Stormwater Management Report
Prince of Wales & Meadowland Drive KDR Redevelopment

SHELL CANADA LIMITED

NOVEMBER 27, 2024

REVISED SEPT 2025

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Revision History

Revision #	Date	Revised By	Revision Description
0	JULY 19 2024	YVONNE	ORGINAL
1	NOV 27 2024	YVONNE	SITE PLAN REVISED SWM AREAS
2	APRIL 16 2025	YVONNE	SPA COMMENTS MARCH 5 2025
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4	Sept 24 2025	Yvonne	SPA comments September 8 2025

Authors

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Report Reviewed By:	Bibi Mapp, Project Manager | AECOM

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1 Project Information

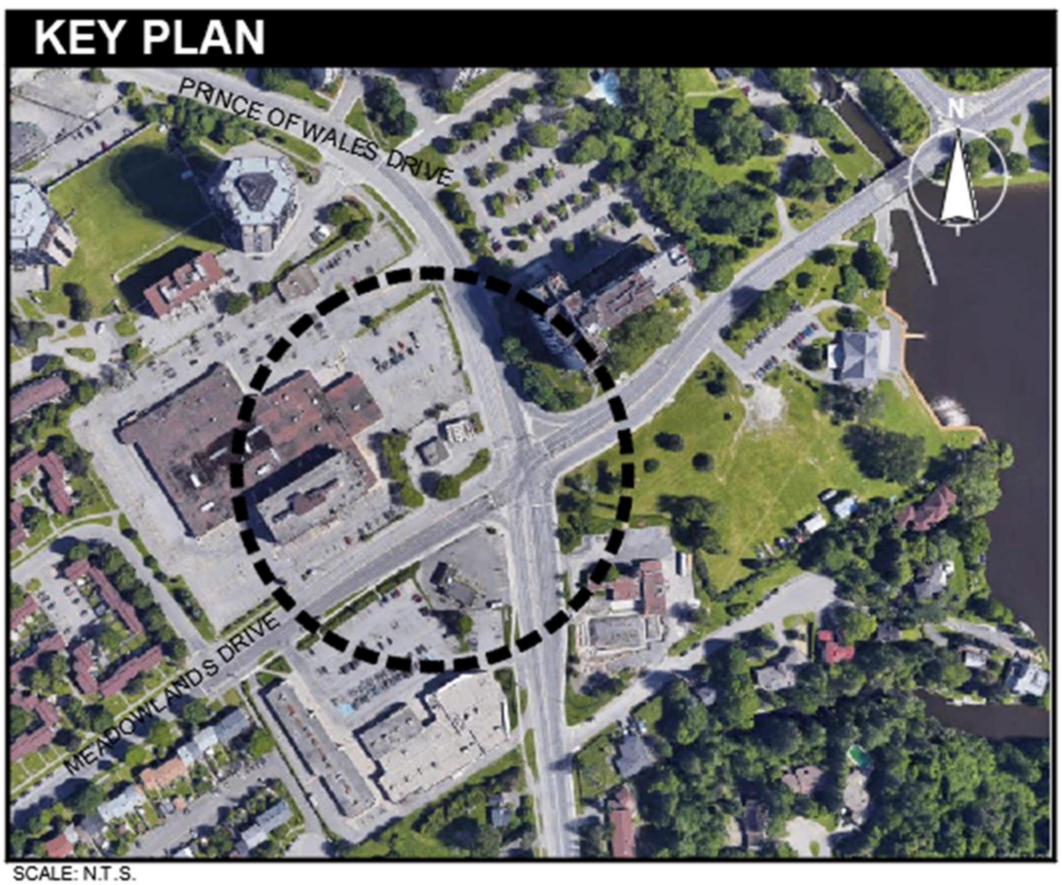
Client:	Shell Canada Products
Contact:	Kerry Morrison, EPCM Advisor
Project Name:	Prince of Wales & Meadowlands KDR
Description:	Redevelopment (Knockdown Rebuild) Gas Bar with Canopy, C-store
Location:	1440 Prince of Wales Drive, Ottawa, Ontario
Consultant:	CTM Design Services Ltd.
Contact:	Yvonne Faas, P.Eng. Civil Engineer

2 Introduction

CTM Design Services Ltd. (CTM) has been retained by Shell Canada Products to provide consulting engineering services for the proposed redevelopment of the property located on the northwest corner of the intersection of Prince of Wales Drive and Meadowlands Drive. The address is 1440 Prince of Wales Drive, Ottawa, Ontario. The location map is shown in Figure 1.

2.1 Location Map

The site is located west of Prince of Wales Drive and north of Meadowlands Drive.



2.2 Existing Conditions

The subject site is 0.444 hectares in size. The site is currently occupied by one c-store and attached canopy over the gas bar which includes 4 dispensers, and a fenced in garbage enclosure. There are two commercial accesses from Prince of Wales Drive and one commercial access from Meadowlands Drive. The existing site cover consists of paved parking and drive areas, and some perimeter grassed landscaping with some mature trees.

2.3 Proposed Conditions

The proposed site will consist of a new C-store, a new 4-dispenser gas bar covered by a canopy, new underground tanks will be installed, new drive-through lanes adjacent to the back property lines, new in-ground waste containers, new retaining wall adjacent to existing parking lot, and new EV charging stations. There will be one commercial access from Prince of Wales Drive and one commercial access from Meadowlands Drive. Most of the site cover will consist of paved parking and drive areas, and some perimeter landscaping frontage; existing mature trees will be protected where possible.

2.4 Purpose of Report

This Stormwater Management Report outlines the engineering design elements for the proposed development, including site grading and driveway access, storm sewers and stormwater management. This report has been prepared in support of the Site Plan Application (SPA).

2.5 Supporting Drawings

This report has been prepared based on the Site Plan, Site Grading, Servicing and Stormwater Management Plans, both Existing and Proposed Conditions and Erosion and Sediment Control. Supporting drawings will accompany the Site Plan Application.

2.6 Supporting Reports

Referencing the Geotechnical Investigation Report, by Gemtec, September 2023, groundwater depth below existing ground surface ranges from 2.3 to 2.5m. Groundwater levels will fluctuate seasonally and may be higher during wet periods of the year such as the early spring or fall, or following periods of heavy precipitation. Hydraulic response testing results in conductivity for sandy silt deposits. The groundwater quality results are presented in the report. Groundwater management during construction may experience inflow and can be controlled with sumps during excavation when required. Suitable detention and filtration will be required before discharging the water to a sewer. The rate of groundwater inflow from the overburden deposits is not expected to exceed 50,000 litres per day, as such the water takings for this project will likely not be subject to an EASR. Although to prevent potential construction delays, a provisional EASR may be considered depending on duration of excavation, trench size and to account for contingencies related to stormwater infiltration. To minimize groundwater management requirements, it is recommended that construction be undertaken during the dry period of the year (i.e. June to September).

3 Stormwater Management – Existing Conditions

3.1 Existing Conditions

Currently, the site is primarily covered with asphalt and concrete surfaces that drain from north to south and west to east, with slopes ranging from 1% to 5%. Two catch basins in the parking lot collect runoff and direct it into a storm sewer system that discharges into the sewer main on Meadowlands Drive. A third catchbasin is located at the edge of the north-east property line, picking up a portion of the runoff leaving the north catchment of the site.

The existing building and canopy have roof leaders connected directly to the storm system.

The landscaped areas are mostly grass, with slopes ranging from 1% to 15%, and runoff currently flows offsite unmitigated.

On-site Storage:

The as-built survey indicates minimal on-site storage capacity, which means the site cannot detain significant volumes of stormwater.

Catchbasins in Flow-by Conditions:

Existing catchbasins are not effectively capturing all the runoff, particularly during higher flow rates. When catchbasins are in flow-by conditions, water bypasses them rather than being captured and conveyed through the drainage system.

No Ponding Storage:

There's no evidence of ponding storage on-site, which could otherwise help in temporarily storing runoff and reducing peak flow rates.

Inlet Capture Efficiency:

During higher flow rates, the efficiency of inlets (catchbasins) to capture runoff decreases exponentially. This is a common issue, as inlets can become overwhelmed, especially if they are not adequately sized or maintained.

Overland Escape Flows:

Under existing conditions, capture during 1:2 and 1:5 year flows into the catchbasins is occurring. Overland flows occur during storm events greater than 1:5. Significant escape flows occur during 1:100 year storm events. Full calculations are provided in Appendix A.

3.3 Table 1: Existing Stormwater Peak Flows and Runoff Volume

EXISTING STORMWATER PEAK FLOWS AND RUNOFF VOLUMES				
CONDITION	2 YEAR	5 YEAR	100 YEAR	UNITS
TOTAL PEAK FLOW GENERATED	30	39	63	L/s
FREE FLOW OFFSITE	2	2	3	L/s
CONTROLLED IN PIPE	28	37	60	L/s
STORAGE VOLUME PROVIDED	4	4	4	m^3

4 Stormwater Management – Proposed Conditions

4.1 Proposed Conditions

The proposed redevelopment site will see an increase to the asphalt and concrete surfaces, and a corresponding decrease to the landscaped surface area. Therefore, an increase in the overall runoff coefficient from 0.77 to 0.84 will occur.

For the redevelopment site, the proposed stormwater management (SWM) plan addresses several elements to improve the current conditions and manage surface runoff effectively:

Site Grading and Drainage:

Slopes will range from 1% to 5% for asphalt and concrete surfaces, and 1% to 10% for landscaped areas.

The site will be graded towards containment of stormwater runoff into two (2) catchbasins and three (3) grated top manhole.

Areas of uncontrolled, unmitigated, free flow have been minimized. Small areas of landscape frontage drains offsite to public lands and a small portion of the access crossing drains onto Meadowlands Drive.

Roof Leaders:

The proposed building and canopy will have roof leaders that connect directly to the stormwater system, ensuring that runoff from these structures is managed effectively. Alternatively, it may be possible to redirect the rain water leaders to the north landscaped area for infiltration, however, it is a small area, and offers little value. Drainage to the south would offer more landscaped area for infiltration, however a sidewalk crossing would be needed, and there is potential for ice build up or clogging. Regular maintenance would be recommended.

Ponding Conditions:

The new catchbasins and grated top manholes will be designed to create ponding conditions, maximizing on-site storage and reducing peak runoff. Ponding depth will be less than 0.300m. Maximum full supply level is shown on the Stormwater Management – Post Development plan. the ponding will not reach the buildings. There is 0.300m of freeboard between the spill elevation and the building opening for assurance.

Flow Control:

An orifice plate will be installed on the outlet pipe to control the release rate of stormwater, ensuring it matches allowable release rate for a runoff coefficient of 0.50, matching a 1:2 year storm event. At this site, the allowable release rate is 19 L/s. The minimum orifice diameter allowable is 75mm. When the 1:100 year ponding elevation is reached, the head acting on the orifice will limit the flow to 18L/s.

Oil Grit Separator (OGS):

A new OGS unit will be installed to treat runoff, removing oil and grit before discharge. A Stormceptor Model EF04 was sized to meet local guidelines.

Overland Escape Flows:

Under proposed conditions, there will be no overland escape flows upto and including the 1:100 year design storm event, including the runoff coefficient c-value increased by 25%. This is a significant improvement over existing conditions. The controlled overland escape route will be to via the access crossings to Prince of Wales Drive and Meadowlands Drive.

Full calculations are provided in Appendix B.

4.2 Table 2: Proposed Redevelopment Stormwater Peak Flows and Runoff Volume

PROPOSED STORMWATER PEAK FLOWS AND RUNOFF VOLUMES					
CONDITION	2 YEAR	5 YEAR	100 YEAR	STRESS TEST (+20%)	UNITS
TOTAL PEAK FLOW GENERATED	31.4	41.1	66.5	81.0	L/s
UNCONTROLLED, FREE FLOW OFFSITE	2.6	3.5	6.2	7.4	L/s
CONTROLLED FLOW TO PIPE	28.8	38.0	67.5	73.7	L/s
STORAGE VOLUME REQUIRED	9	13	27.3	36.5	m3
STORAGE VOLUME PROVIDED	53	53	53	53	m3

4.3 Quantity Control

Peak flow calculations are based on rainfall intensity duration frequency (IDF) curves in accordance with the municipal standards. The rainfall intensity values, i, for the 2, 5 and 100 year return periods are sourced from the following compilation:

- Ottawa Sewer Design Guidelines
- nearby gauged data provided by Environment Canada
- compiled through Simonovic, S.P., A. Schardong, R. Srivastav, and D. Sandink (2015), IDF_CC Web-based Tool for Updating Intensity-Duration-Frequency Curves to Changing Climate – ver 6.0, Western University Facility for Intelligent Decision Support and Institute for Catastrophic Loss Reduction, open access https://www.idf-cc-uwo.ca.

The c value for landscaping in the 100 year event is increased by 25%.

The additional Stress Test adds 20% to the IDF curve.

4.4 Table 3: IDF data

Duration (min)	2 Year (mm/hr)	5 Year (mm/hr)	100 Year (mm/hr)
10	76	101	162

For detailed calculations refer to Appendices A & B. Using the Modified Rational Method, the maximum storage volume requirement and the peak escape flow were predicted for the 1:2, 1:5 and 1:100 year storm events.

The time of concentration is the minimum 10 minutes across the s

4.5 Table 4: Surface Storage

Pond	Area (sq.m)	Depth (m)	Volume (cu.m)
1	120	0.250	10.0
2	140	0.250	11.7
3	218	0.240	17.4
TOTAL			39.1

4.6 Table 5: Underground Storage

Item	Rim or Water Level	Outlet Inv.	Radius	Volume (cu.m)
CB1	82.24	80.34	0.45	1.21
CB2	82.24	80.37	0.45	1.19
GTMH1	82.25	80.03	0.60	2.51
GTMH2	82.42	80.13	0.60	2.59
GTMH3	82.29	80.21	0.60	2.35
TOTAL				9.85

Item	Length	Diameter	Volume (cu.m)
PIPE	19.523	0.150	1.38
PIPE	26.133	0.150	1.85
PIPE	5.739	0.150	0.41
PIPE	7.655	0.150	0.54
TOTAL			4.17

4.7 Table 6: Total Storage

Total Storage	Volume (cu.m)
Surface Storage	39.1
Underground Storage	14.0
Total Storage	53.1

4.8 Quality Control

The landscape areas are generally considered clean runoff and thus permitted to infiltrate and runoff.

The driving surfaces on the redevelopment site will be prone to oil, grit, and sediment collection. These areas will be collected into the on-site storm sewer and transported to an Oil Grit Separator Unit sized to achieve Enhanced Protection Level (Level 1 treatment) which provides a minimum 80% TSS removal. This specification was provided by Ontario Provincial Regulations, Stormwater Management Planning and Design Manual.

For this application a Stormceptor® EF/EFO type oil and grit separator will be selected in accordance with the manufacturer's recommendations. Refer to Appendix C for supporting product documentation, verification of the target 80% TSS removal, Standard Specification, Owner's Manual including Operations & Maintenance Manual.

To ensure the target of 80% TSS is reached, the OGS unit works with a treatment train. The treatment train consists of on-site storage and catchbasin sumps.

5 Summary

The proposed redevelopment of this site aims to significantly improve the current stormwater management system. The new plan will substantially reduce unmitigated overland escape flows, with the discharge rate being controlled by an orifice plate under ponding conditions. Onsite storage capacity has been maximized within the constraints of site grading. Additionally, a new Oil Grit Separator will be installed to further enhance stormwater quality management.

Appendices

Appendix A – Existing Conditions SWM Calculations

Appendix B – Proposed Redevelopment SWM Calculations

Appendix C – Oil Grit Separator Product Supporting Documents

Appendix A – Existing Conditions SWM Calculations

1:2 Year Storm Event

Existing A1	Area, m^2	C		
Building & Canopy	241	1	241	m^2
Asphalt/Concrete	1135	0.9	1022	m^2
Landscaping	419	0.3	126	m^2
Total	1795	0.77	1388	m^2

Rational Method

A =	0.1388	ha
i	76.4	mm/h
Q1 =	2.78*A*C*i L/s	
C1 =	0.77	
Q1 =	30	L/s

1:100 Year Storm Event

Rational Method

A =	0.1388	ha
i	162	mm/h
Q1 =	2.78*A*C*i L/s	
C1 =	0.77	
Q1 =	62.5	L/s

Allowable Release Rate for design of redevelopment sites are determined by using the smaller of a runoff coefficient of 0.5 for the 1:2 year storm event.

Rational Method

A =	0.1388	ha
i	76.4	mm/h
Q1 =	2.78*A*C*i L/s	
C1 =	0.5	
Q1 =	19	L/s

Appendix B – Proposed Redevelopment SWM Calculations

A2-1

Post-Dev	Area, m^2	C		
Building & Canopy	0	1	0	m^2
Asphalt/Concrete	300	0.9	270	m^2
Landscaping	36	0.3	11	m^2
Total	336	0.84	281	m^2

A2-2

Post-Dev	Area, m^2	C		
Building & Canopy	289	1	289	m2
Asphalt/Concrete	235	0.9	212	m2
Landscaping	28	0.3	8	m2
Total	552	0.92	509	m2

A2-3

Post-Dev	Area, m^2	C		
Building & Canopy	0	1	0	m^2
Asphalt/Concrete	200	0.9	180	m^2
Landscaping	0	0.3	0	m^2
Total	200	0.90	180	m^2

A2-4

Post-Dev	Area, m^2	C		
Building & Canopy	190	1	190	m^2
Asphalt/Concrete	0	0.9	0	m^2
Landscaping	0	0.3	0	m^2
Total	190	1.00	190	m^2

A2-5

Post-Dev	Area, m^2	C		
Building & Canopy	0	1	0	m^2
Asphalt/Concrete	194	0.9	175	m^2
Landscaping	65	0.3	20	m^2
Total	259	0.75	194	m^2

B2-1

Post-Dev	Area, m^2	C		
Building & Canopy	0	1	0	m^2
Asphalt/Concrete	33	0.9	30	m^2
Landscaping	115	0.3	35	m^2
Total	148	0.43	64	m^2

B2-2

Post-Dev	Area, m^2	C		
Building & Canopy	0	1	0	m^2
Asphalt/Concrete	43	0.9	39	m^2
Landscaping	67	0.3	20	m^2
Total	110	0.53	59	m^2

Increase c value by 25% for landscape areas in the 100 year event.

C=0.30*1.25 = 0.38

A2-1

Post-Dev	Area, m^2	C		
Building & Canopy	0	1	0	m^2
Asphalt/Concrete	300	0.9	270	m^2
Landscaping	36	0.38	14	m^2
Total	336	0.84	284	m^2

A2-2

Post-Dev	Area, m^2	C		
Building & Canopy	289	1	289	m^2
Asphalt/Concrete	235	0.9	212	m^2
Landscaping	28	0.38	11	m^2
Total	552	0.93	511	m^2

A2-3

Post-Dev	Area, m^2	C		
Building & Canopy	0	1	0	m^2
Asphalt/Concrete	200	0.9	180	m^2
Landscaping	0	0.38	0	m^2
Total	200	0.90	180	m^2

A2-4

Post-Dev	Area, m^2	C		
Building & Canopy	190	1	190	m^2
Asphalt/Concrete	0	0.9	0	m^2
Landscaping	0	0.38	0	m^2
Total	190	1.00	190	m^2

A2-5

Post-Dev	Area, m^2	C		
Building & Canopy	0	1	0	m^2
Asphalt/Concrete	194	0.9	175	m^2
Landscaping	65	0.38	25	m^2
Total	259	0.77	199	m^2

B2-1

Post-Dev	Area, m^2	C	
Building & Canopy	0	1	0 m^2
Asphalt/Concrete	33	0.9	30 m^2
Landscaping	115	0.38	44 m^2
Total	148	0.50	73 m^2

B2-2

Post-Dev	Area, m^2	C	
Building & Canopy	0	1	0 m^2
Asphalt/Concrete	43	0.9	39 m^2
Landscaping	67	0.38	25 m^2
Total	110	0.58	64 m^2

ORIFICE CONTROL IN PR. GTMH#1

	1:2 Year	1:100 Year	Stress Test (20%)	
R =	38	38	38	mm
A_0 =	0.00454	0.00454	0.00454	m^2
Head Calculation				
Top of Pond =	81.300	82.380	82.450	m
Pipe Invert =	80.030	80.030	80.030	m
Water depth in outgoing pipe (if orifice submerged) =	0.092	0.110	0.110	m
H_0 =	1.178	2.282	2.352	m/m
Q_{A2} =	13.1	18.2	18.5	L/s

STORAGE VOLUME REQUIRED (RATIONAL METHOD MODEL)

	1:2 Year	1:100 Year	Stress Test (20%)	
VOLUME $_{REQ}$ =	9.4	27.3	36.5	m^3
ELEVATION REACHED =	81.30	82.38	82.45	m

STORAGE VOLUME PROVIDED

Storage Volume Available in Surface Ponding =	39.1	m^3
SPILL ELEVATION =	82.49	m
Underground Pipe & Barrel Storage	14.0	m^3
Total Storage	53.1	m^3

TOTAL FREE FLOW + CONTROLLED FLOW =

	1:2 Year	1:100 Year	Stress Test (20%)	
$Q_{B2} + Q_{A2}$ =	15.7	24.4	25.9	L/s

$Q_{PR} < Q_{ALL}$

$VOL_{REQ} < VOL_{AVL}$

For a single orifice, flow is determined by the following equation:

Equation 5-9: Orifice Equation

$$Q = C_0 A_0 (2gH_0)^{0.5}$$

where:
- Q = orifice flow rate (m^3/s)
- C_0 = discharge coefficient (0.40-0.60)
- A_0 = area of orifice (m^2)
- H_0 = effective head on the orifice measured from the centroid of the opening (m)
- g = acceleration due to gravity (9.81 m^2/s)

If the orifice discharges as a free outfall, the effective head is measured from the centreline of the orifice to the upstream water surface elevation. If the orifice is submerged, the effective head is the difference in elevation of the upstream and downstream water elevations.

A discharge coefficient of 0.60 is typically used for sharp-edged, uniform orifice entrance conditions.

Appendix C – Oil Grit Separator Product Supporting Documents

Stormceptor® EF Sizing Report

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

07/03/2024

Province:	Ontario
City:	Ottawa
Nearest Rainfall Station:	OTTAWA MACDONALD-CARTIER INT'L AP
NCDC Rainfall Station Id:	6000
Years of Rainfall Data:	37
Site Name:	Prince of Wales Dr. KDR Shell
Drainage Area (ha):	0.1800
Runoff Coefficient 'c':	0.90
Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.0
Estimated Water Quality Flow Rate (L/s):	5.85
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	Yes
Upstream Orifice Control Flow Rate to Stormceptor (L/s):	15
Peak Conveyance (maximum) Flow Rate (L/s):	15

Project Name:	Prince of Wales Dr. KDR Shell
Project Number:	-
Designer Name:	Brandon O'Leary
Designer Company:	Rinker Pipe
Designer Email:	brandon.oleary@RinkerPipe.com
Designer Phone:	905-630-0359
EOR Name:	John Tieu
EOR Company:	CTM Design Services Ltd.
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	86
EFO6	91
EFO8	92
EFO10	93
EFO12	93

LICENSED PROFESSIONAL ENGINEER
Brandon O'Leary
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100230686
July 3, 2024
PROVINCE OF ONTARIO

Recommended Stormceptor EFO Model: EFO4
Estimated Net Annual Sediment (TSS) Load Reduction (%): 86
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 on the left was used 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. Given that the standard OGS sizing methodology for this municipality, based on current understanding, is for the use of a historical coarse PSD, the **FINE PSD** has been used for this sizing. The FINE PSD used for calculations has been provided below on the right. The third-party ISO 14034/ETV test data for TSS removal, which was determined through the use of a test sediment resembling the ETV PSD, was converted to the FINE PSD through the assumption that for each surface loading rate, the TSS removal provided captured this portion of the ETV PSD from largest to smallest particle size. The smallest particle size captured can be determined from the ETV PSD and then converted to the FINE PSD based on the aforementioned particle size limit. The expected TSS removal of the FINE PSD is then determined by the percentage of the PSD composed of the calculated captured particle size and larger. For example, for a measured TSS removal of 41.7% of the ETV PSD, it is expected that particles sizes of 95.75 microns and larger were captured through linear interpolation. This corresponds to 51.7% of the larger sized particles of the FINE PSD provided below. Imbrium has confirmed this methodology through laboratory testing results.

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

FINE PSD Specific Gravity 2.65			
Particle Size (microns)	Percent Less Than	Particle Size Fraction (microns)	Percent
1000	100	500 - 1000	20
500	80	250 - 500	20
250	60	100 - 250	10
100	50	75 - 100	10
75	40	50 - 75	20
50	20	20 - 50	10
20	10	8 - 20	10

imbrium BO

Upstream Flow Controlled Results

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 (%)
1	51.3	51.3	0.45	27.02	23.15	93.6	48.0	48.0
2	8.7	60.0	0.90	54.04	46.29	92.8	8.1	56.1
3	5.8	65.8	1.35	81.06	69.44	90.1	5.2	61.3
4	4.6	70.4	1.80	108.09	92.58	87.4	4.0	65.3
5	4.2	74.6	2.25	135.11	115.73	84.9	3.6	68.9
6	3.2	77.8	2.70	162.13	138.87	82.3	2.6	71.5
7	2.6	80.4	3.15	189.15	162.02	79.8	2.1	73.6
8	2.4	82.8	3.60	216.17	185.17	77.2	1.9	75.5
9	1.9	84.7	4.05	243.19	208.31	74.8	1.4	76.9
10	1.6	86.3	4.50	270.22	231.46	72.8	1.2	78.1
11	1.3	87.6	4.95	297.24	254.60	70.7	0.9	79.0
12	1.1	88.7	5.40	324.26	277.75	68.6	0.8	79.7
13	1.3	90.0	5.85	351.28	300.89	66.5	0.9	80.6
14	1.1	91.1	6.31	378.30	324.04	64.4	0.7	81.3
15	0.6	91.7	6.76	405.32	347.19	62.3	0.4	81.7
16	0.8	92.5	7.21	432.35	370.33	60.2	0.5	82.2
17	0.7	93.2	7.66	459.37	393.48	58.1	0.4	82.6
18	0.5	93.7	8.11	486.39	416.62	57.0	0.3	82.8
19	0.6	94.3	8.56	513.41	439.77	56.3	0.3	83.2
20	0.5	94.8	9.01	540.43	462.92	55.7	0.3	83.5
21	0.2	95.0	9.46	567.45	486.06	55.0	0.1	83.6
22	0.4	95.4	9.91	594.48	509.21	54.3	0.2	83.8
23	0.5	95.9	10.36	621.50	532.35	53.7	0.3	84.1
24	0.4	96.3	10.81	648.52	555.50	53.0	0.2	84.3
25	0.1	96.4	11.26	675.54	578.64	52.3	0.1	84.3

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 (%)
26	0.3	96.7	11.71	702.56	601.79	51.7	0.2	84.5
27	0.4	97.1	12.16	729.58	624.94	51.6	0.2	84.7
28	0.2	97.3	12.61	756.60	648.08	51.5	0.1	84.8
29	0.2	97.5	13.06	783.63	671.23	51.4	0.1	84.9
30	0.2	97.7	13.51	810.65	694.37	51.3	0.1	85.0
31	0.1	97.8	13.96	837.67	717.52	51.2	0.1	85.0
32	0.2	98.0	14.41	864.69	740.66	51.1	0.1	85.1
33	0.1	98.1	14.86	891.71	763.81	51.0	0.1	85.2
34	1.9	100.0	15.00	900.00	770.91	50.9	1.0	86.2
35	0.0	100.0	15.00	900.00	770.91	50.9	0.0	86.2
36	0.0	100.0	15.00	900.00	770.91	50.9	0.0	86.2
37	0.0	100.0	15.00	900.00	770.91	50.9	0.0	86.2
38	0.0	100.0	15.00	900.00	770.91	50.9	0.0	86.2
39	0.0	100.0	15.00	900.00	770.91	50.9	0.0	86.2
40	0.0	100.0	15.00	900.00	770.91	50.9	0.0	86.2
41	0.0	100.0	15.00	900.00	770.91	50.9	0.0	86.2
42	0.0	100.0	15.00	900.00	770.91	50.9	0.0	86.2
43	0.0	100.0	15.00	900.00	770.91	50.9	0.0	86.2
44	0.0	100.0	15.00	900.00	770.91	50.9	0.0	86.2
45	0.0	100.0	15.00	900.00	770.91	50.9	0.0	86.2
46	0.0	100.0	15.00	900.00	770.91	50.9	0.0	86.2
47	0.0	100.0	15.00	900.00	770.91	50.9	0.0	86.2
48	0.0	100.0	15.00	900.00	770.91	50.9	0.0	86.2
49	0.0	100.0	15.00	900.00	770.91	50.9	0.0	86.2
50	0.0	100.0	15.00	900.00	770.91	50.9	0.0	86.2
Estimated Net Annual Sediment (TSS) Load Reduction =								**86 %**

STANDARD SPECIFICATION FOR
"OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREAMENT DEVICE WITH THIRD-PARTY VERIFIED LIGHT LIQUID RE-ENTRAINMENT SIMULATION PERFORMANCE TESTING RESULTS

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, designing, maintaining, and constructing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, **specifically an OGS device that has been third-party tested for oil and fuel retention capability using a protocol for light liquid re-entrainment simulation testing, with testing results and a Statement of Verification in accordance with all the provisions of ISO 14034 Environmental Management – Environmental Technology Verification (ETV)**. Work includes supply and installation of concrete bases, precast sections, and the appropriate precast section with OGS internal components correctly installed within the system, watertight sealed to the precast concrete prior to arrival to the project site.

1.2 REFERENCE STANDARDS

1.2.1 For Canadian projects only, the following reference standards apply:

CAN/CSA-A257.4-14: Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections, and Fittings Using Rubber Gaskets
CAN/CSA-A257.4-14: Precast Reinforced Circular Concrete Manhole Sections, Catch Basins, and Fittings
CAN/CSA-S6-00: Canadian Highway Bridge Design Code

1.2.2 For ALL projects, the following reference standards apply:

ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 891: Standard Practice for Installation of Underground Precast Concrete Utility Structures
ASTM D2563: Standard Practice for Classification of Visual Defects in Reinforced Plastics

1.3 SHOP DRAWINGS

1.3.1 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 the precast concrete components and OGS internal components prior to shipment, including the sequence for installation.

1.3.2 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 based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record. Any and all changes to project cost estimates, bonding amounts, plan check fees for revision of approved documents, or design impacts due to regulatory requirements as a result of a product substitution shall be coordinated by the Contractor with the Engineer of Record.

1.4 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

1.4.1 OGS internal components supplied by the Manufacturer for attachment to the precast concrete vessel shall be pre-fabricated, bolted to the precast and watertight sealed to the precast vessel surface prior to site delivery to ensure Manufacturer's internal assembly process and quality control processes are fully adhered to, and to prevent materials damage on site.

1.4.2 Follow all instructions including the sequence for installation in the shop drawings during installation.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The OGS vessel shall be cylindrical and constructed from precast concrete riser and slab components.

2.1.2 The precast concrete OGS internal components shall include a fiberglass insert bolted and watertight sealed inside the precast concrete vessel, prior to site delivery. Primary internal components that are to be anchored and watertight sealed to the precast concrete vessel shall be done so only by the Manufacturer prior to arrival at the job site to ensure product quality.

2.1.3 The OGS shall be allowed to be specified and have the ability to function as a 240-degree bend structure in the stormwater drainage system, or as a junction structure.

2.1.4 The OGS to be specified shall have the capability to accept influent flow from an inlet grate and an inlet pipe.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be designed and manufactured to meet highway loading conditions per State/Provincial or local requirements.

2.3 GASKETS

Only profile neoprene or nitrile rubber gaskets that are oil resistant shall be accepted. For Canadian projects only, gaskets shall be in accordance to CSA A257.4-14. Mastic sealants, butyl tape/rope or Conseal CS-101 alone are not acceptable gasket materials.

2.4 JOINTS

The concrete joints shall be watertight and meet the design criteria according to ASTM C-990. For projects where joints require gaskets, the concrete joints shall be watertight and oil resistant and meet the design criteria according to ASTM C-443. Mastic sealants or butyl tape/rope alone are not an acceptable alternative.

2.5 FRAMES AND COVERS

Frames and covers shall be manufactured in accordance with State/Provincial or local requirements for inspection and maintenance access purposes. A minimum of one cover, at least 22-inch (560 mm) in diameter, shall be clearly embossed with the OGS manufacturer's product name to properly identify this asset's purpose is for stormwater quality treatment.

2.6 PRECAST CONCRETE

All precast concrete components shall conform to the appropriate CSA or ASTM specifications.

2.7 FIBERGLASS

The fiberglass portion of the OGS device shall be constructed in accordance with ASTM D2563, and in accordance with the PS15-69 manufacturing standard, and shall only be installed, bolted and watertight sealed to the precast concrete by the Manufacturer prior to arrival at the project site to ensure product quality.

2.8 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a fiberglass insert for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The total sediment storage capacity shall be a minimum 40 ft^3 (1.1 m^3). The total petroleum hydrocarbon storage capacity shall be a minimum 50 gallons (189 liters). The access opening to the sump of the OGS device for periodic inspection and maintenance purposes shall be a minimum 16 inches (406 mm) in diameter.

2.9 LADDERS

Ladder rungs shall be provided upon request or to comply with State/Provincial or local requirements.

2.10 INSPECTION

All precast concrete sections shall be level and inspected to ensure dimensions, appearance, integrity of internal components, and quality of the product meets State/Provincial or local specifications and associated standards.

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 HYDROLOGY AND RUNOFF VOLUME

The OGS device shall be engineered, designed and sized to treat a minimum of 90 percent of the average annual runoff volume, unless otherwise stated by the Engineer of Record, using historical rainfall data. Rainfall data sets should be comprised of a minimum 15-years of rainfall data or a longer continuous period if available for a given location, but in all cases a minimum 5-year period of rainfall data.

3.3 ANNUAL (TSS) SEDIMIMENT LOAD AND STORAGE CAPACITY

The OGS device shall be capable of removing and have sufficient storage capacity for the calculated annual total suspended solids (TSS) mass load and volume without scouring previously captured pollutants prior to maintenance being required. The annual (TSS) sediment load and volume transported from the drainage area should be calculated and compared to the OGS device's available storage capacity by the specifying Engineer to ensure adequate capacity between maintenance cycles. Sediment loadings shall be determined by land use and defined as a minimum of 450 kg (992 lb) of sediment (TSS) per impervious hectare of drainage area per year, or greater based on land use, as noted in Table 1 below.

Annual sediment volume calculations shall be performed using the projected average annual treated runoff volume, a typical sediment bulk density of 1602 kg/m^3 (100 lbs/ft^3) and an assumed Event Mean Concentration (EMC) of 125 mg/L TSS in the runoff, or as otherwise determined by the Engineer of Record.

Example calculation for a 1.3-hectares parking lot site:

- 1.28 meters of rainfall depth, per year
- 1.3 hectares of 100% impervious drainage area
- EMC of 125 mg/L TSS in runoff
- Treatment of 90% of the average annual runoff volume
- Target average annual TSS removal rate of 60% by OGS

Annual Runoff Volume:

- 1.28 m rain depth x 1.3 ha x 10,000 m^2/ha= 16,640 m^3 of runoff volume
- 16,640 m^3 x 1000 L/m^3 = 16,640,000 L of runoff volume
- 16,640,000 L x 0.90 = 14,976,000 L to be treated by OGS unit

Annual Sediment Mass and Sediment Volume Load Calculation:

- 14,976,000 L x 125 mg/L x kg/1,000,000 mg = 1,872 kg annual sediment mass
- 1,872 kg x m^3/1602 kg = 1.17 m^3 annual sediment volume
- 1.17 m^3 x 60% TSS removal rate by OGS = 0.70 m^3 minimum expected annual storage requirement in OGS

As a guideline, the U.S. EPA has determined typical annual sediment loads per drainage area for various sites by land use (see Table 1). Certain States, Provinces and local jurisdictions have also established such guidelines.

Table 1 – Annual Mass Sediment Loading by Land Use

	Commercial	Parking Lot	Residential			Highways	Industrial	Shopping Center
			High	Med.	Low			
(lbs/acre/yr)	1,000	400	420	250	10	880	500	440
(kg/hectare/yr)	1,124	450	472	281	11	989	562	494

Source: U.S. EPA Stormwater Best Management Practice Design Guide Volume 1, Appendix D, Table D-1, Burton and Pitt 2002

3.4 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 Table 2, Section 3.5, and based on third-party performance testing conducted in accordance with the Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. 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:

3.4.1 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.

3.4.2 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.

3.4.3 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.

3.4.4 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 3.3.

3.4.5 The Peclet Number is not an approved method or model for calculating TSS removal, sizing, or scaling OGS devices.

3.4.6 If an alternate OGS device is proposed, supporting documentation shall be submitted that demonstrates:

- Canadian ETV or ISO 14034 ETV Verification Statement which verifies third-party performance testing conducted in accordance with the **Procedure for Laboratory Testing of Oil-Grit Separators,** including the Light Liquid Re-entrainment Simulation Testing.
- Equal or better sediment (TSS) removal of the PSD specified in Table 2 at equivalent surface loading rates, as compared to the OGS device specified herein.
- Equal or better Light Liquid Re-entrainment Simulation Test results (using low-density polyethylene beads as a surrogate for light liquids such as oil and fuel) at equivalent surface loading rates, as compared to the OGS device specified herein. However, an alternative OGS device shall not be allowed as a substitute if the Light Liquid Re-entrainment Simulation Test was performed with screening components within the OGS device that are effective at retaining the low-density polyethylene beads, but would not be expected to retain light liquids such as oil and fuel.
- Equal or greater sediment storage capacity, as compared to the OGS device specified herein.
- Supporting documentation shall be signed and sealed by a local registered Professional Engineer. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.5 PARTICLE SIZE DISTRIBUTION (PSD) FOR SIZING

The OGS device shall be sized to achieve the Engineer-specified average annual percent sediment (TSS) removal based solely on the test sediment used in the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** This test sediment is comprised of inorganic ground silica with a specific gravity of 2.65, uniformly mixed, and containing a broad range of particle sizes as specified in Table 2. No alternative PSDs or deviations from Table 2 shall be accepted.

Table 2
Canadian ETV Program Procedure for Laboratory Testing of Oil-Grit Separators
Particle Size Distribution (PSD) of Test Sediment

Particle Diameter (Microns)	% by Mass of All Particles	Specific Gravity
1000	5%	2.65
500	5%	2.65
250	15%	2.65
150	15%	2.65
100	10%	2.65
75	5%	2.65
50	10%	2.65
20	15%	2.65
8	10%	2.65
5	5%	2.65
2	5%	2.65

3.6 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party scour testing conducted and have in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. This scour testing is conducted with the device pre-loaded with test sediment comprised of the particle size distribution (PSD) illustrated in Table 2.

3.6.1 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.

Data generated from laboratory scour testing performed with an OGS device pre-loaded with a coarser PSD than in Table 2 (i.e. the coarser PSD has no particles in the 1-micron to 50-micron size range, or the D_{50} of the test sediment exceeds 75 microns) shall not be acceptable for the determination of the device's suitability for on-line installation.

3.7 DESIGN ACCOUNTING FOR BYPASS

3.7.1 The OGS device shall be specified to achieve the TSS removal performance and water quality objectives without washout of previously captured pollutants. The OGS device shall also have sufficient hydraulic conveyance capacity to convey the peak storm event, in accordance with hydraulic conditions per the Engineer of Record. To ensure this is achieved, there are two design options with associated requirements:

3.7.1.1 The OGS device shall be placed **off-line** with an upstream diversion structure (typically in an upstream manhole) that only allows the water quality volume to be diverted to the OGS device, and excessive flows diverted downstream around the OGS device to prevent high flow washout of pollutants previously captured. This design typically incorporates a triangular layout including an upstream bypass manhole with an appropriately engineered weir wall, the OGS device, and a downstream junction manhole, which is connected to both the OGS device and bypass structure. In this case with an external bypass required, the OGS device manufacturer must provide calculations and designs for all structures, piping and any other required material applicable to the proper functioning of the system, stamped by a Professional Engineer.

3.7.1.2 Alternatively, OGS devices in compliance with Section 3.6 shall be acceptable for an **on-line** design configuration, thereby eliminating the requirement for an upstream bypass manhole and downstream junction manhole.

3.7.2 The OGS device shall also have sufficient hydraulic conveyance capacity to convey the peak storm event, in accordance with hydraulic conditions per the Engineer of Record. If an alternate OGS device is proposed, supporting documentation shall be submitted that demonstrates equal or better hydraulic conveyance capacity as compared to the OGS device specified herein. This documentation shall be signed and sealed by a local registered Professional Engineer. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.8 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.

3.8.1 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.

3.9 PETROLEUM HYDROCARBONS AND FLOATABLES STORAGE CAPACITY

Petroleum hydrocarbons and floatables storage capacity in the OGS device shall be a minimum 50 gallons (189 Liters), or more as specified.

3.9.1 The OGS device shall have gasketed precast concrete joints that are watertight, and oil resistant and meet the design criteria according to ASTM C-443 to provide safe oil and other hydrocarbon materials storage and ground water protection. Mastic sealants or butyl tape/rope alone are not an acceptable alternative.

3.10 SURFACE LOADING RATE SCALING OF DIFFERENT MODEL SIZES

The reference device for scaling shall be an OGS device that has been third-party tested in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. Other model sizes of the tested device shall only be scaled such that the claimed TSS removal efficiency of the scaled device shall be no greater than the TSS removal efficiency of the tested device at identical **surface loading rates** (flow rate divided by settling surface area). The depth of other model sizes of the tested device shall be scaled in accordance with the depth scaling provisions within Section 6.0 of the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**.

3.10.1 The Peclet Number and volumetric scaling are not approved methods for scaling OGS devices.

PART 4 – INSPECTION & MAINTENANCE

The OGS manufacturer shall provide an Owner's Manual upon request.
Maintenance shall be performed by a professional service provider who has experience in cleaning OGS devices and has been trained and certified in applicable health and safety practices, including confined space entry procedures.

4.1 A Quality Assurance Plan that provides inspection for a minimum of 5 years shall be included with the OGS stormwater quality device, and written into the Environmental Compliance Approval (ECA) or the appropriate State/Provincial or local approval document.

4.2 OGS device inspection shall include determination of sediment depth and presence of petroleum hydrocarbons below the insert. Inspection shall be easily conducted from finished grade through a frame and cover of at least 22 inch (560 mm) in diameter.

4.3 Inspection and pollutant removal shall be conducted periodically. For routine maintenance cleaning activities, pollutant removal shall typically utilize a truck equipped with vacuum apparatus, and shall be easily conducted from finished grade through a frame and cover of at least 22-inches (560 mm) in diameter.

4.4 Diameter of the maintenance access opening to the lower chamber and sump shall be scaled consistently across all model sizes, and shall be 1/3 the inside diameter of the OGS structure, or larger.

4.5 No confined space entry shall be required for routine inspection and maintenance cleaning activities.

4.6 For OGS model sizes of diameter 72 inches (1828 mm) and greater, the access opening to the OGS device's lower chamber and sump shall be large enough to allow a maintenance worker to enter the lower chamber to facilitate non-routine maintenance cleaning activities and repairs, as needed.

4.7 The orifice-containing component (i.e. drop pipe, duct, chute, etc.) of the OGS device used to control flow rate into the lower chamber shall be removable from the insert to facilitate cleaning, repair, or replacement of the orifice-containing component, as needed.

PART 5 – EXECUTION

5.1 PRECAST CONCRETE INSTALLATION

The installation of the precast concrete OGS stormwater quality treatment device shall conform to ASTM C 891, ASTM C 478, ASTM C 443, CAN/CSA-A257.4-14, CAN/CSA-A257.4-14, CAN/CSA-S6-00 and all highway, State/Provincial, or local specifications for the construction of manholes. Selected sections of a general specification that are applicable are summarized below. The Contractor shall furnish all labor, equipment and materials necessary to offload, assemble as needed the OGS internal components as specified in the Shop Drawings.

5.2 EXCAVATION

5.2.1 Excavation for the installation of the OGS stormwater quality treatment device shall conform to highway, State/Provincial or local specifications. Topsoil that is removed during the excavation for the OGS stormwater quality treatment device shall be stockpiled in designated areas and not be mixed with subsoil or other materials. Topsoil stockpiles and the general site preparation for the installation of the OGS stormwater quality device shall conform to highway, State/Provincial or local specifications.

5.2.2 The OGS device shall not be installed on frozen ground. Excavation shall extend a minimum of 12 inch (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

5.2.3 In areas with a high water table, continuous dewatering shall be provided to ensure that the excavation is stable and free of water.

5.3 BACKFILLING

Backfill material shall conform to highway, State/Provincial or local specifications. Backfill material shall be placed in uniform layers not exceeding 12 inches (300 mm) in depth and compacted to highway, State/Provincial or local specifications.

5.4 OGS WATER QUALITY DEVICE CONSTRUCTION SEQUENCE

5.4.1 The precast concrete OGS stormwater quality treatment device is installed and leveled in sections in the following sequence:

- aggregate base
- base slab, or base
- riser section(s) (if required)
- riser section w/ pre-installed fiberglass insert
- upper riser section(s)
- internal OGS device components
- connect inlet and outlet pipes
- riser section, top slab and/or transition (if required)
- frame and access cover

5.4.2 The precast concrete base shall be placed level at the specified grade. The entire base shall be in contact with the underlying compacted granular material. Subsequent sections, complete with oil resistant, watertight joint seals, shall be installed in accordance with the precast concrete manufacturer's recommendations.

5.4.3 Adjustment of the OGS stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets shall be repaired or replaced as necessary. Once the OGS stormwater quality treatment device has been constructed, any lift holes must be plugged with mortar.

5.5 DROP PIPE AND OIL INSPECTION PIPE

Once the upper precast concrete riser has been attached to the lower precast concrete riser section, the OGS device Drop Pipe and Oil Inspection Pipe must be attached, and watertight sealed to the fiberglass insert using Sikaflex 1a. Installation instructions and required materials shall be provided by the OGS manufacturer.

5.6 INLET AND OUTLET PIPES

Inlet and outlet pipes shall be securely set using grout or approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight. Non-secure inlets and outlets will result in improper performance.

5.7 FRAME AND COVER OR FRAME AND GRATE INSTALLATION

Precast concrete adjustment units shall be installed to set the frame and cover/grate at the required elevation. The adjustment units shall be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover/grate should be set in a full bed of mortar at the elevation specified.

5.7.1 A minimum of one cover, at least 22-inch (560 mm) in diameter, shall be clearly embossed with the OGS device brand or product name to properly identify this asset's purpose is for stormwater quality treatment.