Parliament Oak Inn

Site Servicing and Stormwater Management Report

August 30, 2024

Prepared for:

Two Sisters
Resorts Corp.

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

Site Servicing and Stormwater Management Report

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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 1, 2024, has been completed for the site. This report indicates that the groundwater table is approximately 1.6m to 7.0m below grade, at 86.7 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 216,000 L/day (2.5L/s) during construction, and long-term foundation drainage will discharge at a rate of 26,100 L/day (0.3L/s), accounting for both groundwater and infiltrated stormwater. It is proposed to make a storage allowance of 26.1 m^3 within the on-site stormwater detention tank to detain the foundation drainage, 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 northwest 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

Return Period	A	B	C	i (mm/hr)
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, MC-3500 Stormtech Chamber by ADS Inc. 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 160mm 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 event 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	73.7	69.0
2 - Centre Street Uncontrolled Flow to Regent Street Outlet	P3	32.1	2.0

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 Kind 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 Stormtech chambers equipped with Isolator Row Plus, which can achieve up to 81% 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. in August 2024. The report outlines that the nearest borehole, 2S, has observed the highest groundwater level at 83.5 on June 6, 2024. As the groundwater level is expected to be at least 1m lower than the bottom of the storm detention tank, the chambers will not require an impermeable liner.

Lastly, as prescribed in Section 2.1, the building's foundation drainage is proposed to be directed into the storm detention tank and controlled to an allowable rate prior to discharging into municipal storm sewer. As a result, the detention tank is required to provide an additional volume of 26.1 m^3 beyond its normal detention capacity for up to 100-year storm to receive the water from foundation drains.

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 (VO2) was created to simulate the storage and discharge characteristics of the site.

The following commands were used to model the site:

- (1) The StandHyd command was used to model the portions of the site directed to the Primary SWM tank. IA values of 5mm and 1mm were assigned to the pervious and impervious components, respectively. Furthermore, a CN value of 95 was applied to mimic the high potential for stormwater to be converted to runoff for rainfall events that exceed the assigned IA values.
- (7) A second StandHyd command was used to model the at grade area of the site which would be directed to the Secondary Tank ("sunken" areas). IA values of 5mm and 1mm were assigned to the green roof components and conventional flat roof portion, respectively. Furthermore, a CN value of 90 was applied to mimic the high potential for stormwater to be converted to runoff for rainfall events that exceed the assigned IA values.
- (8) The RouteReservoir command was used to simulate the pump discharge characteristics from the secondary tank to the site's primary SWM detention tank.
- (6) The AddHyd command was used to add the roof & at grade portions together, as well as the secondary tank hydrographs to calculate the peak site discharge.
- (8) A second RouteReservoir command was used to simulate the detention and discharge characteristics for the site's primary SWM detention tank.

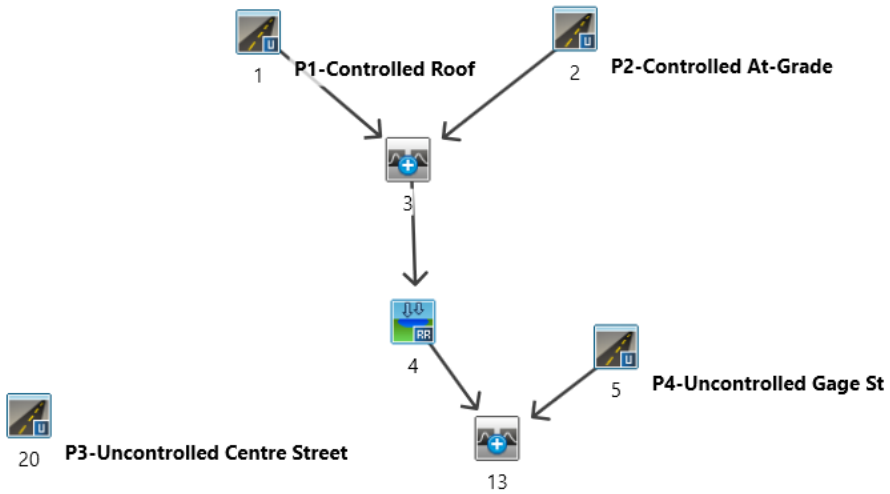


Figure 3.1 – V02 Model Schematic

Based on the stage storage characteristics of the proposed detention tank, a 160mm dia. orifice plate will be placed on the downstream side of the tank's outlet MH. This orifice plate will control the post-development peak flow down to an allowable discharge rate of 69.0 L/s, less than the 2-year pre-development discharge rate.

Table 3.5 summarizes the allowable and post-development peak discharge rate, and

Storm Event	Allowable Peak Discharge Rate (L/s)	Controlled Peak Strom Discharge from SWM Tank (L/s)	Total Storage Provided (m^3)	Total Storage Required (m^3)
2 Year	73.7	41.0	451.0	155.0
100 Year	73.7	69.0	451.0	420.0

detention storage volume requirements.

Refer to Appendix E – Post-Development Peak Discharge Rate and Required Storage for the complete VO2 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 Strom Discharge from SWM Tank (L/s)	Total Storage Provided (m^3)	Total Storage Required (m^3)
2 Year	73.7	41.0	451.0	155.0
100 Year	73.7	69.0	451.0	420.0

As discussed in Sections 2.1 and 3.1.1, 26.1m³ of additional storage is required to receive water from the foundation drainage system. As shown in the above table, since the spare capacity in the detention tank is 31m³ under a 100-year storm event, the tank has adequate storage capacity to receive foundation drainage.

3.1.3 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 manufacture maintenance manual in Section E.
- 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 maximum controlled discharge of 69.0 L/s, which is less than allowable 2-year pre-development peak flow of 73.7 L/s. An underground stormwater detention tank, MC-3500 Stomtech Chamber system with Isolator Row Plus will be utilized to store 451 m^3 to meet both quantity and quality requirement. 160mm Ø orifice plate will be provided to control the peak flow to the allowable discharge rate.

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

Prepared by:

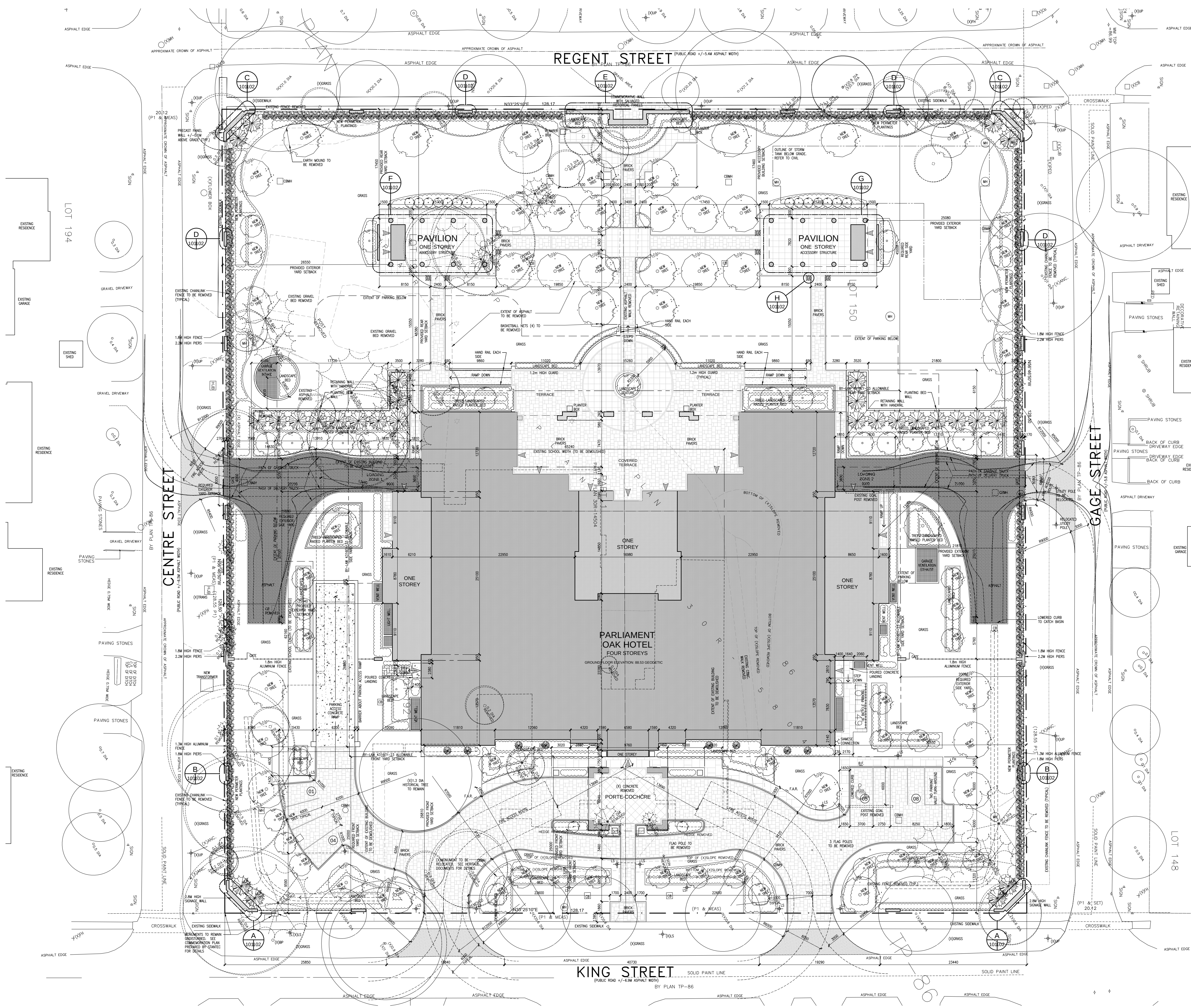
Chloe Cao, EIT, C.E.T.
Project Designer

Reviewed by:

Alex Wong, P.Eng.
Project Manager

APPENDIX A

ARCHITECTURAL PLANS AND SITE STATISTICS



SITE PLAN

SCALE : 1:200

LEGEND

4-STOREY 1-STOREY

- BUILDING
- BUILDING ENTRIES
- ASPHALT SURFACE
- PAVER SURFACE
- CONCRETE SURFACE
- POURED CONCRETE CURB
- ALUMINUM FENCE TO HEIGHT NOTED
- PRECAST CONCRETE WALLS

NOTE:
ALL AREAS NOT HATCHED TO BE GRASS or LANDSCAPING

- EXTENT OF EXISTING BUILDING TO BE DEMOLISHED
- EXTENT OF EXISTING SURFACE TO BE REMOVED
- ## PARKING STALL NUMBER
- FH FIRE HYDRANT
- BP BELL POLE
- LS LAMP STANDARD
- HP HYDRO POLE

IN ALL CASES (X) INDICATES EXISTING

DECIDUOUS CONIFEROUS

- EXISTING TREE TO REMAIN
- EXISTING TREE TO BE REMOVED
- TREE TO BE PLANTED
- LOW GROWTH GROUND COVER
- SHRUBS

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

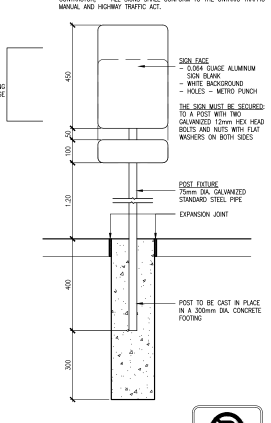
TYPICAL SIGNAGE

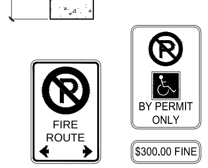
SIGNAGE NOTES:

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 m²		
BUILDING GROUND COVER		EXISTING BUILDING GROUND COVER	
Parliament Oak Hotel	3,445.49 m²	EXISTING INSTITUTIONAL (TO BE DEMOLISHED)	2,496.51 m²
Pavilion West	13.11 m²		
Pavilion East	13.11 m²		
Total Building Coverage	3,471.71 m²		
21.1% of Lot Area (25% Permitted)			
DRIVEWAY/ ASPHALT AREA			
12.0% of Lot Area	1,970.52 m²		
LANDSCAPED AREA			
66.9% of Lot Area	11,014.35 m²		

PARKING REQUIREMENTS

Hotel, Motel	= 1 per quest room in addition to other uses	129	Rooms	129 Spaces
Restaurant	= 1 per 18.5 m² GFLA	775 m²	Restaurant, Bar/ Lounge, Private Bar/ Lounge & Breakfast Room	42 Spaces
Restaurant Outdoor Patio	= 1 per 30 m² GFLA of outdoor patio area in addition to the requirements for a restaurant or take-out restaurant	195 m²	Patio	7 Spaces
Conference Rooms or Areas Used in Conjunction with Other Uses	= 1 per 18.5 m²	551.9 m²	Upper Canada Banquet Room, Lower Canada Banquet Room, Simcoe Meeting Room	30 Spaces
Spa	= 1 per 15.0 m²	313.3 m²		21 Spaces
Office	= 1 per 28.0 m²	84.4 m²		4 spaces
TOTAL PARKING REQUIRED (as per By-Law 4316EY-23)				233 Spaces
REQUIRED DESIGNATED ACCESSIBLE PARKING SPACES				7 Designated Spaces

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

BUILDING AREA

BASEMENT 2	479.4 m²
BASEMENT 1	1,772.7 m²
GROUND FLOOR	3,285.0 m²
MEZZANINE	135.4 m²
SECOND FLOOR	2,609.8 m²
THIRD FLOOR	2,609.8 m²
FOURTH FLOOR	2,543.4 m²
PENTHOUSE	22.2 m²
TOTAL BUILDING AREA	13,457.7 m²

DENSITY

SITE AREA	16,456.58 m²
or	1.65 ha
HOTEL SUITES	129 Units
SUITE DENSITY	78.2 Units per Hectare

Peter J. Lesdow
architect
4465 Drummond Road, Unit 11, Niagara Falls, Ontario L2E 6C5
telephone: 905-357-1112 e-mail: plesdow@cogeco.net

ONTARIO ASSOCIATION OF ARCHITECTS
PETER J. LESDOW
LICENCE
3745

SITE PLAN & STATISTICS

DATE	REVISIONS	DATE	REVISIONS
Jan. 04/ 23	REDESIGN FOR PRE-CONSULTATION	Oct. 26/ 23	O.P.A./Z.B.A. ADDED INFORMATION
Jan. 31/ 23	SHADOW STUDY	Nov. 16/ 23	ENLARGED COVERED TERRACE
Feb. 01/ 23	FOR O.P.A/Z.B.A SUBMISSIONS	Apr. 08/ 24	REVISED PARKING GARAGE
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

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

APPENDIX B

EXISTING SITE & MUNICIPAL INFRASTRUCTURE

GAGE STREET

REG'D PLAN No. TP 86

PART 1, 30R-14504

REGENT STREET

KING STREET

CENTRE STREET

SAN MH
TOP: 87.02
NE INV.: 84.81
NW INV.: 83.99
SE INV.: 80.95
SW INV.: 84.45
SW INV.: 81.04

200mmø SAN @ 1.29%

STM MH
TOP: 86.97
NW INV.: 83.92

450mmø SAN @ 0.35%

525mmø STM @ 0.50%

SAN MH
TOP: 87.70
NW INV.: 81.29
SE INV.: 81.29

450mmø SAN @ 0.35%

250mmø SAN @ 0.56%

SAN MH
TOP: 87.97
SW INV.: 81.46
NW INV.: 81.46
SE INV.: 81.59

450mmø SAN @ 0.18%

SAN MH
TOP: 87.20
NE INV.: 84.71
SW INV.: 84.71

200mmø SAN @ 0.35%

150mmø SAN

250mmø SAN @ 0.34%

SAN MH
TOP: 87.83
SW INV.: 81.60
NE INV.: 81.60
SE INV.: 81.88

STM CBMH
TOP: 87.30
SW INV.: 84.35

250mmø STM

200mmø STM

150mmø STM

SAN MH
TOP: 87.22
NE INV.: 84.96
SW INV.: 84.96
SE INV.: 85.15

200mmø SAN @ 0.60%

SAN MH
TOP: 87.73
NW INV.: 85.65

SAN MH
TOP: 87.61
SW INV.: 82.09
NE INV.: 82.09

450mmø SAN @ 0.35%

450mmø SAN @ 0.68%

MUNICIPAL No. 58
TWO STOREY DWELLING

MUNICIPAL No. 317
TWO STOREY DWELLING

MUNICIPAL No. 327
ONE STOREY DWELLING

MUNICIPAL No. 343
TWO STOREY DWELLING

MUNICIPAL No. 325
FORMERLY PARLIAMENT OAK PUBLIC SCHOOL

MUNICIPAL No. 308
ONE STOREY DWELLING

MUNICIPAL No. 320
1½ STOREY DWELLING

MUNICIPAL No. 8
TWO STOREY DWELLING

MUNICIPAL No. 338
ONE STOREY DWELLING

MUNICIPAL No. 344
1½ STOREY DWELLING

CENTRE LINE OF ROAD
EDGE OF ASPHALT ROAD
GRAVEL SHOULDER
OVERHEAD HYDRO WIRE
2.0m HIGH CHAIN LINK FENCE
1.5m HIGH CHAIN LINK FENCE
CONCRETE SIDEWALK
ASPHALT WALKWAY
ASPHALT PARKING LOT
ASPHALT
HYDRO LINE
BELL LINE
GAS LINE
150mmø WATERMAIN
50mmø WATER
OVERHANG
BASKETBALL HOOP
GOALPOSTS
TETHERBALL
BENCH
BASEBALL BACKSTOP
PARLIAMENT OAK MONUMENT
MONUMENT
BASEMENT ENTRANCE
DRIVEWAY
SHED

LEGEND
- PROPERTY LINE
- CB CATCHBASIN
- WHP HYDRO POLE
- FH FIRE HYDRANT

NOTE: ALL EXISTING UTILITY INFORMATION SHOWN ON THIS DRAWING IS BASED ON TOWN RECORD DRAWINGS.

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		FIGURE: F1
Project No.: 226757		

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

SITE CONDITION PLAN
LOTS 149, 150, 191 & 192
REGISTERED PLAN No. TP 86
TOWN OF NIAGARA-ON-THE-LAKE
REGIONAL MUNICIPALITY OF NIAGARA

SCALE 1:300 METRIC
5m 0 5m 10m 15m 20m

BEARING NOTE

BEARINGS HEREON ARE GRID BEARINGS PREVIOUSLY ESTABLISHED BY THE LAROCQUE GROUP AND ARE REFERRED TO THE CENTRAL MERIDIAN 81°00'W LONGITUDE, ZONE 17, UNIVERSAL TRANSVERSE MERCATOR (6° UTM). THESE VALUES ARE NAD83 (CSRS v6) EPOCH 2010.0 REFERENCE SYSTEM.

ELEVATION NOTE

ELEVATIONS HEREON ARE ORTHOMETRIC AND ARE RELATED TO CGVD28, HT2, AS PREVIOUSLY ESTABLISHED BY THE LAROCQUE GROUP.

METRIC NOTE

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

DISTANCES SHOWN ON THIS PLAN ARE ADJUSTED GROUND LEVEL DISTANCES AND CAN BE USED TO COMPUTE GRID CO-ORDINATES BY MULTIPLYING THE DISTANCES BY A COMBINED SCALE FACTOR OF 0.99990052.

LEGEND

BP	DENOTES BELL PEDESTAL
CB	DENOTES CATCH BASIN
CTB	DENOTES CABLE TV BOX
FH	DENOTES FIRE HYDRANT
FP	DENOTES FLAGPOLE
GW	DENOTES GUY WIRE
HB	DENOTES HYDRO BOX
MH	DENOTES MANHOLE
MS	DENOTES METAL SIGN
WHP	DENOTES WOOD HYDRO POLE
WV	DENOTES WATER VALVE
86.30(FFE)	DENOTES FINISHED FLOOR ELEVATION
86.30(T)	DENOTES TOP OF BUILDING ELEVATION
86.20	DENOTES EXISTING ELEVATION
	DENOTES DECIDUOUS TREE
	DENOTES CONIFEROUS TREE

TREE NOTE

1. ALL DECIDUOUS TREES ARE MAPLE UNLESS OTHERWISE SHOWN.
2. ALL CONIFEROUS TREES ARE PINE UNLESS OTHEWISE SHOWN

THE LAROCQUE GROUP
O.L.S./PROJECT CONSULTANTS/LAND MANAGEMENT
12 LYMAN STREET, ST. CATHARINES, ONTARIO
905-688-1613
6385 COLBORNE STREET, NIAGARA FALLS, ONTARIO
905-358-9400

DATE : AUGUST 12, 2019 FILE No. : 2019-040
DWG.FILE : 2019-040-01

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.

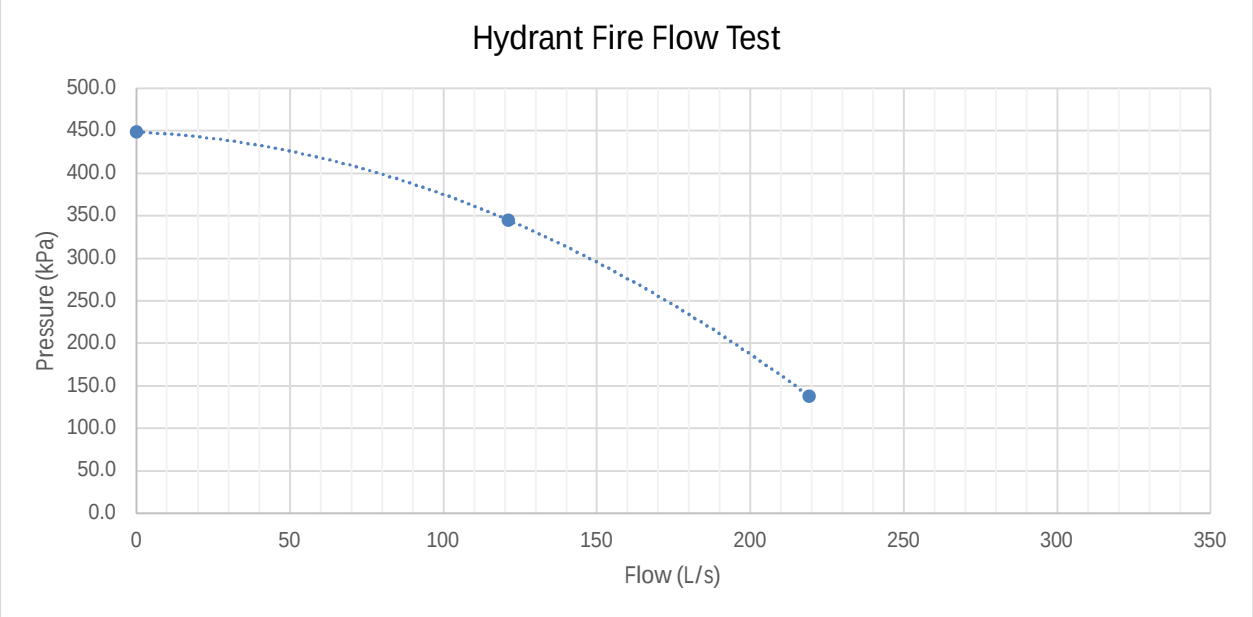
Main Size: 300mm
Type: PVC (2017)

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.

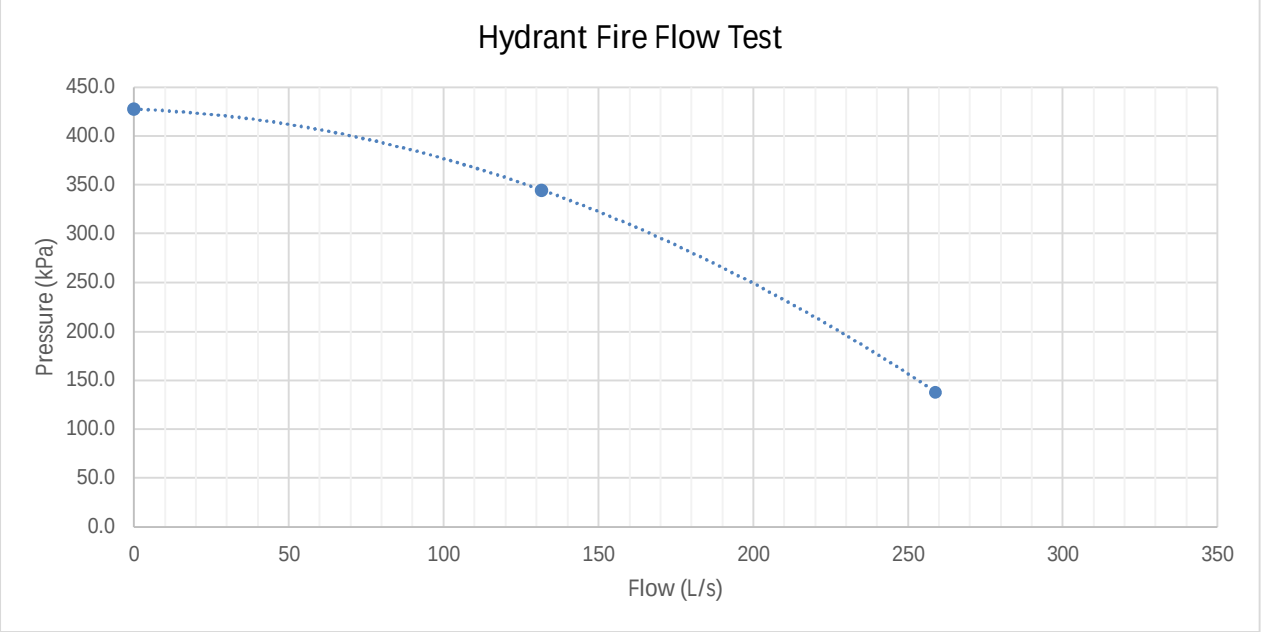
Main Size: 150mm
Type: PVC (2002)

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:

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

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	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.

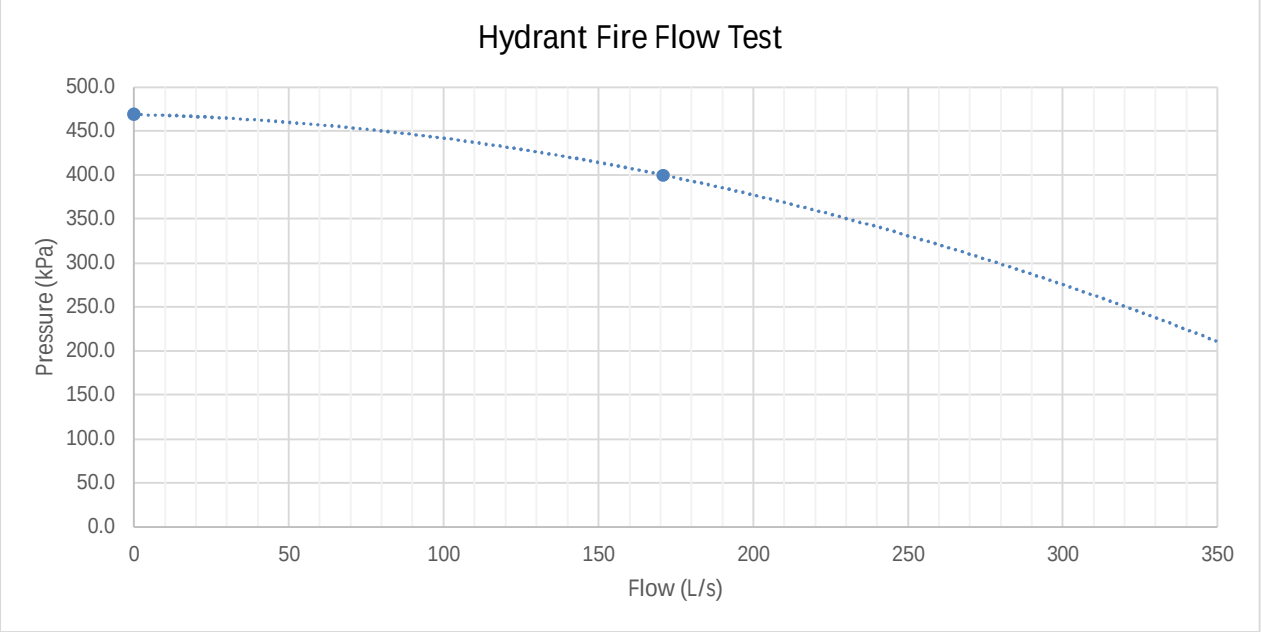
Main Size: 150mm
Type: PVC (2013)

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:

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

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	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.

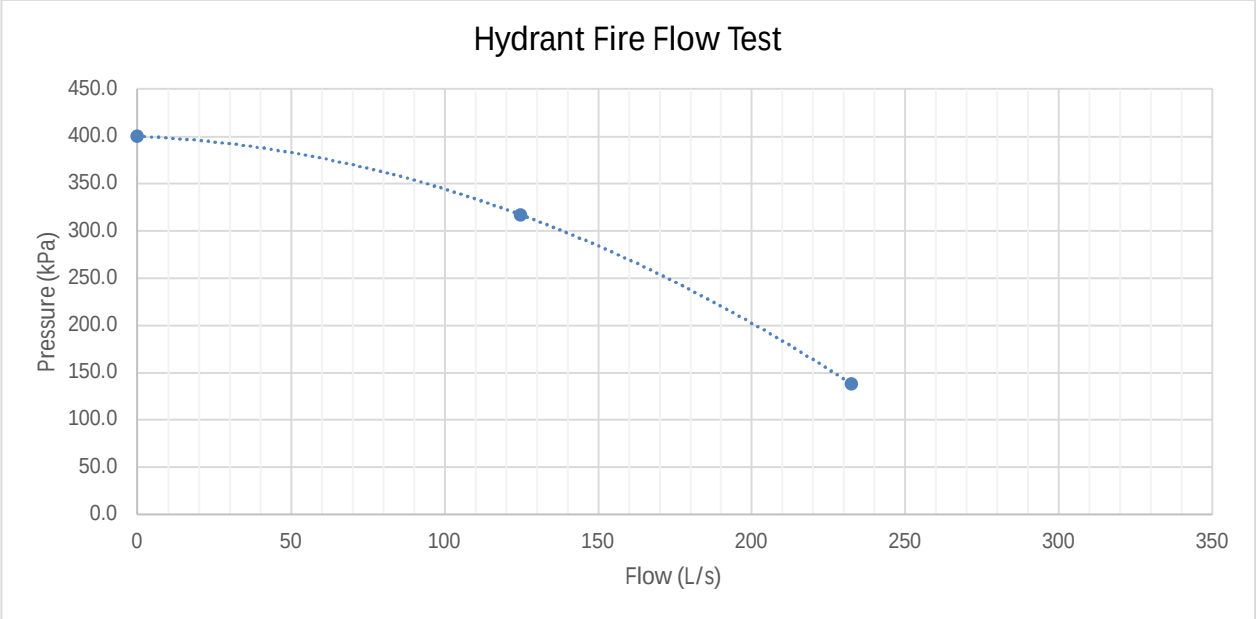
Main Size: 150mm
Type: PVC (2017)

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.

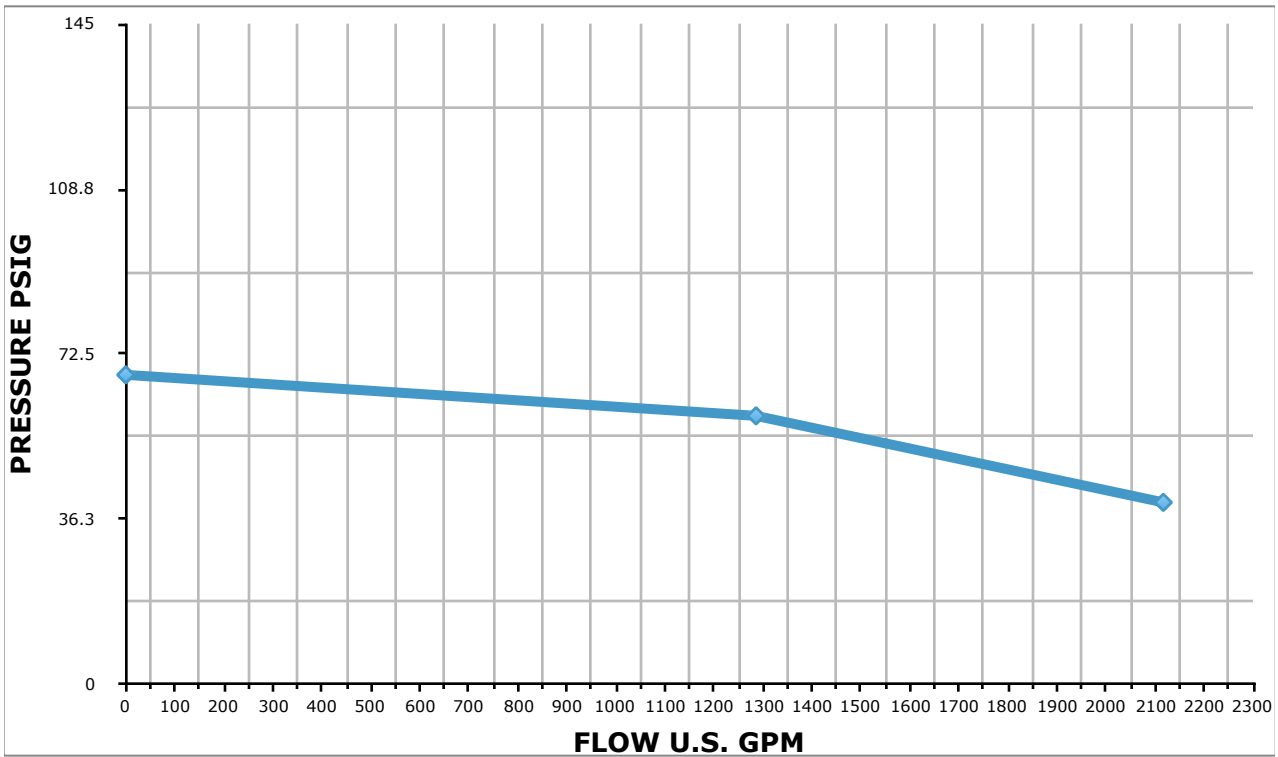
Residual hydrant: in front of 410 King St.

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.

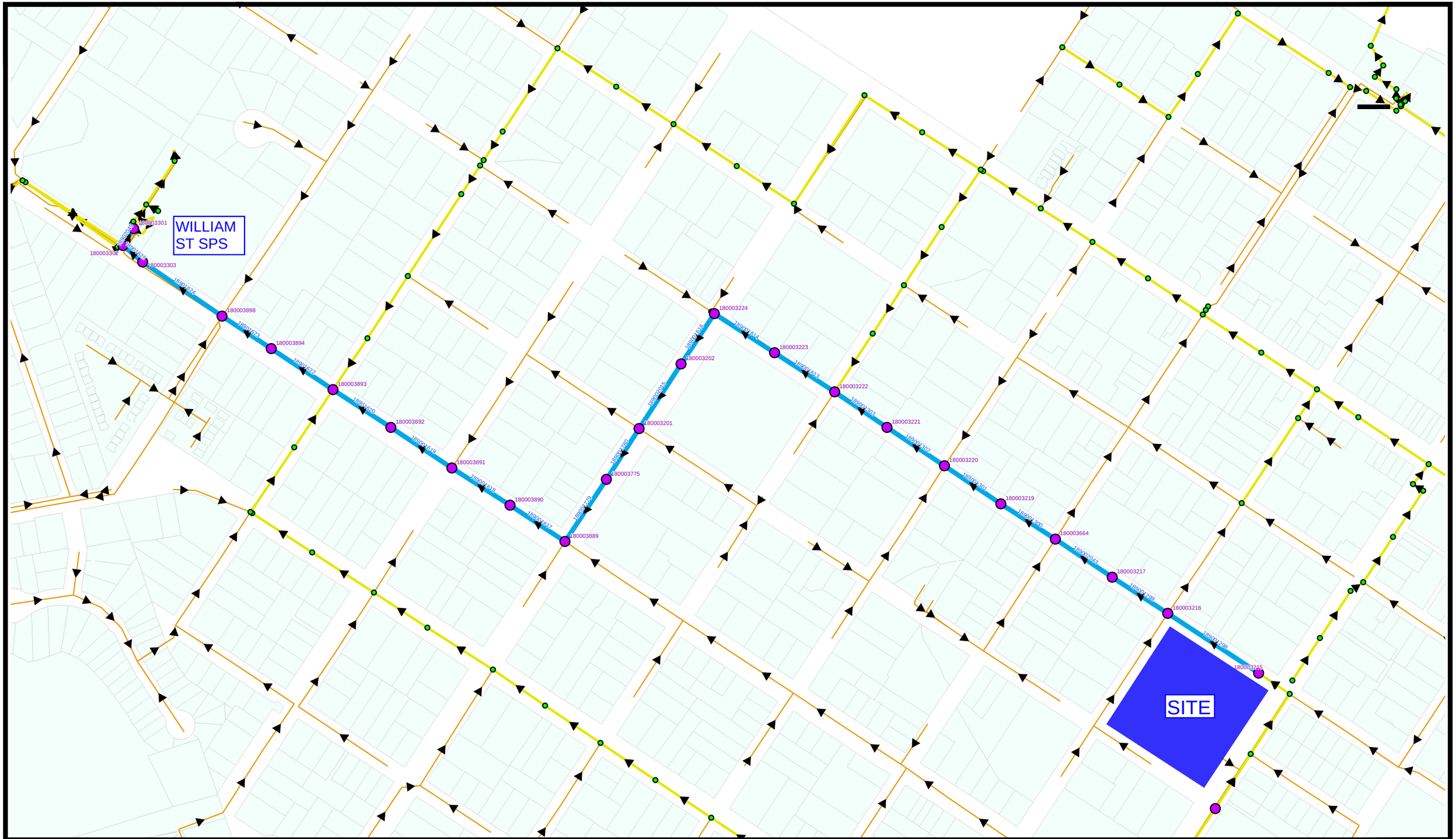
Table 4.D.9 Forcemain Performance

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

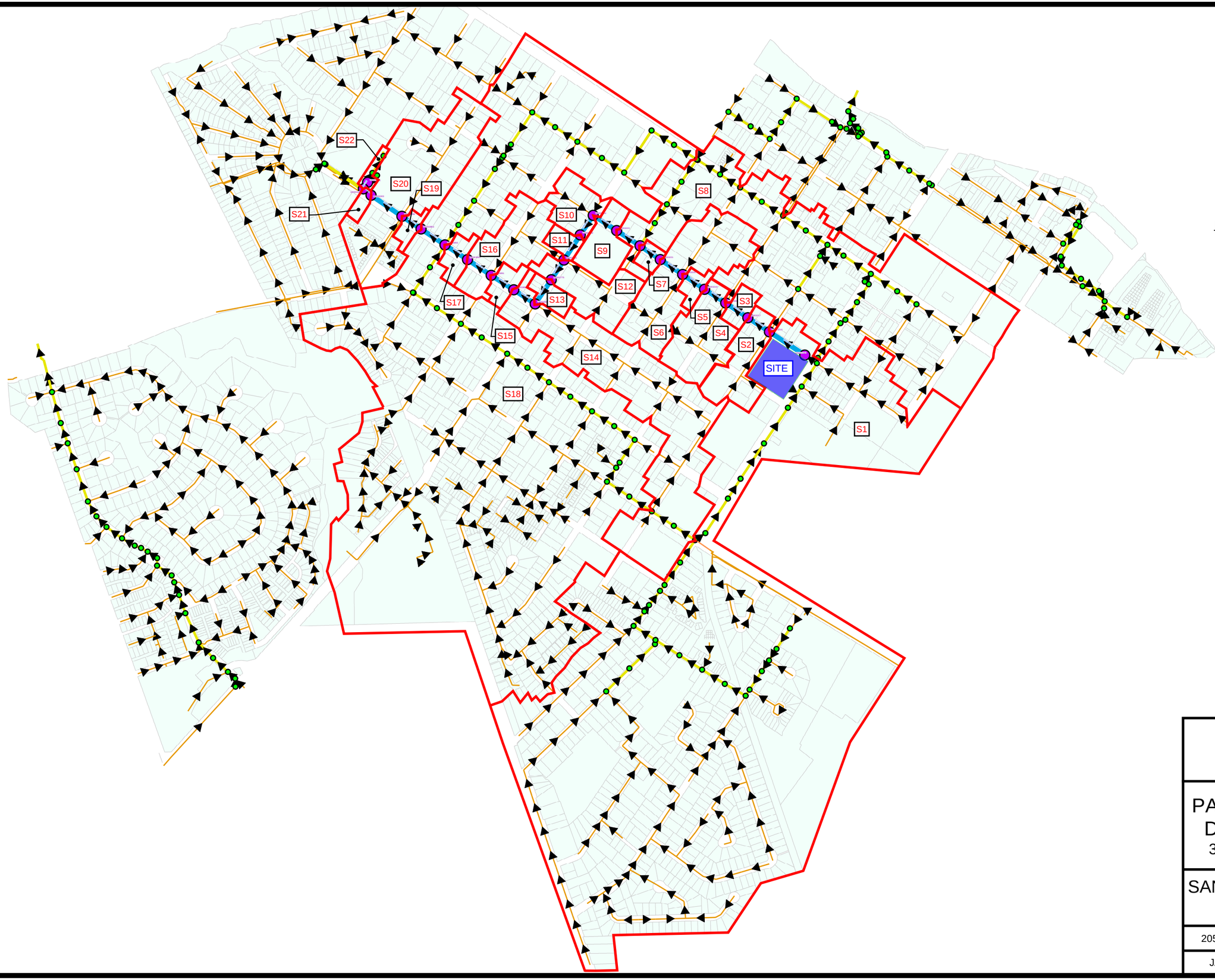
PARLIAMENT OAK DEVELOPMENT
325 KING ST., NOTL

JANUARY 2021

DOWNSTREAM SANITARY SEWER SYSTEM
N.T.S

205254

FIGURE:
F3



N

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

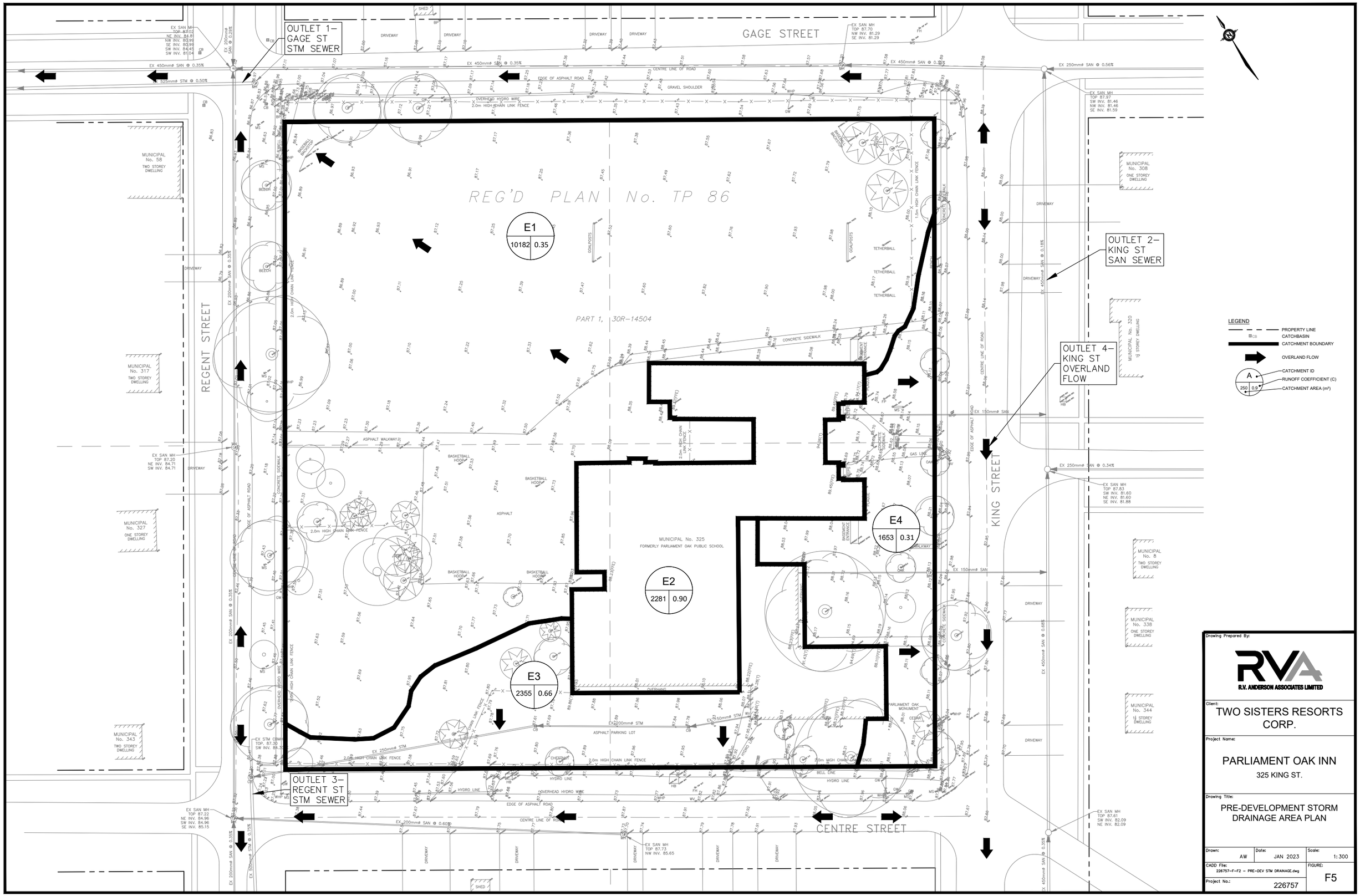
STORM SERVICING & SWM ANALYSIS

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	3445	100.0%	0.90
		3445	**100.0%**	**0.90**
Catchment Area P2				
Soft Landscaped Area	0.25	9111	70.7%	0.18
Impervious Area (i.e. pavers, asphalt driveway)	0.90	3770	29.3%	0.26
		12881	**100.0%**	**0.44**
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**
Total		**16457**		**0.53**

Refer to figure F6 for catchment areas.



Drawing Prepared By:

R.V. ANDERSON ASSOCIATES LIMITED

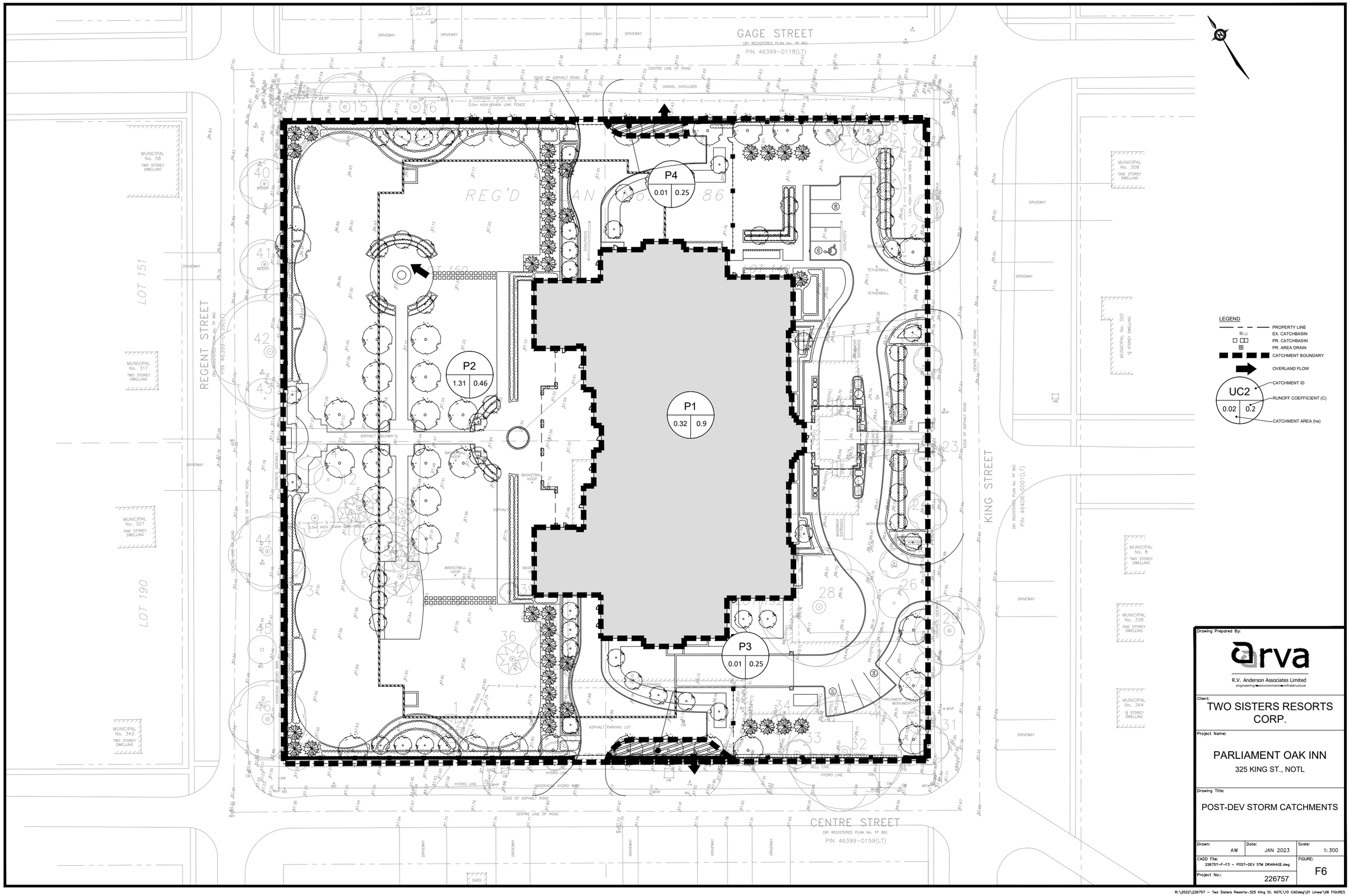
Client:
TWO SISTERS RESORTS CORP.

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-DEV STORM CATCHMENTS

Drawn:	Date:	Scale:
AW	JAN 2023	1: 300
CADD File: 226757-F-F3 - POST-DEV STM DRAINAGE.dwg		FIGURE: F6
Project No.: 226757		

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

Modified Rational Method- SWM Tank Storage Design

Project: 325 King St, NOTL
Date: August 12, 2024

Site Area (ha) =	1.6500
Pre Development Area (Gage Drainage Area)	1.0182
Pre Development Runoff Coefficient =	0.3500
Post Dev.Runoff Coefficient =	0.53

City of St. Catherines IDF

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

Return Period (Year)	A	B	C	I (mm/hr)
2	567	0.746	5.20	74.46
5	664	0.744	4.70	89.88
10	724	0.739	4.30	101.38
25	821	0.735	4.00	118.02
50	900	0.734	3.80	131.09
100	980	0.732	3.70	144.26
T_c=	10	min (in hours)		

Allowed Peak Discharge Rate

$$Q = 2.78 * CIA$$

$Q_{Allowed}$ =	73.8	L/s
$Q_{2\text{-}yr}$ =	73.8	L/s
Q_{100yr} =	350.7	L/s

On Site Detention Storage - SWM Tank

100 Yr Storm Event

Post Development Runoff Coefficeint =	0.53
Site Area (ha) =	1.65
Max Allowed Realease Rate (m^3/s) =	0.074
Peak Storage + 20% Allowance (m^3) =	240.000 (min)

t (min)	i_{100} (mm/hr)	Q_{100} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
1	315.682	0.767	0.693	41.585	
2	274.111	0.666	0.592	71.051	
3	243.523	0.592	0.518	93.202	
4	219.945	0.534	0.461	110.524	
5	201.140	0.489	0.415	124.450	
6	185.742	0.451	0.377	135.874	
7	172.869	0.420	0.346	145.387	
8	161.925	0.393	0.320	153.395	
9	152.490	0.370	0.297	160.194	
10	144.260	0.350	0.277	165.998	
11	137.009	0.333	0.259	170.973	
12	130.565	0.317	0.243	175.245	
13	124.795	0.303	0.229	178.916	
14	119.594	0.291	0.217	182.066	
15	114.878	0.279	0.205	184.761	
16	110.580	0.269	0.195	187.054	
17	106.644	0.259	0.185	188.992	
18	103.024	0.250	0.176	190.612	
19	99.682	0.242	0.168	191.947	
20	96.585	0.235	0.161	193.023	
21	93.707	0.228	0.154	193.865	
22	91.024	0.221	0.147	194.493	
23	88.516	0.215	0.141	194.925	
24	86.165	0.209	0.136	195.178	
25	83.957	0.204	0.130	195.265	***max***
26	81.878	0.199	0.125	195.198	
27	79.917	0.194	0.120	194.989	
28	78.064	0.190	0.116	194.647	
29	76.309	0.185	0.112	194.182	
30	74.645	0.181	0.108	193.601	
31	73.064	0.177	0.104	192.912	
32	71.560	0.174	0.100	192.121	
33	70.128	0.170	0.097	191.235	
34	68.761	0.167	0.093	190.258	
35	67.456	0.164	0.090	189.196	
50	53.074	0.129	0.055	165.473	
51	52.362	0.127	0.053	163.490	
52	51.673	0.126	0.052	161.467	
53	51.004	0.124	0.050	159.407	
54	50.355	0.122	0.049	157.310	
55	49.726	0.121	0.047	155.178	
56	49.115	0.119	0.046	153.012	
57	48.521	0.118	0.044	150.813	
58	47.944	0.116	0.043	148.581	
59	47.383	0.115	0.041	146.320	
60	46.838	0.114	0.040	144.028	
61	46.307	0.112	0.039	141.707	
62	45.790	0.111	0.037	139.358	
63	45.286	0.110	0.036	136.983	
64	44.796	0.109	0.035	134.580	

ORIFICE FLOW DESIGN

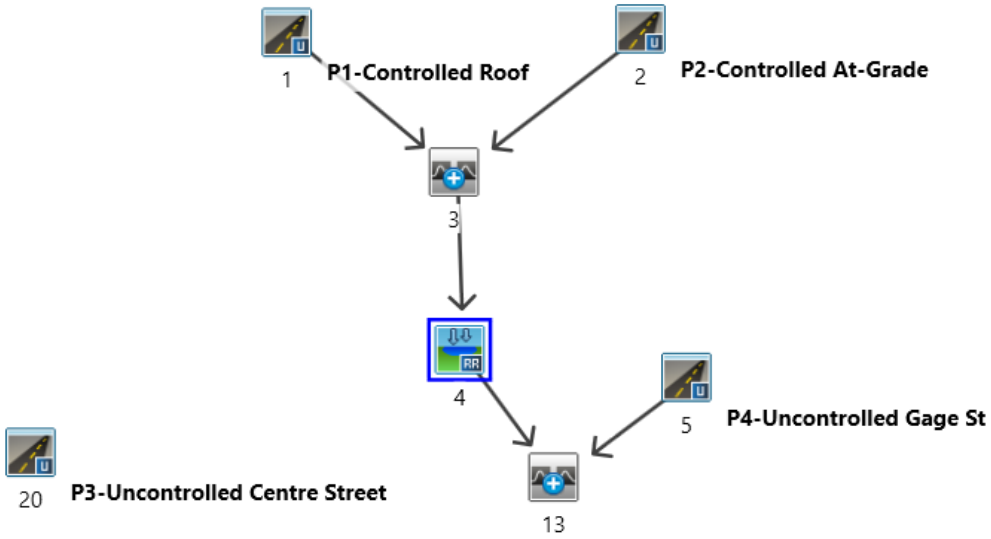
2-100 Yr Storm Rating Curve

Orifice Diameter =	160	mm
Orifice Area =	0.02011	m^2
Orifice Type =	PLATE	
Coefficient =	0.63	
Orifice INV	84.45	
Orifice MID	84.53	

Elevation (m)	Head (m)	Discharge (m^3/s)	Storage (m^3)
0.00	0.00	0.0000	0.00000
0.23	0.23	0.0269	0.00410
0.61	0.61	0.0438	0.01778
0.91	0.91	0.0536	0.02788
1.22	1.22	0.0619	0.03650
1.40	1.40	0.0663	0.04005
1.68	1.68	0.0726	0.04507

Note: volume excludes pipe storage

MODEL LAYOUT



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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

        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 M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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DATE: 08/13/2024                          TIME: 04:18:52

USER:


COMMENTS: _____________________________________________________

--------------------------------------------------------------------------------
-----------------------
  ************************************************
  ** 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    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   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


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area     (ha)=   0.34
|ID= 1 DT=10.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.34          0.00
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       2.00          2.00
     Length            (m)=      47.61         40.00
     Mannings n            =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      74.46         23.16
                over (min)       10.00         20.00
     Storage Coeff.  (min)=       1.50 (ii)   14.17 (ii)
     Unit Hyd. Tpeak (min)=      10.00         20.00
     Unit Hyd. peak  (cms)=       0.17          0.07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.07          0.00          0.070 (iii)
     TIME TO PEAK    (hrs)=       1.33          1.50          1.33
     RUNOFF VOLUME    (mm)=      36.40         17.32         36.21
     TOTAL RAINFALL   (mm)=      37.40         37.40         37.40
     RUNOFF COEFFICIENT   =       0.97          0.46          0.97

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

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area     (ha)=   1.29
|ID= 1 DT=10.0 min |   Total Imp(%)=  29.00   Dir. Conn.(%)=  29.00
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.37          0.92
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      92.74         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)=       2.75 (ii)   15.92 (ii)
     Unit Hyd. Tpeak (min)=      10.00         20.00
     Unit Hyd. peak  (cms)=       0.17          0.06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.08          0.04          0.094 (iii)
     TIME TO PEAK    (hrs)=       1.33          1.50          1.33
     RUNOFF VOLUME    (mm)=      36.40         15.97         21.88
     TOTAL RAINFALL   (mm)=      37.40         37.40         37.40
     RUNOFF COEFFICIENT   =       0.97          0.43          0.59

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

       (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.

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

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):     0.34   0.070     1.33    36.21
     + ID2= 2 (  0002):     1.29   0.094     1.33    21.88
       ================================================
       ID = 3 (  0003):     1.63   0.163     1.33    24.87

     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    |  0.0619     0.0365
                          0.0269     0.0041    |  0.0663     0.0400
                          0.0438     0.0178    |  0.0726     0.0451
                          0.0536     0.0279    |  0.0000     0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)      1.630     0.163     1.33       24.87
   OUTFLOW: ID= 1 (  0004)      1.630     0.041     1.83       24.86
```

```
                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 25.00
                  TIME SHIFT OF PEAK FLOW          (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0155

--------------------------------------------------------------------------------
--------------------
| 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.

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.63   0.041     1.83    24.86
      + ID2= 2 (  0005):     0.01   0.000     1.50     8.15
        ==========================================================
        ID = 3 (  0013):     1.64   0.041     1.83    24.73

     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)=      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    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\soh\AppData\Local\Civica\VH5\0622eba6-6932-4823-be44-
9905272daa96\8e53a27d-8465-4738-9fb1-dff0e4d29571\scenario
  Summary filename: C:\Users\soh\AppData\Local\Civica\VH5\0622eba6-6932-4823-be44-
9905272daa96\8e53a27d-8465-4738-9fb1-dff0e4d29571\scenario


DATE: 08/13/2024                          TIME: 04:18:54

USER:


COMMENTS: _____

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

--------------------
| 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


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   0.34
|ID= 1 DT=10.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
```

```
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.34         0.00
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      47.61        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      89.88        43.89
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       1.39 (ii)   11.20 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=       0.17         0.08
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.08         0.00          0.084 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      43.35        22.92          43.14
     TOTAL RAINFALL   (mm)=      44.35        44.35          44.35
     RUNOFF COEFFICIENT   =       0.98         0.52           0.97

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

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   1.29
|ID= 1 DT=10.0 min |   Total Imp(%)=  29.00   Dir. Conn.(%)=  29.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.37         0.92
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      92.74        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)=       2.55 (ii)   14.26 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=       0.17         0.07
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.09         0.05          0.118 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      43.35        20.95          27.44
     TOTAL RAINFALL   (mm)=      44.35        44.35          44.35
     RUNOFF COEFFICIENT   =       0.98         0.47           0.62

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

       (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.

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

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):     0.34   0.084     1.33    43.14
      + ID2= 2 (  0002):     1.29   0.118     1.33    27.44
        ================================================
        ID = 3 (  0003):     1.63   0.202     1.33    30.71

     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   |   0.0619     0.0365
                         0.0269     0.0041   |   0.0663     0.0400
                         0.0438     0.0178   |   0.0726     0.0451
                         0.0536     0.0279   |   0.0000     0.0000

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)    1.630     0.202      1.33      30.71
   OUTFLOW: ID= 1 (  0004)    1.630     0.046      2.00      30.69

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.94
                TIME SHIFT OF PEAK FLOW         (min)= 40.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0205

--------------------------------------------------------------------------------
--------------------
| 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.

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.63   0.046     2.00    30.69
      + ID2= 2 (  0005):     0.01   0.000     1.50    12.52
        ================================================
        ID = 3 (  0013):     1.64   0.047     2.00    30.55

     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)=      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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================================================================================
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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\soh\AppData\Local\Civica\VH5\0622eba6-6932-4823-be44-
9905272daa96\38ed7818-8679-4c5a-9bd0-623e77e8c754\scenario
  Summary filename: C:\Users\soh\AppData\Local\Civica\VH5\0622eba6-6932-4823-be44-
9905272daa96\38ed7818-8679-4c5a-9bd0-623e77e8c754\scenario


DATE: 08/13/2024                          TIME: 04:18:54

USER:


COMMENTS: _____

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

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 724.000
| Ptotal= 49.77 mm |                          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    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   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)|   Area    (ha)=   0.34
|ID= 1 DT=10.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                                 IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.34          0.00
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       2.00          2.00
     Length            (m)=      47.61         40.00
     Mannings n             =     0.013         0.250

     Max.Eff.Inten.(mm/hr)=     101.38         54.23
                   over (min)      10.00         20.00
     Storage Coeff.  (min)=       1.32 (ii)    10.34 (ii)
     Unit Hyd. Tpeak (min)=      10.00         20.00
     Unit Hyd. peak  (cms)=       0.17          0.08
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.09          0.00          0.095 (iii)
     TIME TO PEAK    (hrs)=       1.33          1.50           1.33
     RUNOFF VOLUME    (mm)=      48.77         27.46          48.55
     TOTAL RAINFALL   (mm)=      49.77         49.77          49.77
     RUNOFF COEFFICIENT   =       0.98          0.55           0.98

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

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   1.29
|ID= 1 DT=10.0 min |   Total Imp(%)=  29.00   Dir. Conn.(%)=  29.00
--------------------
                                 IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.37          0.92
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      92.74         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)=       2.43 (ii)    11.90 (ii)
     Unit Hyd. Tpeak (min)=      10.00         20.00
     Unit Hyd. peak  (cms)=       0.17          0.08
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.10          0.07          0.139 (iii)
     TIME TO PEAK    (hrs)=       1.33          1.50           1.33
     RUNOFF VOLUME    (mm)=      48.77         25.03          31.91
     TOTAL RAINFALL   (mm)=      49.77         49.77          49.77
     RUNOFF COEFFICIENT   =       0.98          0.50           0.64

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

       (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.

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

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):     0.34   0.095     1.33    48.55
```

```
      + ID2= 2 (  0002):     1.29   0.139     1.33    31.91
        ==================================================
        ID = 3 (  0003):     1.63   0.234     1.33    35.38

     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   |   0.0619     0.0365
                           0.0269     0.0041   |   0.0663     0.0400
                           0.0438     0.0178   |   0.0726     0.0451
                           0.0536     0.0279   |   0.0000     0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)      1.630     0.234      1.33      35.38
   OUTFLOW: ID= 1 (  0004)      1.630     0.051      2.00      35.36

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 21.62
                  TIME SHIFT OF PEAK FLOW         (min)= 40.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0248

--------------------------------------------------------------------------------
--------------------
| 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.

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.63   0.051     2.00    35.36
      + ID2= 2 (  0005):     0.01   0.001     1.50    17.00
        ==================================================
        ID = 3 (  0013):     1.64   0.051     2.00    35.22

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

DATE: 08/13/2024                          TIME: 04:18:55

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 hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN 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

CALIB	STANDHYD (0001)	ID= 1 DT=10.0 min	Area (ha)= 0.34	Total Imp(%)= 99.00	Dir. Conn.(%)= 99.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.34	0.00
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	47.61	40.00
Mannings n	=	0.013	0.250
Max.Eff.Inten.(mm/hr)=		118.02	69.92
over (min)		10.00	10.00
Storage Coeff. (min)=		1.24 (ii)	9.39 (ii)
Unit Hyd. Tpeak (min)=		10.00	10.00
Unit Hyd. peak (cms)=		0.17	0.11

		TOTALS
PEAK FLOW	(cms)=	0.11 (iii)
TIME TO PEAK	(hrs)=	1.33
RUNOFF VOLUME	(mm)=	56.52
TOTAL RAINFALL	(mm)=	57.74
RUNOFF COEFFICIENT	=	0.98

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

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

CALIB	STANDHYD (0002)	ID= 1 DT=10.0 min	Area (ha)= 1.29	Total Imp(%)= 29.00	Dir. Conn.(%)= 29.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.37	0.92
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	92.74	40.00
Mannings n	=	0.013	0.250
Max.Eff.Inten.(mm/hr)=		118.02	61.28
over (min)		10.00	20.00
Storage Coeff. (min)=		2.29 (ii)	10.87 (ii)
Unit Hyd. Tpeak (min)=		10.00	20.00
Unit Hyd. peak (cms)=		0.17	0.08

		TOTALS
PEAK FLOW	(cms)=	0.169 (iii)
TIME TO PEAK	(hrs)=	1.33
RUNOFF VOLUME	(mm)=	38.67
TOTAL RAINFALL	(mm)=	57.74
RUNOFF COEFFICIENT	=	0.67

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

(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.

ADD HYD (0003)	1 + 2 = 3		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
	ID1= 1 (0001):		0.34	0.111	1.33	56.52
	+ ID2= 2 (0002):		1.29	0.169	1.33	38.67
	ID = 3 (0003):		1.63	0.279	1.33	42.40

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0004)	IN= 2---> OUT= 1	DT= 10.0 min

OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0619	0.0365
0.0269	0.0041	0.0663	0.0400
0.0438	0.0178	0.0726	0.0451
0.0536	0.0279	0.0000	0.0000

		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0003)		1.630	0.279	1.33	42.40
OUTFLOW: ID= 1 (0004)		1.630	0.057	2.00	42.38

PEAK FLOW REDUCTION [Qout/Qin](%)= 20.28
TIME SHIFT OF PEAK FLOW (min)= 40.00
MAXIMUM STORAGE USED (ha.m.)= 0.0310

CALIB	STANDHYD (0005)	ID= 1 DT=10.0 min	Area (ha)= 0.01	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)=	0.001 (iii)
TIME TO PEAK	(hrs)=	1.50
RUNOFF VOLUME	(mm)=	23.68
TOTAL RAINFALL	(mm)=	57.74
RUNOFF COEFFICIENT	=	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.

ADD HYD (0013)	1 + 2 = 3		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
	ID1= 1 (0004):		1.63	0.057	2.00	42.38
	+ ID2= 2 (0005):		0.01	0.001	1.50	23.68

```
       ================================================
       ID = 3 (  0013):     1.64   0.057     2.00    42.23

     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)=     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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  Summary filename: C:\Users\soh\AppData\Local\Civica\VH5\0622eba6-6932-4823-be44-
9905272daa96\3617ed5a-b42d-44fd-9d21-845b3f953ef8\scenario


DATE: 08/13/2024                          TIME: 04:18:55

USER:



COMMENTS: _____
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  ***********************************************
  ** 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    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   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)=   0.34
|ID= 1 DT=10.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.34          0.00
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       2.00          2.00
     Length            (m)=      47.61         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     131.09         82.41
               over (min)        10.00         10.00
     Storage Coeff.  (min)=       1.19 (ii)     8.82 (ii)
     Unit Hyd. Tpeak (min)=      10.00         10.00
     Unit Hyd. peak  (cms)=       0.17          0.12
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.12          0.00          0.123 (iii)
     TIME TO PEAK    (hrs)=       1.33          1.33           1.33
     RUNOFF VOLUME    (mm)=      62.69         39.63          62.45
     TOTAL RAINFALL   (mm)=      63.69         63.69          63.69
     RUNOFF COEFFICIENT   =       0.98          0.62           0.98

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

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   1.29
|ID= 1 DT=10.0 min |   Total Imp(%)=  29.00   Dir. Conn.(%)=  29.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.37          0.92
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      92.74         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     131.09         72.07
               over (min)        10.00         20.00
     Storage Coeff.  (min)=       2.19 (ii)    10.24 (ii)
     Unit Hyd. Tpeak (min)=      10.00         20.00
     Unit Hyd. peak  (cms)=       0.17          0.08
                                                          *TOTALS*
```

```
     PEAK FLOW       (cms)=       0.14         0.11          0.192 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      62.69        36.14          43.83
     TOTAL RAINFALL   (mm)=      63.69        63.69          63.69
     RUNOFF COEFFICIENT   =       0.98         0.57           0.69

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

       (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.

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

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):     0.34   0.123     1.33    62.45
     + ID2= 2 (  0002):     1.29   0.192     1.33    43.83
       ====================================================
       ID = 3 (  0003):     1.63   0.315     1.33    47.72

     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   |   0.0619     0.0365
                         0.0269     0.0041   |   0.0663     0.0400
                         0.0438     0.0178   |   0.0726     0.0451
                         0.0536     0.0279   |   0.0000     0.0000

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)   1.630     0.315      1.33       47.72
   OUTFLOW: ID= 1 (  0004)   1.630     0.061      2.00       47.70

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 19.47
                  TIME SHIFT OF PEAK FLOW         (min)= 40.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0360

--------------------------------------------------------------------------------
--------------------
| 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.

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

--------------------
| ADD HYD  (  0013)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):     1.63   0.061     2.00    47.70
     + ID2= 2 (  0005):     0.01   0.001     1.33    28.24
       ====================================================
       ID = 3 (  0013):     1.64   0.062     2.00    47.55

     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)=     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!
***** 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\soh\AppData\Local\Civica\VH5\0622eba6-6932-4823-be44-
9905272daa96\3a40ecbe-3904-4825-bc23-243dc8879b58\scenario
  Summary filename: C:\Users\soh\AppData\Local\Civica\VH5\0622eba6-6932-4823-be44-
9905272daa96\3a40ecbe-3904-4825-bc23-243dc8879b58\scenario
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DATE: 08/13/2024                          TIME: 04:18:55

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)=   0.34
|ID= 1 DT=10.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.34         0.00
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      47.61        40.00
     Mannings n            =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     144.26        95.58
                over (min)       10.00        10.00
     Storage Coeff.  (min)=       1.15 (ii)    8.33 (ii)
     Unit Hyd. Tpeak (min)=      10.00        10.00
     Unit Hyd. peak  (cms)=       0.17         0.12
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.13         0.00          0.136 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      69.14        45.45          68.90
     TOTAL RAINFALL   (mm)=      70.14        70.14          70.14
     RUNOFF COEFFICIENT   =       0.99         0.65           0.98

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

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

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----------------------
| CALIB            |
| STANDHYD (  0002)|   Area     (ha)=   1.29
|ID= 1 DT=10.0 min |   Total Imp(%)=  29.00   Dir. Conn.(%)=  29.00
----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.37         0.92
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      92.74        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)=       2.11 (ii)    9.69 (ii)
     Unit Hyd. Tpeak (min)=      10.00        10.00
     Unit Hyd. peak  (cms)=       0.17         0.11
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.15         0.14          0.293 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      69.14        41.52          49.53
     TOTAL RAINFALL   (mm)=      70.14        70.14          70.14
     RUNOFF COEFFICIENT   =       0.99         0.59           0.71

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

       (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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--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------           (ha)     (cms)    (hrs)     (mm)
       ID1= 1 (  0001):      0.34    0.136     1.33     68.90
     + ID2= 2 (  0002):      1.29    0.293     1.33     49.53
       ================================================
       ID = 3 (  0003):      1.63    0.429     1.33     53.57

     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    |   0.0619     0.0365
                         0.0269     0.0041    |   0.0663     0.0400
                         0.0438     0.0178    |   0.0726     0.0451
                         0.0536     0.0279    |   0.0000     0.0000

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)    1.630     0.429      1.33       53.57
   OUTFLOW: ID= 1 (  0004)    1.630     0.069      2.00       53.55

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 15.99
                TIME SHIFT OF PEAK FLOW          (min)= 40.00
                MAXIMUM  STORAGE   USED        (ha.m.)=  0.0420

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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
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     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   0.069     2.00    53.55
     + ID2= 2 (  0005):     0.01   0.002     1.33    33.04
       ==========================================================
       ID = 3 (  0013):     1.64   0.069     2.00    53.39

     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	THROUGH	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	0.033	0.70	0.02	0.02	10.00	0.36	10.36	144.26	**9.26**	300	304.8	0.74	25.61	PVC	0.013	**86.78**	1.19	10.7%	89.3%	77.52
	S2	CBMH6	CBMH7	0.052	0.77	0.04	0.06	10.36	0.37	10.73	141.56	**24.85**	300	304.8	0.37	18.70	PVC	0.013	**61.36**	0.84	40.5%	59.5%	36.52
	S3	CB3	CBMH7	0.015	0.26	0.00	0.00	10.00	0.22	10.22	144.26	**1.58**	300	304.8	1.04	18.31	PVC	0.013	**102.88**	1.41	1.5%	98.5%	101.30
	S4	CBMH7	CBMH8	0.041	0.60	0.02	0.09	10.73	0.20	10.93	138.88	**35.41**	300	304.8	0.67	13.42	PVC	0.013	**82.58**	1.13	42.9%	57.1%	47.17
	S5	CBMH8	CBMH9	0.072	0.20	0.01	0.11	10.93	0.98	11.91	137.51	**40.56**	300	304.8	0.38	50.36	PVC	0.013	**62.19**	0.85	65.2%	34.8%	21.62
	S6	CBMH9	CBMH10	0.041	0.75	0.03	0.14	11.91	0.96	12.87	131.10	**49.88**	300	304.8	0.40	50.18	PVC	0.013	**63.80**	0.87	78.2%	21.8%	13.92
	S7	CBMH10	CBMH11	0.182	0.20	0.04	0.17	12.87	0.81	13.68	125.52	**60.46**	375	381.0	0.30	42.61	PVC	0.013	**100.18**	0.88	60.3%	39.7%	39.73
	S8	CBMH11	CBMH12	0.08	0.36	0.03	0.20	13.68	0.45	14.13	121.22	**68.09**	375	381.0	0.55	32.19	PVC	0.013	**135.65**	1.19	50.2%	49.8%	67.56
	S9	CBMH12	TANK	0.073	0.30	0.02	0.22	14.13	0.13	14.26	118.97	**74.07**	375	381.0	0.29	6.88	PVC	0.013	**98.50**	0.86	75.2%	24.8%	24.43
NORTH SITE																							
	N1	CB1	CBMH1	0.035	0.70	0.02	0.02	10.00	0.36	10.36	144.26	**9.83**	300	304.8	0.74	25.57	PVC	0.013	**86.78**	1.19	11.3%	88.7%	76.96
	N2	CBMH1	CBMH2	0.058	0.68	0.04	0.06	10.36	0.30	10.66	141.56	**25.16**	300	304.8	0.43	16.43	PVC	0.013	**66.15**	0.91	38.0%	62.0%	40.99
	N3	CBMH2	MH1	0.038	0.73	0.03	0.09	10.66	0.27	10.93	139.37	**35.52**	300	304.8	0.46	15.35	PVC	0.013	**68.42**	0.94	51.9%	48.1%	32.90
		MH1	CBMH3				0.09	10.93	0.51	11.44	137.47	**35.04**	300	304.8	0.48	29.36	PVC	0.013	**69.89**	0.96	50.1%	49.9%	34.86
	N4	CBMH3	CBMH4	0.13	0.24	0.03	0.12	11.44	0.29	11.73	134.06	**45.79**	300	304.8	0.89	22.53	PVC	0.013	**95.17**	1.30	48.1%	51.9%	49.38
	N5	CBMH4	CBMH5	0.024	0.90	0.02	0.14	11.73	0.52	12.25	132.22	**53.11**	300	304.8	0.97	42.22	PVC	0.013	**99.36**	1.36	53.5%	46.5%	46.25
	N6	CBMH5	TANK	0.19	0.25	0.05	0.19	12.25	0.04	12.29	129.07	**68.89**	300	304.8	1.42	4.26	PVC	0.013	**120.21**	1.65	57.3%	42.7%	51.33
		TANK	OGS									**73.80**	300	304.8	1.00	3.59	PVC	0.013	**100.88**	1.38	73.2%	26.8%	27.08
		OGS	CTRL MH									**73.80**	300	304.8	0.69	5.63	PVC	0.013	**83.80**	1.15	88.1%	11.9%	10.00
		CTRL MH	EX MH									**73.80**	300	304.8	2.00	13.11	PVC	0.013	**142.67**	1.96	51.7%	48.3%	68.87
FROM BLDG																							
	B1			0.325	0.90	0.29	0.29																
	B2			0.021	0.75	0.02	0.31																
	B3			0.016	0.90	0.01	0.32																
	B4	BLDG	TANK	0.202	0.50	0.10	0.42	10.00	0.03	10.03	144.26	**170.23**	375	381.0	1.59	4.00	PVC	0.013	**230.64**	2.02	73.8%	26.2%	60.42

CALCULATED BY: SO DATE: 2023-08-03
CHECKED BY: AW DATE: 2023-08-03

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER:	HAIDER NASRULLAH 647-850-9417 HAIDER.NASRULLAH@ADSPIPE.COM
ADS SALES REP:	JOHN NADALIN 226-219-6268 JOHN.NADALIN@ADSPIPE.COM
PROJECT NO:	S427334
ONTARIO SITE COORDINATOR:	RYAN RUBENSTEIN 519-710-3687 RYAN.RUBENSTEIN@ADSPIPE.COM

Advanced Drainage Systems, Inc.

SiteAssist™
FOR STORMTECH
INSTALLATION INSTRUCTIONS
VISIT OUR WEBSITE

325 KING STREET

NIAGARA-ON-THE-LAKE, ON.

MC-3500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 75 mm (3").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-3500 CHAMBER SYSTEM

1. STORMTECH MC-3500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 150 mm (6") SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 300 mm (12") INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE WELL GRADED BETWEEN ¾" AND 2" (20-50 mm)..
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
10. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
11. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-3500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT

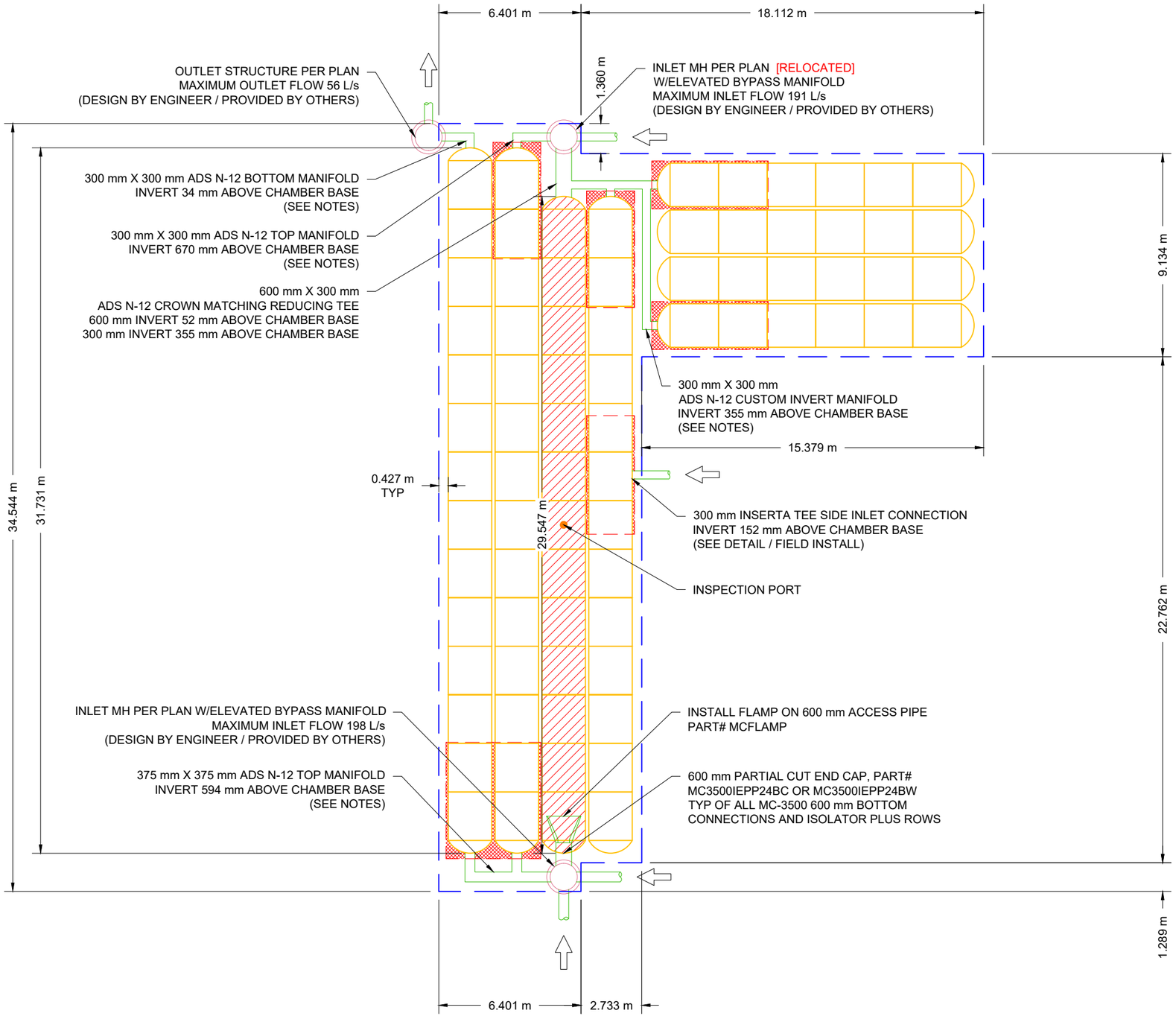
78	STORMTECH MC-3500 CHAMBERS
16	STORMTECH MC-3500 END CAPS
305	STONE ABOVE (mm)
229	STONE BELOW (mm)
40	% STONE VOID
450.6	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
448.7	SYSTEM AREA (m²)
118.1	SYSTEM PERIMETER (m)

PROPOSED ELEVATIONS

88.341	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED)
86.513	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC)
86.360	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC)
86.360	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT)
86.360	MINIMUM ALLOWABLE GRADE (TOP OF RIGID PAVEMENT)
86.208	TOP OF STONE
85.903	TOP OF MC-3500 CHAMBER
85.430	300 mm TOP MANIFOLD/CONNECTION INVERT
85.354	375 mm TOP MANIFOLD/CONNECTION INVERT
85.115	300 mm CUSTOM INVERT MANIFOLD
84.910	INSERTATEE SIDE INLET CONNECTION INVERT
84.812	600 mm ISOLATOR ROW PLUS CONNECTION INVERT
84.794	300 mm BOTTOM MANIFOLD/CONNECTION INVERT
84.760	BOTTOM OF MC-3500 CHAMBER
84.531	BOTTOM OF STONE

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.



ISOLATOR ROW PLUS (SEE DETAIL)

PLACE MINIMUM 5.33 m OF ADSPLUS125 WOVEN GEOTEXTILE
OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET
FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

325 KING STREET
NIAGARA-ON-THE-LAKE, ON.
DATE: 08/09/24 | DRAWN: RCT | CHECKED: RCT
PROJECT #: S427334

DATE	DRWN	CHKD	DESCRIPTION

StormTech®
Chamber System
888-892-2694 | WWW.STORMTECH.COM

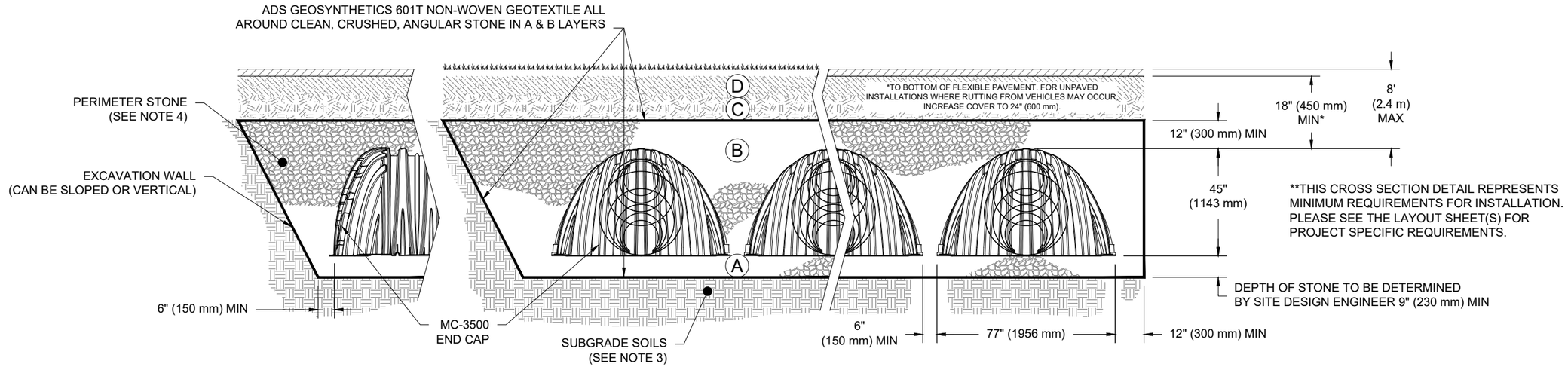
ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

SCALE = 1 : 200

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 18" (450 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE[5]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE[5]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.
5. WHERE RECYCLED CONCRETE AGGREGATE IS USED IN LAYERS 'A' OR 'B' THE MATERIAL SHOULD ALSO MEET THE ACCEPTABILITY CRITERIA OUTLINED IN TECHNICAL NOTE 6.20 "RECYCLED CONCRETE STRUCTURAL BACKFILL".



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/FT/%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

325 KING STREET
NIAGARA-ON-THE-LAKE, ON.
DATE: 08/09/24 | DRAWN: RCT | CHECKED: RCT
PROJECT #: S427334

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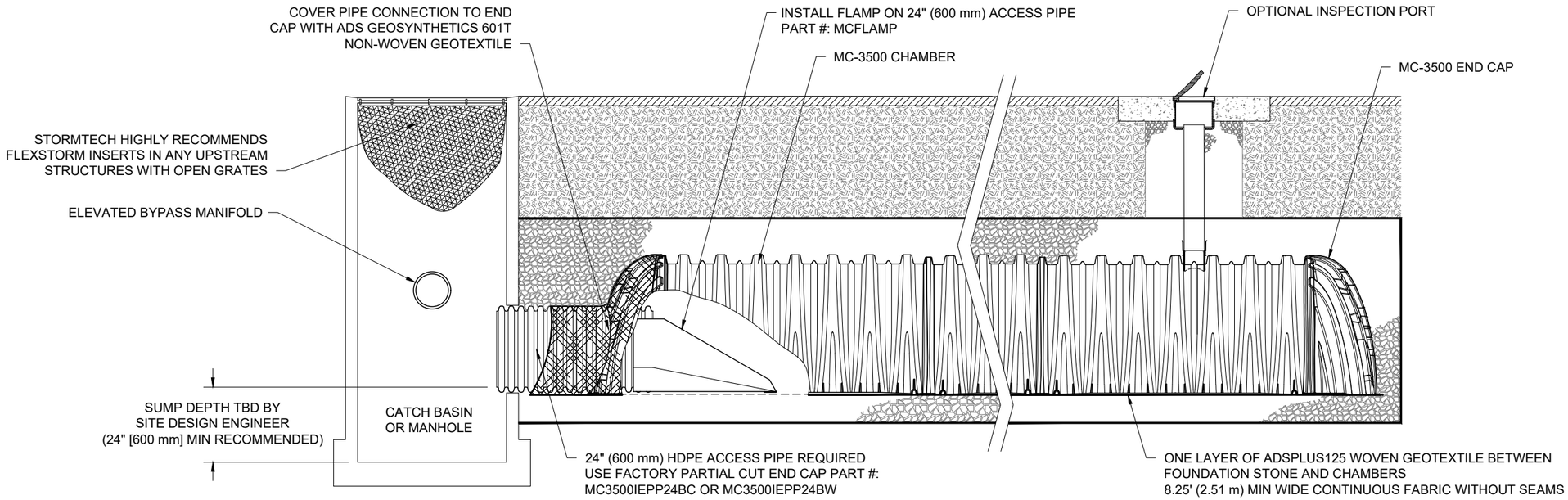
StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026



MC-3500 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

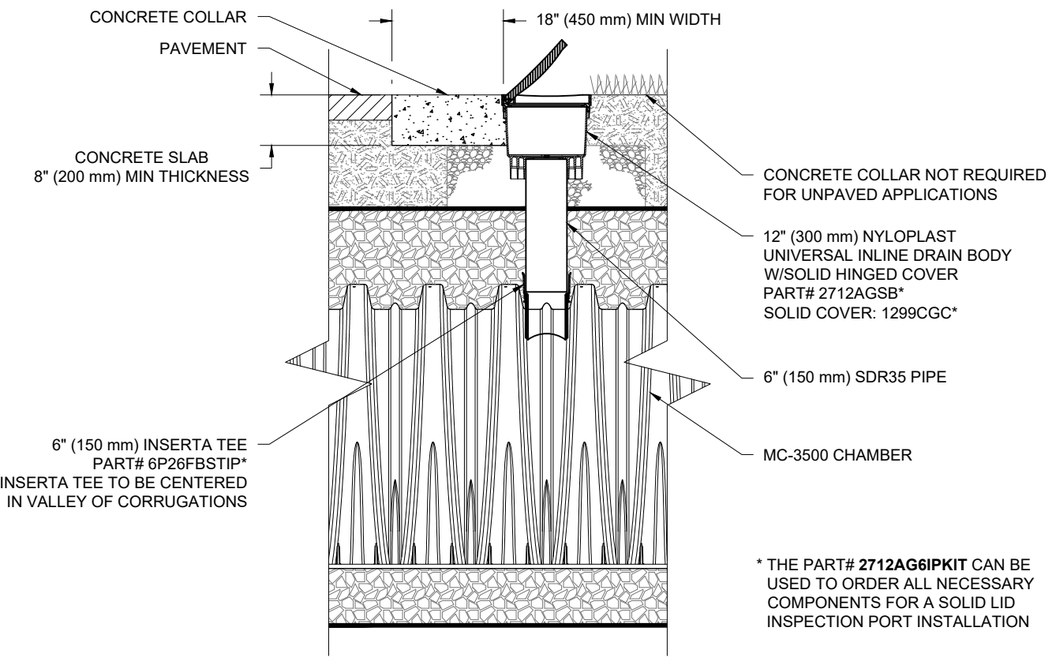
STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



MC-3500 6" (150 mm) INSPECTION PORT DETAIL
NTS

325 KING STREET
NIAGARA-ON-THE-LAKE, ON.
DATE: 08/09/24 | DRAWN: RCT | CHECKED: RCT
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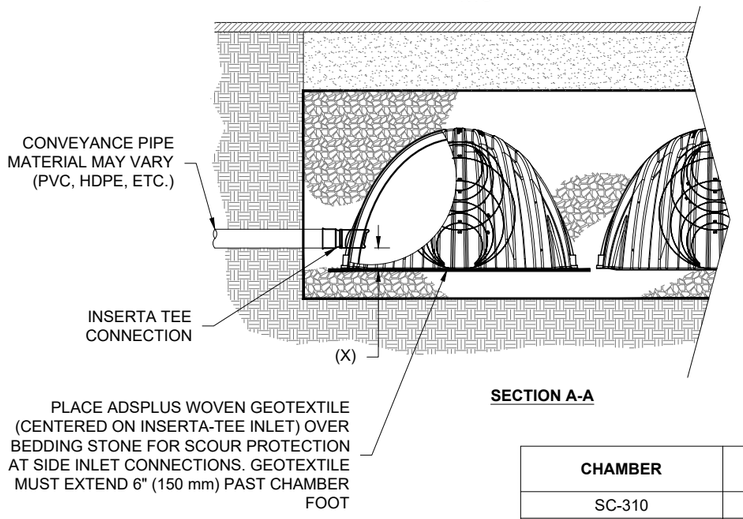
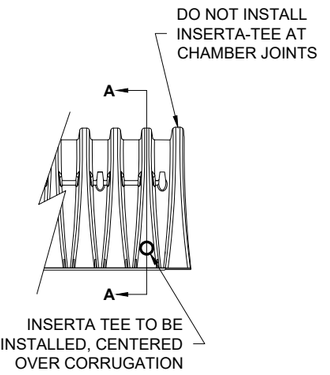
SHEET 4 OF 5

INSERTA TEE DETAIL

NTS



SECTION A-A



SIDE VIEW

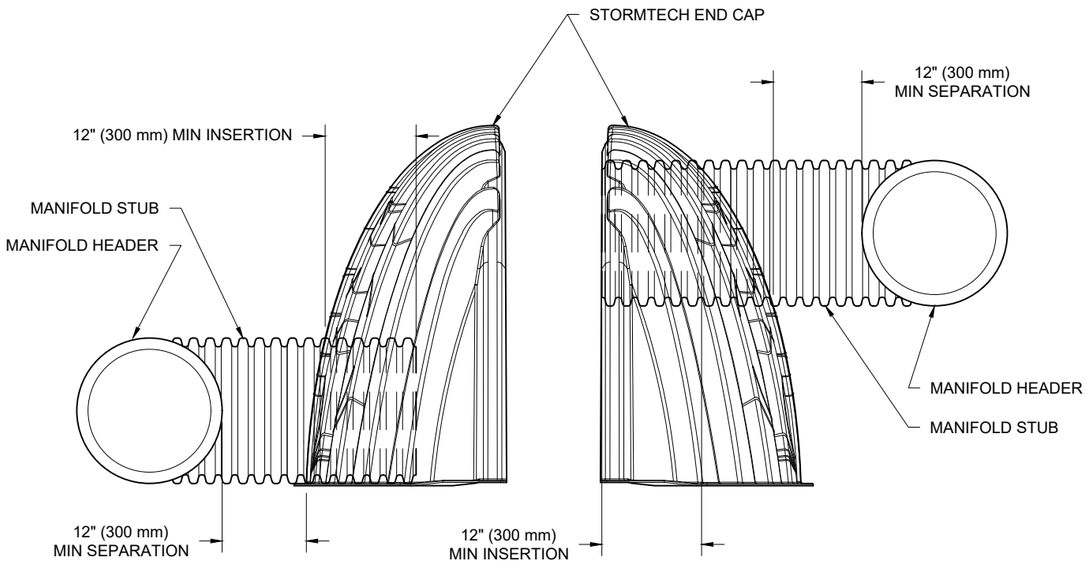
CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6" (150 mm)	4" (100 mm)
SC-740	10" (250 mm)	4" (100 mm)
SC-800	10" (250 mm)	4" (100 mm)
DC-780	10" (250 mm)	4" (100 mm)
MC-3500	12" (300 mm)	6" (150 mm)
MC-4500	12" (300 mm)	8" (200 mm)
MC-7200	12" (300 mm)	8" (200 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON		

NOTES:

- PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.
- CONTACT ADS ENGINEERING SERVICES IF INSERTA TEE INLET MUST BE RAISED AS NOT ALL INVERTS ARE POSSIBLE.

MC-SERIES END CAP INSERTION DETAIL

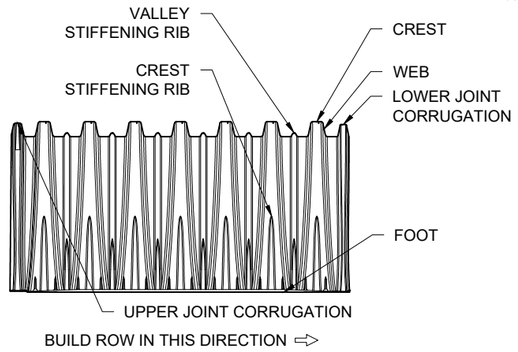
NTS

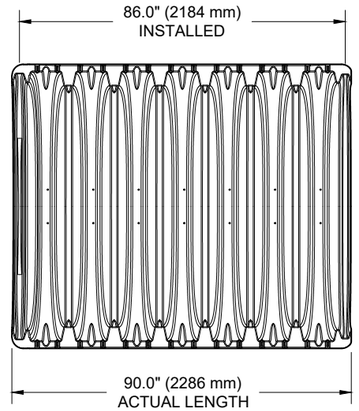


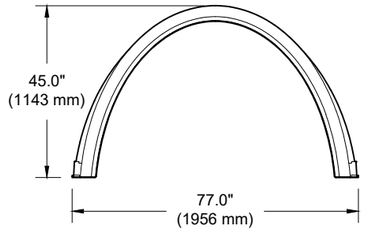
NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

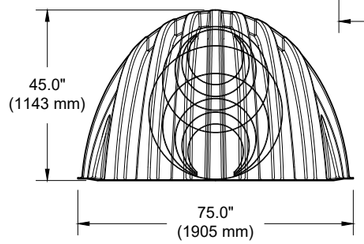
MC-3500 TECHNICAL SPECIFICATION

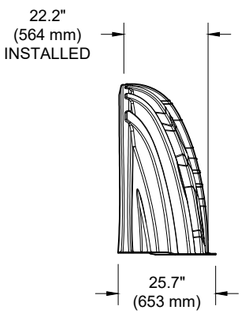
NTS











NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	(4.96 m³)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

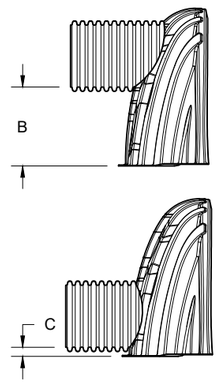
SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	(1.28 m³)
WEIGHT	49 lbs.	(22.2 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" (152 mm) STONE BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"

PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PARTIAL CUT INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

325 KING STREET
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EX 450mmø SAN @ 0.35%

EX 525mmø STM @ 0.50%

EX 150mmø WATERMAIN

EX 450mmø SAN @ 0.35%

S 84.15

14.77m–300mmø PVC STM @ 0.40%

STM CTRL MH
1200mmø
RIM EL 86.93
SW INV 84.27
N INV 84.21

CONNECT TO
AS PER OPSD
CO

EDGE OF ASPHALT ROAD

OVERHEAD HYDRO WIRE

2.0m HIGH CHAIN LINK FENCE

CAN WE USE AN L-SHAPE CONFIGURATION?

3.60m–300mmø PVC STM @ 0.40%

160mmø
ORIFICE PLATE
INV. 84.28

42.22m–300mmø PVC STM @ 1.00%

21.67m–

STM CBMH4
1200mmø
RIM EL 87.25
SE INV 85.61
NW INV 85.58

STM CBMH5
1200mmø
RIM EL 86.50
SE INV 85.16
NW INV 85.16

4.26m–300mmø PVC STM @ 1.40%

SWM TANK
ACCESS
MANHOLE

GW SAMPLING MH
1200mmø
RIM EL 87.37
SE INV 84.96
NW INV 84.96

EXTENT OF
UNDERGROUND
PARKING

INV. 84.78

18.33m–300mmø PVC STM @ 1.00%

INV. 84.79
(FROM FOUNDATION)

3.00m–300mmø PVC STM @ 1.00%

EX. FIRE
HYDRANT

NEED TO AVOID CONFLICT WITH LANDSCAPE BED / TREES

STORMTECH 3500
GROUND ELEV. 86.60
TOP OF CHAMBER. 85.90
BOT OF CHAMBER. 84.76
INCOMING PIPE INV. 85.10

21.34m–375mmø
PVC STM @ 2.00%

INV. 84.78

INV. 85.20
(FROM ROOF)

6.88m–375mmø
PVC STM @ 0.45%

STM CBMH12
1200mmø
RIM EL 86.76
SW INV 85.13
NE INV 85.13
SE INV 85.35

20.18m–200mmø PVC STM @ 0.50%

STM CB5
RIM EL 87.05
NW INV 85.45

EXTENT OF BUILD
AT GRADE (TYP)

MUNICIPAL
No. 58
TWO STOREY
DWELLING

MUNICIPAL
No. 317
TWO STOREY
DWELLING

LOT 151

LOT 150

DRIVEWAY

REGENT STREET

EX 200mmø SAN @ 0.35%

Project: **325 King Street NOTL**

Chamber Model -	MC-3500	
Units -	**Metric**	
Number of Chambers -	78	
Number of End Caps -	16	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	84.53	m
Amount of Stone Above Chambers -	305	mm
Amount of Stone Below Chambers -	229	mm

Area of System- 448.7 sq.meters Min. Area - 383.25 sq.meters

StormTech MC-3500 Cumulative Storage Volumes

Height of System (mm)	Incremental Single Chamber (cubic meters)	Incremental Single End Cap (cubic meters)	Incremental Chambers (cubic meters)	Incremental End Cap (cubic meters)	Incremental Stone (cubic meters)	Incremental Ch, EC and Stone (cubic meters)	Cumulative System (cubic	Elevation (meters)
1676	0.000	0.000	0.00	0.00	4.56	4.56	450.65	86.21
1651	0.000	0.000	0.00	0.00	4.56	4.56	446.09	86.18
1626	0.000	0.000	0.00	0.00	4.56	4.56	441.53	86.16
1600	0.000	0.000	0.00	0.00	4.56	4.56	436.97	86.13
1575	0.000	0.000	0.00	0.00	4.56	4.56	432.41	86.11
1549	0.000	0.000	0.00	0.00	4.56	4.56	427.86	86.08
1524	0.000	0.000	0.00	0.00	4.56	4.56	423.30	86.06
1499	0.000	0.000	0.00	0.00	4.56	4.56	418.74	86.03
1473	0.000	0.000	0.00	0.00	4.56	4.56	414.18	86.00
1448	0.000	0.000	0.00	0.00	4.56	4.56	409.62	85.98
1422	0.000	0.000	0.00	0.00	4.56	4.56	405.06	85.95
1397	0.000	0.000	0.00	0.00	4.56	4.56	400.50	85.93
1372	0.002	0.000	0.13	0.00	4.51	4.64	395.94	85.90
1346	0.005	0.001	0.43	0.01	4.38	4.82	391.31	85.88
1321	0.008	0.001	0.65	0.02	4.29	4.96	386.49	85.85
1295	0.011	0.001	0.89	0.02	4.19	5.11	381.53	85.83
1270	0.019	0.002	1.52	0.03	3.94	5.49	376.42	85.80
1245	0.029	0.002	2.27	0.04	3.63	5.95	370.93	85.78
1219	0.035	0.003	2.76	0.05	3.44	6.24	364.99	85.75
1194	0.040	0.004	3.14	0.06	3.28	6.48	358.74	85.72
1168	0.045	0.004	3.47	0.07	3.14	6.68	352.26	85.70
1143	0.048	0.005	3.77	0.07	3.02	6.87	345.58	85.67
1118	0.052	0.005	4.04	0.08	2.91	7.03	338.72	85.65
1092	0.055	0.006	4.28	0.09	2.81	7.18	331.69	85.62
1067	0.058	0.006	4.51	0.10	2.72	7.32	324.50	85.60
1041	0.060	0.007	4.71	0.11	2.63	7.45	317.18	85.57
1016	0.063	0.007	4.91	0.11	2.55	7.57	309.73	85.55
991	0.065	0.008	5.09	0.12	2.47	7.69	302.16	85.52
965	0.068	0.008	5.27	0.13	2.40	7.80	294.47	85.50
940	0.070	0.008	5.43	0.13	2.33	7.90	286.67	85.47
914	0.072	0.009	5.58	0.14	2.27	7.99	278.77	85.45
889	0.073	0.009	5.73	0.15	2.21	8.08	270.78	85.42
864	0.075	0.009	5.87	0.15	2.15	8.17	262.70	85.39
838	0.077	0.010	6.00	0.16	2.10	8.25	254.53	85.37
813	0.078	0.010	6.12	0.16	2.05	8.33	246.28	85.34
787	0.080	0.011	6.24	0.17	2.00	8.40	237.95	85.32
762	0.081	0.011	6.35	0.17	1.95	8.47	229.54	85.29
737	0.083	0.011	6.46	0.18	1.90	8.54	221.07	85.27
711	0.084	0.012	6.56	0.18	1.86	8.61	212.53	85.24
686	0.085	0.012	6.65	0.19	1.82	8.66	203.92	85.22
660	0.086	0.012	6.74	0.19	1.78	8.72	195.26	85.19
635	0.088	0.012	6.83	0.20	1.75	8.78	186.54	85.17
610	0.089	0.013	6.91	0.20	1.71	8.83	177.76	85.14
584	0.090	0.013	6.99	0.21	1.68	8.88	168.93	85.12
559	0.091	0.013	7.07	0.21	1.65	8.93	160.05	85.09
533	0.091	0.014	7.14	0.22	1.62	8.97	151.12	85.06
508	0.092	0.014	7.20	0.22	1.59	9.01	142.15	85.04
483	0.093	0.014	7.27	0.23	1.56	9.05	133.14	85.01
457	0.094	0.014	7.33	0.23	1.54	9.09	124.08	84.99
432	0.095	0.015	7.39	0.23	1.51	9.13	114.99	84.96
406	0.095	0.015	7.44	0.24	1.49	9.16	105.86	84.94
381	0.096	0.015	7.49	0.24	1.47	9.20	96.69	84.91
356	0.097	0.015	7.54	0.24	1.44	9.23	87.50	84.89
330	0.097	0.015	7.59	0.25	1.42	9.26	78.27	84.86
305	0.098	0.016	7.64	0.25	1.40	9.29	69.00	84.84
279	0.099	0.016	7.68	0.25	1.38	9.32	59.71	84.81
254	0.099	0.017	7.74	0.27	1.35	9.37	50.39	84.79
229	0.000	0.000	0.00	0.00	4.56	4.56	41.03	84.76
203	0.000	0.000	0.00	0.00	4.56	4.56	36.47	84.73
178	0.000	0.000	0.00	0.00	4.56	4.56	31.91	84.71
152	0.000	0.000	0.00	0.00	4.56	4.56	27.35	84.68
127	0.000	0.000	0.00	0.00	4.56	4.56	22.79	84.66
102	0.000	0.000	0.00	0.00	4.56	4.56	18.24	84.63
76	0.000	0.000	0.00	0.00	4.56	4.56	13.68	84.61
51	0.000	0.000	0.00	0.00	4.56	4.56	9.12	84.58
25	0.000	0.000	0.00	0.00	4.56	4.56	4.56	84.56

August 7, 2024

ADS Isolator Row PLUS Sizing

Project Name:	325 King Street		
Consulting Engineer:	RV Anderson Associates Limited		
Location:	Niagara-on-the-lake		
Sizing Completed By:	Haider Nasrullah	**Email:**	haider.nasrullah@ads-pipe.com

Stormtech Details	
Chamber Model	MC-3500
No. Chamber in Isolator Row PLUS:	14
Isolator Row PLUS TSS Removal:	80.8%
Volume Treated by Isolator Row Plus:	>90%

Notes: Refer to Stormtech drawings for full IR+ configuration.

Site Details	
Site Area (ha):	1.65
Rational C:	0.84
Particle Size Distribution:	ETV
Rainfall Station:	Niagara Falls, ONT

Note: Isolator Row PLUS removal efficiencies based solely on ETV/NJDEP PSD, above-noted PSD is for OGS sizing only

Net Annual Removal Efficiency Summary

Rainfall Intensity	Fraction of Rainfall	Removal Efficiency IR PLUS	IR+ % Volume Treated
mm/hr	%	%	%
0.50	0.0%	81.2%	0.0%
1.00	11.2%	81.2%	11.2%
1.50	18.6%	81.2%	18.6%
2.00	13.3%	81.2%	13.3%
2.50	2.9%	81.2%	2.9%
3.00	1.5%	81.2%	1.5%
3.50	8.9%	81.2%	8.9%
4.00	5.6%	81.2%	5.6%
4.50	1.0%	81.2%	1.0%
5.00	5.5%	81.2%	5.5%
6.00	4.3%	81.2%	4.3%
7.00	4.4%	81.2%	4.4%
8.00	3.5%	81.2%	3.5%
9.00	2.1%	81.2%	2.1%
10.00	2.3%	81.2%	2.3%
20.00	9.9%	81.2%	9.9%
30.00	2.7%	81.2%	2.7%
40.00	1.1%	81.2%	1.1%
50.00	0.6%	66.1%	0.5%
100.00	0.5%	33.0%	0.2%
150.00	0.1%	22.0%	0.0%
200.00	0.0%	16.5%	0.0%
200.00	0.0%	16.5%	0.0%
	Total Net Annual Removal Efficiency		**80.8%**
	Total Runoff Volume Treated		**>90%**

Notes:

Isolator Row PLUS removal efficiency based on verified ETV test report. For dimensions and configuration of Isolator Row PLUS, please see Stormtech drawing package.

(1) Rainfall Data: 1965:1990, HLY03, Niagara Falls, ONT, 6135638.

(2) Canada ETV PSD & Test Protocols - ISO14034 Certifed

(3) Rainfall adjusted to 5 min peak intensity based on hourly average.

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. DROP STRUCTURES TO BE AS PER OPSD 1003.01.
6. SANITARY SERVICE CONNECTIONS SHALL BE SINGLE, 135mmø MINIMUM, PVC CLASS DR 28 INSTALLED AT 1 PERCENT AND THE COLOUR SHALL BE GREEN, FOR SINGLE RESIDENTIAL DWELLINGS.
7. SANITARY SERVICES SHALL BE A MINIMUM OF 2.4m AND MAXIMUM OF 3.0m DEEP MEASURED FROM THE FINAL GRADE AT THE STREET LINE.
8. SANITARY MAINTENANCE HOLE SHALL HAVE WATERTIGHT FRAME AND COVER IN PONDING AREAS AS PER OPSD 401.030.
9. LATERAL CONNECTIONS TO SEWERS SHALL BE CORE DRILLING AND FACTORY MADE SADDLES FOR CONNECTION TO EXISTING SEWERS AS PER NOTL REQUIREMENTS.
10. GRANULAR MATERIALS INCLUDING SEWER EMBEDMENT SHALL NOT CONSIST OF RECLAIMED/RECYCLED MATERIAL
11. 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.
12. 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 1.8 METRES BELOW FINISHED GRADE.
4. SERVICE CONNECTIONS SHALL BE 25mm DIAMETER AND CONFORM TO ASTM B88-03 (ASTM B88M-05 FOR METRIC SIZES) TYPE "K" SOFT COPPER.
5. MINIMUM COVER ON WATER SERVICES WILL BE 1.7 METRES BELOW FINISHED GRADE..
6. 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.
7. ALL CURB AND VALVE BOXES TO BE LOCATED AT STREET LINE. VALVE BOXES SHALL BE SET FLUSH WITH GRADE AND PROTECTED FROM ALL DAMAGE.
8. 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.
9. MECHANICAL THRUST RESTRAINTS SHALL BE INSTALLED AT ALL FITTINGS, BENDS, TEES, CROSSES, REDUCERS AND VALVES FOR ALL WATERMAIN SIZES.
10. ALL TEES, PLUGS, HORIZONTAL, VERTICAL BENDS, REDUCERS AND HYDRANTS TO HAVE CONCRETE THRUST BLOCKS AS PER OPSD 1103.01 & OPSD 1103.020.
11. 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.
12. 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.
13. 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.
14. 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. INSULATE WATERMAIN WHERE COVER IS LESS THAN 1.8 m.
18. ALL SERVICE CONNECTION TO BE MARKED WITH A 38 mm x 89 mm x 2.4 m WOOD STAKE, PAINTED BLUE.

ROAD / PAVEMENTS

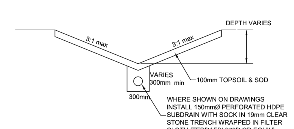
1. WHERE NEW ASPHALT MATCHES EXISTING ASPHALT, GRIND EXISTING ASPHALT A MINIMUM OF 300mm WIDE AND 40mm DEEP FOR KEYING. APPLY HOT RUBBER SEALING COMPOUND IN ACCORDANCE WITH OPSS 1212. ALL SURFACES TO BE TACK COATED WITH SS-1.
2. THE CONCRETE CURB, CONCRETE SIDEWALK (IF APPLICABLE) AND ALL RESTORATION 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:
   - -450mm GRANULAR A (COMPACTED TO 100% SPMDD)
   - -50mm HL8 HS
   - -40mm HL3 HS
10. COMMERCIAL DRIVEWAYS SHALL BE CONSTRUCTED WITH THE FOLLOWING PAVEMENT STRUCTURE:
   - -50mm HL8 MDBC
   - -40mm HL3
   - -375mm GRANULAR A
11. WHERE CONSTRUCTION OF RESIDENTIAL 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.
12. ON-SITE ACCESS ROAD 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

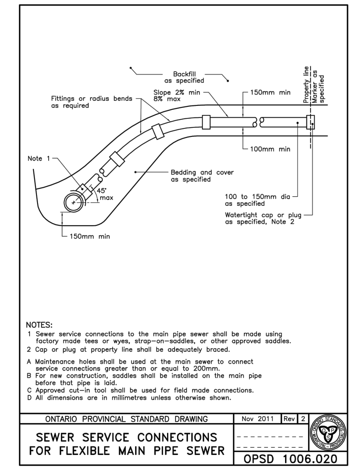
1. FILL SHALL BE NATIVE MATERIAL UNLESS OTHERWISE SHOWN. THE NATIVE MATERIAL SHALL BE FREE OF ORGANICS AND DEBRIS AND WITH A NATURAL MOISTURE CONTENT WHICH IS WITHIN 2% OF THE OPTIMUM MOISTURE CONTENT. WET MATERIAL MAY REQUIRE AERATION FOR PROPER COMPACTION BY SPREADING THEM THINLY ON THE GROUND.
2. 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.

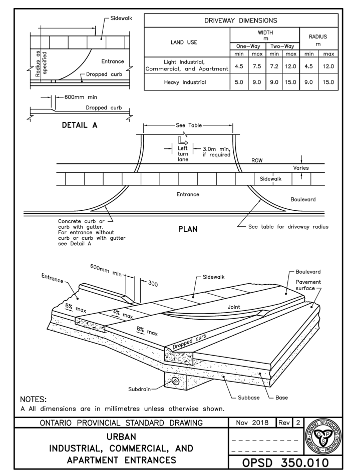


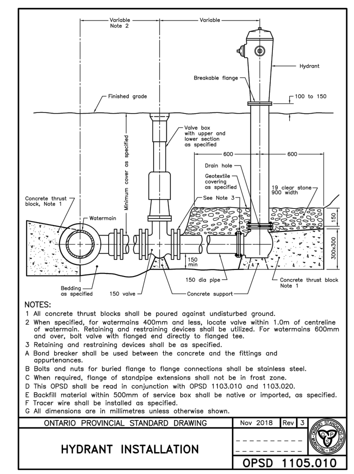
TYPICAL SWALE DETAIL
N.T.S.

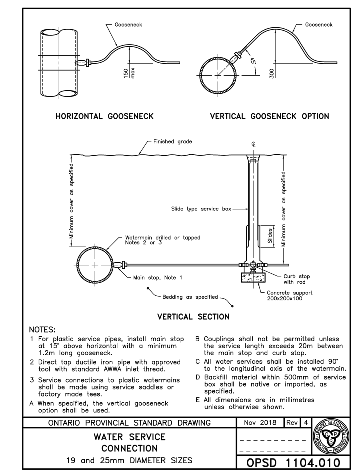
EROSION AND SEDIMENT CONTROL

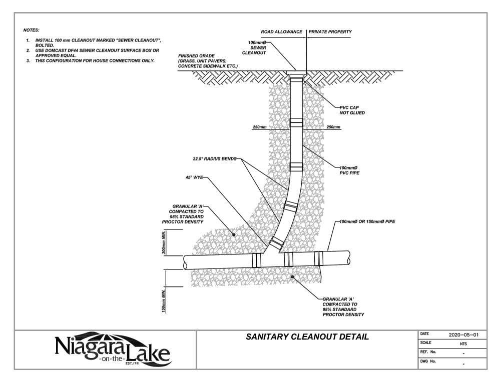
1. SEDIMENT BARRIERS, CHECK DAMS, AND TEMPORARY CONSTRUCTION ACCESS TO BE INSTALLED PRIOR TO THE BEGINNING OF CONSTRUCTION.
2. ALL SEDIMENT CONTROL DEVICES TO BE ROUTINELY INSPECTED AND MAINTAINED IN PROPER WORKING ORDER UNTIL AREA IS STABILIZED.
3. IF NECESSARY, TRUCKS WILL BE WASHED DOWN BEFORE LEAVING 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 "GTA CA'S EROSION & SEDIMENT CONTROL GUIDELINES FOR URBAN CONSTRUCTION" AND/OR OTHER CITY OF TORONTO 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.

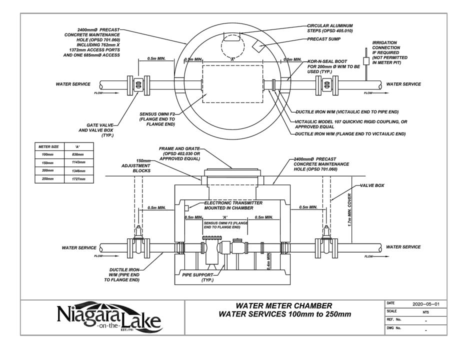












KEY PLAN
N.T.S.

No.	Revision	Comments
1	2023-02-02	ISSUED FOR 1ST ZBA SUBMISSION
2	2024-08-30	ISSUED FOR 1ST SPA SUBMISSION

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

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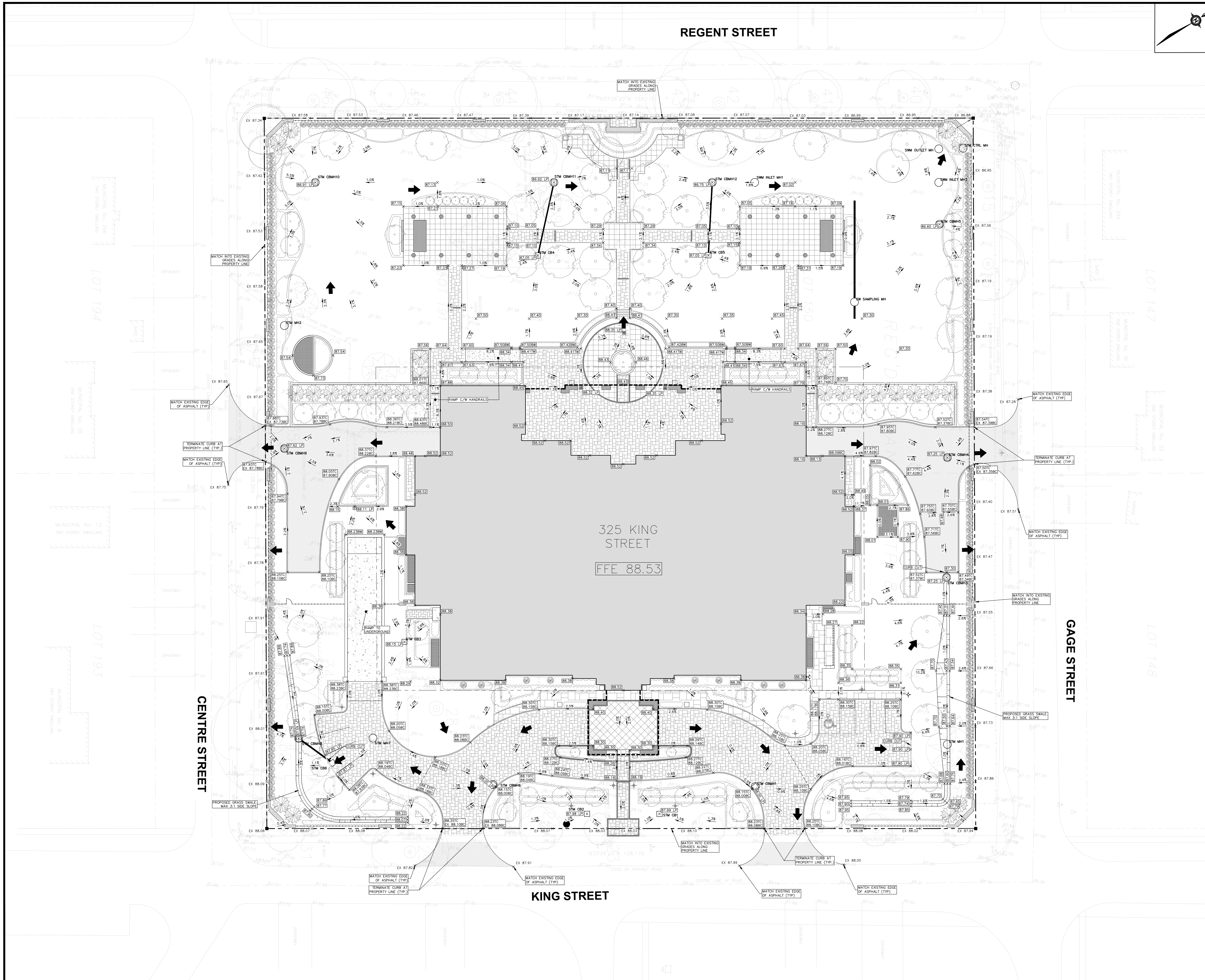

KEY PLAN
N.T.S.

No.	Revision	Comments
1	2023-02-02	ISSUED FOR 1ST ZBA SUBMISSION
2	2024-08-30	ISSUED FOR 1ST SPA SUBMISSION

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

LEGEND

- PROPERTY LINE
- LIMIT OF ROOF OVERHANG
- 123.00 PROPOSED ELEVATION
- 123.00 EXISTING ELEVATION
- 2.5% PROPOSED SLOPE
- AREA DRAIN (AD)
- CATCH BASIN
- STRIP DRAIN (SD)
- ACCESS OPENING FRAME & GRATE (MH)
- PROPOSED RETAINING WALL
- H.P. PROPOSED HIGH POINT
- F.F.E. PROPOSED FINISHED FLOOR ELEVATION
- PROPOSED OVERLAND FLOW ROUTE (GREATER THAN 100-YR STORM)

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:
THE INFORMATION DENOTED IN BOXES WITHIN THE DRAWING DETAILS ON THIS SHEET ARE CONSIDERED TO BE PROPOSED DESIGN/SPECIFICATIONS. ALL OTHER INFORMATION IS SHOWN FOR CONTEXT ONLY. REFER TO THE APPROPRIATE DRAWINGS BY THE ARCHITECT, LANDSCAPE ARCHITECT, STRUCTURAL ENGINEER, AND MECHANICAL ENGINEER FOR DETAIL DESIGN AND SPECIFICATION OF OTHER DESIGN ELEMENTS.

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:	Design:	Date:
SO	SO	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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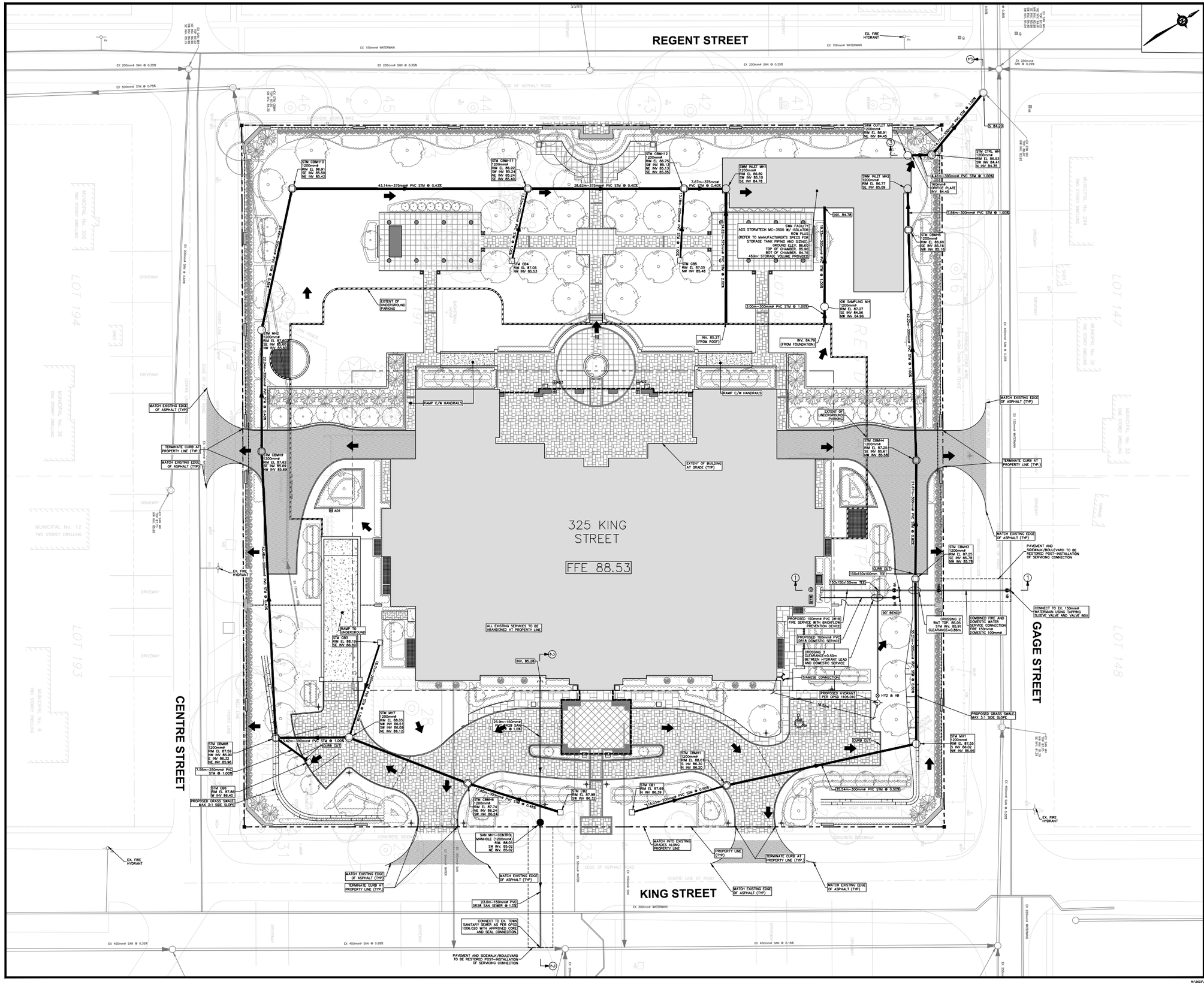

No.	Revision	Comments
1	2023-10-02	ISSUED FOR 1ST ZBA SUBMISSION
2	2024-08-30	ISSUED FOR 1ST SPA SUBMISSION

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
- WATER METER & BACK FLOW PREVENTER
- DETECTOR ASSEMBLY
- PROPOSED SEWER CAP
- EXISTING BELL
- EXISTING GAS MAIN

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 (COVID-19208-7), AND ARE DERIVED FROM GNSS OBSERVATIONS AND NATURAL RESOURCES CANADA'S GEOID MODEL HT2.0.

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

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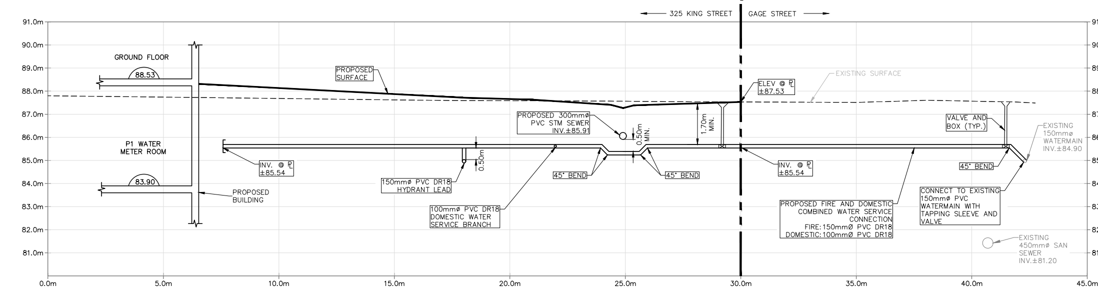

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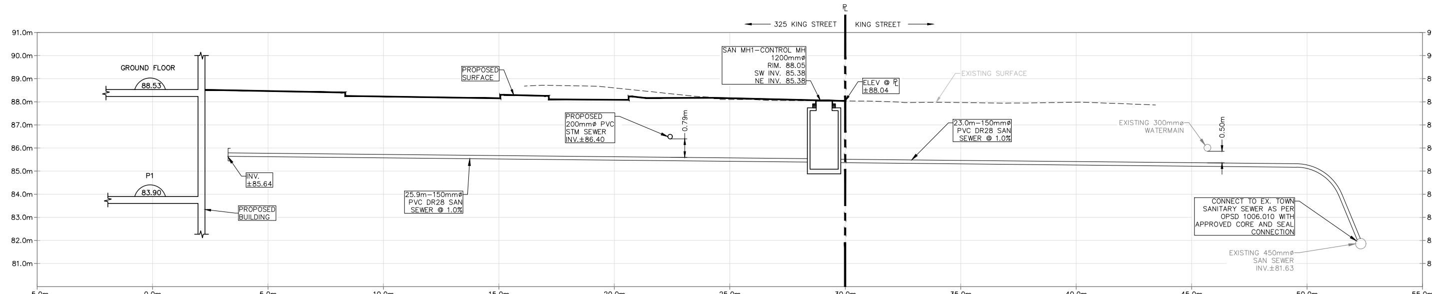

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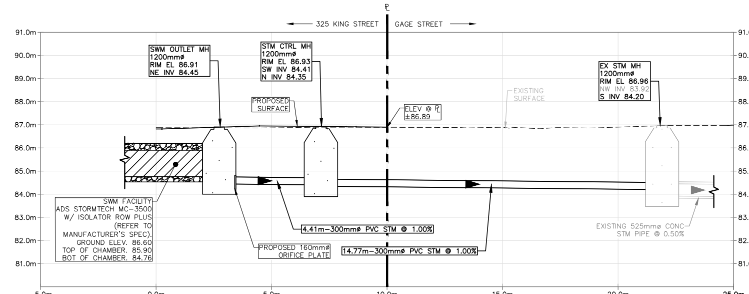

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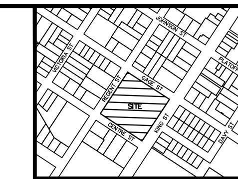

KEY PLAN
N.T.S.

No.	Revision	Comments
1	2023-02-02	ISSUED FOR 1ST ZBA SUBMISSION
2	2024-08-16	ISSUED FOR 1ST SPA SUBMISSION

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

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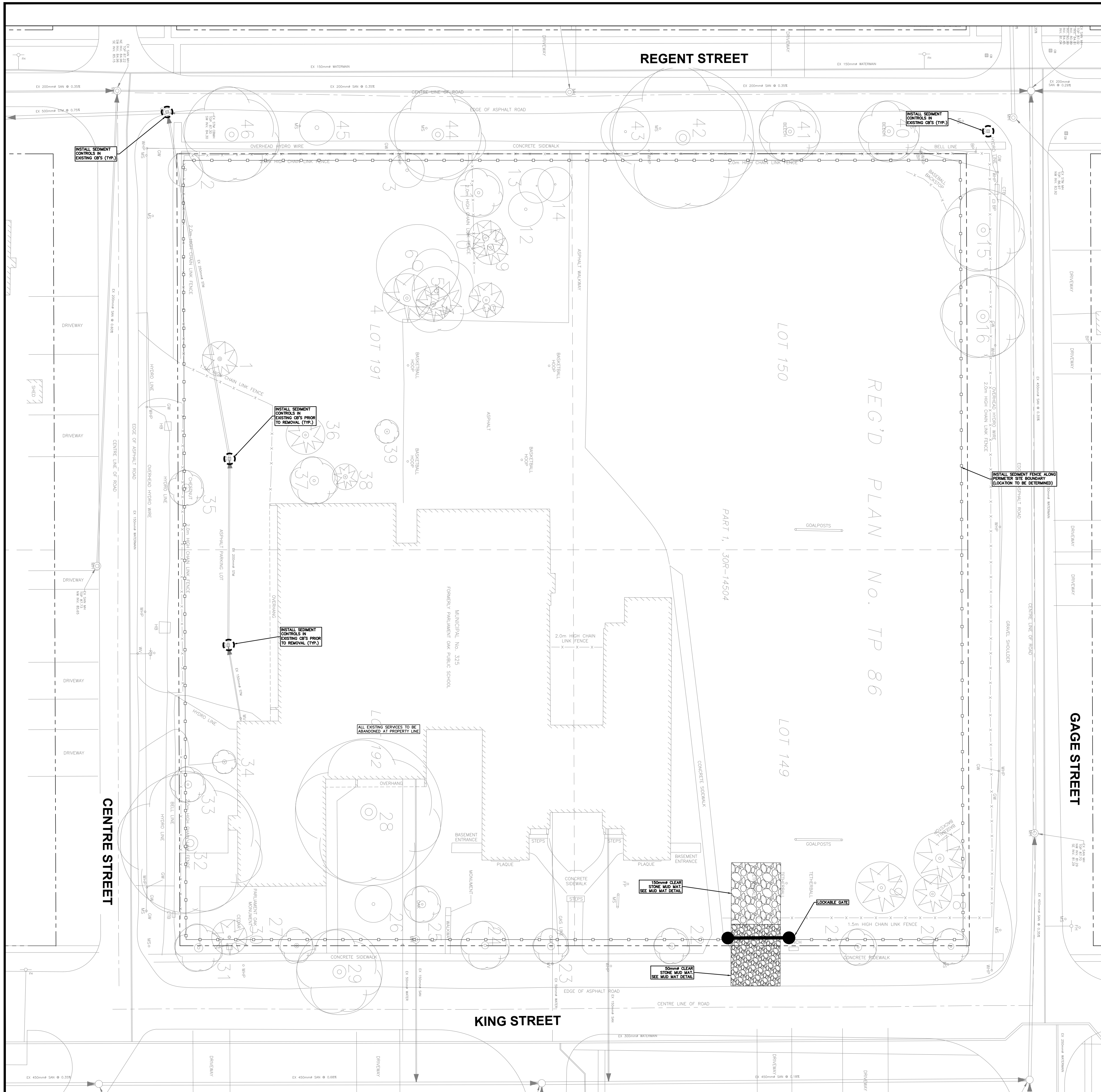
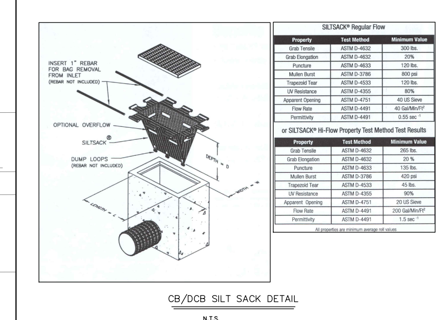
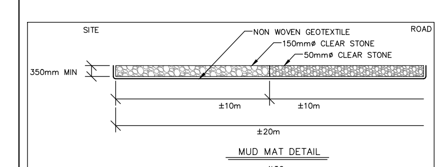
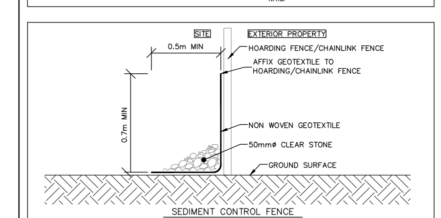
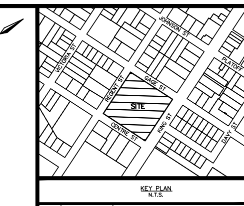








MUD MATS TO BE INSTALLED PER MUD MAT DETAIL, CLEANED AND/OR REPLACED AS REQUIRED. EXACT LOCATION, ORIENTATION AND GRADE OF MUD MAT IS SUBJECT TO CHANGE TO SUIT STAGES OF EXCAVATION AND CONSTRUCTION.



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

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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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		