

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

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STORMWATER MANAGEMENT REPORT

95 - 123 ROYDON PLACE
OTTAWA, ONTARIO

REPORT No. 25080

OCTOBER 28, 2025

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(AN EXCERPT FROM SITE SERVICING DESIGN REPORT,
PREPARED BY TROW ENGINEERING, MARCH 4, 2011)
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1.0 INTRODUCTION

This report has been prepared in support of the Site Plan Control application for a proposed expansion of a Costco parking lot located on two properties at 95 and 123 Roydon Place in Ottawa, Ontario. This report describes the site storm sewer system and stormwater management for these properties. A gas station also occupies 123 Roydon Place. Refer to Pre-Application Consultation Meeting Feedback in Appendix A.

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 STORMWATER MANAGEMENT

2.1 QUALITY CONTROL

As stated in the City of Ottawa's 'Pre-Consultation: Meeting Feedback', dated July 8, 2025: "80% TSS removal is required for the subject site". Refer to Appendix A. To meet the water quality target 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 80% of the TSS. Refer to Appendix C. The CDS PMSU2015-4 has an oil capacity of 232 L and a sediment capacity of 0.7 m³.

An Erosion & Sediment Control Plan has been developed to be implemented during construction. Refer to drawings C-4 and C-5 and notes 2.1 to 2.5 on drawing C-6. To summarize: Sediment capture filter sock inserts are to be installed in all existing and proposed catch-basins and catch-basin/manholes within or adjacent to the site; and any material deposited on the public road is to be removed.

2.2 QUANTITY CONTROL

As stated in the City of Ottawa's 'Pre-Consultation: Meeting Feedback', dated July 8, 2025:

"The Stormwater Management Quantity Criteria, for the subject site, is to be based on the following:

Option 1 – If the existing site is currently controlled:

- a. *The post-development release rate must not exceed the previously approved release rate for the site.*

Option 2 – If the existing site is currently uncontrolled:

- a. *Flows to the storm sewer in excess of the 5-year storm release rate, up to and including the 100-year storm event, must be detained on site. ..."* Refer to Appendix A.

The site is currently being controlled. As stated in the 'Site Servicing Design Brief Report for Proposed Gas Bar and parking Lot Expansion', March 4, 2011, prepared By Trow Engineering (refer to Appendix B for an excerpt): *"The allowable release rate will be limited to 87.4 L/sec for site A [123 Roydon Place] and to 62.8 L/sec for site B [123 Roydon Place] based on the 5-year storm ... for all storm return periods up to the 100-year event ..."*

There are two storm sewer systems serving the subject properties; one is entirely at 95 Roydon Place, and the other is entirely at 123 Roydon Place; both systems connect to the municipal storm sewer in Roydon Place. However, the existing grading is such that drainage for each property is not independent of the other; i.e. some of 95 Roydon Place drains onto 123 Roydon Place (and vice versa). As such, the stormwater criteria followed is that the total allowable release rate (i.e. the sum release from of both properties) is 150.2 L/s (= 87.4 L/s + 62.8 L/s) for all storm return periods up to the 100-year event.

The Rational Method is used to calculate the maximum allowable release rate. The Rational and Modified Rational Methods are used to calculate the post-development flow rates and corresponding storage volumes. The runoff coefficients for the 100-year event are increased by 25% to maximum 1.00. Refer to calculations in Appendix C.

Drainage Area I (Uncontrolled Flow Off Site – 1,058 m²)

Some areas around the perimeter of the property currently drain uncontrolled off site (refer to the Drainage Plans on drawing C-7. This condition will remain. The flow rates are calculated at a time of concentration of 10 minutes.

	100-Year Event	5-Year Event
Maximum Flow Rate	13.69 L/s	6.43 L/s

Drainage Area II (2,004 m²)

An existing inlet control device (ICD) located in the outlet pipe of existing manhole STMH-4 restricts the flow of stormwater and causes it to pond in a landscaped area above existing catch basin CB-7. The existing ICD will be removed and replaced. The new ICD will be a vortex style manufactured by Hydrovex or approved equal, sized by the manufacturer for a discharge rate of 11.50 L/s at 1.92 m. It is calculated that an orifice area of 7,854 sq.mm (100 mm dia.) with a discharge coefficient of 0.238 will achieve the release rate of 11.50 L/s at 1.92 m. Based on this orifice the maximum release rate for the 5-year event is calculated to be 10.92 L/s at 1.74 m.

	100-Year Event	5-Year Event
Maximum Release Rate	11.50 L/s	10.92 L/s
Maximum Water Elevation	87.87 m	87.69 m
Maximum Volume Required & Stored	39.81 m ³	14.46 m ³

Drainage Area III (5,761 m²)

An existing inlet control device (ICD) located in the outlet pipe of existing catch basin/manhole CB/MH-4 restricts the flow of stormwater and causes it to pond in the parking area above existing catch basins and catch basin/manholes CB/MH-1, CB-1, CB-2, EX. CB-3, EX. CBMH-4, EX. CB-5, and EX. CBMH-6. These existing structures will remain (although the top elevation of some will be adjusted). The existing ICD will be removed and replaced. The new ICD will be a plug style with a round orifice located at the bottom of the plug, manufactured by Pedro Plastics or approved equal, and sized by the manufacturer for a release rate of 59.50 L/s at 2.12 m. It is calculated that an orifice area of 15,129 mm² (±139 mm dia.) with a discharge coefficient of 0.61 will restrict the outflow rate to 59.50 L/s at a head of 2.12 m. Based on this orifice the maximum outflow rate for the 5-year storm event is calculated to be 56.69 L/s at 2.06 m.

	100-Year Event	5-Year Event
Maximum Release Rate	59.50 L/s	58.69 L/s
Maximum Water Elevation	88.15 m	88.09 m
Maximum Volume Required & Stored	158.57 m ³	54.83 m ³

Drainage Area IV (5,999 m²)

An existing inlet control device (ICD) located in the outlet pipe of existing catch basin/manhole CB/MH-5 restricts the flow of stormwater and causes it to pond in the parking and landscaped areas above existing catch basins and catch basin/manholes CB-4, CB-5, CB-6, CB-7, CBMH-5 and CB/MH-6. These existing structures will remain (although CB-6 and CB-7 will be relocated slightly). The existing ICD will be removed and replaced. The new ICD will be a plug style with a round orifice located at the bottom of the plug manufactured by Pedro Plastics or approved equal, and sized by the manufacturer for a release rate of 65.51 L/s at 2.21 m. It is calculated that an orifice area of 16,298 mm² (±144 mm dia.) with a discharge coefficient of 0.61 will restrict the outflow rate to 65.51 L/s at a head of 2.21 m. Based on this orifice the maximum outflow rate for the 5-year storm event is calculated to be 64.62 L/s at 2.15 m.

	100-Year Event	5-Year Event
Maximum Release Rate	65.51 L/s	64.62 L/s
Maximum Water Elevation	87.73 m	87.67 m
Maximum Volume Required & Stored	146.19 m ³	48.88 m ³

The Entire Property:

	100-Year Event	5-Year Event
Maximum Allowable Release Rate	150.2 L/s	150.2 L/s
Maximum Release Rate	150.2 L/s	140.65 L/s
Maximum Volume Required & Stored	344.57 m ³	118.17 m ³

The maximum post-development release rate during the 100-year event is 150.2 L/s; equal to the maximum allowable. To achieve the maximum allowable release rate, a maximum storage volume of 344.57 m³ is required and provided. The maximum post-development release rate during the 5-year event is 140.65; about 6% less than the maximum allowable. These release rates are expected to have an acceptable impact on the existing downstream municipal storm sewers.

2.3 STORM SERVICING

The two existing site storm sewer systems connect to an existing municipal storm sewer in Roydon Place.

The peak unrestricted flow rate during the 2-year event in the last sewer segment in the storm sewer system located at 123 Roydon Place is calculated to be 120.05 L/s; which would be at 179% of the capacity of the 300 mm sewer (this is an existing condition). However, the restricted flow rate through the ICDs is 69.09 L/s; which reduces it to about 102% of the capacity. Refer to calculations in Appendix C.

The peak unrestricted flow rate during the 2-year event in the last sewer segment in the storm sewer system located at 95 Roydon Place is calculated to be 103.35 L/s; which would be at 187% of the capacity of the 300 mm sewer (again, this is an existing condition). However, the restricted flow rate through the ICDs is 64.22 L/s; which reduces it to about 115% of its capacity. Refer to calculations in Appendix C.

2.4 ENVIRONMENTAL COMPLIANCE APPROVAL

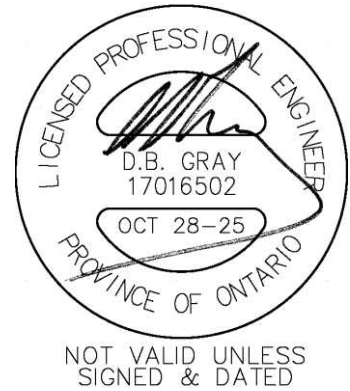
Since the existing and proposed stormwater management facility serves two properties, and since there is an existing gas station located on one of the properties, it is expected that there is an existing Environmental Compliance Approval (ECA) for the facility; and it is expected that it will be required to be amended.

3.0 CONCLUSIONS

1. To meet the water quality target of 80% TSS removal an oil grit separator (OGS) manhole is proposed.
2. An Erosion & Sediment Control Plan has been developed to be implemented during construction.

3. The maximum post-development release rate during the 100-year event is equal to the maximum allowable, and the maximum post-development release rate during the 5-year event is about 6% less than the maximum allowable. These release rates are expected to have an acceptable impact on the existing downstream storm sewers.
4. The existing Environmental Compliance Approval (ECA) is expected to be required to be amended.

Prepared by D.B. Gray Engineering Inc.



APPENDIX A

PRE-APPLICATION CONSULTATION MEETING FEEDBACK

July 8, 2025

Jasmine Paoloni
P-Squared Concepts
Via email: planning@p2concepts.ca

**Subject: Pre-Consultation: Meeting Feedback
Proposed Site Plan Control Application – 123 Roydon PI**

Please find below information regarding next steps as well as consolidated comments from the above-noted pre-consultation meeting held on **June 27, 2025**

Pre-Consultation Preliminary Assessment

Next Steps

1. A review of the proposal and materials submitted for the above-noted pre-consultation has been undertaken. For your next submission, please submit the required Application Form, together with the necessary studies and/or plans to planningcirculations@ottawa.ca, copy (cc:) to the file lead and planning support, Emily Charby and Amanda Davidson.
2. In your subsequent pre-consultation or application submission, please ensure that all comments or issues detailed herein are addressed. A detailed cover letter stating how each issue has been addressed is requested with the submission materials. Please coordinate the numbering of your responses within the cover letter with the comment number(s) herein.
3. Please note, if your development proposal changes significantly in scope, design, or density it is recommended that a subsequent pre-consultation application be submitted.

Supporting Information and Material Requirements

1. The attached **Study and Plan Identification List** outlines the information and material that has been identified, during this phase of pre-consultation, as either required (R) or advised (A) as part of a future complete application submission.
 - a. The required plans and studies must meet the City's Terms of Reference (ToR) and/or Guidelines, as available on Ottawa.ca. These ToR and Guidelines outline the specific requirements that must be met for each plan or study to be deemed adequate.

Consultation with Technical Agencies

1. You are encouraged to consult with technical agencies early in the development process and throughout the development of your project concept. A list of technical agencies and their contact information is enclosed.

Proposed Development

- The proposed development consists of a surface parking lot expansion. The expansion will involve repainting parking stall lines, reduction in median sizes, and removal of existing landscape buffers to create an additional 104 parking stalls within the existing parking lot.
- The surface parking lot serves as satellite parking for the office use located at 415 West Hunt Club Road. An office expansion is currently under construction, and the additional parking on site is intended to service the expanded office use.

Planning

Comments:

Official Plan

1. Pursuant to Schedules A and B3 in the Official Plan, the subject site is located within the Outer Urban Transect, and is designated Neighbourhood.
2. Per Schedule C4 – Urban Road Network, Roydon Place is classified as a Collector Road.
3. The site is located within the Airport Vicinity Development Zone, pursuant to Schedule C14.
 - a. Please review Section 10.2.2 of the Official Plan for direction relating to the protection of airport and aircraft operations.
4. Section 4.8.2 of the Official Plan outlines the provisions pertaining to tree planting, including that development shall preserve and provide space for mature, healthy trees and accommodate space for tree planting. Policy 3 d) identifies that priority shall be given to the protection of large, health trees over replacement plantings and compensations.
 - a. Staff have concerns with the proposed reduced landscaped area and reduced landscape buffer, specifically, that the proposed expansion to the parking lot does not adequately prioritize tree retention, and that the elimination of the landscape buffers on the east and west property limit does not provide adequate opportunities for new tree planting. Please review site design that retains landscaping, including tree retention, or provides opportunities for new soft landscaping/tree planting on site.

- b. Policy 6) of Section 4.8.2 identifies that the City and Committee of Adjustment may refuse a development application where it deems the loss of a tree(s) avoidable.
5. Section 4.1.4 of the Official Plan outlines that the City shall support the shift towards sustainable modes of transportation.
- a. Policy 2) of Section 4.1.4 identifies that the City shall manage the supply of parking to minimize and to gradually reduce the total land area in the City consumed to provide surface parking.
 - b. Policy 11) provides direction for the design of surface parking lots, including identifying that landscaping requirements shall be in addition to landscaping requirements for the right of way around the perimeter of parking lots, and that regular tree islands should be provided.
 - i. Specifically, Policy 11(d) of Section 4.1.4 of the Official Plan directs that surface parking lots should be designed to include regular spacing of tree islands that support the growth of mature shade trees. Please review opportunities to provide tree islands in accordance with this policy.

Zoning

6. The subject site is designated AM[1375]; Arterial Mainstreet Zone, Exception 1375.
- a. The purpose of the Arterial Mainstreet (AM) Zone is to allow a mix of residential, commercial, office, and institutional uses in a form that supports intensification along designated Arterial Mainstreets, while ensuring compatibility with surrounding development.
 - b. Exception [1375] permits a parking lot to provide required parking for lands zoned AM[1374] H(22).
7. Additional detail on the proposal, including dimensions of parking spaces, landscape buffers, etc., is required to provide specific comment on zoning conformity and/or any required relief from zoning provisions.
8. The site is subject to Section 70 of the Zoning By-Law [Protection of Airport Operations \(Section 70\)](#). Please review the airport regulations for any requirements relating to the airport, including bird hazard zones, etc.
9. Please confirm if 95 and 123 Roydon Place are merged on title, or if Section 93 [One Lot for Zoning Purposes \(Section 93\)](#) is applicable.

Landscape requirements

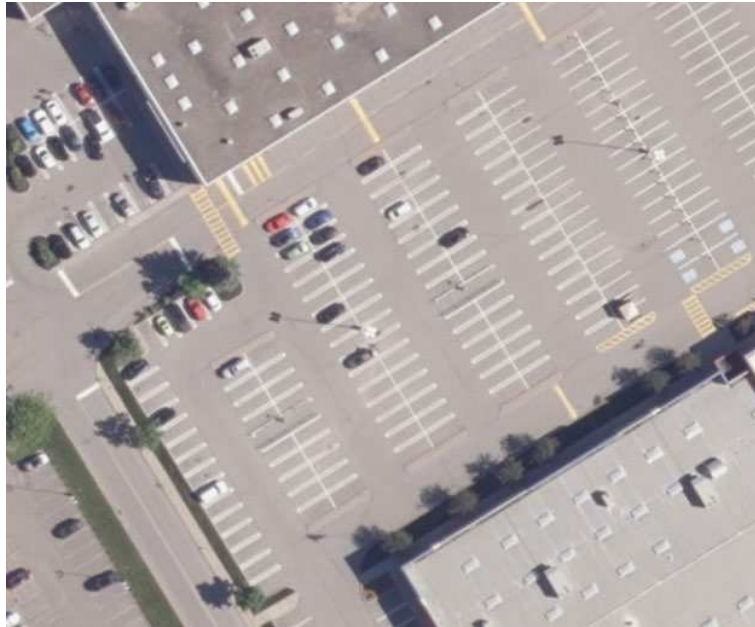
10. Please refer to Section 110 of the Zoning By-law for landscaping provisions for parking lots.

- a. (1) Except in the case of an industrial zone, a minimum of 15% of the area of any parking lot, whether a principal or an accessory use, must be provided as perimeter or interior landscaped area comprised of the following:
 - i. (a) a landscaped buffer must be provided between the perimeter of the parking lot and a lot line in accordance with Table 110. A driveway may cross the landscaped buffer; and (OMB Order, File #PL080959 issued September 18, 2009)
 - ii. In (b) in addition to the landscaped buffer, interior landscaping may be provided including various landscaped islands, landscaped medians, pedestrian pathways or public plazas to meet the minimum 15% requirement. (OMB Order, File #PL080959 issued September 18, 2009)
 - iii. Refer to Table 110 to ensure compliance with the minimum required width of a landscaped buffer 3 m for a parking lot containing 100 or more spaces.
- a. Please provide the dimensions of the proposed landscape buffers and landscaped area for review.
- b. Please review opportunities to retain a landscaping buffer which is compliant with the zoning by-law requirement of 3 meters, to accommodate space for new tree planting and tree retention where feasible.
- c. Consider opportunities to reduce asphalted areas and increase landscaping and tree planting in the parking lot to achieve zoning compliance. For example, consider the provision of compact car spaces (additional detail below) to reduce the overall amount of hardscaping on site.

Parking

11. Please provide a rationale as to the need for additional parking. Can the employee parking needs be met through shared parking with the provided parking at the retail store and/or office site?

- a. For example, consider whether additional parking can be provided on the retail and/or office site through the repainting of lines to provide only the minimum parking stall dimension. See below image for reference:



i.

- b. Please provide dimensions of parking spaces and aisle width on site plan to ensure compliance with Sections 106 and 107 of the Zoning By-law.
- c. Consider opportunities for electric vehicle charging spaces and dedicated car share spaces within the surface parking lot, per Policy 119f) of Section 4.1.4 of the Official Plan.
- d. Consider opportunities to provide compact car spaces as per Section 106 of the Zoning By-law, where 50% of parking spaces may be reduced to a minimum of 4.6m long and 2.4m wide.
- e. Confirm the zoning requirements for parking for the retail and office site, and provide the gross floor area of each for calculation.

12. Please advise as to the proposed location of snow storage.

Required Applications:

13. A Site Plan Control (Standard) application – more information on process, timelines, fees, etc. can be found [here](#).

14. A Minor Variance Application – more information can be found [here](#), or [Minor Zoning By-law Amendment](#) - more information can be found [here](#).

- a. Additional information, including the dimensions of aisle widths, parking spaces, and landscape buffers, is required to confirm conformity with the zoning by-law and any required zoning relief.

15. Ensure that all required plans and studies identified on the Studies and Plans Identification List (SPIL) are prepared in accordance with the applicable terms of

reference. All terms of reference can be found here: [Planning application submission information and materials | City of Ottawa](#).

Emily Charby, Planner I, for follow-up questions.

Urban Design

Comments:

16. Submission requirements:

- a. Site Plan
- b. Landscape Plan

17. Preliminary Design Comments:

- a. Urban design has concern with the loss of landscaped area within parking area and the loss of urban forest canopy. As well as the impacts to the public realm along Roydon Place.
- b. The applicant should look for opportunities for shared parking on site, or restriping parking areas to look for additional areas for parking. If some landscaped strip is removed, significant landscaping and tree planting should be provided as replacement.

Please contact Lisa Stern, Urban Design, for follow-up questions.

Engineering

Stormwater Management

18. The Stormwater Management Quantity Criteria, for the subject site, is to be based on the following:

Option 1 – If the existing site is currently controlled:

- a. The post-development release rate must not exceed the previously approved release rate for the site. The previously approved application can be purchased from geoinformation@ottawa.ca.

Option 2 – If the existing site is currently uncontrolled:

- a. Flows to the storm sewer in excess of the 5-year storm release rate, up to and including the 100-year storm event, must be detained on site.
- b. A calculated time of concentration (cannot be less than 10 minutes).

- c. The pre-development runoff coefficient shall be the lower of the existing coefficient or a maximum equivalent 'C' of 0.5, whichever is less (§ 8.3.7.3).
- d. The 5-year storm event using the IDF information derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collected 1966 to 1997.

19. 80% TSS removal is required for the subject site, if it isn't already being provided.

20. Ensure all external drainage areas are considered in the proposed design.

Additional Comments

21. Please confirm if 95 and 123 Roydon Place are merged on title. If the two properties are not merged on title, and the private storm sewer system is designed to service both properties, the applicant must provide the following requirements through this site plan application:
- a. A MECP Environmental Compliance Approval (ECA) for the private storm sewer system, designed to service more than one property. The applicant must consult the Ontario Regulations 525/98 Approval Exemptions to confirm if an ECA is required. The developer is required to provide a written explanation on why their development should be exempted.
 - b. A Joint Use Maintenance Agreement, servicing easements and an updated reference plan prior to Site Plan Registration for the private storm sewer shared between multiple properties.
22. A MECP Environmental Compliance Approval (ECA) may be required for the industrial effluents released from this site. The applicant must consult the Ontario Regulations 525/98 Approval Exemptions to confirm if an ECA is required. The developer is required to provide a written explanation on why their development should be exempted.
23. Since the scope of work for this site is currently limited to replacing small landscaping buffers by additional parking spaces, a geotechnical report is not required at this time. Please provide the pavement details to the Grading Plan and or General Notes Plan. Please notify our team if the scope of work exceeds what is anticipated above.
24. It is the City of Ottawa's Environmental Remediation Unit's opinion that a Phase I Environmental Site Assessment is not required for this site based on the current proposed scope of work, i.e. replacing landscaping buffers by additional parking spaces. Please notify our team if the scope of work is greater than what is anticipated above.

However, the applicant must ensure they comply with the provincial excess soil regulations based on the quantity of soil generated from the excavation, as this

could trigger the need for an ESA. Though, this ESA would fall outside of the planning application's scope.

25. Some structures (hydrant, catch basin, etc.) will need to be relocated outside of the proposed parking area following the removal of the landscaping buffers.

Feel free to contact Jean-Miguel Roy, Project Manager, for follow-up questions.

Transportation

Comments:

26. The plans show a proposed pedestrian crossover (PXO) on Roydon Place.

- a. RMA is required for the proposed PXO. The functional plan and/or RMA plans must be submitted to deem the application complete, per the TIA Guidelines. Request base mapping ASAP.
- b. Provide evaluation of the appropriate PXO type per OTM Book 15.
- c. Ensure the PXO ties in with sidewalks on both sides of Roydon Place.

27. Ensure that the development proposal complies with the Right-of-Way protection requirements - See [Schedule C16 of the Official Plan](#).

- a. ROW must be unincumbered and conveyed at no cost to the City. Note that conveyance of the ROW will be required prior to registration of the SP agreement. Additional information on the conveyance process can be provided upon request.
- b. Any requests for exceptions to ROW protection requirements must be discussed with Transportation Planning and concurrence provided by Transportation Planning management. The applicant shall submit support evidence and rationale to support any relief to Transportation Planning satisfaction.

28. On Site Plan:

- a. Ensure site accesses meet the [City's Private Approach Bylaw](#) and all driveways/aisles meet the requirements outlined in [Section 107 of the Zoning By-law](#).
- b. Show all details of the roads abutting the site; include such items as pavement markings, accesses and/or sidewalks.
- c. Show all curb radii measurements; ensure that all curb radii are reduced as much as possible and fall within TAC guidelines (Figure 8.5.1).

- d. Show dimensions for site elements (i.e. lane/aisle widths, access width and throat length, parking stalls, sidewalks, pedestrian pathways, etc.)
- e. Grey out any area that will not be impacted by this application.

Feel free to contact Rochelle Fortier-Lesage, Transportation Project Manager, for follow-up questions.

Environment

Comments:

- 29. There are no triggers for an Environmental Impact Study.
- 30. Please consider if there are features that can be added reduce the urban heat island effect (see OP 10.3). For example, this impact can be reduced by adding large canopy trees, green roofs or vegetation walls, or incorporating building with low heat absorbing materials.

Feel free to contact Matthew Hayley, Environmental Planner, for follow-up questions.

Forestry

Comments:

- 31. The almost complete removal of the landscape buffer would result in significant loss of trees and preclude their replacement, in an area that is already primarily hardscaped. The proposed design runs counter to the OP policies under sections 4.8.2, and 10.3, amongst others.
- 32. The proposal should be revised with tree retention in mind and should explore options to increase parking while respecting the 3 m landscape buffer requirement.
- 33. The design of the parking lot should seek ways to provide additional trees within the parking lot area, to provide shade and mitigate the heat island effect.
- 34. The use of hardscape planting systems is strongly encouraged, to permit the growth of larger trees, without sacrificing significant areas for parking.
- 35. The following Tree Conservation Report (TCR) guidelines have been adapted from the Schedule E of the Tree Protection By-law – for more information on these requirements please contact julian.alvarez-barkham@ottawa.ca
 - a. A Tree Conservation Report (TCR) must be supplied for review along with the suite of other plans/reports required by the City.
 - i. An approved TCR is a requirement of Site Plan approval.

- b. Any removal of privately-owned trees 10cm or larger in diameter within the urban area, or city-owned trees of any diameter requires a tree permit issued under the Tree Protection Bylaw (Bylaw 2020 – 340); the permit will be based on an approved TCR and made available at or near plan approval.
 - c. The TCR must contain 2 separate plans:
 - i. Plan/Map 1 - show existing conditions with tree cover information.
 - ii. Plan/Map 2 - show proposed development with tree cover information.
 - d. The TCR must list all trees on site, as well as off-site trees if the CRZ (critical root zone) extends into the developed area, by species, diameter, and health condition.
 - i. For ease of review, the Planning Forester suggests that all trees be numbered and referenced in an inventory table.
 - e. Please identify trees by ownership – private onsite, private on adjoining site, city owned, co-owned (trees on a property line)
 - f. If trees are to be removed, the TCR must clearly show where they are, and document the reason they cannot be retained.
 - i. Compensation may be required for the removal of city owned trees.
 - g. The removal of trees on a property line will require the permission of both property owners.
 - h. All retained trees must be shown, and all retained trees within the area impacted by the development process must be protected as per City guidelines available on the Tree Protection Specification or by searching Ottawa.ca.
 - i. The location of tree protection fencing must be shown on the plan.
 - ii. Show the critical root zone of the retained trees.
 - i. As per the Official Plan §4.8.2, the retention of healthy trees must be prioritized wherever possible. Please seek opportunities for retention of trees that will contribute to the design and function of the site.
36. The following Landscape Plan (LP) guidelines have been adapted from Schedule E of the Tree Protection By-law – for more information on these requirements please contact julian.alvarez-barkham@ottawa.ca

- a. Please ensure any retained trees are shown on the LP.
- b. Minimum Setbacks
 - i. Maintain 1.5m from sidewalk or MUP/cycle track or water service laterals.
 - ii. Maintain 2.5m from curb.
 - iii. Coniferous species require a minimum 4.5m setback from curb, sidewalk, or MUP/cycle track/pathway.
 - iv. Maintain 7.5m between large growing trees, and 4m between small growing trees. Park or open space planting should consider 10m spacing, except where otherwise approved in naturalization / afforestation areas.
 - v. Adhere to Ottawa Hydro's planting guidelines (species and setbacks) when planting around overhead primary conductors.
- b. Tree specifications
 - i. Minimum stock size: 50mm tree caliper for deciduous, 200cm height for coniferous.
 - ii. Maximize the use of large deciduous species wherever possible to maximize future canopy coverage.
- c. Tree planting on city property shall be in accordance with the City of Ottawa's Tree Planting Specification; and if possible, include watering and warranty as described in the specification.
- d. No root barriers, dead-man anchor systems, or planters are permitted.
- e. No tree stakes unless necessary (and only 1 on the prevailing winds side of the tree)
- f. Hard surface planting
 - i. If there are hard surface plantings, a planting detail must be provided.
 - ii. Curb style planter design is highly recommended.
 - iii. No grates are to be used and if guards are required, City of Ottawa standard (which can be provided) shall be used.
- c. Trees are to be planted at grade.
- d. Soil Volume - Please demonstrate as per the **Landscape Plan Terms of Reference** that the available soil volumes for new plantings will meet or exceed the following:

Tree Type/Size	Single Tree Soil Volume (m ³)	Multiple Tree Soil Volume (m ³ /tree)
Ornamental	15	9
Columnar	15	9
Small	20	12

Medium	25	15
Large	30	18
Conifer	25	15

- i. It is strongly suggested that the proposed species list include a column listing the available soil volume.
- e. Sensitive Marine Clay - Please follow the City's 2017 Tree Planting in Sensitive Marine Clay guidelines.
- f. The City requests that consideration be given to planting native species wherever there is a high probability of survival to maturity.
- g. Efforts shall be made to provide as much future canopy cover as possible at a site level, through tree planting and tree retention. The Landscape Plan shall show/document that the proposed tree planting and retention will contribute to the City's overall canopy cover over time. **Please provide a projection of the future canopy cover for the site to 40 years.**

Feel free to contact Julian Alvarez-Barkham, Forester, for follow-up questions.

Parkland

Comments:

37. This proposal is exempt from parkland conveyance.

Feel free to contact steve.gauthier@ottawa.ca, Parks Planner, for follow-up questions.

Submission Requirements and Fees

1. The attached **Study and Plan Identification List** outlines the information and material that has been identified as either required (R) or advised (A) as part of a future complete application submission.
 - a. The required plans and studies must meet the City's Terms of Reference (ToR) and/or Guidelines, as available on Ottawa.ca. These ToR and Guidelines outline the specific requirements that must be met for each plan or study to be deemed adequate.
2. All of the above comments or issues should be addressed to ensure the effectiveness of the application submission review.

Should there be any questions, please do not hesitate to contact myself or the contact identified for the above areas / disciplines.

Yours Truly,
Emily Charby

- c.c. Amanda Davidson, Planner I
Jean-Miguel Roy, Project Manager, Infrastructure Approvals
Mohammed Fawzi, Senior Project Manager,
Lisa Stern, Planner III, Urban Design
Rochelle Fortier-Lesage, Transportation Project Manager
Matthew Hayley, Environmental Planner
Julian Alvarez-Barkham, Forester
Steve Gauthier, Parks Planner

APPENDIX B

STORMWATER MANAGEMENT DESIGN CRITERIA

(AN EXCERPT FROM SITE SERVICING DESIGN REPORT,
PREPARED BY TROW ENGINEERING, MARCH 4, 2011)

2.0 Stormwater Design

2.1. Design Criteria

Design of the storm sewer system was completed in conformance with the City of Ottawa Design Guidelines (November 2004). Section 5 "Storm and Combined Sewer Design".

The allowable release rate for the site is limited to a 5-year storm event using a time of concentration of 20 minutes and a runoff coefficient of 0.20. Flows in excess of the 5-year pre-development runoff rate are detained onsite using onsite storage for up to the 100-year storm event.

During all construction activities, erosion and sediment shall be controlled by techniques outlined in Section 5 of this report.

2.1.1. Minor System Design Criteria

The storm sewers have been designed and sized based on the rational formula and the Manning's Equation under free flow conditions for the 5-year storm using a 10-minute inlet time.

2.1.2. Major System Design Criteria

The major system has been designed to accommodate on-site detention with sufficient capacity to attenuate the 100-year design storm. Excess runoff above the 100 year event will flow overland offsite.

On site storage is provided and calculated for up to the 100-year design storm with maximum ponding of 250mm on the ground surface. Calculation of the required on-site storage volumes has been supported by calculations provided in Appendix B.

Calculation of the required storage volumes has been prepared based on the Modified Rational Method as identified in Section 8.3.10.3 of the City's Sewer Guidelines. The depth and extent of surface storage will be illustrated on the grading plan.

2.2. Runoff Coefficients

Runoff coefficients for impervious surfaces (asphalt) were taken as 0.90, whereas pervious surfaces (grass) were taken as 0.20.

The calculated average runoff coefficient for the site A and site B under post-development controlled flow conditions are 0.86 and 0.75 for 5-year and 1.00 and 0.94 for 100-year. A 25% increase for the post development 100-year runoff coefficients was used as per City of Ottawa guidelines.

2.3. Pre-Development Conditions

Using a time of concentration (T_c) of 20 minutes and an average runoff coefficient of 0.50, the pre-development release rates from the site is determined for the 5-year and 100-year storms using the Rational Method as follows:

$$Q_{PRE} = 2.78 C I A$$

Where:

Q_{PRE}	=	Peak Discharge (L/sec)
C	=	Runoff Coefficient ($C=0.50$)
I	=	Average Rainfall Intensity for return period (mm/hr)
	=	$998.071 / (T_c + 6.053)^{0.814}$ (5-year)
	=	$1735.688 / (T_c + 6.014)^{0.820}$ (100-year)
T_c	=	Time of concentration (20 mins)
A	=	Drainage Area (0.895 ha-site A) & (0.643 ha-site B)

Therefore:

$$\begin{aligned} I_5 &= 998.071 / (20 + 6.053)^{0.814} = 70.25 \text{ mm/hr} \\ I_{100} &= 1735.688 / (20 + 6.014)^{0.820} = 119.95 \text{ mm/hr} \end{aligned}$$

Site A

$$\begin{aligned} Q_{5PRE} &= 2.78 (0.50) (70.25 \text{ mm/hr}) (0.895 \text{ ha}) = 87.4 \text{ L/sec} \\ Q_{100PRE} &= 2.78 (0.50) (119.95 \text{ mm/hr}) (0.895 \text{ ha}) = 149.2 \text{ L/sec} \end{aligned}$$

Site B

$$\begin{aligned} Q_{5PRE} &= 2.78 (0.50) (70.25 \text{ mm/hr}) (0.643 \text{ ha}) = 62.8 \text{ L/sec} \\ Q_{100PRE} &= 2.78 (0.50) (119.95 \text{ mm/hr}) (0.643 \text{ ha}) = 107.1 \text{ L/sec} \end{aligned}$$

In summary the 5-year and 100-year pre-development flows for site A are 87.4 L/sec and 149.2 L/sec and for site B 62.8 L/sec and 107.1 L/s respectively.

2.4. Allowable Release Rate

The allowable release rate will be limited to **87.4 L/sec** for site A and to **62.8 L/s** for site B based on the 5-year storm. To control runoff from the site it will be necessary to limit post-development flows for all storm return periods up to the 100-year event using onsite inlet controls as noted in the proceeding sections.

Site A

The site A is divided into a total of fourteen (14) sub-drainage areas as outlined on drawing SD1. Storm water flows from drainage areas A1, A2 and A8 will be controlled at STMH4 and drainage areas A3 to A6 and A9 to A12 will be controlled at ExCBMH4 prior to entering into the existing municipal storm sewer system on Roydon Place. Drainage areas A7 and A13 will be uncontrolled and will sheet drain towards Roydon Place and Hunt Club West Road.

As a portion of the site A is uncontrolled, the allowable release rate from the storm sewer system (controlled areas) equals the allowable release rate minus the 100-year release rate from the uncontrolled portion of the site. The 100-year un-controlled flow from drainage areas A7 and A13 is 12.2 L/s. Therefore, the post-development release rate from the controlled areas will be restricted to 75.2 L/s.

Site B

The site B is divided into a total of eight (8) sub-drainage areas as outlined on drawing SD1. Storm water flows will be controlled at CBMH 7 prior to entering into the existing municipal storm sewer system on Roydon Place. Drainage areas B5 will be uncontrolled and will sheet drain towards Roydon Place. Drainage area B6 will be uncontrolled and drain into ExDICB.

As a portion of the site B is uncontrolled, the allowable release rate from the storm sewer system (controlled areas) equals the allowable release rate minus the 100-year release rate from the uncontrolled portion of the site. The 100-year un-controlled flow from drainage areas B5 and B6 is 8.5 L/s. Therefore, the post-development release rate from the controlled areas will be restricted to 54.3 L/s.

2.5. Post-Development Runoff

Post development flows will be calculated using the rational method and based on a time of concentration of 10 minutes. Runoff coefficients for the 100-year storm will be increased by 25% to a maximum of 1.00 as per City of Ottawa standards.

Calculations of controlled and required restricted flows are provided in the next sections with a summary of all flows presented in Table A1 for site A and Table B1 for site B.

2.5.1. Controlled Runoff

Drawing GP1 illustrates in detail the grading design for the proposed development.

Using a time of concentration (T_C) of 10 minutes and an average runoff coefficient of 0.20 for grassed areas and 0.90 for hard surfaces, the post-development runoff rates from the site was determined for the 5-year and 100-year storm using the Rational Method as follows:

$$\begin{aligned}
 I_5 &= 998.071 / (T_C + 6.053)^{0.814} &= 104.19 \text{ mm/hr} \\
 I_{100} &= 1735.688 / (T_C + 6.014)^{0.820} &= 178.56 \text{ mm/hr} \\
 Q_{5\text{POST}} &= 2.78 \times C_{\text{AVG}} \times 104.19 \text{ mm/hr} \times \text{Area} \\
 Q_{100\text{ POST}} &= 2.78 \times C_{\text{AVG}} \times 178.56 \text{ mm/hr} \times \text{Area}
 \end{aligned}$$

Based on the storm drainage areas as shown in storm drainage plan, the 5-year and 100-year post-development runoff rates are calculated and summarized in Table A1 for site A and Table B1 for site B with detailed calculations provided in Appendix B.

Site A

From Table A1 below the total 5-year and 100-year post development flows are 186.3 L/sec and 368.8 L/sec. However, flows from A1, A2 and A8 will be restricted to 26.0 L/sec for 5-year and 100-year using an inlet restrictor installed in the storm manhole STTMH4 and flows from A3 to A6 and A9 to A12 will be restricted to 49.2 L/s for 5-year and 100-year using an inlet restrictor installed in ExCBMH4. Further details regarding the onsite detention and storage methods are provided in the next section.

Table 1A – Summary of Post-Development Flows

Area No	Area (ha)	Storm = 5 yr			Storm = 100 yr		
		C _{AVG(5yr)}	Q _{UNCONT} (l/s)	Q _{CONT} (l/s)	C _{AVG(100yr)}	Q _{UNCONT} (l/s)	Q _{CONT} (l/s)
A1	0.073	0.86	18.2	26.0	1.00	36.2	26.0
A2	0.040	0.84	9.7		1.00	19.7	
A3	0.083	0.90	21.6	49.2	1.00	41.0	49.2
A3b	0.092	0.90	24.0		1.00	45.8	
A4	0.056	0.90	14.6		1.00	27.9	
A5	0.021	0.90	5.5		1.00	10.4	
A6	0.018	0.90	4.6		1.00	8.8	
A7	0.063	0.20	3.7	3.7	0.25	7.8	7.8
A8	0.092	0.20	5.3	26.0	0.25	11.4	26.0
A9	0.078	0.90	20.4	49.2	1.00	38.8	49.2
A10	0.085	0.74	18.2		0.93	38.9	
A11	0.078	0.90	20.4		1.00	38.9	
A12	0.081	0.77	18.1		0.96	38.8	
A13	0.035	0.20	2.0	2.0	0.25	4.4	4.4
Totals	0.895		186.3			368.8	

Site B

From Table 1B below the total 5-year and 100-year post development flows are 129.0 L/sec and 245.5 L/sec. However these flows will be restricted to 54.3 L/sec for 5-year 100-year using an inlet restrictor installed in the downstream manhole CBMH7. Further details regarding the onsite detention and storage methods are provided in the next section.

Table 1B – Summary of Post-Development Flows

Area No	Area (ha)	Storm = 5 yr			Storm = 100 yr		
		C _{AVG(5yr)}	Q _{UNCONT} (l/s)	Q _{CONT} (l/s)	C _{AVG(100yr)}	Q _{UNCONT} (l/s)	Q _{CONT} (l/s)
B1	0.105	0.89	27.2	54.3	1.00	52.3	54.3
B2	0.131	0.88	33.5		1.00	65.2	
B3	0.095	0.90	24.6		1.00	46.9	
B4	0.133	0.87	33.4		1.00	66.0	
B5	0.055	0.20	3.2	2.7	0.25	6.9	5.7
B6	0.013	0.20	0.8	0.9	0.25	1.6	1.9
B7	0.053	0.20	3.1	54.3	0.25	6.5	54.3
B8	0.057	0.20	3.3		0.25	7.1	
Totals	0.643		129.0			245.5	

2.6. Storage Requirements

As previously noted an inlet restrictor will be used to control runoff prior to discharge into the existing main which will be installed in storm manhole STMH 4 at a controlled rate of 26.0 L/s and in existing catch basin manhole ExCBMH4 at a controlled rate of 49.2 L/s for site A and in catch basin manhole CBMH7 at a controlled rate of 54.3 L/s for site B. As a result stormwater will backup from both structures upstream within the storm sewer system. Storage of storm water will consist of pipe storage, structure storage and surface storage.

Storage in pipes and structures for both site A and site B were calculated based on cross sectional area multiplied by depth, whereas the surface storage was estimated using the prism formula as follows:

$$V = 1/3 \times A \times d$$

Where:

V	=	storage volume (cu.m.)
A	=	storage area (sq.m.)
d	=	maximum storage depth (m)
		Max Water Elev. – Top of Lid elevation.

The following summarizes the required and calculated 5-year and 100-year runoff rates (Q_{RESTRICTED}), storage requirements and storage provided.

SITE	RELEASE RATE (L/s)	5-YR STORAGE		100-YR STORAGE	
		REQUIRED (m3)	PROVIDED (m3)	REQUIRED (m3)	PROVIDED (m3)
A	26	5.7	8.9	27.7	30.7
	49.2	62.2	63.2	183.7	234.2
B	54.3	42.5	77.5	149.2	280.2

2.7. Inlet Control Design

The discharge rate from the orifice is based on the orifice equation, as provided in the MTO Drainage Manual, and as noted below:

$$Q_{\text{ORIFICE}} = C \times A \times (2 \times g \times H)^{0.5} \quad [\text{Equation 8.79 MTO Drainage Manual}]$$

Where:

Q_{ORIFICE}	Flow through the orifice, m ³ /sec
C	Discharge Coefficient [0.61]
A	Area of orifice opening, m ²
g	Acceleration due to gravity, m/sec ² [9.81]
H	Head over orifice, m [Water Surface – Orifice Centroid]

The following summarizes the orifice size and detail for site A and site B.

SITE	AREA#	STRUCTURE	RELEASE RATE (L/s)	HEAD OVER ORIFICE (m)	ORIFICE TYPE	ORIFICE SIZE (mm)	OUTLET PIPE SIZE (mm)
A	A1, A2, & A8	STMH4	26.00	1.91	PLUG	94.1 CIRC.	250
	A3-A6, A9-A12	EX.CBMH4	49.20	2.04	PLUG	127.4 CIRC.	300
B	B1-B4, B7-B8	CBMH 5	54.30	2.20	PLUG	131.3 CIRC.	300

Refer to Appendix B for detailed orifice calculations.

2.8. Storm Water Management Quality Control

The proposed site A will include Stormceptor Model 750 oil and grit separator to provide water quality treatment for the gas bar. The tributary area to the Stormceptor is 0.80 ha. The Stormceptor has been provided primarily for spill control. However, it will also remove approximately 75 % of the annual total suspended solids. (See Appendix C for Detailed report).

APPENDIX C

STORMWATER MANAGEMENT CALCULATIONS

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



Echelon Environmental

55 Albert Street, Suite #200 | Markham, ON, L3P 2T4

www.echelonenvironmental.ca

info@echelonenvironmental.ca

[905-948-0000](tel:905-948-0000)

Project Name: 91 Roydon Pl	Engineer: D.B. Gray Engineering Inc.
Location: Nepean, ON	Contact: Laurent Brosseau
OGS ID: OGS	Report Date: 24-Oct-25

Area: 0.5999 ha	Rainfall Station # 215	
C Value: 0.84	Particle Size Distribution FINE	
CDS Model: PMSU2015-4	CDS Treatment Capacity: 20 l/s	

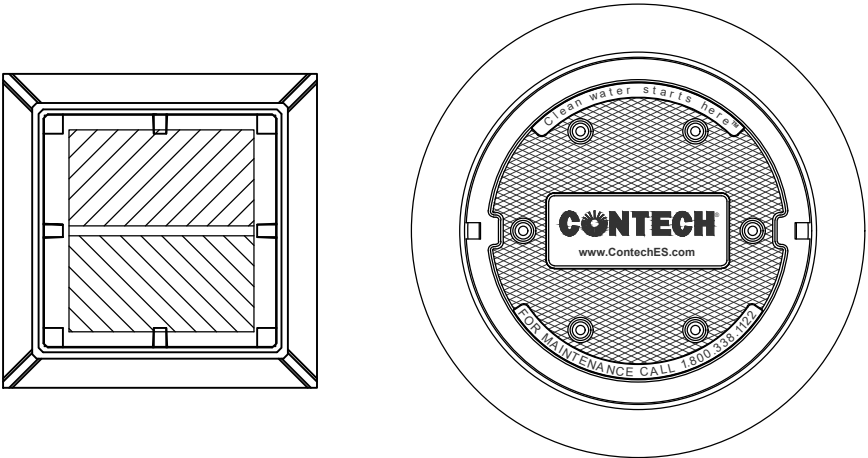
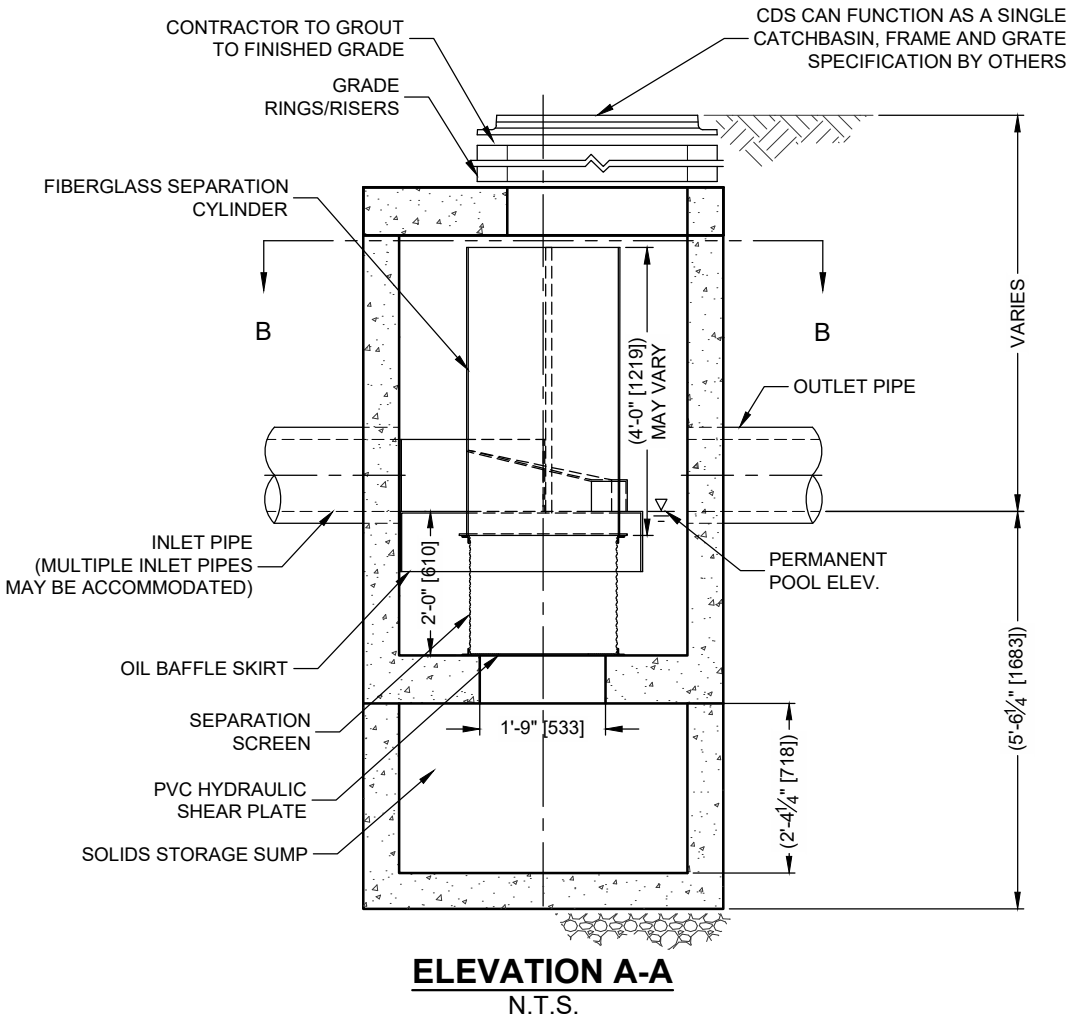
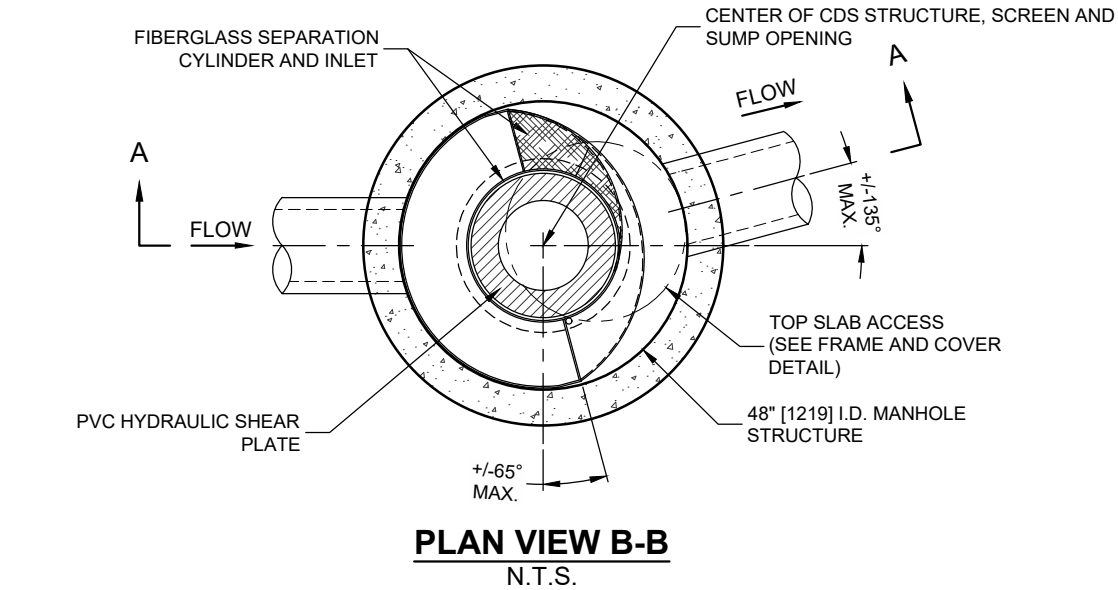
<u>Rainfall Intensity¹</u> <u>(mm/hr)</u>	<u>Percent Rainfall Volume¹</u>	<u>Cumulative Rainfall Volume</u>	<u>Total Flowrate (l/s)</u>	<u>Treated Flowrate (l/s)</u>	<u>Operating Rate (%)</u>	<u>Removal Efficiency (%)</u>	<u>Incremental Removal (%)</u>
0.5	9.2%	9.2%	0.7	0.7	3.5	97.9	9.0
1.0	10.6%	19.8%	1.4	1.4	7.0	96.9	10.3
1.5	9.9%	29.7%	2.1	2.1	10.5	95.9	9.5
2.0	8.4%	38.1%	2.8	2.8	13.9	94.9	7.9
2.5	7.7%	45.8%	3.5	3.5	17.4	93.9	7.2
3.0	5.9%	51.7%	4.2	4.2	20.9	92.9	5.5
3.5	4.4%	56.1%	4.9	4.9	24.4	91.9	4.0
4.0	4.7%	60.7%	5.6	5.6	27.9	90.9	4.2
4.5	3.3%	64.0%	6.3	6.3	31.4	89.9	3.0
5.0	3.0%	67.1%	7.0	7.0	34.8	88.9	2.7
6.0	5.4%	72.4%	8.4	8.4	41.8	86.9	4.7
7.0	4.4%	76.8%	9.8	9.8	48.8	84.9	3.7
8.0	3.5%	80.3%	11.2	11.2	55.7	82.9	2.9
9.0	2.8%	83.2%	12.6	12.6	62.7	80.9	2.3
10.0	2.2%	85.3%	14.0	14.0	69.7	78.9	1.7
15.0	7.0%	92.3%	21.0	20.1	100.0	67.2	4.7
20.0	4.5%	96.9%	28.0	20.1	100.0	50.4	2.3
25.0	1.4%	98.3%	35.0	20.1	100.0	40.3	0.6
30.0	0.7%	99.0%	42.0	20.1	100.0	33.6	0.2
35.0	0.5%	99.5%	49.0	20.1	100.0	28.8	0.1
40.0	0.5%	100.0%	56.0	20.1	100.0	25.2	0.1
45.0	0.0%	100.0%	63.0	20.1	100.0	22.4	0.0
50.0	0.0%	100.0%	70.0	20.1	100.0	20.1	0.0

Removal Efficiency Adjustment ² =	6.5%
Predicted Net Annual TSS Removal Efficiency =	80.2%
Predicted Annual Rainfall Treated =	96.4%

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

CDS PMSU 2015-4-C DESIGN NOTES

THE STANDARD CDS PMSU 2015-4-C CONFIGURATION IS SHOWN.
ANTI-BUOYANCY SLAB MAY BE INCLUDED (NOT SHOWN).
SUMP DEPTH SHOWN IS TYPICAL, CAN BE EXTENDED AS REQUIRED.
HYDRAULIC CHARACTERISTICS VARY BASED ON PIPE SIZE, MATERIAL, AND CDS UNIT SELECTION. FOR CUSTOM HYDRAULIC ANALYSIS PLEASE CONTACT ECHELON ENVIRONMENTAL.
FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT ECHELON ENVIRONMENTAL.



FRAME AND GRATE
(DIMENSIONS VARIES)
N.T.S.

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

- 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 LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET HS20 (AASHTO M 306) AND BE CAST WITH THE CONTECH LOGO.
 6. IF REQUIRED, 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.

SUMMARY TABLES

100-YEAR EVENT				
Drainage Area	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Uncontrolled Flow Off Site)	-	13.69	-	-
AREA II	-	11.50	39.81	39.81
AREA III	-	59.50	158.57	158.57
AREA IV	-	65.51	146.19	146.19
TOTAL	150.20	150.20	344.57	344.57

5-YEAR EVENT				
Drainage Area	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Uncontrolled Flow Off Site)	-	6.43	-	-
AREA II	-	10.92	14.46	14.46
AREA III	-	58.69	54.83	54.83
AREA IV	-	64.62	48.88	48.88
TOTAL	150.20	140.65	118.17	118.17

95-123 Roydon PLACE

Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS

Modified Rational Method

100-YEAR EVENT

PRE-DEVELOPMENT CONDITIONS

As per Site Servicing Design Report, prepared by TROW Engineering, March 4, 2011,:

Maximum Allowable Release Rate: (Site A - 123 Roydon Place)	87.4	L/s
Maximum Allowable Release Rate: (Site B - 95 Roydon Place)	62.8	L/s
	<hr/>	
Maximum Allowable Release Rate:	150.2	L/s

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(100-YEAR EVENT)

			C
Roof Area:	0	sq.m	1.00
Hard Area:	15	sq.m	1.00
Gravel Area:	0	sq.m	1.00
Soft Area:	1,043	sq.m	0.25
<hr/>			
Total Catchment Area:	1,058	sq.m	0.26
Area (A):	1,058	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coefficient (C):	0.26		
Flow Rate (2.78AiC):	13.69	L/s	

DRAINAGE AREA II

(100-YEAR EVENT)

				C
	Roof Area:	0	sq.m	1.00
	Hard Area:	1,087	sq.m	1.00
	Gravel Area:	0	sq.m	1.00
	Soft Area:	917	sq.m	0.25
	Total Catchment Area:	2,004	sq.m	0.66
	Water Elevation:	87.87	m	
	Head:	1.92	m	
	Centroid of ICD Orifice: (ICD in Outlet Pipe of STMH-4)	85.95	m	
	Invert of Outlet Pipe of STMH-4:	85.90	m	
	Orifice Diameter:	100	mm	
	Orifice Area:	7,854	sq.mm	
	Discharge Coefficient:	0.238		
	Maximum Release Rate:	11.50	L/s	
		Width	Depth	
		CB/MH	(sq.m)	Elevation
		EX. CB-7	5	0.32
				39.81
				cu.m
		Maximum Volume Stored:	39.81	cu.m
		Maximum Volume Required:	39.81	cu.m

DRAINAGE AREA II (Continued)

(100-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	65.34	11.50	53.84	32.30
15	143	52.29	11.50	40.79	36.71
20	120	43.89	11.50	32.39	38.87
25	104	38.00	11.50	26.50	39.75
30	92	33.62	11.50	22.12	39.81
35	83	30.22	11.50	18.72	39.31
40	75	27.50	11.50	16.00	38.39
45	69	25.27	11.50	13.77	37.17
50	64	23.40	11.50	11.90	35.71
55	60	21.82	11.50	10.32	34.05
60	56	20.45	11.50	8.95	32.23
65	53	19.26	11.50	7.76	30.28
70	50	18.22	11.50	6.72	28.22
75	47	17.29	11.50	5.79	26.06
80	45	16.46	11.50	4.96	23.82
85	43	15.72	11.50	4.22	21.51
90	41	15.04	11.50	3.54	19.13
95	39	14.43	11.50	2.93	16.70
100	38	13.87	11.50	2.37	14.22
105	36	13.36	11.50	1.86	11.69
110	35	12.88	11.50	1.38	9.12
115	34	12.44	11.50	0.94	6.51
120	33	12.04	11.50	0.54	3.87
125	32	11.66	11.50	0.16	1.19
130	31	11.31	11.31	0.00	0.00
135	30	10.98	10.98	0.00	0.00
140	29	10.67	10.67	0.00	0.00
145	28	10.38	10.38	0.00	0.00
150	28	10.10	10.10	0.00	0.00
180	24	8.75	8.75	0.00	0.00
210	21	7.74	7.74	0.00	0.00
240	19	6.95	6.95	0.00	0.00
270	17	6.33	6.33	0.00	0.00
300	16	5.81	5.81	0.00	0.00

DRAINAGE AREA III

(100-YEAR EVENT)

			C
Roof Area:	588	sq.m	1.00
Hard Area:	5,122	sq.m	1.00
Gravel Area:	0	sq.m	1.00
Soft Area:	51	sq.m	0.25

Total Catchment Area: 5,761 sq.m 0.99

Water Elevation: 88.15 m

Head: 2.12 m

Centroid of ICD Orifice: 86.03 m
(ICD in Outlet Pipe of EX. CB/MH-4)

Invert of Outlet Pipe of EX. CB/MH-4: 85.96 m

Orifice Diameter: 139 mm

Orifice Area: 15,129 sq.mm

Discharge Coefficient: 0.61

Maximum Release Rate: 59.50 L/s

	Top Area	Depth	Volume	
CB/MH	(sq.m)	(m)		
CBMH-1	98	0.08	2.55	cu.m
CB-1	306	0.20	20.20	cu.m
CB-2	213	0.17	11.93	cu.m
EX. CB-3	248	0.23	18.83	cu.m
EX. CB-5	627	0.20	41.37	cu.m
EX. CBMH-4	412	0.18	24.45	cu.m
EX. CBMH-6	594	0.20	39.23	cu.m

Maximum Volume Stored: 158.57 cu.m

Maximum Volume Required: 158.57 cu.m

DRAINAGE AREA III (Continued)

(100-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	284.07	59.50	224.57	134.74
15	143	227.33	59.50	167.83	151.05
20	120	190.83	59.50	131.33	157.60
25	104	165.21	59.50	105.71	158.57
30	92	146.16	59.50	86.66	155.98
35	83	131.38	59.50	71.88	150.94
40	75	119.55	59.50	60.05	144.12
45	69	109.85	59.50	50.35	135.96
50	64	101.75	59.50	42.25	126.74
55	60	94.86	59.50	35.36	116.68
60	56	88.92	59.50	29.42	105.93
65	53	83.76	59.50	24.26	94.60
70	50	79.21	59.50	19.71	82.79
75	47	75.18	59.50	15.68	70.56
80	45	71.58	59.50	12.08	57.97
85	43	68.34	59.50	8.84	45.07
90	41	65.40	59.50	5.90	31.88
95	39	62.74	59.50	3.24	18.46
100	38	60.30	59.50	0.80	4.81
105	36	58.06	58.06	0.00	0.00
110	35	56.00	56.00	0.00	0.00
115	34	54.10	54.10	0.00	0.00
120	33	52.33	52.33	0.00	0.00
125	32	50.69	50.69	0.00	0.00
130	31	49.16	49.16	0.00	0.00
135	30	47.72	47.72	0.00	0.00
140	29	46.38	46.38	0.00	0.00
145	28	45.12	45.12	0.00	0.00
150	28	43.93	43.93	0.00	0.00
180	24	38.03	38.03	0.00	0.00
210	21	33.64	33.64	0.00	0.00
240	19	30.24	30.24	0.00	0.00
270	17	27.51	27.51	0.00	0.00
300	16	25.28	25.28	0.00	0.00

DRAINAGE AREA IV

(100-YEAR EVENT)

			C
Roof Area:	0	sq.m	1.00
Hard Area:	5,491	sq.m	1.00
Gravel Area:	0	sq.m	1.00
Soft Area:	508	sq.m	0.25

Total Catchment Area: 5,999 sq.m 0.94

Water Elevation: 87.73 m

Head: 2.21 m

Centroid of ICD Orifice: 85.52 m
(ICD in Outlet Pipe of CB/MH-5)

Invert of Outlet Pipe of CB/MH-5: 85.45 m

Orifice Diameter: 144 mm

Orifice Area: 16,298 sq.mm

Discharge Coefficient: 0.61

Maximum Release Rate: 65.51 L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CBMH-6	663	0.18	40.85	cu.m
CB-4	328	0.18	20.23	cu.m
CB-5	438	0.15	22.65	cu.m
CBMH-5	747	0.21	53.51	cu.m
CB-7	11	0.10	0.39	cu.m
CB-6	74	0.34	8.55	cu.m

Maximum Volume Stored: 146.19 cu.m

Maximum Volume Required: 146.19 cu.m

DRAINAGE AREA IV (Continued)

(100-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	278.87	65.51	213.36	128.02
15	143	223.17	65.51	157.66	141.90
20	120	187.34	65.51	121.83	146.19
25	104	162.19	65.51	96.68	145.02
30	92	143.48	65.51	77.97	140.34
35	83	128.97	65.51	63.46	133.27
40	75	117.36	65.51	51.85	124.44
45	69	107.84	65.51	42.33	114.30
50	64	99.88	65.51	34.37	103.12
55	60	93.12	65.51	27.61	91.11
60	56	87.30	65.51	21.79	78.43
65	53	82.22	65.51	16.71	65.18
70	50	77.76	65.51	12.25	51.45
75	47	73.80	65.51	8.29	37.32
80	45	70.27	65.51	4.76	22.83
85	43	67.09	65.51	1.57	8.03
90	41	64.21	64.21	0.00	0.00
95	39	61.59	61.59	0.00	0.00
100	38	59.20	59.20	0.00	0.00
105	36	57.00	57.00	0.00	0.00
110	35	54.98	54.98	0.00	0.00
115	34	53.11	53.11	0.00	0.00
120	33	51.38	51.38	0.00	0.00
125	32	49.76	49.76	0.00	0.00
130	31	48.26	48.26	0.00	0.00
135	30	46.85	46.85	0.00	0.00
140	29	45.53	45.53	0.00	0.00
145	28	44.29	44.29	0.00	0.00
150	28	43.12	43.12	0.00	0.00
180	24	37.33	37.33	0.00	0.00
210	21	33.02	33.02	0.00	0.00
240	19	29.68	29.68	0.00	0.00
270	17	27.01	27.01	0.00	0.00
300	16	24.82	24.82	0.00	0.00

5-YEAR EVENT

PRE-DEVELOPMENT CONDITIONS

As per Site Servicing Design Report, prepared by TROW Engineering, March 4, 2011,:

Maximum Allowable Release Rate: (Site A - 123 Roydon Place)	87.4	L/s
Maximum Allowable Release Rate: (Site B - 95 Roydon Place)	62.8	L/s
Maximum Allowable Release Rate:	150.2	L/s

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(5-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Hard Area:	15	sq.m	0.90
Gravel Area:	0	sq.m	0.80
Soft Area:	1,043	sq.m	0.20
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Total Catchment Area:	1,058	sq.m	0.21
Area (A):	1,058	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coefficient (C):	0.21		
Flow Rate (2.78AiC):	6.43	L/s	

DRAINAGE AREA II

(5-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Hard Area:	1,087	sq.m	0.90
Gravel Area:	0	sq.m	0.80
Soft Area:	917	sq.m	0.20

Total Catchment Area: 2,004 sq.m 0.58

Water Elevation: 87.69 m

Head: 1.74 m

Centroid of ICD Orifice: 85.95 m
(ICD in Outlet Pipe of STMH-4)

Invert of Outlet Pipe of STMH-4: 85.90 m

Orifice Diameter: 100 mm

Orifice Area: 7,854 sq.mm

Discharge Coefficient: 0.238

Maximum Release Rate: 10.92 L/s

CB/MH	Width (sq.m)	Depth (m)	Elevation
EX. CB-7	4.9	0.29	14.46 cu.m

Maximum Volume Stored: 14.46 cu.m

Maximum Volume Required: 14.46 cu.m

DRAINAGE AREA II (Continued)

(5-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	33.65	10.92	22.73	13.64
15	84	26.99	10.92	16.07	14.46
20	70	22.69	10.92	11.77	14.12
25	61	19.67	10.92	8.75	13.12
30	54	17.42	10.92	6.50	11.69
35	49	15.67	10.92	4.75	9.97
40	44	14.27	10.92	3.35	8.04
45	41	13.12	10.92	2.20	5.94
50	38	12.16	10.92	1.24	3.72
55	35	11.34	10.92	0.42	1.40
60	33	10.64	10.64	0.00	0.00
65	31	10.03	10.03	0.00	0.00
70	29	9.49	9.49	0.00	0.00
75	28	9.01	9.01	0.00	0.00
80	27	8.58	8.58	0.00	0.00
85	25	8.19	8.19	0.00	0.00
90	24	7.84	7.84	0.00	0.00
95	23	7.53	7.53	0.00	0.00
100	22	7.24	7.24	0.00	0.00
105	22	6.97	6.97	0.00	0.00
110	21	6.72	6.72	0.00	0.00
115	20	6.50	6.50	0.00	0.00
120	19	6.29	6.29	0.00	0.00
125	19	6.09	6.09	0.00	0.00
130	18	5.91	5.91	0.00	0.00
135	18	5.74	5.74	0.00	0.00
140	17	5.58	5.58	0.00	0.00
145	17	5.43	5.43	0.00	0.00
150	16	5.28	5.28	0.00	0.00
180	14	4.58	4.58	0.00	0.00
210	13	4.05	4.05	0.00	0.00
240	11	3.65	3.65	0.00	0.00
270	10	3.32	3.32	0.00	0.00
300	9	3.05	3.05	0.00	0.00

DRAINAGE AREA III

(5-YEAR EVENT)

			C
Roof Area:	588	sq.m	0.90
Hard Area:	5,122	sq.m	0.90
Gravel Area:	0	sq.m	0.80
Soft Area:	51	sq.m	0.20

Total Catchment Area: 5,761 sq.m 0.89

Water Elevation: 88.09 m

Head: 2.06 m

Centroid of ICD Orifice: 86.03 m
(ICD in Outlet Pipe of EX. CB/MH-4)

Invert of Outlet Pipe of EX. CB/MH-4: 85.96 m

Orifice Diameter: 139 mm

Orifice Area: 15,129 sq.mm

Discharge Coefficient: 0.61

Maximum Release Rate: 58.69 L/s

	Top Area	Depth	Volume	
CB/MH	(sq.m)	(m)		
CBMH-1	7	0.02	0.05	cu.m
CB-1	154	0.14	7.21	cu.m
CB-2	92	0.11	3.39	cu.m
EX. CB-3	138	0.17	7.87	cu.m
EX. CB-5	315	0.14	14.76	cu.m
EX. CBMH-4	189	0.12	7.57	cu.m
EX. CBMH-6	299	0.14	14.00	cu.m

Maximum Volume Stored: 54.83 cu.m

Maximum Volume Required: 54.83 cu.m

DRAINAGE AREA III (Continued)

(5-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	149.15	58.69	90.46	54.28
15	84	119.61	58.69	60.92	54.83
20	70	100.56	58.69	41.88	50.25
25	61	87.17	58.69	28.49	42.73
30	54	77.20	58.69	18.51	33.32
35	49	69.45	58.69	10.77	22.61
40	44	63.25	58.69	4.56	10.95
45	41	58.16	58.16	0.00	0.00
50	38	53.90	53.90	0.00	0.00
55	35	50.28	50.28	0.00	0.00
60	33	47.16	47.16	0.00	0.00
65	31	44.44	44.44	0.00	0.00
70	29	42.05	42.05	0.00	0.00
75	28	39.92	39.92	0.00	0.00
80	27	38.02	38.02	0.00	0.00
85	25	36.31	36.31	0.00	0.00
90	24	34.77	34.77	0.00	0.00
95	23	33.36	33.36	0.00	0.00
100	22	32.08	32.08	0.00	0.00
105	22	30.89	30.89	0.00	0.00
110	21	29.81	29.81	0.00	0.00
115	20	28.80	28.80	0.00	0.00
120	19	27.87	27.87	0.00	0.00
125	19	27.00	27.00	0.00	0.00
130	18	26.19	26.19	0.00	0.00
135	18	25.43	25.43	0.00	0.00
140	17	24.72	24.72	0.00	0.00
145	17	24.05	24.05	0.00	0.00
150	16	23.42	23.42	0.00	0.00
180	14	20.30	20.30	0.00	0.00
210	13	17.97	17.97	0.00	0.00
240	11	16.17	16.17	0.00	0.00
270	10	14.72	14.72	0.00	0.00
300	9	13.54	13.54	0.00	0.00

DRAINAGE AREA IV

(5-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Hard Area:	5,491	sq.m	0.90
Gravel Area:	0	sq.m	0.80
Soft Area:	508	sq.m	0.20

Total Catchment Area: 5,999 sq.m 0.84

Water Elevation: 87.67 m

Head: 2.15 m

Centroid of ICD Orifice: 85.52 m
(ICD in Outlet Pipe of CB/MH-5)

Invert of Outlet Pipe of CB/MH-5: 85.45 m

Orifice Diameter: 144 mm

Orifice Area: 16,298 sq.mm

Discharge Coefficient: 0.61

Maximum Release Rate: 64.62 L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CBMH-6	302	0.12	12.58	cu.m
CB-4	150	0.12	6.23	cu.m
CB-5	164	0.09	5.20	cu.m
CBMH-5	388	0.15	20.02	cu.m
CB-7	2	0.04	0.03	cu.m
CB-6	51	0.28	4.82	cu.m

Maximum Volume Stored: 48.88 cu.m

Maximum Volume Required: 48.88 cu.m

DRAINAGE AREA IV (Continued)

(5-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	146.09	64.62	81.47	48.88
15	84	117.15	64.62	52.54	47.29
20	70	98.50	64.62	33.88	40.66
25	61	85.38	64.62	20.77	31.15
30	54	75.61	64.62	11.00	19.79
35	49	68.03	64.62	3.41	7.16
40	44	61.95	61.95	0.00	0.00
45	41	56.97	56.97	0.00	0.00
50	38	52.79	52.79	0.00	0.00
55	35	49.25	49.25	0.00	0.00
60	33	46.19	46.19	0.00	0.00
65	31	43.53	43.53	0.00	0.00
70	29	41.18	41.18	0.00	0.00
75	28	39.10	39.10	0.00	0.00
80	27	37.24	37.24	0.00	0.00
85	25	35.57	35.57	0.00	0.00
90	24	34.05	34.05	0.00	0.00
95	23	32.68	32.68	0.00	0.00
100	22	31.42	31.42	0.00	0.00
105	22	30.26	30.26	0.00	0.00
110	21	29.19	29.19	0.00	0.00
115	20	28.21	28.21	0.00	0.00
120	19	27.30	27.30	0.00	0.00
125	19	26.44	26.44	0.00	0.00
130	18	25.65	25.65	0.00	0.00
135	18	24.91	24.91	0.00	0.00
140	17	24.21	24.21	0.00	0.00
145	17	23.56	23.56	0.00	0.00
150	16	22.94	22.94	0.00	0.00
180	14	19.88	19.88	0.00	0.00
210	13	17.60	17.60	0.00	0.00
240	11	15.84	15.84	0.00	0.00
270	10	14.42	14.42	0.00	0.00
300	9	13.26	13.26	0.00	0.00

2-YEAR EVENT

PRE-DEVELOPMENT CONDITIONS

As per Site Servicing Design Report, prepared by TROW Engineering, March 4, 2011,:

Maximum Allowable Release Rate: (Site A - 123 Roydon Place)	87.4	L/s
Maximum Allowable Release Rate: (Site B - 95 Roydon Place)	62.8	L/s
Maximum Allowable Release Rate:	150.2	L/s

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(2-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Hard Area:	15	sq.m	0.90
Gravel Area:	0	sq.m	0.80
Soft Area:	1,043	sq.m	0.20
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Total Catchment Area:	1,058	sq.m	0.21
Area (A):	1,058	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr	
Runoff Coefficient (C):	0.21		
Flow Rate (2.78AiC):	4.74	L/s	

DRAINAGE AREA II

(2-YEAR EVENT)

				C
	Roof Area:	0	sq.m	0.90
	Hard Area:	1,087	sq.m	0.90
	Gravel Area:	0	sq.m	0.80
	Soft Area:	917	sq.m	0.20
	Total Catchment Area:	2,004	sq.m	0.58
	Water Elevation:	87.63	m	
	Head:	1.68	m	
	Centroid of ICD Orifice: (ICD in Outlet Pipe of STMH-4)	85.95	m	
	Invert of Outlet Pipe of STMH-4:	85.90	m	
	Orifice Diameter:	100	mm	
	Orifice Area:	7,854	sq.mm	
	Discharge Coefficient:	0.238		
	Maximum Release Rate:	10.75	L/s	
		Width	Depth	Elevation
		CB/MH	(sq.m)	(m)
		EX. CB-7	4.9	0.23
				8.43 cu.m
		Maximum Volume Stored:	8.43	cu.m
		Maximum Volume Required:	8.43	cu.m

DRAINAGE AREA II (Continued)

(2-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	77	24.80	10.75	14.05	8.43
15	62	19.95	10.75	9.20	8.28
20	52	16.80	10.75	6.05	7.26
25	45	14.59	10.75	3.84	5.75
30	40	12.93	10.75	2.18	3.93
35	36	11.65	10.75	0.89	1.88
40	33	10.61	10.61	0.00	0.00
45	30	9.77	9.77	0.00	0.00
50	28	9.06	9.06	0.00	0.00
55	26	8.45	8.45	0.00	0.00
60	25	7.93	7.93	0.00	0.00
65	23	7.48	7.48	0.00	0.00
70	22	7.08	7.08	0.00	0.00
75	21	6.72	6.72	0.00	0.00
80	20	6.40	6.40	0.00	0.00
85	19	6.12	6.12	0.00	0.00
90	18	5.86	5.86	0.00	0.00
95	17	5.62	5.62	0.00	0.00
100	17	5.41	5.41	0.00	0.00
105	16	5.21	5.21	0.00	0.00
110	16	5.03	5.03	0.00	0.00
115	15	4.86	4.86	0.00	0.00
120	15	4.70	4.70	0.00	0.00
125	14	4.56	4.56	0.00	0.00
130	14	4.42	4.42	0.00	0.00
135	13	4.29	4.29	0.00	0.00
140	13	4.17	4.17	0.00	0.00
145	13	4.06	4.06	0.00	0.00
150	12	3.96	3.96	0.00	0.00
180	11	3.43	3.43	0.00	0.00
210	9	3.04	3.04	0.00	0.00
240	8	2.74	2.74	0.00	0.00
270	8	2.49	2.49	0.00	0.00
300	7	2.29	2.29	0.00	0.00

DRAINAGE AREA III

(2-YEAR EVENT)

			C
Roof Area:	588	sq.m	0.90
Hard Area:	5,122	sq.m	0.90
Gravel Area:	0	sq.m	0.80
Soft Area:	51	sq.m	0.20

Total Catchment Area: 5,761 sq.m 0.89

Water Elevation: 88.07 m

Head: 2.04 m

Centroid of ICD Orifice: 86.03 m
(ICD in Outlet Pipe of EX. CB/MH-4)

Invert of Outlet Pipe of EX. CB/MH-4: 85.96 m

Orifice Diameter: 139 mm

Orifice Area: 15,129 sq.mm

Discharge Coefficient: 0.61

Maximum Release Rate: 58.34 L/s

	Top Area	Depth	Volume	
CB/MH	(sq.m)	(m)		
CBMH-1	0	0.00	0.00	cu.m
CB-1	106	0.12	4.10	cu.m
CB-2	56	0.09	1.62	cu.m
EX. CB-3	102	0.15	4.98	cu.m
EX. CB-5	217	0.12	8.40	cu.m
EX. CBMH-4	121	0.10	3.88	cu.m
EX. CBMH-6	205	0.12	7.97	cu.m

Maximum Volume Stored: 30.96 cu.m

Maximum Volume Required: 30.96 cu.m

DRAINAGE AREA III (Continued)

(2-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	77	109.94	58.34	51.60	30.96
15	62	88.42	58.34	30.08	27.07
20	52	74.48	58.34	16.14	19.37
25	45	64.66	58.34	6.31	9.47
30	40	57.32	57.32	0.00	0.00
35	36	51.62	51.62	0.00	0.00
40	33	47.04	47.04	0.00	0.00
45	30	43.29	43.29	0.00	0.00
50	28	40.14	40.14	0.00	0.00
55	26	37.46	37.46	0.00	0.00
60	25	35.15	35.15	0.00	0.00
65	23	33.14	33.14	0.00	0.00
70	22	31.37	31.37	0.00	0.00
75	21	29.79	29.79	0.00	0.00
80	20	28.39	28.39	0.00	0.00
85	19	27.12	27.12	0.00	0.00
90	18	25.97	25.97	0.00	0.00
95	17	24.93	24.93	0.00	0.00
100	17	23.97	23.97	0.00	0.00
105	16	23.09	23.09	0.00	0.00
110	16	22.29	22.29	0.00	0.00
115	15	21.54	21.54	0.00	0.00
120	15	20.85	20.85	0.00	0.00
125	14	20.20	20.20	0.00	0.00
130	14	19.60	19.60	0.00	0.00
135	13	19.03	19.03	0.00	0.00
140	13	18.50	18.50	0.00	0.00
145	13	18.01	18.01	0.00	0.00
150	12	17.54	17.54	0.00	0.00
180	11	15.21	15.21	0.00	0.00
210	9	13.48	13.48	0.00	0.00
240	8	12.13	12.13	0.00	0.00
270	8	11.05	11.05	0.00	0.00
300	7	10.17	10.17	0.00	0.00

DRAINAGE AREA IV

(2-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Hard Area:	5,491	sq.m	0.90
Gravel Area:	0	sq.m	0.80
Soft Area:	508	sq.m	0.20

Total Catchment Area: 5,999 sq.m 0.84

Water Elevation: 87.65 m

Head: 2.13 m

Centroid of ICD Orifice: 85.52 m
(ICD in Outlet Pipe of CB/MH-5)

Invert of Outlet Pipe of CB/MH-5: 85.45 m

Orifice Diameter: 144 mm

Orifice Area: 16,298 sq.mm

Discharge Coefficient: 0.61

Maximum Release Rate: 64.22 L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CBMH-6	187	0.10	6.13	cu.m
CB-4	93	0.10	3.04	cu.m
CB-5	85	0.07	1.94	cu.m
CBMH-5	266	0.13	11.38	cu.m
CB-7	0	0.02	0.00	cu.m
CB-6	42	0.26	3.59	cu.m

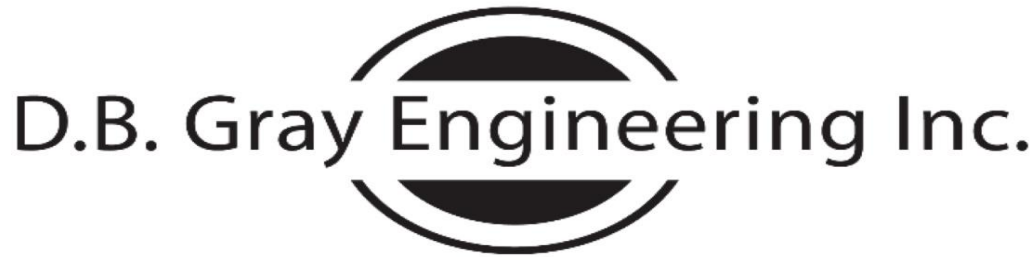
Maximum Volume Stored: 26.08 cu.m

Maximum Volume Required: 26.08 cu.m

DRAINAGE AREA IV (Continued)

(2-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	77	107.69	64.22	43.47	26.08
15	62	86.60	64.22	22.39	20.15
20	52	72.95	64.22	8.74	10.48
25	45	63.33	63.33	0.00	0.00
30	40	56.14	56.14	0.00	0.00
35	36	50.56	50.56	0.00	0.00
40	33	46.08	46.08	0.00	0.00
45	30	42.40	42.40	0.00	0.00
50	28	39.32	39.32	0.00	0.00
55	26	36.69	36.69	0.00	0.00
60	25	34.43	34.43	0.00	0.00
65	23	32.46	32.46	0.00	0.00
70	22	30.72	30.72	0.00	0.00
75	21	29.18	29.18	0.00	0.00
80	20	27.80	27.80	0.00	0.00
85	19	26.56	26.56	0.00	0.00
90	18	25.44	25.44	0.00	0.00
95	17	24.42	24.42	0.00	0.00
100	17	23.48	23.48	0.00	0.00
105	16	22.62	22.62	0.00	0.00
110	16	21.83	21.83	0.00	0.00
115	15	21.10	21.10	0.00	0.00
120	15	20.42	20.42	0.00	0.00
125	14	19.78	19.78	0.00	0.00
130	14	19.19	19.19	0.00	0.00
135	13	18.64	18.64	0.00	0.00
140	13	18.12	18.12	0.00	0.00
145	13	17.64	17.64	0.00	0.00
150	12	17.18	17.18	0.00	0.00
180	11	14.90	14.90	0.00	0.00
210	9	13.20	13.20	0.00	0.00
240	8	11.88	11.88	0.00	0.00
270	8	10.83	10.83	0.00	0.00
300	7	9.96	9.96	0.00	0.00



STORM SEWER CALCULATIONS

Rational Method

Two YEAR EVENT

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

700 Long Point Circle
Ottawa, Ontario K1T 4E9

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

Project: 95-123 Roydon Place
Storm Sewer System **with proposed modification**
Ottawa, Ontario

Date: October 28, 2025

Manning's Roughness Coefficient: 0.013

Location		Individual					Cumulative				Sewer Data									
		Roof C = 0.90 (ha)	Hard C = 0.90 (ha)	Gravel C = 0.70 (ha)	Soft C = 0.20 (ha)	2.78AC	2.78AC	Time (min)	Rainfall Intensity (mm/hr)	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}		
From	To																			
EXIST. CB-3	EXIST. CB/MH-3		0.0067		0.0011	0.0174	0.0174	10.00	77	1.33	11.9	200	201	1.00	1.05	33.24	0.19	0.04		
EXIST. CB/MH-3	EXIST. CB/MH-4		0.0325		0.0025	0.0827	0.1001	10.19	76	7.61	45.6	300	299	0.65	1.10	77.27	0.69	0.10		
EXIST. CB/MH-4	EXIST. STMH-4		0.0695		0.0077	0.1782	0.2783	10.88	74	20.47	22.4	300	299	0.34	0.80	55.89	0.47	0.37		
EXIST. EX. CB-7	EXIST. STMH-4				0.0804	0.0447	0.0447	10.00	77	3.43	11.2	250	251	1.00	1.21	60.10	0.15	0.06		
EXIST. STMH-4	EXIST. EXMH					0.0000	0.3230	11.35	72	23.25	40	250	251	1.00	1.21	60.10	0.55	0.39		
						Flow through inlet control device:				10.75	40	250	251	1.00	1.21	60.10	0.55	0.18		
EXIST. EXMH	EXIST. STMH-5					0.0000	0.3230	11.90	70	22.68	4.3	250	251	0.50	0.86	42.50	0.08	0.53		
								Restricted Flow:		10.75	4.3	250	251	0.50	0.86	42.50	0.08	0.25		
EXIST. EX. CB-3	EXIST. EX.CB/MH-4		0.0591		0.0021	0.1490	0.1490	10.00	77	11.45	29.2	250	251	0.50	0.86	42.50	0.57	0.27		
EXIST. EX. CB-5	EXIST. EX.CB/MH-6		0.0961		0.0013	0.2412	0.2412	10.00	77	18.52	29.2	250	251	0.50	0.86	42.50	0.57	0.44		
EXIST. EX.CB/MH-6	EXIST. EX.CB/MH-4		0.0805		0.0009	0.2019	0.4431	10.57	75	33.10	27.5	300	299	0.50	0.97	67.77	0.47	0.49		
EXIST. CB/MH-1	EXIST. CB/MH-2	0.0253	0.0284			0.1344	0.1344	10.00	77	10.32	26.1	300	299	0.65	1.10	77.27	0.40	0.13		
EXIST. CB/MH-2	EXIST. STMH-1	0.0335	0.0248			0.1459	0.2802	10.40	75	21.11	14	300	299	0.34	0.80	55.89	0.29	0.38		
EXIST. STMH-1	EXIST. STMH-2					0.0000	0.2802	10.69	74	20.81	25.6	300	299	0.34	0.80	55.89	0.54	0.37		
EXIST. STMH-2	EXIST. STMH-3					0.0000	0.2802	11.22	72	20.29	27.8	300	299	0.34	0.80	55.89	0.58	0.36		
EXIST. CB-1	EXIST. STMH-3		0.0934			0.2337	0.2337	10.00	77	17.95	16.6	200	201	1.00	1.05	33.24	0.26	0.54		
EXIST. CB-2	EXIST. STMH-3		0.0653			0.1634	0.1634	10.00	77	12.55	6.2	200	201	1.00	1.05	33.24	0.10	0.38		
EXIST. STMH-3	EXIST. EX.CB/MH-4					0.0000	0.6773	11.81	71	47.75	23.8	300	299	0.50	0.97	67.77	0.41	0.70		
EXIST. EX.CB/MH-4	EXIST. STMH-5		0.0646	0.0008		0.1632	1.4326	12.22	69	99.17	4.8	300	299	2.00	1.93	135.54	0.04	0.73		
							Flow through inlet control device:				58.34	4.8	300	299	2.00	1.93	135.54	0.04	0.43	
EXIST. STMH-5	EXIST. MH STC 750					0.0000	1.7555	12.26	69	121.30	4	300	299	0.50	0.97	67.77	0.07	1.79		
								Restricted Flow:		69.09	4	300	299	0.50	0.97	67.77	0.07	1.02		
EXIST. MH STC 750	EXIST. EX.STMH-2					0.0000	1.7555	12.33	69	120.94	9.8	300	299	0.50	0.97	67.77	0.17	1.78		
								Restricted Flow:		69.09	9.8	300	299	0.50	0.97	67.77	0.17	1.02		
EXIST. EX.STMH-2	Existing					0.0000	1.7555	12.50	68	120.05	10.6	300	299	0.50	0.97	67.77	0.18	1.77		
	525 ST							Restricted Flow:		69.09	10.6	300	299	0.50	0.97	67.77	0.18	1.02		
											EXISTING ROYDON PL MUNICIPAL STORM SEWER									
												525	533	0.34	1.17	261				
EXIST. CB-4	EXIST. CB/MH-6		0.1533		0.0027	0.3851	0.3851	10.00	77	29.57	39.8	200	201	1.00	1.05	33.24	0.63	0.89		
EXIST. CB-6	EXIST. CB/MH-6				0.0266	0.0148	0.0148	10.00	77	1.14	26.1	200	201	1.20	1.15	36.41	0.38	0.03		
EXIST. CB-7	EXIST. CB/MH-6				0.0149	0.0083	0.0083	10.00	77	0.64	22.2	200	201	1.00	1.05	33.24	0.35	0.02		
EXIST. CB/MH-6	EXIST. CB/MH-5		0.1283		0.0018	0.3220	0.7301	10.63	74	54.36	28.7	300	299	0.34	0.80	55.89	0.60	0.97		
EXIST. CB-5	EXIST. CB/MH-5		0.1417		0.0035	0.3565	0.3565	10.00	77	27.38	39	200	201	1.00	1.05	33.24	0.62	0.82		
EXIST. CB/MH-5	MH-A		0.1258		0.0013	0.3155	1.4021	10.62	75	104.46	10.6	300	299	0.34	0.80	55.89	0.22	1.87		
							Flow through inlet control device:				64.22	10.6	300	299	0.34	0.80	55.89	0.22	1.15	
MH-A	Existing					0.0000	1.4021	10.84	74	103.35	9.8	300	299	0.34	0.80	55.89	0.21	1.85		
	375 ST							Restricted Flow:		64.22	9.8	300	299	0.34	0.80	55.89	0.21	1.15		
											EXISTING ROYDON PL MUNICIPAL STORM SEWER									
												375	366	0.25	0.78	82				