Parliament Oak Inn

Site Servicing and Stormwater Management Report

Revision 1: September 16, 2025

Revision 2: November 17, 2025

Prepared for:

Two Sisters
Resorts Corp.

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Resorts Corp.

Parliament Oak Inn
325 King Street
Niagara-on-the-Lake

Site Servicing and Stormwater Management Report

Two Sisters Resorts Corp.

RVA 226757

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PARLIAMENT OAK INN

SITE SERVICING AND STORMWATER MANAGEMENT REPORT

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1.0 Introduction

Two Sisters Resorts Corp. is proposing the redevelopment of 325 King Street in the Town of Niagara-on-the-Lake (Town). The proposed development includes a four-storey hotel, with a restaurant and conference rooms on the first floor, above a single storey parking level below.

R.V. Anderson Associates Limited (RVA) has been retained by Two Sisters Resorts Corp. to prepare a Site Servicing and Stormwater Management Report in support of a Site Plan Application (SPA).

1.1 Objective

This report outlines a servicing plan for the proposed development that includes assessment of the servicing strategy and a stormwater management solution for the site.

In addition to the functional servicing options and storm management solutions for this development, this report shall address the following:

- Identification and review of existing municipal storm, sanitary and water services available for the site.
- Identification of the Town of Niagara-on-the-Lake and Niagara Region criteria with respect to sanitary, water and storm servicing including stormwater management (SWM).
- Estimate water, sanitary and storm demands that will result from the proposed development.
- Investigation of the capacity of existing municipal watermains and sewers.
- Provide a summary of proposed servicing of the site with respect to water, sanitary and storm services.
- Recommendation and description of proposed stormwater management (SWM) system for the site to address water quality and discharge rate targets.

1.2 Background

1.2.1 Existing Conditions

The 1.65-hectare site is located in the historic Old Town neighborhood of the Town of Niagara-on-the-Lake, approximately 800 m south of the Niagara River. The site is currently occupied by the Parliament Oak Public School (which is no longer operating) and bounded

by Gage Street to the north, King Street to the east, Centre Street to the south and Regent Street to the west. The site is generally surrounded by single family residential homes.

The site is approximately 90 m from One Mile Creek, a Niagara Peninsula Conversation Authority (NPCA) regulated watercourse. Based on the NPCA mapping, the site falls outside the limits of the regulated area.

The site consists of approximately 50 % impervious surfaces (school building, asphalt areas and parking lot adjacent to Centre Street) with the remaining being pervious landscape areas.

Refer to Figure 2.1 for the existing site location.

Figure 2.1 – Site Location

1.2.2 Proposed Redevelopment

Based on the architectural drawings received from Peter J. Lesdow Architects, the proposed development includes a four-storey hotel building, with a restaurant and conference rooms on the first floor, atop a two (2) levels of underground parking structure. The underground parking occupies the entire building footprint and extends past the building on the north, east, and south frontages of the building. Access to the building is provided via a u-shape driveway along the King Street frontage of the site, which also

serves as the primary pedestrian and vehicular entrance to the hotel building. Additional vehicular entrances will be provided at the north and south sides of the site, along the Centre Street and Gage Street frontages, respectively, for truck loading and deliveries to the development. The building generally occupies the middle portion of the site with 20 m + setbacks along the north, south, and west portions of the site for the vehicular and pedestrian access areas and minor landscaping. However, along the east frontage of the site, there is a larger setback from the property line which is proposed to include terraced areas and a large, landscaped area at grade.

Refer to Appendix A for the proposed site plan and site statistics.

1.2.3 Background and Resource Information

In preparing this report, the following information was obtained and reviewed:

- Plan and profile drawing no. 94016-1, King St Infrastructure Works obtained from the Town.
- Plan and profile drawing no. 94016-2, King St Infrastructure Works obtained from the Town.
- Plan and profile drawing no. 16-057-PP5, King St Watermain Replacement obtained from the Town.
- Plan and profile drawing no. 1, Centre Street 8” Sanitary Sewer obtained from the Town.
- Plan and profile drawing Regent Street Between William Street and Gage Street obtained from the Town.
- Plan and profile drawing no. 00016PP7, Watermain & Sanitary Sewer Replacement, Regent Street, obtained from the Town.
- Plan and profile drawing no. 00016PP8, Watermain & Sanitary Sewer Replacement, Regent Street, obtained from the Town.
- Plan and profile drawing no. PP01, Gage Street and Simcoe Street Watermain Replacement, obtained from the Town.
- Plan and profile drawing no. PP02, Gage Street and Simcoe Street Watermain Replacement, obtained from the Town.
- Record drawings of the school obtained from the client.
- NOTL InfoSWMM Sanitary Model, obtained from the Region.
- Existing municipal infrastructure GIS Data obtained from the Town.
- Topographic Survey by The Larocque Group, dated April 12, 2019.
- Site Plan and Project Statistics, provided by Peter J. Lesdow Architects.

- Hydrant flow tests obtained from the Town and additional fire hydrant test completed by Lozzi Aqua Check on November 13, 2020.
- A site visit was undertaken on September 04, 2020. The site visit included a general examination of the property to observe surface features that are representative of underground servicing, current surface drainage and to gather additional relevant information. Photos were taken of the entire site and the perimeter of the site to document its location and current condition.
- A pre-consultation meeting with the Town and Region was held on January 5th, 2023, during which the servicing requirements and criteria were discussed.

2.0 Servicing Investigation

Information with respect to existing municipal services and utilities was determined from as-built plan and profile drawings and GIS data obtained from the Town. While this information was generally consistent with the location of maintenance hole covers and other physical features observed during the site visits and identified on the plan of survey and topography, further subsurface utility engineering (SUE) exercises will be undertaken in conjunction with the detail design phases of the project. Refer to Appendix B for the topographical survey completed by The Larocque Group and figure F1 for the existing Town infrastructure within the vicinity of the site.

2.1 Foundation Drainage

A hydrogeological investigation prepared by Soil Engineers Ltd. dated August 7, 2025, has been completed for the site. This report indicates that the groundwater table is approximately 0.6m to 7.0m below grade, at 86.3 to 80.6 masl.

The current Niagara-on-the-Lake Municipal Engineering Standards (2020) and Sewer by-law 2758-94, the Town permits the discharge of foundation drainage connection by gravity to a municipal storm sewer if the sewer was designed for a 5-year storm event. Based on an assumed footing elevation of 79.65, the report estimates a short-term dewatering rate of 214,400 L/day (2.48 L/s) during construction, and long-term foundation drainage will discharge at a rate of 25,300 L/day (0.29 L/s), accounting for both groundwater and infiltrated stormwater. It is proposed to direct the groundwater sump pump to the on-site storm control maintenance hole (MH), and discharge into the municipal storm system at an allowable rate prescribed by the stormwater management plan in Section 3.0.

2.2 Water Servicing

2.2.1 Water Servicing Criteria

The Niagara Region Water-Wastewater Project Design Manual, the 2021 Niagara Region Water and Wastewater Master Servicing Plan Servicing Plan Update (Region Master Plan) and MECP guidelines as well as water demand criteria obtained from the Town were used to analyze the water demand from the proposed development. The criteria are generally summarized as follows:

- Water supply systems should be designed to satisfy the greater of peak hour demand or maximum day demand plus fire flow.
- Fire flow to be calculated in accordance with the Fire Underwriters Survey (FUS).
- Average residential domestic water demands of 240 liters per capita per day.
- Average employment domestic water demands of 270 liters per employee per day.
- Maximum day and peak hour factors of 1.90 and 2.85, respectively.
- Population Densities as follows (rounded to the nearest tenth):
    - Low Density – 1.7 persons per unit
    - Medium Density – 2.2 persons per unit
    - High density – 2.6 persons per unit
    - Commercial/Population-related – 1 person/500 sq. ft

2.2.2 Existing Conditions

Based on record drawings obtained from the Town, there is a local distribution watermain on each of the four streets abutting the site. The entire watermain network in the area is well interconnected. There is a 300 mm Ø watermain on King Street as well as a 150 mm Ø watermain on Centre Street, Gage Street and Regent Street. The King Street and Center Street watermains were constructed in 2017, the Regent Street watermain in 2002 and the Gage Street watermain in 2013.

There are six fire hydrants near the site: at the southwest corner of Regent Street and Gage Street, northwest corner of King Street and Gage Street, northeast corner of King Street and Nelles Street, southwest corner of King Street and Centre Street, along Centre St and at the southwest corner of Regent Street and Centre Street. Refer to Appendix B for the existing site watermains.

Based on the topographical survey location of the water valve, record drawings and service cards obtained from the Town, the existing school has two 50 mm Ø water services from

the 300 mm Ø King Street watermain with curb stops at the property line. The existing water services will be capped and abandoned at the property line as they will not be sufficient to service the proposed development.

2.2.3 Proposed Water Servicing

2.2.3.1 DOMESTIC WATER DEMAND ANALYSIS

The total estimated average daily flow rates, maximum day and peak demand rates required for the proposed entire development are estimated to be as follows:

Table 2.1 – Proposed Water Demand

	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Hotel	1.04	1.98	2.97
Commercial (Restaurant & Conference Rooms)	0.17	0.33	0.49
TOTAL	**1.22**	**2.31**	**3.46**

Refer to Appendix C for water demand calculations.

2.2.3.2 FIRE FLOW ANALYSIS

In accordance with the Fire Underwriters Survey (FUS), fire flows will not be less than 4,800L/min for a 2-hour duration in addition to maximum daily domestic demand. This flow is to be delivered with a residual pressure of not less than 140 kPa (20 psi).

Calculations using the FUS indicate a maximum required fire flow of approximately 166.70 L/s (10,000 L/min) for the development (based on non-combustible construction and with a completely automatic sprinkler system). These flows are to be delivered with a residual pressure of not less than 140 kPa (20 psi). Refer to Appendix C for detailed calculations.

As described in Section 2.1.1, the water supply system should be designed to satisfy the greater of peak hour demand or maximum day demand plus fire flow. Therefore, the maximum day demand plus fire flow rate (i.e., 2.31 L/s + 166.67 L/s = 168.98 L/s (10,198.8 L/min) is the governing requirement.

2.2.3.3 PROPOSED WATERMAIN SERVICE CONNECTIONS

The proposed development will require a new domestic water service and a new fire service for the building's sprinkler system.

A single 150 mm Ø water service will connect to the 150 mm Ø watermain along Gage Street, and approximately 8.0 m in front of the property line, a 100 mm Ø domestic water service will be branched off the 150 mm Ø fire service in an "h" configuration. The 150 mm Ø service will continue into the building and serve as the fire water service for the building. The 100 mm Ø domestic service will enter the building's basement, through a water meter chamber and backflow preventor, as prescribed the Town's water system management by-law. Approximately 12.0 m in front of the property line, the 150 mm Ø hydrant lead will be branched off the 150 mm Ø fire service, which will connect to the proposed hydrant located on the southeast side of the site. The hydrant lead will maintain at least 50 cm vertical separation from the domestic water service which it crosses under.

Based on a review of the record drawings, the proposed connections to the existing watermain are physically possible but will be further investigated for potential conflicts and verified through subsurface utility engineering.

A review of the site fire hydrant coverage indicates the six fire hydrants surrounding the site. A private fire hydrant is proposed near the northeast corner of the site, within 45m distance to the building Siamese connection to satisfy the requirement set out by Ontario Building Code (OBC).

Refer to drawing SS-1 in Appendix F for the Site Servicing plan.

2.2.4 Capacity of Existing Watermain System

Hydrant flow test results for all six (6) hydrants within the vicinity of the site were provided by the Town and permitted for use for the purpose of this report. The flows provided by the City were noted as being capable of providing the following flow with a residual pressure of 20 psi:

- King Street – Hydrant NOTLHYD-0058- 219.20 L/s
- Regent Street – Hydrant NOTLHYD-0059 - 259.0 L/s
- Gage Street – Hydrant HOTLHYD-1246 - 399.0 L/s
- Centre Street – Hydrant NOTLHYD-1409 - 232.4 L/s

The available fire flow of the King Street watermain was much lower than expected considering it is one of the main feeds for the Town and is a 300 mm Ø watermain, whereas

the other watermains are all 150 mm Ø in size. A secondary fire hydrant flow test was completed on November 13, 2020, by Lozzi Aqua Check to ensure there were no irregularities with the test results provided by the Town. The results indicated that the King Street watermain is capable of providing a flow of 200 L/s which is in the same range as the results provided by the Town. In addition, the Town investigated the valves within the vicinity of the site and confirmed all valves were open. For the King Street watermain the capacity was conservatively assumed to be 200 L/s in accordance with the second test. Refer to Appendix C for the hydrant flow test locations, as well as the results provided by the Town and the test performed by Lozzi Aqua Check.

The site is proposed to be serviced from the Gage Street watermain which has an available fire flow of 399.0 L/s, whereas the required flow is 168.65 L/s. Therefore, the capacity of the existing watermain system is sufficient to support the proposed development.

Refer to Appendix C for the hydrant flow test results.

2.3 Sanitary Servicing

2.3.1 Sanitary Servicing Criteria

The 2021 Niagara Region Water and Wastewater Master Servicing Plan Update and sanitary demand criteria obtained from the Town was used to estimate the existing and proposed sanitary demands from the site. This criteria is generally summarized as follows:

- Average residential sewage flows of 255 litres per capita per day.
- Average employment area sewage flows of 310 litres per employee per day.
- Institutional area sewage flows of 180,000 L/day/ha.
- The peak domestic sewage flow to be calculated by utilizing a calculated Harmon Peaking Factor [M = 1 + 14 / (4+P0.5)], min 2.0, max 4.5.
- Infiltration flows of 0.286 L/s/ha.
- Population Densities as follows (rounded to the nearest tenth):
    - Low Density – 1.7 persons per unit
    - Medium Density – 2.2 persons per unit
    - High density – 2.6 persons per unit
    - Commercial/Population-related – 1 person/500 sq. ft

2.3.2 Existing Conditions

Based on record drawings obtained from the Town, there are four sanitary sewers surrounding the site, all of which connect downstream at the intersection of Gage Street and Regent Street. See summary below:

- 200 mm Ø sanitary sewer along Centre Street, which drains to the 200 mm Ø Regent Street sanitary system.
- 200 mm Ø sanitary sewer along Regent Street draining to the 450 mm Ø Gage Street sanitary sewer.
- 450 mm Ø sanitary sewer along King Street which drains north to a 450 mm Ø sanitary sewer on Gage Street.
- 450 mm Ø sanitary sewer on Gage Street receives flows from the King Street sanitary sewer, and the adjacent Gage Street sanitary system, and drains west along Gage Street.

The 450 mm Ø Gage Street sanitary sewer continues west along Gage Street, then south on Mississauga Street and west along William Street, discharging into the William Street Sewage Pumping Station (William Street SPS). The sanitary sewer along William Street receives flows from the majority of the Town's sanitary sewers. The flows from the William Street Sewage Pump Station are pumped to the Niagara-on-the-Lake Wastewater Treatment Plant (WWTP) via a forcemain.

Based on service cards received from the Town, the existing school has two (2) 150 mm Ø sanitary services connected to the King Street sanitary sewer. The existing services are to be removed and abandoned at the property line.

Refer to Appendix D for the existing site sanitary sewers.

The existing estimated peak sanitary discharge rate to the King Street sanitary sewer is estimated to be 0.60 L/s. However, the sanitary flow during a rain event (wet weather flow) is anticipated to be much larger. Based on a review of the existing school drawings, rainwater collected by the school roof, with the exception of the 1975 expansion, drains to the sanitary services. During a 2-year storm event, the peak sanitary flow from the existing site to the King Street sanitary sewer would be 39.36 L/s (38.76 L/s storm + 0.60 L/s sanitary). Refer to section 2.4.1 for further discussion of the storm flows from the existing site.

Refer to Appendix D for existing sanitary flow calculations.

2.3.3 Proposed Sanitary Servicing

2.3.3.1 SANITARY DEMAND

Based on a per employee demand of 310 L/employee/day for commercial and hotel. The proposed site development will result in an estimated total peak sanitary flow rate of 5.6 L/s.

The estimated breakdown of peak sanitary discharge from the redevelopment is as follows:

Table 2.2 – Proposed Sanitary Capacity

	Peak Flow (L/s)
Hotel	4.39
Commercial (Restaurant & Conference Rooms)	0.77
Infiltration Allowance	0.43
TOTAL	**5.60**

Refer to Appendix D for proposed sanitary flow calculations.

2.3.3.2 PROPOSED SANITARY SERVICING

In accordance with the Town' sewer use by-law, a maintenance hole (MH) will be provided near the property line for the site. The site's control MH will be installed on the property line along King Street. The sanitary service for the site will be 150 mm Ø, and will be connected to the existing 450 mm Ø sanitary sewer on King Street.

Based on a review of the record drawings, the proposed connection to the existing sanitary sewer appears to be constructable but will be further investigated for potential conflicts and verified through subsurface utility engineering during the detailed design stage.

Refer to Drawing SS-1 in Appendix F for the site servicing plan.

2.3.3.3 CAPACITY OF EXISTING SANITARY SEWER SYSTEMS

As indicated in Section 2.3.3.1, the proposed development will result in an increase in sanitary demand to the 450 mm Ø sanitary sewer along King Street. This will result in an estimated increase of 5.0 L/s of sanitary flow discharging from the site.

However, as described in Section 2.3.2, a majority of the school roof (area of 2,281 m^2) with the exception of the 1975 addition drains to the 450 mm Ø sanitary sewer on King Street, which is prior to the 1994 replacement works was a combined sewer system. During rainfall events, the site discharges its storm runoff into the King Street sanitary sewer system. Once

the existing storm connection to the sanitary sewer is disconnected as part of the construction, it will provide a peak flow relief during wet weather conditions.

A review of pre- and post-development sewer demands was undertaken to assess the impact of the development on the existing sanitary sewer system, and summarised in the following table:

	Pre-Development (L/s)	Post-Development (L/s)	Difference (Residential Sanitary @450L/c/d) (L/s)
2 Year Storm Flow (L/S)	42.5	0.0	-42.5
Sanitary Flow (L/s)	0.6	5.6	+5.0
TOTAL (L/s)	**43.1**	**5.6**	**-37.5**

As the post-development result in a net-negative flow impact to the King Street sanitary sewer, it can be reasonably expected that there is sufficient capacity to facilitate the development.

This site is located in the William Street SPS catchment. Based on a review of the 2021 Water and Wastewater Master Servicing Plan and the recent upgrades completed at the William Street SPS, the sanitary sewers system is adequately designed for future growth. The Region Master Servicing Plan shows the William Street SPS have existing and future deficiencies under the design allowance during peak wet weather flow; however, the existing and projected 5-year storm PWWF is within the station capacity, as such, the station's capacity is sufficient to support future flows based on 2051 population projected by the Region. Refer to Appendix D for figures and tables from the Region Master Servicing Plan.

2.4 Storm Servicing

2.4.1 Existing Storm Servicing

There are two (2) storm sewers available to service the site, both of which discharge to the One Mile Creek. There is a 500 mm Ø storm sewer starting at the intersection of Center Street and Regent Street, which drains south along Regent Street and discharges into the creek. Secondly, there is a 525 mm Ø storm sewer starting at the intersection of Gage Street and Regent Street which drains west along Gage Street and discharges into One Mile Creek further downstream. King Street, Centre Street and Gage Street from King Street to Regent Street all drain overland along the road edge or via roadside ditches. There

appears to be no defined drainage infrastructure along these streets, apart from catchbasins within direct vicinity of the aforementioned storm sewers.

The existing site has four (4) minor system drainage outlets: the 450 mm Ø sanitary sewer along King Street, the 500 mm Ø storm sewer along Regent Street, the 525 mm Ø storm sewer along Gage Street, and the roadside ditches along King Street. Three (3) of the four (4) outlets ultimately discharge to the creek. The major system drainage consists of overland flow along the roadways fronting the site, as follows:

- King Street generally flows overland south to the creek.
- Center Street generally flows overland west towards Regent Street and then south along Regent Street to the creek.
- Regent Street has split drainage with a high point just north of the intersection of Regent Street and Centre Street. Runoff north of the intersection generally flows overland north towards Gage Street and runoff south of the intersection generally flows overland south towards the creek.
- Gage Street generally flows overland west to the creek.

A majority of the site generally drain in the northwesterly direction where the runoff is captured by the catchbasins at the intersection of Gage Street and Regent Street. These catchbasins drain to the 525 mm Ø storm sewer along Gage Street. The second portion of the site is directed to the 500 mm Ø storm sewer on Regent Street. This is made up of two (2) catchbasins in the asphalt area south of the school building which pick up the landscape areas at the southwest corner of the site, along with the gymnasium building roof. The remaining area of the building roof drains to the 450 mm Ø sanitary sewer along King Street. Lasty, the fourth drainage area for the site, is made up of the east building frontage which drains overland to King Street, where it is conveyed via roadside ditches and catchbasins further south of the site, ultimately discharging to the creek. Refer to Figure F1 in Appendix B for the existing site storm sewers, and Figure F5 in Appendix E for depictions of all the aforementioned drainage areas.

Correspondence with the Town's staff has confirmed that the 525 mm Ø storm sewer along Gage Street was designed for the 2-year storm event. The Town could not confirm the design storm event of the 500 mm Ø Regent Street storm sewer. In the absence of this information, a conservative approach was taken to assume the 500 mm Ø Regent Street storm sewer was also designed for the 2-year event. The existing 2-year peak storm discharge from the site to each outlet can be estimated using the rational method as follows (rainfall intensity calculated using the City of St Catharines IDF curves):

Outlet 1- 450 mm Ø King Street Sanitary Sewer:

$$Q_{existing\ 2y} = 2.78\ x\ CiA = 2.78\ x\ 0.90\ x\ 74.5\ mm/hr\ x\ 0.2281\ ha = 42.5\ L/s$$

Outlet 2- 500 mm Ø Regent Street Storm Sewer:

$$Q_{existing\ 2y} = 2.78\ x\ CiA = 2.78\ x\ 0.66\ x\ 74.5\ mm/hr\ x\ 0.2355\ ha = 32.1\ L/s$$

Outlet 3- 525 mm Ø Gage Street Storm Sewer:

$$Q_{existing\ 2y} = 2.78\ x\ CiA = 2.78\ x\ 0.35\ x\ 74.5\ mm/hr\ x\ 1.0182\ ha = 73.7\ L/s$$

Outlet 4- King Street Roadside Ditches:

$$Q_{existing\ 2y} = 2.78\ x\ CiA = 2.78\ x\ 0.31\ x\ 74.5\ mm/hr\ x\ 0.1653\ ha = \ 10.6\ L/s$$

During a 100-year storm event, the discharge rate from the site to each outlet can be estimated as follows:

Outlet 1- 450 mm Ø King Street Sanitary Sewer:

$$Q_{existing\ 100y} = 2.78\ x\ CiA = 2.78\ x\ 0.90\ x\ 144.3\ mm/hr\ x\ 0.2281\ ha = 82.3\ L/s$$

Outlet 2- 500 mm Ø Regent Street Storm Sewer & Regent Street Overland Flow:

$$Q_{existing\ 100y} = 2.78\ x\ CiA = 2.78\ x\ 0.66\ x\ 144.3\ mm/hr\ x\ 0.2355\ ha = 62.3\ L/s$$

Outlet 3- 525 mm Ø Gage Street Storm Sewer & Gage Street Overland Flow:

$$Q_{existing\ 100y} = 2.78\ x\ CiA = 2.78\ x\ 0.35\ x\ 144.3\ mm/hr\ x\ 1.0182\ ha = 142.8\ L/s$$

Outlet 4- King Street Roadside Ditches & Overland Flow:

$$Q_{existing\ 100y} = 2.78\ x\ CiA = 2.78\ x\ 0.31\ x\ 144.3\ mm/hr\ x\ 0.1653\ ha = \ 20.5\ L/s$$

Refer to Figure F5 in Appendix E, for the pre-development storm catchment areas.

2.4.2 Proposed Storm Servicing

The drainage condition in post-development will consist of minor uncontrolled drainage to the Centre Street and Gage Street right-of-ways, and controlled discharge via a new storm service connections to the Gage Street storm sewer. There will be no storm runoff draining to the King Street sanitary sewer in the proposed conditions. Storm drainage exceeding 100-year return period will drain as overland flow towards the right-of-way as described in 3.3.1.

Refer to Figure F6 in Appendix E, for the proposed storm catchment areas.

2.4.2.1 PROPOSED STORM SERVICE CONNECTION

A new 300 mm Ø storm sewer service connection is proposed to be connected to the existing MH at the intersection of Gage Street and Regent Street, and into the existing 525 mm Ø storm sewer along Gage Street.

In accordance with the Town's sewer use by-law, a storm control maintenance hole will be provided near the property line for City sampling purposes. This MH will locate at the northern corner of the site. Refer to Appendix F for the Site Servicing Plan which shows the proposed location for the control MH.

The proposed storm service connection is designed based on plan and profile information obtained from the town. However, further subsurface utility investigation will be undertaken to identify the location and depth of buried utilities and the underground infrastructures. This will identify whether any relocations will be required to facilitate the connection.

3.0 Proposed Stormwater Management

3.1 Storm Drainage Criteria

Based on the Town Engineering Standards and the MECP Stormwater Management Planning and Design Manual 2003, the following stormwater management criteria will apply to the site.

- Water Quantity: Post development peak flow rates during the 2-year to 100-year must not exceed pre-development flow rates for the same storm event. The City of St. Catharines IDF curves shall be used and the minor system to be designed for the 2-year storm event and major system to be designed for the 100-year storm event.
- Gage Street 525mm storm sewer was designed to receive up to a 2-year storm, as confirmed by Town of Niagara-on-the-Lake. Any discharge from the site to Gage Street storm sewer are required to be designed matching post- to pre- 2-year condition.
- Water Quality: Provide a long-term removal of 70% of total suspended solids (TSS) which corresponds to a normal level of protection.
- Existing drainage patterns on adjacent properties shall not be altered and stormwater runoff from the subject development shall not be directed to drain onto adjacent properties.

Additionally, the Town outlines the following table for consistency regarding a number of general SWM criteria:

Table 3.1 – Proposed Discharge Summary

Surface Type or Recommended land Use	Coefficient
Parks	0.25
Schools	0.40
Single Family Residential	0.40
Semi-Detached	0.50
Marionettes, Townhouses, etc.	0.60
Churches	0.60
Industrial	0.70
Commercial	0.80
Paved Area	0.90 or 1.0

The computer program Visual OTTHYMO version 6.1 (VO6) was used to simulate rainfall events and to estimate stormwater runoff under pre and post development conditions of the subject area. Rainfall events were selected in accordance with the City of St. Catharines (as used by Town of Niagara-on-the-Lake) intensity-duration-frequency (IDF) curve information. Table outlines the IDF curve information used in the hydrological analysis:

$$i = \frac{A}{(T_c + B)^C}$$

i = intensity, mm/hr
A, B, C = IDF equation constants
T_c = Time of concentration, minutes

Table 3.2– IDF Curve Equations

Return Period	A	B	C	i (mm/hr)
2	567	5.2	0.746	74.5
5	664	4.7	0.744	89.9
10	724	4.3	0.739	101.4
25	821	4.0	0.735	118.0
50	900	3.8	0.734	131.1
100	980	3.7	0.732	144.3

Note: A time of concentration of 10 minutes was used to compute the intensity (i) for each return period.

The Chicago storm distribution with a 4-hour duration was used for the rainfall simulations.

3.1.1 General Description of Stormwater Management Plan

Runoff from up to a 100-year event is captured by the site's catch basins and area drains, and conveyed through an internal storm network into the stormwater detention tank, DoubleTrap by StormTrap. As outlined in Section 3.1, Gage Street's 525mm storm sewer was designed to receive only up to a 2-year storm. Therefore, to meet the Town's stormwater peak discharge rate requirements, a 175mm orifice plate will be installed at the downstream of the storage tank MH to control the 100-year post-development peak discharge rate of the site to the 2-year pre-development rate.

In major storm events, that exceeds 100-year return period, temporary ponding up to 250mm will occur, and runoff will ultimately spill towards the right-of-way to protect the building from flooding as emergency overland flow.

The 2-year and 100-year pre-development and post-development peak flows are summarized in Table 3.3 and Table 3.4.

Table 3.3 – Pre-development Peak Flows

OUTLET	CATCHMENTS	EX. 2-YR PEAK FLOW (L/s)	EX. 100-YR PEAK FLOW (L/s)
1 - 450 mm Ø King Street Storm Flow into Sanitary Sewer	E2	42.5	82.3
2 - 500 mm Ø Regent Street Storm Sewer & Uncontrolled Flow	E3	32.1	62.3
3 - 525 mm Ø Gage Street Storm Sewer & Uncontrolled Flow	E1	73.7	142.8
4 - King Street Uncontrolled Flow	E4	10.6	20.5

Table 3.4 – Post-development Peak Flows

OUTLET	CATCHMENTS	EX. 2-YR PEAK FLOW (L/s)	POST 100-YR PEAK FLOW (L/s)
1 - 525 mm Ø Gage Street Storm Sewer & Uncontrolled Flow	P1+P2+P4+P5	73.7	72.2
2 - Centre Street Uncontrolled Flow to Regent Street Outlet	P3	32.1	0.8

Table 3.4 demonstrates that the post-development peak flow during 100-year storm event has been reduced to less than the pre-development peak flow 2-year storm event, for both Gage Street and Centre Street outlets. There will be no uncontrolled drainage going into Regent Street and King Street in post-development condition. Refer to Appendix E for the storm calculations.

To meet stormwater quality requirements, runoff captured from the on-site catch basins are directed into Hydrodome stormwater treatment units upstream of the detention tank system which can achieve up to 80% long-term TSS removal. Terraced amenity area and building roofs are generally considered to inherently meet the Town's water quality targets as they are not subjected to salt or other contaminants, and will be discharged directly into the detention tank.

A Hydrogeological Investigation has been completed by Soil Engineers Ltd. dated August 2025. The report outlines that the nearest borehole, BHMW6, has observed the highest groundwater level at 86.3 on May 6, 2025. As the groundwater level is expected to be above the bottom of the storm detention tank, the chambers will require an impermeable liner. Please refer to the DoubleTrap specifications included in Appendix E, which include details on the impermeable liner.

Lastly, as prescribed in Section 2.1, the building's foundation drainage is proposed to be directed into the storm control maintance hole, downsteam of the detention tank and orifice. As a result, the detention tank discharge will be overcontrolled to allow for the detention tank plus foundation drainage total discharge to be less than or equal to the allowable discharge rate for the site.

3.1.2 Calculation Methodology

3.1.2.1 DETENTION VOLUME

For the purpose of calculating the proposed discharge rates and required detention volumes, a Visual Otthymo Model (VO) was created to simulate the storage and discharge characteristics of the site.

The following commands were used to model the site:

- (1 & 2) The StandHyd command was used to model the portions of the site directed to the SWM tank. IA values of 5mm and 1mm were assigned to the pervious and impervious components, respectively. Furthermore, a CN value of 80 was applied to mimic the high potential for stormwater to be converted to runoff for rainfall events that exceed the assigned IA values.
- (3 & 13) The AddHyd command was used to add the roof & at grade portions together , as well as the uncontrolled and controlled discharge downstream of the detention tank, to calculate the peak site discharge.
- (4) The RouteReservoir command was used to simulate the detention and discharge characteristics for the site's primary SWM detention tank.
- (5) A third StandHyd command was used to model the at grade area of the site which drain uncontrolled to Gage Street. IA values of 5mm and 1mm were assigned to the pervious and impervious components, respectively. Furthermore, a CN value of 80 was applied to mimic the potential for stormwater to be converted to runoff for rainfall events that exceed the assigned IA values.

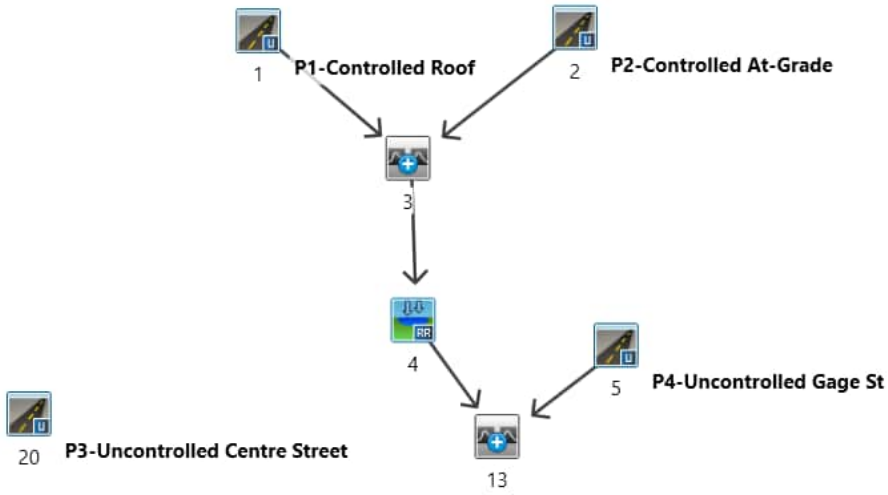


Figure 3.1 – V02 Model Schematic

Based on the stage storage characteristics of the proposed detention tank, a 175mm dia. orifice plate will be placed on the downstream side of the tank's outlet MH. This orifice pate will control the post-development peak flow down to an allowable discharge rate of 71.1 L/s,

less than the 2-year pre-development discharge rate. Furthermore, as noted in Section 3.1.1, the post-development foundation drainage will be discharged to the control maintenance hole downstream of the site. As per coordination with the mechanical consultant, the long-term foundation drainage of 25,300 L/day will be scheduled to pump for 12.5 hours per day; resulting in a peak long-term foundation of 0.56 L/s. This has conservatively been rounded to 0.75 L/s, and added to the model results in Table 3.5 below. Table 3.5 summarizes the allowable and post-development peak discharge rate, and detention storage volume requirements.

Refer to Appendix E – Post-Development Peak Discharge Rate and Required Storage for the complete VO output as well as input parameters for the site.

Table 3.5 – Proposed Stormwater Detention Tank

Storm Event	Allowable Peak Discharge Rate (L/s)	Controlled Peak Storm Discharge from SWM Tank (L/s)	Uncontrolled Flow to Gage Street Storm Sewer (L/s)	Peak Foundation Drainage Discharge Rate (L/s)	Total Peak Storm Discharge Rate from Site (L/s)	Total Storage Provided (m3)	Total Storage Required (m3)
2 Year	73.7	45.8	0.3	0.75	46.75	438.0	183.0
100 Year	73.7	71.0	1.6	0.75	72.2	438.0	436.0

As can be seen in Table 3.5 above, the DoubleTrap detention tank serves to meet the Town's water quantity criteria requirements.

3.1.3 Quality Control

Storm runoff from the site are captured from the building roof, amenity patio, landscaped areas, and vehicular driveway. Since the structure's roof and amenity patio are not subject to vehicular traffic, nor petroleum hydrocarbons and heavy metals, the stormwater captured by the building's area drains are considered clean for the purposes of the water quality control under Stormwater Management guidelines. On the other hand, soft landscaping and the proposed storage basin will allow for infiltration, and removal of the Total Suspended Solids (TSS) and other nutrients.

The remainder of the site that includes vehicular driveway, parking, loading areas, and landscape areas, are conveyed through drainage swales then directed into a hydrodynamic separator, Hydrodome, before entering the detention tank. The drainage swales provide pre-treatment to capture coarse sediments, trash and debris, and the Hydrodome unit is capable of achieving 80% TSS removal efficiency.

By employing this treatment train system, a cumulative TSS removal efficiency of 80% can be achieved for the entire site.

3.1.4 Maintenance

The stormwater management and drainage system for the site does require regular maintenance to ensure that it functions as intended and continues to requirements of the Town. Key components of the system and applicable maintenance issues are as follows:

- SWM Tanks: The SWM detention tank will follow the manufacturer's maintenance manual in Section E. At a minimum, an annual inspection is recommended, and an inspection should be conducted before the stormwater season begin to be sure that the tank is functioning properly for the upcoming storm season. Inspection should be done at least 2-3 days after the most recent rain event, when the tank has sufficient time to drain out. Inspector should observe for excessive signs of infiltration, which may indicate failure of the impermeable liner surrounding the SWM tank.
- Stormwater Treatment Unit: The Hydrodome system will require regular maintenance. The capture and removal of sediment from the stormwater will result in the build up of sediment within the unit, which may impact the unit's performance. These units should be maintained in accordance with the manufacturer's recommendations, and it is suggested that a maintenance contract for inspection be entered into with a qualified contractor.
- Area Drains/Catch basins/Roof Drains: Area drains, and roof drains should be inspected at a minimum semi-annually to ensure that they are free of debris that may clog them. However, the area drains on site shall be designed with a 50% clog factor to ensure that they are capable of capturing up to 100-year storm events.

4.0 Erosion and Sediment Control During Construction

Measures are to be taken during construction to ensure that erosion and/or transportation of sediments off-site is controlled. Mitigation measures include:

- Erection of sediment control fence prior to construction, and maintenance throughout construction activities.
- Construction of a clear-stone "mud-mat" at construction site exits to control the tracking of sediments off-site from the tires of vehicles.
- Use of watering for dust control.

- Application to the Town for a permit to discharge construction water, including the testing and sediment removal pre-pumping measures required to meet the Town permit requirements and sewer use bylaw.

5.0 Utilities

Various utility companies including Bell Canada, Cogeco Data Services, Enbridge Gas Distribution, Canada Post and Niagara-on-the-Lake Hydro have been contacted, informing of the proposed development, and requesting the availability of existing infrastructure available to service the site. Based on the responses received from the individual utility companies, the surrounding streets appear to contain the necessary utilities to service the proposed site, provided some upgrades/system improvements may be required. This will be confirmed during the design stage by the respective utility design consultants.

6.0 Conclusion

6.1 Water

The proposed development will result in an estimated peak water demand of 168.98/s (10,198.8 L/min) of maximum day demand plus fire flow.

Hydrant flow tests provided by the Town indicate that the Gage Street watermain is capable of providing 399 L/s, and the Centre Street and Regent Street watermains are capable of providing at least 230 L/s. Therefore, the watermains have sufficient capacity to service the proposed development.

A 100 mm Ø domestic water service and 150 mm Ø fire service for the site are proposed.

6.2 Sanitary

The proposed development will result in an estimated peak sanitary demand of approximately 5.60 L/s. This represents an approximate 5.0 L/s increase in sanitary demand above the current site condition. However, a total 33.80 L/s of existing storm flows currently draining into the sanitary sewer will be redirected into the Gage Street storm sewer, alleviating capacity in the sanitary sewer on King Street. Due to the offset of existing storm flow into the 450 mm Ø sanitary sewer on King Street, it can be reasonably expected the municipal sanitary system can facilitate this development.

A 150 mm Ø sanitary service for the site is proposed to be connected to the 450 mm Ø sanitary sewer on King Street.

6.3 Storm

A 300 mm Ø storm connection to the existing 525mm Ø storm sewer located at intersection of Gage Street and Regent Street will convey a total peak discharge of 77.2 L/s, which is less than allowable 2-year pre-development peak flow of 73.7 L/s. An underground stormwater detention tank, StormTrap DoubleTrap, with Hydrodome stormwater treatment units, will be utilized to store 438 m^3 to meet quantity and quality requirements. 175mm Ø orifice plate will be provided to control the peak flow to the allowable discharge rate, while also accounting for 0.75 L/s of peak discharge from the long-term foundation drainage system.

We trust that this report satisfies the requirements of the Town of Niagara-on-the-Lake with respect to the subject development. Should you have any questions, please do not hesitate to contact the undersigned.

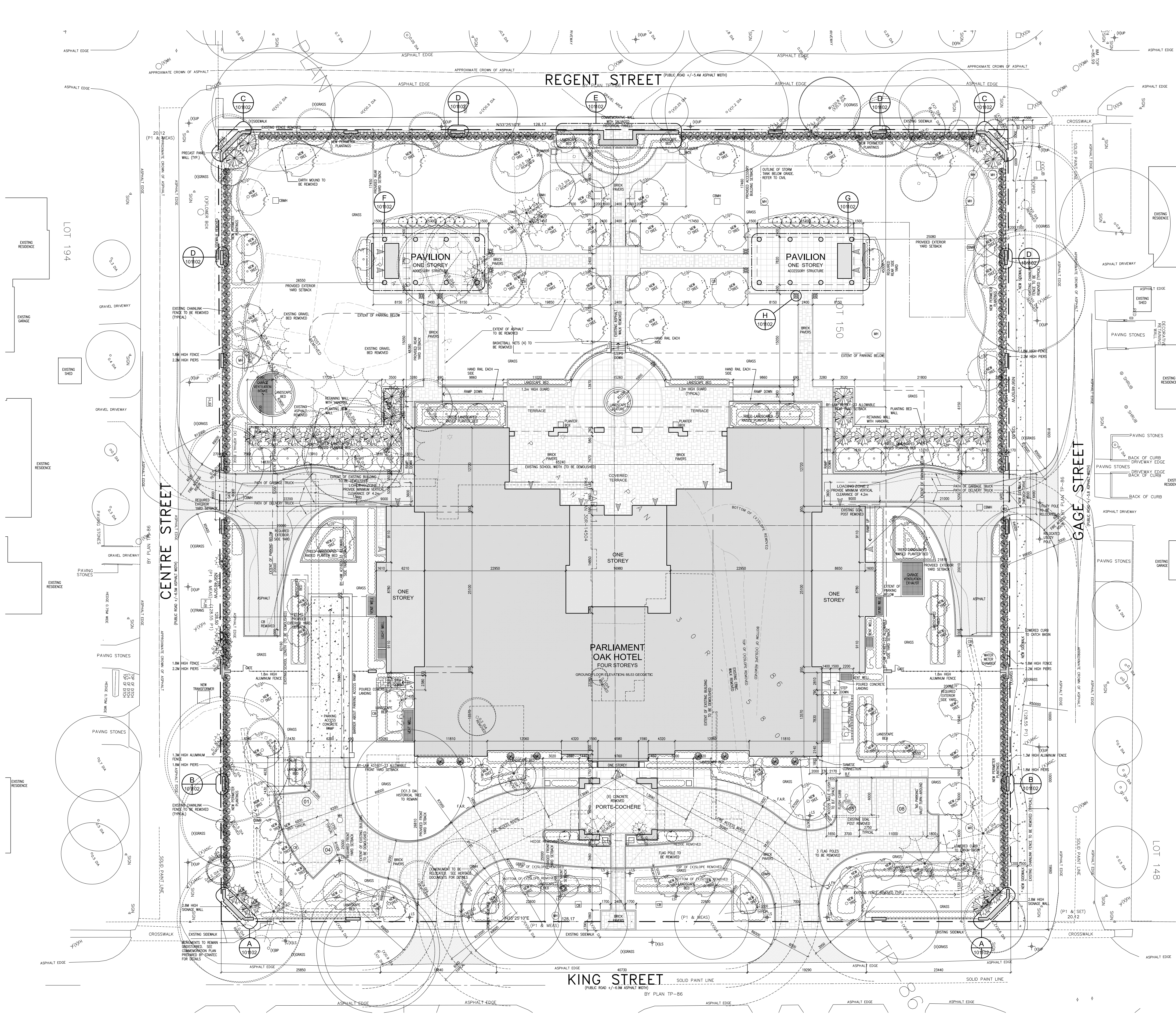
R. V. ANDERSON ASSOCIATES LIMITED

Report by:

Alex Wong, P.Eng.
Associate

APPENDIX A

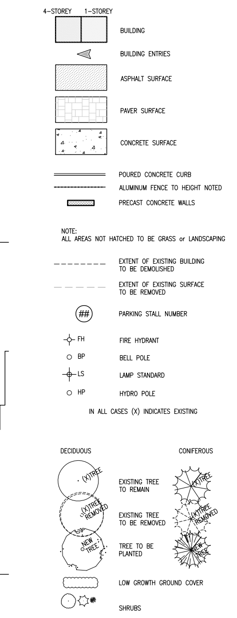
ARCHITECTURAL PLANS AND SITE STATISTICS



SITE PLAN

SCALE: 1:200

LEGEND



FOR LANDSCAPING REFER TO DRAWINGS PRODUCED BY:
STRYBOS BARRON KING LANDSCAPE ARCHITECTURE
5770 HURONTARIO STREET, SUITE 320,
MISSISSAUGA, ONTARIO
L5R 3G5

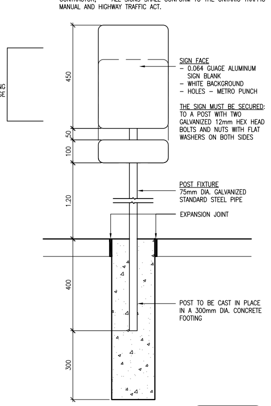
TYPICAL SIGNAGE

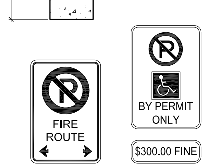
SIGNAGE NOTES:

ALL PARKING SPACES FOR BARRIER-FREE SHALL BE INDICATED WITH TYPICAL BARRIER FREE SIGNAGE CENTERED AT EACH PARKING SPACE – THESE SIGNS SHALL BE SUPPLIED & INSTALLED BY THE GENERAL CONTRACTOR
THE SIGN SHALL BE MOUNTED AT A HEIGHT OF 1.0–1.5 METERS FROM TOP OF CURB TO BOTTOM OF SIGN & CENTERED WITHIN THE PARKING SPACE.

THE GENERAL CONTRACTOR SHALL SUPPLY ALL REQUIRED FIRE ROUTE SIGNS. THESE SIGNS SHALL BE POSTED IN COMPLIANCE WITH THE HIGHWAY TRAFFIC ACT AND OR THE ONTARIO TRAFFIC MANUAL; WITH A MAX. SPACING OF 30M

ALL STOP, BARRIER FREE, STAFF PARKING, NO OVERNIGHT PARKING AND ONE WAY SIGNS SHALL BE SUPPLIED & INSTALLED BY THE GENERAL CONTRACTOR, – ALL SIGNS SHALL CONFORM TO THE ONTARIO TRAFFIC MANUAL AND HIGHWAY TRAFFIC ACT.





F.A.R.
Fire Access Route

B.F.
Barrier Free

NOTE

VEHICULAR MOVEMENT LIMITS FOR GARBAGE AND DELIVERY TRUCKS AS PROVIDED BY:
R.V. ANDERSON ASSOCIATES LIMITED
43 CHURCH STREET, SUITE 104,
ST. CATHARINES, ON,
L2R 7E1

KEY PLAN

SCALE : NOT TO SCALE

SURVEY NOTE:

LOTS 149, 150, 191 & 192, TP PLAN 86 (BEING PART 1 ON PLAN 30R-15804,
325 KING STREET, TOWN OF NIAGARA-ON-THE-LAKE, REGIONAL MUNICIPALITY OF NIAGARA

BOUNDARIES, SURVEY, TOPOGRAPHIC, EXISTING SITE FEATURES:
J.D. BARNES LIMITED, 4318 PORTAGE ROAD – UNIT 2, NIAGARA FALLS, ON, L2E 6A4

SITE STATISTICS

LOT AREA	16,456.58 m^2		
BUILDING GROUND COVER		EXISTING BUILDING GROUND COVER	
Parliament Oak Hotel	3,445.49 m^2	EXISTING INSTITUTIONAL	
Pavilion West	13.11 m^2	(TO BE DEMOLISHED)	2,496.51 m^2
Pavilion East	13.11 m^2		
Total Building Coverage	3,471.71 m^2		
21.1% of Lot Area (25% Permitted)			
DRIVEWAY/ ASPHALT AREA			
12.0% of Lot Area	1,970.52 m^2		
LANDSCAPED AREA			
66.9% of Lot Area	11,014.35 m^2		

PARKING REQUIREMENTS

Hotel, Motel	= 1 per quest room in addition to other uses	129	Rooms	129 Spaces
Restaurant	= 1 per 18.5 m^2 GFLA	775 m^2	Restaurant, Bar/ Lounge, Private Bar/ Lounge & Breakfast Room	42 Spaces
Restaurant Outdoor Patio	= 1 per 30 m^2 GFLA of outdoor patio area in addition to the requirements for a restaurant or take-out restaurant	195 m^2	Patio	7 Spaces
Conference Rooms or Areas Used in Conjunction with Other Uses	= 1 per 18.5 m^2	551.9 m^2	Upper Canada Banquet Room, Lower Canada Banquet Room, Simcoe Meeting Room	30 Spaces
Spa	= 1 per 15.0 m^2	313.3 m^2		21 Spaces
Office	= 1 per 28.0 m^2	84.4 m^2		4 spaces
TOTAL PARKING REQUIRED (as per By-Law 4316EY-23)				233 Spaces
REQUIRED DESIGNATED ACCESSIBLE PARKING SPACES				7 Designated Spaces

VEHICULAR PARKING PROVIDED

STANDARD PARKING SPACE (2.75m x 6.00m TYPICAL)	
AT GRADE	7 Spaces
BELOW GRADE	234 Spaces
DESIGNATED ACCESSIBLE PARKING	
AT GRADE	1 Spaces
BELOW GRADE	6 Spaces
TOTAL PARKING PROVIDED	248 Spaces

BICYCLE PARKING REQUIREMENTS

OFFICE SPACES	1 per 250m^2 GFLA	84.4m^2 ÷ 250 x 1 =	0.3 Spaces
RESTAURANT	2 per 100m^2 GFLA	809.9m^2 ÷ 100 x 2 =	16.2 Spaces
RESTAURANT (TAKE OUT)	2 per 100m^2 GFLA	Not Applicable	0 Spaces
COMMERCIAL	1 per 100m^2 GFLA	Not Applicable	0 Spaces
CONVENIENCE STORE	(Minimum of 5)	Not Applicable	0 Spaces
			16.5 Spaces
			Round to 17 Spaces

BICYCLE PARKING PROVIDED

17 BICYCLE SPACES LOCATED ADJACENT TO EASTERLY ON-GRADE PARKING

BUILDING AREA

BASEMENT 2	479.4 m^2
BASEMENT 1	1,772.7 m^2
GROUND FLOOR	3,285.0 m^2
MEZZANINE	135.4 m^2
SECOND FLOOR	2,609.8 m^2
THIRD FLOOR	2,609.8 m^2
FOURTH FLOOR	2,543.4 m^2
PENTHOUSE	22.2 m^2
TOTAL BUILDING AREA	13,457.7 m^2

DENSITY

SITE AREA	16,456.58 m^2
or	1.65 ha
HOTEL SUITES	129 Units
SUITE DENSITY	78.2 Units per Hectare

Peter J. Lesdow
architect

ONTARIO ASSOCIATION OF ARCHITECTS
PETER J. LESDOW
LICENCE
3745

SITE PLAN & STATISTICS

DATE	REVISIONS	DATE	REVISIONS
May 29/ 23	FOR CONSULTANT COORDINATION	May 22/ 24	COORDINATION CIRCULATION
Jun. 07/ 23	FENCE REVISION	July 06/ 24	COORDINATION CIRCULATION
Sep. 21/ 23	ADDED INFORMATION	Aug. 29/ 24	FOR SITE PLAN AGREEMENT
Oct. 26/ 23	O.P.A./Z.B.A. ADDED INFORMATION	Mar. 06/ 25	S.P.A. SECOND SUBMISSION
Nov. 16/ 23	ENLARGED COVERED TERRACE	May 28/ 25	S.P.A. THIRD SUBMISSION
Apr. 08/ 24	REVISED PARKING GARAGE	July 17/ 25	S.P.A. FOURTH SUBMISSION

PARLIAMENT OAK HOTEL

325 King Street
Niagara-on-the-Lake

DATE:	Nov. 18/ 22
SCALE:	1:100
DRAWN BY:	MRW
CHECK BY:	PJL

22 – 13

A101

TABLE A1 - PROPOSED POPULATION BREAKDOWN

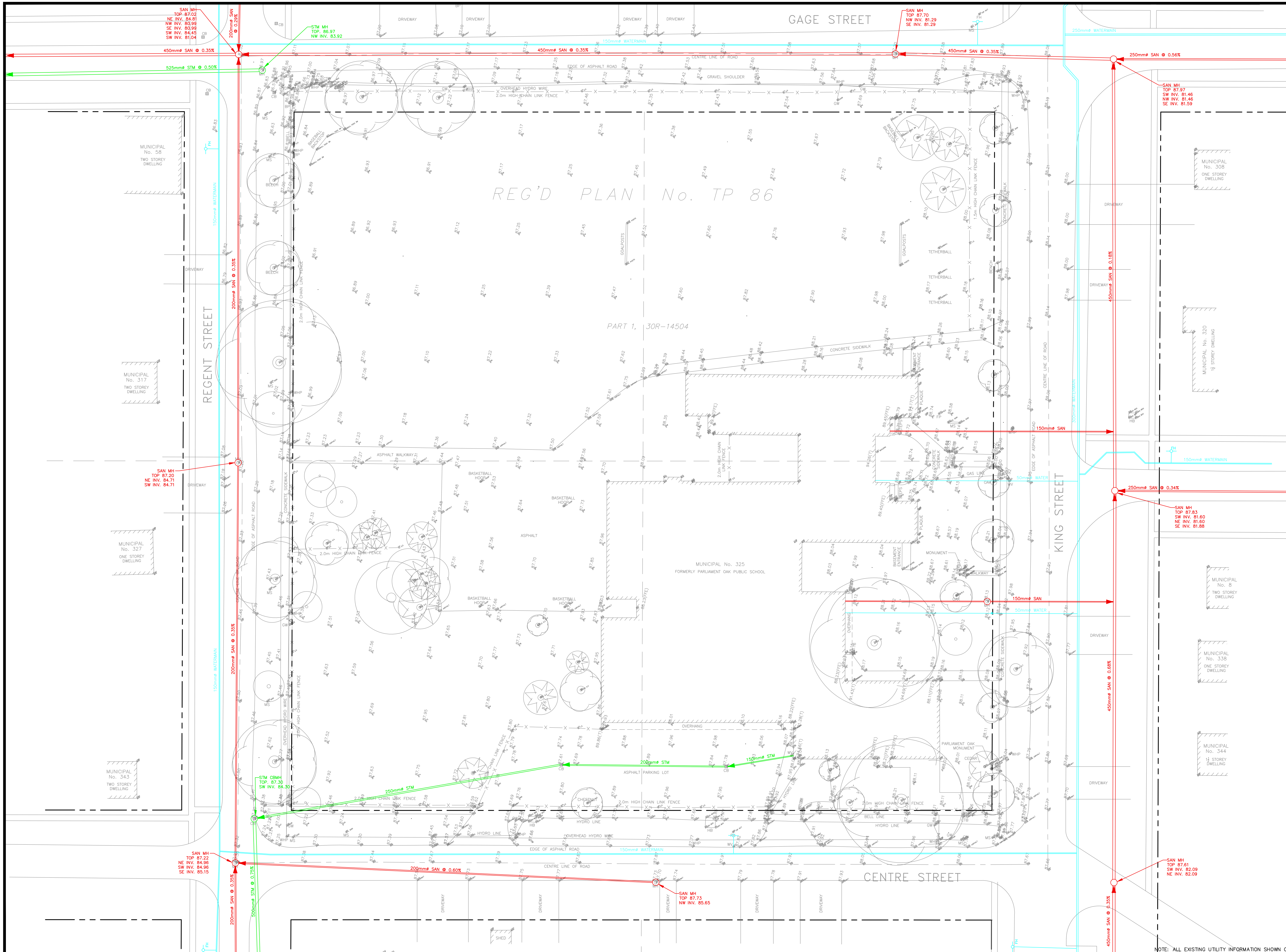
		TOTAL
1.1 Total Hotel Units *	units	129
1.2 Persons Per Unit **	persons/unit	2.2
1.3 Total Hotel Population	persons	284
1.4 Total Hotel Population (Used for Calculation Purposes)	**persons**	**300**
1.5 Total Commercial/Population Related GFA*	m^2	1,799
1.6 Total Commercial/Population Related GFA	ft^2	19,364
1.6 Persons Per GFA (Commercial)**	persons/100ft^2	1.0
1.6 Total Commercial/Population Related Population	persons	39
1.7 Total Commercial/Population Related Population (Used for Calculation Purposes)	**persons**	**50**
1.8 Total Proposed Population (Used for Calculation Purposes)	**persons**	**350**

* Total Units & Unit Breakdown taken from Project Statistics provided by Peter J. Lesdow Architect (dated July 10, 2023)

** Population Densities of 1.7 pserons/unit for low density, 2.2 persons/unit for medium density, 2.6 persons/unit for high density units as provided by the Town and available in the Town of Niagra-on-the-Lake Development Charges Background Study (2018) . It is assumed the hotel units fall under medium density. Population densities of 1 persons/500 sq.ft for commercial/population-related uses also available in the aforementioned report.

APPENDIX B

EXISTING SITE & MUNICIPAL INFRASTRUCTURE



Drawing Prepared By:

arva
R.V. Anderson Associates Limited
engineering • environment • infrastructure

Client:
TWO SISTERS RESORTS CORP.

Project Name:
PARLIAMENT OAK INN
325 KING ST.

Drawing Title:
EXISTING SITE SERVICES

Drawn:	Date:	Scale:
AW	JAN 2023	1:300

CADD File: 226757-F-F1.dwg
Project No.: 226757
FIGURE: F1

R:\2020\205254 - 325 King St\Q CADD - Urban\06 FIGURES

NOTE: THIS SKETCH IS NOT A LEGAL PLAN OF SURVEY

TOPOGRAPHIC SKETCH OF

325 KING STREET

TOWN OF NIAGARA ON-THE-LAKE

REGIONAL MUNICIPALITY OF NIAGARA

SCALE 1 : 250

0 5 10 15 metres

LEGAL DESCRIPTION

LOTS 149, 150, 191 & 192, TP PLAN 88 (BEING PART 1 ON PLAN 30R-15804)

BOUNDARY INFORMATION HAS BEEN DERIVED FROM AVAILABLE RECORDS AND/OR FIELD MEASUREMENTS. THIS IS NOT A PLAN OF SURVEY.

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

NOTES

BEARINGS ARE UTM GRID, DERIVED FROM REAL TIME NETWORK (RTN) OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (2010.0).

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999932.

PRIMARY CONTOUR IS 1.0m
SECONDARY CONTOUR IS 0.25m

ELEVATION NOTE

ELEVATIONS ARE OF GEODETIC DATUM (CGVD 1928:78), AND ARE DERIVED FROM GNSS OBSERVATIONS AND NATURAL RESOURCES CANADA'S CSRS MODEL HTD.0.

LEGEND

- CB — DENOTES CATCHBASIN
- MH — DENOTES MANHOLE
- HJB — DENOTES HYDRO JUNCTION BOX
- TJB — DENOTES TELEPHONE JUNCTION BOX
- FP — DENOTES FLAG POLE
- UP — DENOTES UTILITY POLE
- LS — DENOTES LIGHT STANDARD
- TC — DENOTES TELEPHONE CHAMBER
- PED — DENOTES TELEPHONE PEDESTAL
- CJB — DENOTES CABLE TV JUNCTION BOX
- FH — DENOTES FIRE HYDRANT
- WV — DENOTES WATER VALVE
- WM — DENOTES WATER METER
- C/L — DENOTES CENTERLINE
- OH — DENOTES OVERHEAD CABLE
- DENOTES FENCE
- DENOTES CONIFEROUS TREE
- DENOTES DECIDUOUS TREE

KEY PLAN
(not to scale)

TOWN OF NIAGARA-ON-THE-LAKE

THIS FIELD WORK SHOWN ON THIS SKETCH WAS COMPLETED ON NOVEMBER 30, 2022.

DEC. 21, 2022
DATE

J. LANE WINWOOD
ONTARIO LAND SURVEYOR

CAUTION

(A) THIS IS NOT A PLAN OF SURVEY AND SHALL NOT BE USED EXCEPT FOR THE PURPOSE INDICATED IN THE TITLE BLOCK.

(B) THIS SKETCH IS PROTECTED BY COPYRIGHT

J.D.BARNES LIMITED SURVEYING MAPPING GIS
LAND INFORMATION SPECIALISTS
4318 PORTAGE ROAD - UNIT 3, NIAGARA FALLS, ON L2E 6A4
T. (905) 356-1686 F. (905) 354-4224 www.jdbarnes.com

DRAWN BY:	CHECKED BY:	REFERENCE NO.
SC	AJGH	20-16-397-01

FILE: G:\2020\20-16-397-01 - Two Stores\Drawing\20-16-397-01-TOPOSKETCH.dgn

PLOTTED: 12/20/2022

APPENDIX C

WATER SERVICING AND FIRE FLOW ANALYSIS

TABLE C1 - PROPOSED PEAK WATER DEMAND CALCULATIONS

			Hotel	Commercial/ Population Related	TOTAL
1.1	Total Population (Used for Calculation Purposes)*	Population	300	50	350
1.2	Per Capita Demand @ 300 L/person/day**	L/day	90,000	15,000	105,000
1.3	**Equivalent Population Demand**	**L/s**	**1.04**	**0.17**	**1.22**
1.4	Peak Hour Peaking Factor **		2.85	2.85	
1.5	**Peak Hour Design Demand**	**L/s**	**2.97**	**0.49**	**3.46**
1.6	Maximum Day Peaking Factor **		1.90	1.90	
1.7	**Maximum Day Design Demand**	**L/s**	**1.98**	**0.33**	**2.31**

* Refer to Appendix A - Table A1 for the Proposed Population Breakdown

** Provided by Town, as per Town's Draft Water Model Update

TABLE C2 - FIRE DEMAND CALCULATIONS - BASED ON F.U.S. GUIDELINES

			TOTAL
1.1	Coefficient for type of construction*		0.8
1.2	Height in Stories		4
1.3	Ground Floor Area		3589
1.4	2nd Floor Area		2535
1.5	3rd Floor Area		2535
1.6	4th Floor Area		2535
1.7	Total Area**	m^2	7,392
1.8	Fire Flow Required	L/min	16,000
1.9	15% Reduction for Occupancy Charge - limited combustible	L/min	-2,400
2.0	Fire Flow Required	L/min	13,600
2.1	30% Reduction for Automatic Sprinklers	L/min	-4,080
2.2	Charge for Building Separation		
	North: Nearest Building	>30m	0%
	West: Nearest Building	>30m	0%
	South: Nearest Building	>30m	0%
	East: Nearest Building	>30m	0%
2.3	Charge for Building Separation	L/min	0
2.4	Fire Flow Required	L/min	10,000
2.5	Fire Flow Required	L/s	166.7

* A coefficient of 0.8 is used for the type of construction based on non-combustible construction as defined in the F.U.S guidelines.

TABLE C3 - PROPOSED REDEVELOPMENT TOTAL WATER DEMAND

PER CITY OF TORONTO DESIGN CRITERIA AND MOE DESIGN GUIDELINES, WATER SUPPLY SYSTEMS SHOULD BE DESIGNED TO SATISFY THE GREATER OF EITHER OF THE FOLLOWING DEMANDS:

-MAXIMUM DAY DOMESTIC DEMAND PLUS FIRE FLOW

-PEAK HOUR DOMESTIC DEMAND

MAX DAY & FIRE FLOWS

Max Day Hotel	1.98	L/S
Max Day Commercial	0.33	L/S
MAX DAY RATE	**2.31**	**L/S**
Fire Flow	166.67	L/s
Total Hotel (Max Day & Fire)	168.65	L/s
Total Commercial (Max Day & Fire)	167.00	L/s
TOTAL MAX DAY + FIRE	**168.98**	**L/s**

PEAK HOUR DOMESTIC DEMAND

Peak Rate Hotel	2.97	L/s
Peak Rate Commercial	0.49	L/s
PEAK RATE	**3.46**	**L/s**

THEREFORE, MAX DAY + FIRE FLOW IS GOVERNING REQUIREMENT

WATER DEMAND

Max Day Hotel	1.98	L/S	119	L/min
Max Day Commercial	0.33	L/S	20	L/min
Fire Flow	166.67	L/s	10,000	L/min
Total Hotel (Max Day & Fire)	168.65	L/s	10,119	L/min
Total Commercial (Max Day & Fire)	167.00	L/s	10,020	L/min
TOTAL MAX DAY + FIRE	**168.98**	**L/s**	**10,139**	**L/min**

Note (*): In accordance with the Fire Underwriters Survey (FUS), fire flows will not be less than 4,800L/minute for a 2-hour duration in addition to maximum daily domestic demand, delivered with a residual pressure of not less than 140kPa (20psi).

arva | R.V. Anderson Associates Limited
engineering • environment • infrastructure

PARLIAMENT OAK DEVELOPMENT
325 KING ST., NOTL
FEBRUARY 2021

FIRE HYDRANT TEST LOCATIONS
N.T.S
205254

FIGURE:
F2

Hydrant Test - King St.

(Test results provided by the Town)

Hydrant Location: NOTLHYD-0058
SW Corner of King St. & Centre St.

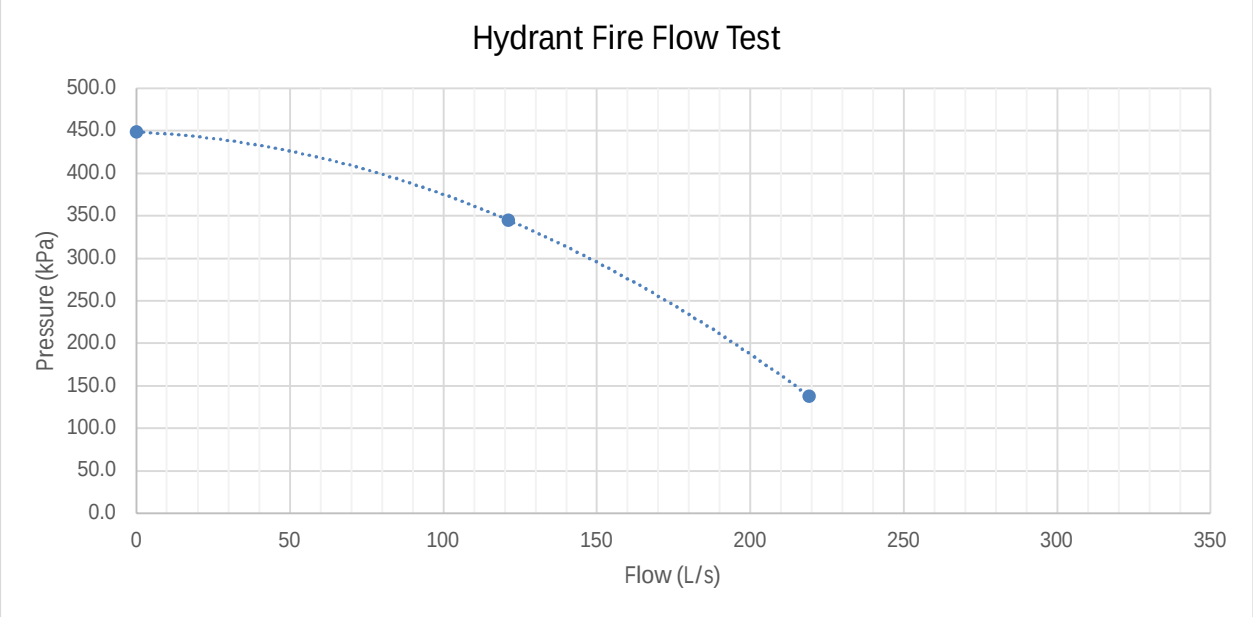
Main Size: 300mm
Type: PVC (2017)

4.10.1.2 The formula that is generally used to compute the discharge at the specified residual pressure or for any desired pressure drop is Equation 4.10.1.2:

$$Q_R = Q_F \times \frac{h_r^{0.54}}{h_f^{0.54}} \qquad (4.10.1.2)$$

where:
Q_R = flow predicted at desired residual pressure
Q_F = total flow measured during test
h_r = pressure drop to desired residual pressure
h_f = pressure drop measured during test

	USGPM	L/s	psi	kPa
Static	0	0	65	448.2
Flow	1920	121	50	344.7
Qr, Theoretical Limit @ 20 psi	3474.9	219.2	20	137.9



Hydrant Test - Regent St.

(Test results provided by the Town)

Hydrant Location: NOTLHYD-0059
SW Corner of Regent St. & Gage St.

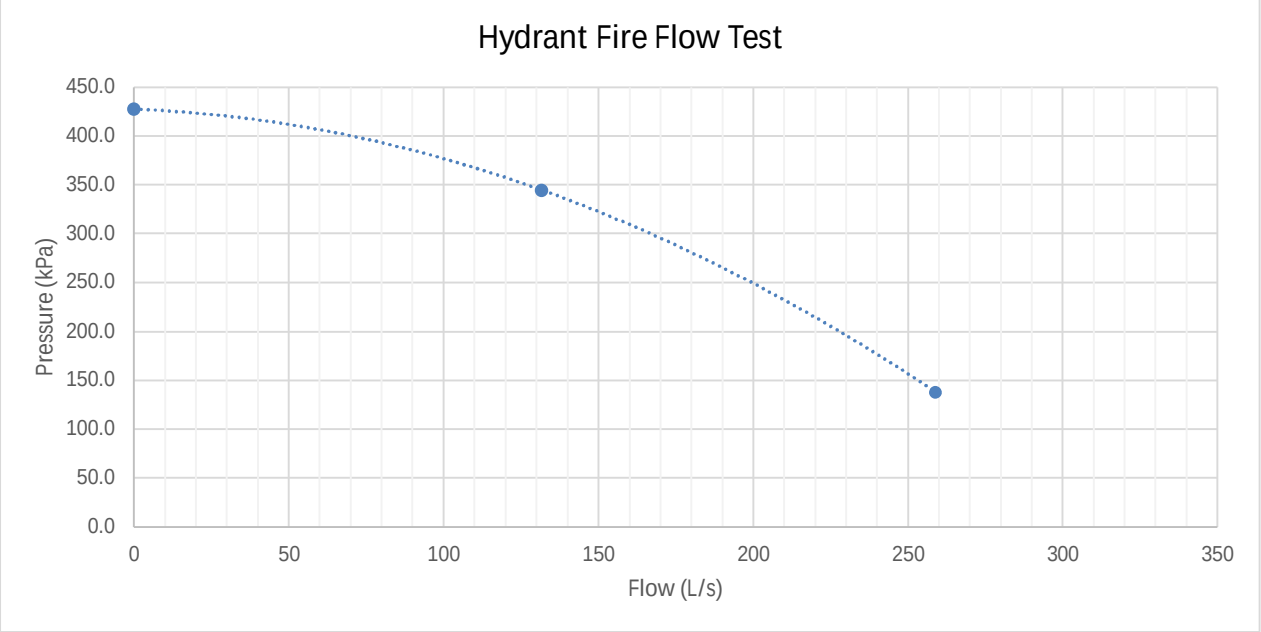
Main Size: 150mm
Type: PVC (2002)

4.10.1.2 The formula that is generally used to compute the discharge at the specified residual pressure or for any desired pressure drop is Equation 4.10.1.2:

$$Q_R = Q_F \times \frac{h_r^{0.54}}{h_f^{0.54}} \quad (4.10.1.2)$$

where:
Q_R = flow predicted at desired residual pressure
Q_F = total flow measured during test
h_r = pressure drop to desired residual pressure
h_f = pressure drop measured during test

	USGPM	L/s	psi	kPa
Static	0	0	62	427.5
Flow	2087	132	50	344.7
Qr, Theoretical Limit @ 20 psi	4105.1	259.0	20	137.9



Hydrant Test - Gage St.

(Test results provided by the Town)

Hydrant Location: NOTLHYD-1246
NW Corner of King St. & Gage St.

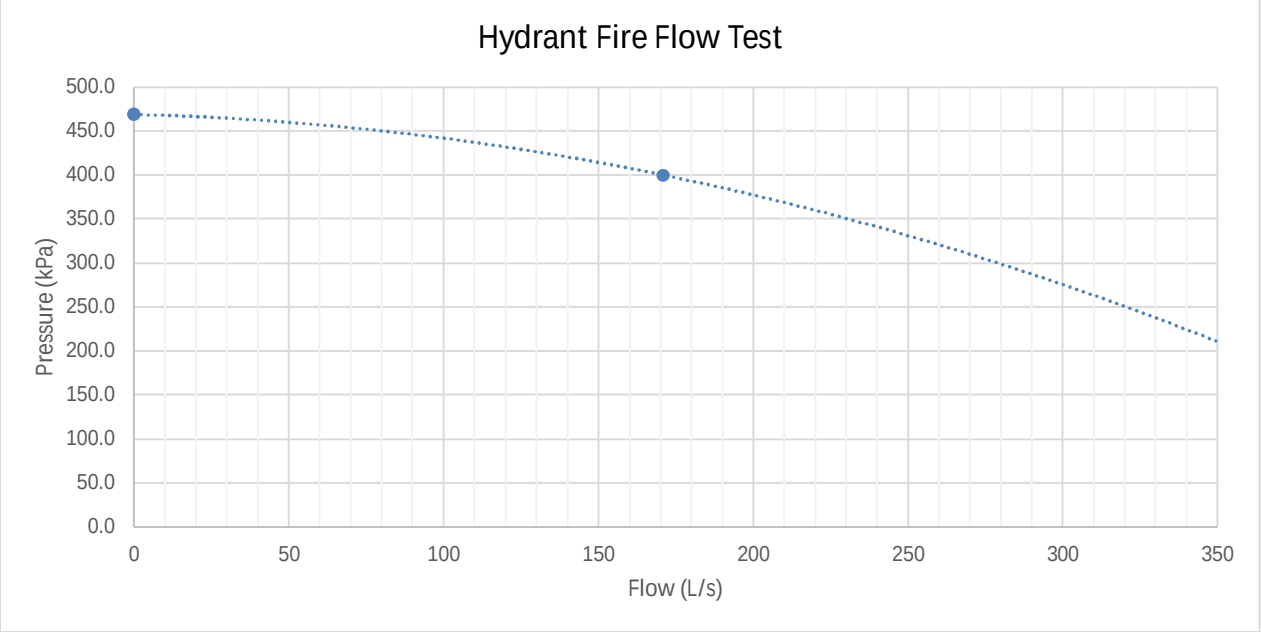
Main Size: 150mm
Type: PVC (2013)

4.10.1.2 The formula that is generally used to compute the discharge at the specified residual pressure or for any desired pressure drop is Equation 4.10.1.2:

$$Q_R = Q_F \times \frac{h_r^{0.54}}{h_f^{0.54}} \quad (4.10.1.2)$$

where:
Q_R = flow predicted at desired residual pressure
Q_F = total flow measured during test
h_r = pressure drop to desired residual pressure
h_f = pressure drop measured during test

	USGPM	L/s	psi	kPa
Static	0	0	68	468.8
Flow	2711	171	58	399.9
Qr, Theoretical Limit @ 20 psi	6324.1	399.0	20	137.9



Hydrant Test - Centre St.

(Test results provided by the Town)

Hydrant Location: NOTLHYD-1409
North Side Across 12 Centre St.

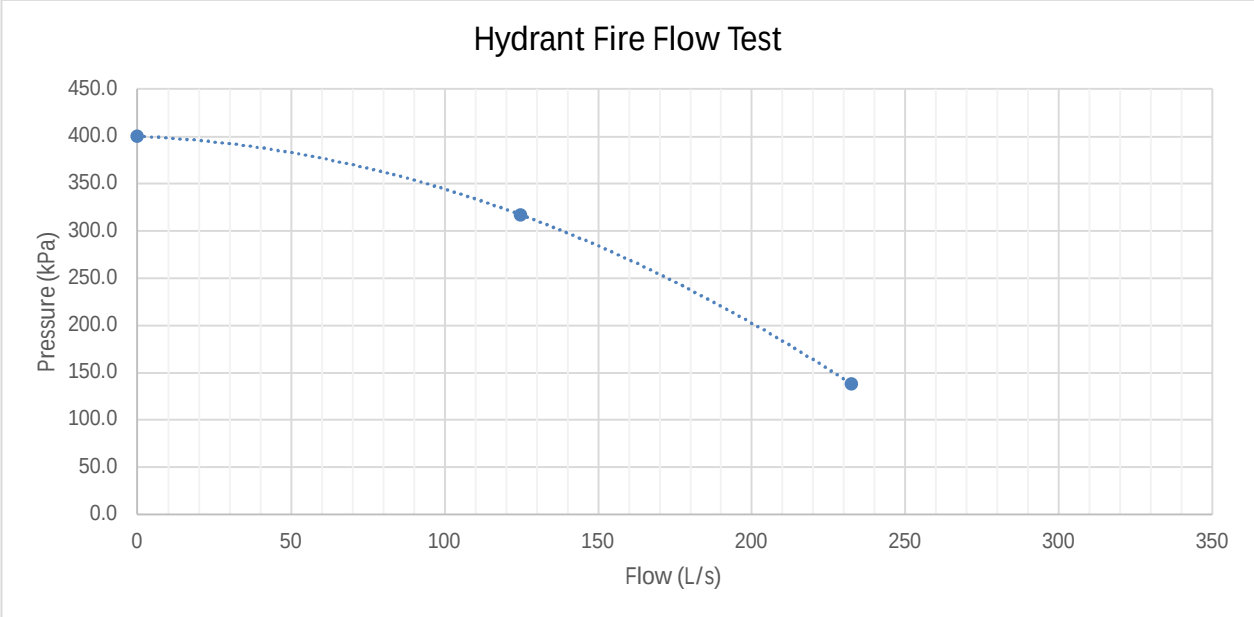
Main Size: 150mm
Type: PVC (2017)

4.10.1.2 The formula that is generally used to compute the discharge at the specified residual pressure or for any desired pressure drop is Equation 4.10.1.2:

$$Q_R = Q_F \times \frac{h_r^{0.54}}{h_f^{0.54}} \qquad (4.10.1.2)$$

where:
Q_R = flow predicted at desired residual pressure
Q_F = total flow measured during test
h_r = pressure drop to desired residual pressure
h_f = pressure drop measured during test

	USGPM	L/s	psi	kPa
Static	0	0	58	399.9
Flow	1977	125	46	317.2
Qr, Theoretical Limit @ 20 psi	3684.1	232.4	20	137.9



Lozzi Aqua Check

4820 18th Sideroad

Schomberg, Ontario

L0G-1T0

Massimo Lozzi Cell: 416 990-2131

E-mail: lozziaquacheck@gmail.com

Hydrant Flow Test Form

Job Location: 325 King St,Niagara On The Lake Date: November 13 ,2020

Test Date

Time of Test: 1:00 pm

Location of Flow Hydrant: at the corner of King St and Centre St.

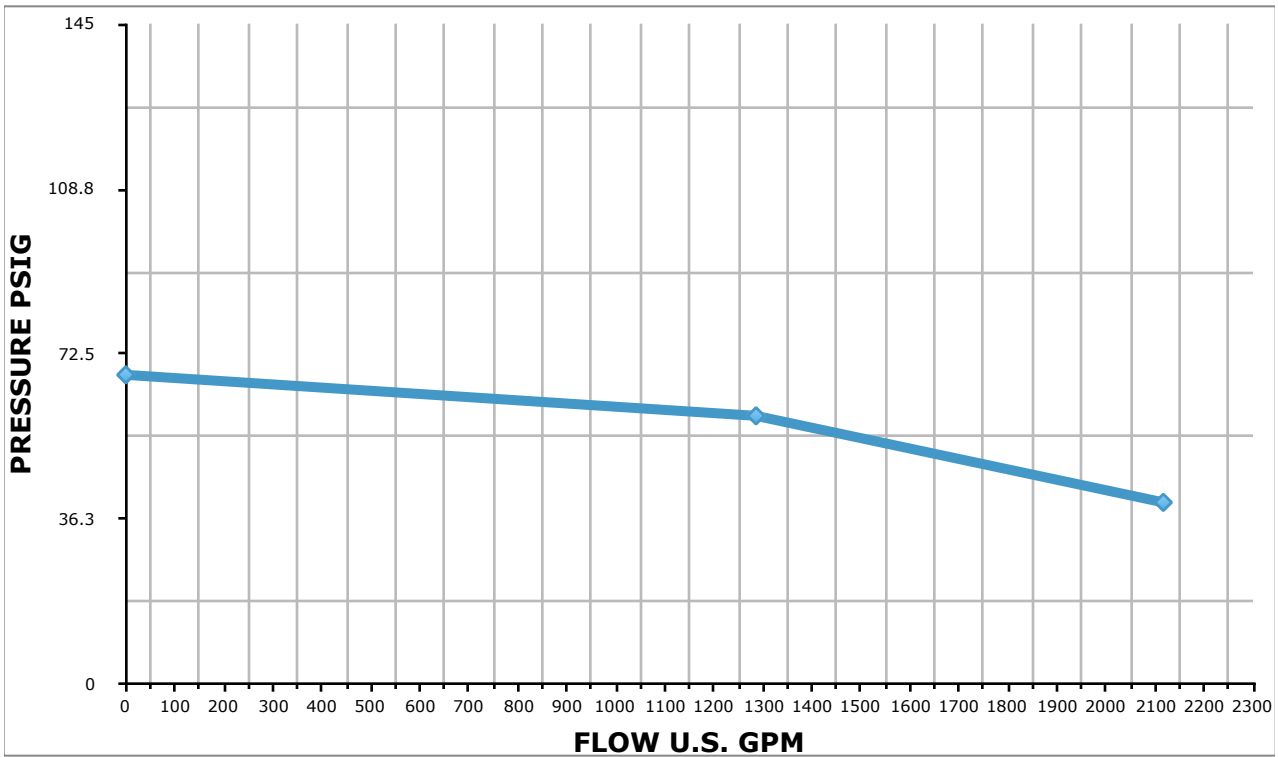
Residual hydrant: in front of 410 King St.

Main Size: 300 mm PVC Static Pressure: 68 psi

Theoretical GPM at 20 psi - 3175 gpm
200.3 L/s

	Number of Outlets & Orifice Size	Pitot Pressure (psi)	Flow (U.S. G.P.M.)	Residual Pressure (psi)
1.	Static	0	0	68
2.	1 x 2 ½	44	1286	59
3.	2 x 2 ½	30	2117	40

Note :Flow test conducted in accordance with NFPA Std 291



APPENDIX D

SANITARY SERVICING ANALYSIS

TABLE D1 - EXISTING COMBINED FLOW ESTIMATE

Combined Flow Outlet to King Street		Unit Rate		Existing Flow
	Number of Floors			1
	Total Floor Area (ha)*	-		0.2873
	Institutional Average Wastewater Flow**	180,000.0	L/floor ha/day	51714
	Total Flows (L/s)			0.60
		Site Area	**C**	**Flow**
	Storm Flow (Q = 2.78 C I A) *I (2 year) -74.46mm/hr (10mins) City of St. Catharines IDF	0.2881	0.65	38.76
	TOTAL EXISTING COMBINED FLOW (L/s)			**39.36**

* Total Floor Area based on topographical survey

** Wastewater Maser Servicing Plan Update 2021

TABLE D2 - ICI SANITARY FLOW ESTIMATE

	Unit Rate (L/e/d)	Proposed Flow
Total Hotel Population (Used for Calculation Purposes)*		300
Daily Retail & Office Flow (L/d)	310	93000
Peaking Factor - ICI		4.08
Hotel Sanitary Peak Flows (L/s)		4.39
Total Commercial Population (Used for Calculation Purposes)**		50
Daily Retail & Office Flow (L/d)	310	15500
Peaking Factor - ICI		4.31
Commercial Sanitary Peak Flows (L/s)		0.77
TOTAL ICI FLOW (L/s)		**5.16**

* Refer to Appendix A - Table A1 for Proposed Population Details

** Calculations as per Niagara-on-the-lake Municipal Engineering Standards Jan 2018

TABLE D3- TOTAL COMBINED FLOW ESTIMATE SUMMARY

		Proposed Flow
Peak Residential (based on 255 L/c/d)	L/s	0.00
Peak ICI (based on 310 L/c/d)	L/s	5.16
Groundwater Flow	L/s	0.00
Infiltration (0.26 L/s/ha)	L/s	0.43
TOTAL PEAK SANITARY FLOW	**L/s**	**5.59**
Combined Flow Increase from Existing Conditions =	L/s	-33.8

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

Existing Wastewater Infrastructure

Facilities - All Others

- Combined Sewage Detention Facility
- Flow Diversion Facility
- Flume
- Leachate Pumping Station
- Sewage Detention Facility
- Sewage Pumping Station (Region)
- Wastewater Treatment Plant

Wastewater Network

- Force Mains
- Regional Mains
- Local Sewers
- Private Sewers

Wastewater Catchments

- Front Street
- Garrison Village
- Lakeshore Road
- Line 2
- Niagara Stone Road
- Ricardo Street
- William Street

Other Features

- Municipal Boundary
- Urban Area Boundary
- Waterbodies

System Performance

- Surplus Capacity
- Surcharging Sewer
- Surcharging Sewer with Basement Flooding Risk

Figure 4.D.4

Existing Design

Peak Wet Weather Flows

Niagara-on-the-Lake WWTP

BluePlan Engineering

May 2023
620126
Projection EPSG: 26917

Niagara Region

2021 Water and Wastewater Master Servicing Plan Update

Existing Wastewater Infrastructure
- Combined Sewage Detention Facility
- Flow Diversion Facility
- Flume
- Sewage Detention Facility
- Sewage Pumping Station (Region)
- Wastewater Treatment Plant

Wastewater Network
- Force Mains
- Regional Mains
- Local Sewers
- Private Sewers

Wastewater Catchments
- Front Street
- Garrison Village
- Lakeshore Road
- Line 2
- Niagara Stone Road
- Ricardo Street
- William Street

Other Features
- Municipal Boundary
- Urban Area Boundaries
- Waterbodies

System Performance
- Surplus Capacity
- Surcharging Sewer
- Surcharging Sewer with Basement Flooding Risk

Figure 4.D.5

2051 Design

Peak Wet Weather Flows

Niagara-on-the-Lake WWTP

BluePlan Engineering

May 2023
620126
Projection EPSG: 26917

D.3.2 Sewage Pumping Station

Table 4.D.8 highlights the sewage pumping station operational firm capacities and the existing and projected flows. The existing average and peak dry weather flows were estimated using the wastewater system model, which was updated using the best available billing, flow monitoring, and SCADA data from 2018 to 2020.

Table 4.D.8 System Sewage Pumping Station Performance

Sewage Pumping System	Station Capacity	2021 Flows				2051 Flows			Post-2051 Flows		
	Operational Firm Capacity	Average Dry Weather Flow	Peak Dry Weather Flow	Design Allowance Peak Wet Weather Flow	5-Year Storm Peak Wet Weather Flow	Peak Dry Weather Flow	Design Allowance Peak Wet Weather Flow	5-Year Storm Peak Wet Weather Flow	Peak Dry Weather Flow	Design Allowance Peak Wet Weather Flow	5-Year Storm Peak Wet Weather Flow
	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
└→Garrison Village SPS	**84.5**	12.9	14.8	55.2	38.6	16.2	56.7	40.2	18.3	58.8	42.2
| └→Niagara Stone Road SPS	**20.7**	2.3	2.9	14.2	11.2	3.5	14.8	11.8	3.9	15.2	12.2
└→Lakeshore Road SPS	**86.0**	17.1	22.6	133.0	167.7	44.1	162.7	197.3	49.0	167.6	202.3
| └→Line 2 SPS	**7.3**	0.6	0.9	7.8	10.5	2.0	8.8	11.6	3.3	10.1	12.8
└→William Street SPS	**202.8**	67.5	76.5	244.8	158.4	90.8	262.7	176.3	94.7	266.6	180.2
└→Front Street SPS	**24.7**	13.3	25.0	51.7	83.2	28.4	55.2	86.7	28.7	55.4	86.9
└→Ricardo Street SPS	**17.2**	6.2	7.2	23.9	14.5	8.9	25.6	16.2	9.1	25.8	16.3

The following SPS have existing and future deficiencies under both design allowance PWWF and 5-year storm, requiring upgrades to support existing and future flows.

- Lakeshore Road SPS
- Line 2 SPS
- Front Street SPS

The following SPS have existing and future deficiencies under the design allowance PWWF; however, the existing and projected 5-year storm PWWF is withing the station's capacity, as such, the stations capacity is sufficient to support future flows.

- William Street SPS
- Ricardo Street SPS

The following stations have surplus capacity to support future flows.

- Garrison Village SPS
- Niagara Stone Road SPS

D.3.3 Forcemain

Table 4.D.9 highlights the existing and projected forcemain performance. Velocities less than 0.6 m/s were flagged in yellow and velocities exceeding 2.5 m/s were flagged in red. Note, if a pumping deficit was identified in **Table 4.D.8,** then projected forcemain velocities were based on the higher of the station's ECA firm capacity or the governing peak wet weather flow scenario, otherwise if no pumping deficit was identified, the operational firm capacity was used for future capacity assessment.

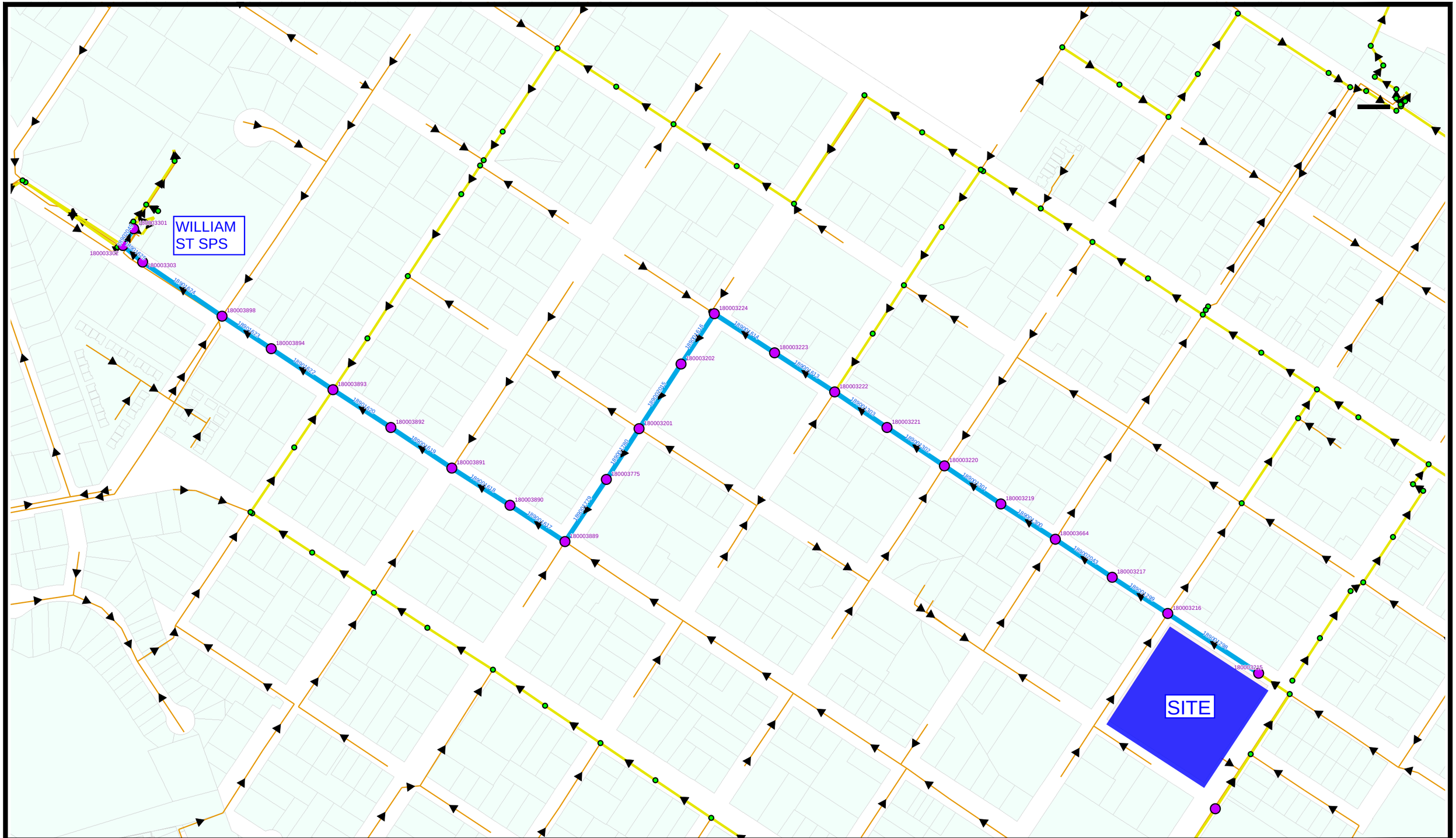
Table 4.D.9 Forcemain Performance

Station Name	Forcemain Diameter (mm)	Operational Firm Capacity		2051		Post-2051	
		Pumped Flow (L/s)	Velocity (m/s)	Pumping Needs (L/s)	Velocity (m/s)	Pumping Needs (L/s)	Velocity (m/s)
└→Garrison Village SPS	250	84.5	1.7	84.5[1]	1.7	84.5[1]	1.7
| └→Niagara Stone Road SPS	147	20.7	1.2	20.7[1]	1.2	20.7[1]	1.2
└→Lakeshore Road SPS	300	63.3	0.9	162.7[3]	2.3	167.6[3]	2.4
| └→Line 2 SPS	100	7.3	0.9	8.8[3]	1.1	10.1[3]	1.3
└→William Street SPS	356	202.8	2.0	202.8[1]	2.0	202.8[1]	2.0
└→Front Street SPS	200	24.7	0.8	55.2[3]	1.8	55.4[3]	1.8
└→Ricardo Street SPS	150	17.2	1.0	17.2[1]	1.0	17.2[1]	1.0

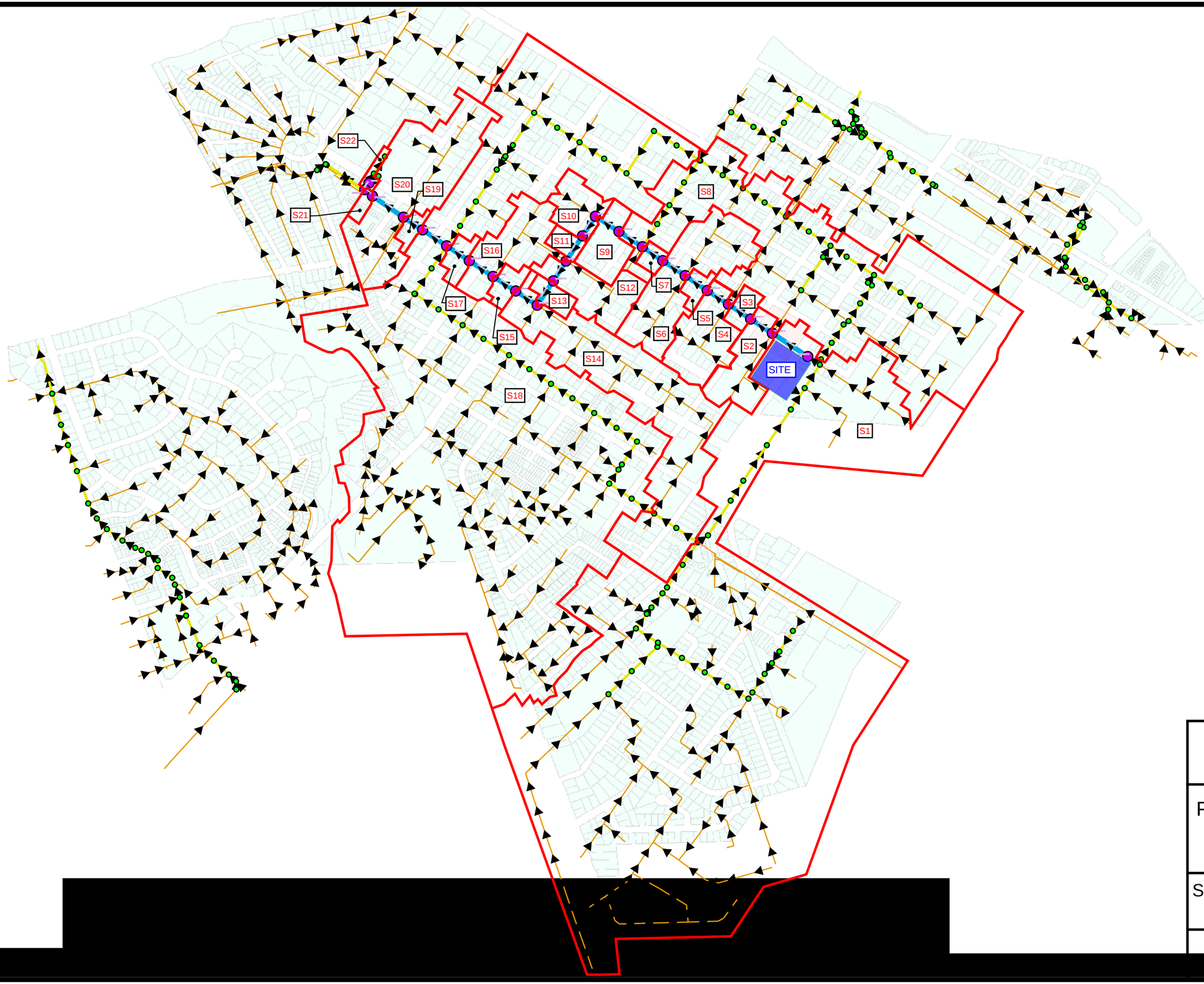
[1] Operational firm capacity
[2] ECA capacity
[3] Minimum of future design allowance PWWF or 5-year storm PWWF

There are no forcemains with low velocities in the current operating regime.

All forcemains have sufficient capacity to meet future flows.



arva R.V. Anderson Associates Limited engineering • environment • infrastructure	PARLIAMENT OAK DEVELOPMENT 325 KING ST., NOTL JANUARY 2021	DOWNSTREAM SANITARY SEWER SYSTEM N.T.S 205254	FIGURE: F3



LEGEND

- SANITARY CATCHMENT BOUNDARY
- S1 — CATCHMENT ID
- SANITARY SEWERS D/S OF SITE

CATCHMENT ID	AREA (ha)
S1	103.47
S2	2.84
S3	0.76
S4	3.72
S5	0.62
S6	6.59
S7	0.48
S8	31.94
S9	2.19
S10	1.97
S11	0.65
S12	3.19
S13	0.83
S14	16.13
S15	0.82
S16	4.08
S17	0.84
S18	95.74
S19	0.54
S20	9.68
S21	0.33
S22	0.33

arva

PARLIAMENT OAK DEVELOPMENT

325 KING ST., NOTL

SANITARY DRAINAGE AREAS

205254 | N.T.S | FIGURE: F4

JANUARY 2021

SANITARY SEWER DESIGN SHEET

PROJECT: **PARLIAMENT OAK DEVELOPMENT, 325 King Street**
NOTE: **EXISTING CONDITIONS, Dry & Wet Weather Flow**

R.V. Anderson Associates Limited
2001 Sheppard Avenue East Suite 300
Toronto Ontario M2J 4Z8 Canada
Tel 416 497 8600 Fax 416 497 0342
www.rvanderson.com

DRY WEATHER INFILTRATION (L / s / ha) = 0
WET WEATHER INFILTRATION (L / s / ha) = 0.286

STREET	CATCHMENT ID	MANHOLE				MAX AVERAGE DAY FLOW (L/s)	TOTAL POPULATION	PEAKING FACTOR	PEAK FLOW (L/s)	AREAS (ha)		DRY WEATHER FLOW (L/S)		WET WEATHER FLOW (L/S)		SEWER DATA								NOTES
		FROM	INV	TO	INV					AREA	ACCUM. AREA	INFILTRATION FLOW (L/s)	PEAK DRY SAN FLOW (L/s)	INFILTRATION FLOW (L/s)	PEAK WET SAN FLOW (L/s)	NOMINAL DIAMETER (mm)	SLOPE (%)	LENGTH (m)	n	CAPACITY (L/s)	FULL VELOCITY (m/s)	% Full Dry Weather Flow	% Full Wet Weather Flow	
Gage Street	S1	180003215	81.414	180003216	80.994	7.38	2319	3.5	26.09	103.47	103.47	0.00	26.09	29.59	55.68	450	0.3%	120.3	0.013	168.5	1.1	15%	33%	
Gage Street	S2	180003216	80.994	180003217	80.731	7.38	2319	3.5	26.09	2.84	106.31	0.00	26.09	30.40	56.49	450	0.4%	73.4	0.013	170.7	1.1	15%	33%	
Gage Street	S3	180003217	80.731	180003664	80.467	7.45	2341	3.5	26.31	0.76	107.07	0.00	26.31	30.62	56.93	450	0.3%	75.7	0.013	168.4	1.1	16%	34%	
Gage Street	S4	180003664	80.467	180003219	80.214	7.45	2341	3.5	26.31	3.72	110.79	0.00	26.31	31.69	58.00	450	0.4%	71.7	0.013	169.4	1.1	16%	34%	
Gage Street	S5	180003219	80.214	180003220	79.951	7.51	2360	3.5	26.50	0.62	111.41	0.00	26.50	31.86	58.37	450	0.3%	75.3	0.013	168.5	1.1	16%	35%	
Gage Street	S6	180003220	79.951	180003221	79.685	7.87	2473	3.5	27.64	6.59	118.00	0.00	27.64	33.75	61.39	450	0.3%	76.4	0.013	168.2	1.1	16%	36%	
Gage Street	S7	180003221	79.685	180003222	79.439	7.89	2479	3.5	27.71	0.48	118.48	0.00	27.71	33.89	61.59	450	0.4%	69.9	0.013	169.1	1.1	16%	36%	
Gage Street	S8	180003222	79.439	180003223	79.258	27.53	8649	3.0	83.06	31.94	150.42	0.00	83.06	43.02	126.08	600	0.2%	79.3	0.013	293.3	1.0	28%	43%	
Gage Street	S9	180003223	79.258	180003224	79.055	27.53	8649	3.0	83.06	2.19	152.61	0.00	83.06	43.65	126.70	600	0.3%	79.5	0.013	310.3	1.1	27%	41%	
Mississagua Street	S10	180003224	79.055	180003202	78.946	27.53	8649	3.0	83.06	1.97	154.58	0.00	83.06	44.21	127.27	600	0.2%	66.7	0.013	248.2	0.9	33%	51%	
Mississagua Street	S11	180003202	78.946	180003201	78.755	27.53	8649	3.0	83.06	0.65	155.23	0.00	83.06	44.40	127.45	600	0.2%	85.2	0.013	290.8	1.0	29%	44%	
Mississagua Street	S12	180003201	78.755	180003775	78.595	27.53	8649	3.0	83.06	3.19	158.42	0.00	83.06	45.31	128.37	600	0.2%	66.7	0.013	300.7	1.1	28%	43%	
Mississagua Street	S13	180003775	78.595	180003889	78.32	27.53	8649	3.0	83.06	0.83	159.25	0.00	83.06	45.55	128.60	600	0.3%	82.5	0.013	354.4	1.3	23%	36%	
William Street	S14	180003889	78.32	180003890	78.172	27.60	8671	3.0	83.24	16.13	175.38	0.00	83.24	50.16	133.40	600	0.2%	72.9	0.013	276.7	1.0	30%	48%	
William Street	S15	180003890	78.172	180003891	77.9	27.60	8671	3.0	83.24	0.82	176.20	0.00	83.24	50.39	133.63	600	0.4%	76.4	0.013	366.5	1.3	23%	36%	
William Street	S16	180003891	77.89	180003892	77.806	27.60	8671	3.0	83.24	4.08	180.28	0.00	83.24	51.56	134.80	600	0.1%	80.9	0.013	197.8	0.7	42%	68%	
William Street	S17	180003892	77.806	180003893	77.667	27.60	8671	3.0	83.24	0.84	181.12	0.00	83.24	51.80	135.04	600	0.2%	76.5	0.013	261.8	0.9	32%	52%	
William Street	S18	180003893	77.667	180003894	77.524	36.08	11336	2.9	104.65	95.74	276.86	0.00	104.65	79.18	183.83	600	0.2%	81.9	0.013	256.6	0.9	41%	72%	
William Street	S19	180003894	77.524	180003898	77.359	36.08	11336	2.9	104.65	0.54	277.40	0.00	104.65	79.34	183.98	600	0.3%	65.3	0.013	308.6	1.1	34%	60%	
William Street	S20	180003898	77.359	180003303	77.139	36.38	11430	2.9	105.39	9.68	287.08	0.00	105.39	82.10	187.49	600	0.2%	106.2	0.013	279.5	1.0	38%	67%	
William Street	S21	180003303	77.059	180003302	76.963	36.38	11430	2.9	105.39	0.33	287.41	0.00	105.39	82.20	187.59	600	0.3%	28.5	0.013	356.4	1.3	30%	53%	
William Street	S22	180003302	76.23	180003301	76.09	39.79	12501	2.9	113.71	0.33	287.74	0.00	113.71	82.29	196.01	600	0.6%	22.1	0.013	489.1	1.7	23%	40%	

Notes:
-Max Average Day Flow obtained from InfoSWMM Model Output provided by Niagara Region.
-Total Population calculated based on a residential flow of 275 L/cap/day.
-Max Average Day Flow peaked using Harmon Peaking Factor.

CALCULATED BY: WN DATE: 2021-02-02
CHECKED BY: SDF DATE: 2021-02-02

SANITARY SEWER DESIGN SHEET

PROJECT: PARLIAMENT OAK DEVELOPMENT, 325 King Street

NOTE: PROPOSED CONDITIONS, Dry & Wet Weather Flow

R.V. Anderson Associates Limited
2001 Sheppard Avenue East Suite 300
Toronto Ontario M2J 4Z8 Canada
Tel 416 497 8600 Fax 416 497 0342
www.rvanderson.com

PROPOSED KING ST SANITARY FLOW (L/s)	5.59
NET DECREASE KING STREET SANITARY FLOW (L/s)	-33.8
DRY WEATHER INFILTRATION (L / s / ha) =	0
WET WEATHER INFILTRATION (L / s / ha) =	0.286

STREET	CATCHMENT ID	MANHOLE				AVERAGE DAY FLOW (L/s)	TOTAL POPULATION	PEAKING FACTOR	PEAK FLOW (L/s)	AREAS (ha)		DRY WEATHER FLOW (L/S)		WET WEATHER FLOW (L/S)		SEWER DATA								NOTES
		FROM	INV	TO	INV					AREA	ACCUM. AREA	INFILTRATION FLOW (L/s)	PEAK DRY SAN FLOW (L/s)	INFILTRATION FLOW (L/s)	PEAK WET SAN FLOW (L/s)	NOMINAL DIAMETER (mm)	SLOPE (%)	LENGTH (m)	n	CAPACITY (L/s)	FULL VELOCITY (m/s)	% Full Dry Weather Flow	% Full Wet Weather Flow	
Gage Street	S1	180003215	81.414	180003216	80.994	7.38	2319	3.5	-7.71	103.47	103.47	0.00	-7.71	29.59	21.88	450	0.3%	120.3	0.013	168.5	1.1	-5%	13%	
Gage Street	S2	180003216	80.994	180003217	80.731	7.38	2319	3.5	-7.71	2.84	106.31	0.00	-7.71	30.40	22.69	450	0.4%	73.4	0.013	170.7	1.1	-5%	13%	
Gage Street	S3	180003217	80.731	180003664	80.467	7.45	2341	3.5	-7.49	0.76	107.07	0.00	-7.49	30.62	23.13	450	0.3%	75.7	0.013	168.4	1.1	-4%	14%	
Gage Street	S4	180003664	80.467	180003219	80.214	7.45	2341	3.5	-7.49	3.72	110.79	0.00	-7.49	31.69	24.20	450	0.4%	71.7	0.013	169.4	1.1	-4%	14%	
Gage Street	S5	180003219	80.214	180003220	79.951	7.51	2360	3.5	-7.30	0.62	111.41	0.00	-7.30	31.86	24.57	450	0.3%	75.3	0.013	168.5	1.1	-4%	15%	
Gage Street	S6	180003220	79.951	180003221	79.685	7.87	2473	3.5	-6.16	6.59	118.00	0.00	-6.16	33.75	27.59	450	0.3%	76.4	0.013	168.2	1.1	-4%	16%	
Gage Street	S7	180003221	79.685	180003222	79.439	7.89	2479	3.5	-6.09	0.48	118.48	0.00	-6.09	33.89	27.79	450	0.4%	69.9	0.013	169.1	1.1	-4%	16%	
Gage Street	S8	180003222	79.439	180003223	79.258	27.53	8649	3.0	49.26	31.94	150.42	0.00	49.26	43.02	92.28	600	0.2%	79.3	0.013	293.3	1.0	17%	31%	
Gage Street	S9	180003223	79.258	180003224	79.055	27.53	8649	3.0	49.26	2.19	152.61	0.00	49.26	43.65	92.90	600	0.3%	79.5	0.013	310.3	1.1	16%	30%	
Mississagua Street	S10	180003224	79.055	180003202	78.946	27.53	8649	3.0	49.26	1.97	154.58	0.00	49.26	44.21	93.47	600	0.2%	66.7	0.013	248.2	0.9	20%	38%	
Mississagua Street	S11	180003202	78.946	180003201	78.755	27.53	8649	3.0	49.26	0.65	155.23	0.00	49.26	44.40	93.65	600	0.2%	85.2	0.013	290.8	1.0	17%	32%	
Mississagua Street	S12	180003201	78.755	180003775	78.595	27.53	8649	3.0	49.26	3.19	158.42	0.00	49.26	45.31	94.57	600	0.2%	66.7	0.013	300.7	1.1	16%	31%	
Mississagua Street	S13	180003775	78.595	180003889	78.32	27.53	8649	3.0	49.26	0.83	159.25	0.00	49.26	45.55	94.80	600	0.3%	82.5	0.013	354.4	1.3	14%	27%	
William Street	S14	180003889	78.32	180003890	78.172	27.60	8671	3.0	49.44	16.13	175.38	0.00	49.44	50.16	99.60	600	0.2%	72.9	0.013	276.7	1.0	18%	36%	
William Street	S15	180003890	78.172	180003891	77.9	27.60	8671	3.0	49.44	0.82	176.20	0.00	49.44	50.39	99.83	600	0.4%	76.4	0.013	366.5	1.3	13%	27%	
William Street	S16	180003891	77.89	180003892	77.806	27.60	8671	3.0	49.44	4.08	180.28	0.00	49.44	51.56	101.00	600	0.1%	80.9	0.013	197.8	0.7	25%	51%	
William Street	S17	180003892	77.806	180003893	77.667	27.60	8671	3.0	49.44	0.84	181.12	0.00	49.44	51.80	101.24	600	0.2%	76.5	0.013	261.8	0.9	19%	39%	
William Street	S18	180003893	77.667	180003894	77.524	36.08	11336	2.9	70.85	95.74	276.86	0.00	70.85	79.18	150.03	600	0.2%	81.9	0.013	256.6	0.9	28%	58%	
William Street	S19	180003894	77.524	180003898	77.359	36.08	11336	2.9	70.85	0.54	277.40	0.00	70.85	79.34	150.18	600	0.3%	65.3	0.013	308.6	1.1	23%	49%	
William Street	S20	180003898	77.359	180003303	77.139	36.38	11430	2.9	71.59	9.68	287.08	0.00	71.59	82.10	153.69	600	0.2%	106.2	0.013	279.5	1.0	26%	55%	
William Street	S21	180003303	77.059	180003302	76.963	36.38	11430	2.9	71.59	0.33	287.41	0.00	71.59	82.20	153.79	600	0.3%	28.5	0.013	356.4	1.3	20%	43%	
William Street	S22	180003302	76.23	180003301	76.09	39.79	12501	2.9	79.91	0.33	287.74	0.00	79.91	82.29	162.21	600	0.6%	22.1	0.013	489.1	1.7	16%	33%	

Notes:

-Max Average Day Flow obtained from InfoSWMM Model Output provided by Niagara Region.

-Total Population calculated based on a residential flow of 275 L/cap/day.

-Max Average Day Flow peaked using Harmon Peaking Factor.

-The post-development sanitary peak flow was added to the peak flows calculated from the max average day flows to model the proposed conditions.

CALCULATED BY: WN/SMP DATE: 2024-08-16

CHECKED BY: SDF DATE: 2021-02-02

APPENDIX E

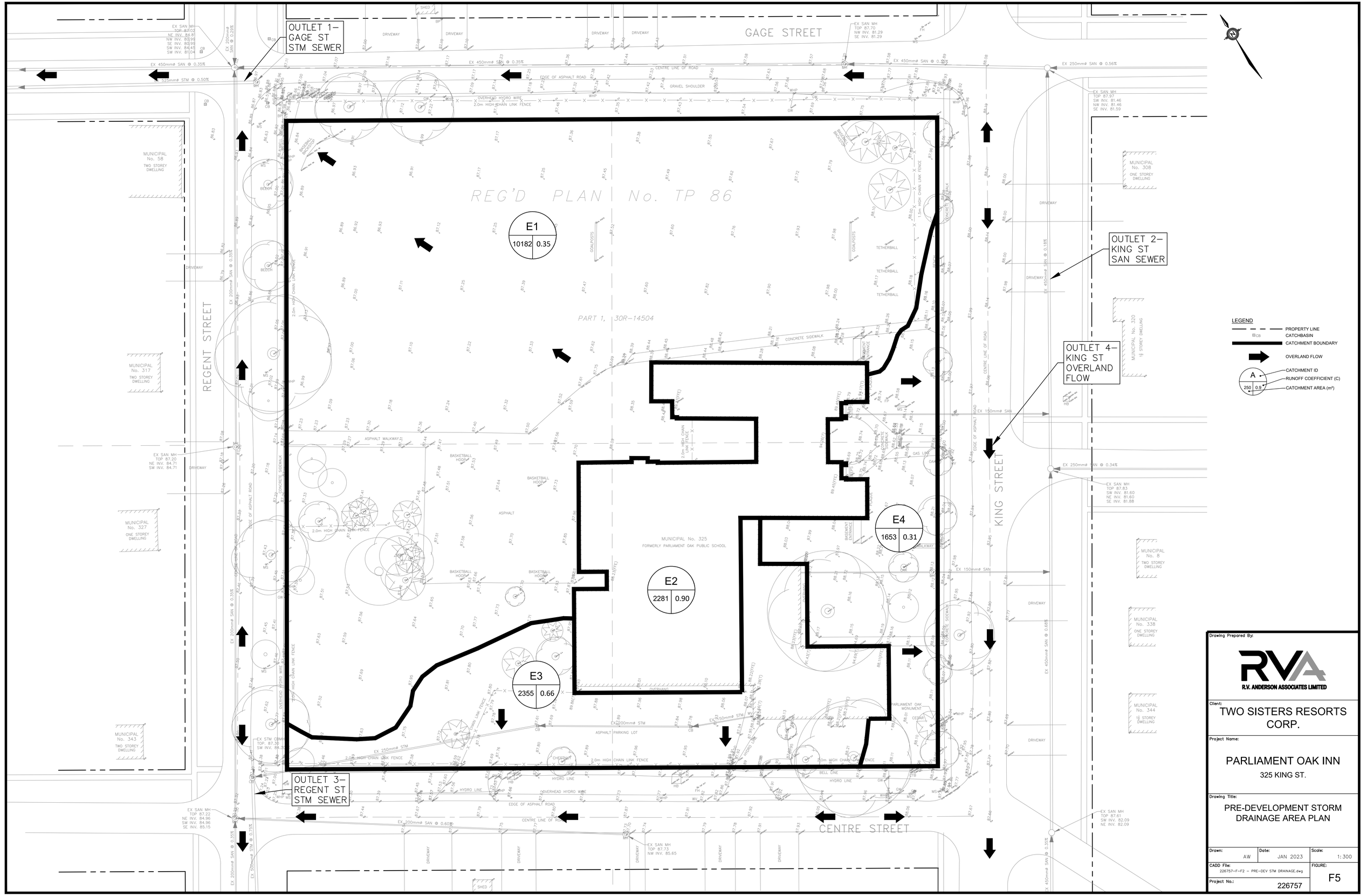
STORM SERVICING & SWM ANALYSIS

TABLE E1- Existing Runoff Coefficient				
Surface	**Runoff Coefficient**	**Area (m2)**	**% Area of Catchment**	**Weighted C Component**
Catchment Area E1				
Soft Landscaped Area	0.25	8572	84.3%	0.21
Impervious Area (i.e. conventional pavement & roof)	0.90	1596	15.7%	0.14
		10168	**100.0%**	**0.35**
Catchment Area E2				
Soft Landscaped Area	0.25	0	0.0%	0.00
Impervious Area (i.e. conventional pavement & roof)	0.90	2281	100.0%	0.90
		2281	**100.0%**	**0.90**
Catchment Area E3				
Soft Landscaped Area	0.25	857	36.4%	0.09
Impervious Area (i.e. conventional pavement & roof)	0.90	1498	63.6%	0.57
		2355	**100%**	**0.66**
Catchment Area E4				
Soft Landscaped Area	0.25	1489	90.1%	0.23
Impervious Area (i.e. conventional pavement & roof)	0.90	164	9.9%	0.09
		1653	**100%**	**0.31**
Total		**16457**		**0.47**

Refer to figure F5 for the existing catchment areas.

TABLE E2- Proposed Runoff Coefficient				
Surface	**Runoff Coefficient**	**Area (m2)**	**% Area of Catchment**	**Weighted C Component**
Catchment Area P1				
Impervious Area (conventional roof)	0.90	4415	100.0%	0.90
		4415	**100.0%**	**0.90**
Catchment Area P2				
Soft Landscaped Area	0.25	5505	72.9%	0.18
Impervious Area (i.e. pavers, asphalt driveway)	0.90	2049	27.1%	0.24
		7554	**100.0%**	**0.43**
Catchment Area P3				
Centre Street Uncontrolled				
Soft Landscaped Area	0.25	82	100.0%	0.25
		82	**100%**	**0.25**
Catchment Area P4				
Gage Street Uncontrolled				
Soft Landscaped Area	0.25	49	100.0%	0.25
		49	**100%**	**0.25**
Catchment Area P5				
Soft Landscaped Area	0.25	606	13.8%	0.03
Impervious Area (i.e. pavers, asphalt driveway)	0.90	3770	86.2%	0.78
		4376	**100.0%**	**0.81**
Total		**16475**		**0.65**

Refer to figure F3 for catchment areas.



Drawing Prepared By:

R.V. ANDERSON ASSOCIATES LIMITED

Client:
TWO SISTERS RESORTS CORP.

Project Name:
PARLIAMENT OAK INN
325 KING ST.

Drawing Title:
PRE-DEVELOPMENT STORM DRAINAGE AREA PLAN

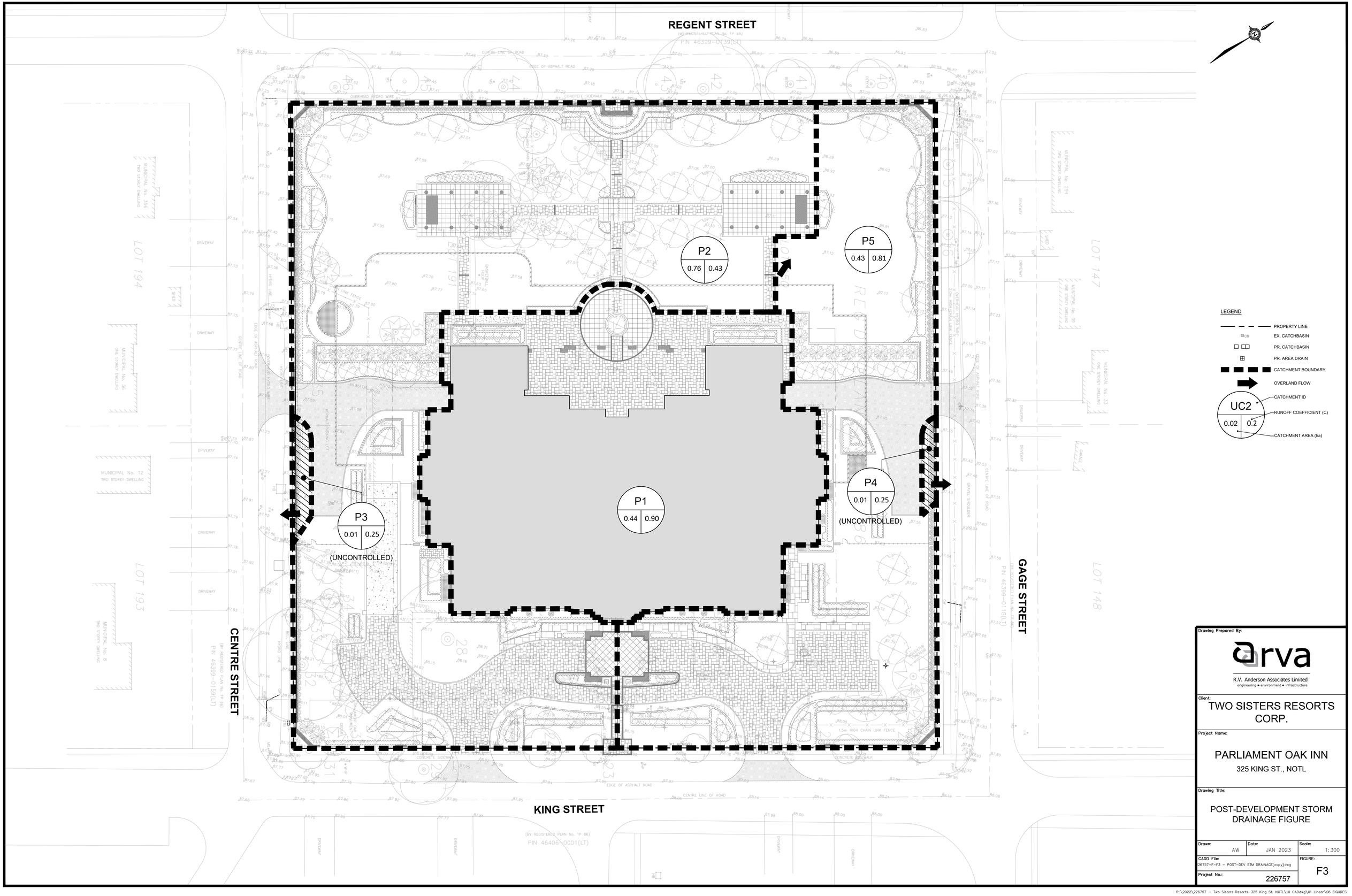
Drawn:	Date:	Scale:
AW	JAN 2023	1:300

CADD File: 226757-F-F2 – PRE-DEV STM DRAINAGE.dwg

FIGURE: F5

Project No.: 226757

R:\2022\226757 – Two Sisters Resorts–325 King St. NOTL\10 CADdwg\01 Linear\06 FIGURES



Drawing Prepared By:

arva
R.V. Anderson Associates Limited
engineering • environment • infrastructure

Client:
TWO SISTERS RESORTS CORP.

Project Name:
PARLIAMENT OAK INN
325 KING ST., NOTL

Drawing Title:
POST-DEVELOPMENT STORM DRAINAGE FIGURE

Drawn:	Date:	Scale:
AW	JAN 2023	1:300
CADD File: 226757-F-F3 – POST-DEV STM DRAINAGE[copy].dwg		FIGURE: F3
Project No.: 226757		

R:\2022\226757 – Two Sisters Resorts–325 King St. NOTL\10 CADdwg\01 Linear\06 FIGURES

ORIFICE FLOW DESIGN

2-100 Yr Storm Rating Curve

Orifice Diameter =	175	mm
Orifice Area =	0.02405	m^2
Orifice Type =	PLATE	
Coefficient =	0.63	
Orifice INV	84.42	
Orifice MID	84.5075	

Elevation (m)	Head (m)	**Discharge (m^3/s)**	**Tank Storage (m^3)**
84.45	0.00	0.0000	0.00000
84.75	0.24	0.0331	0.01035
84.95	0.44	0.0446	0.01725
85.15	0.64	0.0538	0.02414
85.35	0.84	0.0616	0.03104
85.55	1.04	0.0685	0.03794
85.72	1.12	0.0712	0.04380

Note: Volume excludes pipe storage.

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        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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       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: 09-17-2025                          TIME: 04:12:29

USER:



COMMENTS: _____________________________________________________________


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  ***********************************************
  ** SIMULATION : RUN1 - 2 Year - St Catharines **
  ***********************************************


--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 567.000
| Ptotal= 37.40 mm |                          B=   5.200
--------------------                          C=   0.746
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.86	1.00	19.21	2.00	6.35	3.00	3.36
0.17	3.25	1.17	74.46	2.17	5.47	3.17	3.14
0.33	3.78	1.33	24.72	2.33	4.83	3.33	2.95
0.50	4.57	1.50	13.71	2.50	4.33	3.50	2.78
0.67	5.90	1.67	9.72	2.67	3.94	3.67	2.63
0.83	8.67	1.83	7.64	2.83	3.63	3.83	2.50

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--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   0.44
|ID= 1 DT=10.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.44         0.00
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      54.16        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      74.46        13.42
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       1.99 (ii)   17.75 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=       0.17         0.06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.09         0.00          0.090 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.67           1.33
     RUNOFF VOLUME    (mm)=      36.40        10.95          36.14
     TOTAL RAINFALL   (mm)=      37.40        37.40          37.40
     RUNOFF COEFFICIENT   =       0.97         0.29           0.97

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

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

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--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   1.19
|ID= 1 DT=10.0 min |   Total Imp(%)=  49.00   Dir. Conn.(%)=  44.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.58         0.61
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      89.07        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      74.46        16.30
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       2.68 (ii)   17.26 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=       0.17         0.06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.11         0.02          0.114 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      36.40        11.90          22.67
     TOTAL RAINFALL   (mm)=      37.40        37.40          37.40
     RUNOFF COEFFICIENT   =       0.97         0.32           0.61

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

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

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--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):     0.44   0.090     1.33    36.14
      + ID2= 2 (  0002):     1.19   0.114     1.33    22.67
        ================================================
        ID = 3 (  0003):     1.63   0.203     1.33    26.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0616      0.0310
                          0.0331     0.0104   |   0.0685      0.0379
                          0.0446     0.0172   |   0.0712      0.0438
                          0.0538     0.0241   |   0.0000      0.0000

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)      1.630      0.203      1.33      26.31
   OUTFLOW: ID= 1 (  0004)      1.630      0.046      1.83      26.26

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.51
                  TIME SHIFT OF PEAK FLOW         (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0183

--------------------------------------------------------------------------------
------
--------------------
| CALIB            |
| STANDHYD (  0005)|   Area    (ha)=   0.01
|ID= 1 DT=10.0 min |   Total Imp(%)=   1.00   Dir. Conn.(%)=   1.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.00         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=       9.31        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      74.46        13.42
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       0.69 (ii)   16.45 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=       0.17         0.06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.000 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.50
     RUNOFF VOLUME    (mm)=      36.40        10.95           8.15
     TOTAL RAINFALL   (mm)=      37.40        37.40          37.40
     RUNOFF COEFFICIENT   =       0.97         0.29           0.22

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

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

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--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
```

```
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.63   0.046     1.83    26.26
      + ID2= 2 (  0005):     0.01   0.000     1.50     8.15
        ================================================
        ID = 3 (  0013):     1.64   0.046     1.83    26.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| CALIB            |
| STANDHYD (  0020)|   Area    (ha)=   0.01
|ID= 1 DT=10.0 min |   Total Imp(%)=   1.00   Dir. Conn.(%)=   1.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.00         0.01
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=       8.16        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      74.46        21.02
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       0.64 (ii)   13.81 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=       0.17         0.07
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.000 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.50
     RUNOFF VOLUME    (mm)=      36.40        15.97          11.95
     TOTAL RAINFALL   (mm)=      37.40        37.40          37.40
     RUNOFF COEFFICIENT   =       0.97         0.43           0.32

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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        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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       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: 09-17-2025                          TIME: 04:12:29

USER:



COMMENTS: _____________________________________________________________


-------------------------------------------------------------------------------
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  ***********************************************
  ** SIMULATION : RUN2 - 5 Year - St Catharines **
  ***********************************************

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| CHICAGO STORM    |    IDF curve parameters: A= 664.000
| Ptotal= 44.35 mm |                          B=   4.700
--------------------                          C=   0.744
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME
RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs
mm/hr
                0.00    3.39 |  1.00   22.42 |  2.00    7.48 |  3.00
3.98
                0.17    3.85 |  1.17   89.88 |  2.17    6.45 |  3.17
3.72
```

```
                0.33    4.48 |  1.33   28.86 |  2.33    5.70 |  3.33
3.50
                0.50    5.41 |  1.50   16.02 |  2.50    5.12 |  3.50
3.30
                0.67    6.96 |  1.67   11.39 |  2.67    4.67 |  3.67
3.13
                0.83   10.17 |  1.83    8.98 |  2.83    4.29 |  3.83
2.98


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--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   0.44
|ID= 1 DT=10.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.44         0.00
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      54.16        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      89.88        19.21
                over (min)       10.00        20.00
     Storage Coeff.  (min)=       1.85 (ii)   15.50 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=       0.17         0.07
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.11         0.00          0.108 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      43.35        15.06          43.06
     TOTAL RAINFALL   (mm)=      44.35        44.35          44.35
     RUNOFF COEFFICIENT   =       0.98         0.34           0.97

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

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

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--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   1.19
|ID= 1 DT=10.0 min |   Total Imp(%)=  49.00   Dir. Conn.(%)=  44.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.58         0.61
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      89.07        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      89.88        23.06
                over (min)       10.00        20.00
     Storage Coeff.  (min)=       2.49 (ii)   15.18 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=       0.17         0.07
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.13         0.03          0.141 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      43.35        16.22          28.16
     TOTAL RAINFALL   (mm)=      44.35        44.35          44.35
     RUNOFF COEFFICIENT   =       0.98         0.37           0.63

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

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

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--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):     0.44   0.108     1.33    43.06
     + ID2= 2 (  0002):     1.19   0.141     1.33    28.16
       ================================================
       ID = 3 (  0003):     1.63   0.249     1.33    32.18

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0616     0.0310
                          0.0331     0.0104   |   0.0685     0.0379
                          0.0446     0.0172   |   0.0712     0.0438
                          0.0538     0.0241   |   0.0000     0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)      1.630     0.249      1.33      32.18
   OUTFLOW: ID= 1 (  0004)      1.630     0.052      1.83      32.14
```

```
                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 20.98
                TIME SHIFT OF PEAK FLOW         (min)= 30.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0231

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--------------------
| CALIB            |
| STANDHYD (  0005)|   Area    (ha)=   0.01
|ID= 1 DT=10.0 min |   Total Imp(%)=   1.00   Dir. Conn.(%)=   1.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.00         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=       9.31        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      89.88        19.21
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       0.64 (ii)   14.29 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=       0.17         0.07
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.000 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.50
     RUNOFF VOLUME    (mm)=      43.35        15.06          12.52
     TOTAL RAINFALL   (mm)=      44.35        44.35          44.35
     RUNOFF COEFFICIENT   =       0.98         0.34           0.28

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

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

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--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):     1.63   0.052     1.83    32.14
     + ID2= 2 (  0005):     0.01   0.000     1.50    12.52
       ================================================
       ID = 3 (  0013):     1.64   0.053     1.83    31.98

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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| CALIB            |
| STANDHYD (  0020)|   Area    (ha)=   0.01
|ID= 1 DT=10.0 min |   Total Imp(%)=   1.00   Dir. Conn.(%)=   1.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.00         0.01
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=       8.16        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      89.88        28.22
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       0.59 (ii)   12.30 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=       0.17         0.07
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.001 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.50
     RUNOFF VOLUME    (mm)=      43.35        20.95          17.32
     TOTAL RAINFALL   (mm)=      44.35        44.35          44.35
     RUNOFF COEFFICIENT   =       0.98         0.47           0.39

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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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\voin.dat
Output filename: C:\Users\Pignataro\AppData\Local\Civica\VH5\0622eba6-6932-4823-be44-9905272daa96\38ed7818-8679-4c5a-9bd0-623e77e8c754\sc
Summary filename: C:\Users\Pignataro\AppData\Local\Civica\VH5\0622eba6-6932-4823-be44-9905272daa96\38ed7818-8679-4c5a-9bd0-623e77e8c754\sc

DATE: 09-17-2025 TIME: 04:12:29

USER:

COMMENTS: _____

** SIMULATION : RUN3 - 10 Year - St Catharine **

| CHICAGO STORM | Ptotal= 49.77 mm |

IDF curve parameters: A= 724.000
B= 4.300
C= 0.739
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.86	1.00	24.81	2.00	8.40	3.00	4.52
0.17	4.36	1.17	101.38	2.17	7.26	3.17	4.22
0.33	5.07	1.33	31.86	2.33	6.43	3.33	3.97
0.50	6.10	1.50	17.79	2.50	5.79	3.50	3.75
0.67	7.82	1.67	12.71	2.67	5.28	3.67	3.56
0.83	11.37	1.83	10.06	2.83	4.86	3.83	3.39

| CALIB | STANDHYD (0001) | ID= 1 DT=10.0 min |

Area (ha)= 0.44
Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.44	0.00
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	54.16	40.00
Mannings n =	0.013	0.250
Max.Eff.Inten.(mm/hr)=	101.38	24.01
over (min)	10.00	20.00
Storage Coeff. (min)=	1.76 (ii)	14.25 (ii)
Unit Hyd. Tpeak (min)=	10.00	20.00
Unit Hyd. peak (cms)=	0.17	0.07

		TOTALS
PEAK FLOW (cms)=	0.12	0.00	0.122 (iii)
TIME TO PEAK (hrs)=	1.33	1.50	1.33
RUNOFF VOLUME (mm)=	48.77	18.51	48.46
TOTAL RAINFALL (mm)=	49.77	49.77	49.77
RUNOFF COEFFICIENT =	0.98	0.37	0.97

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

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

| CALIB | STANDHYD (0002) | ID= 1 DT=10.0 min |

Area (ha)= 1.19
Total Imp(%)= 49.00 Dir. Conn.(%)= 44.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.58	0.61
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	89.07	40.00
Mannings n =	0.013	0.250
Max.Eff.Inten.(mm/hr)=	101.38	28.62
over (min)	10.00	20.00
Storage Coeff. (min)=	2.37 (ii)	14.01 (ii)
Unit Hyd. Tpeak (min)=	10.00	20.00

```
     Unit Hyd. peak  (cms)=       0.17         0.07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.15         0.03          0.162 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      48.77        19.84          32.56
     TOTAL RAINFALL   (mm)=      49.77        49.77          49.77
     RUNOFF COEFFICIENT   =       0.98         0.40           0.65

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

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

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--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):     0.44   0.122     1.33    48.46
      + ID2= 2 (  0002):     1.19   0.162     1.33    32.56
        ================================================
        ID = 3 (  0003):     1.63   0.284     1.33    36.85

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0616     0.0310
                          0.0331     0.0104   |   0.0685     0.0379
                          0.0446     0.0172   |   0.0712     0.0438
                          0.0538     0.0241   |   0.0000     0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)      1.630      0.284      1.33      36.85
   OUTFLOW: ID= 1 (  0004)      1.630      0.057      1.83      36.81

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 20.03
                  TIME SHIFT OF PEAK FLOW         (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0269

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--------------------
| CALIB            |
| STANDHYD (  0005)|   Area    (ha)=   0.01
|ID= 1 DT=10.0 min |   Total Imp(%)=   1.00   Dir. Conn.(%)=   1.00
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.00         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=       9.31        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     101.38        24.01
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       0.61 (ii)   13.10 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=       0.17         0.07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.001 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.50
     RUNOFF VOLUME    (mm)=      48.77        18.51          17.00
     TOTAL RAINFALL   (mm)=      49.77        49.77          49.77
     RUNOFF COEFFICIENT   =       0.98         0.37           0.34

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

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

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--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.63   0.057     1.83    36.81
      + ID2= 2 (  0005):     0.01   0.001     1.50    17.00
        ================================================
        ID = 3 (  0013):     1.64   0.057     1.83    36.66

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------
------
--------------------
| CALIB            |
| STANDHYD (  0020)|   Area    (ha)=   0.01
|ID= 1 DT=10.0 min |   Total Imp(%)=   1.00   Dir. Conn.(%)=   1.00
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.00         0.01
```

```
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=       8.16        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     101.38        47.98
               over (min)       10.00        20.00
     Storage Coeff.  (min)=       0.56 (ii)   10.03 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=       0.17         0.08
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.001 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.50
     RUNOFF VOLUME    (mm)=      48.77        25.03          22.17
     TOTAL RAINFALL   (mm)=      49.77        49.77          49.77
     RUNOFF COEFFICIENT   =       0.98         0.50           0.45

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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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\voin.dat
  Output  filename: C:\Users\Pignataro\AppData\Local\Civica\VH5\0622eba6-
6932-4823-be44-9905272daa96\c3012cf7-17c9-4a94-8837-665322ac7b26\sc

  Summary filename: C:\Users\Pignataro\AppData\Local\Civica\VH5\0622eba6-
6932-4823-be44-9905272daa96\c3012cf7-17c9-4a94-8837-665322ac7b26\sc


DATE: 09-17-2025                          TIME: 04:12:29

USER:


COMMENTS: _____

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  ************************************************
  ** SIMULATION : RUN4 - 25 Year - St Catharine **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 821.000
| Ptotal= 57.74 mm |                          B=   4.000
--------------------                          C=   0.735
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME
RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs
mm/hr
                0.00    4.52 |  1.00   28.47 |  2.00    9.76 |  3.00
5.28
                0.17    5.11 |  1.17  118.02 |  2.17    8.45 |  3.17
4.94
                0.33    5.92 |  1.33   36.50 |  2.33    7.49 |  3.33
4.65
                0.50    7.12 |  1.50   20.47 |  2.50    6.75 |  3.50
4.40
                0.67    9.10 |  1.67   14.70 |  2.67    6.17 |  3.67
4.17
                0.83   13.16 |  1.83   11.66 |  2.83    5.69 |  3.83
3.97


--------------------------------------------------------------------------
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--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   0.44
|ID= 1 DT=10.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
```

```
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.44         0.00
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      54.16        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     118.02        43.59
                over (min)       10.00        20.00
     Storage Coeff.  (min)=       1.65 (ii)   11.49 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=       0.17         0.08
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.14         0.00          0.143 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      56.74        23.93          56.41
     TOTAL RAINFALL   (mm)=      57.74        57.74          57.74
     RUNOFF COEFFICIENT   =       0.98         0.41           0.98

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

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

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------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   1.19
|ID= 1 DT=10.0 min |   Total Imp(%)=  49.00   Dir. Conn.(%)=  44.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.58         0.61
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      89.07        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     118.02        51.92
                over (min)       10.00        20.00
     Storage Coeff.  (min)=       2.23 (ii)   11.40 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=       0.17         0.08
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.17         0.05          0.194 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      56.74        25.48          39.23
     TOTAL RAINFALL   (mm)=      57.74        57.74          57.74
     RUNOFF COEFFICIENT   =       0.98         0.44           0.68

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

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

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--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):     0.44   0.143    1.33    56.41
     + ID2= 2 (  0002):     1.19   0.194    1.33    39.23
       ================================================
       ID = 3 (  0003):     1.63   0.337    1.33    43.87

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------
------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0616      0.0310
                          0.0331     0.0104   |   0.0685      0.0379
                          0.0446     0.0172   |   0.0712      0.0438
                          0.0538     0.0241   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)      1.630      0.337      1.33      43.87
   OUTFLOW: ID= 1 (  0004)      1.630      0.064      1.83      43.83

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 18.90
                  TIME SHIFT OF PEAK FLOW         (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0332

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--------------------
| CALIB            |
| STANDHYD (  0005)|   Area    (ha)=   0.01
|ID= 1 DT=10.0 min |   Total Imp(%)=   1.00   Dir. Conn.(%)=   1.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.00         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=       9.31        40.00
     Mannings n           =      0.013        0.250
```

```
     Max.Eff.Inten.(mm/hr)=     118.02        43.59
               over (min)       10.00        20.00
     Storage Coeff.  (min)=      0.58 (ii)   10.41 (ii)
     Unit Hyd. Tpeak (min)=     10.00        20.00
     Unit Hyd. peak  (cms)=      0.17         0.08
                                                        *TOTALS*
     PEAK FLOW       (cms)=      0.00         0.00          0.001 (iii)
     TIME TO PEAK    (hrs)=      1.33         1.50           1.50
     RUNOFF VOLUME    (mm)=     56.74        23.93          23.68
     TOTAL RAINFALL   (mm)=     57.74        57.74          57.74
     RUNOFF COEFFICIENT   =      0.98         0.41           0.41

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

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

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--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.63   0.064     1.83    43.83
      + ID2= 2 (  0005):     0.01   0.001     1.50    23.68
        ==================================================
        ID = 3 (  0013):     1.64   0.064     1.83    43.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| CALIB            |
| STANDHYD (  0020)|   Area    (ha)=   0.01
|ID= 1 DT=10.0 min |   Total Imp(%)=   1.00   Dir. Conn.(%)=   1.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.00         0.01
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=       8.16        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     118.02        61.28
               over (min)       10.00        10.00
     Storage Coeff.  (min)=      0.53 (ii)    9.12 (ii)
     Unit Hyd. Tpeak (min)=     10.00        10.00
     Unit Hyd. peak  (cms)=      0.17         0.11
                                                        *TOTALS*
     PEAK FLOW       (cms)=      0.00         0.00          0.001 (iii)
     TIME TO PEAK    (hrs)=      1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=     56.74        31.30          30.17
     TOTAL RAINFALL   (mm)=     57.74        57.74          57.74
     RUNOFF COEFFICIENT   =      0.98         0.54           0.52

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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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 *****


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6.2\VO2\voin.dat
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6932-4823-be44-9905272daa96\3617ed5a-b42d-44fd-9d21-845b3f953ef8\sc
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6932-4823-be44-9905272daa96\3617ed5a-b42d-44fd-9d21-845b3f953ef8\sc


DATE: 09-17-2025                          TIME: 04:12:29

USER:
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COMMENTS: _____

**** SIMULATION : RUN5 - 50 Year - St Catharine ****

CHICAGO STORM	IDF curve parameters: A= 900.000
Ptotal= 63.69 mm	B= 3.800
	C= 0.734

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

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.99	1.00	31.17	2.00	10.74	3.00	5.83
0.17	5.64	1.17	131.09	2.17	9.31	3.17	5.46
0.33	6.53	1.33	39.93	2.33	8.26	3.33	5.13
0.50	7.84	1.50	22.44	2.50	7.45	3.50	4.85
0.67	10.01	1.67	16.13	2.67	6.80	3.67	4.61
0.83	14.46	1.83	12.81	2.83	6.27	3.83	4.39

CALIB	
STANDHYD (0001)	Area (ha)= 0.44
ID= 1 DT=10.0 min	Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.44	0.00
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	54.16	40.00
Mannings n	=	0.013	0.250
Max.Eff.Inten.(mm/hr)=		131.09	52.75
over (min)		10.00	20.00
Storage Coeff. (min)=		1.59 (ii)	10.70 (ii)
Unit Hyd. Tpeak (min)=		10.00	20.00
Unit Hyd. peak (cms)=		0.17	0.08

				TOTALS
PEAK FLOW	(cms)=	0.16	0.00	0.159 (iii)
TIME TO PEAK	(hrs)=	1.33	1.50	1.33
RUNOFF VOLUME	(mm)=	62.69	28.19	62.34
TOTAL RAINFALL	(mm)=	63.69	63.69	63.69
RUNOFF COEFFICIENT	=	0.98	0.44	0.98

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

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

CALIB	
STANDHYD (0002)	Area (ha)= 1.19
ID= 1 DT=10.0 min	Total Imp(%)= 49.00 Dir. Conn.(%)= 44.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.58	0.61
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	89.07	40.00
Mannings n	=	0.013	0.250
Max.Eff.Inten.(mm/hr)=		131.09	62.47
over (min)		10.00	20.00
Storage Coeff. (min)=		2.14 (ii)	10.66 (ii)
Unit Hyd. Tpeak (min)=		10.00	20.00
Unit Hyd. peak (cms)=		0.17	0.08

				TOTALS
PEAK FLOW	(cms)=	0.19	0.06	0.219 (iii)
TIME TO PEAK	(hrs)=	1.33	1.50	1.33
RUNOFF VOLUME	(mm)=	62.69	29.90	44.32
TOTAL RAINFALL	(mm)=	63.69	63.69	63.69
RUNOFF COEFFICIENT	=	0.98	0.47	0.70

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

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

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--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):     0.44   0.159     1.33    62.34
     + ID2= 2 (  0002):     1.19   0.219     1.33    44.32
       ================================================
       ID = 3 (  0003):     1.63   0.378     1.33    49.18

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0616      0.0310
                          0.0331     0.0104   |   0.0685      0.0379
                          0.0446     0.0172   |   0.0712      0.0438
                          0.0538     0.0241   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)      1.630     0.378      1.33      49.18
   OUTFLOW: ID= 1 (  0004)      1.630     0.068      1.83      49.14

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 18.10
                  TIME SHIFT OF PEAK FLOW         (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0381

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--------------------
| CALIB            |
| STANDHYD (  0005)|   Area    (ha)=   0.01
|ID= 1 DT=10.0 min |   Total Imp(%)=   1.00   Dir. Conn.(%)=   1.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.00         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=       9.31        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     131.09        52.75
               over (min)        10.00        10.00
     Storage Coeff.  (min)=       0.55 (ii)    9.67 (ii)
     Unit Hyd. Tpeak (min)=      10.00        10.00
     Unit Hyd. peak  (cms)=       0.17         0.11
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.001 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      62.69        28.19          28.24
     TOTAL RAINFALL   (mm)=      63.69        63.69          63.69
     RUNOFF COEFFICIENT   =       0.98         0.44           0.44

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

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

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--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):     1.63   0.068     1.83    49.14
     + ID2= 2 (  0005):     0.01   0.001     1.33    28.24
       ================================================
       ID = 3 (  0013):     1.64   0.069     1.83    48.98

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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------
--------------------
| CALIB            |
| STANDHYD (  0020)|   Area    (ha)=   0.01
|ID= 1 DT=10.0 min |   Total Imp(%)=   1.00   Dir. Conn.(%)=   1.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.00         0.01
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=       8.16        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     131.09        72.07
               over (min)        10.00        10.00
     Storage Coeff.  (min)=       0.51 (ii)    8.56 (ii)
     Unit Hyd. Tpeak (min)=      10.00        10.00
     Unit Hyd. peak  (cms)=       0.17         0.12
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.001 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      62.69        36.14          36.13
     TOTAL RAINFALL   (mm)=      63.69        63.69          63.69
     RUNOFF COEFFICIENT   =       0.98         0.57           0.57

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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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 *****

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6.2\VO2\voin.dat
  Output  filename: C:\Users\Pignataro\AppData\Local\Civica\VH5\0622eba6-
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6932-4823-be44-9905272daa96\3a40ecbe-3904-4825-bc23-243dc8879b58\sc

DATE: 09-17-2025                          TIME: 04:12:29

USER:


COMMENTS: _____

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  ***********************************************
  ** SIMULATION : RUN6 - 100 Year - St Catharin **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 980.000
| Ptotal= 70.14 mm |                          B=   3.700
--------------------                          C=   0.732
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME
RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs
mm/hr
                0.00    5.52 |  1.00   34.19 |  2.00   11.85 |  3.00
6.45
                0.17    6.24 |  1.17  144.26 |  2.17   10.28 |  3.17
6.04
                0.33    7.22 |  1.33   43.76 |  2.33    9.12 |  3.33
5.68
                0.50    8.67 |  1.50   24.65 |  2.50    8.23 |  3.50
5.37
                0.67   11.05 |  1.67   17.76 |  2.67    7.52 |  3.67
5.10
                0.83   15.93 |  1.83   14.12 |  2.83    6.94 |  3.83
4.86

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--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   0.44
|ID= 1 DT=10.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------

                                  IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.44          0.00
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      54.16         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     144.26         62.74
               over (min)        10.00         20.00
     Storage Coeff.  (min)=       1.53 (ii)    10.03 (ii)
     Unit Hyd. Tpeak (min)=      10.00         20.00
     Unit Hyd. peak  (cms)=       0.17          0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.17          0.00          0.175 (iii)
     TIME TO PEAK    (hrs)=       1.33          1.50           1.33
     RUNOFF VOLUME    (mm)=      69.14         32.98          68.77
     TOTAL RAINFALL   (mm)=      70.14         70.14          70.14
     RUNOFF COEFFICIENT   =       0.99          0.47           0.98
```

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

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

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--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   1.19
|ID= 1 DT=10.0 min |   Total Imp(%)=  49.00   Dir. Conn.(%)=  44.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.58         0.61
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      89.07        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     144.26        73.93
               over (min)       10.00        20.00
     Storage Coeff.  (min)=       2.06 (ii)   10.02 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=       0.17         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.21         0.07          0.246 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      69.14        34.85          49.93
     TOTAL RAINFALL   (mm)=      70.14        70.14          70.14
     RUNOFF COEFFICIENT   =       0.99         0.50           0.71

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

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

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--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):     0.44   0.175     1.33    68.77
     + ID2= 2 (  0002):     1.19   0.246     1.33    49.93
       ================================================
       ID = 3 (  0003):     1.63   0.420     1.33    55.02

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
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--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0616     0.0310
                          0.0331     0.0104   |   0.0685     0.0379
                          0.0446     0.0172   |   0.0712     0.0438
                          0.0538     0.0241   |   0.0000     0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)      1.630      0.420      1.33      55.02
   OUTFLOW: ID= 1 (  0004)      1.630      0.071      2.00      54.98

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 16.91
                  TIME SHIFT OF PEAK FLOW         (min)= 40.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0436

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--------------------
| CALIB            |
| STANDHYD (  0005)|   Area    (ha)=   0.01
|ID= 1 DT=10.0 min |   Total Imp(%)=   1.00   Dir. Conn.(%)=   1.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.00         0.01
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=       9.31        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     144.26        62.74
               over (min)       10.00        10.00
     Storage Coeff.  (min)=       0.53 (ii)    9.04 (ii)
     Unit Hyd. Tpeak (min)=      10.00        10.00
     Unit Hyd. peak  (cms)=       0.17         0.11
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.002 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      69.14        32.98          33.04
     TOTAL RAINFALL   (mm)=      70.14        70.14          70.14
     RUNOFF COEFFICIENT   =       0.99         0.47           0.47

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```

```
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.63   0.071     2.00    54.98
      + ID2= 2 (  0005):     0.01   0.002     1.33    33.04
        ================================================
        ID = 3 (  0013):     1.64   0.071     1.83    54.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| CALIB            |
| STANDHYD (  0020)|   Area    (ha)=   0.01
|ID= 1 DT=10.0 min |   Total Imp(%)=   1.00   Dir. Conn.(%)=   1.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.00         0.01
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=       8.16        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     144.26        83.58
                 over (min)       10.00        10.00
     Storage Coeff.  (min)=       0.49 (ii)    8.07 (ii)
     Unit Hyd. Tpeak (min)=      10.00        10.00
     Unit Hyd. peak  (cms)=       0.17         0.12
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.002 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      69.14        41.52          41.52
     TOTAL RAINFALL   (mm)=      70.14        70.14          70.14
     RUNOFF COEFFICIENT   =       0.99         0.59           0.59

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 FINISH
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STORM SEWER DESIGN SHEET

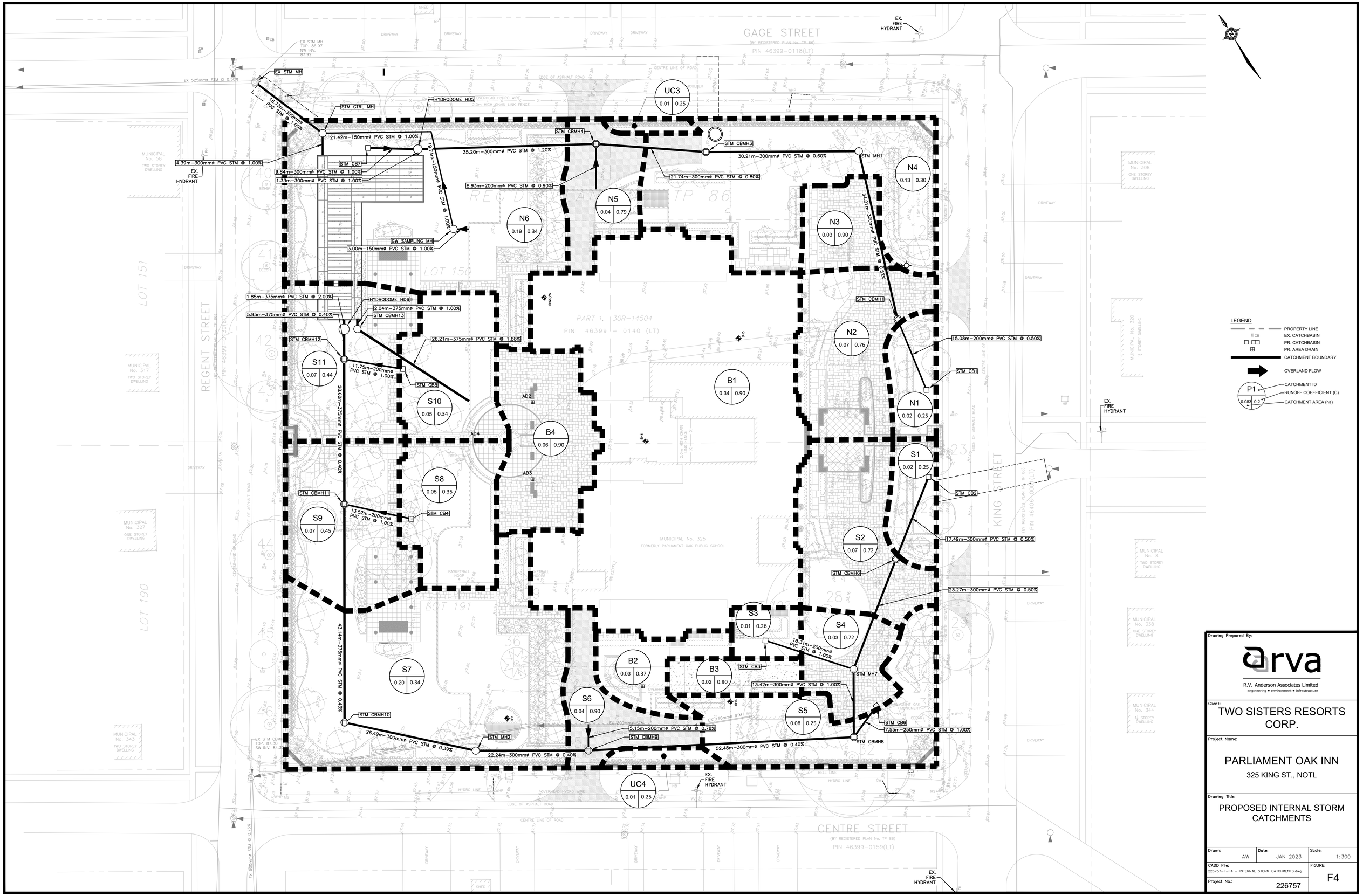
100 YEAR DESIGN STORM

Q = 2.78 x A x C x I	A =	980
I = A / (T + C)^B	C =	3.70
	B =	0.732

Project: 325 King St

STREET	AREA ID	MH		AREAS (ha)				TIME (min)			INTENSITY (mm/hr)	PEAK FLOW (L/s)	SEWER DATA									
		FROM	TO	Total Area	Weighted C	CA	ACCUM. CA	IN	THROUG H	OUT			NOMINAL DIAMETER (mm)	ACTUAL DIAMETER (mm)	SLOPE (%)	LENGTH (m)	TYPE OF PIPE	n	CAPACITY (L/s)	Full Velocity (m/s)	% Full	Spare Capacity %	Remaining Capacity (L/s)
SOUTH SITE																							
	S1	CB2	CBMH6	0.02	0.25	0.01	0.01	10.00	0.30	10.30	144.26	2.01	300	304.8	0.50	17.49	PVC	0.013	**71.33**	0.98	2.8%	97.2%	69.33
	S2	CBMH6	CBMH7	0.07	0.72	0.05	0.06	10.30	0.40	10.69	142.00	21.87	300	304.8	0.50	23.27	PVC	0.013	**71.33**	0.98	30.7%	69.3%	49.46
	S3	CB3	CBMH7	0.01	0.26	0.00	0.00	10.00	0.29	10.29	144.26	1.05	200	203.2	1.00	18.31	PVC	0.013	**34.22**	1.06	3.1%	96.9%	33.17
	S4	CBMH7	CBMH8	0.03	0.72	0.02	0.08	10.69	0.16	10.86	139.13	30.80	300	304.8	1.00	13.42	PVC	0.013	**100.88**	1.38	30.5%	69.5%	70.09
	S5	CBMH8	CBMH9	0.08	0.25	0.02	0.10	10.86	1.00	11.86	138.00	38.22	300	304.8	0.40	52.48	PVC	0.013	**63.80**	0.87	59.9%	40.1%	25.59
		CB6	CBMH8				0.10	11.86	0.10	11.96	131.44	36.40	250	254.0	1.00	7.55	PVC	0.013	**62.04**	1.22	58.7%	41.3%	25.64
	S6	CBMH9	STM MH2	0.04	0.90	0.04	0.14	11.86	0.42	12.28	131.44	49.56	300	304.8	0.40	22.24	PVC	0.013	**63.80**	0.87	77.7%	22.3%	14.25
		STM MH2	CBMH10	0.00	0.00	0.00	0.14	12.28	0.51	12.79	128.88	48.59	300	304.8	0.39	26.49	PVC	0.013	**63.00**	0.86	77.1%	22.9%	14.41
	S7	CBMH10	CBMH11	0.20	0.34	0.07	0.20	12.79	0.68	13.48	125.94	71.29	375	381.0	0.43	43.14	PVC	0.013	**119.94**	1.05	59.4%	40.6%	48.65
	S8	CB4	CBMH11	0.05	0.35	0.02	0.02	10.00	0.21	10.21	144.26	7.02	200	203.2	1.00	13.52	PVC	0.013	**34.22**	1.06	20.5%	79.5%	27.20
	S9	CBMH11	CBMH12	0.07	0.45	0.03	0.18	12.79	0.47	13.26	125.94	64.64	375	381.0	0.40	28.62	PVC	0.013	**115.68**	1.01	55.9%	44.1%	51.04
	S10	CB5	CBMH12	0.05	0.34	0.02	0.02	10.00	0.19	10.19	144.26	6.82	200	203.2	1.00	11.75	PVC	0.013	**34.22**	1.06	19.9%	80.1%	27.40
	S11	CBMH12	HD6	0.07	0.44	0.03	0.23	13.26	0.10	13.36	123.38	79.72	375	381.0	0.40	5.95	PVC	0.013	**115.68**	1.01	68.9%	31.1%	35.96
		HD6	TANK				0.23	13.36	0.01	13.37	122.86	79.38	375	381.0	2.00	1.85	PVC	0.013	**258.68**	2.27	30.7%	69.3%	179.29
NORTH SITE																							
	N1	CB1	CBMH1	0.02	0.25	0.01	0.01	10.00	0.34	10.34	144.26	2.01	200	203.2	0.50	15.08	PVC	0.013	**24.19**	0.75	8.3%	91.7%	22.19
	N2	CBMH1	STM MH1	0.07	0.76	0.05	0.06	10.34	0.57	10.91	141.72	22.93	300	304.8	0.52	34.07	PVC	0.013	**72.75**	1.00	31.5%	68.5%	49.82
	N3			0.03	0.90	0.03	0.03																
		STM MH1	CBMH3				0.06	10.91	0.47	11.38	137.65	22.27	300	304.8	0.60	30.21	PVC	0.013	**78.14**	1.07	28.5%	71.5%	55.87
	N3+N4	CBMH3	CBMH4	0.13	0.30	0.04	0.12	11.38	0.29	11.67	134.50	46.44	300	304.8	0.80	21.74	PVC	0.013	**90.23**	1.24	51.5%	48.5%	43.79
	N5	CBMH4	HD5	0.04	0.79	0.03	0.16	11.67	0.10	11.77	132.61	57.44	300	304.8	1.20	8.93	PVC	0.013	**110.51**	1.51	52.0%	48.0%	53.07
	N6	CB7	HD5	0.19	0.34	0.06	0.06	10.00	0.12	10.12	144.26	25.91	300	304.8	1.00	9.84	PVC	0.013	**100.88**	1.38	25.7%	74.3%	74.97
		HD5	Tank				0.22	11.77	0.12	11.89	132.00	80.88	300	304.8	1.00	9.84	PVC	0.013	**100.88**	1.38	80.2%	19.8%	20.01
		BLDG	GW SAMPLING MH					10.00	0.06	10.06	144.26	*0.75	150	152.4	1.00	3.00	PVC	0.013	**15.89**	0.87	4.7%	95.3%	15.14
		GW SAMPLING MH	STM CTRL MH					10.06	0.79	10.85	143.82	*0.75	150	152.4	1.00	41.16	PVC	0.013	**15.89**	0.87	4.7%	95.3%	15.14
		TANK	STM CTRL MH									*71.00	300	304.8	1.00	4.39	PVC	0.013	**100.88**	1.38	70.4%	29.6%	29.88
		STM CTRL MH	EX STM MH									*71.75	300	304.8	1.00	16.73	PVC	0.013	**100.88**	1.38	71.1%	28.9%	29.13
FROM BLDG																							
	B1			0.34	0.90	0.31																	
	B2			0.03	0.25	0.01																	
	B3+B4			0.08	0.90	0.07																	
	B4	BLDG	TANK	0.45	0.86	0.39	0.39	10.00	0.03	10.03	144.26	154.60	375	381.0	1.88	4.00	PVC	0.013	**250.79**	2.20	61.6%	38.4%	96.19

CALCULATED BY: SO DATE: 9/19/2025
CHECKED BY: AW DATE: 9/19/2025



Drawing Prepared By:

arva

R.V. Anderson Associates Limited
engineering ● environment ● infrastructure

Client:
TWO SISTERS RESORTS CORP.

Project Name:
PARLIAMENT OAK INN
325 KING ST., NOTL

Drawing Title:
PROPOSED INTERNAL STORM CATCHMENTS

Drawn:	Date:	Scale:
AW	JAN 2023	1:300
CADD File: 226757-F-F4 – INTERNAL STORM CATCHMENTS.dwg		FIGURE: F4
Project No.: 226757		

R:\2022\226757 – Two Sisters Resorts–325 King St. NOTL\10 CADdwg\01 Linear\06 FIGURES

StormTrap®

MODULAR CONCRETE
STORMWATER MANAGEMENT

SHEET INDEX

STORMTRAP CONTACT INFORMATION

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CONTACT NAME: Jonathan Donaldson
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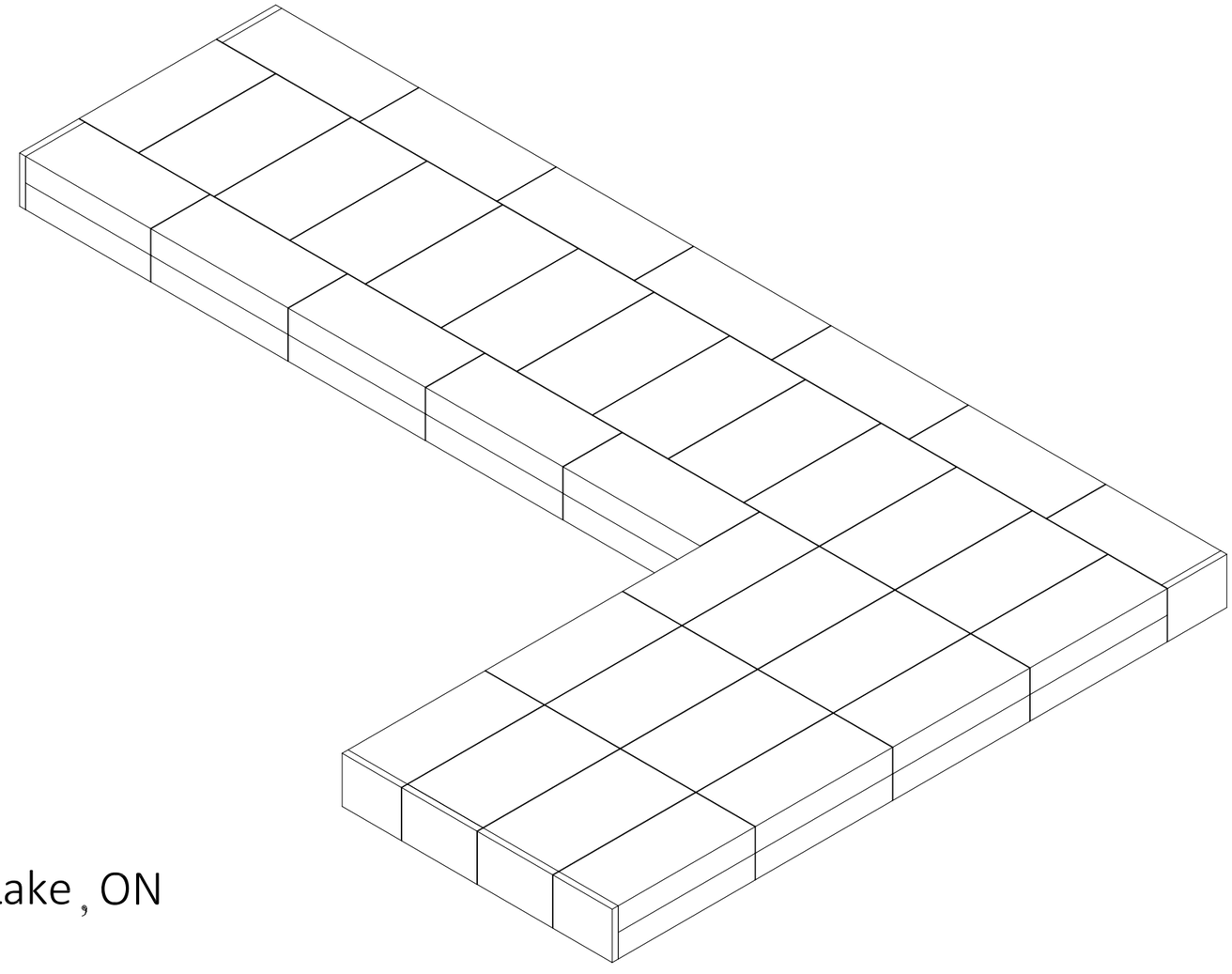

325 King
Niagara on the Lake, ON

StormTrap®
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PROJECT INFORMATION:

325 King

Niagara on the Lake, ON

CURRENT ISSUE DATE:

09/02/2025

ISSUED FOR:

PRELIMINARY

REV.	DATE:	ISSUED FOR:	DWN BY:
1	09/02/2025	PRELIMINARY	LR

SCALE:

NTS

SHEET TITLE:

COVER SHEET

SHEET NUMBER:

0.0

GENERAL NOTES:

1. STRUCTURE PROXIMITY LOADING DISCLAIMER:

   STORMTRAP MODULES AND FOUNDATION ARE NOT DESIGNED TO ACCEPT ANY ADDITIONAL LOADING FROM ANY NEARBY STRUCTURES NEXT TO OR OVER THE TOP OF STORMTRAP. EXAMPLES OF NEARBY STRUCTURES MAY INCLUDE BUT ARE NOT LIMITED TO BUILDINGS, FOUNDATION ELEMENTS, RETAINING WALLS, LIGHT POLES, BOLLARDS, SIGNPOSTS, FENCES. ADDITIONALLY, STORMTRAP IS NOT RESPONSIBLE FOR INSTALLATION CONFLICTS ARISING FROM ANY OF THESE NEARBY STRUCTURES. IF ADDITIONAL LOADING CONSIDERATIONS ARE REQUIRED FOR STRUCTURAL DESIGN OF STORMTRAP, PLEASE CONTACT STORMTRAP IMMEDIATELY. FOR LIGHT POLES SHOWN OVER THE TOP OF THE SYSTEM, STORMTRAP WILL PROVIDE A 1.524m LATERAL DISTANCE CAVITY AROUND THE LIGHT POLE TO ACCOMMODATE IT. THE EOR TO TAKE RESPONSIBILITY FOR ENSURING THE LIGHT POLE IS NOT INFLICTING ANY LOADING ON THE STORMTRAP MODULES AND FOUNDATION.

2. TREE LOADING DISCLAIMER:

   THE NUMBER OF TREES OR WEIGHT OF TOTAL PLANT MATERIAL PRESENT ON TOP OF A SINGLE STORMTRAP MODULE SHALL NOT EXCEED 16,000 LBS. THE REQUIREMENTS LISTED HERE APPLY AT BOTH THE TIME OF INSTALLATION AND FOR THE LIFE OF THE TREES AND PLANTS IN QUESTION. THE EOR AND LANDSCAPE ARCHITECT ARE RESPONSIBLE FOR ENSURING THAT TREE AND OTHER PLANT ROOTS DO NOT INTERFERE WITH OR COMPROMISE THE FUNCTIONAL AND STRUCTURAL INTEGRITY OF STORMTRAP'S UNDERGROUND MODULES. APPROPRIATE MEASURES SHOULD BE TAKEN TO PREVENT ROOT GROWTH INTO THE STORMTRAP SYSTEM FROM ADJACENT OR OVERHEAD TREES. FURTHERMORE, THE ROOTS OF THE TREES MUST BE CONTAINED TO PREVENT FUTURE DAMAGE TO THE STORMTRAP SYSTEM. STORMTRAP ACCEPTS NO LIABILITY FOR DAMAGES CAUSED BY TREES OR OTHER VEGETATION PLACED AROUND OR ON TOP OF THE SYSTEM.

3. PRE-TREATMENT/SEDIMENT/FILTER CHAMBER DISCLAIMER:

   FOR SYSTEMS CONTAINING PRE-TREATMENT, SEDIMENTATION AND/OR FILTER CHAMBERS; IF REQUIRED TO BE SEALED TO PREVENT SAND AND/OR PRE-TREATED WATER FROM MIGRATING INTO ADJOINING MODULES, IT IS THE SOLE RESPONSIBILITY OF THE INSTALLING CONTRACTOR TO ENSURE THAT THOSE MODULES ARE SEALED.

4. OUTLET CONTROL STRUCTURE DISCLAIMER (IF SHOWN ON THESE PLANS):

   IF A WATERTIGHT SOLUTION IS REQUIRED FOR AN OUTLET CONTROL STRUCTURE, ALL EXTERIOR COLD JOINTS, INCLUDING JOINT BETWEEN TOP AND BASE MODULES, BETWEEN TOP AND BASE OF ADJOINING SYMONS WALLS, AND JOINTS BETWEEN MODULE AND ADJACENT END PANELS WILL BE THE SOLE RESPONSIBILITY OF THE INSTALLING CONTRACTOR TO PROVIDE AND INSTALL THE WATERTIGHT APPLICATION PER THE EOR'S SPECIFICATION.

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SCALE:

NTS

SHEET TITLE:

GENERAL NOTES

SHEET NUMBER:

1.0

STRUCTURAL DESIGN LOADING CRITERIA

LIVE LOADING: AASHTO HS-20 HIGHWAY LOADING

ADDITIONAL SURCHARGE LOADING: PER ASTM C857 (3.83kPa)

GROUND WATER TABLE: @ 86.40m

SOIL BEARING PRESSURE: 150 kPa

SOIL DENSITY: 19 kN/m³

EQUIVALENT UNSATURATED LATERAL ACTIVE EARTH PRESSURE: 5.5 kPa/m

EQUIVALENT SATURATED LATERAL ACTIVE EARTH PRESSURE: 12.57 kPa/m

APPLICABLE CODES: ASTM C857, ASTM C858-19, ACI-318, FOR CLEAR COVERS: CSA A23

BACKFILL TYPE: SEE SHEET 4.0 FOR BACKFILL OPTIONS

STORMTRAP SYSTEM INFORMATION

UNIT HEADROOM: 1.270m DOUBLETRAP

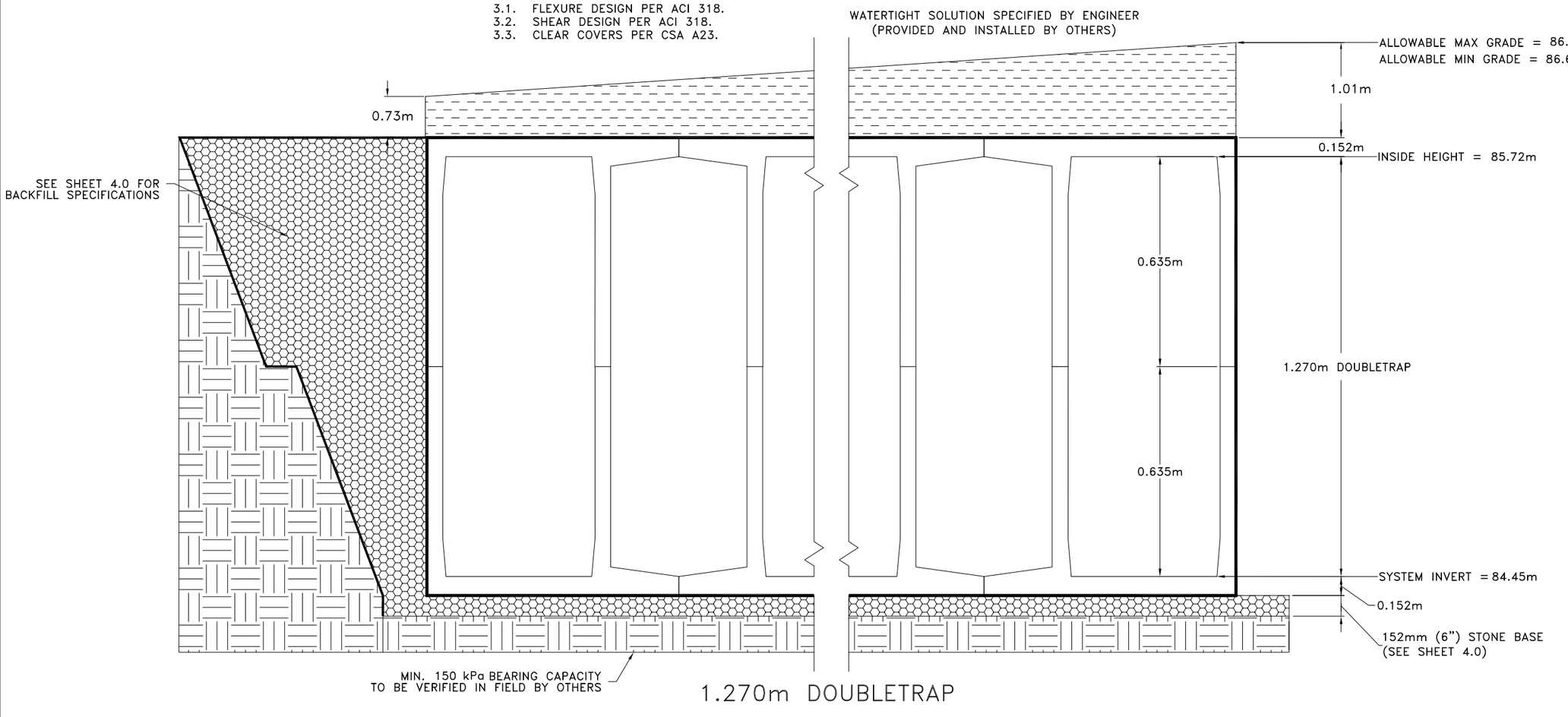
TOTAL STORAGE PROV: 438.04 CUBIC METERS

DESIGN ASSUMPTIONS

1. ASTM C858-19:
   - 1.1. THE ELASTIC METHOD OF STRUCTURAL DESIGN OR THE STRENGTH DESIGN METHOD FOR REINFORCED CONCRETE OUTLINED IN ACI 318 SHALL BE USED TO DESIGN THE CONCRETE SECTIONS. LOAD COMBINATION FACTORS LISTED BELOW.
     - 1.1.1. DEAD: 1.4
     - 1.1.2. DEAD + LIVE: 1.2 + 1.6
     - 1.1.3. SOIL PRESSURE: 1.6
     - 1.1.4. SOIL SURCHARGE: 1.6

2. ASTM C857:
   - 2.1. LIVE LOAD: PER ASTM C858/C857
     - 2.1.1. AASHTO HS-20 – (71 kN) WHEEL LOAD.
     - 2.1.2. IMPACT LOADING PER ASTM C857 SECTION 4.1.2.2, APPLIED TO ALL LIVE LOAD OPTIONS LISTED ABOVE.
       - 2.1.2.1. 0.152m TO 0.305m COVER RANGE: 30% INCREASE
       - 2.1.2.2. ABOVE 0.306m TO 0.610m COVER RANGE: 20% INCREASE
       - 2.1.2.3. ABOVE 0.611m TO 0.889m COVER RANGE: 10% INCREASE
       - 2.1.2.4. ABOVE 0.890m ONWARDS: NOT APPLIED
   - 2.2. DISTRIBUTION OF WHEEL LOADS THROUGH EARTH FILLS: WHEEL LOADS AT GROUND OR SURFACE SHALL BE DISTRIBUTED USING A WHEEL LOAD AREA REPRESENTED IN FIGURE 2 AND DETAILED IN SECTION 4.1.4 OF ASTM C 857. THE WHEEL LOAD DISTRIBUTION CONSIDERATION IS IRRESPECTIVE OF THE THICKNESS OF SOIL COVER AND IS APPLIED TO ALL SOIL COVER RANGES FROM 0.152m UP TO 3.05m.
   - 2.3. EXTERIOR WALLS SURCHARGE LOADS: EXTERIOR WALLS SURCHARGE LOADS SHALL COMPLY WITH ASTM C 857 SECTION 4.2.1 FOR SURCHARGE PRESSURES, WHICH STATES THAT SURCHARGE PRESSURE SHALL BE NO LESS THAN 0.5% OF THE WHEEL LOAD. IN ADDITION TO THIS THE SURCHARGE PRESSURE CAN BE NEGLECTED WHEN THE DEPTH OF THE SOIL EXCEEDS 2.44m.

3. OTHER STANDARDS:
   - 3.1. FLEXURE DESIGN PER ACI 318.
   - 3.2. SHEAR DESIGN PER ACI 318.
   - 3.3. CLEAR COVERS PER CSA A23.



SITE SPECIFIC DESIGN CRITERIA

1. STORMTRAP UNITS SHALL BE MANUFACTURED AND INSTALLED ACCORDING TO SHOP DRAWINGS APPROVED BY THE INSTALLING CONTRACTOR AND ENGINEER OF RECORD. THE SHOP DRAWINGS SHALL INDICATE SIZE AND LOCATION OF ROOF OPENINGS AND INLET/ OUTLET PIPE TYPES, SIZES, INVERT ELEVATIONS AND SIZE OF OPENINGS.
2. COVER RANGE: MIN. 0.73m MAX. 1.01m CONSULT STORMTRAP FOR ADDITIONAL COVER OPTIONS.
3. ALL DIMENSIONS AND SOIL CONDITIONS, INCLUDING BUT NOT LIMITED TO GROUNDWATER AND SOIL BEARING CAPACITY ARE REQUIRED TO BE VERIFIED IN THE FIELD BY OTHERS PRIOR TO STORMTRAP INSTALLATION.
4. FOR STRUCTURAL CALCULATIONS THE GROUND WATER TABLE IS ASSUMED TO BE @ 86.40m. IF WATER TABLE IS DIFFERENT THAN ASSUMED, CONTACT STORMTRAP.
5. SYSTEM DESIGN INTENT IS TO CONTAIN WATER AND / OR PREVENT GROUNDWATER MIGRATION INTO THE SYSTEM AND WILL NOT BE SUBJECT TO LEAKAGE TESTING. A THIRD PARTY WATER PROOFING SOLUTION IS REQUIRED FOR SEALING OF SYSTEM / MODULE JOINTS AND SEAMS. SOLUTION TO BE PROVIDED AND INSTALLED BY CONTRACTOR IN ACCORDANCE WITH THIRD PARTY WATER-PROOFING SUPPLIER'S PRODUCT SPECIFICATIONS.

StormTrap

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ENGINEER INFORMATION:

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2001 Sheppard Ave East
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416-497-8600

PROJECT INFORMATION:

325 King

Niagara on the Lake, ON

CURRENT ISSUE DATE:

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SCALE:

NTS

SHEET TITLE:

DOUBLETRAP DESIGN CRITERIA

SHEET NUMBER:

1.1

BILL OF MATERIALS

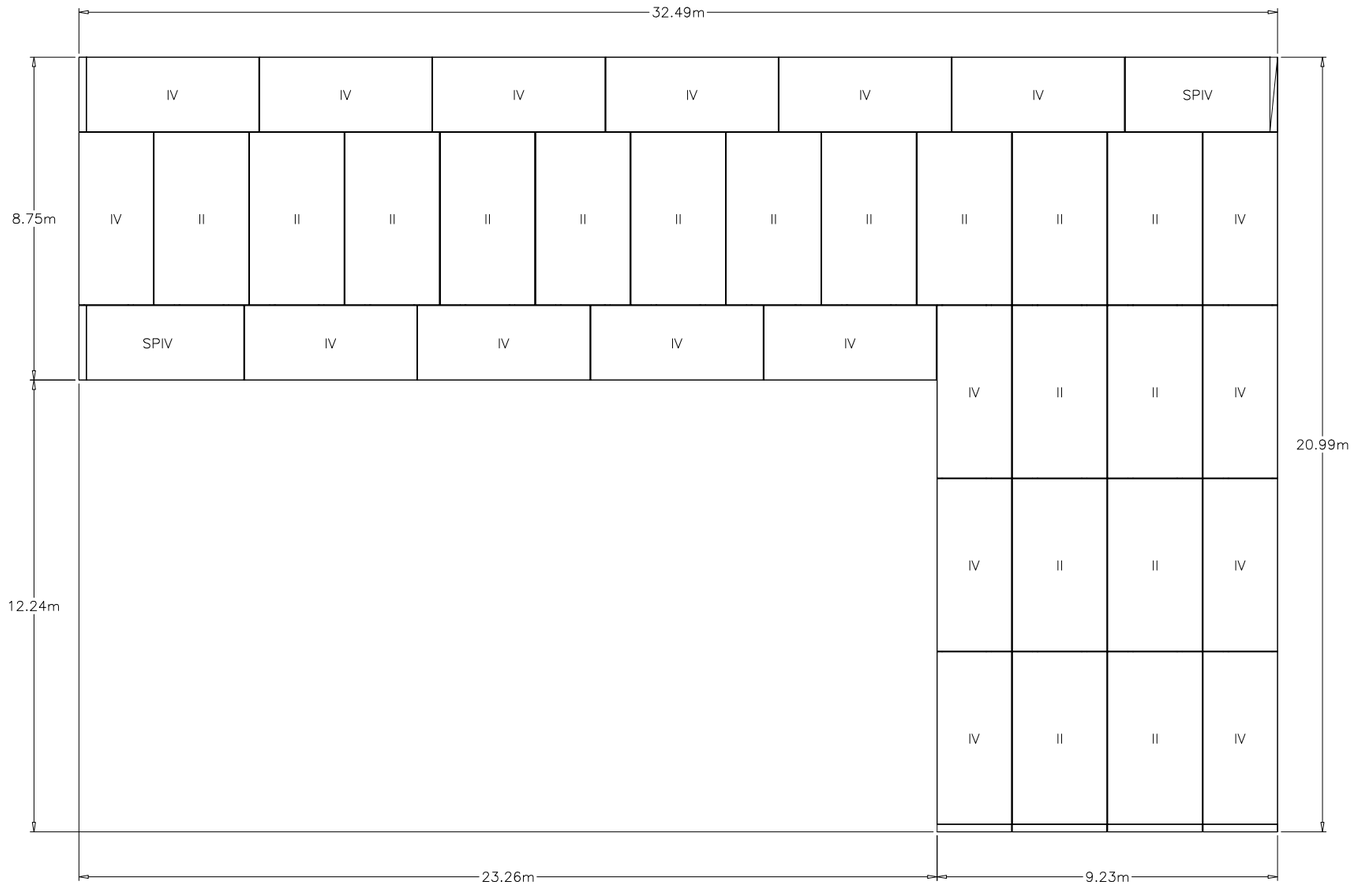
QTY.	UNIT TYPE	DESCRIPTION	TOP WEIGHT	BASE WEIGHT
0	I	1.270m DOUBLETRAP	–	–
34	II	1.270m DOUBLETRAP	6263	6263
0	III	1.270m DOUBLETRAP	–	–
36	IV	1.270m DOUBLETRAP	5339	5339
0	VII	1.270m DOUBLETRAP	–	–
0	VII–1	1.270m DOUBLETRAP	–	–
0	VII–2	1.270m DOUBLETRAP	–	–
0	VII–3	1.270m DOUBLETRAP	–	–
0	VII–4	1.270m DOUBLETRAP	–	–
0	SPIII	1.270m DOUBLETRAP	VARIES	VARIES
4	SPIV	1.270m DOUBLETRAP	VARIES	VARIES
2	T2 PANEL	203mm THICK PANEL	1973	
5	T4 PANEL	203mm THICK PANEL	1552	
0	T7 PANEL	203mm THICK PANEL	–	
19	JOINT WRAP	18.29m PER ROLL		
48	JOINT TAPE	4.42m PER ROLL		
4	GALLON(S)	PRIMER FOR JOINT WRAP		
TOTAL PIECES = 74				
TOTAL PANELS = 7				
HEAVIEST PICK WEIGHT = 6,263				

DESIGN CRITERIA

ALLOWABLE MAX GRADE = 86.88m
ALLOWABLE MIN GRADE = 86.60m
INSIDE HEIGHT ELEVATION = 85.72m
SYSTEM INVERT = 84.45m

NOTES:

1. DIMENSIONING OF STORMTRAP SYSTEM SHOWN BELOW ALLOW FOR A 19mm (3/4") GAP BETWEEN EACH MODULE.
2. ALL DIMENSIONS TO BE VERIFIED IN THE FIELD BY OTHERS.
3. SEE SHEET 3.0 FOR INSTALLATION SPECIFICATIONS.
4. SP – INDICATES A MODULE WITH MODIFICATIONS.
5. P – INDICATES A MODULE WITH A PANEL ATTACHMENT.
6. CONTRACTORS RESPONSIBILITY TO ENSURE CONSISTENCY/ACCURACY TO FINAL ENGINEER OF RECORD PLAN SET.
7. IN ORDER FOR STORMTRAP TO GENERATE APPROVAL DRAWINGS, CIVIL ENGINEERING DRAWINGS MUST BE PROVIDED TO STORMTRAP AND SHALL INCLUDE ALL PIPE SIZES, PIPE MATERIAL, PIPE INVERT ELEVATIONS, ACCESS OPENING SIZE AND SHAPE. IN ADDITION, FINAL GRADING PLANS SHALL ALSO INCLUDE MINIMUM AND MAXIMUM GRADES OVER THE TOP OF THE STORMTRAP SYSTEM.



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DOUBLETRAP
SYSTEM LAYOUT

SHEET NUMBER:

2.0

STORMTRAP INSTALLATION SPECIFICATION

1. STORMTRAP SHALL BE INSTALLED IN ACCORDANCE WITH ASTM C891 (STANDARD PRACTICE FOR INSTALLATION OF UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES). THE FOLLOWING ADDITIONS AND/OR EXCEPTIONS ARE PROVIDED FOR EMPHASIS. THE MENTION OF THESE ITEMS DOES NOT PRECLUDE THE INSTALLING CONTRACTOR FROM FOLLOWING ASTM C891 IN ITS ENTIRETY AND IMPLEMENTING ALL APPROPRIATE MEASURES. THE INSTALLING CONTRACTOR OWNS AND IS RESPONSIBLE FOR THE STORMTRAP SYSTEM UPON REMOVAL OF THE MODULES FROM THE DELIVERY TRUCK THROUGH 'FINAL CONSTRUCTION'. FINAL CONSTRUCTION IS ACHIEVED WHEN ALL MODULES ARE SET, FULLY BACKFILLED, AND WHEN FINAL FINISHED GRADES ARE REACHED. THE CONTRACTOR IS RESPONSIBLE FOR ANY COUNTERMEASURES NECESSARY TO RESIST UPLIFT/BUOYANCY BEFORE 'FINAL CONSTRUCTION' IS ACHIEVED.

2. IT IS THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR TO ENSURE THAT PROPER/ADEQUATE EQUIPMENT IS USED TO SET/INSTALL THE MODULES.

3. STORMTRAP MODULES SHALL BE PLACED ON A LEVEL, 152mm (6") FOUNDATION OF 76mm ($\frac{3}{4}$") AGGREGATE EXTENDING 610mm (2'-0") PAST THE OUTSIDE OF THE SYSTEM (SEE DETAIL 1) AND SHALL BE PLACED ON PROPERLY COMPACTED SOILS (SEE SHEET 1.1 FOR SOIL BEARING CAPACITY REQUIREMENTS), AND IN ACCORDANCE WITH ASTM C891 STANDARD PRACTICE FOR INSTALLATION OF UNDERGROUND PRECAST UTILITY STRUCTURES.

4. THE STORMTRAP MODULES SHALL BE PLACED SUCH THAT THE MAXIMUM SPACE BETWEEN ADJACENT MODULES DOES NOT EXCEED 19mm ($\frac{3}{4}$") (SEE DETAIL 2). IF THE SPACE EXCEEDS 19mm ($\frac{3}{4}$"), THE MODULES SHALL BE RESET WITH APPROPRIATE ADJUSTMENT MADE TO LINE AND GRADE TO BRING THE SPACE INTO SPECIFICATION.

5. STORMTRAP MODULES ARE NOT WATERTIGHT. WATERTIGHT SOLUTION SPECIFIED BY ENGINEER (PROVIDED AND INSTALLED BY OTHERS).

6. THE HORIZONTAL JOINT BETWEEN THE TOP AND BASE LEG CONNECTIONS OF ALL PERIMETER STORMTRAP MODULES SHALL BE SEALED WITH PREFORMED MASTIC JOINT TAPE ACCORDING TO ASTM C891, 8.8 AND 8.12. (SEE DETAIL 3). THE MASTIC JOINT TAPE DOES NOT PROVIDE A WATERTIGHT SEAL.

7. ALL EXTERIOR ROOF AND EXTERIOR VERTICAL WALL JOINTS BETWEEN ADJACENT STORMTRAP MODULES SHALL BE SEALED WITH 203mm (8") WIDE PRE-FORMED, COLD-APPLIED, SELF-ADHERING ELASTOMERIC RESIN, BONDED TO A WOVEN , HIGHLY PUNCTURE RESISTANT POLYMER WRAP, CONFORMING TO ASTM C891 AND SHALL BE INTEGRATED WITH PRIMER SEALANT AS APPROVED BY STORMTRAP (SEE DETAILS 2, 4, & 5). THE JOINT WRAP DOES NOT PROVIDE A WATERTIGHT SEAL. THE SOLE PURPOSE OF THE JOINT WRAP IS TO PROVIDE A SILT AND SOIL TIGHT SYSTEM. THE ADHESIVE EXTERIOR JOINT WRAP SHALL BE INSTALLED ACCORDING TO THE FOLLOWING INSTALLATION INSTRUCTIONS:

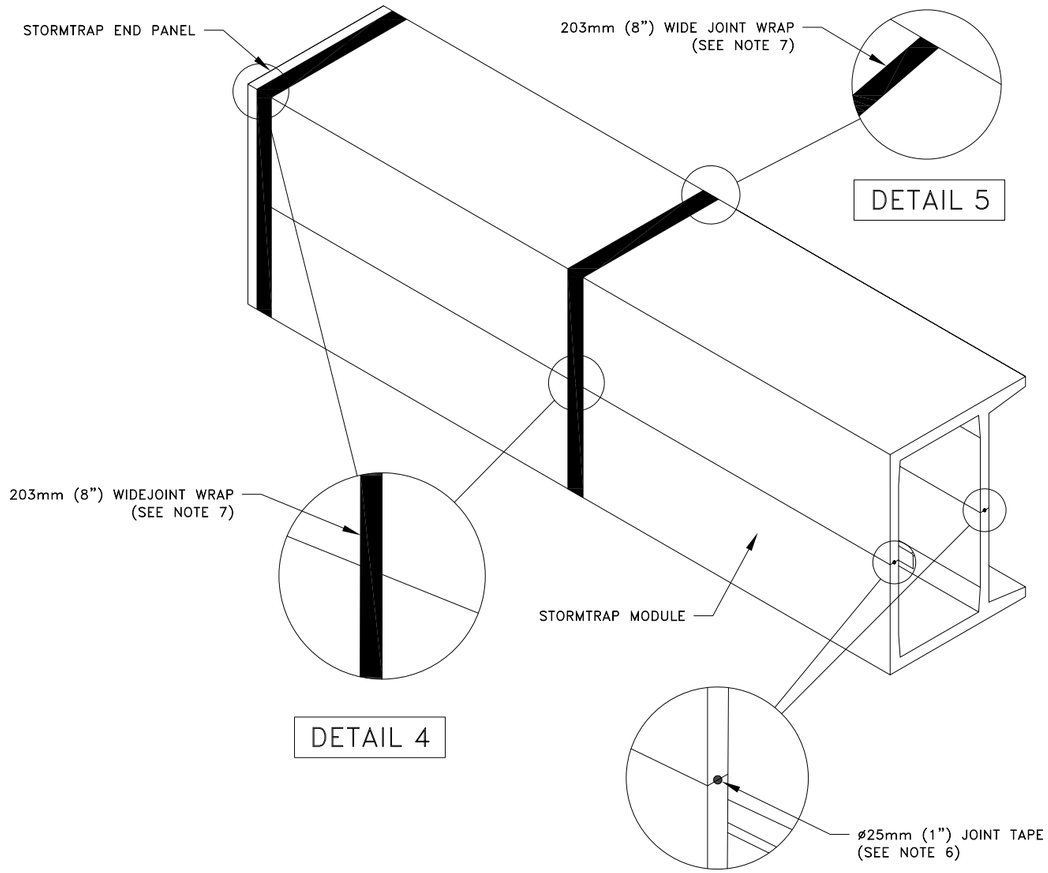
   7.1. USE A BRUSH OR WET CLOTH TO THOROUGHLY CLEAN THE OUTSIDE SURFACE AT THE POINT WHERE JOINT WRAP IS TO BE APPLIED.

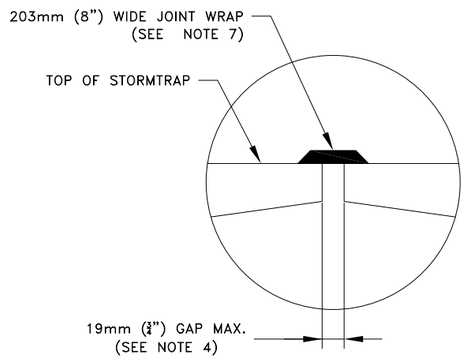
   7.2. A RELEASE PAPER PROTECTS THE ADHESIVE SIDE OF THE JOINT WRAP. PLACE THE ADHESIVE TAPE (ADHESIVE SIDE DOWN) AROUND THE STRUCTURE, REMOVING THE RELEASE PAPER AS YOU GO. PRESS THE JOINT WRAP FIRMLY AGAINST THE STORMTRAP MODULE SURFACE WHEN APPLYING.

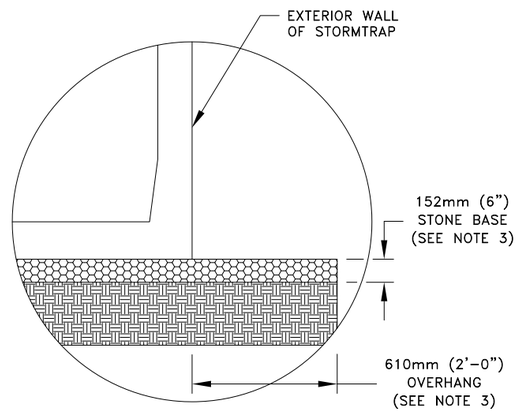
8. IF THE CONTRACTOR NEEDS TO CANCEL ANY SHIPMENTS, THEY MUST DO SO 48 HOURS PRIOR TO THEIR SCHEDULED ARRIVAL AT THE JOB SITE. IF CANCELED AFTER THAT TIME, PLEASE CONTACT THE PROJECT MANAGER.

9. IF THE STORMTRAP MODULE(S) IS DAMAGED IN ANY WAY PRIOR, DURING, OR AFTER INSTALL, STORMTRAP MUST BE CONTACTED IMMEDIATELY TO ASSESS THE DAMAGE AND TO DETERMINE WHETHER OR NOT THE MODULE(S) WILL NEED TO BE REPLACED. IF ANY MODULE ARRIVES AT THE JOBSITE DAMAGED DO NOT UNLOAD IT; CONTACT STORMTRAP IMMEDIATELY. ANY DAMAGE NOT REPORTED BEFORE THE TRUCK IS UNLOADED WILL BE THE CONTRACTOR'S RESPONSIBILITY.

10. STORMTRAP MODULES CANNOT BE ALTERED IN ANY WAY AFTER MANUFACTURING WITHOUT WRITTEN CONSENT FROM STORMTRAP.







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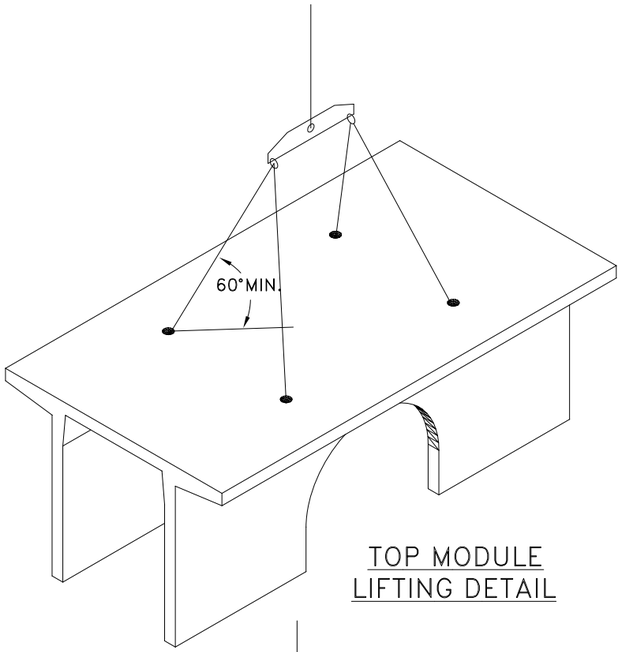
DOUBLETRAP
INSTALLATION
SPECIFICATION

SHEET NUMBER:

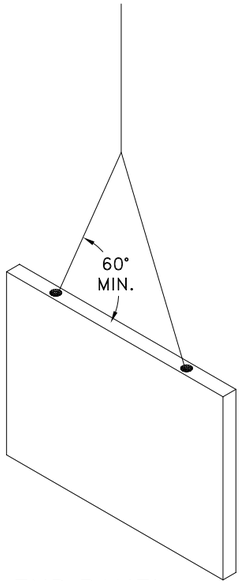
3.0

STORMTRAP MODULE LIFTING SPECIFICATION

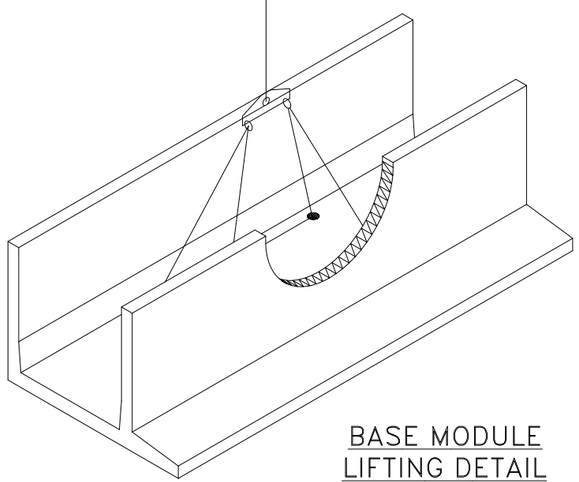
1. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT ALL (4) CHAINS/CABLES ARE SECURED PROPERLY TO THE LIFTING ANCHORS AND IN EQUAL TENSION WHEN LIFTING THE STORMTRAP MODULE.
2. MINIMUM 2134mm (7'FT) CHAIN/CABLE LENGTH TO BE USED TO LIFT STORMTRAP MODULES (SUPPLIED BY CONTRACTOR).
3. CONTRACTOR TO ENSURE MINIMUM LIFTING ANGLE IS 60° FROM TOP SURFACE OF STORMTRAP MODULE. SEE DETAIL.
4. IT IS UNDERSTOOD AND AGREED THAT AT ALL TIMES DURING WHICH HOISTING AND RIGGING EQUIPMENT IS BEING SUPPLIED TO THE PURCHASER, OPERATOR OF SUCH EQUIPMENT SHALL BE IN CHARGE OF HIS ENTIRE EQUIPMENT AND SHALL AT ALL TIMES BE THE JUDGE OF THE SAFETY AND PROPERTY OF ANY SUGGESTION TO HIM FROM THE SELLER, ITS AGENTS OR EMPLOYEES. PURCHASER AGREES TO SAVE, INDEMNIFY AND HOLD HARMLESS SELLER FROM ALL LOSS, CLAIMS, DEMANDS OR CAUSES OF ACTION, WHICH MAY ARISE FROM THE EXISTENCE OR OPERATION OF SAID EQUIPMENT.



TOP MODULE
LIFTING DETAIL



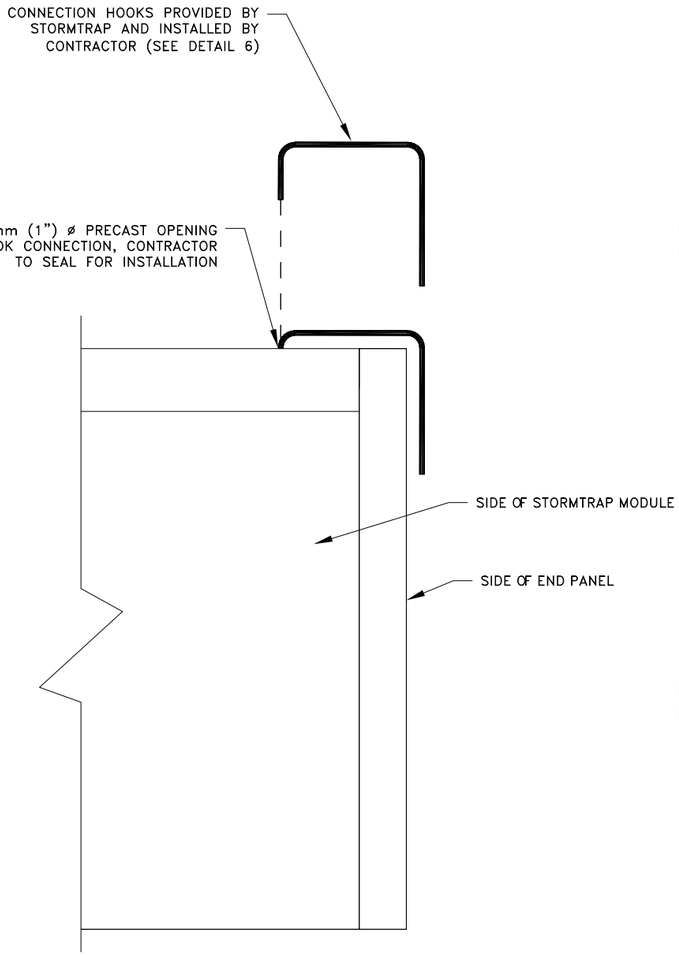
END PANEL
LIFTING DETAIL



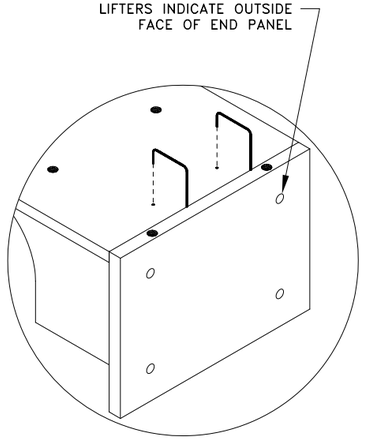
BASE MODULE
LIFTING DETAIL

END PANEL ERECTION/INSTALLATION SPECIFICATION

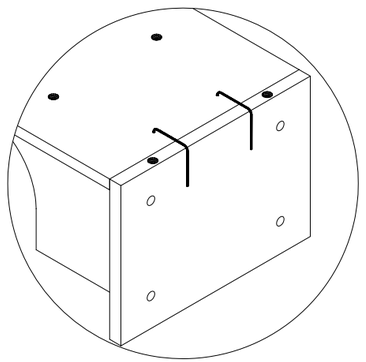
1. END PANELS WILL BE SUPPLIED TO CLOSE OFF OPEN ENDS OF ROWS.
2. PANELS SHALL BE INSTALLED IN A TILT UP FASHION DIRECTLY ADJACENT TO OPEN END OF MODULE (REFER TO SHEET 2.0 FOR END PANEL LOCATIONS). SIDE WITH LIFTERS INDICATES OUTSIDE FACE.
3. CONNECTION HOOKS WILL BE SUPPLIED WITH END PANELS TO SECURELY CONNECT PANEL TO ADJACENT STORMTRAP MODULE (SEE PANEL CONNECTION ELEVATION VIEW).
4. ONCE CONNECTION HOOK IS ATTACHED, LIFTING CLUTCHES MAY BE REMOVED.
5. JOINT WRAP SHALL BE PLACED AROUND PERIMETER JOINT PANEL (SEE SHEET 3.0).



PANEL CONNECTION
ELEVATION VIEW



STEP 1



STEP 2

DETAIL 6

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ZONE CHART

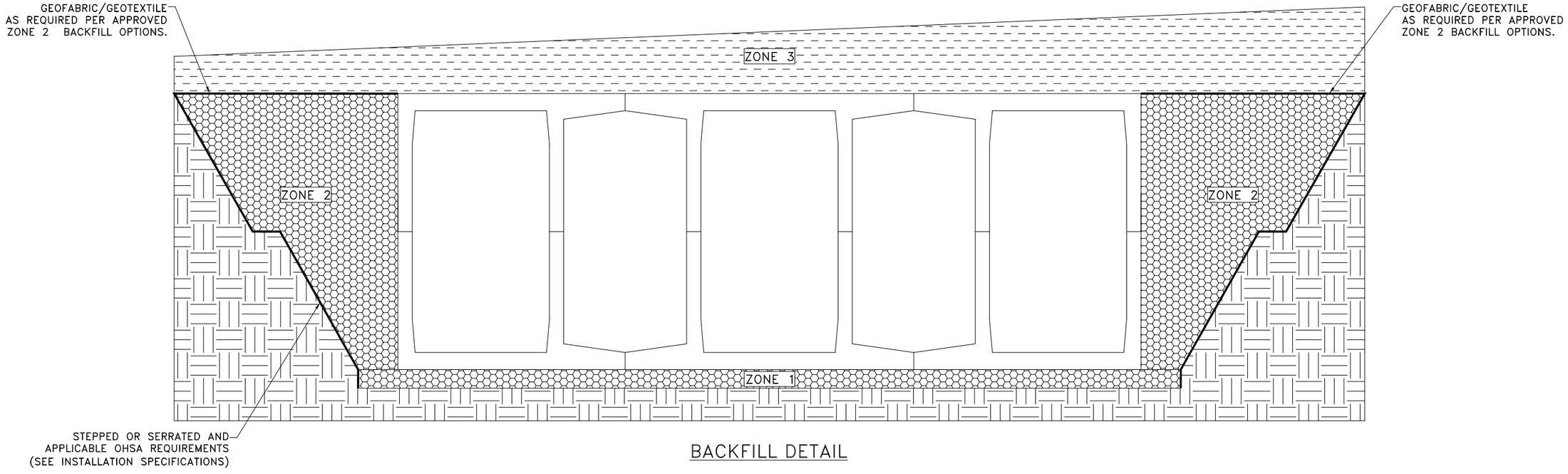
ZONES	ZONE DESCRIPTIONS	REMARKS
ZONE 1	FOUNDATION AGGREGATE	ANGULAR STONE AGGREGATE. 19mm (¾") TYPE I OR II CLEAR STONE (OPSS.MUNI 1004) GRADATION: 100% PASSING 26.5mm SIEVE, 0–10% PASSING 4.75mm SIEVE; 0–2% PASSING 75 MICROMETER SIEVE (SEE NOTE 4)
ZONE 2	BACKFILL	UNIFIED SOILS CLASSIFICATION (GW, GP, SW, SP) OR SEE BELOW FOR APPROVED BACKFILL OPTIONS
ZONE 3	FINAL COVER OVERTOP	MATERIALS NOT TO EXCEED 19 kN/m³

APPROVED ZONE 2 BACKFILL OPTIONS

OPTION	REMARKS
19mm (¾") TYPE I OR II CLEAR STONE (OPSS.MUNI 1004)	THE STONE AGGREGATE SHALL CONSIST OF CLEAN AND FREE DRAINING ANGULAR MATERIAL. THIS MATERIAL SHALL BE SEPARATED FROM THE SURROUNDING NATIVE SOIL AND OTHER FILL MATERIAL USING GEOFABRIC AS DETERMINED BY THE GEOTECHNICAL ENGINEER. GRADATION: 100% PASSING 26.5mm SIEVE, 0–10% PASSING 4.75mm SIEVE; 0–2% PASSING 75 MICROMETER SIEVE.
16mm CLEAR STONE (OPSS.MUNI 1004)	THE STONE AGGREGATE SHALL CONSIST OF CLEAN AND FREE DRAINING ANGULAR MATERIAL. THIS MATERIAL SHALL BE SEPARATED FROM THE SURROUNDING NATIVE SOIL AND OTHER FILL MATERIAL USING GEOFABRIC AS DETERMINED BY THE GEOTECHNICAL ENGINEER. GRADATION: 100% PASSING 19.0mm SIEVE, 0–10% PASSING 4.75mm SIEVE; 0–2% PASSING 75 MICROMETER SIEVE.
13.2mm CLEAR STONE (OPSS.MUNI 1004)	THE STONE AGGREGATE SHALL CONSIST OF CLEAN AND FREE DRAINING ANGULAR MATERIAL. THIS MATERIAL SHALL BE SEPARATED FROM THE SURROUNDING NATIVE SOIL AND OTHER FILL MATERIAL USING GEOFABRIC AS DETERMINED BY THE GEOTECHNICAL ENGINEER. GRADATION: 100% PASSING 16.0mm SIEVE, 0–10% PASSING 4.75mm SIEVE; 0–2% PASSING 75 MICROMETER SIEVE.
GRANULAR O (OPSS.MUNI 1010)	THE STONE AGGREGATE SHALL CONSIST OF CLEAN AND FREE DRAINING ANGULAR MATERIAL. THIS MATERIAL SHALL BE SEPARATED FROM THE SURROUNDING NATIVE SOIL AND OTHER FILL MATERIAL USING GEOFABRIC AS DETERMINED BY THE GEOTECHNICAL ENGINEER. GRADATION: 100% PASSING 37.5mm SIEVE, 95–100% PASSING 26.5mm SIEVE; 0–5% PASSING 75 MICROMETER SIEVE.

STORMTRAP ZONE INSTALLATION SPECIFICATION/PROCEDURE

1. THE FILL PLACED AROUND THE STORMTRAP MODULES MUST BE DEPOSITED ON BOTH SIDES AT THE SAME TIME AND TO APPROXIMATELY THE SAME ELEVATION. AT NO TIME SHALL THE FILL BEHIND ONE SIDE WALL BE MORE THAN 610mm (2'–0") HIGHER THAN THE FILL ON THE OPPOSITE SIDE. BACKFILL SHALL EITHER BE COMPACTED AND/OR VIBRATED TO ENSURE THAT BACKFILL AGGREGATE/STONE MATERIAL IS WELL SEATED AND PROPERLY INTER LOCKED. CARE SHALL BE TAKEN TO PREVENT ANY WEDGING ACTION AGAINST THE STRUCTURE, AND ALL SLOPES WITHIN THE AREA TO BE BACKFILLED MUST BE STEPPED OR SERRATED TO PREVENT WEDGING ACTION. CARE SHALL ALSO BE TAKEN AS NOT TO DISRUPT THE JOINT WRAP FROM THE JOINT DURING THE BACKFILL PROCESS. BACKFILL MUST BE FREE–DRAINING MATERIAL. SEE ZONE 2 BACKFILL CHART ON THIS PAGE FOR APPROVED BACKFILL OPTIONS. IF NATIVE EARTH IS SUSCEPTIBLE TO MIGRATION, CONFIRM WITH GEOTECHNICAL ENGINEER AND PROVIDE PROTECTION AS REQUIRED (PROVIDED BY OTHERS). ALL MODULES MUST BE SET AND ALL SIDES MUST BE FULLY BACKFILLED BEFORE TRAVEL OVERTOP THE SYSTEM IS PERMITTED. SEE NOTE 2 FOR EXCEPTIONS AND LIMITATIONS.
2. THE FILL PLACED OVERTOP THE SYSTEM SHALL BE PLACED IN MINIMUM 152mm (6") LIFTS. AT NO TIME SHALL MACHINERY OR VEHICLES GREATER THAN THE DESIGN LIVE LOAD LISTED ON SHEET 1.1 TRAVEL OVERTOP THE SYSTEM. IF TRAVEL OVER THE SYSTEM OCCURS BEFORE THE MINIMUM DESIGN COVER IS ACHIEVED, IT MAY BE NECESSARY TO REDUCE THE ULTIMATE LOAD/BURDEN OF THE OPERATING MACHINERY SO AS TO NOT EXCEED THE DESIGN CAPACITY OF THE SYSTEM. VEHICLES AND MACHINERY USED TO PLACE FILL MATERIAL ON TOP OF THE SYSTEM SHALL TRAVEL PARALLEL TO THE LONGITUDINAL AXIS OF THE STORMTRAP MODULES WHENEVER POSSIBLE.
3. THE VIBRATORY FUNCTION OF ANY ROLLER, COMPACTOR, VEHICLE, ETC. SHALL NOT BE USED OVERTOP THE SYSTEM WITHOUT PRIOR APPROVAL FROM STORMTRAP. IN SOME CASES, HAND COMPACTION MAY BE NECESSARY TO ENSURE THAT THE ALLOWABLE DESIGN LOADING IS NOT EXCEEDED.
4. STONE AGGREGATE FOUNDATION IN ZONE 1 IS FOR LEVELING PURPOSES.



BACKFILL DETAIL

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DOUBLETRAP BACKFILL SPECIFICATION

SHEET NUMBER:

4.0

ACCESS OPENING SPECIFICATION

1. A TYPICAL ACCESS OPENING FOR THE STORMTRAP SYSTEM ARE 610mm (2'–0") IN DIAMETER. ACCESS OPENINGS LARGER THAN 1219mm (4'–0") IN DIAMETER NEED TO BE APPROVED BY STORMTRAP. ALL OPENINGS MUST RETAIN AT LEAST 610mm (2'–0") OF CLEARANCE FROM THE END OF THE STORMTRAP MODULE UNLESS NOTED OTHERWISE. ALL ACCESS OPENINGS TO BE LOCATED ON INSIDE LEG UNLESS OTHERWISE SPECIFIED. SEE SHEET 2.0 FOR SIZES AND LOCATIONS.
2. UNLESS OTHERWISE SPECIFIED, PLASTIC COATED STEPS ARE PROVIDED INSIDE ANY MODULE WHERE DEEMED NECESSARY. THE HIGHEST STEP IN THE MODULE IS TO BE PLACED A DISTANCE OF 305mm (1'–0") FROM THE INSIDE EDGE OF THE STORMTRAP MODULES. ALL ENSUING STEPS SHALL BE PLACED AT A DISTANCE BETWEEN 254mm (10") MIN AND 356mm (14") MAX BETWEEN THEM. STEPS MAY BE MOVED OR ALTERED TO AVOID OPENINGS OR OTHER IRREGULARITIES IN THE MODULE.
3. STORMTRAP LIFTING INSERTS MAY BE RELOCATED TO AVOID INTERFERENCE WITH ACCESS OPENINGS OR THE CENTER OF GRAVITY OF THE MODULE AS NEEDED.
4. STORMTRAP ACCESS OPENINGS MAY BE RELOCATED TO AVOID INTERFERENCE WITH INLET AND/OR OUTLET PIPE OPENINGS SO PLACEMENT OF STEPS IS ATTAINABLE.
5. ACCESS OPENINGS SHOULD BE LOCATED IN ORDER TO MEET THE APPROPRIATE MUNICIPAL REQUIREMENTS. STORMTRAP RECOMMENDS AT LEAST TWO ACCESS OPENINGS PER SYSTEM FOR ACCESS AND INSPECTION.
6. USE PRECAST ADJUSTING RINGS AS NEEDED TO MEET GRADE. STORMTRAP RECOMMENDS FOR COVER OVER 610mm (2'–0") TO USE PRECAST BARREL OR CONE SECTIONS. (PROVIDED BY OTHERS)

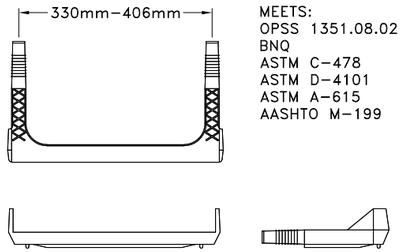
PIPE OPENING SPECIFICATION

1. MINIMUM EDGE DISTANCE FOR AN OPENING ON THE OUTSIDE WALL SHALL BE NO LESS THAN 305mm (1'–0").
2. CONNECTING PIPES MAY BE INSTALLED WITH A 305mm (1'–0") CONCRETE COLLAR AND AN AGGREGATE CRADLE (AS REQUIRED) FOR AT LEAST ONE PIPE LENGTH (SEE PIPE CONNECTION DETAIL). A STRUCTURAL GRADE CONCRETE OR HIGH STRENGTH, NON–SHRINK GROUT WITH A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 35 mPa MAY BE USED.
3. THE ANNULAR SPACE BETWEEN THE PIPE AND THE HOLE SHALL BE FILLED WITH HIGH STRENGTH NON–SHRINK GROUT.

PIPE INSTALLATION INSTRUCTIONS

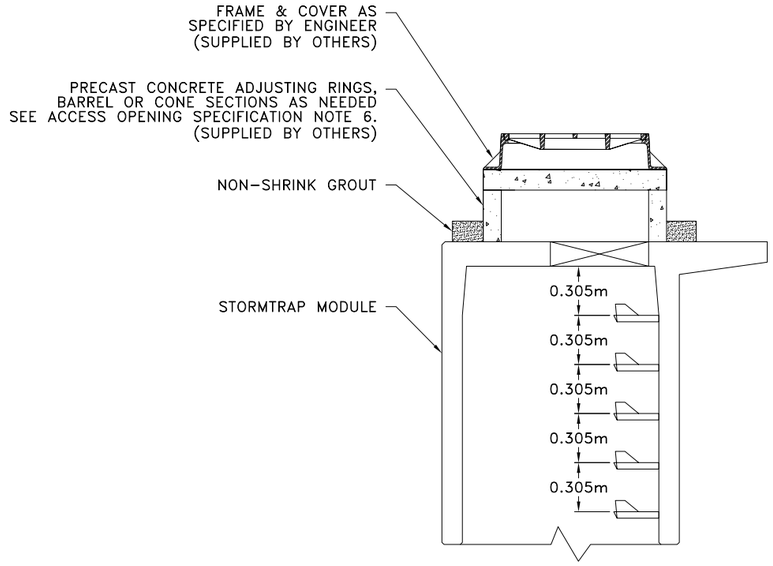
1. CLEAN AND LIGHTLY LUBRICATE ALL OF THE PIPE TO BE INSERTED INTO STORMTRAP.
2. IF PIPE IS CUT, CARE SHOULD BE TAKEN TO ALLOW NO SHARP EDGES. BEVEL AND LUBRICATE LEAD END OF PIPE.
3. ALIGN CENTER OF PIPE TO CORRECT ELEVATION AND INSERT INTO OPENING.

NOTE: ALL ANCILLARY PRODUCTS/SPECIFICATIONS RECOMMENDED AND SHOWN ON THIS SHEET INCLUDING BUT NOT LIMITED TO CONCRETE COLLARS, AGGREGATE CRADLES, GRADE RINGS, RISER SECTIONS, ETC., ARE RECOMMENDATIONS ONLY AND SUBJECT TO CHANGE PER THE INSTALLING CONTRACTOR AND/OR PER LOCAL MUNICIPAL CODE/REQUIREMENTS.

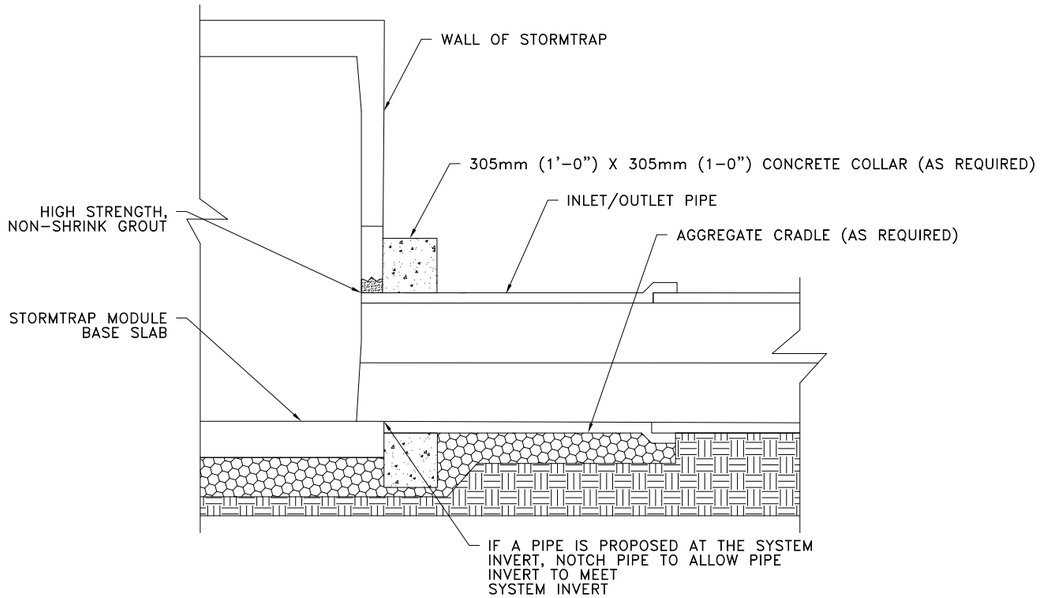


MEETS:
OPSS 1351.08.02
BNQ
ASTM C–478
ASTM D–4101
ASTM A–615
AASHTO M–199

STEP DETAIL



RISER/STAIR DETAIL



NOTCHED PIPE CONNECTION DETAIL
WHEN PIPE INVERT IS AT
INVERT OF STORMTRAP SYSTEM

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PATENTS LISTED AT: [HTTP://STORMTRAP.COM/PATENT]
1287 WINDHAM PARKWAY
ROMEOVILLE, IL 60446
P:815–941–4549 / F:331–318–5347

ENGINEER INFORMATION:

RVA
2001 Sheppard Ave East
Suite 300
Toronto, ON
416–497–8600

PROJECT INFORMATION:

325 King
Niagara on the Lake, ON

CURRENT ISSUE DATE:

09/02/2025

ISSUED FOR:

PRELIMINARY

REV.	DATE:	ISSUED FOR:	DWN BY:
1	09/02/2025	PRELIMINARY	LR

SCALE:

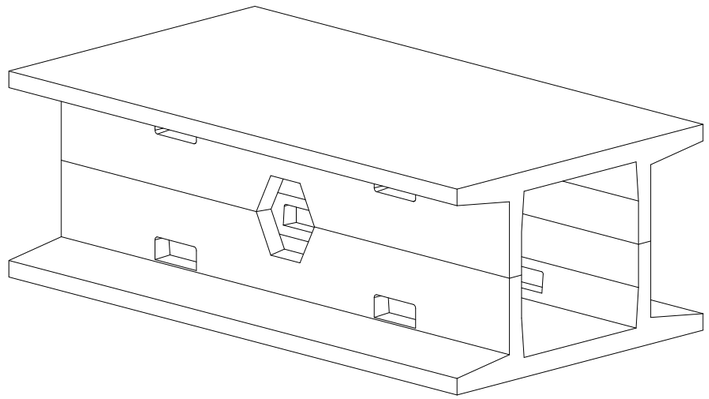
NTS

SHEET TITLE:

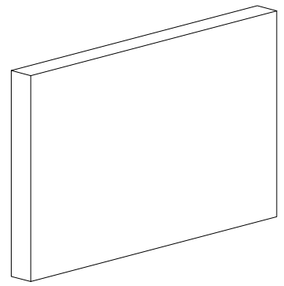
PIPE / ACCESS OPENING SPECIFICATION

SHEET NUMBER:

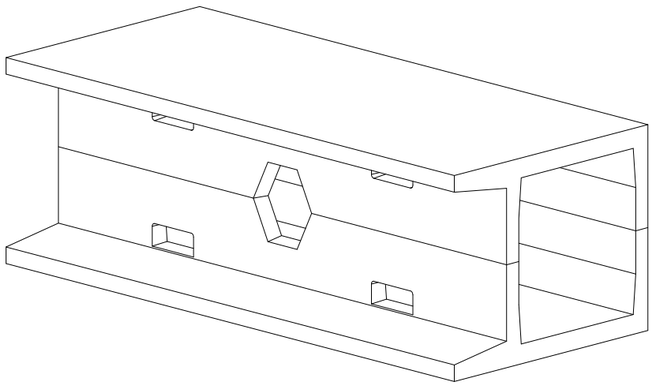
5.0



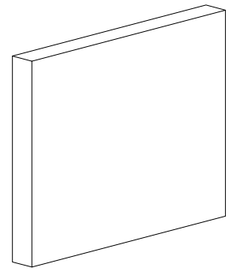
TYPE II



TYPE II END PANEL



TYPE IV



TYPE IV END PANEL

NOTES:
1. OPENING LOCATIONS AND SHAPES MAY VARY.
2. SP – INDICATES A MODULE WITH MODIFICATIONS.
3. P – INDICATES A MODULE WITH A PANEL ATTACHMENT.
4. POCKET WINDOW OPENINGS ARE OPTIONAL.

StormTrap

PATENTS LISTED AT: [HTTP://STORMTRAP.COM/PATENT]

1287 WINDHAM PARKWAY
ROMEOVILLE, IL 60446
P:815-941-4549 / F:331-318-5347

ENGINEER INFORMATION:

RVA
2001 Sheppard Ave East
Suite 300
Toronto, ON
416-497-8600

PROJECT INFORMATION:

325 King

Niagara on the Lake, ON

CURRENT ISSUE DATE:

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ISSUED FOR:

PRELIMINARY

REV.	DATE:	ISSUED FOR:	DWN BY:
1	09/02/2025	PRELIMINARY	LR

SCALE:

NTS

SHEET TITLE:

DOUBLETRAP
MODULE TYPES

SHEET NUMBER:

6.0

StormTrap

September 4, 2025

325 KING - NIAGARA ON THE LAKE, ON
STAGE STORAGE BREAKDOWN
1.270m DoubleTrap
TOTAL VOLUME: 438.04 (m³)

Alex Wong
R V Anderson Associates Ltd.
2001 Sheppard Ave East Ste 300
Toronto, ON

Storage	Type I QTY	Type II QTY	Type III QTY	Type IV QTY	Type V QTY	Type VII QTY	SPIV 1 QTY	SPIV 2 QTY	SPIV 8 QTY	SPIV 9 QTY	SPIV 10 QTY	Total Units	Stage Storage Elevation
	0.000	17.000	0.000	18.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000	37.000	
Height (m)												Storage Volume (m3)	System Invert 84.450
0.100	0.000	18.285	0.000	14.769	0.000	0.000	0.689	0.749	0.000	0.000	0.000	34.49	84.550
0.200	0.000	36.570	0.000	29.537	0.000	0.000	1.378	1.498	0.000	0.000	0.000	68.98	84.650
0.300	0.000	54.855	0.000	44.306	0.000	0.000	2.067	2.248	0.000	0.000	0.000	103.48	84.750
0.400	0.000	73.140	0.000	59.074	0.000	0.000	2.756	2.997	0.000	0.000	0.000	137.97	84.850
0.500	0.000	91.425	0.000	73.843	0.000	0.000	3.445	3.746	0.000	0.000	0.000	172.46	84.950
0.600	0.000	109.710	0.000	88.611	0.000	0.000	4.134	4.495	0.000	0.000	0.000	206.95	85.050
0.700	0.000	127.995	0.000	103.380	0.000	0.000	4.823	5.244	0.000	0.000	0.000	241.44	85.150
0.800	0.000	146.280	0.000	118.148	0.000	0.000	5.512	5.994	0.000	0.000	0.000	275.93	85.250
0.900	0.000	164.565	0.000	132.917	0.000	0.000	6.201	6.743	0.000	0.000	0.000	310.43	85.350
1.000	0.000	182.850	0.000	147.685	0.000	0.000	6.890	7.492	0.000	0.000	0.000	344.92	85.450
1.100	0.000	201.135	0.000	162.454	0.000	0.000	7.579	8.241	0.000	0.000	0.000	379.41	85.550
1.200	0.000	219.420	0.000	177.222	0.000	0.000	8.268	8.990	0.000	0.000	0.000	413.90	85.650
1.270	0.000	232.220	0.000	187.560	0.000	0.000	8.750	9.515	0.000	0.000	0.000	438.04	85.720

Terrafix® Geomembrane

40mil LLDPE Smooth

Typical Properties

Property	ASTM Test Method	Frequency	Units	Value
Thickness (min. ave.)	D-5199	per roll	mm	1
• lowest individual of 10 values			%	-10
Density (min. ave.)	D-1505/ D-792	90,000 kg	g/cc	0.939
Tensile Properties (2) (min. ave.)	D-6693	9,000 kg		
• break strength			N/m	27
• break elongation			%	800
Tear Resistance (min. ave.)	D-1004	20,000 kg	N	100
Puncture Resistance (min. ave.)	D-4833	20,000 kg	N	250
2% Modulus (max.)	D-5323	per formulation	MPa	414
Axi-Symmetric Break Resistance Strain	D-5617	per formulation	%	30
Carbon Black Content (range)	D-4218	9,000 kg	%	2.0-3.0
Carbon Black Dispersion	D-5596	20,000 kg		Note (3)
Oxidative Induction Time (OIT) (min. ave.)				
(a) Standard OIT	D-8117	90,000 kg	min	100
(b) High Pressure OIT	D-5885		min	400
Oven Aging at 85°C	D-5721			
(a) Standard OIT (min. ave.) – retained after 90 days	D-8117	per each formulation	%	35
(b) High Pressure OIT (min. ave.) retained after 90 days	D-5885		%	60
UV Resistance (7)	D-7238			
High Pressure OIT (min. ave.) retained after 1600 hrs	D-5885	per each formulation	%	35

SUPPLY SPECIFICATIONS (Roll dimensions may vary +/-1%)	
Roll Dimension - Width – m	6.80
Roll Dimension - Length - m	237.8
Area (Surface/Roll) – m^2	1617

NOTES:

1. Testing frequency based on standard roll dimensions and one batch is approximately 180,000 lbs (or one railcar).
2. Machine Direction (MD) and Cross Machine Direction (XMD or TD) average values should be on the basis of 5 specimens in each directions.
3. Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3

* All Value are nominal test results, except when specified as minimum or maximum.

455 Horner Avenue Toronto, ON M8W 4W9
Tel: (416) 674-0363 Fax: (416) 674-7346
www.terrafixgeo.com

Terrafix 600R - Geotextile

Function: Filtration, Drainage, Reinforcement & Cushion.

Terrafix 600R is a needle-punched nonwoven geotextile made of 100% virgin polypropylene staple fibers, which are formed into a random network for dimensional stability. Terrafix 600R resists ultraviolet deterioration, rotting, biological degradation, naturally encountered alkalis and acids. Polypropylene is stable within the pH range of 2-13.

Types of applications for 600R are: Light Coastal Applications / Abrasion Resistance Requirements / Cushion Requirements as well for plastic liners to avoid punctures in a plastic liner such as EPDM, PVC, HDPE.

600R: 24" (inches) maximum rip-rap size / Good abrasion resistance / Medium to high strength at high elongation.

Property	ASTM Test Method	Value Metric Units
Typical Geotextile Properties		
• Grab Tensile Strength	D 4632	1110 N
• Grab Elongation	D 4632	50-105 %
• Tear Resistance	D 4533	444 N
• Puncture CBR	D 6241	3110 N
• Permittivity	D 4491	1.2 sec^{-1}
• Water Flow	D 4491	3251 $l/min/m^2$
• Apparent Opening Size	D 4751	0.180 mm
• U.V. Stability	D 4355	70% @ 500hrs

Hydroworks Sizing Summary

325 King St - P5

Niagara On The Lake

09-12-2025

Recommended Size: HydroDome HD 5

Hydroworks Sizing Program Version 5.8.5

A HydroDome HD 5 is recommended to provide 80 % annual TSS removal based on a drainage area of .438 (ha) with an imperviousness of 40 % and St. Catherines A, Ontario rainfall for the ETV particle size distribution.

The recommended HydroDome HD 5 treats 100 % of the annual runoff and provides 84 % annual TSS removal for the St. Catherines A rainfall records and ETV particle size distribution.

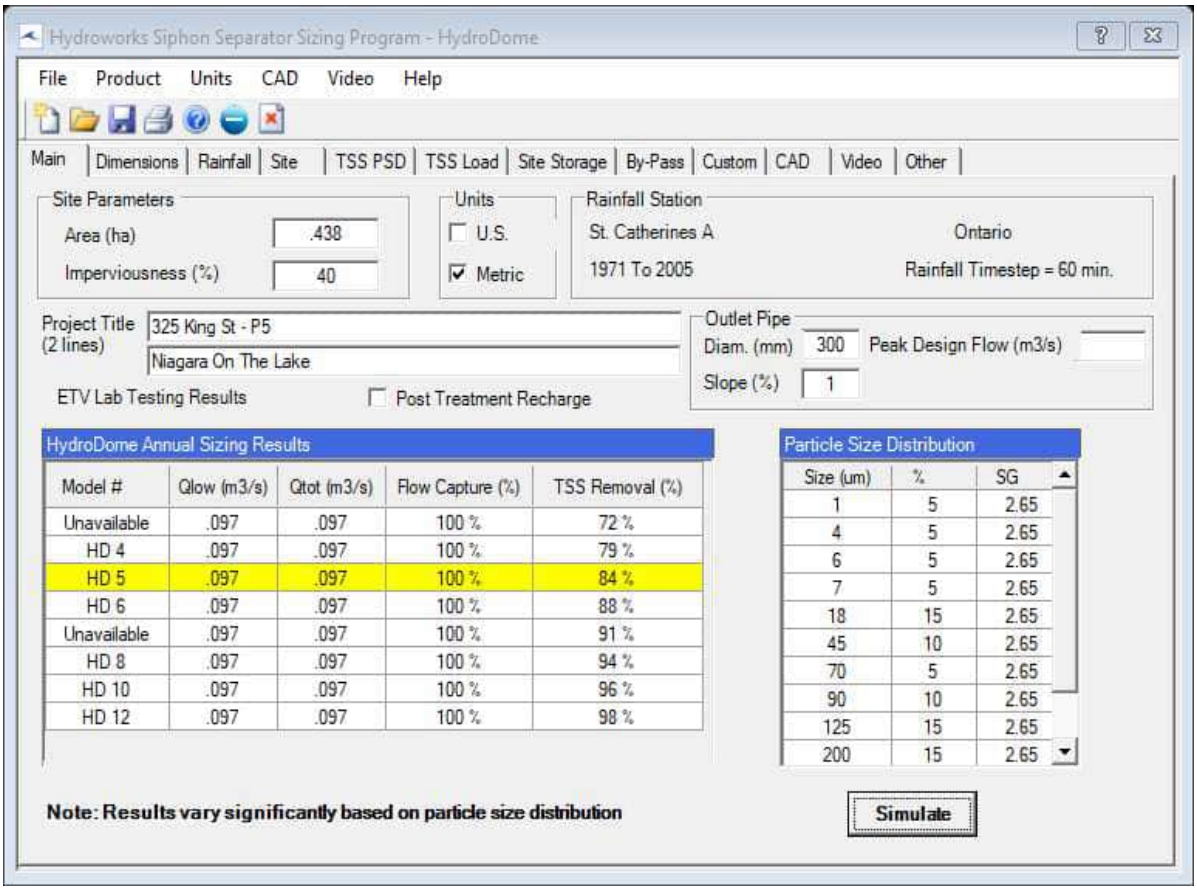
The HydroDome has a siphon which creates a discontinuity in headloss. Since a peak flow was not specified, headloss was calculated using the full pipe flow of .1 (m3/s) for the given 300 (mm) pipe diameter at 1% slope. The headloss was calculated to be 290 (mm) above the crown of the 300 (mm) outlet pipe.

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

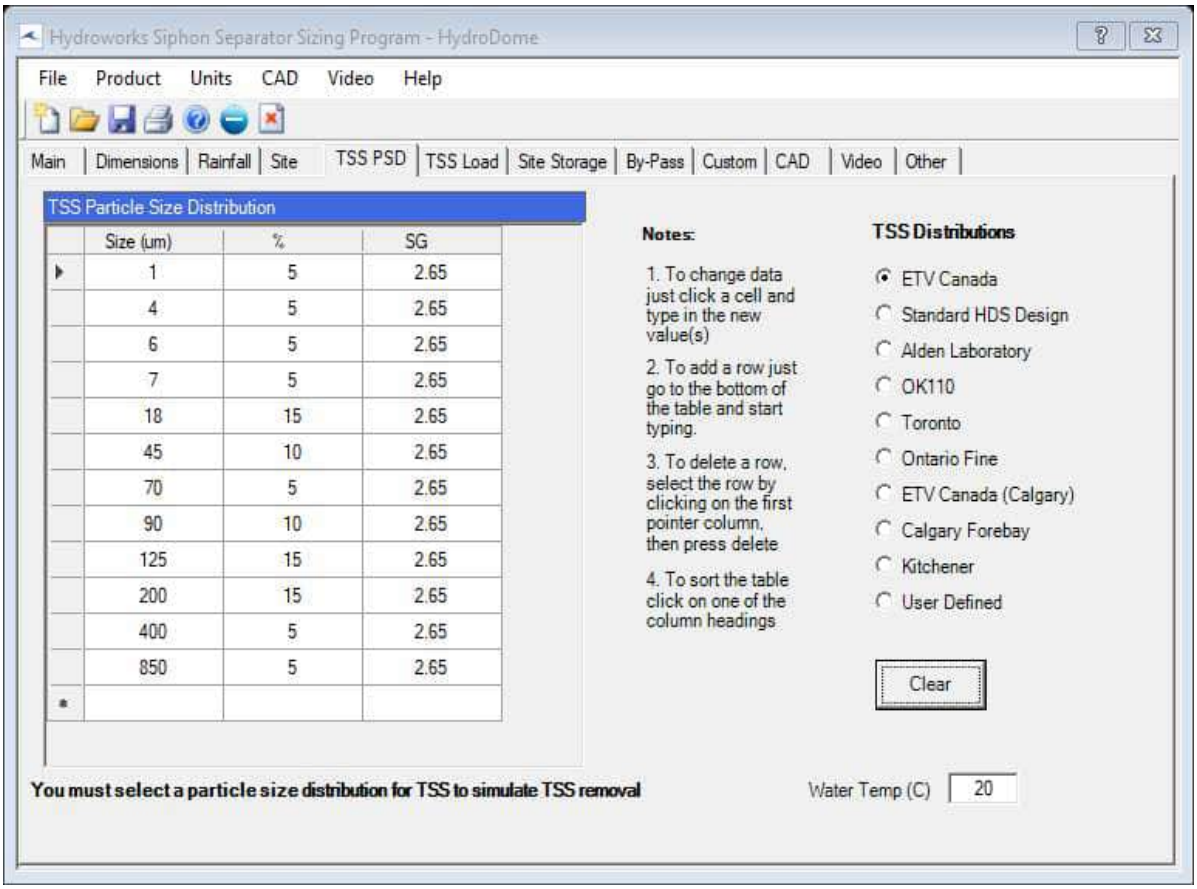
If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroDome .

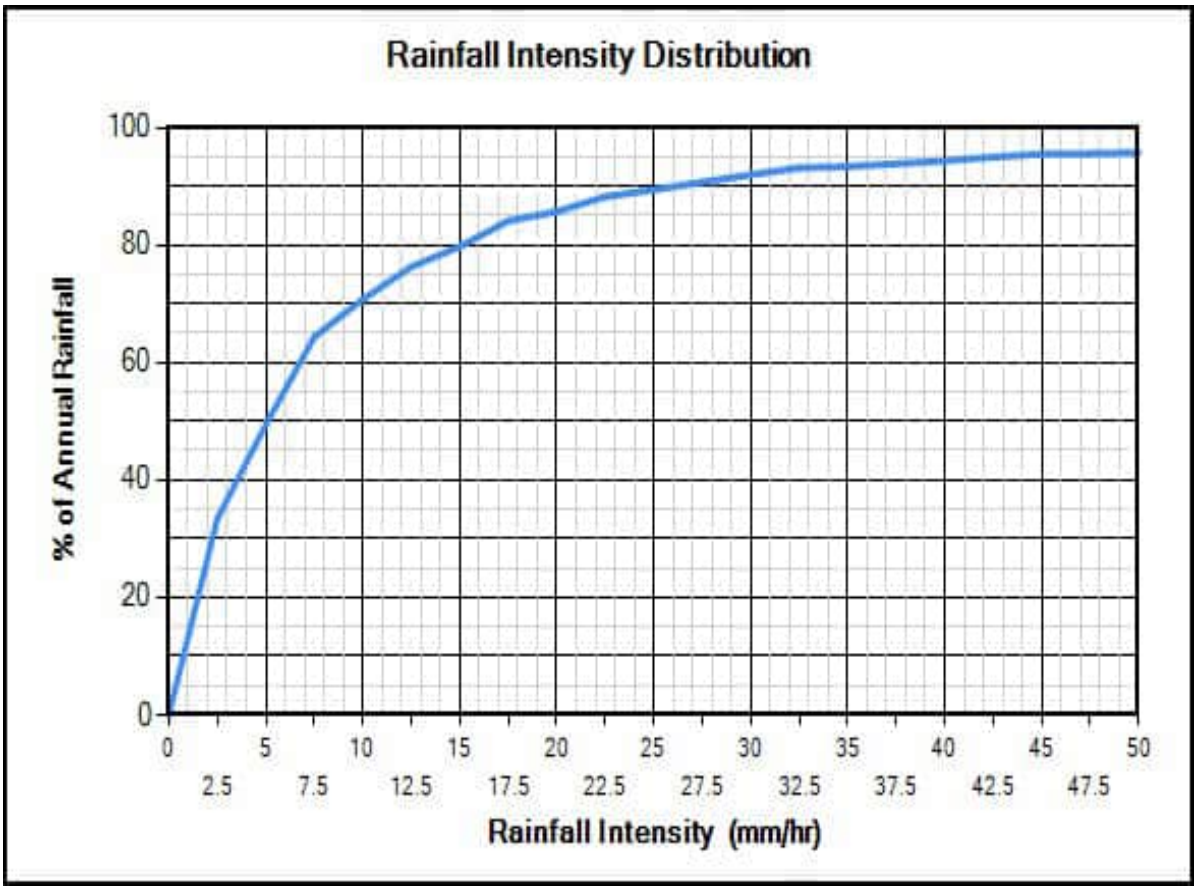
TSS Removal Sizing Summary



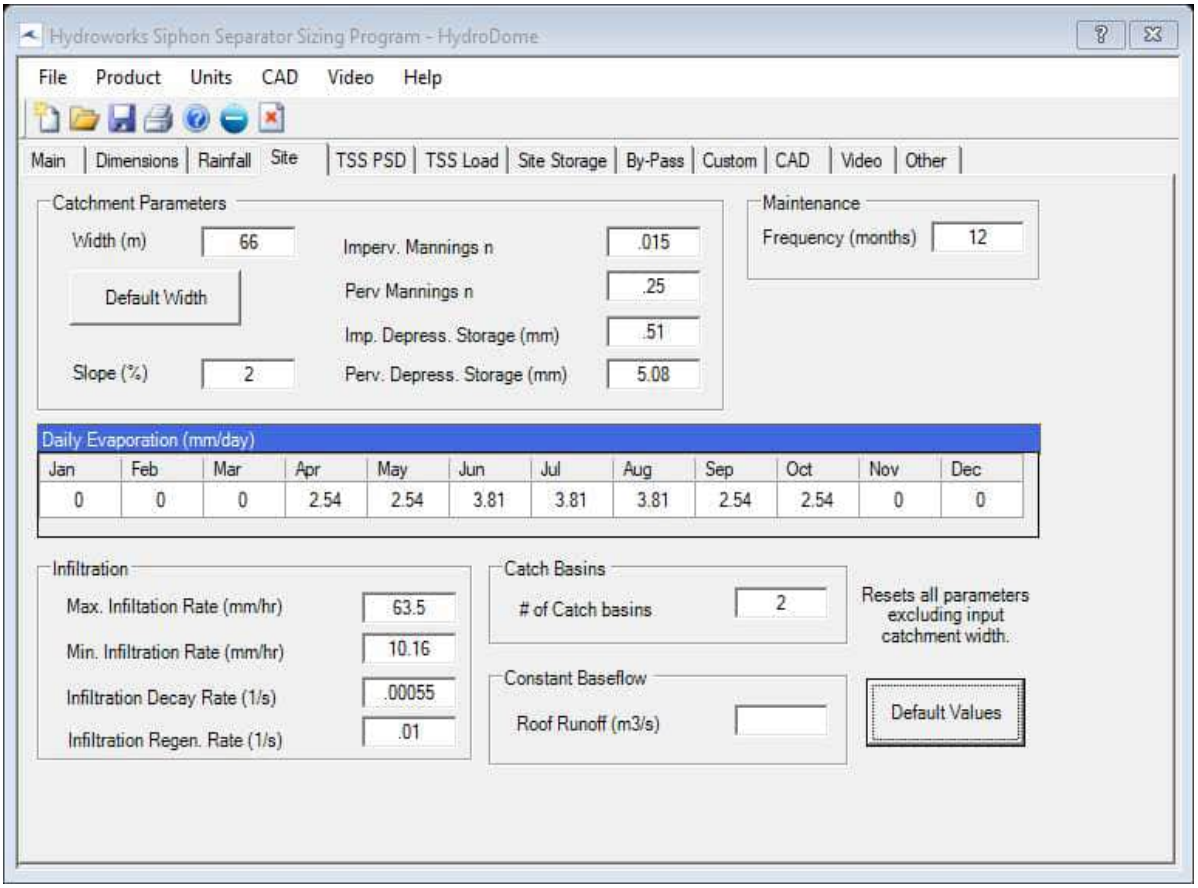
TSS Particle Size Distribution



Rainfall Station - St. Catherines A, Ontario(1971 To 2005)



Site Physical Characteristics



Dimensions And Capacities

Hydroworks Siphon Separator Sizing Program - HydroDome

File Product Units CAD Video Help

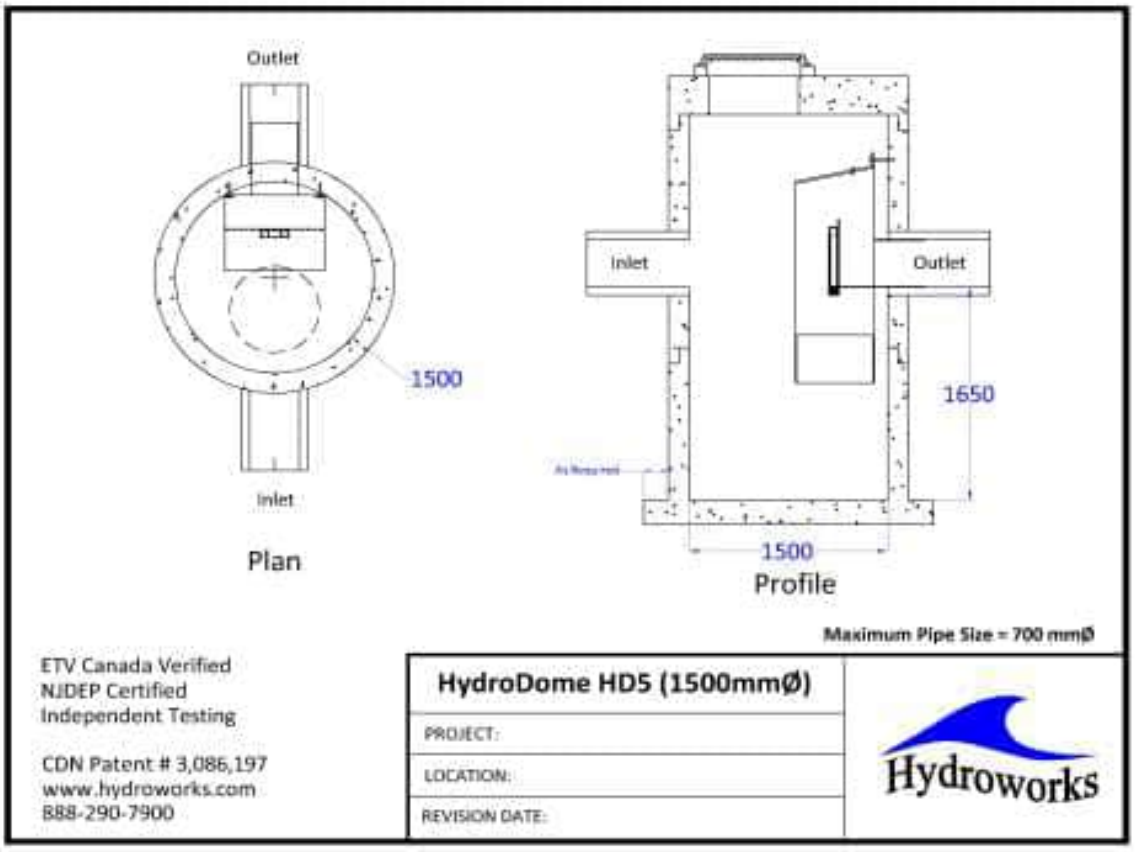
Main | Dimensions | Rainfall | Site | TSS PSD | TSS Load | Site Storage | By-Pass | Custom | CAD | Video | Other

Dimensions and Capacities

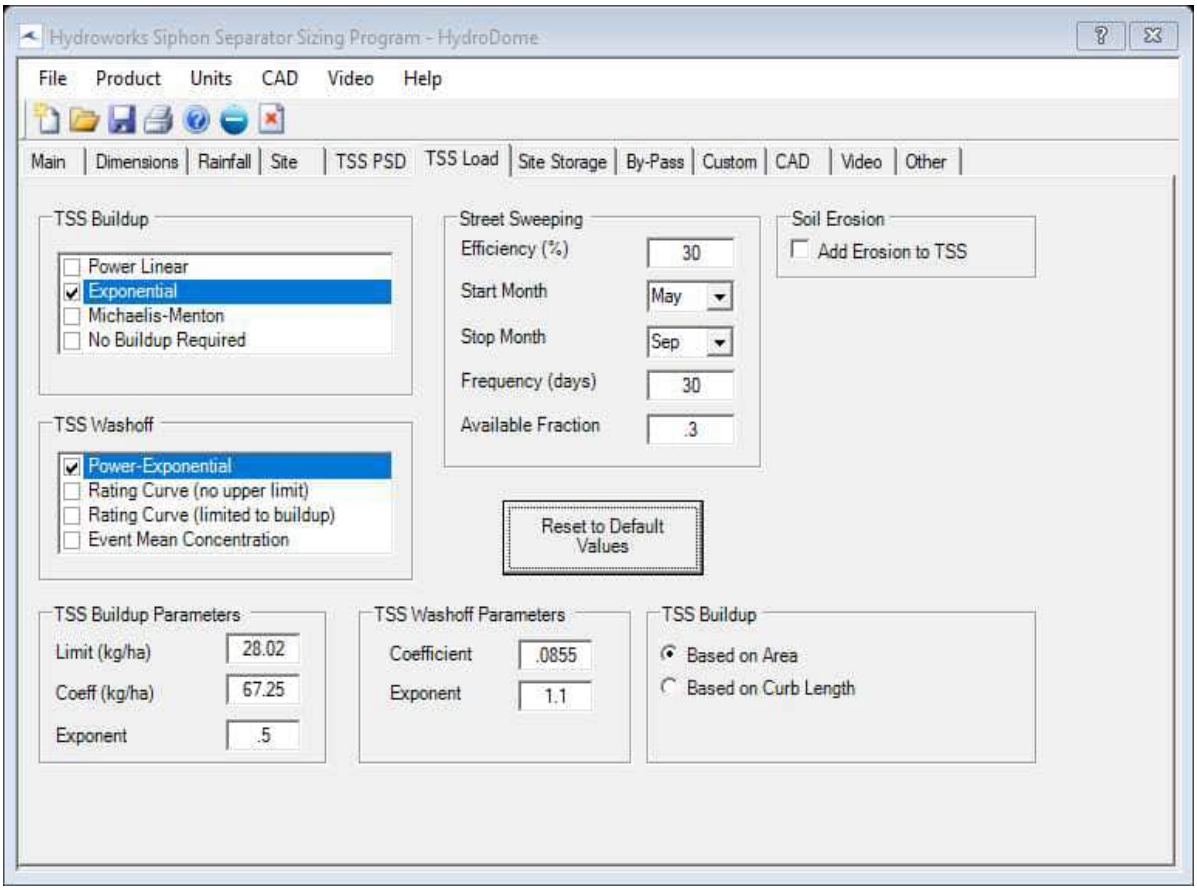
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HD 3	0.91	1.22	123	0.5	0.8
HD 4	1.22	1.37	266	0.9	1.6
HD 5	1.52	1.68	483	1.7	3.1
HD 6	1.83	1.98	803	2.9	5.2
HD 7	2.13	2.29	1226	4.6	8.2
HD 8	2.44	2.59	1863	6.8	12.1
HD 10	3.05	3.2	3617	13	23.3
HD 12	3.66	3.81	6224	22.2	40

Depth = Depth from outlet invert to inside bottom of tank

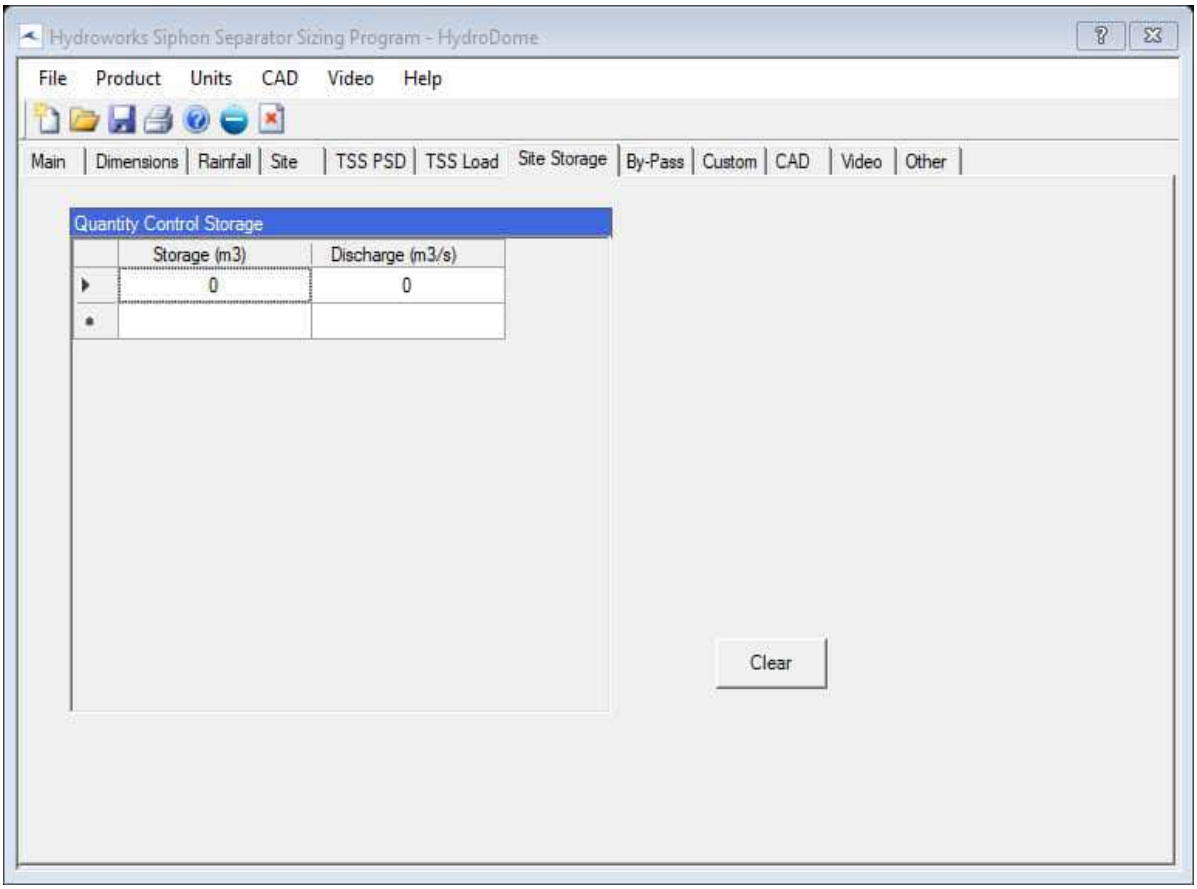
Generic HD 5 CAD Drawing



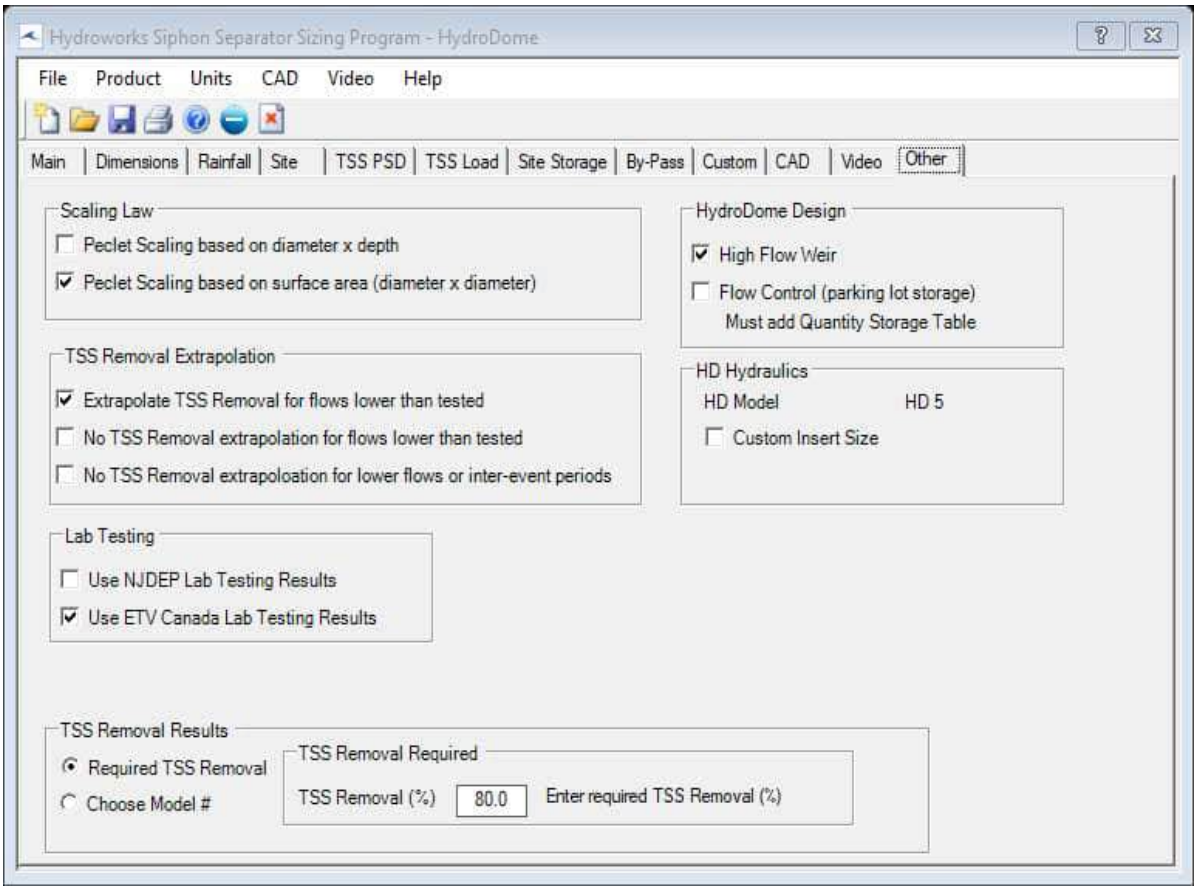
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Flagged Issues

If there is underground detention storage upstream of the HydroDome please contact Hydroworks to ensure it has been modeled correctly.

Hydroworks Sizing Program - Version 5.8.5

1-800-290-7900
www.hydroworks.com

Hydroworks Sizing Summary

325 King St - P2

Niagara On The Lake

09-12-2025

Recommended Size: HydroDome HD 6

Hydroworks Sizing Program Version 5.8.5

A HydroDome HD 6 is recommended to provide 80 % annual TSS removal based on a drainage area of .755 (ha) with an imperviousness of 40 % and St. Catherines A, Ontario rainfall for the ETV particle size distribution.

The recommended HydroDome HD 6 treats 100 % of the annual runoff and provides 83 % annual TSS removal for the St. Catherines A rainfall records and ETV particle size distribution.

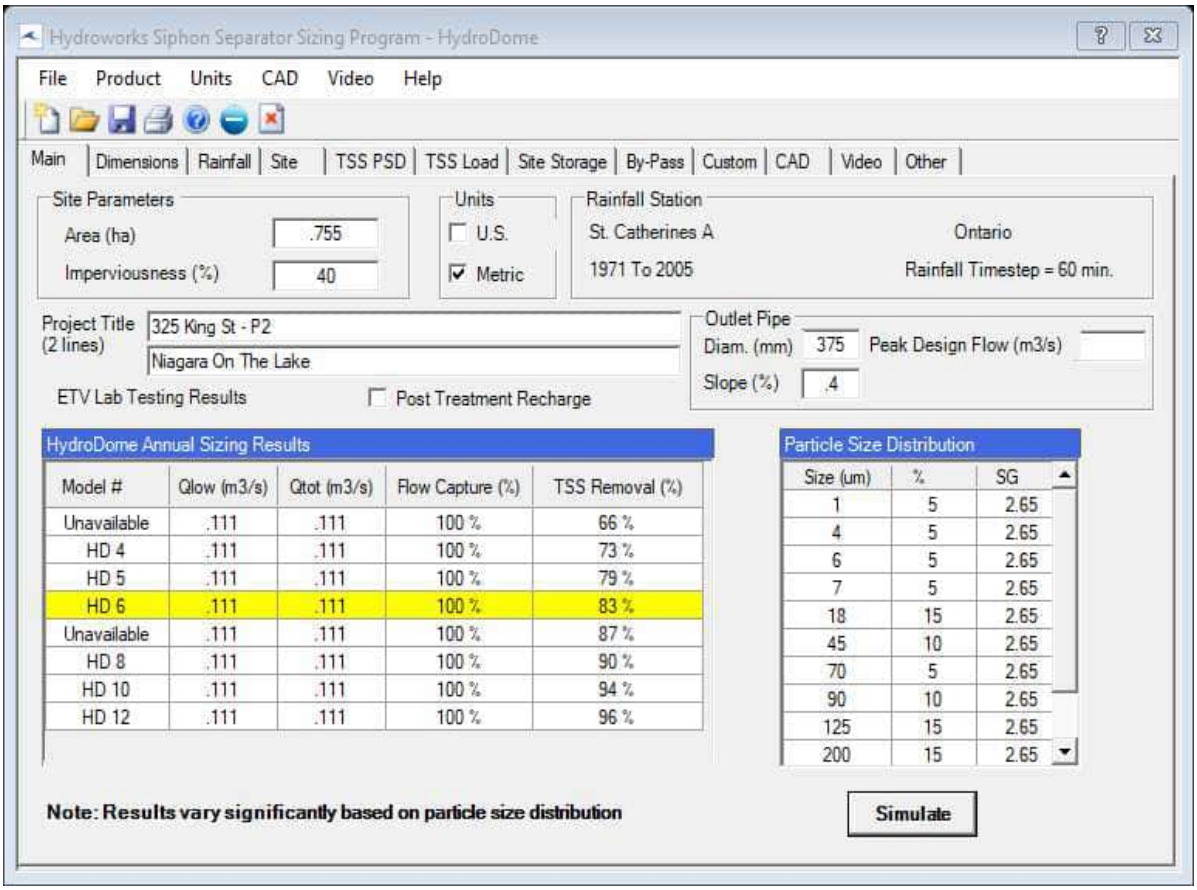
The HydroDome has a siphon which creates a discontinuity in headloss. Since a peak flow was not specified, headloss was calculated using the full pipe flow of .11 (m3/s) for the given 375 (mm) pipe diameter at .4% slope. The headloss was calculated to be 286 (mm) above the crown of the 375 (mm) outlet pipe.

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

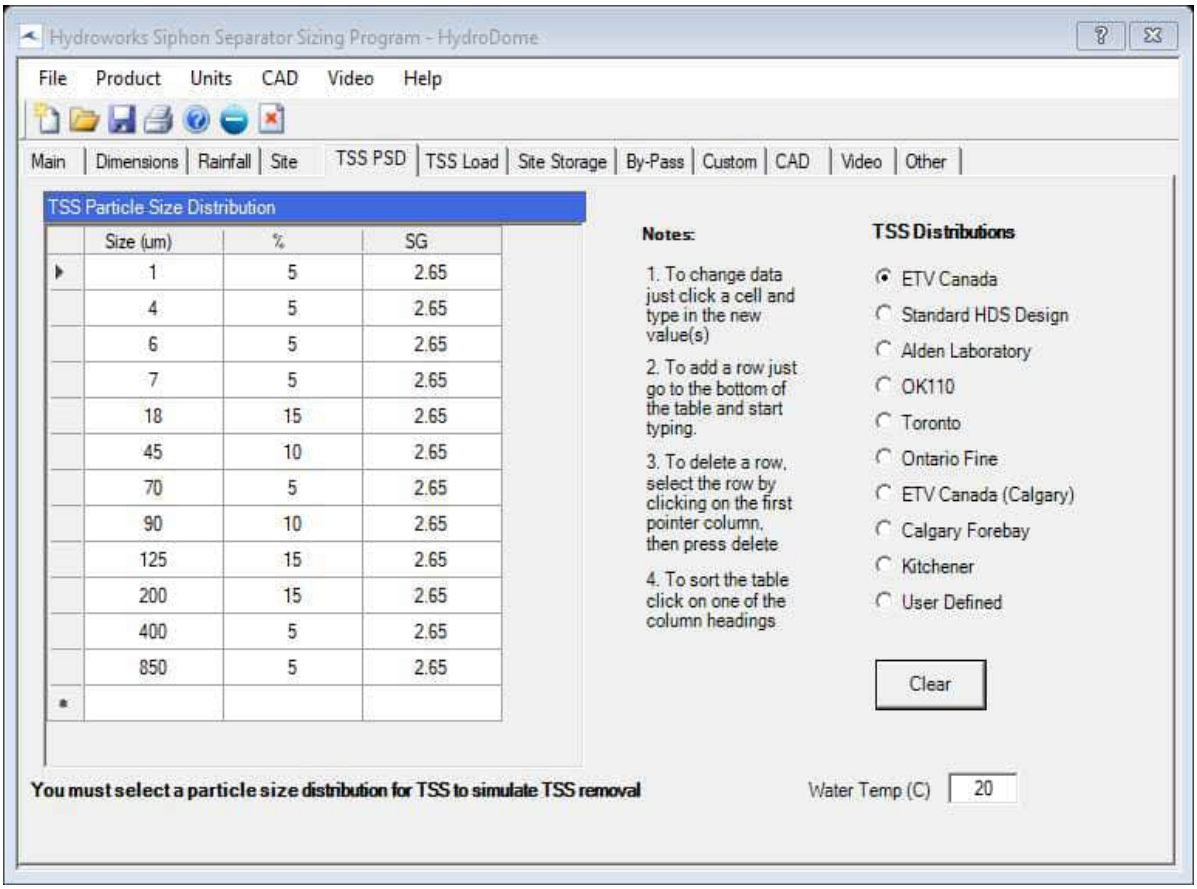
If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroDome .

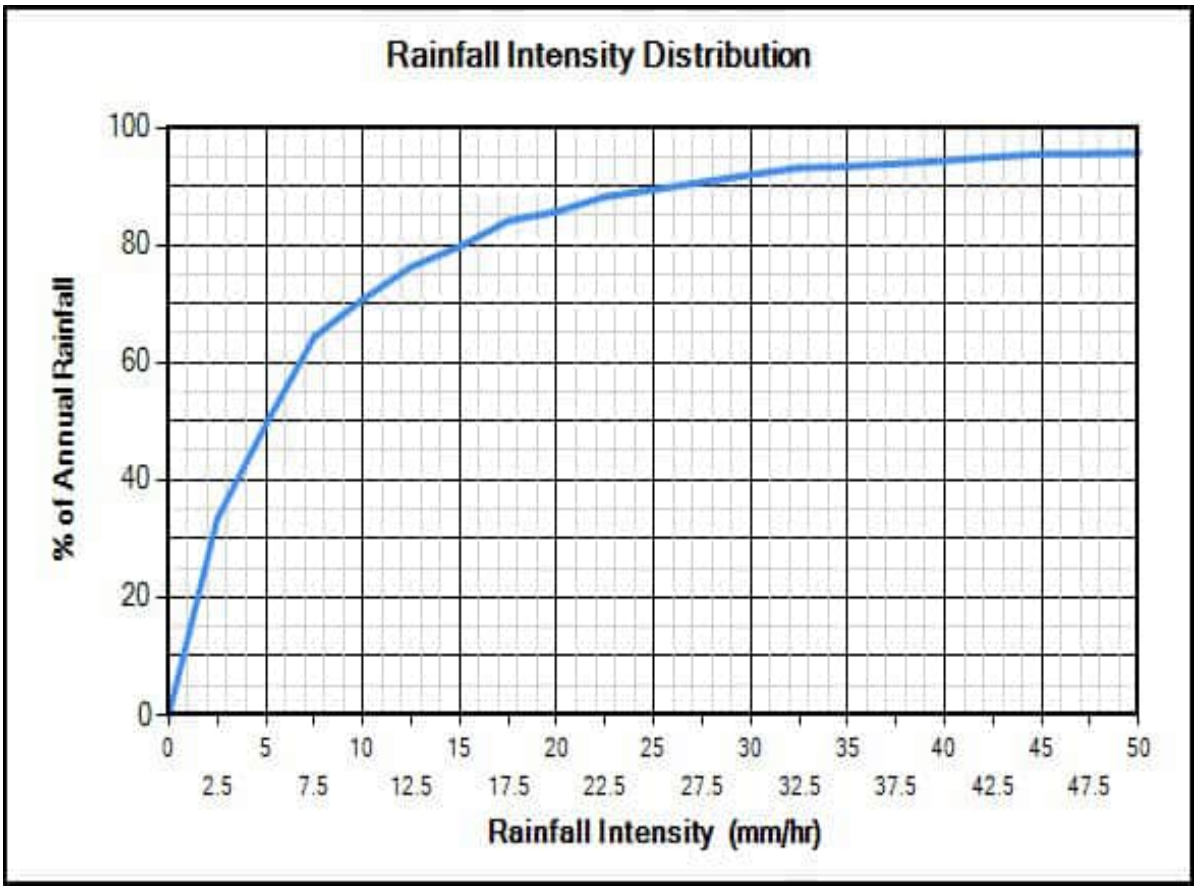
TSS Removal Sizing Summary



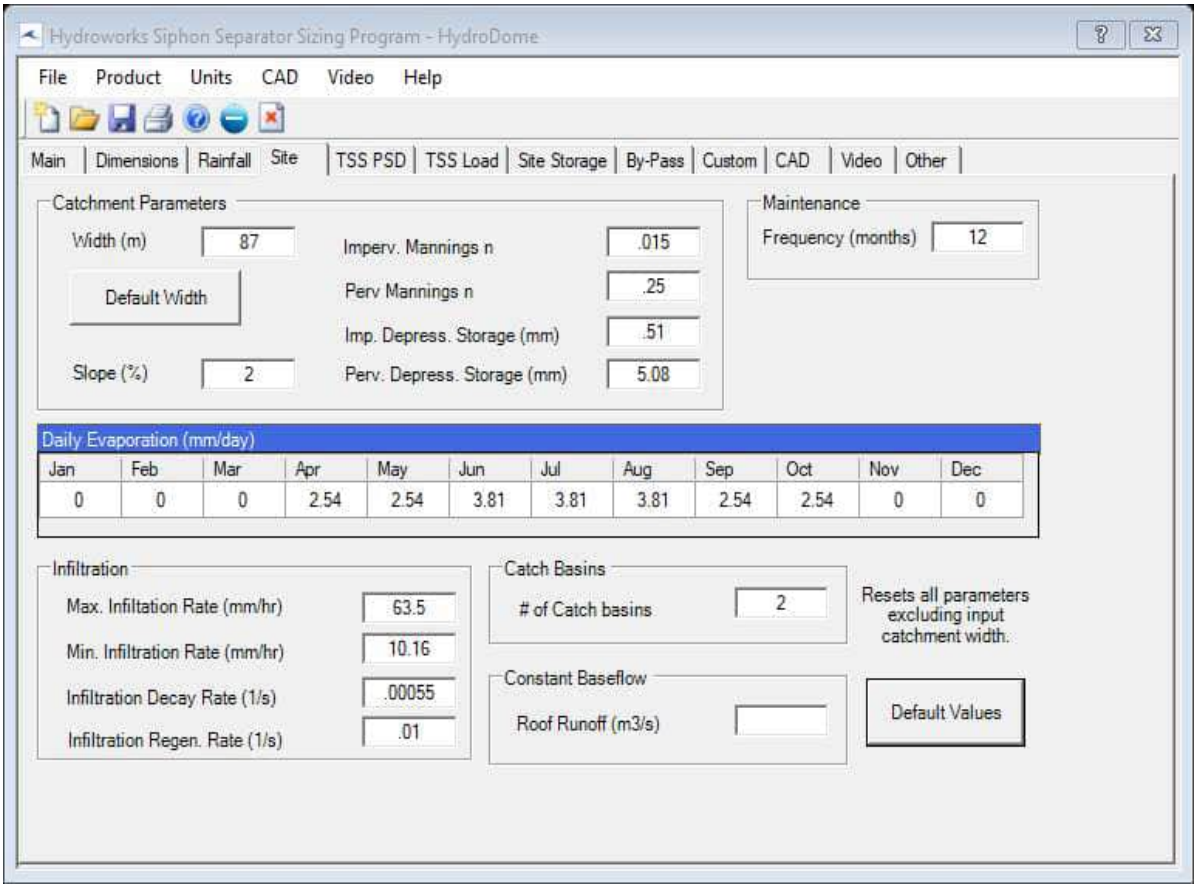
TSS Particle Size Distribution



Rainfall Station - St. Catherines A, Ontario(1971 To 2005)



Site Physical Characteristics



Dimensions And Capacities

Hydroworks Siphon Separator Sizing Program - HydroDome

File Product Units CAD Video Help

Main | Dimensions | Rainfall | Site | TSS PSD | TSS Load | Site Storage | By-Pass | Custom | CAD | Video | Other

Dimensions and Capacities

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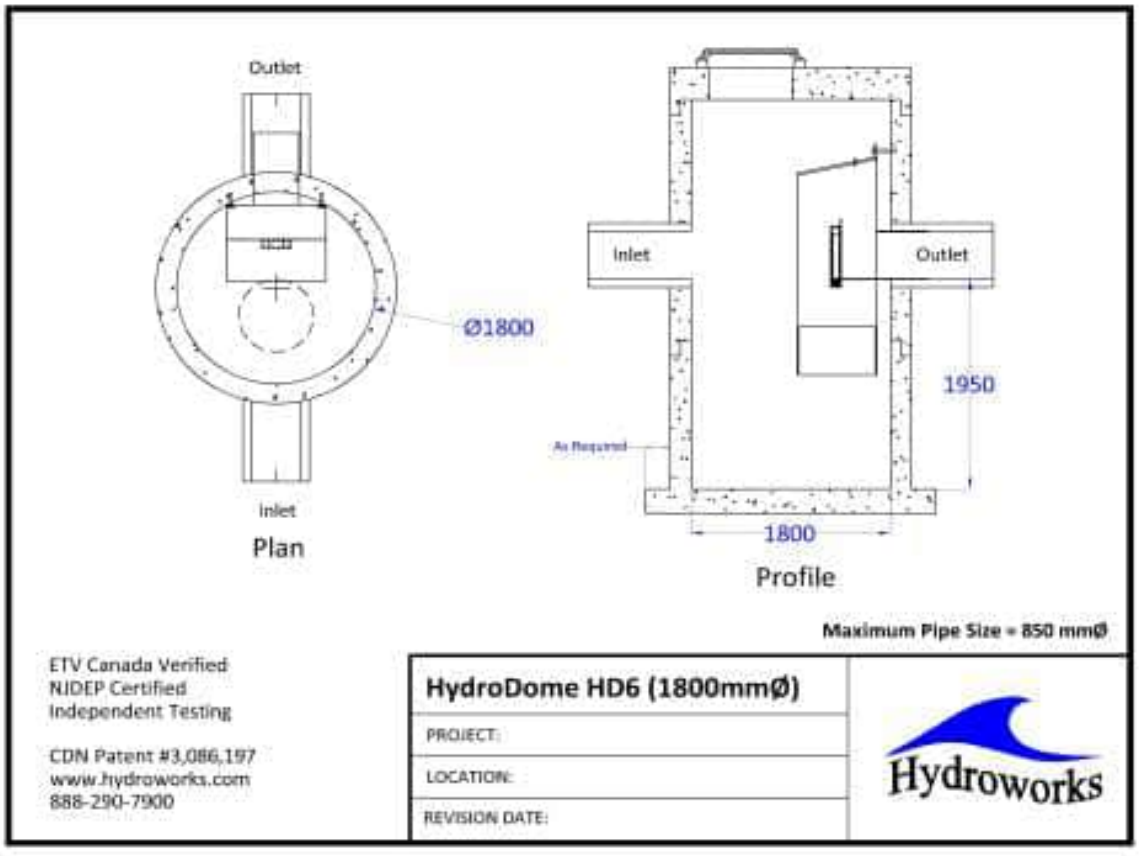
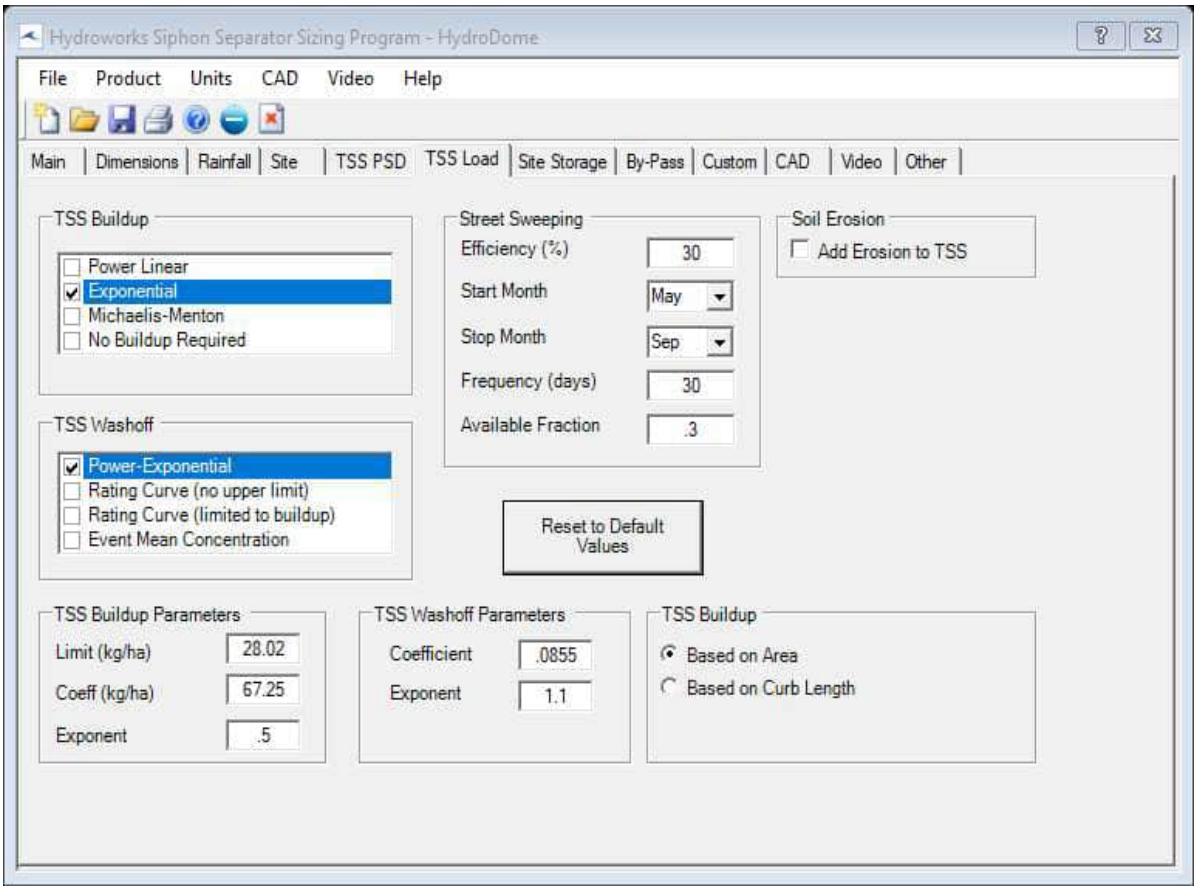
HD 8	2.44	2.59	1863	6.8	12.1
HD 10	3.05	3.2	3617	13	23.3
HD 12	3.66	3.81	6224	22.2	40

Depth = Depth from outlet invert to inside bottom of tank

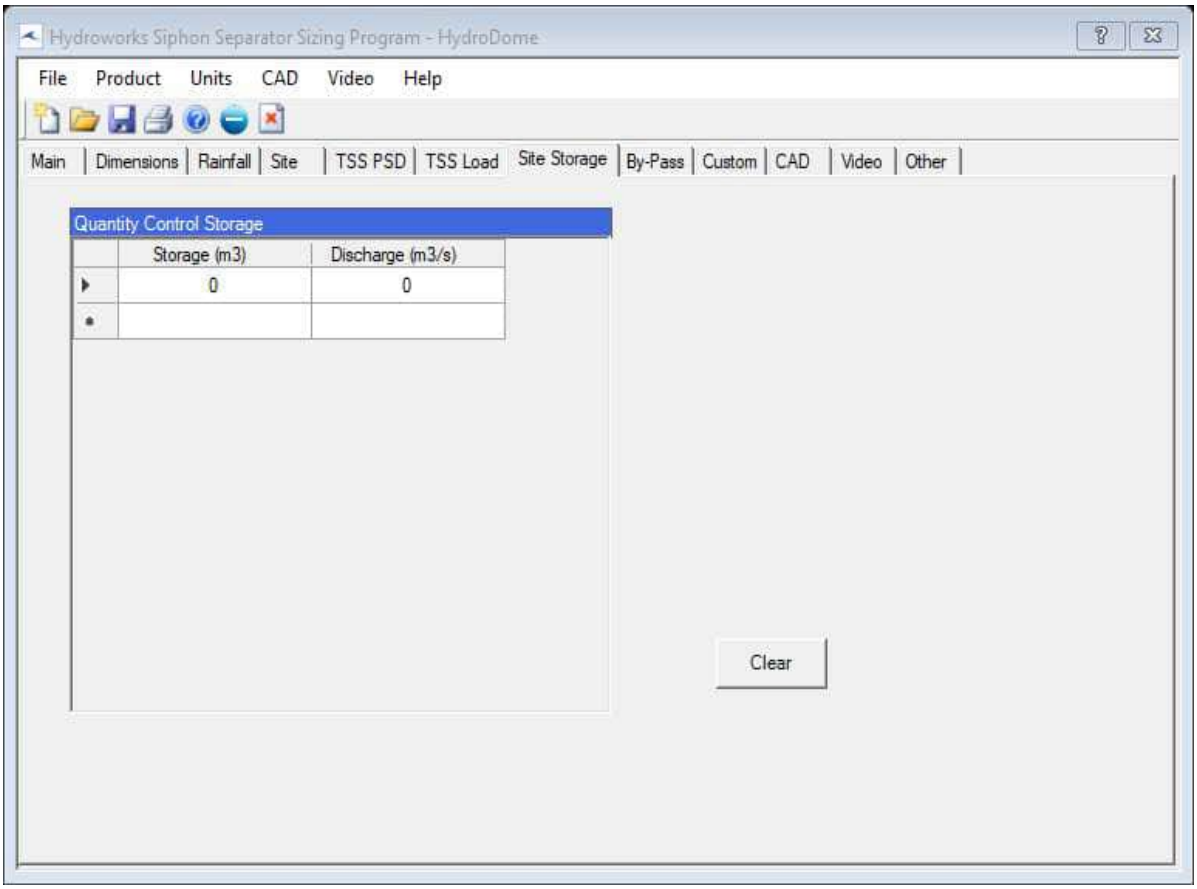
Generic HD 6 CAD Drawing



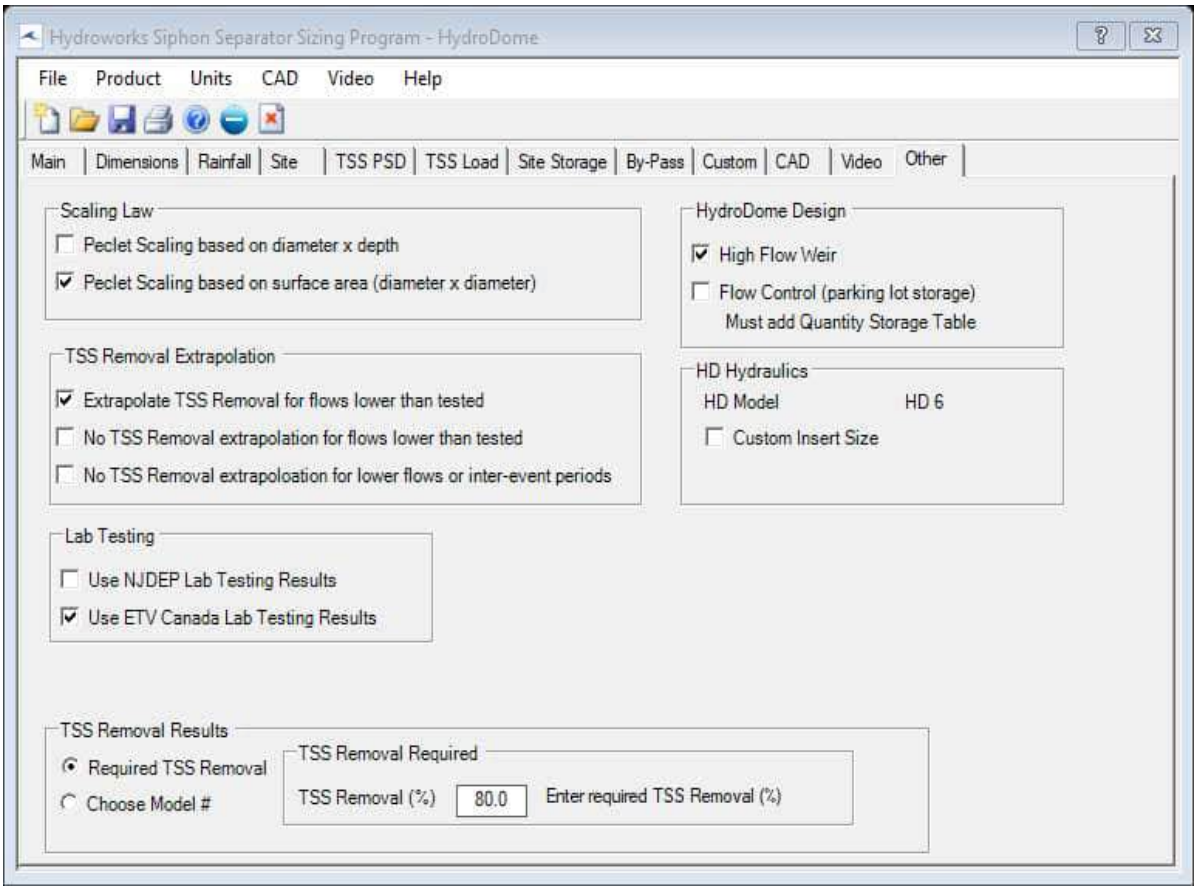
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Flagged Issues

If there is underground detention storage upstream of the HydroDome please contact Hydroworks to ensure it has been modeled correctly.

Hydroworks Sizing Program - Version 5.8.5

1-800-290-7900
www.hydroworks.com

Hydroworks® HydroDome

Operations & Maintenance Manual

Version 1.0

Please call Hydroworks at 888-290-7900 or email us at support@hydroworks.com if you have any questions regarding the Inspection Checklist. Please email a copy of the completed checklist to Hydroworks at support@hydroworks.com for our records.

Introduction

The HydroDome (Figure 1) is a state-of-the-art hydrodynamic separator. HydroDome can be used for water quality and quantity flow control if desired.

Hydrodynamic separators remove solids, debris and lighter than water (oil, trash, floating debris) pollutants from stormwater. Hydrodynamic separators and other water quality measures are mandated by regulatory agencies (Town/City, State, Federal Government) to protect storm water quality from pollution generated by urban development (traffic, people) as part of new development permitting requirements.

As storm water treatment structures fill up with pollutants they become less and less effective in removing new pollution. Therefore, it is important that storm water treatment structures be maintained on a regular basis to ensure that they are operating at optimum performance. The HydroDome is no different in this regard and this manual has been assembled to provide the owner/operator with the necessary information to inspect and coordinate maintenance of their HydroDome.

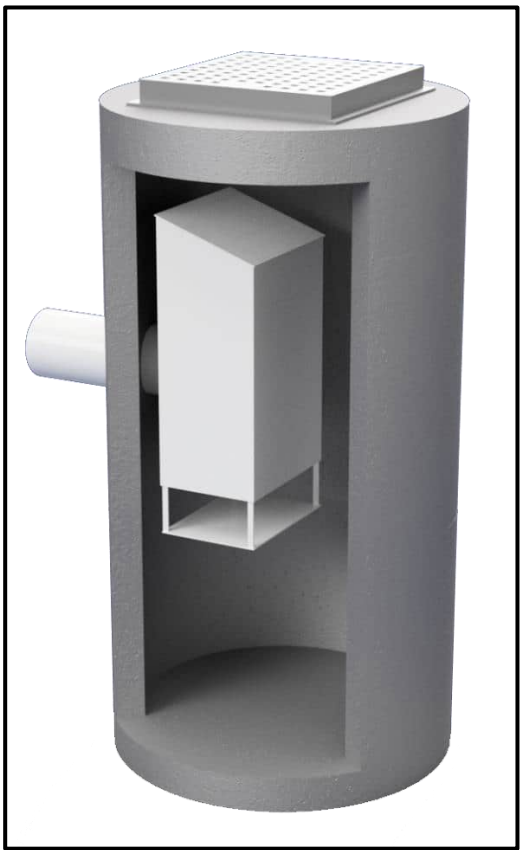


Figure 1. Hydroworks HydroDome

Hydroworks

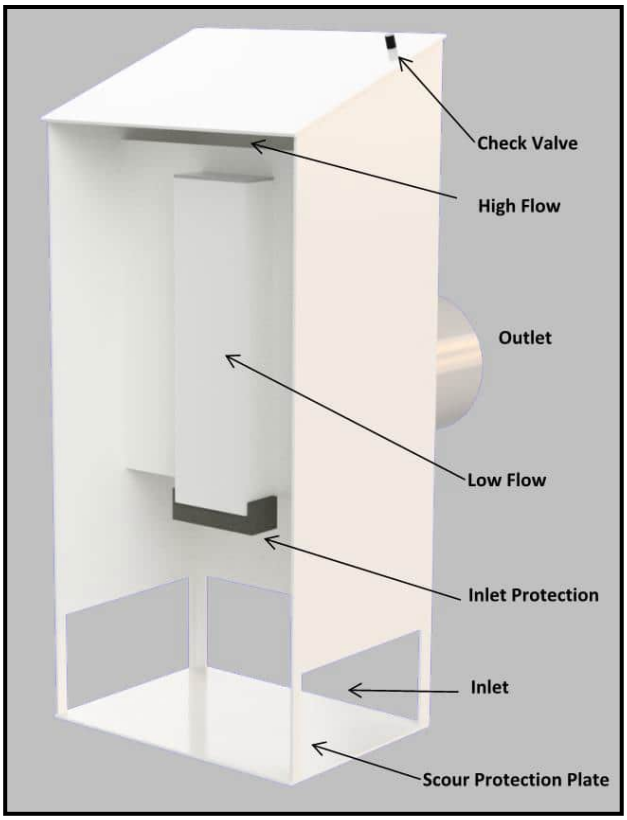


Figure 2 HydroDome Internal Components

Inspection

Procedure

Floatables

A visual inspection can be conducted for floatables by removing the cover/grate and looking down into the separator.

TSS/Sediment

Inspection for TSS build-up can be conducted using a Sludge Judge®, Core Pro®, AccuSludge® or equivalent sampling device that allows the measurement of the depth of TSS/sediment in the unit. These devices typically have a ball valve at the bottom of the tube that allows water and TSS to flow into the tube when lowering the tube into the unit. Once the unit touches the bottom of the device, it is quickly pulled upward such that the water and TSS in the tube forces the ball valve closed allowing the user to see a full core of water/TSS in the unit. Several readings (2 or 3) should be made at different locations of the structure to ensure that an accurate TSS depth measurement is recorded.

Operation

The water level during periods without rain should be near the outlet invert of the structure. If the water level remains near the top of the HydroDome this may suggest that there is an obstruction downstream of the HydroDome or that the inlet protection at the HydroDome may need to be cleaned.

Frequency

Construction Period

The HydroDome separator should be inspected every four weeks and after every large storm (over 0.5" (12.5 mm) of rain) during the construction period.

Post-Construction Period

The Hydroworks HydroDome separator should be inspected during the first year of operation for normal stabilized sites (grassed or paved areas). If the unit is subject to oil spills or runoff from unstabilized areas (storage piles, exposed soils), the HydroDome separator should be inspected more frequently (4 times per year). The initial annual inspection will indicate the required frequency of inspection and maintenance if the unit was maintained after the construction period.

Reporting

Reports should be prepared as part of each inspection and include the following information:

1. Date of inspection
2. GPS coordinates of Hydroworks unit
3. Time since last rainfall
4. Date of last inspection
5. Installation deficiencies (missing parts, incorrect installation of parts)
6. Structural deficiencies (concrete cracks, broken parts)
7. Operational deficiencies (leaks, elevated water level)
8. Presence of oil sheen or depth of oil layer
9. Estimate of depth/volume of floatables (trash, leaves) captured
10. Sediment depth measured
11. Recommendations for any repairs and/or maintenance for the unit
12. Estimation of time before maintenance is required if not required at time of inspection

A sample inspection checklist is provided at the end of this manual.

Maintenance

Procedure

The Hydroworks HydroDome unit is typically maintained using a vacuum truck. There are numerous companies that can maintain the HydroDome separator. Maintenance with a vacuum truck involves removing all of the water and sediment together. The water is then separated from the sediment on the truck or at the disposal facility.

The area around the HydroDome provides clear access to the bottom of the structure (Figure 3). This is the area where a vacuum hose would be lowered to clean the unit.

In instances where a vacuum truck is not available other maintenance methods (i.e. clamshell bucket) can be used, but they will be less effective. If a clamshell bucket is used the water must be decanted prior to cleaning since the sediment is under water and typically fine in nature.

The local municipality should be consulted for the allowable disposal options for both water and sediments prior to any maintenance operation. Once the water is decanted the sediment can be removed with the clamshell bucket.

Maintenance of a Hydroworks HydroDome unit will typically take 1 to 2 hours depending on size of unit and using a vacuum truck. Cleaning may take longer for other cleaning methods (i.e. clamshell bucket).

Inlet protection (Figure 2) is located at the inlet to the low flow opening in the HydroDome to ensure the opening does not become clogged. Although it is not anticipated that the inlet protection will have to be replaced on a regular (i.e. annual) basis since the inlet protection is protected by the submerged entrance to the HydroDome , the inlet protection should be checked each time the HydroDome is inspected or maintained. The inlet protection is removable and should be rinsed with water to ensure any debris caught on the protection is discarded. Unless damaged, the inlet protection can be reinstalled. A replacement piece can be bought through Hydroworks and/or retail stores. Hydroworks can provide information on the inlet protection and where it can be bought. A sign that the inlet protection needs cleaning/replacement would be a water level near the crown of the outlet pipe in the structure during periods with no flow.

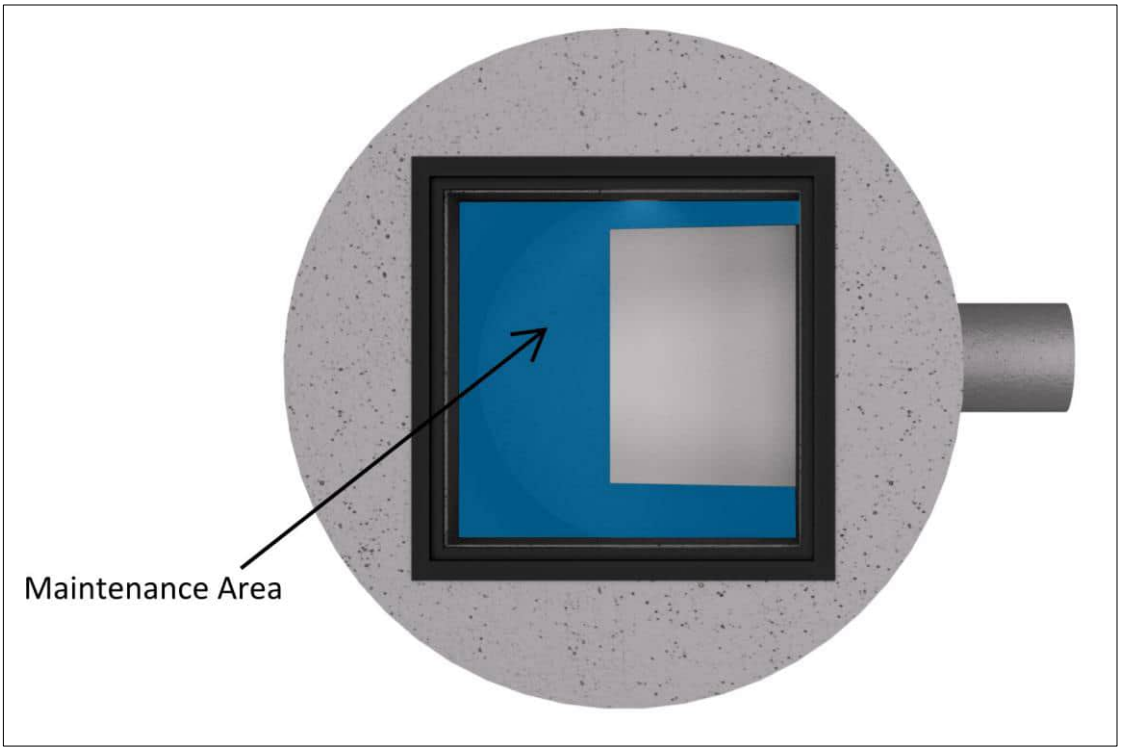


Figure 3. HydroDome Maintenance Access

Frequency

Construction Period

A HydroDome separator can fill with construction sediment quickly during the construction period. The HydroDome must be maintained during the construction period when the depth of TSS/sediment reaches 24” (600 mm). It must also be maintained during the construction period if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the area of the separator

The HydroDome separator should be maintained at the end of the construction period, prior to operation for the post-construction period.

Post-Construction Period

The maintenance for sediment accumulation is required if the depth of sediment is 1 ft or greater in separators with standard water (sump) depths (Table 1).

There will be designs with increased sediment storage based on specifications or site-specific criteria. Please contact Hydroworks at 888-290-7900 to inquire whether your HydroDome was designed with extra sump depth to extend the frequency of maintenance.

The HydroDome separator must also be maintained if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 75% of the water surface of the separator.

Table 1 Standard Dimensions for Hydroworks HydroDome Models

Model	Diameter ft (mm)	Maintenance Sediment Depth in (mm)
HD 3	3 (900)	12 (300)
HD 4	4 (1200)	12 (300)
HD 5	5 (1500)	12 (300)
HD 6	6 (1800)	12 (300)
HD 7	7 (2100)	12 (300)
HD 8	8 (2400)	12 (300)
HD 10	10 (3000)	12 (300)
HD 12	12 (3600	12 (300)

HYDRODOME INSPECTION SHEET

Date _____
Date of Last Inspection _____

Site _____
City _____
State _____
Owner _____

GPS Coordinates _____

Date of last rainfall _____

Site Characteristics	**Yes**	**No**
Soil erosion evident	☐	☐
Exposed material storage on site	☐	☐
Large exposure to leaf litter (lots of trees)	☐	☐
High traffic (vehicle) area	☐	☐

HydroDome	**Yes**	**No**
Obstructions in the inlet	☐ *	☐
Damage to HydroDome (cracked, broken, loose pieces)	☐ **	☐
Improperly installed outlet pipe	☐ ***	☐
Internal component damage (cracked, broken, loose pieces)	☐ **	☐
Floating debris in the separator (oil, leaves, trash)	☐	☐
Large debris visible in the separator	☐ *	☐
Concrete cracks/deficiencies	☐ ***	☐
Exposed rebar	☐ **	☐
Raised water level (water level close to top of HydroDome)	☐ ***	☐
Water seepage (water level not at outlet pipe invert)	☐ ***	☐

Water level depth below outlet pipe invert _____“

Routine Measurements

Floating debris depth	**< 0.5” (13mm)**	☐	**>0.5” 13mm)**	☐ *
Floating debris coverage	**< 75% of surface area**	☐	**> 75% surface area**	☐ *
Sludge depth	**< 12” (300mm)**	☐	**> 12” (300mm)**	☐ *****

* Maintenance required
** Repairs required
*** Further investigation is required

Note: Inspections should not be made within 24 hours of a storm to allow the water to drain from the structure to assess a raised water level or water level seepage

Hydroworks

Other Comments:

Hydroworks

Hydroworks® HydroDome

One Year Limited Warranty

Hydroworks, LLC warrants, to the purchaser and subsequent owner(s) during the warranty period subject to the terms and conditions hereof, the Hydroworks HydroDome to be free from defects in material and workmanship under normal use and service, when properly installed, used, inspected and maintained in accordance with Hydroworks written instructions, for the period of the warranty. The standard warranty period is 1 year.

The warranty period begins once the separator has been manufactured and is available for delivery. Any components determined to be defective, either by failure or by inspection, in material and workmanship will be repaired, replaced or remanufactured at Hydroworks' option provided, however, that by doing so Hydroworks, LLC will not be obligated to replace an entire insert or concrete section, or the complete unit. This warranty does not cover shipping charges, damages, labor, any costs incurred to obtain access to the unit, any costs to repair/replace any surface treatment/cover after repair/replacement, or other charges that may occur due to product failure, repair or replacement.

This warranty does not apply to any material that has been disassembled or modified without prior approval of Hydroworks, LLC, that has been subjected to misuse, misapplication, neglect, alteration, accident or act of God, or that has not been installed, inspected, operated or maintained in accordance with Hydroworks, LLC instructions and is in lieu of all other warranties expressed or implied. Hydroworks, LLC does not authorize any representative or other person to expand or otherwise modify this limited warranty.

The owner shall provide Hydroworks, LLC with written notice of any alleged defect in material or workmanship including a detailed description of the alleged defect upon discovery of the defect. Hydroworks, LLC should be contacted at 136 Central Ave., Clark, NJ 07066 or any other address as supplied by Hydroworks, LLC. (888-290-7900).

This limited warranty is exclusive. There are no other warranties, express or implied, or merchantability or fitness for a particular purpose and none shall be created whether under the uniform commercial code, custom or usage in the industry or the course of dealings between the parties. Hydroworks, LLC will replace any goods that are defective under this warranty as the sole and exclusive remedy for breach of this warranty.

Subject to the foregoing, all conditions, warranties, terms, undertakings or liabilities (including liability as to negligence), expressed or implied, and howsoever arising, as to the condition, suitability, fitness, safety, or title to the Hydroworks HydroDome are hereby negated and excluded and Hydroworks, LLC gives and makes no such representation, warranty or undertaking except as expressly set forth herein. Under no circumstances shall Hydroworks, LLC be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the HydroDome, or the cost of other goods or services related to the purchase and installation of the HydroDome. For this Limited Warranty to apply, the HydroDome must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and Hydroworks' written installation instructions.

Hydroworks, LLC expressly disclaims liability for special, consequential or incidental damages (even if it has been advised of the possibility of the same) or breach of expressed or implied warranty. Hydroworks, LLC shall not be liable for penalties or liquidated damages, including loss of production and profits; labor and materials; overhead costs; or other loss or expense incurred by the purchaser or any third party. Specifically excluded from limited warranty coverage are damages to the HydroDome arising from ordinary wear and tear; alteration, accident, misuse, abuse or neglect; improper maintenance, failure of the product due to improper installation of the concrete sections or improper sizing; or any other event not caused by Hydroworks, LLC. This limited warranty represents Hydroworks' sole liability to the purchaser for claims related to the HydroDome, whether the claim is based upon contract, tort, or other legal basis.

STORMTRAP MAINTENANCE MANUAL

1. Introduction

Regular inspections are recommended to ensure that the system is functioning as designed. Please call your Authorized StormTrap Representative if you have questions in regards to the inspection and maintenance of the StormTrap system. Prior to entry into any underground storm sewer or underground detention systems, appropriate OSHA and local safety regulations and guidelines should be followed.

2. Inspection Schedules for Municipalities

StormTrap Stormwater Management Systems are recommended for inspection whenever the upstream and downstream catch basins and stormwater pipes of the stormwater collection system are inspected or maintained. This will economize the cost of the inspection if it is done at the same time the Municipal crews are visiting the area.

3. Inspection Schedules for Private Development

StormTrap Stormwater Mangement Systems, for a private development, are recommended for inspection after each major storm water event. At a minimum, until a cleaning schedule can be established, an annual inspection is recommended. If inspected on an annual basis, the inspection should be conducted before the stormwater season begins to be sure that everything is functioning properly for the upcoming storm season.

4. Inspection Process

Inspections should be done such that at least 2-3 days has lapsed since the most recent rain event to allow for draining. Visually inspect the system at all manhole locations. Utilizing a sediment pole, measure and document the amount of silt at each manhole location (Figure 1). Inspect each pipe opening to ensure that the silt level or any foreign objects are not blocking the pipes. Be sure to inspect the outlet pipe(s) because this is typically the smallest

pipe in the system. It is common that most of the larger materials will be collected upstream of the system in catch basins, and it is therefore important at time of inspections to check these structures for large trash or blockages.

Remove any blockages if you can during the inspection process only if you can do so safely from the top of the system without entering into the system**. Do not go into the system under any circumstances** without proper ventilation equipment and training. Pass any information requiring action onto the appropriate maintenance personnel if you cannot remove the blockages from above during the inspection process. Be sure to describe the location of each manhole and the type of material that needs to be removed.

The sediment level of the system should also be measured and recorded during the inspection process. Recording the sediment level at each manhole is very important in order get a history of sediment that can be graphed over time (i.e. years) in order to estimate when the system will need to be maintained next. It is also important to keep these records to verify that the inspection process was actually performed if anyone asks for your records in the future.

The sediment level in the underground detention system can be determined from the outside of the system by opening up all the manholes and using a sediment pole to measure the amount of sediment at each location. Force the stick to the bottom of the system and then remove it and measure the amount of sediment at that location. Again, do not go into the system under any circumstances without proper ventilation equipment and training.

5. When to Clean the System

Any blockages should be safely removed as soon as practical so that the Stormwater detention system will fill and drain properly before the next stormwater event.

The Dry Detention System should be completely cleaned whenever the sediment occupies more than 10% to 15% of the originally designed system's volume. The Wet Detention System should be cleaned when the sediment occupies more than 30% or 1/3rd of the originally designed system's volume. NOTE: Check with your municipality in regards to

cleaning criteria, as the allowable sediment before cleaning may be more or less then described above.

6. How to Clean the StormTrap

The system should be completely cleaned back to 100% of the originally designed storage volume whenever the above sediment levels have been reached. Be sure to wait at least 3 days after a stormwater event to be sure that the system is completely drained (if it is a Dry Detention System), and all of the sediments have settled to the bottom of the system (if it is a Wet Detention System).

Do not enter the System unless you are properly trained, equipped, and qualified to enter a confined space as identified by local occupational safety and health regulations.

There are many maintenance companies that are in business to help you clean your underground stormwater detention systems and water quality units. Please call your StormTrap representative for referrals in your area.

A. Dry Detention System Cleaning

Maintenance is typically performed using a vacuum truck. Sediment should be flushed towards a vacuum hose for thorough removal. For a Dry Detention System, remove the manhole cover at the top of the system and lower a vacuum hose into one of the rows of the StormTrap system. Open up the manhole at the opposite end of the StormTrap and use sewer jetting equipment to force water in the same row from one end of the StormTrap row to the opposite side. The rows of the StormTrap are completely open in one contiguous channel from one end to the other for easy cleaning.

Place the vacuum hose and the sewer jetting equipment in the next row and repeat the process until all of the rows have been cleaned.

When finished, replace all covers that were removed and dispose of the collected material properly.

B. Wet Detention System Cleaning

If the system was designed to maintain a permanent pool of water, floatables and any oil should be removed in a separate procedure prior to the removal of all sediment.

The floatable trash is removed first by using a bucket strainer to capture and remove any floating debris.

The floatable oils are then removed off the top of the water by using the vacuum truck to suck off any floatable fluids and liquids.

The next step is to use the vacuum truck to gently remove the clarified water above the sediment layer.

The final step is to clean the sediment for each row as described above in the paragraph "A. Dry Detention System Cleaning". For smaller systems, the vacuum truck can remove all of the sediment in the basin without using the sewer jetting equipment because of the smaller space.

7. Inspection Reports

Proof of these inspections is the responsibility of the property owner. All inspection reports and data should be kept on site or at a location where they will be accessible for years in the future. Some municipalities require these inspection and cleaning reports to be forwarded to the proper governmental permitting agency on an annual basis.

Refer to your local and national regulations for any additional maintenance requirements and schedules not contained herein. Inspections should be a part of your standard operating procedure.

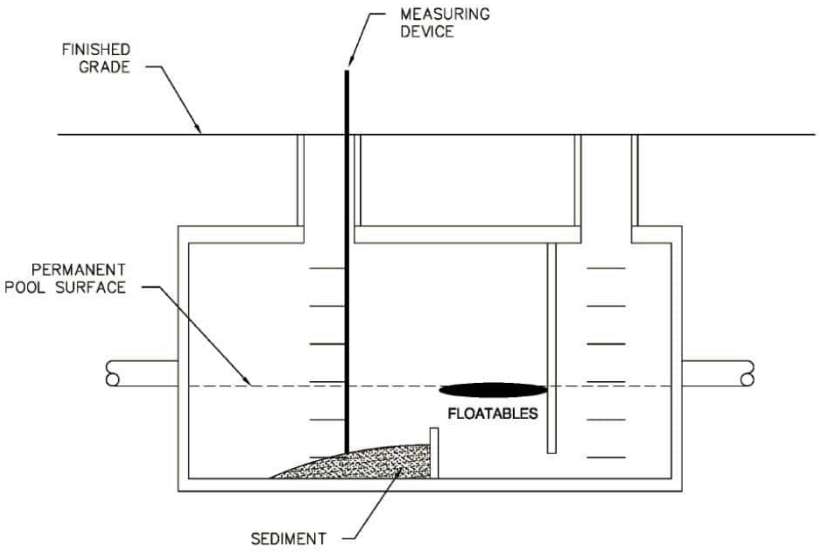


Figure 1. During inspection, measure the distance from finished grade to the top of the sediment inside the system.

Sample inspection and maintenance log

Date	Depth of Sediment	Accumulated Trash	Maintenance Performed	Maintenance Personnel	Comments
2/5/2012	3”	None	Sediment Removal/Vac	B. Johnson	

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1287 Windham Parkway
Romeoville, Illinois 60446

APPENDIX F

CIVIL DRAWINGS

GENERAL NOTES

1. ALL WORK TO CONFORM TO THE LATEST TOWN OF NIAGARA–ON–THE–LAKE STANDARDS AND REQUIREMENTS, REGIONAL MUNICIPALITY OF NIAGARA STANDARDS, LATEST ADOPTED ONTARIO PROVINCIAL STANDARD DRAWINGS AND SPECIFICATIONS AND THE ONTARIO BUILDING CODE UNLESS OTHERWISE NOTED ON THE DRAWINGS.
2. ALL WORK SHALL BE COMPLETED IN ACCORDANCE WITH THE CURRENT "OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATION FOR CONSTRUCTION PROJECTS". THE GENERAL CONTRACTOR SHALL BE DEEMED TO BE THE CONSTRUCTOR AS DEFINED IN THE ACT.
3. ALL TEMPORARY TRAFFIC CONTROL AND SIGNAGE DURING CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE CURRENT ONTARIO TRAFFIC MANUAL BOOK 7: TEMPORARY CONDITIONS FIELD EDITION.
4. ALL TRENCHES WITHIN THE EXISTING RIGHT–OF–WAY PAVED AREAS SHALL BE BACKFILLED WITH GRANULAR A AND SHALL BE COMPACTED TO 100% SPMDD.
5. THE CONTRACTOR SHALL RECTIFY ALL DISTURBED AREAS TO THE ORIGINAL CONDITION OR BETTER AND TO THE SATISFACTION OF THE EXECUTIVE DIRECTOR OF TECHNICAL SERVICES.
6. PRIOR TO COMMENCING ANY WORK WITHIN THE MUNICIPAL RIGHT–OF–WAY THE CONTRACTOR OR DEVELOPER SHALL OBTAIN ALL NECESSARY PERMITS FROM THE TOWN INCLUDED BUT NOT LIMITED TO ROAD OCCUPANCY PERMITS.
7. CONTACT TOWN INSPECTOR AND ENGINEER 48 HOURS BEFORE EXCAVATION, INSTALLATION OR BACKFILL.
8. LOCATION AND COMPLETENESS OF EXISTING SERVICES/UTILITIES SHOWN ON THE DRAWINGS ARE NOT GUARANTEED. CONTRACTOR SHALL NOTIFY THE UTILITY COMPANIES AT LEAST FORTY–EIGHT (48) HOURS PRIOR TO COMMENCEMENT OF ANY LOCATION WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS TO LOCATE THE EXISTING SERVICES ON SITE.
9. THE DRAWINGS INDICATE EXISTING SERVICES AND DID NOT ATTEMPT TO LOCATE THESE SERVICES OR ANY ADDITIONAL SERVICES (I.E. ABANDONED BUILDING FOUNDATIONS AND OTHER EXISTING FACILITIES NOT SHOWN ON THE DRAWINGS).
10. THE CONTRACTOR SHALL PROVE THE EXACT LOCATION AND SIZE OF ALL SERVICES AND STRUCTURES AND SHALL BE RESPONSIBLE FOR ADEQUATELY PROTECTING THEM AGAINST DAMAGE ASSUMING ALL LIABILITIES FOR DAMAGE.
11. THE CONTRACTOR SHALL REPORT TO THE ENGINEER ANY CONFLICT WHICH THE EXISTING SERVICES MAY CREATE WITH THE PROPOSED WORK AND SHALL SCHEDULE CONSTRUCTION WORK AVOIDING CONSTRUCTION DELAYS CAUSED BY SUCH CONFLICTS.
12. MAINTAIN VEHICULAR AND PEDESTRIAN TRAFFIC AT ALL TIMES.
13. ALL SERVICES AND POLES TO BE SUPPORTED AS REQUIRED.
14. THE CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS AND LICENSES BEFORE PROCEEDING WITH ANY WORK.
15. THE CONTRACTOR SHALL BECOME SOLE OWNER OF ALL EXCESS MATERIAL.
16. WITHIN THE PROPOSED LANDSCAPE PAVED AREAS GRANULAR B SHALL BE USED AS BACKFILL WITHIN 1m FROM MANHOLES, VALVE CHAMBERS AND CATCHBASINS, AND APPROVED NATIVE OR IMPORTED BACKFILL SHALL BE USED FOR ALL OTHER LANDSCAPE AREAS.
17. PROTECT ALL TREES FROM DAMAGE. SEE THE ARBORIST/LANDSCAPE DRAWINGS AND REPORT FOR DETAILS.
18. REMOVE OBJECTS AS PER OPSS 510, INCLUDING APPROVED COMPACTED BACKFILL. AND ABANDON PIPE AS PER OPSS 510 INCLUDING SEALING OF PIPE AND FILLING IT WITH 15MPA CONCRETE OR GROUT.
19. ADJUST ALL EXISTING MANHOLE, CATCHBASIN AND VALVEBOX FRAMES TO PROPOSED FINISHED GRADE.
20. RELOCATE EXISTING SERVICES AS REQUIRED TO CONSTRUCT PROPOSED INFRASTRUCTURE.
21. CONTRACTOR TO WORK IN DRY CONDITIONS. TEMPORARY PLUGGING OF SEWER UP AND DOWN STREAM WILL BE REQUIRED. PROVISION FOR WET WEATHER SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
22. WHERE THE STABILITY, SAFETY OR FUNCTION OF THE EXISTING ROADWAY OR UNDERGROUND FACILITIES MAY BE IMPAIRED DUE TO THE CONTRACTOR'S METHOD OF OPERATIONS, THE CONTRACTOR SHALL PROVIDE SUCH PROTECTION AS MAY BE REQUIRED INCLUDING SHEETING, SHORING AND DRIVING PILES WHERE NECESSARY. CONSTRUCTION OF SHORING, BRACING AND PROTECTION SCHEMES SHALL CONFORM TO OPSS 538 AND OPSS 539.
23. ANY AREA OUTSIDE THE LIMIT OF WORK THAT IS DISTURBED SHALL BE RESTORED TO ITS ORIGINAL CONDITION BY THE CONTRACTOR AT NO COST TO THE OWNER.
24. REQUIRED SHOP DRAWINGS SHALL BE BASED ON FIELD MEASUREMENT AND LAYOUT VERIFICATION BY THE CONTRACTOR.
25. WHERE NEW PAVING OR EARTHWORK MEETS EXISTING PAVING OR EARTHWORK, SMOOTHLY BLEND LINE AND GRADE OF EXISTING WITH NEW.
26. EXPANSION JOINT FILLER SHALL BE PLACED WHERE PAVEMENT MEETS STRUCTURES–INCLUDING WALLS, LIGHT POLES, HYDRANTS, BUILDINGS AND BUILDING COLUMNS, STAIRS AND AT OTHER CONDITIONS SHOWN ON THE DRAWINGS.
27. EXCAVATION REQUIRED WITHIN PROXIMITY OF UTILITY LINES AND WITHIN THE TREE PROTECTION ZONE OF TREES DESIGNATED TO REMAIN SHALL BE DONE BY HAND. CONTRACTOR SHALL REPAIR ANY DAMAGE TO EXISTING UTILITY LINES OR STRUCTURES INCURRED DURING CONSTRUCTION OPERATION AT NO COST TO THE UTILITY COMPANIES OR THE OWNER.

LAYOUT AND MATERIALS

1. ALL DIMENSIONS SHOWN ON THE DRAWINGS ARE IN METERS, EXCEPT PIPE DIAMETERS, WHICH ARE IN MILLIMETERS, UNLESS OTHERWISE SHOWN.
2. CONSTRUCTION LAYOUT BY CONTRACTOR.
3. ALL HORIZONTAL DIMENSION ARE TO CENTER OF OBJECT OR TO GUTTER OF CURB.
4. LASER ALIGNMENT CONTROL IS MANDATORY. AS–BUILT OF PIPE INVERT ELEVATIONS WITH CORRESPONDING STATIONS SHALL BE RECORDED PRIOR TO BACK FILLING OF TRENCH.
5. AS–BUILT ELEVATION AND COORDINATES SHALL BE PROVIDED AT 20M INTERVALS, AND AT EVERY HORIZONTAL AND VERTICAL CHANGE OF ALIGNMENT AND UPSTREAM AND DOWNSTREAM OF EACH SANITARY OR STORM MAHHOLE, AND WATERMAIN VALVE CHAMBERS.
6. HORIZONTAL AND VERTICAL CONTROL BASED ON PUBLISHED BENCHMARKS AND HORIZONTAL CONTROL MARKERS.
7. ALL LINE AND GRADE WORK PER DRAWING AND SPECIFICATION SHALL BE LAID OUT BY A REGISTERED CIVIL ENGINEER OR SURVEYOR.

DEWATERING AND SOIL STABILIZATION

1. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DEWATERING AND SOIL STABILIZATION.

SANITARY SEWERS

1. SERVICE CONNECTION PVC PIPE TO BE AS PER DR 28 CSA B182.2–06 CERTIFIED ASTM D3034–04A.
2. BEDDING FOR FLEXIBLE PIPE SHALL BE AS PER OPSD 802.010, 802.013 OR 802.014.
3. MAINTENANCE HOLES AS PER OPSD STANDARDS, 701.010 (1200mm), 701.011 (1500mm), 701.012 (1800mm), 701.013 (2400mm) AND 701.014 (3000mm). FRAME AND COVER AS PER OPSD 401.010 TYPE A CLOSED.
4. BENCHING SHALL BE AS PER OPSD 701.021.
5. SANITARY SERVICES SHALL BE A MINIMUM OF 2.4m AND MAXIMUM OF 3.0m DEEP MEASURED FROM THE FINAL GRADE AT THE STREET LINE.
6. SANITARY MAINTENANCE HOLE SHALL HAVE WATERTIGHT FRAME AND COVER IN PONDING AREAS AS PER OPSD 401.030.
7. LATERAL CONNECTIONS TO SEWERS SHALL BE CORE DRILLING AND FACTORY MADE SADDLES FOR CONNECTION TO EXISTING SEWERS AS PER NOTL REQUIREMENTS.
8. GRANULAR MATERIALS INCLUDING SEWER EMBEDMENT SHALL NOT CONSIST OF RECLAIMED/RECYCLED MATERIAL
9. THE USE OF HIGH PERFORMANCE BEDDING (HPB) FOR SEWER PIPE BEDDING/BACKFILL WILL NOT BE PERMITTED UNLESS REQUIRED AS A RESULT OF A SPECIFIC TRENCH CONDITIONS AND SUPPORTED WITH A RECOMMENDATION FROM A GEOTECHNICAL ENGINEER WHICH WILL INCLUDE THE POTENTIAL FOR MIGRATION OF NATIVE FINES INTO HPB VOIDS AND ITS MITIGATION.
10. CLEAN AND VIDEO INSPECT ALL SEWER AND SERVICE CONNECTIONS PRIOR TO FINAL RESTORATION.

WATERMAINS

1. ALL POLYVINYL CHLORIDE (PVC) PIPES, RANGING IN SIZE FROM 100 mm THROUGH 300 mm IN DIAMETER SHALL BE PRESSURE CLASS 235, DR 18 AND MANUFACTURED IN ACCORDANCE AWWA C900–07 AND TO CSA B137.3–05 AND SHALL HAVE CAST IRON OUTSIDE DIAMETER DIMENSIONS.
2. BEDDING FOR FLEXIBLE PIPE SHALL BE AS PER OPSD 802.010, 802.013 OR 802.014.
3. MINIMUM COVER ON WATERMAINS WILL BE 1.7 METRES BELOW FINISHED GRADE.
4. ALL HYDRANTS SHALL CONFORM TO OPSS 401 AND OPSD 1105.01. HYDRANTS SHALL HAVE TWO 63.5 mm I.D. HOSE NOZZLES AT 180° AND ONE 100 mm STORZ PUMPER NOZZLE, WITH OPERATING NUT "OPEN LEFT". HYDRANTS SHALL BE PAINTED IN ACCORDANCE WITH THE TOWN STANDARDS.
5. ALL CURB AND VALVE BOXES TO BE LOCATED AT STREET LINE. VALVE BOXES SHALL BE SET FLUSH WITH GRADE AND PROTECTED FROM ALL DAMAGE.
6. VALVES SHALL CONFORM TO AWWA C500 & C509 AND SHALL BE IRON–BODY RESILIENT–SEATED GATE VALVES, MECHANICAL JOINTED AND SHALL OPEN LEFT–HANDED WITH 50mm SQUARE OPERATING NUT. VALVE BOXES SHALL BE CAST IRON, SLIDE TYPE.
7. MECHANICAL THRUST RESTRAINTS SHALL BE INSTALLED AT ALL FITTINGS, BENDS, TEES, CROSSES, REDUCERS AND VALVES FOR ALL WATERMAIN SIZES.
8. ALL TEES, PLUGS, HORIZONTAL, VERTICAL BENDS, REDUCERS AND HYDRANTS TO HAVE CONCRETE THRUST BLOCKS AS PER OPSD 1103.01 & OPSD 1103.020.
9. WATERMAINS MUST FOLLOW THE MINISTRY OF THE ENVIRONMENT PROCEDURES THAT GOVERN THE SEPARATION OF SEWERS AND WATERMAINS F–6–1. A MINIMUM VERTICAL CLEARANCE OF 0.5 METRE AND HORIZONTAL SEPARATION OF 2.5 METRES MUST BE MAINTAINED BETWEEN WATERMAIN AND SEWERS.
10. 11.0 kg ZINC SACRIFICIAL ANODES TO BE INSTALLED FOR ALL METAL PIPES, APPURTENANCES AND FITTINGS AND 5.5 kg ZINC SACRIFICIAL ANODES SHALL BE INSTALLED ON ALL WATER SERVICE CONNECTIONS, AS PER OPSD 1109.011.
11. TRACER WIRE SHALL BE 10 GAUGE SEVEN STRAND, INSULATED COPPER WIRE WITH 60 MIL OF BLACK, CROSS–LINKED POLYETHYLENE INSULATION SPECIFICALLY MANUFACTURED FOR DIRECT BURIAL APPLICATIONS AND SHALL BE BROUGHT THE SURFACE AT ALL HYDRANTS AND VALVES.
12. WATERMAINS TO BE INSTALLED TO GRADE AS SHOWN ON APPROVED PLANS, COPY OF GRADE SHEET MUST BE SUPPLIED TO INSPECTOR PRIOR TO COMMENCEMENT OF WORK, WHEN REQUESTED BY INSPECTOR.
17. ALL SERVICE CONNECTION TO BE MARKED WITH A 38 mm x 89 mm x 2.4 m WOOD STAKE, PAINTED BLUE.

ROAD / PAVEMENTS

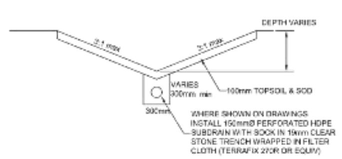
1. WHERE NEW ASPHALT MATCHES EXISTING ASPHALT, GRIND EXISTING ASPHALT A MINIMUM OF 300mm WIDE AND 40mm DEEP FOR KEYING. APPLY HOT RUBBER SEALING COMPOUND IN ACCORDANCE WITH OPSS 1212. ALL SURFACES TO BE TACK COATED WITH SS–1.
2. THE CONCRETE CURB, CONCRETE SIDEWALK (IF APPLICABLE) AND ALL RESTORATION ALONG FRONTING ROADWAYS TO THE SITE MUST BE CONSTRUCTED AND CARRIED OUT IN ACCORDANCE WITH ALL APPLICABLE AND CURRENT TOWN STANDARDS.
3. PRIOR TO PAVING, REMOVE UNSUITABLE MATERIAL AS DIRECTED BY THE ENGINEER.
4. CRUSHED LIME STONE SHALL BE USED FOR ALL GRANULAR BASE MATERIAL BELOW ASPHALT SURFACES.
5. GRANULAR ROAD BASE SHALL BE COMPACTED TO 100% SPMDD.
6. ASPHALT SHALL BE COMPACTED TO 92.0% TO 96.5% MRD.
7. REFER TO OPSS 310 FOR PAVEMENT COMPACTION REQUIREMENTS.
8. SAW CUT EXISTING PAVED SURFACES FULL DEPTH AND IN STRAIGHT LINES, WHERE PROPOSED AND EXISTING PAVED SURFACES MEET.
9. ALL DISTURBED ASPHALT PAVEMENT AREAS ALONG CENTRE STREET, GAGE STREET, AND KING STREET SHALL BE RESTORED TO MATCH EXISTING PAVEMENT STRUCTURE OR:
   –40mm HL3 HS
   –50mm HL8 HS
   –450mm GRANULAR A (COMPACTED TO 100% SPMDD)
10. WHERE CONSTRUCTION OF DRIVEWAY WILL IMPACT TREES TO BE RETAINED, GEOGRID TO BE UTILIZED TO MINIMIZE DEPTH OF DRIVEWAY. GEOGRID DRIVEWAY TO BE DESIGNED BY ENGINEER OR MANUFACTURER.
11. ON–SITE ACCESS PAVEMENT SHALL COMPRISE OF:
   –40mm HL3
   –50mm HL8
   –150mm GRANULAR A
   –450mm GRANULAR B

GRADING

1. ALL AREA GRADING AND RESULTING DRAINAGE PATTERNS SHALL NOT ADVERSELY AFFECT ADJACENT LANDS.
2. MINIMUM GENERALLY ACCEPTED GRADIENT – 2.0%.
3. MAXIMUM GENERALLY ACCEPTABLE GRADIENT – 5.0%.
4. MAXIMUM ACCEPTABLE SLOPE 3 PARTS HORIZONTAL TO 1 PART VERTICAL (3:1).
5. NO ALTERATIONS TO EXISTING BOUNDARY ELEVATIONS OR ADJACENT LANDS SHALL BE UNDERTAKEN UNLESS WRITTEN AGREEMENT WITH THE ADJACENT PROPERTY OWNER IS OBTAINED AND SUBMITTED IN A FORMAT ACCEPTABLE TO THE TOWN.
6. MINIMUM SWALE GRADIENT – 1.0%.
7. MINIMUM SWALE DEPTH – 150MM.
8. ALL SWALES OR DITCHES HAVING A VELOCITY IN EXCESS OF 1.5M/S SHALL BE DESIGNED TO INCORPORATE EROSION PROTECTION.
9. THE MINIMUM GRADIENT ON ANY DRIVEWAY SHALL BE 2.0%. THE MAXIMUM DRIVEWAY GRADIENT IS 8.0%.
10. RETAINING WALLS SHALL BE CONSTRUCTED ENTIRELY ON THE UPPER PROPERTY SO THAT TIE BACKS (IF REQUIRED) DO NOT CROSS PROPERTY BOUNDARIES.
11. MAXIMUM PONDING DEPTH 0.3 METERS.
12. PROPOSED SPOT ELEVATIONS WILL BE SHOWN FOR ASPHALT, LANDSCAPE OR CONCRETE AREAS. UNLESS OTHERWISE NOTED, TOP OF CURB ELEVATIONS ARE 0.15m ABOVE ASPHALT ELEVATIONS EXCEPT AT CURB DEPRESSIONS AND WHEEL CHAIR RAMPS.
13. FINISHED LOT GRADING NOT TO ADVERSELY AFFECT DRAINAGE OF EXISTING LANDS.
14. RESTORE ALL LANDSCAPE AREAS WITH 100mm TOPSOIL AND SOD.

FILL

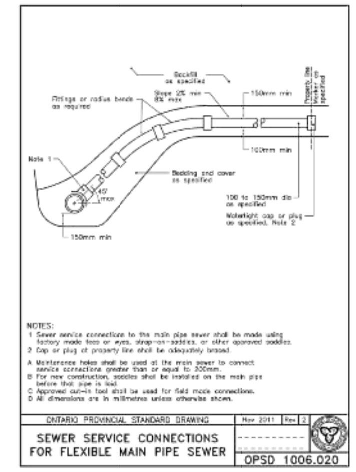
1. FILL SHALL BE NATIVE MATERIAL UNLESS OTHERWISE SHOWN. THE NATIVE MATERIAL SHALL BE FREE OF ORGANICS AND DEBRIS AND WITH A NATURAL MOISTURE CONTENT WHICH IS WITHIN 2% OF THE OPTIMUM MOISTURE CONTENT. WET MATERIAL MAY REQUIRE AERATION FOR PROPER COMPACTION BY SPREADING THEM THINLY ON THE GROUND.
2. ALL PIPE BEDDING MATERIAL SHALL BE COMPACTED TO 95% OF SPMDD.
3. FILL SHALL BE COMPACTED TO 95% SPMDD, EXCEPT UNDER PAVED SURFACES, WHERE THE UPPER 1.0M OF THE SUBGRADE SHALL BE COMPACTED TO 98% SPMDD. THE LIFT OF EACH LAYER SHALL BE LIMITED TO 200 mm OR THE LIFT THICKNESS SHALL BE DETERMINED BY TEST STRIPS.
4. STONES GREATER THAN 75 mm IN ANY DIMENSION WILL NOT BE PERMITTED IN BACKFILL PLACED WITHIN 300MM OF UTILITIES AND PAVEMENT SUBGRADE.
5. FILL SHALL BE PLACED AS FOLLOWS:
   1.1 THE AREA SHALL BE STRIPPED OF ALL EXISTING TOPSOIL AND OTHER UNSUITABLE MATERIALS. ALL SOFT SPOTS SHALL BE SUB–EXCAVATED. THE EXPOSED NATIVE SUBGRADE SHALL BE EXAMINED BY THE SOILS CONSULTANT PRIOR TO PLACEMENT OF FILL.
   1.2 THE FILL SHALL BE PLACED, SUCH THAT THE SPECIFIED FILL GEOMETRY IS ACHIEVED.
   1.3 TYPICALLY THE FILL MUST NOT BE PLACED BETWEEN THE PERIOD BETWEEN LATE NOVEMBER AND EARLY APRIL, AS IT IS DIFFICULT TO ENSURE THAT THE FILL IS FREE OF FROZEN SOILS. IF GRANULAR MATERIAL/RECYCLED CONCRETE IS USED, THE ABOVE PRECAUTIONARY MEASURES ARE NOT NECESSARY.

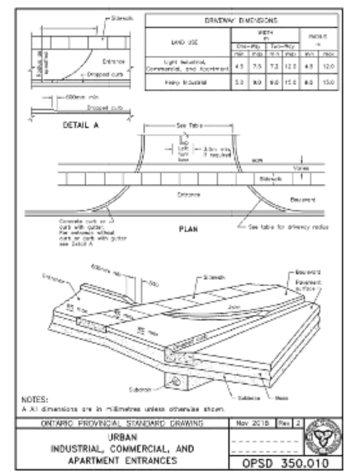


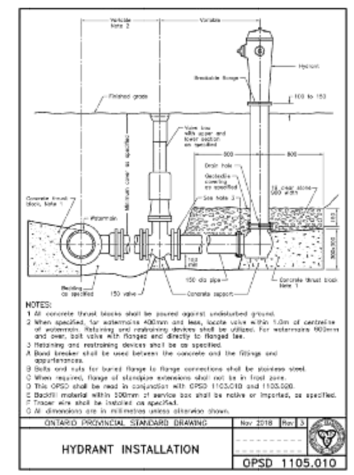
TYPICAL SWALE DETAIL
N.T.S.

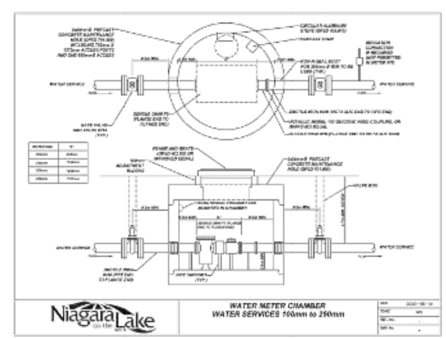
EROSION AND SEDIMENT CONTROL

1. SEDIMENT BARRIERS, CHECK DAMS, AND TEMPORARY CONSTRUCTION ACCESS TO BE INSTALLED PRIOR TO THE BEGINNING OF CONSTRUCTION.
2. ALL SEDIMENT CONTROL DEVICES TO BE ROUTINELY INSPECTED AND MAINTAINED IN PROPER WORKING ORDER UNTIL AREA IS STABILIZED.
3. IF NECESSARY, TRUCKS WILL BE WASHED DOWN BEFORE LEAVING THE SITE.
4. THE SITE WILL BE WET DOWN IF NECESSARY TO CONTROL DUST.
5. ALL CONSTRUCTION EQUIPMENT MUST BE PARKED ON–SITE.
6. ALL CONSTRUCTION ACTIVITY WILL COMPLY WITH THE TOWN NOISE BYLAW.
7. SEDIMENT CONTROL FENCE TO BE AS PER OPSD 219.130.
8. ALL CONSTRUCTION VEHICLES TO ENTER AND EXIT SITE FROM TEMPORARY CONSTRUCTION ACCESS.
9. ALL TOPSOIL STOCKPILES TO BE SURROUNDED WITH SEDIMENT CONTROL FENCING.
10. 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.
11. IN THE 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.
12. STREET SWEEPING, CATCH BASIN CLEANING AND DUST CONTROL ARE THE RESPONSIBILITY OF THE DEVELOPER AND MUST BE KEPT UNDER CONTROL ON ALL ROADWAYS TO THE SATISFACTION OF THE CITY.
13. MUD MATS TO BE INSTALLED AT ALL TEMPORARY CONSTRUCTION ACCESS POINTS.
14. THE CONTRACTOR WILL BE RESPONSIBLE TO DETERMINE LOCATIONS OF TOPSOIL AND/OR GRANULAR STOCKPILES WITHIN THE SITE. LOCATION OF STOCKPILES MAY CHANGE TO SUIT VARIOUS STAGES OF CONSTRUCTION.
15. THE CONTRACTOR SHALL PROVIDE SEPARATE STORAGE AREAS WITHIN THE SITE FOR HAZARDOUS AND WASTE MATERIALS. THE STORAGE AREAS SHALL BE LOCATED AWAY FROM ANY RECEIVING WATER BODIES, INCLUDING PONDS, SEWERS, DITCHES, ETC. AND INCLUDE SPILL CONTAINMENT AREAS WITH IMPERVIOUS SURFACES. THE CONTRACTOR IS RESPONSIBLE FOR ADDRESSING AND REPORTING ANY HAZARDOUS WASTE SPILLS TO THE APPROPRIATE LOCAL AGENCY.
16. CONTRACTOR TO ENSURE THAT PORTABLE TOILETS ARE LOCATED OFF PAVED ROADWAYS AND AWAY FROM ANY RECEIVING WATERS SUCH AS PONDS AND SEWERS.
17. THE SEDIMENT CONTROLS, INCLUDING SEDIMENTS, SHALL BE REMOVED OFF SITE AFTER GRASS SURFACES HAVE BEEN RESTORED TO THE SATISFACTION OF THE ENGINEER.
18. THE CONTRACTOR WILL BE RESPONSIBLE FOR ADDITIONAL SEDIMENT AND EROSION CONTROLS, AS DESCRIBED IN THE "EROSION & SEDIMENT CONTROL GUIDELINES FOR URBAN CONSTRUCTION" AND/OR OTHER TOWN OF NIAGARA–ON–THE–LAKE REQUIREMENTS ON A SITE–BY–SITE BASIS SUCH AS INTERCEPTOR SWALES/DIKES, ROCK CHECK DAMS, SEDIMENT TRAPS, ETC. TO PREVENT SEDIMENTS FROM THEIR CONSTRUCTION OPERATIONS FROM ENTERING THE EXISTING AND PROPOSED STORM DRAINAGE SYSTEMS.
18. AFTER ROAD CONSTRUCTION AND PRIOR TO LANDSCAPE OR SODDING OF SITE, CONTRACTOR TO INSTALL SEDIMENT CONTROLS, SUCH AS SEDIMENT FENCING, ALONG DOWNSTREAM EDGES OF INDIVIDUAL BLOCKS.





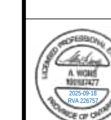




KEY PLAN
N.T.S.

No.	Revision	Comments
1	2023–02–02	ISSUED FOR 1ST ZBA SUBMISSION
2	2024–08–30	ISSUED FOR 1ST SPA SUBMISSION
3	2025–03–07	RE–ISSUED FOR SPA SUBMISSION
4	2025–07–23	RE–ISSUED FOR SPA SUBMISSION
5	2025–09–18	RE–ISSUED FOR SPA SUBMISSION

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS PREPARED BY RVA.



Drawing Prepared By:

R.V. ANDERSON ASSOCIATES LIMITED

Client:
TWO SISTERS RESORTS CORP.

Project Name:
PARLIAMENT OAK INN
325 KING ST.

Drawing Title:
GENERAL NOTES

Drawn:	Design:	Date:
SO	SO	JULY 2023
Checked: SDF	Approved: AST	Scale:
CADD File: 226757–S–GN1.dwg		Dwg. No.: GN1
Project No.: 226757		

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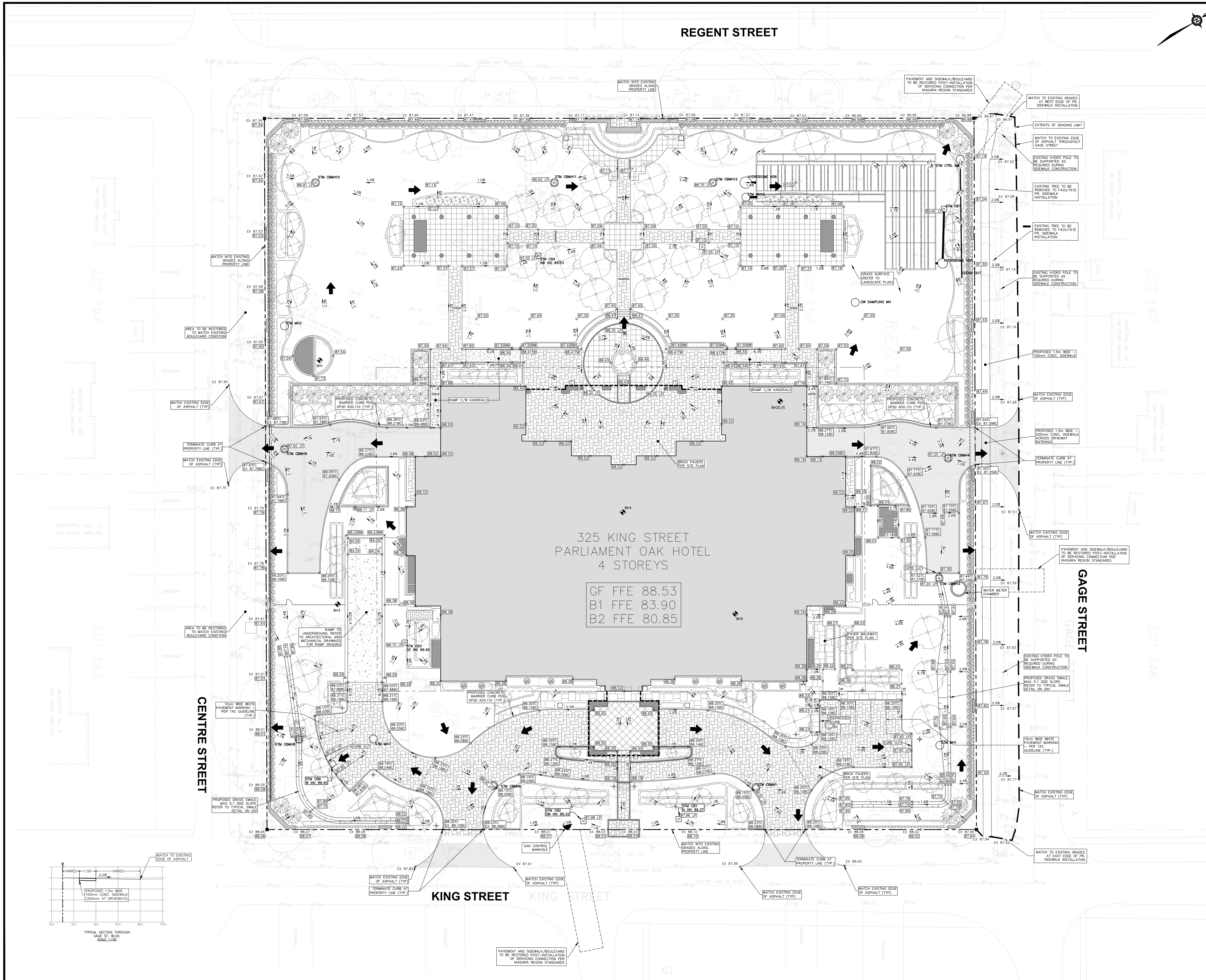

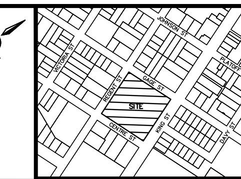

KEY PLAN
N.T.S.

No.	Revision	Comments
1	2023-02-02	ISSUED FOR 1ST ZBA SUBMISSION
2	2024-08-30	ISSUED FOR 1ST SPA SUBMISSION
3	2024-12-17	ISSUED FOR BUILDING PERMIT
4	2025-03-07	RE-ISSUED FOR SPA SUBMISSION
5	2025-07-23	RE-ISSUED FOR SPA SUBMISSION
6	2025-09-18	RE-ISSUED FOR SPA SUBMISSION

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS PREPARED BY RVA.

LEGEND

- PROPERTY LINE
- LIMIT OF ROOF OVERHANG
- PROPOSED ELEVATION
- PROPOSED LOW POINT
- EXISTING ELEVATION
- PROPOSED SLOPE
- AREA DRAIN (AD)
- CATCH BASIN
- STRIP DRAIN (SD)
- ACCESS OPENING FRAME & GRATE (MH)
- PROPOSED RETAINING WALL
- PROPOSED HIGH POINT
- PROPOSED FINISHED FLOOR ELEVATION
- PROPOSED OVERLAND FLOW ROUTE (GREATER THAN 100-YR STORM)
- PROPOSED ASPHALT
- PROPOSED CONCRETE
- PROPOSED PAVER
- PROPOSED LIGHT STANDARD
- BOREHOLE LOCATION (REFER TO GEOTECH INVESTIGATION REPORT)
- EXISTING MUNICIPAL SIGN
- EXISTING HYDRO POLE
- EXISTING BELL
- EXISTING GAS MAIN
- EXISTING GUY WIRE

BENCH MARK:
ELEVATIONS SHOWN ON THIS PLAN ARE EXTRACTED FROM TOPOGRAPHICAL SKETCH OF 325 KING ST., BY J.D. BARNES DATED NOVEMBER 25, 2022. ELEVATIONS ARE OF GEODETIC ORIGIN (CGVD-1928:7), AND ARE DERIVED FROM GNSS OBSERVATIONS AND NATURAL RESOURCES CANADA'S GEOID MODEL HT2.0.

BEARING NOTE:
BEARINGS ARE UTM GRID, DERIVED FROM REAL TIME NETWORK (RTN) OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (2010.0)

Contractor Must Check And Verify All Dimensions On The Job.

This Drawing Is Not To Be Used For Construction Until Signed By The Engineer.

NOTE:
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2025-09-18
RVA 226757

Drawing Prepared By:

R.V. ANDERSON ASSOCIATES LIMITED

Client:
TWO SISTERS RESORTS CORP.

Project Name:
PARLIAMENT OAK INN
325 KING ST.

Drawing Title:
SITE GRADING PLAN

Drawn: SO	Design: SO	Date: JULY 2023
Checked: SDF	Approved: AST	Scale: 1:200
CADD File: 226757-S-SG1.dwg		Dwg. No.: SG1
Project No.: 226757		

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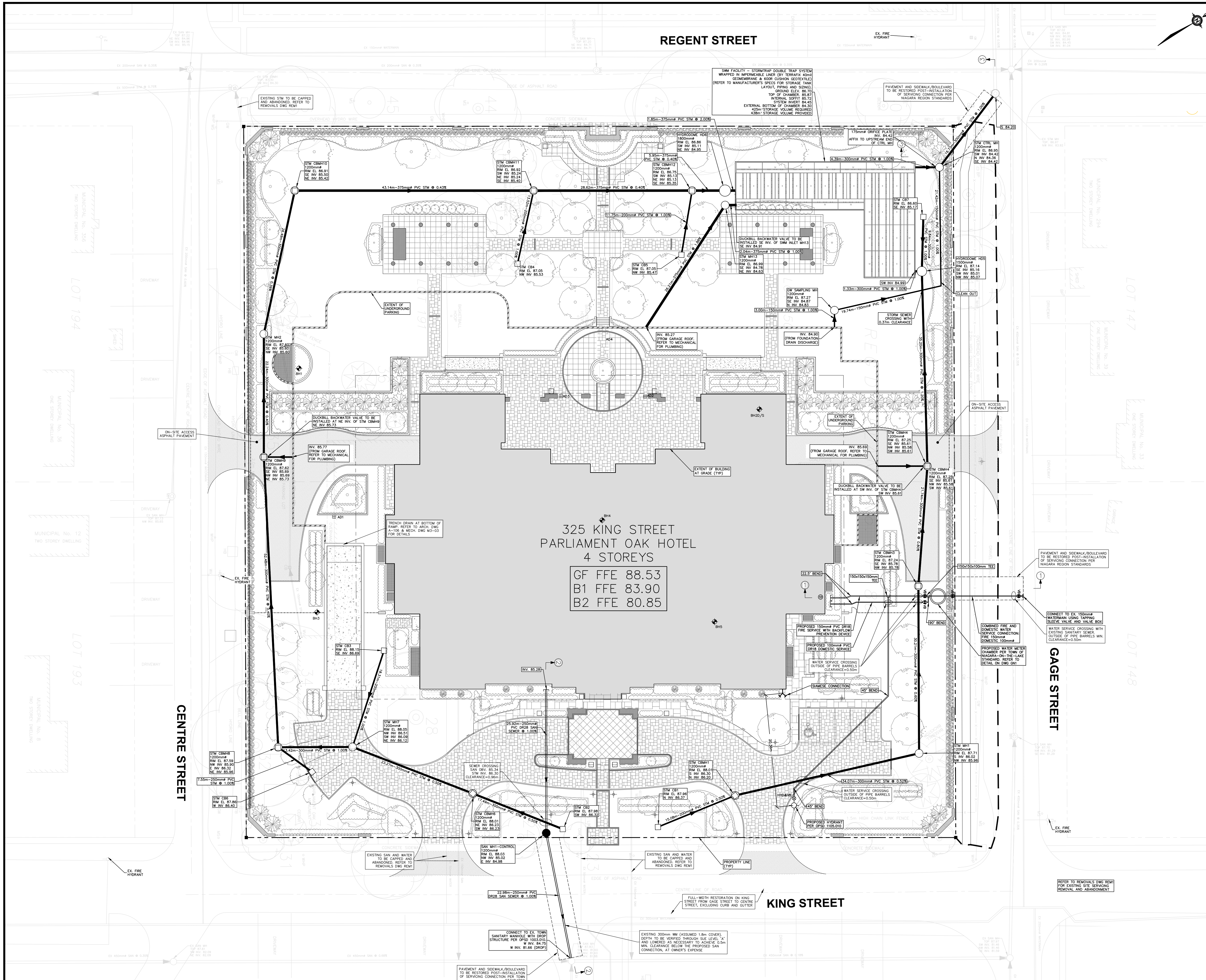

KEY PLAN
N.T.S.

No.	Revision	Comments
1	2023-02-02	ISSUED FOR 1ST ZBA SUBMISSION
2	2024-08-30	ISSUED FOR 1ST SPA SUBMISSION
3	2024-12-17	ISSUED FOR BUILDING PERMIT
4	2025-03-07	RE-ISSUED FOR SPA SUBMISSION
5	2025-07-23	RE-ISSUED FOR SPA SUBMISSION
6	2025-09-18	RE-ISSUED FOR SPA SUBMISSION
7	2025-11-03	REVISED AS PER TOWN COMMENTS

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS PREPARED BY RVA.

LEGEND

- PROPERTY LINE
- UNDERGROUND PARKING STRUCTURE
- AREA DRAIN
- ACCESS OPENING FRAME & GRATE (F&G)
- SEWER AND FLOW DIRECTION
- WATERMAIN
- VALVE & BOX (V&B)
- FIRE DEPARTMENT CONNECTION
- FIRE HYDRANT
- M+B WATER METER & BACK FLOW PREVENTER
- D DETECTOR ASSEMBLY
- PROPOSED SEWER CAP
- PROPOSED LIGHT STANDARD
- BOREHOLE LOCATION (REFER TO GEOTECH INVESTIGATION REPORT)
- MS EXISTING MUNICIPAL SIGN
- WHP EXISTING HYDRO POLE
- B EXISTING BELL
- GM EXISTING GAS MAIN
- EXISTING GUY WIRE

BENCH MARK:
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2025-11-03
RVA226757

Drawing Prepared By:
R.V. ANDERSON ASSOCIATES LIMITED

Client:
TWO SISTERS RESORTS CORP.

Project Name:
PARLIAMENT OAK INN
325 KING ST.

Drawing Title:
SITE SERVICING PLAN

Drawn: SO	Design: SO	Date: JULY 2023
Checked: SDF	Approved: AST	Scale: 1:200
CADD File: 226757-S-SS1.dwg		Dwg. No.: SS1
Project No.: 226757		

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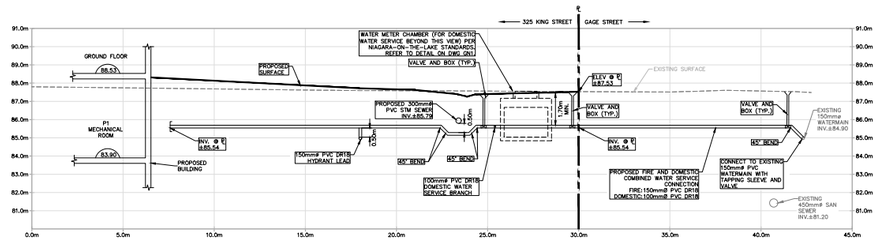

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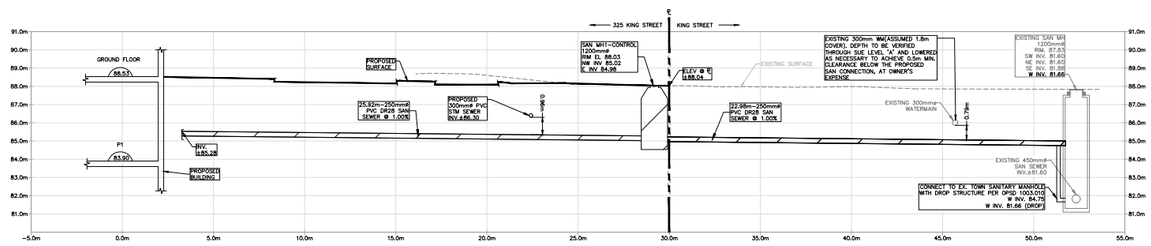

SAN SERVICE 0+55.00

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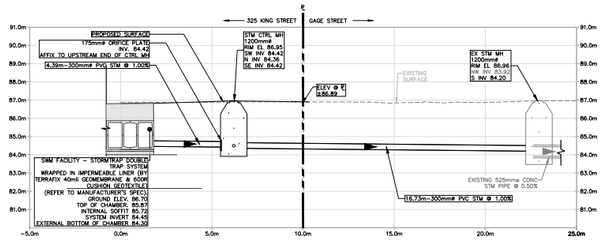

SECTION 3 - STM 0+25.00

SCALE 1:100

KEY PLAN
N.T.S.

No.	Revision	Comments
1	2023-02-02	ISSUED FOR 1ST ZRA SUBMISSION
2	2024-08-16	ISSUED FOR 1ST SPA SUBMISSION
3	2025-07-23	RE-ISSUED FOR SPA SUBMISSION
4	2025-09-18	RE-ISSUED FOR SPA SUBMISSION
5	2025-11-03	REVISED AS PER TOWN COMMENTS

LICENSED PROFESSIONAL ENGINEER A. MONT THOMPSON 2025/12/03 PROVINCE OF ONTARIO

Drawing Prepared By:

R.V. ANDERSON ASSOCIATES LIMITED

Client:

TWO SISTERS RESORTS CORP.

Project Name:

PARLIAMENT OAK INN

325 KING ST.

Drawing Title:

SERVICING CROSS SECTIONS

Drawn:	Design:	Date:
SO	SO	JULY 2023
Checked:	Approved:	Scale:
SDF	AST	AS SHOWN
CADD File:		Dwg. No.:
226757-S-SS1.dwg		SEC1
Project No.:		
226757		

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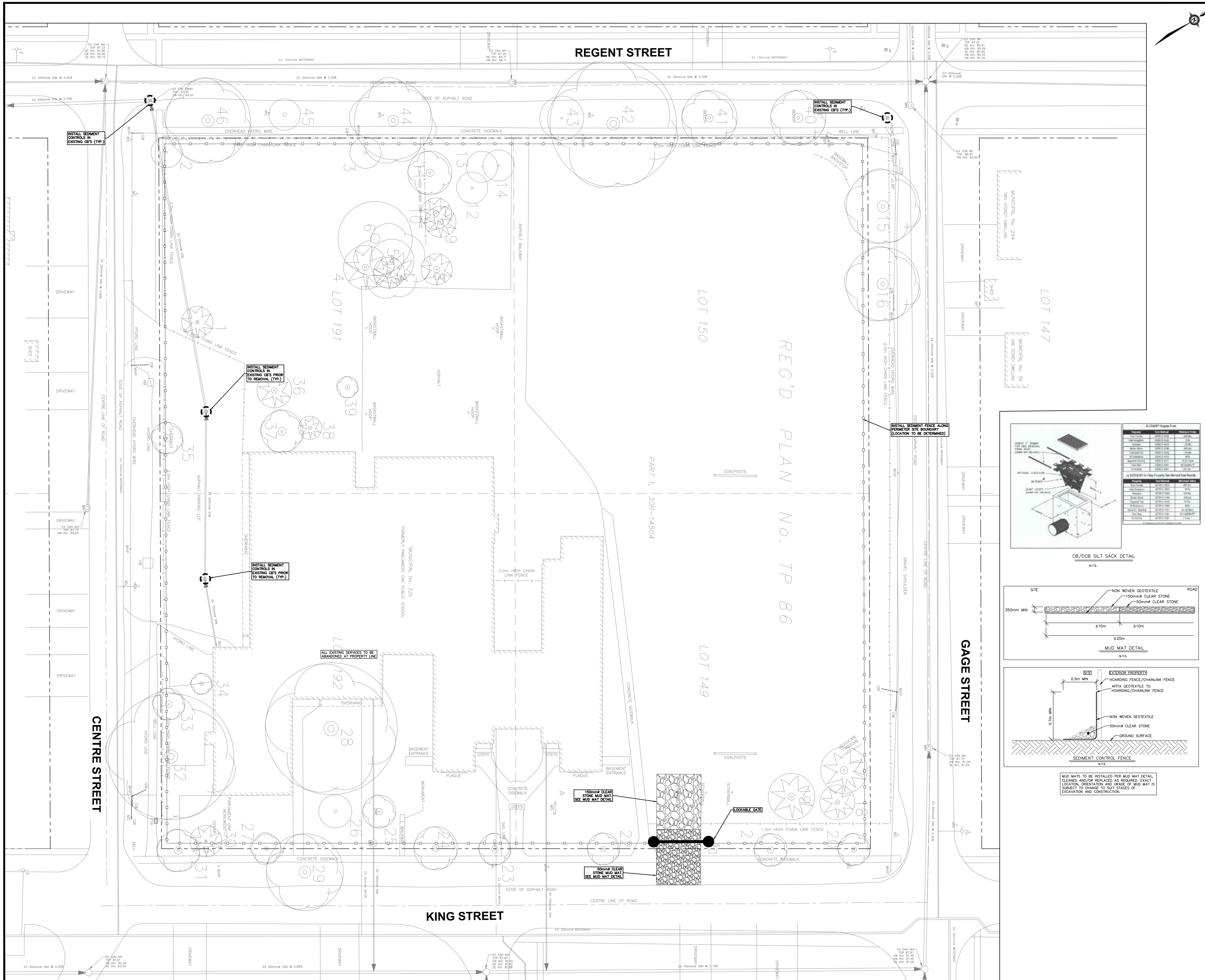

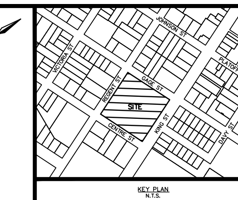

KEY PLAN
N.T.S.

No.	Revision	Comments
1	2023-02-02	ISSUED FOR 1ST ZBA SUBMISSION
2	2024-08-30	ISSUED FOR 1ST SPA SUBMISSION
3	2025-03-07	RE-ISSUED FOR SPA SUBMISSION
4	2025-07-23	RE-ISSUED FOR SPA SUBMISSION
5	2025-09-18	RE-ISSUED FOR SPA SUBMISSION

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS PREPARED BY RVA.

LEGEND

- PROPERTY LINE
- SEDIMENT CONTROL FENCE
- SEDIMENT CONTROL (SILT SACK)

BENCH MARK:
ELEVATIONS SHOWN ON THIS PLAN ARE EXTRACTED FROM TOPOGRAPHICAL SKETCH OF 325 KING ST., BY J.D. BARNES DATED NOVEMBER 25, 2022. ELEVATIONS ARE OF GEODETIC ORIGIN (CGVD-1928:7), AND ARE DERIVED FROM GNSS OBSERVATIONS AND NATURAL RESOURCES CANADA'S GEOID MODEL HT2.0.

BEARING NOTE:
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LICENSED PROFESSIONAL ENGINEER
A. WONG
100087477
2025-09-18
RVA 226757
PROVINCE OF ONTARIO

Drawing Prepared By:
R.V. ANDERSON ASSOCIATES LIMITED

Client:
TWO SISTERS RESORTS CORP.

Project Name:
PARLIAMENT OAK INN
325 KING ST.

Drawing Title:
EROSION AND SEDIMENT CONTROL PLAN

Drawn: SO	Design: SO	Date: JULY 2023
Checked: SDF	Approved: AST	Scale: 1:200
CADD File: 226757-S-ESC1.dwg		Dwg. No.: ESC1
Project No.: 226757		

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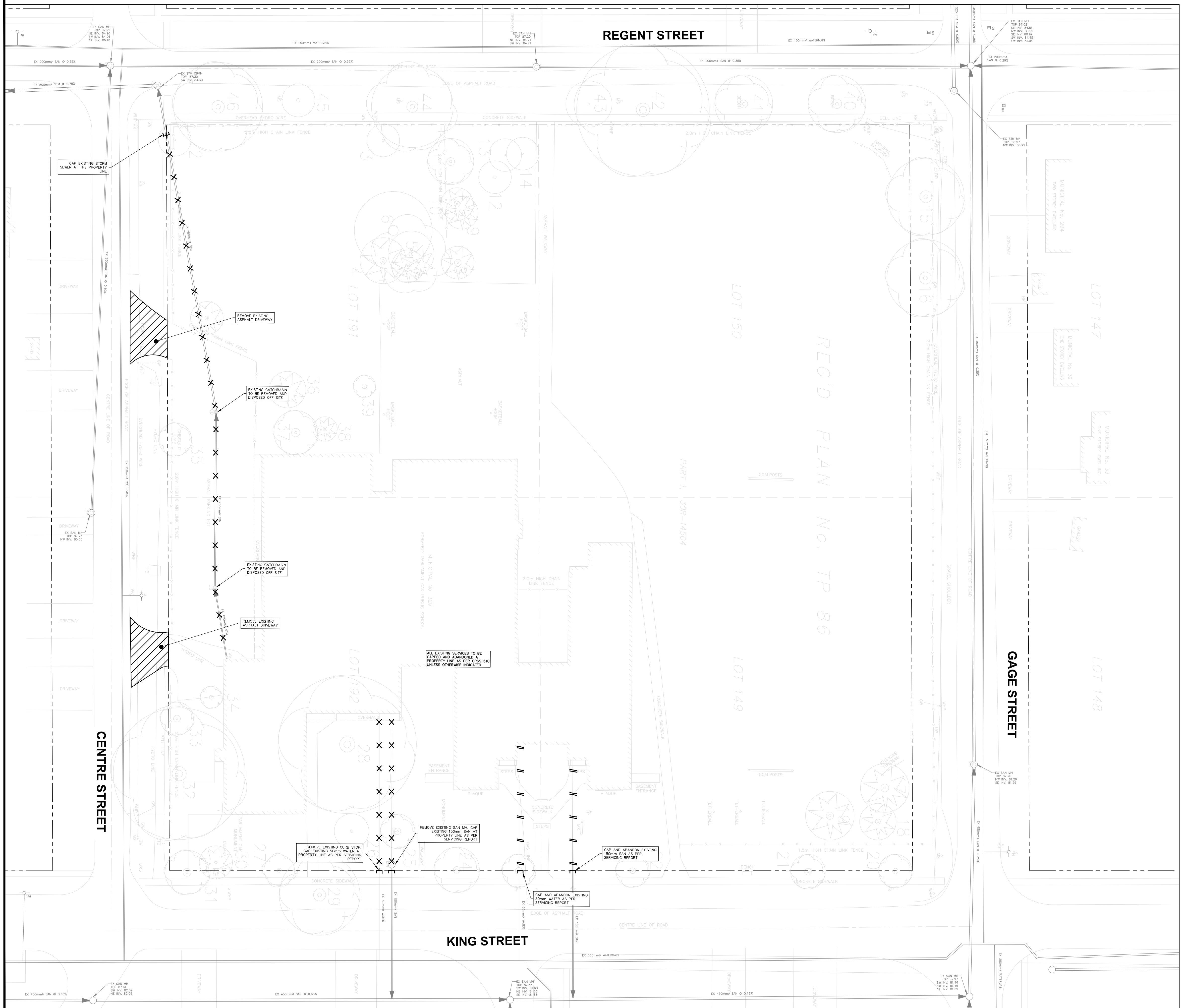

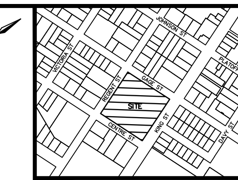

KEY PLAN
N.T.S.

No.	Revision	Comments
1	2023-02-02	ISSUED FOR 1ST ZBA SUBMISSION
2	2024-08-30	ISSUED FOR 1ST SPA SUBMISSION
3	2025-03-07	RE-ISSUED FOR SPA SUBMISSION
4	2025-07-23	RE-ISSUED FOR SPA SUBMISSION
5	2025-09-18	RE-ISSUED FOR SPA SUBMISSION

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS PREPARED BY RVA.

LEGEND

- PROPERTY LINE
- REMOVE AND DISPOSE OFF SITE
- ABANDON IN-PLACE
- ASPHALT REMOVAL

BENCH MARK:
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Contractor Must Check And Verify All Dimensions On The Job.

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2025-09-18
RVA 226757

Drawing Prepared By:
R.V. ANDERSON ASSOCIATES LIMITED

Client:
TWO SISTERS RESORTS CORP.

Project Name:
PARLIAMENT OAK INN
325 KING ST.

Drawing Title:
SERVICING REMOVALS PLAN

Drawn:	Design:	Date:
SO	SO	JULY 2023
Checked: SDF	Approved: AST	Scale: 1:200
CADD File: 226757-S-REM1.dwg		Dwg. No.: REM1
Project No.: 226757		

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