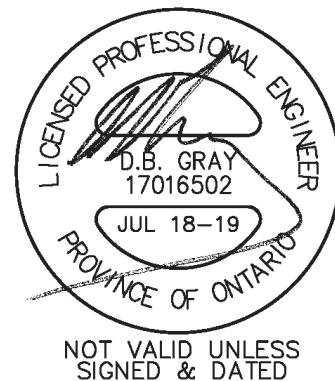


SERVICING BRIEF & STORMWATER MANAGEMENT REPORT

1499 Star Top Road
Ottawa, Ontario

Report No. 18073

July 18, 2019



Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

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SERVICING BRIEF & STORMWATER MANAGEMENT REPORT

1499 Star Top Road
Ottawa, Ontario

This report describes the services and addresses the stormwater management requirements of a 2.1 hectare property at 1499 Star Top Road in Ottawa. There is an existing office / warehouse building, 4,683 sq.m. in area, and an existing 743 sq.m. manufacturing building on the property; both will remain. There is also an existing 439 sq.m. retail building to be demolished. (A 149 sq.m. storage building was demolished in June 2019.) Virtually the entire site is currently hard surfaces (roofs, concrete and asphalt). A 1,352 sq.m. unheated storage building is proposed.

This report forms part of the stormwater management design for the proposed development. Refer to drawing C-1 to C-5 also prepared by D. B. Gray Engineering Inc.

WATER SUPPLY FOR FIREFIGHTING:

There is an existing private fire hydrant on the property approximately 19m to 40m from front façade of the proposed building. There is also a fire hydrant in the municipal road right-of-way adjacent to the northwest corner of the property connecting to an existing 300 mm municipal watermain in Star Top Road.

A fire flow of 167 L/s (10,000 L/min) is required, as calculated as per the Fire Underwriter Survey "Water Supply For Fire Protection".

The boundary conditions for the 167 L/s fire flow (based on the city's computer model of the municipal water distribution system) was received from the City. They include a HGL (hydraulic grade line) of 108.5m during the above flow rate in the 300mm municipal watermain at the subject location which calculates to be 414 kPa (60 psi). Since the pressure is above 138 kPa (20 psi) there is an adequate water supply for firefighting from the municipal fire hydrant.

A model was created using EPANET software to analyze the hydraulics of the existing private watermain and private fire hydrant. Using the 108.5 m HGL boundary condition provided by the City and it was determined that only 120 L/s is available (at 141 kPa / 20.4 psi). (Higher flows are available at the private hydrant (probably 125 to 135 L/s) which could be calculated if boundary conditions were available at these flow rates.

WATER SERVICE:

The proposed unheated building does not have any plumbing fixtures; therefore a water service connection is not required.

SANITARY SERVICE:

The proposed unheated building does not have any plumbing fixtures; therefore a sanitary sewer connection is not required.

STORMWATER MANAGEMENT:

Water Quality:

There are currently no quality control measures on the subject property. However, as stated in a City's Pre-application Consultation Memo: *"A Storm Pollution Device will be required to be installed on the Storm outlet near the large City storm Sewer easement."* An oil/grit separator (OGS) manhole is proposed to be located in the last pipe section prior to the connection to the 2600mm x 3750mm CSPA municipal storm sewer located in an easement on the subject property adjacent to the south property line. An AquaShield Aqua-Swirl Concentrator model AS-3 BYP was selected to achieve a minimum 80% TSS removal. Based on software supplied by the manufacturer, the Aqua-Swirl AS-3 will remove approximately 83% of TSS from the runoff produced by the drainage area draining into the existing storm sewer system being modified. Output from the manufacturer's software is attached to the report. The Aqua-Swirl model AS-3 BYP has a sediment capacity of 0.56 cubic metres and an oil/debris capacity of 417 litres.

An erosion and sediment control plan has been developed to be implemented during construction, (see drawing C-2 and notes 2.1 to 2.7 on drawing C-3). In summary: to filter out construction sediment a silt fence barrier will be installed adjacent to the west property line; and sediment capture filter sock inserts will be installed in all existing catch basins adjacent to the site and all new catch basins as they are installed.

Water Quantity:

There are currently no quantity control measures on the subject property. It is proposed that quantity control measures consider only the 6,356 sq.m. of the subject property being re-developed. Specifically, the stormwater management criteria are to control the post development peak flows from the area to be re-developed, for the 5-year and 100-year storm events, to peak flows during the 5-year storm event using a pre-development runoff coefficient; and a 10 minute time of concentration. It is calculated that the pre-development conditions reflect a 5-year runoff coefficient of 0.88. Therefore based on runoff coefficient of 0.88 and using the Rational Method; the maximum allowable release rate is 162.86 L/s for all storm events. The runoff coefficients for the 100 year event are increased by 25% to maximum 1.00.

Stormwater will be stored within the development on the asphalt surface above catch basins.

Drainage Area I

(Uncontrolled Flow Off Site – 3,090 sq.m.):

The runoff into existing catch basins; from the rear of the proposed building; and the entrance to the site will be allowed to flow uncontrolled off the site. The flow from is calculated at 10 minutes concentration.

	100-year	5-year
Maximum flow rate:	136.19 L/s	70.01 L/s

Drainage Area II (2,367 sq.m.):

An inlet control device (ICD) located at the outlet pipe of catch basin/manhole CB/MH-3 will control the release of stormwater from this drainage area. The ICD will restrict the flow and force the stormwater to back up to the asphalt parking area above catch basin CB-4 and CB/MH-3. The ICD shall be a Hydrovex "VHV Vertical Vortex Flow Regulator" and shall be sized by the manufacturer for a discharge rate of 9.16 L/s at 1.81 m head. It is calculated that an orifice area of 7,854 sq.mm. (100 mm in diameter) and a discharge coefficient of 0.196 will restrict the outflow rate to 9.16 L/s at 1.81 m. Based on this orifice the maximum outflow rate for the 1:5 year storm event is calculated to be 9.02 L/s at 1.75 m.

	100-year	5-year
Maximum ICD release rate:	9.16 L/s	9.02 L/s
Maximum water elevation:	65.99 m	65.93 m
Maximum stored volume:	95.52 cu.m.	39.55 cu.m.

Drainage Area III (899 sq.m.):

An inlet control device (ICD) located at the outlet pipe of catch basin CB-2 will control the release of stormwater from this drainage area. The ICD will restrict the flow and force the stormwater to back up to the asphalt parking area above CB-2. The ICD shall be a plug style with a round orifice design (with the orifice located at the bottom of the plug) manufactured by Pedro Plastics (or approved equal) and shall be sized by the manufacturer for a discharge rate of 17.51 L/s at 1.99m head. It is calculated that an orifice area of 4,592 sq.mm. (± 76 mm in diameter) and a discharge coefficient of 0.61 will restrict the outflow rate to 17.51 L/s at 1.99m. Based on this orifice the maximum outflow rate for the 1:5 year storm event is calculated to be 17.22 L/s at 1.93 m.

	100-year	5-year
Maximum ICD release rate:	17.51 L/s	17.22 L/s
Maximum water elevation:	66.08m	66.02 m
Maximum stored volume:	16.38 cu.m.	4.36 cu.m.

The Entire Site:

	100-year	5-year
Maximum permitted release rate:	162.86 L/s	162.86 L/s
Maximum release rate:	162.86 L/s	96.26 L/s
Maximum stored volume:	111.90 cu.m.	43.91 cu.m.

Therefore maximum post-development release rate for the 100-year storm event is calculated to be equal to the maximum allowable at 162.86 L/s and to achieve this release rate the total maximum required stored volume is 111.90 cu.m. The maximum post-development release rate for the 5-year storm event is calculated to be less than the maximum allowable, at 96.26 L/s, and to achieve this release rate the total maximum required stored volume is 43.91 cu.m.

The unrestricted flowrate resulting from one in five-year storm event will produce a peak flow of 171.78 L/s in the last pipe segment of the existing storm sewer system which is slightly undersized (300mm at 2.5% - 159.5 L/s capacity) being at 108% of its capacity. However the proposed inlet control devices (ICDs) will restrict the flow to 127.66 L/s during the one in five storm event so that flow in the last segment will be only at 80% of its capacity. (There is an existing upstream pipe segment that is significantly undersized - being at over 5 times capacity. The proposed ICDs will improve the situation in this pipe segment reducing the flow to about 3.6 times capacity.)

The 127.66 l/s in stormwater flows contributing to the existing the 2600mm x 3750mm CSPA municipal storm sewer is expected to have a positive impact given the post-development flows from the site are being reduced from 171.78 L/s to 127.66 L/s during the 5-year event.

CONCLUSIONS:

1. There is an adequate water supply for firefighting (167 L/s) from the municipal fire hydrant located adjacent to the northwest corner of the subject property. At least 120 L/s is available from the private fire hydrant on the subject property.
2. The proposed building does not have any plumbing fixtures; therefore a water service and sanitary sewer connections are not required.
3. There are currently no quality control measures on the subject property. An oil/grit separator (OGS) manhole is proposed which will remove approximately 83% of TSS from the runoff produced by the drainage area draining into the existing storm sewer system being modified.
4. An erosion and sediment control plan has been developed to be implemented during construction.
5. There are currently no quantity control measures on the subject property. It is proposed that quantity control measures consider only the portion of the subject property being re-developed and the stormwater management criteria are to control the post development peak flows, for the 5-year and 100-year storm events, to peak flows during the 5-year storm event which is calculated to be 162.86 L/s. The maximum post-development release rate for the 100-year storm event is calculated to be equal to the maximum allowable (162.86 L/s) and to achieve this release rate the total maximum required stored volume is 111.90 cu.m. The maximum post-development release rate for the 5-year storm event is calculated to be less than the

maximum allowable (96.26 L/s) and to achieve this release rate the total maximum required stored volume is 43.91 cu.m.

6. The last pipe segment of the existing storm sewer system is adequately sized for the restricted flow (through the ICDs) during the 5-year event.
7. There is an existing upstream pipe segment that is significantly undersized, however the proposed ICDs will improve the situation.
8. The 127.7 l/s in stormwater flows contributing to the existing the 2600mm x 3750mm CSPA municipal storm sewer is expected to have a positive impact given the post-development flows from the site are being reduced from 171.78 L/s to 127.66 L/s during the 5-year event.

D. B. GRAY ENGINEERING INC.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

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12-Mar-19

REVISED 25-Mar-19

Proposed Covered Exterior Storage 1499 Star Top Rd Ottawa, Ontario

Fire Flow Requirements

Fire flow requirement as calculated as per Fire Underwriter Survey "Water Supply For Fire Protection".

$F = 220 C A^{0.5}$ = the required fire flow in litres per minute

C = coefficient related to the type of construction
= 0.8 Non-Combustible Construction (Unprotected structural components)

A = total floor area (all storeys excluding basements at least 50% below grade)

Proposed Church: Storage Slab 1352 sq.m.
TOTAL FIRE AREA: 1352 sq.m.

F = 6,471 L/min
= 6,000 L/min (rounded off to the nearest 1,000 L/min)

15% Change for Combustible Occupancy

= 6,900 L/min

0% Reduction for Sprinkler System

= - L/min

Increase for Separation Exposed Buildings

		Adjacent Building			Length- Height Factor
		Constuction	Length m	Storeys	
18% North	3.1 to 10	N-C	26	2	52
22% East	0 to 3	N-C	30	1	30
8% South	20.1 to 30	N-C	28	2	56
0% West	>45m	N-C	17	1	17
48%	Total Increase for Exposure (maximum 75%)				
=	3,312	L/min Increase			
=	10,212	L/min			
F =	10,000	L/min (rounded off to the nearest 1,000 L/min)			
=	166.7	l/s			

Elevation at Fire Hydrant: 66.30 m ASL (municipal FH at NW corner of site)

Static Pressure at Fire Hydrant

167 l/s FIRE FLOW: 108.5 m ASL 60 psi 414 kPa



Douglas Gray <d.gray@dbgrayengineering.com>

RE: Boundary Condition Request - 1499 Star Top Rd

1 message

Curry, William <William.Curry@ottawa.ca>

Mon, Mar 25, 2019 at 1:00 PM

To: Douglas Gray <d.gray@dbgrayengineering.com>

Cc: Caoimhin Kennedy <c.kennedy@dbgrayengineering.com>

******The following information may be passed on to the consultant, but do NOT forward this e-mail directly.******

The following are boundary conditions, HGL, for hydraulic analysis at 1499 Star Top (zone 1E) assumed to be connected to the 305mm on Star Top Rd (see attached PDF for location).

MaxDay + FireFlow (167L/s) = 108.5m

Will Curry, C.E.T.

Planning, Infrastructure and Economic Development /

Planification, d'infrastructure et de développement économique

City of Ottawa | Ville d'Ottawa

☎ 613.580.2424 ext./poste 16214

[110 Laurier Ave., 4th Fl East;](#)

Ottawa ON K1P 1J1

William.Curry@Ottawa.ca

From: Douglas Gray <d.gray@dbgrayengineering.com>

Sent: March 14, 2019 4:19 PM

To: Curry, William <William.Curry@ottawa.ca>

Cc: Caoimhin Kennedy <c.kennedy@dbgrayengineering.com>

Subject: Boundary Condition Request - [1499 Star Top Rd](#)

Hi Will

We are working on a project at [1499 Star Top Rd](#). An unheated storage building with no plumbing fixtures is proposed.

Please provide the boundary conditions at this location.

We have calculated the Fire Flow demand to be 166.7 l/s

Our calculations are attached.

Thanks, Doug

D. B. GRAY ENGINEERING INC.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

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 **1499 Star Top March 2019.pdf**
103K

Boundary Condition for 1499 Star Top Rd



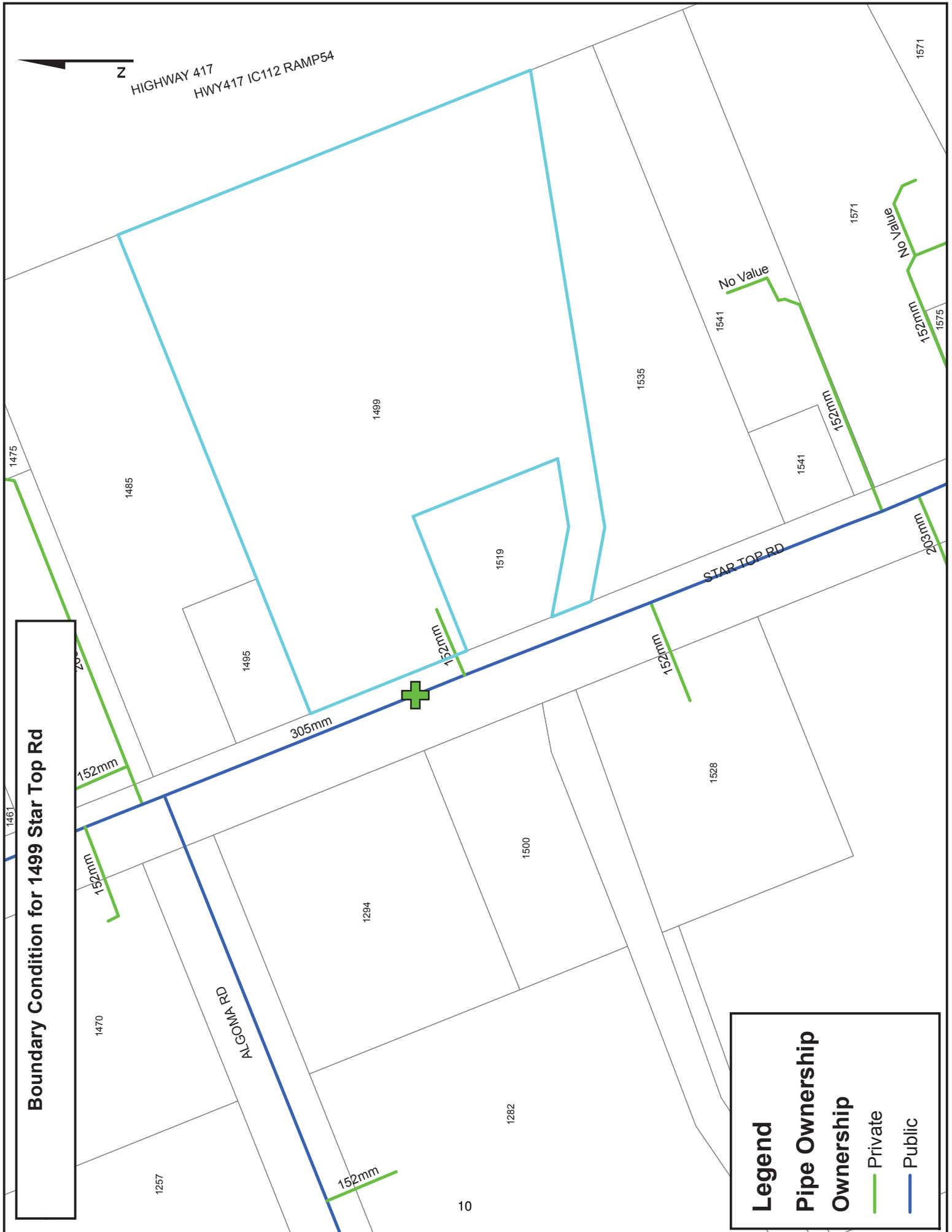
HIGHWAY 417
HWY417 IC112 RAMP54

Legend

Pipe Ownership

Ownership

- Private
- Public



1499 Star Top Road Ottawa, Ontario

EPANET HYDRAULIC MODELLING RESULTS

MAX DAY + FIRE FLOW: 250 l/s

Node ID	Demand	Head	Elevation	Pressure		
	l/s	m	m	m	psi	kPa
1 Reservoir 1	-120	108.50	65.55	42.95	61.1	421
2 Fire Hydrant	120	80.62	66.24	14.38	20.4	141

Link ID	Diameter	Length	Roughness	Loss Coeff.	Flow	Velocity
	mm	m			l/s	m/s
Pipe 1	150	54.1	100	2.00	90.00	5.09



Network Table - Nodes

Node ID	Elevation m	Base Demand LPS	Demand LPS	Head m	Pressure m
Junc 2	66.24	120	120.00	80.62	14.38
Resvr 1	108.5	#N/A	-120.00	108.50	0.00

Network Table - Links

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s
Pipe 1	54.1	150	100	120.00	6.79

STORMWATER MANAGEMENT CALCULATIONS

The orifice calculations are based on the following formula:

$$Q = C_d \times A_o \sqrt{2gh} \times 1000$$

where:

Q = flowrate in litres per second

C_d = coefficient of discharge

A_o = orifice area in sq.m.

g = 9.81 m/s²

h = head above orifice in meters

Storage calculations in the parking area are based on the following formula for volume of a cone:

$$V = (A \times d)/3$$

where:

V = volume in cu.m.

A = ponding area in sq.m.

d = ponding depth in meters

Summary Tables

ONE HUNDRED YEAR EVENT				
Drainage Area	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Uncontrolled Flow Off Site)	-	136.19	-	-
AREA II	-	9.16	95.52	95.52
AREA III	-	17.51	16.38	16.38
TOTAL	162.86	162.86	111.90	111.90

FIVE YEAR EVENT				
Drainage Area	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Uncontrolled Flow Off Site)	-	70.01	-	-
AREA II	-	9.02	39.55	39.55
AREA III	-	17.23	4.36	4.36
TOTAL	162.86	96.26	43.91	43.91

1499 Star Top Road
Ottawa, Ontario

STORM WATER MANAGEMENT CALCULATIONS
Rational Method

ONE HUNDRED YEAR EVENT

Pre-Development Conditions

5 Year Event

Roof Area:	1321	sq.m	0.90
Asphalt/Concrete Area:	4895	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	140	sq.m	0.20

Total Catchment Area:	6356	sq.m	0.88
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Area (A):	6356	sq.m
Time of Concentration:	10	min
Rainfall Intensity (i):	104	mm/hr (5 year event)
Runoff Coefficient (C):	0.88	

Maximum Allowable Release Rate (2.78AiC):	162.86	L/s
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DRAINAGE AREA I (Uncontrolled Flow Off Site)

(ONE HUNDRED YEAR EVENT)

Roof Area:	1434	sq.m	1.00
Asphalt/Concrete Area:	1194	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	462	sq.m	0.25
<hr/>			
Total Catchment Area:	3090	sq.m	0.89
Area (A):	3090	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr (100 year event)	
Runoff Coefficient (C):	0.89		
Flow Rate (2.78AiC):	136.19	L/s	

DRAINAGE AREA II

(ONE HUNDRED YEAR EVENT)

Roof Area:	519	sq.m	1.00	
Asphalt/Concrete Area:	1755	sq.m	1.00	
Gravel Area:	0	sq.m	0.875	
Landscaped Area:	93	sq.m	0.25	
Total Catchment Area:	2367	sq.m	0.97	
Water Elevation:	65.99	m		
Invert of Outlet Pipe - CB/MH-3:	64.13	m		
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-3)	64.18	m		
Head:	1.81	m		
Orifice Diameter:	100	mm		
Orifice Area:	7854	sq.mm		
Coefficient of Discharge:	0.196			
Maximum Release Rate:	9.16	L/s		
Surface Storage Above Catch Basins				
		CB/MH	Top Area (sq.m)	Depth (m)
		CB/MH-3	583	0.22
		CB-4	743	0.22
				Volume
				42.00 cu.m
				53.51 cu.m
			Achieved Volume:	95.52 cu.m
			Maximum Volume Required:	95.52 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	243	155.00	9.16	145.84	43.75
10	179	114.03	9.16	104.87	62.92
15	143	91.26	9.16	82.09	73.88
20	120	76.60	9.16	67.44	80.93
25	104	66.32	9.16	57.16	85.74
30	92	58.67	9.16	49.51	89.11
35	83	52.74	9.16	43.57	91.51
40	75	47.99	9.16	38.83	93.18
45	69	44.10	9.16	34.93	94.32
50	64	40.84	9.16	31.68	95.04
55	60	38.08	9.16	28.91	95.42
60	56	35.70	9.16	26.53	95.52
65	53	33.62	9.16	24.46	95.39
70	50	31.80	9.16	22.63	95.06
75	47	30.18	9.16	21.02	94.57
80	45	28.73	9.16	19.57	93.93
85	43	27.43	9.16	18.27	93.17
90	41	26.25	9.16	17.09	92.29
95	39	25.18	9.16	16.02	91.32
100	38	24.21	9.16	15.04	90.26
105	36	23.31	9.16	14.15	89.11
110	35	22.48	9.16	13.32	87.90
115	34	21.72	9.16	12.55	86.62
120	33	21.01	9.16	11.84	85.28
125	32	20.35	9.16	11.18	83.88
130	31	19.73	9.16	10.57	82.44
135	30	19.16	9.16	9.99	80.95
140	29	18.62	9.16	9.45	79.41
145	28	18.11	9.16	8.95	77.84
150	28	17.63	9.16	8.47	76.23
180	24	15.27	9.16	6.10	65.90
210	21	13.50	9.16	4.34	54.69
240	19	12.14	9.16	2.97	42.83
270	17	11.04	9.16	1.88	30.48
300	16	10.15	9.16	0.99	17.74

DRAINAGE AREA III

(ONE HUNDRED YEAR EVENT)

Roof Area:	87	sq.m	1.00		
Asphalt/Concrete Area:	812	sq.m	1.00		
Gravel Area:	0	sq.m	0.875		
Landscaped Area:	0	sq.m	0.25		
Total Catchment Area:	899	sq.m	1.00		
Water Elevation:	66.08	m			
Invert of Outlet Pipe - CB-2:	64.05	m			
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-2)	64.09	m			
Head:	1.99	m			
Orifice Diameter:	76	mm			
Orifice Area:	4592	sq.mm			
Coefficient of Discharge:	0.610				
Maximum Release Rate:	17.51	L/s			
Surface Storage Above Catch Basins					
		CB/MH	Top Area (sq.m)	Depth (m)	Volume
		CB/MH-2	273	0.18	16.38 cu.m
				Achieved Volume:	16.38 cu.m
				Maximum Volume Required:	16.38 cu.m
Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	243	60.66	17.51	43.15	12.94
10	179	44.63	17.51	27.11	16.27
15	143	35.71	17.51	18.20	16.38
20	120	29.98	17.51	12.47	14.96
25	104	25.95	17.51	8.44	12.66
30	92	22.96	17.51	5.45	9.81
35	83	20.64	17.51	3.13	6.56
40	75	18.78	17.51	1.27	3.04
45	69	17.26	17.26	0.00	0.00
50	64	15.98	15.98	0.00	0.00
55	60	14.90	14.90	0.00	0.00
60	56	13.97	13.97	0.00	0.00
65	53	13.16	13.16	0.00	0.00
70	50	12.44	12.44	0.00	0.00
75	47	11.81	11.81	0.00	0.00
80	45	11.24	11.24	0.00	0.00
85	43	10.74	10.74	0.00	0.00
90	41	10.27	10.27	0.00	0.00
95	39	9.86	9.86	0.00	0.00
100	38	9.47	9.47	0.00	0.00
105	36	9.12	9.12	0.00	0.00
110	35	8.80	8.80	0.00	0.00
115	34	8.50	8.50	0.00	0.00
120	33	8.22	8.22	0.00	0.00
125	32	7.96	7.96	0.00	0.00
130	31	7.72	7.72	0.00	0.00
135	30	7.50	7.50	0.00	0.00
140	29	7.29	7.29	0.00	0.00
145	28	7.09	7.09	0.00	0.00
150	28	6.90	6.90	0.00	0.00
180	24	5.97	5.97	0.00	0.00
210	21	5.28	5.28	0.00	0.00
240	19	4.75	4.75	0.00	0.00
270	20	4.32	4.32	0.00	0.00
300	16	3.97	3.97	0.00	0.00

FIVE YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(FIVE YEAR EVENT)

Roof Area:	1434	sq.m	0.90
Asphalt/Concrete Area:	1194	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	<u>462</u>	<u>sq.m</u>	<u>0.20</u>
Total Catchment Area:	3090	sq.m	0.80
Area (A):	3090	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	102	mm/hr (5 year event)	
Runoff Coefficient (C):	0.80		
Flow Rate (2.78AiC):	70.01	L/s	

DRAINAGE AREA II

(FIVE YEAR EVENT)

Roof Area:	519	sq.m	0.90	
Asphalt/Concrete Area:	1755	sq.m	0.90	
Gravel Area:	0	sq.m	0.70	
Landscaped Area:	93	sq.m	0.20	
Total Catchment Area:	2367	sq.m	0.87	
Water Elevation:	65.93	m		
Invert of Outlet Pipe - CB/MH-3:	64.13	m		
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-3)	64.18	m		
Head:	1.75	m		
Orifice Diameter:	100	mm		
Orifice Area:	7854	sq.mm		
Coefficient of Discharge:	0.196			
Maximum Release Rate:	9.02	L/s		
				Surface Storage Above Catch Basins
		CB/MH	Top Area (sq.m)	Depth (m)
		CB/MH-3	324	0.16
		CB-4	413	0.16
				Volume
				17.39 cu.m
				22.16 cu.m
			Achieved Volume:	39.55 cu.m
			Maximum Volume Required:	39.55 cu.m

Time	i	2.78AiC	Release	Stored	Stored
min	mm/hr	L/s	Rate	Rate	Volume
			L/s	L/s	cu.m
5	141	81.05	9.02	72.03	21.61
10	104	59.82	9.02	50.80	30.48
15	84	47.97	9.02	38.95	35.05
20	70	40.33	9.02	31.31	37.57
25	61	34.96	9.02	25.94	38.91
30	54	30.96	9.02	21.94	39.49
35	49	27.86	9.02	18.83	39.55
40	44	25.37	9.02	16.34	39.23
45	41	23.33	9.02	14.30	38.62
50	38	21.62	9.02	12.59	37.78
55	35	20.17	9.02	11.14	36.77
60	33	18.91	9.02	9.89	35.61
65	31	17.82	9.02	8.80	34.32
70	29	16.86	9.02	7.84	32.93
75	28	16.01	9.02	6.99	31.45
80	27	15.25	9.02	6.23	29.89
85	25	14.56	9.02	5.54	28.26
90	24	13.94	9.02	4.92	26.58
95	23	13.38	9.02	4.36	24.84
100	22	12.86	9.02	3.84	23.05
105	22	12.39	9.02	3.37	21.22
110	21	11.95	9.02	2.93	19.35
115	20	11.55	9.02	2.53	17.45
120	19	11.18	9.02	2.15	15.51
125	19	10.83	9.02	1.81	13.54
130	18	10.50	9.02	1.48	11.55
135	18	10.20	9.02	1.18	9.53
140	17	9.91	9.02	0.89	7.49
145	17	9.65	9.02	0.62	5.42
150	16	9.39	9.02	0.37	3.34
180	14	8.14	8.14	0.00	0.00
210	13	7.21	7.21	0.00	0.00
240	11	6.48	6.48	0.00	0.00
270	20	5.90	5.90	0.00	0.00
300	9	5.43	5.43	0.00	0.00

DRAINAGE AREA III

(FIVE YEAR EVENT)

Roof Area:	87	sq.m	0.90
Asphalt/Concrete Area:	812	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	0	sq.m	0.20

Total Catchment Area: 899 sq.m 0.90

Water Elevation: 66.02 m

Invert of Outlet Pipe - CB-2: 64.05 m

Centroid of ICD Orifice: 64.09 m
(ICD in Outlet Pipe of CB/MH-2)

Head: 1.93 m

Orifice Diameter: 76 mm

Orifice Area: 4592 sq.mm

Coefficient of Discharge: 0.610

Maximum Release Rate: 17.23 L/s

Surface Storage Above Catch Basins

CB/MH	Top Area (sq.m)	Depth (m)	Volume
CB/MH-2	112.95	0.12	4.36 cu.m

Achieved Volume: 4.36 cu.m

Maximum Volume Required: 4.36 cu.m

Time	i	2.78AiC	Release	Stored	Stored
min	mm/hr	L/s	L/s	L/s	cu.m
5	141	31.76	17.23	14.53	4.36
10	104	23.44	17.23	6.21	3.73
15	84	18.79	17.23	1.57	1.41
20	70	15.80	15.80	0.00	0.00
25	61	13.70	13.70	0.00	0.00
30	54	12.13	12.13	0.00	0.00
35	49	10.91	10.91	0.00	0.00
40	44	9.94	9.94	0.00	0.00
45	41	9.14	9.14	0.00	0.00
50	38	8.47	8.47	0.00	0.00
55	35	7.90	7.90	0.00	0.00
60	33	7.41	7.41	0.00	0.00
65	31	6.98	6.98	0.00	0.00
70	29	6.61	6.61	0.00	0.00
75	28	6.27	6.27	0.00	0.00
80	27	5.97	5.97	0.00	0.00
85	25	5.71	5.71	0.00	0.00
90	24	5.46	5.46	0.00	0.00
95	23	5.24	5.24	0.00	0.00
100	22	5.04	5.04	0.00	0.00
105	22	4.85	4.85	0.00	0.00
110	21	4.68	4.68	0.00	0.00
115	20	4.53	4.53	0.00	0.00
120	19	4.38	4.38	0.00	0.00
125	19	4.24	4.24	0.00	0.00
130	18	4.12	4.12	0.00	0.00
135	18	4.00	4.00	0.00	0.00
140	17	3.88	3.88	0.00	0.00
145	17	3.78	3.78	0.00	0.00
150	16	3.68	3.68	0.00	0.00
180	14	3.19	3.19	0.00	0.00
210	13	2.82	2.82	0.00	0.00
240	11	2.54	2.54	0.00	0.00
270	20	2.31	2.31	0.00	0.00
300	9	2.13	2.13	0.00	0.00

D.B. GRAY ENGINEERING INC.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

700 Long Point Circle
Ottawa, Ontario K1T 4E9

613-425-8044
d.gray@dbgrayengineering.com

STORM SEWER COMPUTATION FORM

RATIONAL METHOD $Q = 2.78 \text{ A I R}$ FIVE YEAR EVENT

$n = 0.013$

Project: 1499 Star Top Road

Designed By: DBG

Date: July 18, 2019

Page: 1 of 1

LOCATION			AREA (ha)				Individual 2.78 A R	Accum. 2.78 A R	Time of Conc. (min)	Rainfall Intensity i (mm/hr)	Peak Flow Q (L/s)	SEWER DATA							COMMENTS			
			Hard R = 0.90	Gravel R = 0.70	Landscape R = 0.20	Roof R = 0.90						Type of Pipe	Dia. Actual (mm)	Dia. Nominal (mm)	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)		Time of Flow (min)	Ratio Q/Qfull	
	STREET	FROM	TO																			
24		CB/MH-A	CB/MH-B	0.1818			0.0595	0.604	10.00	104.19	62.90	PVC	203.2	200	0.55	40.3	25.38	0.78	0.86	2.48	EXISTING	
		CB/MH-B	CB/MH-C	0.0695				0.174	10.86	99.87	77.66	PVC	254.0	250	0.47	40.6	42.53	0.84	0.81	1.83	EXISTING	
		CB-4	CB/MH-3	0.0908		0.0047	0.0319	0.310	10.00	104.19	32.26	PVC SDR-35	254.0	250	0.43	18.5	40.68	0.80	0.38	0.79		
		DI-6	CB/MH-5			0.0079	0.1006	0.256	10.00	104.19	26.68	PVC SDR-35	254.0	250	0.43	38.2	40.68	0.80	0.79	0.66		
		CB/MH-5	CB/MH-3			0.0235	0.0061	0.028	10.79	100.18	28.49	PVC SDR-35	254.0	250	0.43	36.3	40.68	0.80	0.75	0.70		
		CB/MH-3	CB/MH-C	0.0847		0.0046	0.0200	0.265	11.55	96.68	83.00	PVC SDR-35	304.8	300	0.69	29.8	83.80	1.15	0.43	0.99		
									0.859	11.55	96.68	36.52	PVC SDR-35	304.8	300	0.69	29.8	83.80	1.15	0.43	0.44	FLOW THROUGH ICD BEFORE TEE
																					FLOW THROUGH ICD AFTER TEE	
		CB-2	CB/MH-C	0.0812			0.0087	0.225	10.00	104.19	23.44	PVC SDR-35	254.0	250	0.43	12.7	40.68	0.80	0.26	0.58		
											17.22	PVC SDR-35	254.0	250	0.43	12.7	40.68	0.80	0.26	0.42	FLOW THROUGH ICD	
		CB/MH-C	CB/MH-D					1.861	11.98	94.79	176.40	PVC	304.8	300	0.12	42.5	34.95	0.48	1.48	5.05	EXISTING	
											126.91	PVC	304.8	300	0.12	42.5	34.95	0.48	1.48	3.63	FLOW THROUGH ICDs	
		CB/MH-D	MH-1	0.0359				0.090	13.46	88.89	173.43	PVC	304.8	300	2.50	30.1	159.51	2.19	0.23	1.09	EXISTING	
											128.63	PVC	304.8	300	2.50	30.1	159.51	2.19	0.23	0.81	FLOW THROUGH ICDs	
		MH-1	EXISTING 2600 x 3750 CSPA ST					1.951	13.69	88.05	171.78	PVC SDR-35	304.8	300	2.50	10.9	159.51	2.19	0.08	1.08		
											127.66	PVC SDR-35	304.8	300	2.50	10.9	159.51	2.19	0.08	0.80	FLOW THROUGH ICDs	



Sizing Report

2733 Kanasita Drive • Suite 111 • Chattanooga, TN 37343 • Phone: (423) 870-8888 • Fax: (423) 826-2112 • www.aquashieldinc.com

Site Information

Project Name: **1499 Star Top Rd. - Ottawa**

Site Area (hectares): **0.6966**

Unit Label: **OGS1**

Runoff Coeff. : **.88**

Unit Location: **Ottawa, ON**

Target Removal Efficiency(%): **80% based on NJDEP**

Product Recommendation

Aqua-Swirl™ Model	Net Annual TSS Removal Efficiency	Chamber Diameter	Maximum Inside Diameter (mm)		Oil/Debris Storage Capacity	Sediment Storage Capacity
AS-3	83.26 %	991 mm.	Offline	BYP ⁵	417 L	0.56 m ³
			251 mm.	535 mm.		

Rainfall Information

NCDC Station¹: **OTTAWA MACDONALD-CARTIER INT'L A**

Data Range⁴: **261,759 readings taken hourly between 1967 to 2007 (~40 years)**

Rainfall Event Range (mm/hre)	Rainfall Interval Point (mm/hre)	Operating Rate (Lps/m ²)	Total Rainfall (%)	Removal Efficiency (%) ²	Relative Efficiency(%)
02.00 - 03.00	02.50	04.76	44.18	92.49	40.86
03.00 - 04.00	03.50	06.67	21.52	89.14	19.18
04.00 - 05.00	04.50	08.57	11.68	85.17	09.95
05.00 - 06.00	05.50	10.48	06.68	80.60	05.38
06.00 - 07.00	06.50	12.38	04.03	75.40	03.04
07.00 - 08.00	07.50	14.29	01.99	69.59	01.38
08.00 - 09.00	08.50	16.20	01.84	63.17	01.16
09.00 - 10.00	09.50	18.10	01.81	56.13	01.02
10.00 - 15.00	12.50	23.82	04.12	31.32	01.29
Total Cumulative Rainfall %:			97.85³	Net Annual %:	83.26

Sales Agent Information

Agent Name: **Dave Kanters**

Phone: **416-347-2799**

Company Name: **Soleno**

Fax:

Address: **347, 15-75 Bayly St. W.**

E-mail: **dkanters@soleno.com**

City, State Zip: **Ajax, ON L1S7K7**

Footnotes

- Recorded as hourly precipitation rainfall data (inches), National Climatic Data Center (NCDC)
- Based on Tennessee Tech University laboratory testing of the AquaSwirl™ Model AS-3 for OK-110 silica particles 50-125 microns(Neary, 2002)
- 90% Rainfall Event, calculated as a cumulative percentile of individual events, www.stormwatercenter.net, sizing criteria (Center for Watershed Protection)
- NCDC data may not be consecutive, skipping days, months and/or years in the range of dates.
- The Aqua-Swirl™ Internal Bypass (BYP) provides full treatment of the "first flush," while the peak design storm is diverted and channeled through the main conveyance pipe. Please refer to your local representative for more information.
- When applicable, the performance curve was adjusted via Peclet Scaling to provide estimated sizing per NJDEP PSD (d50 = 67 microns).

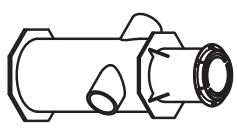
To receive pricing and/or technical support on the Aqua-Swirl, please contact Soleno. (www.Soleno.com)

Paul Antoine
Sales Representative
Tel: 613-292-4094
Email: pantoine@soleno.com

Kevin Dutrisac
Engineer, Technical Service
Tel: 613-323-0364
Email: kdutrisac@soleno.com

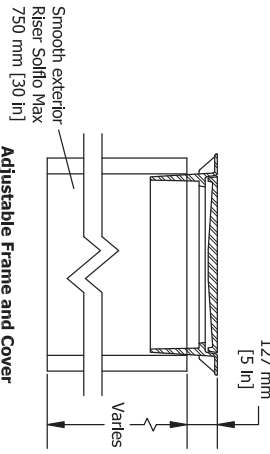
David Kanters
Engineer, Technical Service
Tel: 416-347-2799
Email: dkanters@soleno.com

Aqua-Swirl High Density Polyethylene (HDPE) Stormwater Treatment System



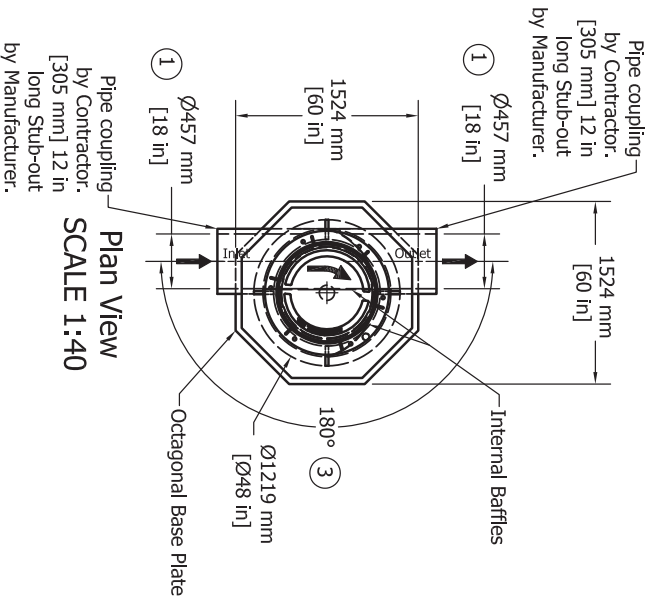
Projected View
SCALE 1:80

Please see accompanied Aqua-Swirl specification notes. See Site Plan for actual system orientation. Approximate dry (pick) weight: 700 kg [1600 lbs].



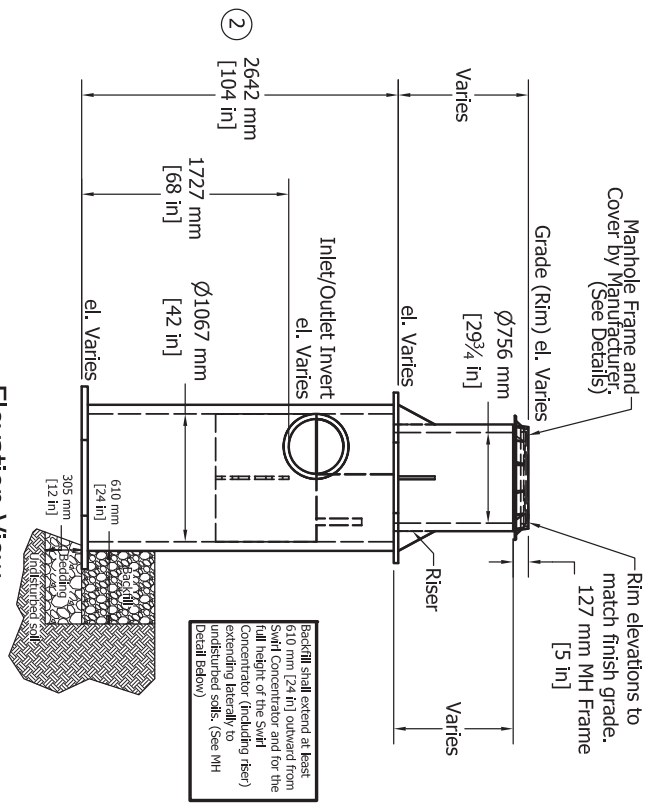
System shall be designed for the following capacities:
Swirl Treatment Flow: 51 L/s [1.8 cfs]
Swirl Sediment Storage: 0.57 m³ [20 ft³]
Swirl Oil/Debris Storage: 416 L [110 gal]

- ① AS-3 BYP inlet/outlet pipe size ranges from 254 mm [10 in] to 533 mm [21 in].
- ② AS-3 chamber height may vary from 2286 mm [90 in] to 2642 mm [104 in], depending on inlet/outlet pipe size.
- ③ Orientation may vary from a minimum of 90° to a maximum of 180°.



Plan View
SCALE 1:40

Elevation View
SCALE 1:40



AquaShield <small>WATER TREATMENT SOLUTIONS</small> 2733 Kanata Drive, Suite 111, Chatham, ON K7M 9B3 Phone: (888) 344-5044 Fax: (423) 826-2112 www.aquashieldinc.com	Aqua-Swirl Concentrator		Structure #:	AS-3 STD	Revised	Rvw. Date
	AS-3 BYP CW STD		Drawn By:	OFB/MS		
			Scale:	AS SHOWN		
			Date:	3/8/2018		

Standard Detail		U.S. Patent No. 6524473 and other Patent Pending	
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City of Ottawa Servicing Study Checklist

General Content

Executive Summary (for large reports only): not applicable

Date and revision number of the report: see page 1 of Servicing Brief and Stormwater Management Report

Location map and plan showing municipal address, boundary, and layout of proposed development: see drawings C-1 to C-5

Plan showing the site and location of all existing services: see drawings C-1 to C-5

Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere: not applicable

Summary of Pre-consultation Meetings with City and other approval agencies: not available

Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defensible design criteria: not applicable

Statement of objectives and servicing criteria: see page 2 of Servicing Brief and Stormwater Management Report

Identification of existing and proposed infrastructure available in the immediate area: see drawings C-1 to C-5

Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available). see drawings C-1 to C-5

Concept level master grading plan to confirm existing and proposed grades in the development and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths: not applicable

Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts: not applicable

Proposed phasing of the development, if applicable: not applicable

Reference to geotechnical studies and recommendations concerning servicing: see note 1.5 on drawing C-1

All preliminary and formal site plan submissions should have the following information:

- **Metric scale:** included
- **North arrow:** included
 - **(including construction North):** not included
- **Key Plan:** included

- **Name and contact information of applicant and property owner:** not available
- **Property limits:** included
 - **including bearings and dimensions:** not included
- **Existing and proposed structures and parking areas:** included
- **Easements, road widening and rights-of-way:** included
- **Adjacent street names:** included

Development Servicing Report: Water

Confirm consistency with Master Servicing Study, if available: not applicable

Availability of public infrastructure to service proposed development: see Servicing Brief and Stormwater Management Report

Identification of system constraints: see page 2 of Servicing Brief

Confirmation of adequate domestic supply and pressure: not applicable

Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow locations throughout the development: see page 2 & 5 to 13 of Servicing Brief and Stormwater Management Report

Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves: not applicable

Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design: not applicable

Address reliability requirements such as appropriate location of shut-off valves: not applicable

Check on the necessity of a pressure zone boundary modification:. not applicable

Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range: not applicable

Description of the proposed water distribution network, including locations of proposed connections to the existing systems, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions: not applicable

Description of off-site required feeder mains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation: not applicable

Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines: see page 2 of Servicing Brief

Provision of a model schematic showing the boundary conditions locations, streets , parcels, and building locations for reference: not applicable

Development Servicing Report: Wastewater

Summary of proposed design criteria: see page 3 of Servicing Brief and Stormwater Management Report

(Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure): not applicable

Confirm consistency with Master Servicing Study and /or justification for deviations: not applicable

Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and conditions of sewers: not applicable

Descriptions of existing sanitary sewer available for discharge of wastewater from proposed development: not applicable

Verify available capacity in downstream sanitary sewer and / or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable): not applicable

Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix C) format. not applicable

Description of proposed sewer network including sewers, pumping stations, and forcemains: not applicable

Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality): not applicable

Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development: not applicable

Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity: not applicable

Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding: not applicable

Special considerations such as contamination, corrosive environment etc: not applicable

Development Servicing Report: Stormwater Checklist

Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property): see page 3 of Servicing Brief and Stormwater Management Report

Analysis of available capacity in existing public infrastructure. not applicable

A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern: see drawings C-1 to C-5

Water quality control objective (e/g/ controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects: see Stormwater Management Report Servicing Brief and Stormwater Management Report

Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements: Servicing Brief and Stormwater Management Report

Descriptions of the references and supporting information.
Set-back from private sewage disposal systems. not applicable

Watercourse and hazard lands setbacks: not applicable

Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed: the pre-application consultation record is not yet been issued

Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists: not applicable

Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period). see drawings C-1 to C-5 and Servicing Brief and Stormwater Management Report

Identification of watercourses within the proposed development and how watercourses will be protected, or , if necessary, altered by the proposed development with applicable approvals. see drawings C-1 to C-5 and Servicing Brief and Stormwater Management Report

Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions: see Servicing Brief and Stormwater Management Report

Any proposed diversion of drainage catchment areas from one outlet to another. : not applicable

Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities. : not applicable

If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event: not applicable

Identification of potential impacts to receiving watercourses: Servicing Brief and Stormwater Management Report

Identification of municipal drains and related approval requirements. : not applicable

Descriptions of how the conveyance and storage capacity will be achieved for the development: see page 4 to 6 of Servicing Brief and Stormwater Management Report

100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading:

Inclusion of hydraulic analysis including hydraulic grade line elevations. : not applicable

Description of approach to erosion and sediment control during construction for the protection of receiving watercourses of drainage corridors: see notes 2.1 to 2.6 on drawing C-3

Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplains elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current: not applicable

Identification of fill constraints related to floodplain and geotechnical investigation. : not applicable

Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act: not applicable

Application for Certificate of Approval (CofA) under the Ontario Water Resources Act:

Changes to Municipal Drains. : not applicable

Other permits (National Capital commission, Parks Canada, public Works and Government Services Canada, Ministry of transportation etc.) : not applicable

Conclusion Checklist

Clearly stated conclusions and recommendations: see page 6 of Servicing Brief and Stormwater Management Report

Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.

All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario: included