

**Chimney Hill Way and
15762 Old Simcoe Road
Township of Scugog**

Stormwater Management Report
268499 Ontario Limited

Project #E21027

February 2023, October 2023

Table of Contents

	Page
1.0 Introduction and Background	1
2.0 Existing Storm Drainage System	3
2.1 Existing Conditions	3
2.2 Design Criteria	3
3.0 Proposed Conditions	4
3.1 Minor System	4
3.1.1 Hydraulic Grade Line	4
3.2 Major System	5
4.0 Stormwater Management	8
4.1 Existing Conditions	8
4.2 Design Criteria	8
4.3 Proposed Conditions	8
4.3.1 Quantity Control	8
4.3.2 Quality Control	10
4.3.3 Erosion Control	11
4.3.4 Phosphorous Removal	12
5.0 Erosion Control During Construction	14
6.0 Conclusions	15

Figures

Figure 1	Key Plan	2
Figure 2	Existing Conditions Drainage Scheme	6
Figure 3	Proposed Drainage Scheme	7
Figure 4	Proposed LID Schematic Trench Details	13

Table of Contents – Continued

Page

Drawings (Rear Pocket)

Drawing SS1.1	_____	Site Servicing Plan
Drawing SG1.1	_____	Site Grading Plan
Drawing CMERS1.1	_____	Construction Management & Temp. ERS Control Plan
Drawing CMERS1.2	_____	Construction Management & Temp. ERS Control Plan

Appendices

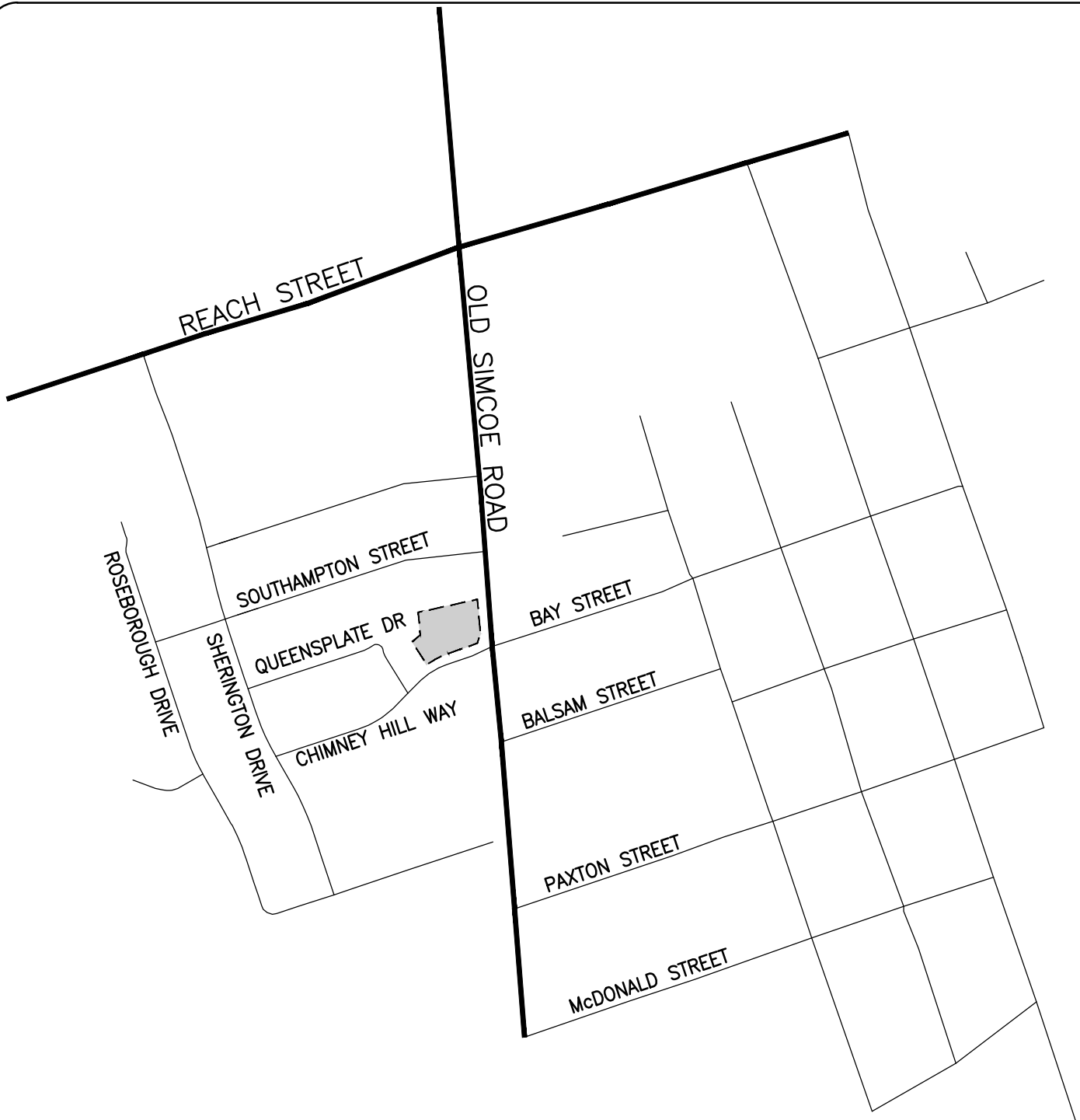
Appendix A	Storm Drainage Area Plan
Appendix B	Minor & Major Flow Calculations
Appendix C	Allowable Release Rates
Appendix D	Stormwater Management Calculations
Appendix E	Quality and Extended Detention Calculations
Appendix F	Phosphorous Removal

1.0 Introduction and Background

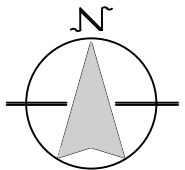
Candevcon East Limited was retained by the Brand Group to provide engineering services for the proposed Chimney Hill Way residential development in the Township of Scugog. The site is located in the north-west corner of Old Simcoe Road and Chimney Hill Way. The location of the site, which has a total area of 0.42 hectares (ha), is shown on **Figure 1**. The proposed development is to consist of two (2) townhouse blocks and one (1) single family residential unit. The current Site Plan Application covers the townhouse blocks but not the single family residential unit; however, this report addresses the drainage and stormwater management for both.

The following documents were reviewed in preparation of this FSSR:

- Chimney Hill Way / 15762 Old Simcoe Road, Township of Scugog, Functional Servicing and Stormwater Management Report, Candevcon East Limited (November 2021)
- Stormwater Management Design Brief for Cawkers Creek Subdivision – Phase 3, Candevcon Limited (April 2017)
- Stormwater Management Report, Cawkers Creek Subdivision, prepared by Valdor Engineering Inc. dated May 2000
- Engineering Design Criteria, Township of Scugog
- Stormwater Management Planning and Design Manual (SWMP Manual) prepared by the Ministry of Environment, March 2003
- MOE's Lake Simcoe Phosphorous Loading Development Tool, 2012
- Managing New Urban Development in Phosphorous Sensitive Watersheds, prepared by Hutchison Environmental Services Ltd., October 2014



SUBJECT LANDS



15762 OLD SIMCOE ROAD
TOWNSHIP OF SCUGOG



CANDEVCON EAST LIMITED
 CONSULTING ENGINEERS & PLANNERS

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Drawn By:	R.B.	Checked By:	A.K.	Proj. No.
				E21027
Designed By:	R.B.	Checked By:	A.K.	DWG. No.
				FIG.1
Scale:	N.T.S.	Date:	OCTOBER 2023	

KEY PLAN

2.0 Existing Storm Drainage System

2.1 Existing Conditions

Under existing conditions, the site generally slopes in an east to west direction towards the Cawkers Creek Phase II development, with a portion of the northeast corner draining towards Old Simcoe Road. The existing topographic conditions and drainage areas are illustrated on **Figure 2**.

There is an existing 375mm storm sewer located adjacent to the subject site within Chimney Hill Way as part of the Cawkers Creek Phase II subdivision which is illustrated on **Drawing SS1.1**. This sewer was designed to accommodate the flows generated by the subject lands with a runoff coefficient of 0.45, during the 5-year storm event. Refer to **Appendix A** for a copy of the Storm Sewer Drainage Scheme (Drawing D1B) and Storm Sewer Design Sheet prepared by Candevcon East Limited showing the drainage area and runoff coefficient. Flows are conveyed west along Chimney Hill Way and then north along Roseborough Court towards the existing Stormwater Management (SWM) facility located at the south-west corner of Reach Street and Sherrington Drive.

2.2 Design Criteria

The storm sewer system will be designed to comply with the Township of Scugog standards which is described as follows:

- The storm drainage system shall be designed with the minor, or storm sewer system sized to convey the 1:5 year storm; and,
- Major overland flow system is to be designed to convey the 100 year less the 5 year storm flows.

3.0 Proposed Conditions

3.1 Minor System

The minor system for the proposed development will be designed to comply with the Township of Scugog design criteria to convey the 1:5 year storm event as outlined above in Section 2.2. Refer to **Appendix B** for the storm sewer design sheet. The storm sewers are proposed to outlet to the existing SWM facility located within the Cawkers Creek development, and will be oversized to provide onsite quantity controls as outlined further below in Section 4.3.1.

After reviewing the existing storm sewer design sheet and Storm Drainage Area Plan included in **Appendix A**, it was established that the site was intended to enter the storm sewer system at Ex MH34. The minor system from the majority of the site, Area 201 on **Figure 3**, will discharge instead into the storm sewer upstream of Ex MH33 (refer to **Figure 3**).

Area 202 on **Figure 3** will drain overland to Old Simcoe Street and enter the storm sewer system at Ex MH34 as intended. Similarly, Area 203 will drain to Old Simcoe Road; however, this portion of the site will drain northerly to Southampton Street (refer to **Figure 1**), resulting in an additional 0.001m³/s being directed to MH106 (refer to Drawing D1B in **Appendix A** for maintenance hole location). Refer to **Appendix B** for supporting flow calculations. After reviewing the storm sewer design sheet, included in **Appendix A**, the existing Southampton Street storm sewer system has adequate capacity to convey these additional flows.

Area 204 on **Figure 3** is the single family dwelling, that although not part of the Site Plan Application has been considered as part of the overall storm drainage and SWM analysis. This lot will drain southerly towards Chimney Hill Way, being captured and conveyed to the existing SWM facility between Ex. MH33 and Ex. MH32 (refer to **Figure 3**).

The routing and sizing of the storm sewer to service the development is shown on the Site Servicing Plan (**Drawing SS1.1**) in the rear pocket with the proposed drainage areas shown on **Figure 3**. Please refer to **Appendix B** for the proposed storm sewer design sheets.

3.1.1 Hydraulic Grade Line

A review of the relationship between the Hydraulic Grade Line (HGL) and basement floor elevations has been undertaken. A maximum water surface elevation of 269.34m is required within the storm sewer system to provide the onsite quantity controls for the development, as discussed in Section 4.3.1. This HGL elevation is higher than the basement elevations of Units 8, 9, 10 and 11 in Block 2. It is therefore proposed to connect the foundation drains for these units to the existing service connection on

Chimney Hill Way as opposed to the proposed storm sewer. Since the service connection ties into the existing storm sewer downstream of the orifice control, there is no backwater causing elevated HGL elevations. This will ensure adequate separation from the basement floor to the HGL elevation is provided. Refer to **Drawing SS1.1** for the proposed service connection locations.

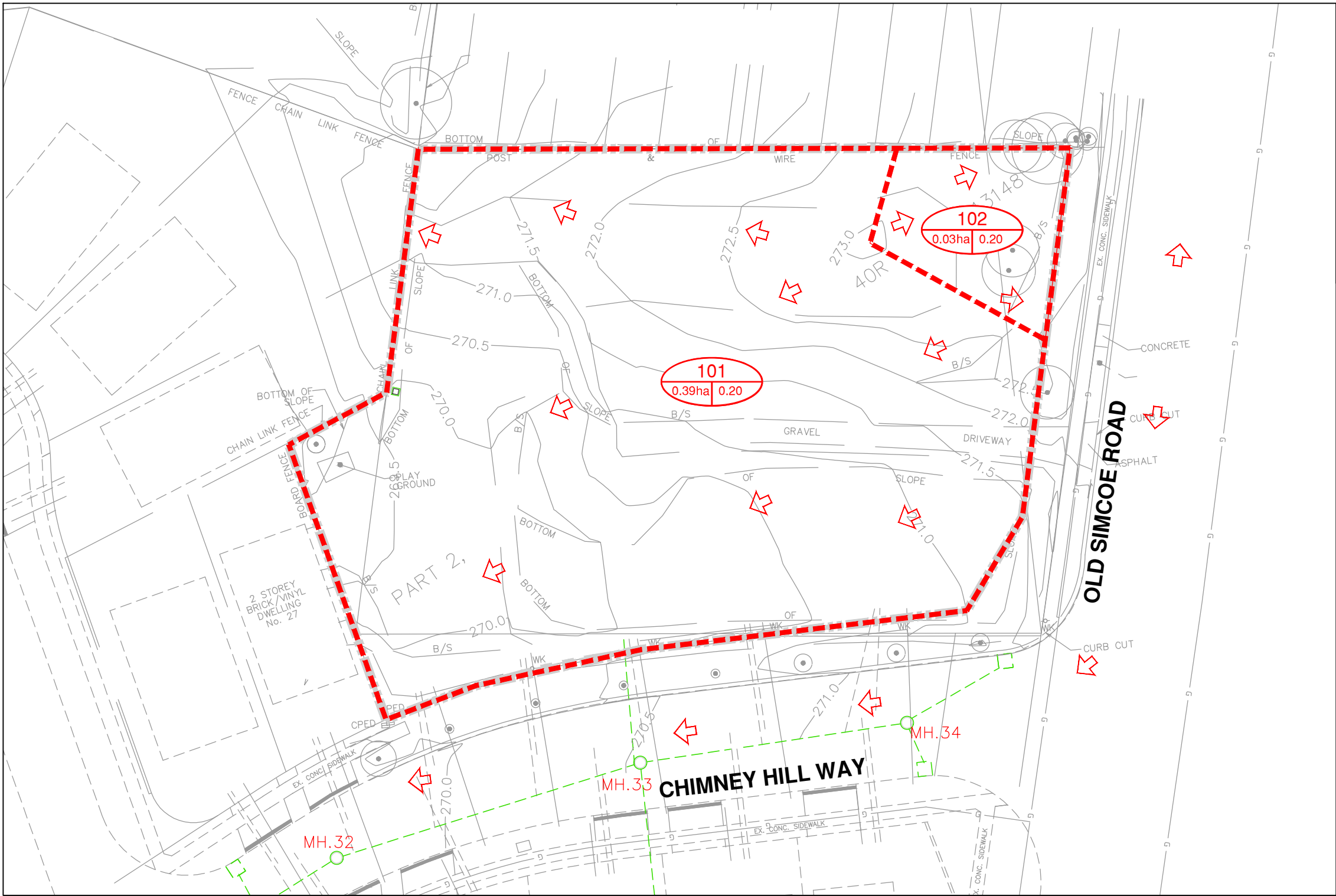
3.2 Major System

The major system flows from Area 201 on **Figure 3** will be directed to catch basins placed along the western property line to capture rear yard drainage, along with catch basins within the laneway. The major flows from these areas will be captured and detained underground and released into the existing storm sewer system at the allowable release rate (refer to Section 4.2.1 below). Areas 202 and 203 will drain overland easterly towards Old Simcoe Road. Area 202 will drain to Old Simcoe Road and flow southerly to Chimney Hill Way, with Area 203 draining northerly to Southhampton Street, ultimately following the existing right of way to the downstream SWM Facility (refer to **Figure 1**).

The proposed grades and overland flow routes are shown on the Site Grading Plan (**Drawing SG1.1**) in the rear pocket. Since the 100 year storm flows will be captured for the majority of the site, the overland flow routes would only be activated should the storm sewer be blocked and/or a storm event greater than the 100 year storm event occurs.

It should be noted that if the rear yard catch basins along the western property line become 100% blocked, flows may drain to private property in an “emergency spill” scenario. However, an overall reduction in flow is expected from the rear yard area (Area 201b on **Figure OLF** included in **Appendix B**) and Area 202 (refer to **Figure 3**). Areas 201b and 202 will contribute 0.09ha and 0.04ha respectively, with corresponding coefficients of 0.53 and 0.45. The total AR value of these areas draining to private property in an emergency spill scenario is 0.066. Area 101 on **Figure 2**, illustrates 0.39ha of drainage, with a runoff coefficient of 0.20, draining towards the private property, resulting in an existing AR value of 0.078. As noted above, should an emergency spill scenario occur, there will still be an overall reduction in flow to private lands. Furthermore, as it is rear yard drainage contributing to these catchbasins, it is unlikely that a significant blockage causing a 100% blockage will occur. Through the regular rear yard maintenance (i.e. lawn mowing, leaf removal) will remove the expected debris that may accumulate.

Refer to **Drawing SG1.1** for catchbasin capture points, and **Appendix B** for supporting capture calculations.



LEGEND

- EXISTING CONTOUR
- SITE BOUNDARY
- EXISTING DRAINAGE BOUNDARY
- EXISTING STORM SEWER
- FLOW DIRECTION

101
0.85ha | 0.45

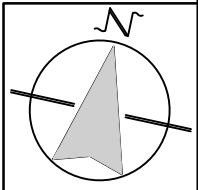
DRAINAGE AREA
IN HECTARES

101
0.03ha | 0.20

AREA ID

0.45

RUNOFF COEFFICIENT



15762 OLD SIMCOE ROAD
TOWNSHIP OF SCUGOG

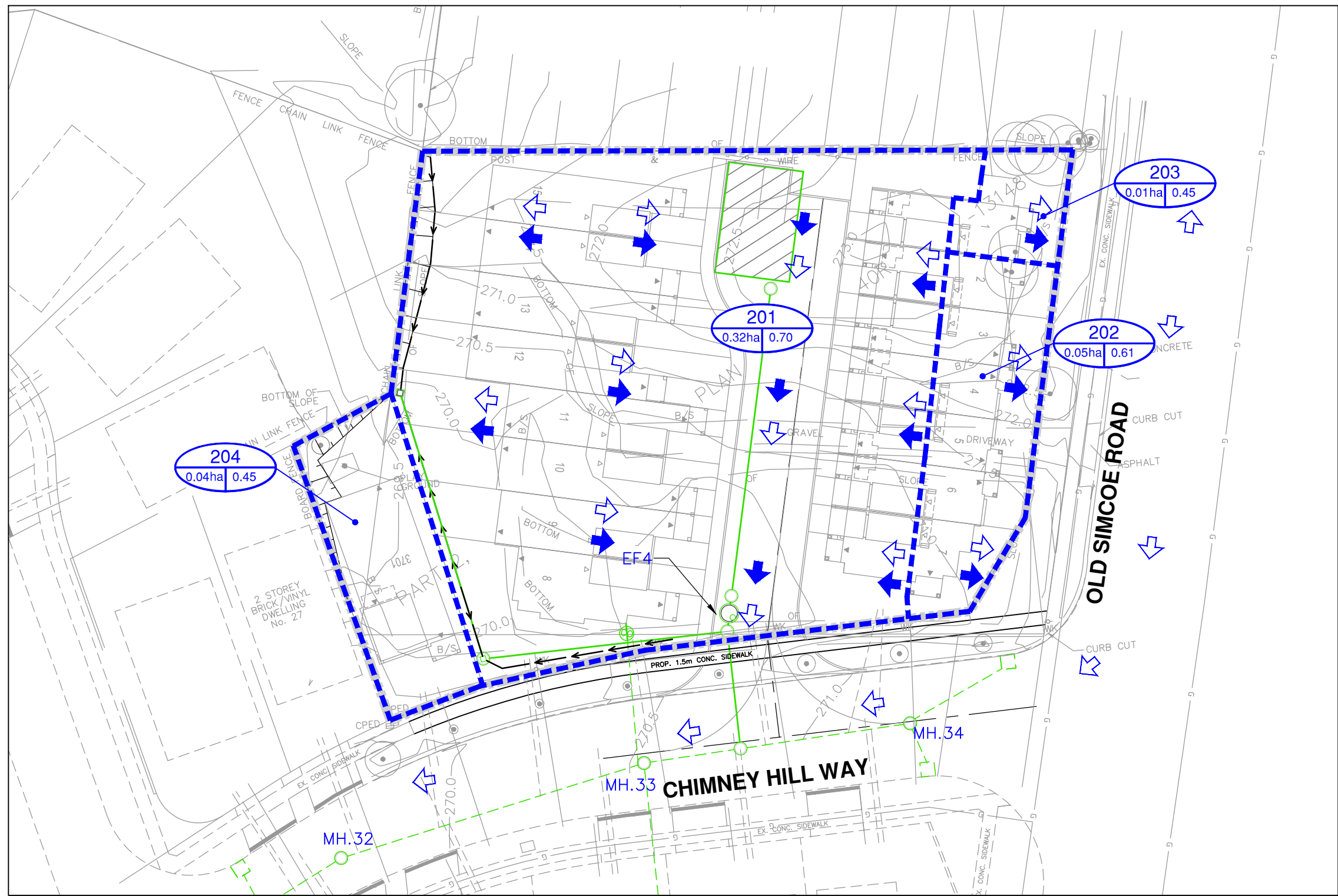
EXISTING DRAINAGE SCHEME

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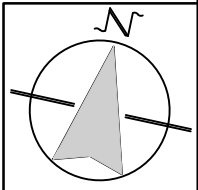
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				E21027
Designed By:	R.B.	Checked By:	A.K.	DWG. No.
				FIG.2
Scale:	1:500	Date:	OCTOBER 2023	



LEGEND

- EXISTING CONTOUR
- SITE BOUNDARY
- PROPOSED DRAINAGE BOUNDARY
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- MAJOR SYSTEM FLOW DIRECTION
- MINOR SYSTEM FLOW DIRECTION
- AREA ID
- DRAINAGE AREA IN HECTARES
- RUNOFF COEFFICIENT



15762 OLD SIMCOE ROAD
TOWNSHIP OF SCUGOG

PROPOSED DRAINAGE SCHEME

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				E21027
Designed By:	R.B.	Checked By:	A.K.	DWG. No.
				FIG.3
Scale:	1:500	Date:	OCTOBER 2023	

4.0 Stormwater Management

4.1 Existing Conditions

As mentioned in Section 3.1, there is an existing end-of-pipe SWM facility located at the south-west corner of Reach Street and Sherrington Drive. As discussed in the Stormwater Management Design Brief, Cawkers Creek Subdivision, prepared by Valdor Engineering Inc. dated May 2000 the facility was sized to provide quantity, quality and erosion control for an upstream drainage area of 37.0 ha, which includes the subject site (refer to **Appendix A**). The facility discharges to Cawkers Creek west of the SWM facility (refer to Figure 1).

4.2 Design Criteria

The criteria for SWM for the subject site are as follows:

- | | |
|---------------------|---|
| Quantity Control | - Control post-development peak flow levels to pre-development peak flow levels for all storms up to and including the 100 year return period event |
| | - Design flows for storm sewer system must not be exceeded |
| Quality Control | - Provide an “Enhanced” level of protection as per Ministry of Environment Conservation and Parks guidelines (minimum 80% total suspended solids removal) |
| Erosion Control | - Extended detention of 25mm rainfall event for 48 hours |
| Phosphorous Removal | - Provide removal of Total Phosphorous through the use of Low Impact Development (LID) measures |

4.3 Proposed Conditions

4.3.1 Quantity Control

The Storm Drainage Area Plan prepared by Candevcon East Limited for the existing subdivision and attached herein as **Appendix A** was reviewed to ensure that drainage from the subject site and external areas were accounted for in the design of the receiving sewer and SWM facility. Based on this review, it has been established that the as-built storm sewer and SWM facility design accounts for the drainage from the subject site at a runoff coefficient of 0.45 (refer to **Appendix A**). Based on the proposed Site Plan, the proposed runoff coefficient is 0.70 (refer to **Appendix C**), and as such SWM controls are required to control 100 year post development flows to the available sewer capacity.

Based on the proposed servicing and grading, the 100 year post-development drainage from 0.32 ha of the development (Area 201 on **Figure 3**) will be captured and controlled to the 5 year design capacity through the use of an orifice plate located in MH4 (refer to **Drawing SS1.1**). Area 202 will drain uncontrolled to Old Simcoe Road with over-control provided in Area 201.

Area 203 will drain to Old Simcoe Road where it will be captured and conveyed by the existing storm sewer on Southampton Street to the SWM facility (refer to **Figure 3** and Drawing D1B in **Appendix A**). As outlined in Section 3.1, it has been shown that the existing sewer has capacity and as such, no further SWM controls are required. Additionally, since the runoff coefficient remains at 0.45, the SWM facility has already been designed to provide the required post to pre controls.

Area 204, the single family residential lot, will drain uncontrolled towards the existing storm sewer system on Chimney Hill Way but will remain consistent with the initial design of the storm sewer system and SWM facility with a runoff coefficient of 0.45, as illustrated on **Figure 3**. Stormwater management controls are therefore not required for this area.

For Areas 201 and 202, SWM controls are required to control 100 year post development flows to the 5 year available capacity in the existing storm sewer. The 5 year target flow for the site area of 0.42 ha based on the design capacity of the receiving sewer was calculated by using the Rational Method and the Township of Scugog rainfall intensities along with a Time of Concentration value of 10 minutes as per the original storm sewer design (**Appendix A**). The target release rate for the site, excluding Area 204, was determined to be $0.051\text{m}^3/\text{s}$. Refer to **Appendix C** for calculations.

Based on the proposed Site Plan for the site area, the runoff coefficient was determined based on the measured impervious surfaces (refer to **Appendix C**). The post-development uncontrolled runoff rates were then calculated for the 2 through 100 year rainfall events. Utilizing the Rational Method along with the Township of Scugog rainfall intensities and a 10 minute starting time of concentration, the post-development flows from the site were determined. Refer to **Appendix D** for the calculations and **Figure 3** for the drainage areas.

The post-development uncontrolled peak flows exceed the allowable design flow rate, and as such on-site controls are required. The 100 year post-development peak flows from Area 201 ($0.156\text{m}^3/\text{s}$) will be captured and controlled on-site to the target flow rate ($0.051\text{m}^3/\text{s}$) less the 5 year uncontrolled flows from Areas 202 ($0.009\text{m}^3/\text{s}$) for a maximum allowable controlled rate of $0.042\text{m}^3/\text{s}$. A 130mm orifice plate is proposed in the south invert of MH4, controlling flows to a flow rate of $0.042\text{m}^3/\text{s}$, at a maximum ponding elevation of 269.37m. Refer to **Appendix D** for orifice sizing calculations.

Utilizing the Modified Rational Method it was determined that a maximum of 73m³ of storage is required to provide control of 100 year post-development flows to the target flow. The required storage will be provided through an over-sized storm sewers, manholes and underground storage chambers. A total of 35 – SC740 chambers (or approved equivalent) are proposed, providing 64m³ of storage at a ponding elevation of 269.37m, along with an additional 13m³ within the storm sewer and manholes, for a total available storage volume of approximately 78m³. Detailed Shop Drawings will be obtained for the storage chambers where there will be the opportunity to reduce the number of chambers so that the available volume is equal to the volume required. Refer to **Appendix D** for supporting calculations, and **Drawings SS1.1** and **SG1.1** for the proposed servicing and grading.

4.3.2 Quality Control

As noted in the Design Criteria Section 4.2 of this report, an “Enhanced” level of protection as presented in Table 3.2 of the MOE Stormwater Management Planning and Design Manual (SWMP Manual, March 2003) is required for the proposed development.

As per the Stormwater Management Design Brief prepared by Candevcon Limited dated April 2017, the actual drainage area directed to the existing pond is 24.98 ha, with an imperviousness of 43%, which includes the subject property. In order to provide “Enhanced” level treatment for this area, a permanent pool volume of 2,998m³ is required, with approximately 3,000m³ of permanent pool volume being available.

As noted above, the subject property is included in the design drainage area of the existing SWM Facility. Based on the proposed Site Plan, the proposed imperviousness exceeds the design imperviousness of the existing SWM facility; therefore, further on-site quality control is required.

Quality treatment will therefore be provided through a treatment train approach including the existing SWM facility with an oil/grit separator (OGS) unit providing pre-treatment for Area 201 on **Figure 3** prior to flows discharging into the existing storm sewer. Based on a drainage area of 0.32 ha with a runoff coefficient of 0.70, a Stormceptor EF4 (or approved equivalent) will provide pre-treatment prior to discharging into the existing storm sewer system on Chimney Hill Way. Refer to **Appendix E** for the sizing summary.

The removal rate of the proposed OGS unit and existing SWM Facility in series was analyzed, see **Appendix E** for supporting calculations. For the purpose of this analysis, a conservative assumption was made, that the SWM Facility TSS removal rate is reduced to 75% due to the increased imperviousness of the site. Understanding the KRCA credits standard OGS Units with 50% TSS Removal, the OGS Unit and existing SWM Facility in series will therefore provide a total removal rate of 88%.

There are portions of the site, Area 202, 203 and 204 on **Figure 3**, which will enter the storm sewer system without being treated via the OGS, as illustrated on **Drawing SS1.1**. These areas consist of rear yards and rooftop drainage which is considered clean water. These areas are also directed to infiltration trenches under the rear yard swale and rain gardens as outlined further below, prior to being collected by the storm sewer; therefore, further pre-treatment is not required.

4.3.3 Erosion Control

The total storage volume allocated in the SWM facility for the subject development as per the original design criteria is 13.02mm of runoff from the 25mm storm event, as determined in the original SWM Facility design outlined in the Stormwater Management Report, prepared by Valdor Engineering Inc. dated May 2000. This results in an available volume of 55m³ for the site. The required erosion control volume for the entire drainage area is 4,817m³, while the current design provides 5,000m³ of erosion control volume.

Due to the increase in imperviousness, the runoff generated by the subject property during the 25mm storm event was approximated to be 83m³, resulting in an additional 28m³ of required erosion control volume within the facility. As noted above, the current design provides an additional 183m³ of storage within the facility and therefore no additional erosion control measures are required for the subject development. Refer to **Appendix E** for the supporting calculations.

4.3.4 Phosphorous Removal

The phosphorous loading in pre- and post-development conditions was determined for the development based on the “Managing New Urban Development in Phosphorous-Sensitive Watersheds” prepared by Hutchison Environmental Services Ltd., dated October 2014. Under pre-development conditions, a Hay/Pasture land use was selected, resulting in an annual Total Phosphorous loading of 0.03 kg/yr. Under post-development conditions, without the implementation of LID measures, the Total Phosphorous load for the 0.42 ha (Areas 201, 202, 203 and 204 on **Figure 3**) residential development will be 0.76 kg P/yr, requiring a Phosphorous removal rate of 0.73 kg P/yr.

It is proposed to install LIDs including rear roof leaders directed to an infiltration trench below the swale in the rear yards and permeable pavers within the parking area as illustrated on **Figure 4**. These proposed LID measures along with the existing SWM Facility, will remove a total of 0.54kg/yr of Total Phosphorous, or approximately 73% of removal target. The resulting post-development Total Phosphorous loading rate will be 0.23 kg/yr.

Through the detailed design of the site, it was determined that there are no further opportunities to provide effective phosphorous removal, and therefore the design represents a best-efforts approach, consistent with what was proposed in the previously approved FSSR. Infiltration trench, phosphorous loading and removal calculations have been attached in **Appendix F**.

5.0 Erosion Control During Construction

Sediment and erosion control practices during construction will include, but not be limited to, standard devices such as silt fences, mud mats and catchbasin buffers. Refer to **Drawings CMERS1.1 & CMPERS1.2**, attached in the rear pocket of this report.

6.0 Conclusions

The servicing and stormwater management for the Chimney Hill residential development can be accomplished by the following:

- The existing storm sewer on Chimney Hill Way and the existing SWM facility were designed to accommodate the site based on a runoff coefficient of 0.45.
- The post-development runoff coefficient will increase based on the proposed Site Plan and as such flows from the site exceed the 5 year design capacity for the existing storm sewer system.
- The storm sewer system will be designed to capture the 100 year post-development flows from the site, and SWM quantity controls provided to control flows to the 5 year design capacity;
- A total of 78m³ of storage is provided onsite within the storm sewer system and 35 SC740 storage chambers;
- Quality control will be provided through a Stormceptor EF4 Unit providing pre-treatment prior to discharging into the existing storm sewer system, where quality control will be provided within the existing stormwater management facility;
- LID measures include disconnected roof leaders, infiltration trench, permeable pavers and rain gardens throughout the site, in a best efforts approach to provide phosphorous removal; and,
- Sediment and Erosion Control practices will be implemented during construction;

Report prepared by:

CANDEVCON EAST LIMITED



Ryan Brockie, P.Eng.
Water Resources Engineer

A handwritten signature in black ink, appearing to read "Mirko Favit".

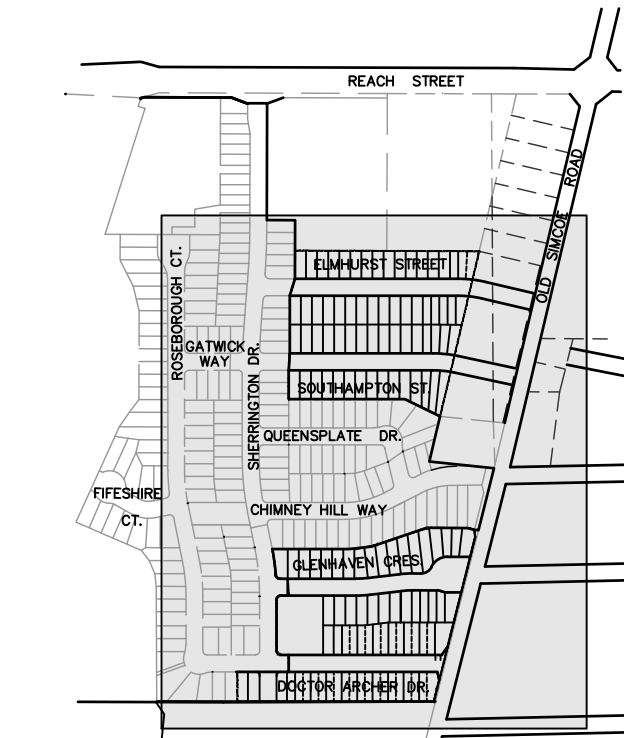
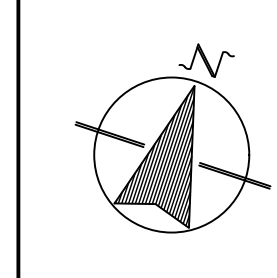
Mirko Favit, P.Eng.
Sr. Project Manager

RB/br

cc: 268499 Ontario Limited, Attn: Mr. David Brand

Appendix A

Existing Storm Drainage Area Plan



KEY PLAN
N.T.S.

NOTES:
1) FOR GENERAL NOTES, LEGEND & BENCHMARK SEE DWG. N1.
2) MEASUREMENTS IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.

LEGEND

MH19	○	STORM MANHOLE
	□	SINGLE CATCHBASIN
	□	DOUBLE CATCHBASIN
	—	PROPOSED SINGLE STORM SERVICE CONNECTION
	—	PROPOSED DOUBLE STORM SERVICE CONNECTION
	---	DRAINAGE AREA BOUNDARY
	→	OVERLAND FLOW ROUTE
1	○	DENOTES AREA NUMBER
0.88ha	○	DENOTES AREA IN HECTARES
C=0.45	○	DENOTES RUN-OFF COEFFICIENT

APPROVED
Approval of the Township of Scugog for the purposes described in the applicable Subdivision or Servicing Agreement. The Township is relying on the technical skill and ability of the P. Eng sealing and signing this drawing.
By: "L. FOX"
Date: "AUG 29 2017"

REVISIONS

No.	BY	DATE	DESCRIPTION	APPROVED
1	D.B.	09.18.17	REVISED LOT AND BLOCK NUMBERS	
2	D.B.	11.21.17	REVISED RLCB4 AND RLCB5 LEADS	

CORPORATION OF THE TOWNSHIP OF SCUGOG
CAWKERS CREEK PHASE III
S-S-2014-01

STORM DRAINAGE AREA PLAN

CANDEVCON LIMITED
CONSULTING ENGINEERS AND PLANNERS
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TEL. (289) 315-3680 FAX (905) 794-0611

	SCALE : 1:1000	PROJECT No. E16004
	DRAWN BY : L.W.	DRAWING No. D1B
	DESIGNED BY : D.B.	
	CHECKED BY :	
	REVISION DATE: Oct. 16, 2017	





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WHITBY, ONTARIO L1N 9B2
PHONE: (289) 315-3680

COMPUTED BY : DB
CHECKED BY : MF
DATE: APR 10, 2017
STATUS: 3rd Submission

TOWNSHIP OF SCUGOG

STORM SEWER DESIGN SHEET

PROJECT NAME: CAWKERS CREEK PHASE 3
S-S-2014-01
(PRE-DEVELOPMENT CONDITION)

TOWNSHIP OF SCUGOG DESIGN CRITERIA:

Q = 2.778 AIR
Q=5 YEAR RETURN STORM
A= AREA IN HECTARES(ha)
R=RUNOFF COEFFICIENT
I=RAINFALL INTENSITY (mm/hr)
Coefficient of Friction in pipe, n =0.013
Time of Concentration (Tc) min = 10
5 Year Intensity = 904 / (T + 5)^{0.788}
25 Year Intensity = 1065 / (T + 5)^{0.788}

PROJECT No. : E16004
5 YEAR DESIGN STORM

LOCATION				FLOWS							SEWER DESIGN							REMARKS
STREET	AREA ID	MANHOLE NO.		"A" AREA (ha)	"R" RUNOFF COEFF.	AR	ACCUM. AR	TIME OF CONC. (min)	RAINFALL INTENSITY (mm/hr)	PEAK FLOW (L/s)	LENGTH (m)	PIPE DIA. (mm)	SLOPE (%)	PIPE CAPACITY (L/s)	FULL VELOCITY (m/s)	TIME IN SECTION (min)	TOTAL TIME (min)	PEAK FLOW / PIPE CAP. (%)
		U/S	D/S															
SHERRINGTON DRIVE		8	MH.9	0.16	0.45	0.072	0.072	10.00	107.0	21	47.5	300	0.84	89	1.26	0.63	10.63	24.1
GLENHAVEN COURT	-	EX.PLUG1	MH.9	1.27	0.67	0.851	0.851	11.52	99.2	234	28.1	525	0.69	358	1.65	0.28	11.80	65.6
SHERRINGTON DRIVE		MH.9	MH.10	0.31	0.45	0.140	1.062	12.33	95.5	282	91.3	600	0.49	430	1.52	1.00	13.33	65.5
DR. ARCHER STREET	7	EX.MH1A	MH.10	2.25	0.68	1.530	1.530	11.51	99.2	422	28.7	600	0.78	543	1.92	0.25	11.76	77.7
ROSEBOROUGH DRIVE		MH.10	11	0.60	0.45	0.270	2.862	13.31	91.5	727	77.5	900	0.23	869	1.37	0.95	14.25	83.7
ROSEBOROUGH DRIVE		11	12	0.07	0.45	0.032	2.894	14.13	88.3	710	15.1	900	0.17	747	1.17	0.21	14.35	95.1
ROSEBOROUGH DRIVE		12	13	0.62	0.45	0.279	3.173	14.28	87.8	774	92.1	900	0.36	1087	1.71	0.90	15.18	71.2
ROSEBOROUGH DRIVE		13	44	0.68	0.45	0.306	3.479	15.27	84.4	816	89.0	975	0.28	1186	1.59	0.93	16.20	68.8
FIFESHIRE COURT		49	45	0.36	0.45	0.162	0.162	10.00	107.0	48	58.7	300	1.13	103	1.46	0.67	10.67	46.8
FIFESHIRE COURT		45	44	0.24	0.45	0.108	0.270	10.69	103.3	77	42.0	375	2.39	271	2.46	0.28	10.98	28.5
ROSEBOROUGH DRIVE		44	15	0.24	0.45	0.108	3.857	16.20	81.5	873	50.9	975	0.26	1143	1.53	0.55	16.75	76.4
ROSEBOROUGH DRIVE		15	16	0.50	0.45	0.225	4.082	16.74	79.9	906	61.2	975	0.34	1307	1.75	0.58	17.32	69.3
ROSEBOROUGH DRIVE		16	17	0.49	0.45	0.221	4.302	16.74	79.9	955	59.3	975	0.32	1268	1.70	0.58	17.32	75.3
GATWICK WAY		46	17	0.47	0.45	0.212	0.212	10.00	107.0	63	46.6	300	1.75	128	1.81	0.43	10.43	49.1
ROSEBOROUGH DRIVE		17	18	0.68	0.45	0.306	4.820	17.32	78.2	1048	104.6	975	0.30	1228	1.65	1.06	18.38	85.3
ROSEBOROUGH DRIVE		18	19	0.46	0.45	0.207	5.027	18.36	75.5	1054	43.8	975	0.27	1165	1.56	0.47	18.83	90.5
ROSEBOROUGH DRIVE		19	HW2	0.00	0.45		5.027	18.79	74.4	1039	37.9	975	0.40	1418	1.90	0.33	19.12	73.3
PEAK FLOW FOR THE CAWKERS CREEK PHASE 1 & 2 DEVELOPMENT = 1039 L/s																		



1600 CHAMPLAIN AVE, SUITE 402
WHITBY, ONTARIO L1N 9B2
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CHECKED BY : MF
DATE: APR 10, 2017
STATUS: 3rd Submission

TOWNSHIP OF SCUGOG

STORM SEWER DESIGN SHEET

PROJECT NAME: CAWKERS CREEK PHASE 3
S-S-2014-01
(PRE-DEVELOPMENT CONDITION)

TOWNSHIP OF SCUGOG DESIGN CRITERIA:

Q = 2.778 AIR
Q=5 YEAR RETURN STORM
A= AREA IN HECTARES(ha)
R=RUNOFF COEFFICIENT
I=RAINFALL INTENSITY (mm/hr)
Coefficient of Friction in pipe, n =0.013
Time of Concentration (Tc) min = 10
5 Year Intensity = 904 / (T + 5)^{0.788}
25 Year Intensity = 1065 / (T + 5)^{0.788}

PROJECT No. : E16004
5 YEAR DESIGN STORM

LOCATION				FLOWS							SEWER DESIGN							REMARKS
STREET	AREA ID	MANHOLE NO.		"A" AREA (ha)	"R" RUNOFF COEFF.	AR	ACCUM. AR	TIME OF CONC. (min)	RAINFALL INTENSITY (mm/hr)	PEAK FLOW (L/s)	LENGTH (m)	PIPE DIA. (mm)	SLOPE (%)	PIPE CAPACITY (L/s)	FULL VELOCITY (m/s)	TIME IN SECTION (min)	TOTAL TIME (min)	PEAK FLOW / PIPE CAP. (%)
		U/S	D/S															
SHERRINGTON DRIVE		8	7	0.16	0.45	0.072	0.072	10.00	107.0	21	43.0	300	1.20	106	1.50	0.48	10.48	20.2
CHIMNEY HILL WAY		34	33	0.90	0.45	0.405	0.405	10.00	107.0	120	30.6	375	2.39	271	2.46	0.21	10.21	44.4
CHIMNEY HILL WAY		33	32	0.17	0.45	0.077	0.482	10.21	105.8	142	36.2	375	2.27	264	2.40	0.25	10.46	53.5
CHIMNEY HILL WAY		32	31	0.57	0.45	0.257	0.738	10.46	104.5	214	78.6	375	2.19	260	2.35	0.56	11.01	82.5
CHIMNEY HILL WAY		31	30	0.57	0.45	0.257	0.995	11.00	101.7	281	64.0	525	2.35	660	3.05	0.35	11.35	42.6
CHIMNEY HILL WAY		30	7	0.64	0.45	0.288	1.283	11.34	100.0	356	72.8	675	0.45	564	1.58	0.77	12.10	63.2
SHERRINGTON DRIVE		7	6	0.45	0.45	0.203	1.557	12.05	96.7	418	88.7	675	0.86	780	2.18	0.68	12.72	53.6
QUEENSPLATE DRIVE		29	28	0.37	0.60	0.222	0.222	10.00	107.0	66	12.5	300	1.60	122	1.73	0.12	10.12	53.9
QUEENSPLATE DRIVE		28	27	0.44	0.60	0.264	0.486	10.11	106.4	144	56.4	375	1.84	238	2.16	0.44	10.54	60.3
QUEENSPLATE DRIVE		27	26	0.75	0.45	0.338	0.824	10.53	104.1	238	45.4	450	1.82	385	2.42	0.31	10.85	61.9
QUEENSPLATE DRIVE		26	6	0.28	0.45	0.126	0.950	10.85	102.5	270	63.8	525	0.42	279	1.29	0.82	11.67	96.9
SHERRINGTON DRIVE		6	MH.5	0.37	0.45	0.167	2.673	12.75	93.7	696	87.5	825	0.58	1094	2.05	0.71	13.47	63.6
SOUTHAMPTON STREET	-	EX.PLUG2	MH.5	2.15	0.54	1.161	1.161	11.81	97.8	315	46.6	600	0.90	583	2.06	0.38	12.19	54.1
SHERRINGTON DRIVE		MH.5	MH.4	0.37	0.45	0.167	4.001	13.53	90.6	1007	87.2	900	0.54	1331	2.09	0.69	14.22	75.7
ELMHURST STREET	-	EX.PLUG3	MH.4	3.30	0.54	1.782	1.782	12.19	96.1	476	43.3	525	1.54	534	2.47	0.29	12.48	89.1
SHERRINGTON DRIVE		MH.4	3	0.59	0.45	0.266	6.048	14.26	87.9	1477	94.2	1200	0.27	2026	1.79	0.88	15.13	72.9
SHERRINGTON DRIVE		3	47		0.45		6.048	15.09	85.0	1428	49.2	1200	0.53	2839	2.51	0.33	15.42	50.3
REACH STREET		DICB	1	0.28	0.60	0.168	0.168	10.00	107.0	50	27.0	450	1.27	322	2.02	0.22	10.22	15.5
SHERRINGTON DRIVE		1	2	0.40	0.45	0.180	0.348	10.29	105.4	102	73.2	450	0.81	257	1.62	0.76	11.04	39.7
SHERRINGTON DRIVE		SCH	2	2.44	0.75	1.830	1.830	11.04	101.5	516	15.0	525	2.00	609	2.81	0.09	11.13	84.8
SHERRINGTON DRIVE		2	47		0.45		2.178	11.13	101.1	611	9.7	600	0.93	593	2.10	0.08	11.21	103.2
POND		47	HW1		0.45		8.226	15.44	83.9	1916	52.3	1350	0.34	3113	2.18	0.40	15.84	61.6
PEAK FLOW FOR THE CAWKERS CREEK PHASE 1 & 2 DEVELOPMENT = 1916 L/s																		



1600 CHAMPLAIN AVE, SUITE 402
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STATUS: 3rd Submission

TOWNSHIP OF SCUGOG

STORM SEWER DESIGN SHEET

PROJECT NAME: CAWKERS CREEK PHASE 3
S-S-2014-01

TOWNSHIP OF SCUGOG DESIGN CRITERIA:

Q = 2.778 AIR
Q=5 YEAR RETURN STORM
A= AREA IN HECTARES(ha)
R=RUNOFF COEFFICIENT
I=RAINFALL INTENSITY (mm/hr)
Coefficient of Friction in pipe, n =0.013
Time of Concentration (Tc) min = 10
5 Year Intensity = 904 / (T + 5)^{0.788}
25 Year Intensity = 1065 / (T + 5)^{0.788}

PROJECT No. : E16004
5 YEAR DESIGN STORM

LOCATION				FLOWS							SEWER DESIGN							REMARKS
STREET	AREA ID	MANHOLE NO.		"A" AREA (ha)	"R" RUNOFF COEFF.	AR	ACCUM. AR	TIME OF CONC. (min)	RAINFALL INTENSITY (mm/hr)	PEAK FLOW (L/s)	LENGTH (m)	PIPE DIA. (mm)	SLOPE (%)	PIPE CAPACITY (L/s)	FULL VELOCITY (m/s)	TIME IN SECTION (min)	TOTAL TIME (min)	PEAK FLOW / PIPE CAP. (%)
		U/S	D/S															
SHERRINGTON DRIVE		8	MH.9	0.16	0.45	0.072	0.072	10.00	107.0	21	47.5	300	0.84	89	1.26	0.63	10.63	24.1
GLENHAVEN COURT	9	MH103	MH104	0.57	0.45	0.257	0.257	10.00	107.0	76	100.0	300	2.70	159	2.25	0.74	10.74	47.9
GLENHAVEN COURT	10	MH104	MH105	0.35	0.45	0.158	0.414	10.74	103.0	118	57.7	375	1.80	235	2.13	0.45	11.19	50.3
GLENHAVEN COURT	11	MH105	EX.PLUG1	0.19	0.45	0.086	0.500	11.19	100.8	140	32.1	525	0.69	358	1.65	0.32	11.52	39.1
GLENHAVEN COURT	-	EX.PLUG1	MH.9	0.00	0.45	0.000	0.500	11.52	99.2	138	28.1	525	0.69	358	1.65	0.28	11.80	38.5
SHERRINGTON DRIVE		MH.9	MH.10	0.31	0.45	0.140	0.711	12.33	95.5	189	91.3	600	0.49	430	1.52	1.00	13.33	43.9
DR. ARCHER STREET	1/2/3	EX.MH2	EX.MH1	1.24	0.52	0.645	0.645	10.00	107.0	192	101.6	450	1.46	345	2.17	0.78	10.78	55.6
DR. ARCHER STREET	4/5/6	EX.MH1	EX.MH1A	0.53	0.53	0.281	0.926	10.78	102.8	264	70.6	525	0.65	347	1.60	0.73	11.51	76.2
PARK	8	CBMH101	EX.MH1A	0.38	0.25	0.095	0.095	10.00	107.0	28	16.5	300	1.00	97	1.37	0.20	10.20	29.2
DR. ARCHER STREET	7	EX.MH1A	MH.10	0.23	0.55	0.127	1.147	11.51	99.2	316	28.7	600	0.78	543	1.92	0.25	11.76	58.3
ROSEBOROUGH DRIVE		MH.10	11	0.60	0.45	0.270	2.128	13.31	91.5	541	77.5	900	0.23	869	1.37	0.95	14.25	62.3
ROSEBOROUGH DRIVE		11	12	0.07	0.45	0.032	2.160	14.13	88.3	530	15.1	900	0.17	747	1.17	0.21	14.35	71.0
ROSEBOROUGH DRIVE		12	13	0.62	0.45	0.279	2.439	14.28	87.8	595	92.1	900	0.36	1087	1.71	0.90	15.18	54.7
ROSEBOROUGH DRIVE		13	44	0.68	0.45	0.306	2.745	15.27	84.4	644	89.0	975	0.28	1186	1.59	0.93	16.20	54.3
FIFESHIRE COURT		49	45	0.36	0.45	0.162	0.162	10.00	107.0	48	58.7	300	1.13	103	1.46	0.67	10.67	46.8
FIFESHIRE COURT		45	44	0.24	0.45	0.108	0.270	10.69	103.3	77	42.0	375	2.39	271	2.46	0.28	10.98	28.5
ROSEBOROUGH DRIVE		44	15	0.24	0.45	0.108	3.123	16.20	81.5	707	50.9	975	0.26	1143	1.53	0.55	16.75	61.8
ROSEBOROUGH DRIVE		15	16	0.50	0.45	0.225	3.348	16.74	79.9	743	61.2	975	0.34	1307	1.75	0.58	17.32	56.8
ROSEBOROUGH DRIVE		16	17	0.49	0.45	0.221	3.568	16.74	79.9	792	59.3	975	0.32	1268	1.70	0.58	17.32	62.4
GATWICK WAY		46	17	0.47	0.45	0.212	0.212	10.00	107.0	63	46.6	300	1.75	128	1.81	0.43	10.43	49.1
ROSEBOROUGH DRIVE		17	18	0.68	0.45	0.306	4.086	17.32	78.2	888	104.6	975	0.30	1228	1.65	1.06	18.38	72.3
ROSEBOROUGH DRIVE		18	19	0.46	0.45	0.207	4.293	18.36	75.5	900	43.8	975	0.27	1165	1.56	0.47	18.83	77.3
ROSEBOROUGH DRIVE		19	HW2	0.00	0.45		4.293	18.79	74.4	887	37.9	975	0.40	1418	1.90	0.33	19.12	62.6
PEAK FLOW FOR THE CAWKERS CREEK PHASE 1 & 2 DEVELOPMENT = 1039 L/s																		



1600 CHAMPLAIN AVE, SUITE 402
WHITBY, ONTARIO L1N 9B2
PHONE: (289) 315-3680

COMPUTED BY : DB
CHECKED BY : MF
DATE: APR 10, 2017
STATUS: 3rd Submission

TOWNSHIP OF SCUGOG

STORM SEWER DESIGN SHEET

PROJECT NAME: CAWKERS CREEK PHASE 3
S-S-2014-01

TOWNSHIP OF SCUGOG DESIGN CRITERIA:

Q = 2.778 AIR
Q=5 YEAR RETURN STORM
A= AREA IN HECTARES(ha)
R=RUNOFF COEFFICIENT
I=RAINFALL INTENSITY (mm/hr)
Coefficient of Friction in pipe, n =0.013
Time of Concentration (Tc) min = 10
5 Year Intensity = 904 / (T + 5)^{0.788}
25 Year Intensity = 1065 / (T + 5)^{0.788}

PROJECT No. : E16004
5 YEAR DESIGN STORM

LOCATION				FLOWS							SEWER DESIGN							REMARKS
STREET	AREA ID	MANHOLE NO.		"A" AREA (ha)	"R" RUNOFF COEFF.	AR	ACCUM. AR	TIME OF CONC. (min)	RAINFALL INTENSITY (mm/hr)	PEAK FLOW (L/s)	LENGTH (m)	PIPE DIA. (mm)	SLOPE (%)	PIPE CAPACITY (L/s)	FULL VELOCITY (m/s)	TIME IN SECTION (min)	TOTAL TIME (min)	PEAK FLOW / PIPE CAP. (%)
		U/S	D/S															
SHERRINGTON DRIVE		8	7	0.26	0.45	0.117	0.117	10.00	107.0	35	43.0	300	1.20	106	1.50	0.48	10.48	32.8
CHIMNEY HILL WAY		34	33	0.86	0.45	0.387	0.387	10.00	107.0	115	30.6	375	2.39	271	2.46	0.21	10.21	42.4
CHIMNEY HILL WAY		33	32	0.17	0.45	0.077	0.464	10.21	105.8	136	36.2	375	2.27	264	2.40	0.25	10.46	51.5
CHIMNEY HILL WAY		32	31	0.62	0.45	0.279	0.743	10.46	104.5	216	78.6	375	2.19	260	2.35	0.56	11.01	83.0
CHIMNEY HILL WAY		31	30	0.54	0.45	0.243	0.986	11.00	101.7	278	64.0	525	2.35	660	3.05	0.35	11.35	42.2
CHIMNEY HILL WAY		30	7	0.56	0.45	0.252	1.238	11.34	100.0	344	72.8	675	0.45	564	1.58	0.77	12.10	61.0
SHERRINGTON DRIVE		7	6	0.45	0.45	0.203	1.557	12.05	96.7	418	88.7	675	0.86	780	2.18	0.68	12.72	53.6
QUEENSPLATE DRIVE		29	28	0.37	0.45	0.167	0.167	10.00	107.0	49	12.5	300	1.60	122	1.73	0.12	10.12	40.4
QUEENSPLATE DRIVE		28	27	0.44	0.45	0.198	0.365	10.11	106.4	108	56.4	375	1.84	238	2.16	0.44	10.54	45.3
QUEENSPLATE DRIVE		27	26	0.76	0.45	0.342	0.707	10.53	104.1	204	45.4	450	1.82	385	2.42	0.31	10.85	53.1
QUEENSPLATE DRIVE		26	6	0.28	0.45	0.126	0.833	10.85	102.5	237	63.8	525	0.42	279	1.29	0.82	11.67	85.0
SHERRINGTON DRIVE		6	MH.5	0.37	0.45	0.167	2.556	12.75	93.7	665	87.5	825	0.58	1094	2.05	0.71	13.47	60.8
FUTURE	FUT1	MH.FUT1	MH106	0.59	0.75	0.443	0.443	10.00	107.0	132	72.7	375	2.00	248	2.25	0.54	10.54	53.0
SOUTHAMPTON STREET	12	MH106	MH107	0.91	0.45	0.410	0.852	10.54	104.1	246	43.6	450	2.00	404	2.54	0.29	10.83	61.0
SOUTHAMPTON STREET	13	MH107	MH108	0.57	0.45	0.257	1.109	10.83	102.6	316	95.6	525	2.00	609	2.81	0.57	11.39	51.9
SOUTHAMPTON STREET	14/15	MH108	EX.PLUG2	0.58	0.45	0.261	1.370	11.39	99.8	380	51.7	600	0.90	583	2.06	0.42	11.81	65.1
SOUTHAMPTON STREET	-	EX.PLUG2	MH.5	0.00	0.45	0.000	1.370	11.81	97.8	372	46.6	600	0.90	583	2.06	0.38	12.19	63.8
SHERRINGTON DRIVE		MH.5	MH.4	0.37	0.45	0.167	4.092	13.53	90.6	1030	87.2	900	0.54	1331	2.09	0.69	14.22	77.4
FUTURE	FUT2	MH.FUT2	MH109	0.86	0.75	0.645	0.645	10.00	107.0	192	68.1	450	1.00	285	1.80	0.63	10.63	67.2
ELMHURST STREET	16	MH109	MH110	0.50	0.45	0.225	0.870	10.63	103.6	250	64.8	525	1.00	430	1.99	0.54	11.18	58.2
ELMHURST STREET	17/18/19	MH110	MH111	1.09	0.45	0.491	1.361	11.18	100.8	381	98.0	525	1.50	527	2.44	0.67	11.85	72.3
ELMHURST STREET	20/21	MH111	EX.PLUG3	0.75	0.45	0.338	1.698	11.85	97.7	511	51.7	525	1.54	534	2.47	0.35	12.19	95.6
ELMHURST STREET	-	EX.PLUG3	MH.4	0.00	0.45	0.000	1.698	12.19	96.1	503	43.3	525	1.54	534	2.47	0.29	12.49	94.2
SHERRINGTON DRIVE		MH.4	3	0.59	0.45	0.266	6.056	14.26	87.9	1528	94.2	1200	0.27	2026	1.79	0.88	15.13	75.4
SHERRINGTON DRIVE		3	47		0.45		6.056	15.09	85.0	1480	49.2	1200	0.53	2839	2.51	0.33	15.42	52.1
REACH STREET		DICB	1	0.28	0.60	0.168	0.168	10.00	107.0	50	27.0	450	1.27	322	2.02	0.22	10.22	15.5
SHERRINGTON DRIVE		1	2	0.40	0.45	0.180	0.348	10.29	105.4	102	73.2	450	0.81	257	1.62	0.76	11.04	39.7
SHERRINGTON DRIVE		SCH	2	2.44	0.75	1.830	1.830	11.04	101.5	516	15.0	525	2.00	609	2.81	0.09	11.13	84.8
SHERRINGTON DRIVE		2	47		0.45		2.178	11.13	101.1	611	9.7	600	0.93	593	2.10	0.08	11.21	103.2
POND		47	HW1		0.45		8.234	15.44	83.9	1968	52.3	1350	0.34	3113	2.18	0.40	15.84	63.2
PEAK FLOW FOR THE CAWKERS CREEK PHASE 1 & 2 DEVELOPMENT = 1916 L/s																		

Appendix B

Minor & Major Flow Calculations

Project Name	Chimney Hill way	Prepared By RB
Project No.	E21027	Checked By AK
Subject	Proposed Uncontrolled Release Rate (Area 203)	

Utilizing the rational method, the proposed conditions release rate can be determined:

$$Q = C I A \quad \text{where,}$$

Q = Flow rate (cms)
C = Runoff Coefficient
I = Intensity (mm/hr)
A = Area (ha)

Where C =

Storm Event	Area (ha)	Runoff Coefficient			
		2, 5 and 10 Year	25 Year	50 Year	100 Year
		1.00	1.1	1.2	1.25
203	0.01	0.45	0.49	0.54	0.56

$$I = a / (b + t)^c \quad \text{where,}$$

The Intensity for: Port Perry can be calculated as:

$$I = a / (b + t)^c \quad \text{where,}$$

I =	Intensity (mm/hr)	2 Year	5 Year	10 Year	25 Year	100 Year
a =	Constant =	645	904	1065	1243	1799
b =	Constant =	5	5	5	4	5
c =	Constant =	0.786	0.788	0.788	0.7897	0.81
t =	Time of Concentration (min) =	10.0	10.0	10.0	10.0	10.0
I =	Intensity (mm/hr)	76.76	107.01	126.06	154.66	200.63

Area ID	Area (ha)	Future Flow (m ³ /s)				
		2 Year	5 Year	10 Year	25 Year	100 Year
203	0.01	0.001	0.001	0.002	0.002	0.003

Project Name	Chimney Hill way	Prepared By RB
Project No.	E21027	Checked By AK
Subject	Proposed Uncontrolled Release Rate	

Utilizing the rational method, the proposed conditions release rate can be determined:

$$Q = C I A \quad \text{where,}$$

Q = Flow rate (cms)
 C = Runoff Coefficient
 I = Intensity (mm/hr)
 A = Area (ha)

Where C =

Storm Event	Area (ha)	Runoff Coefficient					Impervious Area (ha)
		2, 5 and 10 Year	25 Year	50 Year	100 Year		
201a (Lane Way)	0.21	0.79	0.86	0.94	0.98		0.1759
201b (Rear Yards)	0.09	0.56	0.62	0.67	0.70		0.0464
201c (Rear Yards)	0.02	0.40	0.44	0.48	0.50		0.0057
Total Area	0.32	0.70	0.77	0.84	0.87		

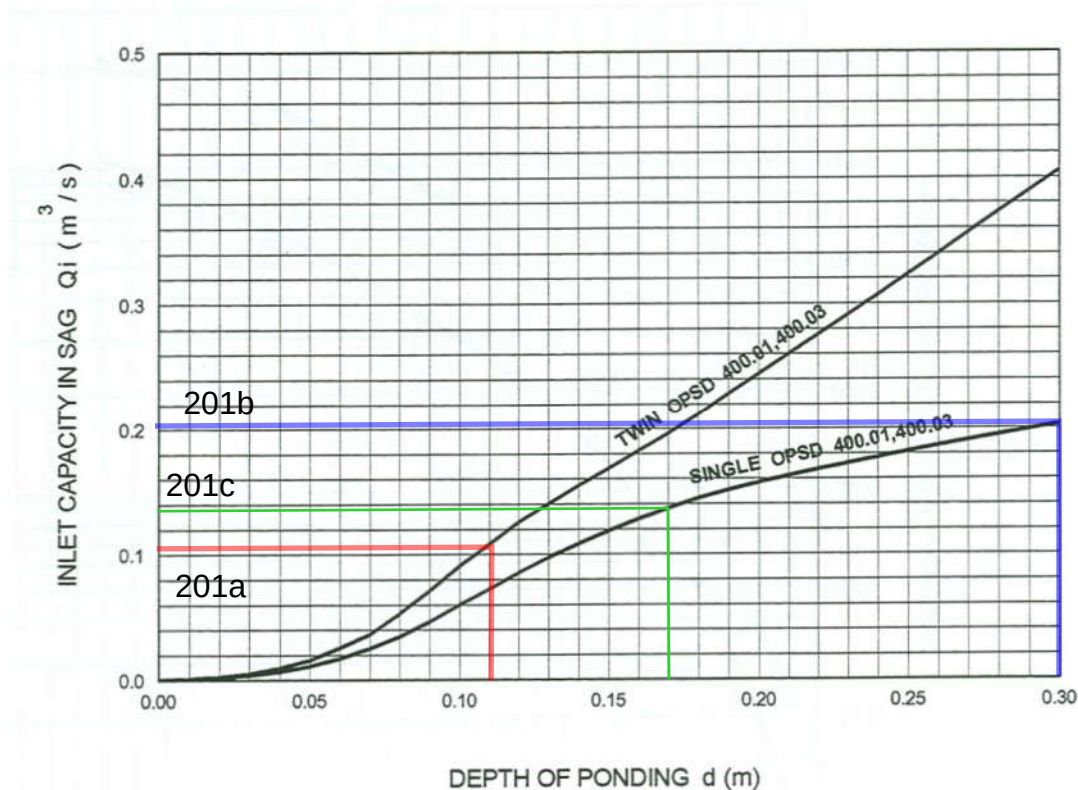
$$I = a / (b + t)^c \quad \text{where,}$$

The Intensity for: Port Perry can be calculated as:

$$I = a / (b + t)^c \quad \text{where,}$$

	Intensity (mm/hr)	2 Year	5 Year	10 Year	25 Year	100 Year
a =	Constant =	645	904	1065	1243	1799
b =	Constant =	5	5	5	4	5
c =	Constant =	0.786	0.788	0.788	0.7897	0.81
t =	Time of Concentration (min) =	10.0	10.0	10.0	10.0	10.0
I =	Intensity (mm/hr)	76.76	107.01	126.06	154.66	200.63

Area ID	Area (ha)	Future Flow (m ³ /s)				
		2 Year	5 Year	10 Year	25 Year	100 Year
201a (Lane Way)	0.21	0.035	0.049	0.058	0.078	0.115
201b (Rear Yards)	0.09	0.011	0.015	0.018	0.024	0.035
201c (Rear Yards)	0.02	0.002	0.002	0.003	0.004	0.006
Total Site Area	0.32	0.048	0.066	0.078	0.106	0.156

Design Chart 4.19: Inlet Capacity at Road Sag**Area 201a:**

The CB's within the laneway are required to capture a total of $0.115\text{m}^3/\text{s}$ during the 100 year storm event.

These CB's have a grate elevation of 270.78m, with spill to Chimney Hill Way occurring at 270.89m, resulting in a maximum ponding depth of 0.11m.

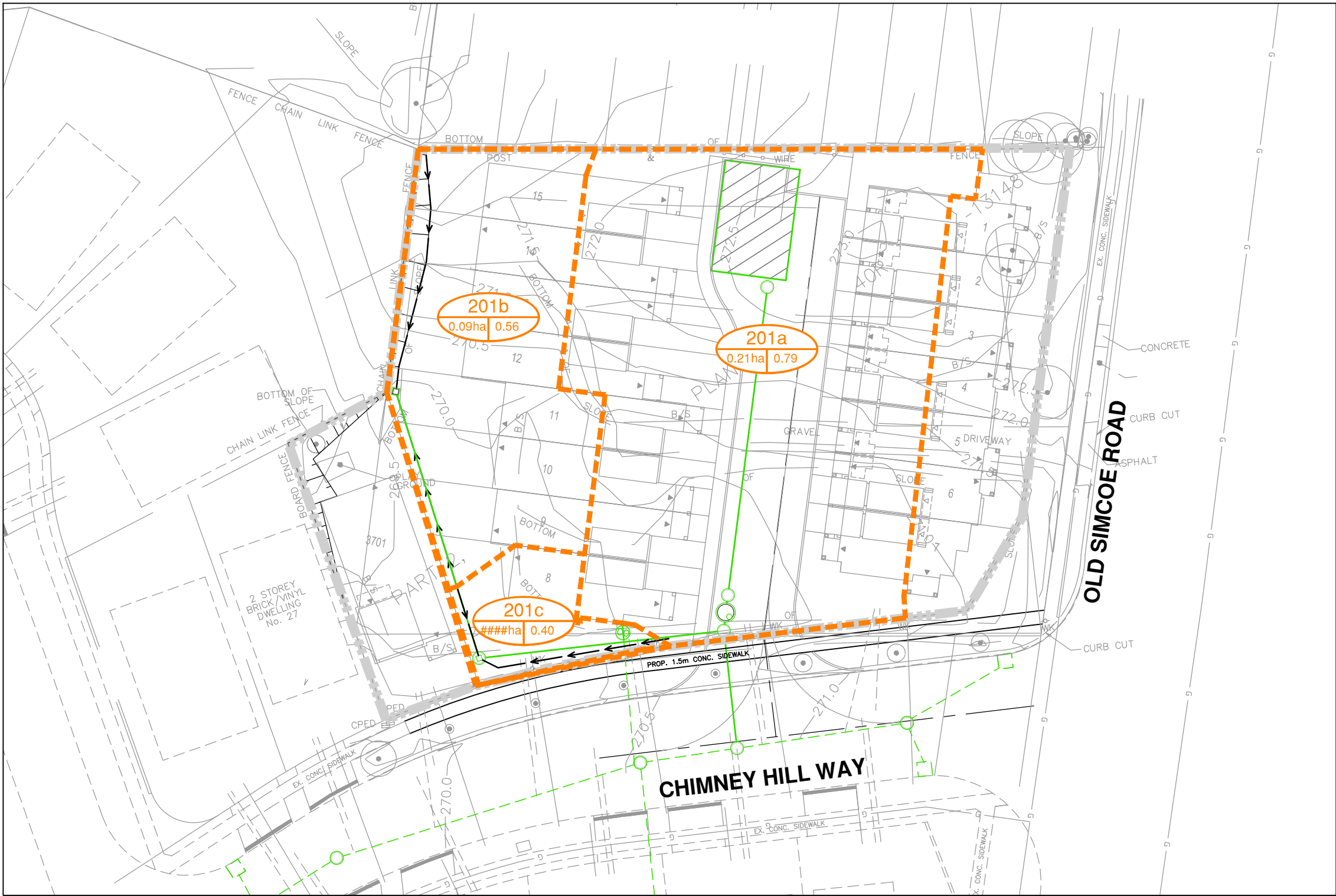
Each CB can capture approximately $0.103\text{m}^3/\text{s}$, however, assuming 50% blockage the total CB capture is approximately $0.103\text{m}^3/\text{s}$.

Area 201b:

The CB's in the western rear yards are required to capture $0.043\text{m}^3/\text{s}$ during the 100 year storm event. The maximum allowable ponding depth for each CB is 0.30m, resulting in a capture rate of approximately $0.205\text{m}^3/\text{s}$. Assuming 50% blockage, each CB can capture approximately $0.103\text{m}^3/\text{s}$.

Area 201c:

The CB's in the southwestern corner is required to capture $0.006\text{m}^3/\text{s}$ during the 100 year storm event. The CB has a grate elevation of 270.08m, with spill to the neighbouring property/Chimney Hill Way occurring at an elevation of 270.25, resulting in an allowable ponding depth of 0.17m, resulting in a capture rate of $0.138\text{m}^3/\text{s}$. Assuming 50% blocks, the CB can capture $0.069\text{m}^3/\text{s}$.

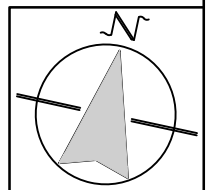


LEGEND

EXISTING CONTOUR
SITE BOUNDARY
PROPOSED DRAINAGE BOUNDARY

AREA ID
DRAINAGE AREA IN HECTARES
RUNOFF COEFFICIENT

201
0.95ha | 0.45



15762 OLD SIMCOE ROAD
TOWNSHIP OF SCUGOG

MAJOR FLOW CAPTURE AREAS

CANDEVCON EAST LIMITED
CONSULTING ENGINEERS & PLANNERS

1600 STELLAR DRIVE, SUITE 402
TEL. (289) 315-3680

WHITBY, ONTARIO L1N 9B2
FAX (905) 794-0611

Drawn By:	R.B.	Checked By:	R.B.	Proj. No.
				E21027
Designed By:	R.B.	Checked By:	R.B.	DWG. No.
				OLF
Scale:	N.T.S.	Date:	OCTOBER 2023	

1600 STELLAR DRIVE, SUITE 402
WHITBY, ONTARIO L1N 9B2
PHONE: (289) 315-3680

PROJECT No. : E21027
5 YEAR DESIGN STORM

COMPUTED BY : K.D.
CHECKED BY : X.X.
DATE: Sep. 29, 2023
STATUS: 2nd Submission

TOWNSHIP OF SCUGOG

STORM SEWER DESIGN SHEET

PROJECT NAME: 15762 OLD SIMCOE ROAD
S-S-2021-02

TOWNSHIP OF SCUGOG DESIGN CRITERIA:

Q = 2.778 AIR
Q=5 YEAR RETURN STORM
A= AREA IN HECTARES(ha)
R=RUNOFF COEFFICIENT
I=RAINFALL INTENSITY (mm/hr)

Coeffecient of Friction in pipe, n =0.013
Time of Concentration (Tc) min = 10
5 Year Intensity = 904 / (T + 5)^0.788
25 Year Intensity = 1243 / (T + 4)^0.787
100 Year Intensity = 1799/(Tc + 5)^0.81

LOCATION				FLOWS							SEWER DESIGN							REMARKS
STREET	AREA ID	MANHOLE NO.		"A" AREA (ha)	"R" RUNOFF COEFF.	AR	ACCUM. AR	TIME OF CONC. (min)	RAINFALL INTENSITY (mm/hr)	PEAK FLOW (L/s)	LENGTH (m)	PIPE DIA. (mm)	SLOPE (%)	PIPE CAPACITY (L/s)	FULL VELOCITY (m/s)	TIME IN SECTION (min)	TOTAL TIME (min)	PEAK FLOW / PIPE CAP. (%)
		U/S	D/S															
SITE	1	MH4	CBMH2	0.21	0.75	0.158	0.158	15.00	85.3	37	34.8	600	0.50	454	1.55	0.37	15.37	8.2
SITE	2	CBMH6	CBMH2	0.11	0.75	0.083	0.083	15.37	84.1	19	86.6	300	0.50	71	0.98	1.47	16.85	27.0
SITE	-	CBMH2	RLBC1	0.00	0.00		0.240	16.85	79.6	41	13.4	300	0.50	71	0.98	0.23	17.08	57.4
Orifice controlled outlet at MH4																		

Appendix C

Allowable Release Rates

Project Name	Chimney Hill Way	Prepared By	RB
Project No.	E21027	Checked By	AK
Subject	Site Imperviousness Calculations		

Site Area	Imp. Area (ha)	Perv. Area (ha)	Area (ha)	% Imp	Runoff Coefficient
201	0.228	0.092	0.32	0.71	0.70
202	0.027	0.019	0.05	0.59	0.61
203	0.005	0.009	0.01	0.36	0.45
204	0.015	0.025	0.04	0.36	0.45

Project Name	Chimney Hill way	Prepared By	RB
Project No.	E21027	Checked By	AK
Subject	Existign Storm Sewer Design Flow		

Utilizing the rational method, the allowale release rate can be determined:

$$Q = C I A \quad \text{where,}$$

Q = Flow rate (cms)
C = Runoff Coefficient
I = Intensity (mm/hr)
A = Area (ha)

Where **C** =

Storm Event	Area (ha)	Runoff Coefficient
		1.00
101	0.39	0.45
102	0.03	0.45
Total Area	0.42	0.45

$$I = a / (b + t)^c \quad \text{where,}$$

The Intensity for: Port Perry can be calculated as:

$$I = a / (b + t)^c \quad \text{where,}$$

I =	Intensity (mm/hr)	2 Year	5 Year	10 Year	25 Year	100 Year
a =	Constant =	645	904	1065	1243	1799
b =	Constant =	5	5	5	4	5
c =	Constant =	0.786	0.788	0.788	0.7897	0.81
t =	Time of Concentration (min) =	10.0	10.0	10.0	10.0	10.0
I =	Intensity (mm/hr)	76.76	107.01	126.06	154.66	200.63

Area Description	Area (ha)	2 Year	5 Year	10 Year	25 Year	100 Year
Total Site Area	0.42	0.040	0.056	0.066	0.081	0.105
Single Dwelling	0.04	0.004	0.005	0.006	0.008	0.010
Allocated Sewer Capacity	0.38	0.036	0.051	0.060	0.073	0.095

Since the single family dwelling will be developed in accordance with the intial design of the storm sewer system, the allocated capacity for this area is removed from the allowble 5-year flow for the site. The allowable reease rate for the remainder of the development is therefore

0.051 m³/s

Appendix D

Stormwater Management Calculations

Project Name	Chimney Hill way	Prepared By RB
Project No.	E21027	Checked By AK
Subject	Proposed Uncontrolled Release Rate	

Utilizing the rational method, the proposed conditions release rate can be determined:

$$Q = C I A \quad \text{where,}$$

Q = Flow rate (cms)
C = Runoff Coefficient
I = Intensity (mm/hr)
A = Area (ha)

Where C =

Storm Event	Area (ha)	Runoff Coefficient			
		2, 5 and 10 Year	25 Year	50 Year	100 Year
		1.00	1.1	1.2	1.25
201	0.32	0.70	0.77	0.84	0.87
202	0.05	0.61	0.67	0.73	0.76
203	0.01	0.45	0.49	0.54	0.56
204	0.04	0.45	0.50	0.55	0.57
Total Area	0.42	0.66	0.72	0.79	0.82

$$I = a / (b + t)^c \quad \text{where,}$$

The Intensity for: Port Perry can be calculated as:

$$I = a / (b + t)^c \quad \text{where,}$$

	Intensity (mm/hr)	2 Year	5 Year	10 Year	25 Year	100 Year
I =		645	904	1065	1243	1799
a =	Constant =	5	5	5	4	5
b =	Constant =	0.786	0.788	0.788	0.7897	0.81
c =	Constant =					
t =	Time of Concentration (min) =	10.0	10.0	10.0	10.0	10.0
I =	Intensity (mm/hr)	76.76	107.01	126.06	154.66	200.63

Area ID	Area (ha)	Future Flow (m ³ /s)				
		2 Year	5 Year	10 Year	25 Year	100 Year
201	0.32	0.048	0.066	0.078	0.106	0.156
202	0.05	0.007	0.009	0.011	0.014	0.021
203	0.01	0.001	0.001	0.002	0.002	0.003
204	0.04	0.004	0.005	0.006	0.009	0.013
Total Site Area	0.42	0.059	0.082	0.097	0.131	0.193

Therefore the post-development 100 year storm event will be controlled to the allowable release rate of 0.051 m³/s

Project Name:	Chimney Hill Way	Prepared By: RB
Project No.:	E21027	Checked By: AK
Subject:	Orifice Calculations	

Controlled Site Area = 0.320 ha
Qo - Allowable Orifice Release Rate = 0.042 m³/s

Catchment ID = Site
 Orifice Location = MH4
 Orifice Type = Orifice Plate
 Invert Elevation = 268.08 m
Diameter of Orifice = 130 mm
 Area of Orifice (A) = 0.013 m²
 Orifice Coefficient (C_d) = 0.620

Calculation of Head

Water Elevation = 269.37 m
 Upstream Head^a, H = 1.229 m

$Q_A = C_d A (2 g h)^{1/2}$
Actual Controlled Discharge, Q_A = 0.042 m³/s

^aHead is based on depth of water above orifice midpoint

^bVelocity based on orifice area @ orifice face not Vena Contracta

Project Name	Chimney Hill Way	Prepared By	RB
Project No.	E21027	Checked By	AK
Subject	Modified Rational Storage Calculation		

100-year

Catchment ID =	201	
Time of Concentration (t_c) =	10	minutes
Time Step (t_1) =	5	minutes
Runoff Coefficient (C) =	0.87	*100 year adjusted 'C'
Catchment Area (A) =	0.32	ha
Minor System Target (Q_o) =	0.042	m ³ /s **Orifice Controlled Release Rate

Time $t = t_c + t_1$ (min.)	Intensity $I = a/(t_c + b)^c$ (mm/hr)	Runoff $Q = CIA$ (m ³ /s)	Storage Rate $Q_s = Q - Q_o$ (m ³ /s)	Required Storage $V = Q_s t$ (m ³)
10	201	0.156	0.113	68
15	159	0.123	0.081	73
20	133	0.103	0.060	72
25	114	0.089	0.046	69
30	101	0.078	0.036	64
35	91	0.070	0.028	58
40	82	0.064	0.021	51
45	76	0.059	0.016	44
50	70	0.054	0.012	35
55	65	0.051	0.008	27
60	61	0.047	0.005	18
65	58	0.045	0.002	8

100 Year Storage Required = 73 m³

Project Name	Chimney Hill Way	Prepared By	RB
Project No.	E21027	Checked By	AK
Subject	Storage Summary		

							Length per Pipe Diameter (mm)									
Area ID	Orifice Invert m	Ponding Elev. M	Ground Elevation m	Underground Storage (Chambers) Vu/g m ³	Underground Storage (Sewer + MH) Vu/g m ³	Storage Available Va = Vs+Vp m ³	Underground Storage									
							150	250	300	375	450	525	600	675	750	825
201	268.08	269.37	271.04	64	13	78							35			

	Invert (m)	Depth (m)	MH Dia. (m)	Volume (m ³)
MH4	268.11	1.26	1.2	1.4
MH2	268.33	1.04	1.2	1.2
MH1	268.50	0.87	1.2	1.0
Total				3.6

Pipe Volume = Pipe Length x pi*(diameter^2)/4
 Pipe Volume = 35m x pi*(0.600m^2)/4
 Pipe Volume = 9.8m³

Project: **E21027**



Chamber Model -
Units -

SC-740
Metric

Number of chambers -
Voids in the stone (porosity) -
Base of Stone Elevation -
Amount of Stone Above Chambers -
Amount of Stone Below Chambers -

35	
40	%
254.31	m
152	mm
223	mm

110	sq.meters	Min. Area -	109.9 sq.meters
-----	-----------	-------------	-----------------

StormTech SC-740 Cumulative Storage Volumes

Height of System (mm)	Incremental Single Chamber (cubic meters)	Incremental Total Chamber (cubic meters)	Incremental Stone (cubic meters)	Incremental Ch & St (cubic meters)	Cumulative Chamber (cubic meters)	Elevation (meters)
1143	0.00	0.00	1.12	1.12	77.616	255.45
1118	0.00	0.00	1.12	1.12	76.498	255.43
1092	0.00	0.00	1.12	1.12	75.380	255.40
1067	0.00	0.00	1.12	1.12	74.263	255.37
1041	0.00	0.00	1.12	1.12	73.145	255.35
1016	0.00	0.00	1.12	1.12	72.028	255.32
991	0.00	0.05	1.10	1.15	70.910	255.30
965	0.00	0.16	1.05	1.21	69.760	255.27
940	0.01	0.28	1.01	1.29	68.545	255.25
914	0.02	0.60	0.88	1.48	67.260	255.22
889	0.02	0.79	0.80	1.59	65.783	255.20
864	0.03	0.94	0.74	1.68	64.189	255.17
838	0.03	1.06	0.69	1.76	62.506	255.15
813	0.03	1.17	0.65	1.82	60.750	255.12
787	0.04	1.25	0.62	1.87	58.930	255.10
762	0.04	1.34	0.58	1.92	57.060	255.07
737	0.04	1.44	0.54	1.98	55.137	255.04
711	0.04	1.51	0.51	2.02	53.154	255.02
686	0.04	1.57	0.49	2.06	51.130	254.99
660	0.05	1.63	0.47	2.09	49.072	254.97
635	0.05	1.68	0.44	2.13	46.977	254.94
610	0.05	1.74	0.42	2.16	44.849	254.92
584	0.05	1.79	0.40	2.19	42.689	254.89
559	0.05	1.84	0.38	2.22	40.500	254.87
533	0.05	1.88	0.37	2.24	38.279	254.84
508	0.05	1.92	0.35	2.27	36.036	254.82
483	0.06	1.96	0.33	2.29	33.768	254.79
457	0.06	1.99	0.32	2.31	31.476	254.77
432	0.06	2.03	0.31	2.33	29.163	254.74
406	0.06	2.06	0.29	2.35	26.830	254.71
381	0.06	2.09	0.28	2.37	24.478	254.69
356	0.06	2.11	0.27	2.39	22.109	254.66
330	0.06	2.13	0.26	2.40	19.724	254.64
305	0.06	2.16	0.25	2.41	17.325	254.61
279	0.06	2.18	0.25	2.42	14.913	254.59
254	0.06	2.19	0.24	2.43	12.488	254.56
229	0.00	0.00	1.12	1.12	10.058	254.54
203	0.00	0.00	1.12	1.12	8.941	254.51
178	0.00	0.00	1.12	1.12	7.823	254.49
152	0.00	0.00	1.12	1.12	6.705	254.46
127	0.00	0.00	1.12	1.12	5.588	254.44
102	0.00	0.00	1.12	1.12	4.470	254.41
76	0.00	0.00	1.12	1.12	3.353	254.38
51	0.00	0.00	1.12	1.12	2.235	254.36
25	0.00	0.00	1.12	1.12	1.118	254.33

Appendix E

Quality & Extended Detention Calculations

Stormceptor®EF Sizing Report

STORMCEPTOR®

ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

01/20/2023

Province:	Ontario	Project Name:	Chimney Hill Way
City:	Port Perry	Project Number:	60520
Nearest Rainfall Station:	TORONTO CITY	Designer Name:	Ryan Brockie
Climate Station Id:	6158355	Designer Company:	Candevcon East Ltd.
Years of Rainfall Data:	20	Designer Email:	rbrockie@candevcon.com
		Designer Phone:	289-315-3680
Site Name:		EOR Name:	
		EOR Company:	
Drainage Area (ha):	0.32	EOR Email:	
Runoff Coefficient 'c':	0.70	EOR Phone:	

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):	7.24
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	62
EF6	66
EF8	69
EF10	70
EF12	70

Recommended Stormceptor EF Model: **EF4**
 Estimated Net Annual Sediment (TSS) Load Reduction (%): **62**
 Water Quality Runoff Volume Capture (%): **> 90**

Stormceptor® EF Sizing Report

THIRD-PARTY TESTING AND VERIFICATION

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

PERFORMANCE

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

PARTICLE SIZE DISTRIBUTION (PSD)

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

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

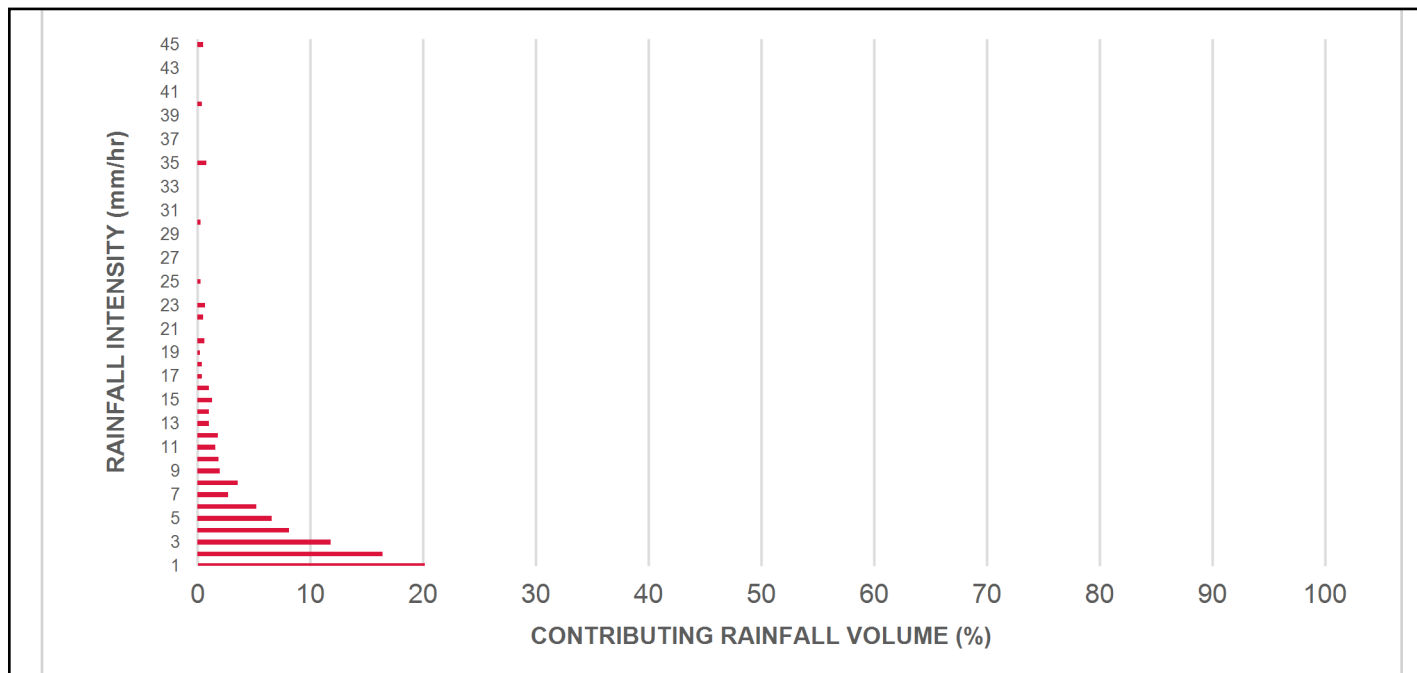
Stormceptor®EF Sizing Report

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 (%)
0.5	8.7	8.7	0.31	19.0	16.0	70	6.1	6.1
1	20.2	28.9	0.62	37.0	31.0	70	14.2	20.4
2	16.4	45.3	1.25	75.0	62.0	67	11.0	31.4
3	11.8	57.1	1.87	112.0	93.0	63	7.4	38.8
4	8.1	65.2	2.49	149.0	125.0	61	4.9	43.8
5	6.6	71.9	3.11	187.0	156.0	58	3.9	47.6
6	5.2	77.1	3.74	224.0	187.0	56	2.9	50.5
7	2.7	79.8	4.36	262.0	218.0	54	1.4	52.0
8	3.6	83.4	4.98	299.0	249.0	53	1.9	53.9
9	2.0	85.4	5.60	336.0	280.0	52	1.0	54.9
10	1.9	87.3	6.23	374.0	311.0	51	1.0	55.9
11	1.6	88.9	6.85	411.0	342.0	50	0.8	56.7
12	1.8	90.7	7.47	448.0	374.0	49	0.9	57.5
13	1.0	91.6	8.10	486.0	405.0	48	0.5	58.0
14	1.0	92.7	8.72	523.0	436.0	48	0.5	58.5
15	1.3	93.9	9.34	560.0	467.0	47	0.6	59.1
16	1.0	95.0	9.96	598.0	498.0	47	0.5	59.6
17	0.4	95.3	10.59	635.0	529.0	47	0.2	59.7
18	0.4	95.7	11.21	673.0	560.0	46	0.2	59.9
19	0.2	95.9	11.83	710.0	592.0	46	0.1	60.0
20	0.6	96.5	12.45	747.0	623.0	46	0.3	60.3
21	0.0	96.5	13.08	785.0	654.0	46	0.0	60.3
22	0.5	97.0	13.70	822.0	685.0	46	0.2	60.5
23	0.7	97.7	14.32	859.0	716.0	45	0.3	60.8
24	0.0	97.7	14.95	897.0	747.0	45	0.0	60.8
25	0.3	98.0	15.57	934.0	778.0	45	0.1	61.0
30	0.3	98.3	18.68	1121.0	934.0	44	0.1	61.1
35	0.8	99.1	21.80	1308.0	1090.0	45	0.3	61.4
40	0.4	99.5	24.91	1495.0	1245.0	47	0.2	61.6
45	0.5	100.0	28.02	1681.0	1401.0	49	0.3	61.9
Estimated Net Annual Sediment (TSS) Load Reduction =								62 %

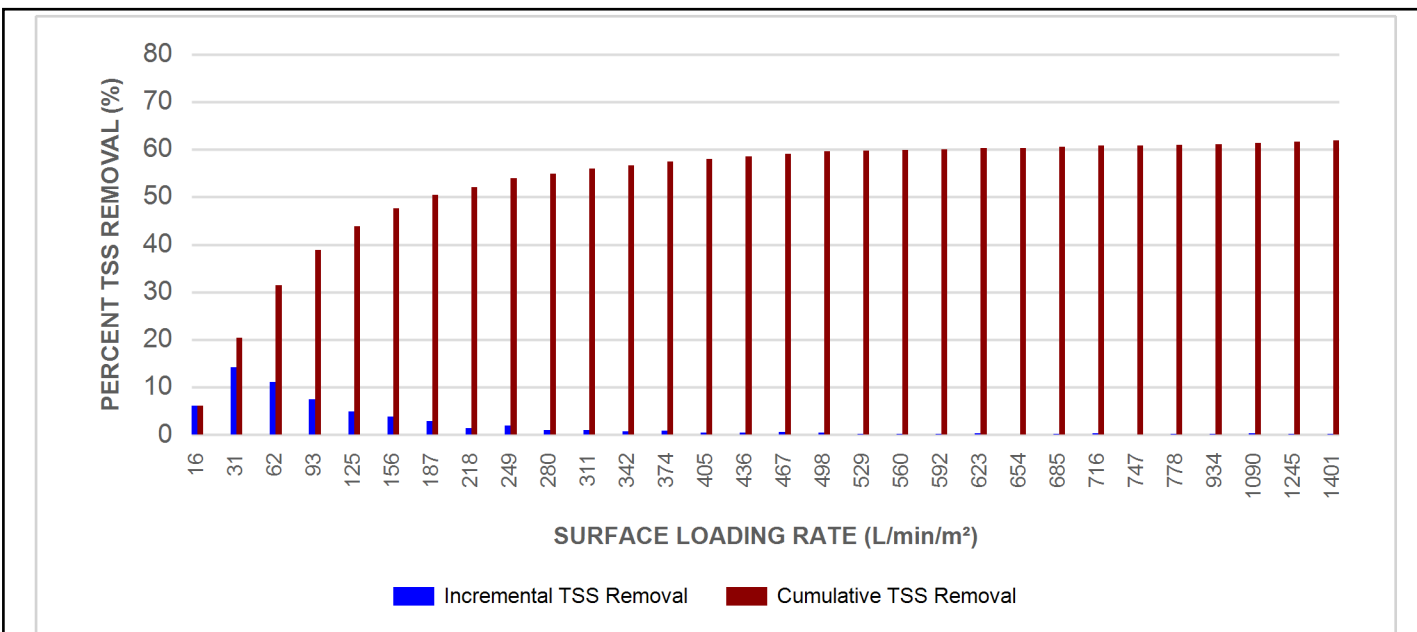
Climate Station ID: 6158355 Years of Rainfall Data: 20

Stormceptor®EF Sizing Report

RAINFALL DATA FROM TORONTO CITY RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Stormceptor® EF Sizing Report

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

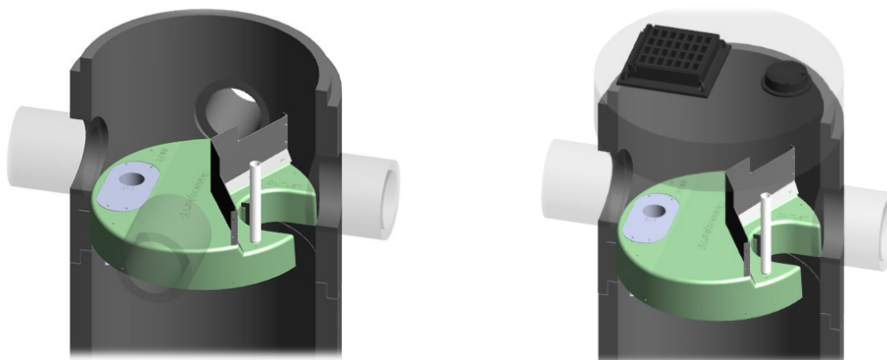
► **Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test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

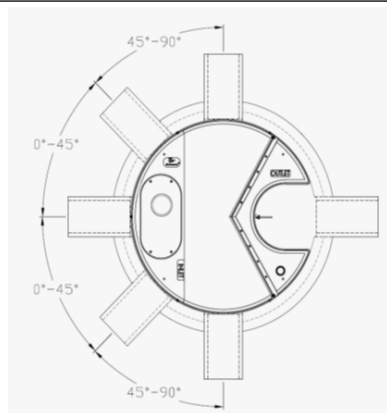
► **Stormceptor® EF and EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend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



Stormceptor® EF Sizing Report



INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

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

For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

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

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

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

STANDARD STORMCEPTOR EF/EFO DRAWINGS

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

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

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

Stormceptor® EF Sizing Report

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

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

Stormceptor®EF Sizing Report

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 Separators**.

1.3 SUBMITTALS

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

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

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

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

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

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m ³ sediment / 265 L oil
	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

Stormceptor®EF Sizing Report

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/m² to 1400 L/min/m², 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/m² and 1400 L/min/m² 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/m² shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m². No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m².

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m² shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m², and shall be calculated using a simple proportioning formula, with 1400 L/min/m² 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/m².

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/m².

Project Name	Chimney Hill Way	Prepared By	RB
Project No.	E21027	Checked By	AK
Subject	BMP/LID In Series TSSP Removal Efficiencies		

	LID/BMP Description	TSS Removal Eff. (%)
LID1	Oil and Grit Separator	50
LID2	Wet Detention Ponds ¹	75

¹ For the purpose of this analysis, it is assumed the increased imperviousness reduces the existing SWMF TSS removal rate to 75%

	LID/BMP Description		TSS Removal (%)
	Wet Detention Pond		50
	Oil/Grit Separator + Wet Detention Pond		88

Overall TSS Treatment Efficiency (%) for Entire Site
88%

Post-Development Load with BMPs)

Equation Reference:

North Carolina Department for Water Quality – Stormwater BMP Manual.

[http://www.ncsu.edu/ehs/envIRON/DWQ_StormwaterBMPmanual_001\[1\].pdf](http://www.ncsu.edu/ehs/envIRON/DWQ_StormwaterBMPmanual_001[1].pdf)

The ‘BMPs in Series’ total pollutant removal efficiency equation may be found in Section 3.9.4 of this Manual.

Project Name	Chimney Hill Way	Prepared By	RB
Project No.	E21027	Checked By	AK
Subject	Existing SWM Facility Required Permanent Pool Volume Calculation		
Criteria: 80% T.S.S Removal Area: 24.98 ha Imperviousness: 43% Permanent Pool Volume¹ = (160m³/ha - 40 m³/ha)x Area = 2,998 m³			
¹ As per the Stormwater Management Planning and Design Manual, Ministry of the Environment, March 2003			

Project Nam	Chimney Hill way	Prepared By	RB
Project No.	E21027	Checked By	AK
Subject	Erosion Control Volumes		

	Site Area	0.42 ha
	Quality Control Event	25 mm
Allocated Erosion Control Runoff		
	Depth	13.02 mm
Allocated Erosion Control		
	Volume	55 m3
	Imperviousness	79%
Proposed Erosion Control Runoff		
	Depth	19.75 mm
	Erosion Control Volume	83 m3

Appendix F

Phosphorous Loading & Removal Calculations

Project Name	Chimney Hill Way	Prepared By RB
Project No.	E21027	Checked By AK
Subject	Phosphorous Loading	

Pre-dev	Area (ha)	Imp. (ha)	P coef	P load (kg/yr)
1. Transition (Area 101)	0.39		0.07	0.03
2. Transition (Area 102)	0.03		0.07	0.00
Total	0.42			0.03

Post-dev	Area (ha)	Imp. (ha)	P coef	P load (kg/yr)
1. Residential (Area 201 Laneway)	0.11	0.06	0.41	0.19
1. Residential (Area 201 - West Rear Yard)	0.11	0.06	0.41	0.17
1. Residential (Area 201 -Front Roof Leader)	0.10	0.10	0.41	0.29
2. Residential (Area 202)	0.05	0.02	0.41	0.06
3. Residential (Area 203)	0.01	0.01	0.41	0.01
4. Residential (Area 204)	0.04	0.02	0.41	0.05
Total	0.42			0.76

	201	201	201	202	203	204
TPi	0.41	0.41	0.41	0.41	0.41	0.41
Precip (Burnside Report)	788.00	788.00	788.00	788.00	788.00	788.00
Pj fraction of precip that produce runoff	0.90	0.90	0.90	0.90	0.90	0.90
Rv runoff coefficient	0.58	0.53	1.00	0.40	0.51	0.39
10^-2	0.01	0.01	0.01	0.01	0.01	0.01
Cal P Load	0.19	0.17	0.29	0.06	0.01	0.05

Phosphorus Export (kg/ha/yr) = TPi x Precip x Pj x RV x 10^-2

residential = 0.41 mg/L

commercial = 0.20 mg/L

transportation = 0.50 mg/L

industrial = 0.41 mg/L

Project Name	Chimney Hill Way					Prepared By RB																															
Project No.	E21027					Checked By AK																															
Subject	BMP TP Removal Summary - Treatment Train																																				
Pre-Development0.03 kg P/yr Post-Development0.76 kg P/yr Required Removal0.73 kg P/yr																																					
Treatment Train 1																																					
	LID Measure	Area (ha)	% ² Treated	% ³ Removal	P _{in}	P _{removed}	P _{remaining}																														
1	Wet Detention Facility (Area 201, 202, 203, 204)	0.31	100%	63%	0.59	0.37	0.22																														
	Total					0.37																															
² Based on percentage of annual rainfall treated ³ TP removal based on Table 11 of the Hutchison Environmental Sciences Ltd., dated Oct 2014 ⁴ TP removal based on discussion with KRCA (See Appendix F)																																					
Treatment Train 2																																					
	LID Measure	Area (ha)	% ² Treated	% ³ Removal	P _{in}	P _{removed}	P _{remaining}																														
1	Infiltration Trenches (Area 201 - Rear Yards)	0.11	83%	100%	0.17	0.14	0.03																														
	Infiltration Trenches (Area 201 - Rear Yards)		17%	60%	0.03	0.00	0.03																														
3	Wet Detention Facility		100%	63%	0.03	0.02	0.01																														
	Total					0.16																															
² Based on percentage of annual rainfall treated ³ TP removal based on Table 11 of the Hutchison Environmental Sciences Ltd., dated Oct 2014 ⁴ TP removal based on discussion with KRCA (See Appendix F)																																					
<table><tr><th colspan="6">Phosphorous Removal Summary Table</th></tr><tr><th></th><th>Area</th><th>P_{loading}</th><th>Total % Removal</th><th>Total P Removal</th><th></th></tr><tr><td>Treatment Train 1</td><td>0.31</td><td>0.59</td><td>63%</td><td>0.37</td><td>kg P/yr</td></tr><tr><td>Treatment Train 3</td><td>0.11</td><td>0.17</td><td>94%</td><td>0.16</td><td>kg P/yr</td></tr><tr><td>Total Removal</td><td colspan="3"></td><td>0.54</td><td>kg P/yr</td></tr></table>								Phosphorous Removal Summary Table							Area	P _{loading}	Total % Removal	Total P Removal		Treatment Train 1	0.31	0.59	63%	0.37	kg P/yr	Treatment Train 3	0.11	0.17	94%	0.16	kg P/yr	Total Removal				0.54	kg P/yr
Phosphorous Removal Summary Table																																					
	Area	P _{loading}	Total % Removal	Total P Removal																																	
Treatment Train 1	0.31	0.59	63%	0.37	kg P/yr																																
Treatment Train 3	0.11	0.17	94%	0.16	kg P/yr																																
Total Removal				0.54	kg P/yr																																
Percentage of Target Removal				73%																																	
Total Post-Development P Loading				0.23 kg P/yr																																	

Project Name	Chimney Hill Way	Prepared By	RB
Project No.	E21027	Checked By	AK
Subject	Infiltration Swale Calculations		

Equation 4.2: Maximum Allowable Infiltration Trench Depth (MOE SWMP Manual, 2003)

$$d = PT / 1000$$

k = Hydraulic Conductivity

P = Percolation Rate

T = Drawdown time

d = Maximum allowable depth of the Infiltration Trench

2.3x(10 ⁻⁷)	m/s
12	mm/hr
48	hr
0.58	m

Equation 4.3: Infiltration Trench Bottom Area (MOE SWMP Manual, 2003)

$$A = 1000 V / P n t$$

n = Porosity of the Storage Media

A = Area to IT (m²)

L = Length of bed

W = Width of bed

D = Depth of bed

A = Bottom Area (m²)

V = Provided Volume (m³)

d = Provide runoff depth (mm)

1						
0.4						
1100						
57.35						
1.0						
0.5						
57.4						
11						
10						

Min. Finished Grade	269.76
Bottom of Trench	268.96
Ground water (approx 3.5mbgs)	266.67
Separation to GW (m)	2.29