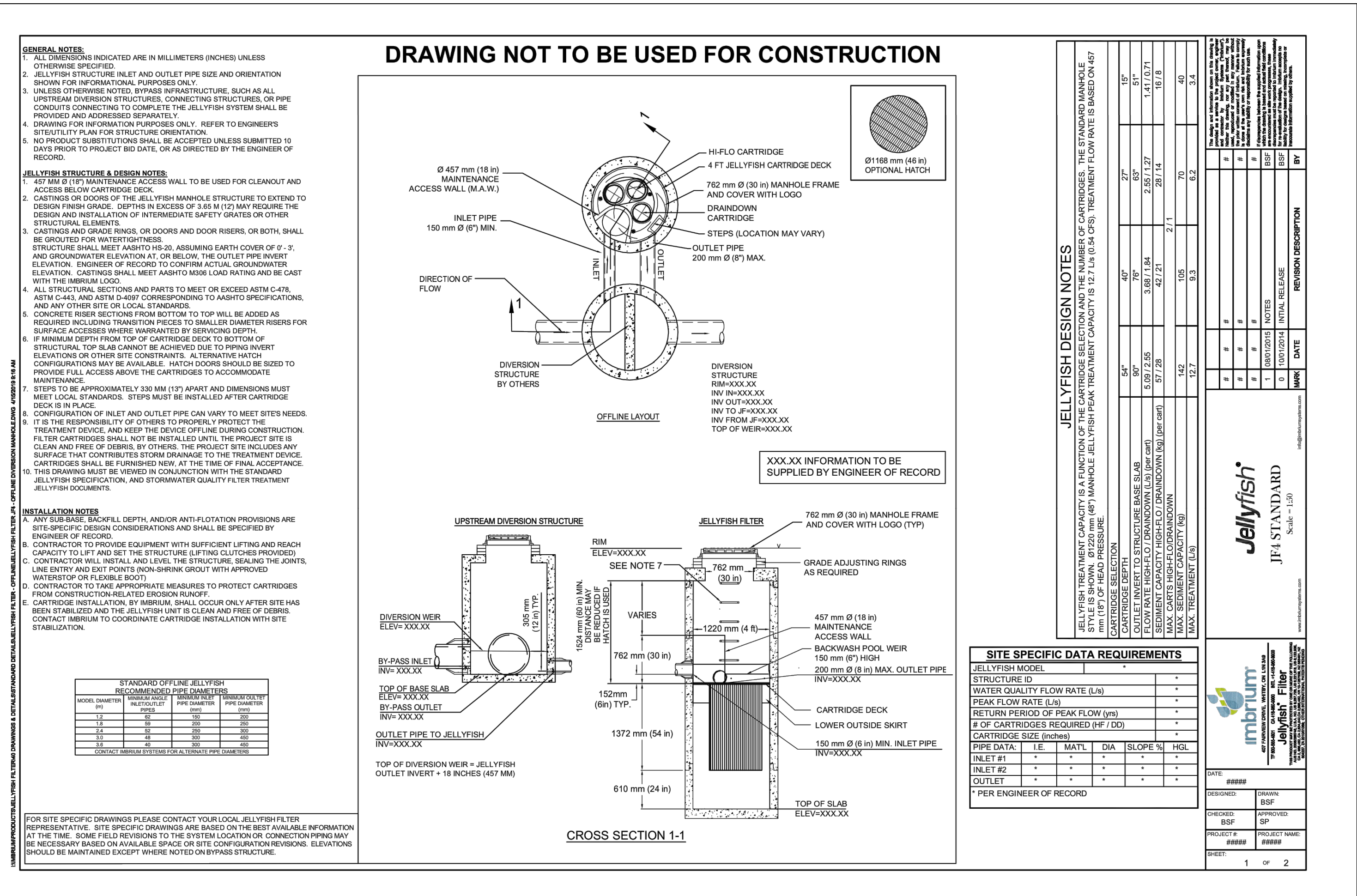
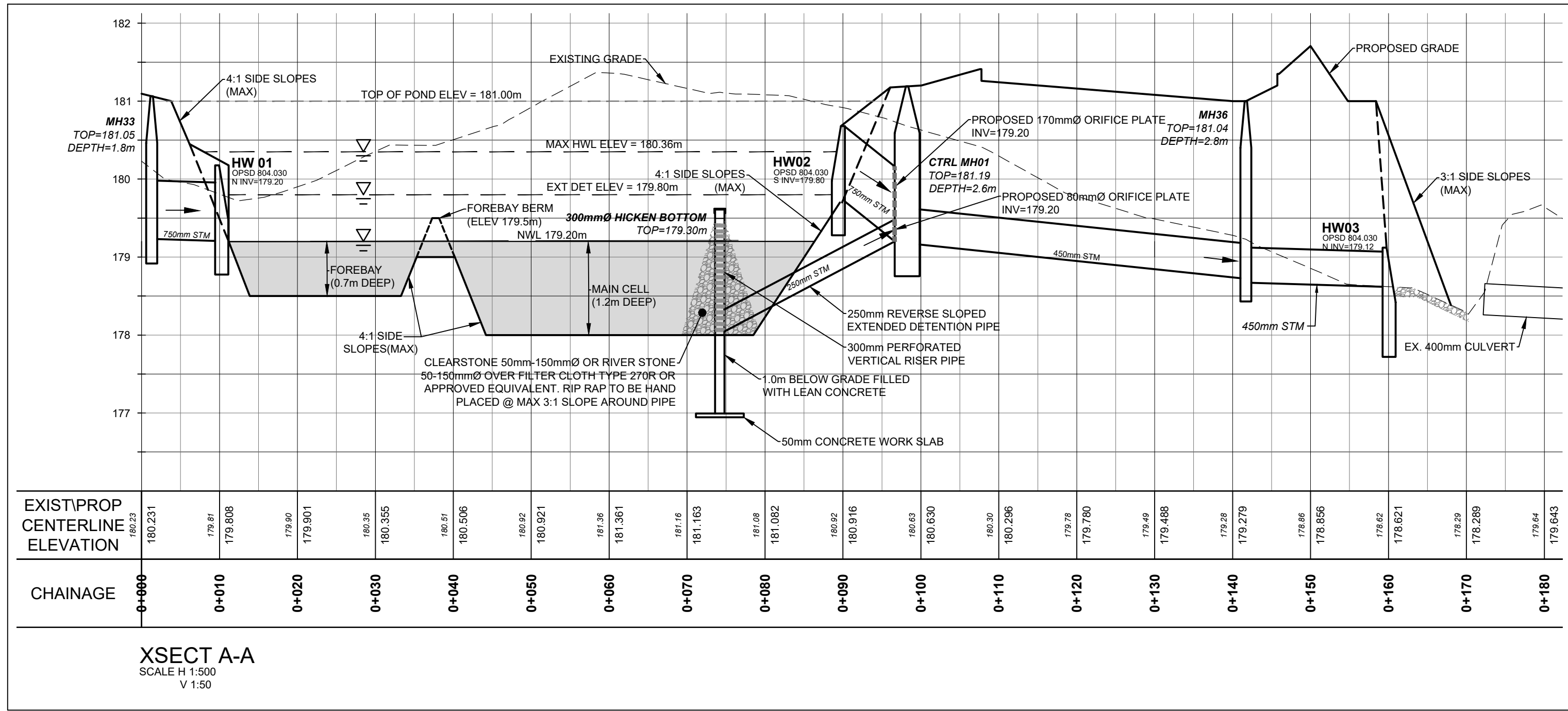
**ONTARIO PROVINCIAL STANDARD DRAWING**  
**CONCRETE HEADWALL**  
**FOR PIPE LESS THAN 900mm DIAMETER**  
**OPSD 804.030**

**NOTES:**  
 A This OPSD to be read in conjunction with OPSD 3940.150.  
 B If a steel grate is required, refer to OPSD 804.05.  
 C Class of concrete: 30MPa.  
 D Cover to reinforcing bars: 70mm ± 20mm.  
 E All dimensions are in millimetres unless otherwise shown.

**CONCAST** No. 703.01  
**1500 mm Dia. PRECAST CONCRETE SINGLE AND TWIN INLET FLAT CAP**

**NOTES:**  
 A. All reinforcing steel shall have 25 mm diameter.  
 B. This standard is to be used in conjunction with OPSD 701.01.  
 C. All dimensions are in millimetres.





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4	RE-ISSUED FOR ZONING	24/04/03	TR

**PROFESSIONAL ENGINEER**  
S. J. ROORDA  
PROV. 5207  
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Client: **St. MARK AND St. DEMIANA COPTIC ORTHODOX CHURCH**  
462 FALGARWOOD DRIVE  
OAKVILLE, ON  
L6H 1N3

Drawing Title: **NINTH LINE MISSISSAUGA**  
DETAIL PLAN

Drawn	Checked	Designed	Checked	Date	Drawing No.
TR	SR	TR	SR	23/07/17	

Project No. 300044049 Contract No. CONTRACT NO. Revision No. 0

Scale: NOT TO SCALE

**D2**



BURNSIDE

[ THE DIFFERENCE IS OUR PEOPLE ]

---

**Appendix A**

**Geotechnical Report**

Appendix A

# **GEOTECHNICAL INVESTIGATION**

**PROPOSED CHURCH  
NINTH LINE  
MISSISSAUGA, ONTARIO**

**CMT Project 20-026.R01**

**Prepared for:**

**St. Mark and St. Demiana Coptic Orthodox Church**

**February 20, 2020**





*CMT Engineering Inc.*  
1011 Industrial Crescent, Unit 1  
St. Clements, Ontario N0B 2M0  
*Tel: 519-699-5775*  
*Fax: 519-699-4664*  
[www.cmtinc.net](http://www.cmtinc.net)

February 20, 2020

20-026.R01

St. Mark and St. Demiana Coptic Orthodox Church  
The Diocese of Mississauga, Vancouver and Western Canada  
2188 Robinwood Court  
Mississauga, Ontario  
L5M 5B9

Dear Sir/Madame:

**Re: Geotechnical Investigation  
Proposed Church  
Ninth Line, Mississauga**

As requested, CMT Engineering Inc. conducted a geotechnical investigation at the above-referenced site, and we are pleased to present the enclosed report.

We trust that this information meets your present requirements and we thank you for allowing us to undertake this project. Should you have any questions, please do not hesitate to contact our office.

Yours truly,

A handwritten signature in blue ink, appearing to read 'Shawn Wheatley', is written over a light blue horizontal line.

*for* Shawn Wheatley, M.Eng.

ks

1cc: R.J. Burnside and Associates Limited - Angela Mason

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## **1.0 INTRODUCTION**

The services of CMT Engineering Inc. (CMT Inc.) were retained by Ms. Angela Mason, M.Sc., P.Geo., of R.J. Burnside & Associates Limited, on behalf of the St. Mark and St. Demiana Coptic Orthodox Church, to conduct a geotechnical investigation for a proposed church building to be located at Ninth Line in Mississauga, Ontario. The geotechnical investigation was carried out in conjunction with a hydrogeology study completed by R.J. Burnside & Associates Limited, which will be provided under separate cover. The location of the site is shown on Drawing 1.

The purpose of the geotechnical investigation was to assess the existing soil and groundwater conditions encountered in the boreholes. Included in the assessment are the soil classification and groundwater observations, as well as comments and recommendations regarding geotechnical resistance (bearing capacity); serviceability limit states (anticipated settlement); dewatering considerations; site classification for seismic site response; recommendations for site grading, site servicing, excavations and backfilling, recommendations for slab-on-grade construction; pavement design/drainage; soil design properties; storm water infiltration, and a summary of the laboratory results.

## **2.0 EXISTING SITE CONDITIONS**

The site is currently primarily used for agricultural crop production. An unpaved parking area and temporary work/storage area for lumber currently exists at the east side of the property. The site has undulating topography, with a range in elevation of approximately 4.5 m across the borehole locations. The site is bounded by Ninth Line to the south, Highway 403 to the north, a commercial storage facility to the west, and vacant land to the east.

## **3.0 FIELD AND LABORATORY PROCEDURES**

Prior to the commencement of the field drilling program, ON1Call locates were organized by CMT Inc. to ensure that underground utilities would not be damaged.

The field investigation was conducted on February 10 and February 12, 2020, and comprised the advancement of seven (7) boreholes (referenced as Boreholes 1 to 7), utilizing a Geoprobe 7822DT drillrig operated by employees of CMT Drilling Inc.

The borehole depths ranged from approximately 4.57 m (15.0 ft) to 7.62 m (25.0 ft) below the existing ground surface elevations as directed by R.J. Burnside & Associates Limited. Standard penetration testing (SPT) and sampling was carried out in all boreholes using 38 mm inside diameter split spoon sampling equipment and an automatic hammer, in accordance with ASTM D 1586 "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils". SPT soil sampling was generally conducted at 0.76 m (2.5 ft) intervals to approximately 3.0 m (10.0 ft) and about every 1.52 m (5.0 ft) thereafter to borehole termination. Macro core (MC5) soil sampling was conducted between the deeper SPT samples in the majority of the

boreholes. Technical staff from CMT Inc. observed the drilling operation and collected and logged the recovered soil samples. A small portion of each sample was placed in a sealed, marked jar for moisture content determinations.

As requested, representative samples from the following boreholes and depths were submitted to our laboratory for grain size analyses:

- Borehole 1 – approximate depth 0.76 m to 1.37 m (2.5 ft to 4.5 ft)
- Borehole 2 - approximate depth 1.52 m to 2.13 m (5.0 ft to 7.0 ft)
- Borehole 4 - approximate depth 3.66 m to 4.57 m (12.0 ft to 15.0 ft)
- Borehole 6 - approximate depth 3.05 m to 3.66 m (10.0 ft to 12.0 ft)

The borehole logs are provided in Appendix A and the resulting grain size analyses can be found in Appendix B.

CMT Inc. may be contacted for additional laboratory testing on samples should it be required. Samples are typically kept for three months, unless other arrangements are made.

Boreholes 1, 5 and 6 were equipped with 50 mm diameter PVC monitoring wells comprising a 1.5 m long prepacked screen backfilled with #2 sand filter and then riser pipe, backfilled with bentonite. The monitoring wells were installed according with the Ontario Water Resources Act, Regulation 903 (O.Reg. 903) by well technicians licensed by the Ministry of the Environment, Conservation and Parks (MECP), working for a contractor also licensed by the MECP. The monitoring wells are registered with the MECP and must be decommissioned in accordance with O.Reg. 903 prior to future construction. The well log records are provided in Appendix C.

CMT Inc. surveyed the ground surface elevations at the borehole locations (using laser survey equipment) on February 12, 2020. A geodetic monument, located immediately west of the intersection of Ninth Line and Burnhamthorpe Road, was used as a benchmark with a reported elevation of 181.90 m above sea level. The ground surface elevations at the borehole locations ranged from about 177.84 m to 182.49 m. The locations of the boreholes are shown on Drawing 2.

#### **4.0 SUBSOIL CONDITIONS**

The soils encountered in the boreholes are described briefly below and a more detailed stratigraphic description is provided on the borehole logs in Appendix A. The following paragraphs have been simplified into terms of major soil strata. The soil boundaries indicated have been inferred from non-continuous samples and observations of sampling and drilling resistance and typically represent transitions from one soil type to another rather than exact planes of geological change. Further, the subsurface conditions are anticipated to vary between and beyond the borehole locations.

#### **4.1. Topsoil**

Very loose to loose, dark brown, silty, organic topsoil was encountered at the surface of all boreholes. The topsoil was considered to be in a moist state. The topsoil ranged in thickness from approximately 50 mm to 120 mm (average 90 mm) at the borehole locations. Given the variation in topsoil thicknesses at the borehole locations, and the undulating nature of the topography, some variance in the topsoil thickness should be expected outside of the sampled areas. It would be expected that topsoil thicknesses would be thinner on the hill tops, with more significant accumulation expected in the low-lying areas. Materials designated as topsoil in this report were classified based solely on visual and textural evidence. Testing of organic content or for other nutrients was not carried out. Therefore, materials classified herein as topsoil cannot necessarily be relied upon for support and growth of landscaping vegetation without supplemental soil nutrient analyses.

#### **4.2. Clayey Silt**

Brown to grey, clayey silt, clay and silt, or clayey sandy silt, with some sand and up to some gravel, was encountered underlying the topsoil in all boreholes. The clayey silt immediately underlying the topsoil was observed to be mottled red, brown and dark brown, and contained trace amounts of organic material from root structures. The clayey silt was considered to be very soft to hard, with SPT N-values ranging from 1 to in excess of 100 blows per 0.3 m (average 28 blows per 0.3 m). Typically, the soft to firm clayey silt was encountered directly underlying the topsoil. It is expected that this material has become loosened/soft from frost action and may require further inspection and remedial action (further compactive effort) at the time of construction, if it will be intended to be utilized during site grading. The clayey silt was considered to be moist, with moisture contents ranging from about 8.5% to 29.9% (average 14.5%).

#### **4.3. Sand**

Brown to grey sand with trace to some gravel and silt, and up to trace amounts of clay was encountered underlying the clayey silt in Boreholes 1 and 6, underlying the silt till in Borehole 2, and underlying the sandy clayey silt till in Boreholes 1 and 6. The sand was considered to be dense to very dense, with SPT N-values ranging from 44 to in excess of 100 blows per 0.3 m (average 72 blows per 0.3 m). The sand was considered to be moist to wet, with moisture contents ranging from about 10.0% to 20.9% (average 17.7%).

#### **4.4. Sandy Clayey Silt Till**

Brown to grey sandy clayey silt till with trace to some gravel was encountered underlying the sand in Borehole 1, underlying the silt till in Boreholes 3 and 6, as well as underlying the clayey silt in Boreholes 4 and 5. The sandy clayey silt till was considered to be dense



to very dense, with SPT N-values ranging from 36 to in excess of 100 blows per 0.3 m (average 66 blows per 0.3 m). The sandy clayey silt till was observed to be moist to wet, with moisture contents ranging from about 9.4% to 13.8% (average 11.1%).

#### 4.5. Silt Till

Brown to grey silt till with some sand and clay, and up to trace amounts of gravel was encountered underlying the clayey silt in Boreholes 2, 3 and 7, underlying the sandy clayey silt till in Boreholes 4 and 5, as well as underlying the sand in Borehole 6. The silt till was considered to be compact to very dense, with SPT N-values ranging from 28 to in excess of 100 blows per 0.3 m (average 67 blows per 0.3 m). The sandy clayey silt till was observed to be moist to wet, with moisture contents ranging from about 7.6% to 24.4% (average 12.5%).

#### 4.6. Groundwater

Boreholes 1, 5 and 6 were equipped with monitoring wells. The monitoring wells were installed and registered in accordance with the Ontario Water Resources Act, Regulation 903 (O.Reg. 903) by well technicians licensed by the Ministry of the Environment (MOE), working for a contractor also licensed by the MOE. The boreholes that were not instrumented with a monitoring well were backfilled with bentonite in accordance with O.Reg. 903.

CMT Engineering Inc. staff measured the water levels in the wells on February 12, 2020. The following table summarizes the borehole number, ground surface elevation, elevation of water in the monitoring well upon completion of drilling, cave elevation, and the bottom of borehole elevation for each borehole:

Borehole No.	Ground Surface Elevation (m)	Measured Elevation of Water in Monitoring Well February 12, 2020 (m)	Measured Elevation of Water in Open Borehole (m)	Cave Elevation (m)	Bottom of Borehole Elevation (m)
1	179.66	177.92	--	--	172.04
2	179.52	--	176.78	176.47	174.95
3	180.13	--	175.41	175.10	174.95
4	182.49	--	--	177.82	177.31
5	177.84	177.69	--	--	171.74

Borehole No.	Ground Surface Elevation (m)	Measured Elevation of Water in Monitoring Well February 12, 2020 (m)	Measured Elevation of Water in Open Borehole (m)	Cave Elevation (m)	Bottom of Borehole Elevation (m)
6	181.68	177.41	--	--	174.06
7	179.02	--	--	--	173.84

It should be noted that the hard and/or fine-grained, less permeable clayey silt, sandy clayey silt till, and silt till soils have the potential to create perched water conditions. Groundwater conditions are generally dependent on the amount of precipitation, control of surface water, as well as the time of year, and can fluctuate significantly in elevation and volume. As such, provisions for site dewatering should be part of the site development and construction process. Recommendations with respect to dewatering conditions are provided in Section 5.8 of this report.

## **5.0 DISCUSSION AND RECOMMENDATIONS**

This section of the report provides CMT Inc.'s interpretation of the factual geotechnical data obtained during the investigation and is intended for the guidance of the owner and design engineer. Where comments are made on construction, they are provided only to highlight those aspects which could affect the design of the project. Contractors bidding on or undertaking the work should make their own independent interpretation of the factual subsurface information provided as it affects their proposed construction means and methods, equipment selection, scheduling, pricing, and the like.

Utilizing the information gathered during the geotechnical investigation and assuming that the borehole information is representative of the subsoil conditions throughout the site, the following comments and recommendations are provided.

### **5.1. Serviceability and Ultimate Limit Pressure**

Based on the information obtained from the boreholes, the following table provides the estimated geotechnical reaction at the Serviceability Limit States (SLS) and factored geotechnical resistance Ultimate Limit States (ULS) pressures at the various elevations, including soil types:

Borehole No.	Ground Surface Elevation (m)	SLS kPa (psf)	ULS kPa (psf)	Estimated Highest Founding Elevation (m)	Depth to Highest Founding Elevation (m)	Soil Type
1	179.66	150 (3,000)	225 (4,500)	178.90 to 172.04 (termination)	0.76	Clay and Silt/Sand/Sandy Clayey Silt Till
2	179.52	150 (3,000)	225 (4,500)	178.00 to 174.95 (termination)	1.52	Clayey Sandy Silt/Silt Till/Sand
3	180.13	150 (3,000)	225 (4,500)	179.37 to 174.95 (termination)	0.76	Clayey Silt/Silt Till/Sandy Clayey Silt Till
4	182.49	150 (3,000)	225 (4,500)	181.73 to 177.31 (termination)	0.76	Clayey Silt/Sandy Clayey Silt Till/Silt Till
5	177.84	150 (3,000)	225 (4,500)	177.08 to 171.74 (termination)	0.76	Clayey Silt/Sandy Clayey Silt Till/Silt Till
6	181.68	150 (3,000)	225 (4,500)	180.92 to 174.06 (termination)	0.76	Clayey Silt/Sand/Silt Till/Sandy Clayey Silt Till
7	179.02	150 (3,000)	225 (4,500)	178.26 to 173.84 (termination)	0.76	Clayey Silt/Silt Till

Should footings be designed to be constructed at elevations higher than the elevations indicated in the table above, then structural fill will be required in order to achieve the design grades for the proposed foundations. The serviceability limit pressure for structural fill placed and compacted in accordance with Section 5.4.3 of this report and constructed on approved competent native soils is estimated to be at least 150 kPa (3,000 psf) at SLS and 225 kPa (4,500 psf) at ULS. Alternatively, footings could be stepped down to bear on approved undisturbed founding soils.

Footings may be placed at a higher elevation relative to another footing provided that the slope between the outside face of the footings is separated by a minimum slope of 10 horizontal to 7 vertical (10H:7V) with an imaginary line projected from the underside of the footings. This must be taken into account for any deep structures such as sump pits.

With respect to the Serviceability Limit State (SLS), the total and differential footing settlements are not expected to exceed the generally acceptable limits of 25 mm (1") and 19 mm (3/4") respectively.

All exterior footings must be provided with a minimum of 1.2 m of soil cover or equivalent thermal insulation (sufficient thermal insulation is required to protect all footings and slab-on-grades during construction until such a time that the structure is heated) in order to provide protection from frost action.

It should be noted that the native soils that exist at or below founding elevations may be in a wet/saturated state and may be too wet to provide suitable bearing for foundations without construction of a mud mat or granular drainage layer. It is imperative that the subgrade soils be inspected and approved by competent geotechnical personnel to ensure that the founding soils are suitable for bearing. Dewatering during construction may be required (see Section 5.8 of this report), along with the potential construction of a mud mat or granular drainage layer.

At the time of investigation, the proposed founding elevations were not available. CMT Inc. would be pleased to review design drawings when they become available and provide further recommendations with respect to bearing and foundation elevations.

## **5.2. Seismic Site Classification**

The site classification for seismic response in Table 4.1.8.4 of the 2012 Ontario Building Code relates to the average properties of the upper 30 m of strata. The information obtained in the geotechnical field investigation was gathered from the upper 4.57 m to 7.62 m of strata. Based on the information gathered in the geotechnical field investigation, the site classification for seismic site response would be considered Site Class D (stiff soils) for structures founded on the native soils at the recommended founding elevations provided in Section 5.1 of this report. For foundations constructed on structural fill, placed in accordance with Section 5.4.3 of this report, the site classification for seismic site response would be considered Site Class D (stiff soil). The structural engineer responsible for the design of the structure should review the earthquake loads and effects.

## **5.3. Soil Design Parameters**

The following table provides the estimated soil design parameters for imported granular fill, as well as the native soils encountered on-site.

The estimated soil design parameters can be utilized for the design of perimeter shoring, foundations and retaining walls, as required:

Soil Type	Soil Density (kg/m <sup>3</sup> )	Friction Angle (Degree)	Coefficient of Active Pressure (K <sub>a</sub> )	Coefficient of Passive Pressure (K <sub>p</sub> )	Coefficient of At-Rest Pressure (K <sub>o</sub> )	Coefficient of Friction (μ)	Cohesion (kPa)
Imported Gran 'A'/Gran 'B' (OPSS 1010)	2,100	34 °	0.28	3.54	0.44	0.45	0
Clayey Silt	1,850	30 °	0.33	3.00	0.50	0.38	10
Sand	1,800	33°	0.29	3.39	0.46	0.43	0
Sandy Clayey Silt Till	1,850	32 °	0.31	3.25	0.41	0.41	5
Silt Till	1,900	33°	0.29	3.39	0.46	0.43	0

#### 5.4. Site Preparation

The site preparation for the proposed church is anticipated to include topsoil stripping, vegetation grubbing, the subexcavation of all relatively loose/soft native soils deemed not capable of supporting the design bearing capacity, the removal or relocation of any existing services (field tiles), followed by the placement of structural fill (as required) and site grading to achieve proposed grades.

##### 5.4.1. Topsoil Stripping/Vegetation Grubbing

Due to the undulating topography and erosion, it should be expected that the thickness of topsoil may vary significantly throughout the site.

All existing topsoil, vegetation (including tree roots and all loose/disturbed soils associated with tree roots) must be removed from within the proposed building envelopes, driveways and parking lots to expose approved competent subgrade soils. The topsoil may be used in landscaped areas where some settlement can be tolerated; otherwise, it should be properly disposed of off-site.

Swelling and shrinkage factors of topsoil during site grading operations is generally relative to the insitu density and moisture content at the time of construction, as well as the type of equipment utilized and the compactive effort that the topsoil is subjected to during stockpiling and the subsequent placement during the final grading process. When topsoil is stripped and then placed in

stockpiles with heavy earthmoving equipment such as motor scrapers or rock trucks and bulldozers, it tends to compact considerably in the stockpile. As previously indicated, the amount of compaction is generally relative to the weight of the equipment utilized, the number of passes that the equipment makes over the stockpiled topsoil, as well as the moisture content of the topsoil at the time of construction. Therefore, the swelling and shrinkage factors can vary significantly. Determination of swelling and shrinkage factors would require considerable laboratory testing throughout the construction process in order to provide an average that may be considered reasonable for quantity calculations. A frequently used practice to determine stripped quantities of topsoil would be to do a topographic survey prior to and following the stripping process. Due to the typical relatively loose insitu state of the topsoil, it should be expected that compacted volumes (when the topsoil is put back down) will be considerably less (again relative to the type and weight of equipment, the number of passes and the moisture content at the time of construction) than in the insitu state.

The volume of topsoil removed during the stripping process is also relative to the equipment utilized for the stripping process as well as the moisture conditions at the time of stripping. If an excavator with a smooth bucket is utilized for stripping, there would generally be less potential for topsoil to become intermixed with the underlying relatively loose subsoil and therefore less concern of over-excavation to remove all topsoil. If the topsoil is stripped with wheeled equipment or bulldozers, then there is an increased potential for the topsoil and subsoil to become intermixed, subsequently requiring additional excavation to remove all topsoil. This is further influenced by rutting which can occur during wet conditions.

It should also be noted that the clayey silt soils that were encountered directly underlying the topsoil are likely in a soft to firm state and may not be suitable to support foundations in their current state. As such, the upper clayey silt soils may require reworking with further compactive effort; otherwise these soils will require subexcavation to expose competent approved native mineral soils. This material will also be subjected to significant volume changes during the construction process.

#### **5.4.2. Removal/Relocation of Existing Services**

Any existing tile drains (field tiles or municipal tile drains) that may be located within the proposed building envelopes, driveways or parking lots must be completely removed to a minimum distance of 15.0 m (50.0 ft) outside of the construction envelopes. All drains that are terminated must be completely sealed with concrete or grout at termination points to prevent the migration of soils into pipe voids which may result in potential settlement. Ideally, depending on flow direction, any existing tile drains (if present) should be redirected and reconnected outside of the building envelopes in order to maintain flow and prevent subsurface

accumulation of water. It may be prudent (if feasible) to incorporate existing field tiles into the storm sewer system or a separate collection system, to assist in systematically draining the subsurface soils in the church building. All existing trench backfill material associated with the drains must be subexcavated and the subsequent excavation must be backfilled with approved soils placed in accordance with Section 5.4.3 of this report. The location of existing field tiles is commonly identified by lines of buried topsoil within the subgrade soils and/or water boiling out of the ground following excavation. The field tiles are historically installed at 15.0 m (50.0 ft) intervals, however this can vary from site to site.

The monitoring wells that have been installed as a part of this investigation can be decommissioned by an MECP licensed well contractor with a Class 1, Class 2 or Class 3 license in accordance with Reg. 903.

#### **5.4.3. Site Grading**

Currently, there are no design grades available. However, based on the existing grades and topography, it is expected that significant cut and fill operations will be required to achieve the final design elevations across the site.

Following stripping of the topsoil, the removal of all trees roots (including all relatively loose soils associated with the tree roots), as well as the subexcavation of any relatively soft native soils deemed unsuitable of supporting the design bearing capacity, the exposed subgrade must be proof-rolled, and any soft or unstable areas must be further subexcavated and replaced with approved fill materials. Any fill materials required to achieve the design site grades should be placed according to the following procedures:

- Should the native subgrade soils at the design founding elevation in the proposed building envelope comprise wet or saturated soils, as was observed in some of the boreholes, then a granular drainage layer, constructed in accordance with Section 9.14.4 of the current Ontario Building Code (OBC) may be required. Alternatively, a lean mix concrete mud mat may be poured overlying the subgrade soils to provide a stable base;
- Prior to placement of any structural fill or bulk fill, the subgrade for the proposed buildings, driveways and roads must be prepared large enough to accommodate a 1:1 slope commencing a distance of 1.0 m beyond the outside edge of the proposed foundation and pavement/concrete edge down to the approved competent founding soils;

- Soils approved for use as structural fill must be placed in loose lifts not exceeding 0.3 m (12") in depth for granular soils (recommended fill material) and 0.2 m (8") in depth for silts and clays, or the capacity of the compactor (whichever is less);
- Imported granular fill materials (OPSS 1010 Type III Granular 'B' recommended for this application) can be compacted utilizing adequate heavy vibratory smooth drum compaction equipment;
- Fine-grained silt and clay soils (not recommended) must be compacted utilizing adequate heavy padfoot vibratory compaction equipment;
- Approved fill materials must be at suitable moisture contents to achieve the specified compaction. The wet to saturated soils encountered in the boreholes would generally be considered difficult for use as structural fill as they would require extensive air-drying in order to achieve the specified density. Soil moisture will also be dependent on weather conditions at the time of construction. Granular soils may require the addition of water in order to achieve the specified compaction;
- Approved structural fill materials that will support structures (including foundations, interior slab-on-grades, sidewalks, large expansive exterior slabs) must be compacted to a minimum of 98% standard Proctor maximum dry density (SPMDD);
- Approved bulk fill (exterior foundation wall backfill in landscaped areas, bulk fill for roadway (including sidewalk subgrade) and driveways) must be compacted to a minimum 95% SPMDD;
- Granular 'B' subbase and Granular 'A' base materials for the roads and driveways must be compacted to 100% SPMDD;
- It is recommended that compactive effort be applied to bulk fill in landscaped areas in order to reduce the effects of long-term settlement.

Based on the subsurface conditions observed in the boreholes, wet soils may be encountered, depending on the depth of excavation. As such, for soils excavated from the zone of saturation, significant air-drying along with working of the soils may be required in order to achieve the specified compaction of 98% SPMDD for structural fill and 95% SPMDD for bulk fill for the parking lot and driveways. Utilizing the existing soils during site grading may be more achievable if work is completed during the generally drier summer months. Reuse of excavated soils on-site will be subject to approval from qualified geotechnical personnel.



It should also be noted that the native soils encountered in the lower zone of the boreholes typically became very dense/hard with depth (SPT N-values in excess of 50 blows per 0.3 m) and may prove difficult to excavate with conventional excavating equipment. It is imperative that if the very dense/hard soils are utilized as fill, the material must be broken down (pulverized) to minimize void space and reduce the potential for settlement. Problems associated with compacting very dense/hard soils include the potential for long-term settlement due to excessive void space caused by the generally blocky structure of the excavated soils. As such, the very dense, blocky material must **not** be used as structural fill. The contractor must have equipment on-site that can effectively break down (pulverize) the very dense excavated soil into workable sizes (as required). Backfilling utilizing this material must be performed in thin lifts with considerable compactive effort applied, thereby reducing the void space and minimizing long-term settlement. This process could be difficult and time-consuming.

#### **5.5. Foundation Subgrade Preparation**

The native soils encountered in the boreholes are sensitive to changes in moisture content and can become loose/soft if the soils are subjected to additional water or precipitation, as well as severe drying conditions. The native subgrade soils could also be easily disturbed if traveled on during construction. Once they become disturbed, they are no longer considered adequate for the support of shallow foundations. To ensure and protect the integrity of the founding soils during construction operations, the following is recommended:

- During construction, the subgrade should be sloped or ditched to a sump located outside the building footprint in the excavation to promote surface drainage of rainwater or seepage and the collected water should be pumped out of the excavation. The environmental consultant must be consulted prior to any on-site water being pumped and/or discharged to municipal outlets to ensure that proper procedures are followed. It is critical that all water be controlled (not allowed to pond) and that the subgrade and foundation preparation commence in dry conditions;
- Should the native subgrade soils at the design founding elevation in the proposed building envelope(s) comprise saturated soils, as was observed in some of the boreholes, then a granular drainage layer, constructed in accordance with Section 9.14.4 of the current Ontario Building Code (OBC) may be required;
- Construction equipment travel and foot traffic on the founding soils should be minimized;

- If construction is to be undertaken during subzero weather conditions, the founding native soils and any potential fill materials must be maintained above freezing;
- Prior to pouring concrete for the foundations, the founding soils must be cleaned of all disturbed or caved materials;
- The foundation formwork and concrete should be installed as soon as practical following the excavation, inspection and approval of the founding soils. The longer that the excavated soils remain open to weather conditions and groundwater seepage, the greater the potential for construction problems to occur;
- If it is expected that the founding soils will be left open to exposure for an extended period of time, it is recommended that a 75 mm concrete mud slab be poured in order to protect the structural integrity of the founding soils.

#### 5.6. Slab-on-Grade/Modulus of Subgrade Reaction

Prior to the placement of the granular base for the slab-on-grade construction, the subgrade soils should be proof-rolled. Any soft or weak zones, as well as any potential unsuitable fill in the subgrade (field tile trenches), should be subexcavated and backfilled with approved fill materials (see Section 5.4.3 of this report).

The following table provides the estimated modulus of subgrade reaction (k) for imported granular fill, as well as the native soils encountered on-site:

Soil Type	Modulus of Subgrade Reaction (k)
Imported Sand and Gravel (OPSS 1010)	81,000 kN/m <sup>3</sup> (300 lb/in <sup>3</sup> )
Clayey silt	40,000 kN/m <sup>3</sup> (150 lb/in <sup>3</sup> )
Sand	40,000 kN/m <sup>3</sup> (150 lb/in <sup>3</sup> )
Sandy Clayey Silt Till	47,000 kN/m <sup>3</sup> (175 lb/in <sup>3</sup> )
Silt Till	47,000 kN/m <sup>3</sup> (175 lb/in <sup>3</sup> )

In dry conditions, the floor slab can be founded on a minimum thickness of 150 mm (6") of Granular 'A' (OPSS 1010) and compacted to 100% SPMDD. Alternatively (particularly in wet conditions), 150 mm (6") of 19 mm clear crushed stone (OPSS 1004) should be used instead of Granular 'A'. Compactive effort should be utilized to consolidate the clear stone.

It is recommended that areas of extensive exterior slab-on-grade (sidewalks, accessibility ramps and exterior stairs) be constructed with a Granular 'B' subbase (450 mm) and a Granular 'A' base (150 mm), as well as incorporating subdrains, to provide rapid drainage and reduce the effects of frost heaving. This is particularly critical at barrier-free access points. Alternatively, a structural frost slab or thermal insulation could be designed and constructed at door entrances.

### 5.7. Excavations

All excavations must be carried out in accordance with Ontario Regulation 213/91 (Reg 213/91) of the Occupational Health and Safety Act and Regulations for Construction Projects.

**Type 2 Soils** - In general, the hard or very dense native clayey silt, silt till, and sandy clayey silt till encountered in a drained state (not wet or saturated), would be classified as Type 2 soils under Reg 213/91. The Type 2 soils must be sloped to within 1.2 m of its bottom with a slope having a minimum gradient of 1 horizontal to 1 vertical. Soils underlain by Type 3 or Type 4 soils that are exposed in the excavation must be treated accordingly as Type 3 or Type 4 soils (see below). Soils in a saturated condition (if encountered) must be treated as Type 4 soils, addressed below.

**Type 3 Soils** - In general, the native sand, and any fill soils encountered in a drained state (not wet or saturated), would be classified as Type 3 soils under Reg 213/91. The Type 3 soils must be sloped from the bottom of the excavation at a minimum gradient of 1 horizontal to 1 vertical. All saturated soils encountered must be treated as Type 4 soils, as described below.

**Type 4 Soils** - In general, any wet to saturated soils would be classified as Type 4 soils under Reg 213/91. Type 4 soils must be sloped from the bottom of the excavation at a minimum gradient of 3 horizontal to 1 vertical.

If it is not practical to excavate according to the above requirements, then a trench support system (designed in accordance with the Ontario Health and Safety Act Regulations) may be utilized. When using a temporary trench support system consisting of trench boxes to reduce the lateral extent of the excavations, it should be noted that the support system is intended primarily to protect workers as opposed to controlling lateral soil movement. Any voids between the excavation walls and the support system should be immediately filled to reduce the potential for loss of ground and to provide support to existing adjacent utilities and roadways, and it is recommended that the excavation be carried out in short sections, with the support system installed immediately upon excavation completion.

As previously noted, the native clayey silt, silt and clay/clay and silt, and silt soils encountered in the lower zone of Boreholes 4, 5 and 6 became very dense/hard with depth (SPT N-values in excess of 50 blows per 0.3 m) and may prove difficult to

excavate with conventional excavating equipment, impacting the production schedule. It is imperative that when the very dense/hard soils are utilized as fill, the material must be broken down (pulverized) to minimize void space and reduce the potential for settlement.

#### **5.8. Construction Dewatering Considerations**

Wet to saturated soils were encountered in Boreholes 1 to 6, as described in Section 4.6 of this report. The relatively impermeable fine-grained, hard/very dense, clayey silt, silt till, as well as the sandy clayey silt till observed in the lower zone of the boreholes, may have the potential to create perched water conditions.

Seepage control requirements and groundwater conditions during construction are generally dependent on the amount of precipitation, control of surface water, the time of year, the area of work on the site, the depth of the excavations, and can fluctuate significantly in elevation and volume. As such, it is critical that provisions for site dewatering be part of the site development and construction process. As required, seepage should generally be adequately controlled using conventional construction dewatering techniques such as pumping from sump pits. However, if heavy seepage occurs, it may be necessary to increase the number of pumps during construction.

Dewatering should be performed in accordance with OPSS 517 and the control of water must be in accordance with OPSS 518. It is the responsibility of the contractor to propose a suitable dewatering system based on the groundwater elevation at the time of construction. Collected water should discharge a sufficient distance away from the excavation to prevent re-entry. Sediment control measures must be installed at the discharge point of the dewatering system to avoid any potential adverse impacts on the environment.

It is recommended that R.J. Burnside & Associates Limited be consulted prior to any on-site water being discharged to municipal outlets to ensure that proper procedures are followed.

#### **5.9. Service Pipe Bedding**

It is expected that the native soils encountered in the geotechnical investigation will be in a saturated state and therefore it is expected that it will be necessary to increase the thickness of the granular base and utilize 19 mm clear stone to create an adequate supporting base for the service pipes and/or manholes and catch basin structures. As such, it is recommended that provisions for extra pipe bedding and clear stone be part of the project tendering and construction process. The general contractor is responsible to protect service piping from damage by heavy equipment. Pipe embedment, cover and backfill for both flexible and rigid pipes should be in accordance with all current and applicable OPSS, OPSD, and OBC standards and guidelines, and as follows:

**Flexible Pipes** – The pipe bedding should be shaped to receive the bottom of the pipe. If necessary, pipe culvert frost treatment should be undertaken in accordance with OPSD-803.030 and OPSD-803.031. The trench excavations should be symmetrical with respect to the centreline of the pipe. The granular material placed under the haunches of the pipe must be compacted to 95% SPMDD prior to the continued placement and compaction of the embedment material. The homogeneous granular material used for embedment should be placed and compacted uniformly around the pipe. Should wet conditions be encountered at the base of the trench, the pipe bedding should consist of 19 mm clear crushed stone (meeting OPSS 1004 specifications). Normally, it would be recommended to wrap the clear crushed stone with geotextile to prevent fine soils from entering the clear stone and thereby creating voids around the pipe. However, in the saturated conditions expected, it is not typically feasible to wrap the clear stone, nor is it necessary, as the void space is quickly filled with fine soils as water (with suspended fine soils) rapidly enters the excavation.

**Rigid Pipes** - In general, the pipe installation recommendations for rigid pipes are the same as those for flexible pipes, except that the minimum bedding depth below a rigid pipe should be  $0.15D$  (where  $D$  is the pipe diameter). In no case should this dimension be less than 150 mm or greater than 300 mm.

#### **5.10. Perimeter Building Drainage, Foundation Wall Backfill and Trench Backfill**

In order to assist in maintaining a dry building with respect to surface water seepage, it is recommended that exterior grades around the buildings be sloped down and away at a 2% gradient or more, for a distance of at least 1.5 m to 2.0 m (depending on side yard setbacks). Any surface discharge rainwater leaders must be constructed with solid piping that discharges with positive drainage at least 1.5 m away from building foundations and/or beyond sidewalks to a drainage swale or appropriate storm drainage system.

The founding elevations for the proposed structures were not available at the time of preparation of this report. CMT Inc. can provide further recommendations for building drainage once the design drawings are completed and the founding elevations have been confirmed.

It should be noted that based on the observations in the boreholes, there is potential for perched water conditions. The construction of foundations, slabs-on-grade, and deep structures such as sump pits within or below zones of saturation will require design of site-specific waterproofing systems constructed in accordance with the 2012 OBC. If required, it would be recommended that a waterproofing supplier/specialist be consulted to recommend an appropriate product and installation requirements that would be suited to this site. It is recommended that a good quality sump pump be utilized, and that the system be equipped with a battery backup in the event of power failure, (keeping in mind that a battery backup system does not typically have a long run time).

It is anticipated that the new building will have a basement level. An exterior perimeter weeping tile system comprising perforated drainage pipe with a factory installed filter sock, bedded in 19 mm clear crushed stone and wrapped in geotextile filter fabric such as Terrafix 270R (or equivalent), must be installed at an elevation that is below the proposed basement slab-on-grade elevation and provided with positive drainage into a sump pit. The portion of the piping that connects the exterior weeping tile system into the sump pit must comprise solid piping to prevent exterior water from being introduced into the interior subslab stone. It may be prudent to install perforated drainage pipe in the interior basement as well to provide an outlet for any water that may collect in the subslab stone. It is also recommended that a capped cleanout port(s) be extended up to the ground surface elevation to provide future access (if required). The rainwater leaders must not be connected to the perimeter weeping tile system.

In order to reduce the effects of surficial frost heave in areas that will be hard surfaced, it is recommended that the exterior foundation backfill consist of free-draining granular material such as approved on-site sand and gravel or imported Granular 'B' Type I or Type III (OPSS 1010), with a maximum aggregate size not exceeding 100 mm, and that it extend a minimum lateral distance of 600 mm out from the foundation walls and/or beyond perimeter sidewalks and entranceway slabs. It is critical that particles greater than 100 mm in diameter are not in contact with the foundation wall to prevent point loading and overstressing. The backfill material used against the foundation walls must be placed so that the allowable lateral capacities of the foundation walls are not exceeded. Where only one side of a foundation wall will be backfilled, and the height of the wall is such that lateral support is required, or where the concrete strength has not been achieved, the wall must be braced or laterally supported prior to backfilling. In situations where both sides of the wall are backfilled, the backfill should be placed in equal lifts, not exceeding 200 mm differential on each side during backfill operations and the backfill should be compacted to a minimum of 98% SPMDD.

The native mineral soils (non-organic) are generally considered suitable for reuse as trench backfill and bulk fill in the driveways and parking lots; however, the wet soils may require air-drying in order to achieve the specified compaction. Air-drying cannot typically be achieved during winter construction; therefore, depending on the time of year that construction takes place, it may be more feasible to utilize an imported granular fill for this project.

Backfilling operations should be carried out with the following minimum requirements:

- Adequate heavy smooth drum or padfoot vibratory compaction equipment (suited to soil type) should be used for the compaction and to break down any large blocky pieces of soil;
- Loose lift thicknesses should not exceed 0.3 m (12") for granular soils or 0.2 m (8") for silt soils or the capacity of the compactor (whichever is less);

- The soils must be at suitable moisture contents to achieve compaction to a minimum 95% SPMDD in non-structural bulk fill areas. Service trenches excavated the zone of influence of footings for structures must be compacted to a minimum of 98% SPMDD;
- It is recommended that inspection and testing be carried out during construction to confirm backfill quality, thickness and to ensure that compaction requirements are achieved;
- Service trench backfill materials may consist of approved excavated soils with no particles greater than 100 mm and no topsoil or other deleterious materials;
- If construction operations are undertaken in the winter, strict consideration should be given to the condition of the backfill material to make certain that frozen material is not used.

#### **5.11. Pavement Design/Drainage**

All topsoil and vegetation (including tree roots and all loose/disturbed soils containing roots or organics material), and any loose/soft native soils, must be subexcavated from within the proposed driveways and parking lot areas. It is recommended to either subexcavate any existing soft subgrade materials or provide further consolidation with vibratory compaction equipment in order to prepare a proper, stable subgrade.

Prior to placement of the granular base, the subgrade must be proof-rolled, and any soft or unstable areas should be subexcavated and replaced with suitable drier materials. The subgrade should be graded smooth (free of depressions) and properly crowned to ensure positive drainage, with a minimum grade of 3% toward the catch basins or to the parking lot/driveway edge (provided that collection and proper gravity drainage to a suitable outlet is provided). When service pipes are installed, pipe bedding and backfilling should be undertaken as indicated in Sections 5.9 and 5.10 of this report.

Rapid drainage of the pavement structure is critical to ensure long-term performance and to help minimize frost heave. The requirement for subdrains will be dependent on the composition of the prepared pavement subgrade soils. Some of the native soils encountered in the boreholes are frost-susceptible soils and, as such, it is recommended to install subdrains (provided gravity drainage to a suitable outlet can be provided). It is recommended to install minimum 100 mm diameter perforated subdrains to collect and redirect water beneath the pavement surface. Subdrains should be designed and installed in accordance with OPSS 405 and OPSD 216.021. If Granular 'A' bedding (OPSS 1010) is utilized, the subdrains should be equipped with a factory installed filter sock. If 19 mm clear stone (OPSS 1004) is utilized as bedding for the subdrain, then the bedding must be wrapped completely with geotextile filter fabric such as Terrafix 270R (or equivalent) and a factory installed filter sock is not required. Installation of rigid subdrains allows for better grade control and less potential for damage during installation; however, it would

be expected that there would be higher cost implications associated with the installation of rigid subdrains over flexible subdrains. Positive drainage through grade control of subdrains is critical, as improperly installed subdrains can turn drainage systems into reservoirs, which can fuel frost action. The subdrains will hasten the removal of water, thereby reducing the risk and effects of frost heaving and load transfer in saturated conditions. It is suggested that, at a minimum, subdrains be installed through all low areas in the parking lot and driveways, and ideally along the curb lines as well to prevent water from entering the granular subbase. The subdrains should be installed in a 0.3 m (1.0 ft) by 0.3 m (1.0 ft) trench in the subgrade and bedded approximately 50 mm (2") above the bottom of the trench. The subgrade must be prepared with positive drainage to the subdrains and the subdrains must be installed with positive drainage into a catch basin structure or other suitable outlet.

Should the subgrade soils comprise free-draining granular soils (minimum 1.0 m thick with positive drainage at the interface with any relatively impermeable soils), then the installation of subdrains may not be required.

The native subgrade soils are sensitive to change in moisture content and can become loose or soft if the soils are subject to inclement weather and seepage or severe drying. Furthermore, the subgrade soils could be easily disturbed if traveled on during construction. As such, where this material will be exposed, it is recommended that the granular subbase be placed immediately upon completion of the subgrade preparation to protect the integrity of the subgrade soils.

It is expected that the driveways and parking lots will experience light traffic (personal vehicles) and some heavy traffic (delivery trucks, as well as maintenance and emergency vehicles). Based on the anticipated vehicle loading and frost-susceptibility of the subgrade soils, the following pavement design is provided:

Material	Recommended Thickness For New Pavement	
	Light Traffic	Heavy Traffic
Asphaltic Concrete	HL3-40 mm (1.5") HL4 or HL8-50 mm (2.0")	HL3-50 mm (2.0") HL4 or HL8-60 mm (2.5")
Granular 'A' Base	150 mm (6.0")	150 mm (6.0")
Granular 'B' Subbase	400 mm (16.0")	450 mm (18.0")

Given the potential for wet subgrade conditions, it is recommended that the driveways and parking lot subgrade soils be assessed at the time of excavation by qualified personnel. Depending on conditions encountered at the time of construction, different options may need to be undertaken to construct a stable driveway and parking lot base. These options may include subexcavation and increasing the thickness of the Granular 'B' subbase, the use of reinforcing geotextile and/or geogrid, or a combination of all. As such, it is recommended that provisions for subexcavation and disposal of wet soils, importing and placing additional Granular 'B' (OPSS 1010), as well as supply and



placement of a reinforcing geotextile (Terrafix 270R or equivalent) and geogrid (Tensar BX1200 or equivalent) should be included in the tender documents.

The granular base and subbase materials must conform to the physical property and gradation requirements of OPSS 1010 and must be compacted to 100% SPMDD. Asphaltic concrete should be supplied, placed and compacted to a minimum 92.0% Marshall maximum relative density, in accordance with OPSS 1150 and OPSS 310.

Construction joints in the surface asphalt must be offset a minimum of 150 mm to 300 mm (6" to 12") from construction joints in the binder asphalt so that longitudinal joints do not coincide.

Frost tapers must be constructed at any changes from light traffic to heavy traffic areas within the driveways and parking lots. If heavy traffic routes are not delineated by barriers or if it is anticipated that heavy equipment (such as loader and dump trucks) will be utilized for snow removal, it would be recommended that the heavy traffic pavement structure be utilized throughout the driveways and parking lots.

Where new asphalt is joined into existing asphalt, it is recommended that the existing asphalt be sawcut in a straight line prior to being milled to a depth of 40 mm and a width of 150 mm as per OPSD 509.010. It is recommended that a tackcoat be applied to the edge and surface of all milled asphalt prior to placement of new asphalt in conformance with OPSS 308.

The pavement should be designed to ensure that water will not pond on the pavement surface. If the surface asphalt is not placed within a reasonable time following placement of the binder asphalt, it is recommended that the catch basin lids are set at a lower elevation or apertures provided to allow surface water to drain into the catch basins and not accumulate around the catch basins. The strength of the pavement structure relies on all of the components to be in place in order to provide the design strength; therefore, it is strongly recommended that the surface asphalt be placed shortly after placement of the binder asphalt so as to avoid undue stress on the binder asphalt by not having the complete pavement structure in place.

It should be noted that, currently, asphalt mixes tend to be more flexible and, as such, there is a tendency for damage to occur from vehicles turning their steering wheels or applying excessive brake pressure. The damage can occur from both passenger vehicles as well as large vehicles. The condition is further intensified during hot weather. In high traffic/tight turning areas, it is recommended that rigid Portland cement pavement be considered.

## 5.12. Excess Soil Management

### 5.12.1 Chemical Testing was NOT Undertaken

Generally, if surplus soils are to be exported off-site, it will be necessary to perform chemical analysis of the soils. Chemical analysis was not undertaken as part of this geotechnical investigation. Should chemical analysis tests be required, the required tests vary and will be dependent on the disposal site utilized by the general contractor.

Most commonly, the soils are tested for the following:

- F1-F4, VOC's, BTEX as per O. Reg. 153/04 as amended by R511
- SVOC as per O. Reg. 153/04 as amended by R511
- Metals/Inorganics as per O. Reg. 153/04 amended by R511

The chemical analysis results are then compared to Ontario Regulation 153/04 - as amended by O.Reg. 511 – April 15, 2011 Standards = [Suite] – ON-511-T1/T2-SOIL-RPI.

### 5.12.2 TCLP Requirement

If soils are transported to a landfill facility, additional chemical testing in accordance with Ontario Regulation 347, Schedule 4, as amended to Ontario Regulation 558/00, dated March 2001, Toxicity Characteristic Leaching Procedure (TCLP) will be required.

When transporting soils off-site, the following is recommended:

- All chemical analyses and environmental assessment reports must be fully disclosed to the receiving site owners/authorities, who must agree to receive the material.
- An environmental consultant must confirm the land use at the receiving site is compatible to receive the material.
- An environmental consultant must monitor the transportation and placement of the materials to ensure that the material is placed appropriately at the pre-approved site.
- The excess materials may not be transported to a site that has previously had a Record of Site Condition (RSC) filed, unless the material meets the criteria outlined in the RSC.

It should be noted that landfill sites will generally only accept laboratory test results that have been completed within 30 days of exporting. Therefore, it is recommended that provisions for chemical analysis be included in the tender documents. It should also be noted that the laboratory testing generally takes five (5) working days to process with a regular turnaround time.

### 5.13. Coefficient of Permeability/T-time

As part of the geotechnical investigation, gradation analyses were performed on samples of the native clayey silt, the silt and clay/clay and silt, as well as the silt soils. The following table provides the sample location (monitoring well/borehole number), sample depth, corresponding estimated coefficient of permeability (k) and T-time, as well as soil type:

Borehole No.	Depth (m)	Estimated Coefficient of Permeability (k) cm/s	Estimated T-time (T) min/cm	Soil Type
1	0.76 – 1.37	$< 1.0 \times 10^{-6}$	> 50	Clay and silt, some sand, trace gravel (ML)
2	1.52 – 2.13	$< 1.0 \times 10^{-6}$	50	Clayey, sandy silt trace gravel (ML)

### 5.14. Radon

According to information provided by Health Canada, radon is a radioactive gas that is naturally formed through the breakdown of uranium in soil, rock and water. When radon escapes the earth in the outdoors, it mixes with fresh air, resulting in concentrations that are too low to be of concern. However, when radon enters an enclosed space, such as a building, high concentration of radon can accumulate and become a health concern. Health Canada indicates that most buildings have some level of radon in them. Unfortunately, it is not possible to predict before construction whether or not a new building will have high radon levels as radon can only be detected by radon measurement devices, which would be installed in a home, post construction. Section 9.13.4.1 Soil Gas Control of the current 2012 Ontario Building Code (OBC) states that "*Where methane or radon gases are known to be a problem, construction shall comply with the requirements for soil gas control in MMAH Supplementary Standard SB-9, Requirements for Soil Gas Control*".

## **6.0 SITE INSPECTIONS**

Qualified geotechnical personnel should supervise excavation inspections as well as compaction testing for structural filling, site grading and site servicing. This will ensure that footings are founded in the proper strata and that proper material and techniques are used and the specified compaction is achieved. CMT Engineering Inc. would be pleased to review the design drawings and provide an inspection and testing program for the construction of the proposed development.

## **7.0 LIMITATIONS OF THE INVESTIGATION**

This report is intended for the Client named herein and for their Client. The report should be read in its entirety, and no portion of this report may be used as a separate entity. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review our recommendations when the drawings and specifications are complete, or if the proposed construction should differ from that mentioned in this report.

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments are based on the results obtained at the test locations only. It is therefore assumed that these results are representative of the subsoil conditions across the site. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations.

It should be noted that this report specifically addresses geotechnical aspects of the project and does not include any investigations or assessments relating to potential subsurface contamination. As such, there should be no assumptions or conclusions derived from this report with respect to potential soil or water contamination. Soil or water contamination is generally caused by the presence of xenobiotic (human-made) chemicals or other alteration processes in the natural soil and groundwater environment. If necessary, the investigation, assessment and rehabilitation of soil and water contaminants should be undertaken by qualified environmental specialists.

The samples obtained during the geotechnical investigation will be stored for a period of three months, after which time they will be disposed of unless alternative arrangements are made.

We trust that this report meets with your present requirements. Should you have any questions, please do not hesitate to contact our office.

Prepared by:



Shawn Wheatley, M.Eng.

ks

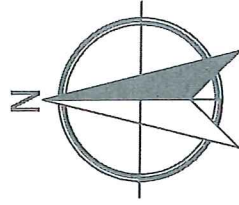


Reviewed by:

Nathan Chortos, P.Eng.

NOTES:

Base map provided by Google Maps



NO.	DESCRIPTION	DATE

REVISIONS

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 Clarendon, Ontario, N0B 2N0  
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PROJECT:

Geotechnical Investigation  
Ninth Line,  
Mississauga, Ontario

DRAWING TITLE:

SITE LOCATION MAP

PROJECT NO:

20-026

DATE:

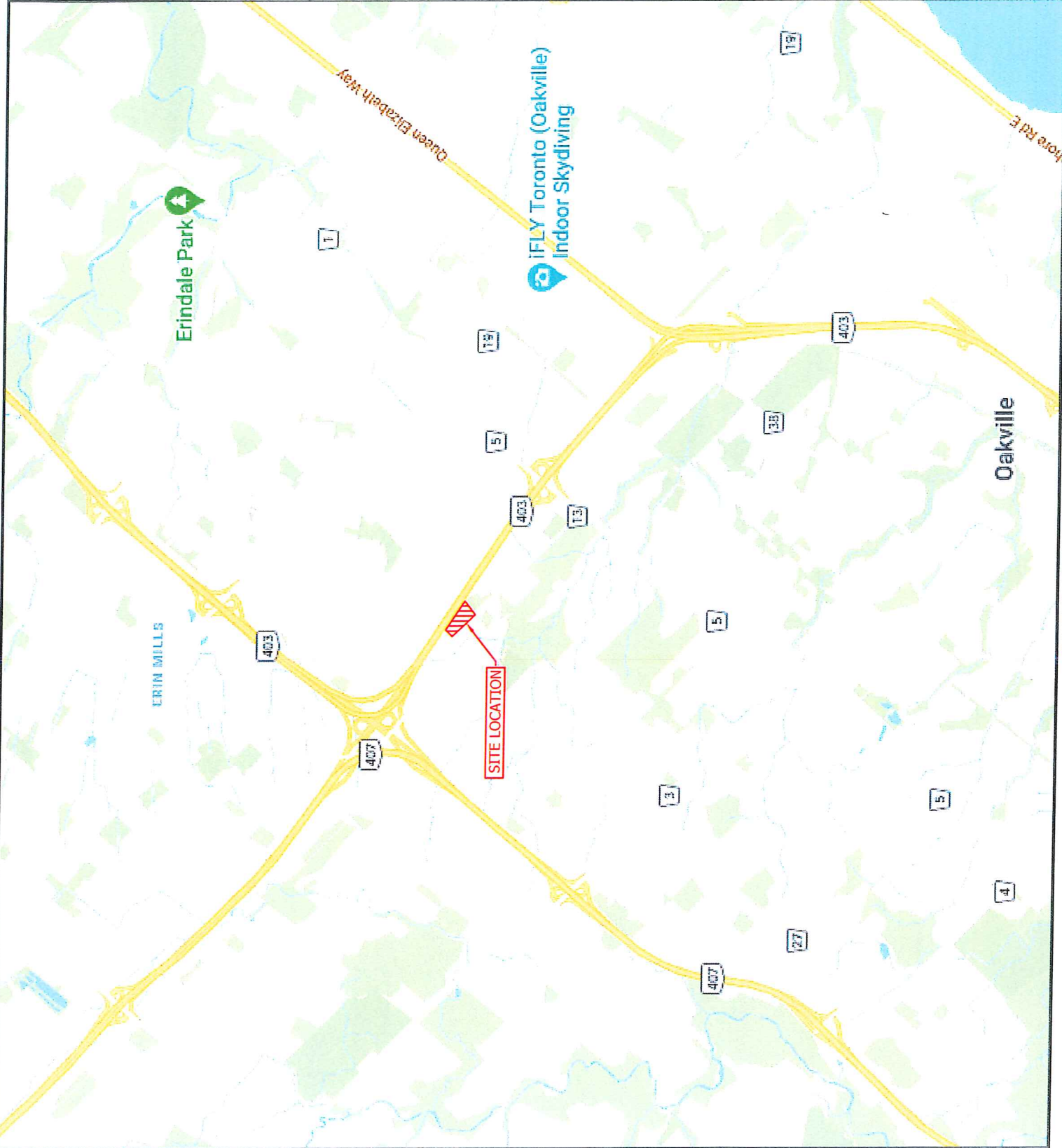
February 19, 2020

SCALE:

N.T.S.

DRAWING NO:

1

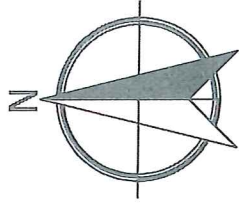


**NOTES:**

1. This drawing is for information purposes only. Locations and sizes of existing and proposed structures are approximate only, and should not be used for construction.
2. Base drawing provided by Google Maps
3. Benchmark: Geodetic Monument  
Station 00119643010  
Reported Elevation = 181.090 m

**LEGEND**

-  CMT Borehole (2020)
-  Benchmark



NO.	DESCRIPTION	DATE

**REVISIONS**

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Fax: 519-659-4664  
www.cmt-inc.net

**PROJECT:**

Geotechnical Investigation  
Ninth Line,  
Mississauga, Ontario

**DRAWING TITLE:**

SITE PLAN SHOWING  
BOREHOLE LOCATIONS

**PROJECT NO.:**

20-026

**DATE:**

February 19, 2020

**SCALE:**

N.T.S.

**DRAWING NO.:**

2



**APPENDIX A**

**BOREHOLE LOGS**

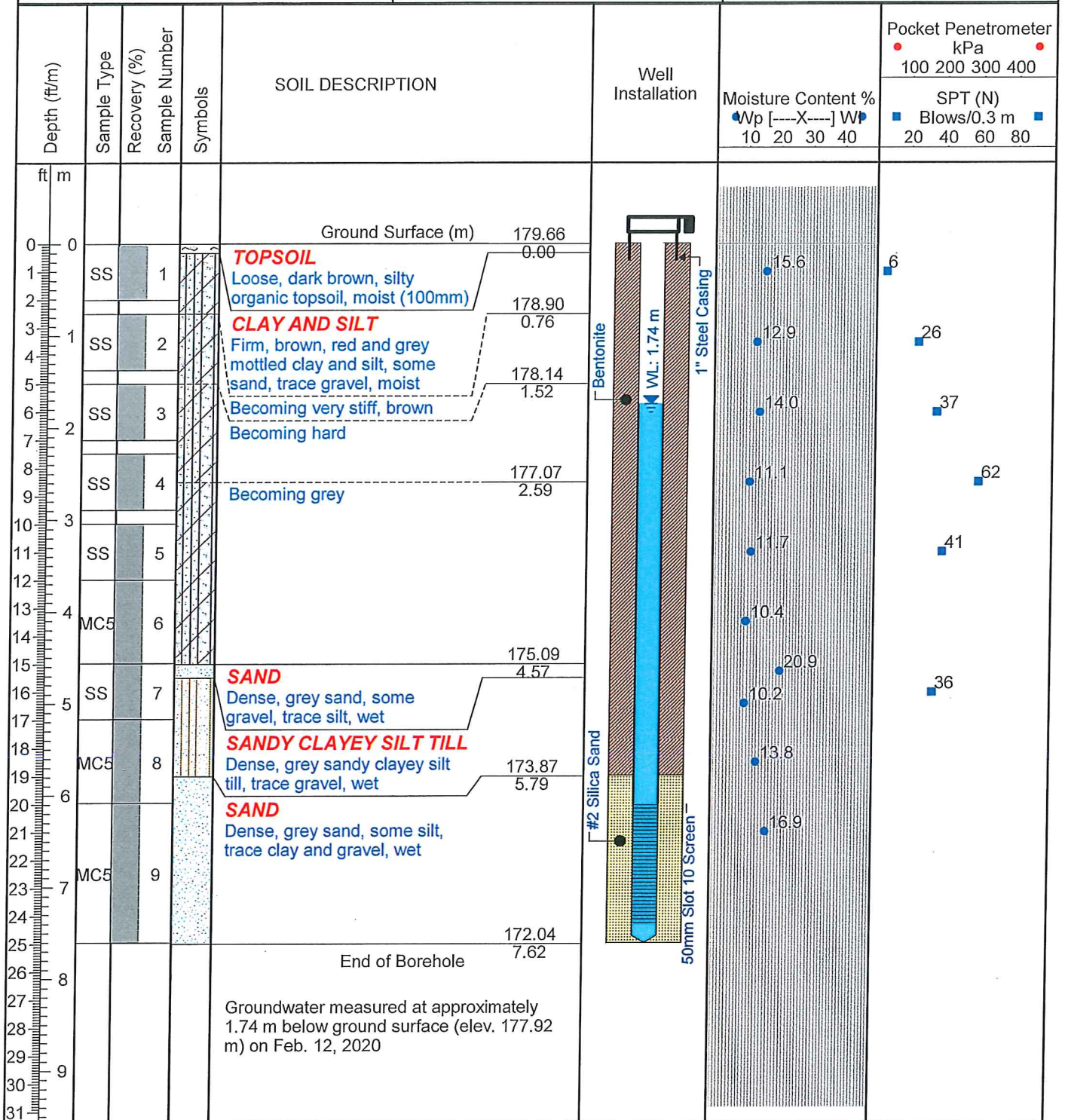


# BOREHOLE 1

Date Drilled: February 10, 2020  
 Rig: Geoprobe 7822DT  
 Contractor: CMT Drilling Inc.  
 Drilling Method: SPT

Elevation: 179.66 m  
 Logged by: SW

Project No.: 20-026  
 Project: Geotech - Proposed Church  
 Location: Ninth Line, Mississauga, ON



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# BOREHOLE 2

Date Drilled: February 12, 2020  
 Rig: Geoprobe 7822DT  
 Contractor: CMT Drilling Inc.  
 Drilling Method: SPT

Elevation: 179.52 m  
 Logged by: SW

Project No.: 20-026  
 Project: Geotech - Proposed Church  
 Location: Ninth Line, Mississauga, ON

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Well Installation	Moisture Content % Wp [---X---] Wp 10 20 30 40	Pocket Penetrometer kPa	
								100	200 300 400
								SPT (N) Blows/0.3 m	
								20	40 60 80
0					Ground Surface (m) 179.52				
0					<b>TOPSOIL</b> Loose, dark brown, silty organic topsoil, moist (100mm)				
1	SS		1				29.9		1
2									
3	SS		2		<b>CLAYEY SANDY SILT</b> Very soft, dark brown clayey, sandy silt, trace gravel, with trace organics and rootlets, moist		18.3		11
4									
5									
6	SS		3		Becoming stiff, brown, with no organics and rootlets		11.0		36
7					Becoming hard				
8	SS		4				11.3		
9							7.7		50(3")
10					<b>SILT TILL</b> Very dense, grey silt till, some sand and clay, moist				
11	SS		5				8.5		50(4")
12									
13							10.6		
14	MC5		6		<b>SAND</b> Very dense, grey sand, some silt, trace clay and gravel, wet		20.2		
15									
16					End of Borehole				
17									
18									
19									
20									
21					Borehole caved at about 3.05 m below ground surface.				
22									
23					Accumulated groundwater encountered at approximately 2.74 m below ground surface in open borehole.				
24									
25									
26									
27									

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# BOREHOLE 3

Date Drilled: February 12, 2020  
 Rig: Geoprobe 7822DT  
 Contractor: CMT Drilling Inc.  
 Drilling Method: SPT

Elevation: 180.13 m  
 Logged by: SW

Project No.: 20-026  
 Project: Geotech - Proposed Church  
 Location: Ninth Line, Mississauga, ON

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Well Installation	Moisture Content % Wp [---X---] Wp 10 20 30 40	Pocket Penetrometer	
								kPa	SPT (N) Blows/0.3 m
								100 200 300 400	20 40 60 80
0					Ground Surface (m) 180.13				
0.00					<b>TOPSOIL</b> Loose, dark brown, silty organic topsoil, moist (90mm)				
1	SS	1					26.1	3	
1.79					179.37				
0.76					<b>CLAYEY SILT</b> Soft, brown and dark brown mottled clayey silt, some sand, trace gravel, organics and rootlets, moist		13.3	30	
1.52					178.61				
1.52					Becoming very stiff, brown, no organics and rootlets		13.7	35	
2					Becoming hard				
2	SS	2					10.8	54	
3									
3	SS	3					12.8		
3									
3	SS	4					14.5		
3									
3	SS	5					12.9		
3									
3	SS	6					10.2	36	
3									
3.61					176.52				
3.61					<b>SILT TILL</b> Very dense, light brown silt till, some clay and sand, moist				
4	MC5	6							
4									
4.67					175.46				
4.67					<b>SANDY CLAYEY SILT TILL</b> Hard, grey sandy clayey silt till, trace gravel, moist				
5.18					174.95				
5.18					End of Borehole				
5.03					Borehole caved at about 5.03 m below ground surface.				
4.72					Accumulated groundwater encountered at approximately 4.72 m below ground surface in open borehole.				

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# BOREHOLE 4

Date Drilled: February 12, 2020  
 Rig: Geoprobe 7822DT  
 Contractor: CMT Drilling Inc.  
 Drilling Method: SPT

Elevation: 182.49 m  
 Logged by: SW

Project No.: 20-026  
 Project: Geotech - Proposed Church  
 Location: Ninth Line, Mississauga, ON

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Well Installation	Moisture Content % Wp [---X---] Wl	Pocket Penetrometer	
								kPa	SPT (N)
							10 20 30 40	100 200 300 400	20 40 60 80
0					Ground Surface (m) 182.49				
0.00					<b>TOPSOIL</b> Loose, dark brown, silty organic topsoil, moist (100mm)		23.9	3	
0.76					<b>CLAYEY SILT</b> Soft, brown and dark brown mottled clayey silt, some sand, trace gravel, organics and rootlets, moist		14.4	30	
2.29					Becoming very stiff, brown, no organics and rootlets		13.3	28	
2.29					Becoming hard		12.3	45	
3.20					<b>SANDY CLAYEY SILT TILL</b> Very dense, brown sandy clayey silt till, trace gravel, moist		11.0	50(4")	
3.81					Becoming grey		12.0		
4.72					<b>SILT TILL</b> Dense, grey silt till, some sand and clay, moist		10.0		
5.18							13.3	41	
5.18					End of Borehole				
4.67					Borehole caved at about 4.67 m below ground surface.				
					No accumulated groundwater encountered in open borehole.				

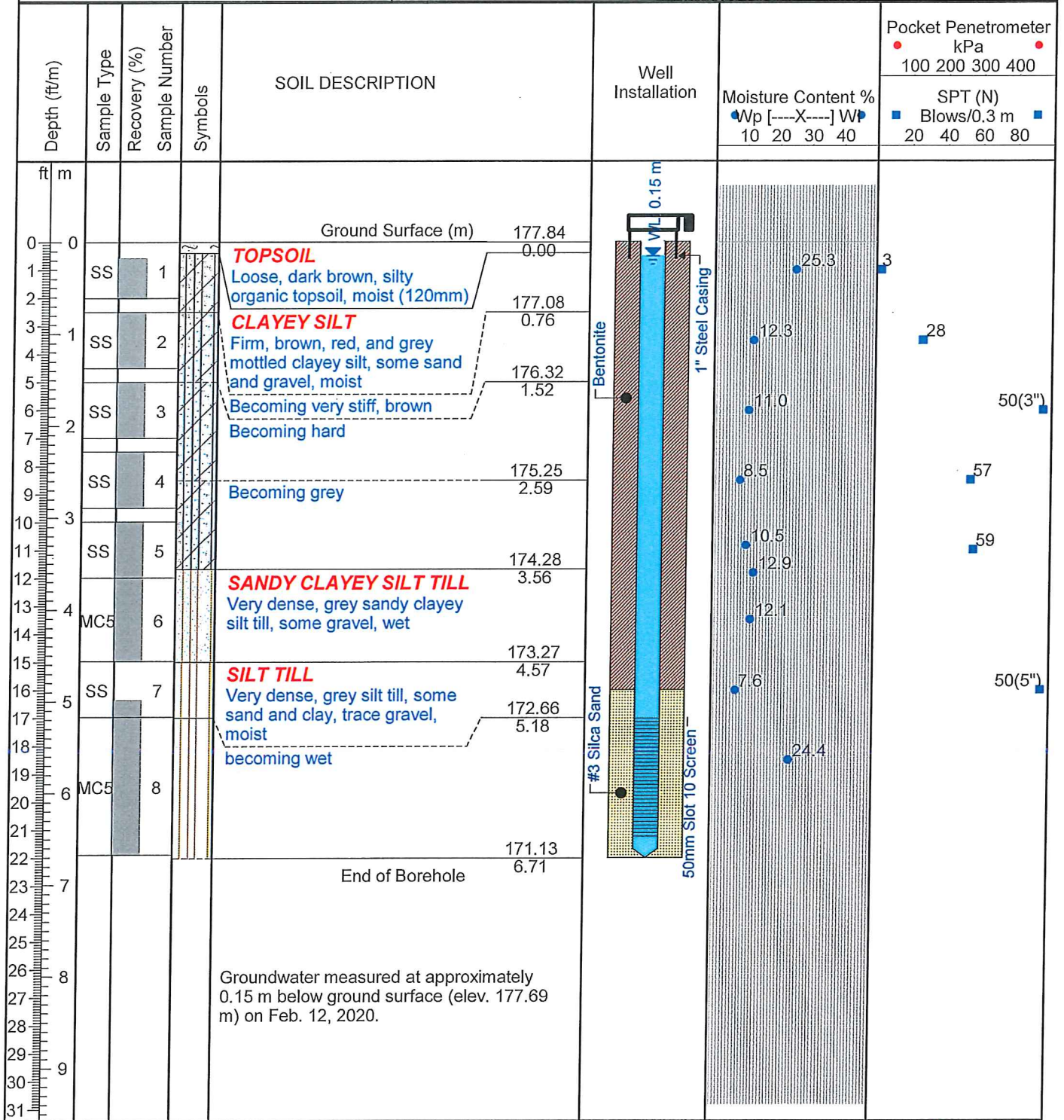


# BOREHOLE 5

Date Drilled: February 10, 2020  
 Rig: Geoprobe 7822DT  
 Contractor: CMT Drilling Inc.  
 Drilling Method: SPT

Elevation: 177.84 m  
 Logged by: SW

Project No.: 20-026  
 Project: Geotech - Proposed Church  
 Location: Ninth Line, Mississauga, ON



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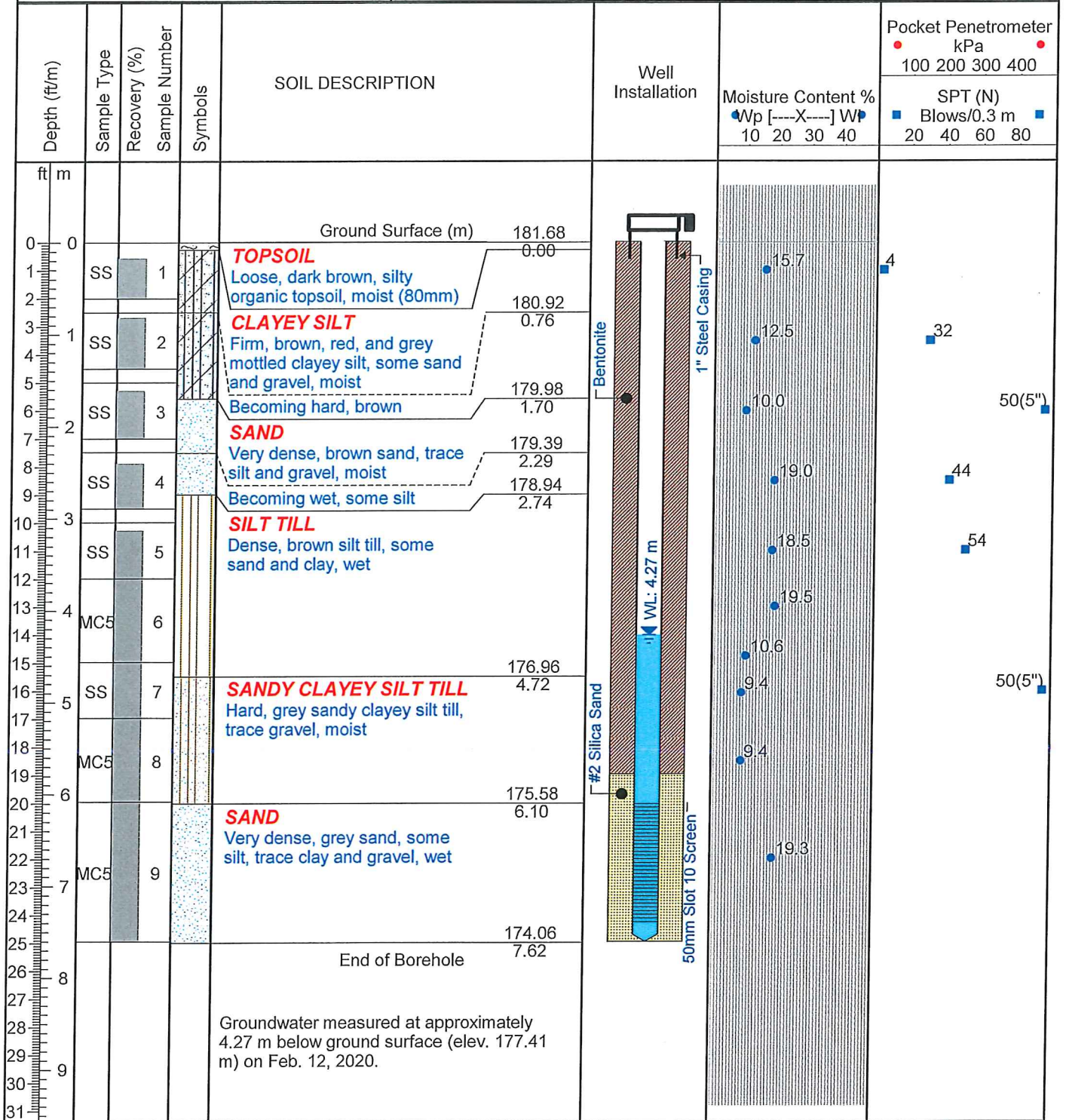


# BOREHOLE 6

Date Drilled: February 10, 2020  
 Rig: Geoprobe 7822DT  
 Contractor: CMT Drilling Inc.  
 Drilling Method: SPT

Elevation: 181.68 m  
 Logged by: SW

Project No.: 20-026  
 Project: Geotech - Proposed Church  
 Location: Ninth Line, Mississauga, ON



Groundwater measured at approximately 4.27 m below ground surface (elev. 177.41 m) on Feb. 12, 2020.

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# BOREHOLE 7

Date Drilled: February 12, 2020  
 Rig: Geoprobe 7822DT  
 Contractor: CMT Drilling Inc.  
 Drilling Method: SPT

Elevation: 179.02 m  
 Logged by: SW

Project No.: 20-026  
 Project: Geotech - Proposed Church  
 Location: Ninth Line, Mississauga, ON

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Well Installation	Moisture Content % Wp [---X---] Wp 10 20 30 40	Pocket Penetrometer kPa	
								100	200 300 400
								SPT (N) Blows/0.3 m	
								20	40 60 80
					Ground Surface (m)	179.02			
0					<b>TOPSOIL</b> Loose, dark brown, silty organic topsoil, moist (50mm)	0.00	16.4	7	
1	SS	1			<b>CLAYEY SILT</b> Soft to firm, brown and dark brown mottled clayey silt, some sand, trace gravel, organics and rootlets, moist Becoming very stiff, brown, no organics and rootlets Becoming hard, red	178.26	12.8	26	
2				0.76					
3	SS	2				177.29	11.6	36	
4						1.73			
5	SS	3			<b>SILT TILL</b> Dense, grey silt till, some sand and clay, moist	175.97	11.1	56	
6						3.05	8.4	48	
7	SS	4					8.8		
8							9.0	28	
9	SS	5				173.84			
10					End of Borehole	5.18			
11	SS	6							
12	MC5	6							
13									
14	SS	7							
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									

Borehole open to termination.  
 No accumulated groundwater encountered in open borehole.

CMT ENGINEERING INC.  
 1011 Industrial Crescent, Unit 1  
 St. Clements, Ontario NOB 2M0  
 phone 519-699-5775 fax 519-699-4664  
 www.cmtinc.net

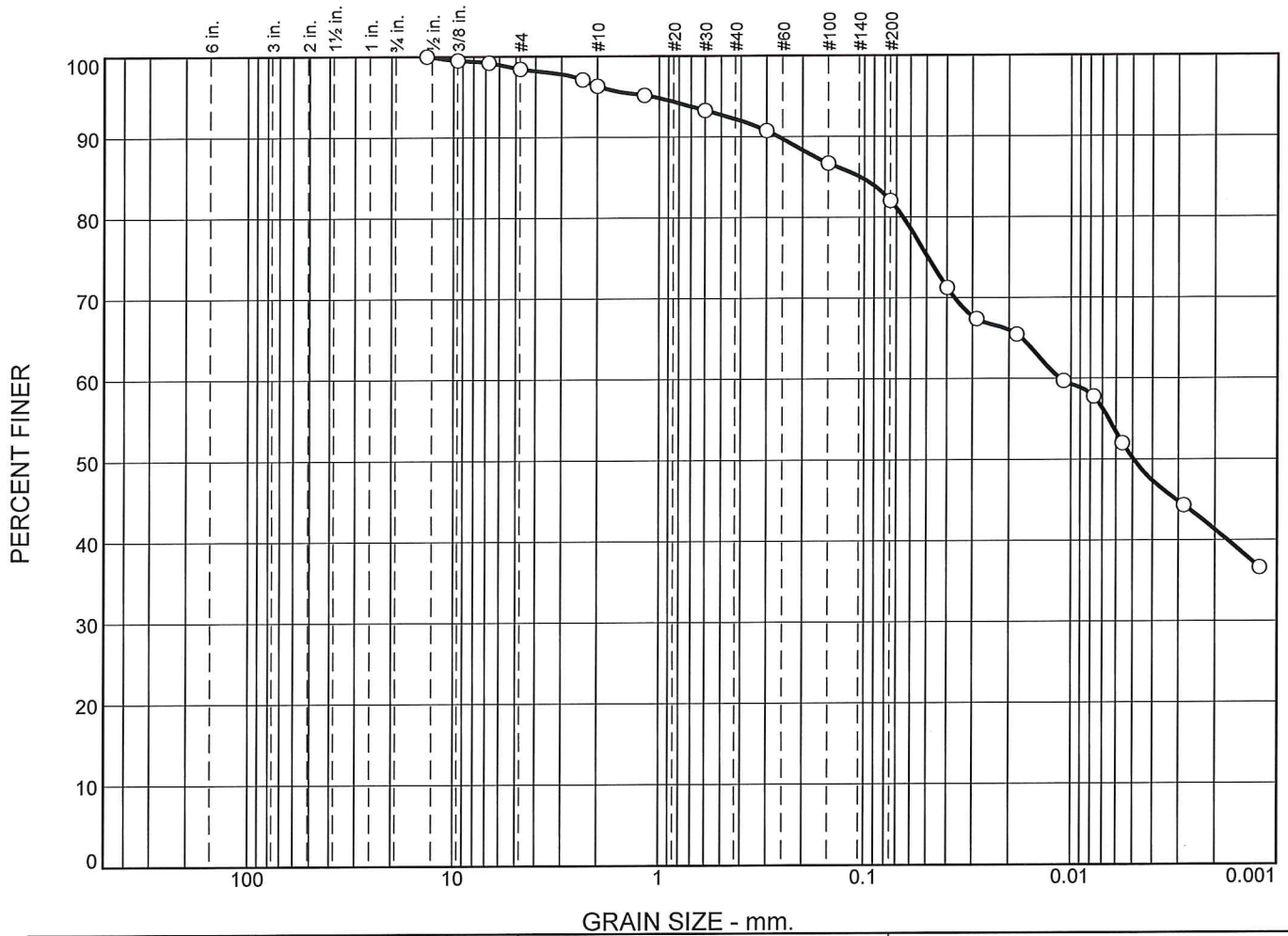


**APPENDIX B**

**GRAIN SIZE ANALYSES**



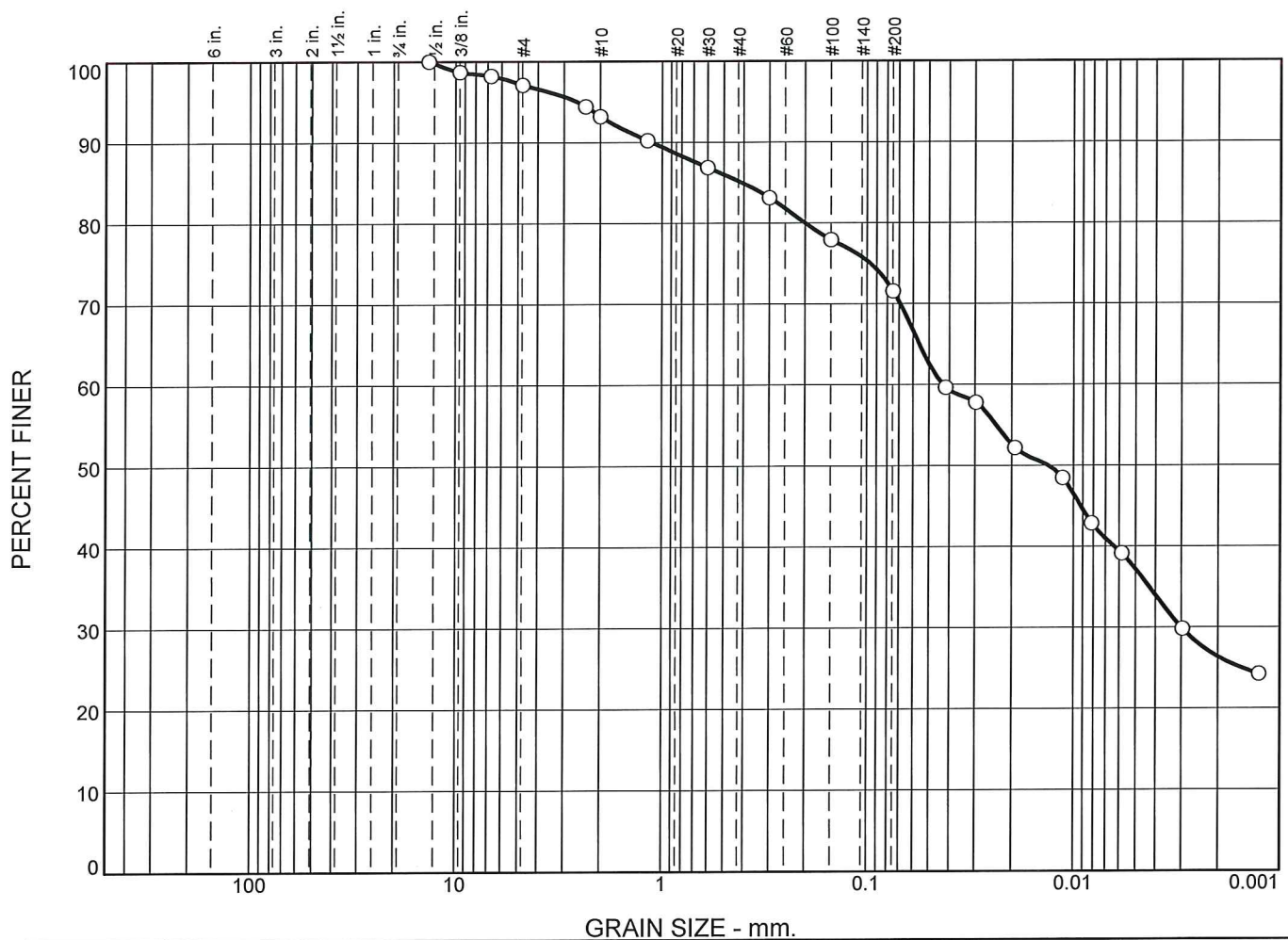
# Particle Size Distribution Report



%	Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.6	2.1	4.1	10.1	40.8	41.3

SOIL DATA					
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH1	2	0.76-1.37m	clay and silt, some sand, trace gravel	ML
				Sampled by SW of CMT Engineering Inc., February 12, 2020	
				Tested by JM of CMT Engineering Inc., February 14, 2020	

# Particle Size Distribution Report

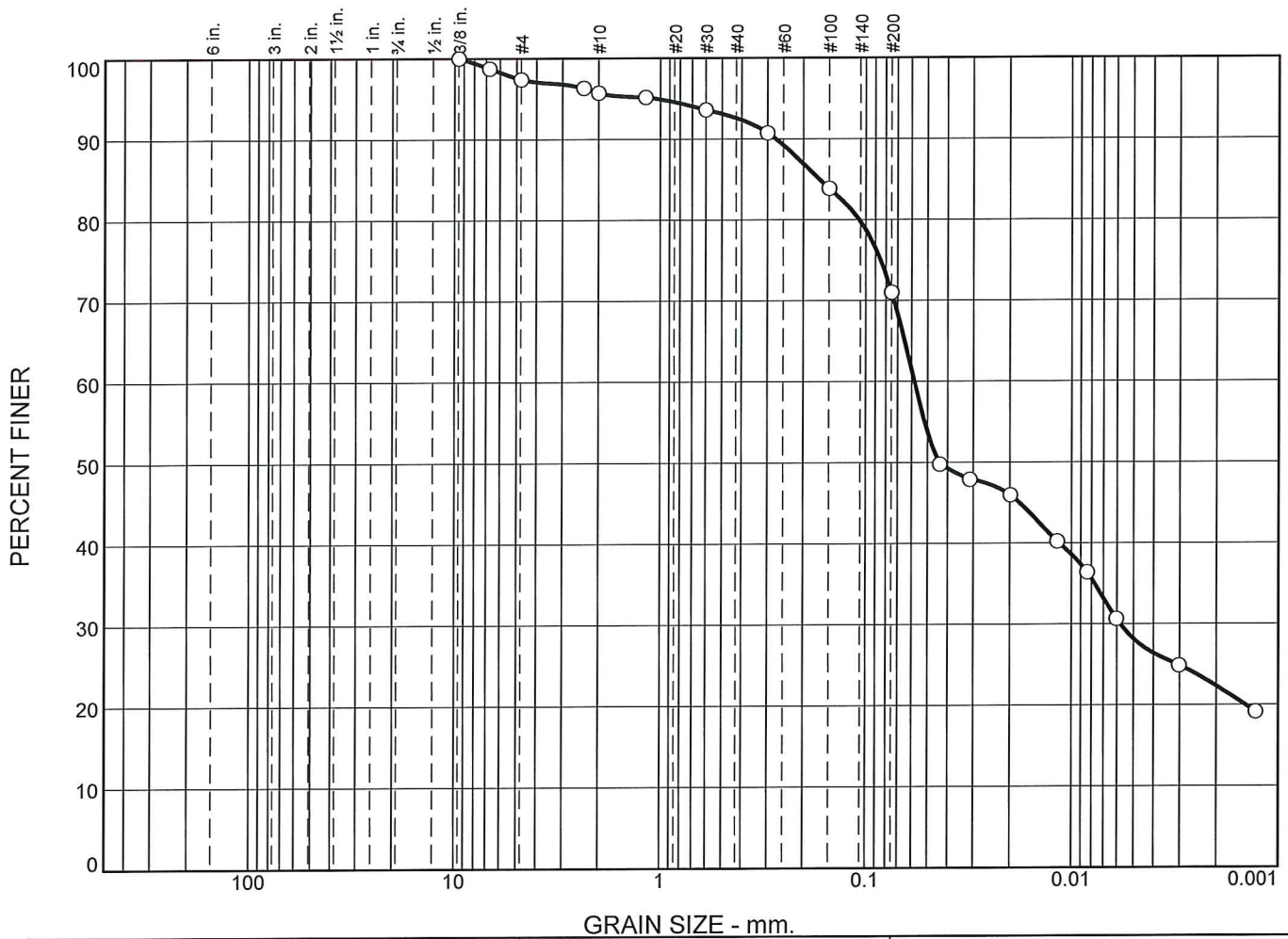


Symbol	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.9	3.9	8.0	13.6	45.2	26.4

SOIL DATA					
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH2	3	1.52-2.13m	clayey, sandy silt, trace gravel	ML
				Sampled by SW of CMT Engineering Inc., February 12, 2020	
				Tested by JM of CMT Engineering Inc., February 14, 2020	

<p><b>CMT Engineering Inc.</b></p> <p><b>St. Clements, ON</b></p>	<p><b>Client:</b> St. Mark and St. Demiana Coptic Orthodox Church</p> <p><b>Project:</b> Ninth Line Mississauga, Ontario</p> <p><b>Project No.:</b> 20-026</p> <p style="text-align: right;"><b>Figure 2</b></p>
---	--

# Particle Size Distribution Report

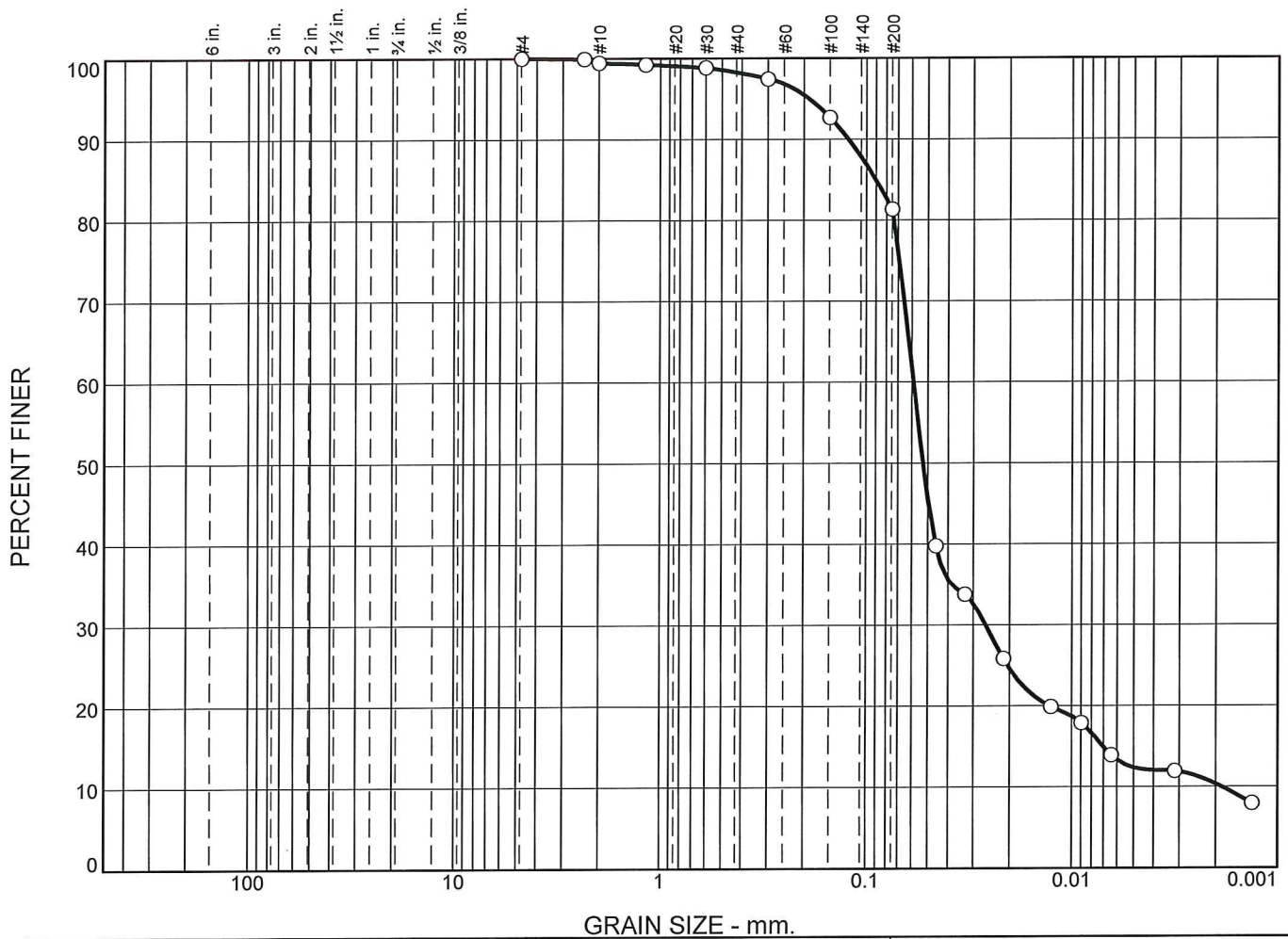


	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.6	1.7	3.1	21.6	48.7	22.3

SOIL DATA					
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH4	6	3.66-4.57m	sandy, clayey silt, trace gravel	ML
				Sampled by SW of CMT Engineering Inc., February 12, 2020	
				Tested by JM of CMT Engineering Inc., February 14, 2020	

<p><b>CMT Engineering Inc.</b></p> <p><b>St. Clements, ON</b></p>	<p><b>Client:</b> St. Mark and St. Demiana Coptic Orthodox Church</p> <p><b>Project:</b> Ninth Line Mississauga, Ontario</p> <p><b>Project No.:</b> 20-026</p> <p style="text-align: right;"><b>Figure 3</b></p>
---	--

# Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.6	1.1	17.0	70.9	10.4

SOIL DATA					
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH6	5	3.05-3.66m	silt, some sand and clay	ML
				Sampled by SW of CMT Engineering Inc., February 12, 2020	
				Tested by JM of CMT Engineering Inc., February 14, 2020	

<p style="font-size: 1.2em; font-weight: bold; margin: 0;">CMT Engineering Inc.</p> <p style="font-size: 1.2em; font-weight: bold; margin: 10px 0 0 0;">St. Clements, ON</p>	<p><b>Client:</b> St. Mark and St. Demiana Coptic Orthodox Church</p> <p><b>Project:</b> Ninth Line Mississauga, Ontario</p> <p><b>Project No.:</b> 20-026</p> <p style="text-align: right;"><b>Figure</b> 4</p>
--	--

**APPENDIX C**  
**WELL RECORDS**



Measurements recorded in:  Metric  Imperial

A282604

Page 1 of 1

Well Owner's Information

First Name: THE DIOCESE OF MISSISSAUGA, VANCOUVER AND WESTERN CANADA ATTN: MOHER MICHAEL
Last Name / Organization:
E-mail Address:
Mailing Address (Street Number/Name): 2188 ROBINWOOD COURT
Municipality: MISSISSAUGA
Province: ON
Postal Code: L5H5B9

Well Location

Address of Well Location (Street Number/Name): NINTH LINE (500M SE OF BURNHAMTHORPE RDE)
Township: OAKVILLE
City/Town/Village:
Province: Ontario
Postal Code:
UTM Coordinates Zone, Easting, Northing: NAD 83 1760397114819466

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

Table with 5 columns: General Colour, Most Common Material, Other Materials, General Description, Depth (m/ft) From To. Rows include BLACK TOPSOIL, BROWN SILT CLAY HARD, GREY SILT CLAY DENSE, GREY SAND SILT DENSE.

Annular Space table with columns: Depth Set at (m/ft) From To, Type of Sealant Used (Material and Type), Volume Placed (m³/ft³). Rows show 0 to 5.4 and 5.4 to 7.6 depths with sealants like 3/8 HOPEPLUS and #2 SAND.

Results of Well Yield Testing table with columns: Draw Down (Time, Water Level), Recovery (Time, Water Level). Includes data for static level, pump intake, pumping rate, and flow rate.

Method of Construction and Well Use checkboxes. Method of Construction includes Rotary (Conventional), Boring, etc. Well Use includes Public, Commercial, Municipal, etc.

Construction Record - Casing table with columns: Inside Diameter (cm/in), Open Hole OR Material, Wall Thickness (cm/in), Depth (m/ft) From To, Status of Well. Row shows 5.08 PLASTIC casing from 0 to 6.1 depth.

Construction Record - Screen table with columns: Outside Diameter (cm/in), Material (Plastic, Galvanized, Steel), Slot No., Depth (m/ft) From To. Row shows 5.3 PLASTIC screen from 6.1 to 7.6 depth.

Water Details and Hole Diameter table. Water Details include Kind of Water (Fresh, Untested, Gas, Other) at various depths. Hole Diameter includes Depth (m/ft) From To and Diameter (cm/in).

Map of Well Location section with instructions: 'Please provide a map below following instructions on the back.' Includes handwritten note: 'SEE ATTACHED MAP'.

Contractor information section including: CMT Drilling Inc., License No. 7366, 1011 Industrial Cres, Unit 1, St. Clements Ontario, N0B 2M0, cblack@cmtinc.net, 519-699-5775, Black, Chris, 3711, 2020/02/25, Tech License No., Signature of Contractor, Date Submitted.

Ministry Use Only section including: Well owner's information package delivered (Yes/No), Date Package Delivered, Date Work Completed, Audit No. 7324519, Received.



Measurements recorded in:  Metric  Imperial

A282605

Well Owner's Information

First Name: THE DIOCESE OF MISSISSAUGA, VANCOUVER AND WESTERN CANADA ATTN: MAHEB MICHAEL
Last Name / Organization: THE DIOCESE OF MISSISSAUGA, VANCOUVER AND WESTERN CANADA ATTN: MAHEB MICHAEL
E-mail Address:
Mailing Address (Street Number/Name): 2188 ROBINWOOD COURT
Municipality: MISSISSAUGA
Province: ON
Postal Code: L5M5B8
Telephone No. (inc. area code):

Well Location

Address of Well Location (Street Number/Name): NINTH LINE (ECON SE OF BURHAMTHORPE RDE)
Township: OAKVILLE
Lot:
Concession:
County/District/Municipality:
City/Town/Village: OAKVILLE
Province: Ontario
Postal Code:
UTM Coordinates: Zone: NAD 83, Easting: 17601411011, Northing: 481913118

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

Table with 5 columns: General Colour, Most Common Material, Other Materials, General Description, Depth (m/ft) From To. Rows include: BLACK TOPSOIL (0-0.3), BROWN CLAY SILT DENSE (0.3-1.5), GREY SILT CLAY DENSE (1.5-4.5), GREY SILT DENSE (4.5-6.7)

Annular Space table with 4 columns: Depth Set at (m/ft) From To, Type of Sealant Used (Material and Type), Volume Placed (m³/ft³). Rows include: 0-4.5 3/8 HOLEPLUG 41, 4.5-6.7 #2 SAND 41

Results of Well Yield Testing table with columns: Draw Down (Time, Water Level), Recovery (Time, Water Level). Includes pumping rate, duration, and static level data.

Method of Construction and Well Use checkboxes. Method of Construction includes Cable Tool, Rotary (Conventional/Reverse), Boring, Air percussion, Other. Well Use includes Public, Domestic, Livestock, Industrial, Commercial, Municipal, Test Hole, Cooling & Air Conditioning, Not used, Dewatering, Monitoring.

Construction Record - Casing table with columns: Inside Diameter (cm/in), Open Hole OR Material, Wall Thickness (cm/in), Depth (m/ft) From To, Status of Well. Row: 5.08 PLASTIC, 0-5.1, Status: Observation and/or Monitoring Hole.

Construction Record - Screen table with columns: Outside Diameter (cm/in), Material, Slot No., Depth (m/ft) From To. Row: 5.3 PLASTIC, 10, 5.1-6.7.

Water Details and Hole Diameter tables. Water Details: Kind of Water (Fresh/Untested/Gas/Other), Depth (m/ft). Hole Diameter: Depth (m/ft) From To, Diameter (cm/in). Row: 0-6.7, 12.

Contractor information: CMT Drilling Inc. License No. 7366, 1011 Industrial Cres, Unit 1, St. Clements Ontario, N0B 2M0, 519-699-5775, 3711, Signature of Contractor: Black, Chris, Date Submitted: 2020/02/25.

Map of Well Location section with text: SEE ATTACHED MAP. Comments field.

Ministry Use Only section: Audit No. 2324520, Date Package Delivered, Date Work Completed, Received.



Well Tag No. (Place Sticker and/or Print Below)
A282606

Measurements recorded in: [X] Metric [ ] Imperial

Well Owner's Information

First Name, Last Name / Organization, E-mail Address, Mailing Address, Municipality, Province, Postal Code, Telephone No.
THE DIOCESE OF MISSISSAUGA, VANCOUVER AND WESTERN CANADA ATTN: MICHELS MICHAEL

Well Location

Address of Well Location, Township, Lot, Concession, City/Town/Village, Province, Postal Code, UTM Coordinates, Municipal Plan and Sublot Number

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

Table with columns: General Colour, Most Common Material, Other Materials, General Description, Depth From, Depth To

Annular Space: Depth Set at, Type of Sealant Used, Volume Placed

Method of Construction, Well Use: Cable Tool, Rotary, Boring, etc.

Construction Record - Casing: Inside Diameter, Material, Wall Thickness, Depth, Status of Well

Construction Record - Screen: Outside Diameter, Material, Slot No., Depth

Water Details, Hole Diameter: Water found at Depth, Kind of Water, Depth, Diameter

Results of Well Yield Testing: Draw Down, Recovery, Pump intake set at, Pumping rate, etc.


Map of Well Location: Please provide a map below following instructions on the back. SEE ATTACHED MAP

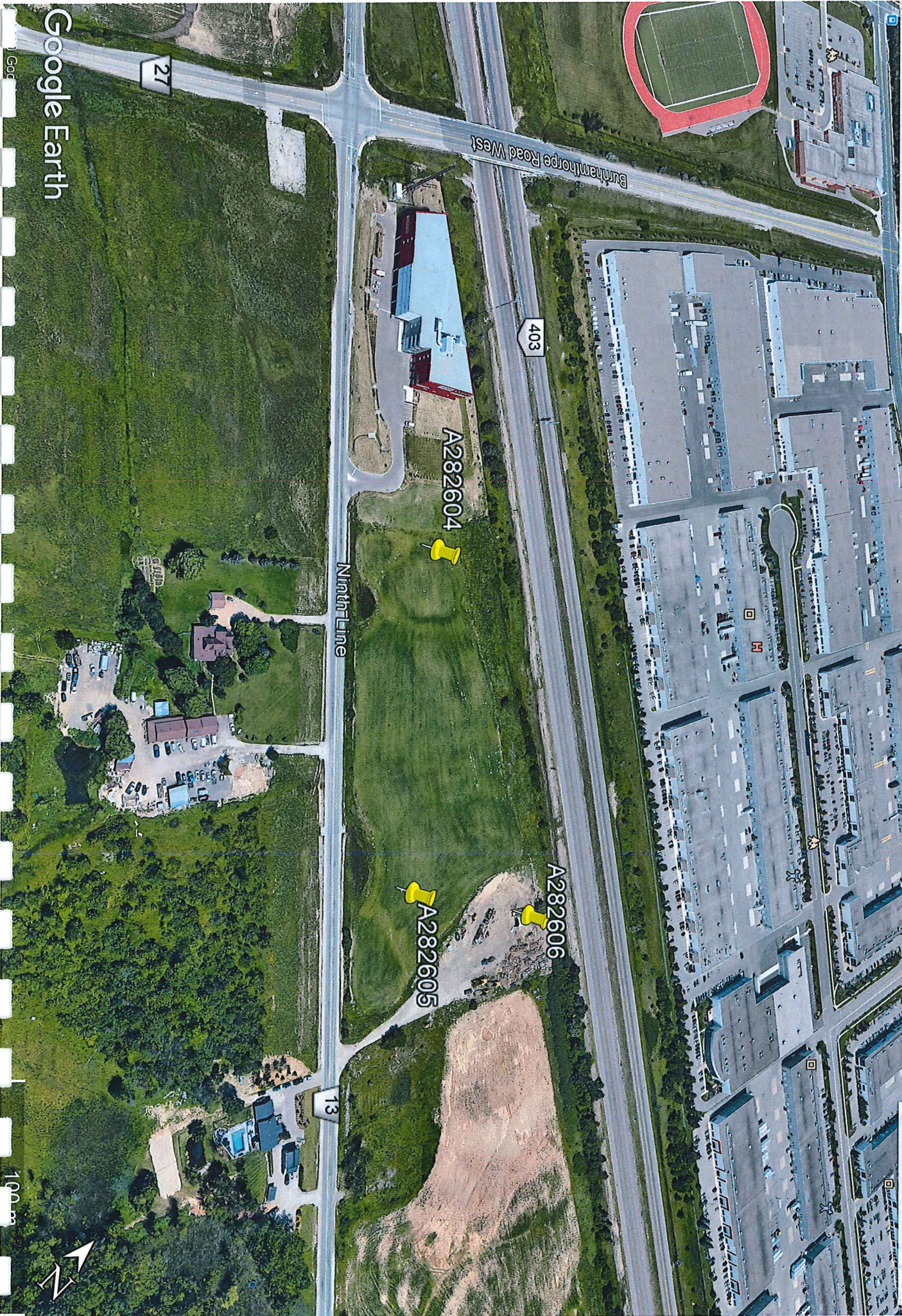
Contractor Information: CMT Drilling Inc., License No. 7366, 1011 Industrial Cres, Unit 1, St. Clements Ontario, NOB 2M0, 519-699-5775, 3711, Tech License No., Signature of Contractor, Date Submitted

Ministry Use Only: Audit No. 7324521, Date Package Delivered, Date Work Completed



# Ninth Line, Oakville

**Legend**  
 Monitoring Well



Google Earth

© 2023 Google

100m



BURNSIDE

[ THE DIFFERENCE IS OUR PEOPLE ]

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## Appendix B

### Stormwater Management Calculations



Project: **Ninth Line**

Task: **CN Number Summary**

Date: **4-Apr-24**

Prepared by: T.R.

Project no.: **3000044049**

<b>Land Cover</b>	Crops	Gravel	Lawn	SWM Pond
<b>Soil Group</b>	C / D	C / D	C / D	C / D
<b>CN Number</b>	89.0	96	81.5	98.0

<b>Catchment</b>	<b>Total Pervious Area</b>	<b>Crops</b>	<b>Gravel</b>	<b>Lawn</b>	<b>SWM Pond</b>	<b>CN Number</b>
101	3.49	3.49	0.00	0.00	0.00	89.0
102	0.21	0.21	0.00	0.00	0.00	89.0
201	1.60	0.00	0.06	1.30	0.24	84.5
UNC1	0.06	0.00	0.00	0.06	0	81.5

Project: **Ninth Line**  
 Project #: 300044049  
 Designed By: T. Rosborough  
 Date: 4-Apr-2024



**Airport Method for Time to Peak Calculations**

Natural Area Watershed Information

WS	Area (ha)	Length (m)	C	Slope (%)	Calculated Time of Concentration (min) *	Time of Concentration Used in Modelling* (min) *	Time to Peak (hrs)
<b>EXISTING</b>							
101	3.49	135	0.25	4.90	19.06	19.06	0.19
102	0.21	9.3	0.25	28.00	2.81	15.00	0.15
<b>POST-DEVELOPMENT</b>							

\* Minimum Tc = 15 min as per City standards

NOTE: Time to Peak = 0.60Tc

NOTE: Airport method was selected to calculate the watershed time of concentration as per the MOE Drainage Management Manual (for RC less than 0.4) - see below

**Airport Formula**

For watersheds where the runoff coefficient, C, is less than 0.40, the Airport formula gives a better estimate of t<sub>c</sub>. This method was developed for airfields and is expressed as follows:

$$t_c = \frac{3.26 * (1.1 - C) * L^{0.5}}{S_w^{0.33}} \tag{8.16}$$

where:

- t<sub>c</sub> = time of concentration, min
- C = runoff coefficient
- S<sub>w</sub> = watershed slope, %
- L = watershed length, m

When a watershed length is made up of widely differing surfaces (e.g. grass and concrete), t<sub>c</sub>, can be calculated for each surface, and the individual values summed to give the overall value.

**Project:** Ninth Line  
**File:** 300044049  
**Designed by:** T.Rosborough  
**Checked by:** S.Roorda  
**Date:** 4-Apr-24



**IMPERVIOUS CALCULATIONS - Post Development (Catchment 201)**

Pond Drainage Area = **34464** m<sup>2</sup> or **3.45** ha

**Impervious (m<sup>2</sup>)**

19169	Roof / Roads / Walkways

Total Area= 1.92 ha

TIMP	100%	Area	1.92 ha
XIMP	100%	Area	1.92 ha

**Landscaped Areas (m<sup>2</sup>)**

4634	Septic Area
8430	Landscape

Total Area= 1.31 ha

TIMP	0%	Area	0.00 ha
XIMP	0%	Area	0.00 ha

**SWM Block (m<sup>2</sup>)**

2231	Pond

Total Area = 0.22 ha

TIMP	50%	Area	0.11 ha
XIMP	50%	Area	0.11 ha


Total Area = 0.00 ha

TIMP	80%	Area	0.18 ha
XIMP	60%	Area	0.13 ha

**IMPERVIOUSNESS**

<b>TOTAL Modelled Area=</b>	<b>3.45 ha</b>	<b>TOTAL Pervious Area=</b>	<b>1.42 ha</b>
<b>OVERALL TIMP</b>	<b>0.589</b>	<b>OVERALL Runoff Coefficient</b>	<b>0.61</b>
<b>OVERALL XIMP</b>	<b>0.589</b>		

**Project:** Ninth Line  
**File:** 300044049  
**Designed by:** T.Rosborough  
**Checked by:** S.Roorda  
**Date:** 4-Apr-24



**IMPERVIOUS CALCULATIONS - Post Development Uncontrolled to Ninth Line ROW (UNC1)**

Drainage Area = 2543 m<sup>2</sup> or 0.25 ha

**Impervious (m<sup>2</sup>)**

1916	Asphalt

**Landscaped Areas (m<sup>2</sup>)**

627	Landscape

Total Area= 0.19 ha

TIMP	100%	Area	0.19 ha
XIMP	100%	Area	0.19 ha

Total Area= 0.06 ha

TIMP	0%	Area	0.00 ha
XIMP	0%	Area	0.00 ha

<b>IMPERVIOUSNESS</b>			
<b>TOTAL Modelled Area=</b>	<b>0.25 ha</b>	<b>TOTAL Pervious Area=</b>	<b>0.06 ha</b>
<b>OVERALL TIMP</b>	<b>0.754</b>	<b>OVERALL Runoff Coefficient</b>	<b>0.73</b>
<b>OVERALL XIMP</b>	<b>0.754</b>		

## Water Quality Design Sheet:

Project Name: Ninth Line  
 Project Number: 300044049  
 Date: 4/4/2024  
 Completed by: T.Rosborough



## Water Quality and Extended Detention Storage - Catchment 201

Summary of Land Uses	Area =	Imperviousness =
Roof / Road / Walkways	1.92 ha	100%
Landscaped Areas	1.31 ha	0%
SWM Pond	0.22 ha	50%
<b>TOTAL</b>	<b>3.45 ha</b>	<b>59%</b>

Protection Level	1	Type "1" for Enhanced, "2" for Normal, "3" for Basic	Table 3.2 Code
Pond Type	Wetpond	Choose Infiltration, Wetpond, Wetland, or Hybrid	3
Imperviousness %	58.9		

MOE 2003 Table 3.2 Volume                      160.3                      m3/ha

Type of SWM Facility	Protection Level	Water Quality Volume (m <sup>3</sup> )
Wetpond	1	552

**EXTENDED DETENTION CALCULATIONS**



**BURNSIDE**

**Project:** Ninth Line  
**File:** 300044049  
**Designed by:** T.Rosborough  
**Checked by:** S.Roorda  
**Date:** 4-Apr-24

**Extended Detention Storage Required - SCS Method**

Q =  $(P-IA)^2/P-(IA-S)$   
 S =  $-254+25400/CN$   
 T IMP = **58.9 %**

Pervious Area		Impervious Area	
P =	<b>25</b> mm	P =	25 mm
IA =	<b>5</b> mm	IA =	<b>1</b> mm
CN =	<b>84.5</b>	CN =	98
S =	46.6	S =	5.2
Q =	6.0 mm	Q =	19.7 mm
	<b>per</b>	<b>imp</b>	<b>total</b>
SCS Runoff Volume	6.0	19.7	mm
Drainage Area	1.42	2.03	<b>3.45</b> ha
Storage Volume	85	400	486 cu.m
<b>Extended Detention Component of Pond:</b>			<b>486 cu.m</b>
<b>EXTENDED DETENTION REQUIRED</b>			<b>486 cu.m</b>



## Falling Head Orifice Equation (Eq. 4.11 MOE 2003)

**Project:** Ninth Line  
**File:** 300044049  
**Designed by:** M.RT  
**Checked by:** J. Smith  
**Date:** 4-Apr-24

$$t = \frac{0.66C_2h^{1.5} + 2C_3h^{0.5}}{2.75 A_o}$$

Known:

$h = 0.56$  m  
 Perm Pool Surface Area =  $922$  m<sup>2</sup>  
 Surface Area of Pond at  $h = 1300$  m<sup>2</sup>  
 $C_2 = 675$   
 $C_3 = 922$   
 Orifice Diameter,  $D = 0.080$  known (trial and error)  
 $D = ((4 \times A_o) / \pi)^{0.5}$   
 $A_o = 0.0050$  cross sectional area of orifice  
 Orifice Coefficient,  $C = 0.62$

check drawdown time

$t = 113334$  seconds  
 $31$  hours  
 $Q = 0.0100$  m<sup>3</sup>/s

### Detention Time

A detention time of 24 hours should be targeted in all instances, unless the outlet is susceptible to clogging due to its small size (i.e., drainage areas < 8 ha). If the outlet may be prone to clogging, the detention time can be reduced to a minimum of 12 hours. The detention time is approximated by the drawdown time.

The drawdown time in the pond can be estimated using Equation 4.10. Equation 4.10 is the classic falling head orifice equation which assumes a constant pond surface area. This assumption is generally not valid, and a more accurate estimation can be made if Equation 4.10 is solved as a differential equation. This is easily done if the relationship between pond surface area and pond depth is approximated using a linear regression.

$$t = \frac{2 A_p}{C A_o (2g)^{0.5}} (h_1^{0.5} - h_2^{0.5}) \quad \text{Equation 4.10: Drawdown Time}$$

or if a relationship between  $A_p$  and  $h$  is known (i.e.,  $A = C_2 h + C_3$ )

$$t = \frac{0.66 C_2 h^{1.5} + 2 C_3 h^{0.5}}{2.75 A_o} \quad \text{Equation 4.11}$$

where  $t$  = drawdown time in seconds  
 $A_p$  = surface area of the pond (m<sup>2</sup>)  
 $C$  = discharge coefficient (typically 0.63)  
 $A_o$  = cross-sectional area of the orifice (m<sup>2</sup>)  
 $g$  = gravitational acceleration constant (9.81 m/s<sup>2</sup>)  
 $h_1$  = starting water elevation above the orifice (m)  
 $h_2$  = ending water elevation above the orifice (m)  
 $h$  = maximum water elevation above the orifice (m)  
 $C_2$  = slope coefficient from the area-depth linear regression  
 $C_3$  = intercept from the area-depth linear regression

## 5mm On-Site Retention Volume

PROJECT: Ninth Line  
 PROJECT #: 300044049  
 DATE: 4-Apr-24  
 MUNICIPALITY: City of Mississauga

Catchment	Area (ha)	Impervious Level	Runoff Volume (mm)	Required Detention Volume (m <sup>3</sup> )
201*	3.39	0.59	5.00	100.1
UNC1**	0.16	0.65	5.00	5.2
<b>Total Developable Area</b>	<b>3.55</b>	<b>0.59</b>		<b>105.3</b>

\*Catchment 201 minus portion of area conveyed to City (0.05ha)

\*\*Catchment UNC1 minus portion of area conveyed to City (0.09ha)

**SWM Facility Storage Design Sheet:**

Project Name: Ninth Line  
 Project Number: 300044049  
 Date: 4/4/2024  
 Completed by: T.R.



**SWM Pond - Storage Calculations**

**INPUT AREA**

Base: 178.00  
 NWL: 179.20  
 Required Water Quality Volume: 552 m<sup>3</sup>  
 Provided Water Quality Volume: 676 m<sup>3</sup>  
  
 Required 100-Year Storage Volume: 1592 m<sup>3</sup>  
 100-Year Storage Volume Provided: 2218 m<sup>3</sup>

**ELEVATION / STORAGE INFORMATION**

	Elevation	Stage	Area 1	Area 2	Total Area	Avg. Area	Incremental Storage	Cumulative Storage	Cumulative Storage above Permanent Pool
	(m)	(m)	(m <sup>2</sup> )	(m <sup>2</sup> )	(m <sup>2</sup> )	(m <sup>2</sup> )	(m <sup>3</sup> )	(m <sup>3</sup> )	(m <sup>3</sup> )
Base	178.00	0.00	200	0	200				
	178.50	0.50	376	178	554	377	189	189	0
	179.00	1.00	591	143	734	644	322	511	0
NWL	179.20	1.20	922		922	828	166	676	0
	179.50	1.50	1,153		1,153	1,038	311	987	311
	180.00	2.00	1,528		1,528	1,341	670	1,658	982
Freeboard	180.50	2.50	1,867		1,867	1,698	849	2,506	1,830
	180.70	2.70	2,009		2,009	1,938	388	2,894	2,218
	181.00	3.00	2,231		2,231	2,120	636	3,530	2,854

### Stage-Discharge-Storage Operation

#### Wet-Pond Facility

**Project:** Ninth Line  
**File:** 300044049  
**Designed by:** T.Rosborough  
**Checked by:** J. Smith  
**Date:** 4-Apr-24

**Input:**

Control used	Control	Inv. Elev. (m)	D or L (mm or m)	Lip Elev. (m)	Description	Orifice Coefficient
Y	Orifice 1	179.20	80	179.20	ED	0.62
Y	Orifice 2	179.20	170	179.80	100-Year	0.62
Y	Weir A	180.70	10.0	180.70	Emergency	-

**Orifice:  $Q=CA(2gH)^{0.5}$**

**Weir:  $Q=Cd*(L-0.06h)*H^{3/2}$**

Pond WS Elev (m)	Orifice 1		Orifice 2		Weir "A"			Total Controlled Outflow (m³/s)	Pond Storage (m³)	Tailwater Elev (m)	Design Storm
	Head (m)	Outflow (m³/s)	Head (m)	Outflow (m³/s)	Head (m)	Discharge Coefficient	Outflow (m³/s)				
179.20	na	0.000	na	0.000	0.00	1.84	0.00	<b>0.000</b>	-	0.00	
179.30	0.06	0.003	na	0.000	0.00	1.84	0.00	<b>0.003</b>	<b>104</b>	0.00	
179.40	0.16	0.006	na	0.000	0.00	1.84	0.00	<b>0.006</b>	<b>208</b>	0.00	
179.50	0.26	0.007	na	0.000	0.00	1.84	0.00	<b>0.007</b>	<b>311</b>	0.00	
179.60	0.36	0.008	na	0.000	0.00	1.84	0.00	<b>0.008</b>	<b>445</b>	0.00	
179.70	0.46	0.009	na	0.000	0.00	1.84	0.00	<b>0.009</b>	<b>579</b>	0.00	
179.80	0.56	0.010	na	0.000	0.00	1.84	0.00	<b>0.010</b>	<b>713</b>	0.00	ED
179.90	0.66	0.011	0.61	0.049	0.00	1.84	0.00	<b>0.060</b>	<b>847</b>	0.00	
180.00	0.76	0.012	0.71	0.053	0.00	1.84	0.00	<b>0.065</b>	<b>982</b>	0.00	
180.10	0.86	0.013	0.81	0.056	0.00	1.84	0.00	<b>0.069</b>	<b>1,151</b>	0.00	
180.20	0.96	0.014	0.91	0.060	0.00	1.84	0.00	<b>0.073</b>	<b>1,321</b>	0.00	
180.30	1.06	0.014	1.01	0.063	0.00	1.84	0.00	<b>0.077</b>	<b>1,491</b>	0.00	
180.32	1.08	0.014	1.03	0.063	0.00	1.84	0.00	<b>0.078</b>	<b>1,525</b>	0.00	
180.34	1.10	0.014	1.05	0.064	0.00	1.84	0.00	<b>0.079</b>	<b>1,559</b>	0.00	
180.36	1.12	0.015	1.07	0.065	0.00	1.84	0.00	<b>0.079</b>	<b>1,592</b>	0.00	100-Year
180.38	1.14	0.015	1.09	0.065	0.00	1.84	0.00	<b>0.080</b>	<b>1,627</b>	0.00	
180.40	1.16	0.015	1.11	0.066	0.00	1.84	0.00	<b>0.081</b>	<b>1,660</b>	0.00	
180.50	1.26	0.015	1.21	0.069	0.00	1.84	0.00	<b>0.084</b>	<b>1,830</b>	0.00	
180.60	1.36	0.016	1.31	0.071	0.00	1.84	0.00	<b>0.088</b>	<b>2,024</b>	0.00	
180.70	1.46	0.017	1.41	0.074	0.00	1.84	0.00	<b>0.091</b>	<b>2,218</b>	0.00	
180.80	1.56	0.017	1.51	0.077	0.10	1.84	0.58	<b>0.675</b>	<b>2,430</b>	0.00	
180.90	1.66	0.018	1.61	0.079	0.20	1.84	1.64	<b>1.738</b>	<b>2,642</b>	0.00	
181.00	1.76	0.018	1.71	0.082	0.30	1.84	3.01	<b>3.113</b>	<b>2,854</b>	0.00	

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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

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000   TTTTT TTTTT H   H   Y   Y   M   M   000   TM
O   O   T   T   H   H   Y Y   MM MM O   O
O   O   T   T   H   H   Y   M   M   O   O
000   T   T   H   H   Y   M   M   000

```

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

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DATE: 04/04/2024 TIME: 02:08:59

USER:

COMMENTS: \_\_\_\_\_

\*\*\*\*\*  
 \*\* SIMULATION : 002-Year Chicago \*\*  
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| CHICAGO STORM | IDF curve parameters: A= 610.000
| Ptotal= 33.45 mm | B= 4.600
| | C= 0.780
| | used in: INTENSITY = A / (t + B)^C
| | Duration of storm = 4.00 hrs
| | Storm time step = 5.00 min
| | Time to peak ratio = 0.33

```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.09	1.00	9.03	2.00	5.76	3.00	2.77
0.08	2.21	1.08	13.85	2.08	5.25	3.08	2.67
0.17	2.36	1.17	32.04	2.17	4.83	3.17	2.57
0.25	2.52	1.25	104.51	2.25	4.47	3.25	2.48
0.33	2.72	1.33	41.36	2.33	4.17	3.33	2.40
0.42	2.95	1.42	22.75	2.42	3.92	3.42	2.32
0.50	3.23	1.50	15.69	2.50	3.69	3.50	2.25
0.58	3.59	1.58	12.03	2.58	3.49	3.58	2.18
0.67	4.04	1.67	9.80	2.67	3.32	3.67	2.12
0.75	4.65	1.75	8.29	2.75	3.16	3.75	2.06
0.83	5.50	1.83	7.21	2.83	3.02	3.83	2.01
0.92	6.80	1.92	6.40	2.92	2.89	3.92	1.95

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| CALIB |
| NASHYD ( 0101) | Area (ha)= 3.49 Curve Number (CN)= 89.0
| ID= 1 DT= 1.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
| | U.H. Tp(hrs)= 0.19

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NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

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----- TRANSFORMED HYETOGRAPH -----

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TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	2.09	1.017	9.03	2.017	5.76	3.02	2.77
0.033	2.09	1.033	9.03	2.033	5.76	3.03	2.77
0.050	2.09	1.050	9.03	2.050	5.76	3.05	2.77
0.067	2.09	1.067	9.03	2.067	5.76	3.07	2.77
0.083	2.09	1.083	9.03	2.083	5.76	3.08	2.77
0.100	2.21	1.100	13.85	2.100	5.25	3.10	2.67

0.117	2.21	1.117	13.85	2.117	5.25	3.12	2.67
0.133	2.21	1.133	13.85	2.133	5.25	3.13	2.67
0.150	2.21	1.150	13.85	2.150	5.25	3.15	2.67
0.167	2.21	1.167	13.85	2.167	5.25	3.17	2.67
0.183	2.36	1.183	32.04	2.183	4.83	3.18	2.57
0.200	2.36	1.200	32.04	2.200	4.83	3.20	2.57
0.217	2.36	1.217	32.04	2.217	4.83	3.22	2.57
0.233	2.36	1.233	32.04	2.233	4.83	3.23	2.57
0.250	2.36	1.250	32.04	2.250	4.83	3.25	2.57
0.267	2.52	1.267	104.51	2.267	4.47	3.27	2.48
0.283	2.52	1.283	104.51	2.283	4.47	3.28	2.48
0.300	2.52	1.300	104.51	2.300	4.47	3.30	2.48
0.317	2.52	1.317	104.51	2.317	4.47	3.32	2.48
0.333	2.52	1.333	104.51	2.333	4.47	3.33	2.48
0.350	2.72	1.350	41.37	2.350	4.17	3.35	2.40
0.367	2.72	1.367	41.36	2.367	4.17	3.37	2.40
0.383	2.72	1.383	41.36	2.383	4.17	3.38	2.40
0.400	2.72	1.400	41.36	2.400	4.17	3.40	2.40
0.417	2.72	1.417	41.36	2.417	4.17	3.42	2.40
0.433	2.95	1.433	22.75	2.433	3.92	3.43	2.32
0.450	2.95	1.450	22.75	2.450	3.92	3.45	2.32
0.467	2.95	1.467	22.75	2.467	3.92	3.47	2.32
0.483	2.95	1.483	22.75	2.483	3.92	3.48	2.32
0.500	2.95	1.500	22.75	2.500	3.92	3.50	2.32
0.517	3.23	1.517	15.69	2.517	3.69	3.52	2.25
0.533	3.23	1.533	15.69	2.533	3.69	3.53	2.25
0.550	3.23	1.550	15.69	2.550	3.69	3.55	2.25
0.567	3.23	1.567	15.69	2.567	3.69	3.57	2.25
0.583	3.23	1.583	15.69	2.583	3.69	3.58	2.25
0.600	3.59	1.600	12.03	2.600	3.49	3.60	2.18
0.617	3.59	1.617	12.03	2.617	3.49	3.62	2.18
0.633	3.59	1.633	12.03	2.633	3.49	3.63	2.18
0.650	3.59	1.650	12.03	2.650	3.49	3.65	2.18
0.667	3.59	1.667	12.03	2.667	3.49	3.67	2.18
0.683	4.04	1.683	9.80	2.683	3.32	3.68	2.12
0.700	4.04	1.700	9.80	2.700	3.32	3.70	2.12
0.717	4.04	1.717	9.80	2.717	3.32	3.72	2.12
0.733	4.04	1.733	9.80	2.733	3.32	3.73	2.12
0.750	4.04	1.750	9.80	2.750	3.32	3.75	2.12
0.767	4.65	1.767	8.29	2.767	3.16	3.77	2.06
0.783	4.65	1.783	8.29	2.783	3.16	3.78	2.06
0.800	4.65	1.800	8.29	2.800	3.16	3.80	2.06
0.817	4.65	1.817	8.29	2.817	3.16	3.82	2.06
0.833	4.65	1.833	8.29	2.833	3.16	3.83	2.06
0.850	5.50	1.850	7.21	2.850	3.02	3.85	2.01
0.867	5.50	1.867	7.21	2.867	3.02	3.87	2.01
0.883	5.50	1.883	7.21	2.883	3.02	3.88	2.01
0.900	5.50	1.900	7.21	2.900	3.02	3.90	2.01
0.917	5.50	1.917	7.21	2.917	3.02	3.92	2.01
0.933	6.80	1.933	6.40	2.933	2.89	3.93	1.95
0.950	6.80	1.950	6.40	2.950	2.89	3.95	1.95
0.967	6.80	1.967	6.40	2.967	2.89	3.97	1.95
0.983	6.80	1.983	6.40	2.983	2.89	3.98	1.95
1.000	6.80	2.000	6.40	3.000	2.89	4.00	1.95

Unit Hyd Qpeak (cms)= 0.702

PEAK FLOW (cms)= 0.149 (i)  
 TIME TO PEAK (hrs)= 1.583  
 RUNOFF VOLUME (mm)= 13.523  
 TOTAL RAINFALL (mm)= 33.447  
 RUNOFF COEFFICIENT = 0.404

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

-----  
 CALIB  
 NASHYD ( 0102) | Area (ha)= 0.21 Curve Number (CN)= 89.0  
 ID= 1 DT= 1.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00  
 U.H. Tp(hrs)= 0.15  
 -----

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	2.09	1.017	9.03	2.017	5.76	3.02	2.77
0.033	2.09	1.033	9.03	2.033	5.76	3.03	2.77
0.050	2.09	1.050	9.03	2.050	5.76	3.05	2.77
0.067	2.09	1.067	9.03	2.067	5.76	3.07	2.77
0.083	2.09	1.083	9.03	2.083	5.76	3.08	2.77
0.100	2.21	1.100	13.85	2.100	5.25	3.10	2.67

0.117	2.21	1.117	13.85	2.117	5.25	3.12	2.67
0.133	2.21	1.133	13.85	2.133	5.25	3.13	2.67
0.150	2.21	1.150	13.85	2.150	5.25	3.15	2.67
0.167	2.21	1.167	13.85	2.167	5.25	3.17	2.67
0.183	2.36	1.183	32.04	2.183	4.83	3.18	2.57
0.200	2.36	1.200	32.04	2.200	4.83	3.20	2.57
0.217	2.36	1.217	32.04	2.217	4.83	3.22	2.57
0.233	2.36	1.233	32.04	2.233	4.83	3.23	2.57
0.250	2.36	1.250	32.04	2.250	4.83	3.25	2.57
0.267	2.52	1.267	104.51	2.267	4.47	3.27	2.48
0.283	2.52	1.283	104.51	2.283	4.47	3.28	2.48
0.300	2.52	1.300	104.51	2.300	4.47	3.30	2.48
0.317	2.52	1.317	104.51	2.317	4.47	3.32	2.48
0.333	2.52	1.333	104.51	2.333	4.47	3.33	2.48
0.350	2.72	1.350	41.37	2.350	4.17	3.35	2.40
0.367	2.72	1.367	41.36	2.367	4.17	3.37	2.40
0.383	2.72	1.383	41.36	2.383	4.17	3.38	2.40
0.400	2.72	1.400	41.36	2.400	4.17	3.40	2.40
0.417	2.72	1.417	41.36	2.417	4.17	3.42	2.40
0.433	2.95	1.433	22.75	2.433	3.92	3.43	2.32
0.450	2.95	1.450	22.75	2.450	3.92	3.45	2.32
0.467	2.95	1.467	22.75	2.467	3.92	3.47	2.32
0.483	2.95	1.483	22.75	2.483	3.92	3.48	2.32
0.500	2.95	1.500	22.75	2.500	3.92	3.50	2.32
0.517	3.23	1.517	15.69	2.517	3.69	3.52	2.25
0.533	3.23	1.533	15.69	2.533	3.69	3.53	2.25
0.550	3.23	1.550	15.69	2.550	3.69	3.55	2.25
0.567	3.23	1.567	15.69	2.567	3.69	3.57	2.25
0.583	3.23	1.583	15.69	2.583	3.69	3.58	2.25
0.600	3.59	1.600	12.03	2.600	3.49	3.60	2.18
0.617	3.59	1.617	12.03	2.617	3.49	3.62	2.18
0.633	3.59	1.633	12.03	2.633	3.49	3.63	2.18
0.650	3.59	1.650	12.03	2.650	3.49	3.65	2.18
0.667	3.59	1.667	12.03	2.667	3.49	3.67	2.18
0.683	4.04	1.683	9.80	2.683	3.32	3.68	2.12
0.700	4.04	1.700	9.80	2.700	3.32	3.70	2.12
0.717	4.04	1.717	9.80	2.717	3.32	3.72	2.12
0.733	4.04	1.733	9.80	2.733	3.32	3.73	2.12
0.750	4.04	1.750	9.80	2.750	3.32	3.75	2.12
0.767	4.65	1.767	8.29	2.767	3.16	3.77	2.06
0.783	4.65	1.783	8.29	2.783	3.16	3.78	2.06
0.800	4.65	1.800	8.29	2.800	3.16	3.80	2.06
0.817	4.65	1.817	8.29	2.817	3.16	3.82	2.06
0.833	4.65	1.833	8.29	2.833	3.16	3.83	2.06
0.850	5.50	1.850	7.21	2.850	3.02	3.85	2.01
0.867	5.50	1.867	7.21	2.867	3.02	3.87	2.01
0.883	5.50	1.883	7.21	2.883	3.02	3.88	2.01
0.900	5.50	1.900	7.21	2.900	3.02	3.90	2.01
0.917	5.50	1.917	7.21	2.917	3.02	3.92	2.01
0.933	6.80	1.933	6.40	2.933	2.89	3.93	1.95
0.950	6.80	1.950	6.40	2.950	2.89	3.95	1.95
0.967	6.80	1.967	6.40	2.967	2.89	3.97	1.95
0.983	6.80	1.983	6.40	2.983	2.89	3.98	1.95
1.000	6.80	2.000	6.40	3.000	2.89	4.00	1.95

Unit Hyd Qpeak (cms)= 0.053

PEAK FLOW (cms)= 0.010 (i)  
 TIME TO PEAK (hrs)= 1.517  
 RUNOFF VOLUME (mm)= 13.521  
 TOTAL RAINFALL (mm)= 33.447  
 RUNOFF COEFFICIENT = 0.404

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

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 =====

```

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: 04/04/2024

TIME: 02:08:59

USER:

COMMENTS: \_\_\_\_\_

\*\*\*\*\*  
 \*\* SIMULATION : 005-Year Chicago \*\*  
 \*\*\*\*\*

CHICAGO STORM  
 Ptotal= 44.96 mm

IDF curve parameters: A= 820.000  
 B= 4.600  
 C= 0.780  
 used in: INTENSITY = A / (t + B)^C  
 Duration of storm = 4.00 hrs  
 Storm time step = 5.00 min  
 Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.81	1.00	12.14	2.00	7.74	3.00	3.73
0.08	2.98	1.08	18.61	2.08	7.06	3.08	3.59
0.17	3.17	1.17	43.07	2.17	6.49	3.17	3.46
0.25	3.39	1.25	140.49	2.25	6.01	3.25	3.33
0.33	3.65	1.33	55.60	2.33	5.61	3.33	3.22
0.42	3.97	1.42	30.58	2.42	5.26	3.42	3.12
0.50	4.35	1.50	21.10	2.50	4.96	3.50	3.02
0.58	4.82	1.58	16.17	2.58	4.69	3.58	2.93
0.67	5.43	1.67	13.17	2.67	4.46	3.67	2.85
0.75	6.24	1.75	11.15	2.75	4.25	3.75	2.77
0.83	7.39	1.83	9.70	2.83	4.06	3.83	2.70
0.92	9.14	1.92	8.60	2.92	3.89	3.92	2.63

CALIB  
 NASHYD ( 0101)  
 ID= 1 DT= 1.0 min

Area (ha)= 3.49 Curve Number (CN)= 89.0  
 Ia (mm)= 5.00 # of Linear Res.(N)= 3.00  
 U.H. Tp(hrs)= 0.19

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	2.81	1.017	12.14	2.017	7.74	3.02	3.73
0.033	2.81	1.033	12.14	2.033	7.74	3.03	3.73
0.050	2.81	1.050	12.14	2.050	7.74	3.05	3.73
0.067	2.81	1.067	12.14	2.067	7.74	3.07	3.73
0.083	2.81	1.083	12.14	2.083	7.74	3.08	3.73
0.100	2.98	1.100	18.61	2.100	7.06	3.10	3.59
0.117	2.98	1.117	18.61	2.117	7.06	3.12	3.59
0.133	2.98	1.133	18.61	2.133	7.06	3.13	3.59
0.150	2.98	1.150	18.61	2.150	7.06	3.15	3.59
0.167	2.98	1.167	18.61	2.167	7.06	3.17	3.59
0.183	3.17	1.183	43.06	2.183	6.49	3.18	3.46
0.200	3.17	1.200	43.07	2.200	6.49	3.20	3.46
0.217	3.17	1.217	43.07	2.217	6.49	3.22	3.46
0.233	3.17	1.233	43.07	2.233	6.49	3.23	3.46
0.250	3.17	1.250	43.07	2.250	6.49	3.25	3.46
0.267	3.39	1.267	140.49	2.267	6.01	3.27	3.33
0.283	3.39	1.283	140.49	2.283	6.01	3.28	3.33
0.300	3.39	1.300	140.49	2.300	6.01	3.30	3.33
0.317	3.39	1.317	140.49	2.317	6.01	3.32	3.33
0.333	3.39	1.333	140.49	2.333	6.01	3.33	3.33
0.350	3.65	1.350	55.61	2.350	5.61	3.35	3.22
0.367	3.65	1.367	55.60	2.367	5.61	3.37	3.22
0.383	3.65	1.383	55.60	2.383	5.61	3.38	3.22
0.400	3.65	1.400	55.60	2.400	5.61	3.40	3.22



0.417	3.65	1.417	55.60	2.417	5.61	3.42	3.22
0.433	3.97	1.433	30.58	2.433	5.26	3.43	3.12
0.450	3.97	1.450	30.58	2.450	5.26	3.45	3.12
0.467	3.97	1.467	30.58	2.467	5.26	3.47	3.12
0.483	3.97	1.483	30.58	2.483	5.26	3.48	3.12
0.500	3.97	1.500	30.58	2.500	5.26	3.50	3.12
0.517	4.35	1.517	21.10	2.517	4.96	3.52	3.02
0.533	4.35	1.533	21.10	2.533	4.96	3.53	3.02
0.550	4.35	1.550	21.10	2.550	4.96	3.55	3.02
0.567	4.35	1.567	21.10	2.567	4.96	3.57	3.02
0.583	4.35	1.583	21.10	2.583	4.96	3.58	3.02
0.600	4.82	1.600	16.17	2.600	4.69	3.60	2.93
0.617	4.82	1.617	16.17	2.617	4.69	3.62	2.93
0.633	4.82	1.633	16.17	2.633	4.69	3.63	2.93
0.650	4.82	1.650	16.17	2.650	4.69	3.65	2.93
0.667	4.82	1.667	16.17	2.667	4.69	3.67	2.93
0.683	5.43	1.683	13.17	2.683	4.46	3.68	2.85
0.700	5.43	1.700	13.17	2.700	4.46	3.70	2.85
0.717	5.43	1.717	13.17	2.717	4.46	3.72	2.85
0.733	5.43	1.733	13.17	2.733	4.46	3.73	2.85
0.750	5.43	1.750	13.17	2.750	4.46	3.75	2.85
0.767	6.24	1.767	11.15	2.767	4.25	3.77	2.77
0.783	6.24	1.783	11.15	2.783	4.25	3.78	2.77
0.800	6.24	1.800	11.15	2.800	4.25	3.80	2.77
0.817	6.24	1.817	11.15	2.817	4.25	3.82	2.77
0.833	6.24	1.833	11.15	2.833	4.25	3.83	2.77
0.850	7.39	1.850	9.70	2.850	4.06	3.85	2.70
0.867	7.39	1.867	9.70	2.867	4.06	3.87	2.70
0.883	7.39	1.883	9.70	2.883	4.06	3.88	2.70
0.900	7.39	1.900	9.70	2.900	4.06	3.90	2.70
0.917	7.39	1.917	9.70	2.917	4.06	3.92	2.70
0.933	9.14	1.933	8.60	2.933	3.89	3.93	2.63
0.950	9.14	1.950	8.60	2.950	3.89	3.95	2.63
0.967	9.14	1.967	8.60	2.967	3.89	3.97	2.63
0.983	9.14	1.983	8.60	2.983	3.89	3.98	2.63
1.000	9.14	2.000	8.60	3.000	3.89	4.00	2.63

Unit Hyd Qpeak (cms)= 0.702

PEAK FLOW (cms)= 0.263 (i)  
 TIME TO PEAK (hrs)= 1.567  
 RUNOFF VOLUME (mm)= 22.380  
 TOTAL RAINFALL (mm)= 44.962  
 RUNOFF COEFFICIENT = 0.498

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

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 CALIB  
 NASHYD ( 0102) | Area (ha)= 0.21 | Curve Number (CN)= 89.0  
 ID= 1 DT= 1.0 min | Ia (mm)= 5.00 | # of Linear Res.(N)= 3.00  
 U.H. Tp(hrs)= 0.15  
 -----

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	2.81	1.017	12.14	2.017	7.74	3.02	3.73
0.033	2.81	1.033	12.14	2.033	7.74	3.03	3.73
0.050	2.81	1.050	12.14	2.050	7.74	3.05	3.73
0.067	2.81	1.067	12.14	2.067	7.74	3.07	3.73
0.083	2.81	1.083	12.14	2.083	7.74	3.08	3.73
0.100	2.98	1.100	18.61	2.100	7.06	3.10	3.59
0.117	2.98	1.117	18.61	2.117	7.06	3.12	3.59
0.133	2.98	1.133	18.61	2.133	7.06	3.13	3.59
0.150	2.98	1.150	18.61	2.150	7.06	3.15	3.59
0.167	2.98	1.167	18.61	2.167	7.06	3.17	3.59
0.183	3.17	1.183	43.06	2.183	6.49	3.18	3.46
0.200	3.17	1.200	43.07	2.200	6.49	3.20	3.46
0.217	3.17	1.217	43.07	2.217	6.49	3.22	3.46
0.233	3.17	1.233	43.07	2.233	6.49	3.23	3.46
0.250	3.17	1.250	43.07	2.250	6.49	3.25	3.46
0.267	3.39	1.267	140.49	2.267	6.01	3.27	3.33
0.283	3.39	1.283	140.49	2.283	6.01	3.28	3.33
0.300	3.39	1.300	140.49	2.300	6.01	3.30	3.33
0.317	3.39	1.317	140.49	2.317	6.01	3.32	3.33
0.333	3.39	1.333	140.49	2.333	6.01	3.33	3.33
0.350	3.65	1.350	55.61	2.350	5.61	3.35	3.22
0.367	3.65	1.367	55.60	2.367	5.61	3.37	3.22
0.383	3.65	1.383	55.60	2.383	5.61	3.38	3.22
0.400	3.65	1.400	55.60	2.400	5.61	3.40	3.22

0.417	3.65	1.417	55.60	2.417	5.61	3.42	3.22
0.433	3.97	1.433	30.58	2.433	5.26	3.43	3.12
0.450	3.97	1.450	30.58	2.450	5.26	3.45	3.12
0.467	3.97	1.467	30.58	2.467	5.26	3.47	3.12
0.483	3.97	1.483	30.58	2.483	5.26	3.48	3.12
0.500	3.97	1.500	30.58	2.500	5.26	3.50	3.12
0.517	4.35	1.517	21.10	2.517	4.96	3.52	3.02
0.533	4.35	1.533	21.10	2.533	4.96	3.53	3.02
0.550	4.35	1.550	21.10	2.550	4.96	3.55	3.02
0.567	4.35	1.567	21.10	2.567	4.96	3.57	3.02
0.583	4.35	1.583	21.10	2.583	4.96	3.58	3.02
0.600	4.82	1.600	16.17	2.600	4.69	3.60	2.93
0.617	4.82	1.617	16.17	2.617	4.69	3.62	2.93
0.633	4.82	1.633	16.17	2.633	4.69	3.63	2.93
0.650	4.82	1.650	16.17	2.650	4.69	3.65	2.93
0.667	4.82	1.667	16.17	2.667	4.69	3.67	2.93
0.683	5.43	1.683	13.17	2.683	4.46	3.68	2.85
0.700	5.43	1.700	13.17	2.700	4.46	3.70	2.85
0.717	5.43	1.717	13.17	2.717	4.46	3.72	2.85
0.733	5.43	1.733	13.17	2.733	4.46	3.73	2.85
0.750	5.43	1.750	13.17	2.750	4.46	3.75	2.85
0.767	6.24	1.767	11.15	2.767	4.25	3.77	2.77
0.783	6.24	1.783	11.15	2.783	4.25	3.78	2.77
0.800	6.24	1.800	11.15	2.800	4.25	3.80	2.77
0.817	6.24	1.817	11.15	2.817	4.25	3.82	2.77
0.833	6.24	1.833	11.15	2.833	4.25	3.83	2.77
0.850	7.39	1.850	9.70	2.850	4.06	3.85	2.70
0.867	7.39	1.867	9.70	2.867	4.06	3.87	2.70
0.883	7.39	1.883	9.70	2.883	4.06	3.88	2.70
0.900	7.39	1.900	9.70	2.900	4.06	3.90	2.70
0.917	7.39	1.917	9.70	2.917	4.06	3.92	2.70
0.933	9.14	1.933	8.60	2.933	3.89	3.93	2.63
0.950	9.14	1.950	8.60	2.950	3.89	3.95	2.63
0.967	9.14	1.967	8.60	2.967	3.89	3.97	2.63
0.983	9.14	1.983	8.60	2.983	3.89	3.98	2.63
1.000	9.14	2.000	8.60	3.000	3.89	4.00	2.63

Unit Hyd Qpeak (cms)= 0.053

PEAK FLOW (cms)= 0.018 (i)  
 TIME TO PEAK (hrs)= 1.500  
 RUNOFF VOLUME (mm)= 22.378  
 TOTAL RAINFALL (mm)= 44.962  
 RUNOFF COEFFICIENT = 0.498

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

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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\voim.dat  
 Output filename: C:\Users\MRitceyThorpe\AppData\Local\Civica\vh5\288aab60-d94f-43e4-8c9b-21a7a9040589\61d7f  
 Summary filename: C:\Users\MRitceyThorpe\AppData\Local\Civica\vh5\288aab60-d94f-43e4-8c9b-21a7a9040589\61d7f

DATE: 04/04/2024 TIME: 02:08:59

USER:

COMMENTS: \_\_\_\_\_

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 CHICAGO STORM  
 Ptotal= 55.38 mm  
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IDF curve parameters: A=1010.000  
 B= 4.600  
 C= 0.780  
 used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs  
 Storm time step = 5.00 min  
 Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.46	1.00	14.96	2.00	9.54	3.00	4.59
0.08	3.66	1.08	22.92	2.08	8.69	3.08	4.42
0.17	3.90	1.17	53.04	2.17	7.99	3.17	4.26
0.25	4.18	1.25	173.04	2.25	7.41	3.25	4.11
0.33	4.50	1.33	68.49	2.33	6.91	3.33	3.97
0.42	4.89	1.42	37.67	2.42	6.48	3.42	3.84
0.50	5.35	1.50	25.98	2.50	6.11	3.50	3.72
0.58	5.94	1.58	19.92	2.58	5.78	3.58	3.61
0.67	6.69	1.67	16.22	2.67	5.49	3.67	3.51
0.75	7.69	1.75	13.73	2.75	5.23	3.75	3.41
0.83	9.10	1.83	11.94	2.83	5.00	3.83	3.32
0.92	11.25	1.92	10.59	2.92	4.79	3.92	3.24

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 CALIB  
 NASHYD ( 0101)  
 ID= 1 DT= 1.0 min  
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Area (ha)= 3.49 Curve Number (CN)= 89.0  
 Ia (mm)= 5.00 # of Linear Res.(N)= 3.00  
 U.H. Tp(hrs)= 0.19

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.46	1.017	14.96	2.017	9.54	3.02	4.59
0.033	3.46	1.033	14.96	2.033	9.54	3.03	4.59
0.050	3.46	1.050	14.96	2.050	9.54	3.05	4.59
0.067	3.46	1.067	14.96	2.067	9.54	3.07	4.59
0.083	3.46	1.083	14.96	2.083	9.54	3.08	4.59
0.100	3.66	1.100	22.92	2.100	8.69	3.10	4.42
0.117	3.66	1.117	22.92	2.117	8.69	3.12	4.42
0.133	3.66	1.133	22.92	2.133	8.69	3.13	4.42
0.150	3.66	1.150	22.92	2.150	8.69	3.15	4.42
0.167	3.66	1.167	22.92	2.167	8.69	3.17	4.42
0.183	3.90	1.183	53.04	2.183	7.99	3.18	4.26
0.200	3.90	1.200	53.04	2.200	7.99	3.20	4.26
0.217	3.90	1.217	53.04	2.217	7.99	3.22	4.26
0.233	3.90	1.233	53.04	2.233	7.99	3.23	4.26
0.250	3.90	1.250	53.04	2.250	7.99	3.25	4.26
0.267	4.18	1.267	173.04	2.267	7.41	3.27	4.11
0.283	4.18	1.283	173.04	2.283	7.41	3.28	4.11
0.300	4.18	1.300	173.04	2.300	7.41	3.30	4.11
0.317	4.18	1.317	173.04	2.317	7.41	3.32	4.11
0.333	4.18	1.333	173.04	2.333	7.41	3.33	4.11
0.350	4.50	1.350	68.49	2.350	6.91	3.35	3.97
0.367	4.50	1.367	68.49	2.367	6.91	3.37	3.97
0.383	4.50	1.383	68.49	2.383	6.91	3.38	3.97
0.400	4.50	1.400	68.49	2.400	6.91	3.40	3.97
0.417	4.50	1.417	68.49	2.417	6.91	3.42	3.97
0.433	4.89	1.433	37.67	2.433	6.48	3.43	3.84
0.450	4.89	1.450	37.67	2.450	6.48	3.45	3.84
0.467	4.89	1.467	37.67	2.467	6.48	3.47	3.84
0.483	4.89	1.483	37.67	2.483	6.48	3.48	3.84
0.500	4.89	1.500	37.67	2.500	6.48	3.50	3.84
0.517	5.35	1.517	25.98	2.517	6.11	3.52	3.72
0.533	5.35	1.533	25.98	2.533	6.11	3.53	3.72
0.550	5.35	1.550	25.98	2.550	6.11	3.55	3.72
0.567	5.35	1.567	25.98	2.567	6.11	3.57	3.72
0.583	5.35	1.583	25.98	2.583	6.11	3.58	3.72
0.600	5.94	1.600	19.92	2.600	5.78	3.60	3.61
0.617	5.94	1.617	19.92	2.617	5.78	3.62	3.61
0.633	5.94	1.633	19.92	2.633	5.78	3.63	3.61
0.650	5.94	1.650	19.92	2.650	5.78	3.65	3.61
0.667	5.94	1.667	19.92	2.667	5.78	3.67	3.61
0.683	6.69	1.683	16.22	2.683	5.49	3.68	3.51
0.700	6.69	1.700	16.22	2.700	5.49	3.70	3.51

0.717	6.69	1.717	16.22	2.717	5.49	3.72	3.51
0.733	6.69	1.733	16.22	2.733	5.49	3.73	3.51
0.750	6.69	1.750	16.22	2.750	5.49	3.75	3.51
0.767	7.69	1.767	13.73	2.767	5.23	3.77	3.41
0.783	7.69	1.783	13.73	2.783	5.23	3.78	3.41
0.800	7.69	1.800	13.73	2.800	5.23	3.80	3.41
0.817	7.69	1.817	13.73	2.817	5.23	3.82	3.41
0.833	7.69	1.833	13.73	2.833	5.23	3.83	3.41
0.850	9.10	1.850	11.94	2.850	5.00	3.85	3.32
0.867	9.10	1.867	11.94	2.867	5.00	3.87	3.32
0.883	9.10	1.883	11.94	2.883	5.00	3.88	3.32
0.900	9.10	1.900	11.94	2.900	5.00	3.90	3.32
0.917	9.10	1.917	11.94	2.917	5.00	3.92	3.32
0.933	11.25	1.933	10.59	2.933	4.79	3.93	3.24
0.950	11.25	1.950	10.59	2.950	4.79	3.95	3.24
0.967	11.25	1.967	10.59	2.967	4.79	3.97	3.24
0.983	11.25	1.983	10.59	2.983	4.79	3.98	3.24
1.000	11.25	2.000	10.59	3.000	4.79	4.00	3.24

Unit Hyd Qpeak (cms)= 0.702

PEAK FLOW (cms)= 0.377 (i)  
 TIME TO PEAK (hrs)= 1.550  
 RUNOFF VOLUME (mm)= 31.038  
 TOTAL RAINFALL (mm)= 55.380  
 RUNOFF COEFFICIENT = 0.560

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

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| CALIB |
| NASHYD ( 0102) | Area (ha)= 0.21 Curve Number (CN)= 89.0
| ID= 1 DT= 1.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
|-----| U.H. Tp(hrs)= 0.15

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NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.46	1.017	14.96	2.017	9.54	3.02	4.59
0.033	3.46	1.033	14.96	2.033	9.54	3.03	4.59
0.050	3.46	1.050	14.96	2.050	9.54	3.05	4.59
0.067	3.46	1.067	14.96	2.067	9.54	3.07	4.59
0.083	3.46	1.083	14.96	2.083	9.54	3.08	4.59
0.100	3.66	1.100	22.92	2.100	8.69	3.10	4.42
0.117	3.66	1.117	22.92	2.117	8.69	3.12	4.42
0.133	3.66	1.133	22.92	2.133	8.69	3.13	4.42
0.150	3.66	1.150	22.92	2.150	8.69	3.15	4.42
0.167	3.66	1.167	22.92	2.167	8.69	3.17	4.42
0.183	3.90	1.183	53.04	2.183	7.99	3.18	4.26
0.200	3.90	1.200	53.04	2.200	7.99	3.20	4.26
0.217	3.90	1.217	53.04	2.217	7.99	3.22	4.26
0.233	3.90	1.233	53.04	2.233	7.99	3.23	4.26
0.250	3.90	1.250	53.04	2.250	7.99	3.25	4.26
0.267	4.18	1.267	173.04	2.267	7.41	3.27	4.11
0.283	4.18	1.283	173.04	2.283	7.41	3.28	4.11
0.300	4.18	1.300	173.04	2.300	7.41	3.30	4.11
0.317	4.18	1.317	173.04	2.317	7.41	3.32	4.11
0.333	4.18	1.333	173.04	2.333	7.41	3.33	4.11
0.350	4.50	1.350	68.49	2.350	6.91	3.35	3.97
0.367	4.50	1.367	68.49	2.367	6.91	3.37	3.97
0.383	4.50	1.383	68.49	2.383	6.91	3.38	3.97
0.400	4.50	1.400	68.49	2.400	6.91	3.40	3.97
0.417	4.50	1.417	68.49	2.417	6.91	3.42	3.97
0.433	4.89	1.433	37.67	2.433	6.48	3.43	3.84
0.450	4.89	1.450	37.67	2.450	6.48	3.45	3.84
0.467	4.89	1.467	37.67	2.467	6.48	3.47	3.84
0.483	4.89	1.483	37.67	2.483	6.48	3.48	3.84
0.500	4.89	1.500	37.67	2.500	6.48	3.50	3.84
0.517	5.35	1.517	25.98	2.517	6.11	3.52	3.72
0.533	5.35	1.533	25.98	2.533	6.11	3.53	3.72
0.550	5.35	1.550	25.98	2.550	6.11	3.55	3.72
0.567	5.35	1.567	25.98	2.567	6.11	3.57	3.72
0.583	5.35	1.583	25.98	2.583	6.11	3.58	3.72
0.600	5.94	1.600	19.92	2.600	5.78	3.60	3.61
0.617	5.94	1.617	19.92	2.617	5.78	3.62	3.61
0.633	5.94	1.633	19.92	2.633	5.78	3.63	3.61
0.650	5.94	1.650	19.92	2.650	5.78	3.65	3.61
0.667	5.94	1.667	19.92	2.667	5.78	3.67	3.61
0.683	6.69	1.683	16.22	2.683	5.49	3.68	3.51
0.700	6.69	1.700	16.22	2.700	5.49	3.70	3.51



0.25	4.80	1.25	198.74	2.25	8.51	3.25	4.72
0.33	5.17	1.33	78.66	2.33	7.94	3.33	4.56
0.42	5.61	1.42	43.26	2.42	7.45	3.42	4.41
0.50	6.15	1.50	29.84	2.50	7.02	3.50	4.28
0.58	6.82	1.58	22.88	2.58	6.64	3.58	4.15
0.67	7.68	1.67	18.63	2.67	6.31	3.67	4.03
0.75	8.83	1.75	15.77	2.75	6.01	3.75	3.92
0.83	10.46	1.83	13.72	2.83	5.74	3.83	3.82
0.92	12.93	1.92	12.17	2.92	5.50	3.92	3.72

CALIB							
NASHYD ( 0101)	Area (ha)=	3.49	Curve Number (CN)=	89.0			
ID= 1 DT= 1.0 min	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00			
	U.H. Tp(hrs)=	0.19					

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.97	1.017	17.18	2.017	10.96	3.02	5.27
0.033	3.97	1.033	17.18	2.033	10.96	3.03	5.27
0.050	3.97	1.050	17.18	2.050	10.96	3.05	5.27
0.067	3.97	1.067	17.18	2.067	10.96	3.07	5.27
0.083	3.97	1.083	17.18	2.083	10.96	3.08	5.27
0.100	4.21	1.100	26.33	2.100	9.98	3.10	5.07
0.117	4.21	1.117	26.33	2.117	9.98	3.12	5.07
0.133	4.21	1.133	26.33	2.133	9.98	3.13	5.07
0.150	4.21	1.150	26.33	2.150	9.98	3.15	5.07
0.167	4.21	1.167	26.33	2.167	9.98	3.17	5.07
0.183	4.48	1.183	60.92	2.183	9.18	3.18	4.89
0.200	4.48	1.200	60.92	2.200	9.18	3.20	4.89
0.217	4.48	1.217	60.92	2.217	9.18	3.22	4.89
0.233	4.48	1.233	60.92	2.233	9.18	3.23	4.89
0.250	4.48	1.250	60.92	2.250	9.18	3.25	4.89
0.267	4.80	1.267	198.74	2.267	8.51	3.27	4.72
0.283	4.80	1.283	198.74	2.283	8.51	3.28	4.72
0.300	4.80	1.300	198.74	2.300	8.51	3.30	4.72
0.317	4.80	1.317	198.74	2.317	8.51	3.32	4.72
0.333	4.80	1.333	198.74	2.333	8.51	3.33	4.72
0.350	5.17	1.350	78.66	2.350	7.94	3.35	4.56
0.367	5.17	1.367	78.66	2.367	7.94	3.37	4.56
0.383	5.17	1.383	78.66	2.383	7.94	3.38	4.56
0.400	5.17	1.400	78.66	2.400	7.94	3.40	4.56
0.417	5.17	1.417	78.66	2.417	7.94	3.42	4.56
0.433	5.61	1.433	43.26	2.433	7.45	3.43	4.41
0.450	5.61	1.450	43.26	2.450	7.45	3.45	4.41
0.467	5.61	1.467	43.26	2.467	7.45	3.47	4.41
0.483	5.61	1.483	43.26	2.483	7.45	3.48	4.41
0.500	5.61	1.500	43.26	2.500	7.45	3.50	4.41
0.517	6.15	1.517	29.84	2.517	7.02	3.52	4.28
0.533	6.15	1.533	29.84	2.533	7.02	3.53	4.28
0.550	6.15	1.550	29.84	2.550	7.02	3.55	4.28
0.567	6.15	1.567	29.84	2.567	7.02	3.57	4.28
0.583	6.15	1.583	29.84	2.583	7.02	3.58	4.28
0.600	6.82	1.600	22.88	2.600	6.64	3.60	4.15
0.617	6.82	1.617	22.88	2.617	6.64	3.62	4.15
0.633	6.82	1.633	22.88	2.633	6.64	3.63	4.15
0.650	6.82	1.650	22.88	2.650	6.64	3.65	4.15
0.667	6.82	1.667	22.88	2.667	6.64	3.67	4.15
0.683	7.68	1.683	18.63	2.683	6.31	3.68	4.03
0.700	7.68	1.700	18.63	2.700	6.31	3.70	4.03
0.717	7.68	1.717	18.63	2.717	6.31	3.72	4.03
0.733	7.68	1.733	18.63	2.733	6.31	3.73	4.03
0.750	7.68	1.750	18.63	2.750	6.31	3.75	4.03
0.767	8.83	1.767	15.77	2.767	6.01	3.77	3.92
0.783	8.83	1.783	15.77	2.783	6.01	3.78	3.92
0.800	8.83	1.800	15.77	2.800	6.01	3.80	3.92
0.817	8.83	1.817	15.77	2.817	6.01	3.82	3.92
0.833	8.83	1.833	15.77	2.833	6.01	3.83	3.92
0.850	10.46	1.850	13.72	2.850	5.74	3.85	3.82
0.867	10.46	1.867	13.72	2.867	5.74	3.87	3.82
0.883	10.46	1.883	13.72	2.883	5.74	3.88	3.82
0.900	10.46	1.900	13.72	2.900	5.74	3.90	3.82
0.917	10.46	1.917	13.72	2.917	5.74	3.92	3.82
0.933	12.93	1.933	12.17	2.933	5.50	3.93	3.72
0.950	12.93	1.950	12.17	2.950	5.50	3.95	3.72
0.967	12.93	1.967	12.17	2.967	5.50	3.97	3.72
0.983	12.93	1.983	12.17	2.983	5.50	3.98	3.72
1.000	12.93	2.000	12.17	3.000	5.50	4.00	3.72

Unit Hyd Qpeak (cms)= 0.702

PEAK FLOW (cms)= 0.471 (i)  
TIME TO PEAK (hrs)= 1.550  
RUNOFF VOLUME (mm)= 38.162  
TOTAL RAINFALL (mm)= 63.604  
RUNOFF COEFFICIENT = 0.600

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

CALIB  
NASHYD ( 0102) | Area (ha)= 0.21 Curve Number (CN)= 89.0  
ID= 1 DT= 1.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00  
U.H. Tp(hrs)= 0.15

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.97	1.017	17.18	2.017	10.96	3.02	5.27
0.033	3.97	1.033	17.18	2.033	10.96	3.03	5.27
0.050	3.97	1.050	17.18	2.050	10.96	3.05	5.27
0.067	3.97	1.067	17.18	2.067	10.96	3.07	5.27
0.083	3.97	1.083	17.18	2.083	10.96	3.08	5.27
0.100	4.21	1.100	26.33	2.100	9.98	3.10	5.07
0.117	4.21	1.117	26.33	2.117	9.98	3.12	5.07
0.133	4.21	1.133	26.33	2.133	9.98	3.13	5.07
0.150	4.21	1.150	26.33	2.150	9.98	3.15	5.07
0.167	4.21	1.167	26.33	2.167	9.98	3.17	5.07
0.183	4.48	1.183	60.92	2.183	9.18	3.18	4.89
0.200	4.48	1.200	60.92	2.200	9.18	3.20	4.89
0.217	4.48	1.217	60.92	2.217	9.18	3.22	4.89
0.233	4.48	1.233	60.92	2.233	9.18	3.23	4.89
0.250	4.48	1.250	60.92	2.250	9.18	3.25	4.89
0.267	4.80	1.267	198.74	2.267	8.51	3.27	4.72
0.283	4.80	1.283	198.74	2.283	8.51	3.28	4.72
0.300	4.80	1.300	198.74	2.300	8.51	3.30	4.72
0.317	4.80	1.317	198.74	2.317	8.51	3.32	4.72
0.333	4.80	1.333	198.74	2.333	8.51	3.33	4.72
0.350	5.17	1.350	78.66	2.350	7.94	3.35	4.56
0.367	5.17	1.367	78.66	2.367	7.94	3.37	4.56
0.383	5.17	1.383	78.66	2.383	7.94	3.38	4.56
0.400	5.17	1.400	78.66	2.400	7.94	3.40	4.56
0.417	5.17	1.417	78.66	2.417	7.94	3.42	4.56
0.433	5.61	1.433	43.26	2.433	7.45	3.43	4.41
0.450	5.61	1.450	43.26	2.450	7.45	3.45	4.41
0.467	5.61	1.467	43.26	2.467	7.45	3.47	4.41
0.483	5.61	1.483	43.26	2.483	7.45	3.48	4.41
0.500	5.61	1.500	43.26	2.500	7.45	3.50	4.41
0.517	6.15	1.517	29.84	2.517	7.02	3.52	4.28
0.533	6.15	1.533	29.84	2.533	7.02	3.53	4.28
0.550	6.15	1.550	29.84	2.550	7.02	3.55	4.28
0.567	6.15	1.567	29.84	2.567	7.02	3.57	4.28
0.583	6.15	1.583	29.84	2.583	7.02	3.58	4.28
0.600	6.82	1.600	22.88	2.600	6.64	3.60	4.15
0.617	6.82	1.617	22.88	2.617	6.64	3.62	4.15
0.633	6.82	1.633	22.88	2.633	6.64	3.63	4.15
0.650	6.82	1.650	22.88	2.650	6.64	3.65	4.15
0.667	6.82	1.667	22.88	2.667	6.64	3.67	4.15
0.683	7.68	1.683	18.63	2.683	6.31	3.68	4.03
0.700	7.68	1.700	18.63	2.700	6.31	3.70	4.03
0.717	7.68	1.717	18.63	2.717	6.31	3.72	4.03
0.733	7.68	1.733	18.63	2.733	6.31	3.73	4.03
0.750	7.68	1.750	18.63	2.750	6.31	3.75	4.03
0.767	8.83	1.767	15.77	2.767	6.01	3.77	3.92
0.783	8.83	1.783	15.77	2.783	6.01	3.78	3.92
0.800	8.83	1.800	15.77	2.800	6.01	3.80	3.92
0.817	8.83	1.817	15.77	2.817	6.01	3.82	3.92
0.833	8.83	1.833	15.77	2.833	6.01	3.83	3.92
0.850	10.46	1.850	13.72	2.850	5.74	3.85	3.82
0.867	10.46	1.867	13.72	2.867	5.74	3.87	3.82
0.883	10.46	1.883	13.72	2.883	5.74	3.88	3.82
0.900	10.46	1.900	13.72	2.900	5.74	3.90	3.82
0.917	10.46	1.917	13.72	2.917	5.74	3.92	3.82
0.933	12.93	1.933	12.17	2.933	5.50	3.93	3.72
0.950	12.93	1.950	12.17	2.950	5.50	3.95	3.72
0.967	12.93	1.967	12.17	2.967	5.50	3.97	3.72
0.983	12.93	1.983	12.17	2.983	5.50	3.98	3.72
1.000	12.93	2.000	12.17	3.000	5.50	4.00	3.72

Unit Hyd Qpeak (cms)= 0.053

PEAK FLOW (cms)= 0.033 (i)  
TIME TO PEAK (hrs)= 1.500  
RUNOFF VOLUME (mm)= 38.160  
TOTAL RAINFALL (mm)= 63.604  
RUNOFF COEFFICIENT = 0.600

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW 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

000 TTTTT TTTTT H H Y Y M M 000 TM  
O O T T H H Y Y MM MM O O  
O O T T H H Y M M O O  
000 T T H H Y M M 000

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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\MRitceyThorpe\AppData\Local\Civica\vh5\288aab60-d94f-43e4-8c9b-21a7a9040589\51861  
Summary filename: C:\Users\MRitceyThorpe\AppData\Local\Civica\vh5\288aab60-d94f-43e4-8c9b-21a7a9040589\51861

DATE: 04/04/2024 TIME: 02:08:59  
USER:

COMMENTS: \_\_\_\_\_

\*\*\*\*\*  
\*\* SIMULATION : 050-Year Chicago \*\*  
\*\*\*\*\*

CHICAGO STORM | IDF curve parameters: A=1300.000  
| Ptotal= 71.26 mm | B= 4.700  
C= 0.780  
used in: INTENSITY = A / (t + B)^C  
Duration of storm = 4.00 hrs  
Storm time step = 5.00 min  
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.46	1.00	19.32	2.00	12.31	3.00	5.92
0.08	4.72	1.08	29.62	2.08	11.21	3.08	5.69
0.17	5.03	1.17	68.42	2.17	10.31	3.17	5.49
0.25	5.38	1.25	220.93	2.25	9.56	3.25	5.29
0.33	5.80	1.33	88.27	2.33	8.91	3.33	5.12
0.42	6.30	1.42	48.66	2.42	8.36	3.42	4.95
0.50	6.90	1.50	33.57	2.50	7.88	3.50	4.80
0.58	7.66	1.58	25.73	2.58	7.46	3.58	4.66
0.67	8.63	1.67	20.95	2.67	7.08	3.67	4.52
0.75	9.92	1.75	17.73	2.75	6.74	3.75	4.40
0.83	11.75	1.83	15.42	2.83	6.44	3.83	4.28
0.92	14.53	1.92	13.67	2.92	6.17	3.92	4.17



NASHYD ( 0101) | Area (ha)= 3.49 Curve Number (CN)= 89.0  
 ID= 1 DT= 1.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00  
 -----  
 U.H. Tp(hrs)= 0.19

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	4.46	1.017	19.32	2.017	12.31	3.02	5.92
0.033	4.46	1.033	19.32	2.033	12.31	3.03	5.92
0.050	4.46	1.050	19.32	2.050	12.31	3.05	5.92
0.067	4.46	1.067	19.32	2.067	12.31	3.07	5.92
0.083	4.46	1.083	19.32	2.083	12.31	3.08	5.92
0.100	4.72	1.100	29.62	2.100	11.21	3.10	5.69
0.117	4.72	1.117	29.62	2.117	11.21	3.12	5.69
0.133	4.72	1.133	29.62	2.133	11.21	3.13	5.69
0.150	4.72	1.150	29.62	2.150	11.21	3.15	5.69
0.167	4.72	1.167	29.62	2.167	11.21	3.17	5.69
0.183	5.03	1.183	68.42	2.183	10.31	3.18	5.49
0.200	5.03	1.200	68.42	2.200	10.31	3.20	5.49
0.217	5.03	1.217	68.42	2.217	10.31	3.22	5.49
0.233	5.03	1.233	68.42	2.233	10.31	3.23	5.49
0.250	5.03	1.250	68.42	2.250	10.31	3.25	5.49
0.267	5.38	1.267	220.93	2.267	9.56	3.27	5.29
0.283	5.38	1.283	220.93	2.283	9.56	3.28	5.29
0.300	5.38	1.300	220.93	2.300	9.56	3.30	5.29
0.317	5.38	1.317	220.93	2.317	9.56	3.32	5.29
0.333	5.38	1.333	220.93	2.333	9.56	3.33	5.29
0.350	5.80	1.350	88.27	2.350	8.91	3.35	5.12
0.367	5.80	1.367	88.27	2.367	8.91	3.37	5.12
0.383	5.80	1.383	88.27	2.383	8.91	3.38	5.12
0.400	5.80	1.400	88.27	2.400	8.91	3.40	5.12
0.417	5.80	1.417	88.27	2.417	8.91	3.42	5.12
0.433	6.30	1.433	48.66	2.433	8.36	3.43	4.95
0.450	6.30	1.450	48.66	2.450	8.36	3.45	4.95
0.467	6.30	1.467	48.66	2.467	8.36	3.47	4.95
0.483	6.30	1.483	48.66	2.483	8.36	3.48	4.95
0.500	6.30	1.500	48.66	2.500	8.36	3.50	4.95
0.517	6.90	1.517	33.57	2.517	7.88	3.52	4.80
0.533	6.90	1.533	33.57	2.533	7.88	3.53	4.80
0.550	6.90	1.550	33.57	2.550	7.88	3.55	4.80
0.567	6.90	1.567	33.57	2.567	7.88	3.57	4.80
0.583	6.90	1.583	33.57	2.583	7.88	3.58	4.80
0.600	7.66	1.600	25.73	2.600	7.46	3.60	4.66
0.617	7.66	1.617	25.73	2.617	7.46	3.62	4.66
0.633	7.66	1.633	25.73	2.633	7.46	3.63	4.66
0.650	7.66	1.650	25.73	2.650	7.46	3.65	4.66
0.667	7.66	1.667	25.73	2.667	7.46	3.67	4.66
0.683	8.63	1.683	20.95	2.683	7.08	3.68	4.52
0.700	8.63	1.700	20.95	2.700	7.08	3.70	4.52
0.717	8.63	1.717	20.95	2.717	7.08	3.72	4.52
0.733	8.63	1.733	20.95	2.733	7.08	3.73	4.52
0.750	8.63	1.750	20.95	2.750	7.08	3.75	4.52
0.767	9.92	1.767	17.73	2.767	6.74	3.77	4.40
0.783	9.92	1.783	17.73	2.783	6.74	3.78	4.40
0.800	9.92	1.800	17.73	2.800	6.74	3.80	4.40
0.817	9.92	1.817	17.73	2.817	6.74	3.82	4.40
0.833	9.92	1.833	17.73	2.833	6.74	3.83	4.40
0.850	11.75	1.850	15.42	2.850	6.44	3.85	4.28
0.867	11.75	1.867	15.42	2.867	6.44	3.87	4.28
0.883	11.75	1.883	15.42	2.883	6.44	3.88	4.28
0.900	11.75	1.900	15.42	2.900	6.44	3.90	4.28
0.917	11.75	1.917	15.42	2.917	6.44	3.92	4.28
0.933	14.53	1.933	13.67	2.933	6.17	3.93	4.17
0.950	14.53	1.950	13.67	2.950	6.17	3.95	4.17
0.967	14.53	1.967	13.67	2.967	6.17	3.97	4.17
0.983	14.53	1.983	13.67	2.983	6.17	3.98	4.17
1.000	14.53	2.000	13.67	3.000	6.17	4.00	4.17

Unit Hyd Qpeak (cms)= 0.702

PEAK FLOW (cms)= 0.560 (i)  
 TIME TO PEAK (hrs)= 1.550  
 RUNOFF VOLUME (mm)= 44.957  
 TOTAL RAINFALL (mm)= 71.258  
 RUNOFF COEFFICIENT = 0.631

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

NASHYD ( 0102) | Area (ha)= 0.21 Curve Number (CN)= 89.0  
 ID= 1 DT= 1.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00  
 ----- U.H. Tp(hrs)= 0.15

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	4.46	1.017	19.32	2.017	12.31	3.02	5.92
0.033	4.46	1.033	19.32	2.033	12.31	3.03	5.92
0.050	4.46	1.050	19.32	2.050	12.31	3.05	5.92
0.067	4.46	1.067	19.32	2.067	12.31	3.07	5.92
0.083	4.46	1.083	19.32	2.083	12.31	3.08	5.92
0.100	4.72	1.100	29.62	2.100	11.21	3.10	5.69
0.117	4.72	1.117	29.62	2.117	11.21	3.12	5.69
0.133	4.72	1.133	29.62	2.133	11.21	3.13	5.69
0.150	4.72	1.150	29.62	2.150	11.21	3.15	5.69
0.167	4.72	1.167	29.62	2.167	11.21	3.17	5.69
0.183	5.03	1.183	68.42	2.183	10.31	3.18	5.49
0.200	5.03	1.200	68.42	2.200	10.31	3.20	5.49
0.217	5.03	1.217	68.42	2.217	10.31	3.22	5.49
0.233	5.03	1.233	68.42	2.233	10.31	3.23	5.49
0.250	5.03	1.250	68.42	2.250	10.31	3.25	5.49
0.267	5.38	1.267	220.93	2.267	9.56	3.27	5.29
0.283	5.38	1.283	220.93	2.283	9.56	3.28	5.29
0.300	5.38	1.300	220.93	2.300	9.56	3.30	5.29
0.317	5.38	1.317	220.93	2.317	9.56	3.32	5.29
0.333	5.38	1.333	220.93	2.333	9.56	3.33	5.29
0.350	5.80	1.350	88.27	2.350	8.91	3.35	5.12
0.367	5.80	1.367	88.27	2.367	8.91	3.37	5.12
0.383	5.80	1.383	88.27	2.383	8.91	3.38	5.12
0.400	5.80	1.400	88.27	2.400	8.91	3.40	5.12
0.417	5.80	1.417	88.27	2.417	8.91	3.42	5.12
0.433	6.30	1.433	48.66	2.433	8.36	3.43	4.95
0.450	6.30	1.450	48.66	2.450	8.36	3.45	4.95
0.467	6.30	1.467	48.66	2.467	8.36	3.47	4.95
0.483	6.30	1.483	48.66	2.483	8.36	3.48	4.95
0.500	6.30	1.500	48.66	2.500	8.36	3.50	4.95
0.517	6.90	1.517	33.57	2.517	7.88	3.52	4.80
0.533	6.90	1.533	33.57	2.533	7.88	3.53	4.80
0.550	6.90	1.550	33.57	2.550	7.88	3.55	4.80
0.567	6.90	1.567	33.57	2.567	7.88	3.57	4.80
0.583	6.90	1.583	33.57	2.583	7.88	3.58	4.80
0.600	7.66	1.600	25.73	2.600	7.46	3.60	4.66
0.617	7.66	1.617	25.73	2.617	7.46	3.62	4.66
0.633	7.66	1.633	25.73	2.633	7.46	3.63	4.66
0.650	7.66	1.650	25.73	2.650	7.46	3.65	4.66
0.667	7.66	1.667	25.73	2.667	7.46	3.67	4.66
0.683	8.63	1.683	20.95	2.683	7.08	3.68	4.52
0.700	8.63	1.700	20.95	2.700	7.08	3.70	4.52
0.717	8.63	1.717	20.95	2.717	7.08	3.72	4.52
0.733	8.63	1.733	20.95	2.733	7.08	3.73	4.52
0.750	8.63	1.750	20.95	2.750	7.08	3.75	4.52
0.767	9.92	1.767	17.73	2.767	6.74	3.77	4.40
0.783	9.92	1.783	17.73	2.783	6.74	3.78	4.40
0.800	9.92	1.800	17.73	2.800	6.74	3.80	4.40
0.817	9.92	1.817	17.73	2.817	6.74	3.82	4.40
0.833	9.92	1.833	17.73	2.833	6.74	3.83	4.40
0.850	11.75	1.850	15.42	2.850	6.44	3.85	4.28
0.867	11.75	1.867	15.42	2.867	6.44	3.87	4.28
0.883	11.75	1.883	15.42	2.883	6.44	3.88	4.28
0.900	11.75	1.900	15.42	2.900	6.44	3.90	4.28
0.917	11.75	1.917	15.42	2.917	6.44	3.92	4.28
0.933	14.53	1.933	13.67	2.933	6.17	3.93	4.17
0.950	14.53	1.950	13.67	2.950	6.17	3.95	4.17
0.967	14.53	1.967	13.67	2.967	6.17	3.97	4.17
0.983	14.53	1.983	13.67	2.983	6.17	3.98	4.17
1.000	14.53	2.000	13.67	3.000	6.17	4.00	4.17

Unit Hyd Qpeak (cms)= 0.053

PEAK FLOW (cms)= 0.039 (i)  
 TIME TO PEAK (hrs)= 1.483  
 RUNOFF VOLUME (mm)= 44.955  
 TOTAL RAINFALL (mm)= 71.258  
 RUNOFF COEFFICIENT = 0.631

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

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V V I SSSSS U U A L (v 6.2.2015)
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V V I SS U U A A A A L
V V I SS U U A A L
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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\MRitceyThorpe\AppData\Local\Civica\vh5\288aab60-d94f-43e4-8c9b-21a7a9040589\5f1ff  
 Summary filename: C:\Users\MRitceyThorpe\AppData\Local\Civica\vh5\288aab60-d94f-43e4-8c9b-21a7a9040589\5f1ff

DATE: 04/04/2024 TIME: 02:08:59

USER:

COMMENTS: \_\_\_\_\_

\*\*\*\*\*  
 \*\* SIMULATION : 100-Year Chicago \*\*  
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CHICAGO STORM  
 Ptotal= 79.43 mm

IDF curve parameters: A=1450.000  
 B= 4.900  
 C= 0.780  
 used in: INTENSITY = A / (t + B)^C  
 Duration of storm = 4.00 hrs  
 Storm time step = 5.00 min  
 Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.98	1.00	21.69	2.00	13.80	3.00	6.62
0.08	5.28	1.08	33.28	2.08	12.57	3.08	6.37
0.17	5.62	1.17	76.62	2.17	11.55	3.17	6.13
0.25	6.02	1.25	242.53	2.25	10.71	3.25	5.92
0.33	6.49	1.33	98.69	2.33	9.98	3.33	5.72
0.42	7.05	1.42	54.64	2.42	9.36	3.42	5.54
0.50	7.72	1.50	37.73	2.50	8.82	3.50	5.37
0.58	8.57	1.58	28.91	2.58	8.35	3.58	5.21
0.67	9.66	1.67	23.53	2.67	7.92	3.67	5.06
0.75	11.12	1.75	19.90	2.75	7.55	3.75	4.92
0.83	13.17	1.83	17.30	2.83	7.21	3.83	4.78
0.92	16.30	1.92	15.34	2.92	6.90	3.92	4.66

CALIB  
 NASHYD ( 0101)  
 ID= 1 DT= 1.0 min

Area (ha)= 3.49 Curve Number (CN)= 89.0  
 Ia (mm)= 5.00 # of Linear Res.(N)= 3.00  
 U.H. Tp(hrs)= 0.19

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	4.98	1.017	21.69	2.017	13.80	3.02	6.62
0.033	4.98	1.033	21.69	2.033	13.80	3.03	6.62
0.050	4.98	1.050	21.69	2.050	13.80	3.05	6.62
0.067	4.98	1.067	21.69	2.067	13.80	3.07	6.62
0.083	4.98	1.083	21.69	2.083	13.80	3.08	6.62
0.100	5.28	1.100	33.28	2.100	12.57	3.10	6.37
0.117	5.28	1.117	33.28	2.117	12.57	3.12	6.37
0.133	5.28	1.133	33.28	2.133	12.57	3.13	6.37

0.150	5.28	1.150	33.28	2.150	12.57	3.15	6.37
0.167	5.28	1.167	33.28	2.167	12.57	3.17	6.37
0.183	5.62	1.183	76.62	2.183	11.55	3.18	6.13
0.200	5.62	1.200	76.62	2.200	11.55	3.20	6.13
0.217	5.62	1.217	76.62	2.217	11.55	3.22	6.13
0.233	5.62	1.233	76.62	2.233	11.55	3.23	6.13
0.250	5.62	1.250	76.62	2.250	11.55	3.25	6.13
0.267	6.02	1.267	242.53	2.267	10.71	3.27	5.92
0.283	6.02	1.283	242.53	2.283	10.71	3.28	5.92
0.300	6.02	1.300	242.53	2.300	10.71	3.30	5.92
0.317	6.02	1.317	242.53	2.317	10.71	3.32	5.92
0.333	6.02	1.333	242.53	2.333	10.71	3.33	5.92
0.350	6.49	1.350	98.70	2.350	9.98	3.35	5.72
0.367	6.49	1.367	98.69	2.367	9.98	3.37	5.72
0.383	6.49	1.383	98.69	2.383	9.98	3.38	5.72
0.400	6.49	1.400	98.69	2.400	9.98	3.40	5.72
0.417	6.49	1.417	98.69	2.417	9.98	3.42	5.72
0.433	7.05	1.433	54.64	2.433	9.36	3.43	5.54
0.450	7.05	1.450	54.64	2.450	9.36	3.45	5.54
0.467	7.05	1.467	54.64	2.467	9.36	3.47	5.54
0.483	7.05	1.483	54.64	2.483	9.36	3.48	5.54
0.500	7.05	1.500	54.64	2.500	9.36	3.50	5.54
0.517	7.72	1.517	37.73	2.517	8.82	3.52	5.37
0.533	7.72	1.533	37.73	2.533	8.82	3.53	5.37
0.550	7.72	1.550	37.73	2.550	8.82	3.55	5.37
0.567	7.72	1.567	37.73	2.567	8.82	3.57	5.37
0.583	7.72	1.583	37.73	2.583	8.82	3.58	5.37
0.600	8.57	1.600	28.91	2.600	8.35	3.60	5.21
0.617	8.57	1.617	28.91	2.617	8.35	3.62	5.21
0.633	8.57	1.633	28.91	2.633	8.35	3.63	5.21
0.650	8.57	1.650	28.91	2.650	8.35	3.65	5.21
0.667	8.57	1.667	28.91	2.667	8.35	3.67	5.21
0.683	9.66	1.683	23.53	2.683	7.92	3.68	5.06
0.700	9.66	1.700	23.53	2.700	7.92	3.70	5.06
0.717	9.66	1.717	23.53	2.717	7.92	3.72	5.06
0.733	9.66	1.733	23.53	2.733	7.92	3.73	5.06
0.750	9.66	1.750	23.53	2.750	7.92	3.75	5.06
0.767	11.12	1.767	19.90	2.767	7.55	3.77	4.92
0.783	11.12	1.783	19.90	2.783	7.55	3.78	4.92
0.800	11.12	1.800	19.90	2.800	7.55	3.80	4.92
0.817	11.12	1.817	19.90	2.817	7.55	3.82	4.92
0.833	11.12	1.833	19.90	2.833	7.55	3.83	4.92
0.850	13.17	1.850	17.30	2.850	7.21	3.85	4.78
0.867	13.17	1.867	17.30	2.867	7.21	3.87	4.78
0.883	13.17	1.883	17.30	2.883	7.21	3.88	4.78
0.900	13.17	1.900	17.30	2.900	7.21	3.90	4.78
0.917	13.17	1.917	17.30	2.917	7.21	3.92	4.78
0.933	16.30	1.933	15.34	2.933	6.90	3.93	4.66
0.950	16.30	1.950	15.34	2.950	6.90	3.95	4.66
0.967	16.30	1.967	15.34	2.967	6.90	3.97	4.66
0.983	16.30	1.983	15.34	2.983	6.90	3.98	4.66
1.000	16.30	2.000	15.34	3.000	6.90	4.00	4.66

Unit Hyd Qpeak (cms)= 0.702

PEAK FLOW (cms)= 0.655 (i)

TIME TO PEAK (hrs)= 1.533

RUNOFF VOLUME (mm)= 52.349

TOTAL RAINFALL (mm)= 79.429

RUNOFF COEFFICIENT = 0.659

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

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 CALIB  
 NASHYD ( 0102) | Area (ha)= 0.21 Curve Number (CN)= 89.0  
 ID= 1 DT= 1.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00  
 U.H. Tp(hrs)= 0.15  
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NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	4.98	1.017	21.69	2.017	13.80	3.02	6.62
0.033	4.98	1.033	21.69	2.033	13.80	3.03	6.62
0.050	4.98	1.050	21.69	2.050	13.80	3.05	6.62
0.067	4.98	1.067	21.69	2.067	13.80	3.07	6.62
0.083	4.98	1.083	21.69	2.083	13.80	3.08	6.62
0.100	5.28	1.100	33.28	2.100	12.57	3.10	6.37
0.117	5.28	1.117	33.28	2.117	12.57	3.12	6.37
0.133	5.28	1.133	33.28	2.133	12.57	3.13	6.37

0.150	5.28	1.150	33.28	2.150	12.57	3.15	6.37
0.167	5.28	1.167	33.28	2.167	12.57	3.17	6.37
0.183	5.62	1.183	76.62	2.183	11.55	3.18	6.13
0.200	5.62	1.200	76.62	2.200	11.55	3.20	6.13
0.217	5.62	1.217	76.62	2.217	11.55	3.22	6.13
0.233	5.62	1.233	76.62	2.233	11.55	3.23	6.13
0.250	5.62	1.250	76.62	2.250	11.55	3.25	6.13
0.267	6.02	1.267	242.53	2.267	10.71	3.27	5.92
0.283	6.02	1.283	242.53	2.283	10.71	3.28	5.92
0.300	6.02	1.300	242.53	2.300	10.71	3.30	5.92
0.317	6.02	1.317	242.53	2.317	10.71	3.32	5.92
0.333	6.02	1.333	242.53	2.333	10.71	3.33	5.92
0.350	6.49	1.350	98.70	2.350	9.98	3.35	5.72
0.367	6.49	1.367	98.69	2.367	9.98	3.37	5.72
0.383	6.49	1.383	98.69	2.383	9.98	3.38	5.72
0.400	6.49	1.400	98.69	2.400	9.98	3.40	5.72
0.417	6.49	1.417	98.69	2.417	9.98	3.42	5.72
0.433	7.05	1.433	54.64	2.433	9.36	3.43	5.54
0.450	7.05	1.450	54.64	2.450	9.36	3.45	5.54
0.467	7.05	1.467	54.64	2.467	9.36	3.47	5.54
0.483	7.05	1.483	54.64	2.483	9.36	3.48	5.54
0.500	7.05	1.500	54.64	2.500	9.36	3.50	5.54
0.517	7.72	1.517	37.73	2.517	8.82	3.52	5.37
0.533	7.72	1.533	37.73	2.533	8.82	3.53	5.37
0.550	7.72	1.550	37.73	2.550	8.82	3.55	5.37
0.567	7.72	1.567	37.73	2.567	8.82	3.57	5.37
0.583	7.72	1.583	37.73	2.583	8.82	3.58	5.37
0.600	8.57	1.600	28.91	2.600	8.35	3.60	5.21
0.617	8.57	1.617	28.91	2.617	8.35	3.62	5.21
0.633	8.57	1.633	28.91	2.633	8.35	3.63	5.21
0.650	8.57	1.650	28.91	2.650	8.35	3.65	5.21
0.667	8.57	1.667	28.91	2.667	8.35	3.67	5.21
0.683	9.66	1.683	23.53	2.683	7.92	3.68	5.06
0.700	9.66	1.700	23.53	2.700	7.92	3.70	5.06
0.717	9.66	1.717	23.53	2.717	7.92	3.72	5.06
0.733	9.66	1.733	23.53	2.733	7.92	3.73	5.06
0.750	9.66	1.750	23.53	2.750	7.92	3.75	5.06
0.767	11.12	1.767	19.90	2.767	7.55	3.77	4.92
0.783	11.12	1.783	19.90	2.783	7.55	3.78	4.92
0.800	11.12	1.800	19.90	2.800	7.55	3.80	4.92
0.817	11.12	1.817	19.90	2.817	7.55	3.82	4.92
0.833	11.12	1.833	19.90	2.833	7.55	3.83	4.92
0.850	13.17	1.850	17.30	2.850	7.21	3.85	4.78
0.867	13.17	1.867	17.30	2.867	7.21	3.87	4.78
0.883	13.17	1.883	17.30	2.883	7.21	3.88	4.78
0.900	13.17	1.900	17.30	2.900	7.21	3.90	4.78
0.917	13.17	1.917	17.30	2.917	7.21	3.92	4.78
0.933	16.30	1.933	15.34	2.933	6.90	3.93	4.66
0.950	16.30	1.950	15.34	2.950	6.90	3.95	4.66
0.967	16.30	1.967	15.34	2.967	6.90	3.97	4.66
0.983	16.30	1.983	15.34	2.983	6.90	3.98	4.66
1.000	16.30	2.000	15.34	3.000	6.90	4.00	4.66

Unit Hyd Qpeak (cms)= 0.053

PEAK FLOW (cms)= 0.045 (i)

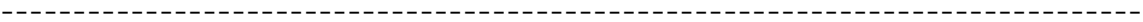
TIME TO PEAK (hrs)= 1.483

RUNOFF VOLUME (mm)= 52.347

TOTAL RAINFALL (mm)= 79.429

RUNOFF COEFFICIENT = 0.659

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



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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

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000 TTTTT TTTTT H H Y Y M M 000 TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
000 T T H H Y M M 000

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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\MRitceyThorpe\AppData\Local\Civica\vh5\288aab60-d94f-43e4-8c9b-21a7a9040589\1f5c0  
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DATE: 04/04/2024 TIME: 02:10:16

USER:

COMMENTS: \_\_\_\_\_

\*\*\*\*\*  
 \*\* SIMULATION : 002-Year Chicago \*\*  
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-----  
 | CHICAGO STORM |  
Ptotal= 33.45 mm

IDF curve parameters: A= 610.000  
 B= 4.600  
 C= 0.780  
 used in: INTENSITY = A / (t + B)^C  
 Duration of storm = 4.00 hrs  
 Storm time step = 5.00 min  
 Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.09	1.00	9.03	2.00	5.76	3.00	2.77
0.08	2.21	1.08	13.85	2.08	5.25	3.08	2.67
0.17	2.36	1.17	32.04	2.17	4.83	3.17	2.57
0.25	2.52	1.25	104.51	2.25	4.47	3.25	2.48
0.33	2.72	1.33	41.36	2.33	4.17	3.33	2.40
0.42	2.95	1.42	22.75	2.42	3.92	3.42	2.32
0.50	3.23	1.50	15.69	2.50	3.69	3.50	2.25
0.58	3.59	1.58	12.03	2.58	3.49	3.58	2.18
0.67	4.04	1.67	9.80	2.67	3.32	3.67	2.12
0.75	4.65	1.75	8.29	2.75	3.16	3.75	2.06
0.83	5.50	1.83	7.21	2.83	3.02	3.83	2.01
0.92	6.80	1.92	6.40	2.92	2.89	3.92	1.95

-----  
 | CALIB |  
 | STANDHYD ( 0001) |  
ID= 1 DT= 1.0 min

Area (ha)= 3.45  
 Total Imp(%)= 58.90 Dir. Conn.(%)= 58.90

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	2.03	1.42
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	151.57	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.00	2.09	1.00	9.03	2.00	5.76	3.00	2.77
0.08	2.21	1.08	13.85	2.08	5.25	3.08	2.67
0.17	2.36	1.17	32.04	2.17	4.83	3.17	2.57
0.25	2.52	1.25	104.51	2.25	4.47	3.25	2.48
0.33	2.72	1.33	41.36	2.33	4.17	3.33	2.40
0.42	2.95	1.42	22.75	2.42	3.92	3.42	2.32
0.50	3.23	1.50	15.69	2.50	3.69	3.50	2.25
0.58	3.59	1.58	12.03	2.58	3.49	3.58	2.18
0.67	4.04	1.67	9.80	2.67	3.32	3.67	2.12
0.75	4.65	1.75	8.29	2.75	3.16	3.75	2.06
0.83	5.50	1.83	7.21	2.83	3.02	3.83	2.01
0.92	6.80	1.92	6.40	2.92	2.89	3.92	1.95

0.017	2.09	1.017	9.03	2.017	5.76	3.02	2.77
0.033	2.09	1.033	9.03	2.033	5.76	3.03	2.77
0.050	2.09	1.050	9.03	2.050	5.76	3.05	2.77
0.067	2.09	1.067	9.03	2.067	5.76	3.07	2.77
0.083	2.09	1.083	9.03	2.083	5.76	3.08	2.77
0.100	2.21	1.100	13.85	2.100	5.25	3.10	2.67
0.117	2.21	1.117	13.85	2.117	5.25	3.12	2.67
0.133	2.21	1.133	13.85	2.133	5.25	3.13	2.67
0.150	2.21	1.150	13.85	2.150	5.25	3.15	2.67
0.167	2.21	1.167	13.85	2.167	5.25	3.17	2.67
0.183	2.36	1.183	32.04	2.183	4.83	3.18	2.57
0.200	2.36	1.200	32.04	2.200	4.83	3.20	2.57
0.217	2.36	1.217	32.04	2.217	4.83	3.22	2.57
0.233	2.36	1.233	32.04	2.233	4.83	3.23	2.57
0.250	2.36	1.250	32.04	2.250	4.83	3.25	2.57
0.267	2.52	1.267	104.51	2.267	4.47	3.27	2.48
0.283	2.52	1.283	104.51	2.283	4.47	3.28	2.48
0.300	2.52	1.300	104.51	2.300	4.47	3.30	2.48
0.317	2.52	1.317	104.51	2.317	4.47	3.32	2.48
0.333	2.52	1.333	104.51	2.333	4.47	3.33	2.48
0.350	2.72	1.350	41.37	2.350	4.17	3.35	2.40
0.367	2.72	1.367	41.36	2.367	4.17	3.37	2.40
0.383	2.72	1.383	41.36	2.383	4.17	3.38	2.40
0.400	2.72	1.400	41.36	2.400	4.17	3.40	2.40
0.417	2.72	1.417	41.36	2.417	4.17	3.42	2.40
0.433	2.95	1.433	22.75	2.433	3.92	3.43	2.32
0.450	2.95	1.450	22.75	2.450	3.92	3.45	2.32
0.467	2.95	1.467	22.75	2.467	3.92	3.47	2.32
0.483	2.95	1.483	22.75	2.483	3.92	3.48	2.32
0.500	2.95	1.500	22.75	2.500	3.92	3.50	2.32
0.517	3.23	1.517	15.69	2.517	3.69	3.52	2.25
0.533	3.23	1.533	15.69	2.533	3.69	3.53	2.25
0.550	3.23	1.550	15.69	2.550	3.69	3.55	2.25
0.567	3.23	1.567	15.69	2.567	3.69	3.57	2.25
0.583	3.23	1.583	15.69	2.583	3.69	3.58	2.25
0.600	3.59	1.600	12.03	2.600	3.49	3.60	2.18
0.617	3.59	1.617	12.03	2.617	3.49	3.62	2.18
0.633	3.59	1.633	12.03	2.633	3.49	3.63	2.18
0.650	3.59	1.650	12.03	2.650	3.49	3.65	2.18
0.667	3.59	1.667	12.03	2.667	3.49	3.67	2.18
0.683	4.04	1.683	9.80	2.683	3.32	3.68	2.12
0.700	4.04	1.700	9.80	2.700	3.32	3.70	2.12
0.717	4.04	1.717	9.80	2.717	3.32	3.72	2.12
0.733	4.04	1.733	9.80	2.733	3.32	3.73	2.12
0.750	4.04	1.750	9.80	2.750	3.32	3.75	2.12
0.767	4.65	1.767	8.29	2.767	3.16	3.77	2.06
0.783	4.65	1.783	8.29	2.783	3.16	3.78	2.06
0.800	4.65	1.800	8.29	2.800	3.16	3.80	2.06
0.817	4.65	1.817	8.29	2.817	3.16	3.82	2.06
0.833	4.65	1.833	8.29	2.833	3.16	3.83	2.06
0.850	5.50	1.850	7.21	2.850	3.02	3.85	2.01
0.867	5.50	1.867	7.21	2.867	3.02	3.87	2.01
0.883	5.50	1.883	7.21	2.883	3.02	3.88	2.01
0.900	5.50	1.900	7.21	2.900	3.02	3.90	2.01
0.917	5.50	1.917	7.21	2.917	3.02	3.92	2.01
0.933	6.80	1.933	6.40	2.933	2.89	3.93	1.95
0.950	6.80	1.950	6.40	2.950	2.89	3.95	1.95
0.967	6.80	1.967	6.40	2.967	2.89	3.97	1.95
0.983	6.80	1.983	6.40	2.983	2.89	3.98	1.95
1.000	6.80	2.000	6.40	3.000	2.89	4.00	1.95

Max.Eff.Inten.(mm/hr)= 104.51 21.48  
over (min) 5.00 10.00  
Storage Coeff. (min)= 3.22 (ii) 9.23 (ii)  
Unit Hyd. Tpeak (min)= 5.00 10.00  
Unit Hyd. peak (cms)= 0.30 0.12

PEAK FLOW (cms)= 0.44 0.05 \*TOTALS\*  
TIME TO PEAK (hrs)= 1.37 1.52 0.462 (iii)  
RUNOFF VOLUME (mm)= 32.45 10.78 23.54  
TOTAL RAINFALL (mm)= 33.45 33.45 33.45  
RUNOFF COEFFICIENT = 0.97 0.32 0.70

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 84.5 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DT= 1.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0730	0.1320
	0.0030	0.0100	0.0770	0.1490
	0.0060	0.0210	0.0810	0.1660
	0.0070	0.0310	0.0840	0.1830
	0.0080	0.0450	0.0880	0.2020
	0.0090	0.0580	0.0910	0.2220
	0.0100	0.0710	0.6750	0.2430
	0.0600	0.0850	1.7380	0.2640
	0.0650	0.0980	3.1130	0.2850
	0.0690	0.1150	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 ( 0001)	3.446	0.462	1.37	23.54
OUTFLOW: ID= 1 ( 0300)	3.446	0.011	4.08	21.76

PEAK FLOW REDUCTION [Qout/Qin] (%) = 2.31  
 TIME SHIFT OF PEAK FLOW (min) = 163.00  
 MAXIMUM STORAGE USED (ha.m.) = 0.0712

CALIB STANDHYD ( 0002) ID= 1 DT= 1.0 min	Area (ha) =	0.25	Dir. Conn. (%) =	75.40
	Total Imp (%) =	75.40		

	IMPERVIOUS (ha)	PERVIOUS (i)
Surface Area	0.19	0.06
Dep. Storage	1.00	5.00
Average slope	1.00	2.00
Length	41.17	40.00
Mannings n	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	2.09	1.017	9.03	2.017	5.76	3.02	2.77
0.033	2.09	1.033	9.03	2.033	5.76	3.03	2.77
0.050	2.09	1.050	9.03	2.050	5.76	3.05	2.77
0.067	2.09	1.067	9.03	2.067	5.76	3.07	2.77
0.083	2.09	1.083	9.03	2.083	5.76	3.08	2.77
0.100	2.21	1.100	13.85	2.100	5.25	3.10	2.67
0.117	2.21	1.117	13.85	2.117	5.25	3.12	2.67
0.133	2.21	1.133	13.85	2.133	5.25	3.13	2.67
0.150	2.21	1.150	13.85	2.150	5.25	3.15	2.67
0.167	2.21	1.167	13.85	2.167	5.25	3.17	2.67
0.183	2.36	1.183	32.04	2.183	4.83	3.18	2.57
0.200	2.36	1.200	32.04	2.200	4.83	3.20	2.57
0.217	2.36	1.217	32.04	2.217	4.83	3.22	2.57
0.233	2.36	1.233	32.04	2.233	4.83	3.23	2.57
0.250	2.36	1.250	32.04	2.250	4.83	3.25	2.57
0.267	2.52	1.267	104.51	2.267	4.47	3.27	2.48
0.283	2.52	1.283	104.51	2.283	4.47	3.28	2.48
0.300	2.52	1.300	104.51	2.300	4.47	3.30	2.48
0.317	2.52	1.317	104.51	2.317	4.47	3.32	2.48
0.333	2.52	1.333	104.51	2.333	4.47	3.33	2.48
0.350	2.72	1.350	41.37	2.350	4.17	3.35	2.40
0.367	2.72	1.367	41.36	2.367	4.17	3.37	2.40
0.383	2.72	1.383	41.36	2.383	4.17	3.38	2.40
0.400	2.72	1.400	41.36	2.400	4.17	3.40	2.40
0.417	2.72	1.417	41.36	2.417	4.17	3.42	2.40
0.433	2.95	1.433	22.75	2.433	3.92	3.43	2.32
0.450	2.95	1.450	22.75	2.450	3.92	3.45	2.32
0.467	2.95	1.467	22.75	2.467	3.92	3.47	2.32
0.483	2.95	1.483	22.75	2.483	3.92	3.48	2.32
0.500	2.95	1.500	22.75	2.500	3.92	3.50	2.32
0.517	3.23	1.517	15.69	2.517	3.69	3.52	2.25
0.533	3.23	1.533	15.69	2.533	3.69	3.53	2.25
0.550	3.23	1.550	15.69	2.550	3.69	3.55	2.25
0.567	3.23	1.567	15.69	2.567	3.69	3.57	2.25
0.583	3.23	1.583	15.69	2.583	3.69	3.58	2.25
0.600	3.59	1.600	12.03	2.600	3.49	3.60	2.18
0.617	3.59	1.617	12.03	2.617	3.49	3.62	2.18
0.633	3.59	1.633	12.03	2.633	3.49	3.63	2.18
0.650	3.59	1.650	12.03	2.650	3.49	3.65	2.18
0.667	3.59	1.667	12.03	2.667	3.49	3.67	2.18
0.683	4.04	1.683	9.80	2.683	3.32	3.68	2.12
0.700	4.04	1.700	9.80	2.700	3.32	3.70	2.12
0.717	4.04	1.717	9.80	2.717	3.32	3.72	2.12



0.733	4.04	1.733	9.80	2.733	3.32	3.73	2.12
0.750	4.04	1.750	9.80	2.750	3.32	3.75	2.12
0.767	4.65	1.767	8.29	2.767	3.16	3.77	2.06
0.783	4.65	1.783	8.29	2.783	3.16	3.78	2.06
0.800	4.65	1.800	8.29	2.800	3.16	3.80	2.06
0.817	4.65	1.817	8.29	2.817	3.16	3.82	2.06
0.833	4.65	1.833	8.29	2.833	3.16	3.83	2.06
0.850	5.50	1.850	7.21	2.850	3.02	3.85	2.01
0.867	5.50	1.867	7.21	2.867	3.02	3.87	2.01
0.883	5.50	1.883	7.21	2.883	3.02	3.88	2.01
0.900	5.50	1.900	7.21	2.900	3.02	3.90	2.01
0.917	5.50	1.917	7.21	2.917	3.02	3.92	2.01
0.933	6.80	1.933	6.40	2.933	2.89	3.93	1.95
0.950	6.80	1.950	6.40	2.950	2.89	3.95	1.95
0.967	6.80	1.967	6.40	2.967	2.89	3.97	1.95
0.983	6.80	1.983	6.40	2.983	2.89	3.98	1.95
1.000	6.80	2.000	6.40	3.000	2.89	4.00	1.95

Max.Eff.Inten.(mm/hr)= 104.51 18.25  
over (min) 5.00 6.00  
Storage Coeff. (min)= 1.47 (ii) 5.90 (ii)  
Unit Hyd. Tpeak (min)= 5.00 6.00  
Unit Hyd. peak (cms)= 0.42 0.19

\*TOTALS\*  
PEAK FLOW (cms)= 0.05 0.00 0.050 (iii)  
TIME TO PEAK (hrs)= 1.35 1.42 1.35  
RUNOFF VOLUME (mm)= 32.45 9.40 26.77  
TOTAL RAINFALL (mm)= 33.45 33.45 33.45  
RUNOFF COEFFICIENT = 0.97 0.28 0.80

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 81.5 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD ( 0005)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 ( 0002):	0.25	0.050	1.35	26.77
+ ID2= 2 ( 0300):	3.45	0.011	4.08	21.76
=====				
ID = 3 ( 0005):	3.70	0.056	1.37	22.10

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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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

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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\MRitceyThorpe\AppData\Local\Civica\5\288aab60-d94f-43e4-8c9b-21a7a9040589\95e8c

DATE: 04/04/2024

TIME: 02:10:16

USER:

COMMENTS: \_\_\_\_\_

\*\*\*\*\*  
 \*\* SIMULATION : 005-Year Chicago \*\*  
 \*\*\*\*\*

CHICAGO STORM  
 Ptotal= 44.96 mm

IDF curve parameters: A= 820.000  
 B= 4.600  
 C= 0.780  
 used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs  
 Storm time step = 5.00 min  
 Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.81	1.00	12.14	2.00	7.74	3.00	3.73
0.08	2.98	1.08	18.61	2.08	7.06	3.08	3.59
0.17	3.17	1.17	43.07	2.17	6.49	3.17	3.46
0.25	3.39	1.25	140.49	2.25	6.01	3.25	3.33
0.33	3.65	1.33	55.60	2.33	5.61	3.33	3.22
0.42	3.97	1.42	30.58	2.42	5.26	3.42	3.12
0.50	4.35	1.50	21.10	2.50	4.96	3.50	3.02
0.58	4.82	1.58	16.17	2.58	4.69	3.58	2.93
0.67	5.43	1.67	13.17	2.67	4.46	3.67	2.85
0.75	6.24	1.75	11.15	2.75	4.25	3.75	2.77
0.83	7.39	1.83	9.70	2.83	4.06	3.83	2.70
0.92	9.14	1.92	8.60	2.92	3.89	3.92	2.63

CALIB  
 STANDHYD ( 0001)  
 ID= 1 DT= 1.0 min

Area (ha)= 3.45  
 Total Imp(%)= 58.90 Dir. Conn.(%)= 58.90

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	2.03	1.42
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	151.57	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	2.81	1.017	12.14	2.017	7.74	3.02	3.73
0.033	2.81	1.033	12.14	2.033	7.74	3.03	3.73
0.050	2.81	1.050	12.14	2.050	7.74	3.05	3.73
0.067	2.81	1.067	12.14	2.067	7.74	3.07	3.73
0.083	2.81	1.083	12.14	2.083	7.74	3.08	3.73
0.100	2.98	1.100	18.61	2.100	7.06	3.10	3.59
0.117	2.98	1.117	18.61	2.117	7.06	3.12	3.59
0.133	2.98	1.133	18.61	2.133	7.06	3.13	3.59
0.150	2.98	1.150	18.61	2.150	7.06	3.15	3.59
0.167	2.98	1.167	18.61	2.167	7.06	3.17	3.59
0.183	3.17	1.183	43.06	2.183	6.49	3.18	3.46
0.200	3.17	1.200	43.07	2.200	6.49	3.20	3.46
0.217	3.17	1.217	43.07	2.217	6.49	3.22	3.46
0.233	3.17	1.233	43.07	2.233	6.49	3.23	3.46
0.250	3.17	1.250	43.07	2.250	6.49	3.25	3.46
0.267	3.39	1.267	140.49	2.267	6.01	3.27	3.33
0.283	3.39	1.283	140.49	2.283	6.01	3.28	3.33
0.300	3.39	1.300	140.49	2.300	6.01	3.30	3.33
0.317	3.39	1.317	140.49	2.317	6.01	3.32	3.33
0.333	3.39	1.333	140.49	2.333	6.01	3.33	3.33
0.350	3.65	1.350	55.61	2.350	5.61	3.35	3.22
0.367	3.65	1.367	55.60	2.367	5.61	3.37	3.22
0.383	3.65	1.383	55.60	2.383	5.61	3.38	3.22
0.400	3.65	1.400	55.60	2.400	5.61	3.40	3.22
0.417	3.65	1.417	55.60	2.417	5.61	3.42	3.22
0.433	3.97	1.433	30.58	2.433	5.26	3.43	3.12
0.450	3.97	1.450	30.58	2.450	5.26	3.45	3.12
0.467	3.97	1.467	30.58	2.467	5.26	3.47	3.12
0.483	3.97	1.483	30.58	2.483	5.26	3.48	3.12
0.500	3.97	1.500	30.58	2.500	5.26	3.50	3.12
0.517	4.35	1.517	21.10	2.517	4.96	3.52	3.02
0.533	4.35	1.533	21.10	2.533	4.96	3.53	3.02
0.550	4.35	1.550	21.10	2.550	4.96	3.55	3.02
0.567	4.35	1.567	21.10	2.567	4.96	3.57	3.02

0.583	4.35	1.583	21.10	2.583	4.96	3.58	3.02
0.600	4.82	1.600	16.17	2.600	4.69	3.60	2.93
0.617	4.82	1.617	16.17	2.617	4.69	3.62	2.93
0.633	4.82	1.633	16.17	2.633	4.69	3.63	2.93
0.650	4.82	1.650	16.17	2.650	4.69	3.65	2.93
0.667	4.82	1.667	16.17	2.667	4.69	3.67	2.93
0.683	5.43	1.683	13.17	2.683	4.46	3.68	2.85
0.700	5.43	1.700	13.17	2.700	4.46	3.70	2.85
0.717	5.43	1.717	13.17	2.717	4.46	3.72	2.85
0.733	5.43	1.733	13.17	2.733	4.46	3.73	2.85
0.750	5.43	1.750	13.17	2.750	4.46	3.75	2.85
0.767	6.24	1.767	11.15	2.767	4.25	3.77	2.77
0.783	6.24	1.783	11.15	2.783	4.25	3.78	2.77
0.800	6.24	1.800	11.15	2.800	4.25	3.80	2.77
0.817	6.24	1.817	11.15	2.817	4.25	3.82	2.77
0.833	6.24	1.833	11.15	2.833	4.25	3.83	2.77
0.850	7.39	1.850	9.70	2.850	4.06	3.85	2.70
0.867	7.39	1.867	9.70	2.867	4.06	3.87	2.70
0.883	7.39	1.883	9.70	2.883	4.06	3.88	2.70
0.900	7.39	1.900	9.70	2.900	4.06	3.90	2.70
0.917	7.39	1.917	9.70	2.917	4.06	3.92	2.70
0.933	9.14	1.933	8.60	2.933	3.89	3.93	2.63
0.950	9.14	1.950	8.60	2.950	3.89	3.95	2.63
0.967	9.14	1.967	8.60	2.967	3.89	3.97	2.63
0.983	9.14	1.983	8.60	2.983	3.89	3.98	2.63
1.000	9.14	2.000	8.60	3.000	3.89	4.00	2.63

Max.Eff.Inten.(mm/hr)= 140.49 39.20  
over (min) 5.00 9.00  
Storage Coeff. (min)= 2.86 (ii) 8.20 (ii)  
Unit Hyd. Tpeak (min)= 5.00 9.00  
Unit Hyd. peak (cms)= 0.32 0.13

\*TOTALS\*  
PEAK FLOW (cms)= 0.61 0.10 0.666 (iii)  
TIME TO PEAK (hrs)= 1.37 1.47 1.37  
RUNOFF VOLUME (mm)= 43.96 18.45 33.48  
TOTAL RAINFALL (mm)= 44.96 44.96 44.96  
RUNOFF COEFFICIENT = 0.98 0.41 0.74

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 84.5 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----  
RESERVOIR( 0300)  
IN= 2---> OUT= 1  
DT= 1.0 min  
-----

OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0730	0.1320
0.0030	0.0100	0.0770	0.1490
0.0060	0.0210	0.0810	0.1660
0.0070	0.0310	0.0840	0.1830
0.0080	0.0450	0.0880	0.2020
0.0090	0.0580	0.0910	0.2220
0.0100	0.0710	0.6750	0.2430
0.0600	0.0850	1.7380	0.2640
0.0650	0.0980	3.1130	0.2850
0.0690	0.1150	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 ( 0001)	3.446	0.666	1.37	33.48
OUTFLOW: ID= 1 ( 0300)	3.446	0.053	2.37	31.54

PEAK FLOW REDUCTION [Qout/Qin](%)= 7.89  
TIME SHIFT OF PEAK FLOW (min)= 60.00  
MAXIMUM STORAGE USED (ha.m.)= 0.0829

-----  
CALIB  
STANDHYD ( 0002)  
ID= 1 DT= 1.0 min  
-----

Area (ha)= 0.25  
Total Imp(%)= 75.40 Dir. Conn.(%)= 75.40

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.19	0.06
Dep. Storage (mm)=	1.00	5.00
Average slope (%)=	1.00	2.00
Length (m)=	41.17	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	2.81	1.017	12.14	2.017	7.74	3.02	3.73
0.033	2.81	1.033	12.14	2.033	7.74	3.03	3.73
0.050	2.81	1.050	12.14	2.050	7.74	3.05	3.73
0.067	2.81	1.067	12.14	2.067	7.74	3.07	3.73
0.083	2.81	1.083	12.14	2.083	7.74	3.08	3.73
0.100	2.98	1.100	18.61	2.100	7.06	3.10	3.59
0.117	2.98	1.117	18.61	2.117	7.06	3.12	3.59
0.133	2.98	1.133	18.61	2.133	7.06	3.13	3.59
0.150	2.98	1.150	18.61	2.150	7.06	3.15	3.59
0.167	2.98	1.167	18.61	2.167	7.06	3.17	3.59
0.183	3.17	1.183	43.06	2.183	6.49	3.18	3.46
0.200	3.17	1.200	43.07	2.200	6.49	3.20	3.46
0.217	3.17	1.217	43.07	2.217	6.49	3.22	3.46
0.233	3.17	1.233	43.07	2.233	6.49	3.23	3.46
0.250	3.17	1.250	43.07	2.250	6.49	3.25	3.46
0.267	3.39	1.267	140.49	2.267	6.01	3.27	3.33
0.283	3.39	1.283	140.49	2.283	6.01	3.28	3.33
0.300	3.39	1.300	140.49	2.300	6.01	3.30	3.33
0.317	3.39	1.317	140.49	2.317	6.01	3.32	3.33
0.333	3.39	1.333	140.49	2.333	6.01	3.33	3.33
0.350	3.65	1.350	55.61	2.350	5.61	3.35	3.22
0.367	3.65	1.367	55.60	2.367	5.61	3.37	3.22
0.383	3.65	1.383	55.60	2.383	5.61	3.38	3.22
0.400	3.65	1.400	55.60	2.400	5.61	3.40	3.22
0.417	3.65	1.417	55.60	2.417	5.61	3.42	3.22
0.433	3.97	1.433	30.58	2.433	5.26	3.43	3.12
0.450	3.97	1.450	30.58	2.450	5.26	3.45	3.12
0.467	3.97	1.467	30.58	2.467	5.26	3.47	3.12
0.483	3.97	1.483	30.58	2.483	5.26	3.48	3.12
0.500	3.97	1.500	30.58	2.500	5.26	3.50	3.12
0.517	4.35	1.517	21.10	2.517	4.96	3.52	3.02
0.533	4.35	1.533	21.10	2.533	4.96	3.53	3.02
0.550	4.35	1.550	21.10	2.550	4.96	3.55	3.02
0.567	4.35	1.567	21.10	2.567	4.96	3.57	3.02
0.583	4.35	1.583	21.10	2.583	4.96	3.58	3.02
0.600	4.82	1.600	16.17	2.600	4.69	3.60	2.93
0.617	4.82	1.617	16.17	2.617	4.69	3.62	2.93
0.633	4.82	1.633	16.17	2.633	4.69	3.63	2.93
0.650	4.82	1.650	16.17	2.650	4.69	3.65	2.93
0.667	4.82	1.667	16.17	2.667	4.69	3.67	2.93
0.683	5.43	1.683	13.17	2.683	4.46	3.68	2.85
0.700	5.43	1.700	13.17	2.700	4.46	3.70	2.85
0.717	5.43	1.717	13.17	2.717	4.46	3.72	2.85
0.733	5.43	1.733	13.17	2.733	4.46	3.73	2.85
0.750	5.43	1.750	13.17	2.750	4.46	3.75	2.85
0.767	6.24	1.767	11.15	2.767	4.25	3.77	2.77
0.783	6.24	1.783	11.15	2.783	4.25	3.78	2.77
0.800	6.24	1.800	11.15	2.800	4.25	3.80	2.77
0.817	6.24	1.817	11.15	2.817	4.25	3.82	2.77
0.833	6.24	1.833	11.15	2.833	4.25	3.83	2.77
0.850	7.39	1.850	9.70	2.850	4.06	3.85	2.70
0.867	7.39	1.867	9.70	2.867	4.06	3.87	2.70
0.883	7.39	1.883	9.70	2.883	4.06	3.88	2.70
0.900	7.39	1.900	9.70	2.900	4.06	3.90	2.70
0.917	7.39	1.917	9.70	2.917	4.06	3.92	2.70
0.933	9.14	1.933	8.60	2.933	3.89	3.93	2.63
0.950	9.14	1.950	8.60	2.950	3.89	3.95	2.63
0.967	9.14	1.967	8.60	2.967	3.89	3.97	2.63
0.983	9.14	1.983	8.60	2.983	3.89	3.98	2.63
1.000	9.14	2.000	8.60	3.000	3.89	4.00	2.63

Max.Eff.Inten.(mm/hr)= 140.49 33.91  
over (min) 5.00 6.00  
Storage Coeff. (min)= 1.31 (ii) 5.25 (ii)  
Unit Hyd. Tpeak (min)= 5.00 6.00  
Unit Hyd. peak (cms)= 0.44 0.21

PEAK FLOW (cms)= 0.07 0.00 \*TOTALS\*  
TIME TO PEAK (hrs)= 1.35 1.42 0.070 (iii)  
RUNOFF VOLUME (mm)= 43.96 16.36 1.35  
TOTAL RAINFALL (mm)= 44.96 44.96 37.16  
RUNOFF COEFFICIENT = 0.98 0.36 44.96  
0.83

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 81.5 Ia = Dep. Storage (Above)  
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT.  
 (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD ( 0005)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 ( 0002):	0.25	0.070	1.35	37.16
+ ID2= 2 ( 0300):	3.45	0.053	2.37	31.54
ID = 3 ( 0005):	3.70	0.077	1.35	31.92

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

  000  TTTTT  TTTTT  H  H  Y  Y  M  M  000  TM
O  O  T  T  H  H  Y  Y  MM  MM  O  O
O  O  T  T  H  H  Y  M  M  O  O
  000  T  T  H  H  Y  M  M  000
  
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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\MRitceyThorpe\AppData\Local\Civica\vh5\288aab60-d94f-43e4-8c9b-21a7a9040589\72d61  
 Summary filename: C:\Users\MRitceyThorpe\AppData\Local\Civica\vh5\288aab60-d94f-43e4-8c9b-21a7a9040589\72d61

DATE: 04/04/2024 TIME: 02:10:16  
 USER:

COMMENTS: \_\_\_\_\_

\*\*\*\*\*  
 \*\* SIMULATION : 010-Year Chicago \*\*  
 \*\*\*\*\*

CHICAGO STORM	IDF curve parameters: A=1010.000
Ptotal= 55.38 mm	B= 4.600
	C= 0.780

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

Duration of storm = 4.00 hrs  
 Storm time step = 5.00 min  
 Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.46	1.00	14.96	2.00	9.54	3.00	4.59
0.08	3.66	1.08	22.92	2.08	8.69	3.08	4.42
0.17	3.90	1.17	53.04	2.17	7.99	3.17	4.26
0.25	4.18	1.25	173.04	2.25	7.41	3.25	4.11
0.33	4.50	1.33	68.49	2.33	6.91	3.33	3.97
0.42	4.89	1.42	37.67	2.42	6.48	3.42	3.84
0.50	5.35	1.50	25.98	2.50	6.11	3.50	3.72
0.58	5.94	1.58	19.92	2.58	5.78	3.58	3.61
0.67	6.69	1.67	16.22	2.67	5.49	3.67	3.51
0.75	7.69	1.75	13.73	2.75	5.23	3.75	3.41
0.83	9.10	1.83	11.94	2.83	5.00	3.83	3.32
0.92	11.25	1.92	10.59	2.92	4.79	3.92	3.24

STANDHYD ( 0001) | Area (ha)= 3.45  
 ID= 1 DT= 1.0 min | Total Imp(%)= 58.90 Dir. Conn.(%)= 58.90

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	2.03	1.42
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	151.57	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.46	1.017	14.96	2.017	9.54	3.02	4.59
0.033	3.46	1.033	14.96	2.033	9.54	3.03	4.59
0.050	3.46	1.050	14.96	2.050	9.54	3.05	4.59
0.067	3.46	1.067	14.96	2.067	9.54	3.07	4.59
0.083	3.46	1.083	14.96	2.083	9.54	3.08	4.59
0.100	3.66	1.100	22.92	2.100	8.69	3.10	4.42
0.117	3.66	1.117	22.92	2.117	8.69	3.12	4.42
0.133	3.66	1.133	22.92	2.133	8.69	3.13	4.42
0.150	3.66	1.150	22.92	2.150	8.69	3.15	4.42
0.167	3.66	1.167	22.92	2.167	8.69	3.17	4.42
0.183	3.90	1.183	53.04	2.183	7.99	3.18	4.26
0.200	3.90	1.200	53.04	2.200	7.99	3.20	4.26
0.217	3.90	1.217	53.04	2.217	7.99	3.22	4.26
0.233	3.90	1.233	53.04	2.233	7.99	3.23	4.26
0.250	3.90	1.250	53.04	2.250	7.99	3.25	4.26
0.267	4.18	1.267	173.04	2.267	7.41	3.27	4.11
0.283	4.18	1.283	173.04	2.283	7.41	3.28	4.11
0.300	4.18	1.300	173.04	2.300	7.41	3.30	4.11
0.317	4.18	1.317	173.04	2.317	7.41	3.32	4.11
0.333	4.18	1.333	173.04	2.333	7.41	3.33	4.11
0.350	4.50	1.350	68.49	2.350	6.91	3.35	3.97
0.367	4.50	1.367	68.49	2.367	6.91	3.37	3.97
0.383	4.50	1.383	68.49	2.383	6.91	3.38	3.97
0.400	4.50	1.400	68.49	2.400	6.91	3.40	3.97
0.417	4.50	1.417	68.49	2.417	6.91	3.42	3.97
0.433	4.89	1.433	37.67	2.433	6.48	3.43	3.84
0.450	4.89	1.450	37.67	2.450	6.48	3.45	3.84
0.467	4.89	1.467	37.67	2.467	6.48	3.47	3.84
0.483	4.89	1.483	37.67	2.483	6.48	3.48	3.84
0.500	4.89	1.500	37.67	2.500	6.48	3.50	3.84
0.517	5.35	1.517	25.98	2.517	6.11	3.52	3.72
0.533	5.35	1.533	25.98	2.533	6.11	3.53	3.72
0.550	5.35	1.550	25.98	2.550	6.11	3.55	3.72
0.567	5.35	1.567	25.98	2.567	6.11	3.57	3.72
0.583	5.35	1.583	25.98	2.583	6.11	3.58	3.72
0.600	5.94	1.600	19.92	2.600	5.78	3.60	3.61
0.617	5.94	1.617	19.92	2.617	5.78	3.62	3.61
0.633	5.94	1.633	19.92	2.633	5.78	3.63	3.61
0.650	5.94	1.650	19.92	2.650	5.78	3.65	3.61
0.667	5.94	1.667	19.92	2.667	5.78	3.67	3.61
0.683	6.69	1.683	16.22	2.683	5.49	3.68	3.51
0.700	6.69	1.700	16.22	2.700	5.49	3.70	3.51
0.717	6.69	1.717	16.22	2.717	5.49	3.72	3.51
0.733	6.69	1.733	16.22	2.733	5.49	3.73	3.51
0.750	6.69	1.750	16.22	2.750	5.49	3.75	3.51
0.767	7.69	1.767	13.73	2.767	5.23	3.77	3.41
0.783	7.69	1.783	13.73	2.783	5.23	3.78	3.41
0.800	7.69	1.800	13.73	2.800	5.23	3.80	3.41
0.817	7.69	1.817	13.73	2.817	5.23	3.82	3.41
0.833	7.69	1.833	13.73	2.833	5.23	3.83	3.41
0.850	9.10	1.850	11.94	2.850	5.00	3.85	3.32
0.867	9.10	1.867	11.94	2.867	5.00	3.87	3.32
0.883	9.10	1.883	11.94	2.883	5.00	3.88	3.32
0.900	9.10	1.900	11.94	2.900	5.00	3.90	3.32
0.917	9.10	1.917	11.94	2.917	5.00	3.92	3.32
0.933	11.25	1.933	10.59	2.933	4.79	3.93	3.24
0.950	11.25	1.950	10.59	2.950	4.79	3.95	3.24
0.967	11.25	1.967	10.59	2.967	4.79	3.97	3.24
0.983	11.25	1.983	10.59	2.983	4.79	3.98	3.24
1.000	11.25	2.000	10.59	3.000	4.79	4.00	3.24

Max.Eff.Inten.(mm/hr)=	173.04	57.43
over (min)	5.00	8.00
Storage Coeff. (min)=	2.63 (ii)	7.54 (ii)
Unit Hyd. Tpeak (min)=	5.00	8.00
Unit Hyd. peak (cms)=	0.33	0.15

PEAK FLOW (cms)= 0.77 0.16 \*TOTALS\* 0.868 (iii)

TIME TO PEAK (hrs)= 1.37 1.45 1.37  
 RUNOFF VOLUME (mm)= 54.38 26.17 42.79  
 TOTAL RAINFALL (mm)= 55.38 55.38 55.38  
 RUNOFF COEFFICIENT = 0.98 0.47 0.77

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 84.5 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR( 0300)  
 IN= 2---> OUT= 1  
 DT= 1.0 min

OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0730	0.1320
0.0030	0.0100	0.0770	0.1490
0.0060	0.0210	0.0810	0.1660
0.0070	0.0310	0.0840	0.1830
0.0080	0.0450	0.0880	0.2020
0.0090	0.0580	0.0910	0.2220
0.0100	0.0710	0.6750	0.2430
0.0600	0.0850	1.7380	0.2640
0.0650	0.0980	3.1130	0.2850
0.0690	0.1150	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 ( 0001)	3.446	0.868	1.37	42.79
OUTFLOW: ID= 1 ( 0300)	3.446	0.066	2.38	40.72

PEAK FLOW REDUCTION [Qout/Qin](%)= 7.57  
 TIME SHIFT OF PEAK FLOW (min)= 61.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.1013

CALIB  
 STANDHYD ( 0002)  
 ID= 1 DT= 1.0 min

Area (ha)= 0.25  
 Total Imp(%)= 75.40 Dir. Conn.(%)= 75.40

	IMPERVIOUS (ha)	PERVIOUS (i)
Surface Area	0.19	0.06
Dep. Storage	1.00	5.00
Average slope	1.00	2.00
Length	41.17	40.00
Mannings n	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.46	1.017	14.96	2.017	9.54	3.02	4.59
0.033	3.46	1.033	14.96	2.033	9.54	3.03	4.59
0.050	3.46	1.050	14.96	2.050	9.54	3.05	4.59
0.067	3.46	1.067	14.96	2.067	9.54	3.07	4.59
0.083	3.46	1.083	14.96	2.083	9.54	3.08	4.59
0.100	3.66	1.100	22.92	2.100	8.69	3.10	4.42
0.117	3.66	1.117	22.92	2.117	8.69	3.12	4.42
0.133	3.66	1.133	22.92	2.133	8.69	3.13	4.42
0.150	3.66	1.150	22.92	2.150	8.69	3.15	4.42
0.167	3.66	1.167	22.92	2.167	8.69	3.17	4.42
0.183	3.90	1.183	53.04	2.183	7.99	3.18	4.26
0.200	3.90	1.200	53.04	2.200	7.99	3.20	4.26
0.217	3.90	1.217	53.04	2.217	7.99	3.22	4.26
0.233	3.90	1.233	53.04	2.233	7.99	3.23	4.26
0.250	3.90	1.250	53.04	2.250	7.99	3.25	4.26
0.267	4.18	1.267	173.04	2.267	7.41	3.27	4.11
0.283	4.18	1.283	173.04	2.283	7.41	3.28	4.11
0.300	4.18	1.300	173.04	2.300	7.41	3.30	4.11
0.317	4.18	1.317	173.04	2.317	7.41	3.32	4.11
0.333	4.18	1.333	173.04	2.333	7.41	3.33	4.11
0.350	4.50	1.350	68.49	2.350	6.91	3.35	3.97
0.367	4.50	1.367	68.49	2.367	6.91	3.37	3.97
0.383	4.50	1.383	68.49	2.383	6.91	3.38	3.97
0.400	4.50	1.400	68.49	2.400	6.91	3.40	3.97
0.417	4.50	1.417	68.49	2.417	6.91	3.42	3.97
0.433	4.89	1.433	37.67	2.433	6.48	3.43	3.84
0.450	4.89	1.450	37.67	2.450	6.48	3.45	3.84

0.467	4.89	1.467	37.67	2.467	6.48	3.47	3.84
0.483	4.89	1.483	37.67	2.483	6.48	3.48	3.84
0.500	4.89	1.500	37.67	2.500	6.48	3.50	3.84
0.517	5.35	1.517	25.98	2.517	6.11	3.52	3.72
0.533	5.35	1.533	25.98	2.533	6.11	3.53	3.72
0.550	5.35	1.550	25.98	2.550	6.11	3.55	3.72
0.567	5.35	1.567	25.98	2.567	6.11	3.57	3.72
0.583	5.35	1.583	25.98	2.583	6.11	3.58	3.72
0.600	5.94	1.600	19.92	2.600	5.78	3.60	3.61
0.617	5.94	1.617	19.92	2.617	5.78	3.62	3.61
0.633	5.94	1.633	19.92	2.633	5.78	3.63	3.61
0.650	5.94	1.650	19.92	2.650	5.78	3.65	3.61
0.667	5.94	1.667	19.92	2.667	5.78	3.67	3.61
0.683	6.69	1.683	16.22	2.683	5.49	3.68	3.51
0.700	6.69	1.700	16.22	2.700	5.49	3.70	3.51
0.717	6.69	1.717	16.22	2.717	5.49	3.72	3.51
0.733	6.69	1.733	16.22	2.733	5.49	3.73	3.51
0.750	6.69	1.750	16.22	2.750	5.49	3.75	3.51
0.767	7.69	1.767	13.73	2.767	5.23	3.77	3.41
0.783	7.69	1.783	13.73	2.783	5.23	3.78	3.41
0.800	7.69	1.800	13.73	2.800	5.23	3.80	3.41
0.817	7.69	1.817	13.73	2.817	5.23	3.82	3.41
0.833	7.69	1.833	13.73	2.833	5.23	3.83	3.41
0.850	9.10	1.850	11.94	2.850	5.00	3.85	3.32
0.867	9.10	1.867	11.94	2.867	5.00	3.87	3.32
0.883	9.10	1.883	11.94	2.883	5.00	3.88	3.32
0.900	9.10	1.900	11.94	2.900	5.00	3.90	3.32
0.917	9.10	1.917	11.94	2.917	5.00	3.92	3.32
0.933	11.25	1.933	10.59	2.933	4.79	3.93	3.24
0.950	11.25	1.950	10.59	2.950	4.79	3.95	3.24
0.967	11.25	1.967	10.59	2.967	4.79	3.97	3.24
0.983	11.25	1.983	10.59	2.983	4.79	3.98	3.24
1.000	11.25	2.000	10.59	3.000	4.79	4.00	3.24

Max.Eff.Inten.(mm/hr)= 173.04 50.36  
over (min) 5.00 5.00  
Storage Coeff. (min)= 1.20 (ii) 4.83 (ii)  
Unit Hyd. Tpeak (min)= 5.00 5.00  
Unit Hyd. peak (cms)= 0.45 0.23

\*TOTALS\*

PEAK FLOW (cms)= 0.08 0.01 0.090 (iii)  
TIME TO PEAK (hrs)= 1.35 1.40 1.35  
RUNOFF VOLUME (mm)= 54.38 23.49 46.77  
TOTAL RAINFALL (mm)= 55.38 55.38 55.38  
RUNOFF COEFFICIENT = 0.98 0.42 0.84

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 81.5 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD ( 0005)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 ( 0002):	0.25	0.090	1.35	46.77
+ ID2= 2 ( 0300):	3.45	0.066	2.38	40.72
=====				
ID = 3 ( 0005):	3.70	0.097	1.35	41.13

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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V V I SSSS U U A L (v 6.2.2015)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A L
VV I SSSS 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\MRitceyThorpe\AppData\Local\Civica\vh5\288aab60-d94f-43e4-8c9b-21a7a9040589\834b0  
 Summary filename: C:\Users\MRitceyThorpe\AppData\Local\Civica\vh5\288aab60-d94f-43e4-8c9b-21a7a9040589\834b0

DATE: 04/04/2024

TIME: 02:10:16

USER:

COMMENTS: \_\_\_\_\_

\*\*\*\*\*  
 \*\* SIMULATION : 025-Year Chicago \*\*  
 \*\*\*\*\*

CHICAGO STORM  
 Ptotal= 63.60 mm

IDF curve parameters: A=1160.000  
 B= 4.600  
 C= 0.780  
 used in: INTENSITY = A / (t + B)<sup>AC</sup>  
 Duration of storm = 4.00 hrs  
 Storm time step = 5.00 min  
 Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.97	1.00	17.18	2.00	10.96	3.00	5.27
0.08	4.21	1.08	26.33	2.08	9.98	3.08	5.07
0.17	4.48	1.17	60.92	2.17	9.18	3.17	4.89
0.25	4.80	1.25	198.74	2.25	8.51	3.25	4.72
0.33	5.17	1.33	78.66	2.33	7.94	3.33	4.56
0.42	5.61	1.42	43.26	2.42	7.45	3.42	4.41
0.50	6.15	1.50	29.84	2.50	7.02	3.50	4.28
0.58	6.82	1.58	22.88	2.58	6.64	3.58	4.15
0.67	7.68	1.67	18.63	2.67	6.31	3.67	4.03
0.75	8.83	1.75	15.77	2.75	6.01	3.75	3.92
0.83	10.46	1.83	13.72	2.83	5.74	3.83	3.82
0.92	12.93	1.92	12.17	2.92	5.50	3.92	3.72

CALIB  
 STANDHYD ( 0001)  
 ID= 1 DT= 1.0 min

Area (ha)= 3.45  
 Total Imp(%)= 58.90 Dir. Conn.(%)= 58.90

	IMPERVIOUS (ha)=	PERVIOUS (i) =
Surface Area	2.03	1.42
Dep. Storage	1.00	5.00
Average Slope	1.00	2.00
Length	151.57	40.00
Mannings n	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.97	1.017	17.18	2.017	10.96	3.02	5.27
0.033	3.97	1.033	17.18	2.033	10.96	3.03	5.27
0.050	3.97	1.050	17.18	2.050	10.96	3.05	5.27
0.067	3.97	1.067	17.18	2.067	10.96	3.07	5.27
0.083	3.97	1.083	17.18	2.083	10.96	3.08	5.27
0.100	4.21	1.100	26.33	2.100	9.98	3.10	5.07
0.117	4.21	1.117	26.33	2.117	9.98	3.12	5.07
0.133	4.21	1.133	26.33	2.133	9.98	3.13	5.07
0.150	4.21	1.150	26.33	2.150	9.98	3.15	5.07
0.167	4.21	1.167	26.33	2.167	9.98	3.17	5.07
0.183	4.48	1.183	60.92	2.183	9.18	3.18	4.89
0.200	4.48	1.200	60.92	2.200	9.18	3.20	4.89
0.217	4.48	1.217	60.92	2.217	9.18	3.22	4.89
0.233	4.48	1.233	60.92	2.233	9.18	3.23	4.89
0.250	4.48	1.250	60.92	2.250	9.18	3.25	4.89
0.267	4.80	1.267	198.74	2.267	8.51	3.27	4.72
0.283	4.80	1.283	198.74	2.283	8.51	3.28	4.72
0.300	4.80	1.300	198.74	2.300	8.51	3.30	4.72

0.317	4.80	1.317	198.74	2.317	8.51	3.32	4.72
0.333	4.80	1.333	198.74	2.333	8.51	3.33	4.72
0.350	5.17	1.350	78.66	2.350	7.94	3.35	4.56
0.367	5.17	1.367	78.66	2.367	7.94	3.37	4.56
0.383	5.17	1.383	78.66	2.383	7.94	3.38	4.56
0.400	5.17	1.400	78.66	2.400	7.94	3.40	4.56
0.417	5.17	1.417	78.66	2.417	7.94	3.42	4.56
0.433	5.61	1.433	43.26	2.433	7.45	3.43	4.41
0.450	5.61	1.450	43.26	2.450	7.45	3.45	4.41
0.467	5.61	1.467	43.26	2.467	7.45	3.47	4.41
0.483	5.61	1.483	43.26	2.483	7.45	3.48	4.41
0.500	5.61	1.500	43.26	2.500	7.45	3.50	4.41
0.517	6.15	1.517	29.84	2.517	7.02	3.52	4.28
0.533	6.15	1.533	29.84	2.533	7.02	3.53	4.28
0.550	6.15	1.550	29.84	2.550	7.02	3.55	4.28
0.567	6.15	1.567	29.84	2.567	7.02	3.57	4.28
0.583	6.15	1.583	29.84	2.583	7.02	3.58	4.28
0.600	6.82	1.600	22.88	2.600	6.64	3.60	4.15
0.617	6.82	1.617	22.88	2.617	6.64	3.62	4.15
0.633	6.82	1.633	22.88	2.633	6.64	3.63	4.15
0.650	6.82	1.650	22.88	2.650	6.64	3.65	4.15
0.667	6.82	1.667	22.88	2.667	6.64	3.67	4.15
0.683	7.68	1.683	18.63	2.683	6.31	3.68	4.03
0.700	7.68	1.700	18.63	2.700	6.31	3.70	4.03
0.717	7.68	1.717	18.63	2.717	6.31	3.72	4.03
0.733	7.68	1.733	18.63	2.733	6.31	3.73	4.03
0.750	7.68	1.750	18.63	2.750	6.31	3.75	4.03
0.767	8.83	1.767	15.77	2.767	6.01	3.77	3.92
0.783	8.83	1.783	15.77	2.783	6.01	3.78	3.92
0.800	8.83	1.800	15.77	2.800	6.01	3.80	3.92
0.817	8.83	1.817	15.77	2.817	6.01	3.82	3.92
0.833	8.83	1.833	15.77	2.833	6.01	3.83	3.92
0.850	10.46	1.850	13.72	2.850	5.74	3.85	3.82
0.867	10.46	1.867	13.72	2.867	5.74	3.87	3.82
0.883	10.46	1.883	13.72	2.883	5.74	3.88	3.82
0.900	10.46	1.900	13.72	2.900	5.74	3.90	3.82
0.917	10.46	1.917	13.72	2.917	5.74	3.92	3.82
0.933	12.93	1.933	12.17	2.933	5.50	3.93	3.72
0.950	12.93	1.950	12.17	2.950	5.50	3.95	3.72
0.967	12.93	1.967	12.17	2.967	5.50	3.97	3.72
0.983	12.93	1.983	12.17	2.983	5.50	3.98	3.72
1.000	12.93	2.000	12.17	3.000	5.50	4.00	3.72

Max.Eff.Inten.(mm/hr)= 198.74 72.87  
over (min) 5.00 8.00  
Storage Coeff. (min)= 2.49 (ii) 7.13 (ii)  
Unit Hyd. Tpeak (min)= 5.00 8.00  
Unit Hyd. peak (cms)= 0.34 0.15

\*TOTALS\*

PEAK FLOW (cms)= 0.89 0.21 1.029 (iii)  
TIME TO PEAK (hrs)= 1.37 1.45 1.37  
RUNOFF VOLUME (mm)= 62.60 32.65 50.29  
TOTAL RAINFALL (mm)= 63.60 63.60 63.60  
RUNOFF COEFFICIENT = 0.98 0.51 0.79

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 84.5 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----  
RESERVOIR( 0300)  
IN= 2---> OUT= 1  
DT= 1.0 min  
-----

OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0730	0.1320
0.0030	0.0100	0.0770	0.1490
0.0060	0.0210	0.0810	0.1660
0.0070	0.0310	0.0840	0.1830
0.0080	0.0450	0.0880	0.2020
0.0090	0.0580	0.0910	0.2220
0.0100	0.0710	0.6750	0.2430
0.0600	0.0850	1.7380	0.2640
0.0650	0.0980	3.1130	0.2850
0.0690	0.1150	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 ( 0001)	3.446	1.029	1.37	50.29
OUTFLOW: ID= 1 ( 0300)	3.446	0.070	2.48	48.02

PEAK FLOW REDUCTION [Qout/Qin] (%)= 6.83  
 TIME SHIFT OF PEAK FLOW (min)= 67.00  
 MAXIMUM STORAGE USED (ha.m.)= 0.1202

CALIB  
 STANDHYD ( 0002)  
 ID= 1 DT= 1.0 min

Area (ha)= 0.25  
 Total Imp(%)= 75.40 Dir. Conn.(%)= 75.40

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.19	0.06
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	41.17	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.97	1.017	17.18	2.017	10.96	3.02	5.27
0.033	3.97	1.033	17.18	2.033	10.96	3.03	5.27
0.050	3.97	1.050	17.18	2.050	10.96	3.05	5.27
0.067	3.97	1.067	17.18	2.067	10.96	3.07	5.27
0.083	3.97	1.083	17.18	2.083	10.96	3.08	5.27
0.100	4.21	1.100	26.33	2.100	9.98	3.10	5.07
0.117	4.21	1.117	26.33	2.117	9.98	3.12	5.07
0.133	4.21	1.133	26.33	2.133	9.98	3.13	5.07
0.150	4.21	1.150	26.33	2.150	9.98	3.15	5.07
0.167	4.21	1.167	26.33	2.167	9.98	3.17	5.07
0.183	4.48	1.183	60.92	2.183	9.18	3.18	4.89
0.200	4.48	1.200	60.92	2.200	9.18	3.20	4.89
0.217	4.48	1.217	60.92	2.217	9.18	3.22	4.89
0.233	4.48	1.233	60.92	2.233	9.18	3.23	4.89
0.250	4.48	1.250	60.92	2.250	9.18	3.25	4.89
0.267	4.80	1.267	198.74	2.267	8.51	3.27	4.72
0.283	4.80	1.283	198.74	2.283	8.51	3.28	4.72
0.300	4.80	1.300	198.74	2.300	8.51	3.30	4.72
0.317	4.80	1.317	198.74	2.317	8.51	3.32	4.72
0.333	4.80	1.333	198.74	2.333	8.51	3.33	4.72
0.350	5.17	1.350	78.66	2.350	7.94	3.35	4.56
0.367	5.17	1.367	78.66	2.367	7.94	3.37	4.56
0.383	5.17	1.383	78.66	2.383	7.94	3.38	4.56
0.400	5.17	1.400	78.66	2.400	7.94	3.40	4.56
0.417	5.17	1.417	78.66	2.417	7.94	3.42	4.56
0.433	5.61	1.433	43.26	2.433	7.45	3.43	4.41
0.450	5.61	1.450	43.26	2.450	7.45	3.45	4.41
0.467	5.61	1.467	43.26	2.467	7.45	3.47	4.41
0.483	5.61	1.483	43.26	2.483	7.45	3.48	4.41
0.500	5.61	1.500	43.26	2.500	7.45	3.50	4.41
0.517	6.15	1.517	29.84	2.517	7.02	3.52	4.28
0.533	6.15	1.533	29.84	2.533	7.02	3.53	4.28
0.550	6.15	1.550	29.84	2.550	7.02	3.55	4.28
0.567	6.15	1.567	29.84	2.567	7.02	3.57	4.28
0.583	6.15	1.583	29.84	2.583	7.02	3.58	4.28
0.600	6.82	1.600	22.88	2.600	6.64	3.60	4.15
0.617	6.82	1.617	22.88	2.617	6.64	3.62	4.15
0.633	6.82	1.633	22.88	2.633	6.64	3.63	4.15
0.650	6.82	1.650	22.88	2.650	6.64	3.65	4.15
0.667	6.82	1.667	22.88	2.667	6.64	3.67	4.15
0.683	7.68	1.683	18.63	2.683	6.31	3.68	4.03
0.700	7.68	1.700	18.63	2.700	6.31	3.70	4.03
0.717	7.68	1.717	18.63	2.717	6.31	3.72	4.03
0.733	7.68	1.733	18.63	2.733	6.31	3.73	4.03
0.750	7.68	1.750	18.63	2.750	6.31	3.75	4.03
0.767	8.83	1.767	15.77	2.767	6.01	3.77	3.92
0.783	8.83	1.783	15.77	2.783	6.01	3.78	3.92
0.800	8.83	1.800	15.77	2.800	6.01	3.80	3.92
0.817	8.83	1.817	15.77	2.817	6.01	3.82	3.92
0.833	8.83	1.833	15.77	2.833	6.01	3.83	3.92
0.850	10.46	1.850	13.72	2.850	5.74	3.85	3.82
0.867	10.46	1.867	13.72	2.867	5.74	3.87	3.82
0.883	10.46	1.883	13.72	2.883	5.74	3.88	3.82
0.900	10.46	1.900	13.72	2.900	5.74	3.90	3.82
0.917	10.46	1.917	13.72	2.917	5.74	3.92	3.82
0.933	12.93	1.933	12.17	2.933	5.50	3.93	3.72
0.950	12.93	1.950	12.17	2.950	5.50	3.95	3.72
0.967	12.93	1.967	12.17	2.967	5.50	3.97	3.72
0.983	12.93	1.983	12.17	2.983	5.50	3.98	3.72
1.000	12.93	2.000	12.17	3.000	5.50	4.00	3.72

```

Max.Eff.Inten.(mm/hr)= 198.74 64.51
over (min) 5.00 5.00
Storage Coeff. (min)= 1.14 (ii) 4.57 (ii)
Unit Hyd. Tpeak (min)= 5.00 5.00
Unit Hyd. peak (cms)= 0.46 0.24

PEAK FLOW (cms)= 0.10 0.01
TIME TO PEAK (hrs)= 1.35 1.40
RUNOFF VOLUME (mm)= 62.60 29.54
TOTAL RAINFALL (mm)= 63.60 63.60
RUNOFF COEFFICIENT = 0.98 0.46

```

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*TOTALS*
0.105 (iii)
1.35
54.46
63.60
0.86

```

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 81.5 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD ( 0005)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 ( 0002):	0.25	0.105	1.35	54.46
+ ID2= 2 ( 0300):	3.45	0.070	2.48	48.02
ID = 3 ( 0005):	3.70	0.112	1.35	48.47

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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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 A A A A L
V V I SS U U A A L
VV I SSSSS UUUUU A A LLLLL

000 TTTTT TTTTT H H Y Y M M 000 TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
000 T T H H Y M M 000

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

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Input filename: C:\Program Files (x86)\visual OTTHYMO 6.2\vo2\voin.dat
Output filename: C:\Users\MRitceyThorpe\AppData\Local\Civica\vh5\288aab60-d94f-43e4-8c9b-21a7a9040589\dc31e
Summary filename: C:\Users\MRitceyThorpe\AppData\Local\Civica\vh5\288aab60-d94f-43e4-8c9b-21a7a9040589\dc31e

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DATE: 04/04/2024 TIME: 02:10:17

USER:

COMMENTS: \_\_\_\_\_

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*****
** SIMULATION : 050-Year Chicago **
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CHICAGO STORM | IDF curve parameters: A=1300.000
Ptotal= 71.26 mm | B= 4.700
| C= 0.780
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.46	1.00	19.32	2.00	12.31	3.00	5.92

0.08	4.72	1.08	29.62	2.08	11.21	3.08	5.69
0.17	5.03	1.17	68.42	2.17	10.31	3.17	5.49
0.25	5.38	1.25	220.93	2.25	9.56	3.25	5.29
0.33	5.80	1.33	88.27	2.33	8.91	3.33	5.12
0.42	6.30	1.42	48.66	2.42	8.36	3.42	4.95
0.50	6.90	1.50	33.57	2.50	7.88	3.50	4.80
0.58	7.66	1.58	25.73	2.58	7.46	3.58	4.66
0.67	8.63	1.67	20.95	2.67	7.08	3.67	4.52
0.75	9.92	1.75	17.73	2.75	6.74	3.75	4.40
0.83	11.75	1.83	15.42	2.83	6.44	3.83	4.28
0.92	14.53	1.92	13.67	2.92	6.17	3.92	4.17

-----  
CALIB  
STANDHYD ( 0001)  
ID= 1 DT= 1.0 min | Area (ha)= 3.45  
Total Imp(%)= 58.90 Dir. Conn.(%)= 58.90

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	2.03	1.42
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	151.57	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	4.46	1.017	19.32	2.017	12.31	3.02	5.92
0.033	4.46	1.033	19.32	2.033	12.31	3.03	5.92
0.050	4.46	1.050	19.32	2.050	12.31	3.05	5.92
0.067	4.46	1.067	19.32	2.067	12.31	3.07	5.92
0.083	4.46	1.083	19.32	2.083	12.31	3.08	5.92
0.100	4.72	1.100	29.62	2.100	11.21	3.10	5.69
0.117	4.72	1.117	29.62	2.117	11.21	3.12	5.69
0.133	4.72	1.133	29.62	2.133	11.21	3.13	5.69
0.150	4.72	1.150	29.62	2.150	11.21	3.15	5.69
0.167	4.72	1.167	29.62	2.167	11.21	3.17	5.69
0.183	5.03	1.183	68.42	2.183	10.31	3.18	5.49
0.200	5.03	1.200	68.42	2.200	10.31	3.20	5.49
0.217	5.03	1.217	68.42	2.217	10.31	3.22	5.49
0.233	5.03	1.233	68.42	2.233	10.31	3.23	5.49
0.250	5.03	1.250	68.42	2.250	10.31	3.25	5.49
0.267	5.38	1.267	220.93	2.267	9.56	3.27	5.29
0.283	5.38	1.283	220.93	2.283	9.56	3.28	5.29
0.300	5.38	1.300	220.93	2.300	9.56	3.30	5.29
0.317	5.38	1.317	220.93	2.317	9.56	3.32	5.29
0.333	5.38	1.333	220.93	2.333	9.56	3.33	5.29
0.350	5.80	1.350	88.28	2.350	8.91	3.35	5.12
0.367	5.80	1.367	88.27	2.367	8.91	3.37	5.12
0.383	5.80	1.383	88.27	2.383	8.91	3.38	5.12
0.400	5.80	1.400	88.27	2.400	8.91	3.40	5.12
0.417	5.80	1.417	88.27	2.417	8.91	3.42	5.12
0.433	6.30	1.433	48.66	2.433	8.36	3.43	4.95
0.450	6.30	1.450	48.66	2.450	8.36	3.45	4.95
0.467	6.30	1.467	48.66	2.467	8.36	3.47	4.95
0.483	6.30	1.483	48.66	2.483	8.36	3.48	4.95
0.500	6.30	1.500	48.66	2.500	8.36	3.50	4.95
0.517	6.90	1.517	33.57	2.517	7.88	3.52	4.80
0.533	6.90	1.533	33.57	2.533	7.88	3.53	4.80
0.550	6.90	1.550	33.57	2.550	7.88	3.55	4.80
0.567	6.90	1.567	33.57	2.567	7.88	3.57	4.80
0.583	6.90	1.583	33.57	2.583	7.88	3.58	4.80
0.600	7.66	1.600	25.73	2.600	7.46	3.60	4.66
0.617	7.66	1.617	25.73	2.617	7.46	3.62	4.66
0.633	7.66	1.633	25.73	2.633	7.46	3.63	4.66
0.650	7.66	1.650	25.73	2.650	7.46	3.65	4.66
0.667	7.66	1.667	25.73	2.667	7.46	3.67	4.66
0.683	8.63	1.683	20.95	2.683	7.08	3.68	4.52
0.700	8.63	1.700	20.95	2.700	7.08	3.70	4.52
0.717	8.63	1.717	20.95	2.717	7.08	3.72	4.52
0.733	8.63	1.733	20.95	2.733	7.08	3.73	4.52
0.750	8.63	1.750	20.95	2.750	7.08	3.75	4.52
0.767	9.92	1.767	17.73	2.767	6.74	3.77	4.40
0.783	9.92	1.783	17.73	2.783	6.74	3.78	4.40
0.800	9.92	1.800	17.73	2.800	6.74	3.80	4.40
0.817	9.92	1.817	17.73	2.817	6.74	3.82	4.40
0.833	9.92	1.833	17.73	2.833	6.74	3.83	4.40
0.850	11.75	1.850	15.42	2.850	6.44	3.85	4.28
0.867	11.75	1.867	15.42	2.867	6.44	3.87	4.28

0.883	11.75	1.883	15.42	2.883	6.44	3.88	4.28
0.900	11.75	1.900	15.42	2.900	6.44	3.90	4.28
0.917	11.75	1.917	15.42	2.917	6.44	3.92	4.28
0.933	14.53	1.933	13.67	2.933	6.17	3.93	4.17
0.950	14.53	1.950	13.67	2.950	6.17	3.95	4.17
0.967	14.53	1.967	13.67	2.967	6.17	3.97	4.17
0.983	14.53	1.983	13.67	2.983	6.17	3.98	4.17
1.000	14.53	2.000	13.67	3.000	6.17	4.00	4.17

Max.Eff.Inten.(mm/hr)= 220.93 87.42  
over (min) 5.00 7.00  
Storage Coeff. (min)= 2.39 (ii) 6.84 (ii)  
Unit Hyd. Tpeak (min)= 5.00 7.00  
Unit Hyd. peak (cms)= 0.35 0.16

PEAK FLOW (cms)= 1.00 0.26 \*TOTALS\* 1.196 (iii)  
TIME TO PEAK (hrs)= 1.37 1.43 1.37  
RUNOFF VOLUME (mm)= 70.26 38.90 57.37  
TOTAL RAINFALL (mm)= 71.26 71.26 71.26  
RUNOFF COEFFICIENT = 0.99 0.55 0.81

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 84.5 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR( 0300)  
IN= 2---> OUT= 1  
DT= 1.0 min

OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0730	0.1320
0.0030	0.0100	0.0770	0.1490
0.0060	0.0210	0.0810	0.1660
0.0070	0.0310	0.0840	0.1830
0.0080	0.0450	0.0880	0.2020
0.0090	0.0580	0.0910	0.2220
0.0100	0.0710	0.6750	0.2430
0.0600	0.0850	1.7380	0.2640
0.0650	0.0980	3.1130	0.2850
0.0690	0.1150	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 ( 0001)	3.446	1.196	1.37	57.37
OUTFLOW: ID= 1 ( 0300)	3.446	0.075	2.57	54.90

PEAK FLOW REDUCTION [Qout/Qin](%)= 6.23  
TIME SHIFT OF PEAK FLOW (min)= 72.00  
MAXIMUM STORAGE USED (ha.m.)= 0.1388

CALIB  
STANDHYD ( 0002)  
ID= 1 DT= 1.0 min

Area (ha)= 0.25  
Total Imp(%)= 75.40 Dir. Conn.(%)= 75.40

	IMPERVIOUS (ha)	PERVIOUS (i) (mm)
Surface Area	0.19	0.06
Dep. Storage	1.00	5.00
Average slope (%)	1.00	2.00
Length (m)	41.17	40.00
Mannings n	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	4.46	1.017	19.32	2.017	12.31	3.02	5.92
0.033	4.46	1.033	19.32	2.033	12.31	3.03	5.92
0.050	4.46	1.050	19.32	2.050	12.31	3.05	5.92
0.067	4.46	1.067	19.32	2.067	12.31	3.07	5.92
0.083	4.46	1.083	19.32	2.083	12.31	3.08	5.92
0.100	4.72	1.100	29.62	2.100	11.21	3.10	5.69
0.117	4.72	1.117	29.62	2.117	11.21	3.12	5.69
0.133	4.72	1.133	29.62	2.133	11.21	3.13	5.69
0.150	4.72	1.150	29.62	2.150	11.21	3.15	5.69
0.167	4.72	1.167	29.62	2.167	11.21	3.17	5.69
0.183	5.03	1.183	68.42	2.183	10.31	3.18	5.49

0.200	5.03	1.200	68.42	2.200	10.31	3.20	5.49
0.217	5.03	1.217	68.42	2.217	10.31	3.22	5.49
0.233	5.03	1.233	68.42	2.233	10.31	3.23	5.49
0.250	5.03	1.250	68.42	2.250	10.31	3.25	5.49
0.267	5.38	1.267	220.93	2.267	9.56	3.27	5.29
0.283	5.38	1.283	220.93	2.283	9.56	3.28	5.29
0.300	5.38	1.300	220.93	2.300	9.56	3.30	5.29
0.317	5.38	1.317	220.93	2.317	9.56	3.32	5.29
0.333	5.38	1.333	220.93	2.333	9.56	3.33	5.29
0.350	5.80	1.350	88.28	2.350	8.91	3.35	5.12
0.367	5.80	1.367	88.27	2.367	8.91	3.37	5.12
0.383	5.80	1.383	88.27	2.383	8.91	3.38	5.12
0.400	5.80	1.400	88.27	2.400	8.91	3.40	5.12
0.417	5.80	1.417	88.27	2.417	8.91	3.42	5.12
0.433	6.30	1.433	48.66	2.433	8.36	3.43	4.95
0.450	6.30	1.450	48.66	2.450	8.36	3.45	4.95
0.467	6.30	1.467	48.66	2.467	8.36	3.47	4.95
0.483	6.30	1.483	48.66	2.483	8.36	3.48	4.95
0.500	6.30	1.500	48.66	2.500	8.36	3.50	4.95
0.517	6.90	1.517	33.57	2.517	7.88	3.52	4.80
0.533	6.90	1.533	33.57	2.533	7.88	3.53	4.80
0.550	6.90	1.550	33.57	2.550	7.88	3.55	4.80
0.567	6.90	1.567	33.57	2.567	7.88	3.57	4.80
0.583	6.90	1.583	33.57	2.583	7.88	3.58	4.80
0.600	7.66	1.600	25.73	2.600	7.46	3.60	4.66
0.617	7.66	1.617	25.73	2.617	7.46	3.62	4.66
0.633	7.66	1.633	25.73	2.633	7.46	3.63	4.66
0.650	7.66	1.650	25.73	2.650	7.46	3.65	4.66
0.667	7.66	1.667	25.73	2.667	7.46	3.67	4.66
0.683	8.63	1.683	20.95	2.683	7.08	3.68	4.52
0.700	8.63	1.700	20.95	2.700	7.08	3.70	4.52
0.717	8.63	1.717	20.95	2.717	7.08	3.72	4.52
0.733	8.63	1.733	20.95	2.733	7.08	3.73	4.52
0.750	8.63	1.750	20.95	2.750	7.08	3.75	4.52
0.767	9.92	1.767	17.73	2.767	6.74	3.77	4.40
0.783	9.92	1.783	17.73	2.783	6.74	3.78	4.40
0.800	9.92	1.800	17.73	2.800	6.74	3.80	4.40
0.817	9.92	1.817	17.73	2.817	6.74	3.82	4.40
0.833	9.92	1.833	17.73	2.833	6.74	3.83	4.40
0.850	11.75	1.850	15.42	2.850	6.44	3.85	4.28
0.867	11.75	1.867	15.42	2.867	6.44	3.87	4.28
0.883	11.75	1.883	15.42	2.883	6.44	3.88	4.28
0.900	11.75	1.900	15.42	2.900	6.44	3.90	4.28
0.917	11.75	1.917	15.42	2.917	6.44	3.92	4.28
0.933	14.53	1.933	13.67	2.933	6.17	3.93	4.17
0.950	14.53	1.950	13.67	2.950	6.17	3.95	4.17
0.967	14.53	1.967	13.67	2.967	6.17	3.97	4.17
0.983	14.53	1.983	13.67	2.983	6.17	3.98	4.17
1.000	14.53	2.000	13.67	3.000	6.17	4.00	4.17

Max.Eff.Inten.(mm/hr)= 220.93 77.99  
over (min) 5.00 5.00  
Storage Coeff. (min)= 1.09 (ii) 4.38 (ii)  
Unit Hyd. Tpeak (min)= 5.00 5.00  
Unit Hyd. peak (cms)= 0.46 0.25

\*TOTALS\*  
PEAK FLOW (cms)= 0.11 0.01 0.118 (iii)  
TIME TO PEAK (hrs)= 1.35 1.40 1.35  
RUNOFF VOLUME (mm)= 70.26 35.43 61.68  
TOTAL RAINFALL (mm)= 71.26 71.26 71.26  
RUNOFF COEFFICIENT = 0.99 0.50 0.87

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 81.5 Ia = Dep. Storage (Above)  
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.  
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD ( 0005)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 ( 0002):	0.25	0.118	1.35	61.68
+ ID2= 2 ( 0300):	3.45	0.075	2.57	54.90
=====				
ID = 3 ( 0005):	3.70	0.126	1.35	55.37

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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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 A A A A L
V V I SS U U A A L
VV I SSSSS UUUUU A A LLLLL

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000 TTTTT TTTTT H H Y Y M M 000 TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
000 T T H H Y M M 000

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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\MRitceyThorpe\AppData\Local\Civica\vh5\288aab60-d94f-43e4-8c9b-21a7a9040589\dc5ce  
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DATE: 04/04/2024 TIME: 02:10:17

USER:

COMMENTS: \_\_\_\_\_

\*\*\*\*\*  
 \*\* SIMULATION : 100-Year Chicago \*\*  
 \*\*\*\*\*

CHICAGO STORM  
 Ptotal= 79.43 mm

IDF curve parameters: A=1450.000  
 B= 4.900  
 C= 0.780  
 used in: INTENSITY = A / (t + B)^C  
 Duration of storm = 4.00 hrs  
 Storm time step = 5.00 min  
 Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.98	1.00	21.69	2.00	13.80	3.00	6.62
0.08	5.28	1.08	33.28	2.08	12.57	3.08	6.37
0.17	5.62	1.17	76.62	2.17	11.55	3.17	6.13
0.25	6.02	1.25	242.53	2.25	10.71	3.25	5.92
0.33	6.49	1.33	98.69	2.33	9.98	3.33	5.72
0.42	7.05	1.42	54.64	2.42	9.36	3.42	5.54
0.50	7.72	1.50	37.73	2.50	8.82	3.50	5.37
0.58	8.57	1.58	28.91	2.58	8.35	3.58	5.21
0.67	9.66	1.67	23.53	2.67	7.92	3.67	5.06
0.75	11.12	1.75	19.90	2.75	7.55	3.75	4.92
0.83	13.17	1.83	17.30	2.83	7.21	3.83	4.78
0.92	16.30	1.92	15.34	2.92	6.90	3.92	4.66

CALIB  
 STANDHYD ( 0001)  
 ID= 1 DT= 1.0 min

Area (ha)= 3.45  
 Total Imp(%)= 58.90 Dir. Conn.(%)= 58.90

	IMPERVIOUS (ha)	PERVIOUS (i)
Surface Area	2.03	1.42
Dep. Storage	1.00	5.00
Average Slope	1.00	2.00
Length	151.57	40.00
Mannings n	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	4.98	1.017	21.69	2.017	13.80	3.02	6.62
0.033	4.98	1.033	21.69	2.033	13.80	3.03	6.62



0.050	4.98	1.050	21.69	2.050	13.80	3.05	6.62
0.067	4.98	1.067	21.69	2.067	13.80	3.07	6.62
0.083	4.98	1.083	21.69	2.083	13.80	3.08	6.62
0.100	5.28	1.100	33.28	2.100	12.57	3.10	6.37
0.117	5.28	1.117	33.28	2.117	12.57	3.12	6.37
0.133	5.28	1.133	33.28	2.133	12.57	3.13	6.37
0.150	5.28	1.150	33.28	2.150	12.57	3.15	6.37
0.167	5.28	1.167	33.28	2.167	12.57	3.17	6.37
0.183	5.62	1.183	76.62	2.183	11.55	3.18	6.13
0.200	5.62	1.200	76.62	2.200	11.55	3.20	6.13
0.217	5.62	1.217	76.62	2.217	11.55	3.22	6.13
0.233	5.62	1.233	76.62	2.233	11.55	3.23	6.13
0.250	5.62	1.250	76.62	2.250	11.55	3.25	6.13
0.267	6.02	1.267	242.53	2.267	10.71	3.27	5.92
0.283	6.02	1.283	242.53	2.283	10.71	3.28	5.92
0.300	6.02	1.300	242.53	2.300	10.71	3.30	5.92
0.317	6.02	1.317	242.53	2.317	10.71	3.32	5.92
0.333	6.02	1.333	242.53	2.333	10.71	3.33	5.92
0.350	6.49	1.350	98.70	2.350	9.98	3.35	5.72
0.367	6.49	1.367	98.69	2.367	9.98	3.37	5.72
0.383	6.49	1.383	98.69	2.383	9.98	3.38	5.72
0.400	6.49	1.400	98.69	2.400	9.98	3.40	5.72
0.417	6.49	1.417	98.69	2.417	9.98	3.42	5.72
0.433	7.05	1.433	54.64	2.433	9.36	3.43	5.54
0.450	7.05	1.450	54.64	2.450	9.36	3.45	5.54
0.467	7.05	1.467	54.64	2.467	9.36	3.47	5.54
0.483	7.05	1.483	54.64	2.483	9.36	3.48	5.54
0.500	7.05	1.500	54.64	2.500	9.36	3.50	5.54
0.517	7.72	1.517	37.73	2.517	8.82	3.52	5.37
0.533	7.72	1.533	37.73	2.533	8.82	3.53	5.37
0.550	7.72	1.550	37.73	2.550	8.82	3.55	5.37
0.567	7.72	1.567	37.73	2.567	8.82	3.57	5.37
0.583	7.72	1.583	37.73	2.583	8.82	3.58	5.37
0.600	8.57	1.600	28.91	2.600	8.35	3.60	5.21
0.617	8.57	1.617	28.91	2.617	8.35	3.62	5.21
0.633	8.57	1.633	28.91	2.633	8.35	3.63	5.21
0.650	8.57	1.650	28.91	2.650	8.35	3.65	5.21
0.667	8.57	1.667	28.91	2.667	8.35	3.67	5.21
0.683	9.66	1.683	23.53	2.683	7.92	3.68	5.06
0.700	9.66	1.700	23.53	2.700	7.92	3.70	5.06
0.717	9.66	1.717	23.53	2.717	7.92	3.72	5.06
0.733	9.66	1.733	23.53	2.733	7.92	3.73	5.06
0.750	9.66	1.750	23.53	2.750	7.92	3.75	5.06
0.767	11.12	1.767	19.90	2.767	7.55	3.77	4.92
0.783	11.12	1.783	19.90	2.783	7.55	3.78	4.92
0.800	11.12	1.800	19.90	2.800	7.55	3.80	4.92
0.817	11.12	1.817	19.90	2.817	7.55	3.82	4.92
0.833	11.12	1.833	19.90	2.833	7.55	3.83	4.92
0.850	13.17	1.850	17.30	2.850	7.21	3.85	4.78
0.867	13.17	1.867	17.30	2.867	7.21	3.87	4.78
0.883	13.17	1.883	17.30	2.883	7.21	3.88	4.78
0.900	13.17	1.900	17.30	2.900	7.21	3.90	4.78
0.917	13.17	1.917	17.30	2.917	7.21	3.92	4.78
0.933	16.30	1.933	15.34	2.933	6.90	3.93	4.66
0.950	16.30	1.950	15.34	2.950	6.90	3.95	4.66
0.967	16.30	1.967	15.34	2.967	6.90	3.97	4.66
0.983	16.30	1.983	15.34	2.983	6.90	3.98	4.66
1.000	16.30	2.000	15.34	3.000	6.90	4.00	4.66

Max.Eff.Inten.(mm/hr)= 242.53 102.83  
over (min) 5.00 7.00  
Storage Coeff. (min)= 2.30 (ii) 6.59 (ii)  
Unit Hyd. Tpeak (min)= 5.00 7.00  
Unit Hyd. peak (cms)= 0.35 0.17

\*TOTALS\*

PEAK FLOW (cms)= 1.11 0.31 1.348 (iii)  
TIME TO PEAK (hrs)= 1.37 1.43 1.37  
RUNOFF VOLUME (mm)= 78.43 45.77 65.01  
TOTAL RAINFALL (mm)= 79.43 79.43 79.43  
RUNOFF COEFFICIENT = 0.99 0.58 0.82

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 84.5 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----  
RESERVOIR( 0300)  
IN= 2---> OUT= 1  
DT= 1.0 min  
-----

OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
------------------	--------------------	------------------	--------------------

0.0000	0.0000	0.0730	0.1320
0.0030	0.0100	0.0770	0.1490
0.0060	0.0210	0.0810	0.1660
0.0070	0.0310	0.0840	0.1830
0.0080	0.0450	0.0880	0.2020
0.0090	0.0580	0.0910	0.2220
0.0100	0.0710	0.6750	0.2430
0.0600	0.0850	1.7380	0.2640
0.0650	0.0980	3.1130	0.2850
0.0690	0.1150	0.0000	0.0000

INFLOW : ID= 2 ( 0001)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
OUTFLOW: ID= 1 ( 0300)	3.446	1.348	1.37	65.01
	3.446	0.079	2.65	62.32

PEAK FLOW REDUCTION [Qout/Qin] (%) = 5.89  
 TIME SHIFT OF PEAK FLOW (min) = 77.00  
 MAXIMUM STORAGE USED (ha.m.) = 0.1592

CALIB	Area (ha) =	0.25		
STANDHYD ( 0002)	Total Imp (%) =	75.40	Dir. Conn. (%) =	75.40
ID= 1 DT= 1.0 min				

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha) =	0.19	0.06
Dep. Storage (mm) =	1.00	5.00
Average Slope (%) =	1.00	2.00
Length (m) =	41.17	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	4.98	1.017	21.69	2.017	13.80	3.02	6.62
0.033	4.98	1.033	21.69	2.033	13.80	3.03	6.62
0.050	4.98	1.050	21.69	2.050	13.80	3.05	6.62
0.067	4.98	1.067	21.69	2.067	13.80	3.07	6.62
0.083	4.98	1.083	21.69	2.083	13.80	3.08	6.62
0.100	5.28	1.100	33.28	2.100	12.57	3.10	6.37
0.117	5.28	1.117	33.28	2.117	12.57	3.12	6.37
0.133	5.28	1.133	33.28	2.133	12.57	3.13	6.37
0.150	5.28	1.150	33.28	2.150	12.57	3.15	6.37
0.167	5.28	1.167	33.28	2.167	12.57	3.17	6.37
0.183	5.62	1.183	76.62	2.183	11.55	3.18	6.13
0.200	5.62	1.200	76.62	2.200	11.55	3.20	6.13
0.217	5.62	1.217	76.62	2.217	11.55	3.22	6.13
0.233	5.62	1.233	76.62	2.233	11.55	3.23	6.13
0.250	5.62	1.250	76.62	2.250	11.55	3.25	6.13
0.267	6.02	1.267	242.53	2.267	10.71	3.27	5.92
0.283	6.02	1.283	242.53	2.283	10.71	3.28	5.92
0.300	6.02	1.300	242.53	2.300	10.71	3.30	5.92
0.317	6.02	1.317	242.53	2.317	10.71	3.32	5.92
0.333	6.02	1.333	242.53	2.333	10.71	3.33	5.92
0.350	6.49	1.350	98.70	2.350	9.98	3.35	5.72
0.367	6.49	1.367	98.69	2.367	9.98	3.37	5.72
0.383	6.49	1.383	98.69	2.383	9.98	3.38	5.72
0.400	6.49	1.400	98.69	2.400	9.98	3.40	5.72
0.417	6.49	1.417	98.69	2.417	9.98	3.42	5.72
0.433	7.05	1.433	54.64	2.433	9.36	3.43	5.54
0.450	7.05	1.450	54.64	2.450	9.36	3.45	5.54
0.467	7.05	1.467	54.64	2.467	9.36	3.47	5.54
0.483	7.05	1.483	54.64	2.483	9.36	3.48	5.54
0.500	7.05	1.500	54.64	2.500	9.36	3.50	5.54
0.517	7.72	1.517	37.73	2.517	8.82	3.52	5.37
0.533	7.72	1.533	37.73	2.533	8.82	3.53	5.37
0.550	7.72	1.550	37.73	2.550	8.82	3.55	5.37
0.567	7.72	1.567	37.73	2.567	8.82	3.57	5.37
0.583	7.72	1.583	37.73	2.583	8.82	3.58	5.37
0.600	8.57	1.600	28.91	2.600	8.35	3.60	5.21
0.617	8.57	1.617	28.91	2.617	8.35	3.62	5.21
0.633	8.57	1.633	28.91	2.633	8.35	3.63	5.21
0.650	8.57	1.650	28.91	2.650	8.35	3.65	5.21
0.667	8.57	1.667	28.91	2.667	8.35	3.67	5.21
0.683	9.66	1.683	23.53	2.683	7.92	3.68	5.06
0.700	9.66	1.700	23.53	2.700	7.92	3.70	5.06
0.717	9.66	1.717	23.53	2.717	7.92	3.72	5.06
0.733	9.66	1.733	23.53	2.733	7.92	3.73	5.06
0.750	9.66	1.750	23.53	2.750	7.92	3.75	5.06

0.767	11.12	1.767	19.90	2.767	7.55	3.77	4.92
0.783	11.12	1.783	19.90	2.783	7.55	3.78	4.92
0.800	11.12	1.800	19.90	2.800	7.55	3.80	4.92
0.817	11.12	1.817	19.90	2.817	7.55	3.82	4.92
0.833	11.12	1.833	19.90	2.833	7.55	3.83	4.92
0.850	13.17	1.850	17.30	2.850	7.21	3.85	4.78
0.867	13.17	1.867	17.30	2.867	7.21	3.87	4.78
0.883	13.17	1.883	17.30	2.883	7.21	3.88	4.78
0.900	13.17	1.900	17.30	2.900	7.21	3.90	4.78
0.917	13.17	1.917	17.30	2.917	7.21	3.92	4.78
0.933	16.30	1.933	15.34	2.933	6.90	3.93	4.66
0.950	16.30	1.950	15.34	2.950	6.90	3.95	4.66
0.967	16.30	1.967	15.34	2.967	6.90	3.97	4.66
0.983	16.30	1.983	15.34	2.983	6.90	3.98	4.66
1.000	16.30	2.000	15.34	3.000	6.90	4.00	4.66

Max.Eff.Inten.(mm/hr)=	242.53	92.41	
over (min)	5.00	5.00	
Storage Coeff. (min)=	1.05 (ii)	4.22 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.47	0.25	
			*TOTALS*
PEAK FLOW (cms)=	0.12	0.01	0.132 (iii)
TIME TO PEAK (hrs)=	1.35	1.38	1.35
RUNOFF VOLUME (mm)=	78.43	41.94	69.44
TOTAL RAINFALL (mm)=	79.43	79.43	79.43
RUNOFF COEFFICIENT =	0.99	0.53	0.87

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 81.5 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD ( 0005)				
1	+	2	=	3
ID	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 ( 0002):	0.25	0.132	1.35	69.44
+ ID2= 2 ( 0300):	3.45	0.079	2.65	62.32
=====				
ID = 3 ( 0005):	3.70	0.140	1.35	62.81

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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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

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000  TTTTT  TTTTT  H   H   Y   Y   M   M   000  TM
O   O   T   T   H   H   Y   Y   MM  MM  O   O
O   O   T   T   H   H   Y   M   M   O   O
000  T   T   H   H   Y   M   M   000

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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\MRitceyThorpe\AppData\Local\Civica\vh5\288aab60-d94f-43e4-8c9b-21a7a9040589\a0c64  
Summary filename: C:\Users\MRitceyThorpe\AppData\Local\Civica\vh5\288aab60-d94f-43e4-8c9b-21a7a9040589\a0c64

DATE: 04/04/2024

TIME: 02:10:17

USER:

COMMENTS: \_\_\_\_\_

\*\*\*\*\*

-----  
 READ STORM  
 -----  
 Ptotal= 25.00 mm  
 -----

Filename: C:\Users\MRitceyThorpe\AppData\Local\Temp\1d418be2-619f-4dcd-993b-826a149918b6\7eec0554  
 Comments: 25mm4hr

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.74	1.00	10.72	2.00	3.75	3.00	2.04
0.17	1.97	1.17	62.85	2.17	3.25	3.17	1.91
0.33	2.29	1.33	13.74	2.33	2.89	3.33	1.79
0.50	2.74	1.50	7.73	2.50	2.61	3.50	1.70
0.67	3.50	1.67	5.59	2.67	2.38	3.67	1.61
0.83	5.02	1.83	4.46	2.83	2.19	3.83	1.53

-----  
 CALIB  
 STANDHYD ( 0001)  
 ID= 1 DT= 1.0 min  
 -----

Area (ha)= 3.45  
 Total Imp(%)= 58.90 Dir. Conn.(%)= 58.90

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	2.03	1.42
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	151.57	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	1.74	1.017	10.72	2.017	3.75	3.02	2.04
0.033	1.74	1.033	10.72	2.033	3.75	3.03	2.04
0.050	1.74	1.050	10.72	2.050	3.75	3.05	2.04
0.067	1.74	1.067	10.72	2.067	3.75	3.07	2.04
0.083	1.74	1.083	10.72	2.083	3.75	3.08	2.04
0.100	1.74	1.100	10.72	2.100	3.75	3.10	2.04
0.117	1.74	1.117	10.72	2.117	3.75	3.12	2.04
0.133	1.74	1.133	10.72	2.133	3.75	3.13	2.04
0.150	1.74	1.150	10.72	2.150	3.75	3.15	2.04
0.167	1.74	1.167	10.72	2.167	3.75	3.17	2.04
0.183	1.97	1.183	62.85	2.183	3.25	3.18	1.91
0.200	1.97	1.200	62.85	2.200	3.25	3.20	1.91
0.217	1.97	1.217	62.85	2.217	3.25	3.22	1.91
0.233	1.97	1.233	62.85	2.233	3.25	3.23	1.91
0.250	1.97	1.250	62.85	2.250	3.25	3.25	1.91
0.267	1.97	1.267	62.85	2.267	3.25	3.27	1.91
0.283	1.97	1.283	62.85	2.283	3.25	3.28	1.91
0.300	1.97	1.300	62.85	2.300	3.25	3.30	1.91
0.317	1.97	1.317	62.85	2.317	3.25	3.32	1.91
0.333	1.97	1.333	62.85	2.333	3.25	3.33	1.91
0.350	2.29	1.350	13.74	2.350	2.89	3.35	1.79
0.367	2.29	1.367	13.74	2.367	2.89	3.37	1.79
0.383	2.29	1.383	13.74	2.383	2.89	3.38	1.79
0.400	2.29	1.400	13.74	2.400	2.89	3.40	1.79
0.417	2.29	1.417	13.74	2.417	2.89	3.42	1.79
0.433	2.29	1.433	13.74	2.433	2.89	3.43	1.79
0.450	2.29	1.450	13.74	2.450	2.89	3.45	1.79
0.467	2.29	1.467	13.74	2.467	2.89	3.47	1.79
0.483	2.29	1.483	13.74	2.483	2.89	3.48	1.79
0.500	2.29	1.500	13.74	2.500	2.89	3.50	1.79
0.517	2.74	1.517	7.73	2.517	2.61	3.52	1.70
0.533	2.74	1.533	7.73	2.533	2.61	3.53	1.70
0.550	2.74	1.550	7.73	2.550	2.61	3.55	1.70
0.567	2.74	1.567	7.73	2.567	2.61	3.57	1.70
0.583	2.74	1.583	7.73	2.583	2.61	3.58	1.70
0.600	2.74	1.600	7.73	2.600	2.61	3.60	1.70
0.617	2.74	1.617	7.73	2.617	2.61	3.62	1.70
0.633	2.74	1.633	7.73	2.633	2.61	3.63	1.70
0.650	2.74	1.650	7.73	2.650	2.61	3.65	1.70
0.667	2.74	1.667	7.73	2.667	2.61	3.67	1.70
0.683	3.50	1.683	5.59	2.683	2.38	3.68	1.61
0.700	3.50	1.700	5.59	2.700	2.38	3.70	1.61
0.717	3.50	1.717	5.59	2.717	2.38	3.72	1.61
0.733	3.50	1.733	5.59	2.733	2.38	3.73	1.61
0.750	3.50	1.750	5.59	2.750	2.38	3.75	1.61

0.767	3.50	1.767	5.59	2.767	2.38	3.77	1.61
0.783	3.50	1.783	5.59	2.783	2.38	3.78	1.61
0.800	3.50	1.800	5.59	2.800	2.38	3.80	1.61
0.817	3.50	1.817	5.59	2.817	2.38	3.82	1.61
0.833	3.50	1.833	5.59	2.833	2.38	3.83	1.61
0.850	5.02	1.850	4.46	2.850	2.19	3.85	1.53
0.867	5.02	1.867	4.46	2.867	2.19	3.87	1.53
0.883	5.02	1.883	4.46	2.883	2.19	3.88	1.53
0.900	5.02	1.900	4.46	2.900	2.19	3.90	1.53
0.917	5.02	1.917	4.46	2.917	2.19	3.92	1.53
0.933	5.02	1.933	4.46	2.933	2.19	3.93	1.53
0.950	5.02	1.950	4.46	2.950	2.19	3.95	1.53
0.967	5.02	1.967	4.46	2.967	2.19	3.97	1.53
0.983	5.02	1.983	4.46	2.983	2.19	3.98	1.53
1.000	5.02	2.000	4.46	3.000	2.19	4.00	1.53

Max.Eff.Inten.(mm/hr)=	62.85	11.40	
over (min)	5.00	12.00	
Storage Coeff. (min)=	3.95 (ii)	11.31 (ii)	
Unit Hyd. Tpeak (min)=	5.00	12.00	
Unit Hyd. peak (cms)=	0.26	0.10	
			*TOTALS*
PEAK FLOW (cms)=	0.31	0.03	0.321 (iii)
TIME TO PEAK (hrs)=	1.35	1.50	1.35
RUNOFF VOLUME (mm)=	24.00	6.01	16.60
TOTAL RAINFALL (mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT =	0.96	0.24	0.66

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 84.5 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR( 0300)		OVERFLOW IS OFF			
IN= 2---> OUT= 1					
DT= 1.0 min					
	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)	
	0.0000	0.0000	0.0730	0.1320	
	0.0030	0.0100	0.0770	0.1490	
	0.0060	0.0210	0.0810	0.1660	
	0.0070	0.0310	0.0840	0.1830	
	0.0080	0.0450	0.0880	0.2020	
	0.0090	0.0580	0.0910	0.2220	
	0.0100	0.0710	0.6750	0.2430	
	0.0600	0.0850	1.7380	0.2640	
	0.0650	0.0980	3.1130	0.2850	
	0.0690	0.1150	0.0000	0.0000	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	
INFLOW : ID= 2 ( 0001)	3.446	0.321	1.35	16.60	
OUTFLOW: ID= 1 ( 0300)	3.446	0.008	4.08	15.75	
	PEAK FLOW REDUCTION [Qout/Qin](%)=	2.58			
	TIME SHIFT OF PEAK FLOW (min)=	164.00			
	MAXIMUM STORAGE USED (ha.m.)=	0.0488			

CALIB STANDHYD ( 0002)		Area (ha)=	0.25	
ID= 1 DT= 1.0 min		Total Imp(%)=	75.40	Dir. Conn.(%)= 75.40
	IMPERVIOUS	PERVIOUS (i)		
Surface Area (ha)=	0.19	0.06		
Dep. Storage (mm)=	1.00	5.00		
Average Slope (%)=	1.00	2.00		
Length (m)=	41.17	40.00		
Mannings n =	0.013	0.250		

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	1.74	1.017	10.72	2.017	3.75	3.02	2.04
0.033	1.74	1.033	10.72	2.033	3.75	3.03	2.04
0.050	1.74	1.050	10.72	2.050	3.75	3.05	2.04
0.067	1.74	1.067	10.72	2.067	3.75	3.07	2.04

0.083	1.74	1.083	10.72	2.083	3.75	3.08	2.04
0.100	1.74	1.100	10.72	2.100	3.75	3.10	2.04
0.117	1.74	1.117	10.72	2.117	3.75	3.12	2.04
0.133	1.74	1.133	10.72	2.133	3.75	3.13	2.04
0.150	1.74	1.150	10.72	2.150	3.75	3.15	2.04
0.167	1.74	1.167	10.72	2.167	3.75	3.17	2.04
0.183	1.97	1.183	62.85	2.183	3.25	3.18	1.91
0.200	1.97	1.200	62.85	2.200	3.25	3.20	1.91
0.217	1.97	1.217	62.85	2.217	3.25	3.22	1.91
0.233	1.97	1.233	62.85	2.233	3.25	3.23	1.91
0.250	1.97	1.250	62.85	2.250	3.25	3.25	1.91
0.267	1.97	1.267	62.85	2.267	3.25	3.27	1.91
0.283	1.97	1.283	62.85	2.283	3.25	3.28	1.91
0.300	1.97	1.300	62.85	2.300	3.25	3.30	1.91
0.317	1.97	1.317	62.85	2.317	3.25	3.32	1.91
0.333	1.97	1.333	62.85	2.333	3.25	3.33	1.91
0.350	2.29	1.350	13.74	2.350	2.89	3.35	1.79
0.367	2.29	1.367	13.74	2.367	2.89	3.37	1.79
0.383	2.29	1.383	13.74	2.383	2.89	3.38	1.79
0.400	2.29	1.400	13.74	2.400	2.89	3.40	1.79
0.417	2.29	1.417	13.74	2.417	2.89	3.42	1.79
0.433	2.29	1.433	13.74	2.433	2.89	3.43	1.79
0.450	2.29	1.450	13.74	2.450	2.89	3.45	1.79
0.467	2.29	1.467	13.74	2.467	2.89	3.47	1.79
0.483	2.29	1.483	13.74	2.483	2.89	3.48	1.79
0.500	2.29	1.500	13.74	2.500	2.89	3.50	1.79
0.517	2.74	1.517	7.73	2.517	2.61	3.52	1.70
0.533	2.74	1.533	7.73	2.533	2.61	3.53	1.70
0.550	2.74	1.550	7.73	2.550	2.61	3.55	1.70
0.567	2.74	1.567	7.73	2.567	2.61	3.57	1.70
0.583	2.74	1.583	7.73	2.583	2.61	3.58	1.70
0.600	2.74	1.600	7.73	2.600	2.61	3.60	1.70
0.617	2.74	1.617	7.73	2.617	2.61	3.62	1.70
0.633	2.74	1.633	7.73	2.633	2.61	3.63	1.70
0.650	2.74	1.650	7.73	2.650	2.61	3.65	1.70
0.667	2.74	1.667	7.73	2.667	2.61	3.67	1.70
0.683	3.50	1.683	5.59	2.683	2.38	3.68	1.61
0.700	3.50	1.700	5.59	2.700	2.38	3.70	1.61
0.717	3.50	1.717	5.59	2.717	2.38	3.72	1.61
0.733	3.50	1.733	5.59	2.733	2.38	3.73	1.61
0.750	3.50	1.750	5.59	2.750	2.38	3.75	1.61
0.767	3.50	1.767	5.59	2.767	2.38	3.77	1.61
0.783	3.50	1.783	5.59	2.783	2.38	3.78	1.61
0.800	3.50	1.800	5.59	2.800	2.38	3.80	1.61
0.817	3.50	1.817	5.59	2.817	2.38	3.82	1.61
0.833	3.50	1.833	5.59	2.833	2.38	3.83	1.61
0.850	5.02	1.850	4.46	2.850	2.19	3.85	1.53
0.867	5.02	1.867	4.46	2.867	2.19	3.87	1.53
0.883	5.02	1.883	4.46	2.883	2.19	3.88	1.53
0.900	5.02	1.900	4.46	2.900	2.19	3.90	1.53
0.917	5.02	1.917	4.46	2.917	2.19	3.92	1.53
0.933	5.02	1.933	4.46	2.933	2.19	3.93	1.53
0.950	5.02	1.950	4.46	2.950	2.19	3.95	1.53
0.967	5.02	1.967	4.46	2.967	2.19	3.97	1.53
0.983	5.02	1.983	4.46	2.983	2.19	3.98	1.53
1.000	5.02	2.000	4.46	3.000	2.19	4.00	1.53

Max.Eff.Inten.(mm/hr)= 62.85 9.56  
over (min) 5.00 8.00  
Storage Coeff. (min)= 1.81 (ii) 7.24 (ii)  
Unit Hyd. Tpeak (min)= 5.00 8.00  
Unit Hyd. peak (cms)= 0.39 0.15

\*TOTALS\*  
PEAK FLOW (cms)= 0.03 0.00 0.034 (iii)  
TIME TO PEAK (hrs)= 1.33 1.43 1.33  
RUNOFF VOLUME (mm)= 24.00 5.15 19.35  
TOTAL RAINFALL (mm)= 25.00 25.00 25.00  
RUNOFF COEFFICIENT = 0.96 0.21 0.77

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:  
CN\* = 81.5 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL  
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD ( 0005)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 ( 0002):	0.25	0.034	1.33	19.35
+ ID2= 2 ( 0300):	3.45	0.008	4.08	15.75

=====

ID = 3 ( 0005):	3.70	0.038	1.33	15.99
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NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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FINISH

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**Project:** Ninth Line  
**File:** 300044049  
**Designed by:** M.RT  
**Checked by:** J.Smith  
**Date:** 4-Apr-24



BURNSIDE

### TSS Removal Efficiency - Treatment Train

Catchment Area Description	Treated Drainage Area (ha)	Removal Efficiency		
		Oil/Grit Separator	Wet Pond (Enhanced)	Total Efficiency
Catchment 201 - To OGS Unit	2.40	80%	80%	96%
Catchment 201 - To Pond	1.05		80%	80%
Catchment UNC1 - To Ninth Line	0.25	0%	0%	0%
<b>Total</b>	<b>3.70</b>			<b>85%</b>



## Ditch Conveyance Analysis and Design

Project Name: Ninth Line  
Project Number: 300044049  
Date: 4-Apr-24

**Calculate 100-year flow within drainage area**

City of Mississauga 100-year
a= 1450.00
b= 4.90
c= 0.780

Catchment ID/Description	Hydrology					Channel Capacity (Manning's Equation)								
	Area	Runoff Coeff.	Time of Concentration	Rainfall Intensity	Flow	Channel Section	Flow Depth	Maximum Flow Depth	Slope	Manning's 'n'	Velocity	Design Flow	Channel Capacity	% of Maximum Channel Capacity
	(ha)	RC	Tc (min)	(mm/hr)	(m <sup>3</sup> /s)		(m)	(m)	(%)		(m/s)	(m <sup>3</sup> /s)	(m <sup>3</sup> /s)	%
Area 1 - Catchment 201 (Controlled - SWMF) and Area 2 - Catchment UNC1 (Uncontrolled)	3.70	FLOW CALCULATED IN VO MODEL			0.140									
External Area	1.29	0.46	15.00	140.69	0.232									
Total Area	4.99			Total Flow	0.372	F	0.21	0.37	0.33	0.08	0.21	0.37	1.10	33.70
						G	0.26	0.84	0.22	0.08	0.20	0.37	4.02	9.26
						H	0.37	0.65	0.14	0.08	0.18	0.37	1.35	27.58

\* Runoff coefficient has been multiplied by 1.25 to accommodate saturated conditions during the 100-year rainfall event.

# Channel Report

## Section F

### User-defined

Invert Elev (m) = 100.0000  
Slope (%) = 0.3300  
N-Value = 0.080

### Highlighted

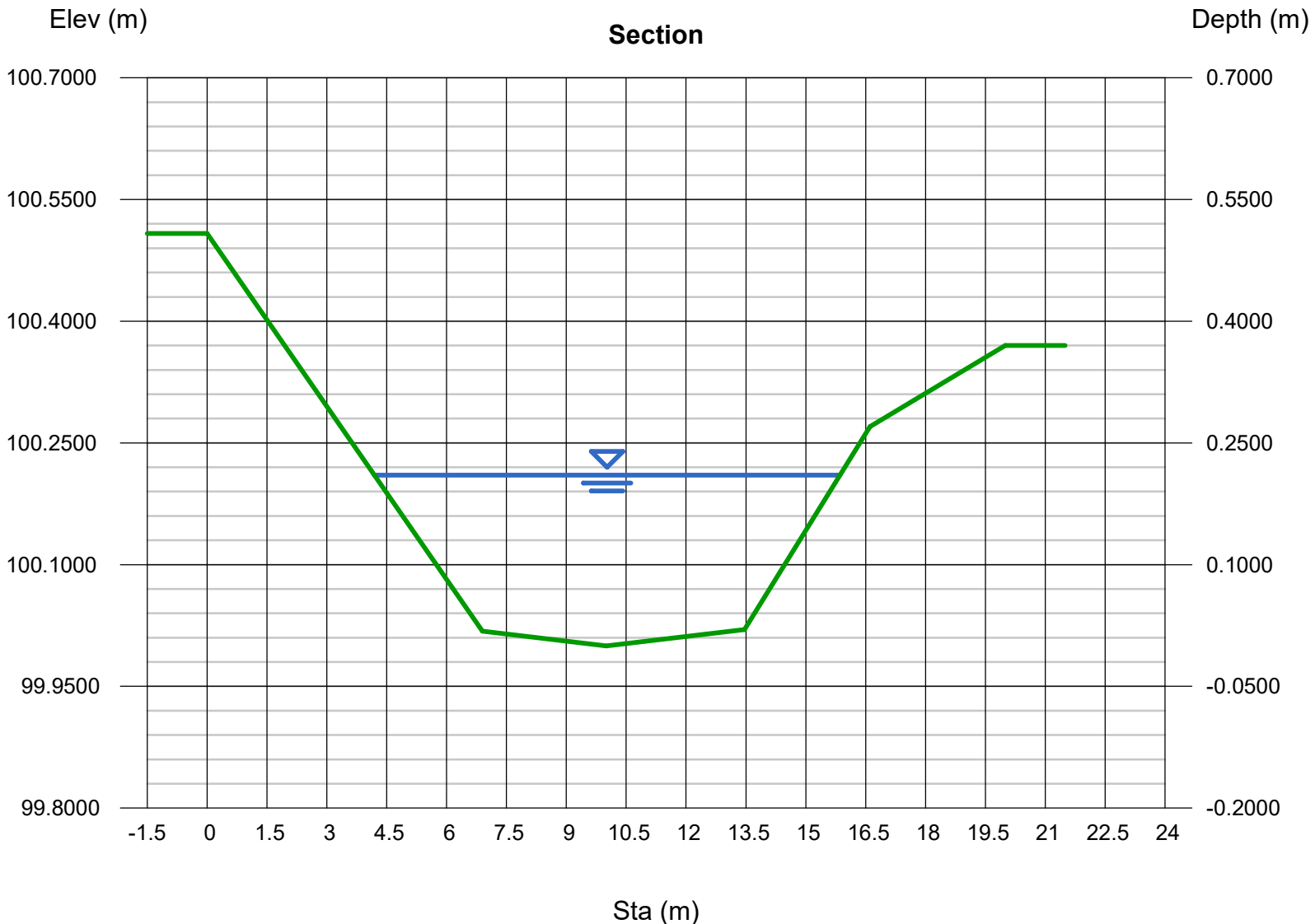
Depth (m) = 0.2103  
Q (cms) = 0.3720  
Area (sqm) = 1.8069  
Velocity (m/s) = 0.2059  
Wetted Perim (m) = 11.6839  
Crit Depth, Yc (m) = 0.0792  
Top Width (m) = 11.6694  
EGL (m) = 0.2125

### Calculations

Compute by: Known Q  
Known Q (cms) = 0.3720

### (Sta, El, n)-(Sta, El, n)...

(0.0000, 100.5080)-(6.8940, 100.0180, 0.080)-(10.0000, 100.0000, 0.080)-(13.4620, 100.0200, 0.080)-(16.6090, 100.2700, 0.080)-(20.0000, 100.3700, 0.080)



# Channel Report

## Section F

### User-defined

Invert Elev (m) = 100.0000  
Slope (%) = 0.3300  
N-Value = 0.080

### Highlighted

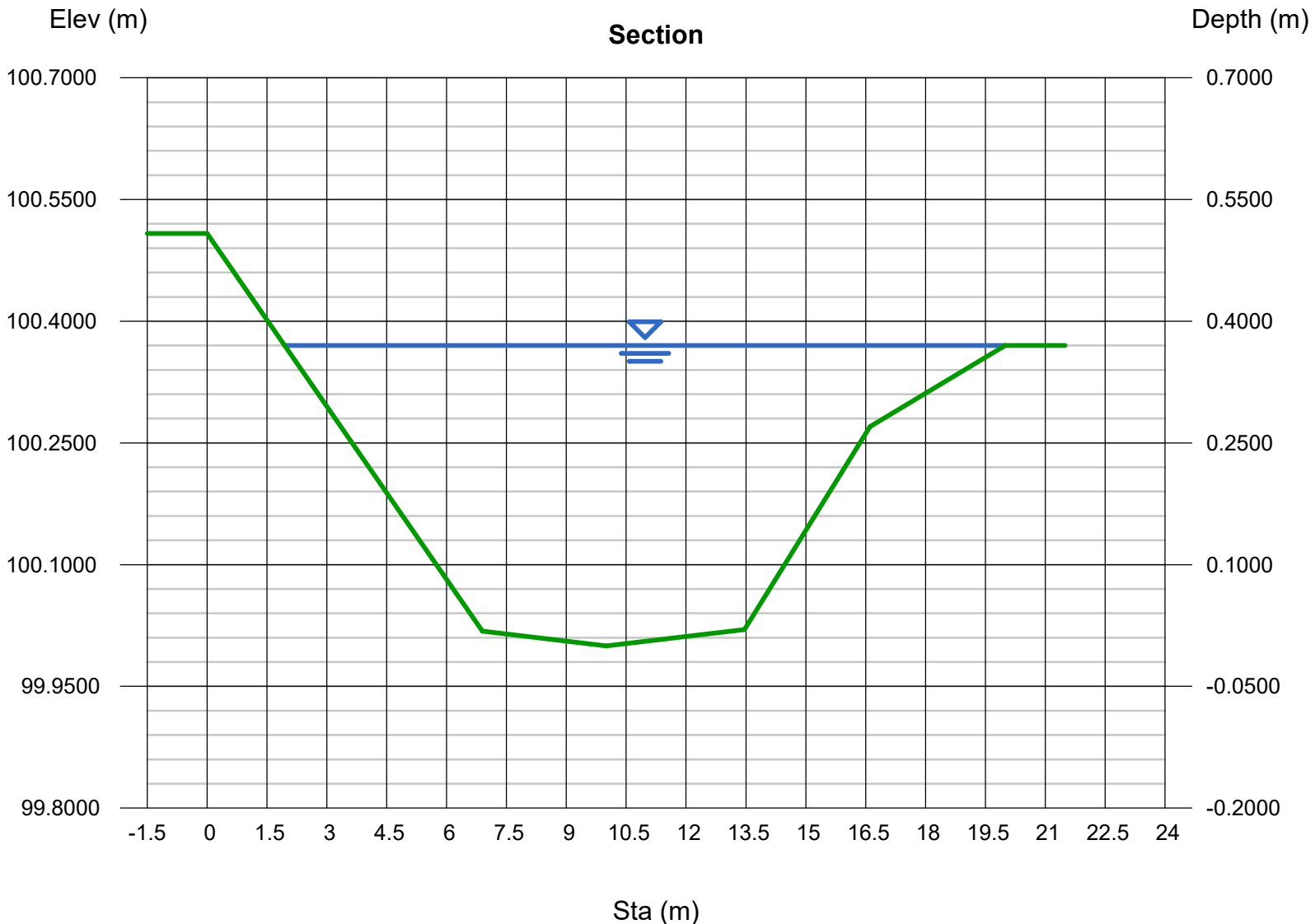
Depth (m) = 0.3700  
Q (cms) = 1.1036  
Area (sqm) = 4.1168  
Velocity (m/s) = 0.2681  
Wetted Perim (m) = 18.0820  
Crit Depth, Yc (m) = 0.1433  
Top Width (m) = 18.0580  
EGL (m) = 0.3737

### Calculations

Compute by: Known Depth  
Known Depth (m) = 0.3700

### (Sta, El, n)-(Sta, El, n)...

(0.0000, 100.5080)-(6.8940, 100.0180, 0.080)-(10.0000, 100.0000, 0.080)-(13.4620, 100.0200, 0.080)-(16.6090, 100.2700, 0.080)-(20.0000, 100.3700, 0.080)



# Channel Report

## Section G - SWM Discharge

### User-defined

Invert Elev (m) = 100.0000  
Slope (%) = 0.2200  
N-Value = 0.080

### Highlighted

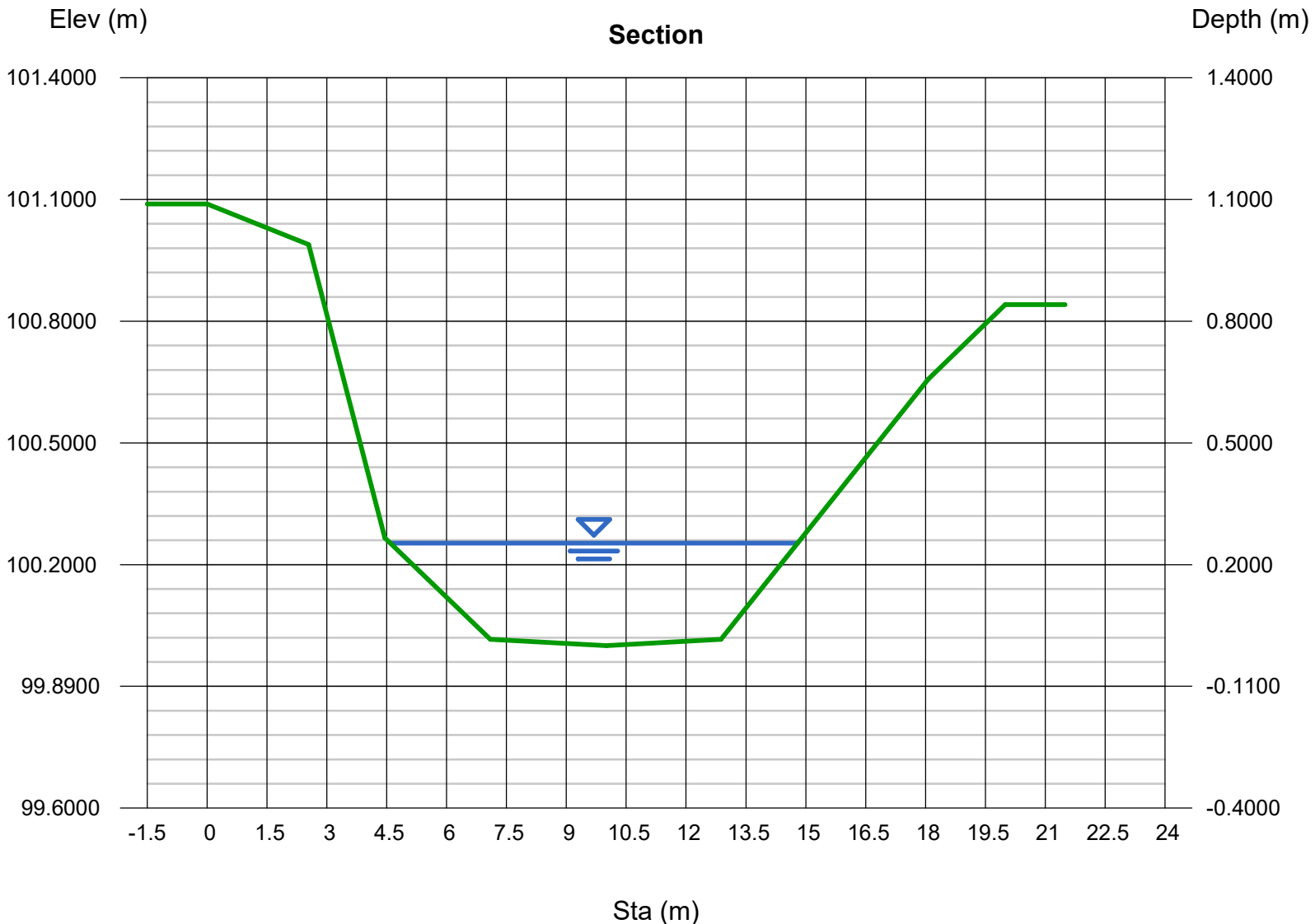
Depth (m) = 0.2530  
Q (cms) = 0.3720  
Area (sqm) = 1.9402  
Velocity (m/s) = 0.1917  
Wetted Perim (m) = 10.2329  
Crit Depth, Yc (m) = 0.0823  
Top Width (m) = 10.2071  
EGL (m) = 0.2549

### Calculations

Compute by: Known Q  
Known Q (cms) = 0.3720

### (Sta, El, n)-(Sta, El, n)...

(0.0000, 101.0890)-(2.5410, 100.9890, 0.080)-(4.4510, 100.2660, 0.080)-(7.0980, 100.0160, 0.080)-(10.0000, 100.0000, 0.080)-(12.8750, 100.0160, 0.080)-(18.0710, 100.8410, 0.080)



# Channel Report

## Section G

### User-defined

Invert Elev (m) = 100.0000  
Slope (%) = 0.2200  
N-Value = 0.080

### Highlighted

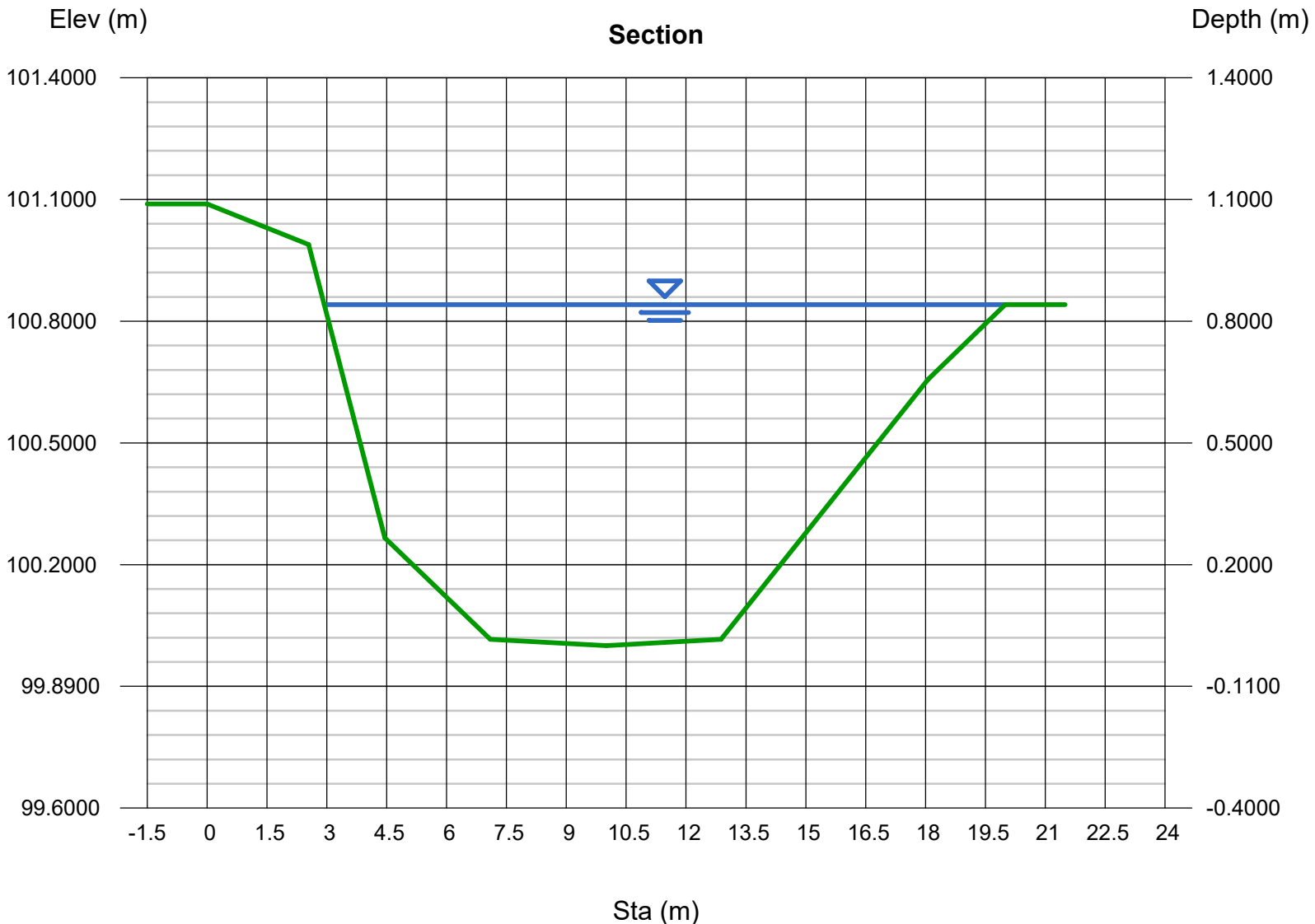
Depth (m) = 0.8410  
Q (cms) = 4.0178  
Area (sqm) = 9.9007  
Velocity (m/s) = 0.4058  
Wetted Perim (m) = 17.2332  
Crit Depth, Yc (m) = 0.3200  
Top Width (m) = 17.0680  
EGL (m) = 0.8494

### Calculations

Compute by: Known Depth  
Known Depth (m) = 0.8410

### (Sta, El, n)-(Sta, El, n)...

(0.0000, 101.0890)-(2.5410, 100.9890, 0.080)-(4.4510, 100.2660, 0.080)-(7.0980, 100.0160, 0.080)-(10.0000, 100.0000, 0.080)-(12.8750, 100.0160, 0.080)-(18.0710, 100.8410, 0.080)-(20.0000, 100.8410, 0.080)



# Channel Report

## Section H - SWM Discharge

### User-defined

Invert Elev (m) = 100.0000  
Slope (%) = 0.1400  
N-Value = 0.080

### Highlighted

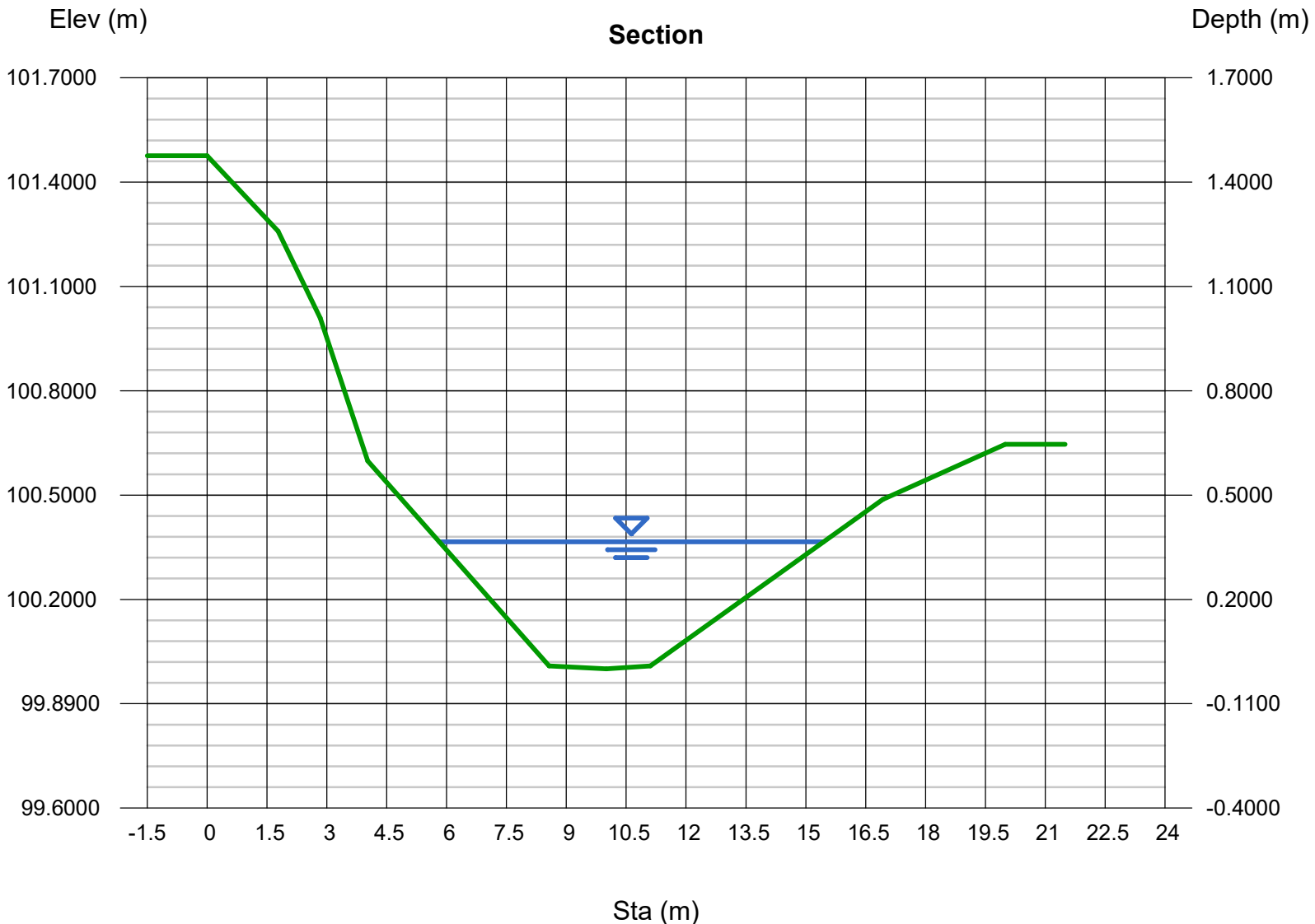
Depth (m) = 0.3658  
Q (cms) = 0.3720  
Area (sqm) = 2.1815  
Velocity (m/s) = 0.1705  
Wetted Perim (m) = 9.6685  
Crit Depth, Yc (m) = 0.1189  
Top Width (m) = 9.6308  
EGL (m) = 0.3672

### Calculations

Compute by: Known Q  
Known Q (cms) = 0.3720

### (Sta, El, n)-(Sta, El, n)...

(0.0000, 101.4760)-(1.7750, 101.2590, 0.080)-(2.8320, 101.0090, 0.080)-(4.0210, 100.5980, 0.080)-(8.5670, 100.0090, 0.080)-(10.0000, 100.0000, 0.080)-(11.1020, 99.9320, 0.080)-(16.9320, 100.4880, 0.080)-(20.0000, 100.6460, 0.080)



# Channel Report

## Section H

### User-defined

Invert Elev (m) = 100.0000  
Slope (%) = 0.1400  
N-Value = 0.080

### Highlighted

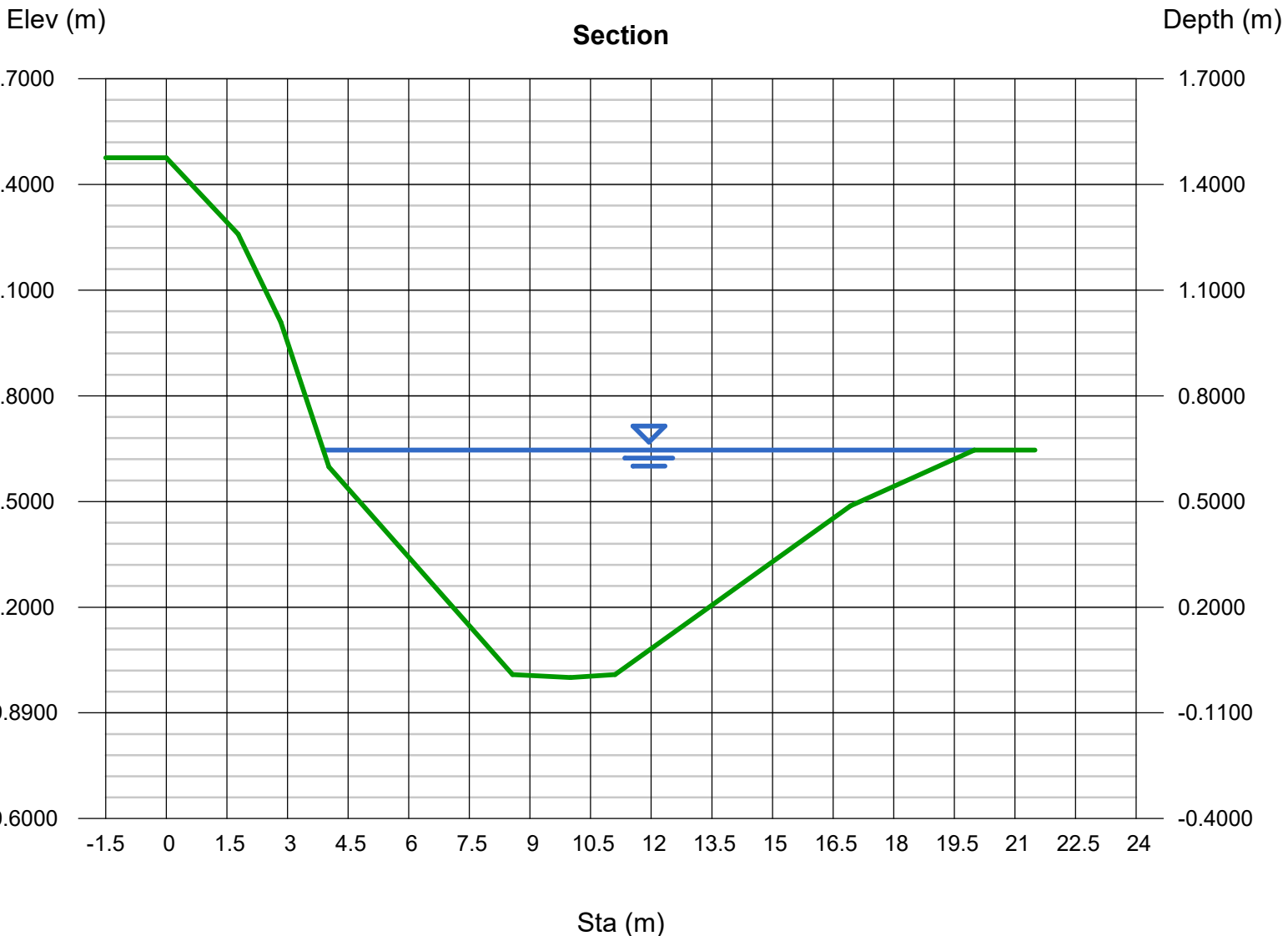
Depth (m) = 0.6460  
Q (cms) = 1.3493  
Area (sqm) = 5.7463  
Velocity (m/s) = 0.2348  
Wetted Perim (m) = 16.1875  
Crit Depth, Yc (m) = 0.2377  
Top Width (m) = 16.1177  
EGL (m) = 0.6488

### Calculations

Compute by: Known Depth  
Known Depth (m) = 0.6460

### (Sta, El, n)-(Sta, El, n)...

(0.0000, 101.4760)-(1.7750, 101.2590, 0.080)-(2.8320, 101.0090, 0.080)-(4.0210, 100.5980, 0.080)-(8.5670, 100.0090, 0.080)-(10.0000, 100.0000, 0.080)-(11.1020, 99.9320, 0.080)-(20.0000, 100.6460, 0.080)



**STORM SEWER DESIGN SHEET: (10 Year Storm)**

**PROPOSED SEWER SYSTEM  
NINTH LINE, CITY OF MISSISSAUGA**



Project #: 300044049.0000  
Date: 4-Apr-24  
Designed: TR  
Checked: SR

Min. Diameter = 250 mm  
Mannings 'n' = 0.013  
Starting Tc = 15 min  
Factor of Safety = 10 %

Rainfall Intensity =  $\frac{A}{(Tc+B)^c}$  where Tc is in minutes  
 A = 1010  
 B = 4.6  
 C = 0.78 } (10 Yr)

**NOMINAL PIPE SIZE USED**

DESCRIPTION	FROM MH	TO MH	AREA (ha)	RUNOFF COEFFICIENT "R"	'AR'	ACCUM. 'AR'	RAINFALL INTENSITY (mm/hr)	FLOW (m3/s)	CONSTANT FLOW (m3/s)	ACCUM. CONSTANT FLOW (m3/s)	TOTAL FLOW (m3/s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m3/s)	FULL FLOW VELOCITY (m/s)	INITIAL Tc (min)	TIME OF CONCENTRATION (min)	ACC. TIME OF CONCENTRATION (min)	PERCENT FULL (%)
	DCBMH11	MH10	0.42	0.70	0.29	0.29	99.2	0.081			0.081	20.7	0.40	375	0.111	1.00	15.00	0.34	15.34	73%
	MH10	CBMH09				0.29	97.8	0.080			0.080	55.0	0.40	375	0.111	1.00	15.34	0.91	16.26	72%
	RD01	CBMH09	0.50	0.90	0.45	0.45	99.2	0.124			0.124	26.6	2.00	375	0.248	2.25	15.00	0.20	15.20	50%
	CBMH09	DCBMH07	0.37	0.62	0.23	0.97	94.5	0.255			0.255	76.7	0.40	600	0.388	1.37	16.26	0.93	17.19	66%
	DCBMH07	DCBMH06	0.15	0.56	0.08	1.06	91.3	0.268			0.268	18.0	0.30	600	0.336	1.19	17.19	0.25	17.44	80%
	DCBMH06	DCBMH03	0.16	0.83	0.13	1.19	90.5	0.299			0.299	36.7	0.30	600	0.336	1.19	17.44	0.51	17.95	89%
	DCBMH05	CBMH04	0.37	0.71	0.27	0.27	99.2	0.073			0.073	16.7	0.30	375	0.096	0.87	15.00	0.32	15.32	76%
	CBMH04	DCBMH03	0.19	0.77	0.14	0.41	97.9	0.111			0.111	51.0	0.30	450	0.156	0.98	15.32	0.87	16.19	71%
	DCBMH03	DCBMH02	0.12	0.88	0.11	1.70	88.9	0.421			0.421	17.6	0.30	750	0.610	1.38	17.95	0.21	18.17	69%
	DICB03	MH12	0.50	0.25	0.12	0.12	99.2	0.034			0.034	9.1	1.00	250	0.059	1.21	15.00	0.13	15.13	57%
	MH12	DCBMH02				0.12	98.7	0.034			0.034	51.9	0.50	300	0.068	0.97	15.13	0.89	16.02	50%
	DCBMH02	CHAMBER	0.09	0.59	0.05	1.88	88.2	0.460			0.460	3.5	0.30	750	0.610	1.38	18.17	0.04	18.21	76%
	CHAMBER	MH35				1.88	88.1	0.460			0.460	6.4	0.30	750	0.610	1.38	18.21	0.08	18.29	75%
	MH35	MH34				1.88	87.9	0.459			0.459	28.0	0.30	750	0.610	1.38	18.29	0.34	18.62	75%
	MH34	MH33				1.88	86.9	0.453			0.453	30.9	0.30	750	0.610	1.38	18.62	0.37	19.00	74%
	DICB02	MH33	0.38	0.33	0.13	0.13	99.2	0.035			0.035	21.8	0.50	300	0.068	0.97	15.00	0.38	15.38	51%
	MH33	HW01				2.00	85.8	0.478			0.478	9.8	0.30	750	0.610	1.38	19.00	0.12	19.12	78%





BURNSIDE

[ THE DIFFERENCE IS OUR PEOPLE ]

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## Appendix C

### Watermain Calculations

Project: **Ninth Line Church Development (Phase I - Church)**  
**Mississauga, Ontario**  
**Water Demand Calculations**

Prepared by: TR  
 Checked by: LG  
 Project No: 300044049  
 Date: March 28, 2024

**I. Fire Flow Calculation**

*\*Based on Fire Underwriters Survey*

1  $F = 220 C (A)^{1/2}$

Where F= Fire flow in Lpm

C = construction type coefficient

Type II - Noncombustible

= 0.8

A = total floor area in sq.m. excluding basements, includes garage\*

Floor	Area (sq.m)	%
1st Floor	4977 m <sup>2</sup>	100%
2nd Floor	1560 m <sup>2</sup>	25%

\*Largest floor area + 25% of adjoining floor areas, assuming vertical opening are properly protected (one hour rating)

Largest Area = 5,367 sq.m.

F = 12,893.73 L/min

Round to nearest 1000 l/min

F = 13,000 L/min

2 **Occupancy Contents Adjustment Factor**

Type = Combustible Contents

Factor = 0%

Adjustment = 0 L/min

F = 13,000 L/min

3 **Sprinkler Reduction**

Sprinkler Design System = Automatic sprinkler protection in accordance with NFPA standards

Factor = 30%

Reduction = 3,900 L/min

4 **Exposure Adjustment Charge**

Use conservative method = YES

Face	Distance	Separation Charge
North	>30m	0%
West	>30m	0%
South	>30m	0%
East	>30m	0%

Total Separation Charge = 0%

MAX Separation Charge = 75%

Charge = 0 L/min

F = 9,000 L/min

150.00 L/s

F = 2,378 US GPM

**Fire Flow Required = 150.00 L/s**  
**= 9,000 L/min**

**2,378 US GPM**

Project: **Ninth Line Church Development (Phase I - Church)**  
**Mississauga, Ontario**  
**Water Demand Calculations**

Prepared by: TR  
 Checked by: LG  
 Project No: 300044049  
 Date: March 28, 2024

**II. Domestic Flow Calculations**
**Church**

Average Day Per Capita Flow = 300 L/cap/d (Region of Peel Section 2.3 - Table #1 - Typical Water Demand Criteria)  
 Population = 798  
 Average Day Demand = 239400 L/day  
 = 2.77 L/s  
 = 44 US GPM

Max. Daily Demand Peaking Factor = 1.4

Max. Daily Demand = 3.88 L/s  
 = 61 US GPM

or

Max. Hourly Demand Peaking Factor = 3.0

Max. Hourly Demand = 8.31 L/s  
 = 132 US GPM

**Church Domestic Flow = 8.31 L/s 132 US GPM**

Phase 1	Peak Domestic Flow =	8.31 L/s
	Fire Flow =	150.00 L/s
	Max Day + Fire Demand =	153.88 L/s
		9232.75 L/min

**III. Pressure Loss Calculations**

$$h_f = \frac{10.7L}{C^{1.852} D^{4.87}} Q^{1.852}$$

**Site Service (From Burnhamthorpe Road West)**

Length, L = 236.0 m  
 C = 150  
 Diameter, D = 300 mm  
 Flow, Q = 150.00 L/s  
 Velocity, V = 2.12 m/s  
 Pressure Loss,  $h_f$  = 2.47 m  
 = 3.51 psi

**Domestic Service**

Length, L = 226.0 m  
 C = 150  
 Diameter, D = 150 mm  
 Flow, Q = 8.31 L/s  
 Velocity, V = 0.47 m/s  
 Pressure Loss,  $h_f$  = 0.33 m  
 = 0.46 psi

**Fire Service**

Length, L = 320.0 m  
 C = 150  
 Diameter, D = 250 mm  
 Flow, Q = 150.00 L/s  
 Velocity, V = 3.06 m/s  
 Pressure Loss,  $h_f$  = 8.14 m  
 = 11.58 psi

**Total Domestic Service**

Total P. Loss  $h_{tot}$  = 2.80 m  
 = 3.98 psi

**Total Fire Service**

Total P. Loss,  $h_{tot}$  = 10.61 m  
 = 15.09 psi

Project: **Ninth Line Church Development (Phase I - Church)**  
**Mississauga, Ontario**  
**Water Demand Calculations**

Prepared by: TR  
 Checked by: LG  
 Project No: 300044049  
 Date: March 28, 2024

**IV. Flow Test Results - Test 1**

\* As per fire flow test completed on a fire hydrant located at 3800 Burnhamthorpe Road West\*

Static Pressure = 64 psi  
 = 45.0 m head

Pressure (psi)	Pressure (m)	Flow (GPM)	Flow (L/s)
61	42.90	1222	77
56	39.38	2041	129

**Pump Head Equation**

$$Head(m) = A - B(Q^C)$$

A = 45.00  
 B = 0.0005288  
 C = 1.91

Theoretical Flow @ 20.3 psi = 312 L/s  
 = 18728 L/min  
 = 4947 US GPM

Required Fire Flow = 150 L/s \*Sufficient Pressure

**Anticipated Residual Pressures**

Scenario	Flow (L/s)	Pressure (psi)	
		Estimated	Required
Peak Hour	8.3	63.9	39.9
Fire + Max Day	153.9	52.7	20.3

\* Minimum pressure of 275 kpa (39.9 psi)

\* Minimum pressure of 140 kpa (20.3 psi)

Project: <b>Ninth Line Church Development (Phase II - Church &amp; Community Services Building)</b> <b>Mississauga, Ontario</b> <b>Water Demand Calculations</b>	Prepared by: TR Checked by: LG Project No: 300044049 Date: March 28, 2024	
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**I. Fire Flow Calculation**
*\*Based on Fire Underwriters Survey*

1  $F = 220 C (A)^{1/2}$

Where F= Fire flow in Lpm

C = construction type coefficient

Type II - Noncombustible

= 0.8

A = total floor area in sq.m. excluding basements, includes garage\*

Floor	Area (sq.m)	%
1st Floor	2596 m <sup>2</sup>	100%
2nd Floor	1466 m <sup>2</sup>	25%
3rd Floor	1466 m <sup>2</sup>	25%

\*Largest floor area + 25% of adjoining floor areas, assuming vertical opening are properly protected (one hour rating)

Largest Area = 3,329 sq.m.

F = 10,154.76 L/min

Round to nearest 1000 l/min

F = 10,000 L/min

2 **Occupancy Contents Adjustment Factor**

Type = Limited Combustible Contents

Factor = -15%

Adjustment = -1,500 L/min

F = 8,500 L/min

3 **Sprinkler Reduction**

Sprinkler Design System = No System

Factor = 0%

Reduction = 0 L/min

4 **Exposure Adjustment Charge**

Use conservative method = YES

Face	Distance	Separation Charge
North	>30m	0%
West	>30m	0%
South	>30m	0%
East	>30m	0%

Total Separation Charge = 0%

MAX Separation Charge = 75%

Charge = 0 L/min

F = 9,000 L/min

150.00 L/s

F = 2,378 US GPM

**Fire Flow Required = 150.00 L/s**  
**= 9,000 L/min**

**2,378 US GPM**

<b>Project:</b> <b>Ninth Line Church Development (Phase II - Church &amp; Community Services Building)</b> <b>Mississauga, Ontario</b> <b>Water Demand Calculations</b>	<b>Prepared by:</b> TR <b>Checked by:</b> LG <b>Project No:</b> 300044049 <b>Date:</b> March 28, 2024
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**II. Domestic Flow Calculations**
**Community Services Building**

Average Day Per Capita Flow = 300 L/cap/d (Region of Peel Section 2.3 - Table #1 - Typical Water Demand Criteria)  
 Population = 162

Average Day Demand = 48600 L/day  
 = 0.56 L/s  
 = 9 US GPM

Max. Daily Demand Peaking Factor = 1.4
--

Max. Daily Demand = 0.79 L/s  
 = 12 US GPM

or

Max. Hourly Demand Peaking Factor = 3.0
---

Max. Hourly Demand = 1.69 L/s  
 = 27 US GPM

<b>Community Services Building Domestic Flow = 1.69 L/s</b>	<b>27</b>	<b>US GPM</b>
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<b>Church Domestic Flow = 8.31 L/s</b>	<b>132</b>	<b>US GPM</b>
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<b>Phase 2</b>	<b>Peak Domestic Flow = 10.00 L/s</b>
	<b>Fire Flow = 150.00 L/s</b>
	<b>Max Day + Fire Demand = 151.69 L/s</b>
	<b>9101.25 L/min</b>

<b>Phase 1</b>	<b>Peak Domestic Flow = 8.31 L/s</b>
	<b>Fire Flow = 150.00 L/s</b>
	<b>Max Day + Fire Demand = 153.88 L/s</b>
	<b>9232.75 L/min</b>

\*Domestic Flow Requirements add Phase 1 - Church Building and Phase 2 - Community Services Building = 8.31 L/s.\*

\*Fire Flow Requirements are greater for Phase 1 Church Building. Proceed with higher flow rate requirement of 153.88 L/s\*

**III. Pressure Loss Calculations**

$$h_f = \frac{10.7L}{C^{1.852}D^{4.87}} Q^{1.852}$$

**Site Service (From Burnhamthorpe Road West)**

Length, L = 236.0 m  
 C = 150  
 Diameter, D = 300 mm  
 Flow, Q = 150.00 L/s  
 Velocity, V = 2.12 m/s  
 Pressure Loss,  $h_f$  = 2.47 m  
 = 3.51 psi

**Domestic Service**

Length, L = 226.0 m  
 C = 150  
 Diameter, D = 150 mm  
 Flow, Q = 10.00 L/s  
 Velocity, V = 0.57 m/s  
 Pressure Loss,  $h_f$  = 0.46 m  
 = 0.65 psi

**Fire Service**

Length, L = 320.0 m  
 C = 150  
 Diameter, D = 250 mm  
 Flow, Q = 153.88 L/s  
 Velocity, V = 3.13 m/s  
 Pressure Loss,  $h_f$  = 8.53 m  
 = 12.14 psi

**Total Domestic Service**

Total P. Loss  $h_{tot}$  = 2.93 m  
 = 4.17 psi

**Total Fire Service**

Total P. Loss,  $h_{tot}$  = 11.00 m  
 = 15.66 psi

Project: <b>Ninth Line Church Development (Phase II - Church &amp; Community Services Building)</b> <b>Mississauga, Ontario</b> <b>Water Demand Calculations</b>	Prepared by: TR Checked by: LG Project No: 300044049 Date: March 28, 2024
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**IV. Flow Test Results - Test 1**
*\* As per fire flow test completed on a fire hydrant located at 3800 Burnhamthorpe Road West\**

Static Pressure = 64 psi  
 = 45.0 m head

Pressure (psi)	Pressure (m)	Flow (GPM)	Flow (L/s)
61	42.90	1222	77
56	39.38	2041	129

**Pump Head Equation**

$$Head(m) = A - B(Q^C)$$

A = 45.00  
 B = 0.0005288  
 C = 1.91

Theoretical Flow @ 20.3 psi = 312 L/s  
 = 18728 L/min  
 = 4947 US GPM

Required Fire Flow = 150 L/s \*Sufficient Pressure

**Anticipated Residual Pressures**

Scenario	Flow (L/s)	Pressure (psi)	
		Estimated	Required
Peak Hour	10.0	63.9	39.9
Fire + Max Day	151.7	53.0	20.3

*\* Minimum pressure of 275 kpa (39.9 psi)*
*\* Minimum pressure of 140 kpa (20.3 psi)*

# Hydrant Flow Test Report

SITE NAME: \_\_\_\_\_  
 SITE ADDRESS / MUNICIPALITY: Ninth Line Mississauga, ON  
 TEST HYDRANT LOCATION: 3800 Burnhamthorpe Road West  
 BASE HYDRANT LOCATION: 1Fire hydrant Southwest of Ridgeway Drive on Burnhamthorpe Road West  
 TEST BY: Luzia Wood

TEST DATE:  
May16,2023

TEST TIME:  
12:45PM

## TEST DATA

FLOW HYDRANT	Pipe Diam. (in / mm)	300mm,PVC	
		<u>PITOT 1</u>	<u>PITOT 2</u>
SIZE OPENING (inches):		<u>2.5</u>	<u>2.5</u>
COEFFICIENT (note 1):		<u>0.90</u>	<u>0.90</u>
PITOT READING (psi):		<u>53</u>	<u>37 / 37</u>
FLOW (usgpm):		<u>1222</u>	<u>2041</u>

THEORETICAL FLOW @ 20 PSI	5209
---------------------------	------

BASE HYDRANT Pipe Diam. (in / mm) 300mm, PVC  
 STATIC READING (psi): 64 RESIDUAL 1 (psi): 61 RESIDUAL 2 (psi): 56

REMARKS: Both fire hydrants are on Burnhamthorpe Road West

**NOTE 1:** Conversion factor of .90 used for flow calculation based on rounded and flush internal nozzle configuration. No appreciable difference in pipe invert between flow and base hydrants.

