FUNCTIONAL SERVICING REPORT

Prepared For

145 SPEEDVALE INC.

Proposed C-Store, Gas Bar and Car Wash

145 Speedvale Avenue West

Guelph, ON N1K 1K5

PREPARED BY

GAMA Engineering Inc.

Consulting Structural, Mechanical, Electrical and Civil Engineers

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Revision 0

October 2021

GamaEng Project No. 1808

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1. INTRODUCTION AND BACKGROUND

1.1 Overview

Gama Engineering Inc. has been retained by 145 SPEEDVALE INC. to provide engineering services for the proposed development at 145 Speedvale Avenue West, Guelph, Ontario. (See Figure 1 for location plan.)

The proposed development consists in construction of a Convenience Store, Carwash and Gas Bar with related canopy and underground fuel tanks and Car Wash buildings, parking lot and driveways.

This report will outline the functional servicing strategy of the proposed development and will provide detailed information of proposed servicing system. Please refer to Site Plan and Engineering Plans prepared by Gama Engineering.

1.2 Background Information

The following documents were referenced in the preparation of this report.

- MECP Stormwater Management Practices Planning and Design Manual (Ministry of Environment, March 2003)
- City of Guelph Development Engineering Manual (V-2, January 2019)
- Low Impact Development Stormwater Management Planning and Design Guide, Version 1.0 (CVC and TRCA, 2010)
- Erosion & Sediment Control Guidelines for Urban Construction (TRCA, December 2006)

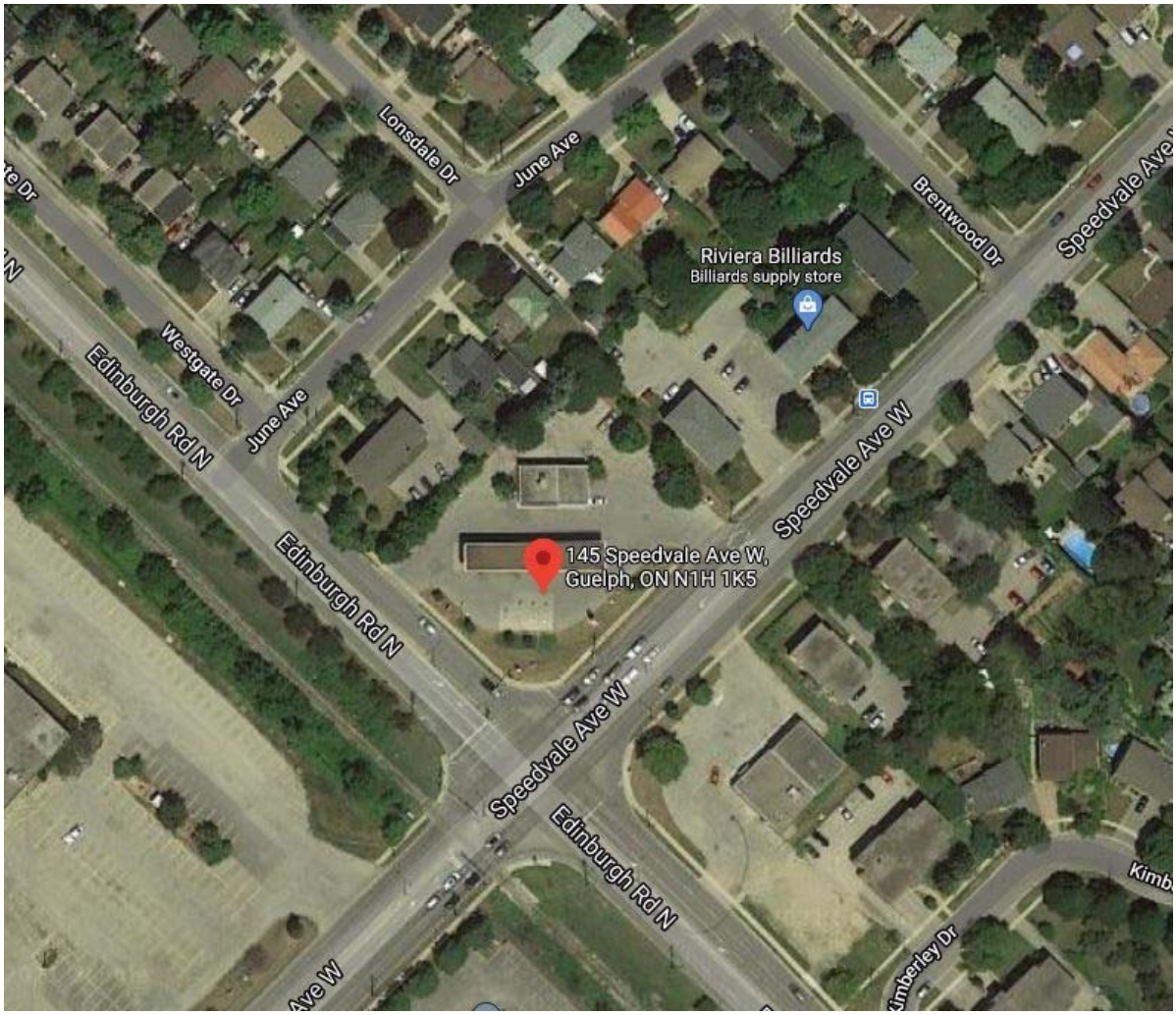

Figure 1 Location Plan

2. STORMWATER MANAGEMENT

2.1 Objectives of Stormwater Management Study

The objectives of the stormwater management study are to develop a strategy for the project that will:

- Identify potential stormwater runoff (quality and quantity) impacts to the receiving storm drainage networks from the proposed development area.
- Address concerns from the review agencies including the City of Guelph and the Ministry of Environment, Climate and Parks (MECP) for the preparation of a stormwater management study for quantity and quality purposes
- Provide an appropriate site drainage system for safe operational use.

2.2 Design Criteria

In accordance with City of Guelph Design Criteria the following stormwater management criteria will be applied:

Quantity Control

The stormwater management servicing strategy proposed for the development has been prepared per City of Guelph requirement, abiding by the following guidelines.

- Post-development peak flow rates are not to exceed the corresponding pre-development peak flow rates for the 1 in 2 Year, 1 in 5 Year, 1 in 10 Year, 1 in 25 Year, 1 in 50 Year and the 1 in 100 Year design storm events.
- Excess runoff generated by storms up to and including the 1 in 100 Year event must be contained onsite and released at the allowable release rate defined above.
- A safe overland discharge to be provided for storm events that exceed the 1 in 100 Year storm event parameters.

Quality Control

A treatment train approach to stormwater management will be applied, conform to MECP (Stormwater Management Planning and Design Manual, MECP, 2003) to achieve the "ENHANCED LEVEL" quality control treatment (80% long term removal of total suspended solids and hydrocarbon pollutants form the runoff generated on site).

Water Balance

Maintain pre-development or better water balance via on site permanent retention and infiltration of a minimum 5mm rainfall, 24 hr event.

Erosion Control

Erosion and sediment control measures will be implemented in accordance with Erosion & Sediment Control Guidelines for Urban Construction – TRCA December 2006.

2.3 Land Use

The study area is 0.325 ha of bare land designated for commercial use.

2.4 Pre-Development Conditions

The area under stormwater management is approximately 0.325 ha existing developed land is comprised of a joint gas bar & store building with open space paved parking lot. Stormwater runoff generated on site flows uncontrolled overland towards the site perimeter.

On the south of property limit, the runoff discharges into municipal storm sewers on Speedvale Avenue, respectively. On the west property limit the runoff discharges into municipal storm sewers on Edinburgh Road.

The rainfall intensity for all storm events is calculated per IDF parameters provided by City of Guelph as follows:

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

For the estimated time of concentration of 5 minutes the rainfall intensity for all storm events are shown on Table 1 below

Storm Event	Rainfall Intensity (mm/hr)			
	a	b	c	I
2-Year	743	6	0.7989	109.40
5-Year	1593	11	0.8789	139.29
10-Year	2221	12	0.9080	169.55
25-Year	3158	15	0.9355	191.56
50-Year	3886	16	0.9495	215.80
100-Year	4688	17	0.9624	239.35

Table 1 Rainfall Intensity for 2 to 100 Year Storm Events

The corresponding 2 -Year pre-development peak flow is:

$$Q = 0.00278\ C\ I\ A \quad \leftarrow Equation\,(1)$$

$$Where\ Q := Maximum\ Runoff\ Rate\,(m^3/sec)$$

$$C := Runoff\ Coefficient$$

$$I := Rainfall\ Intensity\,(mm/hr)$$

$$A := Drainage\ Area\,(ha)$$

$$Q_2 = 0.00278\ x\ 0.10\ x\ 109.40\ mm/hr\ x\ 0.325\ ha = \ 0.0099\ m^3/sec$$

Pre-Development drainage pattern and runoff coefficient are shown on Appendix 1 of this report, Drainage Plan-Detail 1.

2.5 Post Development Conditions

The post-development hydrologic conditions for the site were established utilizing the current City of Guelph design criteria. A conservative surface run-off coefficient of 0.90

was used for impervious surfaces (i.e., Roof drainage and parking area) and 0.2 was used for pervious surfaces (i.e. landscape).

The proposed site stormwater drainage, quantity and quality control strategy has been developed to capture, control and treat the stormwater on site.

The water level will remain below ground for all major storm events. When the storm exceeds the 1 in 100 Year event parameters the water level will reach maximum possible surface ponding at elevation 335.48 m and will discharge via laminar flow at site's driveway entrance onto Edinburgh Road.

For practical reasons the run-off generated by a small portion of landscape area along the property limit and the southern entrance will flow uncontrolled towards the Avenue.

The storm runoff will be restricted to the pre-development flow rates via an orifice plate restrictor located at exiting STM/MH #1 before the flow discharges into existing municipal storm line on Edinburgh Road.

The weighted surface run-off coefficients for existing and proposed conditions, are shown on Table 2 and Table 3 below.

Surface Composition		Impervious	Pervious	Total
Existing Condition	(m^2)	2595.97	654.10	3250.07
	(ha)	0.260	0.065	0.325
Runoff Coefficient		0.900	0.200	0.759

Table 2 Weighted Run-off Coefficient - Existing Condition

Surface Composition		Impervious	Pervious	Total
Proposed Condition	(m^2)	2541.22	708.85	3250.07
	(ha)	0.254	0.071	0.325
Runoff Coefficient		0.900	0.200	0.747

Table 3 Weighted Surface Run-Off Coefficient – Proposed Condition

For the purpose of this study the variation of runoff coefficient of the catchment areas and the amount of uncontrolled runoff has been ignored as insignificant.
The proposed site is being analysed as one catchment area with the weighted runoff coefficient calculated per Table 3.
The results of peak flow rates (m^3) generated by the "Rational Method" for existing and proposed conditions is shown on Table 4 below

Storm Event	Rainfall Intensity (mm/hr)				<Equation 1> Flow Rate (m^3/sec)		
	a	b	c	I	Existing	Proposed	Excess Flow
2-Year	743	6	0.7989	109.40	0.0750	0.0739	-0.0012
5-Year	1593	11	0.8789	139.29	0.0955	0.0941	-0.0015
10-Year	2221	12	0.9080	169.55	0.1163	0.1145	-0.0018
25-Year	3158	15	0.9355	191.56	0.1314	0.1293	-0.0020
50-Year	3886	16	0.9495	215.80	0.1480	0.1457	-0.0023
100-Year	4688	17	0.9624	239.35	0.1642	0.1616	-0.0026

Table 4 Peak Flow Rates – 2 to 100 Year Storm Events

Post Development drainage pattern, stormwater controls, storage and overland flow route are shown on Drawing GP-4 Post Development Drainage Plan.

2.6 Storage Requirements

With the proposed development, the drainage pattern is expected to change, resulting in increased post-development run-off coefficients as shown on Table 4.

To mitigate the impacts of the proposed development, onsite storage and flow control is provided via orifice pipe restrictor located at existing STM/MH at Edinburgh Road to limit the release rate to pre-development rates or less for all Storm Events up to and including 1 in 100 Year Event.

Sizing of the orifice is given by the formula:

$$Q = CA\sqrt{2gh} \leftarrow Equation\ (2)$$

Where *Q = Flow Rate through orifice (m^3/sec) = Q allowable*

C = Contraction Coefficient = 0.82 (for orifice pipe)

A = Area of orifice opening (m^2)

g = Gravity acceleration (m/sec^2) = 9.81 m/sec^2

h = Pressure head to be dissipated (m)

By trial-and-error calculations a 70mm diameter orifice opening is required to control the flow rate to the allowable rate.

Based on the chosen size of orifice pipe the maximum required retention volume is calculated using the “Modified Rational Method” and is shown on Table 5.

Stm Event	Td	Id	Qpost	Qpredev	Excess Flow	Volume(cum)
	1	290.34	0.2451	0.1250	0.120	7.20
	2	275.62	0.2326	0.1250	0.108	12.92
	3	262.35	0.2214	0.1250	0.096	17.36
	4	250.31	0.2113	0.1250	0.086	20.71
	5	239.35	0.2020	0.1250	0.077	23.11
100 Year	6	229.33	0.1936	0.1250	0.069	24.68
	7	220.13	0.1858	0.1250	0.061	25.53
	8	211.65	0.1786	0.1250	0.054	25.75
	9	203.81	0.1720	0.1250	0.047	25.39
	10	196.54	0.1659	0.1250	0.041	24.53
				Max Volume Required	cum	**25.75**

Table 5 Required Storage Volume

Referring to Table 5 above, 25.75 m^3 is the required on-site storage volume during a 100-Year return Storm Event.

The required storage volume is achieved by surface ponding at approximately 336.45m of surface ponding elevation. The post development runoff rate is calculated per Equation (2) as follows:

$$Q100 = 0.63\,\pi\,(0.1^2/4)\sqrt{2(9.81)\left(336.45-\left(334.34+\frac{0.1}{2}\right)\right)}$$

$$= 0.0512\ m^3/\text{sec}\ < 0.0750\ m^3/\text{sec}\ (Allowable\ sewer\ load)$$

$$< 0.1642\ m^3/\text{sec}\ (Pre-development\ 100-Year\ Storm)$$

Tables 6 below shows all of stormwater storage provided by the manholes, other underground structures and piping and parking lot surface ponding.

Structure	Diameter (mm)	Area (m^2)	Maximum. Water level	Invert	Volume (m^3)
CB#1	600x600	0.36	335.85	334.45	0.50
CB#2	600x600	0.36	336.20	335.25	0.34
CB#3	600x600	0.36	336.20	335.30	0.32
STM/MH#1	1200.00	1.13	336.10	334.85	1.41
Sum					**2.58**

U/G Conduit	Diameter (m)	Area (m^2)	Length (m)	Volume (m^3)
1	200.00	0.03	30.10	0.95
2	250.00	0.05	19.50	0.96
3	250.00	0.05	31.70	1.56
4	200.00	0.03	7.00	0.22
Sum				**3.68**

Storage Volume For 100-Year Event (m^3)	
Catch Basins & Manholes	2.58
Underground Conduits	3.68
Surface Ponding	19.48
Total Provided	**25.75**

Table 6 Maximum On-Site Provided Storage

The proposed drainage system can store 25.75m^3 of stormwater runoff at surface ponding elevation 336.45 m to meet the required storage volume 19.48 m^3 during the 100-Year return storm event.

The provided surface ponding volumes are calculated via 3D modelling for the corresponding water levels for 2-Year, 25-Year, 100-Year return Storm Event and the maximum available storage when the event exceeds the 100-Year parameters or during a system failure.

When the Storm Event exceeds the 100-Year return storm event and all underground storage volume is used, the system has an extra stormwater storage capacity of 25.75 m^3 of surface ponding before the water level reaches the maximum ponding elevation 336.50m.

When all provided stormwater storage volume is used or during a system failure, the stormwater will be discharged via laminary flow at site entrance driveway onto Speedvale Avenue West drainage system.

2.7 Quality Control

For quality control purposes, existing Stormceptor STC 750 oil/grit separator unit is to remain as a pre-treatment device for the western portion of the site collecting waters from gas bar area, and C-store
Sizing and performance of Stormceptor oil/grit separator unit is based on guidelines provided by manufacturer using the independently tested CA ETV particle distribution.

The proposed OGS units provide respectively an estimated 63% and 61% annual sediment reduction (TSS removal).
"ENHANCED LEVEL" (80% of long term suspended solids removal) is achieved by sequential treatment provided by the storm chamber isolator rows and infiltration beds. The combined sequential treatment is estimated to be about 88%.

Detailed Sizing Reports for STC 750 is shown on Appendix 2 of this report.
The "*Stormceptor STC Technical Manual*" and "*Isolator Row O&M Manual*" are attached for reference.

3. EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

The erosion potential of the study area was assessed using methods described in the "*MTO Drainage Management Manual*" of temporary erosion and sediment control measures suitable for construction sites close to highways.

During Site construction, various temporary measures will be implemented to prevent the discharge of sediment laden Stormwater from the Site. These measures include silt fencing, catch basin buffers and mud-mats as shown on drawing GP-1 - Grading Plan.

In addition to the above, the following "good housekeeping" measures are recommended:

- All exposed soil shall be stabilized as soon as possible with a seed and mulch application as directed by the Engineer.
- No construction activity or machinery shall intrude beyond the silt/snow fence or limit of construction area. All construction vehicles shall leave the site at designated locations as shown on the plans.
- Stockpiles of soil shall be set back from any watercourse and stabilized against erosion as soon as possible. A set back of at least 15m from any top-of-bank, watercourse or pond is required.
- Cleaning and repairs of mud-mats and any other temporary sediment control measures shall be completed as deemed necessary through regular inspection.
- Sediment/silt shall be removed from the sediment control devices after storm events and deposited in areas as approved by the engineer.
- All re-graded areas within the development which are not occupied by buildings, roadways, sidewalks, or driveways shall be top-soiled and sodded/seeded immediately after completion of final grading operations as directed by the engineer.

4. SUMMARY AND CONCLUSIONS

In summary, all required conditions of the Township of Cavan Monaghan have been satisfied as follows:

- There is no increase in Stormwater flow from the Site.
- The SWM facilities provide ENHANCED LEVEL of quality treatment.
- The Sediment and Erosion Control Plan demonstrates how erosion and sedimentation will be minimized during construction

This SWM Report satisfies all requirements for stormwater quantity, quality, and sedimentation and erosion control.

5. SANITARY SEWER SERVICING

5.1. OVERVIEW

The proposed C-store and Carwash Building will be serviced by a new 200mm diameter sanitary service at a slope of 0.48 % (full flow capacity = 22.2 L/s) discharging into existing SAN/MH #1.

The proposed Convenience Store building will be serviced by 150mm sanitary service to a new SAN/MAN #2 and the proposed Carwash building will be serviced by 150mm sanitary service to a new 3 compartment interceptor and then into the prosed SAN/MH #2.

Existing SAN/MH#1 is connected to the existing 300mm diameter sanitary main on Edinburgh Drive via 250mm diameter sanitary lateral at 0.4% slope.

Refer to Drawing GP-2 Servicing Plan for details on proposed site sanitary services and connections.

As per the anticipated sewage flow from the proposed development; a downstream analysis has been completed to confirm the existing sanitary sewer system has adequate capacity to service the proposed development.

6. DOMESTIC AND FIRE WATER SERVICE

6.1. OVERVIEW

The proposed development consists of Convenience store and carwash with an approximate total gross floor area of 340 m^2.
The Convenience Store building will have an approximate gross floor area of 142 m^2.

The Carwash and C-Store building will be serviced by a 100mm diameter PVC water service lateral connected via cut-in TEE on existing 50mm diameter PVC watermain on Edinburgh Drive.

The Convenience Store and Carwash building will be serviced by 100mm diameter

Details and description of water service for the proposed facility at 145 Speedvale Avenue in Guelph is shown on Drawing GP-2 Servicing Plan.

5.0 SUMMARY AND CONCLUSIONS

Based on information and analysis provided in this report, it is concluded that the proposed works meet the requirements of the City of Guelph and other regulatory agencies.

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Appendix 1
SUPPORTING CALCULATIONS

Stm Event	Td	Id	Qpost	Qpredev	Excess Flow	Volume(cum)
	1	290.34	0.2451	0.1250	0.120	7.20
	2	275.62	0.2326	0.1250	0.108	12.92
	3	262.35	0.2214	0.1250	0.096	17.36
	4	250.31	0.2113	0.1250	0.086	20.71
	5	239.35	0.2020	0.1250	0.077	23.11
100 Year	6	229.33	0.1936	0.1250	0.069	24.68
	7	220.13	0.1858	0.1250	0.061	25.53
	8	211.65	0.1786	0.1250	0.054	25.75
	9	203.81	0.1720	0.1250	0.047	25.39
	10	196.54	0.1659	0.1250	0.041	24.53
				Max Volume Required	cum	**25.75**

Stm Event	Td	Id	Qpost	Qpredev	Excess Flow	Volume(cum)
	1	263.75	0.2137	0.1250	0.089	5.32
	2	249.82	0.2024	0.1250	0.077	9.29
	3	237.32	0.1923	0.1250	0.067	12.11
	4	226.03	0.1831	0.1250	0.058	13.96
	5	215.80	0.1749	0.1250	0.050	14.96
50 Year	6	206.48	0.1673	0.1250	0.042	15.23
	7	197.94	0.1604	0.1250	0.035	14.86
	8	190.10	0.1540	0.1250	0.029	13.94
	9	182.88	0.1482	0.1250	0.023	12.52
	10	176.19	0.1428	0.1250	0.018	10.66
				Max Volume Required	cum	**15.23**

Stm Event	Td	Id	Qpost	Qpredev	Excess Flow	Volume(cum)
	1	236.02	0.1753	0.1250	0.050	3.02
	2	223.01	0.1656	0.1250	0.041	4.88
	3	211.40	0.1570	0.1250	0.032	5.76
	4	200.97	0.1493	0.1250	0.024	5.83
	5	191.56	0.1423	0.1250	0.017	5.18
25 Year	6	183.01	0.1359	0.1250	0.011	3.94
	7	175.22	0.1301	0.1250	0.005	2.16
	8	168.08	0.1248	0.1250	0.000	-0.08
	9	161.52	0.1200	0.1250	-0.005	-2.72
	10	155.47	0.1155	0.1250	-0.010	-5.72
				Max Volume Required	cum	**5.83**

Stm Event	Td	Id	Qpost	Qpredev	Excess Flow	Volume(cum)
	1	216.32	0.1461	0.1250	0.021	1.26
	2	202.24	0.1366	0.1250	0.012	1.39
	3	189.96	0.1283	0.1250	0.003	0.59
	4	179.15	0.1210	0.1250	-0.004	-0.97
	5	169.55	0.1145	0.1250	-0.011	-3.15
10 Year	6	160.98	0.1087	0.1250	-0.016	-5.87
	7	153.26	0.1035	0.1250	-0.022	-9.04
	8	146.29	0.0988	0.1250	-0.026	-12.59
	9	139.95	0.0945	0.1250	-0.031	-16.47
	10	134.16	0.0906	0.1250	-0.034	-20.65
				Max Volume Required	cum	1.39

Stm Event	Td	Id	Qpost	Qpredev	Excess Flow	Volume(cum)
	1	179.36	0.1211	0.1250	-0.004	-0.23
	2	167.17	0.1129	0.1250	-0.012	-1.45
	3	156.63	0.1058	0.1250	-0.019	-3.46
	4	147.42	0.0995	0.1250	-0.025	0.00
	5	139.29	0.0941	0.1250	-0.031	0.00
5 Year	6	132.06	0.0892	0.1250	-0.036	0.00
	7	125.59	0.0848	0.1250	-0.040	0.00
	8	119.76	0.0809	0.1250	-0.044	0.00
	9	114.48	0.0773	0.1250	-0.048	0.00
	10	109.68	0.0741	0.1250	-0.051	0.00
				Max Volume Required	cum	0.00

Stm Event	Td	Id	Qpost	Qpredev	Excess Flow	Volume(cum)
	1	156.98	0.1060	0.1250	-0.019	-1.14
	2	141.09	0.0953	0.1250	-0.030	0.00
	3	128.42	0.0867	0.1250	-0.038	0.00
	4	118.06	0.0797	0.1250	-0.045	0.00
	5	109.40	0.0739	0.1250	-0.051	0.00
2 Year	6	102.05	0.0689	0.1250	-0.056	0.00
	7	95.73	0.0646	0.1250	-0.060	0.00
	8	90.23	0.0609	0.1250	-0.064	0.00
	9	85.39	0.0577	0.1250	-0.067	0.00
	10	81.10	0.0548	0.1250	-0.070	0.00
				Max Volume Required	cum	0.00

Appendix 2
STORMCEPTOR STC SIZING REPORTS

Detailed Stormceptor Sizing Report – Guelph

Project Information & Location			
Project Name	145 Speedvale Ave. west	**Project Number**	1808
City	Guelph	**State/ Province**	Ontario
Country	Canada	**Date**	10/14/2021
Designer Information		**EOR Information (optional)**	
Name	Jay Goudarzi	**Name**	Wajid Mansuri
Company	GAMA Engineering Inc.	**Company**	
Phone #	905-264-9295	**Phone #**	
Email	jgoudarzi@gamaeng.ca	**Email**	wmansuri@gamaeng.ca

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	Guelph
Recommended Stormceptor Model	STC 300
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	85
PSD	City of Kitchener
Rainfall Station	WATERLOO WELLINGTON A

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 300	85
STC 750	91
STC 1000	92
STC 1500	92
STC 2000	94
STC 3000	94
STC 4000	96
STC 5000	96
STC 6000	97
STC 9000	98
STC 10000	98
STC 14000	98
StormceptorMAX	Custom

Stormceptor
The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for each rainfall event, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur.
Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Design Methodology
Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:
• Site parameters
• Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
• Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
• TSS load
• Detention time of the system

Hydrology Analysis
PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of Stormceptor are based on the average annual removal of TSS for the selected site parameters. The Stormceptor is engineered to capture sediment particles by treating the required average annual runoff volume, ensuring positive removal efficiency is maintained during each rainfall event, and preventing negative removal efficiency (scour). Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station			
State/Province	Ontario	**Total Number of Rainfall Events**	2980
Rainfall Station Name	WATERLOO WELLINGTON A	**Total Rainfall (mm)**	16119.1
Station ID #	9387	**Average Annual Rainfall (mm)**	474.1
Coordinates	43°27'N, 80°23'W	**Total Evaporation (mm)**	1113.8
Elevation (ft)	1028	**Total Infiltration (mm)**	3184.0
Years of Rainfall Data	34	**Total Rainfall that is Runoff (mm)**	11821.3

Notes
• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules. • Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed. • For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

Drainage Area	
Total Area (ha)	0.33
Imperviousness %	80.00

Up Stream Storage	
Storage (ha-m)	Discharge (cms)
0.000	0.000

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (L)	
Peak Conveyed Flow Rate (L/s)	
Water Quality Flow Rate (L/s)	

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cms)	

Design Details	
Stormceptor Inlet Invert Elev (m)	
Stormceptor Outlet Invert Elev (m)	
Stormceptor Rim Elev (m)	
Normal Water Level Elevation (m)	
Pipe Diameter (mm)	
Pipe Material	
Multiple Inlets (Y/N)	No
Grate Inlet (Y/N)	No

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

City of Kitchener		
Particle Diameter (microns)	Distribution %	Specific Gravity
2.0	2.1	2.65
5.0	2.1	2.65
8.0	3.2	2.65
20.0	2.1	2.65
45.0	1.1	2.65
75.0	2.1	2.65
106.0	30.7	2.65
425.0	20.0	2.65
850.0	17.6	2.65
2000.0	12.2	2.65
4750.0	6.8	2.65

Site Name	Guelph

Site Details

Drainage Area

Total Area (ha)	0.33
Imperviousness %	80.00

Surface Characteristics

Width (m)	115.00
Slope %	2
Impervious Depression Storage (mm)	0.508
Pervious Depression Storage (mm)	5.08
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Maintenance Frequency

Maintenance Frequency (months) >	12

Infiltration Parameters

Horton's equation is used to estimate infiltration

Max. Infiltration Rate (mm/hr)	61.98
Min. Infiltration Rate (mm/hr)	10.16
Decay Rate (1/sec)	0.00055
Regeneration Rate (1/sec)	0.01

Evaporation

Daily Evaporation Rate (mm/day)	2.54

Dry Weather Flow

Dry Weather Flow (lps)	0

Winter Months

Winter Infiltration	0

TSS Loading Parameters

TSS Loading Function	

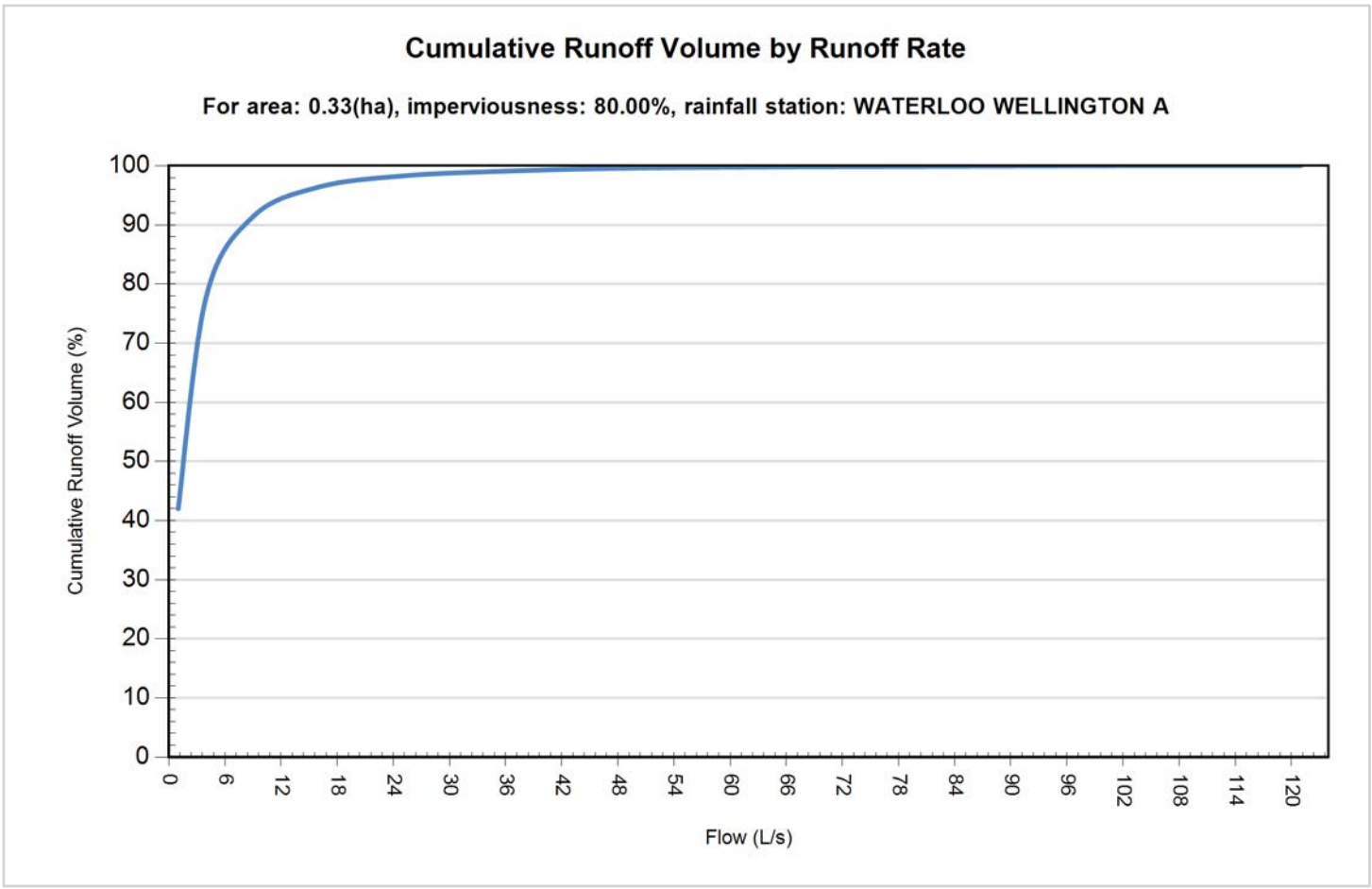
Buildup/Wash-off Parameters

Target Event Mean Conc. (EMC) mg/L	
Exponential Buildup Power	
Exponential Washoff Exponent	

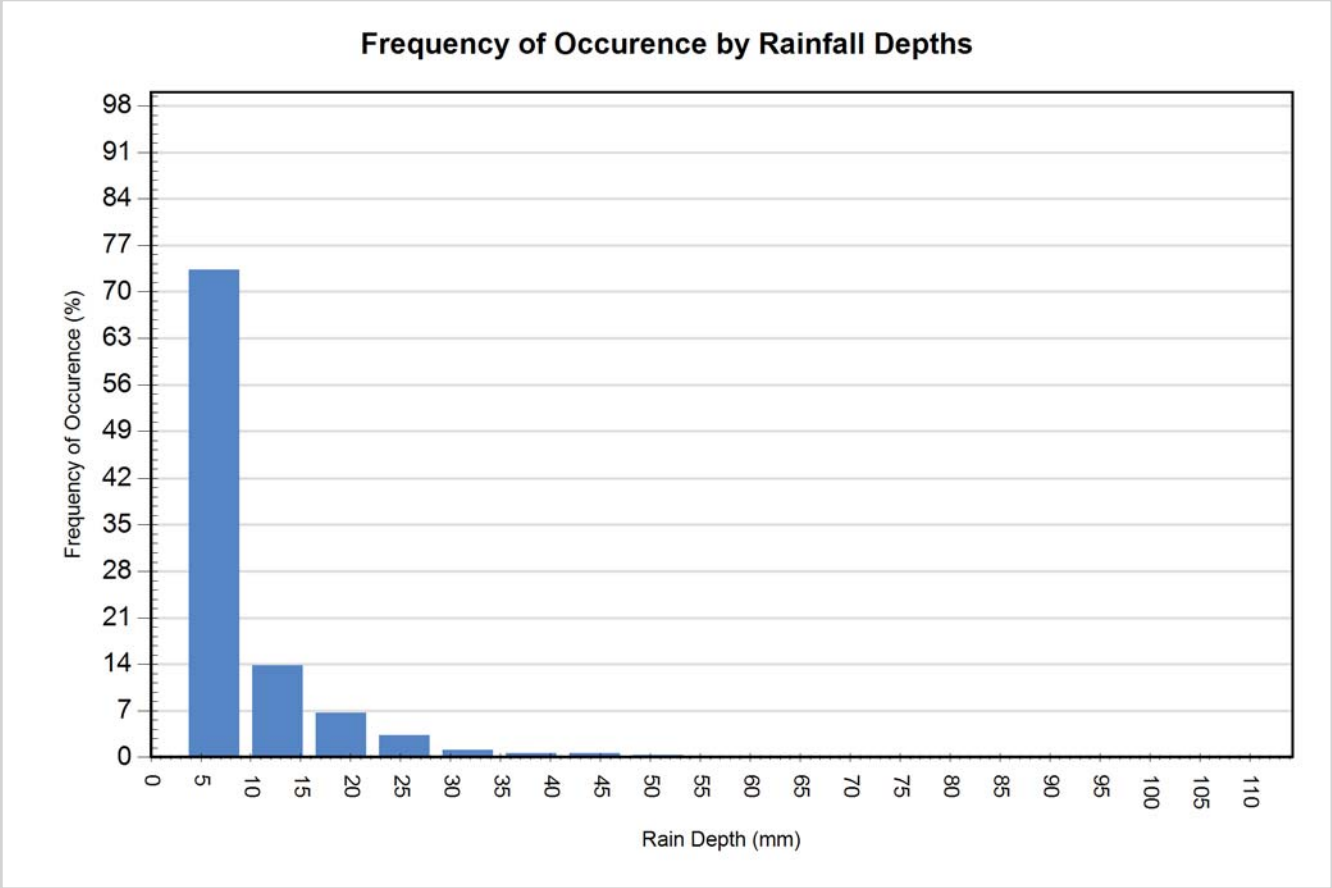
TSS Availability Parameters

Availability Constant A	
Availability Factor B	
Availability Exponent C	
Min. Particle Size Affected by Availability (micron)	

Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (L/s)	Runoff Volume (m³)	Volume Over (m³)	Cumulative Runoff Volume (%)
1	16502	22775	42.0
4	30579	8696	77.9
9	35879	3396	91.4
16	37875	1400	96.4
25	38619	656	98.3
36	38941	334	99.1
49	39114	161	99.6
64	39205	70	99.8
81	39249	26	99.9
100	39266	10	100.0
121	39275	0	100.0



Rainfall Event Analysis				
Rainfall Depth (mm)	No. of Events	Percentage of Total Events (%)	Total Volume (mm)	Percentage of Annual Volume (%)
6.35	2184	73.3	3643	22.6
12.70	411	13.8	3779	23.4
19.05	199	6.7	3108	19.3
25.40	97	3.3	2102	13.0
31.75	34	1.1	964	6.0
38.10	17	0.6	590	3.7
44.45	18	0.6	723	4.5
50.80	8	0.3	380	2.4
57.15	4	0.1	212	1.3
63.50	0	0.0	0	0.0
69.85	4	0.1	267	1.7
76.20	0	0.0	0	0.0
82.55	0	0.0	0	0.0
88.90	3	0.1	256	1.6
95.25	1	0.0	93	0.6
101.60	0	0.0	0	0.0
107.95	0	0.0	0	0.0



For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications