PETRIES LANDING III
Functional Servicing and Stormwater Management

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1.0 Introduction

1.1 Project Information

This report is prepared to demonstrate the Functional Servicing and Stormwater Management in support of a Draft Plan of Subdivision application for the proposed development located at 8600 Jeanne d'Arc Boulevard N. in the City of Ottawa. The site is 10.43 ha in size and located in the Chatelaine Village neighbourhood of the City of Ottawa.

The site location is illustrated in **Figure 1.1** below.

Figure 1.1: Key Plan of Site

Current zoning is O1 and DR. The site is currently vacant and is farmed. The site is bound by Jeanne D'Arc Boulevard N. to the north, institutional development to the east, Regional Road 174 to the south, and residential development to the east.

A copy of the proposed Concept Plan and preliminary building statistics prepared by BDP Quadrangle architects is provided in **Appendix A**. The proposed plan consists of a public road, park dedication, and four private development blocks. Private development blocks are anticipated to contain multi-storey residential apartment units with private open space and internal roadways (where needed).

The current anticipated unit counts per private development block are listed in **Table 1.1** below.

Table 1.1: Unit Count

Development Block	Apartment Units
A	330
B	994
C	461
D	1074
Total	**2859**

A unit type breakdown for each of the buildings is not yet confirmed. Subsequent applications through the development process can confirm unit types as needed.

1.2 Regulatory Framework

The development of the Petries Landing III site is governed by the City of Ottawa's current Official Plan, the Orleans Corridor Secondary Plan, and applicable development application requirements.

The Rideau Valley Conservation Authority (RVCA) administers development regulations in areas subject to natural hazards (such as flooding, erosion, and unstable slopes) and in environmentally sensitive areas (such as wetlands, shorelines, and waterways). The RVCA also reviews development proposals and municipal planning applications within or adjacent to natural areas.

The pre-application consultation process with the City of Ottawa and the RVCA establishes the initial design criteria associated with demonstrating the suitability of servicing and stormwater management on the site.

1.2.1 REFERENCE DOCUMENTS

Documents referenced in support of this report include:

- *City of Ottawa Sewer Design Guidelines* (SDG), City of Ottawa, October 2012, including all subsequent technical bulletins

- *City of Ottawa Design Guidelines – Water Distribution*, City of Ottawa, July 2010, including all subsequent technical bulletins
- *Design Guidelines for Drinking Water Systems*, Ministry of the Environment, Conservation, and Parks (MECP), 2008
- *Fire Protection Water Supply Guideline* for Part 3 in the Ontario Building Code, Office of the Fire Marshal (OFM), October 2020
- *Water Supply for Public Fire Protection*, Fire Underwriters Survey (FUS), 2020
- *Fire Code*, National Fire Protection Agency, 2012
- Pre-Application Consultation meeting notes and related correspondence with City of Ottawa and RVCA staff (see **Appendix B**).
- *Geotechnical Investigation Petrie's Landing III 8600 Jeanne D'Arc Boulevard*, Paterson Group, Report PG6414-1, December 23, 2022
- Site topographic survey data provided to Stantec.

Information on infrastructure located within the adjacent public roads are obtained from available City of Ottawa as-built records.

It is noted that there is no Master Drainage Plan or Sub-watershed study available to support the stormwater management (SWM) objectives.

1.3 Objective

This Functional Servicing and Stormwater Management report assesses and identifies preliminary servicing and stormwater management (SWM) conditions which are generally consistent with City of Ottawa Design Guidelines and considers related pre-application consultation advice provided by City of Ottawa and RVCA staff. Deviations from existing reference documents or pre-consultation advice is identified with an explanation for the change in relation to site specific circumstances.

Preliminary general and applicable site-specific objectives considered are summarized below. Specific technical design criteria details are described in the associated servicing sections of this report.

Potable Water Servicing

- Develop a functional assessment of the potable water and fire flow demand for the site.
- Identify that the City of Ottawa water distribution system can supply adequate water pressure to the site for typical operational and emergency conditions.

Wastewater (Sanitary Sewer) Servicing

- Develop a functional assessment of the wastewater flow projected for the site.

- Identify that the City of Ottawa sanitary sewer system can support the project wastewater flow from the site.

Storm Sewer Servicing and Stormwater Management

- Identify allowable flow contributions from the site to the adjacent receiving water bodies.
- Identify applicable water quality control targets.
- Develop a functional assessment of the SWM system for the site to achieve applicable water quantity (minor and major system) control and water quality control targets.

Site Grading Plan

- Prepare a preliminary grading plan to support the servicing assessments and identify compatibility with surrounding existing ground conditions.

The accompanying figures and drawings illustrate the key components of the functional servicing assessments.

To reflect changes in design conditions, related objectives and/or assessment findings may be adjusted as needed through subsequent stages of the development application process.

2.0 Potable Water Servicing

2.1 Background

The site is within Pressure Zone '1E' of the City of Ottawa water distribution system.

The existing watermains along the boundaries of the site consist of a 400 mm diameter PVC watermain within Jeanne D'Arc Boulevard N.

Existing fire hydrants are located along Jeanne D'Arc Boulevard N. immediately adjacent to the site.

2.2 Design Criteria

The following design criteria are considered with the assessment of the potable water and fire protection servicing for the site.

2.2.1 WATER DEMAND AND ALLOWABLE PRESSURE

Preliminary potable water demand and allowable water pressure are assessed using the City of Ottawa Guidelines – Water Distribution (2010) as amended, and the ISTB 2021-03 Technical Bulletin.

Residential Apartment Population Rate	
Average Apartment	1.8 persons / unit
Residential Apartment Demand	
Average Daily (AVDY)	280 L/cap/day
Maximum Daily (MXDY)	2.5 x AVDY
Peak Hour (PKHR)	2.2 x MXDY
Allowable Water Pressure	
MXDY Flow	345 kPa (50 psi) to 552 kPa (80 psi)
PKHR Flow Minimum	276 kPa (40 psi.)
MXDY + Fire Flow	140 kPa (20 psi.)
Maximum Allowable for Occupied Area	552 kPa (80 psi)

2.2.2 FIRE FLOW AND HYDRANT CAPACITY

Preliminary fire flow requirements are assessed using the Fire Underwriters Survey (FUS) methodology (2020). Site specific criteria considered are noted in Section 2.3.2.

Fire hydrant capacity is assessed based on Table 18.5.4.3 of the National Fire Protection Agency (NFPA) Fire Code document. A hydrant situated less than 76 m away from a building can supply a maximum capacity of 5,678 L/min, and a hydrant 76 to less than 152 m away can supply a maximum capacity of 3,785 L/min.

2.2.3 WATERMAIN SERVICING

The preliminary watermain network is considered in general accordance with Ministry of Environment, Conservation and Parks (MECP) Guidelines, City of Ottawa Design Guidelines – Water Distribution (2010), Ministry of Environment, Conservation and Parks (MECP) Guidelines, and the pre-application meeting notes.

2.3 Water Demand

2.3.1 DOMESTIC WATER DEMAND

The domestic water demand is assessed based on the proposed development conditions described in **Table 1.1** and the design criteria described in **Section 2.2**.

The assessed domestic water demand for the site is summarized in **Table 2.1**. Supporting calculations are provided in **Appendix C.1**.

Table 2.1: Estimated Domestic Water Demand

Demand Type	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Block A - Residential Apartment	594	1.9	4.8	10.6
Block B - Residential Apartment	1789	5.8	14.5	31.9
Block C - Residential Apartment	830	2.7	6.7	14.8
Block D - Residential Apartment	1933	6.3	15.7	34.5
Total	**5146**	**16.7**	**41.7**	**91.7**

2.3.2 FIRE FLOW DEMAND

The fire flow demand is assessed based on:

- Type II - Noncombustible Construction / Type IV-A - Mass Timber Construction (i.e., building construction materials with a 1-hour fire resistance rating).
- Total effective building area is the gross floor area of the two largest floor plus 50% of the floor area for eight adjoining floors.
    - Vertical openings are not protected.

- Occupancy and contents factor considering non-combustible materials.
- A fully supervised automatic sprinkler system that conforms to the NFPA 13 standard supplied by a standard water supply.
- Exposure distances based on the proposed adjacent structures having Type I-II (fire resistive or non-combustible rating) construction with unprotected openings.

The highest fire flow is assessed to be approximately 10,000 L/min (167 L/s) for the proposed site plan. Supporting calculations per the FUS methodology are provided in **Appendix C.2**.

2.4 Available Level of Service

2.4.1 BOUNDARY CONDITIONS

The assessed domestic water and fire flow demands are used to confirm the level of servicing available to the proposed development from the adjacent municipal watermain and hydrants. The associated hydraulic grade line (HGL) elevation boundary conditions provided by the City of Ottawa (see **Appendix C.3** for correspondence) are summarized in **Table 2.2**. It is of note that boundary conditions were initially requested on a higher residential population of 5,414. The previously received boundary conditions have been used for a conservative assessment of the proposed water system.

Table 2.2: Boundary Conditions

HGL Condition	Elevation (m)
Minimum HGL	106.1
Maximum HGL	113.7
Max. Day + Fire Flow (167 L/s) HGL	102.1

2.4.2 ALLOWABLE DOMESTIC PRESSURE

Finished elevations across the site will vary. To review the anticipated pressure conditions, a low elevation and high elevation are considered as reference for the calculation of residual pressures at ground level. The low elevation selected is 50.5 m. The high elevation selected is 54.0m.

From the boundary condition HGL elevations, the pressures under normal operating conditions are anticipated as:

- Low elevation (50.5 m) = 545 kPa to 620 kPa (79 psi to 90 psi).
- High elevation (54.0 m) = 511 kPa to 585 kPa (74 psi to 85 psi).

The anticipated pressures may exceed the maximum allowable for occupied areas under the potential maximum pressure condition. Pressure reducing measures may be required.

To ensure adequate water pressure above the first-floor elevation of the apartment buildings, booster pump requirements are to be confirmed by the mechanical engineering consultant during subsequent stages of the development application process.

2.4.3 ALLOWABLE FIRE FLOW PRESSURE

From the boundary condition HGL elevations, the existing watermain can provide the required fire flow while maintaining the minimum residual pressure of 138 kPa (20 psi).

2.4.4 FIRE HYDRANT COVERAGE

The buildings are to be sprinklered and a Siamese (fire department) connection provided. The Siamese connections are to be within 45 m of a fire hydrant.

Fire hydrant coverage will be developed and confirmed within the site during the subsequent stages of the development application process.

2.5 Proposed Water Servicing

The development is to be serviced with connections to the existing 400 mm watermain in Jeanne D'Arc Boulevard N. The proposed water servicing is shown on **Drawing WTR-1**. Connections and service requirements are to be consistent with City of Ottawa guidelines and specifications.

Service connections from the development blocks are made to a 250 mm looped watermain within the proposed public road. Block A is anticipated to have a 200 mm water service connected to the existing water main in Jeanne D'Arc Boulevard N. and the proposed 250 mm watermain within the site. Block B, C, and D are anticipated to have paired 200mm service laterals extended into each development block from the 250 mm watermain within the site.

For each proposed building, a mechanical engineering consultant is responsible to confirm the service size required and that the water pressure within each building is adequate to meet building code requirements. This confirmation is to occur during subsequent stages of the development application process.

2.6 Hydraulic Assessment

The proposed watermains within the Petries Landing III site are modeled in the H2OMAP hydraulic model to test the service pressure under average day, peak hour, and maximum day plus fire flow conditions.

The hydraulic model uses the boundary conditions provided by the City of Ottawa, as described in Section 2.4.1. The boundary conditions are applied to a fixed head reservoir simulated at the eastern and western connections from the Petries Landing III site to the existing 400 mm watermain in Jeanne D'Arc Boulevard N. Demand values are applied within the modeled system based on the values for each development block as described in Section 2.3.1. The demand values are applied at a node that approximates the anticipated service location for each development block. Demand values are consistent with the original boundary conditions request, and are conservative with respect to anticipated population values under the current revised draft plan.

Hazen-Williams coefficients ("C-Factors") are applied to the simulated watermains in accordance with the City of Ottawa's Water Distribution Design Guidelines and as shown in **Table 2.3** below.

Table 2.3: Proposed Watermain C-Factors

Pipe Diameter (mm)	C-Factor
150	100
200 to 250	110
300 to 600	120
> 600	130

2.6.1 AVERAGE DAY DEMAND (AVDY)

The hydraulic modeling results indicate that under the average day demand, the pressure in the proposed watermain ranges from 587 kPa to 621 kPa (85.1 psi to 90.1 psi). These pressures exceed the serviceable limit of 276 kPa to 550 kPa (40 psi to 80 psi) as specified in the City of Ottawa Design Guidelines – Water Distribution. Results are shown in **Figure 2.1** below.

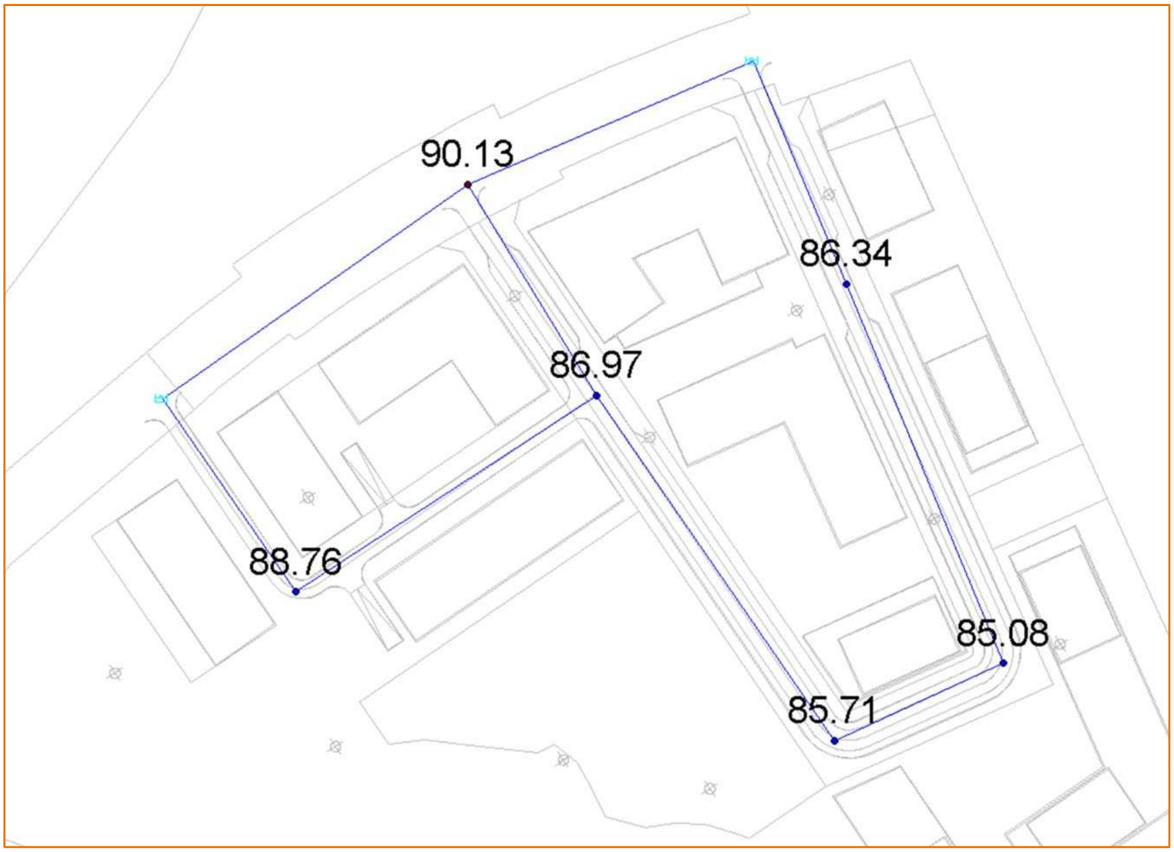


Figure 2.1: AVDY Pressure Results (psi)

As noted in Section 2.4.2, the anticipated pressures under the average day demand (AVDY) may exceed the maximum allowable for occupied areas. Pressure reducing measures may be required.

2.6.2 PEAK HOUR DEMAND (PKHR)

The hydraulic modeling results indicate that under the peak hour demands, the pressure in the proposed watermain ranges from 508 kPa to 547 kPa (73.7 psi to 79.3 psi). These pressures are within the serviceable limit of 276 kPa to 552 kPa (40 psi to 80 psi) as specified in the City of Ottawa Design Guidelines – Water Distribution. Results are shown in **Figure 2.2** below.

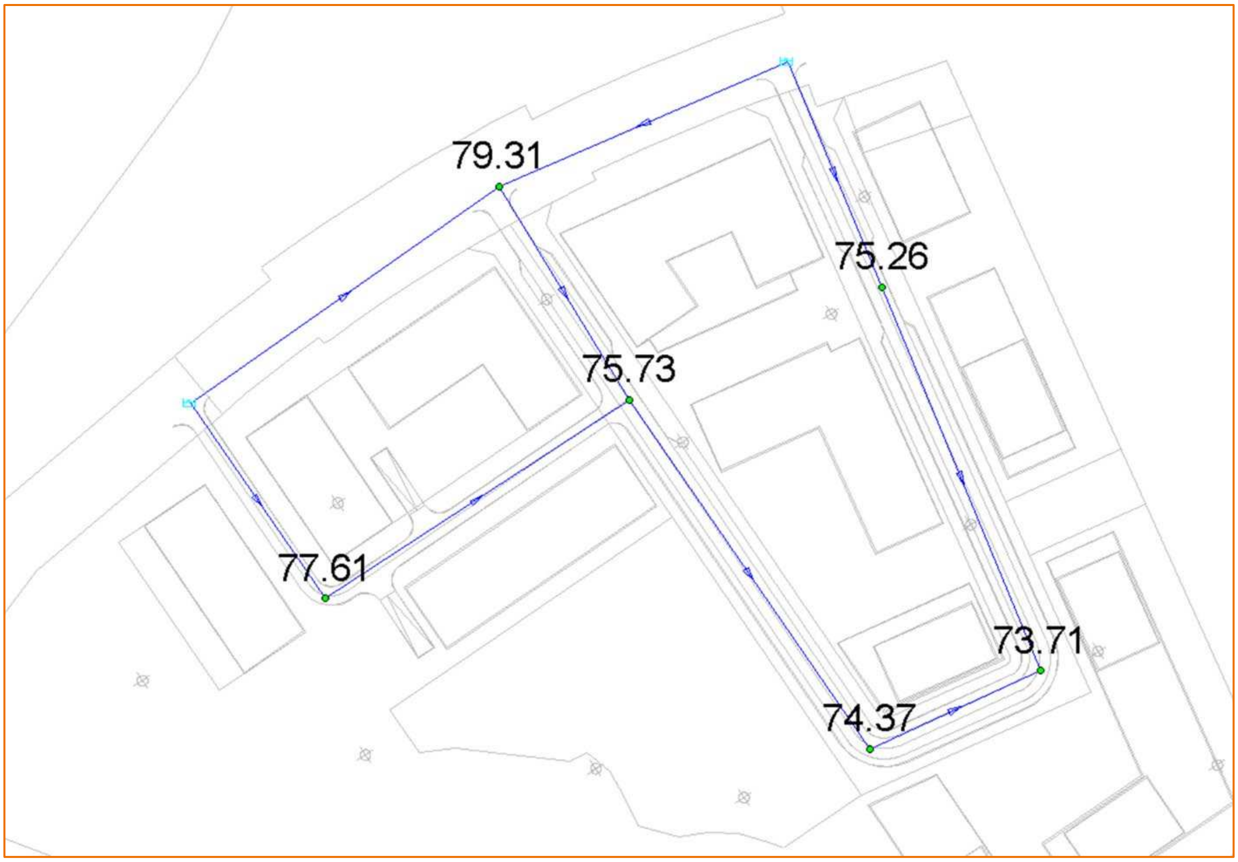


Figure 2.2: PKHR Pressure Results (psi)

2.6.3 MAXIMUM DAY DEMAND + FIRE FLOW (MXDY+FF)

The hydraulic modeling is also used to assess the maximum day and fire flow demands while maintaining a residual pressure of 138 kPa (20 psi), per the City of Ottawa Design Guidelines – Water Distribution. The modeling is conducted using a steady-state maximum day demand scenario along with the automated fire flow simulation feature of H2OMAP. The fire flow demand is set to 167 L/s as per the value noted in Section 2.3.2.

Figure 2.3 illustrates that the proposed watermain can deliver flows exceeding 10,000 L/min (167 L/s) while maintaining the required residual pressure of 138 kPa (20 psi).

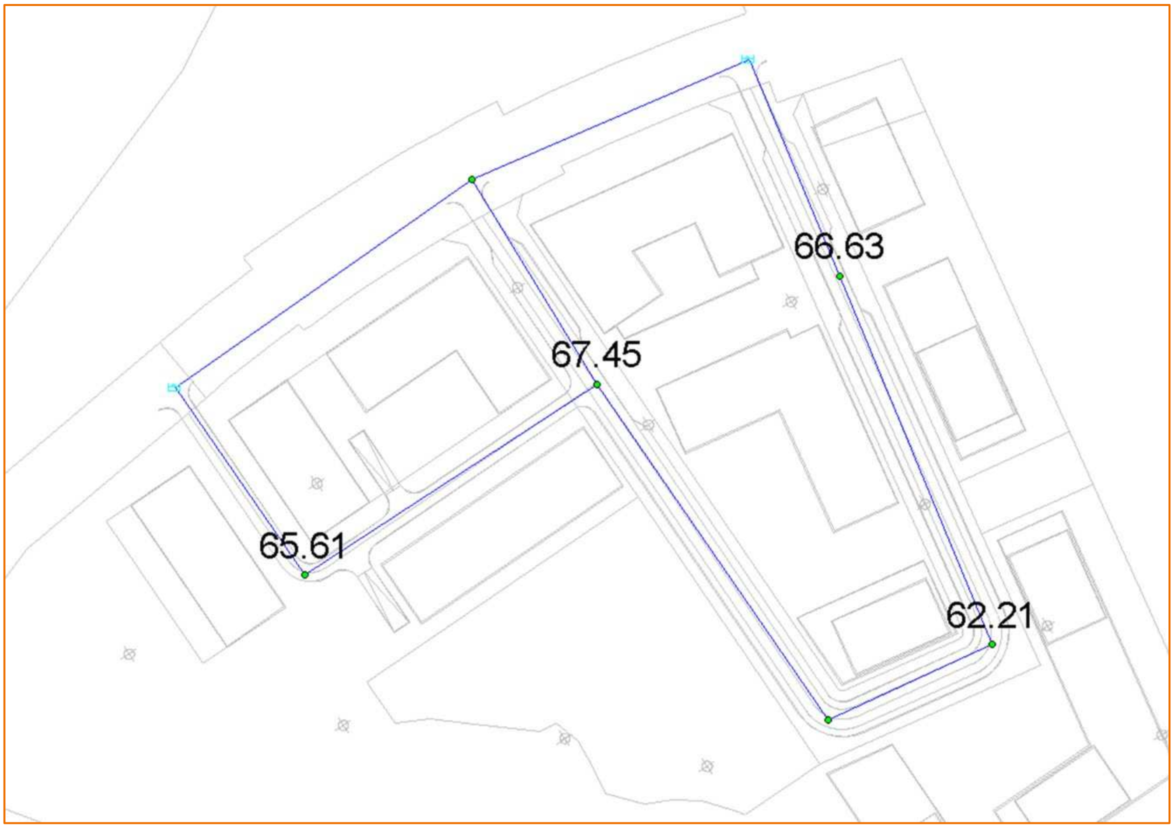


Figure 2.3: Fire Flow Results – Residual Pressure (psi)

2.6.4 HYDARULIC ASSESSMENT SUMMARY

Based on the boundary conditions provided by the City of Ottawa and the hydraulic assessment using H2OMAP, the water distribution system provides adequate pressure to satisfy the potable water and fire flow needs of the proposed development.

A model schematic and summary results from the H2OMAP hydraulic assessment of the water distribution systems are included in **Appendix C.4**.

3.0 Wastewater Servicing

3.1 Background

The existing sanitary sewers along the boundaries of the site consist of a 900 mm diameter trunk sewer along Jeanne D'Arc Boulevard N.

3.2 Design Criteria

Preliminary wastewater servicing is assessed using the City of Ottawa Sewer Design Guidelines (2012) as amended, and the MECP Design Guidelines for Sewage Works. The following design criteria are considered with the assessment of wastewater servicing for the site.

Population criteria are the same as that applied for the water demand analysis (see **Section 2.2.1**).

Residential Wastewater Flow	
Average Flow Generation	280 L/cap/day
Peaking Factor	Harmon Equation (max. residential = 4.0)
Harmon Correction Factor	0.80
Infiltration Allowance	0.33 L/s/ha

Sewer Design	
Minimum Velocity	0.6 m/s (0.8 m/s for upstream sections)
Maximum Velocity	3.0 m/s
Minimum Service Size	135 mm
Manning Roughness Coefficient	0.013
Minimum Service Slope	1.0 % (2.0 % preferred)
Minimum Service Cover	2.0 m

3.3 Wastewater Generation and Servicing Design

The peak wastewater flow is assessed based on the proposed development conditions described in **Table 1.1** and the design criteria described in **Section 3.2**.

The assessed peak wastewater flow for the site is summarized in **Table 3.1**. Supporting calculations are provided in **Appendix D.1**.

Table 3.1: Estimated Peak Wastewater Flow

Location Reference	Peak Residential Wastewater Flow			Infiltration Flow (L/s)	Total Peak Flow (L/s)
	Population	Peak Factor	Peak Flow (L/s)		
West Connection	2383	3.02	23.3	1.2	24.5
East Connection	2763	2.98	26.7	0.6	27.3
Total	**5414**	**-**	**50.0**	**1.8**	**51.8**

The anticipated peak wastewater flows for the proposed development were initially provided to the City of Ottawa staff to evaluate the adequacy of the receiving municipal sanitary sewer system in the vicinity of the site and downstream network based on a then-anticipated peak flow rate of 50.8L/s. City of Ottawa staff indicated no concerns with sanitary capacity from the development (see correspondence in **Appendix D.2**).

3.4 Proposed Sanitary Servicing

The development is to be serviced with connections to the existing sanitary sewer in Jeanne D'Arc Boulevard N. The proposed sanitary servicing is shown on **Drawing SAN-1**. Related preliminary sanitary sewer design calculations are provided in **Appendix D.1**. Connections and service requirements are to be consistent with City of Ottawa guidelines and specifications.

Service connections from the development blocks are made to 250mm sewers within the proposed public road. Block A is anticipated to have a 250mm sanitary service lateral, and Block B, C, and D are anticipated to have 200mm service laterals.

For each proposed building, a mechanical engineering consultant is responsible to confirm the service size required and that the appropriate backwater valve requirements are satisfied. This confirmation is to occur during subsequent stages of the development application process.

4.0 Stormwater Management and Servicing

4.1 Background

The existing storm drainage system along the boundaries of the site consists of a ditch and culvert drainage system along Jeanne D'Arc Boulevard N. A portion of the ditch drains to Taylor Creek and the remainder drains to the Ottawa River. There are two culvert systems conveying runoff from the south side of Jeanne D'Arc Boulevard N. to the Ottawa River to the north. Subject to confirmation from field investigation, the existing culverts are currently considered 600mm diameter corrugated steel pipe (CSP) material.

As noted in Section 1.2.1, there is no Master Drainage Plan or Sub-watershed study available to support the stormwater management (SWM) objectives.

4.2 Design Criteria

Preliminary stormwater management (SWM) and storm sewer servicing is assessed using the City of Ottawa Sewer Design Guidelines (2012) as amended, and the pre-application consultation notes provided by the City of Ottawa and RVCA staff. The following design criteria are considered with the assessment of SWM and storm sewer servicing for the site.

General

- Use of the dual drainage principle.
- Wherever feasible and practical, site-level measures should be used to reduce and control the volume and rate of runoff.
- Consider the impact of 100-year event outlined in the City of Ottawa Sewer Design Guidelines on the major and minor drainage systems.

Storm Sewer & Inlet Controls

- Surcharge in the storm sewer system shall not occur for the 2-year design storm on local roads and the 5-year design storm for collector roads.
- Within private development blocks, peak flows generated from events greater than the 5-year and including the 100-year storm must be detained on-site.

Surface Storage & Overland Flow

- Building openings to be a minimum of 0.30 m above the 100-year water level.

- Maximum depth of flow under either static or dynamic conditions shall be less than 0.35 for the 100-year design storm. Within the private development blocks, runoff greater than the 100-year design would spill to the city right-of-way.
- Provide adequate emergency overflow conveyance off-site with a minimum vertical clearance of 0.15 m between the spill elevation and the ground elevation at the building envelope in the proximity of the flow route or ponding area.

Water Quality Control

- An enhanced level of water quality control - 80% Total Suspended Solids (TSS) removal.

Taylor Creek

- Considerations for a new storm sewer outlet to Taylor need to include geotechnical, environmental (terrestrial and aquatic), geomorphological (erosion), and runoff elements.

4.3 Existing Conditions

As noted in Section 1.1, the site is currently vacant and is farmed. All runoff from the site currently drains uncontrolled to the adjacent water bodies of Taylor Creek and the Ottawa River. There is no external drainage area draining into this property. The current pre-development drainage pattern is illustrated on **Figure E1.1 Pre-Development Storm Drainage Area** (located in **Appendix E.1**). A summary of pre-development drainage areas and runoff coefficients are provided in **Table 4.1**. Supporting calculations are provided in **Appendix E.1**.

Table 4.1: Summary of Pre-Development Drainage Areas

Drainage Areas	Area (ha)	Runoff Coefficient, C	Time of Concentration (min)	Outlet
PRE1	1.08	0.20	28	Taylor Creek
PRE1A	0.31	0.43	10	Taylor Creek
PRE2	1.33	0.20	29	Taylor Creek
PRE3	2.56	0.20	45	Ottawa River
PRE3A	0.23	0.53	10	Ottawa River
PRE3B	0.16	0.42	10	Ottawa River
PRE4	1.65	0.20	50	Ottawa River

Given the intended SWM design for the site, pre-development runoff rates are developed from Rational Method calculations. The existing condition rational method runoff coefficient is assessed based on the existing surface condition (e.g., asphalt, concrete, gravel, grass, etc.), or assigned a minimum value of C = 0.20. Time of Concentration values are developed based on a review of the site topography and existing conditions. Supporting calculations are provided in **Appendix E.1**.

4.4 Stormwater Management Design

Based on the proposed Site Plan, drainage area boundaries are defined as illustrated on **Drawing STM-1**. Overall, the proposed SWM design intent is to direct storm runoff from the site to the Ottawa River. The only runoff intended to be direct to Taylor Creek is from the proposed public park and from landscaped portions of Block A and Block D not anticipated to be intercepted by the storm drainage system.

No new storm sewer outlet to Taylor Creek is proposed so no additional assessments of Taylor Creek are completed.

Preliminary runoff coefficient values for storm sewer design calculations and imperviousness allocations are assigned to each drainage area based on the anticipated finished surface condition (e.g., asphalt, concrete, gravel, grass, etc.) typically associated with the associated land use. A summary of drainage areas and runoff coefficients are provided in **Table 4.2**. Supporting calculations are provided in **Appendix E.2**.

Table 4.2: Summary of Post-Development Drainage Areas

Drainage Areas	Area (ha)	Runoff Coefficient, C	Outlet
C101A (Block B)	1.55	0.80	Ottawa River
C101B (Road)	0.53	0.70	Ottawa River
C102A (Block A)	1.54	0.80	Ottawa River
C201A (Road)	0.53	0.70	Ottawa River
C201B (Block C)	0.61	0.80	Ottawa River
C201C (Block D)	0.78	0.80	Ottawa River
UNC-1	0.15	0.20	Taylor Creek
PARK	0.63	0.40	Ottawa River
UNC-3	0.21	0.20	Taylor Creek
PRE1A	*0.31*	*0.43*	*Taylor Creek*
PRE3A	*0.23*	*0.53*	*Ottawa River*
PRE3B	*0.16*	*0.42*	*Ottawa River*

The areas ‘PRE1A’, ‘PRE3A’, and ‘PRE3B’ represent contributing areas associated with the existing Jeanne D’Arc Boulevard N. They are expected to be the same in both pre-development and post-development conditions. They are not shown on **Drawing STM-1** but are included in the assessments of this report to allow for reasonable pre-development to post-development comparisons.

4.4.1 ALLOWABLE RELEASE RATE

With no applicable watershed or sub-watershed study, allowable release rates are considered relative to the respective receiving water body or connection to the proposed storm sewer system.

Ottawa River

For runoff directed to the Ottawa River, no specific allowable release rate is applied. The City of Ottawa design guideline of preventing surcharge conditions in the storm sewer with the 5-year design storm event is considered.

Taylor Creek

The allowable release to Taylor Creek should be less than the pre-development peak flow for both the 5-year and 100-year design storm events. A summary of the applicable pre-development peak flows is provided below.

Table 4.3: Allowable Target Release Rate to Taylor Creek

Area	Size (ha)	Runoff Coefficient, C	Pre-Development Flow Rate (L/s)	
			5-Year	100-Year
PRE1	1.08	0.20	33.1	56.5
PRE1A	0.31	0.43	20.2	34.5
PRE2	1.33	0.20	40.8	69.5
Total			**94.2**	**160.5**

The flows reported in Table 4.3 are for the highest time of concentration associated with area ‘PRE2’ at 29 minutes. Supporting calculations are provided in **Appendix E.1**.

Public Road to Storm Sewer

For runoff from the public roadway (both within the site and from Jeanne D’Arc Boulevard N.), flow is directed to the Ottawa River so no specific allowable release rate is applied. As noted previously, the City of Ottawa design guideline of preventing surcharge conditions in the storm sewer with the 5-year design storm event is considered. This approach eliminates the need for underground storage to be provided in the public road system.

Development Block to Storm Sewer

Each development block will have an allowable release rate set as per the 5-year design storm event associated with the site storm sewer design. A summary of the applicable allowable release rates is provided in the following table. Supporting calculations are provided in **Appendix E.2**.

Table 4.4: Allowable Target Release Rate for Development Blocks

Development Block	Size (ha)	Runoff Coefficient, C	Allowable 5-Year Release Rate (L/s)
A (C102A)	1.54	0.80	356.9
B (C101A)	1.55	0.80	359.5
Park	0.66	0.40	76.5
C (C201B)	0.61	0.80	140.8
D (C201C)	0.78	0.80	181.0

The target allowable release rate for each development block is used to assess water quantity control conditions anticipated for each block.

4.4.1.1 Uncontrolled Areas

Portions of the proposed site plan are anticipated to have drainage areas that will not be intercepted by the storm drainage systems. These areas are the western edge of Block A (UNC-1), and the western and southern portion of Block D (UNC-3). These areas are illustrated on **Drawing STM-1**. These areas are anticipated as effectively 'undeveloped' landscape areas with a 'sheet flow' condition comparable to the pre-development drainage area condition. Consideration for some impervious elements integrated into the finished landscape condition is accommodated by the impervious areas selected and listed in **Table 4.2**. The flows reported in Table 4.3 are for the typical post-development time of concentration associated with each area at 10 minutes. The comparison of a higher value time of concentration assigned to the pre-development condition with a lower value time of concentration assigned to the post-development condition should offer a conservative reference.

The data summarized in **Table 4.5** indicates that the proposed SWM plan reduces the overall site storm runoff release rate to Taylor Creek in comparison to the pre-development design storm events. Compensating for an increase in uncontrolled areas as part of the allowable release rate condition is not required.

Table 4.5: Comparison of Pre- and Post-Development Release Rates to Taylor Creek

Drainage Area	5-Year Discharge (L/s)	100-Year Discharge (L/s)
Pre-Development Total (2.72 ha)	94.2	160.5
Post-Development		
PRE1A (0.31 ha)	38.2	65.5
UNC-1 (0.15 ha)	8.7	14.9
UNC-3 (0.21 ha)	12.2	20.8
Post-Development Total (1.41 ha)	59.1	101.3
Difference (Post minus Pre)	**-35.1 (-37.3%)**	**-59.2 (-36.9%)**

Additionally, with the net reduction in peak flow anticipated to Taylor Creek, no additional assessment of the conditions within Taylor Creek or the associated valley lands is considered.

4.4.2 QUANTITY CONTROL

With no specified allowable release rate target for discharge to the Ottawa River, no overall site water quantity control measure (i.e., a stormwater management pond) is considered.

The only water quantity control measures applicable are for each development block to ensure that only the 5-year storm sewer design flow is released from each block during the 100-year design storm event. A summary of the current anticipated storage requirements for each development block is provided with the discussion of the proposed stormwater servicing strategy in **Section 4.5**.

Initial outlines of the ponding areas anticipated within the low points of the public roads is illustrated on **Drawing STM-1**. In coordination with the functional grading plan as illustrated on **Drawing GP-1**, an effective overland conveyance and emergency overland escape routes for stormwater management and flood protection is available. Potential ponding areas within each development block are subject to the final site design details are not available at this stage of the development application process.

The analytical assessment of the ponding areas in the public roads and within the development blocks is to be completed during the subsequent stages of the development application process.

4.4.3 QUALITY CONTROL

Water quality control is to be provided with oil-grit separator (OGS) units. A single OGS unit associated with each of the two storm sewer outlets is to be provided within the site boundary. Each OGS unit will provide the required water quality treatment for both the public roads and the development blocks.

Information on conceptual OGS unit sizing is provided in Section 4.5.2.

4.5 Proposed Stormwater Servicing

The proposed stormwater servicing approach is illustrated on **Drawing STM-1**. Related preliminary storm sewer design calculations are provided in **Appendix E.2**. The western roadway segment, Block A, and Block B will discharge to the Ottawa River via an upgrade to the nearest associated existing culvert system (Outlet 1). The eastern roadway segment, Block C, and Block D will discharge to the Ottawa River with an outlet to the existing ditch on the south side of Jeanne D’Arc Boulevard N. and then through the nearest associated existing culvert system (Outlet 2).

Given the nature of the proposed stormwater servicing system, PCSWMM is used to assess the design criterion of preventing surcharge in the storm sewer system during the 5-year design storm event. Only the minor system condition is considered at this functional assessment stage. Major system considerations will be included as needed during subsequent stages of the development application process. The PCSWMM analysis is also used to provide a preliminary site storage value for each development block. Information on the methodology and project specific data with the PCSWMM analysis is provided in **Appendix E.3** and **Appendix E.4**.

The following describes the conditions proposed for the stormwater servicing associated with the public roads and the private development blocks.

4.5.1 PUBLIC ROADS

4.5.1.1 Outlet 1

The storm system for Outlet 1 intends to replace the existing culverts under Jeanne D'Arc Boulevard N. and the adjacent pathway. The culverts will be replaced with a 900mm storm sewer to facilitate a storm sewer system at a lower elevation which offers a preferred design condition to support the development of Block A. To maintain the existing drainage pattern of Jeanne D'Arc Boulevard N., ditch inlets will be connected to the new 900mm storm sewer.

The outlet elevation of the new 900 mm storm sewer will generally match the outlet of the existing culverts at an elevation of approximately 47.0 m. This elevation is above the Ottawa River flood elevation in the area which is at approximately 44.0 m.

In the western segment of the proposed road a 600mm storm sewer will support the road drainage and the service connection for development Block B. Based on the initial PCSWMM review, it is anticipated that the road drainage could be directed to the proposed storm sewer without the use of ICDs in the catch basins. This approach can be confirmed through the subsequent stages of the development application process.

From the preliminary PCSWMM review, the following summarizes the outlet peak flow and HGL elevations anticipated in the public storm sewer system for Outlet 1.

Table 4.6: Outlet 1 HGL and Peak Flow

Node ID	Elevation (m)				Peak Flow (L/s)	
	Rim	Pipe Obvert	5-Year HGL	100-Year HGL	5-Year	100-Year
101	53.38	49.75	49.53	49.62	548	679
100	50.53	48.10	47.78	47.88	970	1,195
HW1	48.00	47.98	47.57	47.63	970	1,195

From the intimal PCSWMM review, there are no surcharge conditions anticipated in the storm sewer system for the 5-year design storm event. Surcharge conditions for the 100-year design storm event are to be considered with respect to future development block connections through the subsequent stages of the development application process.

The location of Outlet 1 on the north side of Jeanne D'Arc Boulevard N is within land owned by the applicant (11034936 Canada Inc.). Outlet 1 is intended to be outside the Ottawa River floodplain, have access via Jeanne D'Arc Boulevard N and the adjacent pathway, and have appropriate erosion protection downstream of the headwall.

The design details for Outlet 1 are to be established through the subsequent stages of the development application process.

4.5.1.2 Outlet 2

The storm system for Outlet 2 intends to maintain the existing culverts under Jeanne D'Arc Boulevard N. and the adjacent pathway.

The outlet elevation of the new 675 mm storm sewer will generally match the inlet elevation of the existing culverts at approximately 48.9 m. This elevation is also above the Ottawa River flood elevation in the area which, as noted with Outlet 1, is at approximately 44.0 m.

In the eastern segment of the proposed road a 600mm storm sewer will support the road drainage and the service connection for development Block C and Block D. As with the road segment supported through Outlet 1, it is anticipated that the road drainage could be directed to the proposed storm sewer without the use of ICDs in the catch basins. This approach can be confirmed through the subsequent stages of the development application process.

From the preliminary PCSWMM review, the following summarizes the outlet peak flow and HGL elevations anticipated in the public storm sewer system for Outlet 2.

Table 4.7: Outlet 2 HGL and Peak Flow

Node ID	Elevation (m)				Peak Flow (L/s)	
	Rim	Pipe Obvert	5-Year HGL	100-Year HGL	5-Year	100-Year
201	53.60	51.23	51.10	51.40	443	521
200	50.91	49.62	49.38	49.43	443	546
HW2	51.00	49.53	49.12	49.24	472	596

From the intimal PCSWMM review, there are no surcharge conditions anticipated in the storm sewer system for the 5-year design storm event. Surcharge conditions for the 100-year design storm event are to be considered with respect to future development block connections through the subsequent stages of the development application process.

The location of Outlet 2 on the south side of Jeanne D'Arc Boulevard N is within the public road boundary. Outlet 2 is intended to be outside the Ottawa River floodplain, have access via Jeanne D'Arc Boulevard N, and have appropriate erosion protection downstream of the headwall.

The design details for Outlet 2 are to be established through the subsequent stages of the development application process.

4.5.2 CONCEPTUAL OGS UNIT SIZING

The *'PCSWMM for Stormceptor'* online tool provide by Imbrium Systems is used to develop an initial approximation of the OGS unit size at Outlet 1 and Outlet 2. The runoff coefficient and area for the applicable drainage areas, on which the sizing is based, is listed in the following table.

Table 4.8: OGS Sizing Parameters

Drainage Area	Runoff Coefficient, C	Area (ha)
Outlet 1		
C101A	0.80	1.55
C101B	0.70	0.53
C102A	0.80	1.54
PARK	0.40	0.63
Outlet 1 Total	**0.71**	**4.25**
Outlet 2		
C201A	0.70	0.53
C201B	0.80	0.61
C201C	0.80	0.78
East Outlet Total	**0.77**	**1.92**

Using a fine particle size distribution, a Stormceptor model EFO10 achieves 83% TSS removal for Outlet 1. A Stormceptor model EFO8 achieves 87% TSS removal for Outlet 2. Both OGS models exceed the minimum required TSS removal level of 80%. The Stormceptor sizing report for each unit is included in **Appendix 0**. Preliminary locations for each OGS unit are illustrated on **Drawing STM-1**.

The OGS unit sizes are considered conceptual for the purposes of validating the proposed stormwater servicing condition. Alternative OGS products or treatment systems with equivalent TSS removal capabilities may be selected based on the associated site design conditions and water quality objectives. The final OGS unit size and type is to be confirmed through subsequent stages of the development application process.

4.5.3 DEVELOPMENT BLOCKS

For this assessment, the focus for the development blocks is to summarize the anticipated storage requirements within each block. The storage requirements are needed to ensure that only the 5-year storm sewer design flow is released from each block during the 100-year design storm event. The following is the current summary of the design parameters applicable to the development blocks.

Table 4.9: Site Plan Block Design Parameters

Development Block	Area (ha)	Reference MH	Allowable Release Rate (L/s)	Design Storage Volume (m^3)
A (C102A)	1.54	100	356.9	181
B (C101A)	1.55	101	359.5	181
Park	0.66	101	76.5	39
C (C201B)	0.61	201	140.8	73
D (C201C)	0.78	201	181.0	92

The water quantity control storage volumes may be accommodated with the development blocks through a combination of techniques. This may include, but not be limited to, any combination of roof top, cisterns internal to the buildings, underground storage external to the buildings, surface storage, Low Impact Development (LID) measures, etc.

For each proposed building, a mechanical engineering consultant is responsible to confirm the service size required, that the appropriate backwater valve requirements are satisfied, the nature of the foundation drainage system, and that any roof drainage systems (including internal storage systems, roof drains, scuppers, etc.) are adequate for accommodating the 100-year design storm conditions. It is noted that the 100-year SWM design condition is more stringent than the design condition associated with the typical building code requirements. This confirmation is to occur during subsequent stages of the development application process.

5.0 Site Grading

A functional grading plan is illustrated on **Drawing GP-1**. The overall grading strategy serves to:

- Match existing grades along adjacent existing property, existing roadway, and proposed/required development setback boundaries.
- Respect recommended grade raise restrictions.
- Provide suitable cover conditions for sanitary sewer, storm sewer, and watermain servicing.
- Establish effective overland conveyance and emergency overland escape routes for stormwater management and flood protection.

During subsequent stages of the development application process, adjustments to grading conditions may be made as needed. The associated servicing and stormwater management conditions will be considered and may also be adjusted as needed to maintain consistency with the related design criteria.

6.0 Other Considerations

6.1 Geotechnical

Geotechnical conditions for the site are investigated by Paterson Group with findings presented in the supporting investigation report PG6414-1 dated December 23, 2022 (provided under separate cover in support of the development application process). Recommendations from the geotechnical report are intended to be followed as they relate to the proposed servicing strategy for the site.

It is noted that shallow ground water conditions at select locations across the site may limit the implementation of infiltration-focused LID measures. Subsequent review of groundwater conditions for future block development will confirm the applicability of LID measures relative to local groundwater conditions as needed.

Additional geotechnical investigation to support the proposed storm sewer outlets is to be prepared and provided through the subsequent stages of the development application process.

6.2 Utilities

Existing utilities from Hydro Ottawa, Bell, Rogers, and Enbridge are anticipated to be used to service this site. The exact size, location, and routing of utilities is to be finalized during subsequent stages of the development application process.

6.3 Erosion and Sediment Control During Construction

To protect downstream water quality and prevent sediment build-up in catch basins and storm sewers, erosion and sediment control measures must be implemented during construction. Erosion and sediment control (ESC) measures are the responsibility of the contractor. Recommendations for ESC implementation will be included with subsequent submissions through the development application process.

6.4 Regulatory Approvals

Information on anticipated regulatory approvals associated with the site will be confirmed and provided with subsequent submissions through the development application process.

7.0 Closing

The water, wastewater, and storm water servicing conditions assessed in this report indicate that the existing public services immediately adjacent to the project site are adequate to support the proposed development and that a suitable design condition can be created to support the development plan.

The details of the block development and the associated confirmations from the mechanical engineering consultant are to occur during subsequent stages of the development application process.

APPENDICES

Appendix A Site Information

A.1 Concept Plan

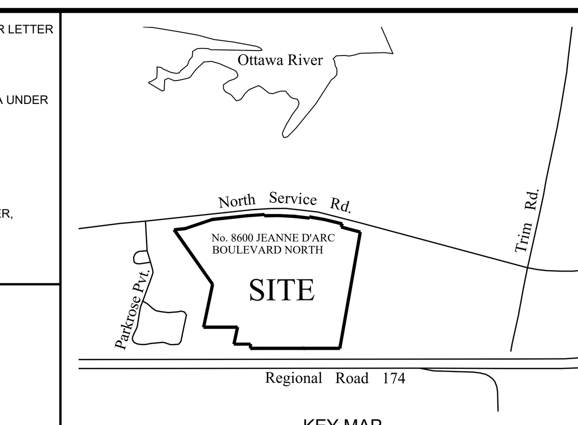
SUBJECT TO THE CONDITIONS, IF ANY, SET FORTH IN OUR LETTER DATED

_________________________.

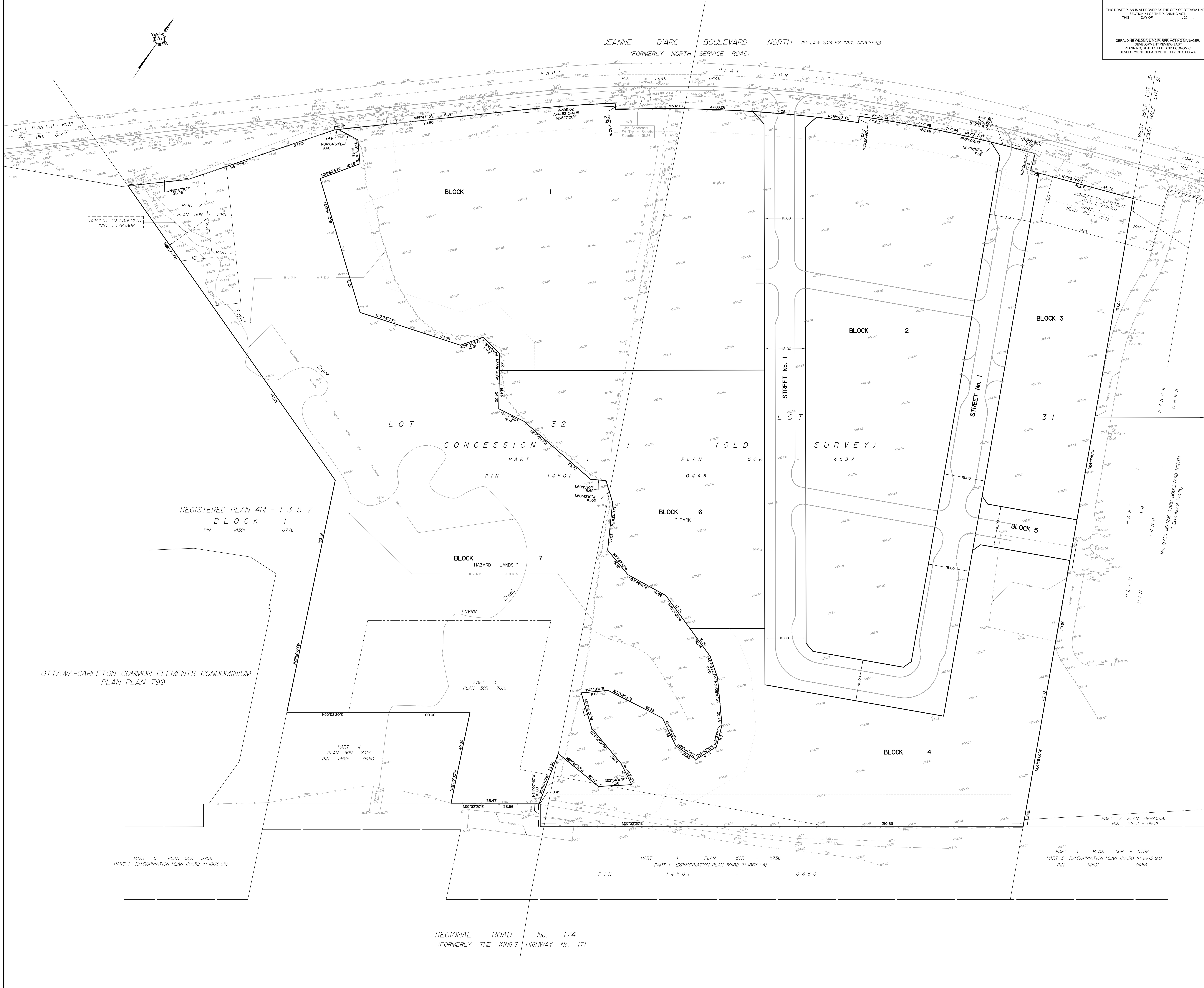
THIS DRAFT PLAN IS APPROVED BY THE CITY OF OTTAWA UNDER SECTION 51 OF THE PLANNING ACT.
THIS ____ DAY OF ____________, 20__ .

____

GERALDINE WILDMAN, MCIP, RPP, ACTING MANAGER,
DEVELOPMENT REVIEW-EAST
PLANNING, REAL ESTATE AND ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



KEY MAP
Not to Scale



DRAFT PLAN OF SUBDIVISION OF

PART OF LOTS 31 AND 32 CONCESSION 1 (OLD SURVEY)

Geographic Township of Cumberland

CITY OF OTTAWA

Prepared by Annis , O'Sullivan , Vollebekk Ltd.

Scale 1 : 500

20 15 10 5 0 10 20 Metres

Metric

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

SURVEYOR'S CERTIFICATE

I CERTIFY THAT :
The boundaries of the lands to be subdivided and their relationship to adjoining lands have been accurately and correctly shown.

____________ Date

____
E. H. Herweyer
ONTARIO LAND SURVEYOR

OWNER'S CERTIFICATE

This is to certify that I am the owner / agent of the lands to be subdivided and that this plan was prepared in accordance with my instructions.

____________ Date

____
Jean-Luc Rivard (Authorized Signing Officer)
3223701 CANADA INC.
I have authority to bind the corporation.

Notes & Legend

	Denotes	
○ MH-ST	"	Maintenance Hole (Storm Sewer)
○ MH-S	"	Maintenance Hole (Sanitary)
○ MH	"	Maintenance Hole (Unidentified)
FH	"	Fire Hydrant
WV	"	Water Valve
□ CB	"	Catch Basin
AN	"	Anchor
LS	"	Light Standard
UP	"	Utility Pole
P&W	"	Post and Wire
CSP	"	Corrugated Steel Pipe
PPP	"	Plastic Pipe
TOS	"	Top of Slope
BOS	"	Bottom of Slope
+ 65.00	"	Location of Elevations
C/L	"	Centreline
———	"	Property Line
△ S	"	Sign
Ø	"	Diameter
Inv.	"	Invert
T/G	"	Top of Grate
+ 65.00	"	Location of Existing Elevations

AREA SCHEDULE

BLOCK	Square Metres
1	19455
2	15469
3	6131
4	14005
5	775
6	8634
7	30242
Street No. 1	9820
Total	104531

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51-17 OF THE PLANNING ACT

(a) see plan
(b) see plan
(c) see plan
(d) multi-family residential housing
(e) see plan
(f) see plan
(g) see plan
(h) City of Ottawa
(i) see soils report
(j) see plan
(k) sanitary, storm sewers, municipal water, bell, hydro, cable and gas to be available
(l) see plan

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
14 Concourse Gate, Suite 500
Nepean, Ont. K2E 7S6
Phone: (613) 727-0850 / Fax: (613) 727-1079
Email: Nepean@aovltd.com
Ontario Land Surveyors

Job No. 23989-23 Brigil PtLt31&32 CI (OS) DSub D8 | ap/TP

A.2 Site Information

Demonstration Plan

Tower Separation Dimensions (orange)
Tower Separation Dimensions (pink)
Phasing Line

Future Connection
Public Road
Private Road

Primary Entrance
Secondary Entrance

Non-Residential Podium

Block	Use*	Unit Total	Gross Floor Area Total
Block 1 "A" buildings	Residential Low-Rise Residential / Mixed-Use Mid-Rise	392	39,150 m²
Block 2 "B" buildings	Residential / Mixed-Use Mid-Rise Residential / Mixed-Use High-Rise	1,089	88,015 m²
Block 3 "C" buildings	Residential / Mixed-Use Mid-Rise Residential / Mixed-Use High-Rise	477	37,908 m²
Block 5 "D" buildings	Residential / Mixed-Use High-Rise	1,065	83,172 m²
Total		3,022 units	248,245 m²

*the proposed uses are subject to change, and through the refinement of the Draft Plan of Subdivision, the location of non-residential uses will be confirmed.

Appendix B Pre-Application Consultation

Description:

A Design Brief is the core submission document that illustrates how the development is designed to work with its existing and planned context, to improve its surroundings and also demonstrate how the proposal supports the overall goals of the Official Plan, relevant secondary plans, Council approved plans and design guidelines. The purpose of the Terms of Reference is to assist the applicant to organize and substantiate the design justification in support of the proposed development and to assist staff and the public in the review of the proposal.

Authority to Request a Design Brief:

The *Planning Act* gives municipalities the authority to require that a Design Brief be prepared. Under Sections 22(4), (5) and Section 41(4) of the *Planning Act*, a Council has the authority to request such other information or material that the authority needs in order to evaluate and make a decision on an application. Section 5.2.6 of the Official Plan sets out the general requirement for a Design Brief.

Preparation:

The Design Brief should be signed by an urban designer, licenced architect, landscape architect, or a full member of the Canadian Institute of Planners.

When Required:

A Design Brief is required for a Site Plan Control planning application.

A Scoped Design Brief* is required when the following planning applications are applied for and not accompanied by a Site Plan Control application:

- Official Plan Amendment
- Zoning By-law Amendment (exception: a change in use which does not result in an increase in height or massing)

The requirement and scope of a Design Brief will be determined at the formal pre-application consultation meeting. Should an application be required to go to the Urban Design Review Panel (UDRP), the Design Brief may be submitted as part of the submission materials to the panel.

Contents for Design Brief Submissions:

A Design Brief will contain and/or address the points identified during the pre-consultation meeting. Failure to address the critical elements identified in the pre-consultation meeting may result in the application being considered incomplete.

** A Scoped Design Brief is composed of:*

- *Section 1 should be combined into the Planning Rationale submission, and*
- *Section 2 items will be confirmed in the pre-application consultation meeting.*

SECTION 1 Note: This section can be combined with the Planning Rationale report.

Application Submission:

Not Required	Required	
☐	☒	State the: type of application, legal description, municipal address, purpose of the application and provide an overall vision statement and goals for the proposal.

Response to City Documents:

Not Required	Required	
☐	☒	State the Official Plan land use designation for the subject property and demonstrate how the proposal conforms to the Official Plan as it relates to the design of the subject site. Reference specific policy numbers from the Official Plan to show consistency. Justify areas of non-compliance and explain why there is non-compliance.
☐	☒	State the applicable plans which apply to the subject proposal: community design plan, secondary plan, concept plan and design guideline. Reference the relevant design related polices within the applicable plans/guidelines and provide a comprehensive analysis as to how the proposed development incorporates the objectives or why it does not incorporate the objectives.

Context Plan:

Not Required	Required	
☐	☒	Provide a contextual analysis that discusses/illustrates abutting properties, key destinations and linkages within a 100 meter radius (a larger radius may be requested for larger/more complex projects), such as transit stations, transportation networks for cars, cyclists, and pedestrians, focal points/nodes, gateways; parks/open spaces, topography, views towards the site, the urban pattern (streets, blocks), future and current proposals (if applicable), public art and heritage resources.
☐	☒	Photographs to illustrate existing site conditions and surrounding contexts. Include a map pinpointing (with numbers) where each photo is taken and correspond these numbers with the site photos. Arrows illustrating the direction the photo is taken is also useful.

Note:
Please explore and illustrate the broader future context of the Trim Road TOD area.

SECTION 2

Design Proposal:
The purpose of the Design Proposal is to show the building elevations, exterior details, transitions in form, treatment of the public realm and compatibility with adjacent buildings, using 3-D models, illustrations, diagrams, plans, and cross sections. Referencing Official Plan, Section 5.2.1, as determined at time of pre-application consultation meeting, submissions will need to address the following in the form of labelled graphics and written explanation:

Massing and Scale

Not Required	Required	
		Images which show: Building massing – from:
☐	☐	• at least two sides set within it current context (showing the entire height and width of the building) **OR**
☐	x	• all four sides set within it current context (showing the entire height and width of the building).
		Views – of the entire block, from:
☐	☐	• at least two perspectives to show how the proposed building is set within its current context **OR**
☐	x	• all four perspectives to show how the proposed building is set within its current context.
☐	x	Building transition – to adjacent uses, with labelled explanation of the transition measures used.
☐	x	Grading – if grades are an issue.
☐	x	Alternative building massing – additional imagery and site layouts considered and provide justification for the ultimate proposal sought.

Note:
Please explore and compare site plan and massing options.

Public Realm

Not Required	Required	
		Labelled graphics and a written explanation which show:
☐	x	Streetscape – cross sections which illustrate the street design and right of way (referencing the City's design manuals).
☐	x	Relationship to the public realm – illustrating how the first few storeys of the proposed development responds to and relates to the existing context (e.g. through a podium plan and first floor plan). This is to include detailed explanation on: • Architectural responses • Landscaping details • Public art features (in accordance with Official Plan, Section 4.11) • For developments in Design Priority Areas, detail the building and site features, (in accordance with Official Plan, Section 4.11) which will enhance the public realm. Provide explanation for features which are not provided.

Building Design

Not Required	Required	
☐	☒	Labelled graphics (e.g. building elevations and floor plans) and a written explanation which document the proposed exterior architectural details and design (in accordance with Official Plan, Section 5.2.1).
☐	☒	For high-rise development applications, detail the building design and massing and scale elements and how they relate to the proposed high-rise development (in accordance with Official Plan, Section 5.2.1).

Sustainability

Not Required	Required	
☐	☒	Any sustainable design features to be incorporated, such as green roofs or walls, sun traps, reflective or permeable surfaces.

Heritage

Not Required	Required	
☒	☐	How the building relates to the historic details, materials, site and setting of any existing historic resources on or adjacent to the subject property (if applicable).

Additional Contents:

Some proponents may be requested to provide submission material which complements the Design Brief. These additional requirements could be incorporated into the Design Brief submission for ease of review. These will be identified at the time of application consultation meeting:

- Site Plan x
- Landscape Plan x
- Plan showing existing and proposed servicing x
- Shadow Analysis x
- Wind Analysis x

Submission Requirements

- Six hard copies and one digital copy

Parks & Facilities Planning
City of Ottawa

To / Destinataire	Shoma Murshid Developer Review East	File/N° de fichier: Pre-consultation
From / Expéditeur	Mary Ellen Wood, Planner Parks and Facilities Planning	
Subject / Objet	Plan of Subdivision 8600 Jeanne d'Arc Blvd. N Brigil Homes Park Review Comments	Date: July 15 , 2021

Please find below Parks & Facilities Planning comments on the above-noted development application.

Parkland Dedication:

- The amount of parkland dedication that is required is to be calculated as per the City of Ottawa Parkland Dedication By-law No.2009-95 (as amended).
- Parks and Facilities Planning is currently undertaking a legislated replacement of the Parkland Dedication By-law, with the new by-law to be considered by City Council on August 31, 2022. The by-law recommended for approval by Council increases the required parkland conveyance for mid-rise and high-rise residential development, and includes one-year transition policies for in-stream development and building permit applications or those that will be submitted and meet the requirements for completeness by September 1, 2022.
- To ensure you are aware of parkland dedication requirements for your proposed development, we encourage you to familiarize yourself with the staff report and recommended by-law that were recommended for Council approval by Planning Committee on July 7, 2022. For any questions or information, please contact the project lead at Kersten.Nitsche@ottawa.ca
- The subject property is identified as Station Core and Station Periphery in the proposed Orleans Corridor Secondary Plan. The Secondary Plan is not yet approved. The intent of the Station Core and Station Periphery is similar to the existing Transit Orientation Developments currently identified in the Zoning By-law.
- The new Parkland Dedication By-law, Section 5 recognizes residential development or mixed-use development on lands zoned as Transit Oriented Development pursuant to the Zoning By-law. If the required total conveyance exceeds 10% of the gross land area, conveyance in the form of parkland shall not exceed 10% of the gross land area with the remainder of the required conveyance to be provided as cash-in-lieu of parkland.

- PFP is applying the identified intent of the Secondary Plan and, Section 4 and Section 5 of the new Parkland Dedication By-law to the subject property. Therefore, land conveyance will be requried at 10% of the gross land area and the remainder of the required conveyance will be provided as cash-in-lieu of parkland.
- The proposal presented at the pre-consultation meeting illustrated approximately 10% of the land area as parkland with a park block of 8075m2.
- Please provide the City with a surveyor's area certificate/memo which specifies the exact gross land area of the property parcel being developed.
- Please note that the park comments are preliminary and will be finalized (and subject to change) upon receipt of the development application and the requested supporting documentation. Additionally, if the proposed land use changes, then the parkland dedication requirement will be re-evaluated accordingly.

Form of Parkland Dedication:

- PFP will be requesting **land conveyances and cash-in-lieu of parkland** for parkland dedication in accordance with the Parkland Dedication By-law (as amended).

Shape & Location of Park Block:

- The preferred location of the park block is the central-west area of the property, adjacent to the existing Taylor Creek corridor.
- The parkland conveyance is to be dedicated as one, contiguous park block.
- Parks & Facility Planning recognizes that achieving the goal of 50% right-of-way may be difficult in this location. A lower percentage can be considered if other factors are favourable (ie: visibility into the site from the ROW; CPTED; etc).
- Please reconfigure Building A4 to open-up the park block onto the municipal street frontage. The Park block needs to have better visibility from the municipal street.
- The portion of the park block with frontage on Jeanne d'Arch is separated and should form one, contiguous park block.
- Parkland dedication will not be accepted with encumbrances, floodplain, hazardous slopes etc.

Additional information to the applicant with respect to the future park block

- The park block is to show high level park grading on the Preliminary Grading Plan, including key spot elevations, stormwater flow arrows and slope percentages. Park block is to be graded to the surrounding levels and needs to show positive surface drainage towards the ROW.

- Confirmation that there are no existing or proposed encumbrances on the proposed park block.

Developer Requirements for Land Conveyance of a Park Block

- Please review the following reference documents which outline the requirements for parkland dedication and park block conveyance to the City;
  - City of Ottawa Park Development Manual, 2nd edition
  - City of Ottawa Parkland Dedication By-Law
  - The standard parks conditions.

- Park services are to be provided as per the standard park requirement. The developer is responsible for services (hydro, water, sanitary and stormwater) to the future park block. Services are to be connected from a municipal street.

General Comments:

- Creek corridor needs to be reviewed/investigated, at this time, unable to comment if creek corridor could handle a recreational trail. Lands developed with a recreational trail would not form part of the required parkland dedication.
- Through a zoning by-law amendment, the park block is to be identified and appropriately zoned.
- PFP will provide park conditions for park development once a formal subdivision application is submitted.

If you have any questions, please let me know.
Regards,
Mary Ellen Wood
Maryellen.wood@ottawa.ca

Meeting Minutes
8600 Jeanne d'Arc

Meeting/Project Name:	Petrie Island III – RVCA consultation		
Date of Meeting:	August 3rd, 2022	**Time:**	9am – 10am
Meeting Facilitator:	Lisa Dalla Rosa / Jamie Batchelor	**Location:**	MS Teams

Meeting Objective

This meeting is a pre-consultation meeting with RVCA prior to the submission of planning applications to the City of Ottawa.

Attendees

Name	**Representing**
Philip Thibert	Brigil
Kris Kilborn	Stantec
Faisal Abou-Seido	Paterson Group
Michelle Lavictoire	CIMA+
Lisa Dalla Rosa	Fotenn
Patricia Warren	Fotenn
Jamie Batchelor	RVCA – Planner
Jennifer Lamoureux	RVCA – Aquatic Ecologist
Claire Milloy	RVCA – Hydrogeologist
Evelyn Liu	RVCA – Engineer

Meeting Minutes

Topic

Lisa – gave an overview of the concept plan, discussed locating height at the southern end and the park along the ravine
Phil – wants to start the project off on the right foot with the RVCA
Jamie

- Two things related to slopes:
  - Normal slope stability and the limit of hazard land Reports
  - Very close to an escarpment that has historically had largescale landslides – will be looking for Landslide Hazard Assessment (whether it pertains to the escarpment or the ravine as well… will get confirmation on this)
- Is it anticipated Paterson Group will undertake the Landslide Hazard Assessment or co-authoring it?
  - Yes, Paterson will be taking it
  - Trigger point is the escarpment for this assessment
- May be helpful to have a pre-con with BCG and Paterson Group prior to landslide hazard assessment
- Need to confirm if meander belt will be required
  - Paterson confirms that this will be looked at
- Will be looking at SWM on this – are you proposing any outlets or will it all be going to existing storm sewers
  - Kris – capacity analysis has not been completed yet but does not believe there is existing storm sewers. SWM would probably be on site, likely a wet pond depending on where we can put it

    - One thing to consider, if there are alterations proposed for an outlet, this needs to be incorporated into the Geotech studies
- Storm – will be emphasizing water budget
    - Jennifer – clarifying that the ravine is Taylor Creek, so there is a lot of background information about that
        - Phil – does that change anything for an outlet into Taylor Creek?
            - Jennifer – not necessarily. The City has done a lot of restoration work along Taylor Creek. There is a lot of old infrastructure that would not really be permitted now (i.e. Gabian mattress). There is a lot of erosion and invasive species, so would suggest choosing an area with invasive species with minimal erosion for an outlet location.
    - Claire – do you know if the site has had boreholes done yet?
        - Faisal – not specifically on site, but knows that it's 200 kpa clay
        - Recommend a geomorphology assessment be done to confirm the small landslides
        - If there is an outlet, RVCA will need to see that flows are understood pre and post development – need to start flow monitoring very soon if looking to get a development application shortly.
            - If the pre-development is already highly erosive, we know we will need to do a lot to control the flows on site for post-development
        - A lot of the solutions can be related to evapotranspiration (i.e. the park with trees)
        - Would like pre-development flow measured in the clay plain
    - Jennifer – showed map of erosion locations, erosion protection required
    - Kris – are there any background reports for flows under the 174 or Jeanne d'Arc culverts?
        - Jennifer – provided a City of Ottawa contact to get this information, RVCA has some, but not exactly what we would need
    - Claire – storage, loss of evapotranspiration and overall increase in flows to the creek that may cause additional erosion are important items to consider
    - Evelyn – also checking MOECP guidelines
    - Claire – sometimes just the generic mapping is used, you should create a map for the site
    - Jamie – geomorph will be key, we want to make sure we're not exceed the erosion in the post development and even better if we lessen the erosion and reduce the hazard.
    - Consideration for snow melt
    - Provincial LID guidelines
- Jamie – what can be done in the constraint lands
    - Lot lines not allowed in the constraint lands
    - From a Geotech perspective, usually nothing in the limit of hazard lands.
    - For an environmental setback, have most of the pathways outside that setback as well
    - Jennifer – nicely treed on both sides right now, so want to maintain that
        - Keep pathways out of the riparian buffer area – keep the pathways on the edge of the trees
        - If you want to poke in and see Taylor Creek with a lookout spot, pick an area with invasive species
    - Lisa – do we need fencing?
        - Jamie – only would ask for fencing if the constraint lands are adjacent to parking lot or roadway. If the proposed land is a passive space, we can have a conversation about fencing and if it's needed (depends on the context)
        - Michelle – there would be a turtle fence needed
        - Jennifer – sometimes pathways can be a nice barrier for people to not garden and encroach on the space. Really depends on the people who are using the space
        - Lisa – confirmed that this won't be a development where there are individual backyards, it will be controlled by a condo corp or property manager
        - Jamie – once the design is narrowed down, we can have further discussions about fencing

        - Jamie – fencing doesn't have to be chain link fencing either, it can be something that fits better with the area.
- Jennifer – do you have a sense now of what the city is looking for in the park?
    - Lisa – they want programmable space, but the City's new parkland by-law has come out and we might need to provide more park. We might do something where we have a transition from a field to a more passive space towards Taylor Creek. City is on board with a park that buffers that existing corridor.
        - Once we get into the park design we would loop the RVCA in to discuss with City staff
- Michelle – most of the work was done in 2015 and 2018, going to go back and take a look at a few things
    - Just an EIS and a tree report for this site
    - The corridor for the Taylor Creek is trying to be protected, which has been identified previously
    - Jamie – did the city indicate that EIS is being triggered because of Taylor Creek or did they mention lands within 120m of a PSW? Not seeing it being a big concern since Jeanne d'Arc bisects the area, but just want the context for what the city has asked for.
        - Lisa – Michelle wasn't at the pre-app, but the City did bring up what was going on the north side of the Jeanne d'Arc
        - Michelle – in the other developments, we haven't had to deal with the PSW
        - Jennifer – on Taylor Creek itself is there a wetland polygon? If so you protect Taylor Creek, you protect this feature as well
    - Jennifer – will send the 2018 report and headwaters data from 2012 to have as background to inform the EIS
    - Michelle – not planning on doing a headwater study, which is fine
- Kris – outlet would probably be around where the existing culvert is crossing Jeanne d'Arc. As far as the geomorph and upstream studies, it looks like more of a linear outlet than a meander, is geomorph still required?
    - Jamie – will check with Geotech
    - Jennifer – typically would want the outlet to be upstream
        - Kris – would the RVCA permit multiple smaller outlets at the upstream end?
    - Michelle – fish habitat here as well, so we will need to consider this, which is outside of the RVCA area. DFO considerations.

Wu, Michael

From: Polyak, Alex <alex.polyak@ottawa.ca>
Sent: September 18, 2023 09:15
To: Wu, Michael
Cc: Kilborn, Kris; Brandrick, Robert; Murshid, Shoma; Martinov, Amya
Subject: 8600 Jeanne D'Arc Boulevard (Petries Landing III) Sanitary Sewer Capacity

Good morning Michael,

Staff have reviewed the available capacity of the downstream sewers on Jeanne d'Arc Boulevard and have no concerns regarding an additional 50.8 L/s of sanitary peak flows from the above site.

Regards,

Oleksandr (Alex) Polyak, B.Eng., P.Eng
Project Manager, Infrastructure Approvals, Development Review East Branch | Gestionnaire de projet, Direction de l'examen des projets d'aménagement – Est.
Planning, Real Estate and Economic Development Department | Direction générale de la planification, des biens immobiliers et du développement économique

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Appendix C Water

C.1 Domestic Water Demand

Petries Landing III - Domestic Water Demand Estimates

Project Number: 160401751

Population densities as per Table 4.1 of the City of Ottawa Water Design Guidelines:		
Average Apartment	1.8	ppu

Demand conversion factors as per Table 4.2 of the City of Ottawa Water Design Guidelines:		
Residential	280	L/cap/day

Building ID	Number of Apt Units[2]	Estimated Population	Avg. Day Demand		Max. Day Demand[1]		Peak Hour Demand[1]	
			(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Plot A	330	594	115.5	1.9	288.8	4.8	635.3	10.6
Plot B	994	1,789	347.9	5.8	869.8	14.5	1913.5	31.9
Plot C	461	830	161.4	2.7	403.4	6.7	887.4	14.8
Plot D	1,074	1,933	375.9	6.3	939.8	15.7	2067.5	34.5
Total Site :	**2,859**	**5,146**	**1,000.7**	**16.7**	**2,501.6**	**41.7**	**5,503.6**	**91.7**

Notes:

1 Water demand criteria used to estimate peak demand rates for residential areas are as follows:

maximum day demand rate = 2.5 x average day demand rate

peak hour demand rate = 2.2 x maximum day demand rate (as per Technical Bulletin ISD-2010-02)

2 Number of apartment units as per Quandrangle Preliminary Plan development statistics table (April 21, 2023).

C.2 Fire Flow Demand (2020 FUS)

Stantec

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160401751
Project Name: 8600 Jeanne D'Arc Boulevard (Petries Landing III)
Date: 2023-06-19
Fire Flow Calculation #: 10
Description: Plot 'D1', 24-Storey High-Rise Tower with 6-Storey Podium
Podium Area: 3503 m^2; Tower Area: 1564 m^2

Notes: Footprint areas as per BDP Quadrangle Architects Site Plan (April 25th, 2023)

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type II - Noncombustible Construction / Type IV-A - Mass Timber Construction										0.8	-
2	Determine Effective Floor Area	Sum of Two Largest Floors + 50% of Eight Additional Floors					Vertical Openings Protected?					NO	-
		3503	3503	3503	3503	3503	3503	1564	1564	1564	1564	17140	-
3	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min										-	23000
4	Determine Occupancy Charge	Limited Combustible										-15%	19550
5	Determine Sprinkler Reduction	Conforms to NFPA 13										-30%	-9775
		Standard Water Supply										-10%	
		Fully Supervised										-10%	
		% Coverage of Sprinkler System										100%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall		Firewall / Sprinklered ?			-	-
		North	> 30	0	0	0-20	Type V		NO			0%	0
		East	> 30	0	0	0-20	Type V		NO			0%	
		South	> 30	0	0	0-20	Type V		NO			0%	
		West	10.1 to 20	25	24	> 100	Type I-II - Unprotected Openings		YES			0%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											10000
		Total Required Fire Flow in L/s											166.7
		Required Duration of Fire Flow (hrs)											2.00
		Required Volume of Fire Flow (m^3)											1200

C.3 Boundary Conditions (City of Ottawa)

Boundary Conditions
8600 Jeanne D'Arc Boulevard

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	1,050	17.50
Maximum Daily Demand	2,634	43.90
Peak Hour	5,790	96.50
Fire Flow Demand #1	10,002	166.70

Location

Results

Connection 1 - Jeanne D'Arc

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	113.7	88.6
Peak Hour	106.1	77.8
Max Day plus Fire Flow	102.1	72.2

[1] Ground Elevation = 51.3 m

Notes

1. System level peaking factors and domestic demands should be used for applications exceeding 500 persons.

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

C.4 Preliminary H2OMAP Results Summary

Petries III H2OMap

Prepared By:

Date: 2024-03-06

Junction Results - Basic Day

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)	Pressure (kPa)
10	2.30	51.25	113.69	88.76	611.98
12	6.00	52.51	113.69	86.97	599.64
14	0.00	53.39	113.68	85.71	590.95
16	6.50	53.83	113.68	85.08	586.61
18	2.80	52.96	113.69	86.34	595.29
20	0.00	50.30	113.70	90.13	621.42

Link Results - Basic Day

ID	FROM	TO	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
15	JDA1	10	84.19	204	110	3.75	0.11
17	10	12	114.40	204	110	1.45	0.04
21	12	14	151.67	250	110	2.49	0.05
23	14	16	44.03	250	110	2.49	0.05
25	16	18	171.30	250	110	-4.01	0.08
27	18	JDA3	58.50	250	110	-6.81	0.14
29	20	12	83.96	250	110	7.04	0.14
31	JDA1	20	123.70	393	120	3.37	0.03
33	20	JDA3	105.81	393	120	-3.67	0.03

Junction Results - Peak Hour

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)	Pressure (kPa)
10	12.60	51.25	105.84	77.61	535.10
12	33.00	52.51	105.78	75.73	522.14
14	0.00	53.39	105.70	74.37	512.76
16	35.60	53.83	105.68	73.71	508.21
18	15.30	52.96	105.90	75.26	518.90
20	0.00	50.30	106.09	79.31	546.82

Link Results - Peak Hour

ID	FROM	TO	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
15	JDA1	10	84.19	204	110	20.56	0.63
17	10	12	114.40	204	110	7.96	0.24
21	12	14	151.67	250	110	13.59	0.28
23	14	16	44.03	250	110	13.59	0.28
25	16	18	171.30	250	110	-22.01	0.45
27	18	JDA3	58.50	250	110	-37.31	0.76
29	20	12	83.96	250	110	38.64	0.79
31	JDA1	20	123.70	393	120	18.51	0.15
33	20	JDA3	105.81	393	120	-20.13	0.17

Fire Flow Results - Max Day + 10,000L/min

ID	Static Demand (L/s)	Static Pressure (kPa)	Static Pressure (psi)	Static Head (m)	Fire Flow Demand (L/s)	Residual Pressure (psi)	Available Flow (L/s)	Available Pressure (psi)
10	5.70	497.80	72.20	102.04	166.67	65.61	531.74	20.01
12	15.00	485.32	70.39	102.03	166.67	67.45	874.72	20.01
16	16.20	472.15	68.48	102.00	166.67	62.21	557.21	20.01
18	6.90	481.19	69.79	102.05	166.67	66.63	805.07	20.01

Appendix D Sanitary

D.1 Sanitary Sewer Flow

Stantec

SUBDIVISION:

PETRIES III

DATE: 3/20/2025
REVISION: 2
DESIGNED BY: MJS
CHECKED BY: DT

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401751

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.33 l/s/Ha	HARMON CORRECTION FACTOR	0.8
PERSONS / APARTMENT	1.8				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)	
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)
G3A	3	2	0.00	0	0	0	0	0.00	0	3.80	0.0	0.00	0.00	0.00	0.00	0.00	0.00
R4A, G4A	4	2	0.89	0	0	330	594	0.89	594	3.35	6.4	0.00	0.00	0.00	0.00	0.00	0.00
R2A, G2A	2	1	0.73	0	0	994	1789	1.62	2383	3.02	23.3	0.00	0.00	0.00	0.00	0.00	0.00
R6A, R6B, G6A, G6B, G6C	6	5	0.73	0	0	1535	2763	0.73	2763	2.98	26.7	0.00	0.00	0.00	0.00	0.00	0.00

AREA ID NUMBER	INSTITUTIONAL AREA (ha)	INSTITUTIONAL ACCU. AREA (ha)	GREEN / UNUSED AREA (ha)	GREEN / UNUSED ACCU. AREA (ha)	C+I+I PEAK FLOW (l/s)	INFILTRATION TOTAL AREA (ha)	INFILTRATION ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	PIPE LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
G3A	0.00	0.00	0.53	0.53	0.0	0.53	0.53	0.2	0.2	154.2	250	PVC	SDR 35	0.40	38.3	**0.46%**	0.77	0.17
R4A, G4A	0.00	0.00	0.65	0.65	0.0	1.54	1.54	0.5	7.0	114.4	250	PVC	SDR 35	0.40	38.3	**18.13%**	0.77	0.48
R2A, G2A	0.00	0.00	0.82	2.00	0.0	1.55	3.62	1.2	24.5	104.5	250	PVC	SDR 35	0.40	38.3	**63.94%**	0.77	0.71
											250							
R6A, R6B, G6A, G6B, G6C	0.00	0.00	1.19	1.19	0.0	1.92	1.92	0.6	27.3	268.7	250	PVC	SDR 35	0.40	38.3	**71.19%**	0.77	0.73
											250							

D.2 Sanitary Sewer Capacity

Wu, Michael

From: Polyak, Alex <alex.polyak@ottawa.ca>
Sent: September 18, 2023 09:15
To: Wu, Michael
Cc: Kilborn, Kris; Brandrick, Robert; Murshid, Shoma; Martinov, Amya
Subject: 8600 Jeanne D'Arc Boulevard (Petries Landing III) Sanitary Sewer Capacity

Good morning Michael,

Staff have reviewed the available capacity of the downstream sewers on Jeanne d'Arc Boulevard and have no concerns regarding an additional 50.8 L/s of sanitary peak flows from the above site.

Regards,

Oleksandr (Alex) Polyak, B.Eng., P.Eng
Project Manager, Infrastructure Approvals, Development Review East Branch | Gestionnaire de projet, Direction de l'examen des projets d'aménagement – Est.
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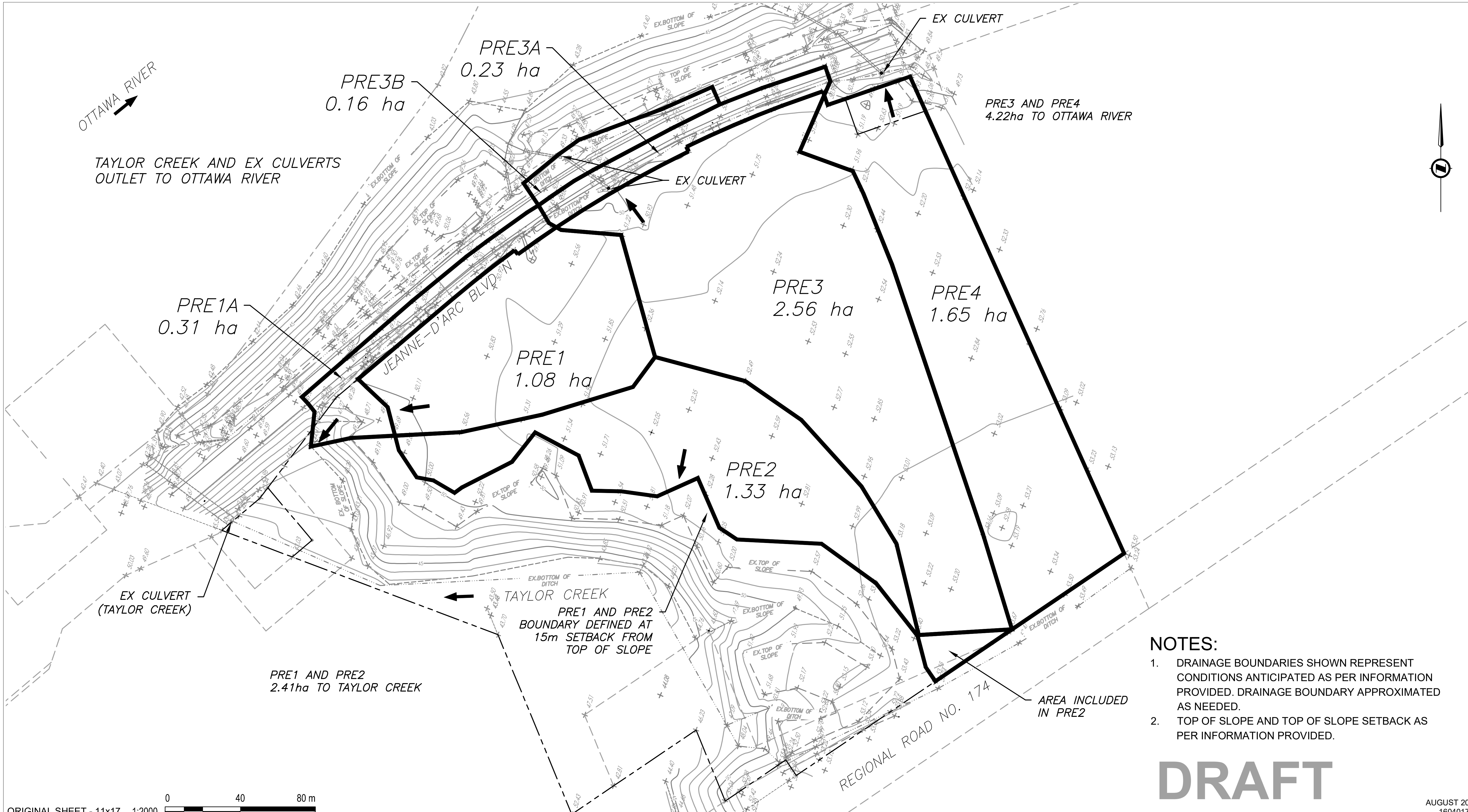
Appendix E Storm

E.1 Pre-Development



NOTES:

1. DRAINAGE BOUNDARIES SHOWN REPRESENT CONDITIONS ANTICIPATED AS PER INFORMATION PROVIDED. DRAINAGE BOUNDARY APPROXIMATED AS NEEDED.
2. TOP OF SLOPE AND TOP OF SLOPE SETBACK AS PER INFORMATION PROVIDED.

DRAFT

AUGUST 2023
160401751

Stantec
300 – 1331 Clyde Avenue
Ottawa, ON K2C 3G4
www.stantec.com

Client/Project
BRIGIL
PETRIES LANDING III
FUNCTIONAL SERVICING

Figure No.
E1.1

Title
PRE-DEVELOPMENT STORM DRAINAGE AREA

Stormwater Management Calculations

File No: **160401751**
Project: **Petries III**
Date: **May 2024**

SWM Approach:
Post-development to Pre-development flows (Taylor Creek)

Pre-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table								
Catchment Type	**Sub-catchment Area ID / Description**		**Area (ha) "A"**		**Runoff Coefficient "C"**	**"A x C"**		**Overall Runoff Coefficient**
Uncontrolled								
Pre-Development 1	PRE1	Hard	0.00		0.9	0.00		
Taylor Creek		Soft	1.08		0.2	0.22		
	Subtotal			1.08			0.22	0.20
Pre-Development 1A	PRE1A	Hard	0.10		0.9	0.09		
Taylor Creek		Soft	0.21		0.2	0.04		
	Subtotal			0.31			0.13	0.43
Pre-Development 2	PRE2	Hard	0.00		0.9	0.00		
Taylor Creek		Soft	1.33		0.2	0.27		
	Subtotal			1.33			0.27	0.20
Pre-Development 3	PRE3	Hard	0.00		0.9	0.00		
Ottawa River		Soft	2.56		0.2	0.51		
	Subtotal			2.56			0.51	0.20
Pre-Development 3A	PRE3A	Hard	0.11		0.9	0.10		
Ottawa River		Soft	0.12		0.2	0.02		
	Subtotal			0.23			0.12	0.53
Pre-Development 3B	PRE3B	Hard	0.05		0.9	0.05		
Ottawa River		Soft	0.11		0.2	0.02		
	Subtotal			0.16			0.07	0.42
Pre-Development 4	PRE4	Hard	0.00		0.9	0.00		
Ottawa River		Soft	1.65		0.2	0.33		
	Subtotal			1.65			0.33	0.20
Total				**7.32**			**1.65**	
Overall Runoff Coefficient= C:								**0.22**

Total Tributary Surface Areas #1 (Taylor Creek)	**2.72**
Total Tributary Surface Areas #2 (Ottawa River)	**2.95**
Total Tributary Surface Areas #3 (Ottawa River)	**1.65 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**7.32 ha**

Project # 160401751, Petries III
Target Release Rates

5-yr Intensity
City of Ottawa

$I = a/(T+b)^c$		
	a =	998.071
	b =	6.053
	c =	0.814

5-Year Pre-Development Target Release to Taylor Creek

Area Label	Area (ha)	Coefficient (C)	Tc (min)	Intensity (mm/hr)	Qtarget (L/s)
PRE1	1.08	0.20	28	56.49	**33.9**
PRE1A	0.31	0.43	10	104.19	**38.2**
PRE2	1.33	0.20	29	55.18	**40.8**
				Total	**113.0**

Tc from calculated values using topographic survey data
Tc for PRE1A set to 10 based on existing roadway condition

5-Year Pre-Development Target Release to Ottawa River (West Culvert)

Area Label	Area (ha)	Coefficient (C)	Tc (min)	Intensity (mm/hr)	Qtarget (L/s)
PRE3	2.56	0.20	45	40.63	**57.8**
PRE3A	0.23	0.53	10	104.19	**35.6**
PRE3B	0.16	0.42	10	104.19	**19.4**
				Total	**112.9**

Tc from calculated values using topographic survey data
Tc for PRE3A and PRE3B set to 10 based on existing roadway condition

5-Year Pre-Development Target Release to Ottawa River (East Culvert)

Area Label	Area (ha)	Coefficient (C)	Tc (min)	Intensity (mm/hr)	Qtarget (L/s)
PRE4	1.65	0.20	50	37.65	**34.5**

Tc from calculated values using topographic survey data

Project # 160401751, Petries III
Target Release Rates

100-yr Intensity
City of Ottawa

$I = a/(T+b)^c$		
	a =	1735.688
	b =	6.014
	c =	0.820

100-Year Pre-Development Target Release to Taylor Creek

Area Label	Area (ha)	Coefficient (C)	Tc (min)	Intensity (mm/hr)	Qtarget (L/s)
PRE1	1.08	0.20	28	96.27	**57.8**
PRE1A	0.31	0.43	10	178.56	**65.5**
PRE2	1.33	0.20	29	94.01	**69.5**
				Total	**192.9**

Tc from calculated values using topographic survey data
Tc for PRE1A set to 10 based on existing roadway condition

100-Year Pre-Development Target Release to Ottawa River (West Culvert)

Area Label	Area (ha)	Coefficient (C)	Tc (min)	Intensity (mm/hr)	Qtarget (L/s)
PRE3	2.56	0.20	45	69.05	**98.3**
PRE3A	0.23	0.53	10	178.56	**61.1**
PRE3B	0.16	0.42	10	178.56	**33.3**
				Total	**192.6**

Tc from calculated values using topographic survey data
Tc for PRE3A and PRE3B set to 10 based on existing roadway condition

100-Year Pre-Development Target Release to Ottawa River (East Culvert)

Area Label	Area (ha)	Coefficient (C)	Tc (min)	Intensity (mm/hr)	Qtarget (L/s)
PRE4	1.65	0.20	50	63.95	**58.7**

Tc from calculated values using topographic survey data

Stantec	Project	Petrie III	No.	160401751
	PRE-DEVELOPMENT CONDITIONS Calculation of Time of Concentration			
	Revision:	1	Prepared By:	RB
	Revision Date	May 2024	Checked By:	

OVERLAND SHEET FLOW TIME

Runoff Coeffient = 0.20

Length = 150 m (longest overland flow path)
DEM Slope = 2.13% (along overland flow path)

C > 0.4 **Bransby Williams Method**

$tc = 0.057 \times L / (S_w^{0.2} \times A^{0.1})$

L	0	m (longest flow path)
S_w	2.13%	
A	1.08	ha
t_c	0.00	min

C ≤ 0.4 **Airport Method**

$tc = [3.26 \times (1.1-C) \times L^{0.5}] / S_w^{0.33}$

L	150	m
S_w	2.13%	
C	0.20	
t_c	28.0	min

SHALLOW CONCENTRATED FLOW TIME

Uplands Method

1. Channel Segment 1 - Overland

Length =		m (longest flow path)
DEM Slope		(along overland flow path)
Channel Type =	Short grass pasture (overland flow)	
k =	2.3	
	V = k * S^(1/2)	
Velocity =	0.00	m/s
Channel Length =	0	m
Travel time =	0.0	min

2. Channel Segment 2 - Overland within creek channel

Length =		m (longest flow path)
DEM Slope		(along overland flow path)
Channel Type =	Forest with heavy ground liter, hay meadow (overland flow)	
k =	0.6	
	V = k * S^(1/2)	
Velocity =	0.00	m/s
Channel Length =	0	m
Travel time =	0.0	min

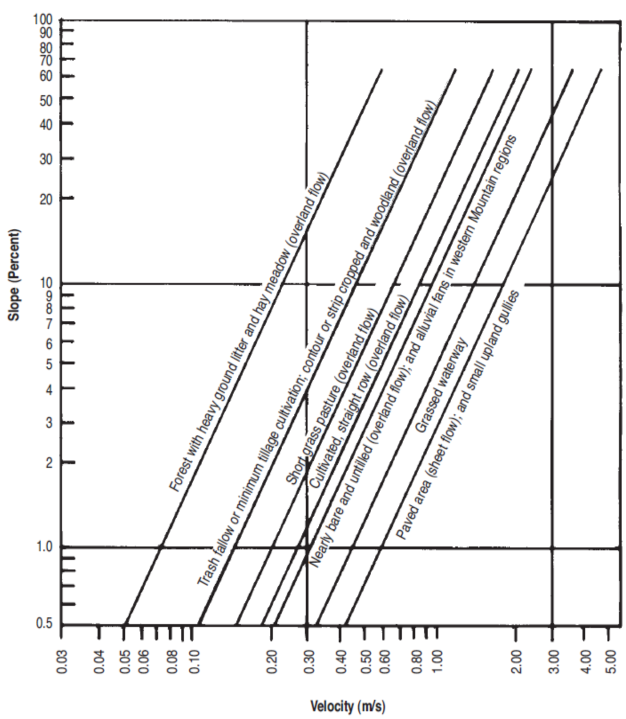
Therefore, Total T_c =	**28.0**	min
	0.5	hrs

Uplands Method Chart

118 STEEL DRAINAGE AND HIGHWAY CONSTRUCTION PRODUCTS

Table 3.9 $V/S^{0.5}$ relationship for various land covers

Land Cover	$V/S^{0.5}$ (m/s)
Forest with heavy ground litter, hay meadow (overland flow)	0.6
Trash fallow or minimum tillage cultivation, contour, strip cropped woodland (overland flow)	1.5
Short grass pasture (overland flow)	2.3
Cultivated, straight row (overland flow)	2.7
Nearly bare and untilled (overland flow) or alluvial fans in Western mountain regions	3.0
Grassed waterway	4.6
Paved areas (sheet flow); small upland gullies	6.1



	Project	Petrie III	No.	160401751
	PRE-DEVELOPMENT CONDITIONS Calculation of Time of Concentration			
	Revision:	1	Prepared By:	RB
	Revision Date	May 2024	Checked By:	

OVERLAND SHEET FLOW TIME

Runoff Coeffient = 0.20

Length = 100 m (longest overland flow path)
DEM Slope = 1.00% (along overland flow path)

C > 0.4 **Bransby Williams Method**
$tc = 0.057 \times L / (S_w^{0.2} \times A^{0.1})$

L	0	m (longest flow path)
S_w	1.00%	
A	1.33	ha
t_c	0.00	min

C ≤ 0.4 **Airport Method**
$tc = [3.26 \times (1.1\text{-}C) \times L^{0.5}] / S_w^{0.33}$

L	100	m
S_w	1.00%	
C	0.20	
t_c	29.3	min

SHALLOW CONCENTRATED FLOW TIME

Uplands Method

1. Channel Segment 1 - Overland

Length = m (longest flow path)
DEM Slope (along overland flow path)
Channel Type = Short grass pasture (overland flow)
k = 2.3
V = k * S^(1/2)
Velocity = 0.00 m/s
Channel Length = 0 m
Travel time = 0.0 min

2. Channel Segment 2 - Overland within creek channel

Length = m (longest flow path)
DEM Slope (along overland flow path)
Channel Type = Forest with heavy ground liter, hay meadow (overland flow)
k = 0.6
V = k * S^(1/2)
Velocity = 0.00 m/s
Channel Length = 0 m
Travel time = 0.0 min

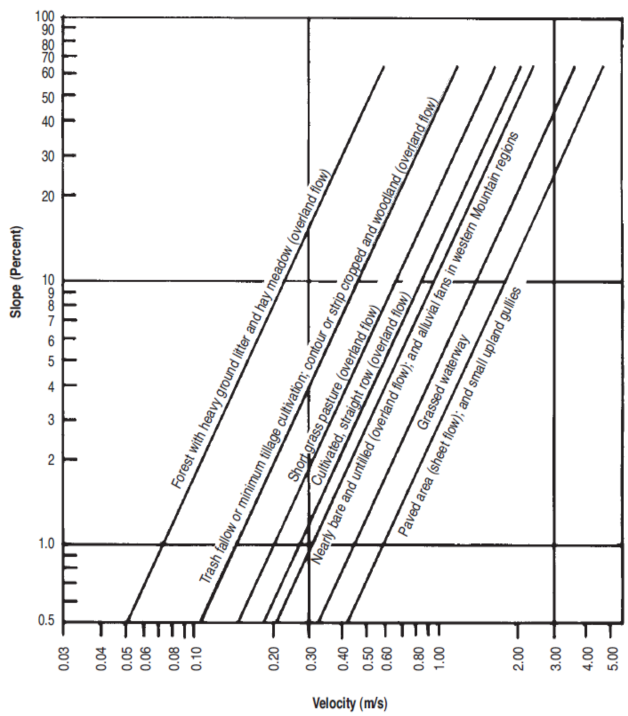
Therefore, Total T_c = **29.3** min
0.5 hrs

Uplands Method Chart

118 STEEL DRAINAGE AND HIGHWAY CONSTRUCTION PRODUCTS

Table 3.9 $V/S^{0.5}$ relationship for various land covers

Land Cover	$V/S^{0.5}$ (m/s)
Forest with heavy ground litter, hay meadow (overland flow)	0.6
Trash fallow or minimum tillage cultivation, contour, strip cropped woodland (overland flow)	1.5
Short grass pasture (overland flow)	2.3
Cultivated, straight row (overland flow)	2.7
Nearly bare and untilled (overland flow) or alluvial fans in Western mountain regions	3.0
Grassed waterway	4.6
Paved areas (sheet flow); small upland gullies	6.1



	Project	Petrie III	No.	160401751
Stantec	PRE-DEVELOPMENT CONDITIONS Calculation of Time of Concentration			
	Revision:	1	Prepared By:	RB
	Revision Date	May 2024	Checked By:	

OVERLAND SHEET FLOW TIME

Runoff Coeffient = 0.20

Length = 316 m (longest overland flow path)
DEM Slope = 1.52% (along overland flow path)

C > 0.4 **Bransby Williams Method**

$tc = 0.057 \times L /(S_w^{0.2} \times A^{0.1})$

L	0	m (longest flow path)
S_w	1.52%	
A	2.56	ha
t_c	0.00	min

C ≤ 0.4 **Airport Method**

$tc = [3.26 \times (1.1\text{-}C) \times L^{0.5}] / S_w^{0.33}$

L	316	m
S_w	1.52%	
C	0.20	
t_c	45.4	min

SHALLOW CONCENTRATED FLOW TIME

Uplands Method

1. Channel Segment 1 - Overland

Length = m (longest flow path)
DEM Slope (along overland flow path)
Channel Type = Short grass pasture (overland flow)
k = 2.3
V = k * S^(1/2)
Velocity = 0.00 m/s
Channel Length = 0 m
Travel time = 0.0 min

2. Channel Segment 2 - Overland within creek channel

Length = m (longest flow path)
DEM Slope (along overland flow path)
Channel Type = Forest with heavy ground liter, hay meadow (overland flow)
k = 0.6
V = k * S^(1/2)
Velocity = 0.00 m/s
Channel Length = 0 m
Travel time = 0.0 min

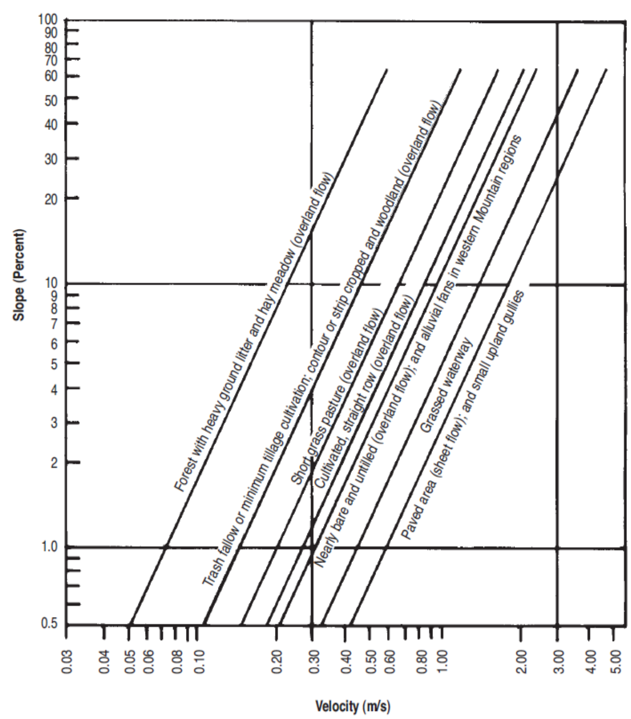
Therefore, Total T_c = **45.4** min
0.8 hrs

Uplands Method Chart

118 STEEL DRAINAGE AND HIGHWAY CONSTRUCTION PRODUCTS

Table 3.9 $V/S^{0.5}$ relationship for various land covers

Land Cover	$V/S^{0.5}$ (m/s)
Forest with heavy ground litter, hay meadow (overland flow)	0.6
Trash fallow or minimum tillage cultivation, contour, strip cropped woodland (overland flow)	1.5
Short grass pasture (overland flow)	2.3
Cultivated, straight row (overland flow)	2.7
Nearly bare and untilled (overland flow) or alluvial fans in Western mountain regions	3.0
Grassed waterway	4.6
Paved areas (sheet flow); small upland gullies	6.1



Stantec	Project	Petrie III	No.	160401751
	PRE-DEVELOPMENT CONDITIONS Calculation of Time of Concentration			
	Revision:	`	Prepared By:	RB
	Revision Date	May 2024	Checked By:	

OVERLAND SHEET FLOW TIME

Runoff Coeffient = 0.20

Length = 300 m (longest overland flow path)
DEM Slope = 1.07% (along overland flow path)

C > 0.4 **Bransby Williams Method**

$tc = 0.057 \times L / (S_w^{0.2} \times A^{0.1})$

L	0	m (longest flow path)
S_w	1.07%	
A	1.65	ha
t_c	0.00	min

C ≤ 0.4 **Airport Method**

$tc = [3.26 \times (1.1-C) \times L^{0.5}] / S_w^{0.33}$

L	300	m
S_w	1.07%	
C	0.20	
t_c	49.7	min

SHALLOW CONCENTRATED FLOW TIME

Uplands Method

1. Channel Segment 1 - Overland

Length =		m (longest flow path)
DEM Slope		(along overland flow path)
Channel Type =	Short grass pasture (overland flow)	
k =	2.3	
	V = k * S^(1/2)	
Velocity =	0.00	m/s
Channel Length =	0	m
Travel time =	0.0	min

2. Channel Segment 2 - Overland within creek channel

Length =		m (longest flow path)
DEM Slope		(along overland flow path)
Channel Type =	Forest with heavy ground liter, hay meadow (overland flow)	
k =	0.6	
	V = k * S^(1/2)	
Velocity =	0.00	m/s
Channel Length =	0	m
Travel time =	0.0	min

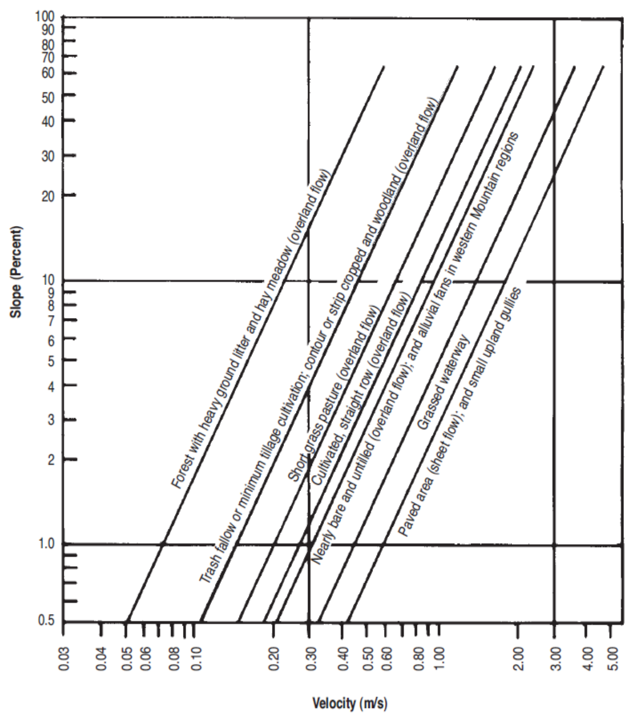
Therefore, Total T_c = 49.7 min
0.8 hrs

Uplands Method Chart

118 STEEL DRAINAGE AND HIGHWAY CONSTRUCTION PRODUCTS

Table 3.9 $V/S^{0.5}$ relationship for various land covers

Land Cover	$V/S^{0.5}$ (m/s)
Forest with heavy ground litter, hay meadow (overland flow)	0.6
Trash fallow or minimum tillage cultivation, contour, strip cropped woodland (overland flow)	1.5
Short grass pasture (overland flow)	2.3
Cultivated, straight row (overland flow)	2.7
Nearly bare and untilled (overland flow) or alluvial fans in Western mountain regions	3.0
Grassed waterway	4.6
Paved areas (sheet flow); small upland gullies	6.1



E.2 Post-Development

Stormwater Management Calculations

File No: **160401751**
Project: **Petries III**
Date: **May 2025**

SWM Approach:
Post-development to Pre-development flows (Taylor Creek)

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table

Sub-catchment Area Catchment Type	ID / Description		Area (ha) "A"		Runoff Coefficient "C"	"A x C"		Overall Runoff Coefficient
Controlled - Ottawa River (West Culvert)								
Block A - Private	C102A	Soft	0.22		0.20	0.04		
		Hard	1.32		0.90	1.19		
		Subtotal		1.54			1.23	0.80
Block B - Private	C101A	Soft	0.22		0.20	0.04		
		Hard	1.33		0.90	1.20		
		Subtotal		1.55			1.24	0.80
Park	PARK	Park	0.66		0.40	0.26		
			0.00		0.20	0.00		
		Subtotal		0.66			0.26	0.40
Road - Public	C101B	Soft	0.15		0.20	0.03		
Ottawa River		Hard	0.38		0.90	0.34		
		Subtotal		0.53			0.37	0.70
		Subtotal		4.28			3.11	0.73
Controlled - Ottawa River (East Culvert)								
Block C - Private	C201B	Soft	0.09		0.20	0.02		
Ottawa River		Hard	0.52		0.90	0.47		
		Subtotal		0.61			0.49	0.80
Block D - Private	C201C	Soft	0.11		0.20	0.02		
Ottawa River		Hard	0.67		0.90	0.60		
		Subtotal		0.78			0.63	0.80
Road - Public	C201A	Soft	0.15		0.20	0.03		
Ottawa River		Hard	0.38		0.90	0.34		
		Subtotal		0.53			0.37	0.70
		Subtotal		1.92			1.48	0.77

Stormwater Management Calculations

File No: **160401751**
Project: **Petries III**
Date: **May 2025**

SWM Approach:
Post-development to Pre-development flows (Taylor Creek)

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table								
Catchment Type	**Sub-catchment Area ID / Description**		**Area (ha) "A"**		**Runoff Coefficient "C"**	**"A x C"**		**Overall Runoff Coefficient**
Uncontrolled - Taylor Creek								
Pre-Development 1A	Pre1A	Hard	0.10		0.90	0.09		
Taylor Creek		Soft	0.21		0.20	0.04		
		Subtotal		0.31			0.13	0.43
Block A Buffer	UNC-1	Hard	0.00		0.90	0.00		
Taylor Creek		Soft	0.15		0.20	0.03		
		Subtotal		0.15			0.03	0.20
Block D Buffer	UNC-3	Hard	0.00		0.90	0.00		
Taylor Creek		Soft	0.21		0.20	0.04		
		Subtotal		0.21			0.04	0.20
Uncontrolled - Ottawa River								
Pre-Development 3A	PRE3A	Hard	0.11		0.9	0.10		
Ottawa River		Soft	0.12		0.2	0.02		
		Subtotal		0.23			0.12	0.53
Pre-Development 3B	PRE3B	Hard	0.05		0.9	0.05		
Ottawa River		Soft	0.11		0.2	0.02		
		Subtotal		0.16			0.07	0.42

Total Controlled Areas - Ottawa River (West Culvert)	**4.28**	**ha**
Total Controlled Areas - Ottawa River (East Culvert)	**1.92**	**ha**
Total Uncontrolled Areas - Taylor Creek	**0.67**	**ha**
Total Uncontrolled Areas - Ottawa River	**0.39**	**ha**
Total Tributary Area to Outlet	**7.26**	**ha**

Project # 160401751, Petries III
Design Discharge Rates

5-yr Intensity
City of Ottawa

$I = a/(T+b)^c$

a =	998.071
b =	6.053
c =	0.814

5-Year Post-Development Discharge to Taylor Creek

Area Label	Area (ha)	Coefficient (C)	Tc (min)	Intensity (mm/hr)	Qtarget (L/s)
Pre1A	0.31	0.43	10	104.19	**38.2**
UNC-1	0.15	0.20	10	104.19	**8.7**
UNC-3	0.21	0.20	10	104.19	**12.2**
				Total	**59.1**

5-Year Post-Development Discharge to Ottawa River (West Culvert)

Area Label	Area (ha)	Coefficient (C)	Tc (min)	Intensity (mm/hr)	Qtarget (L/s)
C102A	1.54	0.80	10	104.19	**356.9**
C101A	1.55	0.80	10	104.19	**359.5**
PARK	0.66	0.40	10	104.19	**76.5**
C101B	0.53	0.70	10	104.19	**107.8**
				Total	**900.5**

5-Year Post-Development Discharge to Ottawa River (East Culvert)

Area Label	Area (ha)	Coefficient (C)	Tc (min)	Intensity (mm/hr)	Qtarget (L/s)
C201B	0.61	0.80	10	104.19	**140.8**
C201C	0.78	0.80	10	104.19	**181.0**
C201A	0.53	0.70	10	104.19	**107.8**
				Total	**429.6**

Project # 160401751, Petries III
Design Discharge Rates

100-yr Intensity
City of Ottawa

$I = a/(T+b)^c$

a =	1735.688
b =	6.014
c =	0.820

100-Year Post-Development Discharge to Taylor Creek

Area Label	Area (ha)	Coefficient (C)	Tc (min)	Intensity (mm/hr)	Qtarget (L/s)
Pre1A	0.31	0.43	10	178.56	**65.5**
UNC-1	0.15	0.20	10	178.56	**14.9**
UNC-3	0.21	0.20	10	178.56	**20.8**
				Total	**101.3**

100-Year Post-Development Discharge to Ottawa River (West Culvert)

Area Label	Area (ha)	Coefficient (C)	Tc (min)	Intensity (mm/hr)	Qtarget (L/s)
C102A	1.54	0.80	10	178.56	**611.6**
C101A	1.55	0.80	10	178.56	**616.0**
PARK	0.66	0.40	10	178.56	**131.0**
C101B	0.53	0.70	10	178.56	**184.7**
				Total	**1543.3**

100-Year Post-Development Discharge to Ottawa River (East Culvert)

Area Label	Area (ha)	Coefficient (C)	Tc (min)	Intensity (mm/hr)	Qtarget (L/s)
C201B	0.61	0.80	10	178.56	**241.2**
C201C	0.78	0.80	10	178.56	**310.2**
C201A	0.53	0.70	10	178.56	**184.7**
				Total	**736.2**

PETRIES III		STORM SEWER DESIGN SHEET (City of Ottawa)
DATE:	2025-03-21	
REVISION:	2	
DESIGNED BY:	MJS	FILE NUMBER: 160401751
CHECKED BY:	DT	

DESIGN PARAMETERS

$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:5 yr	1:10 yr	1:100 yr			
a =	732.951	998.071	1174.184	1735.688	MANNING'S n =	0.013	BEDDING CLASS = B
b =	6.199	6.053	6.014	6.014	MINIMUM COVER:	2.00 m	
c =	0.810	0.814	0.816	0.820	TIME OF ENTRY	10 min	

LOCATION / DRAINAGE AREA

AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)
C201A, C201C, C201B	201	200	0.00	2.02	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.000	0.000	1.553	1.553	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	449.5
	200	HDWL 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	1.553	0.000	0.000	0.000	0.000	12.08	69.63	94.34	110.54	161.52	0.0	0.0	407.0
																				12.29							
C101B, C101A, PARK	101	100	0.00	2.71	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.000	0.000	1.863	1.863	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	539.2
																				12.05							
	104	103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0
	103	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0
C102A	102	100	0.00	1.54	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.000	0.000	1.233	1.233	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	356.9
																				11.40							
	100	34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	3.096	0.000	0.000	0.000	0.000	12.05	69.73	94.47	110.70	161.75	0.0	0.0	812.5
	34	HDWL 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	3.096	0.000	0.000	0.000	0.000	12.12	69.51	94.17	110.34	161.23	0.0	0.0	809.9
																				12.83							

PIPE SELECTION

FROM M.H.	TO M.H.	LENGTH (m)	PIPE WIDTH OR DIAMETE (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
201	200	229.9	600	600	CIRCULAR	CONCRETE	-	0.70	535.9	**83.87%**	1.84	1.84	2.08
200	HDWL 2	18.9	675	675	CIRCULAR	CONCRETE	-	0.50	620.1	**65.63%**	1.68	1.56	0.20
			675	675									
101	100	235.2	675	675	CIRCULAR	CONCRETE	-	0.70	733.7	**73.49%**	1.99	1.91	2.05
104	103	90.5	450	450	CIRCULAR	CONCRETE	-	0.50	210.3	**0.00%**	1.28	0.00	0.00
103	102	68.9	450	450	CIRCULAR	CONCRETE	-	0.50	210.3	**0.00%**	1.28	0.00	0.00
102	100	123.4	600	600	CIRCULAR	CONCRETE	-	0.45	429.7	**83.05%**	1.47	1.47	1.40
100	34	5.6	975	975	CIRCULAR	CONCRETE	-	0.20	1045.6	**77.71%**	1.36	1.32	0.07
34	HDWL 1	56.0	975	975	CIRCULAR	CONCRETE	-	0.20	1045.6	**77.46%**	1.36	1.32	0.71
			975	975									

E.3 PCSWMM Methodology

PCSWMM Methodology

The use of PCSWMM for modeling of the site hydrology and hydraulics allows for an analysis of the systems response during various design storm events. It also allows for the analysis to use a dual conduit system to represent the minor and major drainage systems, with 1) closed circular and rectangular conduits representing the sewers; 2) irregular conduits using street-shaped cross-sections (as transects) to represent the saw-toothed overland road network from high-point to low-point; 3) storage or junction nodes representing maintenance holes (MH), catch basins (CB), connections between the road conduits, and internal storage conditions within site blocks where separate runoff storage control is required..

The dual conduit systems are connected via orifice or outlet objects (which represent Inlet control devices) from CB to MH. Subcatchments, defining the contributing surface runoff to the drainage system, are linked to the storage node representing the CB to direct runoff hydrographs to the minor system. The following figure offers a schematic representation of a typical dual drainage analysis configuration in PCSWMM.

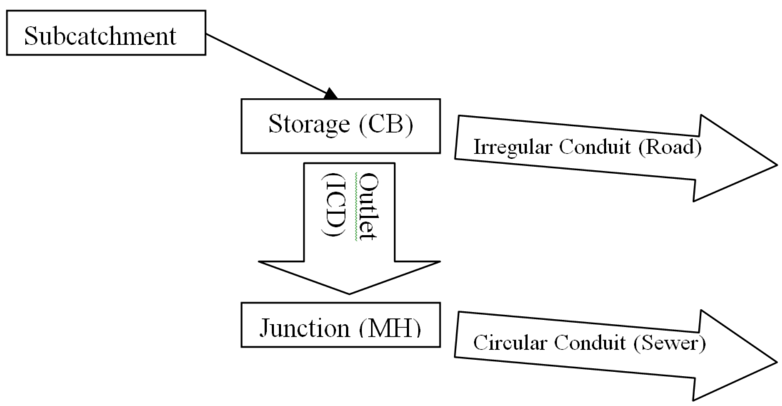


Figure: Schematic Representing PCSWMM Object Roles

The following describes the general conditions typically applied for each of the primary model inputs. Where non-typical conditions are needed, additional detail is provided with the project specific PCSWMM input information provided.

<u>Design Storms</u>

The typical storm distributions, as described by the City of Ottawa Sewer Design Guidelines (OSDG), are assessed: 3-hour Chicago Storm distribution for the 2, 5, and 100-year return periods, the 24-hour SCS Storm distribution for the 100-year return period.

To ‘stress test’ the system a ‘climate change’ scenario is created by adding 20% of the individual intensity values of the 100-year Chicago design storm event at each specified time step.

Subcatchments

General parameters are applied to each subcatchment based on the OSDG. These include parameters for the infiltration method and associated values, Manning's 'n' for pervious and impervious surfaces, and depression storage values for pervious and impervious surface.

The following summarizes the general subcatchment parameters applied to PCSWM analyses.

Parameter	Value
Infiltration Method	Horton
Max. Infiltration Rate (mm/hr)	76.2
Min. Infiltration Rate (mm/hr)	13.2
Decay Constant (1/hr)	4.14
Drying Time (d)	7
N Impervious	0.013
N Pervious	0.25
Dstore Imperv. (mm)	1.57
Dstore Perv. (mm)	4.67
Zero Imperv. (%)	0

Subcatchment areas are defined from high-point to high-point where sags occur. Subcatchment width is determined by calculating 2.0 x primary flow segment length (length of overland flow path measured from high-point to high-point) for street (double-sided) catchments, 1.5 x primary flow segment length for single-loaded roads, 1.0 x primary flow segment length for single-sided catchments, or by multiplying the subcatchment area by 225 m where a street segment flow path has not otherwise been defined.

Subcatchment imperviousness is calculated based on the project conditions related to grading and anticipated finished surface treatments. Where applicable imperviousness is converted to or from the equivalent Rational Method runoff coefficient, the relationship C = (Imp. x 0.7) + 0.2 is used.

Note that recent changes in interpretation of the OSDG introduced the requirement to determine the proposed subcatchment imperviousness based on maximum zoning constraints rather than those of the builder anticipated maximum building size or based on other prevailing criteria such as minimum tree setbacks.

Subcatchment slope is applied based on the project grading condition applicable to each area defined.

Subcatchment routing is generally applied at 100% routed to the outlet assigned.

Junctions

Junctions are used to join conduits where the details of the hydraulic analysis by the model are less sensitive to potential irregularity. The use of storage nodes rather than junctions for conduit connections is generally considered to allow for a more stable hydraulic modeling condition, even with no specific storage condition applied to a storage node.

Storage Nodes – Catch Basins (Sags)

For storage nodes representing CBs, the invert elevation of the storage node represents the invert of the CB. The rim elevation used on the CB storage nodes is not directly representative of a design value. The rim elevation of the storage node is set at an elevation to allow for representation of depth of surface water over the adjacent road high point storage node to allow routing from one surface storage to the next.

The functional storage curve values are set to zero for each CB. This allows the storage at each road sag supported by the CB to be represented by the transect defined for the roadway cross-section.

Where additional detail is needed to define a storage condition at a road sag or other low point, a tabular storage condition with a defined storage curve may be used. A tabular storage curve is defined by a depth and corresponding surface area that is derived from the associated design condition.

Storage Nodes – Road High Points

The invert elevation of the storage node used to represent a road high point is set based on the design spill elevation at the curb line. The rim elevation is set at a fixed distance above the invert elevation (typically 0.5 m) to allow for representation of depth of surface water over the storage node to allow routing from one surface storage to the next. The volume stored within the road sags then includes the total static volume and the ponded depth above the node representing the dynamic flow depth.

The functional storage curve values are set to zero for each high point nodes to disable storage being considered at the high points. In this manner, storage accumulates according to the actual ponding depths, from sag elevation to high point elevation. Runoff exceeding the sag storage available in the roadway (transect) will spill at the associated high/spill point into the next sag and continue routing through the system until ultimately flows either re-enter the minor system or reach the outfall of the major system.

Storage Nodes – Maintenance Holes

The invert and rim elevations for the MH storage nodes represent the design elevations. The functional storage curve values for the ‘coefficient’ and ‘exponent’ are set to zero. The functional storage curve value for the ‘constant’ is set to 1.13 m^2 to represent the volume available within a typical MH.

Where ‘Fixed’ outfall conditions are applied based on anticipated downstream water levels in a storm sewer system, ‘Initial Depth’ values may be applied. The ‘Initial Depth’ value is set to match the static downstream water level elevation at the applicable outfall.

Storage Nodes – Site Storage and Stormwater Management Facilities

Where additional detail is needed to define a storage condition within an existing or proposed adjacent development, site plan area, open space, stormwater management facility, or any other relevant storage feature, a tabular storage condition with a defined storage curve is used. A tabular storage curve is defined by a depth and corresponding surface area that is derived from the associated design condition or set based on a generic condition.

The use of tabular storage curves generally allows storage volumes to be defined for the applicable subcatchment area draining to the associated storage feature.

Conduit – Storm Sewer (Minor System)

Conduit parameters for the storm sewer system are set from the design conditions. The roughness is set based on the Manning's n conditions defined by the OSDG. Hydraulic loss through the minor system under surcharge conditions is represented by assigning an 'Exit Loss Coefficient' value to each applicable conduit. The loss coefficients applied are assigned based on the deflection angle between the upstream and downstream segments. Based on Appendix 6-B of the OSDG, assuming no flow deflector in the MH, the following typical values are used.

Deflection Angle	Value
0	0.022
15	0.094
45	0.384
90	1.344

Conduit – Roads (Major System)

Conduit parameters for the road segments are set from the design conditions. The roughness is set based on the Manning's n conditions defined by the OSDG. There are no hydraulic losses considered.

The conduit cross-section is defined with an irregular condition. The transect applied is based on the cross-section of the associated road type and width (i.e., residential, collector, etc.).

Orifice and Outlet

To maintain target inflow rates to the storm sewer, CB inflow is restricted with inlet-control devices (ICDs). ICDs as represented by orifice and/or outlet links with a user-specified diameter and discharge coefficient or functional head relationship taken from manufacturer's specifications for the chosen ICD model. Orifice sizes are chosen as needed at each CB to achieve the desired design objectives.

All orifices are generally assigned as Type = 'Side', Cross-Section = 'Circular', and with a discharge coefficient of 0.572 to correspond to manufacturer supplied discharge curves for IPEX Tempest HF/MHF models. The value for a flap gate is set to 'No'. Invert elevations are set to correspond to the invert of the associated CB elevation.

The height of the orifice is also set to correspond to the IPEX Tempest HF/MHF models. The following orifice size/heights are the most common.

Typical Orifice Height (m)
0.083
0.095
0.102
0.108
0.127
0.152
0.178

Where additional detail is needed to define a controlled flow condition (e.g., to define an outflow condition from an existing or proposed adjacent development, site plan area, open space, stormwater management facility, or any other relevant feature), an outlet with an associated rating curve may be used. An outlet rating curve is defined by a head and corresponding outflow that is derived from the associated design condition or set based on a desired condition.

The use of outlets with rating curves is generally paired with tabular storage curves and allows for defined flow limits to be applied either as inputs to the minor system or as outflow from a storm pond.

<u>Outfall</u>

Outfalls are used to define the end of a series of conduit segments representing either the storm sewer (minor) or roadway (major) systems. Invert and rim elevations are generally set to represent the design condition. The type of outfall is generally set to 'Free' for major system outlets.

For minor system outlets the type of outfall is set to correspond with the anticipated condition at the system end point considered. A 'Fixed' outfall type is often used where a downstream water level will influence the hydraulic grade line (HGL) within the storm sewer system. The applicable downstream water elevation is assigned with the 'Fixed' outfall condition. A 'Fixed' outfall condition maintains a static water level through the dynamic model analysis.

E.4 Project Specific PCSWMM Data

he following tables summarize the input parameters for subcatchments, storage nodes, orifice, and outlets applied to the PCSWMM analysis.

Subcatchment Parameters

Name	Outlet	Area (ha)	Width (m)	Slope (%)	Imperviousness (%)
C101A	SU-B	1.55	348.8	1.5	85.7
C101B	STM101	0.53	520	1.5	71.4
C102A	SU-A	1.54	346.5	1.5	85.7
PARK	SU-P	0.63	141.8	1.5	28.6
C201A	STM201	0.53	460	1.5	71.4
C201B	SU-C	0.61	137.3	1.5	85.7
C201C	SU-D	0.78	175.5	1.5	85.7
PRE3A	STM100	0.23	170	1.5	50
PRE3B	STM100	0.16	110	1.5	35

Storage Node Parameters

Name	Invert (m)	Rim (m)	Depth (m)	Storage Curve	Curve Name
EC-in	48.36	51.00	2.64	FUNCTIONAL	*
HW2	48.85	51.00	2.15	FUNCTIONAL	*
STM100	47.12	50.53	3.41	FUNCTIONAL	*
STM101	48.92	53.38	4.46	FUNCTIONAL	*
STM200	48.94	50.91	1.97	FUNCTIONAL	*
STM201	50.43	53.60	3.17	FUNCTIONAL	*
SU-A	49.30	51.90	2.60	TABULAR	SiteStorage
SU-B	49.60	52.20	2.60	TABULAR	SiteStorage
SU-P	49.60	52.20	2.60	TABULAR	SiteStorage
SU-C	51.20	53.80	2.60	TABULAR	SiteStorage
SU-D	51.20	53.80	2.60	TABULAR	SiteStorage

Stroage Curves

Name	Head	Outflow (m^3/s)
SiteStorage	0.0	1
	1.29	1
	1.6	1000
	2.6	1000

Orifice Parameters **(None Used)**

Name	Inlet	Outlet	Inlet Elev. (m)	Type	Diameter (m)

Outlet Parameters

Name	Inlet	Outlet	Inlet Elev. (m)	Curve Type	Curve Name
SU-A_STM100	SU-A	STM100	49.3	TABULAR/DEPTH	BLKA-out
SU-B_STM101	SU-B	STM101	49.6	TABULAR/DEPTH	BLKB-out
SU-C_STM201	SU-C	STM201	51.2	TABULAR/DEPTH	BLKC-out
SU-D_STM201	SU-D	STM201	51.2	TABULAR/DEPTH	BLKD-out
SU-P_STM101	SU-P	STM101	49.6	TABULAR/DEPTH	BLKP-out

Rating Curves

Name	Head	Outflow (m^3/s)
BLKA-out	0.0	0.000
	1.3	0.357
	1.6	0.357
	2.6	0.357
BLKB-out	0.0	0.000
	1.3	0.360
	1.6	0.360
	2.6	0.360
BLKP-out	0.0	0.000
	1.3	0.077
	1.6	0.077
	2.6	0.077
BLKC-out	0.0	0.000
	1.3	0.141
	1.6	0.141
	2.6	0.141
BLKD-out	0.0	0.000
	1.3	0.181
	1.6	0.181
	2.6	0.181

```
[TITLE]
;;Project Title/Notes
Pertries III
Post-Development
Functional Servicing
March 2025 - Version 0-3
All flow to Ottawa River, west culvert replacement
************************************************
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[OPTIONS]
;;Option             Value
FLOW_UNITS           CMS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           6/30/2023
START_TIME           00:00:00
REPORT_START_DATE    6/30/2023
REPORT_START_TIME    00:00:00
END_DATE             7/1/2023
END_TIME             00:00:00
SWEEP_START          1/1
SWEEP_END            12/31
```

```
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         5
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
August4_1988     INTENSITY 0:05     1.0      TIMESERIES August4_1988
August8_1996     INTENSITY 0:05     1.0      TIMESERIES August8_1996
Chicago_100yr_3h INTENSITY 0:10     1.0      TIMESERIES Chicago_100yr_3h
Chicago_100yr_6h INTENSITY 0:10     1.0      TIMESERIES Chicago_100yr_6h
Chicago_100yr+20%_3h INTENSITY 0:10     1.0      TIMESERIES Chicago_100yr+20%_3h
Chicago_2yr_3h   INTENSITY 0:10     1.0      TIMESERIES Chicago_2yr_3h
Chicago_5yr_3h   INTENSITY 0:10     1.0      TIMESERIES Chicago_5yr_3h
July1_1979       INTENSITY 0:05     1.0      TIMESERIES July1_1979
SCS_Type_II_100yr-24hr_103.2mm INTENSITY 1:00     1.0      TIMESERIES SCS_Type_II_100yr-24hr_103.2mm
```

```
[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- --------
----------------
C101A            Chicago_100yr_3h SU-B             1.55     85.714   348.8    1.5      0
C101B            Chicago_100yr_3h STM101           0.53     71.429   520      1.5      0
C102A            Chicago_100yr_3h SU-A             1.54     85.714   346.5    1.5      0
C201A            Chicago_100yr_3h STM201           0.53     71.429   460      1.5      0
C201B            Chicago_100yr_3h SU-C             0.61     85.714   137.3    1.5      0
C201C            Chicago_100yr_3h SU-D             0.78     85.714   175.5    1.5      0
;0.40
PARK             Chicago_100yr_3h SU-P             0.63     28.571   141.8    1.5      0
Pre3A            Chicago_100yr_3h STM100           0.23     50       170      1.5      0
Pre3B            Chicago_100yr_3h STM100           0.16     35       110      1.5      0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
C101A            0.013      0.25       1.57       4.67       0          OUTLET
C101B            0.013      0.25       1.57       4.67       0          OUTLET
C102A            0.013      0.25       1.57       4.67       0          OUTLET
C201A            0.013      0.25       1.57       4.67       0          OUTLET
C201B            0.013      0.25       1.57       4.67       0          OUTLET
C201C            0.013      0.25       1.57       4.67       0          OUTLET
PARK             0.013      0.25       1.57       4.67       0          OUTLET
Pre3A            0.013      0.25       1.57       4.67       0          OUTLET
Pre3B            0.013      0.25       1.57       4.67       0          OUTLET

[INFILTRATION]
```

```
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
C101A            76.2       13.2       4.14       7          0
C101B            76.2       13.2       4.14       7          0
C102A            76.2       13.2       4.14       7          0
C201A            76.2       13.2       4.14       7          0
C201B            76.2       13.2       4.14       7          0
C201C            76.2       13.2       4.14       7          0
PARK             76.2       13.2       4.14       7          0
Pre3A            76.2       13.2       4.14       7          0
Pre3B            76.2       13.2       4.14       7          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
EC-out           47.33      FREE                        NO
HW1              47         FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            SurDepth Fevap
Psi      Ksat     IMD
;;-------------- -------- ---------- ----------- ---------- ---------------------------- -------- --------
-------- -------- --------
EC-in            48.36    2.64       0          FUNCTIONAL 0         0         1        0        0
HW2              48.85    2.15       0          FUNCTIONAL 0         0         1        0        0
STM100           47.12    3.41       0          FUNCTIONAL 0         0         1.13     0        0
STM101           48.92    4.46       0          FUNCTIONAL 0         0         1.13     0        0
STM200           48.94    1.97       0          FUNCTIONAL 0         0         1.13     0        0
STM201           50.43    3.17       0          FUNCTIONAL 0         0         1.13     0        0
SU-A             49.3     2.6        0          TABULAR    SiteStorage                  0        0
SU-B             49.6     2.6        0          TABULAR    SiteStorage                  0        0
SU-C             51.2     2.6        0          TABULAR    SiteStorage                  0        0
SU-D             51.2     2.6        0          TABULAR    SiteStorage                  0        0
SU-P             49.6     2.6        0          TABULAR    SiteStorage                  0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow
MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ----------
```

```
----------
100-HW1(C-STRM)  STM100           HW1              60.192     0.013      47.12      47         0          0

101-100_(C-STRM) STM101           STM100           235.2      0.013      49.07      47.42      0          0

200-HW2_(C-STRM) STM200           HW2              18.885     0.013      48.94      48.85      0          0

201-200_(C-STRM) STM201           STM200           229.9      0.013      50.63      49.02      0          0

EastCulvert      EC-in            EC-out           29.172     0.024      48.36      47.33      0          0

EastDitch        HW2              EC-in            20.427     0.035      48.85      48.36      0          0


[OUTLETS]
;;Name           From Node        To Node          Offset     Type             QTable/Qcoeff    Qexpon
Gated
;;-------------- ---------------- ---------------- ---------- ---------------- ---------------- ----------
--------
SU-A_STM100      SU-A             STM100           49.3       TABULAR/DEPTH    BLKA-out
NO
SU-B_STM101      SU-B             STM101           49.6       TABULAR/DEPTH    BLKB-out
NO
SU-C_STM201      SU-C             STM201           51.2       TABULAR/DEPTH    BLKC-out
NO
SU-D_STM201      SU-D             STM201           51.2       TABULAR/DEPTH    BLKD-out
NO
SU-P_STM101      SU-P             STM101           49.6       TABULAR/DEPTH    BLKP-out
NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
100-HW1(C-STRM)  CIRCULAR     0.975            0          0          0          1
101-100_(C-STRM) CIRCULAR     0.675            0          0          0          1
200-HW2_(C-STRM) CIRCULAR     0.675            0          0          0          1
201-200_(C-STRM) CIRCULAR     0.6              0          0          0          1
EastCulvert      CIRCULAR     0.6              0          0          0          1          6
EastDitch        TRAPEZOIDAL  2.7              2          4          4          1
```

```
[TRANSECTS]
;;Transect Data in HEC-2 format
;
NC 0.025    0.025    0.013
X1 18mROW            7        4.75     13.25    0.0      0.0      0.0      0.0      0.0
GR 0.3      0        0.15     4.75     0        4.75     0.13     9        0        13.25
GR 0.15     13.25    0.3      18
;
NC 0.025    0.025    0.013
X1 24mROW            7        6.75     17.5     0.0      0.0      0.0      0.0      0.0
GR 0.38     0        0.19     6.75     0        6.75     0.17     12       0        17.5
GR 0.19     17.5     0.38     24

[LOSSES]
;;Link           Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------
101-100_(C-STRM) 0          0.384      0          NO         0
201-200_(C-STRM) 0          1.344      0          NO         0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
;Allowable flow out of Block A based on 5-yr flow rate
BLKA-out         Rating     0          0
BLKA-out                    1.3        0.357
BLKA-out                    1.6        0.357
BLKA-out                    2.6        0.357

;Allowable flow out of Block B based on 5-yr flow rate
BLKB-out         Rating     0          0
BLKB-out                    1.3        0.36
BLKB-out                    1.6        0.36
BLKB-out                    2.6        0.36

;Allowable flow out of Block C based on 5-yr flow rate
BLKC-out         Rating     0          0
BLKC-out                    1.3        0.141
BLKC-out                    1.6        0.141
```

```
BLKC-out                    2.6        0.141

;Allowable flow out of Block D based on 5-yr flow rate
BLKD-out         Rating     0          0
BLKD-out                    1.3        0.181
BLKD-out                    1.6        0.181
BLKD-out                    2.6        0.181

;Allowable flow out of Park based on 5-yr flow rate
BLKP-out         Rating     0          0
BLKP-out                    1.3        0.077
BLKP-out                    1.6        0.077
BLKP-out                    2.6        0.077

;Generic Site Storage
SiteStorage      Storage    0          1
SiteStorage                 1.29       1
SiteStorage                 1.3        1000
SiteStorage                 2.6        1000

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
August4_1988                0:00       0
August4_1988                0:05       0.1
August4_1988                0:10       0.1
August4_1988                0:15       0
August4_1988                0:20       3.7
August4_1988                0:25       6.2
August4_1988                0:30       101.5
August4_1988                0:35       15.5
August4_1988                0:40       29.3
August4_1988                0:45       19.8
August4_1988                0:50       1.5
August4_1988                0:55       1.7
August4_1988                1:00       5.4
August4_1988                1:05       24.6
August4_1988                1:10       26.5
August4_1988                1:15       34.9
```

```
August4_1988                1:20       10.2
August4_1988                1:25       27.1
August4_1988                1:30       104.4
August4_1988                1:35       27.5
August4_1988                1:40       62.5
August4_1988                1:45       31.8
August4_1988                1:50       79.8
August4_1988                1:55       67.5
August4_1988                2:00       156.2
August4_1988                2:05       5.1
August4_1988                2:10       0.2
August4_1988                2:15       0.2
August4_1988                2:20       0.2
August4_1988                2:25       0.2
August4_1988                2:30       0.2
August4_1988                2:35       0.2
August4_1988                2:40       0.2
August4_1988                2:45       0.2
August4_1988                2:50       0.2
August4_1988                2:55       0.2
August4_1988                3:00       12.8
August4_1988                3:05       14
August4_1988                3:10       22.2
August4_1988                3:15       21.8
August4_1988                3:20       1.4
August4_1988                3:25       0.2
August4_1988                3:30       0.2
August4_1988                3:35       0.2
August4_1988                3:40       0.2
August4_1988                3:45       0.2
August4_1988                3:50       0.2
August4_1988                3:55       0.2
August4_1988                4:00       0.2
August4_1988                4:05       0.2
August4_1988                4:10       0.2
August4_1988                4:15       0.2
August4_1988                4:20       0.2
August4_1988                4:25       0.2
August4_1988                4:30       0.2
```

August4_1988	4:35	0.2
August4_1988	4:40	0.2
August4_1988	4:45	0.2
August4_1988	4:50	0.2
August4_1988	4:55	0.2
August4_1988	5:00	2.9
August4_1988	5:05	7.8
August4_1988	5:10	10
August4_1988	5:15	6.3
August4_1988	5:20	5.1
August4_1988	5:25	9.8
August4_1988	5:30	2.6
August4_1988	5:35	1.7

August8_1996	0:00	4
August8_1996	0:05	11.9
August8_1996	0:10	26.5
August8_1996	0:15	13.3
August8_1996	0:20	0
August8_1996	0:25	2.7
August8_1996	0:30	0
August8_1996	0:35	8
August8_1996	0:40	18.6
August8_1996	0:45	10.6
August8_1996	0:50	21.2
August8_1996	0:55	2.7
August8_1996	1:00	2.7
August8_1996	1:05	15.9
August8_1996	1:10	66.3
August8_1996	1:15	55.7
August8_1996	1:20	122
August8_1996	1:25	88.9
August8_1996	1:30	9.63
August8_1996	1:35	8
August8_1996	1:40	4
August8_1996	1:45	0
August8_1996	1:50	2.7
August8_1996	1:55	0
August8_1996	2:00	0

August8_1996	2:05	0
August8_1996	2:10	5.3
August8_1996	2:15	0
August8_1996	2:20	0
August8_1996	2:25	0
August8_1996	2:30	0
August8_1996	2:35	0
August8_1996	2:40	0
August8_1996	2:45	4
August8_1996	2:50	53.1
August8_1996	2:55	69
August8_1996	3:00	63.7
August8_1996	3:05	58.4
August8_1996	3:10	47.8
August8_1996	3:15	15.9
August8_1996	3:20	13.3
August8_1996	3:25	8
August8_1996	3:30	5.3
August8_1996	3:35	6.6
August8_1996	3:40	2.7
August8_1996	3:45	4
August8_1996	3:50	2.7
August8_1996	3:55	4
August8_1996	4:00	2.7
August8_1996	4:05	5.3
August8_1996	4:10	4
August8_1996	4:15	2.7
August8_1996	4:20	4
August8_1996	4:25	2.7
August8_1996	4:30	1.3
August8_1996	4:35	1.3
August8_1996	4:40	0
August8_1996	4:45	0
August8_1996	4:50	0
August8_1996	4:55	0
August8_1996	5:00	2.7
August8_1996	5:05	0
August8_1996	5:10	0
August8_1996	5:15	0

August8_1996	5:20	0
August8_1996	5:25	0
August8_1996	5:30	0
August8_1996	5:35	0
August8_1996	5:40	1.3

Chicago_100yr_3h	0:00	0
Chicago_100yr_3h	0:10	6.05
Chicago_100yr_3h	0:20	7.54
Chicago_100yr_3h	0:30	10.16
Chicago_100yr_3h	0:40	15.97
Chicago_100yr_3h	0:50	40.65
Chicago_100yr_3h	1:00	178.56
Chicago_100yr_3h	1:10	54.05
Chicago_100yr_3h	1:20	27.32
Chicago_100yr_3h	1:30	18.24
Chicago_100yr_3h	1:40	13.74
Chicago_100yr_3h	1:50	11.06
Chicago_100yr_3h	2:00	9.29
Chicago_100yr_3h	2:10	8.02
Chicago_100yr_3h	2:20	7.08
Chicago_100yr_3h	2:30	6.35
Chicago_100yr_3h	2:40	5.76
Chicago_100yr_3h	2:50	5.28
Chicago_100yr_3h	3:00	4.88

Chicago_100yr_6h	0:10	2.91
Chicago_100yr_6h	0:20	3.17
Chicago_100yr_6h	0:30	3.48
Chicago_100yr_6h	0:40	3.88
Chicago_100yr_6h	0:50	4.39
Chicago_100yr_6h	1:00	5.08
Chicago_100yr_6h	1:10	6.05
Chicago_100yr_6h	1:20	7.55
Chicago_100yr_6h	1:30	10.17
Chicago_100yr_6h	1:40	15.98
Chicago_100yr_6h	1:50	40.67
Chicago_100yr_6h	2:00	178.56
Chicago_100yr_6h	2:10	54.04
Chicago_100yr_6h	2:20	27.31
Chicago_100yr_6h	2:30	18.23
Chicago_100yr_6h	2:40	13.73
Chicago_100yr_6h	2:50	11.05
Chicago_100yr_6h	3:00	9.28
Chicago_100yr_6h	3:10	8.02
Chicago_100yr_6h	3:20	7.08
Chicago_100yr_6h	3:30	6.34
Chicago_100yr_6h	3:40	5.76
Chicago_100yr_6h	3:50	5.28
Chicago_100yr_6h	4:00	4.88
Chicago_100yr_6h	4:10	4.54
Chicago_100yr_6h	4:20	4.25
Chicago_100yr_6h	4:30	3.99
Chicago_100yr_6h	4:40	3.77
Chicago_100yr_6h	4:50	3.57
Chicago_100yr_6h	5:00	3.4
Chicago_100yr_6h	5:10	3.24
Chicago_100yr_6h	5:20	3.1
Chicago_100yr_6h	5:30	2.97
Chicago_100yr_6h	5:40	2.85
Chicago_100yr_6h	5:50	2.74
Chicago_100yr_6h	6:00	2.64

Chicago_100yr+20%_3h	0:00	0
Chicago_100yr+20%_3h	0:10	7.26
Chicago_100yr+20%_3h	0:20	9.048
Chicago_100yr+20%_3h	0:30	12.192
Chicago_100yr+20%_3h	0:40	19.164
Chicago_100yr+20%_3h	0:50	48.78
Chicago_100yr+20%_3h	1:00	214.272
Chicago_100yr+20%_3h	1:10	64.86
Chicago_100yr+20%_3h	1:20	32.784
Chicago_100yr+20%_3h	1:30	21.888
Chicago_100yr+20%_3h	1:40	16.488
Chicago_100yr+20%_3h	1:50	13.272
Chicago_100yr+20%_3h	2:00	11.148
Chicago_100yr+20%_3h	2:10	9.624
Chicago_100yr+20%_3h	2:20	8.496

Chicago_100yr+20%_3h	2:30	7.62
Chicago_100yr+20%_3h	2:40	6.912
Chicago_100yr+20%_3h	2:50	6.336
Chicago_100yr+20%_3h	3:00	5.856

Chicago_2yr_3h	0:00	0
Chicago_2yr_3h	0:10	2.81
Chicago_2yr_3h	0:20	3.5
Chicago_2yr_3h	0:30	4.69
Chicago_2yr_3h	0:40	7.3
Chicago_2yr_3h	0:50	18.21
Chicago_2yr_3h	1:00	76.81
Chicago_2yr_3h	1:10	24.08
Chicago_2yr_3h	1:20	12.36
Chicago_2yr_3h	1:30	8.32
Chicago_2yr_3h	1:40	6.3
Chicago_2yr_3h	1:50	5.09
Chicago_2yr_3h	2:00	4.29
Chicago_2yr_3h	2:10	3.72
Chicago_2yr_3h	2:20	3.29
Chicago_2yr_3h	2:30	2.95
Chicago_2yr_3h	2:40	2.68
Chicago_2yr_3h	2:50	2.46
Chicago_2yr_3h	3:00	2.28

Chicago_5yr_3h	0:00	0
Chicago_5yr_3h	0:10	3.68
Chicago_5yr_3h	0:20	4.58
Chicago_5yr_3h	0:30	6.15
Chicago_5yr_3h	0:40	9.61
Chicago_5yr_3h	0:50	24.17
Chicago_5yr_3h	1:00	104.19
Chicago_5yr_3h	1:10	32.04
Chicago_5yr_3h	1:20	16.34
Chicago_5yr_3h	1:30	10.96
Chicago_5yr_3h	1:40	8.29
Chicago_5yr_3h	1:50	6.69
Chicago_5yr_3h	2:00	5.63
Chicago_5yr_3h	2:10	4.87
Chicago_5yr_3h	2:20	4.3
Chicago_5yr_3h	2:30	3.86
Chicago_5yr_3h	2:40	3.51
Chicago_5yr_3h	2:50	3.22
Chicago_5yr_3h	3:00	2.98

July1_1979	0:00	0
July1_1979	0:05	2.3
July1_1979	0:10	2.3
July1_1979	0:15	8.89
July1_1979	0:20	8.89
July1_1979	0:25	8.89
July1_1979	0:30	8.89
July1_1979	0:35	38.1
July1_1979	0:40	38.1
July1_1979	0:45	38.1
July1_1979	0:50	38.1
July1_1979	0:55	38.1
July1_1979	1:00	38.1
July1_1979	1:05	38.1
July1_1979	1:10	50.8
July1_1979	1:15	50.8
July1_1979	1:20	76.2
July1_1979	1:25	106.7
July1_1979	1:30	106.7
July1_1979	1:35	71.1
July1_1979	1:40	71.1
July1_1979	1:45	30.5
July1_1979	1:50	30.5
July1_1979	1:55	30.5
July1_1979	2:00	30.5
July1_1979	2:05	3.8
July1_1979	2:10	3.8
July1_1979	2:15	3.8
July1_1979	2:20	3.8
July1_1979	2:25	3.8
July1_1979	2:30	3.8
July1_1979	2:35	3.8
July1_1979	2:40	3.8

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July1_1979                 2:45       3.8
July1_1979                 2:50       3.8
July1_1979                 2:55       3.8
July1_1979                 3:00       3.8

SCS_Type_II_100yr-24hr_103.2mm            0:00       0
SCS_Type_II_100yr-24hr_103.2mm            1:00       3.10
SCS_Type_II_100yr-24hr_103.2mm            2:00       1.44
SCS_Type_II_100yr-24hr_103.2mm            3:00       2.68
SCS_Type_II_100yr-24hr_103.2mm            4:00       2.68
SCS_Type_II_100yr-24hr_103.2mm            5:00       3.51
SCS_Type_II_100yr-24hr_103.2mm            6:00       3.10
SCS_Type_II_100yr-24hr_103.2mm            7:00       4.13
SCS_Type_II_100yr-24hr_103.2mm            8:00       4.13
SCS_Type_II_100yr-24hr_103.2mm            9:00       5.57
SCS_Type_II_100yr-24hr_103.2mm            10:00      7.02
SCS_Type_II_100yr-24hr_103.2mm            11:00      11.15
SCS_Type_II_100yr-24hr_103.2mm            12:00      88.34
SCS_Type_II_100yr-24hr_103.2mm            13:00      22.50
SCS_Type_II_100yr-24hr_103.2mm            14:00      9.91
SCS_Type_II_100yr-24hr_103.2mm            15:00      6.60
SCS_Type_II_100yr-24hr_103.2mm            16:00      5.78
SCS_Type_II_100yr-24hr_103.2mm            17:00      4.54
SCS_Type_II_100yr-24hr_103.2mm            18:00      4.75
SCS_Type_II_100yr-24hr_103.2mm            19:00      3.10
SCS_Type_II_100yr-24hr_103.2mm            20:00      2.48
SCS_Type_II_100yr-24hr_103.2mm            21:00      3.51
SCS_Type_II_100yr-24hr_103.2mm            22:00      2.27
SCS_Type_II_100yr-24hr_103.2mm            23:00      2.06
SCS_Type_II_100yr-24hr_103.2mm            24:00      2.06

[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL
```

```
[TAGS]
Subcatch   C101A            Block
Subcatch   C101B            Road
Subcatch   C102A            Block
Subcatch   C201A            Road
Subcatch   C201B            Block
Subcatch   C201C            Block
Subcatch   PARK             Block
Subcatch   Pre3A            JDB
Subcatch   Pre3B            JDB
Node       EC-in            Culvert-In
Node       HW2              HW
Node       STM100           MH
Node       STM101           MH
Node       STM200           MH
Node       STM201           MH
Node       SU-A             Onsite
Node       SU-B             Onsite
Node       SU-C             Onsite
Node       SU-D             Onsite
Node       SU-P             Onsite
Link       100-HW1(C-STRM)  MinorSystem
Link       101-100_(C-STRM) MinorSystem
Link       200-HW2_(C-STRM) MinorSystem
Link       201-200_(C-STRM) MinorSystem
Link       EastCulvert      Culvert
Link       EastDitch        Ditch

[MAP]
DIMENSIONS       383597.2846      5039718.6057     384026.5574      5040079.5883
UNITS            Meters

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
EC-out           383855.668         5040063.18
HW1              383689.493         5040001.255
EC-in            383877.306         5040043.615
HW2              383858.016         5040036.897
```

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STM100           383747.401         5039984.837
STM101           383867.743         5039807.863
STM200           383841.722         5040027.35
STM201           383924.547         5039842.819
SU-A             383726.589         5039910.78
SU-B             383813.207         5039955.248
SU-C             383884.726         5040017.619
SU-D             383939.727         5039805.127
SU-P             383803.353         5039844.379

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[POLYGONS]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
C101A            383775.18          5040001.271
C101A            383773.978         5040003.744
C101A            383776.25          5040004.842
C101A            383778.527         5040005.93
C101A            383780.808         5040007.009
C101A            383783.093         5040008.078
C101A            383785.384         5040009.137
C101A            383787.678         5040010.186
C101A            383789.977         5040011.226
C101A            383792.281         5040012.256
C101A            383794.589         5040013.276
C101A            383796.901         5040014.286
C101A            383799.217         5040015.287
C101A            383801.538         5040016.277
C101A            383803.863         5040017.258
C101A            383806.192         5040018.229
C101A            383808.525         5040019.19
C101A            383810.862         5040020.141
C101A            383813.203         5040021.082
C101A            383815.548         5040022.014
C101A            383817.897         5040022.935
C101A            383820.25          5040023.846
C101A            383822.607         5040024.748
C101A            383824.968         5040025.639
C101A            383824.968         5040025.639
C101A            383833.053         5040022.245
C101A            383854.934         5039973.494
C101A            383865.99          5039948.862
C101A            383914.145         5039841.573
C101A            383914.199         5039841.441
C101A            383914.243         5039841.305
C101A            383914.278         5039841.166
C101A            383914.302         5039841.026
C101A            383914.317         5039840.884
C101A            383914.321         5039840.741
C101A            383914.315         5039840.598
C101A            383914.298         5039840.457
C101A            383914.272         5039840.316
C101A            383914.236         5039840.178
C101A            383914.19          5039840.043
C101A            383914.135         5039839.911
C101A            383914.07          5039839.784
C101A            383913.996         5039839.662
C101A            383913.914         5039839.545
C101A            383913.824         5039839.435
C101A            383913.726         5039839.331
C101A            383913.621         5039839.234
C101A            383913.509         5039839.145
C101A            383913.391         5039839.065
C101A            383913.268         5039838.993
C101A            383913.14          5039838.929
C101A            383913.14          5039838.929
C101A            383872.968         5039820.899
C101A            383870.496         5039821.599
C101A            383870.496         5039821.599
C101A            383787.774         5039943.249
C101A            383758.603         5039986.146
C101A            383760.538         5039993.905
C101A            383761.199         5039994.249
C101A            383761.86          5039994.592
C101A            383762.522         5039994.933
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C101A	383763.185	5039995.275
C101A	383763.848	5039995.615
C101A	383764.511	5039995.954
C101A	383765.174	5039996.293
C101A	383765.839	5039996.631
C101A	383766.503	5039996.967
C101A	383767.168	5039997.304
C101A	383767.833	5039997.639
C101A	383768.499	5039997.973
C101A	383769.165	5039998.307
C101A	383769.832	5039998.639
C101A	383770.499	5039998.971
C101A	383771.167	5039999.302
C101A	383771.834	5039999.633
C101A	383772.503	5039999.962
C101A	383773.171	5040000.29
C101A	383773.841	5040000.618
C101A	383774.51	5040000.945
C101A	383775.18	5040001.271
C101A	383775.18	5040001.271
C101A	383775.18	5040001.271
C101B	383741.048	5039976.396
C101B	383732.494	5039978.329
C101B	383733.751	5039979.07
C101B	383735.009	5039979.808
C101B	383736.268	5039980.542
C101B	383737.53	5039981.274
C101B	383738.793	5039982.002
C101B	383740.058	5039982.727
C101B	383741.325	5039983.45
C101B	383742.594	5039984.169
C101B	383743.864	5039984.885
C101B	383745.137	5039985.597
C101B	383746.411	5039986.307
C101B	383747.686	5039987.014
C101B	383748.964	5039987.717
C101B	383750.243	5039988.417
C101B	383751.524	5039989.114
C101B	383752.807	5039989.808

C101B	383754.091	5039990.499
C101B	383755.377	5039991.187
C101B	383756.665	5039991.871
C101B	383757.954	5039992.552
C101B	383759.245	5039993.23
C101B	383760.538	5039993.905
C101B	383760.538	5039993.905
C101B	383758.603	5039986.146
C101B	383787.774	5039943.249
C101B	383870.496	5039821.599
C101B	383872.968	5039820.899
C101B	383872.968	5039820.899
C101B	383913.14	5039838.929
C101B	383917.235	5039829.806
C101B	383921.329	5039820.683
C101B	383864.329	5039795.099
C101B	383800.951	5039888.304
C101B	383777.896	5039922.208
C101B	383772.273	5039930.477
C101B	383741.048	5039976.396
C101B	383741.048	5039976.396
C102A	383657.209	5039835.787
C102A	383623.47	5039885.402
C102A	383616.797	5039894.999
C102A	383636.087	5039911.308
C102A	383649.818	5039922.918
C102A	383651.264	5039924.137
C102A	383652.714	5039925.351
C102A	383654.167	5039926.56
C102A	383655.625	5039927.765
C102A	383657.086	5039928.965
C102A	383658.551	5039930.161
C102A	383660.02	5039931.352
C102A	383661.493	5039932.538
C102A	383662.969	5039933.719
C102A	383664.449	5039934.896
C102A	383665.933	5039936.068
C102A	383667.421	5039937.235
C102A	383668.912	5039938.398

C102A	383670.407	5039939.556
C102A	383671.906	5039940.709
C102A	383673.408	5039941.857
C102A	383674.914	5039943.001
C102A	383676.424	5039944.139
C102A	383677.937	5039945.273
C102A	383679.454	5039946.402
C102A	383680.974	5039947.527
C102A	383682.498	5039948.646
C102A	383682.498	5039948.646
C102A	383684.278	5039946.541
C102A	383686.401	5039948.087
C102A	383688.531	5039949.624
C102A	383690.667	5039951.151
C102A	383692.81	5039952.668
C102A	383694.96	5039954.176
C102A	383697.117	5039955.675
C102A	383699.28	5039957.164
C102A	383701.45	5039958.643
C102A	383703.626	5039960.113
C102A	383705.809	5039961.573
C102A	383707.999	5039963.023
C102A	383710.194	5039964.464
C102A	383712.396	5039965.895
C102A	383714.605	5039967.316
C102A	383716.819	5039968.727
C102A	383719.04	5039970.128
C102A	383721.268	5039971.52
C102A	383723.501	5039972.902
C102A	383725.74	5039974.273
C102A	383727.986	5039975.635
C102A	383730.237	5039976.987
C102A	383732.494	5039978.329
C102A	383732.494	5039978.329
C102A	383741.048	5039976.396
C102A	383772.273	5039930.477
C102A	383777.896	5039922.208
C102A	383800.951	5039888.304
C102A	383719.134	5039832.668
C102A	383716.643	5039839.323
C102A	383693.455	5039851.614
C102A	383677.882	5039849.845
C102A	383657.209	5039835.787
C102A	383657.209	5039835.787
C201A	383951.51	5039910.957
C201A	383958.19	5039896.074
C201A	383959.7	5039892.711
C201A	383920.926	5039875.308
C201A	383941.4	5039829.692
C201A	383921.329	5039820.683
C201A	383917.235	5039829.806
C201A	383913.14	5039838.929
C201A	383913.268	5039838.993
C201A	383913.391	5039839.065
C201A	383913.509	5039839.145
C201A	383913.621	5039839.234
C201A	383913.726	5039839.331
C201A	383913.824	5039839.435
C201A	383913.914	5039839.545
C201A	383913.996	5039839.662
C201A	383914.07	5039839.784
C201A	383914.135	5039839.911
C201A	383914.19	5039840.043
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C201A	383914.272	5039840.316
C201A	383914.298	5039840.457
C201A	383914.315	5039840.598
C201A	383914.321	5039840.741
C201A	383914.317	5039840.884
C201A	383914.302	5039841.026
C201A	383914.278	5039841.166
C201A	383914.243	5039841.305
C201A	383914.199	5039841.441
C201A	383914.145	5039841.573
C201A	383914.145	5039841.573
C201A	383865.99	5039948.862
C201A	383854.934	5039973.494
C201A	383833.053	5040022.245

C201A	383824.968	5040025.639
C201A	383825.643	5040025.892
C201A	383826.319	5040026.144
C201A	383826.996	5040026.396
C201A	383827.672	5040026.647
C201A	383828.349	5040026.896
C201A	383829.027	5040027.146
C201A	383829.704	5040027.394
C201A	383830.382	5040027.641
C201A	383831.06	5040027.888
C201A	383831.739	5040028.133
C201A	383832.418	5040028.378
C201A	383833.097	5040028.622
C201A	383833.776	5040028.866
C201A	383834.456	5040029.108
C201A	383835.136	5040029.35
C201A	383835.816	5040029.59
C201A	383836.497	5040029.83
C201A	383837.177	5040030.069
C201A	383837.859	5040030.308
C201A	383838.54	5040030.545
C201A	383839.222	5040030.782
C201A	383839.904	5040031.017
C201A	383839.904	5040031.017
C201A	383846.655	5040033.347
C201A	383849.181	5040026.027
C201A	383858.4	5040029.208
C201A	383855.185	5040021.777
C201A	383912.736	5039893.554
C201A	383951.51	5039910.957
C201A	383951.51	5039910.957
C201B	383858.4	5040029.208
C201B	383893.065	5040041.17
C201B	383951.51	5039910.957
C201B	383912.736	5039893.554
C201B	383855.185	5040021.777
C201B	383858.4	5040029.208
C201B	383858.4	5040029.208
C201C	383959.7	5039892.711

C201C	384007.045	5039787.227
C201C	383989.813	5039792.65
C201C	383938.957	5039758.068
C201C	383931.312	5039769.348
C201C	383918.068	5039760.371
C201C	383925.748	5039749.039
C201C	383905.054	5039735.014
C201C	383866.608	5039791.737
C201C	383864.329	5039795.099
C201C	383921.329	5039820.683
C201C	383941.4	5039829.692
C201C	383920.926	5039875.308
C201C	383959.7	5039892.711
C201C	383959.7	5039892.711
PARK	383718.636	5039832.347
PARK	383801.727	5039888.86
PARK	383801.727	5039888.86
PARK	383865.114	5039795.661
PARK	383865.114	5039795.661
PARK	383853.391	5039787.662
PARK	383853.391	5039787.662
PARK	383823.255	5039798.492
PARK	383823.255	5039798.492
PARK	383800.308	5039796.367
PARK	383800.308	5039796.367
PARK	383791.109	5039813.509
PARK	383791.109	5039813.509
PARK	383773.044	5039828.293
PARK	383773.044	5039828.293
PARK	383762.582	5039822.319
PARK	383762.582	5039822.319
PARK	383727.095	5039826.562
PARK	383727.095	5039826.562
PARK	383722.536	5039825.944
PARK	383722.536	5039825.944
PARK	383718.636	5039832.347
Pre3A	383775.18	5040001.271
Pre3A	383773.978	5040003.744
Pre3A	383776.25	5040004.842

Pre3A	383778.527	5040005.93
Pre3A	383780.808	5040007.009
Pre3A	383783.093	5040008.078
Pre3A	383785.384	5040009.137
Pre3A	383787.678	5040010.186
Pre3A	383789.977	5040011.226
Pre3A	383792.281	5040012.256
Pre3A	383794.589	5040013.276
Pre3A	383796.901	5040014.286
Pre3A	383799.217	5040015.287
Pre3A	383801.538	5040016.277
Pre3A	383803.862	5040017.258
Pre3A	383806.191	5040018.229
Pre3A	383808.524	5040019.19
Pre3A	383810.862	5040020.141
Pre3A	383813.203	5040021.082
Pre3A	383815.548	5040022.014
Pre3A	383817.897	5040022.935
Pre3A	383820.25	5040023.846
Pre3A	383822.606	5040024.748
Pre3A	383824.967	5040025.639
Pre3A	383824.967	5040025.639
Pre3A	383824.968	5040025.639
Pre3A	383825.948	5040026.004
Pre3A	383826.929	5040026.367
Pre3A	383827.911	5040026.729
Pre3A	383828.893	5040027.09
Pre3A	383829.876	5040027.449
Pre3A	383830.859	5040027.807
Pre3A	383831.842	5040028.164
Pre3A	383832.827	5040028.519
Pre3A	383833.811	5040028.873
Pre3A	383834.796	5040029.225
Pre3A	383835.782	5040029.576
Pre3A	383836.768	5040029.926
Pre3A	383837.755	5040030.274
Pre3A	383838.742	5040030.621
Pre3A	383839.729	5040030.967
Pre3A	383840.717	5040031.311

Pre3A	383841.706	5040031.654
Pre3A	383842.695	5040031.995
Pre3A	383843.684	5040032.335
Pre3A	383844.674	5040032.674
Pre3A	383845.664	5040033.011
Pre3A	383846.655	5040033.347
Pre3A	383846.655	5040033.347
Pre3A	383847.386	5040031.23
Pre3A	383850.622	5040038.645
Pre3A	383847.912	5040046.468
Pre3A	383814.403	5040035.112
Pre3A	383791.865	5040026.341
Pre3A	383766.371	5040013.657
Pre3A	383725.26	5039991.905
Pre3A	383714.177	5039985.595
Pre3A	383702.288	5039977.539
Pre3A	383695.248	5039972.565
Pre3A	383700.851	5039963.12
Pre3A	383704.795	5039960.896
Pre3A	383706.033	5039961.722
Pre3A	383707.273	5039962.544
Pre3A	383708.515	5039963.363
Pre3A	383709.759	5039964.179
Pre3A	383711.005	5039964.992
Pre3A	383712.253	5039965.802
Pre3A	383713.504	5039966.609
Pre3A	383714.756	5039967.412
Pre3A	383716.01	5039968.213
Pre3A	383717.266	5039969.01
Pre3A	383718.524	5039969.804
Pre3A	383719.785	5039970.595
Pre3A	383721.047	5039971.383
Pre3A	383722.311	5039972.167
Pre3A	383723.577	5039972.949
Pre3A	383724.845	5039973.727
Pre3A	383726.115	5039974.502
Pre3A	383727.387	5039975.274
Pre3A	383728.661	5039976.042
Pre3A	383729.937	5039976.808

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Pre3A           383731.215        5039977.57
Pre3A           383732.494        5039978.329
Pre3A           383732.494        5039978.329
Pre3A           383733.751        5039979.07
Pre3A           383735.009        5039979.808
Pre3A           383736.268        5039980.542
Pre3A           383737.53         5039981.274
Pre3A           383738.793        5039982.002
Pre3A           383740.058        5039982.727
Pre3A           383741.325        5039983.45
Pre3A           383742.594        5039984.169
Pre3A           383743.864        5039984.885
Pre3A           383745.137        5039985.597
Pre3A           383746.411        5039986.307
Pre3A           383747.686        5039987.014
Pre3A           383748.964        5039987.717
Pre3A           383750.243        5039988.417
Pre3A           383751.524        5039989.114
Pre3A           383752.807        5039989.808
Pre3A           383754.091        5039990.499
Pre3A           383755.377        5039991.187
Pre3A           383756.665        5039991.871
Pre3A           383757.954        5039992.552
Pre3A           383759.245        5039993.23
Pre3A           383760.538        5039993.905
Pre3A           383760.538        5039993.905
Pre3A           383761.199        5039994.249
Pre3A           383761.86         5039994.592
Pre3A           383762.522        5039994.933
Pre3A           383763.185        5039995.275
Pre3A           383763.848        5039995.615
Pre3A           383764.511        5039995.954
Pre3A           383765.174        5039996.293
Pre3A           383765.839        5039996.631
Pre3A           383766.503        5039996.967
Pre3A           383767.168        5039997.304
Pre3A           383767.833        5039997.639
Pre3A           383768.499        5039997.973
Pre3A           383769.165        5039998.307
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Pre3A           383769.832        5039998.639
Pre3A           383770.499        5039998.971
Pre3A           383771.167        5039999.302
Pre3A           383771.834        5039999.633
Pre3A           383772.503        5039999.962
Pre3A           383773.171        5040000.29
Pre3A           383773.841        5040000.618
Pre3A           383774.51         5040000.945
Pre3A           383775.18         5040001.271
Pre3A           383775.18         5040001.271
Pre3B           383766.371        5040013.657
Pre3B           383791.865        5040026.341
Pre3B           383787.75         5040035.636
Pre3B           383760.967        5040023.855
Pre3B           383716.801        5040007.43
Pre3B           383705.808        5039999.579
Pre3B           383687.259        5039984.34
Pre3B           383695.248        5039972.565
Pre3B           383702.288        5039977.539
Pre3B           383714.177        5039985.595
Pre3B           383725.26         5039991.905
Pre3B           383766.371        5040013.657

;;Storage Node   X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
```

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

Pertries III
Post-Development
Functional Servicing

****
Element Count
****
Number of rain gages 9
Number of subcatchments ... 9
Number of nodes 13
Number of links 11
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
August4_1988	August4_1988	INTENSITY	5 min.
August8_1996	August8_1996	INTENSITY	5 min.
Chicago_100yr_3h	Chicago_100yr_3h	INTENSITY	10 min.
Chicago_100yr_6h	Chicago_100yr_6h	INTENSITY	10 min.
Chicago_100yr+20%_3h	Chicago_100yr+20%_3h	INTENSITY	10 min.
Chicago_2yr_3h	Chicago_2yr_3h	INTENSITY	10 min.
Chicago_5yr_3h	Chicago_5yr_3h	INTENSITY	10 min.
July1_1979	July1_1979	INTENSITY	5 min.
SCS_Type_II_100yr-24hr_103.2mm	SCS_Type_II_100yr-24hr_103.2mm	INTENSITY	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
C101A	1.55	348.80	85.71	1.5000	Chicago_100yr_3h	SU-B
C101B	0.53	520.00	71.43	1.5000	Chicago_100yr_3h	STM101
C102A	1.54	346.50	85.71	1.5000	Chicago_100yr_3h	SU-A
C201A	0.53	460.00	71.43	1.5000	Chicago_100yr_3h	STM201
C201B	0.61	137.30	85.71	1.5000	Chicago_100yr_3h	SU-C
C201C	0.78	175.50	85.71	1.5000	Chicago_100yr_3h	SU-D
PARK	0.63	141.80	28.57	1.5000	Chicago_100yr_3h	SU-P
Pre3A	0.23	170.00	50.00	1.5000	Chicago_100yr_3h	STM100
Pre3B	0.16	110.00	35.00	1.5000	Chicago_100yr_3h	STM100

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
EC-out	OUTFALL	47.33	0.60	0.0	
HW1	OUTFALL	47.00	0.97	0.0	
EC-in	STORAGE	48.36	2.64	0.0	
HW2	STORAGE	48.85	2.15	0.0	
STM100	STORAGE	47.12	3.41	0.0	
STM101	STORAGE	48.92	4.46	0.0	
STM200	STORAGE	48.94	1.97	0.0	
STM201	STORAGE	50.43	3.17	0.0	
SU-A	STORAGE	49.30	2.60	0.0	
SU-B	STORAGE	49.60	2.60	0.0	
SU-C	STORAGE	51.20	2.60	0.0	
SU-D	STORAGE	51.20	2.60	0.0	
SU-P	STORAGE	49.60	2.60	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness

```
-------------------------------------------------------------------------------------------
100-HW1(C-STRM)  STM100           HW1              CONDUIT          60.2    0.1994    0.0130
101-100_(C-STRM) STM101           STM100           CONDUIT         235.2    0.7015    0.0130
200-HW2_(C-STRM) STM200           HW2              CONDUIT          18.9    0.4766    0.0130
201-200_(C-STRM) STM201           STM200           CONDUIT         229.9    0.7003    0.0130
EastCulvert      EC-in            EC-out           CONDUIT          29.2    3.5330    0.0240
EastDitch        HW2              EC-in            CONDUIT          20.4    2.3995    0.0350
SU-A_STM100      SU-A             STM100           OUTLET
SU-B_STM101      SU-B             STM101           OUTLET
SU-C_STM201      SU-C             STM201           OUTLET
SU-D_STM201      SU-D             STM201           OUTLET
SU-P_STM101      SU-P             STM101           OUTLET


*********************
Cross Section Summary
*********************
                                      Full     Full     Hyd.     Max.   No. of     Full
Conduit          Shape               Depth     Area     Rad.    Width  Barrels     Flow
---------------------------------------------------------------------------------------
100-HW1(C-STRM)  CIRCULAR             0.97     0.75     0.24     0.97        1     1.00
101-100_(C-STRM) CIRCULAR             0.68     0.36     0.17     0.68        1     0.70
200-HW2_(C-STRM) CIRCULAR             0.68     0.36     0.17     0.68        1     0.58
201-200_(C-STRM) CIRCULAR             0.60     0.28     0.15     0.60        1     0.51
EastCulvert      CIRCULAR             0.60     0.28     0.15     0.60        1     0.63
EastDitch        TRAPEZOIDAL          2.70    34.56     1.42    23.60        1   193.66


****************
Transect Summary
****************

Transect 18mROW
Area:
            0.0004     0.0017     0.0039     0.0069     0.0109
            0.0156     0.0213     0.0278     0.0352     0.0434
            0.0525     0.0625     0.0734     0.0851     0.0977
            0.1112     0.1255     0.1407     0.1568     0.1737
            0.1915     0.2101     0.2290     0.2478     0.2666
            0.2858     0.3059     0.3268     0.3486     0.3712
            0.3947     0.4190     0.4441     0.4701     0.4969
            0.5245     0.5530     0.5823     0.6125     0.6435
            0.6754     0.7081     0.7416     0.7760     0.8113
            0.8473     0.8842     0.9220     0.9606     1.0000
Hrad:
            0.0178     0.0357     0.0535     0.0714     0.0892
            0.1070     0.1249     0.1427     0.1606     0.1784
            0.1963     0.2141     0.2319     0.2498     0.2676
            0.2855     0.3033     0.3211     0.3390     0.3568
            0.3747     0.3983     0.4333     0.4683     0.5032
            0.5376     0.5699     0.6003     0.6290     0.6560
            0.6815     0.7057     0.7287     0.7505     0.7712
            0.7910     0.8099     0.8280     0.8453     0.8619
            0.8779     0.8933     0.9082     0.9225     0.9364
            0.9499     0.9629     0.9756     0.9880     1.0000
Width:
            0.0218     0.0436     0.0654     0.0872     0.1090
            0.1308     0.1526     0.1744     0.1962     0.2179
            0.2397     0.2615     0.2833     0.3051     0.3269
            0.3487     0.3705     0.3923     0.4141     0.4359
            0.4577     0.4722     0.4722     0.4722     0.4722
            0.4933     0.5144     0.5356     0.5567     0.5778
            0.5989     0.6200     0.6411     0.6622     0.6833
            0.7044     0.7256     0.7467     0.7678     0.7889
            0.8100     0.8311     0.8522     0.8733     0.8944
            0.9156     0.9367     0.9578     0.9789     1.0000

Transect 24mROW
Area:
            0.0004     0.0016     0.0037     0.0066     0.0103
            0.0148     0.0202     0.0264     0.0334     0.0412
            0.0499     0.0594     0.0697     0.0808     0.0928
            0.1055     0.1191     0.1336     0.1488     0.1649
            0.1818     0.1995     0.2179     0.2364     0.2548
            0.2737     0.2935     0.3142     0.3358     0.3584
            0.3818     0.4062     0.4314     0.4576     0.4847
            0.5127     0.5416     0.5714     0.6021     0.6337
            0.6663     0.6997     0.7341     0.7693     0.8055
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            0.8426     0.8806     0.9195     0.9593     1.0000
Hrad:
            0.0185     0.0370     0.0556     0.0741     0.0926
            0.1111     0.1296     0.1482     0.1667     0.1852
            0.2037     0.2222     0.2408     0.2593     0.2778
            0.2963     0.3148     0.3334     0.3519     0.3704
            0.3889     0.4074     0.4373     0.4736     0.5099
            0.5455     0.5788     0.6098     0.6389     0.6662
            0.6918     0.7159     0.7386     0.7601     0.7805
            0.7998     0.8182     0.8357     0.8524     0.8684
            0.8837     0.8985     0.9127     0.9264     0.9396
            0.9524     0.9648     0.9769     0.9886     1.0000
Width:
            0.0200     0.0400     0.0601     0.0801     0.1001
            0.1201     0.1402     0.1602     0.1802     0.2002
            0.2203     0.2403     0.2603     0.2803     0.3004
            0.3204     0.3404     0.3604     0.3805     0.4005
            0.4205     0.4405     0.4479     0.4479     0.4479
            0.4700     0.4921     0.5142     0.5363     0.5583
            0.5804     0.6025     0.6246     0.6467     0.6687
            0.6908     0.7129     0.7350     0.7571     0.7792
            0.8013     0.8233     0.8454     0.8675     0.8896
            0.9117     0.9338     0.9558     0.9779     1.0000


****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
```

```
Surcharge Method ......... EXTRAN
Starting Date ............ 06/30/2023 00:00:00
Ending Date .............. 07/01/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001524 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.470        71.667
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.073        11.078
Surface Runoff ...........         0.394        60.107
Final Storage ............         0.008         1.185
Continuity Error (%) .....        -0.982


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.394         3.942
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.394         3.940
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
```

Continuity Error (%) 0.058

****
Time-Step Critical Elements
****
Link 200-HW2_(C-STRM) (4.06%)

****
Highest Flow Instability Indexes
****
Link EastCulvert (4)
Link 200-HW2_(C-STRM) (2)

****
Most Frequent Nonconverging Nodes
****
Convergence obtained at all time steps.

****
Routing Time Step Summary
****

Minimum Time Step	:	0.12 sec
Average Time Step	:	4.95 sec
Maximum Time Step	:	5.00 sec
% of Time in Steady State	:	0.00
Average Iterations per Step	:	2.02
% of Steps Not Converging	:	0.05
Time Step Frequencies	:	
5.000 - 3.155 sec	:	100.00 %
3.155 - 1.991 sec	:	0.00 %
1.991 - 1.256 sec	:	0.00 %
1.256 - 0.792 sec	:	0.00 %
0.792 - 0.500 sec	:	0.00 %

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
C101A	71.67	0.00	0.00	6.35	60.47	4.17	64.64	1.00	0.74	0.902
C101B	71.67	0.00	0.00	12.58	50.13	8.78	58.91	0.31	0.25	0.822
C102A	71.67	0.00	0.00	6.35	60.47	4.17	64.64	1.00	0.74	0.902
C201A	71.67	0.00	0.00	12.60	50.14	8.71	58.85	0.31	0.25	0.821
C201B	71.67	0.00	0.00	6.35	60.47	4.17	64.64	0.39	0.29	0.902
C201C	71.67	0.00	0.00	6.35	60.47	4.17	64.64	0.50	0.37	0.902
PARK	71.67	0.00	0.00	33.52	20.07	18.08	38.15	0.24	0.17	0.532
Pre3A	71.67	0.00	0.00	22.24	35.09	14.52	49.61	0.11	0.10	0.692
Pre3B	71.67	0.00	0.00	29.10	24.56	18.44	42.99	0.07	0.06	0.600

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
EC-out	OUTFALL	0.02	0.41	47.74	0 01:15	0.40
HW1	OUTFALL	0.03	0.63	47.63	0 01:10	0.63
EC-in	STORAGE	0.04	0.88	49.24	0 01:15	0.88
HW2	STORAGE	0.01	0.39	49.24	0 01:14	0.39
STM100	STORAGE	0.04	0.76	47.88	0 01:10	0.76
STM101	STORAGE	0.18	0.70	49.62	0 01:10	0.70
STM200	STORAGE	0.03	0.49	49.43	0 01:07	0.49
STM201	STORAGE	0.23	0.97	51.40	0 01:11	0.97
SU-A	STORAGE	0.06	1.47	50.77	0 01:13	1.47
SU-B	STORAGE	0.06	1.47	51.07	0 01:13	1.47
SU-C	STORAGE	0.05	1.37	52.57	0 01:13	1.37
SU-D	STORAGE	0.05	1.39	52.59	0 01:13	1.39
SU-P	STORAGE	0.06	1.33	50.93	0 01:21	1.33

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
EC-out	OUTFALL	0.000	0.501	0 01:15	0	1.21	0.000
HW1	OUTFALL	0.000	1.195	0 01:10	0	2.73	0.000
EC-in	STORAGE	0.000	0.596	0 01:13	0	1.21	0.051
HW2	STORAGE	0.000	0.546	0 01:11	0	1.21	-0.046
STM100	STORAGE	0.162	1.196	0 01:10	0.183	2.73	-0.005
STM101	STORAGE	0.251	0.688	0 01:10	0.312	1.55	0.008
STM200	STORAGE	0.000	0.521	0 01:11	0	1.21	0.019
STM201	STORAGE	0.250	0.572	0 01:10	0.312	1.21	0.010
SU-A	STORAGE	0.737	0.737	0 01:10	0.995	0.995	0.108
SU-B	STORAGE	0.742	0.742	0 01:10	1	1	-0.004
SU-C	STORAGE	0.292	0.292	0 01:10	0.394	0.394	0.113
SU-D	STORAGE	0.373	0.373	0 01:10	0.504	0.504	0.053
SU-P	STORAGE	0.167	0.167	0 01:10	0.24	0.24	0.064

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
EC-in	0.000	1.6	0.0	0.0	0.001	33.4	0 01:15	0.501
HW2	0.000	0.6	0.0	0.0	0.000	18.2	0 01:14	0.596
STM100	0.000	1.3	0.0	0.0	0.001	22.2	0 01:10	1.195
STM101	0.000	3.9	0.0	0.0	0.001	15.8	0 01:10	0.679
STM200	0.000	1.4	0.0	0.0	0.001	24.7	0 01:07	0.546
STM201	0.000	7.1	0.0	0.0	0.001	30.6	0 01:11	0.521
SU-A	0.003	0.2	0.0	0.0	0.181	13.8	0 01:13	0.357
SU-B	0.003	0.2	0.0	0.0	0.181	13.9	0 01:13	0.360
SU-C	0.001	0.1	0.0	0.0	0.073	5.6	0 01:13	0.141

SU-D	0.001	0.1	0.0	0.0	0.092	7.0	0	01:13	0.181
SU-P	0.001	0.1	0.0	0.0	0.039	3.0	0	01:21	0.077

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
EC-out	26.05	0.067	0.501	1.209
HW1	28.36	0.141	1.195	2.731
System	27.20	0.208	1.671	3.940

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
100-HW1(C-STRM)	CONDUIT	1.195	0 01:10	2.10	1.19	0.71
101-100_(C-STRM)	CONDUIT	0.679	0 01:10	2.22	0.96	0.80
200-HW2_(C-STRM)	CONDUIT	0.546	0 01:11	2.92	0.94	0.64
201-200_(C-STRM)	CONDUIT	0.521	0 01:11	1.98	1.01	0.89
EastCulvert	CONDUIT	0.501	0 01:15	1.98	0.80	0.84
EastDitch	CONDUIT	0.596	0 01:13	0.33	0.00	0.23
SU-A_STM100	DUMMY	0.357	0 01:03			
SU-B_STM101	DUMMY	0.360	0 01:03			
SU-C_STM201	DUMMY	0.141	0 01:04			
SU-D_STM201	DUMMY	0.181	0 01:03			
SU-P_STM101	DUMMY	0.077	0 01:06			

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
100-HW1(C-STRM)	1.00	0.01	0.00	0.00	0.98	0.01	0.00	0.00	0.00	0.00
101-100_(C-STRM)	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00
200-HW2_(C-STRM)	1.00	0.02	0.00	0.00	0.75	0.23	0.00	0.00	0.07	0.00
201-200_(C-STRM)	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00
EastCulvert	1.00	0.02	0.00	0.00	0.76	0.22	0.00	0.00	0.00	0.49
EastDitch	1.00	0.02	0.03	0.00	0.95	0.00	0.00	0.00	0.96	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
100-HW1(C-STRM)	0.01	0.01	0.01	0.17	0.01
201-200_(C-STRM)	0.01	0.13	0.01	0.06	0.01
EastCulvert	0.01	0.48	0.01	0.01	0.01

Analysis begun on: Thu Mar 20 15:58:37 2025
Analysis ended on: Thu Mar 20 15:58:37 2025
Total elapsed time: < 1 sec

E.5 Preliminary Stormceptor Sizing Reports

Stormceptor® Rinker

Stormceptor® EF Sizing Report

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

03/21/2025

Province:	Ontario
City:	Ottawa
Nearest Rainfall Station:	OTTAWA CDA RCS
Climate Station Id:	6105978
Years of Rainfall Data:	20
Site Name:	East Outlet
Drainage Area (ha):	1.92
Runoff Coefficient 'c':	0.77

Project Name:	Petries III
Project Number:	160401751
Designer Name:	Michael Wu
Designer Company:	Stantec
Designer Email:	Michael.Wu@stantec.com
Designer Phone:	613-738-6033
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	47.72
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	1781
Estimated Average Annual Sediment Volume (L/yr):	1448

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	64
EFO5	73
EFO6	79
EFO8	87
EFO10	91

Recommended Stormceptor EFO Model:	**EFO8**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**87**
Water Quality Runoff Volume Capture (%):	**> 90**

imbrium

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

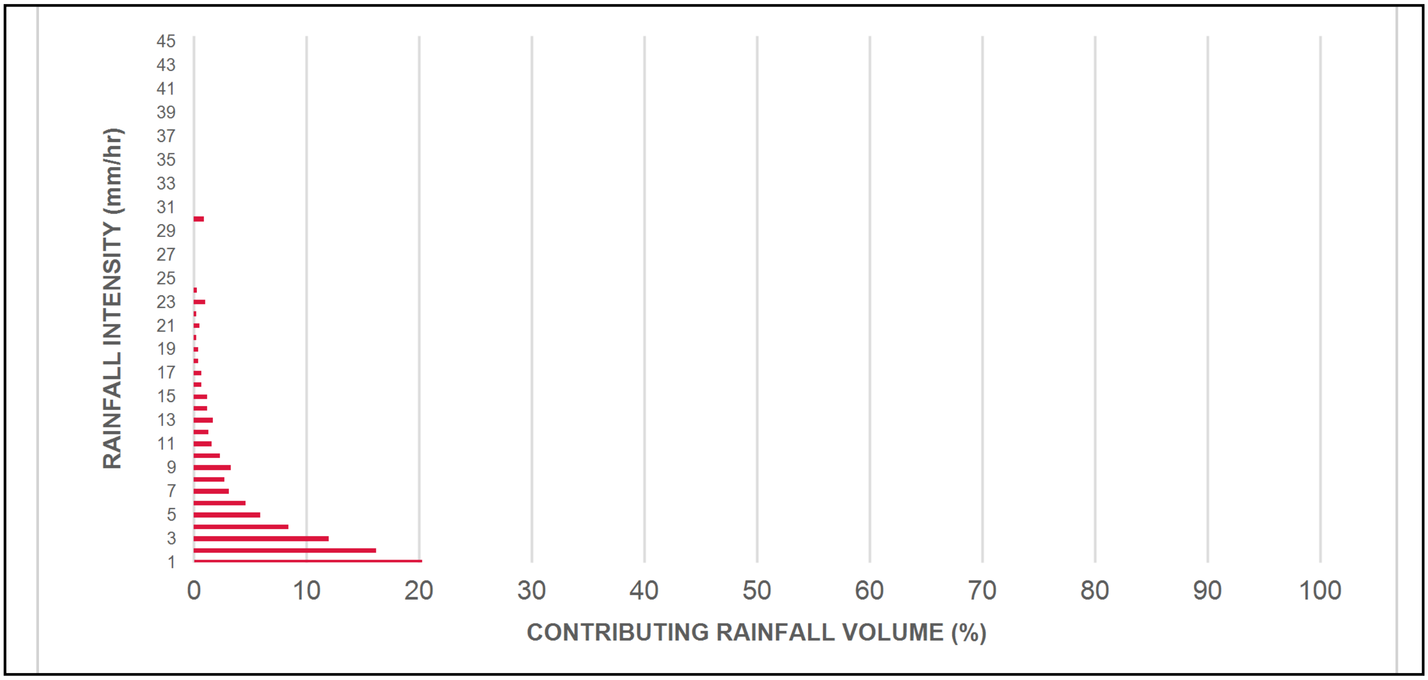
►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

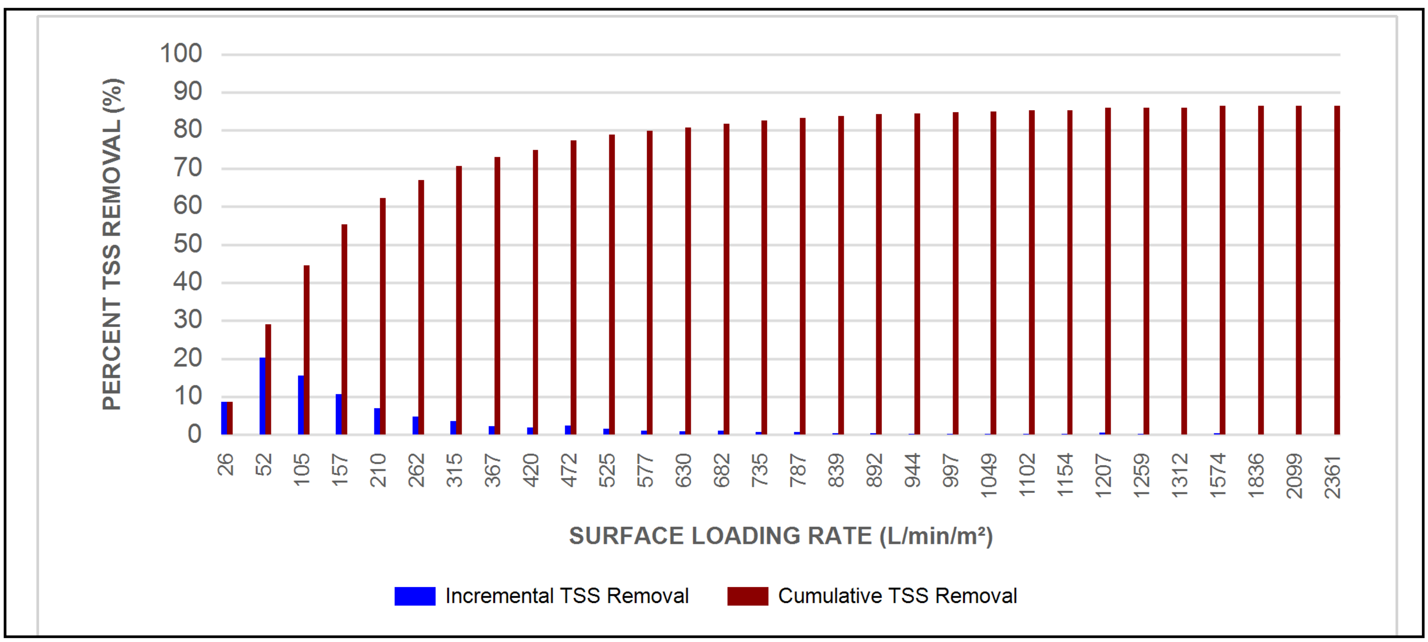
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.6	8.6	2.05	123.0	26.0	100	8.6	8.6
1.00	20.3	29.0	4.11	247.0	52.0	100	20.3	29.0
2.00	16.2	45.2	8.22	493.0	105.0	96	15.6	44.5
3.00	12.0	57.2	12.33	740.0	157.0	89	10.7	55.3
4.00	8.4	65.6	16.44	986.0	210.0	83	7.0	62.2
5.00	5.9	71.6	20.55	1233.0	262.0	80	4.8	67.0
6.00	4.6	76.2	24.66	1480.0	315.0	78	3.6	70.6
7.00	3.1	79.3	28.77	1726.0	367.0	76	2.3	72.9
8.00	2.7	82.0	32.88	1973.0	420.0	73	2.0	74.9
9.00	3.3	85.3	36.99	2219.0	472.0	71	2.4	77.3
10.00	2.3	87.6	41.10	2466.0	525.0	68	1.6	78.9
11.00	1.6	89.2	45.21	2713.0	577.0	66	1.0	79.9
12.00	1.3	90.5	49.32	2959.0	630.0	64	0.8	80.7
13.00	1.7	92.2	53.43	3206.0	682.0	64	1.1	81.8
14.00	1.2	93.5	57.54	3452.0	735.0	64	0.8	82.6
15.00	1.2	94.6	61.65	3699.0	787.0	63	0.7	83.3
16.00	0.7	95.3	65.76	3946.0	839.0	63	0.4	83.8
17.00	0.7	96.1	69.87	4192.0	892.0	62	0.5	84.2
18.00	0.4	96.5	73.98	4439.0	944.0	62	0.2	84.5
19.00	0.4	96.9	78.09	4685.0	997.0	62	0.3	84.7
20.00	0.2	97.1	82.20	4932.0	1049.0	60	0.1	84.9
21.00	0.5	97.5	86.31	5179.0	1102.0	59	0.3	85.2
22.00	0.2	97.8	90.42	5425.0	1154.0	58	0.1	85.3
23.00	1.0	98.8	94.53	5672.0	1207.0	57	0.6	85.9
24.00	0.3	99.1	98.64	5918.0	1259.0	56	0.1	86.0
25.00	0.0	99.1	102.75	6165.0	1312.0	54	0.0	86.0
30.00	0.9	100.0	123.30	7398.0	1574.0	47	0.4	86.5
35.00	0.0	100.0	143.85	8631.0	1836.0	40	0.0	86.5
40.00	0.0	100.0	164.40	9864.0	2099.0	35	0.0	86.5
45.00	0.0	100.0	184.95	11097.0	2361.0	31	0.0	86.5
Estimated Net Annual Sediment (TSS) Load Reduction =								**86 %**

Climate Station ID: 6105978 *Years of Rainfall Data*: 20

RAINFALL DATA FROM OTTAWA CDA RCS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter (m)	Model Diameter (ft)	Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter (mm)	Max Inlet Pipe Diameter (in)	Max Outlet Pipe Diameter (mm)	Max Outlet Pipe Diameter (in)	Peak Conveyance Flow Rate (L/s)	Peak Conveyance Flow Rate (cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF5 / EFO5	1.5	5	90	762	30	762	30	710	25
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

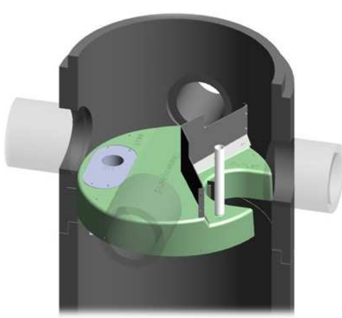
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

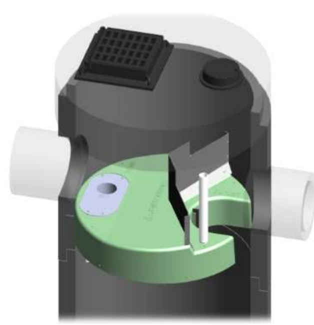
DESIGN FLEXIBILITY

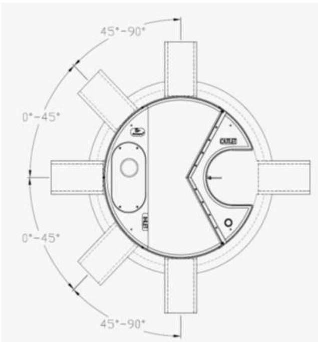
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP
Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.
0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.
45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS
The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF5 / EFO5	1.5	5	1.62	5.3	420	111	305	10	2124	75	2612	5758
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR
"OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREAMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	5 ft (1524 mm) Diameter OGS Units:	1.95 m^3 sediment / 420 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid

Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

Stormceptor® Rinker Materials

Stormceptor® EF Sizing Report

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

03/21/2025

Province:	Ontario
City:	Ottawa
Nearest Rainfall Station:	OTTAWA CDA RCS
Climate Station Id:	6105978
Years of Rainfall Data:	20

Site Name:	West Outlet

Drainage Area (ha):	4.25
Runoff Coefficient 'c':	0.71

Project Name:	Petries III
Project Number:	160401751
Designer Name:	Michael Wu
Designer Company:	Stantec
Designer Email:	Michael.Wu@stantec.com
Designer Phone:	613-738-6033
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	97.39
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	3280
Estimated Average Annual Sediment Volume (L/yr):	2667

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	50
EFO5	59
EFO6	66
EFO8	77
EFO10	83

Recommended Stormceptor EFO Model: EFO10

Estimated Net Annual Sediment (TSS) Load Reduction (%): 83

Water Quality Runoff Volume Capture (%): > 90

imbrium

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

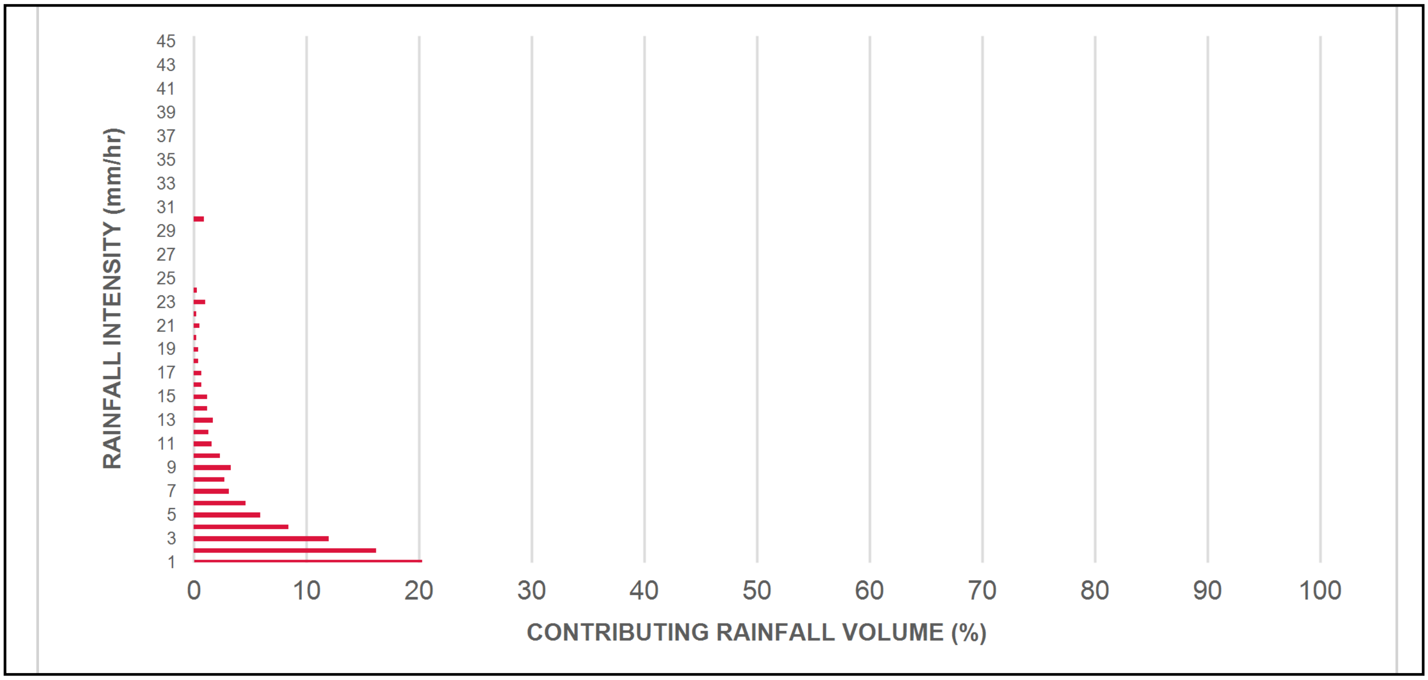
►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

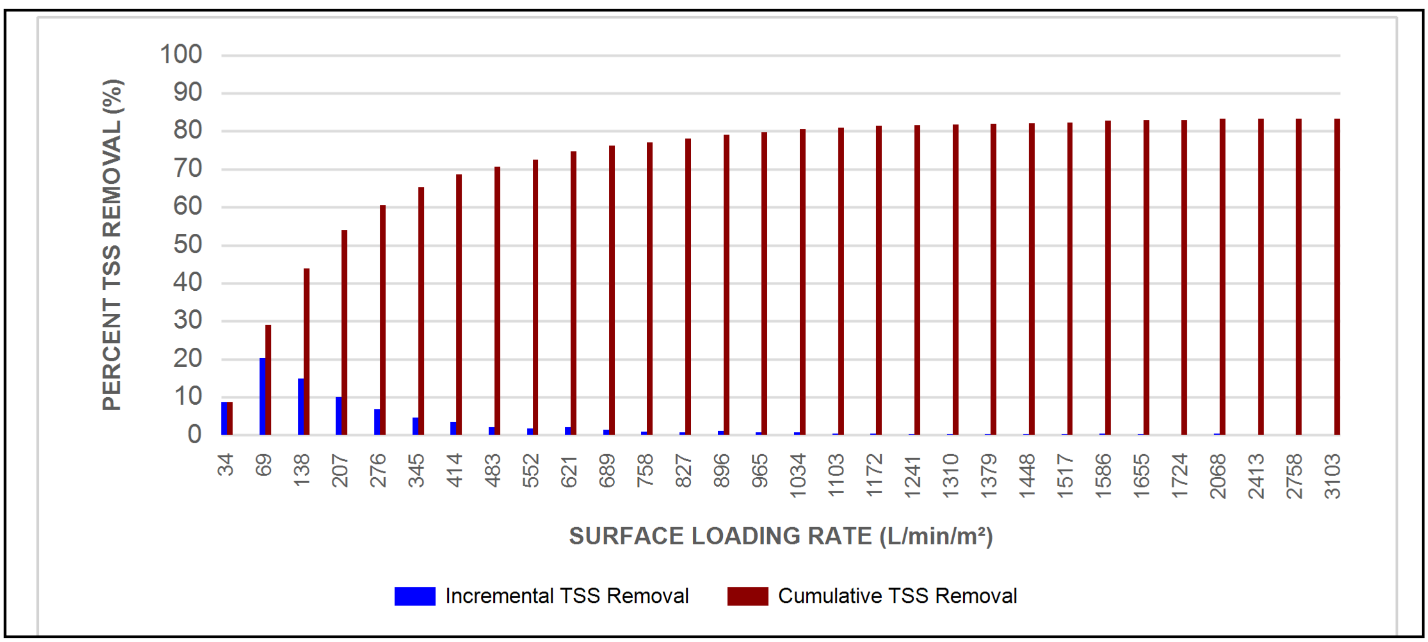
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.6	8.6	4.19	252.0	34.0	100	8.6	8.6
1.00	20.3	29.0	8.39	503.0	69.0	100	20.3	29.0
2.00	16.2	45.2	16.78	1007.0	138.0	92	14.9	43.9
3.00	12.0	57.2	25.17	1510.0	207.0	83	10.0	53.9
4.00	8.4	65.6	33.55	2013.0	276.0	80	6.7	60.6
5.00	5.9	71.6	41.94	2517.0	345.0	77	4.6	65.2
6.00	4.6	76.2	50.33	3020.0	414.0	73	3.4	68.6
7.00	3.1	79.3	58.72	3523.0	483.0	70	2.1	70.7
8.00	2.7	82.0	67.11	4027.0	552.0	67	1.8	72.5
9.00	3.3	85.3	75.50	4530.0	621.0	64	2.1	74.7
10.00	2.3	87.6	83.89	5033.0	689.0	64	1.5	76.2
11.00	1.6	89.2	92.28	5537.0	758.0	63	1.0	77.1
12.00	1.3	90.5	100.66	6040.0	827.0	63	0.8	78.0
13.00	1.7	92.2	109.05	6543.0	896.0	62	1.1	79.1
14.00	1.2	93.5	117.44	7046.0	965.0	62	0.8	79.8
15.00	1.2	94.6	125.83	7550.0	1034.0	61	0.7	80.5
16.00	0.7	95.3	134.22	8053.0	1103.0	59	0.4	80.9
17.00	0.7	96.1	142.61	8556.0	1172.0	58	0.4	81.4
18.00	0.4	96.5	151.00	9060.0	1241.0	56	0.2	81.6
19.00	0.4	96.9	159.38	9563.0	1310.0	54	0.2	81.8
20.00	0.2	97.1	167.77	10066.0	1379.0	53	0.1	81.9
21.00	0.5	97.5	176.16	10570.0	1448.0	51	0.2	82.1
22.00	0.2	97.8	184.55	11073.0	1517.0	48	0.1	82.3
23.00	1.0	98.8	192.94	11576.0	1586.0	46	0.5	82.7
24.00	0.3	99.1	201.33	12080.0	1655.0	44	0.1	82.9
25.00	0.0	99.1	209.72	12583.0	1724.0	43	0.0	82.9
30.00	0.9	100.0	251.66	15100.0	2068.0	36	0.3	83.2
35.00	0.0	100.0	293.60	17616.0	2413.0	30	0.0	83.2
40.00	0.0	100.0	335.55	20133.0	2758.0	27	0.0	83.2
45.00	0.0	100.0	377.49	22649.0	3103.0	24	0.0	83.2
Estimated Net Annual Sediment (TSS) Load Reduction =								**83 %**

Climate Station ID: 6105978 *Years of Rainfall Data*: 20

RAINFALL DATA FROM OTTAWA CDA RCS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF5 / EFO5	1.5	5	90	762	30	762	30	710	25
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

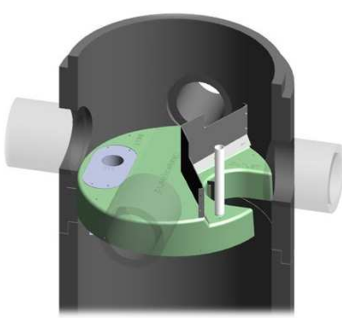
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

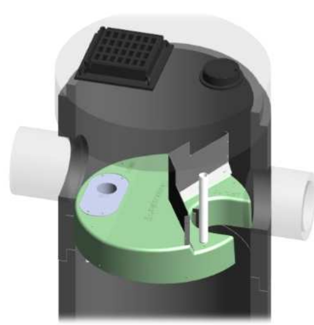
DESIGN FLEXIBILITY

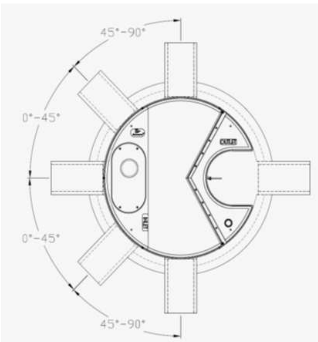
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP
Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.
0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.
45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS
The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF5 / EFO5	1.5	5	1.62	5.3	420	111	305	10	2124	75	2612	5758
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS
For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef
STANDARD STORMCEPTOR EF/EFO SPECIFICATION
For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREAMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	5 ft (1524 mm) Diameter OGS Units:	1.95 m^3 sediment / 420 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid

Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.