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SITE SERVICING STUDY, STORMWATER MANAGEMENT AND DEVELOPMENT WITHIN A FLOODPLAIN REPORT

2104 ROGER STEVENS DRIVE
OTTAWA, ONTARIO

REPORT NO. 23024

OCTOBER 25, 2024
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LIST OF APPENDICES

1.0 INTRODUCTION

This Site Servicing Study, Stormwater Management and Development Within A Floodplain Report is a description of the servicing for a proposed Hindu Temple and Priest's Residence, addresses the stormwater management requirements, and addresses development within a floodplain requirements, of 2.04 ha of land located at 2104 Roger Stevens Drive, in Ottawa. Approximately 1.11 ha of the subject is in the floodplain (i.e. having a grade elevation lower than the local 100-year flood plain elevation of 89.67). Less than half of the property is proposed to be developed (0.93 ha); and, although, small areas of 'cut and fill' are proposed, the floodplain will remain at 1.11 ha in area and will remain undeveloped on the property. Currently, the property is occupied by a former single family dwelling.

This report forms part of the stormwater management design for the proposed development. Also refer to drawings C-1 to C-7 prepared by D. B. Gray Engineering Inc.

2.0 WATER SERVICING

2.1 WATER SUPPLY FOR FIREFIGHTING

Using the Ontario Building Code (OBC) method to calculate the water supply for firefighting the required storage volume (Q) is 185,398 L and the required flowrate (FF) is 5,400 L/min (as per OBC A-3.2.5.7. Table 2). As per the City of Ottawa Technical Bulletin IWSTB-2024-05, if FF is 5,400 or 6,300 L/min the minimum required storage is Q; therefore, the minimum is 185,398 L. Refer to calculations in Appendix A.

Five 45,000 L (approximately 10,000 Imperial gallon) tanks are proposed for a total of 225,000 L, exceeding the required volume. This volume calculates to be about a 42-minute water supply at 5,400 L/min, which is greater than the 30-minute minimum required by OBC. One tank will be equipped with a chute and draw pipe, and the other tanks will have a chute and vent.

2.2 DOMESTIC WATER SUPPLY

An existing drilled well located with the footprint of the proposed temple building will be decommissioned. A recently constructed drilled well; approximately 7 m north of the proposed temple building, will provide the domestic water supply. A 'Hydrogeological Assessment and Terrain Analysis', is being prepared by Paterson Group.

3.0 SANITARY SERVICING

An on-site sewage (septic) system is proposed. (The existing septic system will be decommissioned and components removed from the site and disposed at a licensed facility.) The total daily design sanitary sewage flow (TDDSSF) of the new septic system is 7,250 L/day, as calculated in accordance with the Part 8 of the OBC. The TDDSSF is based on a Temple occupancy of 125 people (with an allowance for two showers within the Temple), one two-bedroom (each with a single bed) apartment within the Temple, and a two-bedroom Priest's Residence (with a ground floor assembly hall):

Temple Building ('Churches & Similar Places of Worship – with kitchen facilities provided'):
- 125 people x 36 L/day per person = 4,500 L/day
- 2 people x 275 L/day per person (one two-person apartment) = 550 L/day
- 30 people x 30 L/day per person (allowance for showers) = 900 L/day
- Sub-total: 5,950 L/day

Priest's Residence:
- One 2-bedroom dwelling: 1,100 L/day
- 'Assembly Hall (with no food service)': 25 people x 8 L/day per person = 200 L/day
- Sub-total: 1,300 L/day

Total TDDSSF: 7,250 L/day

As concluded in the 'Preliminary Nitrate Impact Assessment', prepared by Paterson Group (File: PH4905-LET.01, dated August 2, 2024): *"The current site plans combined with the assumptions mentioned in this report were used to calculate a maximum TDDSSF for the subject site. The use of a conventional sewage system (40 mg/L nitrate concentration) would allow for a maximum TDDSSF of 3,440 L/day to attenuate the nitrate concentration to 10 mg/L in the groundwater prior to the property line. The maximum allowable sewage flows can be increased to 10,000 L/day if a certified CAN/BNQ or NSF/ANSI tertiary treatment system with nitrate reduction technology with a minimum of 50 % nitrate reduction is used."*

The proposed on-site septic system will be a Class 4 system sized for a TDDSSF flow of 7,250 L/day; consisting of a minimum 21,750 L (3 x TDDSSF) septic tank; a minimum 3,000 L time-dosing pump tank; four ECOFLO biofilter treatment units (two 650B and two 650BR (pumped) units – each having a 2,500 L capacity with time dosing) with an ECOFLO Denitrification Unit certified for 50% reduction in nitrates as per NSF/ANSI Standard 245); and a Type 'A' dispersal bed.

An application for a septic permit will be submitted to the Ottawa Septic System Office (OSSO).

4.0 STORMWATER MANAGEMENT

4.1 QUALITY CONTROL

As stated in the 'Pre-Application Consultation Meeting Notes' (refer to Appendix D): *"LID is required as per the memo from the former MOECC (now MECP)"*; and the Rideau Valley Conservation Authority (RVCA) has set the water quality criteria as 'enhanced', which is 80% TSS (total suspended solids) removal.

To meet the water quality target of 80% total suspended solids (TSS) removal, an oil grit separator (OGS) manhole is proposed. 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 82% of the TSS. Refer to Appendix B. The CDS PMSU2015-4 has an oil capacity of 232 L and a sediment capacity of 0.7 m^3.

To achieve a LID design, permeable pavers are proposed for parking stalls and a 'procession' walkway, totalling about 1,231 m^2 (about 22% of all pavement areas). As per the Annual Water Budget Calculation prepared by Paterson Group (after consultation with RVCA staff) (refer to Appendix B) the total annual infiltration for the pre-development (existing) conditions is calculated to be 2,042,712 L/year. Post development, without permeable pavers, it is 1,248,383 L/year (39% less), but with the installation of 1,231 m^2 of permeable pavers, annual infiltration 1,635,286 L/year; 20% less than pre-development conditions but an increase of 31% if permeable pavers are not installed. Refer to calculations in Appendix B.

Permeable Paver Maintenance: Based on the 'Sustainable Technologies Evaluation Program Low Impact Development Stormwater Management Planning and Design Guide', the following maintenance procedures and preventative measures should be incorporated into a maintenance plan:

- Annual inspections of permeable pavement should be conducted in the spring. These inspections should check for evidence of spills and surface ponding (staining or sediment accumulation on pavement surface), damage and deterioration.
- Keep the pavement surface free of organic material through regular sweeping and vacuuming.
- Surface sweeping should occur once or twice a year with a commercial vacuum sweeping unit. Permeable pavement should not be washed with high pressure water systems or compressed air units, because they will push particles deeper into the pavement.
- Vacuuming of the surface should occur on an annual basis.
- Seal coats should never be applied to permeable pavements.
- An uneven paver surface can be repaired by pulling up the pavers, redistributing the bedding course, and then placing the pavers back. New joint filling will need to be swept into the replaced pavers. A set of replacement pavers should be kept onsite for making future repairs.

Winter Maintenance:

- Sand should not be spread on permeable pavement as it can quickly lead to clogging.

- De-icers should only be used in moderation and only when needed.
- Snow should not be stored on top of permeable pavements.

An erosion and sediment control plan has been developed to be implemented during construction, (see drawing C-4 and notes 2.1 to 2.7 on drawing C-5). In summary: to filter out construction sediment a silt fence barrier will be installed around the perimeter of the site where runoff will drain off the site, a mud mat will be installed at the egress point, sediment capture filter sock inserts are to be installed in all new catch basins as they are installed, and any material deposited on a public road will be removed.

4.2 QUANTITY CONTROL

As stated in the 'Pre-Application Consultation Meeting Notes' (refer to Appendix D): *"The 100-year post development flow must be controlled to the 2-year pre-development return period storm level … using the smaller of a run-off coefficient of: 0.5* [or] *actual existing approved site runoff coefficient."*

It is determined that pre-development condition reflected a runoff coefficient of 0.29; and, using the Bransby Williams Formula, the time of concentration is 5 minutes; however, as required by the City the time of concentration shall not be less than 10 minutes. Using the Rational Method, and a time of concentration of 10 minutes, a proposed developed area of 9,347 m^2, the pre-development 2-year peak flow is 58.72 L/s. Therefore, the maximum allowable release rate is 58.72 L/s for all storm events up to the 100-year event. Refer to calculations in Appendix B.

Stormwater will be stored within the development on the Temple roof and on the surface above catch basins. The stormwater released from the site will discharge to the Roger Stevens Drive roadside ditch. The Modified Rational Method is used to calculate the required storage volume. The runoff coefficients for the 100-year event are increased by 25% to maximum 1.00.

The 1.11 ha of floodplain is not being developed and is not included in the calculations.

Drainage Area I (Uncontrolled Flow Off Site – 1,623 m^2)
Areas around the perimeter of the property and adjacent to the floodplain will drain uncontrolled off site. The flow rates are calculated at a time of concentration of 10 minutes.

	100-Year Event	2-Year Event
Maximum Flow Rate	25.87 L/s	9.23 L/s

Drainage Area III (Temple Roof – 1,040 m^2)
Six roof drains on the Temple roof will be flow control type roof drains which will restrict the flow of stormwater and cause it to pond on the roof. Each roof drain is to be installed with one parabolic slotted weir and releasing 0.01242 L/s/mm (5 USgpm/in). The stormwater released through the roof drains will drain to an uncontrolled storm sewer that drains to the roadside ditch near the northeast corner of the property. The roof drains will be Watts with an Accutrol Weir RD-100-A1 or approved equal. The opening at the top of the flow control weir is to be a minimum 50 mm in diameter. A minimum of eight scuppers each a minimum 400 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	2-Year Event
Maximum Release Rate	9.85 L/s	6.49 L/s
Maximum Depth at Roof Drain	132 mm	87 mm
Maximum Volume Stored	30.25 m^3	8.63 m^3

Drainage Area III (6,684 m^2)

An inlet control device (ICD) located in the outlet pipe of catch basin/manhole CB/MH-13 will control the release of stormwater from this drainage area and will discharge to the roadside ditch (via the OGS manhole) near the northeast corner of the property. The ICD will restrict the flow and force the stormwater to rise in the sewer pipes, catch basins and manholes, and onto the surfaces above the catch basins. The ICD shall be a plug style design with a trash basket and a round orifice located at the bottom of the plug, and shall be manufactured by Pedro Plastics (or approved equal), and each shall be sized by the manufacturer for a discharge rate of 22.99 L/s at 1.71 m head. It is calculated that an orifice area of 6,500 mm^2 ($\pm$91 mm diameter) and a discharge coefficient of 0.61 will restrict the outflow rate to 22.99 L/s at a head of 1.71 m. Based on this orifice the maximum outflow rate for the 2-year storm event is calculated to be 22.64 L/s at 1.66 m.

	100-Year Event	2-Year Event
Maximum ICD Release Rate	23.55 L/s	22.64 L/s
Maximum Ponding Elevation	91.92 m	91.87 m
Maximum Volume Stored	156.95 m^3	50.96 m^3

Entire Site

	100-Year Event	2-Year Event
Pre-Development Flow Rate	167.88 L/s	58.72 L/s
Maximum Allowable Release Rate	58.72 L/s	58.72 L/s
Maximum Release Rate	58.72 L/s	38.36 L/s
Maximum Volume Required & Stored	178.31 m^3	59.59 m^3

The maximum post-development release rate during the 100-year event is calculated to be 58.72 L/s, which is 65% less than the pre-development flow rate and equal to the maximum allowable release rate. To achieve the maximum allowable release rate, a maximum storage volume of 178.31 m^3 is required and provided. The maximum post-development release rate during the 2-year event is calculated to be 38.36 L/s, which is 35% less than the pre-development flow rate and the maximum allowable release rate. Therefore, the proposed stormwater management quantity control measures are expected to have a positive impact on the downstream municipal infrastructure.

4.2 STORM SERVICING

Stormwater will be conveyed off the site via a proposed storm sewer system outletting to the Roger Steven Drive roadside ditch. The unrestricted flowrate resulting from 2-year storm event will produce a peak flow of 85.00 L/s resulting in the last pipe segment being 65% full. However, the restricted flow through the flow control roof drains ICD will restrict the flow to a maximum flow of 29.83 L/s so that the last pipe segment will only be 23% full. Refer to calculations in Appendix B.

5.0 DEVELOPMENT WITHIN A FLOODPLAIN:

The Rideau Valley Conservation Authority (RVCA) has the authority to regulate 'Fill, Construction and Alteration to Waterways' including placing fill in a regulated area such as a floodplain. The RVCA also has the authority to regulate the construction of buildings and structures in any area susceptible to flooding. A principal mandate of the RVCA is to prevent property damage due to flooding and erosion.

The following describes how the proposed development meets the policies of the RVCA for placing fill in a floodplain and preventing property damage. Reference *'Interim Policy for the Administration and Implementation of Ontario Regulation 41/24 Parts VI and VII of the Conservation Authorities Act, R.S.O. 1990, c. C.27 & Ontario Regulation 41/24: Prohibited Activities, Exemptions and Permits Effective Date: April 1, 2024'*.

Cut and Fill – RVCA Policies:

"New development must result in no significant impact on expected flood levels or velocities, taking into consideration the direct and cumulative effects of the development on flood plain conveyance capacity and storage capacity"
" .. site grading or fill placement or removal may be permitted provided it will not have an adverse effect on the control of flooding, erosion, pollution or the conservation of land."
"Exceptions may be considered for the minor removal or placement of fill / minor site grading / minor site alteration in the floodway where flood depths in the floodway are shallow, flow velocities are minimal and the proposed development or site alteration is considered to be minor in nature with no impact in terms of its effect on the control of flooding, pollution, erosion and the conservation of land …"
Specifically:

"The site alteration (cut and fill operation) is confined to lands toward the edge of the flood plain with ground elevations that are at present no more than 0.3 metres lower than the estimated 1:100 year water surface elevation".

"The loss of flood plain storage volume within the 1:100 year flood plain which will result from the placement of fill shall be fully compensated for by a balanced cut (or excavation) to be carried out in close proximity to and concurrent with the placement of the fill"

"… the volume of available flood plain storage capacity within the affected river or stream reach shall not be reduced; and the minimum proposed ground elevation in the compensating excavation area shall not be lower than the minimum existing ground elevation in the proposed fill area … the proposed site grading (cut and fill) must be designed to result in no increase in upstream water surface elevations and no increase in flow velocities".

"… adequate overland flow routes in local drainage networks must be maintained".

As previously mentioned, approximately 1.11 ha of the subject is in the floodplain (i.e. having a grade elevation lower than the local 100-year floodplain elevation of 89.67 m geodetic); less than half of the property is proposed to be developed (0.93 ha); and, small areas of 'cut and fill' are proposed affecting only 0.12 ha of the floodplain located on the subject property. Specifically, the grade is proposed to be raised in a narrow strip of the floodplain land immediately adjacent to the east property line ('Floodplain Fill Area 'A'' – refer to drawing C-3). The grade is also proposed to be raised near the southwest corner of the proposed development to accommodate the relocated onsite sewage (septic) system and to provide access to the south portion of the subject property ('Floodplain Fill Area 'B''). To compensate for the placement of fill in the floodplain (i.e. in 'Floodplain Fill Areas A and 'B"), a 'Floodplain Cut Area' will be excavated immediately southeast of the area proposed to be development where the leaching bed of the existing septic system is located. The existing septic system will be decommissioned and components removed from the property, and the removal of the existing raised leaching bed will provide much of the excavated material in the cut area.

Within the cut and fill areas the storage capacity is calculated for each 0.15 m contour interval below the 89.67 m floodplain elevation for both the pre and post development conditions (refer methodology and calculations in Appendix D). The gain in storage volume in the 'Cut Area' more than compensates for the loss of storage volume in the 'Fill Areas' by a volume that is greater than the loss for each contour interval. In summary:

Contour Interval (m)	Fill Volume (m^3)	Cut Volume (m^3)	Gain in Volume (m^3)
89.52 - 89.67	50.0	51.2	1.2
89.37- 89.52	13.5	25.7	12.2
89.22 - 89.37	2.3	12.5	10.2
89.07 – 89.22	0.3	3.3	3.0

Therefore, since the loss of flood plain storage volume is more than fully compensated and the cut and fill areas are in close proximity to each other; the proposed development will not significant impact on expected flood levels, including upstream water surface elevations.

The pre-development drainage in the cut and fill areas is via sheet flow; post development these areas will continue to be via sheet flow; therefore, conveyance capacity will not be impacted by the proposed development and the local overland flow routes are maintained.

The cut and fill areas are at the edge of the floodplain, more than 175 m from the nearest watercourse (the Dillon Wallace Drain); therefore, velocities and erosion will be minimal.

In addition to being at edge of the floodplain, the cut and fill affects only about 11% of the floodplain located on the subject property (0.12 ha out of 1.11 ha); therefore the removal and placement of fill, and grading in the floodplain should be considered to be minor in nature.

It should also be noted that within about 25 m to 50 m of the 100-year flood contour, and in much of the floodplain on the subject property, the existing grade elevation is at least 1 m below the 100-year flood level; therefore, opportunities for cut and fill on the subject property are limited. Also, adjacent to the east property line (including Floodplain Fill Area 'A') and adjacent to the area around the existing raised septic bed (Floodplain Cut Area) the floodplain slopes between about 5:1 and 8:1; as such, the existing grade elevations in a small part of these cut and fill areas are more than 0.3 m lower than the 100-year flood elevation. However, the cut and fill volumes in these areas are very small (a net of 3.0 m^3 0.45 to 0.60 m below the 100-year flood, and 10.2 m^3 , 0.30 to 0.45 m below); and therefore, the removal and placement of fill, should still be considered to be minor in nature.

Protection of Structures – RVCA Policy:

"New development involving capital investment in flood susceptible areas by the public and private sectors must be designed so that structures and their contents are protected against flood damage." Specifically, for slab-on-grade construction, "*the underside of slab shall be set at least 300 mm above the 1:100 year flood level;* and for other structures; "*the underside of main floor shall be at least 300 mm above the 1:100 year flood level*".

No buildings are proposed to be located within the floodplain. Regardless, the proposed basement floor elevation of the Temple building is 89.97m; 0.30 m above the 100-year flood elevation of 89.67; and the floor elevation of the slab-on-grade Priest's Residence is 92.22 m; 2.55 m above the 100-year flood. Therefore, all structures are protected against flood damage.

Site Servicing – RVCA Policy:

"New development must not, in the opinion of the Authority, have the result of polluting or contributing to the pollution of the abutting watercourse" and *"the replacement of sewage disposal systems on existing lots of record may be permitted within the Regulatory floodplain if it has been demonstrated to the satisfaction of the Conservation Authority that locating the system outside the flood plain is not possible and, if so, that the control of flooding, erosion, pollution or the conservation of land will not be affected by the system placement.* Specifically: *"Systems shall be designed such that replacement systems have the bottom of the gravel layer no lower than the 1:20 year flood elevation. … The elevation of the leaching bed will be the minimum of the highest elevation as determined by the bottom of the gravel layer to the flood elevation or the vertical separation distance from the bottom of the gravel layer to the high ground water table. Advanced technology in the form of tertiary treatment systems affording a higher level of treatment and approvable for use under the Ontario Building Code may be required so as to reduce and limit the amount of fill being placed."*

The proposed sewage disposal system (septic system) will replace the existing septic system, which as previously mentioned, is in the 'cut area' and will be removed. Part of the leaching bed of the replacement septic system will be located in floodplain (part of Floodplain Fill Area 'B'); however, it will be at edge of the floodplain, about 235 m from the nearest watercourse (the Dillon Wallace Drain – the existing septic system

is about 60 m closer to the drain); and the underside of the stone (gravel) layer will be 89.97; 0.30 m above the 100-year flood level. The proposed septic system will be a tertiary treatment system so the amount of fill required is reduced and pollution minimized. Also, as required by the Ontario Building Code, the side slopes of the raised bed will be 4:1, which will minimize erosion. Therefore, flooding, erosion, and pollution will not be significantly affected by the proposed septic system.

Site Servicing – RVCA Policy:

"… any new well must be located no closer than a minimum of 15 metres from the water's edge. A drilled well must be capped no less than the 1:100 year flood elevation + 0.3 metres and installed and grouted fully in accordance with Ontario Regulation 903."

A recently installed drilled well (constructed by a licensed well installer) is located outside of the floodplain, approximately 26 m from the 100-year floodplain contour, about 200 m from the nearest watercourse, and is capped more than 3 m above the 100-year flood.

Access and Egress – RVCA Policy:

"New development must not increase the risks to public safety which are expected to be present during the regulatory flood (or more frequent floods); in this regard the viability of access to and egress from the structure and the potential depths of water over access routes will be the primary consideration." Specifically, *"for vehicular and pedestrian access routes (municipal roadways and private rights-of-way) safe access will be considered to be available if the depth of flooding at regulatory (1:100 year) flood level along the full length of the travelled surface of the access roadway or right-of-way is no greater than 0.3 metres."*

No roads or walkways are proposed within the flood plain. The lowest road or walkway elevation within the proposed development is 91.72 m; more than 2 m above the 100-year flood level; therefore, the proposed development will not increase the risks to public safety with regard to access to and egress from the proposed buildings.

An application for permission for all works within a regulated area (i.e. the floodplain) will be submitted to the RVCA.

6.0 CONCLUSIONS

1. Five tanks, having a total volume of 225,000 L, are proposed for a water supply for firefighting exceeding the minimum required volume of 185,398 L.

2. A recently constructed drilled well will provide the domestic water supply. A 'Hydrogeological Assessment and Terrain Analysis', is being prepared by Paterson Group.

3. An on-site septic system is proposed. An application for a septic permit will be submitted to the Ottawa Septic System Office (OSSO).

4. To meet the water quality target of 80% total suspended solids (TSS) removal, an oil grit separator (OGS) manhole is proposed.

5. Post development, with the installation of permeable pavers, annual infiltration is calculated to be 20% less than pre-development conditions, but an increase of 31% if permeable pavers are not installed.

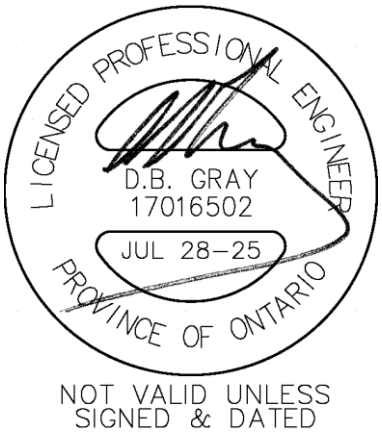
6. An Erosion & Sediment Control Plan has been developed to be implemented during construction.

7. The maximum post-development release rate during the 100-year event is calculated to be 65% less than the pre-development flow rate and equal to the maximum allowable release rate. The maximum post-development release rate during the 2-year event is calculated to be 35% less than the pre-development

flow rate and the maximum allowable release rate. Therefore, the proposed stormwater management quantity control measures are expected to have a positive impact on the downstream municipal infrastructure.

8. Work within the floodplain:
   - Cut and fill in the floodplain is minimal and is in close proximity of each other, and the loss of floodplain storage volume in the fill areas is more than fully compensated in the cut area.
   - The proposed development will not have a significant impact on expected flood levels, including upstream water surface elevations and conveyance capacity; and velocities and erosion will be minimal.
   - No buildings are proposed to be located within the floodplain.
   - The proposed septic system will replace the existing septic system, and the proposed system is a tertiary treatment system, as such the fill requirement is reduced and pollution minimized.
   - A recently installed drilled well is located outside of the floodplain.
   - No roads or walkways are proposed within the floodplain.
   - An application for permission for all works within a regulated area (i.e. the floodplain) will be submitted to the RVCA.

Prepared by D.B. Gray Engineering Inc.



APPENDIX A

WATER SERVICING

D.B. Gray Engineering Inc.

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

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March 24, 2025

2104 Roger Stevens Drive
Temple Building
Ottawa, Ontario

FIRE FLOW CALCULATIONS
OBC Method

Q = Required water supply in litres
= KVS_{Total}

K = Water supply coefficient as per OBC A-3.2.5.7. Table 1
= 16 Group A, Division 2 Occupancy, Building is of noncombustible construction with fire separations without fire resistance ratings.

V = Building volume in cubic meters

	Floor Area (sq.m)	Height (m)	Volume (cu.m)
1st Floor:	1,037	5.97	6,191
Basement:	1,255	4.3	5,397
			11,587

S_{Total} = Total of spatial coefficients from exposure distances
= $1.0 + S_{Side\ 1} + S_{Side\ 2} + S_{Side\ 3} + S_{Side\ 4}$

	Spatial Coefficient	Exposure Distance (m)	
$S_{Side\ 1}$	0.0	45	(north to centerline of road)
$S_{Side\ 2}$	0.0	17	(to east property line)
$S_{Side\ 3}$	0.0	30	(south to priest residence)
$S_{Side\ 4}$	0.0	17	(to west property line)
S_{Total}	1.0		

Q = KVS_{Tot} (required water supply in litres)
= 185,398 L
= 5,400 L/min as per OBC A-3.2.5.7. Table 2
(less than 9,000 L/min; therefore, FUS calculations are not required)
$Q_{REQUIRED}$ = 185,398 L (5,400 L/min or 6,300 L/min; therefore, Storage = Q)

$Q_{PROVIDED}$ = 225,000 L (5 x 45,000 L Tanks)
42 minute water supply at 5,400 L/min

APPENDIX B

STORMWATER MANAGEMENT & STORM SERVICING

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

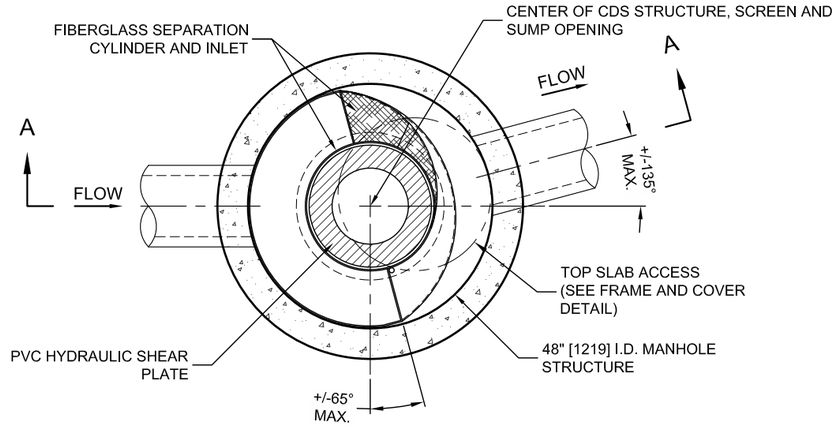
Project Name: 2104 Roger Stevens Dr.
Location: Ottawa, ON
OGS #: OGS

Engineer: D. B. Gray Engineering Inc.
Contact: Douglas Gray, P.Eng.
Report Date: 18-Oct-24

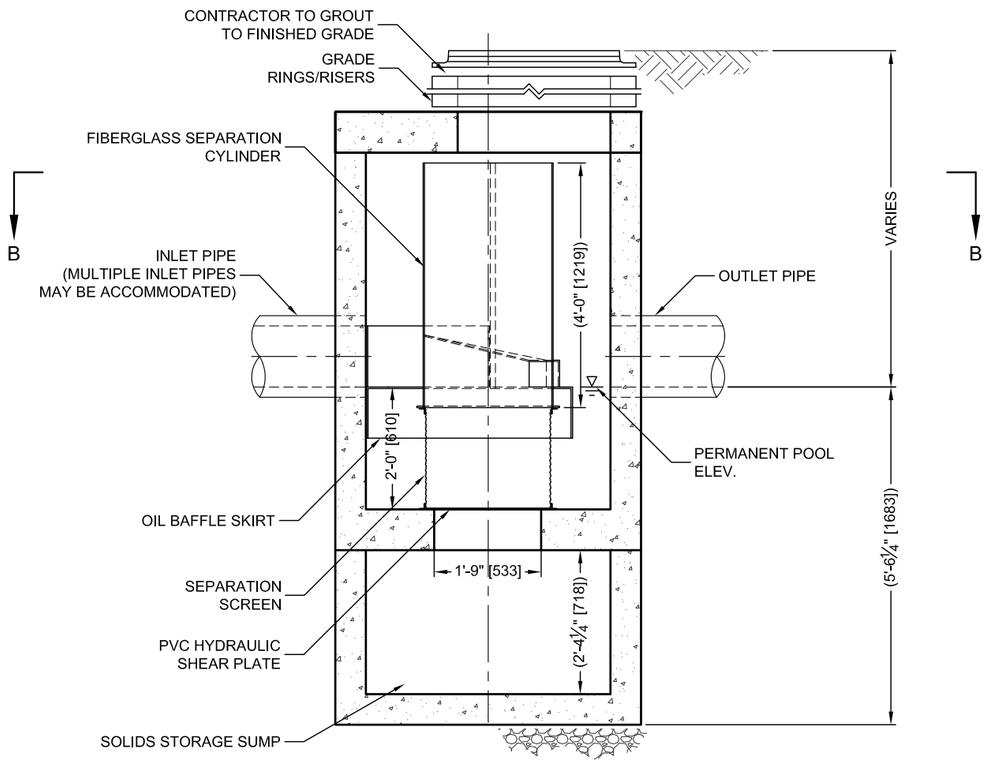
Area	0.67	ha	**Rainfall Station #**	215	
Weighted C	0.66		**Particle Size Distribution**	FINE	
CDS Model	2015-4	.	**CDS Treatment Capacity**	20	l/s

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%	0.6	0.6	3.1	98.0	9.0
1.0	10.6%	19.8%	1.2	1.2	6.2	97.1	10.3
1.5	9.9%	29.7%	1.8	1.8	9.3	96.2	9.5
2.0	8.4%	38.1%	2.5	2.5	12.4	95.3	8.0
2.5	7.7%	45.8%	3.1	3.1	15.5	94.4	7.3
3.0	5.9%	51.7%	3.7	3.7	18.6	93.5	5.6
3.5	4.4%	56.1%	4.3	4.3	21.7	92.6	4.0
4.0	4.7%	60.7%	4.9	4.9	24.8	91.7	4.3
4.5	3.3%	64.0%	5.5	5.5	27.9	90.9	3.0
5.0	3.0%	67.1%	6.1	6.1	31.0	90.0	2.7
6.0	5.4%	72.4%	7.4	7.4	37.2	88.2	4.8
7.0	4.4%	76.8%	8.6	8.6	43.4	86.4	3.8
8.0	3.5%	80.3%	9.8	9.8	49.6	84.6	3.0
9.0	2.8%	83.2%	11.1	11.1	55.8	82.9	2.3
10.0	2.2%	85.3%	12.3	12.3	62.0	81.1	1.8
15.0	7.0%	92.3%	18.4	18.4	93.1	72.2	5.0
20.0	4.5%	96.9%	24.6	19.8	100.0	56.6	2.6
25.0	1.4%	98.3%	30.7	19.8	100.0	45.3	0.7
30.0	0.7%	99.0%	36.9	19.8	100.0	37.7	0.3
35.0	0.5%	99.5%	43.0	19.8	100.0	32.3	0.2
40.0	0.5%	100.0%	49.2	19.8	100.0	28.3	0.2
45.0	0.0%	100.0%	55.3	19.8	100.0	25.1	0.0
50.0	0.0%	100.0%	61.5	19.8	100.0	22.6	0.0
							88.1
						Removal Efficiency Adjustment[2] =	6.5%
						Predicted Net Annual Load Removal Efficiency =	**82%**
						Predicted Annual Rainfall Treated =	**98%**

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 and scaling based on original manufacturer model and product specifications.



PLAN VIEW B-B
N.T.S.



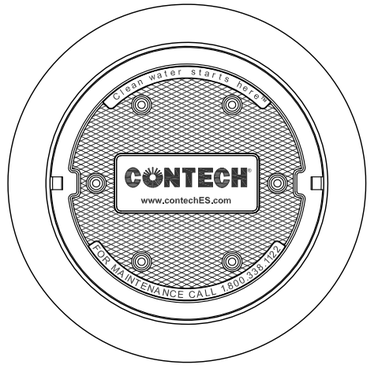
ELEVATION A-A
N.T.S.

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

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

CDS Hydrodynamic Separator®

Developed by CONTECH Engineered Solutions LLC
Scarborough, Maine, USA

Registration: GPS-ETV_VR2020-03-31_CDS

In accordance with

ISO 14034:2016

Environmental Management —
Environmental Technology Verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

March 31, 2020
Vancouver, BC, Canada

Verification Body
GLOBE Performance Solutions
404 – 999 Canada Place | Vancouver, B.C | Canada |V6C 3E2

Technology description and application

The CDS® is a Stormwater treatment device designed to remove pollutants, including sediment, trash and hydrocarbons from Stormwater runoff. The CDS is typically comprised of a manhole that houses flow and screening controls that use a combination of swirl concentration and continuous deflective separation.

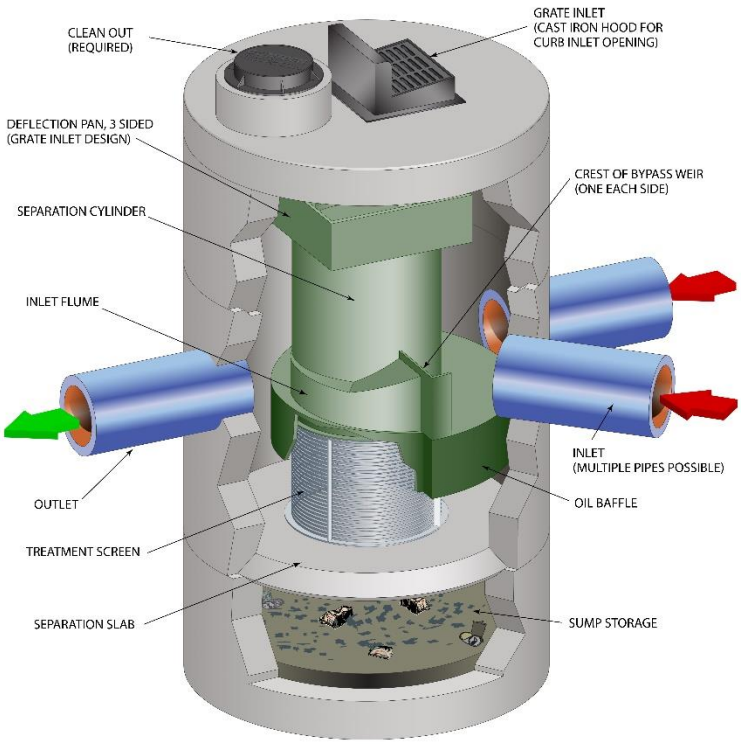


Figure 1. Graphic of typical inline CDS unit and core components.

When stormwater runoff enters the CDS unit's diversion chamber, the diversion pan guides the flow into the unit's separation chamber. The water and associated gross pollutants contained within the separation cylinder are kept in continuous circular motion by the energy generated from the incoming flow. This has the effect of a continuous deflective separation of the pollutants and their eventual deposition into the sump storage below. A perforated screen plate allows the filtered water to pass through to a volute return system and thence to the outlet pipe. The oil and other light liquids are retained within the oil baffle. Figure 1 shows a schematic representation of a typical CDS unit including critical components

Performance conditions

The data and results published in this Technology Fact Sheet were obtained from the testing program conducted on the Contech CDS-4 OGS device, in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014). The Procedure was prepared by the Toronto and Region Conservation Authority (TRCA) for Environment Canada's Environmental Technology Verification (ETV) Program requirements. A copy of the Procedure may be accessed on the Canadian ETV website at www.etvcanada.ca.

Performance claim(s)

Capture test[1]:

During the sediment capture test, the Contech CDS OGS device with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removed 74, 70, 63, 53, 45, 42, 32 and 23 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, 1400 and 1893 L/min/m^2, respectively.

Scour test[a]:

During the scour test, the Contech CDS OGS device with preloaded test sediment reaching 50% of the manufacturer's recommended maximum sediment storage depth, generated corrected effluent concentrations of 1.8, 6.5, 8.2, 11.2, and 309.3 mg/L during a test run[2] with approximately 5 minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

Light liquid re-entrainment test[a]:

During the light liquid re-entrainment test, the Contech CDS OGS device with surrogate low-density polyethylene beads preloaded within the oil collection skirt area, representing floating liquid to a volume equal to a depth of 50.8 mm over the sedimentation area, retained 100, 99.9, 98.6, 99.5, and 99.7 percent of loaded beads by volume during a test run[2] with 5 minutes duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

Performance results

The test sediment consisted of ground silica (1 – 1000 micron) with a specific gravity of 2.65, uniformly mixed to meet the particle size distribution specified in the testing procedure. The *Procedure for Laboratory Testing of Oil Grit Separators* requires that the three sample average of the test sediment particle size distribution (PSD) meet the specified PSD percent less than values within a boundary threshold of 6%. The comparison of the average test sediment PSD to the CETV specified PSD in Figure 2 indicates that the test sediment used for the capture and scour tests met this condition.

[1] The claim can be applied to other units smaller or larger than the tested unit as long as the untested units meet the scaling rule specified in the Procedure for Laboratory of Testing of Oil Grit Separators (Version 3.0, June 2014)
[2] See variance #1 in "Variances from testing procedure" section below.

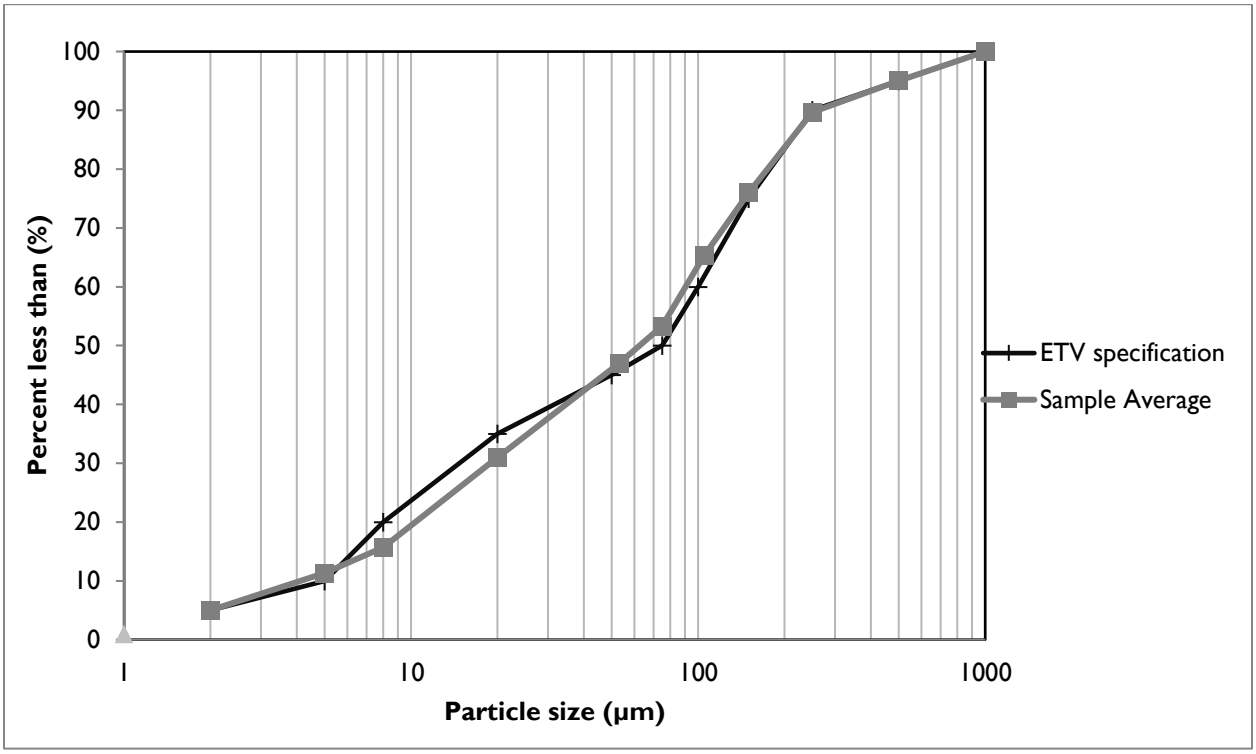


Figure 2. The three sample average particle size distribution (PSD) of the test sediment used for the capture and scour test compared to the specified PSD.

The capacity of the device to retain sediment was determined at eight surface loading rates using the modified mass balance method. This method involved measuring the mass and particle size distribution of the injected and retained sediment for each test run. Performance was evaluated with a false floor simulating the technology filled to 50% of the manufacturer's recommended maximum sediment storage depth. The test was carried out with clean water that maintained a sediment concentration below 20 mg/L. Based on these conditions, removal efficiencies for individual particle size classes and for the test sediment as a whole were determined for each of the tested surface loading rates (Table 1).

In some instances, the calculated removal efficiencies were above 100% for certain particle size fractions (marked with asterisks in Table 1). These discrepancies are not entirely avoidable and may be attributed to errors relating to the blending of sediment, collection of representative samples, and laboratory analysis of PSD. Due to these errors, caution should be exercised in applying the removal efficiencies by particle size fraction for the purposes of sizing the tested device (see Bulletin # CETV 2016-11-0001). The results for "all particle sizes by mass balance" in Table 1 are based on measurements of the total injected and retained sediment mass, and are therefore not subject to sampling or PSD analysis errors.

Table 1. Removal efficiencies (%) at specified surface loading rates.

Particle size fraction (µm)	Surface loading rate (L/min/m²)							
	40	80	200	400	600	1000	1400	1893
>500	100	100*	66	79	97	100*	84	77
250 - 500	100*	100*	85	95	100*	91	100*	75
150 - 250	99	100*	100*	97	100	75	68	37
105 - 150	100	100*	100*	74	47	45	30	27
75 - 105	90	91	100*	61	33	36	26	18
53 - 75	71	27	54	100	42	44	15	16
20 - 53	65	51	20	8	10	8	5	4
8 - 20	28	22	9	7	1	1	2	1
5 – 8	30	9	0	8	2	0	1	0
<5	11	8	16	2	6	5	2	2
All particle sizes by mass balance	**73.5**	**70.3**	**63.4**	**52.6**	**45.1**	**41.5**	**32.4**	**23.0**

* Removal efficiencies were calculated to be above 100%. Calculated values typically ranged between 101 and 175% (average 126%). Higher values were observed for the >500 µm and 150-250 µm size fractions during the 80 L/min/m² test run. See text and Bulletin # CETV 2016-11-0001 for more information.

Figure 3 compares the particle size distribution (PSD) of the three sample average of the test sediment to the PSD of the retained sediment at each of the tested surface loading rates. As expected, the capture efficiency for fine particles was generally found to decrease as surface loading rates increased.

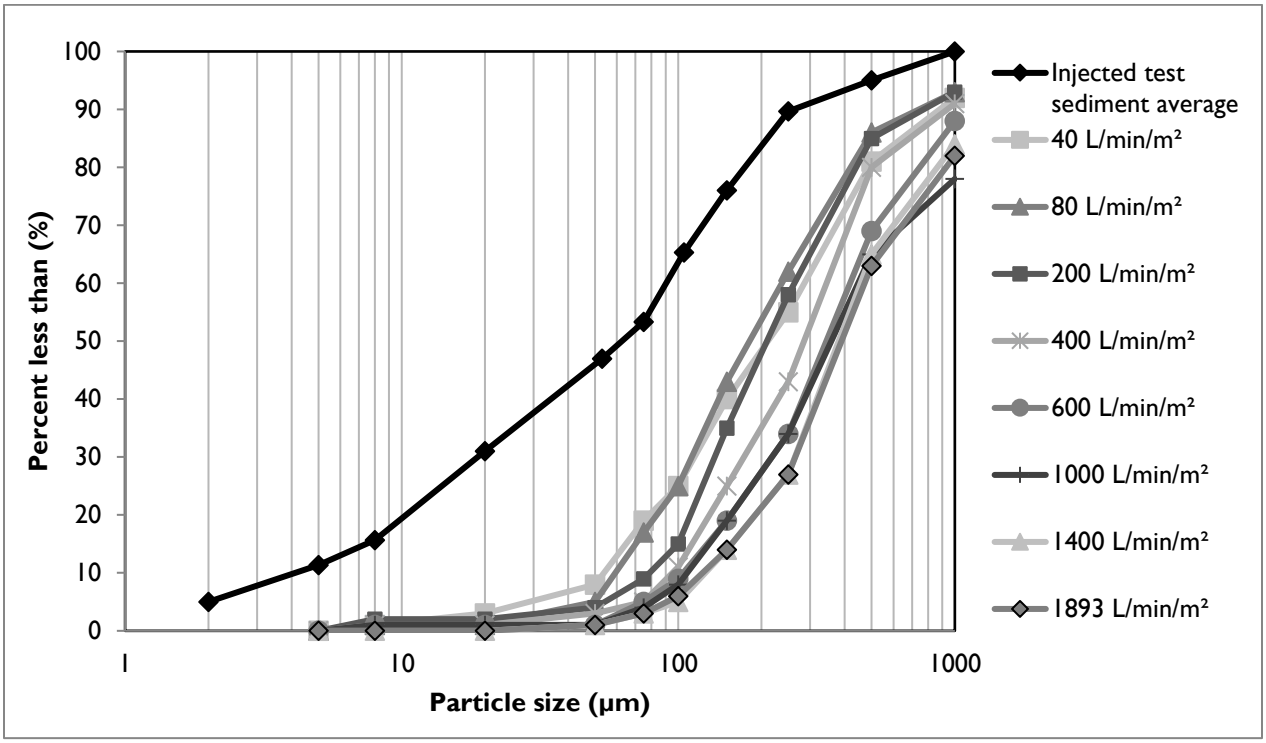


Figure 3. Particle size distribution of retained sediment in relation to the injected test sediment average.

Table 2 shows the results of the sediment scour and re-suspension test. This test involved preloading 10.2 cm of fresh test sediment into the sedimentation sump of the device. The sediment was placed on a false floor to mimic a device filled to 50% of the maximum recommended sediment storage depth. Sediment was also pre-loaded to the same depth on the separation slab (see Figure 1) since sediment was observed to have been deposited in this area during the sediment capture test. Clean water was run through the device at five surface loading rates over a 36 minute period. The test was stopped and started after the second flow rate in order to change flow meters. Each flow rate was maintained for 5 minutes with a one minute transition time between flow rates. Effluent samples were collected at one minute sampling intervals and analyzed for Suspended Sediment Concentration (SSC) and PSD by recognized methods. The effluent samples were subsequently adjusted based on the background concentration of the influent water and the smallest 5% of particles captured during the 40 L/min/m^2 sediment capture test, as per the method described in Bulletin # CETV 2016-09-0001.

Table 2. Scour test adjusted effluent sediment concentration.

Run	Surface loading rate (L/min/m^2)	Run time (min)	Background sample concentration (mg/L)	Adjusted effluent suspended sediment concentration (mg/L)[†]	Average (mg/L)
1	200	1.03	0.5	1.0	1.8
		2.03		1.6	
		3.03		1.8	
		4.03		1.8	
		5.03		2.6	
2	800	6.23	2.0	5.0	6.5
		7.23		6.7	
		8.23		9.4	
		9.23		5.4	
		10.23		5.9	
3	1400	11.43[‡]	2.0	3.1	8.2
		12.43		11.0	
		13.43		14.6	
		14.43		7.1	
		15.43		5.2	
4	2000	17.20	3.2	7.3	11.2
		18.20		22.8	
		19.20		6.9	
		20.20		6.8	
		21.20		12.1	
5	2600	22.40	8.5	248.5	309.3
		23.40		83.0	
		24.40		438.9	
		25.40		338.7	
		26.40		437.5	

[†] The adjusted effluent suspended sediment concentration represents the actual measured effluent concentration minus the smallest 5% of sediment particles (i.e. d5) removed during the 40 L/min/m^2 capture test, minus the background concentration. For more information see Bulletin # CETV 2016-09-0001.

[‡] See variance #1 in "Variances from testing procedure" section below.

The results of the light liquid re-entrainment test used to evaluate the unit's capacity to prevent re-entrainment of light liquids are reported in Table 3. The test involved preloading 58.3 L (corresponding to a 5 cm depth over the collection sump area of 1.17m^2) of surrogate low-density polyethylene beads within the oil collection skirt and running clean water through the device at five surface loading rates (200, 800, 1400, 2000, and 2600 L/min/m^2) over a 38 minute period. As with the sediment scour test, flow was stopped and started after the second flow rate to change flow meters. Each flow rate was maintained for 5 minutes with approximately 1 minute transition time between flow rates. The effluent flow was screened to capture all re-entrained pellets throughout the test.

Table 3. Light liquid re-entrainment test results.

Target Flow (L/min/m^2)	Time Stamp	Collected Volume (L)	Collected Mass (g)	Percent re-entrained by volume	Percent retained by volume
200	10:48:42	27 pellets	0.8	0.01	99.99
800	10:55:09	0.07	41	0.12	99.88
1400	11:06:59	0.8	439	1.37	98.63
2000	11:13:00	0.31	177	0.53	99.47
2600	11:19:00	0.18	98	0.31	99.69
Interim Collection Net		0.025	14.2	0.04	99.96
Total Loaded		58.3	33398	--	--
Total Re-entrained		1.385	770	--	--
Percent Re-entrained and retained		--	--	2.38	97.62

Variances from testing Procedure

The following minor deviations from the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014) have been noted:

1. It was necessary to change flow meters during the scour and light liquid re-entrainment test, as the required flows exceeded the minimum and/or maximum range of any single meter. After the loading rate of 800 L/min/m^2, the flow was gradually shut down and re-initiated through the larger meter immediately after closing the valve controlling flows to the small meter. The transition time of 1-minute for each target flow was followed, resulting in an elapsed time of 3 minutes to reach the next target flow of 1400 L/min/m^2. This procedure was approved by CETV prior to testing, in recognition that most particles susceptible to scour at low flows would not be in the sump at higher flows. Similarly, re-entrainment of the oil beads was not expected to be significantly affected by the flow meter change.

2. As part of the capture test, evaluation of the 40 L/min/m^2 surface loading rate was split into 3 parts due to the long duration needed to feed the required minimum of 11.3 kg of test sediment into the unit. At the end of the first and second parts of the test, the flow rates were gradually shutdown to prevent capture of particles that would have been washed out under normal circumstances. The amended procedure was reviewed and approved by the verifier prior to testing.

3. Inflow concentrations during the 40 L/min/m^2 surface loading rate varied from 162 mg/L to 246 mg/L, which is wider than specified ±25 mg/L range in the Procedure.

Verification

This verification was first completed in March 2017 and is considered valid for subsequent renewal periods every three (3) years thereafter, subject to review and confirmation of the original performance and performance claims. The original verification was completed by the Toronto and Region Conservation Authority of Mississauga, Ontario, Canada using the Canadian ETV Program's General Verification Protocol (June 2012) and taking into account ISO 14034:2016. This ETV renewal is considered to meet the equivalency of an ETV verification completed using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***.

Data and information provided by Contech Engineered Solutions to support the performance claim included the following: Performance test report prepared by Alden Research Laboratory, Inc of Holden, Massachusetts, USA and dated February 2015; the report is based on testing completed in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014).

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV) and was developed and published by the International Organization for Standardization (ISO). The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

For more information on the CDS Stormwater Treatment System please contact:

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Scarborough, ME
04074 USA
Tel: 207-885-9830
info@conteches.com
www.conteches.com

For more information on ISO 14034:2016 / ETV please contact:

GLOBE Performance Solutions
404 – 999 Canada Place
Vancouver, BC
V6C 3E2 Canada
Tel: 604-695-5018 / Toll Free: 1-855-695-5018
etv@globeperformance.com
www.globeperformance.com

Table 1 - Pre-Development Annual Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/year)	Total Infiltration (L/year)	Total Runoff (mm/year)	Total Runoff (L/year)
Impervious Surfaces	2,486	449	0	0	0	0	1	0	0	449	1,116,214
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	7,720	378	0.2	0.4	0.1	0.7	0.3	264.6	2,042,712	113.4	875,448
Total	**10,206**								**2,042,712**		**1,991,662**

Table 2 - Post-Development Annual Water Budget Calculations - No Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/year)	Total Infiltration (L/year)	Total Runoff (mm/year)	Total Runoff (L/year)
Impervious Surfaces	5,488	449	0	0	0	0	1	0	0	449	2,464,112
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	378	0.2	0.4	0.1	0.7	0.3	264.6	1,248,383	113.4	535,021
Total	**10,206**								**1,248,383**		**2,999,133**
Difference (L/year)									**-794,329**		**1,007,471**
Percentage Variation									**-39%**		**51%**

Table 3 - Post-Development Annual Water Budget Calculations - Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/year)	Total Infiltration (L/year)	Total Runoff (mm/year)	Total Runoff (L/year)
Impervious Surfaces	4,257	449	0	0	0	0	1	0	0	449	1,911,393
Permeable Pavers	1,231	449	0	0	0	0.7	0.3	314.3	386,903	134.7	165,816
Fine Sandy Loam (Urban Lawn / Shallow Rooted Crops)	4,718	378	0.2	0.4	0.1	0.7	0.3	264.6	1,248,383	113.4	535,021
Total	**10,206**								**1,635,286**		**2,612,230**
Difference (L/year)									**-407,426**		**620,568**
Percentage Variation									**-20%**		**31%**

STORMWATER MANAGEMENT CALCULATIONS
(Quantity Control)

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/s^2
- h = head above orifice in meters

Flow control roof drain calculations are based on the following formula:

$$Q = N \times S \times d \times F$$

where:

- Q = flowrate in litres per second
- N = number of roof drains
- S = slots per weir
- d = pond depth at roof drain in mm
- F = flowrate through each slot

Storage volume calculations for ponding above catch basins are based on the following formula for volume of a cone:

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

where:

- V = volume in m^3
- A = ponding area in m^2
- d = ponding depth in meters

SUMMARY TABLES

100-YEAR EVENT

Drainage Area	Pre-Development Flow Rate (L/s)	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)	-	-	25.87	-	-
AREA II (Roof)	-	-	9.85	30.25	30.25
AREA III	-	-	22.99	148.05	148.05
TOTAL	168.19	58.72	58.72	178.31	178.31

2-YEAR EVENT

Drainage Area	Pre-Development Flow Rate (L/s)	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)	-	-	9.23	-	-
AREA II (Roof)	-	-	6.49	8.63	8.63
AREA III	-	-	22.64	50.96	50.96
TOTAL	58.72	58.72	38.36	59.59	59.59

July 28, 2025

2104 Roger Stevens Drive

Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS
Modified Rational Method

PRE-DEVELOPMENT CONDITIONS

100-YEAR EVENT

			C
Roof Area:	322	sq.m	1.00
Hard Area:	74	sq.m	1.00
Gravel Area:	1,006	sq.m	1.00
Soft Area:	7,945	sq.m	0.25
Total Catchment Area:	9,347	sq.m	0.36

Time of Concentration (Tc)
Bransby Williams Formula

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

Sheet Flow Distance (L):	110	m
Slope of Land (Sw):	2.2	%
Area (A):	0.9347	ha
Time of Concentration (Sheet Flow):	5	min
Time of Concentration:	10	min
Rainfall Intensity (i):	179	mm/hr
100-Year Pre-Development Flow Rate (2.78AiC):	168.19	L/s

2-YEAR EVENT & MAXIMUM ALLOWBALE RELEASE RATE

			C
Roof Area:	322	sq.m	0.90
Hard Area:	74	sq.m	0.90
Gravel Area:	1,006	sq.m	0.80
Soft Area:	7,945	sq.m	0.20
Total Catchment Area:	9,347	sq.m	0.29
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr	
2-Year Pre-Development Flow Rate (2.78AiC):	58.72	L/s	

100-YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(100-YEAR EVENT)

			C
Roof Area:	0	sq.m	1.00
Hard Area:	154	sq.m	1.00
Permeable Paver Area:	0	sq.m	0.3125
Soft Area:	1,469	sq.m	0.25
Total Catchment Area:	1,623	sq.m	0.32
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Flow Rate (2.78AiC):	25.87	L/s	

DRAINAGE AREA II (Temple Roof)

(100-YEAR EVENT)

			C
Total Catchment Area:	1,040	sq.m	1.00

No. of Roof Drains:	6	
Slots per Wier:	1	0.01242 L/s/mm/slot (5 USgpm/in/slot)
Depth at Roof Drains:	132	mm
Maximum Release Rate:	9.85	L/s

Pond Area:	686	sq.m
Maximum Volume Stored:	30.25	cu.m
Maximum Volume Required:	30.25	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	51.62	9.85	41.77	25.06
15	143	41.31	9.85	31.46	28.31
20	120	34.68	9.85	24.83	29.79
25	104	30.02	9.85	20.17	30.25
30	92	26.56	9.85	16.71	30.07
35	83	23.88	9.85	14.02	29.44
40	75	21.73	9.85	11.87	28.49
45	69	19.96	9.85	10.11	27.29
50	64	18.49	9.85	8.64	25.91
55	60	17.24	9.85	7.38	24.37
60	56	16.16	9.85	6.31	22.70
65	53	15.22	9.85	5.37	20.93
70	50	14.40	9.85	4.54	19.07
75	47	13.66	9.85	3.81	17.13
80	45	13.01	9.85	3.15	15.13
85	43	12.42	9.85	2.56	13.08
90	41	11.89	9.85	2.03	10.97
95	39	11.40	9.85	1.55	8.81
100	38	10.96	9.85	1.10	6.62
105	36	10.55	9.85	0.70	4.39
110	35	10.18	9.85	0.32	2.13
115	34	9.83	9.83	0.00	0.00
120	33	9.51	9.51	0.00	0.00
150	28	7.98	7.98	0.00	0.00
180	24	6.91	6.91	0.00	0.00
210	21	6.11	6.11	0.00	0.00
240	19	5.49	5.49	0.00	0.00

DRAINAGE AREA III

(100-YEAR EVENT)

			C
Roof Area:	272	sq.m	1.00
Hard Area:	2,802	sq.m	1.00
Permeable Paver Area:	1,231	sq.m	0.3125
Soft Area:	2,379	sq.m	0.25
Total Catchment Area:	6,684	sq.m	0.61

Water Elevation:	91.92	m
Head:	1.71	m
Centroid of ICD Orifice:	90.21	m
Invert of Outlet Pipe of CB/MH-13:	90.16	m
Orifice Diameter:	91	mm
Orifice Area:	6,500	sq.mm
Discharge Coefficient:	0.61	
Maximum Release Rate:	22.99	L/s

CB/MH	Top Area	Depth	Volume	
CB-2	144	0.11	5.24	cu.m
CB/MH-3	143	0.11	5.20	cu.m
CB/MH-4	113	0.10	3.74	cu.m
CB-5	114	0.10	3.77	cu.m
CB-6	397	0.20	26.34	cu.m
CB/MH-7	510	0.20	33.85	cu.m
CB/MH-8	457	0.20	30.36	cu.m
CB/MH-9	223	0.18	13.32	cu.m
CB-10	236	0.18	14.09	cu.m
CB/MH-11	122	0.10	4.03	cu.m
CB/MH-12	126	0.10	4.16	cu.m
CB/MH-13	119	0.10	3.94	cu.m
		Maximum Volume Stored:	148.05	cu.m
		Maximum Volume Required:	148.05	cu.m

DRAINAGE AREA III (Continued)

(100-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	201.21	22.99	178.22	106.93
15	143	161.02	22.99	138.03	124.23
20	120	135.17	22.99	112.18	134.61
25	104	117.02	22.99	94.03	141.05
30	92	103.52	22.99	80.53	144.96
35	83	93.05	22.99	70.06	147.14
40	75	84.68	22.99	61.69	148.05
45	69	77.81	22.99	54.82	148.01
50	64	72.07	22.99	49.08	147.23
55	60	67.19	22.99	44.20	145.85
60	56	62.99	22.99	40.00	143.98
65	53	59.33	22.99	36.34	141.71
70	50	56.11	22.99	33.12	139.09
75	47	53.25	22.99	30.26	136.17
80	45	50.70	22.99	27.71	133.00
85	43	48.40	22.99	25.41	129.61
90	41	46.33	22.99	23.34	126.02
95	39	44.44	22.99	21.45	122.25
100	38	42.71	22.99	19.72	118.33
105	36	41.13	22.99	18.14	114.27
110	35	39.67	22.99	16.68	110.08
115	34	38.32	22.99	15.33	105.77
120	33	37.07	22.99	14.08	101.36
150	28	31.11	22.99	8.12	73.11
180	24	26.93	22.99	3.94	42.61
210	21	23.83	22.99	0.84	10.55
240	19	21.42	21.42	0.00	0.00

2-YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(2-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Hard Area:	154	sq.m	0.90
Permeable Paver Area:	0	sq.m	0.25
Soft Area:	1,469	sq.m	0.20
Total Catchment Area:	1,623	sq.m	0.27
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr	
Flow Rate (2.78AiC):	9.23	L/s	

DRAINAGE AREA II (Temple Roof)

(2-YEAR EVENT)

			C
Total Catchment Area:	1,040	sq.m	0.90

No. of Roof Drains:	6	
Slots per Wier:	1	0.01242 L/s/mm/slot (5 USgpm/in/slot)
Depth at Roof Drains:	87	mm
Maximum Release Rate:	6.49	L/s

Pond Area:	297	sq.m
Maximum Volume Stored:	8.63	cu.m
Maximum Volume Required:	8.63	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	77	19.99	6.49	13.50	8.10
15	62	16.07	6.49	9.59	8.63
20	52	13.54	6.49	7.05	8.46
25	45	11.75	6.49	5.27	7.90
30	40	10.42	6.49	3.93	7.08
35	36	9.38	6.49	2.90	6.08
40	33	8.55	6.49	2.06	4.96
45	30	7.87	6.49	1.38	3.73
50	28	7.30	6.49	0.81	2.43
55	26	6.81	6.49	0.32	1.07
60	25	6.39	6.39	0.00	0.00
65	23	6.02	6.02	0.00	0.00
70	22	5.70	5.70	0.00	0.00
75	21	5.42	5.42	0.00	0.00
80	20	5.16	5.16	0.00	0.00
85	19	4.93	4.93	0.00	0.00
90	18	4.72	4.72	0.00	0.00
95	17	4.53	4.53	0.00	0.00
100	17	4.36	4.36	0.00	0.00
105	16	4.20	4.20	0.00	0.00
110	16	4.05	4.05	0.00	0.00
115	15	3.92	3.92	0.00	0.00
120	15	3.79	3.79	0.00	0.00
150	12	3.19	3.19	0.00	0.00
180	11	2.77	2.77	0.00	0.00
210	9	2.45	2.45	0.00	0.00
240	8	2.21	2.21	0.00	0.00

DRAINAGE AREA III

(2-YEAR EVENT)

			C
Roof Area:	272	sq.m	0.90
Hard Area:	2,802	sq.m	0.90
Permeable Paver Area:	1,231	sq.m	0.25
Soft Area:	2,379	sq.m	0.20
Total Catchment Area:	6,684	sq.m	0.53

Water Elevation:	91.87	m
Head:	1.66	m
Centroid of ICD Orifice:	90.21	m
Invert of Outlet Pipe of CB/MH-13:	90.16	m
Orifice Diameter:	91	mm
Orifice Area:	6,500	sq.mm
Discharge Coefficient:	0.61	
Maximum Release Rate:	22.64	L/s

CB/MH	Top Area	Depth	Volume	
CB-2	41	0.06	0.79	cu.m
CB/MH-3	40	0.06	0.78	cu.m
CB/MH-4	27	0.05	0.42	cu.m
CB-5	27	0.05	0.43	cu.m
CB-6	219	0.15	10.81	cu.m
CB/MH-7	282	0.15	13.89	cu.m
CB/MH-8	253	0.15	12.46	cu.m
CB/MH-9	114	0.13	4.86	cu.m
CB-10	120	0.13	5.14	cu.m
CB/MH-11	29	0.05	0.46	cu.m
CB/MH-12	30	0.05	0.47	cu.m
CB/MH-13	28	0.05	0.45	cu.m
		Maximum Volume Stored:	50.96	cu.m
		Maximum Volume Required:	50.96	cu.m

DRAINAGE AREA III (Continued)

(2-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	77	75.80	11.32	64.48	38.69
15	62	60.96	11.32	49.64	44.67
20	52	51.35	11.32	40.03	48.04
25	45	44.58	11.32	33.26	49.88
30	40	39.52	11.32	28.20	50.76
35	36	35.59	11.32	24.27	50.96
40	33	32.44	11.32	21.11	50.67
45	30	29.84	11.32	18.52	50.01
50	28	27.67	11.32	16.35	49.06
55	26	25.83	11.32	14.51	47.87
60	25	24.24	11.32	12.91	46.49
65	23	22.85	11.32	11.53	44.95
70	22	21.63	11.32	10.30	43.28
75	21	20.54	11.32	9.22	41.49
80	20	19.57	11.32	8.25	39.59
85	19	18.70	11.32	7.38	37.61
90	18	17.91	11.32	6.58	35.55
95	17	17.19	11.32	5.86	33.42
100	17	16.53	11.32	5.21	31.23
105	16	15.92	11.32	4.60	28.99
110	16	15.37	11.32	4.04	26.69
115	15	14.85	11.32	3.53	24.34
120	15	14.37	11.32	3.05	21.96
150	12	12.09	11.32	0.77	6.93
180	11	10.49	10.49	0.00	0.00
210	9	9.29	9.29	0.00	0.00
240	8	8.36	8.36	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 CALCULATIONS

Rational Method

2-YEAR EVENT

Project: 2104 Roger Stevens Drive
1-Storey Temple and 2-Storey Priest Residence
Ottawa, Ontario

Date: March 24, 2025

Manning's Roughness Coefficient: 0.013

Location		Individual					Cumulative				Sewer Data							
From	To	Roof C = 0.90 (ha)	Hard C = 0.90 (ha)	Permeable C = 0.25 (ha)	Soft C = 0.20 (ha)	2.78AC	2.78AC	Time (min)	Rainfall Intensity (mm/hr)	Q Flow Rate (L/s)	Length (m)	Nominal Diameter (mm)	Actual Diameter (mm)	Slope (%)	Velocity (m/s)	Q_{Full} Capacity (L/s)	Time (min)	Q / Q_{Full}
Roof Drains	MH-1	0.1040				0.2602	0.2602	10.00	77	19.99	23.6	200	201	1.00	1.05	33.31	0.38	60%
							Flow through flow control roof drains:			6.49	23.6	200	201	1.00	1.05	33.31	0.38	19%
MH-1	MH-15					0.0000	0.2602	10.38	75	19.62	64.9	200	201	0.59	0.81	25.58	1.34	77%
								Restricted upstream flow:		6.49	64.9	200	201	0.59	0.81	25.58	1.34	25%
CB-2	CB/MH-3		0.0275		0.0115	0.0752	0.0752	10.00	77	5.78	21.6	250	251	0.46	0.82	40.96	0.44	14%
CB/MH-3	CB/MH-4		0.0313		0.0103	0.0840	0.1592	10.44	75	11.97	19.4	450	456	0.21	0.83	135.35	0.39	9%
CB-5	CB/MH-4		0.0118		0.0025	0.0309	0.1902	10.00	77	14.60	12.6	250	251	1.00	1.22	60.40	0.17	24%
CB/MH-4	CB/MH-13		0.0115		0.0131	0.0361	0.3854	10.83	74	28.43	16.9	450	456	0.24	0.89	144.69	0.32	20%
CB-6	CB/MH-7		0.0280	0.0096	0.0249	0.0906	0.0906	10.00	77	6.96	31.3	250	251	0.45	0.82	40.52	0.64	17%
CB/MH-7	CB/MH-8	0.0272	0.0519	0.0290	0.0226	0.2306	0.3212	10.64	74	23.91	32.1	450	456	0.22	0.85	138.53	0.63	17%
CB/MH-8	CB/MH-9		0.0545	0.0242	0.0246	0.1669	0.4881	11.27	72	35.26	25.9	450	456	0.23	0.87	141.65	0.50	25%
CB-10	CB/MH-9		0.0241	0.0119	0.0213	0.0804	0.0804	10.00	77	6.18	9.1	250	251	1.00	1.22	60.40	0.12	10%
CB/MH-9	CB/MH-11		0.0189	0.0096	0.0123	0.0608	0.6489	11.77	71	45.83	32.5	450	456	0.22	0.85	138.53	0.64	33%
CB/MH-11	CB/MH-12		0.0035	0.0140	0.0198	0.0295	0.6784	12.41	69	46.57	19.0	450	456	0.21	0.83	135.35	0.38	34%
CB/MH-12	CB/MH-13		0.0127	0.0127	0.0393	0.0625	0.7408	12.79	68	50.03	18.8	450	456	0.21	0.83	135.35	0.38	37%
CB/MH-13	MH-14		0.0019	0.0121	0.0371	0.0338	1.1601	13.17	66	77.10	10.6	450	456	0.195	0.80	130.43	0.22	59%
							Flow through inlet control device:			22.61	10.6	450	456	0.195	0.80	130.43	0.22	17%
MH-14	MH-15					0.0000	1.1601	13.39	66	76.40	15.7	450	456	0.28	0.96	156.29	0.27	49%
								Restricted upstream flow:		22.61	15.7	450	456	0.28	0.96	156.29	0.27	14%
MH-15	Ditch					0.0000	1.4203	13.66	65	92.49	10.0	450	456	0.20	0.81	132.09	0.21	70%
								Restricted upstream flow:		29.09	10.0	450	456	0.20	0.81	132.09	0.21	22%

APPENDIX C

FLOODPLAIN CUT & FILL REPORT

2104 Roger Stevens Drive
Ottawa, Ontario

Cut & Fill Calculation Methodology

Existing Conditions of Proposed Fill Areas:

1. Draw existing contour lines at 0.15m intervals below the 100-year 89.67 m flood level.
2. Measure top area of each existing contour interval.
3. Calculate existing volume of water being stored between each 0.15m interval using prizmoidal formula.
4. Cumulative volumes represent total volume of water being stored.

Proposed Conditions of Proposed Fill Areas:

5. Draw proposed contour lines at 0.15m intervals below 89.67.
6. Measure top area of each proposed contour line, (if applicable, ignoring ditches as they are considered to be full under normal stormwater conveyance).
7. Calculate proposed volume of water being stored between each 0.15m interval using prizmoidal formula.
8. Cumulative volumes represent total volume of water being stored.
9. Subtract proposed volume stored from existing volume stored to yield loss of storage volume.
10. Cumulative volumes represent total loss of storage volume.

Existing Conditions of Proposed Cut Area

11. Draw existing contour lines at 0.15m intervals below 94.07.
12. Measure top area of each existing contour interval.
13. Calculate existing volume of water being stored between each 0.15m interval using prizmoidal formula.
14. Cumulative volumes represent total volume of water being stored.

Proposed Conditions of Proposed Cut Area

15. Draw proposed contour lines at 0.15m intervals below 94.07.
16. Measure top area of each proposed contour interval.
17. Calculate proposed volume of water being stored between each 0.15m interval using prizmoidal formula.
18. Cumulative volumes represent total volume of water being stored.
19. Subtract existing volume stored from proposed volume stored to yield gain of storage volume in cut area.
20. Cumulative volumes represent total gain of storage volume.

Cut & Fill Calculations - 2104 Roger Stevens Drive

March 19, 2025

FLOOD PLAIN FILL AREA 'A'

Contour Interval (m)	EXISTING GRADES					PROPOSED GRADES					Change in Storage Volume	
	Top Area (sq.m)	Bottom Area (sq.m)	Depth (m)	Volume (cu.m)	Cummulative Volume (cu.m)	Top Area (sq.m)	Bottom Area (sq.m)	Depth (m)	Volume (cu.m)	Cummulative Volume (cu.m)	Volume (cu.m)	Cummulative Volume (cu.m)
89.07 - 89.22	6	0	0.15	0.3	0.3	0	0	0.15	0.0	0.0	-0.3	-0.3
89.22 - 89.37	27	6	0.15	2.3	2.6	0	0	0.15	0.0	0.0	-2.3	-2.6
89.37 - 89.52	52	27	0.15	5.8	8.4	0	0	0.15	0.0	0.0	-5.8	-8.4
89.52 - 89.67	87	52	0.15	10.3	18.7	0	0	0.15	0.0	0.0	-10.3	-18.7

FLOOD PLAIN FILL AREA 'B'

Contour Interval (m)	EXISTING GRADES					PROPOSED GRADES					Change in Storage Volume	
	Top Area (sq.m)	Bottom Area (sq.m)	Depth (m)	Volume (cu.m)	Cummulative Volume (cu.m)	Top Area (sq.m)	Bottom Area (sq.m)	Depth (m)	Volume (cu.m)	Cummulative Volume (cu.m)	Volume (cu.m)	Cummulative Volume (cu.m)
89.07 - 89.22	0	0	0.15	0.0	0.0	0	0	0.15	0.0	0.0	0.0	0.0
89.22 - 89.37	0	0	0.15	0.0	0.0	0	0	0.15	0.0	0.0	0.0	0.0
89.37 - 89.52	181	0	0.15	9.1	9.1	12	0	0.15	0.6	0.6	-8.5	-8.5
89.52 - 89.67	479	181	0.15	47.7	56.8	61	12	0.15	5.0	5.6	-42.7	-51.2

FLOOD PLAIN CUT AREA

Contour Interval (m)	EXISTING GRADES					PROPOSED GRADES					Change in Storage Volume	
	Top Area (sq.m)	Bottom Area (sq.m)	Depth (m)	Volume (cu.m)	Cummulative Volume (cu.m)	Top Area (sq.m)	Bottom Area (sq.m)	Depth (m)	Volume (cu.m)	Cummulative Volume (cu.m)	Volume (cu.m)	Cummulative Volume (cu.m)
89.07 - 89.22	33	0	0.15	1.7	1.7	98	0	0.15	4.9	4.9	3.3	3.3
89.22 - 89.37	80	33	0.15	8.2	9.9	263	98	0.15	26.1	31.0	17.9	21.1
89.37 - 89.52	148	80	0.15	16.8	26.7	446	263	0.15	52.6	83.6	35.7	56.8
89.52 - 89.67	234	148	0.15	28.4	55.1	677	446	0.15	83.6	167.2	55.2	112.1

Contour Interval (m)	Change in Storage Volume			
	Fill Volume (cu.m)	Cut Volume (cu.m)	Gain in Volume (cu.m)	Cummulative Gain (cu.m)
89.07 - 89.22	-0.3	3.3	3.0	3.0
89.22 - 89.37	-2.3	17.9	15.6	18.5
89.37 - 89.52	-14.3	35.7	21.5	40.0
89.52 - 89.67	-53.0	55.2	2.2	42.2

APPENDIX D

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

Pre-Application Consultation Meeting Notes

Property Address: 2104 Roger Stevens Drive
PC2022-0235
September 21, 2022, Microsoft Teams Meeting

Attendees:
Erica Ogden, Planner, City of Ottawa
Damien Whittaker, Engineer, City of Ottawa
Mark Elliot, Environmental Planner, City of Ottawa
Christopher Moise, Urban Design, City of Ottawa
Adiva Saadat, Student Planner, City of Ottawa
Jasdeep Brar, Student Planner, City of Ottawa

Kula Sellathurai, CIMA
Patrick Rutherford, P2 Concepts
Patrick England, P2 Concepts
Aira Muttulingam, Ottawa Sivan Temple
Nantha Aiyadurai, Ottawa Sivan Temple
Ranjani Kala, Ottawa Sivan Temple
Suthakar, Ottawa Sivan Temple

Regrets:
Anissa McAlpine, Parks Planner, City of Ottawa
Tessa Di Iorio, Hydrogeologist, City of Ottawa
Neeti Paudel, Transportation, City of Ottawa
Eric Lalande, Rideau Valley Conservation Authority

Subject: 2104 Roger Stevens Drive

Meeting notes:

Overview of Proposal

- The applicants would like to build a temple. A temple has been operating at the site for 15 years, since July 2007, and space has become limited. They would like to construct a larger building with Hindu architecture. The building will be approximately 1000 square meters. There are two access points to the site. The new temple will be built behind the existing temple, away from the street with parking at the front. Additional parking will be provided as needed, with accessible parking spaces.
- The main floor is intended to be a worship area. There will be a discussion area with kitchen, food, and coat storage alongside other miscellaneous services in the basement.
- The existing temple will be operational while the new temple is being built. After construction, when the new temple will be operational, the existing one will be used for the priest residence, but will ultimately be removed.

Preliminary comments and questions from staff and agencies, including follow-up actions:

- Planning - Erica Ogden, erica.ogden@ottawa.ca
  - Official Plan
    - The subject property is designated as Village on Schedule A of the Official Plan and Flood Plain on Schedule K.

        - The property is within the Village of North Gower Secondary Plan and designated as Residential and Agriculture, on Schedule A.
        - The rear of the property is designated Agriculture, which due to the extensive floodplain hazard, permitted uses are limited to farm and forestry.
        - The Residential designation permits minor institutional uses (e.g. churches) within the Residential land use designation, provided the required zoning is in place to accommodate the use.
    - New Official Plan
        - Within the Council adopted New Official Plan, which is awaiting approval from the Ministry of Municipal Affairs and Housing, the property is designated as Village on Schedule B9.
        - The property is also within the Village of North Gower Secondary Plan in Volume 2B of the New Official Plan and designated as Residential and Agriculture on Schedule A.
        - The Residential designation continues to permit institutional uses, limited in size and scale; and the Agriculture designation limits non-agricultural uses.
    - Zoning By-law
        - The subject property is zoned Rural Institutional Subzone 3, rural exception 608 RI3[608r] with flood plain overlay.
        - The rural exception 608r prohibits all uses permitted within the Rural Institutional zone, with the exception of a school, place of worship or a dwelling unit accessory to these uses, which are permitted.
        - Despite the provisions of the underlying zone, development is prohibited within the area subject to the floodplain overlay.
        - The maximum permitted height within the RI3 zone is 12 metres. Ornamental dome, skylight, cupola, clock tower, church spire, steeple or belfry are permitted projections above the maximum permitted height.
    - Discussion
        - Parking Spaces
            - Parking for a Place of Worship is to be provided at 10 spaces per 100 sq.m. of gross floor area (GFA) of assembly area.
            - As currently shown on the Site Plan with a GFA of 948.96 sq.m. a total of 95 spaces is provided. The site is currently deficient with only 63 parking spaces provided.
            - If the existing structure will continue to be used as a place of worship, school or accessory dwelling unit following the construction of the new temple, the appropriate number of parking spaces must be provided for the use.
            - The new parking spaces to be added must remain outside of the flood plain.
        - Please identify the location of the existing septic and well on the site plan.
        - Please include the locations for the proposed well and septic on the site plan.
        - Locations for garbage collection/storage and snow storage should be shown.
        - Include the location of the flood line on the plans submitted.
        - A Landscape Plan will be required.
        - An Archaeological Impact Assessment will be required.

- Urban Design - Christopher Moise, christopher.moise@ottawa.ca
    - This proposal does not run along or does not meet the threshold in one of the City's Design Priority Areas and need not attend the City's UDRP. Staff will be responsible for evaluating the proposal and providing design direction;

- We appreciate the drawings submitted for the pre-consultation and have the following comments/questions about the new Hindu temple proposal:
  - **Orientation**: We understand the desire to have the temple face due East and the limits this puts on its placement however it is a large site and some flexibility with its orientation relating to the street may be warranted. We recommend considering a more precise orientation to have the building axis due East/West may provide additional opportunities for site design, parking location and pedestrian access;
  - **Setback**: We understand the placement of the new Temple behind the existing temple may be more desirable than placing it in front of the existing, however, we recommend consideration of the site design after the existing building is removed and how the 'front yard' can be planted of beautified to prevent it becoming a parking lot in the future;
  - **Parking locations**: Although lining the edges of the property with parking may be an easy approach we recommend consideration of a parking area behind the new Temple to free some of the residual areas around the site for landscaping instead of a ring of asphalt;
  - **Pedestrian access**: We recommend attention to how pedestrians will access the Temple from the parking areas with safety and aesthetics in mind;
  - **Main entrance**: Access and visibility of the main entrance to the Temple is currently located behind the existing building. We recommend some consideration for how visitors will easily locate this and providing visual cues and design features to facilitate this;
  - **Ramp**: The barrier free ramp is located on the street facing elevation of the new Temple and we recommend consideration for what this will look like from the street. Perhaps some vegetative screening in this location might help the design fit in with the rural context.
- A scoped Design Brief is a required submittal for all Site Plan/Re-zoning applications and can be combined with the Planning Rationale. Please see the Design Brief Terms of Reference provided.
  - ***Note. The Design Brief submittal should have a section which addresses these pre-consultation comments;***
- This is an exciting project in an area full of potential. We look forward to helping you achieve its goals with the highest level of design resolution. We are happy to assist and answer any questions regarding the above. Good luck.

- Engineering - Damien Whittaker, Damien.Whittaker@ottawa.ca
  - **Survey**
    - A topographic survey needs to identify all representative elevation points, currently existing features, all property lines and vertices, bodies of water, regulated floodplain elevation and location, vegetation, easements etc. It needs to provide a note that references the horizontal and vertical datums that were used and tied into to complete the project. A temporary benchmark will need to be shown on at least one plan.

- **Water Service**
  - It is an existing site, and it is understood that there are no municipal water pipes near the application.
  - Please retain a hydrogeological consultant to provide the design demands and the fire-fighting demand to enable a review. Fire-fighting demands are to be provided by the FUS process.

- **Sanitary Service**
  - There are no municipal sanitary sewers adjacent the proposed development. A terrain analysis study is required to show that a sufficient septic treatment system, or systems, will work for the development.
  - If the design sanitary flow is less than 10,000 l/day, as anticipated, OSSO approval is required and this is needed prior to site plan approval being given, otherwise ECA application is required.
  - Minimum Septic Field Setback from property lines is 3 metres & 5 metres from buildings. Note: if the septic fields are raised beds then these separations distances increase (they increase by 2x the grade raise) – please see Ottawa Septic System Office guidelines for details.

- **Groundwater**
  - The proposed well on-site needs to follow the determinations of the Hydrogeological report and needs to assure that adequate water supply is provided that exceeds the determined design requirements. The parameters of review shall be the "subdivision suite" known to local hydrogeological consultants and trace metals (listed in the Hydrogeological and Terrain Analysis Guidelines, City of Ottawa, March 2021) and VOCs.
  - The proposed development falls within the jurisdiction of Rideau Valley Conservation Authority and is within Mississippi-Rideau source water protection area and would need to observe any criteria therein.

- **Storm Sewers**
  - There are no municipal storm sewers adjacent the proposed development. A retained consultant will need to review the existing downstream ditch network for capacity and prepare a SWM plan and report that will assure that the post development surface run-off will not adversely affect the downstream drainage system and the adjacent properties.
  - Adjacent properties should not be adversely affected by the surface runoff during construction and in the post-construction condition- legal & sufficient outlet will need to be confirmed.
  - Snow storage area should be separated from the septic field locations so there is no snow melt impacting the septic field. In addition, the snow storage areas should drain into the SWM system for discharge from the site.
  - Additional controls might need to be implemented, to prevent contaminates (salts and other) infiltration into the ground.

- **Storm Water Management**
    - LID is required as per the memo from the former MOECC (now MECP). Efforts are required to provide low flow runoff in the summer. Any existing stormwater runoff from adjacent site(s) that crosses the property must be accommodated by the proposed stormwater management design. No adverse effect is permitted to be imposed upon the surrounding properties.
    - The entire site needs to be controlled via on-site control measures. The 100-year post development flow must be controlled to the 2-year pre-development return period storm level.
    - All stormwater management report determinations shall have supporting rationale.
    - Stormwater management quality criteria is set by the Rideau Valley Conservation Authority (RVCA) and it is enhanced- 80% TSS removal.
    - The SWM Report may also need to reference soil hydrogeological and geotechnical conditions and the infiltration capacity limitations of the soil and what, if any, surface run-off water treatment measures are being applied to protect the highly vulnerable aquifer.
    - As this is a re-development the pre-development condition will be determined using the smaller of a run-off coefficient of:
        - 0.5
        - actual existing approved site runoff coefficient, as per section 8.3.7.3 of the SDG
    - Property access points (driveways) need to have culverts, which are to be designed by a Professional Engineer and need to be at least 0.5 m in diameter. The culvert design needs to be considered, as per Section 6.4.2 of Ottawa Sewer Design Guidelines.
    - The application is not located within any known subwatershed study areas and is therefore not required to address the criteria within any additional reports.
    - Floodplain mapping of 350 year frequency may be available, and, if so, should be checked against.

- **Geotechnical Investigation**
    - Please note that sensitive marine clays are anticipated in the area of the proposal and, if so, enhanced geotechnical investigation and exhaustive analysis will be necessary. Investigation of clays should be undertaken with vane shear testing, Atterberg limits testing (from a number of depths in each column), shrinkage, grain size, grade raise restriction, consolidation, compaction sensitivity, remolded strength and liquefaction analysis- amongst others.
    - It should also include infiltration/percolation testing for SWM & septic field design due to a highly vulnerable aquifer present on site within Mississippi-Rideau source water protection area. Infiltration here might be of concern with somewhat impervious clay soils.
    - The groundwater level is to be investigated and the level is to be derived from spring-time investigation
    - Baseline water quality sampling program may be required

- **Slope stability**
    - As the application is near a watercourse slope stability may be a concern; please have a consultant provide a slope stability analysis (if required). Or for the retaining wall.
- **Roads**
    - Schedule H, of the current Official Plan specifies the ROW of Roger Stevens Drive to be an arterial at this location. Annex 1, goes on to specify that the ROW to be protected here should be provided 30 m of protection.
    - Please refer to the City of Ottawa Private Approach By-Law 2003-447 for the entrance design. The east entrance looks very close and the flares need to be offset from the extension of the property line to where it meets the paved surface.
- **Energy conservation**
    - Energy conservation is required to be demonstrated throughout design as per section 2.2.3 of the Official Plan (resilience to floods, protection of trees wetlands, reduction of urban heat, renewable energy, mitigation of climate change impacts and others).
- **Noise**
    - Being adjacent to an existing arterial road a noise report will be required.
- **Permits and Approvals**
    - Please contact the Rideau Valley Conservation Authority (RVCA), amongst other federal and provincial departments/agencies, to identify all the necessary permits and approvals required to facilitate the development: responsibility rests with the developer and their consultant for determining which approvals are needed and for obtaining all external agency approvals. The address shall be in good standing with all approval agencies, for example RVCA, prior to approval. Copies of confirmation of correspondence will be required by the City of Ottawa from all approval agencies that a form of assent is given. Please note that a stormwater program for multiple lots is understood to be the expanded type of Environmental Compliance Approval (ECA) application with the MECP; please speak with your engineering consultant to understand the impact this has on the application.
    - An MECP ECA application is not submitted until after City of Ottawa engineering is satisfied that components directly or indirectly aligned with the ECA process concur with standards, directives, and guidelines of the MECP.
    - No construction shall commence until after a commence work notification is given by Development Review
    - Ministry of the Environment, Conservation and Parks contact information:
        - Jena Lavoy – water inspector; (613)521-3450 x 236; Jena.Leavoy@ontario.ca

- Hydrogeology – Tessa Di Iorio, tessa.diiorio@ottawa.ca
    - A hydrogeological and terrain analysis (HGTA) report is required to support the private servicing (well and septic).
    - HGTA report must meet the requirement of the City's Hydrogeological and Terrain Analysis Guideline Guidelines (March, 2021); requirements related to site plan applications are listed in Section 5.0.

- Water quantity and quality: The supply well must be established and tested to support the water quantity and water quality.
    - Support must be provided for the pump test rate; use the maximum day rate.
    - Must meet the water quality testing requirements outlined in the City Guidelines (See section 5.2.4v) – i.e. sample for subdivision suite parameters, trace metals and VOCs. Also consider local existing and historic land use and determine if any additional parameters need to be included.
- If the existing well will be used for the new development, then an inspection and assessment of the well is required to ensure the well meet the current wells regulations (O.Reg. 903 under the *Ontario Water Resources Act*), and ensure the well is in good working order. A camera inspection is recommended to confirm the integrity of the casing.
- The well should be shown on all plans and should be located where it is safe from vehicular damage. The grading plan should show how the grading around the well meets O.Reg. 903 requirements.
- Note that if the total septic flows for the site will be greater than 10,000 L/day, then an ECA from the MECP will be required for the septic system at Site Plan. If the septic flows are less than 10,000 L/day then a septic assessment is required to ensure that the septic does not impact the local aquifer; the required methodology for the assessment is outlined in the City Guidelines – refer to the predictive assessment for commercial/industrial developments.
- Groundwater Impact Assessment – the HGTA report must include an assessment for potential impact during construction activities; the impact to existing well users should be assessed. Based on local well records, it is noted that the bedrock is generally deeper than 50 feet, however the records indicate dense till “hardpan” (starting at depths from 3 to 12 ft) which may require blasting. The report should indicate if blasting will be required (based on the geotechnical investigation) and assess if there may be impact to local well users. Impact may be water quantity (construction dewatering) or quality (blasting or other construction activities that cause vibrations and cause a change in water quality of near-by wells).
    - If there is a potential to impact nearby wells, then a baseline water quality sampling program will be required. The purposed of the sampling program is to get baseline water quality and water use information from existing near-by well prior to the start of construction, for reference in the unlikely event that development impact and existing well users. The City must be consulted and agree to the wells to be included if a baseline water quality program is recommended,
- Regulated system: Since the well will be servicing the public, it falls under O.Reg 319 (Small Drinking Water Systems) under the Health Protection and Promotion Act, which is administer by Ottawa Public Health (OPH). OPH will need to be notified of the changes to the existing system (i.e. increase in use) and need to provide confirmation that requirements outlined by OPH (if any) have been met prior to the provision of water.
- Technical consultation with the hydrogeological reviewer of the site plan application is encouraged with the hydrogeological consultant prior to starting field work to help scope report requirements.

- Transportation - Neeti Paudel, neeti.paudel@ottawa.ca
  - Follow Traffic Impact Assessment Guidelines
    - For the trip generation trigger in the screening form, please provide number of person trips anticipated for this development. Submit the updated form to the transportation project manager at neeti.paudel@ottawa.ca for review.
    - Start this process ASAP. 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).
  - Noise Impact Studies required for the following:
    - Road- (place of worship is considered to be noise sensitive).
    - Stationary (due to the proximity to neighbouring exposed mechanical equipment) **or** (if there will be any exposed mechanical equipment due to the proximity to neighbouring noise sensitive land uses)
  - Ensure throat length requirements at accesses are met. Accesses should be upgraded as per City standards.
  - Consider paving the drive aisle.
  - On site plan:
    - **Parking stalls at the end of dead-end parking aisles require adequate turning around space**
    - 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 all curb radii measurements; ensure that all curb radii are reduced as much as possible
    - Show lane/aisle widths.
  - AODA legislation applies to this development. Please ensure AODA guidelines are met.
    - Clearly define accessible parking stalls and ensure they meet AODA standards (**include an access aisle next to the parking stall and a pedestrian curb ramp at the end of the access aisle, as required**).
    - Please consider using the City's Accessibility Design Standards, which provide a summary of AODA requirements. https://ottawa.ca/en/city-hall/creating-equal-inclusive-and-diverse-city/accessibility-services/accessibility-design-standards-features#accessibility-design-standards

- Environmental - Mark Elliott, mark.elliott@ottawa.ca
  - There are some trees on site but it's not clear if they will be affected by the proposed development. Consequently, a Tree Conservation Report (TCR) will be required. The goals of this is mainly to identify where the trees on site are in relation to the development and ensure that their Critical Root Zones are not impacted. Guidelines for what a TCR should incorporate can be found in Schedule E of the Tree Protection Bylaw here: https://ottawa.ca/en/living-ottawa/laws-licences-and-permits/laws/laws-z/tree-protection-law-no-2020-340#section-6b36ffbc-e9d2-4d08-b9bb-d68407d47af8
  - There are species-at-risk birds on site, the Bobolink. The potential presence of these animals does not preclude development, but the applicant will have to undertake the mitigation actions presented in the Protocol for the Protection of Wildlife During Construction. While all the mitigation measures listed in the Best Practices section should be incorporated, the most important one to consider in the early stages of the project are the Sensitive Timing Windows described in section 2.2 of the Protocol as these will affect when certain activities may be carried out on site. The Protocol may

be found here:
https://documents.ottawa.ca/sites/documents/files/documents/construction_en.pdf

- Parks
  - No conveyance of land or payment of cash-in-lieu under the Parkland By-law is required in the case of the development or redevelopment of a place of worship, excluding any ancillary uses as defined by the Zoning By-law.

  Questions regarding the above requirements can be directed to Anissa McAlpine, Parks Planner, at anissa.mcalpine@ottawa.ca

- City Surveyor
  - The determination of property boundaries, minimum setbacks and other regulatory constraints are a critical component of development. An Ontario Land Surveyor (O.L.S.) needs to be consulted at the outset of a project to ensure properties are properly defined and can be used as the geospatial framework for the development.
  - Topographic details may also be required for a project and should be either carried out by the O.L.S. that has provided the Legal Survey or done in consultation with the O.L.S. to ensure that the project is integrated to the appropriate control network.

  Questions regarding the above requirements can be directed to the City's Surveyor, Bill Harper, at Bill.Harper@ottawa.ca

- Rideau Valley Conservation Authority - Eric Lalande eric.lalande@rvca.ca
  - The RVCA notes that the property is affected by floodplain. It appears that all development is proposed outside of the floodplain limits as well as the updated floodplain mapping being finalized. Please ensure that all grading work remains outside the floodplain boundary. Written permission will be required for work within 15 metres of the floodplain. Please contact our office to undertake the permitting process under section 28 of the Conservation Authorities Act.
  - From a stormwater management perspective, the RVCA requires enhanced water quality protection (80% TSS removal).

Submission requirements and fees

- A Rural Standard Site Plan Control application will be required.
- Required Plans
  - Site Plan
  - Landscape Plan
  - Survey
  - Site Servicing Plan*
  - Grading and Drainage Area Plan – showing snow storage
  - Erosion and Sediment Control Plan*
  - Lighting Plan (not required at submission, but for registration)
  - *All identified required plans are to be submitted on standard A1 size sheets as per City of Ottawa Servicing and Grading Plan Requirements and shall note the survey monument used to establish datum on the plans with sufficient information to enable a layperson to locate the monument.

- Required Reports
    - Planning Rationale
    - Archaeological Impact Assessment
    - Urban Design Brief
    - Site Servicing Study/Report (include firefighting considerations, Water & Sanitary)
    - Storm Water Management Report and Plan
    - Hydrogeological and terrain analysis report
    - Well inspection report
    - Septic condition report
    - Geotechnical Investigation Report
        - The geotechnical consultant will need to provide full copies of any published and peer reviewed papers relied on to determine results and conclusions. Earthquake analysis is now required to be provided in the report.
    - Slope Stability study (if required)
    - Noise Impact Study
    - Transportation Impact Assessment
    - Tree Conservation Report
- Additional information regarding fees related to planning applications can be found here.
- Plans are to be standard A1 size (594 mm x 841 mm) or Arch D size (609.6 mm x 914.4 mm) sheets, dimensioned in metric and utilizing an appropriate Metric scale (1:200, 1:250, 1:300, 1:400 or 1:500).
- All PDF submitted documents are to be unlocked and flattened.
- Guide to preparing City of Ottawa Studies and Plans: http://ottawa.ca/en/development-application-review-process-0/guide-preparing-studies-and-plans
- To request City of Ottawa plan(s) or report information please contact the ISD GeoInformation Centre: Information Centre (613) 580-2424 ext. 44455

Next steps

- You are encouraged to discuss the proposal with Councillor, community groups and neighbours

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: **N/A**

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**
- 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: **Included**

Confirmation of adequate fire flow: **Included**

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: **N/A**

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: **Included**

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: **N/A**

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: **N/A**

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: **Included**

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: **N/A**

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. The Conservation Authority is not the 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: **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**