FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

FIRST SUBMISSION - FEB 2026

1600 James Naismith Drive, Ottawa
Proposed Residential Development – Phase 2
KWA PROJECT: 24062

Report Prepared for:
1600 James Naismith LP
1460 The Queensway, Suite M264
Toronto, ON M8Z 1S4

Report Prepared by:
KWA Site Development Consulting Inc.
2453 Auckland Drive
Burlington, Ontario
L7L 7A9

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1.0 INTRODUCTION

KWA Site Development Consulting Inc. (KWA) has been retained by 1600 James Naismith LP to prepare a detailed Functional Servicing and Stormwater Management Report along with a corresponding grading and servicing design in support of the Site Plan Amendment (SPA) for the proposed development. The subject property is located at the northwest corner of Telesat Court at municipal address 1600 James Naismith Drive in the City of Ottawa. The proposed development is Phase 2 of the subject site, located north-west of the existing building. Phase 1 involved the conversion of the former office building into a multi-residential apartment building. Refer to **Figure 1.1** below.

This report will:

- Provide background information regarding the subject property;
- Summarize the existing site conditions;
- Provide information regarding the proposed development conditions;
- Outline the proposed grading for the development; and
- Outline the existing and proposed municipal servicing.

The recommended servicing has been developed in accordance with the applicable design criteria and requirements of the City of Ottawa (the City).

Figure 1-1: Location Plan

1.1 PROJECT BACKGROUND

The total property is approximately 3.8ha in area at municipal address 1600 James Naismith Drive in the City of Ottawa. The site consists of an existing 8 storey mid-rise rental apartment building (recently converted from an office building) and parking areas associated with that previous use. This report will focus on Phase 2 of the proposed development which is located at the north-western side of the property to the west of the existing building, with a site area of approximately 1.35ha. The remaining land is not part of this application.

The subject site is bound by the existing Phase 1 lands to the east, existing and future parkland to the south, existing residential on Aurele Street to the west, and Queensway Regional Highway 174 to the north. The site is currently occupied by an existing parking lot.

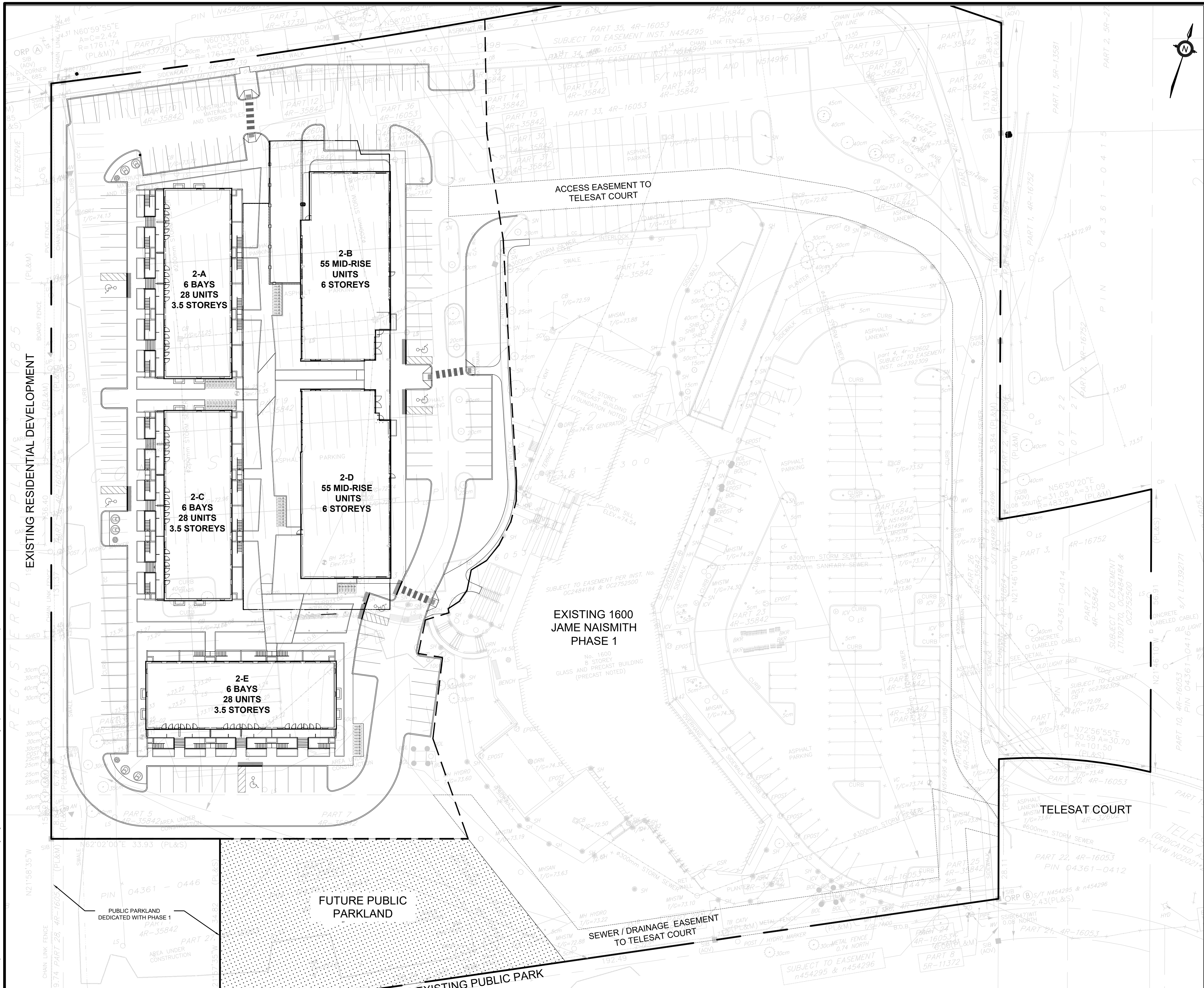
The existing topography of the site has a gentle slope from North to South, towards the existing parkland to the south of the site with elevation differences of approximately 1.0-1.5m across the length of the site.

1.2 PROPOSED DEVELOPMENT

The proposed development of the site includes the construction of three (3) blocks of 3.5 storey stacked townhomes and two (2) blocks of 6 storey mid-rise buildings with a total of 194 units. The buildings will have a perimeter circular wrap-around driveway, with at grade parking, underground parking, and a primary connection to the existing east development and a vehicular connection to Telesat Court through the existing Phase 1 development area. Refer to Figure 1.2 for the proposed development plan.

1.3 SITE ACCESS

The site's main vehicular access will be through the existing Phase 1 development from James Naismith Drive and Telesat Court.



LEGEND

NOT FOR CONSTRUCTION

KWA SITE DEVELOPMENT CONSULTING INC.
2453 AUCKLAND DRIVE BURLINGTON, ON L7L 7A9

1600 JAMES NAISMITH
PHASE 2

PROPOSED DEVELOPMENT PLAN

PROJECT # 24062	DRAWING # 1.2
SCALE:	1:750
DATE:	JAN 2026
DRAWN BY:	TF
DESIGNED BY:	TF
CHECKED BY:	TF

2.0 STORMWATER MANAGEMENT

2.1 EXISTING DRAINAGE CONDITIONS

The existing topography of the site has a gentle slope from north to south, with existing catchbasins scattered throughout the existing parking lot which capture site drainage, collect it and discharge it to the municipal storm sewer. The minor system drainage drains to a 300mm storm sewer along the north-east corner of the Phase 2 site, which connects to a 450mm running through the Phase 1 lands, which ultimately discharges at the south-east corner of the property into a 600mm municipal storm sewer located in Telesat Court. The site's major emergency flow route discharges to the south end of the existing parking lot, which then flows overland to the parkland to the south into a collection conveyance swale continuing to drain south to the downstream municipal storm sewer.

There is a 600mm storm sewer along the south property line that will collect the drainage from Phase 2 and route it to Telesat Court via an easement on the Phase 1 lands. This storm sewer is connected to the 600mm storm sewer in Telesat Court, so ultimately the storm drainage from the site will have an equivalent flow condition for the municipal storm sewer system.

The existing sewer infrastructure is shown on the **Servicing Plan (S1)** and existing drainage is shown on the **Existing Drainage Plan F2-1.**

2.2 STORMWATER MANAGEMENT DESIGN CRITERIA

The proposed stormwater management design is based on the MOE 2008 Stormwater Management Planning & Design (SWMPD), The City of Ottawa Sewer Guidelines (October 2012), The City of Ottawa Stormwater Management Design Guidelines (2012), and the pre-consultation comments received by the City of Ottawa on March 3, 2025:

- **Quantity Control:** Post-development 100-year storm event flows to be controlled to the pre-development 5-year peak flow, with a maximum runoff coefficient of 0.50. An overflow must be provided of 100yr + 20% of site flows.
- **Quality Control:** Stormwater quality control measures will be provided to achieve, as a minimum, the Enhanced level of protection (i.e. 80% TSS removal) as described in the MOE SWMPD manual.
- **Construction Erosion and Sediment Control:** All applicants must include an Erosion and Sediment Control plan demonstrating that fish habitat and water quality are not affected by sediment from the property during or following site construction.
- **Stormwater Outlet:** Stormwater drainage systems shall discharge to municipal storm sewer system where feasible. In cases where this is not possible, stormwater drainage systems may discharge to natural watercourses.

2.3 PROPOSED STORMWATER OUTLET

There is a 600mm storm sewer along the south property line that will collect the drainage from Phase 2 and route it to Telesat Court via an easement on the Phase 1 lands. This sewer was designed to convey drainage from the subject site through the Phase 1 lands along the southern property line, flowing west to east, and ultimately discharging to the existing 600 mm storm sewer on Telesat Court. Accordingly, the proposed Phase 2 development will connect to this existing 600 mm storm sewer at the southeast corner of the Phase 2 site.

The proposed and existing sewer infrastructure is shown on the **Servicing Plan (S1).**

2.4 PROPOSED STORMWATER MANAGEMENT DESIGN STRATEGY

The proposed stormwater management system will include the capture and conveyance of the entire Phase 2 site (1.35ha) along with a portion of the existing Phase 1 site area to be received as an external flow allowance. Drainage will be captured by a series of catchbasins spread out across the site. The storm sewers will be sized to convey 100-year flow rate and directed to an underground stormwater storage chamber located in the south-east corner. An orifice will be designed at the outlet of the control maintenance hole at the south-east corner prior to the connection to the existing storm sewer maintenance hole connected to the existing 600mm storm sewer. Proposed underground stormwater chamber is designed to provide the necessary attenuation to maximize the storage volume and ultimately allow the site to release post-development flows from the site to allowable levels. Total suspended solids treatment will be achieved primarily using an oil-grit separator system located downstream of the chamber.

2.5 STORMWATER QUANTITY CONTROL

The City of Ottawa's stormwater management criteria requires that the 100-year post-development peak flow from the site be controlled to the 5-year pre-development peak flow. As per guidance from the pre-consultation comments and correspondence with the City, the City mandates that the outflow release rate be set at 50% of the peak allowable rate when estimating the required storage volume using the rational method. This requirement arises from the fact that stored runoff experience fluctuating discharge rates (from a peak flow corresponding to a maximum head down to zero), whereas the rational method assumes a constant peak outflow rate. While this nuance regarding outflow release rates is acknowledged, it is also important to note that the rational method conservatively assumes a constant peak inflow, whereas a runoff hydrograph actually has a more dynamic flow pattern, including rising and falling limbs.

Given these assumptions in the rational method, the City requires: 1) The average release rate equal to 50% of the peak allowable rate to estimate the required storage using the rational method, or 2) If option #1 is not preferred, the City requires a detailed PCSWMM model, which will be subject review by City's Water Resources group.

An analysis using PCSWMM is completed for the existing and proposed conditions using both 3-hr and 6-hr Chicago storm distributions. The 5-year pre-development peak flow for a total site area of 1.35 ha with 80% imperviousness is approximately **303 L/s**. Under proposed conditions, on-site runoff for the proposed development will be captured within the private storm sewer network and controlled as follows:

- **Parking lot/ drive aisle drainage area (1.28 ha):** The allowable release rate for this area is 303 L/s less the uncontrolled peak flows from the site. The required storage will be provided within an underground chamber located at the southeast corner of the site, with a depth of 1.1 m and a total storage volume of approximately **230 m^3.** The outflow will be controlled to **265 L/s** using a **355 mm** diameter orifice plate. The controlled flows ultimately discharge to the 600 mm site outlet.
- **Uncontrolled basement patio drainage area (0.07 ha):** Runoff from this area is directed to the bypass storm sewer, which is not subject to any controls. The uncontrolled flow in the 100-year storm event is **33 L/s.**

Runoff from private basement walkouts in the Phase 1 development is also conveyed through the Phase 2 lands as an external flow allowance. Pumped drainage from the rear of the Phase 1 building, totaling 16 L/s, is conveyed via a 250 mm storm sewer flowing at 0.25%. This pumped flow rate is confirmed in the Phase 1 Issued for Tender Servicing Plans prepared by LRL Engineering. This external drainage ultimately connects to the 600 mm site outlet through the bypass storm sewer.

Refer to **Appendix A** for the stormwater management calculations and to the Servicing Plan (**Drawing S1**) for the proposed stormwater management design.

2.6 STORMWATER EMERGENCY OVERLAND FLOW ROUTE

Under existing conditions, the existing emergency overland flow route for the Phase 2 site area spill to the south parking lot, with an existing low elevation of 72.83m, approximately 1.0m lower than the north entrance side of the Phase 2 area. Under proposed conditions, the overland flow route is located at the southeast corner of the Phase 2 lands, where flows will overtop the parking lot curb and be directed towards a conveyance swale that flows south through the parkland and ultimately discharges to the municipal storm sewer system.

The City of Ottawa stormwater management criteria requires that the overland flow route conveyance swale be designed for the 100-year post development flow from the site + 20% as a safety factor. The post development 100-yr flow generated from the subject site is approximately 603 L/s, therefore the design flow with 20% safety factor is conservatively taken as 800 L/s. This will be achieved through a conveyance swale of 1.7 m bottom width, 3.5 m top width, flow depth of 0.30 m, and a slope of 1.0%. Refer to **Appendix A** for swale design calculations and proposed **Grading Plan (G2)** for layout configuration.

2.7 STORMWATER WATER QUALITY

The quality control objective is to provide an enhanced protection level, which corresponds to the removal of minimum 80% TSS. Although runoff from the rooftops and landscaped areas can be considered clean, all runoff on site, including rooftops, parking lots, and drive aisles, will be treated by an oil-grit separator (OGS) downstream of the underground storage chamber. An **EFO6** unit is proposed which will provide **82% TSS removal**, with more than 90% of rainfall volume treated. The OGS unit efficiently removes sediment, trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants.

Refer to **Appendix A** for OGS specifications and the ETV verification statement.

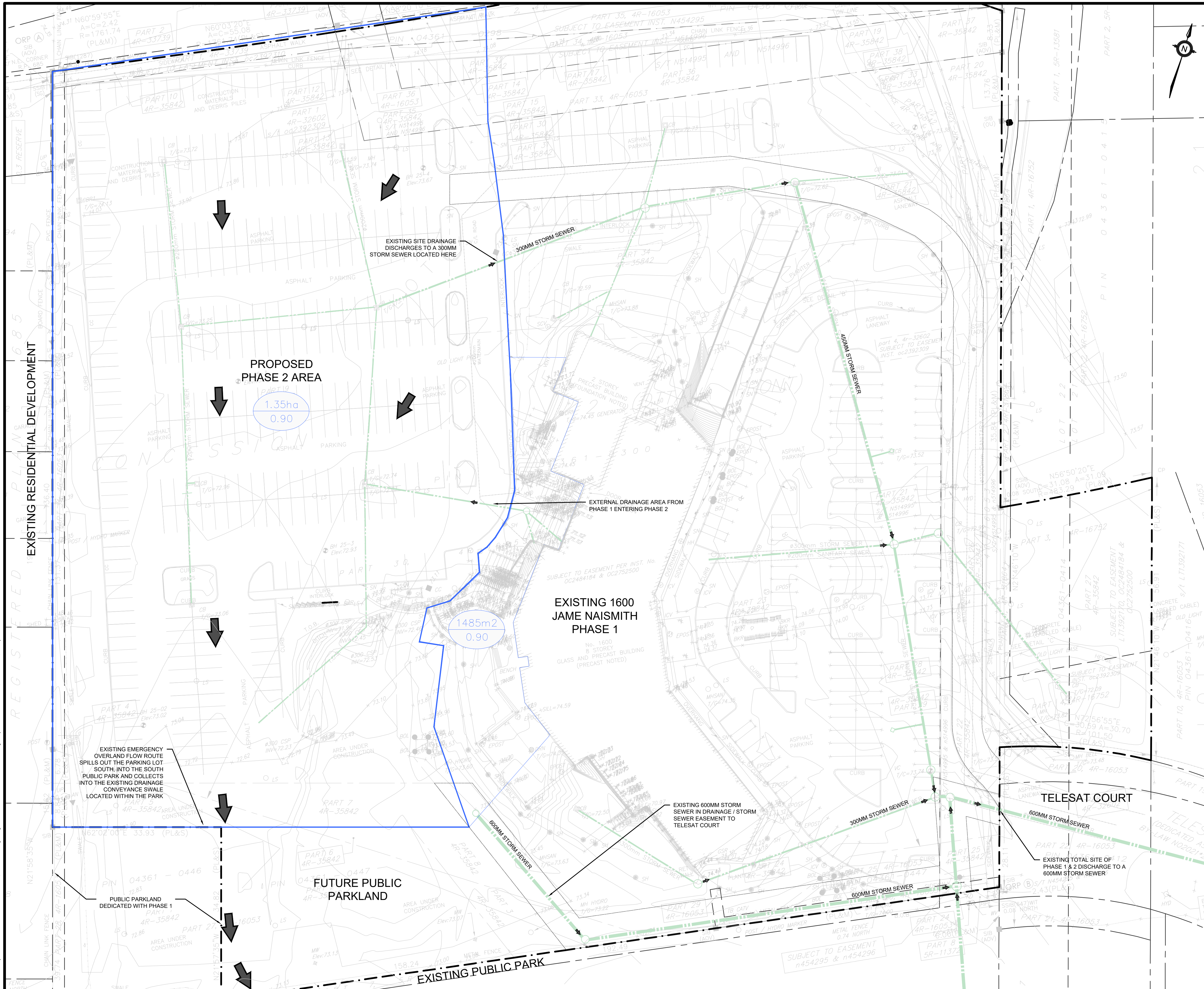
2.8 CONSTRUCTION EROSION AND SEDIMENT CONTROL

Best practices are implemented to control erosion and sedimentation during construction and prior to build-out of stormwater quantity and quality control measures. In general, the ESC approach can be outlined as:

- Silt fence to be installed around the site perimeter.
- A construction access (mud mat) is to be provided at the entrance off Phase 1 lands.
- Catch basins and catch basin manholes on adjacent streets to have underside of the grate covered with Terrafix 240R non-woven geotextile.

These ESC measures should be regularly inspected and maintained to ensure they are operating as designed.

Refer to the **Erosion and Sediment Control Plan**.



LEGEND

1485m2	DRAINAGE AREA
0.90	RUNOFF COEFFICIENT
	EMERGENCY OVERLAND FLOW ROUTE
	PIPE DRAINAGE CONVEYANCE ROUTE
	DRAINAGE BOUNDARY
	EXISTING STORM SEWER

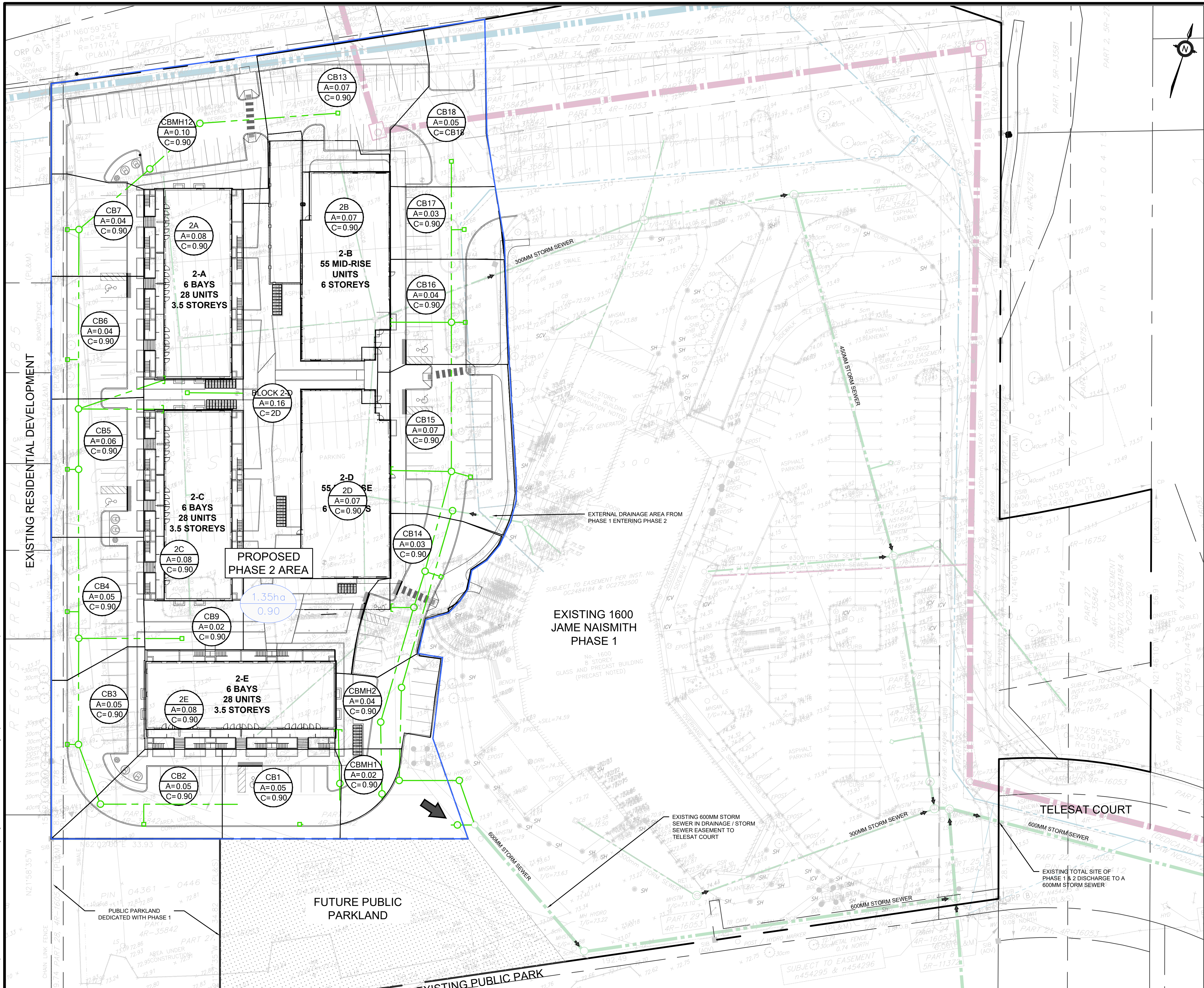
NOT FOR CONSTRUCTION

KWA SITE DEVELOPMENT CONSULTING INC.
2453 AUCKLAND DRIVE BURLINGTON, ON L7L 7A9

1600 JAMES NAISMITH PHASE 2

EXISTING DRAINAGE AREA PLAN

PROJECT # 24062	DRAWING # 2.1
SCALE:	1:750
DATE:	JAN 2026
DRAWN BY:	TF
DESIGNED BY:	TF
CHECKED BY:	TF



LEGEND

NOT FOR CONSTRUCTION

KWA SITE DEVELOPMENT CONSULTING

KWA SITE DEVELOPMENT CONSULTING INC.
2453 AUCKLAND DRIVE BURLINGTON, ON L7L 7A9

1600 JAMES NAISMITH PHASE 2

PROPOSED DRAINAGE AREA PLAN

PROJECT # 24062	DRAWING # 2.2
SCALE:	1:750
DATE:	JAN 2026
DRAWN BY:	TF
DESIGNED BY:	TF
CHECKED BY:	TF

3.0 SANITARY SERVICING

3.1 EXISTING SANITARY SERVICING

The existing site servicing details obtained from The City of Ottawa engineering plan and profiles and a topographical survey completed of the area indicate that there is sanitary sewer infrastructure in the vicinity of the site. The following sanitary infrastructure is adjacent to the subject site;

- A 250 mm sanitary sewer on Aurele Street to the West of the site; and
- A 1200mm trunk sanitary sewer located within the easement along the North-East corner of the site, which flows south-east through the site outletting to the James Naimsmith and Telesat Court right-of-way.

Refer to the **Servicing Drawing (S1)** for the existing sanitary sewer infrastructure and proposed sanitary service design.

3.2 PROPOSED SANITARY SERVICING

Design flows for the proposed development have been calculated using the Ottawa Sewer Design Guidelines (Second Edition – Technical Bulletin ISTB-2018-1 Update March 21, 2018). The total peak sanitary flow is estimated at **4.93 L/s**, based on an average flow of 280 L/day/person, an estimated population of 404, Harmon's peaking factor, and an infiltration allowance of 0.26 L/s/ha.

The proposed sanitary outlet has been analyzed based on available records drawings and preliminary discussions with City Engineering staff. First consideration for ease of access would be to proposed to connect to the 1200mm sanitary trunk sewer located within the subject site. However, City staff have suggested this is not their preferred option and would rather like to see a connection to the sanitary sewer in Eugene Street. As such, we have analyzed this configuration and have confirmed that is should be functionally viable.

Each townhome block will be serviced by a 150 mm diameter sanitary connection. The two mid-rise buildings will share a single mechanical room, also serviced by a 150 mm diameter sanitary connection. The total sanitary flow represents approximately **45.8%** of the capacity of the proposed 150 mm sanitary sewer main. The subject site will have proposed new municipal sanitary sewer proposed along Eugene Street, connecting to the existing 250 mm municipal sanitary sewer on Aurele Street.

Refer to **Appendix B** for details of the calculations. The proposed and existing servicing is shown on the **Servicing Drawing (S1)**.

4.0 WATER SERVICING

4.1 EXISTING WATER SERVICING

The existing site servicing details obtained from The City of Ottawa engineering plan and profiles and a topographical survey completed of the area, indicate that there is watermain infrastructure in the vicinity of the site. The following watermain infrastructure is adjacent to the subject site;

- A 200mm diameter watermain on East side of the property, currently servicing Phase 1 of 1600 James Naismith Drive;
- A 1220mm diameter transmission watermain in an easement located along the North property of the subject site; and
- A 200mm diameter watermain stubbed at the North-West corner of the subject site connected to a 200mm watermain in Eugene Street.

Refer to the **Servicing Drawing (S1)** for the location of the existing watermain infrastructure.

4.2 PROPOSED WATER SERVICING

The proposed water servicing design and calculations are based on the Ottawa Design Guidelines – Water Distribution (Technical Bulletin ISTB-2021-03 – August 18, 2021). Based on the available record drawings indicated above there are potentially three (3) watermain connection options to service the proposed Phase 2 development. The three options are explained further below along with our current proposed recommendation.

- The first option is to connect to the existing 200 mm watermain within the Phase 1 area, located along the east side of Phase 2. This watermain currently services Phase 1 and runs along the north side of the existing building, where it connects to a 300 mm watermain along the east property line that is tapped into the 1,200 mm transmission watermain. This is an undesirable connection as it conflicts with an anticipated future development which is contemplated to be located north of the existing building and east of the proposed phase 2.
- The second option may be to do a direct connection to the 1200mm transmission watermain along the north property easement. This may be the most straight forward and simple connection to make for the proposed development; however, it is understood that municipality typical does not permit connections to large watermain infrastructure, though this configuration could be made should City staff consider it acceptable under the current site constraints.
- The third option, which is our current proposed option, is to connect to the existing 200mm watermain at the north-west corner of the site which is extended from Eugene Street. This connection will provide a direct water service feed independent of Phase 1 and would also not require a direct connection to the transmission watermain. The proposed connection will consist of a 200mm extension into the site and then be reduced internally to a 150mm watermain to service the site domestic and water demands.

Through discussions with City Engineering staff option 3 is the preferred configuration with two watermain connections to Eugene Street, one existing and one proposed.

Domestic water demand was calculated based on the Ottawa Design Guidelines for Water Distribution. A population estimate of 404 and a per-capita water demand of 280 Lpcd were used to determine the average water demand for the proposed development. The average day water demand was calculated to be 1.31 L/s. A Peak Hour factor of 2.20 and a Maximum Day factor of 2.5 were used in determining Peak Hour and Maximum Day demands. The Peak Hour demand was calculated to be **2.88 L/s** and Maximum Day demand was calculated to be **3.27 L/s**.

In accordance with the City's criteria, fire flow demands are determined using the Fire Underwriters Survey methodology. The highest fire flow demand of **100 L/s** for a middle townhouse unit was calculated. This is based on the following inputs:

- NBC Occupancy 'C' for residential occupancy
- Ordinary construction class
- No supervised NFPA 13 compliant sprinkler system

- Combustible contents factor
- Applicable exposure charges based on distance to adjacent buildings

As per City 's design criteria, watermains shall be sized to meet the greater of either:

- Maximum day demand plus fire flow or
- Maximum hour demand

Therefore, the overall water demand for the development is factored water demand plus fire flow, **103.27 L/s** (100 L/s + 3.27 L/s).

A hydrant flow test was completed in April 2025 by Hydrant Testing Ontario at the hydrant located at 1580 Aurele Street. The test recorded a static pressure of 58 psi and a theoretical fire flow of 2,530 USGPM (160 L/s) at a residual pressure of 20 psi. Based on the test results, a water demand of 103.27 L/s corresponds to an estimated system pressure of approximately 42 psi. After accounting for minor losses, major losses, and elevation differences, a minimum residual pressure of 20 psi is anticipated at the hydrant located at the furthest point on site. Therefore, the hydrant flow test confirms that the municipal water system has sufficient pressure and capacity to meet the fire flow requirements of the proposed development.

The water demand calculations are shown in **Appendix C** and the proposed and existing watermain infrastructure are shown on the **Servicing Drawing (S1).**

4.3 FIRE HYDRANT COVERAGE

There are four (4) proposed fire hydrants to provide sufficient fire protection coverage. The coverage radius is shown and indicated by a dashed circle on the servicing plan to show sufficient coverage is provided for fire protection.

5.0 CONCLUSION

The proposed development consists of three (3) blocks of 3.5 storey stacked townhomes and two (2) blocks of 6 storey mid-rise buildings with a total of 194 units. The proposed development can be serviced utilizing the existing and proposed infrastructure outlined in the Servicing Drawing (S1). Our conclusions and recommendations for servicing of the proposed development are summarized as follows:

Stormwater Management Servicing:

- The proposed development will match its post-development 100-year flows to the existing development 5-year flows.
- The proposed development site stormwater drainage will have no adverse impact to the downstream sewer infrastructure.
- Stormwater quality will be achieved by an oil-grit separator.
- Sediment and erosion control measures to be taken during construction have been presented in this report.
- Under post-development conditions, stormwater runoff quality and quantity are expected to improve relative to pre-development conditions.

Sanitary Servicing:

- The anticipated peak sanitary peak flow for the proposed development is 4.93L/s.
- It is anticipated that the additional loading will not adversely affect the existing municipal sanitary sewer system, which has sufficient capacity to accommodate the increased flows.
- The new service connection will consist of a 150 mm diameter municipal sanitary sewer along Eugene Street, which will connect to the existing 250 mm municipal sanitary sewer on Aurele Street.

Water Servicing:

- The calculated maximum day and peak hour demands were calculated as 3.27L/s and 2.88L/.
- The calculated fire flow demand due to the proposed development is 100 L/s.
- The proposed development will be serviced by an internal 200mm watermain connection provided off the 200mm diameter watermain on Eugene Street.
- Additional confirmation of the fire and domestic branch sizing and fire flow requirements should be provided by the Mechanical Consultant at the Building Permit stage of approval.

5.1 RECOMMENDATIONS

The following recommendations are presented:

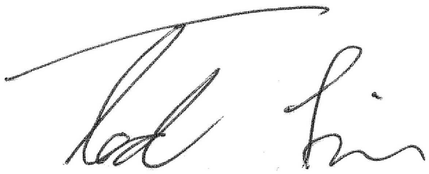
- The contractor shall locate and verify all dimensions, levels, inverts, and datums onsite and report any discrepancies or omissions to the engineer prior to construction.

In summary, the site can be adequately serviced in respect to water supply, sanitary drainage, stormwater drainage, and stormwater management. The stormwater quantity and quality controls can be implemented in accordance to The City of Ottawa Sewer Guidelines (October 2012), and The City of Ottawa Stormwater Management Design Guidelines (2012).

Accordingly, we hereby recommend the adoption of this report as it relates to the provision of servicing works, and for the purposes of site plan application, and building permit application approvals. We trust that this Functional Servicing and Stormwater Management Report is sufficient for your purposes. If you have any questions or comments, please do not hesitate to contact the undersigned.

Yours very truly,

KWA Site Development Consulting Inc.



Ted Fair, P.Eng.

ted.fair@kwasitedev.com

APPENDIX A

STORMWATER CALCULATIONS

Summary of Model Attributes

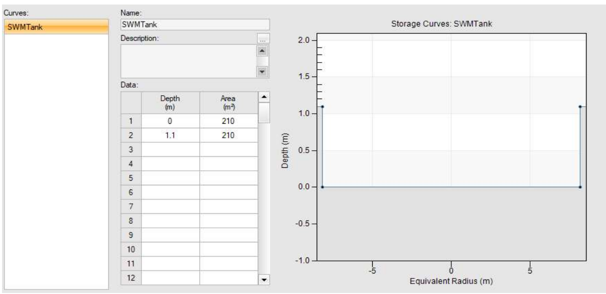
Existing Drainage Areas

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Infiltration Method	Suction Head (mm)	Conductivity (mm/hr)	Initial Deficit (frac.)
S1	OF1	1.35	80	169	2	80	0.013	0.24	2	5	GREEN_AMPT	169.93	6.6	0.366

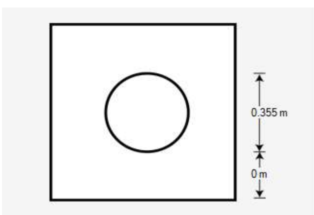
Proposed Drainage Areas

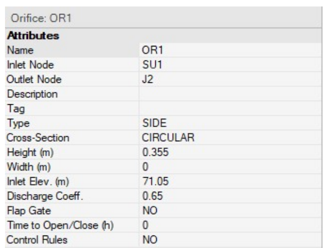
Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Infiltration Method	Suction Head (mm)	Conductivity (mm/hr)	Initial Deficit (frac.)
S1	OF1	1.28	80	160	2	80	0.013	0.24	2	5	GREEN_AMPT	169.93	6.6	0.366
S2	OF2	0.023	10	23	1	80	0.013	0.24	2	5	GREEN_AMPT	169.93	6.6	0.366
S3	OF2	0.023	10	23	1	80	0.013	0.24	2	5	GREEN_AMPT	169.93	6.6	0.366
S4	OF2	0.023	10	23	1	80	0.013	0.24	2	5	GREEN_AMPT	169.93	6.6	0.366

SWM Tank



Orifice Size





Orifice: OR1

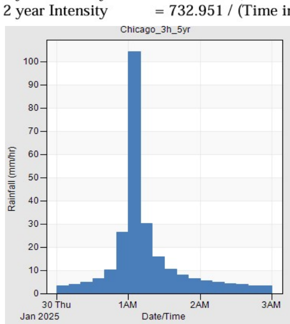
Attributes	
Name	OR1
Inlet Node	SU1
Outlet Node	J2
Description	
Tag	
Type	SIDE
Cross-Section	CIRCULAR
Height (m)	0.355
Width (m)	0
Inlet Elev. (m)	71.05
Discharge Coeff.	0.65
Flap Gate	NO
Time to Open/Close (h)	0
Control Rules	NO

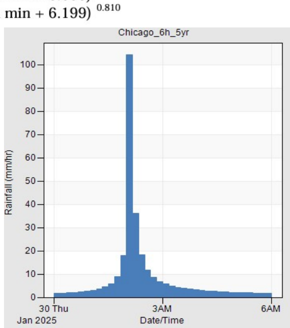
Rain Gauge

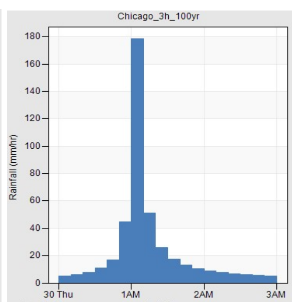
3-hour and 6-hour duration Chicago Storm distribution based on the following City of Ottawa Intensity Duration Frequency (IDF) parameters:

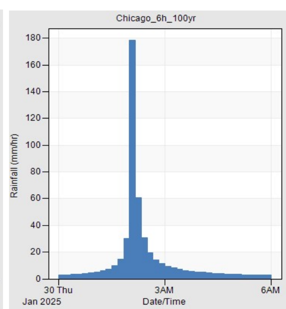
IDF curve equations (Intensity in mm/hr)

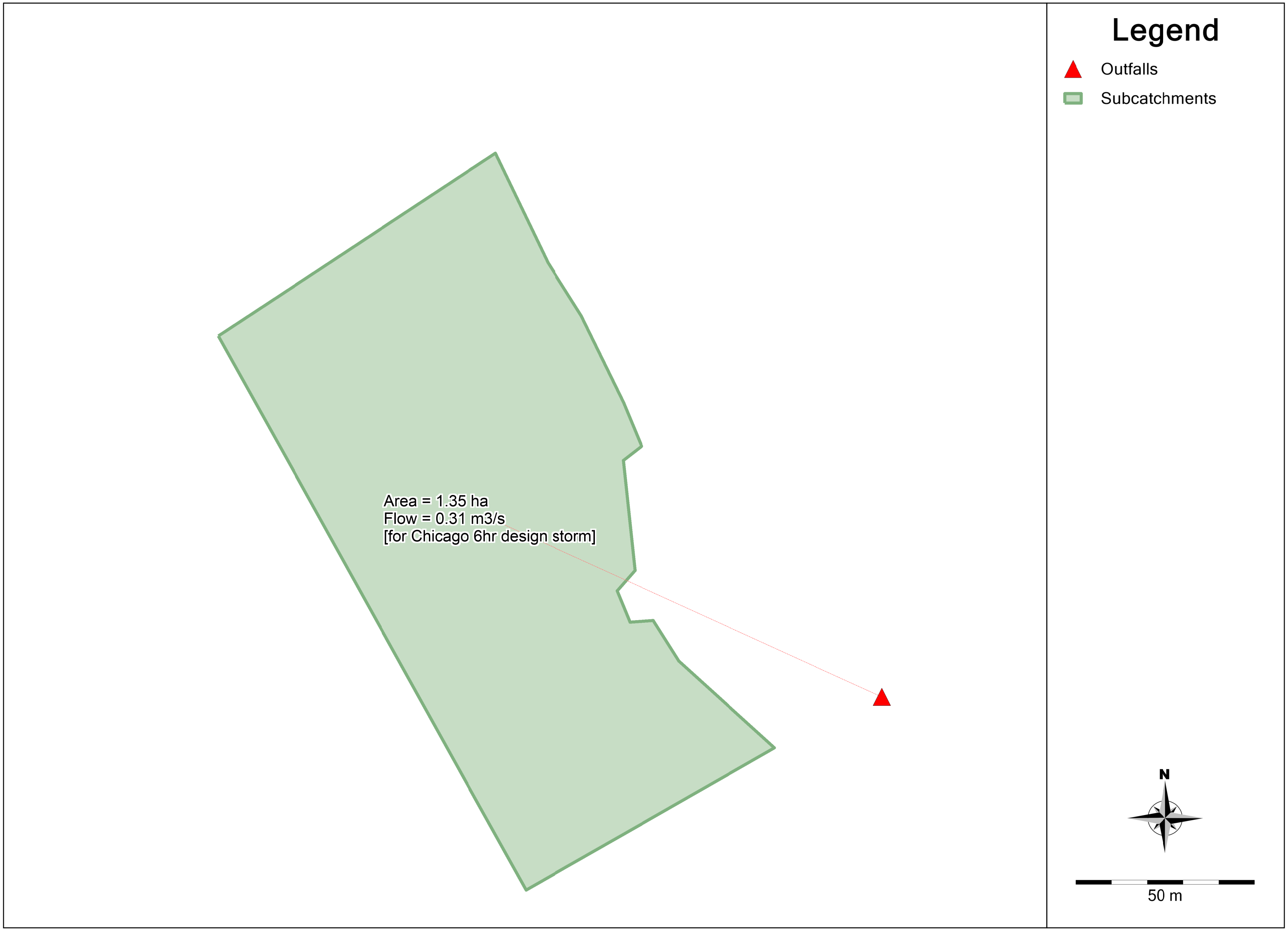
100 year Intensity $= 1735.688 / (\text{Time in min} + 6.014)^{0.820}$
50 year Intensity $= 1569.580 / (\text{Time in min} + 6.014)^{0.820}$
25 year Intensity $= 1402.884 / (\text{Time in min} + 6.018)^{0.819}$
10 year Intensity $= 1174.184 / (\text{Time in min} + 6.014)^{0.816}$
5 year Intensity $= 998.071 / (\text{Time in min} + 6.053)^{0.814}$
2 year Intensity $= 732.951 / (\text{Time in min} + 6.199)^{0.810}$










Legend
Outfalls
Subcatchments
Area = 1.35 ha
Flow = 0.31 m3/s
[for Chicago 6hr design storm]
N
50 m

Existing - 5yr - 3hr Chicago

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

****
Element Count
****

Number of rain gages 4
Number of subcatchments ... 1
Number of nodes 1
Number of links 0
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100yr	Chicago_3h_100yr	INTENSITY	10 min.
Chicago_3h_5yr	Chicago_3h_5yr	INTENSITY	10 min.
Chicago_6h_100yr	Chicago_6h_100yr	INTENSITY	10 min.
Chicago_6h_5yr	Chicago_6h_5yr	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
S1	1.35	80.00	80.00	2.0000	Chicago_3h_5yr	OF1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	100.00	0.00	0.0	

****
Analysis Options
****

Flow Units .... CMS
Process Models:
  Rainfall/Runoff .... YES
  RDII .... NO
  Snowmelt .... NO
  Groundwater .... NO

```
    Flow Routing ........... NO
    Water Quality .......... NO
  Infiltration Method ...... HORTON
  Surcharge Method ......... EXTRAN
  Starting Date ............ 01/30/2025 00:00:00
  Ending Date .............. 01/31/2025 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
```

**************************	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**************************	---------	-------
Total Precipitation	0.057	42.541
Evaporation Loss	0.000	0.000
Infiltration Loss	0.011	8.081
Surface Runoff	0.045	33.565
Final Storage	0.002	1.203
Continuity Error (%)	-0.727	

**************************	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
**************************	---------	---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.045	0.453
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.045	0.453
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 (%)	0.000	

```
  ***************************
  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
S1	42.54	0.00	0.00	8.08	33.11	0.46	33.57	0.45	0.31	0.789

```
Analysis begun on:  Fri Feb  6 11:38:30 2026
Analysis ended on:  Fri Feb  6 11:38:30 2026
Total elapsed time: < 1 sec
```

Existing - 5yr - 6hr Chicago

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


  *************
  Element Count
  *************
  Number of rain gages ...... 4
  Number of subcatchments ... 1
  Number of nodes ........... 1
  Number of links ........... 0
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                              Data       Recording
  Name                 Data Source                            Type       Interval 
  ------------------------------------------------------------------------
  Chicago_3h_100yr     Chicago_3h_100yr                       INTENSITY   10 min.
  Chicago_3h_5yr       Chicago_3h_5yr                         INTENSITY   10 min.
  Chicago_6h_100yr     Chicago_6h_100yr                       INTENSITY   10 min.
  Chicago_6h_5yr       Chicago_6h_5yr                         INTENSITY   10 min.


  ********************
  Subcatchment Summary
  ********************
  Name                       Area     Width   %Imperv    %Slope Rain Gage
Outlet
  ---------------------------------------------------------------------------------
--------------------------
  S1                         1.35     80.00     80.00    2.0000 Chicago_6h_5yr
OF1


  ************
  Node Summary
  ************
                                          Invert      Max.    Ponded    External
  Name                 Type                Elev.     Depth      Area    Inflow  
  -------------------------------------------------------------------------------
  OF1                  OUTFALL            100.00      0.00       0.0


  ****************
  Analysis Options
  ****************
  Flow Units ............... CMS
  Process Models:
    Rainfall/Runoff ........ YES
    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
```

```
    Flow Routing ........... NO
    Water Quality .......... NO
  Infiltration Method ...... HORTON
  Surcharge Method ......... EXTRAN
  Starting Date ............ 01/30/2025 00:00:00
  Ending Date .............. 01/31/2025 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


  **************************        Volume         Depth
  Runoff Quantity Continuity     hectare-m            mm
  **************************     ---------       -------
  Total Precipitation ......         0.066        49.044
  Evaporation Loss .........         0.000         0.000
  Infiltration Loss ........         0.012         9.258
  Surface Runoff ...........         0.053        38.908
  Final Storage ............         0.002         1.204
  Continuity Error (%) .....        -0.663


  **************************        Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  **************************     ---------     ---------
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......         0.053         0.525
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........         0.000         0.000
  External Outflow .........         0.053         0.525
  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 (%) .....         0.000


  ***************************
  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
S1	49.04	0.00	0.00	9.26	38.33	0.58	38.91	0.53	0.30	0.793

```
Analysis begun on:  Fri Feb  6 11:39:01 2026
Analysis ended on:  Fri Feb  6 11:39:01 2026
Total elapsed time: < 1 sec
```

Legend
Junctions
Outfalls
Storages
Conduits
Orifices
Subcatchments
Area = 0.023 ha
Area = 1.28 ha
Area = 0.023 ha
Area = 0.023 ha
N
45 m

Proposed - 100yr - 3hr Chicago

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

****
Element Count
****

Number of rain gages 4
Number of subcatchments ... 4
Number of nodes 5
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100yr	Chicago_3h_100yr	INTENSITY	10 min.
Chicago_3h_5yr	Chicago_3h_5yr	INTENSITY	10 min.
Chicago_6h_100yr	Chicago_6h_100yr	INTENSITY	10 min.
Chicago_6h_5yr	Chicago_6h_5yr	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
S1	1.28	80.00	80.00	2.0000	Chicago_3h_100yr	J1
S2	0.02	10.00	80.00	1.0000	Chicago_3h_100yr	OF2
S3	0.02	10.00	80.00	1.0000	Chicago_3h_100yr	OF2
S4	0.02	10.00	80.00	1.0000	Chicago_3h_100yr	OF2

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	71.06	1.94	0.0	
J2	JUNCTION	71.02	2.27	0.0	
OF1	OUTFALL	70.98	0.53	0.0	
OF2	OUTFALL	0.00	0.00	0.0	
SU1	STORAGE	71.05	1.10	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	% Slope	Roughness
C1	J1	SU1	CONDUIT	10.0	0.1000	0.0130
C2	J2	OF1	CONDUIT	2.8	1.4287	0.0130
OR1	SU1	J2	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	CIRCULAR	0.75	0.44	0.19	0.75	1	0.35
C2	CIRCULAR	0.53	0.22	0.13	0.53	1	0.51

****
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 ............ 01/30/2025 00:00:00
Ending Date .............. 01/31/2025 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 ......         0.097         71.708
Evaporation Loss .........         0.000          0.000
Infiltration Loss ........         0.012          9.248
Surface Runoff ...........         0.083         61.898
Final Storage ............         0.002          1.203
Continuity Error (%) .....        -0.894


**************************        Volume         Volume
Flow Routing Continuity        hectare-m       10^6 ltr
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.083          0.835
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........         0.000          0.000
External Outflow .........         0.083          0.835
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 (%) .....         0.000


***************************
Time-Step Critical Elements
***************************
Link C2 (66.31%)


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


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


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     2.91 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :    48.20 %
    3.155 -  1.991 sec      :     8.24 %
```

1.991 - 1.256 sec : 8.16 %
1.256 - 0.792 sec : 18.33 %
0.792 - 0.500 sec : 17.07 %

****
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
S1	71.71	0.00	0.00	9.28	56.66	5.21	61.87	0.79	0.56	0.863
S2	71.71	0.00	0.00	8.75	56.40	6.03	62.43	0.01	0.01	0.871
S3	71.71	0.00	0.00	8.75	56.40	6.03	62.43	0.01	0.01	0.871
S4	71.71	0.00	0.00	8.75	56.40	6.03	62.43	0.01	0.01	0.871

****
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
J1	JUNCTION	0.16	1.09	72.15	0 01:15	1.09
J2	JUNCTION	0.06	0.27	71.29	0 01:14	0.27
OF1	OUTFALL	0.06	0.27	71.25	0 01:14	0.27
OF2	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
SU1	STORAGE	0.16	1.10	72.15	0 01:14	1.10

****
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

J1	JUNCTION	0.555	0.555	0	01:10	0.792	0.792	-0.005
J2	JUNCTION	0.000	0.265	0	01:14	0	0.792	0.003
OF1	OUTFALL	0.000	0.265	0	01:14	0	0.792	0.000
OF2	OUTFALL	0.033	0.033	0	01:10	0.0431	0.0431	0.000
SU1	STORAGE	0.000	0.555	0	01:10	0	0.792	0.005

****

Node Surcharge Summary

****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
J1	JUNCTION	0.37	0.345	0.845

****

Node Flooding Summary

****

No nodes were flooded.

****

Storage Volume Summary

****

Storage Unit	Average Volume 1000 m³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m³	Max Pcnt Full	Time of Max Occurrence days	hr:min	Maximum Outflow CMS
SU1	0.034	14.2	0.0	0.0	0.242	100.0	0	01:14	0.265

****

Outfall Loading Summary

****

Flow	Avg	Max	Total

Outfall Node	Freq Pcnt	Flow CMS	Flow CMS	Volume 10^6 ltr
OF1	66.44	0.060	0.265	0.792
OF2	41.33	0.005	0.033	0.043
System	53.89	0.065	0.280	0.835

****
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
C1	CONDUIT	0.555	0 01:10	1.47	1.58	1.00
C2	CONDUIT	0.265	0 01:14	2.39	0.51	0.51
OR1	ORIFICE	0.265	0 01:14			1.00

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		---------- Fraction of Time in Flow Class ----------								
C1	1.00	0.00	0.00	0.00	0.97	0.03	0.00	0.00	0.01	0.00
C2	1.00	0.00	0.00	0.00	0.24	0.76	0.00	0.00	0.10	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C1	0.37	0.37	0.37	0.16	0.07

Analysis begun on: Fri Feb 6 11:42:34 2026
Analysis ended on: Fri Feb 6 11:42:34 2026
Total elapsed time: < 1 sec

Proposed - 100yr - 6hr Chicago

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

****
Element Count
****

Number of rain gages 4
Number of subcatchments ... 4
Number of nodes 5
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100yr	Chicago_3h_100yr	INTENSITY	10 min.
Chicago_3h_5yr	Chicago_3h_5yr	INTENSITY	10 min.
Chicago_6h_100yr	Chicago_6h_100yr	INTENSITY	10 min.
Chicago_6h_5yr	Chicago_6h_5yr	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
S1	1.28	80.00	80.00	2.0000	Chicago_6h_100yr	J1
S2	0.02	10.00	80.00	1.0000	Chicago_6h_100yr	OF2
S3	0.02	10.00	80.00	1.0000	Chicago_6h_100yr	OF2
S4	0.02	10.00	80.00	1.0000	Chicago_6h_100yr	OF2

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	71.06	1.94	0.0	
J2	JUNCTION	71.02	2.27	0.0	
OF1	OUTFALL	70.98	0.53	0.0	
OF2	OUTFALL	0.00	0.00	0.0	
SU1	STORAGE	71.05	1.10	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	% Slope	Roughness
C1	J1	SU1	CONDUIT	10.0	0.1000	0.0130
C2	J2	OF1	CONDUIT	2.8	1.4287	0.0130
OR1	SU1	J2	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	CIRCULAR	0.75	0.44	0.19	0.75	1	0.35
C2	CIRCULAR	0.53	0.22	0.13	0.53	1	0.51

****
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 ............ 01/30/2025 00:00:00
Ending Date .............. 01/31/2025 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

```
**************************        hectare-m         mm
Runoff Quantity Continuity     hectare-m           mm
**************************     ---------      -------
Total Precipitation ......         0.111       82.330
Evaporation Loss .........         0.000        0.000
Infiltration Loss ........         0.014       10.664
Surface Runoff ...........         0.096       71.148
Final Storage ............         0.002        1.203
Continuity Error (%) .....        -0.832


**************************        Volume       Volume
Flow Routing Continuity        hectare-m     10^6 ltr
**************************     ---------    ---------
Dry Weather Inflow .......         0.000        0.000
Wet Weather Inflow .......         0.096        0.960
Groundwater Inflow .......         0.000        0.000
RDII Inflow ..............         0.000        0.000
External Inflow ..........         0.000        0.000
External Outflow .........         0.096        0.960
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 (%) .....         0.000


***************************
Time-Step Critical Elements
***************************
Link C2 (76.50%)


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


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


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.25 sec
Average Time Step           :     2.50 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :    36.12 %
    3.155 -  1.991 sec      :     8.00 %
```

1.991 - 1.256 sec   :   20.46 %
1.256 - 0.792 sec   :   20.48 %
0.792 - 0.500 sec   :   14.95 %

****
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
S1	82.33	0.00	0.00	10.69	65.20	5.92	71.13	0.91	0.55	0.864
S2	82.33	0.00	0.00	10.23	64.88	6.70	71.58	0.02	0.01	0.869
S3	82.33	0.00	0.00	10.23	64.88	6.70	71.58	0.02	0.01	0.869
S4	82.33	0.00	0.00	10.23	64.88	6.70	71.58	0.02	0.01	0.869

****
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
J1	JUNCTION	0.16	1.10	72.16	0 02:15	1.09
J2	JUNCTION	0.06	0.27	71.29	0 02:15	0.27
OF1	OUTFALL	0.06	0.27	71.25	0 02:15	0.27
OF2	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
SU1	STORAGE	0.15	1.10	72.15	0 02:15	1.10

****
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

J1	JUNCTION	0.552	0.552	0	02:10	0.91	0.91	-0.003
J2	JUNCTION	0.000	0.265	0	02:15	0	0.91	0.002
OF1	OUTFALL	0.000	0.265	0	02:15	0	0.91	0.000
OF2	OUTFALL	0.033	0.033	0	02:10	0.0494	0.0494	0.000
SU1	STORAGE	0.000	0.552	0	02:10	0	0.91	0.003

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
J1	JUNCTION	0.39	0.345	0.845

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	0.032	14.0	0.0	0.0	0.231	99.9	0 02:15	0.265

****
Outfall Loading Summary
****

Flow Avg Max Total

Outfall Node	Freq Pcnt	Flow CMS	Flow CMS	Volume 10^6 ltr
OF1	76.61	0.049	0.265	0.910
OF2	56.60	0.004	0.033	0.049
System	66.61	0.052	0.280	0.960

****
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
C1	CONDUIT	0.552	0 02:10	1.58	1.57	1.00
C2	CONDUIT	0.265	0 02:15	2.39	0.51	0.51
OR1	ORIFICE	0.265	0 02:15			1.00

****
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
C1	1.00	0.00	0.00	0.00	0.95	0.05	0.00	0.00	0.00	0.00
C2	1.00	0.00	0.00	0.00	0.13	0.86	0.00	0.00	0.10	0.00

****
Conduit Surcharge Summary
****

Conduit	--------- Hours Full -------- Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C1	0.39	0.39	0.40	0.16	0.07

Analysis begun on: Fri Feb 6 11:43:41 2026
Analysis ended on: Fri Feb 6 11:43:42 2026
Total elapsed time: 00:00:01

Swale Sheet Flow Calculations

SWALE CONVEYANCE

Mannings' Equation			TRAPEZOIDAL CHANNEL	
Flow Depth (m) =	0.300			
Side Slope Ratio (H:V) =	3.0	/1	Top width	3.5
Bed Width (m)=	1.70		Hyd. Rad, 'R'	
Area (m^2)=	0.780		0.216825	m
Wetted Perimeter (m)=	3.597	m	Friction Slope Sf	
Slope (%) =	1.00		0.0100	m/m
Manning 'n' =	0.035		Velocity	
Channel Capacity, Q =	0.804	m3/sec	1.031	m/s
Required Capacity =	665	L/s		
100yr + 20%	798	L/s		

Project Name: MORETON JAMES NAISMITH
Project #: 24062
Date: 1/16/2026

Prepared by: TG
Checked by: TF

LOCATION: OTTAWA
STORM SEWER DESIGN SHEET
STORM EVENT (yr) 100

a = 1735.688
b = 6.014
c = 0.82

$i = a[(T+b)/60]^{-c}$, where i (mm/h) ; T (min)
Q = A(i)C/3600 + C. FLOW x (42), where A (m^2) ; i (mm/h)
AC = AREA x RUNOFF COEFFICIENT
C. FLOW = CONTROLLED FLOW

STREET	UPSTREAM STRUCTURE	DOWNSTREAM STRUCTURE	AREA (m^2) C=0.90	AC (m^2)	CUMULATIVE AC (m^2)	ToC (min)	C. FLOW @42L/s/ha (m^2)	CUMULATIVE C. FLOW (m^2)	OVERRIDE STORM EVENT	OVERRIDE a	OVERRIDE b	OVERRIDE c	i (mm/h)	Q (L/s)	PIPE SIZE (mm)	GRADE (%)	CAPACITY (L/s)	VELOCITY (m/s)	LENGTH (m)
	STM MH11	STM MH7		0	1530	10.96		0					170.20	72.3	375	0.25	87.7	0.8	18.75
	BLOCK 2-D STM STUB	STM MH8	1600	1440	1440	10.00		0					178.56	71.4	300	1.63	123.5	1.7	4.55
	STM MH8	STM CBMH2		0	3690	12.05		1400					161.76	171.7	525	0.25	215.0	1.0	24
	STM CBMH1	CULTEC	100	90	4050	12.70		1400					157.17	182.7	525	0.25	215.0	1.0	1.2
	STM CB18	STM MH14	500	450	450	10.00		0					178.56	22.3	250	0.25	29.7	0.6	32.43
	STM MH14	STM MH13		0	1260	10.89		700					170.79	62.7	375	0.25	87.7	0.8	29.99
	STM MH13	STM MH12		0	1890	11.52		1400					165.75	92.9	450	0.25	142.6	0.9	20.79
	STM MH12	STM MH8		0	2250	11.91		1400					162.81	107.6	450	0.25	142.6	0.9	7.63
	STM MH6	STM MH5		0	2340	11.85		800					163.28	109.5	450	0.25	142.6	0.9	22.08
	STM MH4	STM MH3		0	3420	12.82		1600					156.35	155.3	525	0.23	206.3	1.0	21.39
	STM MH3	STM MH2		0	3420	13.19		1600					153.85	152.9	525	0.25	215.0	1.0	12.77
	STM CBMH12	STM MH11	1000	900	1530	10.68		0					172.58	73.3	375	0.25	87.7	0.8	13.62
	STM CB13	STM CBMH12	700	630	630	10.00		0					178.56	31.2	300	0.25	48.4	0.7	27.86
	STM CB10	STM MH8		0	0	10.00		0					178.56	0.0	250	0.36	35.7	0.7	11.12
	STM CB9	STM MH4	200	180	180	10.00		0					178.56	8.9	250	0.25	29.7	0.6	20.77
	STM CBMH2	STM CBMH1	300	270	3960	12.45		1400					158.86	180.6	525	0.25	215.0	1.0	14.47
	STM CB1	-		0	0	10.00		0					178.56	0.0	250	3.29	107.9	2.2	0.65
	STM CB2	STM MH2	400	360	360	10.00		0					178.56	17.9	250	0.99	59.2	1.2	3.87
	OGS MH	EXISTING MH		0	7830	13.85		3800					149.64	341.4	675	0.25	420.3	1.2	2.84
	CULTEC	OGS MH		0	7830	13.83		3800					149.75	341.7	675	0.25	420.3	1.2	1.24
	STORM MH21	STORM MH20		0	0	10.00		0					178.56	0.0	250	0.25	29.7	0.6	37.05
	STORM MH20	STORM MH2		0	0	11.02		0					169.75	0.0	250	0.25	29.7	0.6	18.71
	STORM MH2	STM MH15		0	0	11.53		0					165.65	0.0	250	0.25	29.7	0.6	12.1
	STM MH15	EXISTING MH		0	0	11.87		0					163.12	0.0	250	0.25	29.7	0.6	8.79
	STM MH7	STM MH6		0	1890	11.36		800					167.03	91.0	450	0.25	142.6	0.9	26.17
	BLOCK A - ROOF STM STUB	STM MH7		0	0	10.00	800	800					178.56	3.4	250	1	59.5	1.2	12.6
	STM MH5	STM MH4		0	3240	12.26		1600					160.27	151.0	525	0.26	219.3	1.0	34.02
	BLOCK C - ROOF STM STUB	STM MH5		0	0	10.00	800	800					178.56	3.4	250	1	59.5	1.2	12.39
	BLOCK E - ROOF STM STUB	STM MH1		0	0	10.00	800	800					178.56	3.4	250	1	59.5	1.2	6.73
	STM MH2	CULTEC		0	3780	13.40		1600					152.46	166.8	525	0.29	231.6	1.1	27.56
	STM MH1	CULTEC		0	0	10.09		800					177.72	3.4	250	1	59.5	1.2	3.34
	STM CB3	STM MH3		0	0	10.00		0					178.56	0.0	250	1	59.5	1.2	2.23
	STM CB4	STM MH5	500	450	450	10.00		0					178.56	22.3	250	1	59.5	1.2	2.17
	STM CB5	STM MH5	500	450	450	10.00		0					178.56	22.3	250	1	59.5	1.2	2.25
	STM CB6	STM MH6	500	450	450	10.00		0					178.56	22.3	250	1	59.5	1.2	2.21
	STM CB7	STM MH7	400	360	360	10.00		0					178.56	17.9	250	1	59.5	1.2	2.32
	STM CB14	STM MH12	400	360	360	10.00		0					178.56	17.9	250	1	59.5	1.2	3.46
	STM CB15	STM MH13	700	630	630	10.00		0					178.56	31.2	250	0.5	42.0	0.9	4
	STM CB16	STM MH14	500	450	450	10.00		0					178.56	22.3	250	0.5	42.0	0.9	2.79
	STM CB17	STM MH14	400	360	360	10.00		0					178.56	17.9	250	1	59.5	1.2	2.42
	BLOCK D - ROOF STM STUB	STM MH13		0	0	10.00	700	700					178.56	2.9	250	0.25	29.7	0.6	12.13
	BLOCK B - ROOF STM STUB	STM MH14		0	0	10.00	700	700					178.56	2.9	250	0.5	42.0	0.9	12.35

Project Name: MORETON JAMES NAISMITH (BASEMENT FLOWS)
Project #: 24062 Prepared by: TG
Date: 1/16/2026 Checked by: TF

LOCATION: OTTAWA
STORM SEWER DESIGN SHEET
STORM EVENT (yr) 100

a = 1735.688
b = 6.014
c = 0.82

$i = a[(T+b)/60]^{-c}$, where i (mm/h) ; T (min)
Q = A(i)C/3600 + C. FLOW x (42), where A (m²) ; i (mm/h)
AC = AREA x RUNOFF COEFFICIENT
C. FLOW = CONTROLLED FLOW

STREET	UPSTREAM STRUCTURE	DOWNSTREAM STRUCTURE	AREA (m^2) C=0.90	AC (m^2)	CUMULATIVE AC (m^2)	ToC (min)	C. FLOW @42L/s/ha (m^2)	CUMULATIVE C. FLOW (m^2)	OVERRIDE STORM EVENT	OVERRIDE a	OVERRIDE b	OVERRIDE c	i (mm/h)	Q (L/s)	PIPE SIZE (mm)	GRADE (%)	CAPACITY (L/s)	VELOCITY (m/s)	LENGTH (m)	TOTAL TIME (min)	% CAPACITY
	BLOCK 2-A - PATIO STM STUB	STM MH104	244	220	220	10.00		0					178.56	10.9	200	0.25	16.4	0.5	8.8	10.28	66%
	STM MH104	STM MH103		0	220	10.28		0					176.03	10.7	200	0.25	16.4	0.5	44.4	11.70	65%
	BLOCK 2-C - PATIO STM STUB	STM MH103	244	220	220	10.00		0					178.56	10.9	200	0.25	16.4	0.5	8.9	10.28	66%
	STM MH103	STM MH102		0	439	11.70		0					164.38	20.1	250	0.25	29.7	0.6	26.4	12.43	67%
	STM MH102	STM MH101		0	439	12.43		0					159.05	19.4	250	0.25	29.7	0.6	14.3	12.82	65%
	STM MH101	STM MH100		0	439	12.82		0					156.33	19.1	250	0.28	31.5	0.6	35.7	13.75	61%
	STM MH100	STORM MH2		0	659	13.75		0					150.29	27.5	300	0.16	38.7	0.5	13.2	14.15	71%
	BLOCK 2-E - PATIO STM STUB	STM MH100	244	220	220	10.00		0					178.56	10.9	200	0.20	14.7	0.5	4.7	10.17	74%

Inlet Capcity Analysis

Project Name: James Naismith
Project Number: 24062
Location: Ottawa
Date: 1/16/2026

Prepared By: T.G
Checked By: T.F

Rainfall Data		
Location:	Ottawa	
Event	5 year	100 year
a	998.071	1735.688
b	6.053	6.014
c	0.814	0.820

Drain ID	Structure Name	Drainage Catchment Area (ha)	Drain Catchment Area (m^2)	Runoff Coefficient	Tc (min)	Intensity (mm/hr)	Flow (m^3/s)	Drain Type	Depth of Ponding (m)	Inlet Capacity (m^3/s)	Inlet Capacity with 50% Blockage (m^3/s)	OK with 50% Blockage?
1	STM CB13	0.07	700	0.90	10.00	178.6	0.031	Single CB	0.12	0.085	0.043	OK
2	STM CB18	0.05	500	0.90	10.00	178.6	0.022	Single CB	0.10	0.060	0.030	OK
3	STM CB17	0.04	400	0.90	10.00	178.6	0.018	Single CB	0.10	0.060	0.030	OK
4	STM CB16	0.05	500	0.90	10.00	178.6	0.022	Single CB	0.10	0.060	0.030	OK
5	STM CB7	0.04	400	0.90	10.00	178.6	0.018	Single CB	0.09	0.045	0.023	OK
6	STM CB6	0.05	500	0.90	10.00	178.6	0.022	Single CB	0.09	0.045	0.023	OK
7	STM CB5	0.05	500	0.90	10.00	178.6	0.022	Single CB	0.13	0.095	0.048	OK
8	STM CB10	0.01	100	0.90	10.00	178.6	0.004	Single CB	0.09	0.045	0.023	OK
9	STM CB15	0.07	700	0.90	10.00	178.6	0.031	Single CB	0.16	0.130	0.065	OK
10	STM CB14	0.04	400	0.90	10.00	178.6	0.018	Single CB	0.25	0.180	0.090	OK
11	STM CB4	0.05	500	0.90	10.00	178.6	0.022	Single CB	0.12	0.085	0.043	OK
12	STM CB9	0.02	200	0.90	10.00	178.6	0.009	Single CB	0.13	0.095	0.110	OK
13	STM CB3	0.05	500	0.90	10.00	178.6	0.022	Single CB	0.12	0.085	0.043	OK
14	STM CB2	0.04	500	0.90	10.00	178.6	0.022	Single CB	0.11	0.075	0.038	OK
15	STM CBMH12	0.1	1000	0.90	10.00	178.6	0.045	Single CB	0.13	0.095	0.048	OK
16	STM CB1	0.04	400	0.90	10.00	178.6	0.018	Twin CB	0.08	0.055	0.028	OK
17	STM CBMH2	0.03	300	0.90	10.00	178.6	0.013	Single CB	0.08	0.035	0.018	OK
18	STM CBMH1	0.01	100	0.90	10.00	178.6	0.004	Single CB	0.15	0.120	0.060	OK

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

01/15/2026

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

Site Name:	

Drainage Area (ha):	1.35
Runoff Coefficient 'c':	0.90

Project Name:	James Naismith
Project Number:	24062
Designer Name:	Pavneet Brar
Designer Company:	KWA Site Dev
Designer Email:	pavneet.brar@kwasitedev.com
Designer Phone:	289-259-3545
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):	39.21
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):	1506
Estimated Average Annual Sediment Volume (L/yr):	1225

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	69
EFO5	76
EFO6	82
EFO8	89
EFO10	93
EFO12	96

Recommended Stormceptor EFO Model: EFO6

Estimated Net Annual Sediment (TSS) Load Reduction (%): 82

Water Quality Runoff Volume Capture (%): > 90

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)

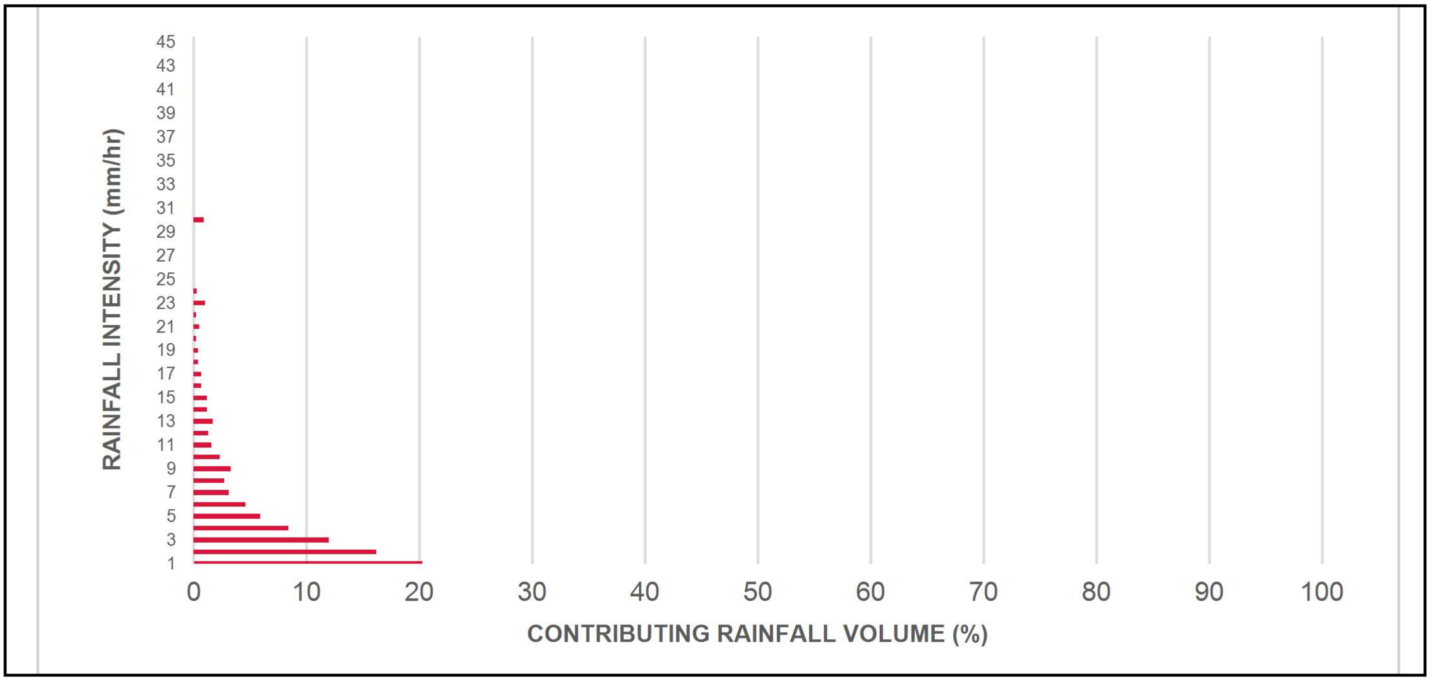
►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a 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

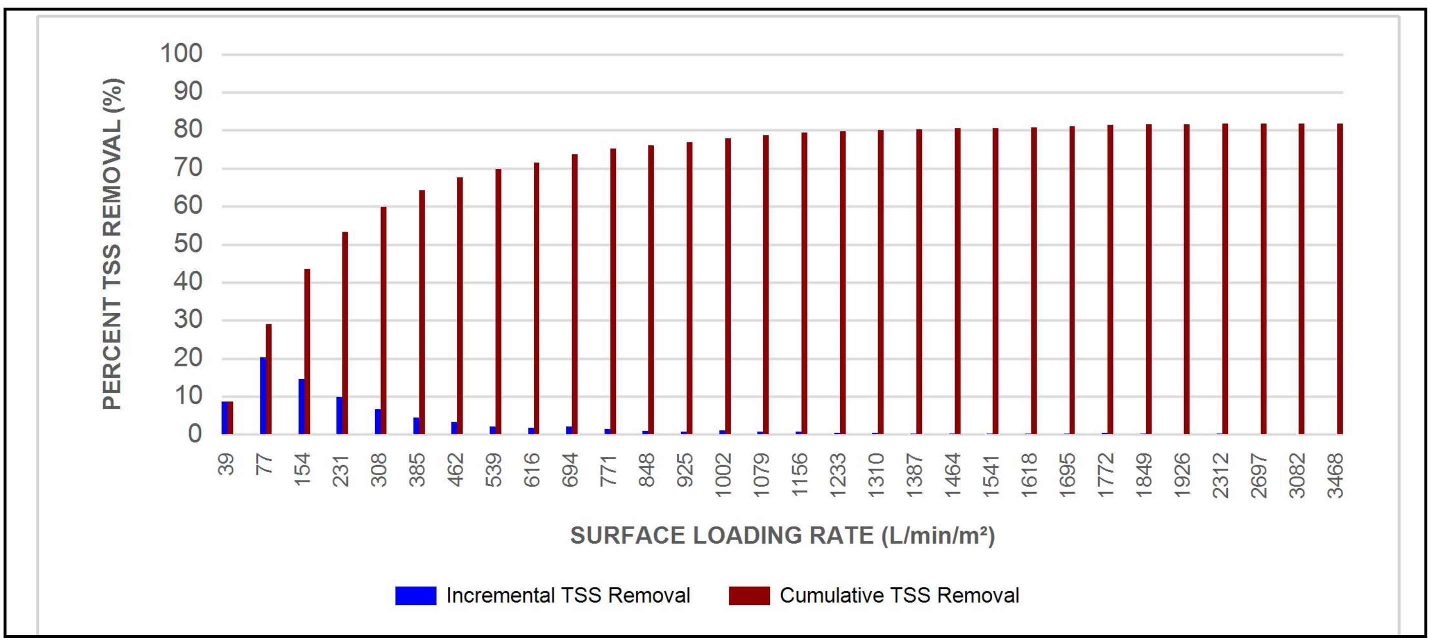
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.6	8.6	1.69	101.0	39.0	100	8.6	8.6
1.00	20.3	29.0	3.38	203.0	77.0	100	20.3	29.0
2.00	16.2	45.2	6.76	405.0	154.0	89	14.5	43.5
3.00	12.0	57.2	10.13	608.0	231.0	82	9.8	53.3
4.00	8.4	65.6	13.51	811.0	308.0	78	6.6	59.9
5.00	5.9	71.6	16.89	1013.0	385.0	75	4.4	64.3
6.00	4.6	76.2	20.27	1216.0	462.0	71	3.3	67.6
7.00	3.1	79.3	23.64	1419.0	539.0	67	2.1	69.7
8.00	2.7	82.0	27.02	1621.0	616.0	65	1.8	71.5
9.00	3.3	85.3	30.40	1824.0	694.0	64	2.1	73.6
10.00	2.3	87.6	33.78	2027.0	771.0	63	1.5	75.1
11.00	1.6	89.2	37.15	2229.0	848.0	63	1.0	76.0
12.00	1.3	90.5	40.53	2432.0	925.0	62	0.8	76.9
13.00	1.7	92.2	43.91	2635.0	1002.0	62	1.1	77.9
14.00	1.2	93.5	47.29	2837.0	1079.0	60	0.7	78.7
15.00	1.2	94.6	50.67	3040.0	1156.0	58	0.7	79.3
16.00	0.7	95.3	54.04	3243.0	1233.0	56	0.4	79.7
17.00	0.7	96.1	57.42	3445.0	1310.0	54	0.4	80.1
18.00	0.4	96.5	60.80	3648.0	1387.0	53	0.2	80.3
19.00	0.4	96.9	64.18	3851.0	1464.0	50	0.2	80.5
20.00	0.2	97.1	67.55	4053.0	1541.0	48	0.1	80.6
21.00	0.5	97.5	70.93	4256.0	1618.0	45	0.2	80.8
22.00	0.2	97.8	74.31	4459.0	1695.0	43	0.1	81.0
23.00	1.0	98.8	77.69	4661.0	1772.0	41	0.4	81.4
24.00	0.3	99.1	81.06	4864.0	1849.0	40	0.1	81.5
25.00	0.0	99.1	84.44	5067.0	1926.0	38	0.0	81.5
30.00	0.9	100.0	101.33	6080.0	2312.0	32	0.3	81.8
35.00	0.0	100.0	118.22	7093.0	2697.0	28	0.0	81.8
40.00	0.0	100.0	135.11	8106.0	3082.0	24	0.0	81.8
45.00	0.0	100.0	152.00	9120.0	3468.0	22	0.0	81.8
							Estimated Net Annual Sediment (TSS) Load Reduction =	**82 %**

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

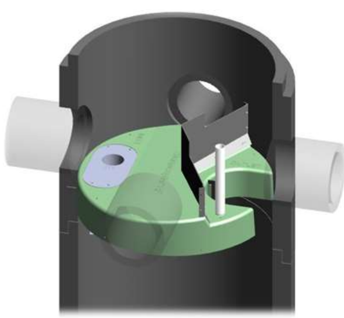
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test 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.

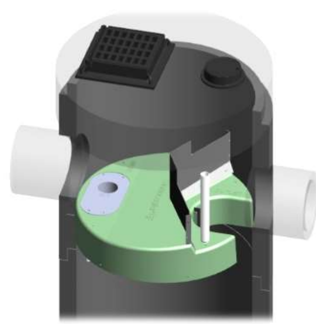
DESIGN FLEXIBILITY

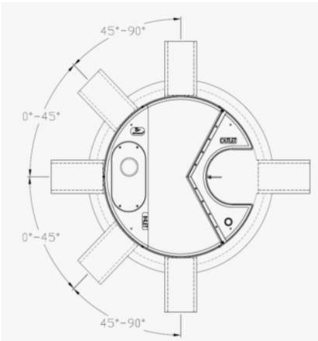
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend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

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

Stormceptor® EF and EFO Oil-Grit Separators

Developed by Imbrium Systems, Inc.,
Whitby, Ontario, Canada

Registration: GPS-ETV_VR2023-11-15_Imbrium-SC

In accordance with

ISO 14034:2016

Environmental management —
Environmental technology verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

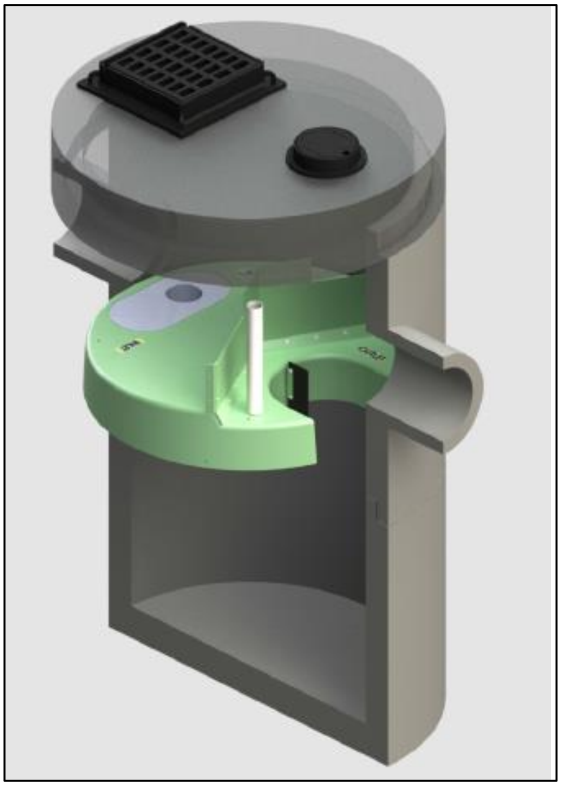
November 15, 2023
Vancouver, BC, Canada

GLOBE PERFORMANCE SOLUTIONS

Verification Body
GLOBE Performance Solutions
404 – 999 Canada Place | Vancouver, B.C | Canada |V6C 3E2

Technology description and application

The Stormceptor® EF and EFO are treatment devices designed to remove oil, sediment, trash, debris, and pollutants attached to particulates from Stormwater and snowmelt runoff. The device takes the place of a conventional manhole within a storm drain system and offers design flexibility that works with various site constraints. The EFO is designed with a shorter bypass weir height, which accepts lower surface loading rate into the sump, thereby reducing re-entrainment of captured free floating light liquids.



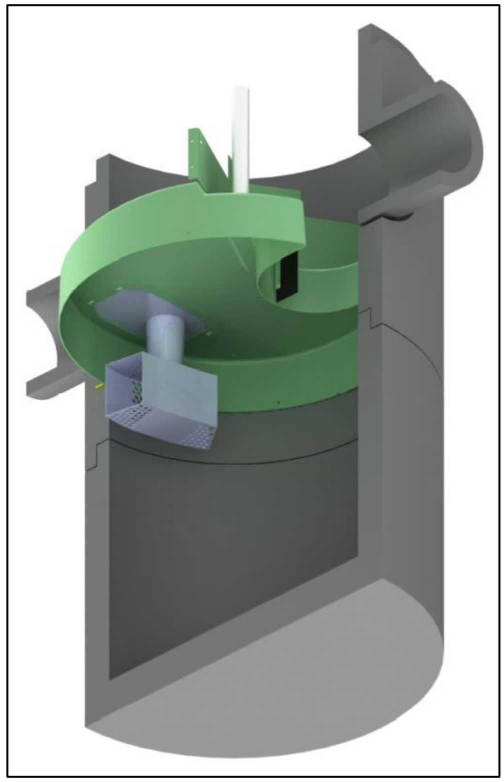


Figure 1. Graphic of typical inline Stormceptor® unit and core components.

Stormwater and snowmelt runoff enters the Stormceptor® EF/EFO's upper chamber through the inlet pipe(s) or a surface inlet grate. An insert divides the unit into lower and upper chambers and incorporates a weir to reduce influent velocity and separate influent (untreated) from effluent (treated) flows. Influent water ponds upstream of the insert's weir providing driving head for the water flowing downwards into the drop pipe where a vortex pulls the water into the lower chamber. The water diffuses at lower velocities in multiple directions through the drop pipe outlet openings. Oil and other floatables rise up and are trapped beneath the insert, while sediments undergo gravitational settling to the sump's bottom. Water from the sump can exit by flowing upward to the outlet riser onto the top side of the insert and downstream of the weir, where it discharges through the outlet pipe.

Maximum flow rate into the lower chamber is a function of weir height and drop pipe orifice diameter. The Stormceptor® EF and EFO are designed to allow a surface loading rate of 1135 L/min/m^2 (27.9 gal/min/ft^2) and 535 L/min/m^2 (13.1 gal/min/ft^2) into the lower chamber, respectively. When prescribed surface loading rates are exceeded, ponding water can overtop the weir height and bypass the lower treatment chamber, exiting directly through the outlet pipe. Hydraulic testing and scour testing demonstrate that the internal bypass effectively prevents scour at all bypass flow rates. Increasing the bypass flow rate does not increase the orifice-controlled flow rate into the lower treatment chamber where sediment is stored. This internal bypass feature allows for in-line installation, avoiding the cost of additional bypass structures. During bypass, treatment continues in the lower chamber at the maximum flow rate. The Stormceptor® EFO's lower design surface loading rate is favorable for minimizing re-entrainment and washout of captured light liquids. Inspection of Stormceptor® EF and EFO devices is performed from grade by inserting a sediment probe through the outlet riser and an oil dipstick through the oil inspection pipe. The unit can be maintained by using a vacuum hose through the outlet riser.

Performance conditions

The data and results published in this Technology Fact Sheet were obtained from the testing program conducted on the Imbrium Systems Inc.'s Stormceptor® EF4 and EFO4 Oil-Grit Separators, in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014). The Procedure was prepared by the Toronto and Region Conservation Authority (TRCA) for Environment Canada's Environmental Technology Verification (ETV) Program. A copy of the Procedure may be accessed on the Canadian ETV website at www.etvcanada.ca.

Performance claim(s)

Capture test [a]:

During the capture test, the Stormceptor® EF4 OGS device, with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removes 70, 64, 54, 48, 46, 44, and 49 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, and 1400 L/min/m^2, respectively.

Stormceptor® EFO4, with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removes 70, 64, 54, 48, 42, 40, and 34 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, and 1400 L/min/m^2, respectively.

Scour test [a]:

During the scour test, the Stormceptor® EF4 and Stormceptor® EFO4 OGS devices, with 10.2 cm (4 inches) of test sediment pre-loaded onto a false floor reaching 50% of the manufacturer's recommended maximum sediment storage depth, generate corrected effluent concentrations of 4.6, 0.7, 0, 0.2, and 0.4 mg/L at 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

Light liquid re-entrainment test [a]:

During the light liquid re-entrainment test, the Stormceptor® EFO4 OGS device with surrogate low-density polyethylene beads preloaded within the lower chamber oil collection zone, representing a floating light liquid volume equal to a depth of 50.8 mm over the sedimentation area, retained 100, 99.5, 99.8, 99.8, and 99.9 percent of loaded beads by mass during the 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2.

[a] The claim can be applied to other units smaller or larger than the tested unit as long as the untested units meet the scaling rule specified in the Procedure for Laboratory of Testing of Oil Grit Separators (Version 3.0, June 2014)

Performance results

The test sediment consisted of ground silica (1 – 1000 micron) with a specific gravity of 2.65, uniformly mixed to meet the particle size distribution specified in the testing procedure. The *Procedure for Laboratory Testing of Oil Grit Separators* requires that the three sample average of the test sediment particle size distribution (PSD) meet the specified PSD percent less than values within a boundary threshold of 6%. The comparison of the average test sediment PSD to the CETV specified PSD in Figure 2 indicates that the test sediment used for the capture and scour tests met this condition.

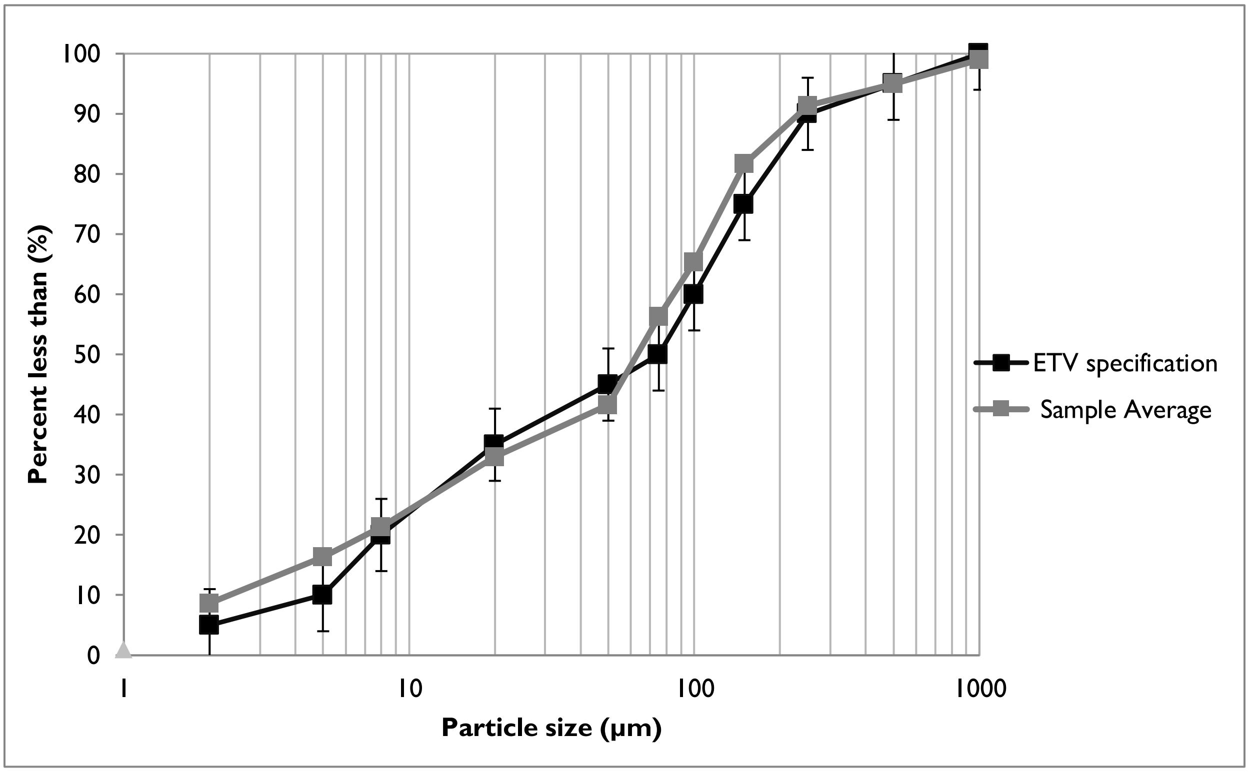


Figure 2. The three sample average particle size distribution (PSD) of the test sediment used for the capture and scour test compared to the specified PSD.

The capacity of the device to retain sediment was determined at seven surface loading rates using the modified mass balance method. This method involved measuring the mass and particle size distribution of the injected and retained sediment for each test run. Performance was evaluated with a false floor simulating the technology filled to 50% of the manufacturer's recommended maximum sediment storage depth. The test was carried out with clean water that maintained a sediment concentration below 20 mg/L. Based on these conditions, removal efficiencies for individual particle size classes and for the test sediment as a whole were determined for each of the tested surface loading rates (Table 1). Since the EF and EFO models are identical except for the weir height, which bypasses flows from the EFO model at a surface loading rate of 535 L/min/m^2 (13.1 gpm/ft^2), sediment capture tests at surface loading rates from 40 to 400 L/min/m^2 were only performed on the EF unit. Surface loading rates of 600, 1000, and 1400 L/min/m^2 were tested on both units separately. Results for the EFO model at these higher flow rates are presented in Table 2.

In some instances, the removal efficiencies were above 100% for certain particle size fractions. These discrepancies are not unique to any one test laboratory and may be attributed to errors relating to the blending of sediment, collection of representative samples for laboratory submission, and laboratory analysis of PSD. Due to these errors, caution should be exercised in applying the removal efficiencies by particle size fraction for the purposes of sizing the tested device (see Bulletin # CETV 2016-11-0001). The results for "all particle sizes by mass balance" (see Table 1 and 2) are based on measurements of the total injected and retained sediment mass, and are therefore not subject to blending, sampling or PSD analysis errors.

Table 1. Removal efficiencies (%) of the EF4 at specified surface loading rates

Particle size fraction (µm)	Surface loading rate (L/min/m²)						
	40	80	200	400	600	1000	1400
>500	90	58	58	100*	86	72	100*
250 - 500	100*	100*	100	100*	100*	100*	100*
150 - 250	90	82	26	100*	100*	67	90
105 - 150	100*	100*	100*	100*	100*	100*	100
75 - 105	100*	92	74	82	77	68	76
53 - 75	Undefined [a]	56	100*	72	69	50	80
20 - 53	54	100*	54	33	36	40	31
8 - 20	67	52	25	21	17	20	20
5 – 8	33	29	11	12	9	7	19
<5	13	0	0	0	0	0	4
All particle sizes by mass balance	**70.4**	**63.8**	**53.9**	**47.5**	**46.0**	**43.7**	**49.0**

[a] An outlier in the feed sample sieve data resulted in a negative removal efficiency for this size fraction.
* Removal efficiencies were calculated to be above 100%. Calculated values ranged between 101 and 171% (average 128%). See text and Bulletin # CETV 2016-11-0001 for more information.

Table 2. Removal efficiencies (%) of the EFO4 at surface loading rates above the bypass rate of 535 L/min/m²

Particle size fraction (µm)	Surface loading rate (L/min/m²)		
	600	1000	1400
>500	89	83	100*
250 - 500	90	100*	92
150 - 250	90	67	100*
105 - 150	85	92	77
75 - 105	80	71	65
53 - 75	60	31	36
20 - 53	33	43	23
8 - 20	17	23	15
5 – 8	10	3	3
<5	0	0	0
All particle sizes by mass balance	**41.7**	**39.7**	**34.2**

* Removal efficiencies were calculated to be above 100%. Calculated values ranged between 103 and 111% (average 107%). See text and Bulletin # CETV 2016-11-0001 for more information.

Figure 3 compares the particle size distribution (PSD) of the three sample average of the test sediment to the PSD of the sediment retained by the EF4 at each of the tested surface loading rates. Figure 4 shows the same graph for the EFO4 unit at surface loading rates above the bypass rate of 535 L/min/m².

As expected, the capture efficiency for fine particles in both units was generally found to decrease as surface loading rates increased.

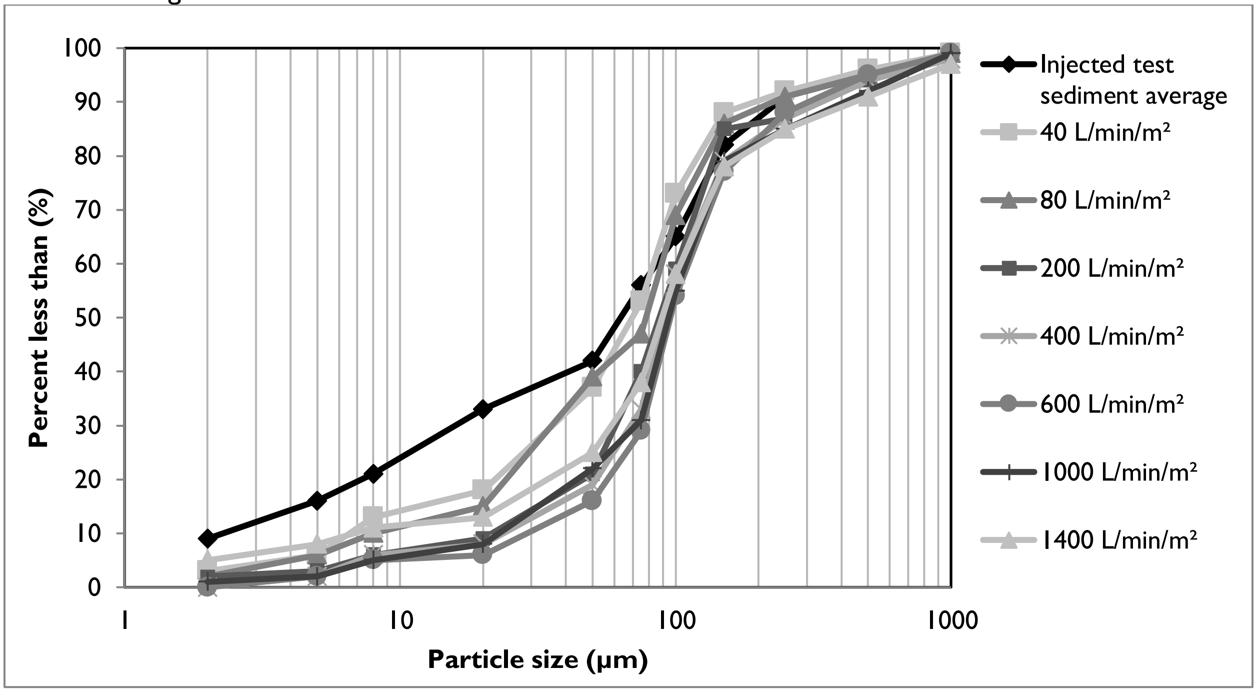


Figure 3. Particle size distribution of sediment retained in the EF4 in relation to the injected test sediment average.

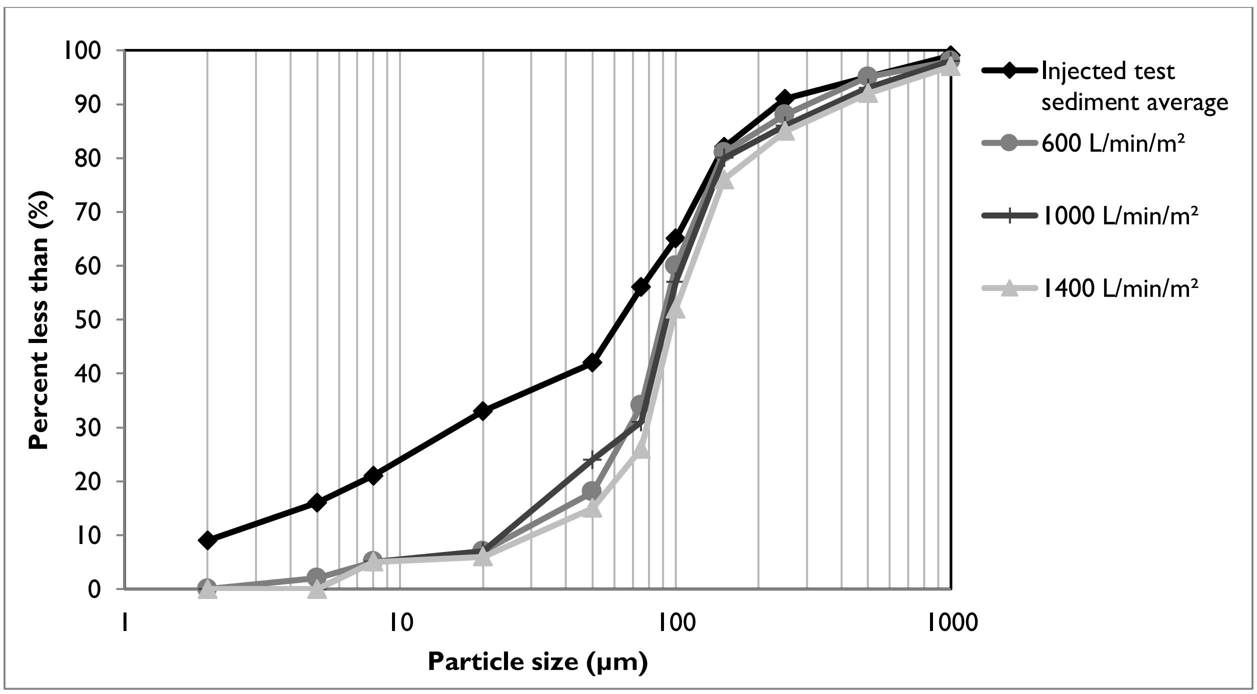


Figure 4. Particle size distribution of sediment retained in the EFO4 in relation to the injected test sediment average at surface loading rates above the bypass rate of 535 L/min/m²

Table 4 shows the results of the sediment scour and re-suspension test for the EF4 unit. The EFO4 was not tested as it was reasonably assumed that scour rates would be lower given that flow bypass occurs at a lower surface loading rate. The scour test involved preloading 10.2 cm of fresh test sediment into the sedimentation sump of the device. The sediment was placed on a false floor to mimic a device filled to 50% of the maximum recommended sediment storage depth. Clean water was run through the device at five surface loading rates over a 30 minute period. Each flow rate was maintained for 5 minutes with a one minute transition time between flow rates. Effluent samples were collected at one minute sampling intervals and analyzed for Suspended Sediment Concentration (SSC) and PSD by recognized methods. The effluent samples were subsequently adjusted based on the background concentration of the influent water. Typically, the smallest 5% of particles captured during the 40 L/min/m² sediment capture test is also used to adjust the concentration, as per the method described in Bulletin # CETV 2016-09-0001. However, since the composites of effluent concentrations were below the Reporting Detection Limit of the Laser Diffraction PSD methodology, this adjustment was not made. Results showed average adjusted effluent sediment concentrations below 5 mg/L at all tested surface loading rates.

It should be noted that the EF4 starts to internally bypass water at 1135 L/min/m², potentially resulting in the dilution of effluent concentrations, which would not normally occur under typical field conditions because the field influent concentration would contain a much higher sediment concentration than during the lab test. Recalculation of effluent concentrations to account for dilution at surface loading rates above the bypass rate showed sediment effluent concentrations to be below 1.6 mg/L.

Table 4. Scour test adjusted effluent sediment concentration.

Run	Surface loading rate (L/min/m²)	Run time (min)	Background sample concentration (mg/L)	Adjusted effluent suspended sediment concentration (mg/L) [a]	Average (mg/L)
1	200	1:00	<RDL	11.9	4.6
		2:00		7.0	
		3:00		4.4	
		4:00		2.2	
		5:00		1.0	
		6:00		1.2	
2	800	7:00	<RDL	1.1	0.7
		8:00		0.9	
		9:00		0.6	
		10:00		1.4	
		11:00		0.1	
		12:00		0	
3	1400	13:00	<RDL	0	0
		14:00		0.1	
		15:00		0	
		16:00		0	
		17:00		0	
		18:00		0	
4	2000	19:00	1.2	0.2	0.2
		20:00		0	
		21:00		0	
		22:00		0.7	
		23:00		0	
		24:00		0.4	

5	2600	25:00	1.6	0.3	0.4
		26:00		0.4	
		27:00		0.7	
		28:00		0.4	
		29:00		0.2	
		30:00		0.4	

[a] The adjusted effluent suspended sediment concentration represents the actual measured effluent concentration minus the background concentration. For more information see Bulletin # CETV 2016-09-0001.

The results of the light liquid re-entrainment test used to evaluate the unit's capacity to prevent re-entrainment of light liquids are reported in Table 5. The test involved preloading 58.3 L (corresponding to a 5 cm depth over the collection sump area of 1.17m^2) of surrogate low-density polyethylene beads within the oil collection skirt and running clean water through the device continuously at five surface loading rates (200, 800, 1400, 2000, and 2600 L/min/m^2). Each flow rate was maintained for 5 minutes with approximately 1 minute transition time between flow rates. The effluent flow was screened to capture all re-entrained pellets throughout the test.

Table 5. Light liquid re-entrainment test results for the EFO4.

Surface Loading Rate (L/min/m2)	Time Stamp	Amount of Beads Re-entrained			
		Mass (g)	Volume (L)[a]	% of Pre-loaded Mass Re-entrained	% of Pre-loaded Mass Retained
200	62	0	0	0.00	100
800	247	168.45	0.3	0.52	99.48
1400	432	51.88	0.09	0.16	99.83
2000	617	55.54	0.1	0.17	99.84
2600	802	19.73	0.035	0.06	99.94
Total Re-entrained		295.60	0.525	0.91	--
Total Retained		32403	57.78	--	99.09
Total Loaded		32699	58.3	--	--

[a] Determined from bead bulk density of 0.56074 g/cm^3

Variances from testing Procedure

The following minor deviations from the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014) have been noted:

1. During the capture test, the 40 L/min/m^2 and 80 L/min/m^2 surface loading rates were evaluated over 3 and 2 days respectively due to the long duration needed to feed the required minimum of 11.3 kg of test sediment into the unit at these lower flow rates. Pumps were shut down at the end of each intermediate day, and turned on again the following morning. The target flow rate was re-established within 30 seconds of switching on the pump. This procedure may have allowed sediments to be captured that otherwise may have exited the unit if the test was continuous. On the basis of practical considerations, this variance was approved by the verifier prior to testing.

2. During the scour test, the coefficient of variation (COV) for the lowest flow rate tested (200 L/min/m²) was 0.07, which exceeded the specified limit of 0.04 target specified in the OGS Procedure. A pump capable of attaining the highest flow rate of 3036 L/min had difficulty maintaining the lowest flow of 234 L/min but still remained within +/- 10% of the target flow and is viewed as having very little impact on the observed results. Similarly, for the light liquid re-entrainment test the COV for the flow rate of the 200 L/min/m² run was 0.049, exceeding the limit of 0.04, but is believed to introduce negligible bias.

3. Due to pressure build up in the filters, the runs at 1000 L/min/m² for the Stormceptor® EF4 and 1000 and 1400 L/min/m² for the Stormceptor® EFO4 were slightly shorter than the target. The run times were 54, 59 and 43 minutes respectively, versus targets of 60 and 50 minutes. The final feed samples were timed to coincide with the end of the run. Since >25 lbs of sediment was fed, the shortened time did not invalidate the runs.

Verification

The verification was completed by the Verification Expert, Toronto and Region Conservation Authority, contracted by GLOBE Performance Solutions, using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***. Data and information provided by Imbrium Systems Inc. to support the performance claim included the following: Performance test report prepared by Good Harbour Laboratories, and dated September 8, 2017; the report is based on testing completed in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014).

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV), and was developed and published by the *International Organization for Standardization (ISO)*. The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

For more information on the Stormceptor® EF and EFO OGS please contact:

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Whitby, ON
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Tel: 416-960-9900
info@imbriumsystems.com

For more information on ISO 14034:2016 / ETV please contact:

GLOBE Performance Solutions
World Trade Centre
404 – 999 Canada Place
Vancouver, BC
V6C 3E2 Canada
Tel: 604-695-5018 / Toll Free: 1-855-695-5018
etv@globeperformance.com

APPENDIX B

SANITARY CALCULATIONS

Project Name :	**1600 James Naismith Drive - Phase 2**	Prepared by:	PB
Project # :	**24062**	Checked by:	TF
	Sanitary Servicing Analysis	Date:	January 16, 2026

Standards = Ottawa

Formulas

Peaking Factor (Harmon) = $1+14/[4+(P/1000)^{1/2}]$

Peak Flow = p(q)M(unit conversion) + infiltration

Existing Sanitary Design Flow

Land Type	Area (m^2)	# of Units /Floor Area	Density	Population (p)	Average Flow (q)	Peaking Factor (M)	Peak Flow (Q) (L/s)
Infiltration Allowance	13500				0.26 L/s/ha		0.35
Total	**13500**						**0.35**

Proposed Sanitary Design Flow

Land Type	Area (m^2)	# of Units /Floor Area	Density	Population (p)	Average Flow (q)	Peaking Factor (M)	Peak Flow (Q) (L/s)
Infiltration Allowance	13500				0.26 L/ha/d		0.35
Residential (Peak Flow) (Townhouse)		195 Units		404	280 L/day/person	3.50	4.58
Total	**13500**						**4.93**

Summary

Existing Sanitary Design Flow =	0.35	L/s
Proposed Sanitary Design Flow =	4.93	L/s
Increased Flow =	4.58	L/s

Service Connection	Diameter (m)	Slope (%)	Velocity (m/s)	Full Flow Capacity (L/s)	Spare Capacity (L/s)	Usage Increased (%)	Total Usage (%)
Residential	150	0.50	0.61	10.77	5.84	-	45.8%
San. Main	1200	0.5	2.44	2756.82	2751.89	0.2%	0.2%

Notes

1. The proposed development is an increase of 4.58 L/s of peak sanitary flow to the downstream sanitary sewer system.
2. This flow is equal to 45.8% of the total pipe capacity of a 150mm diameter service connection.

APPENDIX C

WATER CALCULATIONS

1600 James Naismith Drive - Phase 2

Project Number 24062

Domestic Demand

Prepared by: **PB**
Checked by: **TF**
Date: **January 16, 2026**

as per City of Ottawa Guidelines

Population =	404	
Per Capita Demand =	280	L/cap/day
Average Daily Demand =	113120	L/day
	1.31	L/s

200

	Average Day	**Minimum Hour**	**Peak Hour**	**Maximum Day**	
Peaking Factor	n/a	0.80	2.20	2.50	
Demand	**1.31**	**1.05**	**2.88**	**3.27**	**L/s**
	20.75	16.60	45.65	51.88	GPM

1600 James Naismith Drive - Phase 2
Project Number 24062
Required Fire Flow

Prepared by: **PB**
Checked by: **TF**
Date: **January 16, 2026**

as per City of Ottawa Guidelines

1. Initial Required Fire Flow (Step A, B, C)

Construction Type = Type III Ordinary Construction
Construction Coefficient, C = 1
Total Effective Area, A* = 192.5 m^2
*Single townhome unit, middle worst case surrounded, 55sqm x 3.5 storeys
Required Fire Flow, RFF = 3052.376124 LPM
RFF, rounded = 3000 LPM

2. Occupancy and Contents Adjustment Factor (Step D)

Contents = Combustible contents
Adjustment Factor = 0%
RFF = 3000 LPM

3. Automatic Sprinkler Protection (Step E)

Sprinkler Design	Designed	Building Coverage	Credit
Automatic sprinkler protection designed and installed in accordance with NFPA 13	No	100%	0%
Water supply is standard for both the system and Fire Department hose lines	No	100%	0%
Fully supervised system	No	100%	0%
	Total Sprinkler Credit =		0%

Reduction = 0 LPM

4. Exposure Adjustment Charge (Step F)

Direction	Distance	Charge
North	0m to 3m	25%
South	0m to 3m	25%
East	0m to 3m	25%
West	3.1m to 10m	20%

Total Charge = 95%
Charge = 2850 LPM

5. Final Required Fire Flow (Step G)

RFF = 3000 LPM
Reduction = 0 LPM
Charge = 2850 LPM
RFF = 5850 LPM

Final RFF, rounded = 6000 LPM
1585 GPM
100 L/s

1600 James Naismith Drive - Phase 2
Project Number 24062
Required Fire Flow

Prepared by: **PB**
Checked by: **TF**
Date: **February 9, 2026**

as per City of Ottawa Guidelines

1. Initial Required Fire Flow (Step A, B, C)

Construction Type = Type II Noncombustible Construction
Construction Coefficient, C = 0.8
Total Effective Area, A* = 1300 m^2

*Largest Floor + 25% two adjacent floors (650 +325 +325)

*Mid-rise building

Required Fire Flow, RFF = 6345.770245 LPM
RFF, rounded = 6000 LPM

2. Occupancy and Contents Adjustment Factor (Step D)

Contents = Combustible contents
Adjustment Factor = 0%
RFF = 6000 LPM

3. Automatic Sprinkler Protection (Step E)

Sprinkler Design	Designed	Building Coverage	Credit
Automatic sprinkler protection designed and installed in accordance with NFPA 13	Yes	100%	30%
Water supply is standard for both the system and Fire Department hose lines	Yes	100%	10%
Fully supervised system	Yes	100%	10%
		Total Sprinkler Credit =	50%

Reduction = 3000 LPM

4. Exposure Adjustment Charge (Step F)

Direction	Distance	Charge
North	Greater than 30	0%
South	3.1m to 10m	20%
East	Greater than 30	0%
West	10.1m to 20m	15%

Total Charge = 35%
Charge = 2100 LPM

5. Final Required Fire Flow (Step G)

RFF = 6000 LPM
Reduction = 3000 LPM
Charge = 2100 LPM
RFF = 5100 LPM

Final RFF, rounded = 5000 LPM
1321 GPM
83 L/s

as per City of Ottawa Guidelines

Fire Flow =	100	L/s
Max Day Flow =	3.27	L/s
Total Flow =	**103.3**	**L/s**

Major Losses

Pipe Section	Diameter	Area (m^2)	Length (m)	Velocity (m/s)	Hydraulic Radius	S	Headloss (m)	Headloss (psi)
1	200	0.0314	110	3.3	0.05	0.05	5.41	7.70
2	150	0.0177	0	5.8	0.0375	0.20	0.00	0.00
						Total major loss (psi) =		**7.70**

Minor Losses

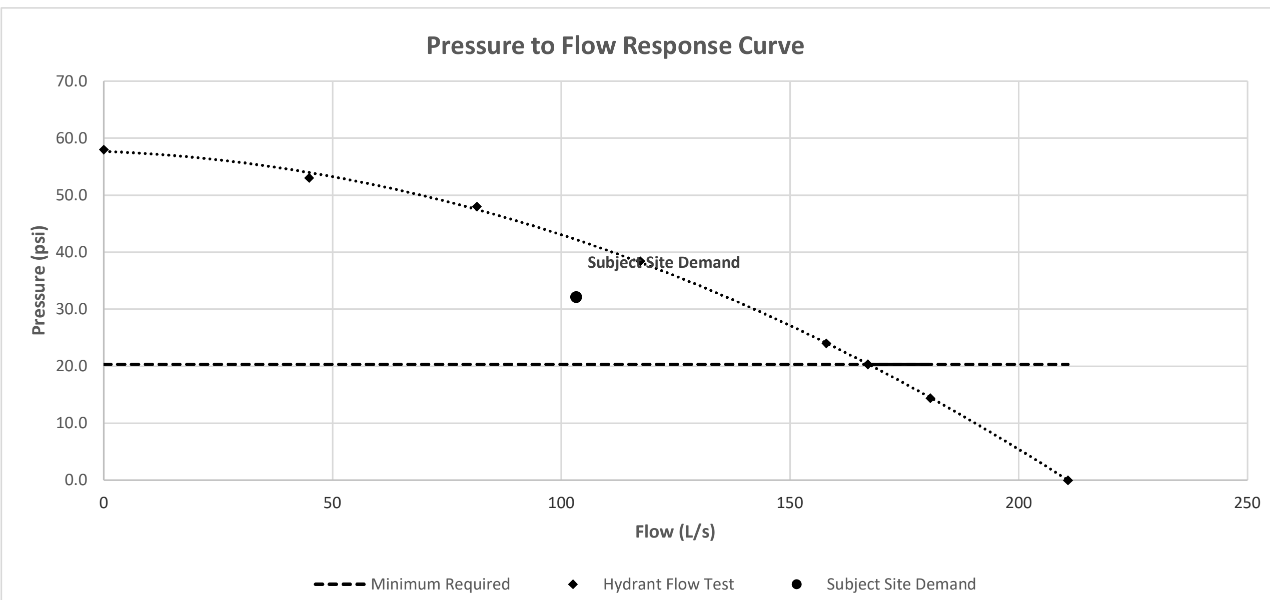
System Component	K-Value	Velocity (m/s)	Velocity Head (m)	Headloss (m)	Headloss (psi)
	3	3.29	0.55	1.7	2.35
			Total minor loss (psi) =		**2.35**

Total Headloss = 10.05 psi

Flow Test Results & Servicing Hydraulic Analysis

Pressure (psi)	*Flow (L/s)*	
58	0	*Static Pressure*
53	44.9	
48	81.6	

Flow Requirement =	***103***	L/s
Theoretical Pressure =	***42.2***	psi
With Pressure Losses =	***32.1***	psi
Minimum Required =	***20.3***	psi



as per City of Ottawa Guidelines

Fire Flow =	50	L/s
Max Day Flow =	3.27	L/s
Total Flow =	**53.3**	**L/s**

Major Losses

Pipe Section	Diameter	Area (m^2)	Length (m)	Velocity (m/s)	Hydraulic Radius	S	Headloss (m)	Headloss (psi)
1	200	0.0314	260	1.7	0.05	0.01	3.75	5.34
2	150	0.0177	0	3.0	0.0375	0.06	0.00	0.00
						Total major loss (psi) =		**5.34**

Minor Losses

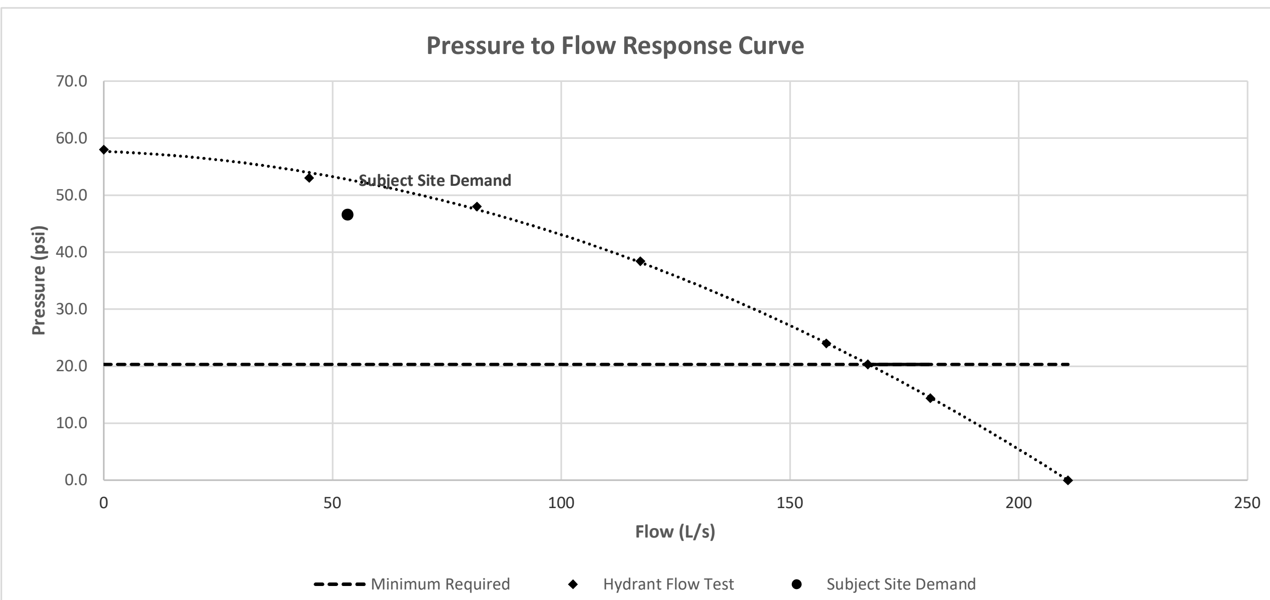
System Component	K-Value	Velocity (m/s)	Velocity Head (m)	Headloss (m)	Headloss (psi)
	4	1.70	0.15	0.6	0.83
			Total minor loss (psi) =		**0.83**

Total Headloss = 6.18 psi

Flow Test Results & Servicing Hydraulic Analysis

Pressure (psi)	*Flow (L/s)*	
58	0	*Static Pressure*
53	44.9	
48	81.6	

Flow Requirement =	***53***	L/s
Theoretical Pressure =	***52.7***	psi
With Pressure Losses =	***46.6***	psi
Minimum Required =	***20.3***	psi



Hydrant Testing Ontario
Tel: 289-354-1942
Info@HTOntario.ca

REPORT
N°. 2590

April 30, 2025

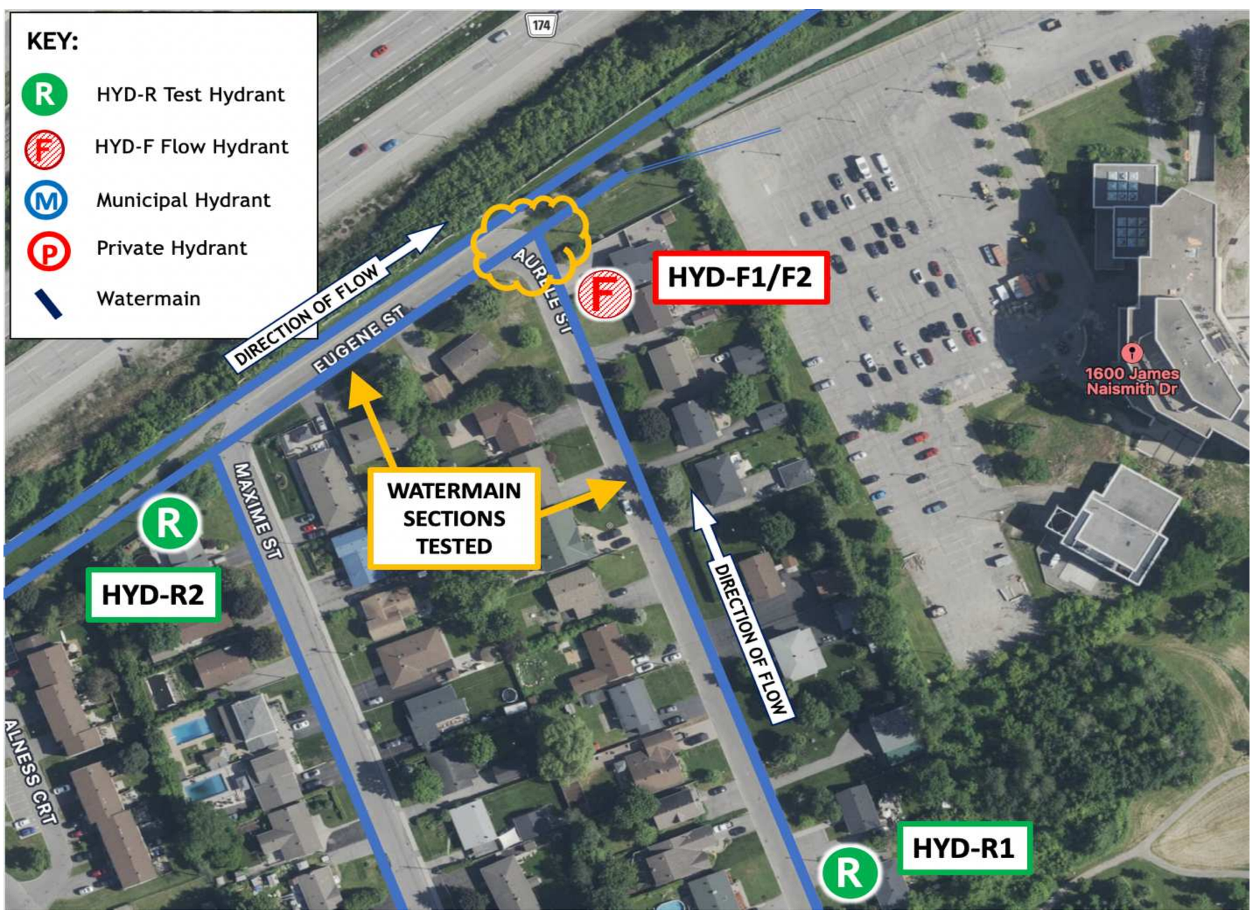
To:

Ted Fair, P. Eng.
KWA Site Development Consulting Inc.

RE: Hydrant Flow Test – 1600 JAMES NAISMITH DRIVE, OTTAWA

Please find the Report for the following works

Scope: Conducted Hydrant Flow Test as per NFPA291 Recommended Practices for Water Flow Testing and Marking of Hydrants.



HYDRANT FLOW TEST

OTTAWA

TEST 1

DATE: April 28, 2025 TIME: 10:45 AM

R -TEST HYDRANT 1580 AURELE STREET HYDRANT No. HYD-R1

HYDRANT MODEL: MCAVITY COLOUR: BLUE

STATIC PRESSURE psi (hr-20^0.54): **58** VARIANCE: 16%

Q - FLOW HYDRANT 1298 AURELE STREET HYDRANT No. HYD-F1

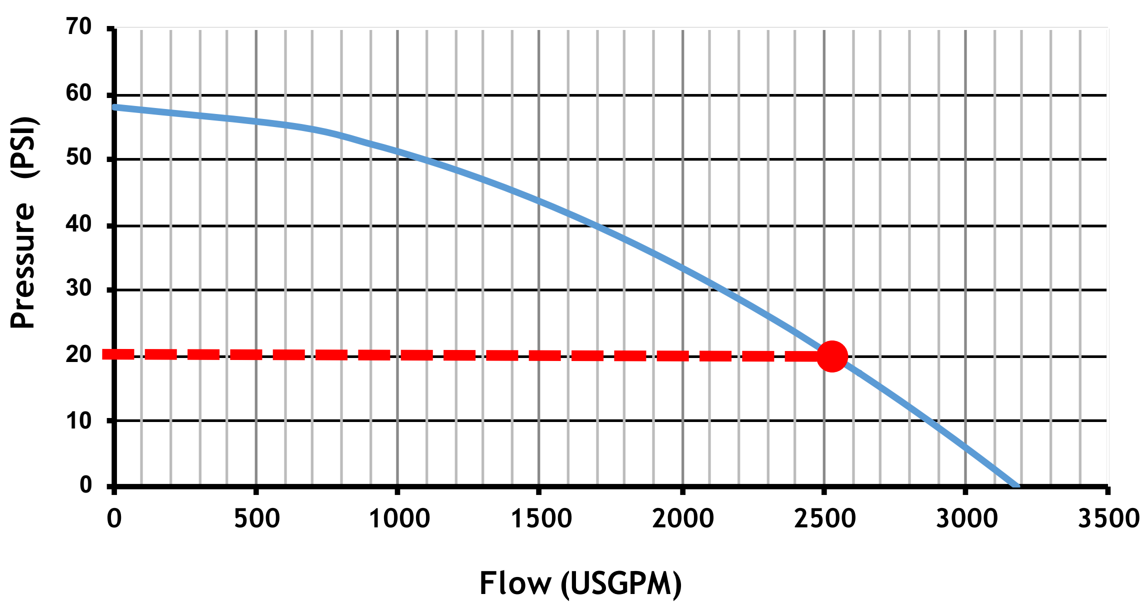
HYDRANT MODEL: MCAVITY COLOUR: BLUE

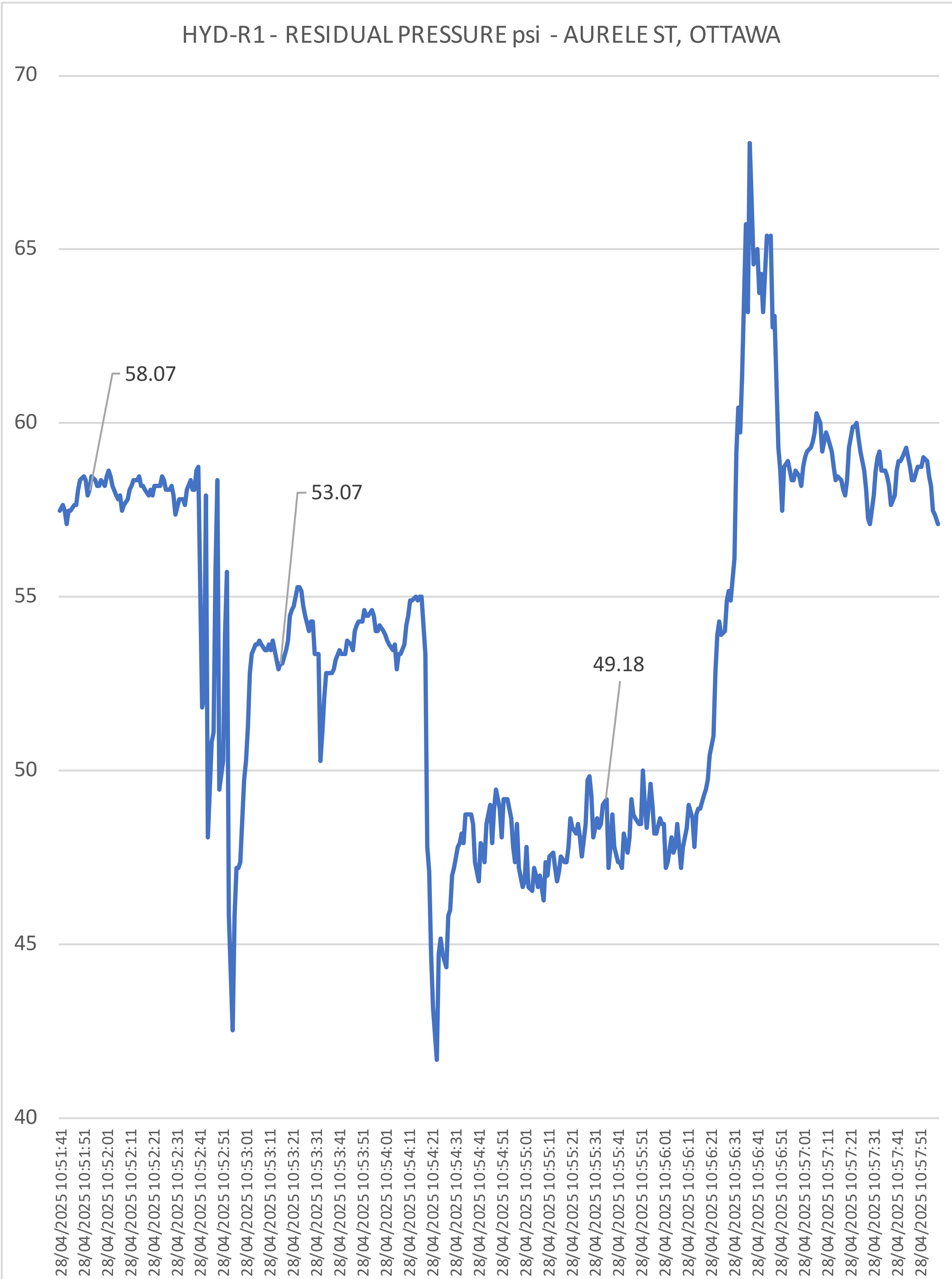
No. Outlets	Residual Pressure (hf-R^0.54)	Orifice Dia Dia. (in.) (d^2)	Coefficient	Nozzle PSI ($\sqrt{psi}$)	Q = Flow (USGPM) $Q = 29.83\ (c)\ (d2)\ (\sqrt{psi})$
1	53	2.5	0.9	18	712
2	49	2.5	0.9	12	581
			Q_F = Total Flow (USGPM)		**1163**

Q_R = flow predicted @ 20 psi — 2530 USGPM

$Q_R = Q_F * (H_r - 20^{0.54}) / (H_f - R^{0.54})$ — 160 L/s

NFPA Rating: **CLASS AA - BLUE**




HYD-R1 - RESIDUAL PRESSURE psi - AURELE ST, OTTAWA
70
65
60
55
50
45
40
58.07
53.07
49.18
28/04/2025 10:51:41
28/04/2025 10:51:51
28/04/2025 10:52:01
28/04/2025 10:52:11
28/04/2025 10:52:21
28/04/2025 10:52:31
28/04/2025 10:52:41
28/04/2025 10:52:51
28/04/2025 10:53:01
28/04/2025 10:53:11
28/04/2025 10:53:21
28/04/2025 10:53:31
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28/04/2025 10:53:51
28/04/2025 10:54:01
28/04/2025 10:54:11
28/04/2025 10:54:21
28/04/2025 10:54:31
28/04/2025 10:54:41
28/04/2025 10:54:51
28/04/2025 10:55:01
28/04/2025 10:55:11
28/04/2025 10:55:21
28/04/2025 10:55:31
28/04/2025 10:55:41
28/04/2025 10:55:51
28/04/2025 10:56:01
28/04/2025 10:56:11
28/04/2025 10:56:21
28/04/2025 10:56:31
28/04/2025 10:56:41
28/04/2025 10:56:51
28/04/2025 10:57:01
28/04/2025 10:57:11
28/04/2025 10:57:21
28/04/2025 10:57:31
28/04/2025 10:57:41
28/04/2025 10:57:51

HYDRANT FLOW TEST

OTTAWA

TEST 2

DATE: April 28, 2025 TIME: 10:45 PM

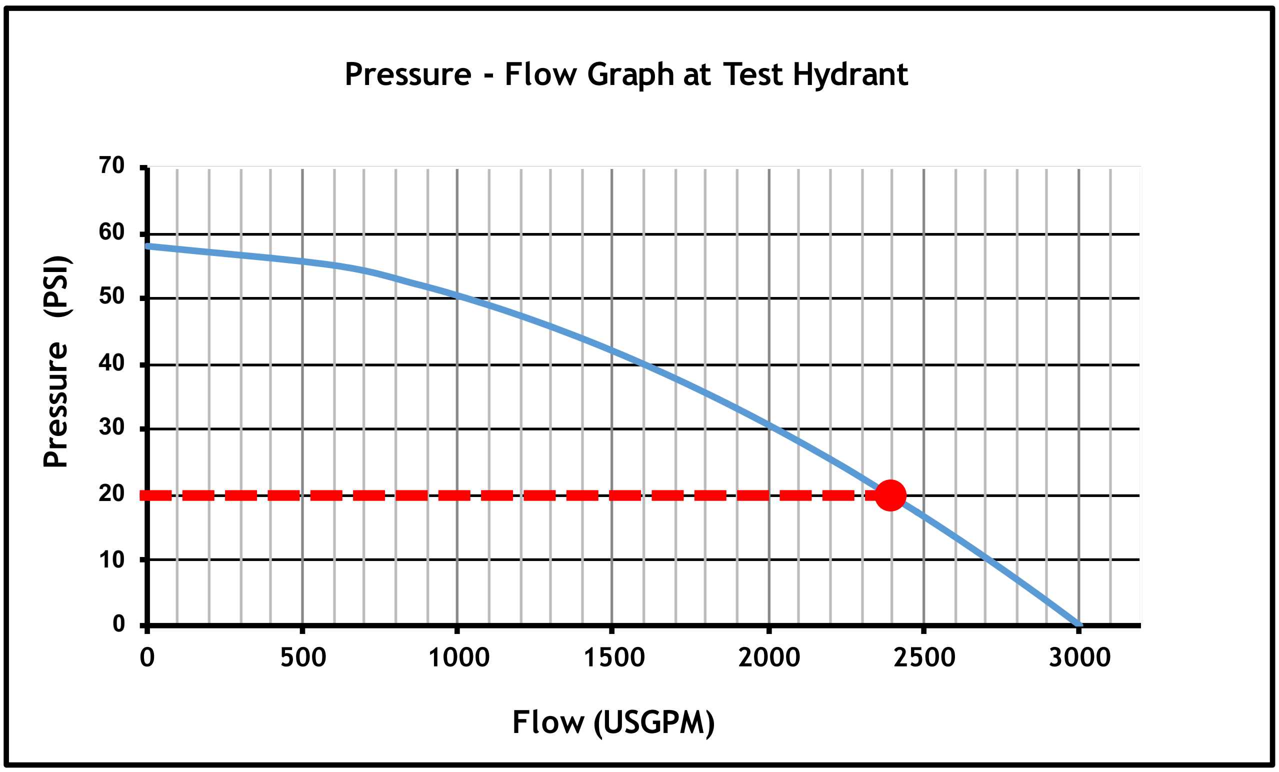
R -TEST HYDRANT	MAXIME ST / EUGENE ST	HYDRANT No.	HYD-R2
HYDRANT MODEL:	MCAVITY	COLOUR:	BLUE
STATIC PRESSURE psi (hr-20^0.54):	**58**	VARIANCE:	17%
Q - FLOW HYDRANT	1298 AURELL STREET	HYDRANT No.	HYD-F2
HYDRANT MODEL:	MCAVITY	COLOUR:	BLUE

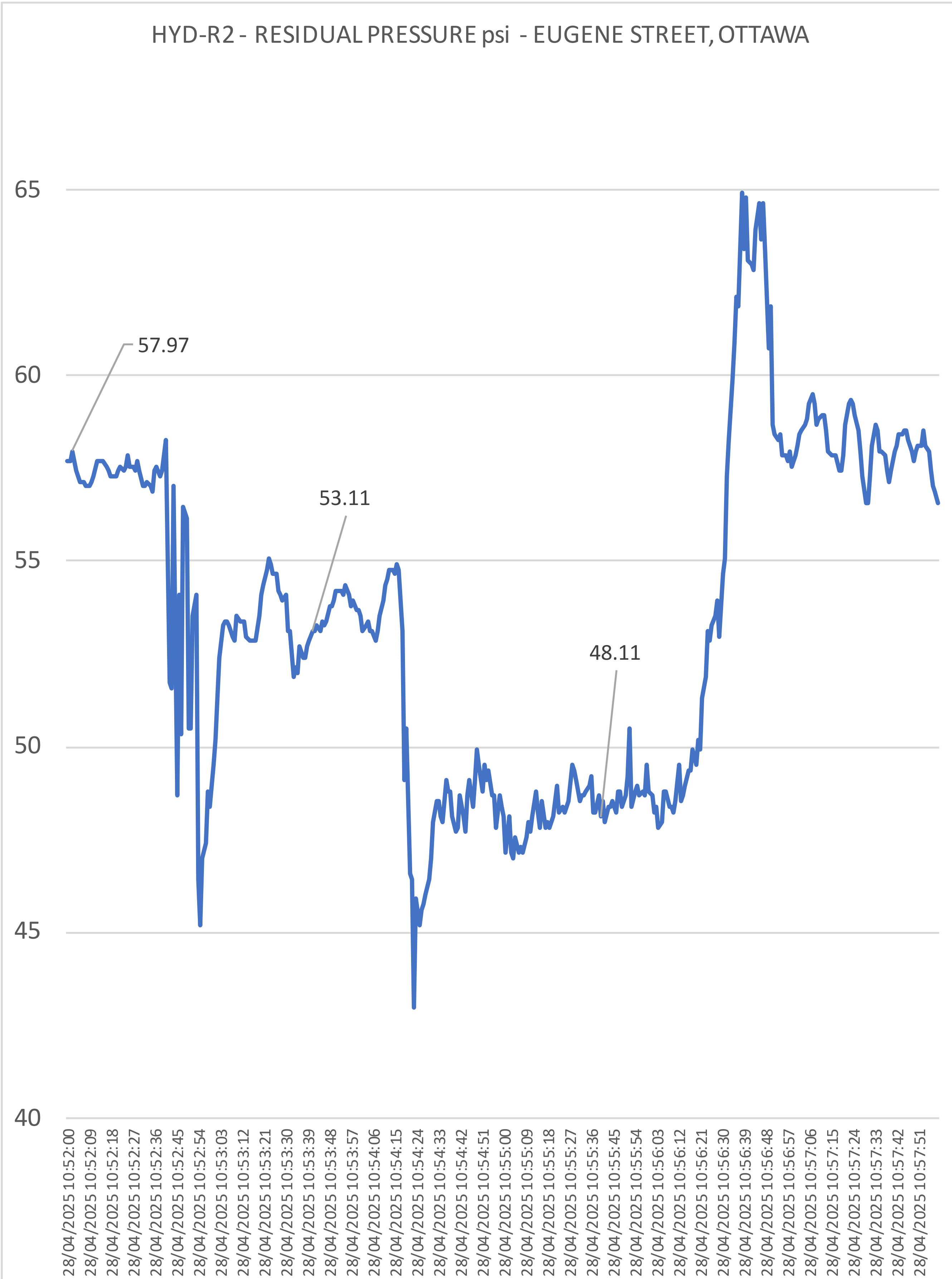
No. Outlets	Residual Pressure (hf-R^0.54)	Orifice Dia Dia. (in.) (d^2)	Coefficient	Nozzle PSI $(\sqrt{psi})$	Q = Flow (USGPM) $Q = 29.83\ (c)\ (d2)\ (\sqrt{psi})$
1	53	2.5	0.9	18	712
2	48	2.5	0.9	12	581
			Q_F = Total Flow (USGPM)		**1163**

Q_R = flow predicted @ 20 psi — 2390 USGPM

$Q_R = Q_F * (H_r - 20^{0.54}) / (H_f - R^{0.54})$ — 151 L/s

NFPA Rating: CLASS AA - BLUE




HYD-R2 - RESIDUAL PRESSURE psi - EUGENE STREET, OTTAWA
65
60
55
50
45
40
57.97
53.11
48.11
28/04/2025 10:52:00
28/04/2025 10:52:09
28/04/2025 10:52:18
28/04/2025 10:52:27
28/04/2025 10:52:36
28/04/2025 10:52:45
28/04/2025 10:52:54
28/04/2025 10:53:03
28/04/2025 10:53:12
28/04/2025 10:53:21
28/04/2025 10:53:30
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28/04/2025 10:54:06
28/04/2025 10:54:15
28/04/2025 10:54:24
28/04/2025 10:54:33
28/04/2025 10:54:42
28/04/2025 10:54:51
28/04/2025 10:55:00
28/04/2025 10:55:09
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28/04/2025 10:55:27
28/04/2025 10:55:36
28/04/2025 10:55:45
28/04/2025 10:55:54
28/04/2025 10:56:03
28/04/2025 10:56:12
28/04/2025 10:56:21
28/04/2025 10:56:30
28/04/2025 10:56:39
28/04/2025 10:56:48
28/04/2025 10:56:57
28/04/2025 10:57:06
28/04/2025 10:57:15
28/04/2025 10:57:24
28/04/2025 10:57:33
28/04/2025 10:57:42
28/04/2025 10:57:51

Test Conclusion

The system at the time of testing produced a theorectical projected flow rate of:

LOCATION	Total USGPM	USGPM at 20 psi	lps at 20 psi	Test #
EUGENE ST	1163	2530	160	1
AURELE AST	1163	2390	151	2

Hydrants are classified in accordance with their rated capacities as per NFPA291.

COLOUR	CLASS	Available Flow @ 20psi
BLUE	***AA***	***1500 GPM or more***
GREEN	A	1000 – 1499 GPM
ORANGE	B	500 – 999 GPM
RED	C	Below 500 GPM

We strongly feel that all attempts have been made to ensure that the required data as stipulated was captured, stored and presented in an accurate, efficient and timely manner for the required period.

We look forward to working with you in the future.

Please feel free to contact the undersigned should you require any further information.

Best Regards

Rob Gamache E.P
Manager of Operations
Hydrant Testing Ontario
Info@HTOntario.ca

APPENDIX D

SUPPORTING DOCUMENTS