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

SITE SERVICING STUDY & STORMWATER MANAGEMENT REPORT

1353 COKER STREET
OTTAWA, ONTARIO

REPORT NO. 20127

MARCH 7, 2022
REVISED: JUNE 3, 2022
REVISED: FEBRUARY 7, 2023

CONTENTS

LIST OF APPENDICES

1.0 INTRODUCTION

This report describes the servicing and stormwater management requirements for a proposed 1-storey, 310 sq.m. warehouse located at 1353 Coker Street in Ottawa, Ontario. The property is currently occupied by an existing 1-storey building. Refer to Pre-Application Consultation meeting notes in Appendix B.

This report forms part of the servicing and stormwater management design for the proposed development. Also refer to drawings C-1 to C-4, prepared by D.B. Gray Engineering Inc.

2.0 WATER SERVICE

2.1 WATER SUPPLY FOR FIREFIGHTING

As per OBC A-3.2.5.7. Table 2, the required water supply flow rate for firefighting for the proposed 1-storey 310 sq.m. building is 1,800 L/min. (i.e., a 1-storey building not exceeding 600 sq.m.) which calculated to be a 54,000 L volume for 30-minute water supply. As per City of Ottawa Technical Bulletin ISTB-2021-03 the requirements for levels of fire protection on private property in rural areas is based on the Fire Underwriters Survey (FUS) method. Using the FUS method the required fire flow was calculated to be 5,000 L/min calculated to be a 525,000 L volume for 1.75 hour water supply (as required by FUS). Refer to calculations in Appendix A. In the City of Ottawa buildings less than 600 sq.m. typically do not require an onsite water supply.

2.2 DOMESTIC WATER SUPPLY

The existing drilled well to the west of the existing building will provide the domestic water supply via an underground connection to the plumbing of the existing building. As per the Hydrogeological and Terrain Study, prepared by Paterson Group Inc.:

> *"The total volume of water pumped during the 8 hour pumping event was approximately 9,120 L. This is approximately three times the maximum total daily design volume of water required to support the development as part of the site plan application (approximately 3,600 L/day)."*

As per the Hydrogeological and Terrain Study the design volume of water is assumed to be equal to the design sewage flow of 3,600 L/day as calculated by Paterson (refer to Sanitary Service below).

3.0 SANITARY SERVICE

The existing on-site septic system will be decommissioned, and a new on-site septic system is proposed to service the existing and proposed buildings (refer to design by Paterson Group Inc.). As per the Hydrogeological and Terrain Study, prepared by Paterson Group Inc.:

> "Proposed Sewage System
>
> *Paterson has completed a replacement sewage system design for the proposed development. A septic flow value of 1,900 L/day was used for the existing building and a septic flow value of 1,700 L/day was calculated for the proposed building addition. This results in a total daily design sewage flow (TDDSF) of 3,600 L/day. Refer to the approved OSSO Septic Permit attached* [to the Paterson Report] *for more specific details. The septic flow values were calculated in accordance with the OBC and are as follows:*

Existing Building:

- *Factory (no showers) with 6 employees = 6 x 76 L/day = 450 L/day OR*
- *Number of water closets = 2 x 950 L/day = 1,900 L/day*

Proposed Building Addition:

- *Warehouse with 5 bay door = 5 x 150 l/day = 750 L/day; AND*
- *Number of water closets = 1 x 950 L/day = 950 L/day*

Proposed Building Addition:

- *Warehouse with 5 bay door = 5 x 150 l/day = 750 L/day; AND*
- *Number of water closets = 1 x 950 L/day = 950 L/day*

Combined Existing Building and Proposed Building Addition:

- *Existing Building (1,900 L/day) + Proposed Building Addition (1,700 L/day) = 3,600 L/day."*

4.0 STORMWATER MANAGEMENT

4.1 QUALITY CONTROL

The Shields Creek Subwatershed Study recommends a Normal Protection (a target of 70% suspended solids removal); however, James Holland with South Nation Conservation (SNC) has stated: *"There Is a water course on site needs quality protection … need update stormwater - from old site plan - 80% TSS post to pre quantity."*

To meet the water quality target of 80% total suspended solids (TSS) removal, runoff from the north portion of the property (previously undeveloped – prior to 2015) will drain through a proposed oil grit separator (OGS) manhole. A CDS Model PMSU2015-4 was selected by the manufacturer based on the provided description of the drainage area and the manufacturer's software. The CDS PMSU2015-4 is calculated to remove approximately 92% of the TSS. Refer to Appendix B. The OGS has an oil capacity of 232 L and a sediment capacity of 0.7 cu.m. The south (developed) portion of the property will remain virtually unchanged: There are no existing quality control measures, and none are proposed since the location of the existing building, septic system, and asphalted areas; and the shallow roadside ditch and high water table preclude opportunities for quality control.

In the pre-consultation meeting notes received from the City James Holland with the South Nation Conservation stated: *"Watercourses are likely low-flow, intermittent watercourses that likely are indirect fish habitat. Year-round use is unlikely due to flow and heavy vegetation. SNC recommends that DFO is consulted via a Request for Review when a project has the potential to cause a Harmful Alteration, Disruption, or Destruction (HADD) to fish and/or fish habitat. However, if a project can be completed following all of DFO's fish protection measures, a Request for Review is not needed. In this case, I think a piping/culverts of this watercourse can be done without a RFR provided all of the fish protection measures are followed."* With reference to DFO's website *"Measures to protect fish and fish habitat"*; relevant measures have been incorporated into an Erosion & Sediment Control Plan that has been developed to be implemented during construction. Refer to drawing C-2 and notes 2.1 to 2.7 on drawing C-4.

4.2 QUANTITY CONTROL

Both the South Nation Conservation (SNC) and the City require that the stormwater management design needs to demonstrate post development flows are controlled to pre-development conditions. For water quantity the Shields Creek Subwatershed Study recommends:

"Water quantity targets are to be met include:

- *Infiltration - levels to be maintained at predevelopment rates as specified in Table 5.5.1*
- *Peak flow target – peak flow control for all design events (post to pre, 2 to 100 year events, inclusive)"*

Infiltration:
As per Figure 5.5.1 and Table 6.3.2 in the Shields Creek Subwatershed Study the subject property is in area of *"sand, reworked glaciofluvial"* with a target infiltration rate of 100 to 250 mm/yr. Based on the pre-development water balance and infiltration calculations; the annual infiltration of the 955 sq.m. north portion of the property (previously undeveloped forested area – prior to 2015) is 137 mm/year. Post development permeable pavers are proposed to be installed over about two third of this area. In eastern Ontario, on hard surfaces, approximately 150 mm of the 943 mm annual precipitation is lost to evapotranspiration (Eastern Ontario Water Resources Management Study (2001) & Carp River Watershed / Subwatershed Study). Permeable pavers have showed an 16% increase in evaporation rates relative impermeable pavements (Effects on Evaporation Rates from Different Water-Permeable Pavement Designs; P. Starke, P. Göbel & W. G. Coldewey). Therefore, assuming 174 mm (16% increase from 150 mm) of the 943 mm annual precipitation is lost to evaporation, 769 mm of the precipitation on permeable pavers is available for infiltration. Based on the water balance and infiltration calculations, with the installation of 634 sq.m. of permeable pavers, the post development the annual infiltration of the 955 sq.m. north portion of the property is 148 mm/year; greater than the pre-development infiltration rate and within 100 to 250 mm/yr target infiltration rate. Refer to calculations in Appendix A.

Peak Flow Target:
The stormwater quantity control criterion is to control the post-development peak flow rates to the pre-development peak flow rates for the 2-year, 5-year and 100-year storm events. The pre-development topography of the property is such that 36% of the property currently drains north towards the watercourse (previously undeveloped forested area – prior to 2015) and 64% of the property currently drains south towards the roadside ditch. Using the Rational Method with a time of concentration of 10 minutes, the pre-development 100-year flow rates were calculated to be 17.78 L/s draining north and 64.96 L/s draining south; the pre-development 5-year flow rates were calculated to be 8.30 L/s draining north and 33.52 L/s draining south; and the pre-development 2-year flow rates were calculated to be 6.12 L/s draining north and 24.41 L/s draining south. The overall pre-development flow rates draining off site were calculated to be 82.74 L/s during the 100-year event; 41.82 L/s during the 5-year event; and 30.83 L/s during the 2-year event. The Rational Method was used calculate the post-development flow rates and the Modified Rational Method was used to calculate the required storage volumes. The runoff coefficients for the 100-year event are increased by 25% to maximum 1.00. Refer to calculations in Appendix A.

Drainage Area I (Uncontrolled Flow Rate North – 625 sq.m)
The area to the north of the property will continue to drain uncontrolled north towards the watercourse (albeit reduced in area by 35%). The flow rates are calculated at a time of concentration of 10 minutes.

	100-Year Event	5-Year Event	2-Year Event
Maximum Flow Rate	10.57 L/s	5.61 L/s	4.13 L/s

Drainage Area II (Uncontrolled Flow Rate South – 1,752 sq.m)
The area to the south of the property will continue to drain uncontrolled south towards the roadside ditch. The flow rates are calculated at a time of concentration of 10 minutes.

	100-Year Event	5-Year Event	2-Year Event
Maximum Flow Rate	59.99 L/s	30.89 L/s	22.77 L/s

Drainage Area III (Proposed Roof – Drains South – 326 sq.m)
The two roof drains are to be fully closed adjustable flow control type roof drains which will restrict the flow of stormwater and cause it to pond on the roof. Roof drains shall be a fully closed adjustable flow control type each

installed with a fixed weir cone and an adjustable upper weir cone; each roof drain shall release 5 USgpm. Opening at top of flow control weir shall be a minimum 50mm in diameter: Watts Roof Drain with Watts Adjustable Accutrol Weir RD-100-A1 or approved equal. A minimum of 3 scuppers each a minimum 300 mm wide are to be installed 150 mm above the roof drains. Refer to architectural for exact locations and details. The roof is to be designed to carry the load of water having a 50 mm depth at the scuppers or 200 mm depth at the roof drains (refer to structural).

	100-Year Event	5-Year Event	2-Year Event
Maximum Release Rate	0.63 L/s	0.63 L/s	0.63 L/s
Maximum Depth at Roof Drain	146 mm	103 mm	87 mm
Maximum Volume Stored	16.92 cu.m.	7.41 cu.m.	4.97 cu.m.

Entire Site:

	100-Year Event	5-Year Event	2-Year Event
Pre-Development Flow Rate North	17.78 L/s	8.30 L/s	6.12 L/s
Pre-Development Flow Rate South	64.96 L/s	33.52 L/s	24.71 L/s
Overall Pre-Development Flow Rate	82.74 L/s	41.82 L/s	30.83 L/s
Post-Development Flow Rate North	10.57 L/s	5.61 L/s	4.13 L/s
Post-Development Flow Rate South	60.62 L/s	31.52 L/s	23.40 L/s
Overall Post-Development Flow Rate	71.19 L/s	37.13 L/s	27.54 L/s

Therefore, maximum post-development flow rate draining north is calculated to be 32% to 41% less than the pre-development flow rate; the maximum post-development flow rate draining south is calculated to be 5% to 7% less than the pre-development flow rate; and the overall maximum post-development flow rate is calculated to be 11% to 14% less than the pre-development flow rate. The post-development reduction in flow rates is expected to have a positive impact on the watercourse at the north end of the property and on the roadside ditch at the south end of the property.

4.3 STORMWATER

The roof drains will drain to grade. Foundation drains are not required.

The Ministry of Environment, Conservation and Parks (MECP) is expected to consider the property “industrial lands”; therefore, an Environmental Compliance Approval (ECA) is expected to be required for the proposed stormwater management facility. A response to a Pre-Submission Consultation Request is required, from the Ottawa office of MECP, to confirm.

5.0 CONCLUSIONS

1. As per OBC method the required water supply flow rate for firefighting for the proposed building is 1,800 L/min, which calculated to be a 54,000 L volume for 30-minute water supply. Using the FUS method the required fire flow was calculated to be 5,000 L/min and the required water supply was calculated to be 525,000 L. Since the building is less than 600 sq.m. it is expected that an onsite water supply will not be required.

2. The existing drilled well to the west of the existing building will provide the domestic water supply via an underground connection to the plumbing of the existing building. As per the Hydrogeological and Terrain Study, prepared by Paterson Group Inc. *"The total volume of water pumped during the 8 hour pumping event was approximately 9,120 L. This is approximately three times the maximum total daily design volume of water required to support the development …"*

3. The existing on-site septic system will be decommissioned, and a new on-site septic system is proposed to service the existing and proposed buildings (refer to design by Paterson Group Inc.).

4. To meet the water quality target of 80% total suspended solids (TSS) removal, runoff from the north portion of the property (previously undeveloped – prior to 2015) will drain through a proposed oil grit separator (OGS) manhole.

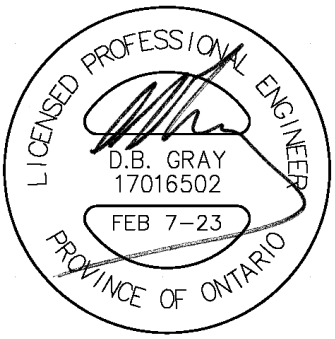
5. With the installation of permeable pavers, the post development the annual infiltration of the north portion of the property is greater than the pre-development infiltration rate and within 100 to 250 mm/yr target infiltration rate.

6. The maximum post-development flow rate draining north is calculated to be 32% to 41% less than the pre-development flow rate; the maximum post-development flow rate draining south is calculated to be 5% to 7% less than the pre-development flow rate; and the overall maximum post-development flow rate is calculated to be 11% to 14% less than the pre-development flow rate.

7. The post-development reduction in flow rates is expected to have a positive impact on the watercourse at the north end of the property and on the roadside ditch at the south end of the property.

8. It is expected that an Environmental Compliance Approval (ECA) from the Ministry of the Environment, Conservation and Parks (MECP) will be required.

Prepared by D.B. Gray Engineering Inc.



NOT VALID UNLESS
SIGNED & DATED

APPENDIX A

WATER SERVICING

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

May 30, 2022

1353 Coker Street

1-Storey Warehouse

Ottawa, Ontario

FIRE FLOW CALCULATIONS

FUS Method

F = Required fire flow in litres per minutes
= $220CA^{0.5}$

C = Coefficient related to the type of construction
= 0.8 Noncombustible Construction

A = Total floor area in square meters (excluding basements at least 50% below grade)
= 310 sq.m

F = 3,099 L/min
= 3,000 L/min (rounded to nearest 1,000 L/min)

15% Charge for Combustible Occupancy

= 3,450 L/min

Charge	Side	Separation	Construction	Length	Storeys	Length • Height
8%	North	20.1 to 30	Wood Frame	17	1	17
17%	East	3.1 to 10	Noncombustible	8	2	16
22%	South	0 to 3	Noncombustible	13	1	13
0%	West					

47% Total Exposure Charge

= 1,622 L/min Exposure Increase

= 5,072 L/min
= 5,000 L/min (rounded to nearest 1000 L/min)

Required duration of fire flow in hours
= 1.75 h as per Required Duration of Fire Flow table on page 16

Required water supply in litres
= 525,000 L

APPENDIX B

STORMWATER MANAGEMENT

D.B. Gray Engineering Inc.

Douglas Gray <d.gray@dbgrayengineering.com>

RE: CDS Sizing - 1353 Coker St, Ottawa

1 message

Natalie W <natalie@echelonenvironmental.ca> Tue, Feb 7, 2023 at 8:52 AM
To: Douglas Gray <d.gray@dbgrayengineering.com>
Cc: Ryan Faith <r.faith@dbgrayengineering.com>

Good Morning Doug,

Thank you for the sizing request! The selected CDS model is a PMSU2015-4. Please find attached our sizing calculations with a sample cut sheet drawing included for your files. If you have any questions, please feel free to contact our office at your convenience.

Best Regards,

Natalie

Natalie Wong, P.Eng.

Echelon Environmental Inc.

Office Address	Mailing Address
55 Albert Street – Suite 200	5694 Hwy #7 East - Suite 354
Markham, ON	Markham, ON
L3P 2T4	L3P 0E3

PH: 905-948-0000

MOBILE: 416-476-8936

EMAIL: Natalie@echelonenvironmental.ca

From: Douglas Gray <d.gray@dbgrayengineering.com>
Sent: February-07-23 8:41 AM
To: Natalie W <natalie@echelonenvironmental.ca>
Cc: Ryan Faith <r.faith@dbgrayengineering.com>
Subject: CDS Sizing - 1353 Coker St, Ottawa

Hi Natalie

We are working on a project at 1353 Coker St in Ottawa, Ontario. Please size the required CDS for 80% TSS removal for the following drainage area.

Landscaped Area: 23 sq.m. C = 0.20
Permeable Pavers Area: 595 sq.m. C = 0.30
Total Catchment Area: 618 sq.m.

Thanks, Doug

D.B. Gray Engineering Inc.

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

700 Long Point Circle Tel: 613-425-8044

Ottawa, Ontario K1T 4E9 d.gray@dbgrayengineering.com

1353 Coker St - CDS TSSR (07-Feb-23).pdf
510K

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

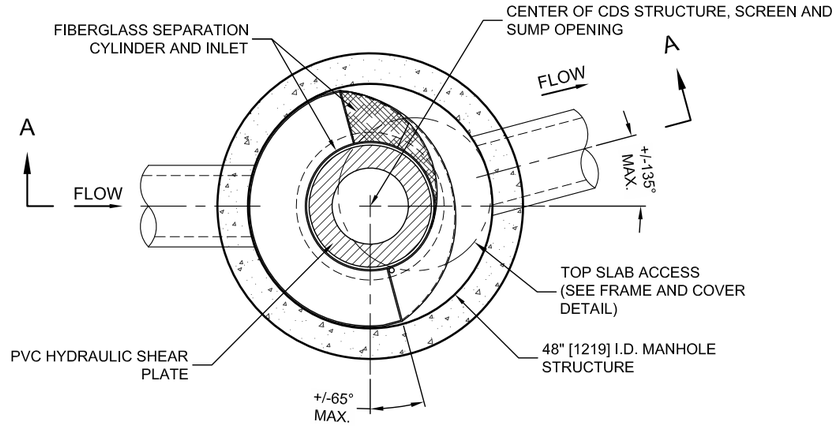
Project Name:	1353 Coker Street	**Engineer:**	**D.B. Gray Engineering**
Location:	Ottawa, ON	**Contact:**	D. Gray, P.Eng.
OGS #:	OGS	**Report Date:**	7-Feb-23

Area	0.0618	ha	**Rainfall Station #**	215	
Weighted C	0.3		**Particle Size Distribution**	FINE	
CDS Model	2015-4		**CDS Treatment Capacity**	20	l/s

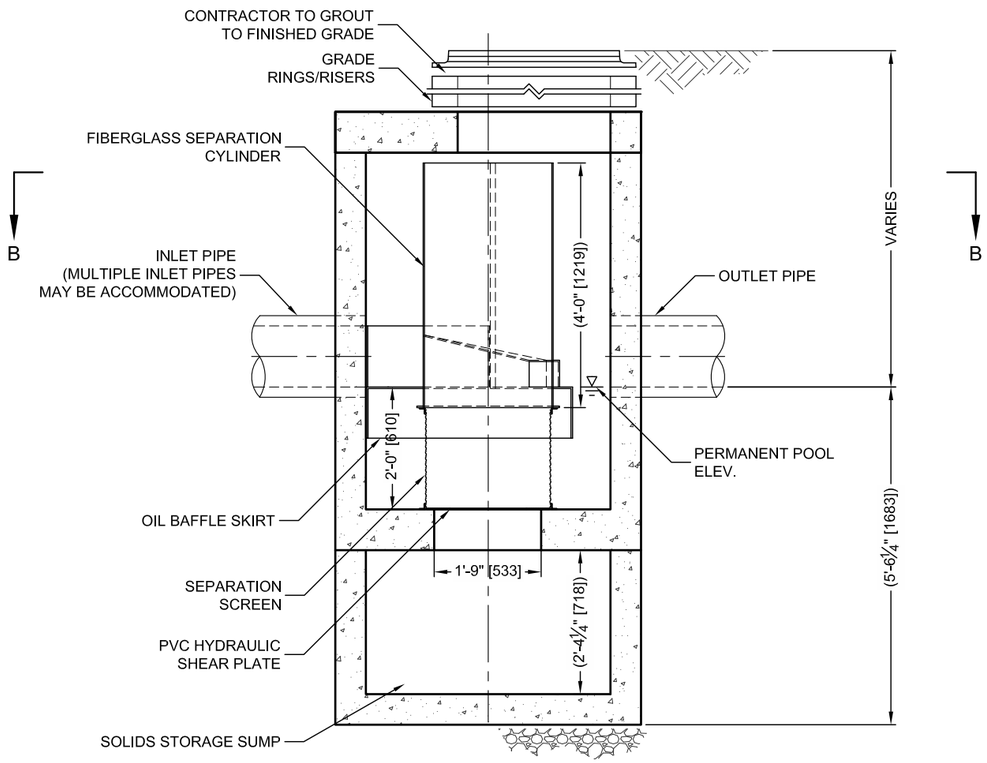
Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.5	9.2%	9.2%	0.0	0.0	0.1	98.8	9.1
1.0	10.6%	19.8%	0.1	0.1	0.3	98.8	10.5
1.5	9.9%	29.7%	0.1	0.1	0.4	98.7	9.8
2.0	8.4%	38.1%	0.1	0.1	0.5	98.7	8.3
2.5	7.7%	45.8%	0.1	0.1	0.6	98.7	7.6
3.0	5.9%	51.7%	0.2	0.2	0.8	98.6	5.9
3.5	4.4%	56.1%	0.2	0.2	0.9	98.6	4.3
4.0	4.7%	60.7%	0.2	0.2	1.0	98.6	4.6
4.5	3.3%	64.0%	0.2	0.2	1.2	98.5	3.3
5.0	3.0%	67.1%	0.3	0.3	1.3	98.5	3.0
6.0	5.4%	72.4%	0.3	0.3	1.6	98.4	5.3
7.0	4.4%	76.8%	0.4	0.4	1.8	98.3	4.3
8.0	3.5%	80.3%	0.4	0.4	2.1	98.3	3.5
9.0	2.8%	83.2%	0.5	0.5	2.3	98.2	2.8
10.0	2.2%	85.3%	0.5	0.5	2.6	98.1	2.1
15.0	7.0%	92.3%	0.8	0.8	3.9	97.7	6.8
20.0	4.5%	96.9%	1.0	1.0	5.2	97.4	4.4
25.0	1.4%	98.3%	1.3	1.3	6.5	97.0	1.4
30.0	0.7%	99.0%	1.5	1.5	7.8	96.6	0.6
35.0	0.5%	99.5%	1.8	1.8	9.1	96.2	0.5
40.0	0.5%	100.0%	2.1	2.1	10.4	95.9	0.5
45.0	0.0%	100.0%	2.3	2.3	11.7	95.5	0.0
50.0	0.0%	100.0%	2.6	2.6	13.0	95.1	0.0
							98.4

Removal Efficiency Adjustment[2] =	6.5%
Predicted Net Annual Load Removal Efficiency =	**91.9%**
Predicted % Annual Rainfall Treated =	**100.0%**

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.
3 - CDS Efficiency based on testing conducted at the University of Central Florida
4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications



PLAN VIEW B-B
N.T.S.



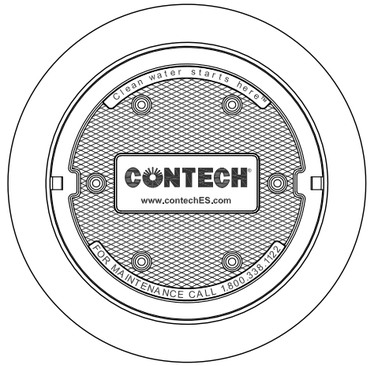
ELEVATION A-A
N.T.S.

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 8,511,500; 6,581,783; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

CDS PMSU2015-4-C DESIGN NOTES

THE STANDARD CDS PMSU2015-4-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
CUSTOMIZABLE SUMP DEPTH AVAILABLE
ANTI-FLOTATION DESIGN AVAILABLE UPON REQUEST



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH® ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS PMSU2015-4-C INLINE CDS STANDARD DETAIL

03-Feb-23

1353 Coker Street

Ottawa, Ontario

Water Balance and Infiltration Calculations

Water Balance is based on the equation: Mean Annual Precipitation - Change in Groundwater Storage - Evapotranspiration = Runoff + Infiltration

Where: Long term changes to groundwater storage are assumed to be negligible
and
Short term or seasonal changes to groundwater are assumed to balance out over the year.

Therefore: Mean Annual Precipitation - Evapotranspiration = Runoff + Infiltration

Infiltration is based on the equations: Surplus (available for infiltration) = Mean Annual Precipitation - Evapotranspiration
and
Infiltration = Surplus x Infiltration Coefficient
and
Infiltration Coefficient = Topography Factor + Soil Factor + Vegetation Factor
(as per the MOE SWM Planning & Design Manual, 2003 - see below)

Pre-Development (undeveloped area prior to 2015 - draining north)

	Area (sq.m.)	Precipitation + (mm/yr)	Evapo-transpiration ++ (mm/yr)	Surplus (mm/yr)	Topography Factor *	Soil Factor **	Vegetation Factor ***	Infiltration Coefficient	Infiltration (mm/yr)
"Forest-decidous"	955	943	638	305	0.10	0.15	0.2	0.45	137
Total:	955							Weighted Average:	137

Post Development

	Area (sq.m.)	Precipitation + (mm/yr)	Evapo-transpiration ++ (mm/yr)	Surplus (mm/yr)	Topography Factor *	Soil Factor **	Vegetation Factor ***	Infiltration Coefficient	Infiltration (mm/yr)
Landscaped	36	943	577	366	0.10	0.15	0.1	0.35	128
Permeable Pavers	634	943	174	769	0.13	0.15	0.0	0.28	215
Hard Surfaces	285	943	150	793				0.00	0
Total:	955							Weighted Average:	148

\+ Ottawa International Airport (1981-2010)
++ Eastern Ontario Water Resources Management Study (2001); Carp River Watershed / Subwatershed Study; & Effects On Evaporation Rates From Different Water-Permeable Pavement Designs, P. Starke, P. Göbel & W. G. Coldewey (16% increase relative impermeable pavements)

		Factor	Subject Property
* Topography:	Flat Land, average slope < 0.6m/km (<.06%)	0.3	Permeable Pavers: 0.13 = 0.15 for 377 sq.m. (1% to 2.8% slopes) +
	Rolling Land, average slope 2.8 to 3.8m/km (0.28% to 0.38%)	0.2	0.10 for 257 sq.m. (2.8% to 5% slopes)
	Hilly Land, average slope 28 to 47m/km (2.8% to 4.7%)	0.1	Landscaped: 0.10 (2.8% to 4.7%)
** Soil:	Tight impervious clay	0.1	= 0.15 for sily sand / silty clay
	Medium combination of clay and loam	0.2	
	Open sandy loam	0.4	
*** Cover:	Cultivated Lands	0.1	
	Woodland	0.2	

As per MOE SWM Planning & Design Manual, 2003

SUMMARY TABLES

ONE-HUNDRED-YEAR EVENT

Drainage Area	Pre-Development Flow Rate			Post Development Flow Rate			Maximum Volume Required & Stored (cu.m)
	North (L/s)	South (L/s)	Total (L/s)	North (L/s)	South (L/s)	Total (L/s)	
AREA I (Uncontrolled Flow Rate North)	-	-	-	10.57	-	-	-
AREA II (Uncontrolled Flow Rate South)	-	-	-	-	59.99	-	-
AREA III (Roof South)	-	-	-	-	0.63	-	16.92
TOTAL	17.78	64.96	82.74	10.57	60.62	71.19	16.92

FIVE-YEAR EVENT

Drainage Area	Pre-Development Flow Rate			Post Development Flow Rate			Maximum Volume Required & Stored (cu.m)
	North (L/s)	South (L/s)	Total (L/s)	North (L/s)	South (L/s)	Total (L/s)	
AREA I (Uncontrolled Flow Rate North)	-	-	-	5.61	-	-	-
AREA II (Uncontrolled Flow Rate South)	-	-	-	-	30.89	-	-
AREA III (Roof South)	-	-	-	-	0.63	-	7.41
TOTAL	8.30	33.52	41.82	5.61	31.52	37.13	7.41

TWO-YEAR EVENT

Drainage Area	Pre-Development Flow Rate			Post Development Flow Rate			Maximum Volume Required & Stored (cu.m)
	North (L/s)	South (L/s)	Total (L/s)	North (L/s)	South (L/s)	Total (L/s)	
AREA I (Uncontrolled Flow Rate North)	-	-	-	4.13	-	-	-
AREA II (Uncontrolled Flow Rate South)	-	-	-	-	22.77	-	-
AREA III (Roof South)	-	-	-	-	0.63	-	4.97
TOTAL	6.12	24.71	30.83	4.13	23.40	27.54	4.97

March 7, 2022
REVISED February 3, 2023

1353 Coker Street

Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS
Modified Rational Method

ONE-HUNDRED-YEAR EVENT

NORTH PRE-DEVELOPMENT (2015) FLOW RATE

			C	
Roof Area:	0	sq.m	1.00	
Asphalt/Concrete Area:	0	sq.m	1.00	1.25 x Woodland or Pasture - Flat - Clay and Silt Loam as per Table 5.7 Ottawa Sewer Design Guidelines
Gravel Area:	0	sq.m	0.875	
Exisitng Conditions:	955	sq.m	0.375	
Landscaped Area:	0	sq.m	0.25	
Total Catchment Area:	955	sq.m	0.38	

Bransby Williams Formula

$$Tc = \frac{0.057 \bullet L}{Sw^{0.2} \bullet A^{0.1}} \text{ min}$$

Sheet Flow Distance (L):	50	m
Slope of Land (Sw):	1	%
Area (A):	0.0955	ha
Time of Concentration (Sheet Flow):	4	min
Area (A):	955	sq.m
Time of Concentration:	10	min
Rainfall Intensity (i):	179	mm/hr
Runoff Coeficient (C):	0.38	
Flow Rate (2.78AiC):	17.78	L/s

SOUTH PRE-DEVELOPMENT (2015) FLOW RATE

			C
Roof Area:	505	sq.m	1.00
Asphalt/Concrete Area:	600	sq.m	1.00
Gravel Area:	75	sq.m	0.875
Landscaped Area:	552	sq.m	0.25
Total Catchment Area:	1,732	sq.m	0.76

Bransby Williams Formula

$$Tc = \frac{0.057 \bullet L}{Sw^{0.2} \bullet A^{0.1}} \text{ min}$$

Sheet Flow Distance (L):	35	m
Slope of Land (Sw):	0.5	%
Area (A):	0.1732	ha
Time of Concentration (Sheet Flow):	3	min
Area (A):	1,732	sq.m
Time of Concentration:	10	min
Rainfall Intensity (i):	179	mm/hr
Runoff Coeficient (C):	0.76	
Flow Rate (2.78AiC):	64.96	L/s

DRAINAGE AREA I (Uncontrolled Flow Rate North)

(ONE-HUNDRED-YEAR EVENT)

			C
Roof Area:	0	sq.m	1.00
Asphalt/Concrete Area:	0	sq.m	1.00
Gravel Area:	21	sq.m	0.875
Permeable Pavers Area:	581	sq.m	0.325
Landscaped Area:	23	sq.m	0.25
Total Catchment Area:	625	sq.m	0.34
Area (A):	625	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	0.34		
Flow Rate (2.78AiC):	10.57	L/s	

DRAINAGE AREA II (Uncontrolled Flow Rate South)

(ONE-HUNDRED-YEAR EVENT)

			C
Roof Area:	387	sq.m	1.00
Asphalt/Concrete Area:	581	sq.m	1.00
Gravel Area:	69	sq.m	0.875
Permeable Pavers Area:	72	sq.m	0.325
Landscaped Area:	627	sq.m	0.25
Total Catchment Area:	1,736	sq.m	0.70
Area (A):	1,736	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	0.70		
Flow Rate (2.78AiC):	59.99	L/s	

DRAINAGE AREA III (Proposed Roof - Drains South)

(ONE-HUNDRED-YEAR EVENT)

			C
Total Catchment Area:	326	sq.m	1.00

No. of Roof Drains:	2	
Fully Closed Adjustable Wiers:	1	0.01242 L/s/slot (5 USgpm/slot)

Depth at Roof Drain:	146	mm			
Maximum Release Rate:	0.63	L/s	Pond Area:	281	sq.m
			Maximum Volume Stored:	16.92	cu.m
			Maximum Volume Required:	16.92	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
5	243	22.00	0.63	21.36	6.41
10	179	16.18	0.63	15.55	9.33
15	143	12.95	0.63	12.32	11.09
20	120	10.87	0.63	10.24	12.29
25	104	9.41	0.63	8.78	13.17
30	92	8.33	0.63	7.69	13.85
40	75	6.81	0.63	6.18	14.83
50	64	5.80	0.63	5.17	15.50
60	56	5.07	0.63	4.43	15.96
70	50	4.51	0.63	3.88	16.30
80	45	4.08	0.63	3.45	16.54
90	41	3.73	0.63	3.09	16.71
100	38	3.44	0.63	2.80	16.82
110	35	3.19	0.63	2.56	16.89
120	33	2.98	0.63	2.35	16.92
130	31	2.80	0.63	2.17	16.92
140	29	2.64	0.63	2.01	16.89
150	28	2.50	0.63	1.87	16.84
160	26	2.38	0.63	1.75	16.77
170	25	2.27	0.63	1.64	16.68
180	24	2.17	0.63	1.54	16.58
190	23	2.08	0.63	1.44	16.46
200	22	1.99	0.63	1.36	16.34
210	21	1.92	0.63	1.29	16.20

FIVE-YEAR EVENT

NORTH PRE-DEVELOPMENT (2015) FLOW RATE

			C	
Roof Area:	0	sq.m	0.90	
Asphalt/Concrete Area:	0	sq.m	0.90	1.25 x Woodland or Pasture - Flat - Clay and Silt Loam as per Table 5.7 Ottawa Sewer Design Guidelines
Gravel Area:	0	sq.m	0.80	
Exisitng Conditions:	955	sq.m	0.30	
Landscaped Area:	0	sq.m	0.20	
Total Catchment Area:	955	sq.m	0.30	
Area (A):	955	sq.m		
Time of Concentration:	10	min		
Rainfall Intensity (i):	104	mm/hr		
Runoff Coeficient (C):	0.30			
Flow Rate (2.78AiC):	8.30	L/s		

SOUTH PRE-DEVELOPMENT (2015) FLOW RATE

			C
Roof Area:	505	sq.m	0.90
Asphalt/Concrete Area:	600	sq.m	0.90
Gravel Area:	75	sq.m	0.70
Landscaped Area:	552	sq.m	0.20
Total Catchment Area:	1,732	sq.m	0.67
Area (A):	1,732	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.67		
Flow Rate (2.78AiC):	33.52	L/s	

DRAINAGE AREA I (Uncontrolled Flow Rate North)

(FIVE-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Asphalt/Concrete Area:	0	sq.m	0.90
Gravel Area:	21	sq.m	0.70
Permeable Pavers Area:	581	sq.m	0.30
Landscaped Area:	23	sq.m	0.20
Total Catchment Area:	625	sq.m	0.31
Area (A):	625	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.31		
Flow Rate (2.78AiC):	5.61	L/s	

DRAINAGE AREA II (Uncontrolled Flow Rate South)

(FIVE-YEAR EVENT)

			C
Roof Area:	387	sq.m	0.90
Asphalt/Concrete Area:	581	sq.m	0.90
Gravel Area:	69	sq.m	0.70
Permeable Pavers Area:	72	sq.m	0.30
Landscaped Area:	627	sq.m	0.20
Total Catchment Area:	1,736	sq.m	0.61
Area (A):	1,736	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.61		
Flow Rate (2.78AiC):	30.89	L/s	

DRAINAGE AREA III (Proposed Roof - Drains South)

(FIVE-YEAR EVENT)

			C
Total Catchment Area:	326	sq.m	0.90

No. of Roof Drains:	2	
Fully Closed Adjustable Wiers:	1	0.01242 L/s/slot (5 USgpm/slot)

Depth at Roof Drain:	103	mm			
Maximum Release Rate:	0.63	L/s	Pond Area:	168	sq.m
			Maximum Volume Stored:	7.41	cu.m
			Maximum Volume Required:	7.41	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
5	141	11.52	0.63	10.88	3.27
10	104	8.50	0.63	7.87	4.72
15	84	6.82	0.63	6.18	5.57
20	70	5.73	0.63	5.10	6.12
25	61	4.97	0.63	4.34	6.50
30	54	4.40	0.63	3.77	6.78
40	44	3.60	0.63	2.97	7.14
50	38	3.07	0.63	2.44	7.32
60	33	2.69	0.63	2.06	7.40
70	29	2.40	0.63	1.76	7.41
80	27	2.17	0.63	1.54	7.37
90	24	1.98	0.63	1.35	7.29
100	22	1.83	0.63	1.20	7.18
110	21	1.70	0.63	1.07	7.05
120	19	1.59	0.63	0.96	6.89
130	18	1.49	0.63	0.86	6.72
140	17	1.41	0.63	0.78	6.53
150	16	1.33	0.63	0.70	6.33
160	16	1.27	0.63	0.64	6.12
170	15	1.21	0.63	0.58	5.90
180	14	1.16	0.63	0.53	5.68
190	14	1.11	0.63	0.48	5.44
200	13	1.06	0.63	0.43	5.20
210	13	1.02	0.63	0.39	4.95

TWO-YEAR EVENT

NORTH PRE-DEVELOPMENT (2015) FLOW RATE

			C	
Roof Area:	0	sq.m	0.90	
Asphalt/Concrete Area:	0	sq.m	0.90	1.25 x Woodland or Pasture - Flat - Clay and Silt Loam as per Table 5.7 Ottawa Sewer Design Guidelines
Gravel Area:	0	sq.m	0.80	
Exisitng Conditions:	955	sq.m	0.30	
Landscaped Area:	0	sq.m	0.20	
Total Catchment Area:	955	sq.m	0.30	
Area (A):	955	sq.m		
Time of Concentration:	10	min		
Rainfall Intensity (i):	77	mm/hr		
Runoff Coeficient (C):	0.30			
Flow Rate (2.78AiC):	6.12	L/s		

SOUTH PRE-DEVELOPMENT (2015) FLOW RATE

			C
Roof Area:	505	sq.m	0.90
Asphalt/Concrete Area:	600	sq.m	0.90
Gravel Area:	75	sq.m	0.70
Landscaped Area:	552	sq.m	0.20
Total Catchment Area:	1,732	sq.m	0.67
Area (A):	1,732	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr	
Runoff Coeficient (C):	0.67		
Flow Rate (2.78AiC):	24.71	L/s	

DRAINAGE AREA I (Uncontrolled Flow Rate North)

(TWO-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Asphalt/Concrete Area:	0	sq.m	0.90
Gravel Area:	21	sq.m	0.70
Permeable Pavers Area:	581	sq.m	0.30
Landscaped Area:	23	sq.m	0.20
Total Catchment Area:	625	sq.m	0.31
Area (A):	625	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr	
Runoff Coeficient (C):	0.31		
Flow Rate (2.78AiC):	4.13	L/s	

DRAINAGE AREA II (Uncontrolled Flow Rate South)

(TWO-YEAR EVENT)

			C
Roof Area:	387	sq.m	0.90
Asphalt/Concrete Area:	581	sq.m	0.90
Gravel Area:	69	sq.m	0.70
Permeable Pavers Area:	72	sq.m	0.30
Landscaped Area:	627	sq.m	0.20
Total Catchment Area:	1,736	sq.m	0.61
Area (A):	1,736	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr	
Runoff Coeficient (C):	0.61		
Flow Rate (2.78AiC):	22.77	L/s	

DRAINAGE AREA III (Proposed Roof - Drains South)

(TWO-YEAR EVENT)

			C
Total Catchment Area:	326	sq.m	0.90

No. of Roof Drains:	2	
Fully Closed Adjustable Wiers:	1	0.01242 L/s/slot (5 USgpm/slot)

Depth at Roof Drain:	87	mm			
Maximum Release Rate:	0.63	L/s	Pond Area:	132	sq.m
			Maximum Volume Stored:	4.97	cu.m
			Maximum Volume Required:	4.97	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
5	104	8.45	0.63	7.82	2.35
10	77	6.26	0.63	5.63	3.38
15	62	5.04	0.63	4.41	3.97
20	52	4.24	0.63	3.61	4.34
25	45	3.68	0.63	3.05	4.58
30	40	3.27	0.63	2.64	4.74
40	33	2.68	0.63	2.05	4.92
50	28	2.29	0.63	1.66	4.97
60	25	2.00	0.63	1.37	4.94
70	22	1.79	0.63	1.16	4.86
80	20	1.62	0.63	0.99	4.74
90	18	1.48	0.63	0.85	4.58
100	17	1.37	0.63	0.73	4.41
110	16	1.27	0.63	0.64	4.22
120	15	1.19	0.63	0.56	4.01
130	14	1.12	0.63	0.49	3.79
140	13	1.05	0.63	0.42	3.56
150	12	1.00	0.63	0.37	3.32
160	12	0.95	0.63	0.32	3.07
170	11	0.91	0.63	0.28	2.81
180	11	0.87	0.63	0.24	2.55
190	10	0.83	0.63	0.20	2.28
200	10	0.80	0.63	0.17	2.00
210	9	0.77	0.63	0.14	1.73

APPENDIX C

PRE-CONSULTATION MEETING NOTES & CITY OF OTTAWA SERVICING STUDY CHECKLIST

Pre-Consult 1353 and 1359 Cooker Street

South Nation Conservation – James Holland

- There Is a water course on site
- needs quality protection
- permit previously issued for enclosing watercourse only a section 30 ft long with a 20 inch dia pipe.
- review/require DFO
- need update stormwater - from old site plan - 80% TSS post to pre quantity.
- Watercourses are likely low-flow, intermittent watercourses that likely are indirect fish habitat. Year-round use is unlikely due to flow and heavy vegetation.
- SNC recommends that DFO is consulted via a Request for Review when a project has the potential to cause a Harmful Alteration, Disruption, or Destruction (HADD) to fish and/or fish habitat. However, if a project can be completed following all of DFO's fish protection measures, a Request for Review is not needed. In this case, I think a piping/culverts of this watercourse can be done without a RFR provided all of the fish protection measures are followed.

Engineering (Reza Bakhit)

- need new Stormwater Managament – demonstrate post to pre
- comply with the Shields Creek Subwatershed Study
- site servicing report required
- erosion and sediment
- geotech
- hydrogeological assessment and terrain analysis report required to demonstrate private servicing (well and septic)
- ECA required from MECP

Other (C McWilliams)

- Fire services may require addition on site suppression
- landscape plan needed, so also incclde a tree conservation report.
- verify permitting for buildings on site – appears to be more than had been permitted between the 3 parcels
- demonstrate zoning compliance

Transportation (Mike Giampa)

- Submit a screening form. If a TIA is warranted proceed to scoping.

The application will not be deemed complete until the submission of the draft step 1-4, including the functional draft RMA package (if applicable) and/or monitoring report (if applicable).
Although a full review of the TIA Strategy report (Step 4) is not required prior to an application, it is strongly recommended.

- A Noise Impact Study is not required
- On site plan:

Show all details of the roads abutting the site up to and including the opposite curb; include such items as pavement markings, accesses and/or sidewalks.
Turning templates will be required for all accesses showing the largest vehicle to access the site; required for internal movements and at all access (entering and exiting and going in both directions).
Show existing and proposed access widths.

CITY OF OTTAWA SERVICING STUDY CHECKLIST

GENERAL

Executive Summary: **N/A**

Date and revision number of report: **Included**

Location map and plan showing municipal address, boundary and layout of proposed development: **Included**

Plan showing site and location of all existing services: **Included**

Development statistics, land use, density, adherence to zoning and Official Plan and reference to applicable watershed and subwatershed plans: **N/A**

Summary of Pre-Application Consultation meetings with City of Ottawa and other approval agencies: **Included**

Confirmation of conformance with higher level studies: **N/A**

Statement of objectives and servicing criteria: **Included**

Identification of existing and proposed infrastructure available in the immediate area: **Included**

Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development: **Included**

Concept level master grading plan to confirm existing and proposed grades in the proposed development: **Included**

Identification of potential impacts of proposed piped services on private services on adjacent lands: **N/A**

Proposed phasing of proposed development: **N/A**

Reference to geotechnical studies: **Included**

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

- Metric scale: **Included**
- North arrow: **Included**
- Key plan: **Included**
- Name and contact information of applicant and property owner: **N/A**
- Property limits: **Included**
- Existing and proposed structures and parking areas: **Included**
- Easements, road widenings and right-of-ways: **Included**
- Street names: **Included**

WATER SERVICING

Confirmation of conformance with Master Servicing Study: **N/A**

Availability of public infrastructure to service proposed development: **N/A**

Identification of system constraints: **N/A**

Identification of boundary conditions: **N/A**

Confirmation of adequate domestic supply: **N/A**

Confirmation of adequate fire flow: **TBD**

Check of high pressures: **N/A**

Definition of phasing constraints: **N/A**

Address reliability requirements: **N/A**

Check on necessity of a pressure zone boundary modification: **N/A**

Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for proposed development: **N/A**

Description of proposed water distribution network: **N/A**

Description of required off-site infrastructure to service proposed development: **N/A**

Confirmation that water demands are calculated based on the City of Ottawa Water Design Guidelines: **N/A**

Provision of a model schematic showing the boundary conditions locations, streets, parcels and building locations: **N/A**

SANITARY SERVICING

Summary of proposed design criteria: **Included**

Confirmation of conformance with Master Servicing Study: **N/A**

Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the City of Ottawa Sewer Design Guidelines: **N/A**

Description of existing sanitary sewer available for discharge of wastewater from proposed development: **N/A**

Verification of available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service proposed development: **N/A**

Calculations related to dry-weather and wet-weather flow rates: **N/A**

Description of proposed sewer network: **Included**

Discussion of previously identified environmental constraints and impact on servicing: **N/A**

Impacts of proposed development on existing pumping stations or requirements for new pumping station: **N/A**

Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity: **N/A**

Identification and implementation of emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding: **N/A**

Special considerations (e.g. contamination, corrosive environment): **N/A**

STORMWATER MANAGEMENT & STORM SERVICING

Description of drainage outlets and downstream constraints: **Included**

Analysis of available capacity in existing public infrastructure: **N/A**

Plan showing subject lands, its surroundings, receiving watercourse, existing drainage pattern and proposed drainage pattern: **Included**

Water quantity control objective: **Included**

Water quality control objective: **Included**

Description of the stormwater management concept: **Included**

Setback from private sewage disposal systems: **N/A**

Watercourse and hazard lands setbacks: **N/A**

Record of pre-consultation with the Ministry of the Environment, Conservation and Parks and the Conservation Authority having jurisdiction on the affected watershed: **Included**

Confirmation of conformance with Master Servicing Study: **N/A**

Storage requirements and conveyance capacity for minor events (5-year return period) and major events (100-year return period): **Included**

Identification of watercourses within the proposed development and how watercourses will be protected or if necessary altered by the proposed development: **Included**
Calculation of pre-development and post-development peak flow rates: **Included**

Any proposed diversion of drainage catchment areas from one outlet to another: **N/A**

Proposed minor and major systems: **N/A**

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: **N/A**

Identification of potential impacts to receiving watercourses: **Included**

Identification of municipal drains: **N/A**

Description of how the conveyance and storage capacity will be achieved for the proposed development: **Included**

100-year flood levels and major flow routing: **Included**

Inclusion of hydraulic analysis including hydraulic grade line elevations: **N/A**

Description of erosion and sediment control during construction: **Included**

Obtain relevant floodplain information from Conservation Authority: **N/A**

Identification of fill constraints related to floodplain and geotechnical investigation: **N/A**

APPROVAL AND PERMIT REQUIREMENTS

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: **N/A**

Application for Certificate of Approval (CofA) under the Ontario Water Resources Act: **N/A**

Changes to Municipal Drains: **N/A**

Other permits (e.g. National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation): **N/A**

CONCLUSIONS

Clearly stated conclusions and recommendations: **Included**

Comments received from review agencies: **N/A**

Signed and stamped by a professional Engineer registered in Ontario: **Included**