December 20, 2023 Reference: 20-731

The Alton Development Inc.
1402 Queen Street West
Alton, ON
L7K 0C3

Attention: Jeremy Grant and Jordan Grant, Developer
Reference: Urbanization of Agnes Street, Alton –Stormwater Management Design Brief

Dear Mr. Jeremy Grant and Mr. Jordan Grant,

Greck and Associates (Greck) have been retained to prepare a Stormwater Management Design Brief for the urbanization of a portion of Agnes Street. Agnes Street is located within the Town of Caledon (Town), Region of Peel (Region) and is within the Credit Valley Conservation (CVC) jurisdiction. This design brief is in support of the development application at 0 Agnes Street and to demonstrate compliance with the Town's Consolidated Linear Infrastructure Environmental Compliance Approvals (CLI ECA) criteria. The portion of Agnes Street to be urbanized is approximately 152m long starting from Queen Street West going south.

This design brief provides an overview of the proposed urbanization plans and considers the Town's CLI ECA criteria, which pertains to drainage and stormwater management:

- Water Quality
- Water Quantity
- Water Balance
- Erosion Control

This memo has been prepared in accordance with accepted engineering practices and criteria from the Town of Caledon Development Standards Manual (2019) and Environmental Compliance Approval 324-S701 (October 2022).

EXISTING CONDITIONS

Based on publicly available lidar data from Land Information Ontario (DTM Peel 2016 Package B), topographic survey prepared by Van Harten Surveying Inc. (September 16, 2022) and the provided Alton Sewershed Map from the Town, 6.26ha drains towards the south side of the intersection of Queen Street West and Agnes Street. Since this memo only pertains to the urbanization of Agnes Street south of Queen Street West, the north area that drains to Queen Street West has been excluded from the stormwater management (SWM) analysis.

Note that there is also a small 0.52ha area within the 0 Agnes Street property that drains towards Emeline Street. This area has been included in the overall study catchment as it is part of the

property's development area. In the proposed conditions, all drainage from the property will discharge to Agnes Street. The Alton Sewershed Map provided by the Town and the topographic survey by Van Harten Surveying Inc. have been appended to the end of this memo.

The 6.26ha drainage area has been further divided into four (4) catchments; all of which ultimately discharges to Shaw's Creek located northeast of the study area:

- Area 101 (3.53ha) is a part of the property to be developed by The Alton Development Inc. (0 Agnes Street). It currently consists of a grassed field and a driveway area. It drains in the northeasterly direction towards the intersection of Queen Street West and Agnes Street.
- Area 102 (0.52ha) is a part of the property to be developed by The Alton Development Inc. (0 Agnes Street). It currently consists of a grassed field and drains in the west direction towards Emmeline Street. Runoff is then piped northeast along Queen Street West.
- Area 103 (1.44ha) consists of single detached dwellings, grassed lawns and private driveways. It generally drains in the northeast direction towards the intersection of Queen Street West and Agnes Street. This area will remain unchanged in the existing and proposed conditions.
- Area 104 (0.27ha) consists of the Agnes Street right-of-way (ROW). It is currently a bi-directional, two (2) lane street and is 15m ROW. There are roadside ditches on both sides of the street that direct drainage north to ditch inlet catchbasins at the north end of Agnes Street.

Table 1 is an area breakdown of the existing land uses.

Table 1 Existing Area Breakdown

Surface	Area 101	Area 102	Area 103	Area 104
Asphalt (m^2)	1,574.9	0.0	1,090.9	1,832.8
Permeable Pavers (m^2)	0.0	0.0	0.0	0.0
Hardscape (m^2)	0.0	0.0	108.5	0.0
Roof (m^2)	516.4	0.0	1,003.1	0.0
Grassed (m^2)	33,202.8	5,179.3	12,175.5	861.1
Total (m^2)	35,294.1	5,179.3	14,378.0	2,693.9
Percent Impervious	5.9%	0.0%	15.3%	68.0%
Runoff Coefficient	0.29	0.25	0.35	0.69

Table 2 presents the pre-development peak flows. Intensity was calculated using the intensity-duration-frequency curves from the Town of Caledon's Development Standards Manual (2019).

Table 2 Pre-Development Peak Flows

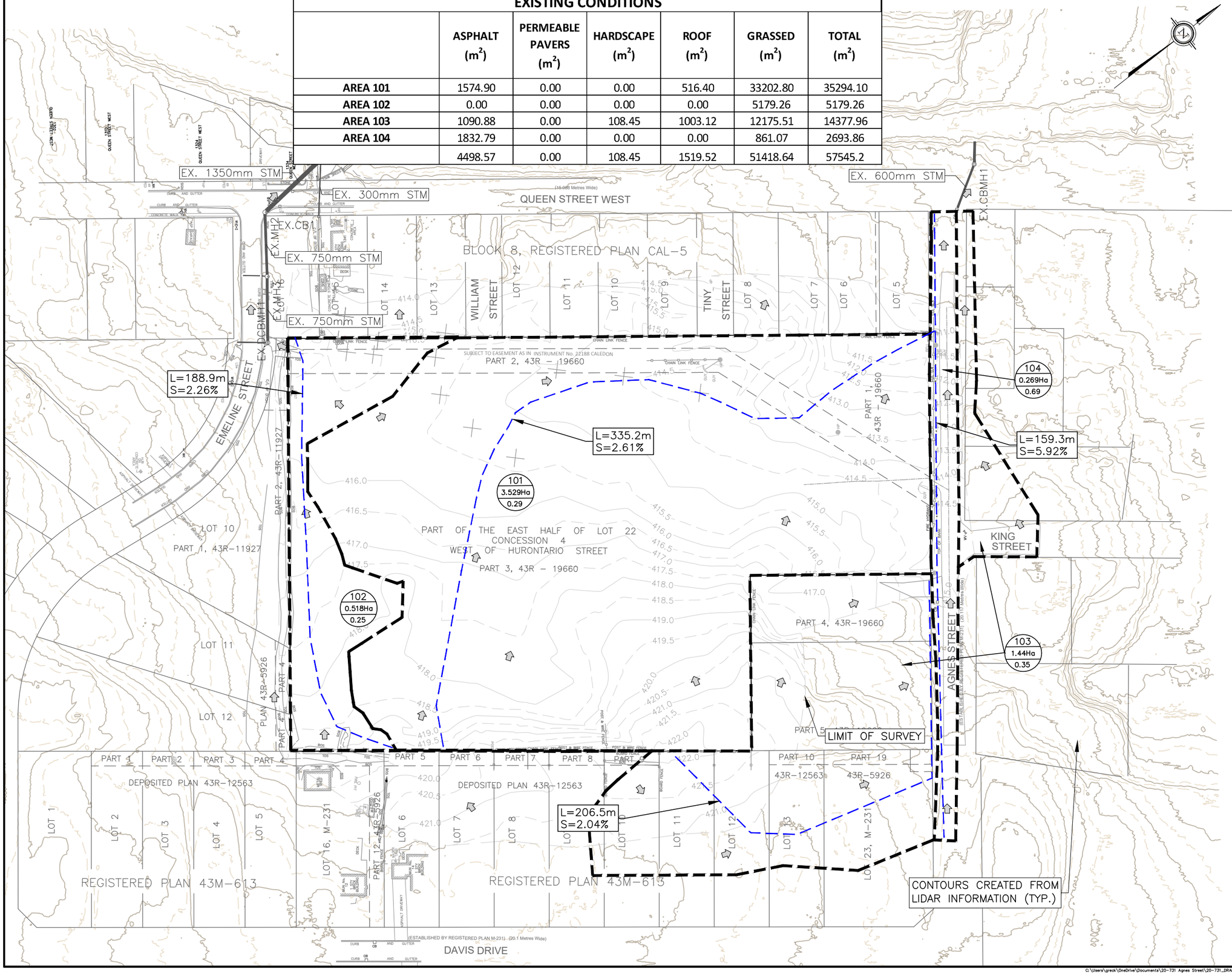
Storm Event	Area 101 (L/s)	Area 102 (L/s)	Area 103 (L/s)	Area 104 (L/s)	Total (L/s)
2	111.9	16.3	65.3	44.4	238.0
5	154.9	22.3	89.3	56.8	323.4
10	189.4	27.4	109.4	69.5	395.7
25*	253.6	36.4	145.5	89.2	524.7
50*	313.8	45.1	180.0	109.5	648.3
100*	367.9	52.8	210.8	127.3	758.7

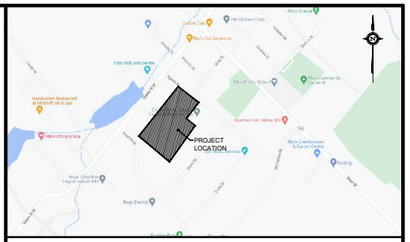
*Incorporates runoff coefficient adjustment factor of: 25 year = 1.1, 50 year = 1.2, 100 year = 1.25

Detailed calculations are included in the attachments at the end of this memo. See **Figure 1** below for the study area location and delineated catchments for existing conditions.

EXISTING CONDITIONS

	ASPHALT (m^2)	PERMEABLE PAVERS (m^2)	HARDSCAPE (m^2)	ROOF (m^2)	GRASSED (m^2)	TOTAL (m^2)
AREA 101	1574.90	0.00	0.00	516.40	33202.80	35294.10
AREA 102	0.00	0.00	0.00	0.00	5179.26	5179.26
AREA 103	1090.88	0.00	108.45	1003.12	12175.51	14377.96
AREA 104	1832.79	0.00	0.00	0.00	861.07	2693.86
	4498.57	0.00	108.45	1519.52	51418.64	57545.2





KEY PLAN

N.T.S.

LEGEND

EXISTING	PROPOSED	
MH1	MH1	STORM MANHOLE
MH1	MH1	STORM CATCHBASIN MANHOLE
CB	CB	SINGLE CATCHBASIN
DCB	DCB	DOUBLE CATCHBASIN
		STORM SEWER
		LIMIT OF SUBJECT PROPERTY
		EASEMENT
		RIGHT OF WAY
		LOT LINE
X	X	FENCE LINE
		CURB/SIDEWALK
		BUILDING
		MAJOR CONTOUR LABEL
		MINOR CONTOUR LABEL
		SWALE
		OVERLAND FLOW
		TREE
		STORM DRAINAGE BOUNDARY LONGEST TRAVEL PATH
		DENOTES AREA NUMBER
	3 0.023Ha 0.40	DENOTES AREA IN HECTARES DENOTES RUNOFF COEFFICIENT

NOTES
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. CONTOUR INTERVAL IS 0.50m.
3. ALL DIMENSIONS SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION, AND ANY DISCREPANCIES SHALL BE REPORTED IMMEDIATELY TO THE ENGINEER.
4. ALL WORK SHALL BE IN ACCORDANCE WITH CURRENT TOWN OF CALEDON STANDARD SPECIFICATIONS AND DRAWINGS UNLESS OTHERWISE NOTED HEREIN.
5. ORDER OF PRECEDENCE OF STANDARDS DRAWINGS IS FIRSTLY TOWN OF CALEDON, AND SECONDLY ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).

BENCHMARK

BENCHMARK No. N/A
ELEVATION = N/A
DESCRIPTION:
ELEVATIONS ARE BASED ON GPS OBSERVATIONS FROM PERMANENT REFERENCE STATIONS IN THE NAD83 (CSRS-2010) COORDINATE SYSTEM, WITH HEIGHTS CONVERTED TO ORTHOMETRIC ELEVATION ON THE CVD28 DATUM (1978 ADJUSTMENT) WITH GEOID MODEL HTV2.0, AS SUPPLIED BY NATURAL RESOURCES CANADA.

COMPLETED BY:
VAN HARTEN SURVEYING INC.
COMPLETED ON:
MAY 10, 2018
DEM SOURCE:
LIDAR DTM PEEL 2016 PACKAGE B AVAILABLE FROM LAND INFORMATION ONTARIO

Greck
5770 Highway 7, Woodbridge, Ontario, L4L 1T8 www.greck.ca

CLIENT NAME:

THE ALTON DEVELOPMENTS INC.
1402 QUEEN STREET
ALTON, ON
L7K 0C3

PROJECT NAME:

AGNES STREET SUBDIVISION

AGNES STREET CALEDON, ON

DRAINAGE PLAN EXISTING CONDITIONS (AGNES STREET URBANIZATION)

DESIGNED BY:	A.J.	SCALES:		PROJECT No.	20-731
CHECKED BY:	J.C.	HORIZONTAL:	1:1500	DRAWING No.	FIG. 1
DRAWN BY:	A.J.	VERTICAL:	N/A	SHEET No.	
DATE:	NOV 30, 2023	SHEET SIZE:	11"x17"		

UNDERLYING SOILS

Terraprobe Inc. (Terraprobe) prepared a Geotechnical Investigation dated March 2019, and a Hydrogeological Investigation and Septic Impact Assessment dated March 2023. Both of these reports pertain to the property at 0 Agnes Street. Since a site specific report for Agnes Street has not been done, these two reports will be used for reference as the property fronts Agnes Street. The following is a summary of the report findings.

The work included drilling eight (8) boreholes equipped with monitoring wells to boreholes 2, 5, and 8 spread throughout the property. The soil conditions within the limits of the property consist primarily of the following:

- A surficial topsoil layer with a measured thickness of 150mm to 600mm, encountered at eight (8) boreholes.
- Fill consisting predominantly of silt fine sand with trave gravel and topsoil was encountered immediately beneath the ground covers in Boreholes 2,5,6,7, and 8. The fill extended to a depth generally varying from 0.8m to 2.1m below ground.
- Boreholes 1,5, and 6 penetrated a stratum of silty fine sand to depths ranging from 2.1m to 4.0m below ground.
- A deposit of silt sand and gravel with cobbles and boulders was encountered in all boreholes beneath the filly and silty fine sand to depths of about 2.5m to 6.7m below ground.

As shown within the Hydrogeological investigation, monitoring wells were installed in boreholes 2, 5, and 8, and groundwater measurements were taken from March 4, 2019 to August 9, 2019. The seasonal high groundwater table at the site ranged from 1.1m to 6.4m below ground surface. The groundwater flow direction is easterly towards Shaw's Creek.

Borehole 8 is the closest borehole to Agnes Street and where the urbanization is proposed. As such, a design groundwater elevation of 412.8m will be considered in the SWM analysis. The Groundwater Flow Direction Plan by Terraprobe has been included in the memo attachments. The full geotechnical and hydrogeological reports prepared by Terraprobe are submitted under separate cover.

PROPOSED CONDITIONS

In the proposed conditions, 152m of Agnes Street south of Queen Street West will be urbanized into a 15m wide ROW with a sidewalk on the west side. A cross section detail of the ROW has been appended to the end of this memo. Overall drainage patterns will be maintained in proposed conditions as the delineated catchments will continue to drain in the northeasterly direction towards Agnes Street and ultimately discharge at Shaw's Creek.

The proposed condition study area has been delineated into four (4) catchments:

- Area 201 (2.34ha) is a part of the property to be developed by The Alton Development Inc. (0 Agnes Street). It will consist of townhome blocks, a 6.0m wide private roadway and an amenity area. Drainage from this area will be piped to the proposed storm sewer on Agnes Street.
- Area 202 (1.71ha) is a part of the property to be developed by The Alton Development Inc. (0 Agnes Street). It will consist of townhome blocks and a 6.0m wide private roadway. Drainage from this area will be piped to the proposed storm sewer on Agnes Street.
- Area 203 (1.44ha) consists of single detached dwellings, grassed lawns and private driveways. It generally drains in the northeast direction towards the intersection of Queen Street West and Agnes Street. This area will remain unchanged in the existing and proposed conditions.
- Area 204 (0.27ha) consists of the Agnes Street right-of-way (ROW). Approximately 152m of Agnes Street will be urbanized into a 15m wide ROW. The urbanized portion will also include a sidewalk on the west side of the street that will replace the existing roadside ditch. A new 450mm diameter storm sewer will be installed and the existing ditch inlet catchbasin at the north end of Agnes Street will be replaced with a catchbasin manhole. The remaining southern portion of Agnes Street will remain unchanged.

The development at 0 Agnes Street (Area 201 and Area 202) will provide its own stormwater management to meet water quality, water quantity and water balance criteria, as such, the property area will be omitted from this memo's SWM analysis. A separate Functional Servicing and Stormwater Management Report for this development has been submitted under separate cover.

Area 203 consists of private residential properties and will remain unchanged in proposed conditions, as such, runoff flows will also remain unchanged. Further, the land uses consist majorly of roof areas and grassed lawns; these areas are considered clean with respect to water quality. As such, Area 203 has also been omitted from the SWM analysis.

Table 3 is an area breakdown of the proposed land uses.

Table 3 Proposed Area Breakdown

Surface	Area 201	Area 202	Area 203	Area 204
Asphalt (m^2)	3,094.8	1,035.1	1,090.9	1,832.8
Permeable Pavers (m^2)	2,098.5	438.3	0.0	236.3
Hardscape (m^2)	1,483.8	1,370.7	108.5	0.0
Roof (m^2)	6,662.2	4,608.9	1,003.1	0.0
Grassed (m^2)	10,089.0	9,592.1	12,175.5	624.7
Total (m^2)	23,428.3	17,045.1	14,378.0	2,693.9
Percent Impervious	52.5%	42.4%	15.3%	72.4%
Runoff Coefficient	0.59	0.53	0.35	0.72

Table 4 presents the post-development peak flows. Intensity was calculated using the intensity-duration-frequency curves from the Town of Caledon's Development Standards Manual (2019).

Table 4 Post-Development Peak Flows

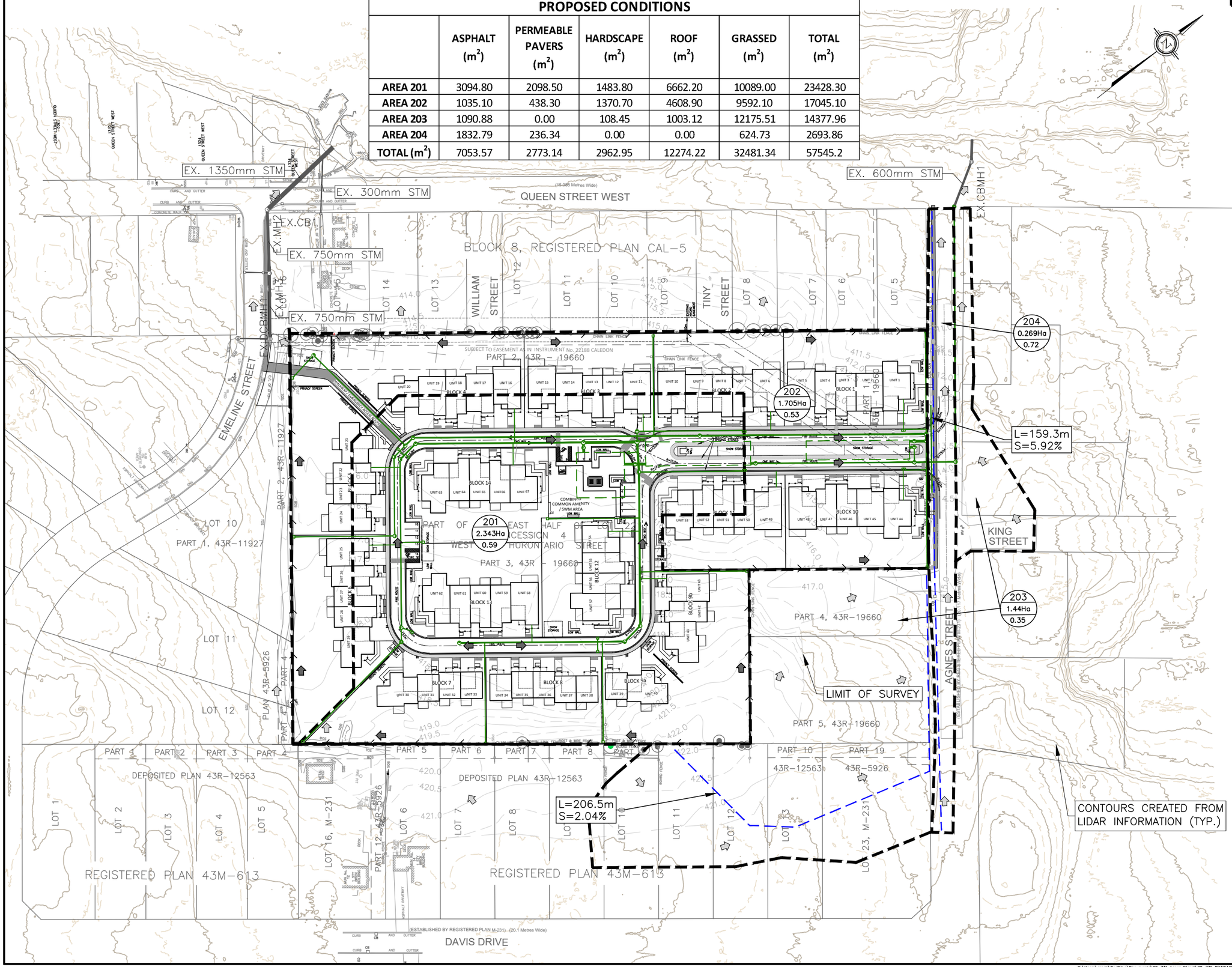
Storm Event	Area 201 (L/s)	Area 202 (L/s)	Area 203 (L/s)	Area 204 (L/s)	Total (L/s)
2	329.7	213.4	65.3	46.2	654.7
5	421.9	273.1	89.3	59.2	843.4
10	516.0	334.1	109.4	72.4	1031.8
25*	662.0	428.6	145.5	92.8	1329.0
50*	813.2	526.5	180.0	114.0	1633.7
100*	944.9	611.7	210.8	132.5	1899.9

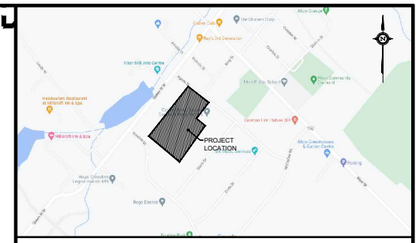
*Incorporates Runoff coefficient adjustment factor of: 25 year = 1.1, 50 year = 1.2, 100 year = 1.25

Detailed calculations are included in the attachments at the end of this memo. See **Figure 2** below for the proposed drainage patterns and catchments.

PROPOSED CONDITIONS

	ASPHALT (m^2)	PERMEABLE PAVERS (m^2)	HARDSCAPE (m^2)	ROOF (m^2)	GRASSED (m^2)	TOTAL (m^2)
AREA 201	3094.80	2098.50	1483.80	6662.20	10089.00	23428.30
AREA 202	1035.10	438.30	1370.70	4608.90	9592.10	17045.10
AREA 203	1090.88	0.00	108.45	1003.12	12175.51	14377.96
AREA 204	1832.79	236.34	0.00	0.00	624.73	2693.86
TOTAL (m^2)	7053.57	2773.14	2962.95	12274.22	32481.34	57545.2





KEY PLAN
N.T.S.

LEGEND

EXISTING	PROPOSED	
MH1	MH1	STORM MANHOLE
MH1	MH1	STORM CATCHBASIN MANHOLE
CB	CB	SINGLE CATCHBASIN
DCB	DCB	DOUBLE CATCHBASIN
		STORM SEWER
		LIMIT OF SUBJECT PROPERTY
		EASEMENT
		RIGHT OF WAY
		LOT LINE
-X-	-X-	FENCE LINE
		CURB/SIDEWALK
		BUILDING
		MAJOR CONTOUR LABEL
		MINOR CONTOUR LABEL
		SWALE
		OVERLAND FLOW
		TREE
		STORM DRAINAGE BOUNDARY
		LONGEST TRAVEL PATH
	3	DENOTES AREA NUMBER
	0.023Ha	DENOTES AREA IN HECTARES
	0.40	DENOTES RUNOFF COEFFICIENT

NOTES
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. CONTOUR INTERVAL IS 0.50m.
3. ALL DIMENSIONS SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION, AND ANY DISCREPANCIES SHALL BE REPORTED IMMEDIATELY TO THE ENGINEER.
4. ALL WORK SHALL BE IN ACCORDANCE WITH CURRENT TOWN OF CALEDON STANDARD SPECIFICATIONS AND DRAWINGS UNLESS OTHERWISE NOTED HEREIN.
5. ORDER OF PRECEDENCE OF STANDARDS DRAWINGS IS FIRSTLY TOWN OF CALEDON, AND SECONDLY ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).

BENCHMARK

BENCHMARK No. N/A
ELEVATION = N/A
DESCRIPTION:
ELEVATIONS ARE BASED ON GPS OBSERVATIONS FROM PERMANENT REFERENCE STATIONS IN THE NAD83 (CSRS-2010) COORDINATE SYSTEM, WITH HEIGHTS CONVERTED TO ORTHOMETRIC ELEVATION ON THE CVGD28 DATUM (1978 ADJUSTMENT) WITH GEOID MODEL HTV2.0, AS SUPPLIED BY NATURAL RESOURCES CANADA.

COMPLETED BY:
VAN HARTEN SURVEYING INC.
COMPLETED ON:
MAY 10, 2018

DEM SOURCE:
LIDAR DTM PEEL 2016 PACKAGE B AVAILABLE FROM LAND INFORMATION ONTARIO

Greck
5770 Highway 7, Woodbridge, Ontario, L4L 1T8 www.greck.ca

CLIENT NAME:

THE ALTON DEVELOPMENTS INC.
1402 QUEEN STREET
ALTON, ON
L7K 0C3

PROJECT NAME:

AGNES STREET SUBDIVISION

AGNES STREET CALEDON, ON

DRAINAGE PLAN PROPOSED CONDITIONS (AGNES STREET URBANIZATION)

DESIGNED BY:	A.J.	SCALES:	PROJECT No. 20-731
CHECKED BY:	J.C.	HORIZONTAL: 1:1500	DRAWING No. FIG. 2
DRAWN BY:	A.J.	VERTICAL: N/A	SHEET No.
DATE:	NOV 30, 2023	SHEET SIZE: 11"x17"	

C:\Users\greck\OneDrive\Documents\20-731 Agnes Street\20-731_DRAINAGE-urbanization.dwg

Date Plotted: Dec 11, 2023 - 2:59 PM

STORMWATER MANAGEMENT

The following stormwater management criteria is to be addressed in accordance with regulatory policy and requirements set in the Town of Caledon's Environmental Compliance Approval 324-S701 (October 2022). Note that the urbanization of Agnes Street is considered a retrofit scenario.

- **Water Quality** – Improve current level of water quality control and consider the Town's water quality criteria in the Development Standards Manual (2019)
- **Water Quantity** – Post-development peak flows to be controlled to pre-development levels.
- **Water Balance** – Maintain pre-development infiltration volumes in post-development conditions.
- **Erosion Control** – Improve level of erosion control

As discussed previously, SWM will only be considered for Area 203 as Area 201 will provide its own stormwater management infrastructure and Area 202 will remain unchanged in proposed conditions.

WATER QUALITY

As per the CLI ECA requirements for retrofit scenarios, the proposed urbanization must improve the current level of water quality control and consider the Town's water quality criteria in the Development Standards Manual (2019).

Stormwater from the development area can be characterized by the gravel parking surfaces and landscaped areas. Given the relatively small site, water quality from the proposed development is likely to be relatively clean with the main contaminants of concern being:

- Suspended sediments
- Phosphorus
- Other (oil, grease, gas)

An oil grit separator (OGS) unit will be installed in the new catchbasin manhole at the north end of Agnes Street which will provide stormwater treatment by trapping free oils, floatable solids and settling any captured sediment. The OGS unit has been sized to provide a TSS removal of 60%. While this does not meet the enhanced protection 80% TSS removal, it is a significant improvement of existing conditions. 60% long-term removal of TSS equates to the basic protection level as per the MECP. The OGS unit specifications and manual are appended to the end of this memo.

WATER QUANTITY

The Town's Environmental Compliance Approval 324-S701 (October 2022) and Development Standards Manual (2019) requires that for retrofit scenarios, post-development peak flows be controlled to the pre-development peak flows.

In the existing condition, the runoff coefficient for Area 204 is 0.69 and the corresponding percent impervious is 68%. In the proposed condition, the runoff coefficient for Area 204 is 0.72 and the percent impervious is 74%. Therefore, in the proposed condition, the runoff coefficient will increase by 0.03 and the percent impervious will increase by 4.4%; both of which can be considered minor changes. **Table 5** presents a comparison of the pre- and post-development peak runoff rates from Area 203.

Table 5 Pre- to Post-Development Peak Runoff Comparison

Storm Event	Area 104 Peak Runoff (L/s)	Area 204 Peak Runoff (L/s)	Difference (L/s)	% Change
2	44.4	46.2	1.8	4.1%
5	56.8	59.2	2.3	4.1%
10	69.5	72.4	2.9	4.1%
25*	89.2	92.8	3.7	4.1%
50*	109.5	114.0	4.5	4.1%
100*	127.3	132.5	5.2	4.1%

*Incorporates Runoff coefficient adjustment factor of: 25 year = 1.1, 50 year = 1.2, 100 year = 1.25

Note that in the proposed condition, the maximum increase in flows is 5.2L/s in the 100-year storm event which equates to a percent change of 4.1%. This change can be considered negligible, as such, quantity control has not been provided for the urbanized portion of Agnes Street.

Detailed peak flow calculations can be found in the memo attachments.

WATER BALANCE

For retrofit scenarios, pre-development infiltration volumes should be maintained in post-development conditions.

As per the Terraprobe Hydrogeological Investigation (March 2023), there is a high groundwater elevation at Borehole 8. As such, subsurface infiltration facilities are not feasible for this area as the minimum 1m clearance between the bottom of infiltration facilities and groundwater table cannot be provided.

As a best-efforts approach, permeable pavers will be installed in the sidewalk area to provide a higher initial abstraction than a typical concrete sidewalk. This would promote evapotranspiration and infiltration of runoff into the underlying soils. A permeable pavement infographic by the CVC

and TRCA has been appended to the end of this memo for guidance on operations and maintenance of permeable pavers.

EROSION CONTROL

The Town's Environmental Compliance Approval 324-S701 (October 2022) requires that for retrofit scenarios, the proposed condition should improve the level of erosion control. Typically, for sites less than 2ha, retention of the 5mm storm event is required.

However, due to the high groundwater elevation in the Agnes Street area, infiltration cannot be proposed to retain the 5mm volume. Further, due to the nature of the urbanization of a ROW, water reuse methods such as irrigation and toilet flushing are not feasible as well.

Note that in the proposed condition, the only major change will be the addition of a 1.5m wide, sidewalk replacing the existing roadside ditch. The sidewalk will have a total area of 236m^2. As a best-efforts approach, permeable pavers will be installed for the sidewalk area which will increase the depression storage and promote evapotranspiration and infiltration of runoff into the ground.

Further, in the existing conditions, the runoff coefficient is 0.69 and in the urbanized conditions, the runoff coefficient is 0.72. This minor change in land use due to the proposed sidewalk will have a negligible impact runoff volume. As demonstrated under the water quantity section, the increase in flows will also be minor.

EROSION AND SEDIMENT CONTROLS DURING CONSTRUCTION

Erosion and sediment controls (ESC) will be implemented for all construction activities, including topsoil striping, material stockpiling, and grading operations. The following erosion and sediment control elements are proposed on site:

- Sediment control fence – Fencing will be constructed downslope of the proposed development area prior to all construction activities. Geotextile material should have a non-woven density of 270R or equivalent;
- Filtrexx Siltsoxx check dams are to be placed within drainage swales/ditches and low points to hold back water and reduce velocities to prevent erosion and promote sedimentation.
- Restoration of landscaped areas – all exposed soil after grading is to be immediately sodded to promote vegetation growth and protection for erosion and sediment control
- ESC's will be erected prior to the start of construction works and maintained through all phases of development. ESC strategies are not static and may need to be upgraded/amended as site conditions change to minimize sediment laden runoff from leaving the work areas;
- Sediment controls must be inspected on a regular basis and after every rain fall event. Repairs must be done in a timely manner to prevent movement of sediment.

CONCLUSIONS

Greck and Associates is confident that this memo and the analyses completed are consistent with the latest municipal and provincial standards and guidelines with respect to scientific analysis and engineering principles. In summary:

- An oil grit separator unit has been specified for the urbanized portion of Agnes Street to provide water quality control.
- Permeable pavers will be installed in the sidewalk area of the urbanized portion of Agnes Street.

If you require additional information or have any questions, please feel free to contact me at (289) 657-9797 ext. 226.

Respectfully submitted,

Jennifer Chan, P.Eng.
Water Resources Engineer

ATTACHMENTS

- Alton Sewershed Map provided by the Town of Caledon
- Topographic Survey prepared by Van Harten Surveying Inc. dated September 16, 2022
- Groundwater Flow Direction Plan by Terraprobe from Hydrogeological Investigation dated March 2023
- Cross Section Detail prepared by Greck, dated December 2023
- Oil Grit Separator Specifications and Manual
- Stormwater Management Calculations by Greck
- Permeable Pavement Infographic by CVC and TRCA

Legend

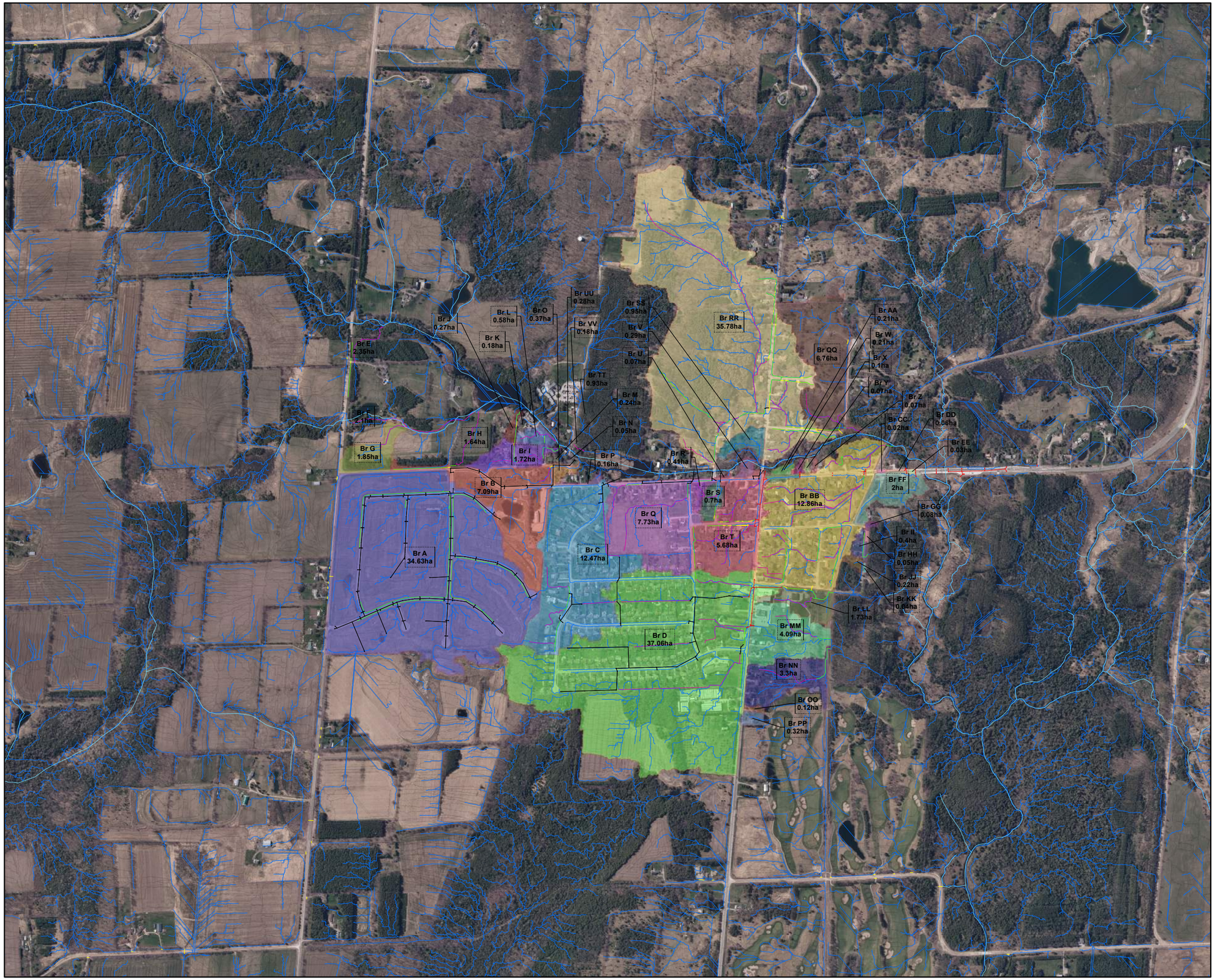
- Storm_Outflow
- Storm_Manhole
- Storm_Inlet
- Outfalls
- Manholes
- CatchBasins
- Rivers_and_streams
- Storm_Main
- Storm_Inlet_Lead
- STML_Pipes
- Pipes
- Lead_Pipes
- Minor system subcatchment/Branch
- Property lines
- Private swale
- Public swale
- Culverts

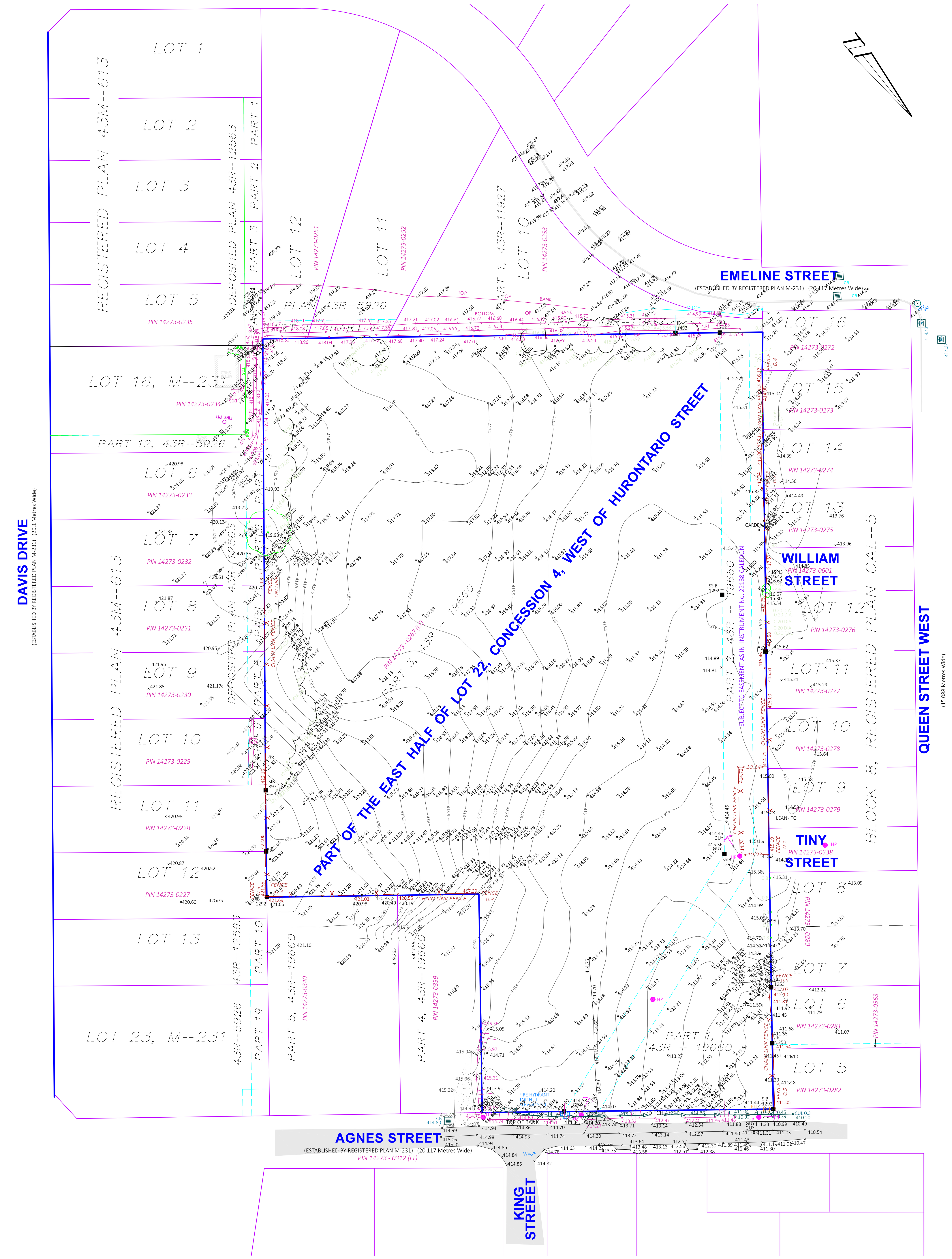
1937PEEL_15cm_2019.sid

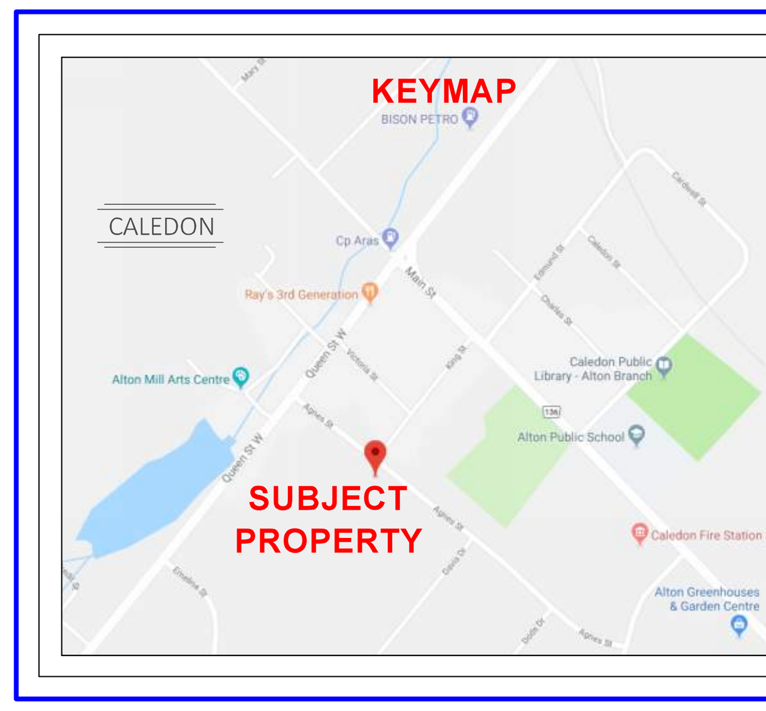
RGB

- Red: Band_1
- Green: Band_2
- Blue: Band_3

Branch ID
Total area in ha







TOPOGRAPHIC SURVEY OF PART OF EAST HALF OF LOT 22, CONCESSION 4, WEST OF HURONTARIO STREET

GEOGRAPHIC TOWNSHIP OF CALEDON, COUNTY OF PEEL

TOWN OF CALEDON

REGIONAL MUNICIPALITY OF PEEL

SCALE 1 : 750

0 5 10 20 30 40 50 metres

VAN HARTEN SURVEYING INC.

LEGEND

	DENOTES SURVEY MONUMENT SET
	DENOTES SURVEY MONUMENT FOUND
SIB	DENOTES .025 x .025 x 1.20 STANDARD IRON BAR
IB	DENOTES .015 x .015 x 0.60 IRON BAR
SSIB	DENOTES .025 x .025 x 0.60 SHORT STANDARD IRON BAR
RP	DENOTES .015 DIA. X 0.07 ROUND IRON BAR WITH STAMPED WASHER
PB	DENOTES .025 x .025 x 0.30 PLASTIC BAR
CC	DENOTES CUT CROSS
WIT	DENOTES WITNESS
OU	DENOTES ORIGIN UNKNOWN
VH	DENOTES VAN HARTEN SURVEYING INC., O.L.S.'s
1292	DENOTES WM. E. BENNETT SURVEYING LTD., O.L.S.'s
897	DENOTES WILLIAM J. QUINSEY, O.L.S.'s
1493	DENOTES YOUNG AND YOUNG SURVEYORS INC., O.L.S.
375	DENOTES D.J. CULLEN LTD., O.L.S.

EXISTING ELEVATION × 206.55
GUY WIRE GUY
HYDRO POLE HP
FIRE HYDRANT FH
CATCHBASIN CB
BELL PEDESTAL BELL

LINETYPES

OVERHEAD HYDRO OH
FENCELINE X
DITCH/SWALE
CENTRELINE OF ROAD
TOP OF BANK

HATCHES

ASPHALT
GRAVEL

BENCHMARK:

ELEVATIONS ARE BASED ON GPS OBSERVATIONS FROM PERMANENT REFERENCE STATIONS IN THE NAD83 (CSRS-2010) COORDINATE SYSTEM, WITH HEIGHTS CONVERTED TO ORTHOMETRIC ELEVATIONS ON THE CVGD28 DATUM (1978 ADJUSTMENT) WITH GEOID MODEL HTv2.0, AS SUPPLIED BY NATURAL RESOURCES CANADA.

REFERENCE:

1. BEARINGS ARE GRID BEARINGS AND ARE DERIVED FROM GPS OBSERVATIONS AND ARE REFERRED TO THE UTM PROJECTION, ZONE 17. NAD 83-CSRS (2010) ADJUSTMENT.
2. DISTANCES SHOWN ON THE PLAN ARE ADJUSTED GROUND DISTANCES AND CAN BE CONVERTED TO UTM GRID DISTANCES BY MULTIPLYING BY AN AVERAGED COMBINED SCALE FACTOR OF 0.9996086

NOTE:

BOUNDARY INFORMATION SHOWN ON THIS PLAN WAS COMPILED FROM REGISTRY OFFICE INFORMATION AND PLAN FOR THE SUBJECT PROPERTY: 43R-19660

FIELD WORK FOR THIS SURVEY WAS COMPLETED ON THE 10th DAY OF MAY , 2018
ADDITIONAL FIELD WORK FOR THIS SURVEY WAS COMPLETED ON THE 2 AUGUST 2022

SEPTEMBER 16, 2022

JAMES M. LAWS
ONTARIO LAND SURVEYOR

METRIC:

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

REVISION SCHEDULE

No.	DATE	BY	COMMENTS
1	7/25/18	S.J.	INITIAL SUBMISSION
2	9/16/22	JL	2ND SUBMISSION

Van Harten SURVEYING INC.
LAND SURVEYORS and ENGINEERS

Kitchener	Guelph	Orangeville
Ph: 519-742-8371	Ph: 519-821-2763	Ph: 519-940-4110

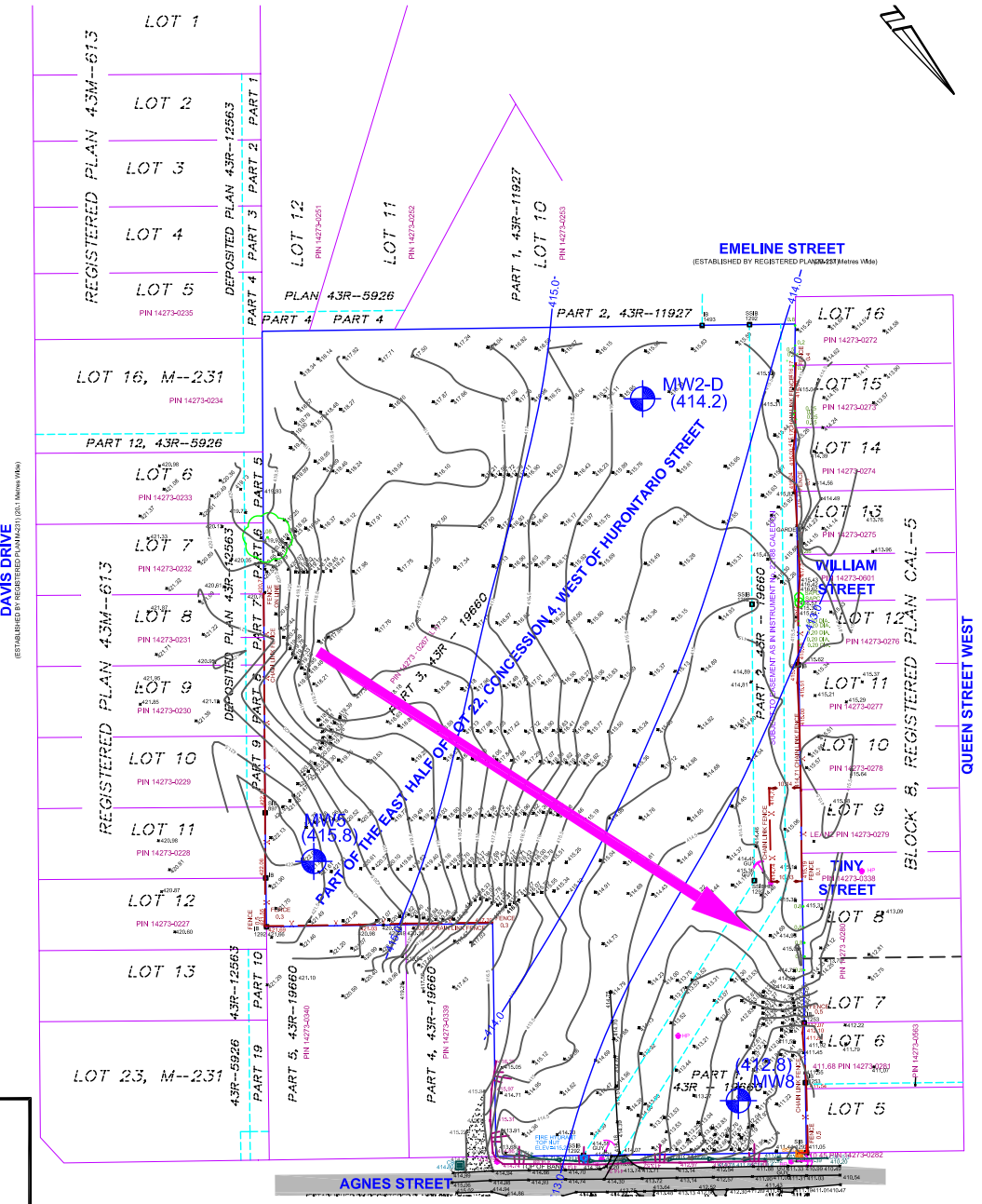
www.vanharten.com info@vanharten.com

DRAWN BY: S.J. CHECKED BY: JML PROJECT No. 25228-17

Sep 16,2022-12:12pm
G:\CALEDON\CON4WHS\AGNES ST DEVELPOMENT\ACAD\TOPO-ROBB UTM 2010 NR REV 1.dwg

750

SEATON GROUP



LEGEND

- Monitoring Well Location
- Inferred Groundwater Flow Direction
- (412.8) Groundwater Elevation (Apr.25,2019)
- Groundwater Contour (1.0m Interval)

Source:

REVISION SCHEDULE

No.	DATE	BY	COMMENTS
1	7/25/18	S.J.	INITIAL SUBMISSION

Van Harten SURVEYING INC.
LAND SURVEYORS and ENGINEERS

Kitchener Ph: 519-742-8371 | Guelph Ph: 519-821-2763 | Orangeville Ph: 519-940-4110

www.vanharten.com info@vanharten.com

DRAWN BY: S.A. | CHECKED BY:ML | PROJECT No. 25228-17

Jul 25,2019-9:41pm G:\CAD\DWGS\DWGS\WHS\AGNES ST DEVELOPMENT\ACAD\TOPO-ROBB UTM 2010 NR.dwg

Terraprobe
903 Barton Street - Unit 22, Stoney Creek, Ontario, L8E 5R7
Tel: (905) 643-7560, Fax: (905) 643-7559

Title: GROUNDWATER FLOW DIRECTION PLAN

File No. 7-18-0158-01

FIGURE : 3

SUBMISSION DRAWING

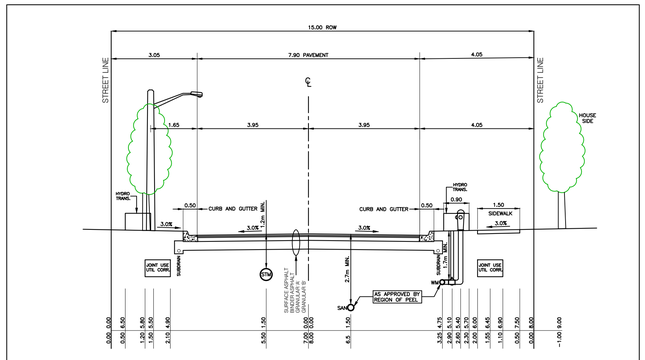
NOT TO BE USED FOR CONSTRUCTION

DRAWING LIST

(GRECK AND ASSOCIATES LTD.)

NOTE:

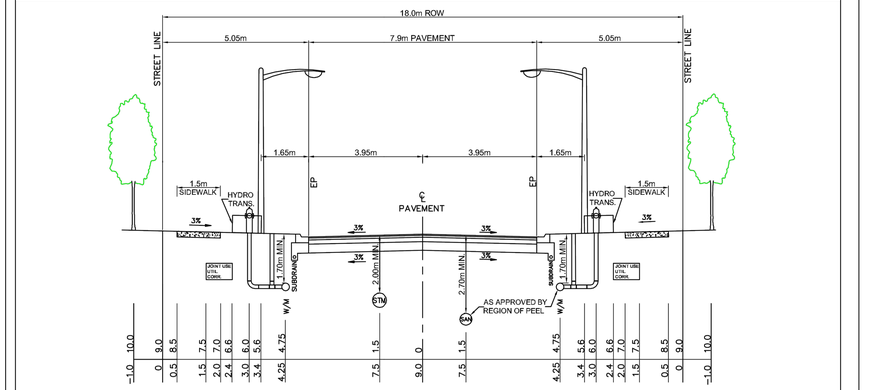
THE CONTRACTOR IS CAUTIONED THAT ALL EXISTING UTILITIES ARE NOT INDICATED ON THIS DRAWING. THE CONTRACTOR MUST ARRANGE FOR LOCATES FROM EACH UTILITY COMPANY PRIOR TO ANY CONSTRUCTION OR EXCAVATION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES, INCLUDING THOSE NOT INCLUDED ON THIS DRAWING. GRECK AND ASSOCIATES LIMITED CAN NOT ACCEPT RESPONSIBILITY FOR DAMAGE TO ANY EXISTING UTILITY WHICH MAY, OR MAY NOT BE INDICATED ON THIS DRAWING.



TYPICAL ROAD CROSS SECTION
15m LOCAL WINDOW STREET
7.90m PAVEMENT
SCALE 1:75

AGNES STREET CROSS SECTION

(QUEEN STREET WEST TO KING STREET)



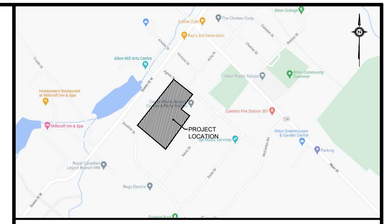
NOTES
1. WATERMAIN TO HAVE MINIMUM COVER OF 1.7m.
2. UTILITY CORRIDOR TO HAVE A MINIMUM COVER OF 0.9m.
3. TREES TO BE PLACED IN LOCATIONS PER APPROVED LANDSCAPE PLAN.
4. STREETLIGHT FIXTURE PER APPROVED TOWN STANDARD.
5. THE FOLLOWING IS A MINIMUM ROAD BASE AND WILL REQUIRE A SOILS REPORT VERIFICATION
   40 mm HL3
   65 mm HL8
   150 mm GRANULAR "A"
   300 mm GRANULAR "B"
6. THE BOULEVARDS REQUIRE A MINIMUM OF 300mm OF TOPSOIL AND NURSERY SOD.
7. ON A CRESCENT THE WATERMAIN SHALL BE PLACED ON THE OUTSIDE.
8. FULL LENGTH MINIMUM 100 MM DIA.SUB-DRAINS C/W FILTERCLOTH SHALL BE INSTALLED, AS PER APPROVED TOWN OF CALEDON STANDARD NO. 219.
9. SUB-GRADE SHALL BE COMPACTED TO A MINIMUM 95% OF S.P.D. AT OPTIMUM MOISTURE CONTENT.
10. WHERE POSSIBLE MANHOLE LIDS TO BE LOCATED OUT OF TIRE LANE OF TRAFFIC.
11. LONG DIMENSION OF TRANSFORMER TO BE PARALLEL TO STREETLINE.

TOWN OF CALEDON	NO.	REVISION	APR'D	DATE
18.0m LOCAL ROAD 8.5m ROADWAY (7.9m PAVEMENT)	3	DIMENSION AND TEXT REVISION		JAN. 09
	2	DIMENSION AND LAYOUT REVISION		JULY 08
	1	DIMENSION EDIT		JUNE 08

APR'D: C.C. DATE: JUNE 08
DRAWN: SCALE: N.T.S.
STANDARD No. 202

AGNES STREET CROSS SECTION

(KING STREET TO DAVIS DRIVE)



KEY PLAN
N.T.S.

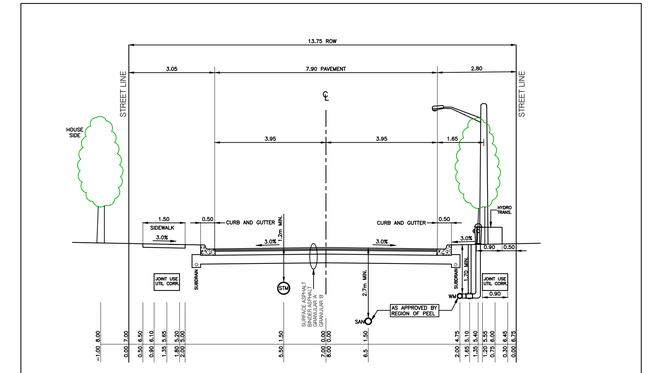
BENCHMARK

BENCHMARK No. N/A
ELEVATION = N/A
DESCRIPTION:
ELEVATIONS ARE BASED ON GPS OBSERVATIONS FROM PERMANENT REFERENCE STATIONS IN THE NAD83 (CSRS-2010) COORDINATE SYSTEM, WITH HEIGHTS CONVERTED TO ORTHOMETRIC ELEVATION ON THE CVGD28 DATUM (1978 ADJUSTMENT) WITH GEOID MODEL HTV2.0, AS SUPPLIED BY NATURAL RESOURCES CANADA.

COMPLETED BY:
VAN HARTEN SURVEYING INC.
COMPLETED ON:
MAY 10, 2018

DEM SOURCE:
LIDAR DTM PEEL 2016 PACKAGE B AVAILABLE FROM LAND INFORMATION ONTARIO

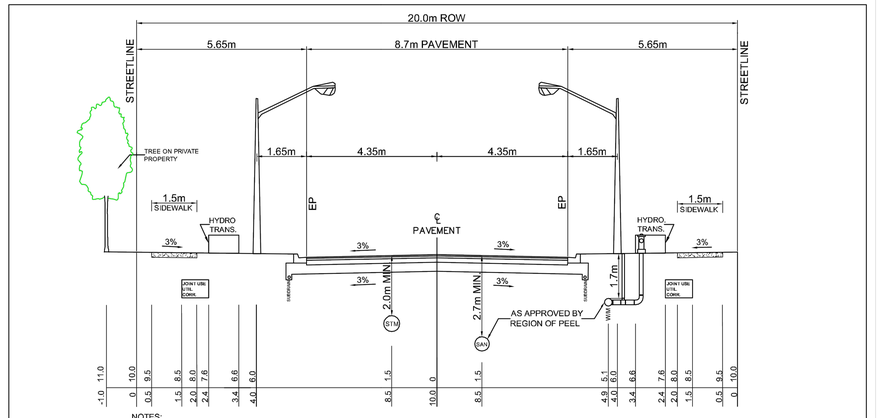
NO.	REVISION	DATE	BY	APPROVED
01	ISSUED FOR 2ND SUBMISSION	2023/12/20	K.M.	



TYPICAL ROAD CROSS SECTION
13.75m LOCAL WINDOW STREET
7.90m PAVEMENT
SCALE 1:75

EMELINE STREET CROSS SECTION

(QUEEN STREET TO DEVELOPMENT NORTH LIMIT)



NOTES:
1. UTILITY CORRIDOR TO HAVE A MINIMUM COVER OF 0.9m.
2. WATERMAIN TO HAVE MINIMUM COVER OF 1.7m.
3. THE FOLLOWING IS A MINIMUM ROAD BASE AND WILL REQUIRE A SOILS REPORT VERIFICATION
   40mm HL3
   65mm HL8
   150mm GRANULAR "A"
   300mm GRANULAR 'B'
4. THE BOULEVARDS REQUIRE A MINIMUM OF 300mm OF TOPSOIL AND NURSERY SOD
5. TREES TO BE PLACED IN LOCATIONS PER APPROVED LANDSCAPE PLAN
6. STREETLIGHT FIXTURE PER APPROVED TOWN STANDARD.
7. ON A CRESCENT THE WATERMAIN SHALL BE PLACED ON THE OUTSIDE.
8. FULL LENGTH MINIMUM 100MM DIA.SUB-DRAINS C/W FILTERCLOTH SHALL BE INSTALLED TO TOWN OF CALEDON STANDARD NO. 219.
9. SUB-GRADE SHALL BE COMPACTED TO A MINIMUM 95% OF S.P.D. AT OPTIMUM MOISTURE CONTENT.
10. WHERE POSSIBLE MANHOLE LIDS TO BE LOCATED OUT OF TIRE LANE OF TRAFFIC.
11. ESTATE RESIDENTIAL 4.0 METERS LANE WIDTH.

TOWN OF CALEDON	NO.	REVISION	APR'D	DATE
20.0m LOCAL URBAN/RURAL 9.3m ROADWAY (8.7m PAVEMENT)	4	DIMENSION AND TEXT REVISION		JAN. 09
	3	DIMENSION, LAYOUT REVISION		JULY 08
	2	DIMENSION EDIT, STD No. 201 NOW 203		JUNE 08
	1	OFFSETS		APRIL 08

APR'D: C.C. DATE: 19/01/00
DRAWN: BJM SCALE: N.T.S.
STANDARD No. 203

EMELINE STREET CROSS SECTION

(DEVELOPMENT NORTH LIMIT TO DAVIS DRIVE)

Greck
5770 Highway 7, Woodbridge, Ontario, L4L 1T8 www.greck.ca

LICENSED PROFESSIONAL ENGINEER
K. MAHMOOD
100160233
Dec. 20, 2023
20-731
PROVINCE OF ONTARIO

CLIENT NAME:
THE ALTON DEVELOPMENT INC.
1402 QUEEN STREET
ALTON, ON
L7K 0C3

PROJECT NAME:
AGNES STREET SUBDIVISION
AGNES STREET CALEDON, ON

CROSS SECTIONS

DESIGNED BY: J.N.	SCALES:	PROJECT No.	20-731
CHECKED BY: K.M.	HORIZONTAL: AS NOTED	DRAWING No.	CS
DRAWN BY: J.N.	VERTICAL: N/A	SHEET No.	04
DATE: MAR. 08, 2023	SHEET SIZE: 24"x36"		

Stormceptor®

Rinker MATERIALS™

Stormceptor® EF Sizing Report

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

12/01/2023

Province:	Ontario
City:	Alton
Nearest Rainfall Station:	TORONTO INTL AP
Climate Station Id:	6158731
Years of Rainfall Data:	20

Project Name:	Agnes Street
Project Number:	20-731
Designer Name:	Jennifer Chan
Designer Company:	Greck
Designer Email:	jchan@greck.ca
Designer Phone:	289-657-9797
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Site Name:	Agnes St Urbanization

Drainage Area (ha):	0.27
% Imperviousness:	72.40

Runoff Coefficient 'c': 0.73

Particle Size Distribution:	CA ETV
Target TSS Removal (%):	60.0

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	6.17
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):	151
Estimated Average Annual Sediment Volume (L/yr):	123

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	63
EFO6	67
EFO8	69
EFO10	70
EFO12	70

Recommended Stormceptor EFO Model: EFO4

Estimated Net Annual Sediment (TSS) Load Reduction (%): 63

Water Quality Runoff Volume Capture (%): > 90

imbrium

THIRD-PARTY TESTING AND VERIFICATION

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

PERFORMANCE

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

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

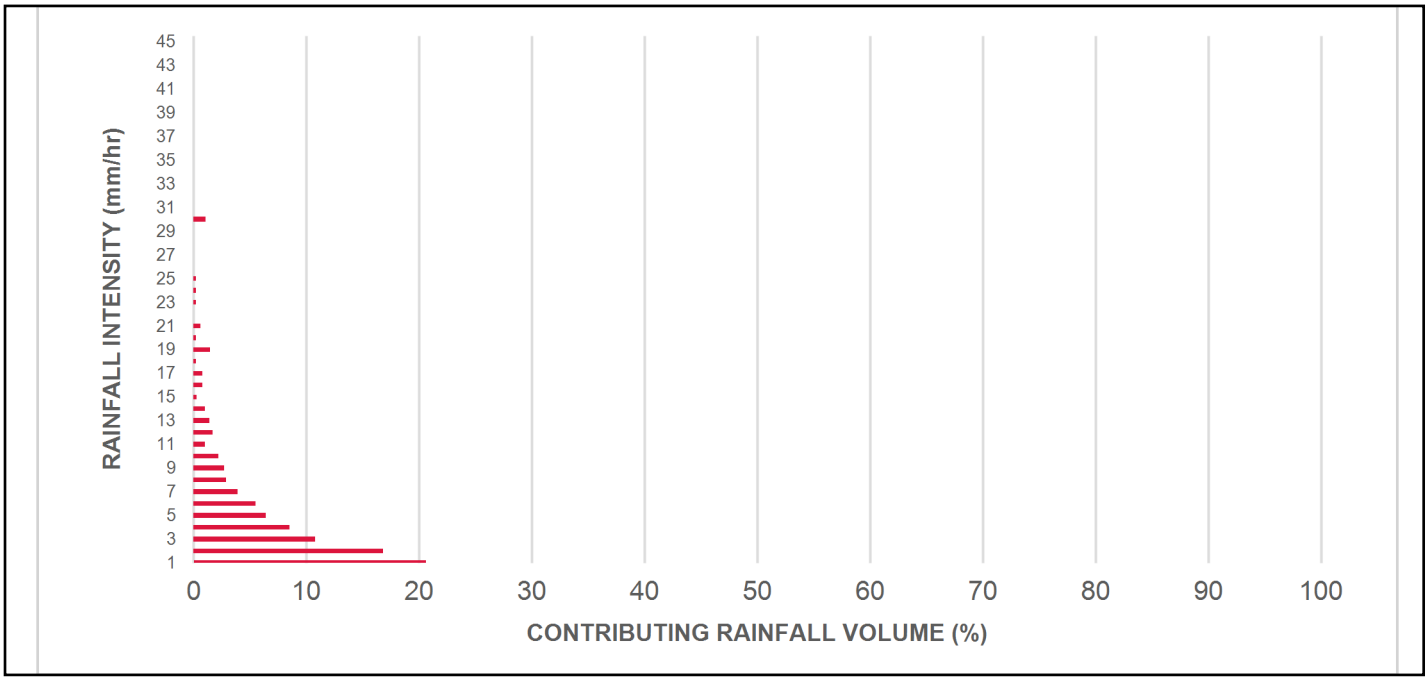
Stormceptor® EF Sizing Report

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	8.5	8.5	0.28	17.0	14.0	70	6.0	6.0
1.00	20.6	29.1	0.55	33.0	28.0	70	14.5	20.5
2.00	16.8	45.9	1.10	66.0	55.0	69	11.6	32.1
3.00	10.8	56.7	1.65	99.0	83.0	64	6.9	39.0
4.00	8.5	65.2	2.20	132.0	110.0	62	5.2	44.2
5.00	6.4	71.6	2.76	165.0	138.0	60	3.8	48.0
6.00	5.5	77.0	3.31	198.0	165.0	57	3.1	51.1
7.00	3.9	81.0	3.86	232.0	193.0	55	2.2	53.3
8.00	2.9	83.9	4.41	265.0	220.0	53	1.5	54.8
9.00	2.7	86.5	4.96	298.0	248.0	53	1.4	56.2
10.00	2.2	88.7	5.51	331.0	276.0	52	1.1	57.4
11.00	1.0	89.7	6.06	364.0	303.0	51	0.5	57.9
12.00	1.7	91.3	6.61	397.0	331.0	50	0.8	58.7
13.00	1.4	92.8	7.17	430.0	358.0	50	0.7	59.4
14.00	1.0	93.7	7.72	463.0	386.0	49	0.5	59.9
15.00	0.3	94.0	8.27	496.0	413.0	48	0.1	60.0
16.00	0.8	94.8	8.82	529.0	441.0	47	0.4	60.4
17.00	0.8	95.7	9.37	562.0	469.0	46	0.4	60.8
18.00	0.2	95.8	9.92	595.0	496.0	45	0.1	60.9
19.00	1.5	97.3	10.47	628.0	524.0	44	0.7	61.5
20.00	0.2	97.5	11.02	661.0	551.0	44	0.1	61.6
21.00	0.6	98.2	11.58	695.0	579.0	43	0.3	61.9
22.00	0.0	98.2	12.13	728.0	606.0	42	0.0	61.9
23.00	0.2	98.4	12.68	761.0	634.0	42	0.1	62.0
24.00	0.2	98.6	13.23	794.0	661.0	42	0.1	62.1
25.00	0.2	98.9	13.78	827.0	689.0	42	0.1	62.2
30.00	1.1	100.0	16.54	992.0	827.0	41	0.5	62.6
35.00	0.0	100.0	19.29	1158.0	965.0	40	0.0	62.6
40.00	0.0	100.0	22.05	1323.0	1102.0	39	0.0	62.6
45.00	0.0	100.0	24.81	1488.0	1240.0	36	0.0	62.6
Estimated Net Annual Sediment (TSS) Load Reduction =								**63 %**

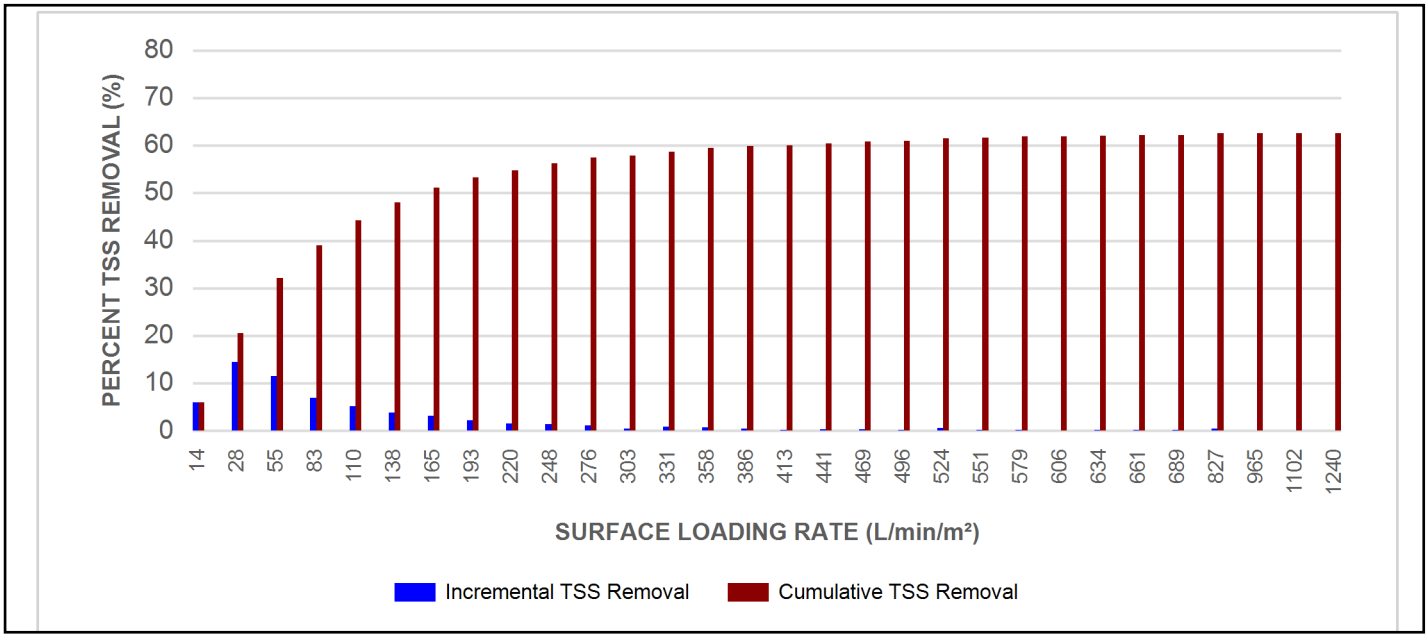
Climate Station ID: 6158731 *Years of Rainfall Data*: 20

imbrium

RAINFALL DATA FROM TORONTO INTL AP 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
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

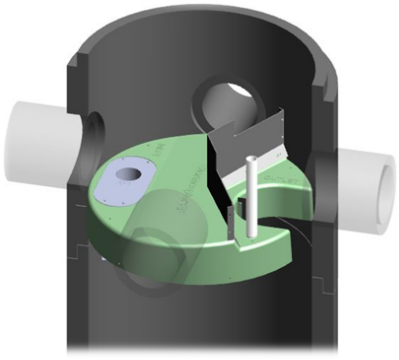
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test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

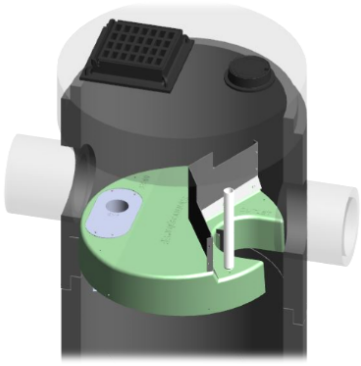
DESIGN FLEXIBILITY

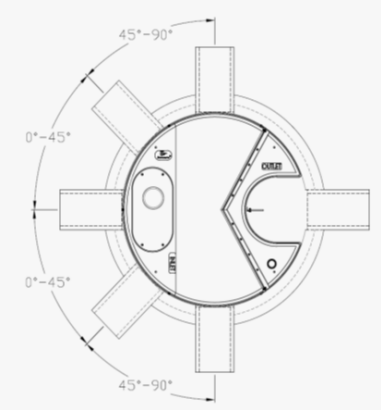
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend 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)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
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/ft^3)

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

Table of TSS Removal vs Surface Loading Rate Based on Third-Party Test Results
Stormceptor® EFO

SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL
1	70	660	42	1320	35	1980	24
30	70	690	42	1350	35	2010	24
60	67	720	41	1380	34	2040	23
90	63	750	41	1410	34	2070	23
120	61	780	41	1440	33	2100	23
150	58	810	41	1470	32	2130	22
180	56	840	41	1500	32	2160	22
210	54	870	41	1530	31	2190	22
240	53	900	41	1560	31	2220	21
270	52	930	40	1590	30	2250	21
300	51	960	40	1620	29	2280	21
330	50	990	40	1650	29	2310	21
360	49	1020	40	1680	28	2340	20
390	48	1050	39	1710	28	2370	20
420	47	1080	39	1740	27	2400	20
450	47	1110	38	1770	27	2430	20
480	46	1140	38	1800	26	2460	19
510	45	1170	37	1830	26	2490	19
540	44	1200	37	1860	26	2520	19
570	43	1230	37	1890	25	2550	19
600	42	1260	36	1920	25	2580	18
630	42	1290	36	1950	24	2600	26

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT 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** S**eparators**

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
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall

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

3.2 SIZING METHODOLOGY

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

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

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

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

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

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

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

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

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

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

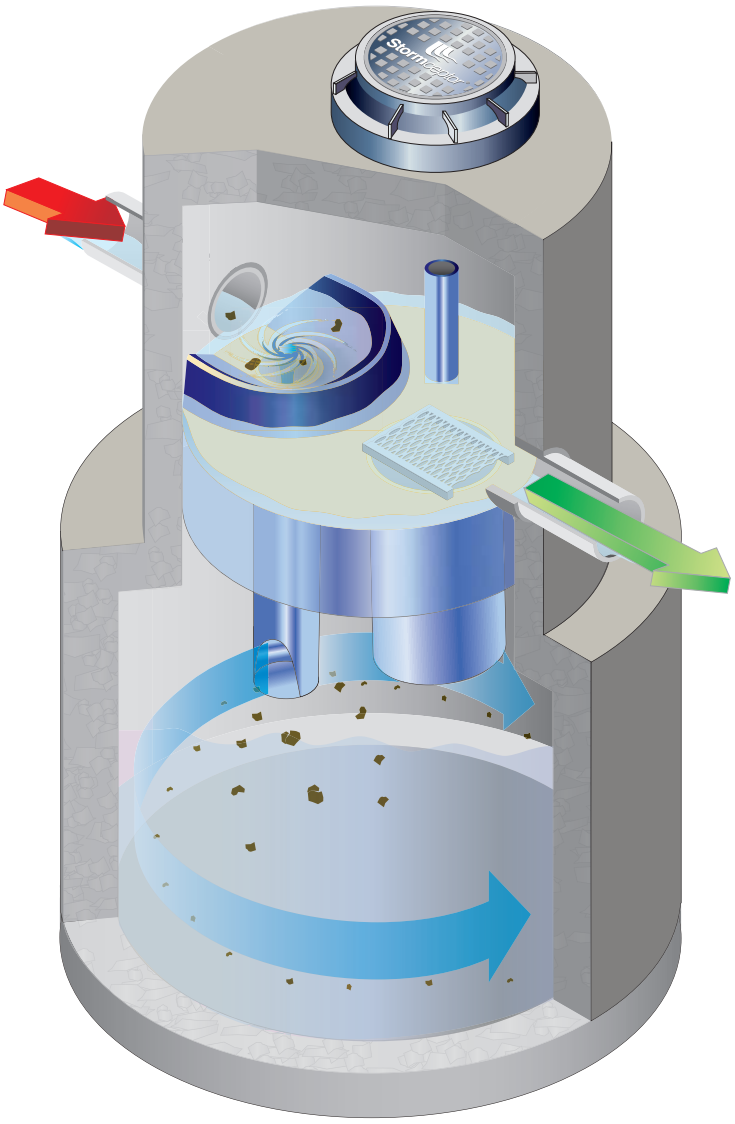
The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to

assess whether light liquids captured after a spill are effectively retained at high flow rates.

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

Stormceptor®

Owner's Manual



Stormceptor is protected by one or more of the following patents:

Canadian Patent No. 2,137,942
Canadian Patent No. 2,175,277
Canadian Patent No. 2,180,305
Canadian Patent No. 2,180,338
Canadian Patent No. 2,206,338
Canadian Patent No. 2,327,768
U.S. Patent No. 5,753,115
U.S. Patent No. 5,849,181
U.S. Patent No. 6,068,765
U.S. Patent No. 6,371,690
U.S. Patent No. 7,582,216
U.S. Patent No. 7,666,303
Australia Patent No. 693.164
Australia Patent No. 707,133
Australia Patent No. 729,096
Australia Patent No. 779,401
Australia Patent No. 2008,279,378
Australia Patent No. 2008,288,900
Indonesia Patent No. 0007058
Japan Patent No. 3581233
Japan Patent No. 9-11476
Korean Patent No. 0519212
Malaysia Patent No. 118987
New Zealand Patent No. 314,646
New Zealand Patent No. 583,008
New Zealand Patent No. 583,583
South African Patent No. 2010/00682
South African Patent No. 2010/01796
Other Patents Pending

Table of Contents

Congratulations!

Your selection of a Stormceptor® means that you have chosen the most recognized and efficient stormwater oil/sediment separator available for protecting the environment. Stormceptor is a pollution control device often referred to as a “Hydrodynamic Separator (HDS)” or an “Oil Grit Separator (OGS)”, engineered to remove and retain pollutants from stormwater runoff to protect our lakes, rivers and streams from the harmful effects of non-point source pollution.

1 – Stormceptor Overview

Stormceptor is a patented stormwater quality structure most often utilized as a treatment component of the underground storm drain network for stormwater pollution prevention. Stormceptor is designed to remove sediment, total suspended solids (TSS), other pollutants attached to sediment, hydrocarbons and free oil from stormwater runoff. Collectively the Stormceptor provides spill protection and prevents non-point source pollution from entering downstream waterways.

Key benefits of Stormceptor include:

- Removes sediment, suspended solids, debris, nutrients, heavy metals, and hydrocarbons (oil and grease) from runoff and snowmelt.
- Will not scour or re-suspend trapped pollutants.
- Provides sediment and oil storage.
- Provides spill control for accidents, commercial and industrial developments.
- Easy to inspect and maintain (vacuum truck).
- “STORMCEPTOR” is *clearly* marked on the access cover (excluding inlet designs).
- Relatively small footprint.
- 3rd Party tested and independently verified.
- Dedicated team of experts available to provide support.

Model Types:

- STC (Standard)
- STF (Fiberglass)
- EOS (Extended Oil Storage)
- OSR (Oil and Sand Removal)
- MAX (Custom designed unit, specific to site)

Configuration Types:

- Inlet unit (accommodates inlet flow entry, and multi-pipe entry)
- In-Line (accommodates multi-pipe entry)
- Submerged Unit (accommodates the site’s tailwater conditions)
- Series Unit (combines treatment in two systems)

Please Maintain Your Stormceptor

To ensure long-term environmental protection through continued performance as originally designed for your site, **Stormceptor must be maintained**, as any stormwater treatment practice does. The need for maintenance is determined through inspection of the Stormceptor. Procedures for inspection are provided within this document. Maintenance of the Stormceptor is performed from the surface via vacuum truck.

If you require information about Stormceptor, or assistance in finding resources to facilitate inspections or maintenance of your Stormceptor please call your local Stormceptor Licensee or Imbrium® Systems.

2 – Stormceptor Operation & Components

Stormceptor is a flexibly designed underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention using patented flow separation technology.

Stormceptor creates a non-turbulent treatment environment below the insert platform within the system. The insert diverts water into the lower chamber, allowing free oils and debris to rise, and sediment to settle under relatively low velocity conditions. These pollutants are trapped and stored below the insert and protected from large runoff events for later removal during the maintenance procedure.

With thousands of units operating worldwide, Stormceptor delivers reliable protection every day, in every storm. The patented Stormceptor design prohibits the scour and release of captured pollutants, ensuring superior water quality treatment and protection during even the most extreme storm events. Stormceptor's proven performance is backed by the longest record of lab and field verification in the industry.

Stormceptor Schematic and Component Functions

Below are schematics of two common Stormceptor configurations with key components identified and their functions briefly described.

Figure 1.

Inline Stormceptor

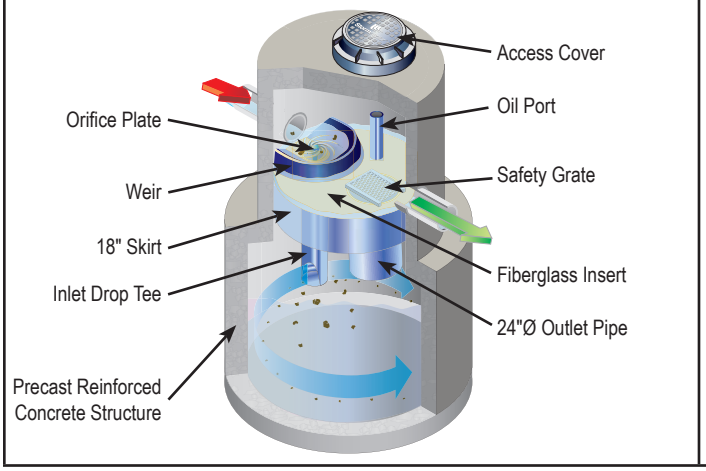
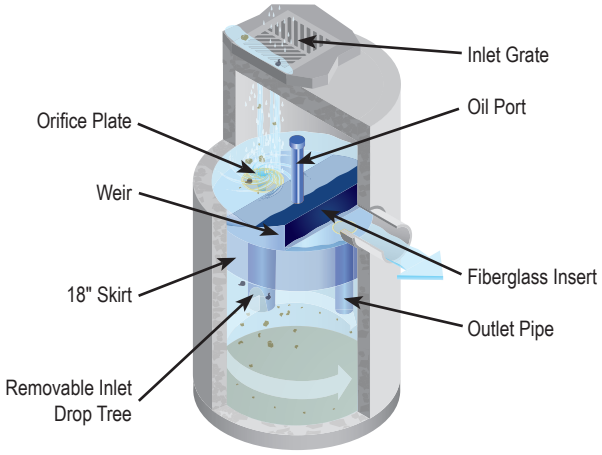


Figure 2.

Inlet Stormceptor



- **Manhole access cover** – provides access to the subsurface components
- **Precast reinforced concrete structure** – provides the vessel's watertight structural support
- **Fiberglass insert** – separates vessel into upper and lower chambers
- **Weir** – directs incoming stormwater and oil spills into the lower chamber
- **Orifice plate** – prevents scour of accumulated pollutants
- **Inlet drop tee** – conveys stormwater into the lower chamber
- **Fiberglass skirt** – provides double-wall containment of hydrocarbons
- **Outlet riser pipe** – conveys treated water to the upper chamber; primary vacuum line access port for sediment removal
- **Oil inspection port** – primary access for measuring oil depth and oil removal
- **Safety grate** – safety measure to cover riser pipe in the event of manned entry into vessel

3 – Stormceptor Identification

Stormceptor is available in both precast concrete and fiberglass vessels, with precast concrete often being the dominant material of construction.

In the Stormceptor, a patented, engineered fiberglass insert separates the structure into an upper chamber and lower chamber. The lower chamber will remain full of water, as this is where the pollutants are sequestered for later removal. Multiple Stormceptor model (STC, OSR, EOS, MAX and STF) configurations exist, each to be inspected and maintained in a similar fashion.

Each unit is easily identifiable as a Stormceptor by the trade name "Stormceptor" embossed on each access cover at the surface. To determine the location of "inlet" Stormceptor units with horizontal catch basin inlet, look down into the grate as the Stormceptor insert will be visible. The name "Stormceptor" is not embossed on inlet models due to the variability of inlet grates used/ approved across North America.

Once the location of the Stormceptor is determined, the model number may be identified by comparing the measured depth from the fiberglass insert level at the outlet pipe's invert (water level) to the bottom of the tank using **Table 1**.

In addition, starting in 1996 a metal serial number tag containing the model number has been affixed to the inside of the unit, on the fiberglass insert. If the unit does not have a serial number, or if there is any uncertainty regarding the size of the unit using depth measurements, please contact your local Stormceptor Representative for assistance.

Sizes/Models

Typical general dimensions and capacities of the standard precast STC, EOS & OSR Stormceptor models in both USA and Canada/International (excluding South East Asia and Australia) are provided in **Tables 1 and 2**. Typical rim to invert measurements are provided later in this document. The total depth for cleaning will be the sum of the depth from outlet pipe invert (generally the water level) to rim (grade) and the depth from outlet pipe invert to the precast bottom of the unit. Note that depths and capacities may vary slightly between regions.

Table 1A. (US) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (in.)
450	60
900	55
1200	71
1800	105
2400	94
3600	134
4800	128
6000	150
7200	134
11000*	128
13000*	150
16000*	134

EOS Model	Insert to Base (in.)
4-175	60
9-365	55
12-590	71
18-1000	105
24-1400	94
36-1700	134
48-2000	128
60-2500	150
72-3400	134
110-5000*	128
130-6000*	150
160-7800*	134

OSR Model	Insert to Base (in.)
65	60
140	55
250	94
390	128
560	134
780*	128
1125*	134

Typical STF m (in.)
1.5 (60)
1.5 (61)
1.8 (73)
2.9 (115)
2.3 (89)
3.2 (127)
2.9 (113)
3.5 (138)
3.3 (128)

Notes:

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

**Consist of two chamber structures in series.*

Table 1B. (CA & Int'l) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (m)
300	1.5
750	1.5
1000	1.8
1500	2.8
2000	2.8
3000	3.7
4000	3.4
5000	4.0
6000	3.7
9000*	3.4
11000*	4.0
14000*	3.7

EOS Model	Insert to Base (m)
300	1.5
750	1.5
1000	1.8
2000	2.8
3000	3.7
4000	3.4
5000	4.0
6000	3.7
9000*	3.4
10000*	4.0
14000*	3.7

OSR Model	Insert to Base (m)
300	1.7
750	1.6
2000	2.6
4000	3.6
6000	3.7
9000*	3.6
14000*	3.7

Typical STF m (in.)
1.5 (60)
1.5 (61)
1.8 (73)
2.9 (115)
2.3 (89)
3.2 (127)
2.9 (113)
3.5 (138)
3.3 (128)

Notes:

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

**Consist of two chamber structures in series.*

Table 2A. (US) Storage Capacities

STC Model	Hydrocarbon Storage Capacity gal	Sediment Capacity ft^3	**EOS Model**	Hydrocarbon Storage Capacity gal	**OSR Model**	Hydrocarbon Storage Capacity gal	Sediment Capacity ft^3
450	86	46	**4-175**	175	**065**	115	46
900	251	89	**9-365**	365	**140**	233	58
1200	251	127	**12-590**	591			
1800	251	207	**18-1000**	1198			
2400	840	205	**24-1400**	1457	**250**	792	156
3600	840	373	**36-1700**	1773			
4800	909	543	**48-2000**	2005	**390**	1233	465
6000	909	687	**60-2500**	2514			
7200	1059	839	**72-3400**	3418	**560**	1384	690
11000*	2797	1089	**110-5000***	5023	**780***	2430	930
13000*	2797	1374	**130-6000***	6041			
16000*	3055	1677	**160-7800***	7850	**1125***	2689	1378

Notes:

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

**Consist of two chamber structures in series.*

Table 2B. (CA & Int'l) Storage Capacities

STC Model	Hydrocarbon Storage Capacity L	Sediment Capacity L	EOS Model	Hydrocarbon Storage Capacity L	OSR Model	Hydrocarbon Storage Capacity L	Sediment Capacity L
300	300	1450	**300**	662	**300**	300	1500
750	915	3000	**750**	1380	**750**	900	3000
1000	915	3800	**1000**	2235			
1500	915	6205					
2000	2890	7700	**2000**	5515	**2000**	2790	7700
3000	2890	11965	**3000**	6710			
4000	3360	16490	**4000**	7585	**4000**	4700	22200
5000	3360	20940	**5000**	9515			
6000	3930	26945	**6000**	12940	**6000**	5200	26900
9000*	10555	32980	**9000***	19010	**9000***	9300	33000
11000*	10555	37415	**10000***	22865			
14000*	11700	53890	**14000***	29715	**14000***	10500	53900

Notes:

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

**Consist of two chamber structures in series.*

4 – Stormceptor Inspection & Maintenance

Regular inspection and maintenance is a proven, cost-effective way to maximize water resource protection for all stormwater pollution control practices, and is required to insure proper functioning of the Stormceptor. Both inspection and maintenance of the Stormceptor is easily performed from the surface. Stormceptor's patented technology has no moving parts, simplifying the inspection and maintenance process.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

When is inspection needed?

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess the sediment accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

When is maintenance cleaning needed?

- For optimum performance, the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, which is approximately 15% of the unit's total storage capacity (see **Table 2**). The frequency should be adjusted based on historical inspection results due to variable site pollutant loading.

- Sediment removal is easier when removed on a regular basis at or prior to the recommended maintenance sediment depths, as sediment build-up can compact making removal more difficult.
- The unit should be cleaned out immediately after an oil, fuel or chemical spill.

What conditions can compromise Stormceptor performance?

- If construction sediment and debris is not removed prior to activating the Stormceptor unit, maintenance frequency may be reduced.
- If the system is not maintained regularly and fills with sediment and debris beyond the capacity as indicated in **Table 2**, pollutant removal efficiency may be reduced.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured.
- If debris clogs the inlet of the system, removal efficiency of sediment and hydrocarbons may be reduced.
- If a downstream blockage occurs, a backwater condition may occur for the Stormceptor and removal efficiency of sediment and hydrocarbons may be reduced.

What training is required?

The Stormceptor is to be inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins. For typical inspection and maintenance activities, no specific supplemental training is required for the Stormceptor. Information provided within this Manual (provided to the site owner) contains sufficient guidance to maintain the system properly.

In unusual circumstances, such as if a damaged component needs replacement or some other condition requires manned entry into the vessel, confined space entry procedures must be followed. Only professional maintenance service providers trained in these procedures should enter the vessel. Service provider companies typically have personnel who are trained and certified in confined space entry procedures according to local, state, and federal standards.

What equipment is typically required for inspection?

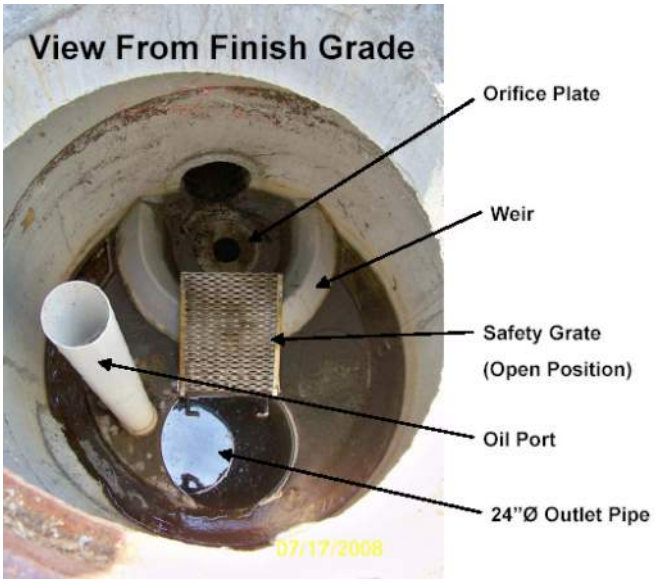
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

Recommended Stormceptor Inspection Procedure:

- Stormceptor is to be inspected from grade through a standard surface manhole access cover.
- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick.
- Oil depth is measured through the oil inspection port, either a 4-inch (100 mm) or 6-inch (150 mm) diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch (610 mm) diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

Figure 3.

Figure 4.



What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, and safety harness for specially trained personnel if confined space entry is required

Recommended Stormceptor Maintenance Procedure

Maintenance of Stormceptor is performed using a vacuum truck.

No entry into the unit is required for maintenance. ***DO NOT ENTER THE STORMCEPTOR CHAMBER*** unless you have the proper personal safety equipment, have been trained and are qualified to enter a confined space, as identified by local Occupational Safety and Health Regulations (e.g. 29 CFR 1910.146 or Canada Occupational Safety and Health Regulations – SOR/86-304). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local, provincial, and/or state regulations to determine the requirements for confined space entry. Be aware, and take precaution that the Stormceptor fiberglass insert may be slippery. In addition, be aware that some units do not have a safety grate to cover the outlet riser pipe that leads to the submerged, lower chamber.

- Ideally maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is to be maintained through a standard surface manhole access cover.
- Insert the oil dipstick into the oil inspection port. If oil is present, pump off the oil layer into separate containment using a small pump and tubing.
- Maintenance cleaning of accumulated sediment is performed with a vacuum truck.
    - For 6-ft (1800 mm) diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch (610 mm) outlet riser pipe.
    - For 4-ft (1200 mm) diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch (305 mm) drop tee hole.

Figure 5.

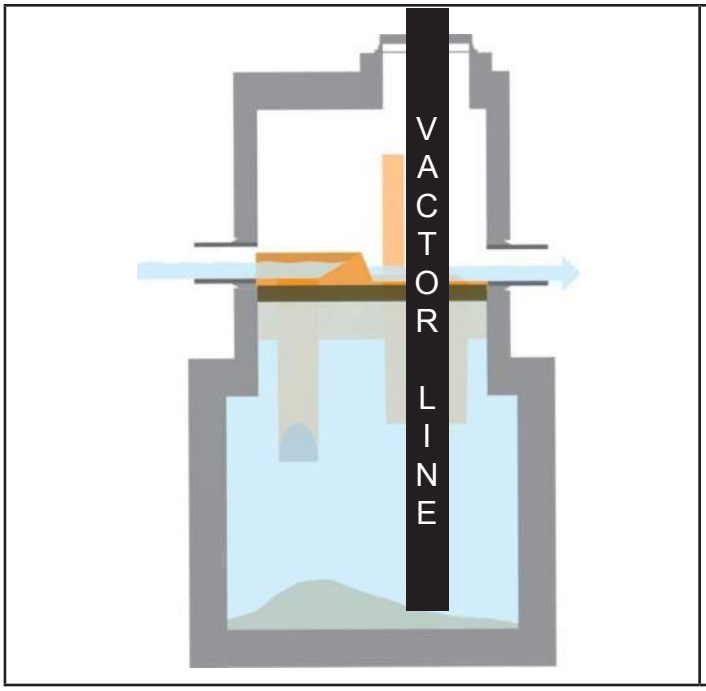
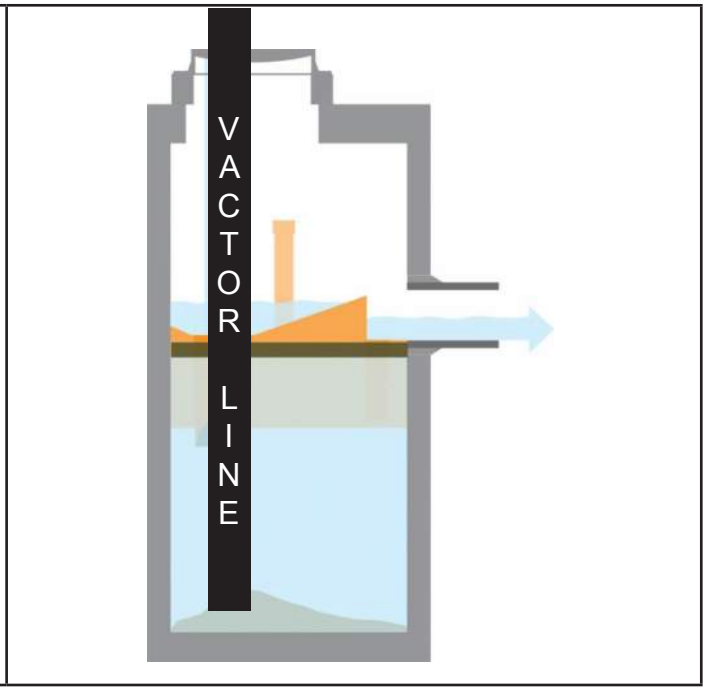


Figure 6.



- Using the vacuum hose, decant the water from the lower chamber into a separate containment tank or to the sanitary sewer, if permitted by the local regulating authority.
- Remove the sediment sludge from the bottom of the unit using the vacuum hose. For large Stormceptor units, a flexible hose is often connected to the primary vacuum line for ease of movement in the lower chamber.
- Units that have not been maintained regularly, have surpassed the maximum recommended sediment capacity, or contain damaged components may require manned entry by trained personnel using safe and proper confined space entry procedures.

Figure 7.

Figure 8.

A maintenance worker stationed at the above ground surface uses a vacuum hose to evacuate water, sediment, and debris from the system.

What is required for proper disposal?

The requirements for the disposal of material removed from Stormceptor units are similar to that of any other stormwater treatment Best Management Practices (BMP). Local guidelines should be consulted prior to disposal of the separator contents. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste. This could be site and pollutant dependent. In some cases, approval from the disposal facility operator/agency may be required.

What about oil spills?

Stormceptor is often implemented in areas where there is high potential for oil, fuel or other hydrocarbon or chemical spills. Stormceptor units should be cleaned immediately after a spill occurs by a licensed liquid waste hauler. You should also notify the appropriate regulatory agencies as required in the event of a spill.

What if I see an oil rainbow or sheen at the Stormceptor outlet?

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a hydrocarbon rainbow or sheen can be seen at

very small oil concentrations (< 10 ppm). Stormceptor is effective at removing 95% of free oil, and the appearance of a sheen at the outlet with high influent oil concentrations does not mean that the unit is not working to this level of removal. In addition, if the influent oil is emulsified, the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified or dissolved oil conditions.

What factors affect the costs involved with inspection/maintenance?
The Vacuum Service Industry for stormwater drainage and sewer systems is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean Stormceptor units will vary. Inspection and maintenance costs are most often based on unit size, the number of units on a site, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations.

What factors predict maintenance frequency?
Maintenance frequency will vary with the amount of pollution on your site (number of hydrocarbon spills, amount of sediment, site activity and use, etc.). It is recommended that the frequency of maintenance be increased or reduced based on local conditions. If the sediment load is high from an unstable site or sediment loads transported from upstream catchments, maintenance may be required semi-annually. Conversely once a site has stabilized, maintenance may be required less frequently (for example: two to seven year, site and situation dependent). Maintenance should be performed immediately after an oil spill or once the sediment depth in Stormceptor reaches the value specified in **Table 3** based on the unit size.

Table 3A. (US) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (in)	EOS Model	Maintenance Sediment depth (in)	Oil Storage Depth (in)	OSR Model	Maintenance Sediment depth (in)
450	8	**4-175**	9	24	**065**	8
900	8	**9-365**	9	24	**140**	8
1200	10	**12-590**	11	39		
1800	15					
2400	12	**24-1400**	14	68	**250**	12
3600	17	**36-1700**	19	79		
4800	15	**48-2000**	16	68	**390**	17
6000	18	**60-2500**	20	79		
7200	15	**72-3400**	17	79	**560**	17
11000*	17	**110-5000***	16	68	**780***	17
13000*	20	**130-6000***	20	79		
16000*	17	**160-7800***	17	79	**1125***	17

Note:

1. *The values above are for typical standard units.*

**Per structure.*

Table 3B. (CA & Int'l) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (mm)	EOS Model	Maintenance Sediment depth (mm)	Oil Storage Depth (mm)	OSR Model	Maintenance Sediment depth (mm)
300	225	**300**	225	610	**300**	200
750	230	**750**	230	610	**750**	200
1000	275	**1000**	275	990		
1500	400					
2000	350	**2000**	350	1727	**2000**	300
3000	475	**3000**	475	2006		
4000	400	**4000**	400	1727	**4000**	375
5000	500	**5000**	500	2006		
6000	425	**6000**	425	2006	**6000**	375
9000*	400	**9000***	400	1727	**9000***	425
11000*	500	**10000***	500	2006		
14000*	425	**14000***	425	2006	**14000***	425

Note:

1. *The values above are for typical standard units.*

   **Per structure.*

Replacement parts

Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. Therefore, inspection and maintenance activities are generally focused on pollutant removal. However, if replacements parts are necessary, they may be purchased by contacting your local Stormceptor Representative, or Imbrium Systems.

The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to Stormceptor's long and effective service life.

Stormceptor Inspection and Maintenance Log

Stormceptor Model No: _____

Allowable Sediment Depth: _____

Serial Number: _____

Installation Date: _____

Location Description of Unit: _____

Other Comments: _____

Contact Information

Questions regarding the Stormceptor can be addressed by contacting your area Stormceptor Licensee, Imbrium Systems, or visit our website at www.stormceptor.com.

Stormceptor Licensees:

CANADA

Lafarge Canada Inc.
www.lafargepipe.com

403-292-9502 / 1-888-422-4022	Calgary, AB
780-468-5910	Edmonton, AB
204-958-6348	Winnipeg, MB, NW. ON, SK

Langley Concrete Group
www.langleyconcretegroup.com

604-502-5236	BC

Hanson Pipe & Precast Inc.
www.hansonpipeandprecast.com

519-622-7574 / 1-888-888-3222	ON

Lécuyer et Fils Ltée.
www.lecuyerbeton.com

450-454-3928 / 1-800-561-0970	QC

Strescon Limited
www.strescon.com

902-494-7400	NS, NF
506-633-8877	NB, PE

UNITED STATES

Rinker Materials
www.rinkerstormceptor.com
1-800-909-7763

AUSTRALIA & SOUTHEAST ASIA, including New Zealand & Japan

Humes Water Solutions
www.humes.com.au
+61 7 3364 2894

Imbrium Systems Inc. & Imbrium Systems LLC

Canada	1-416-960-9900 / 1-800-565-4801
United States	1-301-279-8827 / 1-888-279-8826
International	+1-416-960-9900 / +1-301-279-8827
Email	info@imbriumsystems.com

www.imbriumsystems.com
www.stormceptor.com

Site Characteristics
Site: Agnes Street Urbanization, Alton, Ontario
December 20, 2023

Pre-Development

Land-Use	Impervious Ratio	Area 101 (m^2)	Area 102 (m^2)	Area 103 (m^2)	Area 104 (m^2)	Total (m^2)	Coverage
Asphalt	1.00	1,574.9	0.0	1,090.9	1,832.8	4,498.6	8%
Permeable Pavers	0.50	0.0	0.0	0.0	0.0	0.0	0%
Hardscape	1.00	0.0	0.0	108.5	0.0	108.5	0%
Roof	1.00	516.4	0.0	1,003.1	0.0	1,519.5	3%
Grassed	0.00	33,202.8	5,179.3	12,175.5	861.1	51,418.6	89%
Total		35,294.1	5,179.3	14,378.0	2,693.9	57,545.2	100%
	Area (ha) =	3.529	0.518	1.438	0.269	5.755	
	% Impervious =	5.9%	0.0%	15.3%	68.0%	10.6%	
	Runoff Coefficient* =	0.29	0.25	0.35	0.69	0.32	

*Pervious areas were assigned a runoff coefficient of 0.25 and impervious areas were assigned a runoff coefficient of 0.90

Post-Development

Land-Use	Impervious Ratio	Area 201 (m^2)	Area 202 (m^2)	Area 203 (m^2)	Area 204 (m^2)	Total (m^2)	Coverage
Asphalt	1.00	3,094.8	1,035.1	1,090.9	1,832.8	7,053.6	12%
Permeable Pavers	0.50	2,098.5	438.3	0.0	236.3	2,773.1	5%
Hardscape	1.00	1,483.8	1,370.7	108.5	0.0	2,963.0	5%
Roof	1.00	6,662.2	4,608.9	1,003.1	0.0	12,274.2	21%
Grassed	0.00	10,089.0	9,592.1	12,175.5	624.7	32,481.3	56%
Total		23,428.3	17,045.1	14,378.0	2,693.9	57,545.2	100%
	Area (ha) =	2.343	1.705	1.438	0.269	5.755	
	% Impervious =	52.5%	42.4%	15.3%	72.4%	41.1%	
	Runoff Coefficient* =	0.59	0.53	0.35	0.72	0.52	

*Pervious areas were assigned a runoff coefficient of 0.25 and impervious areas were assigned a runoff coefficient of 0.90

Peak Runoff Assessment
Site: Agnes Street Urbanization, Alton, Ontario
December 20, 2023

Peak Runoff Assessment

Town of Caledon Intensity-Duration Frequency Curves (from Development Standards Manual 2019)

Return Period	A	B	C
2	1,070	0.8759	7.85
5	1,593	0.8789	11
10	2,221	0.908	12
25	3,158	0.9335	15
50	3,886	0.9495	16
100	4,688	0.9624	17

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

a, b, c = IDF Parameters
I = Intensity (mm/h)
t = Storm Duration, 10 minutes minimum (min)

Time of Concentration
Airport
If Runoff Coefficient < 0.4

$$T_c = \frac{3.26\ (1.1 - C)\ L^{0.5}}{S_w^{0.33}}$$

where, L = Flow length (m)
Sw = slope (%)
C = Runoff Coefficient

Bransby
If Runoff Coefficient > 0.4

$$T_c = \frac{0.057\ L}{S_w^{0.2}\ A^{0.1}}$$

where, L = Flow length (m)
Sw = slope (%)

Parameter	Existing 101	Existing 102	Existing 103	Existing 104*	Proposed 201*	Proposed 202*	Proposed 203	Proposed 204*
C	0.29	0.25	0.35	0.69	0.59	0.53	0.35	0.72
L	335.2	188.9	206.5	159.3	233.5	194.0	206.5	159.3
A	3.529	0.518	1.438	0.269	2.343	1.705	1.438	0.269
S_w	2.61	2.26	2.0	5.9	0.81	2.74	2.04	5.92
Method	Airport	Airport	Airport	Bransby	Bransby	Bransby	Airport	Bransby
T =	35	29	28	10	10	10	28	10

**10 minute mininum time of concentration as per Town of Caledon Development Standards Manual 2019)*

Rational Method

$$Q = 2.778CIA$$

C = Runoff Coefficient
I = Intensity (mm/h)
A = Area (ha)

Existing Condition

Return Period	Existing 101		Existing 102		Existing 103		Existing 104		Total Runoff (L/s)
	Intensity (mm/hr)	Runoff (L/s)	Intensity (mm/hr)	Runoff (L/s)	Intensity (mm/hr)	Runoff (L/s)	Intensity (mm/hr)	Runoff (L/s)	
2	39.6	111.9	45.3	16.3	46.8	65.3	85.7	44.4	238.0
5	54.8	154.9	62.1	22.3	64.0	89.3	109.7	56.8	323.4
10	67.0	189.4	76.1	27.4	78.3	109.4	134.2	69.5	395.7
25*	81.5	253.6	92.1	36.4	94.8	145.5	156.5	89.2	524.7
50*	92.4	313.8	104.4	45.1	107.4	180.0	176.2	109.5	648.3
100*	104.0	367.9	117.4	52.8	120.8	210.8	196.5	127.3	758.7

Proposed Condition

Return Period	Proposed 201		Proposed 202		Proposed 203		Proposed 204		Total Runoff (L/s)
	Intensity (mm/hr)	Runoff (L/s)	Intensity (mm/hr)	Runoff (L/s)	Intensity (mm/hr)	Runoff (L/s)	Intensity (mm/hr)	Runoff (L/s)	
2	85.7	329.7	85.7	213.4	46.8	65.3	85.7	46.2	654.7
5	109.7	421.9	109.7	273.1	64.0	89.3	109.7	59.2	843.4
10	134.2	516.0	134.2	334.1	78.3	109.4	134.2	72.4	1031.8
25*	156.5	662.0	156.5	428.6	94.8	145.5	156.5	92.8	1329.0
50*	176.2	813.2	176.2	526.5	107.4	180.0	176.2	114.0	1633.7
100*	196.5	944.9	196.5	611.7	120.8	210.8	196.5	132.5	1899.9

*Incorporates Runoff coefficient adjustment factor of: 25 year = 1.1, 50 year = 1.2, 100 year = 1.25

Pre- and Post-Development Peak Flow Comparison

Return Period	Area 104 Runoff (L/s)	Area 204 Runoff (L/s)	Difference (L/s)	% Change
2	44.4	46.2	1.8	4.1%
5	56.8	59.2	2.3	4.1%
10	69.5	72.4	2.9	4.1%
25*	89.2	92.8	3.7	4.1%
50*	109.5	114.0	4.5	4.1%
100*	127.3	132.5	5.2	4.1%

GENERAL DESCRIPTION

Permeable pavements, an alternative to traditional impervious pavement, allow stormwater to drain through them and into a stone reservoir where it is infiltrated into the underlying native soil or temporarily detained. They can be used for low traffic roads, parking lots, driveways, pedestrian plazas and walkways. Permeable pavement is ideal for sites with limited space for other surface stormwater BMPs. Examples of permeable pavement types include:

- permeable interlocking concrete pavers (i.e., block pavers);
- plastic or concrete grid systems (i.e., grid pavers);
- pervious concrete; and
- porous asphalt.

Depending on the native soils and physical constraints, the system may be designed with no underdrain for full infiltration, with an underdrain for partial infiltration, or with an impermeable liner and underdrain for a no infiltration or detention and filtration only practice.

DESIGN GUIDANCE

GEOMETRY & SITE LAYOUT

Permeable pavement systems can be used for entire parking lot areas or driveways or can be designed to receive runoff from adjacent impervious pavement. For example, the parking spaces of a parking lot or road can be permeable pavers while the drive lanes are impervious asphalt. In general, the impervious area should not exceed 1.2 times the area of the permeable pavement which receives the runoff (GVRD, 2005).

PRE-TREATMENT

In most permeable pavement designs, the pavement bedding layer acts as pretreatment to the stone reservoir below. Periodic vacuum sweeping and preventative measures like not storing snow or other materials on the pavement are critical to prevent clogging. An optional pretreatment element can be a pea gravel choking layer above the coarse gravel storage reservoir.

CONVEYANCE AND OVERFLOW

All designs require an overflow outlet connected to a storm sewer with capacity to convey larger storms. One option is to set storm drain inlets slightly above the surface elevation of the pavement, which allows for temporary shallow ponding above the surface. Another design option is an overflow edge, which is a gravel trench along the downgradient edge of the pavement surface that drains to the stone reservoir below.

Pavements designed for full infiltration, where native soil infiltration rate is 15 mm/hr or greater, do not require incorporation of a perforated pipe underdrain. Pavements designed for partial infiltration, where native soil infiltration rate is less than 15 mm/hr, should incorporate a perforated pipe underdrain placed near the top of the granular stone reservoir. Partial infiltration designs can also include a flow restrictor assembly on the underdrain to optimize infiltration with desired drawdown time between storm events.

MONITORING WELLS

A capped vertical standpipe consisting of an anchored 100 to 150 mm diameter perforated pipe with a lockable cap installed to the bottom of the facility is recommended for monitoring the length of time required to fully drain the facility between storms.

STONE RESERVOIR

The stone reservoir must be designed to meet both runoff storage and structural support requirements. Clean washed stone is recommended as any fines in the aggregate material will migrate to the bottom and may prematurely clog the native soil. The bottom of the reservoir should be flat so that runoff will be able to infiltrate evenly through the entire surface. If the system is not designed for infiltration, the bottom should be sloped at 1 to 5% toward the underdrain.

GEOTEXTILE

A non-woven needle punched, or woven monofilament geotextile fabric should be installed between the stone reservoir and native soil to maintain separation.

EDGE RESTRAINTS

Pavers must abut tightly against the restraints to prevent rotation under load and any consequent spreading of joints. The restraints must be able to withstand the impact of temperature changes, vehicular traffic and snow removal equipment. Metal or plastic stripping is acceptable in some cases, but concrete edges are preferred. Concrete edge restraints should be supported on a minimum base of 150 mm of aggregate.

LANDSCAPING

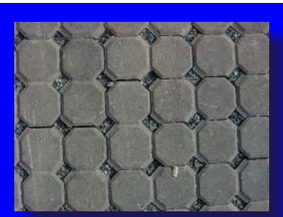
Adjacent landscaping areas should drain away from permeable pavement to prevent sediments from running onto the surface. Urban trees also benefit from being surrounded by permeable pavement rather than impervious cover, because their roots receive more air and water.

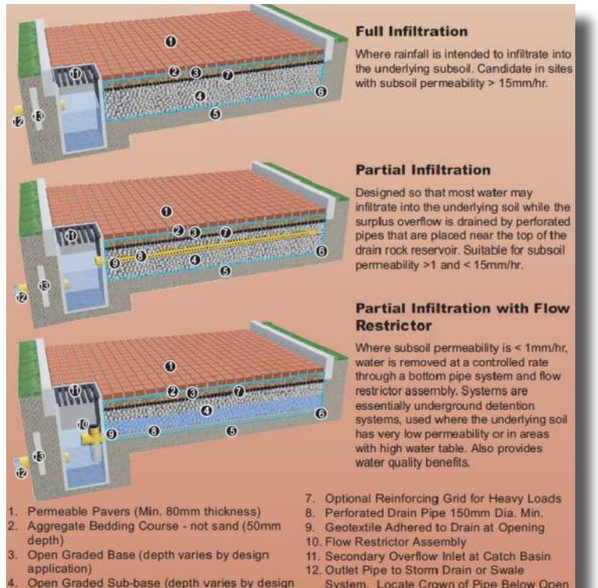
OPERATION AND MAINTENANCE

Annual inspections of permeable pavement should be conducted in the spring to ensure continued infiltration performance. Check for deterioration and whether water is draining between storms. The pavement reservoir should drain completely within 72 hours of the end of the storm event. The following maintenance procedures and preventative measures should be incorporated into a maintenance plan:

Surface Sweeping: Sweeping should occur once or twice a year with a commercial vacuum sweeping unit. Permeable pavement should not be washed with high pressure water systems or compressed air units.

Inlet Structures: Drainage pipes and structures within or draining to the subsurface bedding beneath permeable pavement should be cleaned out on regular intervals.





Full Infiltration

Where rainfall is intended to infiltrate into the underlying subsoil. Candidate in sites with subsoil permeability > 15mm/hr.

Partial Infiltration

Designed so that most water may infiltrate into the underlying soil while the surplus overflow is drained by perforated pipes that are placed near the top of the drain rock reservoir. Suitable for subsoil permeability >1 and < 15mm/hr.

Partial Infiltration with Flow Restrictor

Where subsoil permeability is < 1mm/hr, water is removed at a controlled rate through a bottom pipe system and flow restrictor assembly. Systems are essentially underground detention systems, used where the underlying soil has very low permeability or in areas with high water table. Also provides water quality benefits.

1. Permeable Pavers (Min. 80mm thickness)
2. Aggregate Bedding Course - not sand (50mm depth)
3. Open Graded Base (depth varies by design application)
4. Open Graded Sub-base (depth varies by design application)
5. Subsoil - flat and scarified in infiltration designs
6. Geotextile on All Sides of Reservoir
7. Optional Reinforcing Grid for Heavy Loads
8. Perforated Drain Pipe 150mm Dia. Min.
9. Geotextile Adhered to Drain at Opening
10. Flow Restrictor Assembly
11. Secondary Overflow Inlet at Catch Basin
12. Outlet Pipe to Storm Drain or Swale System. Locate Crown of Pipe Below Open Graded Base (no. 3) to Prevent Heaving During Freeze/Thaw Cycle
13. Trench Dams at All Utility Crossings

Source: GVRD

ABILTY TO MEET SWM OBJECTIVES

BMP	Water Balance Benefit	Water Quality Improvement	Stream Channel Erosion Control Benefit
Permeable pavement with no underdrain	Yes	Yes - size for water quality storage requirement	Partial - based on available storage volume and soil infiltration rate
Permeable pavement with underdrain	Moderate - based on native soil infiltration rates and storage beneath the underdrain	Yes - size for water quality storage requirement	Partial - based on available storage volume and soil infiltration rate
Permeable pavement with underdrain and liner	No - some volume reduction occurs through evapotranspiration	Moderate - limited filtering and settling of sediments	Partial - based on available storage volume and soil infiltration rate

Heavy Vehicles: Trucks and other heavy vehicles should be prevented from tracking or spilling dirt onto the permeable pavement.

Construction and Hazardous Materials: Due to the potential for groundwater contamination, all construction or hazardous material carriers should be prohibited from entering a permeable pavement site.

Drainage Areas: Impervious areas contributing to the permeable pavement should be regularly swept and kept clear of litter and debris. Flows from any landscaped areas should be diverted away from thepavement or be well stabilized with vegetation.

Grid Pavers: Grid paver systems that have been planted with grass should be mowed regularly with the clippings removed. Grassed grid pavers may require periodic watering and fertilization to establish and maintain healthy vegetation.

Winter Maintenance: Sand should not be spread on permeable pavement as it can quickly lead to clogging. Deicers should only be used in moderation and only when needed. Pilot studies have found that permeable pavement requires 75% less de-icing salt than conventional pavement over the course of a typical winter season. Permeable pavement is plowed for snow removal like any other pavement. Plowed snow piles should not be stored on permeable pavement systems.

GENERAL SPECIFICATIONS

Material	Specification	Quantity
Pervious Concrete	• NO4-RG-S7 mix with air entrainment proven to have the best freeze-thaw durability after 300 freeze-thaw cycles. • 28 day compressive strength = 5.5 to 20 MPa • Void ratio = 14% - 31% • Permeability = 900 to 21,500 mm/hr	Thickness will range from 100mm - 150 mm depending on the expected loads
Porous Asphalt	• Open-graded asphalt mix with a minimum of 16% air voids • Polymers can be added to provide additional strength for heavy loads • The University of New Hampshire Stormwater Center has detailed design specifications for porous asphalt on their webpage: http://www.unh.edu/erg/cstev/pubs_specs_info	Thickness will range from 50 mm to 100 mm depending on the expected loads.
Permeable Pavers	• Permeable pavers should conform to manufacturer specifications. • ASTM No. 8 (5 mm dia.) crushed aggregate is recommended for fill material in the paver openings. For narrow joints between interlocking shapes, a smaller sized aggregate may be used (Smith, 2006). • Pavers shall meet the minimum material and physical properties set forth in CAN 3-A231.2, Standard Specification for Precast Concrete Pavers. • Pigment in concrete pavers shall conform to ASTM C 979. • Maximum allowable breakage of product is 5%.	For vehicular applications, the minimum paver thickness is 80 mm and for pedestrian applications is 60 mm. Joint widths should be no greater than 15 mm for pedestrian applications.
Stone Reservoir	All aggregates should meet the following criteria: • Maximum wash loss of 0.5% • Minimum durability index of 35 • Maximum abrasion of 10% for 100 revolutions and maximum of 50% for 500 revolutions Granular Subbase The granular subbase material shall consist of granular material graded in accordance with ASTM D 2940. Material should be clear crushed 50 mm diameter stone with void space ratio of 0.4. Granular Base The granular base material shall be crushed stone conforming to ASTM C 33 No 57. Material should be clear crushed 20 mm diameter stone. Bedding The granular bedding material shall be graded in accordance with the requirements of ASTM C 33 No 8. The typical bedding thickness is between 40 mm and 75 mm. Material should be 5 mm diameter stone or as determined by the Design Engineer (Smith, 2006).	See BMP Sizing section for aggregate bed depth and multiply by application are to get total volume.
Geotextile	Material specifications should conform to Ontario Provincial Standard Specification (OPSS) 1860 for Class II geotextile fabrics. Should be woven monofilament or non-woven needle punched fabrics. Woven slit film and non-woven heat bonded fabrics should not be used as they are prone to clogging. Primary considerations are: • Suitable apparent opening size (AOS) for non-woven fabrics, or percent open area (POA) for woven fabrics, to maintain water flow even with sediment and microbial film build-up; • Maximum forces that will be exerted on the fabric (i.e., what tensile, tear and puncture strength ratings are required?); • Load bearing ratio of the underlying native soil (i.e., is geotextile needed to prevent downward migration of aggregate into the native soil?); • Texture (i.e., grain size distribution) of the overlying aggregate material; and • Permeability of the native soil. For further guidance see CVC/TRCA LID SWM Planning and Design Guide, Table 4.7.3.	Between stone reservoir and native soil.
Underdrain (optional)	• HDPE or equivalent material, continuously perforated with smooth interior and a minimum inside diameter of 100 mm. • Perforations in pipes should be 10 mm in diameter. • A standpipe from the underdrain to the pavement surface can be used for monitoring and maintenance of the underdrain. The top of the standpipe should be covered with a screw cap and a vandal-proof lock.	Pipes should terminate 0.3 m short from the sides of the base.

SITE CONSIDERATIONS

Wellhead Protection

Permeable pavement should not be used for road or parking surfaces within two (2) year time-of-travel wellhead protection areas.

Site Topography

Permeable pavement surface should be at least 1% and no greater than 5%.

Water Table

The base of permeable pavement stone reservoir should be at least one (1) metre above the seasonally high water table or top of bedrock elevation.

Soil

Systems located in native soils with an infiltration rate of less than 15 mm/hr (i.e., hydraulic conductivity of less than 1x10-6 cm/s) require a perforated pipe underdrain. Native soil infiltration rate at the proposed location and depth should be confirmed through measurement of hydraulic conductivity under field saturated conditions.

Drainage Area & Runoff Volume

In general, the impervious area treated should not exceed 1.2 times the area of permeable pavement which receives the runoff.

Setback from Buildings

Should be located downslope from building foundations. If the pavement does not receive runoff from other surfaces, no setback is required. If the pavement receives runoff from other surfaces a minimum setback of four (4) metres downgradient is recommended.

Pollution Hot Spot Runoff

To protect groundwater from possible contamination, runoff from pollution hot spots should not be treated by permeable pavement.

CONSTRUCTION CONSIDERATIONS

SEDIMENT CONTROL

The treatment area should be fully protected during construction so that no sediment reaches the permeable pavement system. Construction traffic should be blocked from the permeable pavement and its drainage areas once the pavement has been installed.

BASE CONSTRUCTION

In parking lots, the stone aggregate should be placed in 100 mm to 150 mm lifts and compacted with a minimum 9,070 kg (10 ton) steel drum roller.

WEATHER

Porous asphalt and pervious concrete will not properly pour and set in extremely high and low temperatures.

PAVEMENT PLACEMENT

Properly installed permeable pavement requires trained and experienced producers and construction contractors.

CVC/TRCA LOW IMPACT DEVELOPMENT
PLANNING AND DESIGN GUIDE - FACT SHEET

PERMEABLE PAVEMENT

TORONTO AND REGION Conservation for The Living City

CVC CREDIT VALLEY CONSERVATION

FOR FURTHER DETAILS SEE SECTION 4.7 OF THE CVC/TRCA LID SWM GUIDE