SITE SERVICING
AND
STORMWATER MANAGEMENT REPORT

Proposed Travel Stop Development
(TOWN FILE # SPA 2019-0065)

AT
14027 of Hurontario Street
Town of Caledon

Prepared for
Antrix Architects Inc.

Apr 16, 2025	Issued for SPA Re-Submission
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REVISIONS

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1.0 INTRODUCTION

Flora Designs Inc. has been retained by Antrix Architects Inc. (the "Consultant") to prepare a Site Servicing and Stormwater Management Report for a proposed Travel Stop development, located at NE Corner of Hurontario Street & King Street, Town of Caledon, Ontario (**Appendix "A"**), in accordance with the Engineering Design Standards provided by the Town of Caledon, Region of Peel, and MOE Stormwater Management Planning and Design Manual 2003 (SWMPD).

This report is prepared in support of a Site Plan Application (SPA) by Antrix Architects Inc. acting on behalf of the Owner. The purpose of this report is to provide site-specific information for the Town and Region's review with respect to the infrastructure required to support the proposed development regarding storm drainage, sanitary drainage and water supply.

An inventory of the existing infrastructure in the area of proposed development was carried out. This report discusses the existing services together with the servicing requirements for the proposed development.

2.0 SITE DESCRIPTION

The proposed development site is located at 14027 Hurontario Street, Town of Caledon, Ontario (**Appendix "A"**). The site is bounded as follows:

- An existing residential development East,
- King Street to the South,
- Hurontario Street to the West, and
- Undeveloped agricultural lands to the North.

The subject site is approximately 32,125 m^2 (3.21 hectares) in size. Currently the property is vacant.

3.0 SITE PROPOSAL

The Site Plan Application proposes Card Lock Fuelling Stations, Retail Gas Fuelling Stations, Convenient Store, Three standalone restaurants and associated parking lot. A reduced version of the architectural site plan is included in **Appendix "A"**. Please refer to the building and site statistics provided by Antrix Architects Inc.

In the post-development development condition, the stormwater runoff from the building roofs and site area will be conveyed to the on-site stormwater dry pond facility through the on-site private sewer network. The entire major and minor system flows from the site will be discharged to an existing municipal culvert located across King Street in compliance with the pre-development drainage pattern.

An on-site subsurface disposal facility will be provided for sanitary drainage system. Please refer to the design documents prepared by Envision Consultants Ltd. for MECP Sewage Treatment and Disposal System Design.

The water supply requirements for this development will be fulfilled by an existing 300 mm dia watermain located with the municipal allowance of King Street through an existing 300 mm dia fire and domestic combined service provided by the Region to serve future development on this land.

4.0 STORMWATER MANAGEMENT AND DRAINAGE

4.1 Design Criteria

The proposed development will meet the Province of Ontario standards as set out in the MOE Stormwater Management Planning and Design Manual 2003 (SWMPD), Region of Peel Design Guidelines and local engineering standards provided by the Town of Caledon in the Development Standards, Policies & Guidelines Manual. A brief summary of the design criteria are as follows;

- For new developments, return frequency values for design shall be 5-year for Minor System and 100-year for Major System.
- Town of Caledon Rainfall Intensity Curves provided in the Standards No.104 are to be used for analysis **(Appendix "B")**.
- Per the Town of Caledon requirements, the post-development peak flows for all events from the site up to and including 100-year rainfall event should be controlled to the peak flow resulting from the target pre-development conditions during respective rainfall events.
- Per the TRCA comments, the post-development peak flows for all events from the site up to and including 100-year rainfall event should be controlled to the target allowable release rate provided for the Basin 1 and catchment 14 within Appendix J4 of the Etobicoke Creek Hydrology Study (2013).
- The on-site storm sewer network is sized to convey minor system flows.
- Overland flow route shall be provided to direct runoff in excess of the 100-year storm event to a safe outlet.
- Maximum detention depth in parking areas during the 100-year storm event is not to exceed 300mm.
- Stormwater should be treated to Enhanced Protection level as defined in the MOE SWM Planning & Design Manual (2003).

4.2 Existing Conditions

Currently the property is vacant with an abandoned residential house. Based on review of the topographic survey and a site visit, we have concluded that, the site area drains towards the South property limits through overland sheet flow, which subsequently generates uncontrolled discharge to an existing municipal culvert and an unnamed municipal stream. In addition to this property, a small portion of upstream external lands to the North drains through this property that generates uncontrolled discharge to the same municipal culvert. The pre-development surface condition and drainage area for this site has been illustrated in **Appendix "B"**.

For calculating the pre-development discharge rates and runoff for the 5-Year and 100-Year storm events, Inlet time of Concentration (Tc) is based on the minimum

Tc provided by the Town of Caledon. The value for the pre-development weighted runoff coefficient C=0.26 is calculated based on actual surface conditions for this site. Input parameters used to model the target pre-development condition are provided in **Table-1** below and detailed calculations have been illustrated in **Appendix "B"**.

Table-1 - Pre-development Input Parameters

Drainage System	**Catchment #**	**Drainage Area** (ha)	**Runoff Coefficient** (C)	**Time of Concentration** (Tc)
Uncontrolled	CA-1-Pre	3.21	0.26	10
TOTAL		**3.21**	**0.26**	**10**

The pre-development peak flow was simulated using the Town of Caledon Rainfall Intensity Curves using the Rational Method. The results of the pre-development peak flow calculations are provided in **Table-2** below, and detailed calculations have been illustrated in **Appendix "B".**

Table-2 - Pre-development Peak Flows

Catchment #	**Peak Flow** (m^3/s)					
	2-yr	**5-yr**	**10-yr**	**25-yr**	**50-yr**	**100-yr**
CA-1-Pre	0.1989	0.2545	0.3113	0.3630	0.4088	0.4560

Per the TRCA comments, the target allowable release rate for the 3.21 ha site area in accordance with the unit flow rates provided for the Basin 1 and catchment 14 within Appendix J4 of the Etobicoke Creek Hydrology Study (2013) are provided in **Table-3** below and detailed calculations have been illustrated in **Appendix "B"**.

Table-3 - Post-development Allowable Peak Release Rate

Catchment #	**Peak Flow** (m^3/s)					
	2-yr	**5-yr**	**10-yr**	**25-yr**	**50-yr**	**100-yr**
CA-1-Pre	0.0126	0.0219	0.0290	0.0387	0.0463	0.0542

4.3 Stormwater Management

In the post-development condition, the site grading is designed to restrict stormwater flow from the upstream lands from entering to this site. A bypass swale is provided along west property line to divert upstream flow to the existing municipal culvert across King Street. Therefore, only the lands occupied by this site is considered for the stormwater management design for this development proposal. There are uncontrolled site areas contributing to the total storm discharge from the site. Therefore, the site is divided into two primary drainage systems; “Controlled” (CA-1-Post) and “Uncontrolled” (CA-2-Post). The post-development drainage areas have been illustrated in **Appendix "B"**.

For calculating the post-development discharge rates and runoff for 5-Year and 100-Year storm events, Inlet time of Concentration (Tc) and weighted runoff coefficient (C) is calculated similar to the pre-development calculations. Input parameters used to model the target pre-development condition are provided in **Table-4** below and detailed calculations have been illustrated in **Appendix "B"**.

Table-4 - Post-development Input Parameters

Drainage System	**Catchment #**	**Drainage Area** (ha)	**Runoff Coefficient** (C)	**Time of Concentration** (Tc)
Controlled	CA-1-Post	2.94	0.65	10
Uncontrolled	CA-2-Post	0.27	0.33	10
TOTAL		**3.21**	**0.62**	**10**

Results of the post-development peak flow calculations by considering minimum Tc and IDF data similar to the pre-development flow calculations are provided in **Table-5** below, and detailed post-development flow calculations have been illustrated in **Appendix "B".**

Table-5 - Post-development Peak Flows

Catchment #	**Peak Flow** (m^3/s)					
	2-yr	**5-yr**	**10-yr**	**25-yr**	**50-yr**	**100-yr**
CA-1-Post	0.4554	0.5827	0.7127	0.8313	0.9360	1.0441
CA-2-Post	0.0212	0.0272	0.0332	0.0388	0.0436	0.0487

The post-development peak flow targets will be achieved using a combination of surface storage, detention storage in the storm sewer system and an on-site End-of-Pipe Dry Storage facility (SU-1). Site grading for the controlled portion of the site area (CA-1-Post) has been designed to capture runoff from the site using a series of on-site catch basins. When the incoming flow is greater than the allowable peak discharge rate through an orifice plate and a weir installed at the dry pond Outlet-1, the storm sewer system will surcharge and the excess runoff volume will be stored within the storm sewer pipes and dry storage facility (SU-1). A summary of the stage and storage volumes available on site are provided in **Table-6** below and detailed calculations have been illustrated in **Appendix "B".**

Table-6 - Available Stage Storage Summary

Stage Elevation	**Stage Storage Volume (m^3)**				
	CB-MH	**Pipe**	**Surface**	**SU-1**	**Total**
286.75	1.62	20.10	0.00	361.81	**383.53**
287.50	11.00	62.14	0.00	967.87	**1041.01**
287.75	14.83	63.11	148.23	1229.48	**1455.65**

The post-development Stormwater Management will be justified by discussing the following stormwater controls:

4.3.1 Quantity Control

Stormwater quantity control is typically implemented to minimise the potential for downstream flooding, stream bank erosion and overflow of infrastructure. As per minimum standards provided by the Town of Caledon, the post-development peak flows for all events from the site should be controlled in line with the respective peak flow resulting from the target pre-development condition during 5-year to 100-year storm events.

The site grading is designed such that, no external areas from the adjoining properties shall affect the stormwater flow from this site.

Modified Rational Method calculations were undertaken to determine the peak flows and required storage volume from the proposed site during 2-Year to 100-Year storm events. This method calculates the storage volume using the composite runoff coefficient and the allowable release rate based on rainfall intensities over a three-hour storm event. A summary of the post-development quantity control analysis per the Town of Caledon requirement is provided in **Table-7** below and detailed calculations have been illustrated in **Appendix "B".**

Table-7 - Post-development Peak Flow and Quantity Control Analysis (Per Town of Caledon Standards)

Storm Event	Allowable Release Rate (m^3/s)	Runoff from Controlled Area (m^3/s)	Runoff from Uncont. Area (m^3/s)	Total Peak Runoff (m^3/s)	Available Storage Volume (m^3)	Storage Volume Used (m^3)
2-year	0.1989	0.0115	0.0212	0.0327	1041.01	503.43
5-year	0.2545	0.0133	0.0272	0.0405	1041.01	759.59
10-year	0.3113	0.0163	0.0332	0.0495	1455.65	900.28
25-year	0.3630	0.0243	0.0388	0.0631	1455.65	1065.99
50-year	0.4088	0.0367	0.0436	0.0803	1455.65	1137.48
100-year	0.4560	0.0511	0.0487	0.0998	1455.65	1221.19

As discussed with TRCA Engineering Review staff in a comment review meeting, the post-development uncontrolled portion of site area (CA-2-Post) is provided as conveyance path to by-pass stormwater runoff from the upstream lands. Therefore, this portion of site area shall be excluded and stormwater quantity control shall be provided for the controlled portion of site area in accordance with the unit flow rates provided for the Basin 1 and catchment 14 within Appendix J4 of the Etobicoke Creek Hydrology Study (2013). A summary of the post-development quantity control analysis per TRCA requirement is provided in **Table-8** below and detailed calculations have been illustrated in **Appendix "B".**

Table-8 - Post-development Peak Flow and Quantity Control Analysis (Per TRCA Requirements)

Storm Event	Allowable Release Rate (m^3/s)	Runoff from Controlled Area (m^3/s)	Available Storage Volume (m^3)	Storage Volume Used (m^3)	Water Surface Elevation (m)
2-year	0.0126	0.0115	1041.01	503.43	286.91
5-year	0.0219	0.0133	1041.01	759.59	287.21
10-year	0.0290	0.0163	1455.65	900.28	287.36
25-year	0.0387	0.0243	1455.65	1065.99	287.52
50-year	0.0463	0.0367	1455.65	1137.48	287.56
100-year	0.0542	0.0511	1455.65	1221.19	287.61

The post-development peak flow targets will be achieved by controlling discharge from the site area using a combination of 75mm dia orifice plate and 250mm(w) X 300mm(d) rectangle weir installed in the perforated CSP outlet structure (Outlet-1). Detailed calculations for orifice-weir ratings and stage storage in the dry storage facility have been illustrated in **Appendix "B".**

4.3.2 Quality Control

In accordance with the MOE SWM Planning & Design Manual, various levels of treatment are defined with a goal of maintain or enhance existing aquatic habitat based on the total suspended solids (TSS) removal efficiency. For this development, based on the Town standards, enhanced (Level 1) quality protection is typically implemented to treat the runoff.

The quality control for the site is provided by a multiple component treatment train consisting of a dry, end-of-pipe, detention storage facility and CDS oil and grit separator unit. In the post-development condition, the site area occupied by CA-2-Post are mainly consists of grassed area which generates uncontrolled discharge to the municipal culvert and unnamed municipal stream. Considering, this portion of the site area does not have any vehicular traffic, it is excluded from the quality control modelling. Therefore, only 2.95 ha site area occupied by CA-1-Post having 61.50 % imperviousness that contributes to the proposed quality control unit are accounted in the quality control modelling.

CDS model PMSU 20-20 oil grit separator unit is proposed at downstream of the Outlet-1 structure. The CDS unit will receive controlled release through the orifice / weir installed at the Outlet-1 and hence it will not operate in a surcharged condition.

Please refer to **Appendix "B"** for the design summary of CDS model PMSU 20-20 oil grit separator unit provided by Echelon Environmental. Proposed water quality unit will treat 98.40% of average annual rainfall volume and remove 80.50% of TSS prior to discharging from the site. This is concluded by considering the controlled portion of the site area that discharges to the dry pond facilities and contributing to the proposed quality control unit. The option for upstream attenuation and storage-discharge relationship for dry pond facility SU-1 is used to access TSS removal by the CDS system.

An ongoing maintenance program, consisting of periodic inspection and cleaning of the CDS and on-site catch basins are recommended (minimum once per year).

4.3.3 Water Balance

The water balance criteria provided by the TRCA require that 5mm of rainfall be diverted from the storm sewer system through infiltration, evapotranspiration, or rainwater reuse. A 5mm of rainfall over the entire site area equates to a required site balance volume of 160.63 m^3. In order to meet water balance requirement, Initial Abstractions were selected for the various surfaces within the subject site area based on TRCA guidelines. The following represents a brief description of typical surfaces and associated assumed Initial Abstractions:

- Conventional rooftop areas are considered to be constructed with gravel / ballast. The cracks and irregularities of this surface will provide depression storage until evaporation takes place. As such, an IA of 1.0mm is considered for roof area.
- Green roof areas and roof planters have been assigned an IA of 5.0mm.
- Uncontrolled grassed areas have been assigned an IA of 5.0mm.
- Landscape islands and mulch play areas located in the controlled portion of the site are considered as planters. The finish grade elevation for the landscape area at the back of the curb will be kept 50mm lower than the top of the curb elevation, which will provide edge containment. As such, an IA of 5.0mm is considered for this portion of the site area.
- Asphalt and other paved site area have been assigned an IA of 1.0mm considering the fact that a large percent the individual storm events during an average year will be small and will result in high evaporation rates during the summer months.

A summary of the surface conditions, initial abstraction values, and rainfall capture depths for the site is provided in **Table-9** below.

Table-9 - Initial Abstraction Calculations

Surface	Area (m^2)	% of Site Area	IA (mm)	Retention (m^3)	Effective IA (mm)
Perimeter Landscape (Uncontrolled)	2328.55	7.25	5.00	11.64	0.36
Asphalt & Other Paved Area (Uncontrolled)	349.59	1.09	1.00	0.35	0.01
Landscape Islands (Controlled)	11305.06	35.19	5.00	56.53	1.76
Mulch Islands (Controlled)	0.00	0.00	5.00	0.00	0.00
Landscape Roof (Green Roof)	0.00	0.00	5.00	0.00	0.00
Conventional Roof	1516.67	4.72	1.00	1.52	0.05
Asphalt & Paved Area-Traffic Load (By OGS)	16625.81	51.75	1.00	16.63	0.52
TOTAL	**32125.70**	**100.00**		**86.66**	**2.70**

Above calculated total value of 2.70 mm of initial abstraction and infiltration over the site, equates to the retention of 86.66 m^3 of rainfall within the soils for infiltration and evapotranspiration.

In addition to above, a subdrain system consists of 100mm dia perforated pipe within a 450mm wide and 300mm deep stone trench is provided below 531.75 long on-site swales. This equates to the retention of 28.71 m^3 of volume accounting 0.40 porosity in exfiltration stone trenches.

To meet the remaining water balance requirement for this site, a stone bed of size 26.40m(L) x 14.80m(W) x 0.30m(D) is provided at the bottom of stormwater retention pond. The stone bed equates to the retention of 46.89 m^3 of volume accounting 0.40 porosity.

A summary of the storage volume provided on site through exfiltration trench, Initial Abstraction and stone bed is provided in **Table-10** below confirms that the retention of a total 5.05mm rainfall will be achieved and a total of 162.26 m^3 volume will be retained on site.

Table-10 - Water Balance Calculations

Retention in IA (m^3)	Storage in Swale Subdrain (m^3)	Storage in Stone Bed (m^3)	Total Retention Provided (m^3)	Total IA Achieved (mm)
86.66	28.71	46.89	162.26	5.05

4.4 Downstream Capacity

The site area occupied by this development is contributing to the existing municipal culvert and an unnamed stream located at the south property limits in the pre-development condition. Since, the post-development peak flows from this site are controlled conservatively in accordance with the unit flow rates provided for the Basin 1 and catchment 14 within Appendix J4 of the Etobicoke Creek Hydrology Study (2013), there will be no need to map downstream capacity of existing municipal conveyance system.

5.0 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

Construction activity, especially operations involving the handling of earthen material, dramatically increases the availability of particulate matter for erosion and transport by surface drainage. In order to mitigate the adverse environmental impacts caused by the release of silt--laden stormwater runoff into receiving watercourses, measures for erosion and sediment control are required for construction sites.

The impact of construction on the environment is recognized by the Greater Golden Horseshoe Area Conservation Authorities. "Erosion & Sediment Control Guidelines for Urban Construction" released by Authority in December 2006, provides guidance for the preparation of effective erosion and sediment control plans. Control measures must be selected in light of the erosion potential of the site. It is important to have implementations and modifications on a staged basis to reflect the site's activities. Furthermore, the effectiveness of control measures decreases with sediment loading as a result inspection and maintenance is recommended. The selection, implementation, inspection, and maintenance of the control features are summarized as follows:

5.1 Control Measures

On relatively small sites, measures for erosion and sediment control typically include the use of silt fencing, mud mats and sediment traps. The description of the sediment controls to be implemented on the subject site is as follows.

- Installation of ***Silt Fences*** adjacent to all property limits subject to drainage from the development area prior to topsoil stripping and in other locations, such as at the bases of topsoil stockpiles.
- Installation of ***Mud Mats*** at all construction entrances prior to commencing earthworks to minimize the tracking of mud onto municipal roads.
- Installation of ***Sediment Traps*** at all catch basins and area drain locations once the storm sewer system has been constructed to prevent silt-laden runoff from entering the municipal storm sewer system.

5.2 Construction Sequencing

The schedule of construction activities with respect to sediment controls is as follows:

- Installation of the silt fences prior to any other activities on the site.
- Construction of temporary mud mats at all construction access.
- Installation of site servicing and underground utilities.
- Construction of building foundations and disposal of all the surplus excavated materials off site.
- Construction of building, parking lot and driveways.
- Restoration / re-vegetation of disturbed areas either with temporary measures such as mulch or seeding or with final landscape and paving.
- Removal of the sediment controls following stabilization of disturbed areas.

5.3 Inspection & Maintenance

In order to ensure that the erosion and sediment control measures operate effectively, regular monitoring together with periodic cleaning (e.g. removal of accumulated silt), maintenance and/or re-construction is strongly recommended. Inspections of all the erosion and sediment controls on the construction site should be undertaken with the following frequency:

- On a weekly basis
- After every rainfall event
- After significant snow melt events
- Prior to forecasted rainfall events

If damaged control measures are found, they should be repaired and/or replaced within 48 hours. Site inspection staff and construction managers should refer to the Erosion and Sediment Control Inspection Guide (2008) prepared by the Greater Golden Horseshoe Area Conservation Authorities. This Inspection Guide provides information related to the inspection reporting, problem response and proper installation techniques. Infiltration Gallery shall be kept offline until the site has been stabilised.

6.0 SANITARY DRAINAGE SYSTEM

The Owner has retained Envision Consultants Ltd. to prepare design documents for private on-site sub-surface disposal facility in accordance with the MECP design guidelines.

The Envision Consultant is working with MECP regional and head office and already filed an ECA Application for the approval of proposed Sewage Treatment and Disposal System.

Please refer to the design documents prepared by Envision Consultants Ltd. for MECP Sewage Treatment and Disposal System Design.

7.0 WATER SUPPLY SYSTEM

Currently the property is vacant with an abandoned residential house. An existing 300mm dia watermain located within the municipal allowance of King Street is available to serve the future development on this site. The region of Peel has provided a 300 mm dia fire and domestic combined service to serve future development on this land.

7.1 Proposed Water Supply Requirements

The post-development water supply requirement is calculated in accordance with the Watermain Linear Design Manual provided by the Region of Peel. This manual provides peaking factors to calculate peak hour and maximum day based on Ministry of Environment Guidelines.

The estimated water consumption of approximately 0.78 L/s with a peak hourly demand of 1.68 L/s will be required to service proposed development with domestic water based on population density calculated for this site and proposed land use. Detailed calculations have been illustrated in **Appendix "C"**.

The Town of Caledon and Region of Peel requires the fire flow calculations based on the Water Supply for Public Fire Protection Guidelines provided by the Fire Underwriters Survey (FUS). The fire flow required for the proposed Travel Stop development is estimated at 66.67 L/s for 4 hours, delivered with a residual pressure of not less then 140 kilopascals. Detailed calculations have been illustrated in **Appendix "C"**.

A flow and pressure test were conducted by Cortese Design Inc. on the Region of Peel hydrants connected to an existing 300mm dia watermain located within the South Boulevard of King Street. The test report is included in **Appendix "D".** A flow of 61 L/s (960 USGPM) was measured at First Hydrant on King Street, West side of Hurontario Street Intersection using Two 2.5" orifices, that resulted in a residual pressure of 173 kPa (25 psi) at the Second Hydrant, West side of Hurontario Street Intersection. Based on actual pressure test on nearby municipal hydrants, a maximum flow of 68 L/s can be achieved while maintaining a water pressure of 20 psi (140 kPa) Detailed calculations for the projected fire flow at 20 psi residual pressure is included in **Appendix "D"**.

The actual available suppression within municipal watermains is more than the required fire flow for the proposed development and it is in compliance with the minimum requirements for fire suppression outlined in the FUS and the Town guidelines.

7.2 Proposed Water Service

This development application proposes to make use of the existing 300mm dia fire and domestic combines service provided by the Region of Peel from the existing 300mm dia municipal watermain located within road allowance of King Street. The proposed combined service will split at the property line into fire and domestic services. An internal network of 150 mm dia fire main and 100 mm dia domestic watermain are proposed in accordance with the Region of Peel Standard Drawing 1-8-5A to serve future development.

8.0 CONCLUSIONS AND RECOMMENDATIONS

This report is to be read in conjunction with the submission materials for the project proposal known as proposed Travel Stop development, located at NE Corner of Hurontario Street & King Street, Town of Caledon, Ontario.

8.1 STORM

1. The site is divided into two primary drainage systems; “Controlled” (CA-1-Post) and “Uncontrolled” (CA-2-Post).
2. The post-development peak flow targets in accordance with the unit flow rates provided for the Basin 1 and catchment 14 within Appendix J4 of the Etobicoke Creek Hydrology Study (2013) will be achieved using detention storage within an on-site End-of-Pipe Dry Storage facility (SU-1).
3. The post-development peak flow targets will be achieved by controlling discharge from the site area using a combination of 75mm dia orifice plate and 250mm(w) X 300mm(d) rectangle weir installed in the perforated CSP outlet structure (Outlet-1).

4. Total 1,221.19 m^3 of storage is used out of 1,455.65 m^3 storage volume provided during 100-year storm event.
5. The quality control for the site is provided by a multiple component treatment train consisting of a dry, end-of-pipe, detention storage facility and CDS oil and grit separator unit.
6. Proposed water quality unit will treat 98.40% of average annual rainfall volume and remove 80.50% of TSS prior to discharging from the site.
7. An ongoing maintenance program consists of periodic inspection and cleaning of the Stormceptor and Catch basins are recommended (minimum once per year).
8. Water balance target will be achieved with the help of exfiltration trench, Initial Abstraction and stone bed provided at the bottom of stormwater retention pond.
9. Erosion and Sediment controls are to be implemented during construction to prevent silt-laden runoff from leaving the site in accordance with the "Erosion & Sediment Control Guidelines for Urban Construction".

8.2 SANITARY

1. The Envision Consultants Ltd. is working with MECP regional and head office and already filed an ECA Application for the approval of proposed Sewage Treatment and Disposal System.
2. Please refer to the design documents prepared by Envision Consultants Ltd. for MECP Sewage Treatment and Disposal System Design.

8.3 WATER

1. The estimated water consumption of approximately 0.78 L/s with a peak hourly demand of 1.68 L/s will be required to service the proposed development with domestic water.
2. The fire flow required for proposed development is estimated at 66.67 L/s for 4 hours, delivered with a residual pressure of not less then 140 kilopascals.
3. The actual available suppression within municipal watermains is more than the required fire flow for the proposed development and it is in compliance with the minimum requirements for fire suppression outlined in the FUS and the Town guidelines.
4. This development application proposes to make use of the existing 300mm dia fire and domestic combines service provided by the Region of Peel from the existing 300mm dia municipal watermain located within road allowance of King Street.
5. The proposed combined service will split at the property line into fire and domestic services.

We trust that this report satisfies the requirements of the Town of Caledon and Region of Peel with respect to the subject development. Should you have any questions, please feel free to contact the undersigned.

Yours truly,
FLORA DESIGNS INC.

Chirag C. Patel, P.Eng, PMP
Senior Project Manager

Appendix "A" Plans

- Location Map
- Site Survey Drawing
- Architectural Site Plan

LOCATION MAP **(NTS)**

SITE SURVEY DRAWING (NTS)

ARCHITECTURAL SITE PLAN (NTS)

Appendix "B" Stormwater Management

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- Orifice-Weir Rating Calculations
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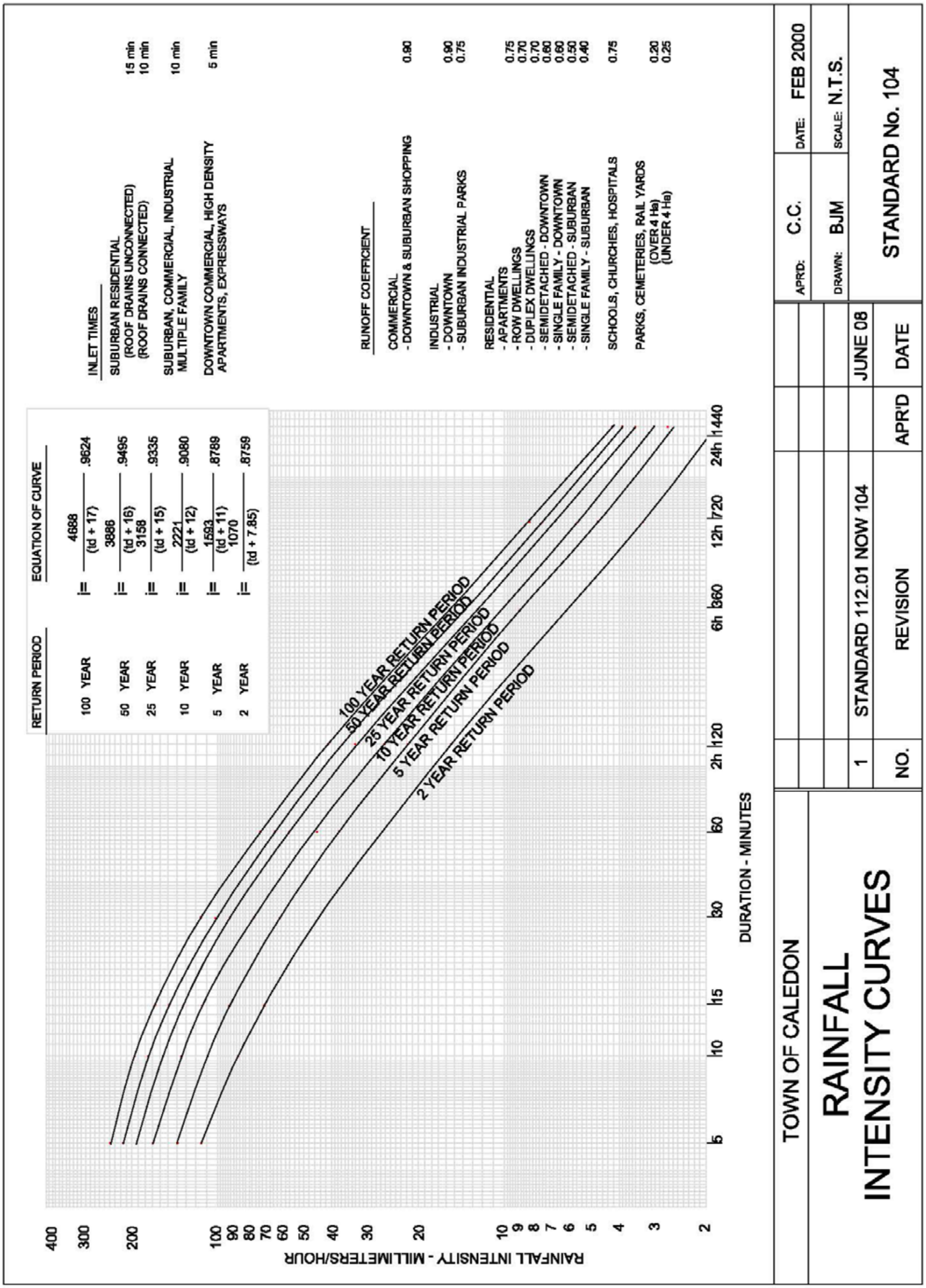
- Perforated CSP Pipe Calculations (Outlet-1)
- CDS Design Summary
- CDS Model 2020 – Typical Drawing

<u>IDF CURVE - TOWN OF CALEDON</u>

(Standard No. 104)



RUNOFF COEFFICIENT CALCULATIONS

In Accordance with STD No.104, Development Standards, Policies & Guidelines Manual

Character of Surface	Runoff Coeff. "C"
Parks (Under 4 Ha)	0.25
Asphalt, Concrete, Roof Areas	0.90

Pre-Development Drainage Area

Catchment Type	Catchment #	Area (m^2)		Area (ha)		% Impervious	Runoff Coeff. "C"
		Impervious	Total	Impervious	Total		
Uncontrolled	**CA-1-Pre**	509.55	32125.68	0.05	3.21	1.59	0.26
Total Site		**509.55**	**32125.68**	**0.05**	**3.21**	**1.59**	**0.26**

Post-Development Drainage Area

Catchment Type	Catchment #	Area (m^2)		Area (ha)		% Imp.	Runoff Coeff. "C"
		Imp.	Total	Imp.	Total		
Controlled	**CA-1-Post**	18142.48	29447.54	1.81	2.94	61.61	0.65
Uncontrolled	**CA-2-Post**	349.59	2678.14	0.03	0.27	13.05	0.33
Total Site		**18492.07**	**32125.68**	**1.85**	**3.21**	**57.56**	**0.62**

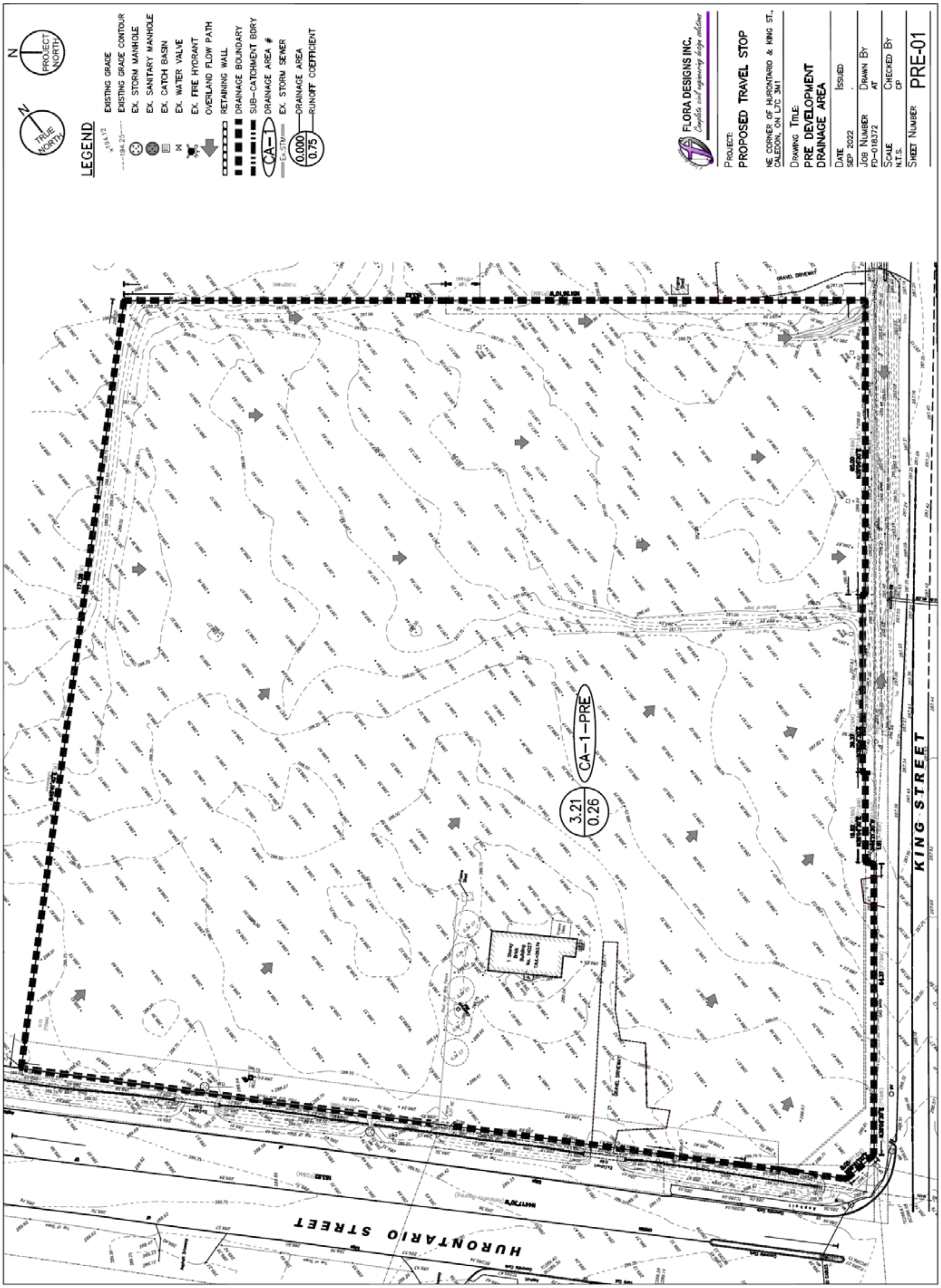
Runoff Coefficient (C)

C = 0.9 i + 0.25 (1 - i), Where i = Imperviousness Ratio

Sub-Catchment Area of CA-1-Post

Catchment Type	Inlet Location	Area (m^2)		Area (ha)		% Impervious	Runoff Coeff. "C"
		Impervious	Total	Impervious	Total		
Controlled	**CB-1**	1514.89	1828.96	0.15	0.18	82.83	0.79
	CB-2	811.12	943.64	0.08	0.09	85.96	0.81
	Canopy-Retail	216.87	216.87	0.02	0.02	100.00	0.90
	CBMH-3	1773.13	3113.34	0.18	0.31	56.95	0.62
	Canopy-Comm	238.06	238.06	0.02	0.02	100.00	0.90
	DCB-3	2186.59	2327.44	0.22	0.23	93.95	0.86
	CB-4	625.76	797.48	0.06	0.08	78.47	0.76
	CB-5	972.14	1199.90	0.10	0.12	81.02	0.78
	Bldg-A Roof	548.75	548.75	0.05	0.05	100.00	0.90
	Bldg-B Roof	298.00	298.00	0.03	0.03	100.00	0.90
	CBMH-6	182.72	232.17	0.02	0.02	78.70	0.76
	Bldg-C Roof	334.96	334.96	0.03	0.03	100.00	0.90
	Bldg-D Roof	334.96	334.96	0.03	0.03	100.00	0.90
	DCB-6	1582.79	2057.62	0.16	0.21	76.92	0.75
	CBMH-8	2406.13	2453.53	0.24	0.25	98.07	0.89
	CB-7	0.00	4683.35	0.00	0.47	0.00	0.25
	CB-8	1306.49	1552.77	0.13	0.16	84.14	0.80
	CB-9	1665.64	1665.64	0.17	0.17	100.00	0.90
	CB-10	325.01	325.01	0.03	0.03	100.00	0.90
	POND	818.47	4295.09	0.08	0.43	19.06	0.37
Sub Total - Controlled		**18142.48**	**29447.54**	**1.81**	**2.94**	**61.61**	**0.65**

EXISTING STORM DRAINAGE PLAN (NTS)



PRE-DEVELOPMENT PEAK FLOW CALCULATIONS – Per TOWN STANDARDS

Catchment #	Drainage Area	Runoff Coefficient	Time of Concentration
	"A" in Hector	"C"	"Tc" in Minute
CA-1-Pre	3.21	0.26	10

Rational Method Calculation:

Q = 2.78CIA

Where: Q = Runoff Quantity (Flow) in litre/sec
A = Drainage Area in Hectors
C = Runoff Coefficient
I = Average Rainfall Intensity - mm/h (IDF Data Set, Town of Caledon)

Event 2 yr

Coefficient, a =	1070.00
Coefficient, b =	7.85
Exponent, c =	-0.8759

*(I) = a * (Tc + b)^c*

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Pre	3.21	85.72	0.26	198.88	0.1989

Event 5 yr

Coefficient, a =	1593.00
Coefficient, b =	11.00
Exponent, c =	-0.8789

*(I) = a * (Tc + b)^c*

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Pre	3.21	109.68	0.26	254.47	0.2545

Event 10 yr

Coefficient, a =	2221.00
Coefficient, b =	12.00
Exponent, c =	-0.9080

*(I) = a * (Tc + b)^c*

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Pre	3.21	134.16	0.26	311.28	0.3113

Event 25 yr

Coefficient, a =	3158.00
Coefficient, b =	15.00
Exponent, c =	-0.9335

*(I) = a * (Tc + b)^c*

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Pre	3.21	156.47	0.26	363.04	0.3630

Event 50 yr

Coefficient, a =	3886.00
Coefficient, b =	16.00
Exponent, c =	-0.9495

*(I) = a * (Tc + b)^c*

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Pre	3.21	176.19	0.26	408.80	0.4088

Event 100 yr

Coefficient, a =	4688.00
Coefficient, b =	17.00
Exponent, c =	-0.9624

*(I) = a * (Tc + b)^c*

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Pre	3.21	196.54	0.26	456.00	0.4560

POST-DEVELOPMENT ALLOWABLE RELEASE CALCULATIONS – Per TRCA Requirements

(in accordance with the unit flow rates provided for the Basin 1 and catchment 14 within Appendix J4 of the Etobicoke Creek Hydrology Study (2013)

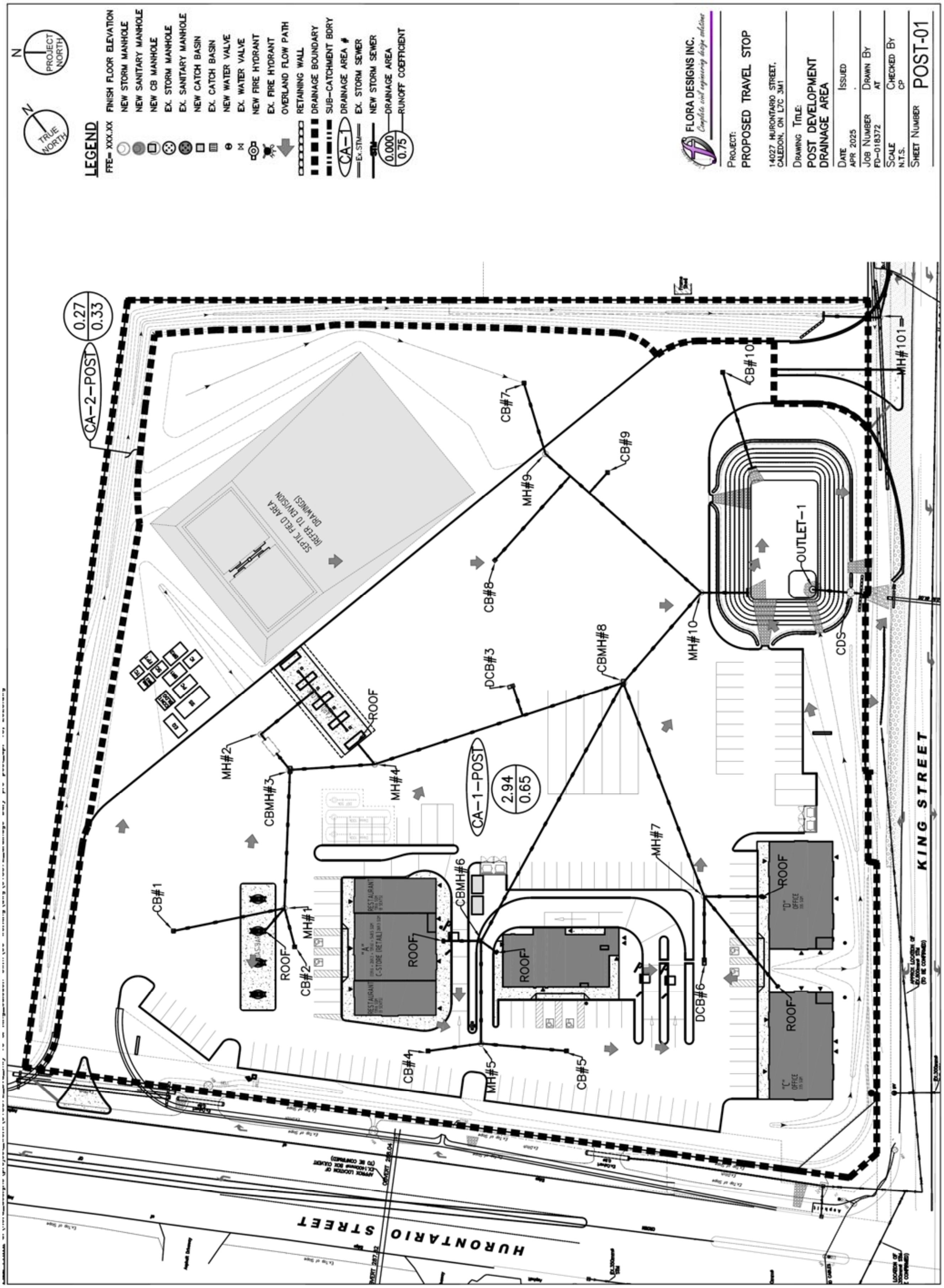
Design Storm	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Unit Flow Rate (m3/s/ha)	0.00391	0.00682	0.00904	0.01205	0.01441	0.01689

Site Area	3.21	ha

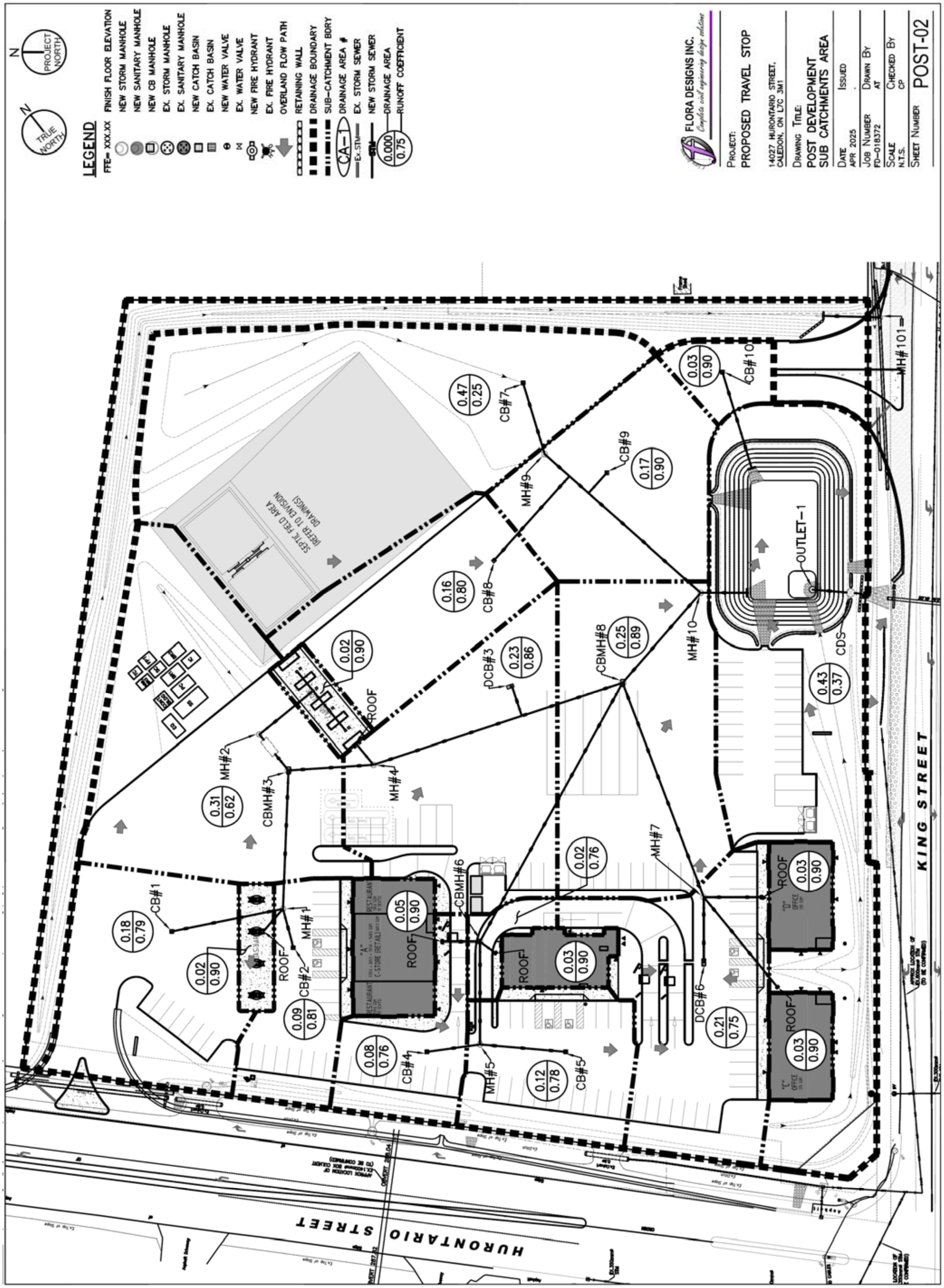
Post-development allowable release rate

Catchment #	Peak Flow (m3/s)					
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
CA-1-Pre	0.0126	0.0219	0.0290	0.0387	0.0463	0.0542

PROPOSED STORM DRAINAGE PLAN **(NTS)**



PROPOSED SUB-CATCHMENT AREA PLAN **(NTS)**



POST-DEVELOPMENT UNMITIGATED PEAK FLOW CALCULATIONS

Catchment #	Drainage Area	Runoff Coefficient	Time of Concentration
	"A" in Hector	"C"	"Tc" in Minute
CA-1-Post	2.94	0.65	10
CA-2-Post	0.27	0.33	10

Rational Method Calculation:

Q = 2.78CIA

Where: Q = Runoff Quantity (Flow) in litre/sec
A = Drainage Area in Hectors
C = Runoff Coefficient
I = Average Rainfall Intensity - mm/h (IDF Data Set, Town of Caledon)

Event 2 yr

*(I) = a * (Tc + b)^c*

Coefficient, a =	1070.00
Coefficient, b =	7.85
Exponent, c =	-0.8759

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Post	2.94	85.72	0.65	455.39	0.4554
CA-2-Post	0.27	85.72	0.33	21.23	0.0212

Event 5 yr

*(I) = a * (Tc + b)^c*

Coefficient, a =	1593.00
Coefficient, b =	11.00
Exponent, c =	-0.8789

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Post	2.94	109.68	0.65	582.67	0.5827
CA-2-Post	0.27	109.68	0.33	27.17	0.0272

Event 10 yr

*(I) = a * (Tc + b)^c*

Coefficient, a =	2221.00
Coefficient, b =	12.00
Exponent, c =	-0.9080

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Post	2.94	134.16	0.65	712.75	0.7127
CA-2-Post	0.27	134.16	0.33	33.23	0.0332

Event 25 yr

*(I) = a * (Tc + b)^c*

Coefficient, a =	3158.00
Coefficient, b =	15.00
Exponent, c =	-0.9335

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Post	2.94	156.47	0.65	831.27	0.8313
CA-2-Post	0.27	156.47	0.33	38.76	0.0388

Event 50 yr

*(I) = a * (Tc + b)^c*

Coefficient, a =	3886.00
Coefficient, b =	16.00
Exponent, c =	-0.9495

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Post	2.94	176.19	0.65	936.03	0.9360
CA-2-Post	0.27	176.19	0.33	43.64	0.0436

Event 100 yr

*(I) = a * (Tc + b)^c*

Coefficient, a =	4688.00
Coefficient, b =	17.00
Exponent, c =	-0.9624

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Post	2.94	196.54	0.65	1044.12	1.0441
CA-2-Post	0.27	196.54	0.33	48.68	0.0487

STAGE STORAGE CALCULATIONS – POND SU-1

Bottom Elevation, Base = 286.00 m

Stage-Storage Information:

POND STORAGE (SU-1)					Incremental Storage Volume (SITE)	Cumulative Storage Volume
	Elevation (m)	Stage (m)	Surface Area (m2)	Incremental Storage Volume (POND) V=[(A1+A2)/2]d (m3)	(m3)	(m3)
Base	286.00	0.00	34.10	--	--	0.00
	286.10	0.10	389.76	21.19	0.00	21.19
	286.25	0.25	461.64	63.85	5.01	90.06
	286.50	0.50	551.95	126.70	8.35	225.11
	286.75	0.75	648.54	150.06	8.35	383.53
	287.00	1.00	751.42	175.00	17.14	575.66
	287.25	1.25	860.57	201.50	17.14	794.30
	287.50	1.50	976.01	229.57	17.14	1041.01
Top	287.75	1.75	1116.80	261.60	153.04	1455.65

STAGE STORAGE CALCULATIONS – SITE AREA

Orifice Invert = 286.00
Stage = 286.75
Storage Depth = 0.75 m

CB & MH Storage:

ID	RIM Elevation (m)	INV Elevation (m)	Stage Elevation (m)	Water Depth (m)	Nominal MH Dia (mm)	MH Diameter (m)	Area (m^2)	Storage Volume (m^3)
CB-1	288.70	287.38	286.75	0.00	CB	N/A	0.36	0.00
CB-2	288.75	287.34	286.75	0.00	CB	N/A	0.36	0.00
DCB-3	287.90	286.76	286.75	0.00	DCB	N/A	0.72	0.00
CB-4	288.70	287.25	286.75	0.00	CB	N/A	0.36	0.00
CB-5	288.50	287.28	286.75	0.00	CB	N/A	0.36	0.00
DCB-6	288.25	287.02	286.75	0.00	DCB	N/A	0.72	0.00
CB-7	287.55	286.81	286.75	0.00	CB	N/A	0.36	0.00
CB-8	287.80	286.74	286.75	0.01	CB	N/A	0.36	0.00
CB-9	287.50	286.63	286.75	0.12	CB	N/A	0.36	0.04
CB-10	287.65	286.47	286.75	0.28	CB	N/A	0.36	0.10
MH-1	288.84	287.17	286.75	0.00	1200	1.22	1.17	0.00
CBMH-3	288.20	286.94	286.75	0.00	1500	1.52	1.81	0.00
MH-4	288.27	286.77	286.75	0.00	1200	1.22	1.17	0.00
MH-5	288.74	287.14	286.75	0.00	1200	1.22	1.17	0.00
CBMH-6	288.55	286.95	286.75	0.00	1200	1.22	1.17	0.00
MH-7	288.48	286.87	286.75	0.00	1200	1.22	1.17	0.00
CBMH-8	287.90	286.40	286.75	0.35	1500	1.52	1.81	0.63
MH-9	287.80	286.58	286.75	0.17	1200	1.22	1.17	0.20
MH-10	288.17	286.20	286.75	0.55	1200	1.22	1.17	0.64
Total CB & MH Storage Volume								**1.62**

Pipe Storage:

Pipe Dia. (m)	Pipe Length (m)	From				To				Storage Volume (m^3)
		ID	Invert Elevation (m)	Water Depth (m)	Area (m^2)	ID	Invert Elevation (m)	Water Depth (m)	Area (m^2)	
0.300	25.00	CB-1	287.38	0.00	0.00	MH-1	287.25	0.00	0.00	0.00
0.200	6.61	Canopy	287.42	0.00	0.00	MH-1	287.35	0.00	0.00	0.00
0.250	8.82	CB-2	287.34	0.00	0.00	MH-1	287.30	0.00	0.00	0.00
0.375	30.67	MH-1	287.17	0.00	0.00	CBMH-3	287.02	0.00	0.00	0.00
0.450	18.76	CBMH-3	286.94	0.00	0.00	MH-4	286.85	0.00	0.00	0.00
0.200	6.16	Canopy	287.16	0.00	0.00	MH-4	287.10	0.00	0.00	0.00
0.300	6.98	DCB-3	286.76	0.00	0.00	Lead	266.72	0.30	0.07	0.24
0.525	57.83	MH-4	286.77	0.00	0.00	CBMH-8	286.48	0.27	0.11	3.18
0.250	11.83	CB-4	287.25	0.00	0.00	MH-5	287.19	0.00	0.00	0.00
0.250	18.95	CB-5	287.28	0.00	0.00	MH-5	287.19	0.00	0.00	0.00
0.300	22.67	MH-5	287.14	0.00	0.00	CBMH-6	287.03	0.00	0.00	0.00
0.250	8.47	Roof-A	287.16	0.00	0.00	CBMH-6	287.08	0.00	0.00	0.00
0.250	4.41	Roof-B	287.12	0.00	0.00	CBMH-6	287.08	0.00	0.00	0.00
0.375	65.23	CBMH-6	286.95	0.00	0.00	CBMH-8	286.62	0.13	0.03	0.98
0.300	13.97	DCB-6	287.02	0.00	0.00	MH-7	286.95	0.00	0.00	0.00
0.250	25.80	Roof-C	287.13	0.00	0.00	MH-7	287.00	0.00	0.00	0.00
0.250	12.88	Roof-D	287.06	0.00	0.00	MH-7	287.00	0.00	0.00	0.00
0.375	50.63	MH-7	286.87	0.00	0.00	CBMH-8	286.62	0.13	0.03	0.76
0.600	26.33	CBMH-8	286.40	0.35	0.17	MH-10	286.26	0.49	0.25	5.53
0.300	16.41	CB-7	286.81	0.00	0.00	MH-9	287.73	0.00	0.00	0.00
0.300	25.00	CB-8	286.74	0.01	0.00	Lead	286.62	0.13	0.03	0.38
0.300	6.05	CB-9	286.63	0.12	0.03	Lead	286.60	0.15	0.04	0.21
0.450	46.10	MH-9	286.58	0.17	0.06	MH-10	286.35	0.40	0.15	4.84
0.600	10.40	MH-10	286.20	0.55	0.27	Head Wall	286.10	0.60	0.28	2.86
0.250	22.33	CB-10	286.47	0.25	0.05	Head Wall	286.25	0.25	0.05	1.12
Total Pipe Storage Volume										**20.10**

Surface Storage:

ID	RIM Elevation (m)	HWL (m)	Surface Area @ HWL (m^2)	Stage Elevation (m)	Ponding Depth (m)	Storage Volume (m^3)
CB-7	287.55	287.75	425.11	286.75	0.00	0.00
CB-9	287.50	287.75	780.10	286.75	0.00	0.00
CB-10	287.65	287.75	164.15	286.75	0.00	0.00
Total Surface Storage Volume						**0.00**

TOTAL STAGE STORAGE AT ELEVATION	**286.75**	**=**	**21.72**	**m^3**

Orifice Invert = 286.00
Stage = 287.50
Storage Depth = 1.50 m

CB & MH Storage:

ID	RIM Elevation (m)	INV Elevation (m)	Stage Elevation (m)	Water Depth (m)	Nominal MH Dia (mm)	MH Diameter (m)	Area (m^2)	Storage Volume (m^3)
CB-1	288.70	287.38	287.50	0.12	CB	N/A	0.36	0.04
CB-2	288.75	287.34	287.50	0.16	CB	N/A	0.36	0.06
DCB-3	287.90	286.76	287.50	0.74	DCB	N/A	0.72	0.53
CB-4	288.70	287.25	287.50	0.25	CB	N/A	0.36	0.09
CB-5	288.50	287.28	287.50	0.22	CB	N/A	0.36	0.08
DCB-6	288.25	287.02	287.50	0.48	DCB	N/A	0.72	0.35
CB-7	287.55	286.81	287.50	0.69	CB	N/A	0.36	0.25
CB-8	287.80	286.74	287.50	0.76	CB	N/A	0.36	0.27
CB-9	287.50	286.63	287.50	0.87	CB	N/A	0.36	0.31
CB-10	287.65	286.47	287.50	1.03	CB	N/A	0.36	0.37
MH-1	288.84	287.17	287.50	0.33	1200	1.22	1.17	0.39
CBMH-3	288.20	286.94	287.50	0.56	1500	1.52	1.81	1.02
MH-4	288.27	286.77	287.50	0.73	1200	1.22	1.17	0.85
MH-5	288.74	287.14	287.50	0.36	1200	1.22	1.17	0.42
CBMH-6	288.55	286.95	287.50	0.55	1200	1.22	1.17	0.64
MH-7	288.48	286.87	287.50	0.63	1200	1.22	1.17	0.74
CBMH-8	287.90	286.40	287.50	1.10	1500	1.52	1.81	2.00
MH-9	287.80	286.58	287.50	0.92	1200	1.22	1.17	1.07
MH-10	288.17	286.20	287.50	1.30	1200	1.22	1.17	1.52
Total CB & MH Storage Volume								**11.00**

Pipe Storage:

Pipe Dia. (m)	Pipe Length (m)	From				To				Storage Volume (m^3)
		ID	Invert Elevation (m)	Water Depth (m)	Area (m^2)	ID	Invert Elevation (m)	Water Depth (m)	Area (m^2)	
0.300	25.00	CB-1	287.38	0.12	0.03	MH-1	287.25	0.25	0.06	1.13
0.200	6.61	Canopy	287.42	0.08	0.01	MH-1	287.35	0.15	0.03	0.13
0.250	8.82	CB-2	287.34	0.16	0.03	MH-1	287.30	0.20	0.04	0.31
0.375	30.67	MH-1	287.17	0.33	0.10	CBMH-3	287.02	0.38	0.11	3.22
0.450	18.76	CBMH-3	286.94	0.45	0.16	MH-4	286.85	0.45	0.16	3.00
0.200	6.16	Canopy	287.16	0.20	0.03	MH-4	287.10	0.20	0.03	0.18
0.300	6.98	DCB-3	286.76	0.30	0.07	Lead	266.72	0.30	0.07	0.49
0.525	57.83	MH-4	286.77	0.53	0.22	CBMH-8	286.48	0.53	0.22	12.72
0.250	11.83	CB-4	287.25	0.25	0.05	MH-5	287.19	0.25	0.05	0.59
0.250	18.95	CB-5	287.28	0.22	0.05	MH-5	287.19	0.25	0.05	0.95
0.300	22.67	MH-5	287.14	0.30	0.07	CBMH-6	287.03	0.30	0.07	1.59
0.250	8.47	Roof-A	287.16	0.25	0.05	CBMH-6	287.08	0.25	0.05	0.42
0.250	4.41	Roof-B	287.12	0.25	0.05	CBMH-6	287.08	0.25	0.05	0.22
0.375	65.23	CBMH-6	286.95	0.38	0.11	CBMH-8	286.62	0.38	0.11	7.18
0.300	13.97	DCB-6	287.02	0.30	0.07	MH-7	286.95	0.30	0.07	0.98
0.250	25.80	Roof-C	287.13	0.25	0.05	MH-7	287.00	0.25	0.05	1.29
0.250	12.88	Roof-D	287.06	0.25	0.05	MH-7	287.00	0.25	0.05	0.64
0.375	50.63	MH-7	286.87	0.38	0.11	CBMH-8	286.62	0.38	0.11	5.57
0.600	26.33	CBMH-8	286.40	0.60	0.28	MH-10	286.26	0.60	0.28	7.37
0.300	16.41	CB-7	286.81	0.30	0.07	MH-9	287.73	0.00	0.00	0.57
0.300	25.00	CB-8	286.74	0.30	0.07	Lead	286.62	0.30	0.07	1.75
0.300	6.05	CB-9	286.63	0.30	0.07	Lead	286.60	0.30	0.07	0.42
0.450	46.10	MH-9	286.58	0.45	0.16	MH-10	286.35	0.45	0.16	7.38
0.600	10.40	MH-10	286.20	0.60	0.28	Head Wall	286.10	0.60	0.28	2.91
0.250	22.33	CB-10	286.47	0.25	0.05	Head Wall	286.25	0.25	0.05	1.12
Total Pipe Storage Volume										**62.14**

Surface Storage:

ID	RIM Elevation (m)	HWL (m)	Surface Area @ HWL (m^2)	Stage Elevation (m)	Ponding Depth (m)	Storage Volume (m^3)
CB-7	287.55	287.75	425.11	287.50	0.00	0.00
CB-9	287.50	287.75	780.10	287.50	0.00	0.00
CB-10	287.65	287.75	164.15	287.50	0.00	0.00
Total Surface Storage Volume						**0.00**

TOTAL STAGE STORAGE AT ELEVATION	**287.50**	**=**	**73.13**	**m^3**

Orifice Invert = 286.00
Stage = 287.75
Storage Depth = 1.75 m

CB & MH Storage:

ID	RIM Elevation (m)	INV Elevation (m)	Stage Elevation (m)	Water Depth (m)	Nominal MH Dia (mm)	MH Diameter (m)	Area (m^2)	Storage Volume (m^3)
CB-1	288.70	287.38	287.75	0.37	CB	N/A	0.36	0.13
CB-2	288.75	287.34	287.75	0.41	CB	N/A	0.36	0.15
DCB-3	287.90	286.76	287.75	0.99	DCB	N/A	0.72	0.71
CB-4	288.70	287.25	287.75	0.50	CB	N/A	0.36	0.18
CB-5	288.50	287.28	287.75	0.47	CB	N/A	0.36	0.17
DCB-6	288.25	287.02	287.75	0.73	DCB	N/A	0.72	0.53
CB-7	287.55	286.81	287.55	0.74	CB	N/A	0.36	0.27
CB-8	287.80	286.74	287.75	1.01	CB	N/A	0.36	0.36
CB-9	287.50	286.63	287.50	0.87	CB	N/A	0.36	0.31
CB-10	287.65	286.47	287.65	1.18	CB	N/A	0.36	0.42
MH-1	288.84	287.17	287.75	0.58	1200	1.22	1.17	0.68
CBMH-3	288.20	286.94	287.75	0.81	1500	1.52	1.81	1.47
MH-4	288.27	286.77	287.75	0.98	1200	1.22	1.17	1.15
MH-5	288.74	287.14	287.75	0.61	1200	1.22	1.17	0.71
CBMH-6	288.55	286.95	287.75	0.80	1200	1.22	1.17	0.93
MH-7	288.48	286.87	287.75	0.88	1200	1.22	1.17	1.03
CBMH-8	287.90	286.40	287.75	1.35	1500	1.52	1.81	2.45
MH-9	287.80	286.58	287.75	1.17	1200	1.22	1.17	1.37
MH-10	288.17	286.20	287.75	1.55	1200	1.22	1.17	1.81
Total CB & MH Storage Volume								**14.83**

Pipe Storage:

Pipe Dia. (m)	Pipe Length (m)	From				To				Storage Volume (m^3)
		ID	Invert Elevation (m)	Water Depth (m)	Area (m^2)	ID	Invert Elevation (m)	Water Depth (m)	Area (m^2)	
0.300	25.00	CB-1	287.38	0.30	0.07	MH-1	287.25	0.30	0.07	1.75
0.200	6.61	Canopy	287.42	0.20	0.03	MH-1	287.35	0.20	0.03	0.20
0.250	8.82	CB-2	287.34	0.25	0.05	MH-1	287.30	0.25	0.05	0.44
0.375	30.67	MH-1	287.17	0.38	0.11	CBMH-3	287.02	0.38	0.11	3.37
0.450	18.76	CBMH-3	286.94	0.45	0.16	MH-4	286.85	0.45	0.16	3.00
0.200	6.16	Canopy	287.16	0.20	0.03	MH-4	287.10	0.20	0.03	0.18
0.300	6.98	DCB-3	286.76	0.30	0.07	Lead	266.72	0.30	0.07	0.49
0.525	57.83	MH-4	286.77	0.53	0.22	CBMH-8	286.48	0.53	0.22	12.72
0.250	11.83	CB-4	287.25	0.25	0.05	MH-5	287.19	0.25	0.05	0.59
0.250	18.95	CB-5	287.28	0.25	0.05	MH-5	287.19	0.25	0.05	0.95
0.300	22.67	MH-5	287.14	0.30	0.07	CBMH-6	287.03	0.30	0.07	1.59
0.250	8.47	Roof-A	287.16	0.25	0.05	CBMH-6	287.08	0.25	0.05	0.42
0.250	4.41	Roof-B	287.12	0.25	0.05	CBMH-6	287.08	0.25	0.05	0.22
0.375	65.23	CBMH-6	286.95	0.38	0.11	CBMH-8	286.62	0.38	0.11	7.18
0.300	13.97	DCB-6	287.02	0.30	0.07	MH-7	286.95	0.30	0.07	0.98
0.250	25.80	Roof-C	287.13	0.25	0.05	MH-7	287.00	0.25	0.05	1.29
0.250	12.88	Roof-D	287.06	0.25	0.05	MH-7	287.00	0.25	0.05	0.64
0.375	50.63	MH-7	286.87	0.38	0.11	CBMH-8	286.62	0.38	0.11	5.57
0.600	26.33	CBMH-8	286.40	0.60	0.28	MH-10	286.26	0.60	0.28	7.37
0.300	16.41	CB-7	286.81	0.30	0.07	MH-9	287.73	0.02	0.00	0.57
0.300	25.00	CB-8	286.74	0.30	0.07	Lead	286.62	0.30	0.07	1.75
0.300	6.05	CB-9	286.63	0.30	0.07	Lead	286.60	0.30	0.07	0.42
0.450	46.10	MH-9	286.58	0.45	0.16	MH-10	286.35	0.45	0.16	7.38
0.600	10.40	MH-10	286.20	0.60	0.28	Head Wall	286.10	0.60	0.28	2.91
0.250	22.33	CB-10	286.47	0.25	0.05	Head Wall	286.25	0.25	0.05	1.12
Total Pipe Storage Volume										**63.11**

Surface Storage:

ID	RIM Elevation (m)	HWL (m)	Surface Area @ HWL (m^2)	Stage Elevation (m)	Ponding Depth (m)	Storage Volume (m^3)
CB-7	287.55	287.75	425.11	287.75	0.20	42.51
CB-9	287.50	287.75	780.10	287.75	0.25	97.51
CB-10	287.65	287.75	164.15	287.75	0.10	8.21
Total Surface Storage Volume						**148.23**

TOTAL STAGE STORAGE AT ELEVATION	**287.75**	**=**	**226.17**	**m^3**

Stage Storage Summary

Stage Elevation	Stage Storage Volume (m^3)			
	CB-MH	Pipe	Surface	Total
286.75	1.62	20.10	0.00	**21.72**
287.50	11.00	62.14	0.00	**73.13**
287.75	14.83	63.11	148.23	**226.17**

POST-DEVELOPMENT SITE FLOW AND STORAGE USED SUMMARY - 2-YEAR STORM

Actual Release Rate (RR)				0.0115	m^3/s
Actual Release Volume per 5-min. Interval				3.45	m^3
5-year Design Storm				**Catchment #**	**CA-1-Post**
a =	1070.00				
b =	7.85			Area (ha) =	2.94
c =	-0.88			C =	0.65
i =	a * (Tc + b)^c			Tc (min.)=	10
1	2	3	4	5	6
Time (min.)	**Rainfall Intensity (mm/hr)**	**Storm Runoff (m^3/s)**	**Storm Runoff Volume (m^3)**	**Released Volume (m^3)**	**Storage Volume (m^3)**
	(2)=a*((1))^b	(3)=[(2)*A*C]/360	(4)=(3)*(1)*60	(5)=(RR)*(1)*60	(6)=(4)-(5)
10	85.72	0.455	273.01	6.90	266.11
15	69.05	0.367	329.86	10.35	319.51
20	58.06	0.308	369.83	13.80	356.03
25	50.24	0.267	400.04	17.25	382.79
30	44.38	0.236	424.02	20.70	403.32
35	39.81	0.211	443.75	24.15	419.60
40	36.14	0.192	460.41	27.60	432.81
45	33.13	0.176	474.78	31.05	443.73
50	30.60	0.162	487.37	34.50	452.87
55	28.46	0.151	498.56	37.95	460.61
60	26.62	0.141	508.62	41.40	467.22
65	25.01	0.133	517.73	44.85	472.88
70	23.60	0.125	526.06	48.30	477.76
75	22.34	0.119	533.73	51.75	481.98
80	21.23	0.113	540.83	55.20	485.63
85	20.22	0.107	547.43	58.65	488.78
90	19.31	0.103	553.61	62.10	491.51
95	18.49	0.098	559.41	65.55	493.86
100	17.74	0.094	564.87	69.00	495.87
105	17.05	0.090	570.03	72.45	497.58
110	16.41	0.087	574.92	75.90	499.02
115	15.82	0.084	579.57	79.35	500.22
120	15.28	0.081	584.00	82.80	501.20
125	14.78	0.078	588.23	86.25	501.98
130	14.30	0.076	592.28	89.70	502.58
135	13.87	0.074	596.17	93.15	503.02
140	13.45	0.071	599.89	96.60	503.29
145	13.07	0.069	603.48	100.05	503.43
150	12.70	0.067	606.93	103.50	**503.43**
155	12.36	0.066	610.27	106.95	503.32
160	12.04	0.064	613.49	110.40	503.09
165	11.73	0.062	616.60	113.85	502.75
170	11.44	0.061	619.61	117.30	502.31
175	11.17	0.059	622.53	120.75	501.78
180	10.91	0.058	625.37	124.20	501.17

POST-DEVELOPMENT SITE FLOW AND STORAGE USED SUMMARY - 5-YEAR STORM

Actual Release Rate (RR)				0.0133	m^3/s
Actual Release Volume per 5-min. Interval				3.99	m^3
5-year Design Storm				**Catchment #**	**CA-1-Post**
a =	1593.00				
b =	11.00			Area (ha) =	2.94
c =	-0.879			C =	0.65
i =	a * (Tc + b)^c			Tc (min.)=	10
1	2	3	4	5	6
Time (min.)	**Rainfall Intensity (mm/hr)**	**Storm Runoff (m^3/s)**	**Storm Runoff Volume (m^3)**	**Released Volume (m^3)**	**Storage Volume (m^3)**
	(2)=a*((1))^b	(3)=[(2)*A*C]/360	(4)=(3)*(1)*60	(5)=(RR)*(1)*60	(6)=(4)-(5)
10	109.68	0.582	349.32	7.98	341.34
15	90.91	0.483	434.31	11.97	422.34
20	77.89	0.413	496.13	15.96	480.17
25	68.29	0.363	543.79	19.95	523.84
30	60.92	0.323	582.06	23.94	558.12
35	55.06	0.292	613.76	27.93	585.83
40	50.28	0.267	640.62	31.92	608.70
45	46.32	0.246	663.83	35.91	627.92
50	42.96	0.228	684.18	39.90	644.28
55	40.09	0.213	702.25	43.89	658.36
60	37.60	0.200	718.46	47.88	670.58
65	35.41	0.188	733.15	51.87	681.28
70	33.48	0.178	746.54	55.86	690.68
75	31.77	0.169	758.85	59.85	699.00
80	30.23	0.160	770.22	63.84	706.38
85	28.84	0.153	780.78	67.83	712.95
90	27.58	0.146	790.62	71.82	718.80
95	26.43	0.140	799.85	75.81	724.04
100	25.39	0.135	808.52	79.80	728.72
105	24.42	0.130	816.70	83.79	732.91
110	23.53	0.125	824.44	87.78	736.66
115	22.71	0.121	831.78	91.77	740.01
120	21.95	0.116	838.76	95.76	743.00
125	21.23	0.113	845.41	99.75	745.66
130	20.57	0.109	851.77	103.74	748.03
135	19.95	0.106	857.85	107.73	750.12
140	19.37	0.103	863.68	111.72	751.96
145	18.82	0.100	869.27	115.71	753.56
150	18.31	0.097	874.66	119.70	754.96
155	17.82	0.095	879.84	123.69	756.15
160	17.36	0.092	884.84	127.68	757.16
165	16.93	0.090	889.67	131.67	758.00
170	16.52	0.088	894.34	135.66	758.68
175	16.13	0.086	898.85	139.65	759.20
180	15.75	0.084	903.23	143.64	**759.59**

POST-DEVELOPMENT SITE FLOW AND STORAGE USED SUMMARY - 10-YEAR STORM

Actual Release Rate (RR)				0.0163	m^3/s
Actual Release Volume per 5-min. Interval				4.89	m^3
5-year Design Storm				**Catchment #**	**CA-1-Post**
a =	2221.00				
b =	12.00			Area (ha) =	2.94
c =	-0.91			C =	0.65
i =	a * (Tc + b)^c			Tc (min.)=	10
1	2	3	4	5	6
Time (min.)	**Rainfall Intensity (mm/hr)**	**Storm Runoff (m^3/s)**	**Storm Runoff Volume (m^3)**	**Released Volume (m^3)**	**Storage Volume (m^3)**
	(2)=a*((1))^b	(3)=[(2)*A*C]/360	(4)=(3)*(1)*60	(5)=(RR)*(1)*60	(6)=(4)-(5)
10	134.16	0.712	427.31	9.78	417.53
15	111.40	0.591	532.20	14.67	517.53
20	95.47	0.507	608.15	19.56	588.59
25	83.68	0.444	666.30	24.45	641.85
30	74.58	0.396	712.64	29.34	683.30
35	67.34	0.357	750.69	34.23	716.46
40	61.44	0.326	782.68	39.12	743.56
45	56.52	0.300	810.10	44.01	766.09
50	52.37	0.278	833.94	48.90	785.04
55	48.81	0.259	854.96	53.79	801.17
60	45.72	0.243	873.68	58.68	815.00
65	43.01	0.228	890.51	63.57	826.94
70	40.63	0.216	905.76	68.46	837.30
75	38.50	0.204	919.68	73.35	846.33
80	36.60	0.194	932.46	78.24	854.22
85	34.88	0.185	944.25	83.13	861.12
90	33.32	0.177	955.19	88.02	867.17
95	31.91	0.169	965.39	92.91	872.48
100	30.61	0.162	974.92	97.80	877.12
105	29.42	0.156	983.86	102.69	881.17
110	28.32	0.150	992.28	107.58	884.70
115	27.31	0.145	1000.24	112.47	887.77
120	26.37	0.140	1007.76	117.36	890.40
125	25.49	0.135	1014.91	122.25	892.66
130	24.68	0.131	1021.70	127.14	894.56
135	23.91	0.127	1028.18	132.03	896.15
140	23.20	0.123	1034.36	136.92	897.44
145	22.53	0.120	1040.28	141.81	898.47
150	21.89	0.116	1045.95	146.70	899.25
155	21.30	0.113	1051.39	151.59	899.80
160	20.73	0.110	1056.62	156.48	900.14
165	20.20	0.107	1061.65	161.37	**900.28**
170	19.70	0.105	1066.50	166.26	900.24
175	19.22	0.102	1071.18	171.15	900.03
180	18.76	0.100	1075.70	176.04	899.66

POST-DEVELOPMENT SITE FLOW AND STORAGE USED SUMMARY - 25-YEAR STORM

Actual Release Rate (RR)				0.0243	m^3/s
Actual Release Volume per 5-min. Interval				7.30	m^3
5-year Design Storm				**Catchment #**	**CA-1-Post**
a =	3158.00				
b =	15.00			Area (ha) =	2.94
c =	-0.93			C =	0.65
i =	a * (Tc + b)^c			Tc (min.)=	10
1	2	3	4	5	6
Time (min.)	**Rainfall Intensity (mm/hr)**	**Storm Runoff (m^3/s)**	**Storm Runoff Volume (m^3)**	**Released Volume (m^3)**	**Storage Volume (m^3)**
	(2)=a*((1))^b	(3)=[(2)*A*C]/360	(4)=(3)*(1)*60	(5)=(RR)*(1)*60	(6)=(4)-(5)
10	156.47	0.831	498.36	14.61	483.75
15	131.98	0.701	630.55	21.91	608.64
20	114.29	0.607	728.05	29.22	698.84
25	100.90	0.536	803.41	36.52	766.89
30	90.39	0.480	863.71	43.83	819.89
35	81.93	0.435	913.27	51.13	862.14
40	74.95	0.398	954.89	58.44	896.45
45	69.10	0.367	990.44	65.74	924.70
50	64.13	0.340	1021.26	73.04	948.22
55	59.84	0.318	1048.30	80.35	967.95
60	56.11	0.298	1072.27	87.65	984.61
65	52.83	0.280	1093.71	94.96	998.75
70	49.92	0.265	1113.03	102.26	1010.77
75	47.33	0.251	1130.57	109.57	1021.00
80	45.00	0.239	1146.59	116.87	1029.72
85	42.90	0.228	1161.29	124.17	1037.11
90	40.99	0.218	1174.85	131.48	1043.37
95	39.24	0.208	1187.42	138.78	1048.64
100	37.65	0.200	1199.11	146.09	1053.03
105	36.18	0.192	1210.03	153.39	1056.63
110	34.83	0.185	1220.25	160.70	1059.55
115	33.58	0.178	1229.85	168.00	1061.85
120	32.41	0.172	1238.90	175.31	1063.59
125	31.33	0.166	1247.44	182.61	1064.83
130	30.32	0.161	1255.53	189.91	1065.62
135	29.38	0.156	1263.21	197.22	**1065.99**
140	28.49	0.151	1270.50	204.52	1065.98
145	27.66	0.147	1277.45	211.83	1065.62
150	26.88	0.143	1284.08	219.13	1064.95
155	26.14	0.139	1290.41	226.44	1063.98
160	25.44	0.135	1296.48	233.74	1062.74
165	24.78	0.132	1302.29	241.05	1061.25
170	24.16	0.128	1307.87	248.35	1059.52
175	23.56	0.125	1313.24	255.65	1057.58
180	23.00	0.122	1318.40	262.96	1055.44

POST-DEVELOPMENT SITE FLOW AND STORAGE USED SUMMARY - 50-YEAR STORM

Actual Release Rate (RR)				0.0367	m^3/s
Actual Release Volume per 5-min. Interval				11.00	m^3
5-year Design Storm				**Catchment #**	**CA-1-Post**
a =	3886.00				
b =	16.00			Area (ha) =	2.94
c =	-0.95			C =	0.65
i =	a * (Tc + b)^c			Tc (min.)=	10
1	2	3	4	5	6
Time (min.)	**Rainfall Intensity (mm/hr)**	**Storm Runoff (m^3/s)**	**Storm Runoff Volume (m^3)**	**Released Volume (m^3)**	**Storage Volume (m^3)**
	(2)=a*((1))^b	(3)=[(2)*A*C]/360	(4)=(3)*(1)*60	(5)=(RR)*(1)*60	(6)=(4)-(5)
10	176.19	0.935	561.17	22.00	539.17
15	149.09	0.791	712.29	32.99	679.29
20	129.36	0.687	824.01	43.99	780.02
25	114.33	0.607	910.36	54.99	855.37
30	102.50	0.544	979.37	65.99	913.38
35	92.93	0.493	1035.96	76.99	958.97
40	85.04	0.451	1083.35	87.98	995.36
45	78.40	0.416	1123.71	98.98	1024.73
50	72.75	0.386	1158.58	109.98	1048.60
55	67.88	0.360	1189.06	120.98	1068.09
60	63.63	0.338	1215.99	131.98	1084.02
65	59.90	0.318	1239.99	142.97	1097.02
70	56.58	0.300	1261.55	153.97	1107.58
75	53.63	0.285	1281.04	164.97	1116.07
80	50.97	0.271	1298.78	175.97	1122.81
85	48.57	0.258	1315.01	186.97	1128.04
90	46.40	0.246	1329.92	197.96	1131.96
95	44.41	0.236	1343.70	208.96	1134.74
100	42.59	0.226	1356.47	219.96	1136.51
105	40.92	0.217	1368.35	230.96	1137.39
110	39.37	0.209	1379.44	241.96	**1137.48**
115	37.94	0.201	1389.83	252.95	1136.87
120	36.62	0.194	1399.58	263.95	1135.63
125	35.39	0.188	1408.77	274.95	1133.82
130	34.23	0.182	1417.43	285.95	1131.49
135	33.16	0.176	1425.63	296.95	1128.69
140	32.15	0.171	1433.40	307.94	1125.46
145	31.20	0.166	1440.78	318.94	1121.84
150	30.30	0.161	1447.81	329.94	1117.87
155	29.46	0.156	1454.50	340.94	1113.56
160	28.67	0.152	1460.89	351.94	1108.96
165	27.91	0.148	1467.00	362.93	1104.07
170	27.20	0.144	1472.85	373.93	1098.92
175	26.53	0.141	1478.46	384.93	1093.53
180	25.88	0.137	1483.84	395.93	1087.91

POST-DEVELOPMENT SITE FLOW AND STORAGE USED SUMMARY - 100-YEAR STORM

Actual Release Rate (RR)				0.0511	m^3/s
Actual Release Volume per 5-min. Interval				15.33	m^3
100-year Design Storm				**Catchment #**	**CA-1-Post**
a =	4688.00				
b =	17.00			Area (ha) =	2.94
c =	-0.962			C =	0.65
i =	a * (Tc + b)^c			Tc (min.)=	10
1	2	3	4	5	6
Time (min.)	**Rainfall Intensity (mm/hr)**	**Storm Runoff (m^3/s)**	**Storm Runoff Volume (m^3)**	**Released Volume (m^3)**	**Storage Volume (m^3)**
	(2)=a*((1))^b	(3)=[(2)*A*C]/360	(4)=(3)*(1)*60	(5)=(RR)*(1)*60	(6)=(4)-(5)
10	196.54	1.043	625.97	30.66	595.31
15	166.89	0.886	797.32	45.99	751.33
20	145.13	0.770	924.46	61.32	863.14
25	128.46	0.682	1022.87	76.65	946.22
30	115.28	0.612	1101.52	91.98	1009.54
35	104.59	0.555	1165.96	107.31	1058.65
40	95.75	0.508	1219.84	122.64	1097.20
45	88.31	0.469	1265.64	137.97	1127.67
50	81.95	0.435	1305.13	153.30	1151.83
55	76.47	0.406	1339.56	168.63	1170.93
60	71.69	0.381	1369.90	183.96	1185.94
65	67.47	0.358	1396.87	199.29	1197.58
70	63.74	0.338	1421.03	214.62	1206.41
75	60.40	0.321	1442.81	229.95	1212.86
80	57.40	0.305	1462.57	245.28	1217.29
85	54.69	0.290	1480.60	260.61	1219.99
90	52.23	0.277	1497.13	275.94	**1221.19**
95	49.98	0.265	1512.35	291.27	1221.08
100	47.93	0.254	1526.42	306.60	1219.82
105	46.03	0.244	1539.48	321.93	1217.55
110	44.29	0.235	1551.63	337.26	1214.37
115	42.67	0.227	1562.98	352.59	1210.39
120	41.17	0.219	1573.61	367.92	1205.69
125	39.78	0.211	1583.60	383.25	1200.35
130	38.47	0.204	1592.99	398.58	1194.41
135	37.25	0.198	1601.86	413.91	1187.95
140	36.11	0.192	1610.24	429.24	1181.00
145	35.04	0.186	1618.18	444.57	1173.61
150	34.03	0.181	1625.72	459.90	1165.82
155	33.08	0.176	1632.89	475.23	1157.66
160	32.18	0.171	1639.71	490.56	1149.15
165	31.33	0.166	1646.22	505.89	1140.33
170	30.52	0.162	1652.44	521.22	1131.22
175	29.75	0.158	1658.39	536.55	1121.84
180	29.03	0.154	1664.08	551.88	1112.20

ORIFICE-WEIR RATING CALCULATIONS

Active Storage Stage-Orifice Flow Relationship: **(Dry Pond Outlet-1)**

	Elevation (m)	Stage (m)	Cumulative Storage Volume (m^3)	Flow Orifice-1 (m^3/s)	Flow Weir-1 (m^3/s)	Total Flow (m^3/s)
Base	286.00	0.00	0.00	0.000	0.000	0.000
	286.10	0.10	21.19	0.003	0.000	0.003
	286.25	0.25	90.06	0.006	0.000	0.006
	286.50	0.50	225.11	0.008	0.000	0.008
	286.75	0.75	383.53	0.010	0.000	0.010
	287.00	1.00	575.66	0.012	0.000	0.012
	287.25	1.25	794.30	0.014	0.000	0.014
	287.50	1.50	1041.01	0.015	0.005	0.020
Top	287.75	1.75	1455.65	0.016	0.075	0.092

Orifice-1

Orifice Invert = 286.00 m

Orifice Characteristics:

$$Q_P = CA_O(2gh_{CL})^{0.5}$$

where,

Orifice Coefficient, C =	0.63	
Orifice Plate Diameter, D_O =	75	mm
Orifice sectional area, A_O =	0.00442	m^2
Elev at Centre of Orifice =	286.04	m
Acceleration - gravity, g =	9.81	m/s^2
Elev at Centre of Orifice =	0.14	m

Weir-1 **(Sharp Crested Rectangular)**

Weir Invert = 287.45 m

Weir Characteristics:

$$Q_P = C_w * b * (h)^{3/2}$$

where,

Weir Coefficient, C_w =	1.837	
Head on the Weir, h =	Per Stage	m
Downstream Headwater, h_s =	Nan	m
Width of the Weir, b =	0.25	m
Max. Depth of the Weir, d =	0.30	m

STORM SEWER DESIGN SHEET

STORM SEWER DESIGN SHEET

MUNICIPALITY: Town of Caledon
PROJECT NAME: Proposed Travel Stop
DESIGNER: Flora Designs Inc.
PROJECT No: 18372

RAINFALL PARAMETERS:
Event: 5 Year Rainfall
IDF Data: Town of Caledon
A = 1593.00
B = 11.00
C = -0.8789

Pipe Capacity Q : $1/n * A * R^{2/3} * S^{1/2}$
Pipe Velocity V : Q / A
Time of Flow: $(L/V_{act})/60$

Pipe Roughness ("n" Value): 0.013 Plastic; 0.013 Concrete; 0.024 CSP

LOCATION			STORMWATER ANALYSIS									STORM SEWER DESIGN										
DESCRIPTION	From MH	To MH	Contri. Area A (ha)	Runoff Coeff. C	A x C	Accum. A x C	Time of Conc. Tc (min)	Rainfall Intensity I (mm/hr)	Total Peak Flow Q_{act} (L/s)	Actual Flow Velocity V_{act} (m/s)	Length (m)	Diameter (mm)	Slope (%)	Pipe Material	"n" Value	Full Flow Capacity Q_{cap} (L/s)	Full Flow Velocity V_{cap} (m/s)	Percent Full Q_{act}/Q_{cap}	Travel Time (min)	Total Time of Flow (min)		
	CB-1	MH-1	0.18	0.79	0.14	0.14	10.0	109.68	43.36	1.02	25.00	300	0.50%	PVC	0.013	68.28	0.97	63.50%	0.4	10.4		
	CB-2	MH-1	0.09	0.81	0.07	0.07	10.0	109.68	22.23	0.87	8.82	250	0.50%	PVC	0.013	41.99	0.86	52.94%	0.2	10.2		
	Canopy-Retail	MH-1	0.02	0.90	0.02	0.02	10.0	109.68	5.49	0.76	6.61	200	1.00%	PVC	0.013	32.75	1.04	16.76%	0.1	10.1		
	MH-1	CBMH-3			0.00	0.23	10.4	107.87	69.90	1.15	30.67	375	0.50%	PVC	0.013	123.82	1.12	56.46%	0.4	10.8		
	CBMH-3	MH-4	0.31	0.62	0.19	0.43	10.8	106.13	125.48	1.33	18.76	450	0.50%	CONC	0.013	201.35	1.27	62.32%	0.2	11.0		
	Canopy-Comm	MH-4	0.02	0.90	0.02	0.02	10.0	109.68	5.49	0.76	6.16	200	1.00%	PVC	0.013	32.75	1.04	16.76%	0.1	10.1		
	DCB-3	Lead	0.23	0.86	0.20	0.20	10.0	109.68	60.31	1.16	6.98	300	0.60%	PVC	0.013	74.80	1.06	80.63%	0.1	10.1		
	MH-4	CBMH-8			0.00	0.64	11.0	105.28	187.64	1.47	57.83	525	0.50%	CONC	0.013	303.74	1.40	61.78%	0.7	11.7		
	CB-4	MH-5	0.08	0.76	0.06	0.06	10.0	109.68	18.54	0.83	11.83	250	0.50%	PVC	0.013	41.99	0.86	44.15%	0.2	10.2		
	CB-5	MH-5	0.12	0.78	0.09	0.09	10.0	109.68	28.54	0.92	18.95	250	0.50%	PVC	0.013	41.99	0.86	67.97%	0.3	10.3		
	MH-5	CBMH-6			0.00	0.15	10.3	108.32	46.49	1.03	22.67	300	0.50%	PVC	0.013	68.28	0.97	68.09%	0.4	10.7		
	Bldg-A Roof	CBMH-6	0.05	0.90	0.05	0.05	10.0	109.68	13.72	0.98	8.47	250	1.00%	PVC	0.013	59.38	1.21	23.11%	0.1	10.1		
	Bldg-B Roof	CBMH-6	0.03	0.90	0.03	0.03	10.0	109.68	8.23	0.85	4.41	250	1.00%	PVC	0.013	59.38	1.21	13.86%	0.1	10.1		
	CBMH-6	CBMH-8	0.02	0.76	0.02	0.24	10.7	106.56	71.57	1.16	65.23	375	0.50%	PVC	0.013	123.82	1.12	57.80%	0.9	11.6		
	Bldg-C Roof	MH-7	0.03	0.90	0.03	0.03	10.0	109.68	8.23	0.64	25.80	250	0.50%	PVC	0.013	41.99	0.86	19.61%	0.7	10.7		
	Bldg-D Roof	MH-7	0.03	0.90	0.03	0.03	10.0	109.68	8.23	0.64	12.88	250	0.50%	PVC	0.013	41.99	0.86	19.61%	0.3	10.3		
	DCB-6	MH-7	0.21	0.75	0.16	0.16	10.0	109.68	48.02	1.04	13.97	300	0.50%	PVC	0.013	68.28	0.97	70.33%	0.2	10.2		
	MH-7	CBMH-8			0.00	0.21	10.7	106.56	62.66	1.12	50.63	375	0.50%	PVC	0.013	123.82	1.12	50.60%	0.8	11.5		
	CBMH-8	MH-10	0.25	0.89	0.22	1.32	11.7	102.42	374.92	1.79	26.33	600	0.55%	CONC	0.013	454.84	1.61	82.43%	0.2	11.9		
	CB-7	MH-9	0.47	0.25	0.12	0.12	10.0	109.68	35.83	0.98	16.41	300	0.50%	PVC	0.013	68.28	0.97	52.47%	0.3	10.3		
	CB-8	Lead	0.16	0.80	0.13	0.13	10.0	109.68	39.03	1.00	25.00	300	0.50%	PVC	0.013	68.28	0.97	57.15%	0.4	10.4		
	CB-9	Lead	0.17	0.90	0.15	0.15	10.0	109.68	46.65	1.03	6.05	300	0.50%	PVC	0.013	68.28	0.97	68.32%	0.1	10.1		
	MH-9	MH-10			0.00	0.40	10.4	107.87	119.51	1.32	46.10	450	0.50%	CONC	0.013	201.35	1.27	59.35%	0.6	11.0		
	MH-10	Pond			0.00	1.72	11.9	101.64	484.64	2.39	10.40	600	1.00%	CONC	0.013	613.31	2.17	79.02%	0.1	12.0		
	CB-10	Pond	0.03	0.90	0.03	0.03	10.0	109.68	8.23	0.85	22.33	250	1.00%	PVC	0.013	59.38	1.21	13.86%	0.4	10.4		
	Outlet-1	CDS	100-Year Max Flow from **Outlet-1**						51.10	1.35	7.53	450	1.00%	CONC	0.013	284.75	1.79	17.95%	0.1	0.1		
	CDS	Head Wall	100-Year Max Flow from **Outlet-1**						51.10	1.35	1.40	450	1.00%	CONC	0.013	284.75	1.79	17.95%	0.0	0.0		

PERFORATED CSP PIPE CALCULATIONS (OUTLET-1)

Pipe Diameter =	1500	mm	Perforation Diameter =	50	mm
Perforated Pipe Length =	1.75	m	Perforation Spacing =	150	mm (center to center)
Pipe Circumference =	4.710	m	Perforation Area =	0.00196	m^2

# of Perforations per Row (Pipe Circumference) =	31	
# of Rows per Perforated Pipe Length =	10	
Total # of Perforations in Pipe =	310	
Total Perforated Area of Pipe =	0.608	m^2

NOTE:

The perforated portion of the outlet pipe is designed to provide sufficient flow to the downstream orifice plate even under a 75% blockage condition of the perforated pipe.
The perforated area of the outlet pipe provides a minimum opening area that is four (4) times greater than the cross-sectional area of the proposed orifice plate located downstream.

Orifice / Weir Characteristics:

	Orifice-1		Weir-1		
Size	75	mm	250	300	mm
Area	0.004	m^2	0.075		m^2

4 x Orifice/Weir Area =	0.318	m^2

Total Perforated Area of Pipe > 4 x Orifice/Weir Area …………O.K.

CDS DESIGN SUMMARY

CDS Average Annual Efficiency For TSS Removal & Total Annual Volume Treated

Area = 2.95 ha
Impervious: 62 %
CDS Model: PMSU2020_5
Flowrate: 31 l/s
IDF Data: Toronto Airport
PSD: FINE

Upstream Storage:
Storage 1003 m^3

Engineer: **Flora Designs**
Contact: Chirag Patel. P.Eng, P.M.P
Date: 23/Sep/22

Project: Highway 10 & King Street
Location: Caledon, ON
OGS ID: OGS 1

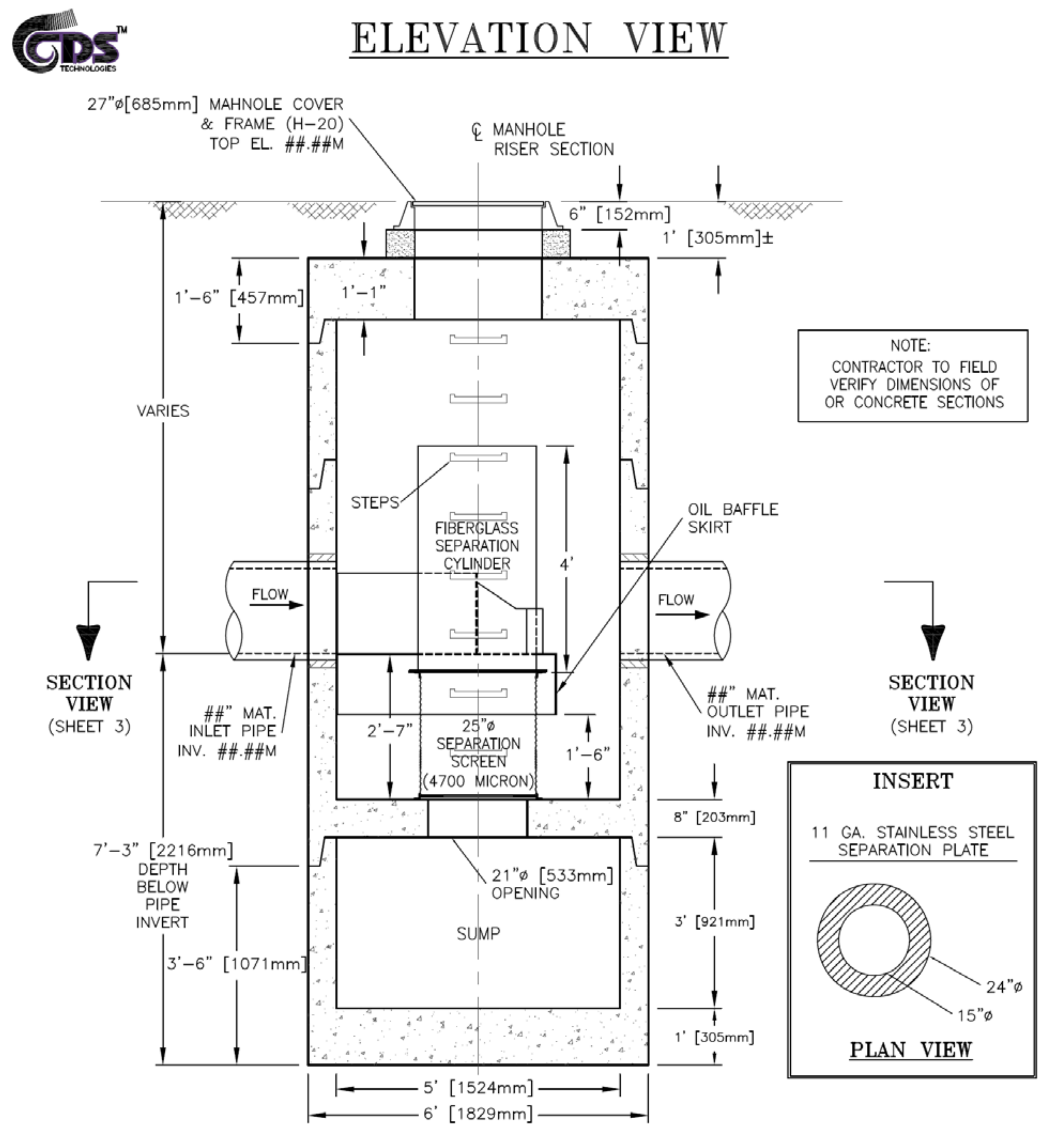
Return	Period	Peak Flow	TSS Percentage Captured	Treated Flow Volume	Total Flow Volume	Annual Exceedance Probability	System Flow	CDS Flow	By-Pass Flow	Volume Percentage Treated
month / yr	Yr	l/s	%	litres	litres	%	l/s	l/s	l/s	%
1-M	0.08	10.18	92.05	83288	83288	**100.00**	10.18	10.18	0.00	100.00
2-M	0.17	15.14	88.61	125498	125498	**99.75**	15.14	15.14	0.00	100.00
3-M	0.25	19.06	85.82	160123	160123	**98.17**	19.06	19.06	0.00	100.00
4-M	0.33	22.45	83.36	191153	191153	**95.04**	22.45	22.45	0.00	100.00
5-M	0.42	24.92	81.51	214687	214687	**90.91**	24.92	24.92	0.00	100.00
6-M	0.50	27.39	79.67	238221	238221	**86.47**	27.39	27.39	0.00	100.00
7-M	0.58	29.10	78.26	254694	255355	**82.01**	29.10	29.10	0.00	99.77
8-M	0.67	30.80	76.84	271168	272489	**77.67**	30.80	30.80	0.00	99.54
9-M	0.75	32.51	75.43	287641	289624	**73.64**	32.51	31.15	1.36	99.32
10-M	0.83	33.74	74.03	297000	302710	**69.90**	33.74	31.15	2.59	98.21
11-M	0.92	34.98	72.62	306359	315797	**66.40**	34.98	31.15	3.83	97.10
1-Yr	1	36.21	71.22	315717	328884	**63.21**	36.21	31.15	5.06	96.00
2-Yr	2	45.00	60.17	362989	430466	**39.35**	45.00	31.15	13.85	84.32
5-Yr	5	47.00	57.58	369717	455512	**18.13**	47.00	31.15	15.85	81.17
10-Yr	10	55.00	47.33	378545	563130	**9.52**	55.00	31.15	23.85	67.22
25-Yr	25	68.00	36.68	380930	730728	**3.92**	68.00	31.15	36.85	52.13
50-Yr	50	81.00	31.97	381972	840530	**1.98**	81.00	31.15	49.85	45.44
100-Yr	100	103.00	27.39	382701	982719	**1.00**	103.00	31.15	71.85	38.94

Average Annual TSS Removal Efficiency [%]: **80.5** Ave. Ann. T. Volume [%]: **98.4**

Notes:
1) CDS Efficiency based on testing conducted at the University of Central Florida
2) CDS design flowrate and scaling based on standard manufacturer model & product specificiations

ECHELON ENVIRONMENTAL

CDS MODEL 2020 - TYPICAL DRAWING (NTS)



CDS MODEL PMSU20_20m, 31 L/s TREATMENT CAPACITY
STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	NE CORNER OF KING STREET & HURONTARIO STREET TOWN OF CALEDON, ONTARIO	JOB# XX-##-###	SCALE N.T.S.
		DATE ##/##/##	SHEET
		DRAWN INITIALS	2
		APPROV.	

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848-9955

Appendix "C" Water Supply System

- Post-development Population Density Calculations
- Post-development Water Supply Requirement Calculations
- Post-development Fire Flow Requirement Calculations
- Region of Peel Demand Table
- Hydrant Flow Test Report
- Fire Protection Calculations

POST-DEVELOPMENT POPULATION DENSITY CALCULATIONS

(According to the Sanitary Sewer Design Criteria, Region of Peel)

Development Type	**Equivalent Population Density** (Persons/ha)	**Area of Site** (ha)	**Population** (Persons)
Commercial	50	3.21	161

POST-DEVELOPMENT WATER SUPPLY REQUIREMENT CALCULATIONS

Typical Water Demand Criteria (According to the Watermain Design Criteria, Region of Peel)

Population Type	Unit	Average Consumption Rate	Max Day Factor	Peak Hour Factor
ICI	L / Employee . D	300	1.4	3.0

Post-development Water Supply Requirements

Development Type	Commercial
Eq. Population Density	161

No.	Demand Type	Demand	Units
1	Average day flow	0.56	L/Sec
2	Maximum day flow	0.78	L/Sec
3	Peak hour flow	1.68	L/Sec
4	Fire flow	66.67	L/Sec
Analysis			
5	Maximum day plus fire flow	67.45	L/Sec
6	Peak hour flow	1.68	L/Sec
7	**Maximum demand flow**	**67.45**	L/Sec

POST-DEVELOPMENT FIRE FLOW REQUIREMENT CALCULATIONS

The Fire Underwriters Survey (2020) requires that a minimum water supply source "F" be provided at 140 kPa.

1 Estimate of Required Fire Flow

$$F = 220 * C * (A)^{0.5}$$

Where => F = Required Fire Flow (L/min)
C = Coefficient related to construction
A = Total Area (m^2)

Determining "C"

C =	0.8	Type II Non-combustible Construction

Determining "A"

A =	Total floor area of all storeys in the building	For non-combustible construction

Largest Floor Area =	548.50	m^2	Building A
1st adjoining Floor Area =	0.00	m^2	
2nd adjoining Floor Area =	0.00	m^2	
A =	548.50	m^2	

So that,

F =	**4,000.00**	**L/min.**	(Rounded per FUS Guide Page # 20)

2 Addition / Reduction for Occupancy and Contents Adjustment Factor

No Charge	0%	Combustible Contents

So that,

F =	**4,000.00**	**L/min.**

3 Reduction for sprinkler system

Reduced by	0%	No sprinkler system
Reduced by	0%	No sprinkler system
Reduced by	0%	No sprinkler system
Total	**0%**	Shall not exceed 50%

4 Addition for structures exposed within distance of fire area

Side	Distance (m)	Length (m)	Height (m)	Length-Height Factor	% Addition
North	None	N.A.	N.A.	0	0%
South	14.51	11.56	6.20	71.67	6%
East	0.00	N.A.	N.A.	0	0%
West	0.00	N.A.	N.A.	0	0%
Total (Shall not exceed 75%)					**6%**

Net Reduction / Addition for step 3 & 4

Increased by	6%

So that,

F =	**4000.00**	**L/min.**	(Rounded per FUS Guide Page # 20)

N.B. - As per FUS requirements fire flow shall not exceed **45000 L/min** nor be less than **2000 L/min**.

Therefore, the fire flow required is =	**4000.00**	L/min.
	66.67	L/sec
	1056.69	USGPM
	880.57	Imp. GPM

REGION OF PEEL DEMAND TABLE

Project : Proposed Travel Stop
Project Address : NW Corner of Hurontario Street & King Street
SPA No. : 2019-0065

WATER CONNECTION

Connection Point :	Approximate 38.0m west of centerline of Hurontario Street from the existing 300mm dia watermain located within road allowance of King Street		
Pressure zone of connection point			
Total equivalent population to be serviced 1)			161
Total lands to be serviced			3.21 ha
Hydrant Flow Test:	On 300 mm Ø WM within ROW of Hurontario Street		
Hydrant flow test location	1st Hydrant on King Street at West side of Hurontario Street Intersection		
Hydrant residual test location	2nd Hydrant on King Street at West side of Hurontario Street Intersection		
		Pitot Pressure (kPa)	Time
Minimum water pressure		69	10:00 am
Maximum water pressure		173	10:00 am

WATER DEMANDS

No.	Demand Type	Demand	Units
1	Average day flow	0.56	L/Sec
2	Maximum day flow	0.78	L/Sec
3	Peak hour flow	1.68	L/Sec
4	Fire flow 2)	66.67	L/Sec
Analysis			
5	Maximum day plus fire flow	67.45	L/Sec

WASTEWATER CONNECTION

Connection Point 3)**:**	Private on-site sub-surface disposal facility		
Total equivalent population to be serviced 1)			161
Total lands to be serviced			3.21 ha
6	Wastewater sewer effluent	N.A.	L/Sec

1) The calculations should be based on the development estimated population (employment or residential).
2) Please reference the Fire Underwriters Survey Document
3) Please specify the connection point ID
4) Please specify the connection point (wastewater line of manhole ID)
Also, the ``total equivalent population to be serviced`` and the ``total lands to be serviced should reference the connection point (The FSR should contain one copy of Site Servicing Plan)

HYDRANT FLOW TEST REPORT

CORTESE DESIGN INC.

PHONE: 416–806–5800
CORTESE@CORTESEDESIGN.CA
SPECIALIZING IN SPRINKLER DESIGN

1995 WESTON ROAD
P.O. BOX #79741
TORONTO, ONTARIO M9N 3W9

HYDRANT FLOW TEST REPORT

LOCATION: KING STREET AND HURONTARIO STREET
CALEDON, ONTARIO

DATE: JUNE 22, 2022

TEST DONE BY: FRANK CORTESE

TIME: 10:00 AM

REPRESENTATIVE OF: CORTESE DESIGN INC.

WITNESS: REGION OF PEEL

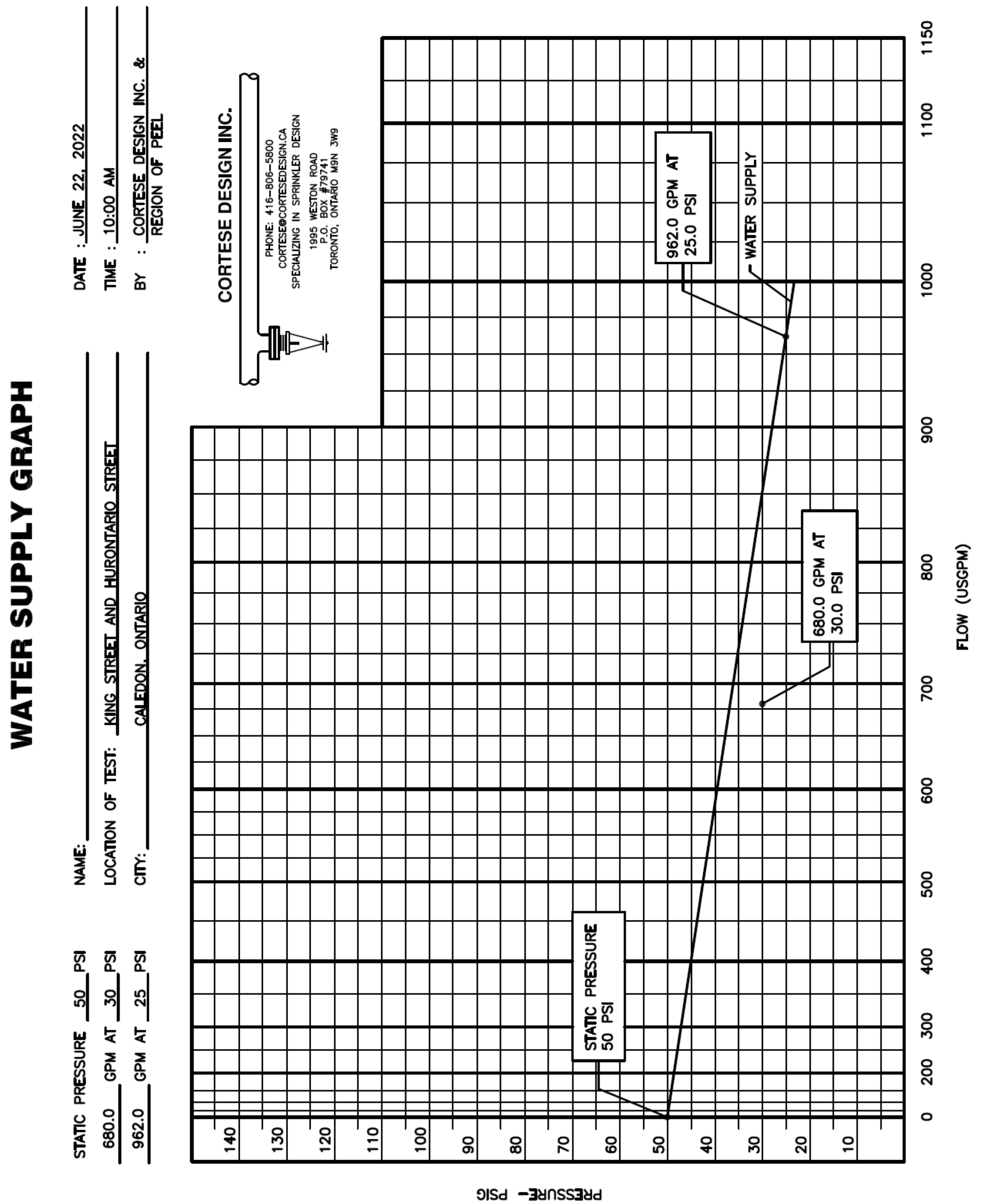
FLOW HYDRANT:

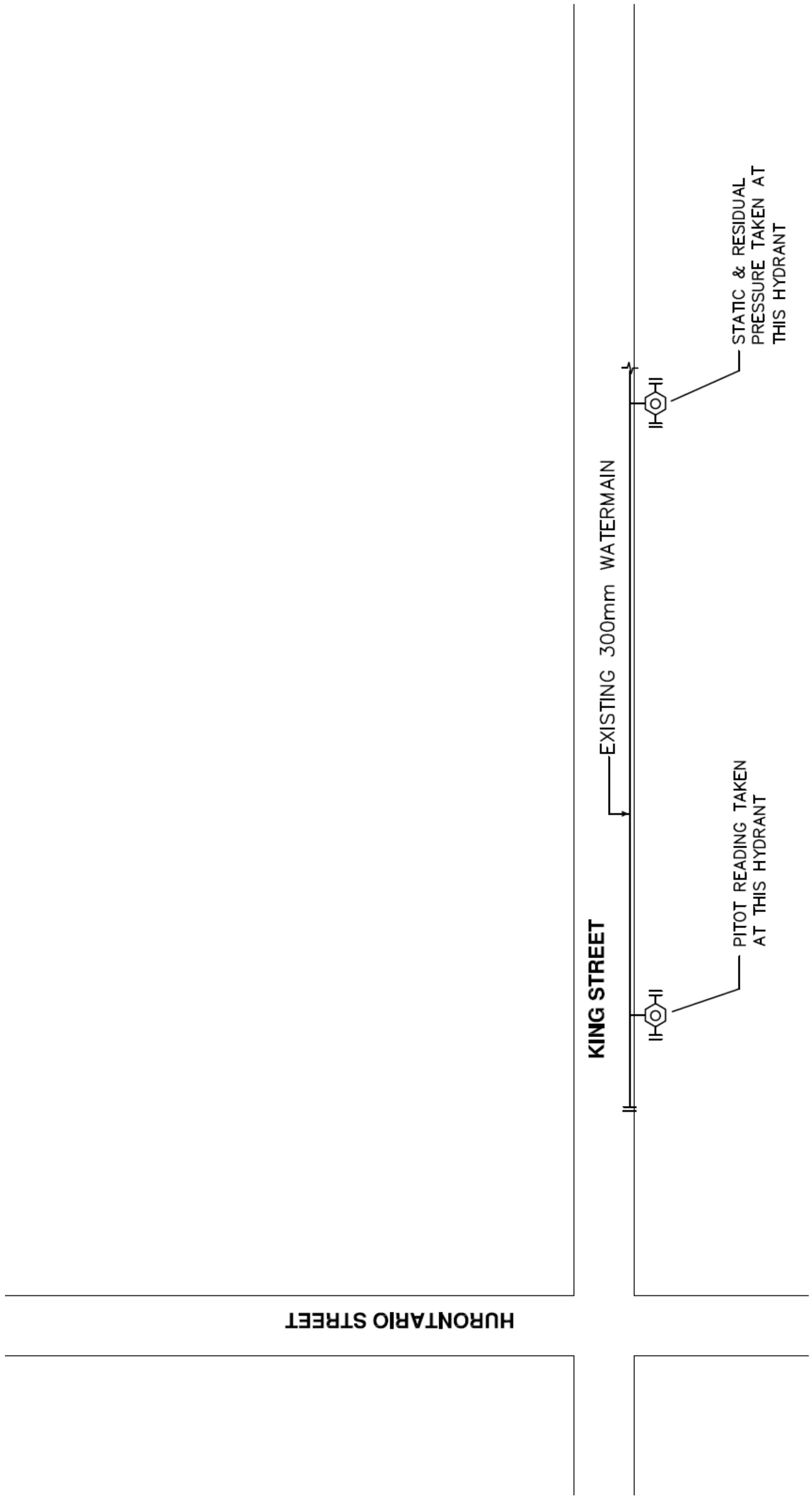
NOZZLE SIZE: 2 1/2"

POLLARD WATER ALUMINUM DECHLORINATING DIFFUSER MODEL #LPD–250A: 0.814

STATIC PRESSURE 50 PSI

NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S. GPM)	RESIDUAL PRESSURE
1 X 2 1/2"	20	680.0	30
1 X 2 1/2"	10	481.0	
1 X 2 1/2"	10	481.0	
		962.0	25


WATER SUPPLY GRAPH
STATIC PRESSURE 50 PSI
680.0 GPM AT 30 PSI
962.0 GPM AT 25 PSI
NAME:
LOCATION OF TEST: KING STREET AND HURONTARIO STREET
CITY: CALEDON, ONTARIO
DATE : JUNE 22, 2022
TIME : 10:00 AM
BY : CORTESE DESIGN INC. & REGION OF PEEL
CORTESE DESIGN INC.
PHONE: 416-806-5800
CORTESE@CORTESEDESIGN.CA
SPECIALIZING IN SPRINKLER DESIGN
1995 WESTON ROAD
P.O. BOX #79741
TORONTO, ONTARIO M9N 3W9
STATIC PRESSURE 50 PSI
680.0 GPM AT 30.0 PSI
962.0 GPM AT 25.0 PSI
WATER SUPPLY
PRESSURE– PSIG
FLOW (USGPM)
0 200 300 400 500 600 700 800 900 1000 1100 1150
10 20 30 40 50 60 70 80 90 100 110 120 130 140



FLOW TEST KEY PLAN KING STREET AND HURONTARIO STREET

N.T.S.

FIRE PROTECTION CALCULATIONS

(According to the National Fire Protection Association (NFPA) Guidelines)

MUNICIPALITY:	Town of Caledon
PROJECT NAME:	Proposed Travel Stop
PROJECT No:	18372
FLOW TEST BY:	Cortese Design Inc.
Test Location (FLOW)	1st Hydrant on King Street at West side of Hurontario Street Intersection
Test Location (RESIDUAL)	2nd Hydrant on King Street at West side of Hurontario Street Intersection
Mainline Pipe Size	300 mm Ø

Observed Flow From Hydrant Test $Q_f = 29.83 * c * (d^2)*(p^{1/2})$								**Projected Fire Flow** $Q_r = Q_f*((P_s-P_{rd})/(P_s-P_{ra}))^{0.54}$		
Test #	**# of Nozzle/ Orifice**	**Nozzle/ Orifice Dia. d** (in)	**Discharge Coeff. (c)**	**Static Pressure (P_s)** (psi)	**Pitot Pressure (P_p)** (psi)	**Actual Residual Pressure (P_{ra})** (psi)	**Q_f** (USGPM)	**Desired Residual Pressure (P_{rd})** (psi)	**Q_r** (USGPM)	**Q_r** (L/sec)
1	1	2.5	0.814	50	20	30	679	20	846	54
2	1	2.5	0.814	50	10	25	480	20	530	34
	1	2.5	0.814	50	10	25	480	20	530	34
							960	**20**	**1060**	**68**

Appendix "D" Statement of Limiting Conditions and Assumptions

Statement of Limiting Conditions and Assumptions

1. This Report/Study (the "Work") has been prepared at the request of, and for the exclusive use of, the Owner, and its affiliates (the "Intended Users"). No one other then the intended users have the right to use and rely on the work without first obtaining the written authorization of FLORA DESIGNS INC. and its Owners. All concerned governing authorities and reviewing agencies are permitted to use all engineering design documents prepared for this project.
2. The comments, recommendations and material in this report reflect Flora Designs best judgement in light of the information available to it at the time of preparation of this report. It is not qualified to and is not providing legal or planning advice in this work.
3. Flora Designs expressly excludes liability to any third party except the Intended Users for any use of, and/or reliance upon, the work.
4. Flora Designs notes that the following assumptions were made in completing the work
   a) The land use description(s) supplied to Flora Designs are correct
   b) The surveys and other data supplied to Flora Designs by the Owner are accurate
   c) Market timing, approval delivery and secondary information is within the control of parties other then Flora Designs
   d) There are no encroachments, leases, covenants, binding agreements, restrictions, pledges, charges, liens or special assessments outstanding, or encumbrances, which would significantly affect the use or servicing

   Investigations have not carried out to verify these assumptions. Flora Designs deems the sources of data and statistical information contained herein to be reliable, but we extend no guarantee of accuracy in these respects.
5. All the plans, photographs, and sketches prepared and presented in this report/study are included solely to aid the visualizing the location of the property, the boundaries of the site, and the relative position of the improvements on the said lands are based on information provided by Owner
6. Flora Designs accepts no responsibility for legal interpretations, questions of survey, opinion of title, hidden or inconspicuous conditions of the property, toxic wastes or contaminated materials, soil or sub soil conditions, environmental, engineering or other factual and technical matters disclosed by the owner, the clients, or any public agency, which by their nature, may change the outcome of the work.
7. In the preparation of this report, Flora Designs have made investigations from secondary sources as documented in the work, but did not checked compliance with by-laws, codes, agency and government regulations, etc., unless specifically noted in the work.
8. The value of proposed improvements should apply only with regard to the purpose and function of the work, as outlined in the body of this work. Any cost estimated set out in the work based on construction averages and subject to change.
9. Neither possession of Work, nor a copy of it, carries the right of publication. All copyright in the work reserved to Flora Designs and considered confidential by Flora Designs. The Work shall not be disclosed, reproduced, quoted from, or referred to, in whole or in part, or published in any manner, without the express written consent of Flora Designs and the Owner.
10. The work is only valid if it bears the Professional Engineer's seal and original signature of author, and if considered in its entity. Responsibility for unauthorised alteration to the Work is denied.

Appendix "E" Environmental Technology Verification (ETV) for CDS Hydrodynamic Separator & CDS Operation and Maintenance Manual

◆ 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_VR2023-03-31_CDS

In accordance with

ISO 14034:2016

Environmental Management —
Environmental Technology Verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

March 31, 2023
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.

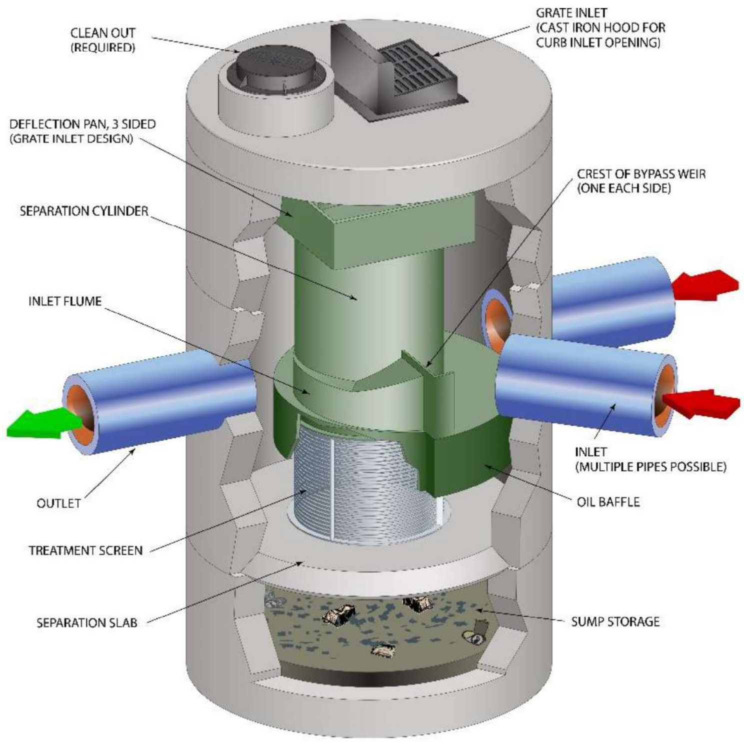


Figure 1. Graphic of typical inline CDS unit and core components.

When stormwater runoff enters the CDS unit, treatment flows are routed through one of two inlet flumes into the separation chamber. During high intensity rain events the water surface elevation in the system rises and once flows exceed the capacity of the inlet flumes a portion of flow begins to overtop the weirs at the top of the flumes which serve as an internal bypass. Flows routed over the internal bypass are then conveyed to the outlet. 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 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.

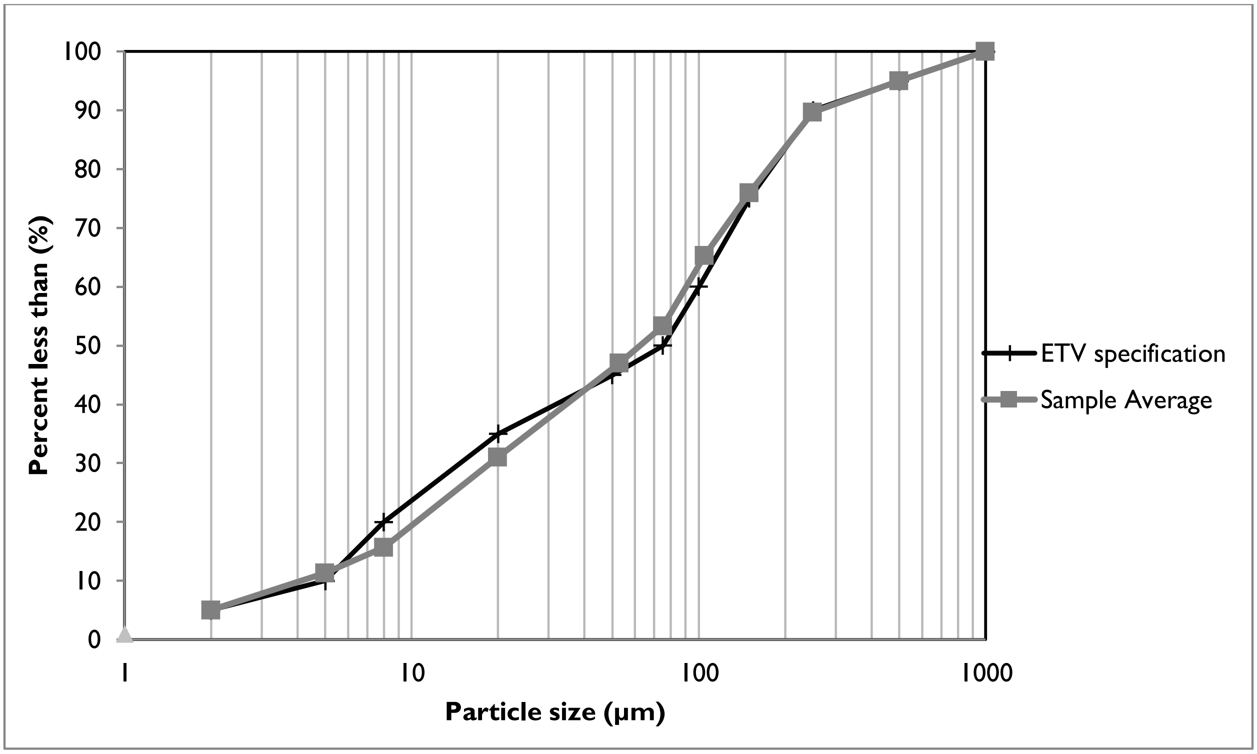


Figure 2. The three sample average particle size distribution (PSD) of the test sediment used for the capture and scour test compared to the specified PSD.

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.

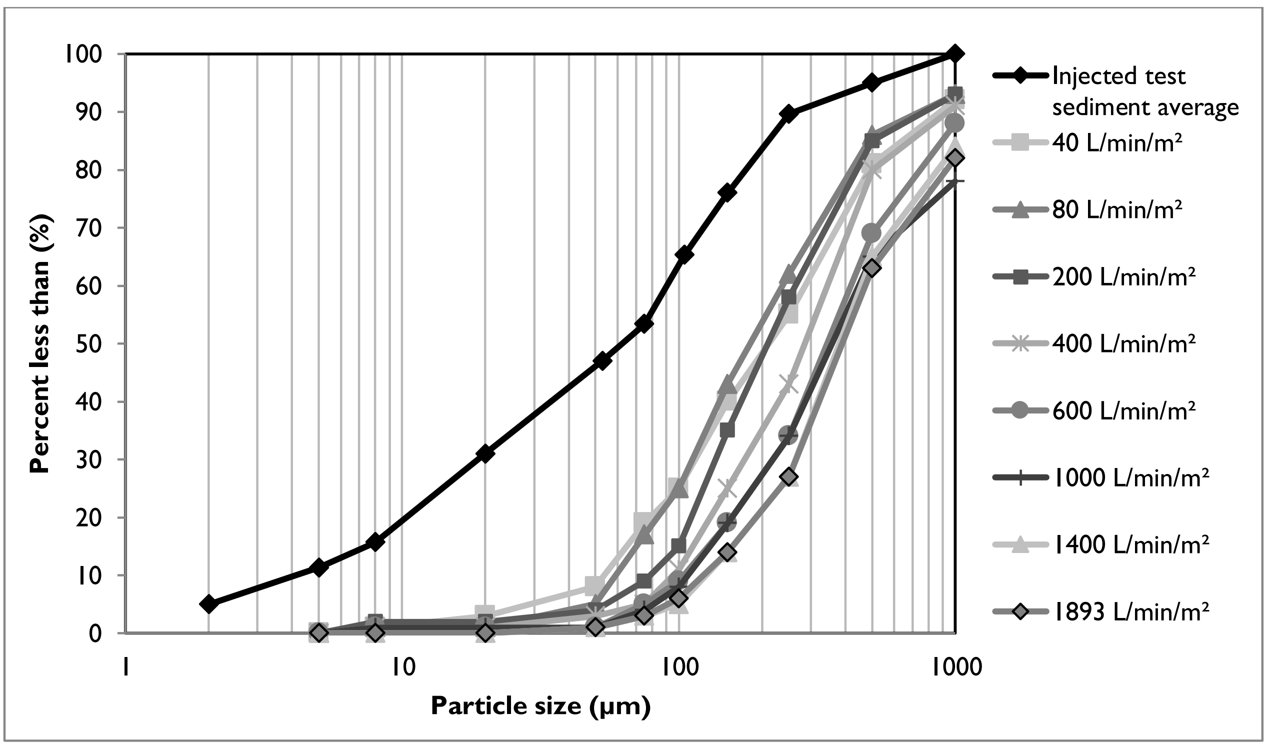


Figure 3. Particle size distribution of retained sediment in relation to the injected test sediment average.

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 1.17m²) 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/m²) 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/m²)	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/m², 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/m². 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/m² 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/m² 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

STORMWATER TREATMENT UNIT OPERATION & MAINTENANCE MANUAL

Proposed Travel Stop

14027 Hurontario Street,
Town of Caledon, ON

ECHELON ENVIRONMENTAL

505 Hood Road, Unit 26
Markham, ON L3R 5V6
Tel: (905) 948-0000 Fax: (905) 948-0577
Email: info@echelonenvironmental.ca
Website: www.echelonenvironmental.ca

OPERATIONS AND MAINTENANCE GUIDELINES
FOR CDS® UNIT MODEL PMSU 2025_5
(Continuous Deflective Separation Unit)

DAVISVILLE PUBLIC SCHOOL, TORONTO

1. INTRODUCTION

The CDS® unit is an important and effective component of your stormwater management program and proper operation and maintenance of the unit are essential to demonstrate your compliance with local, provincial and federal water pollution control requirements.

Your CDS® system utilizes patented "continuous deflective separation" (CDS®) technology to separate and trap debris, sediment and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material that is larger than the screen aperture.

2. OPERATION OVERVIEW

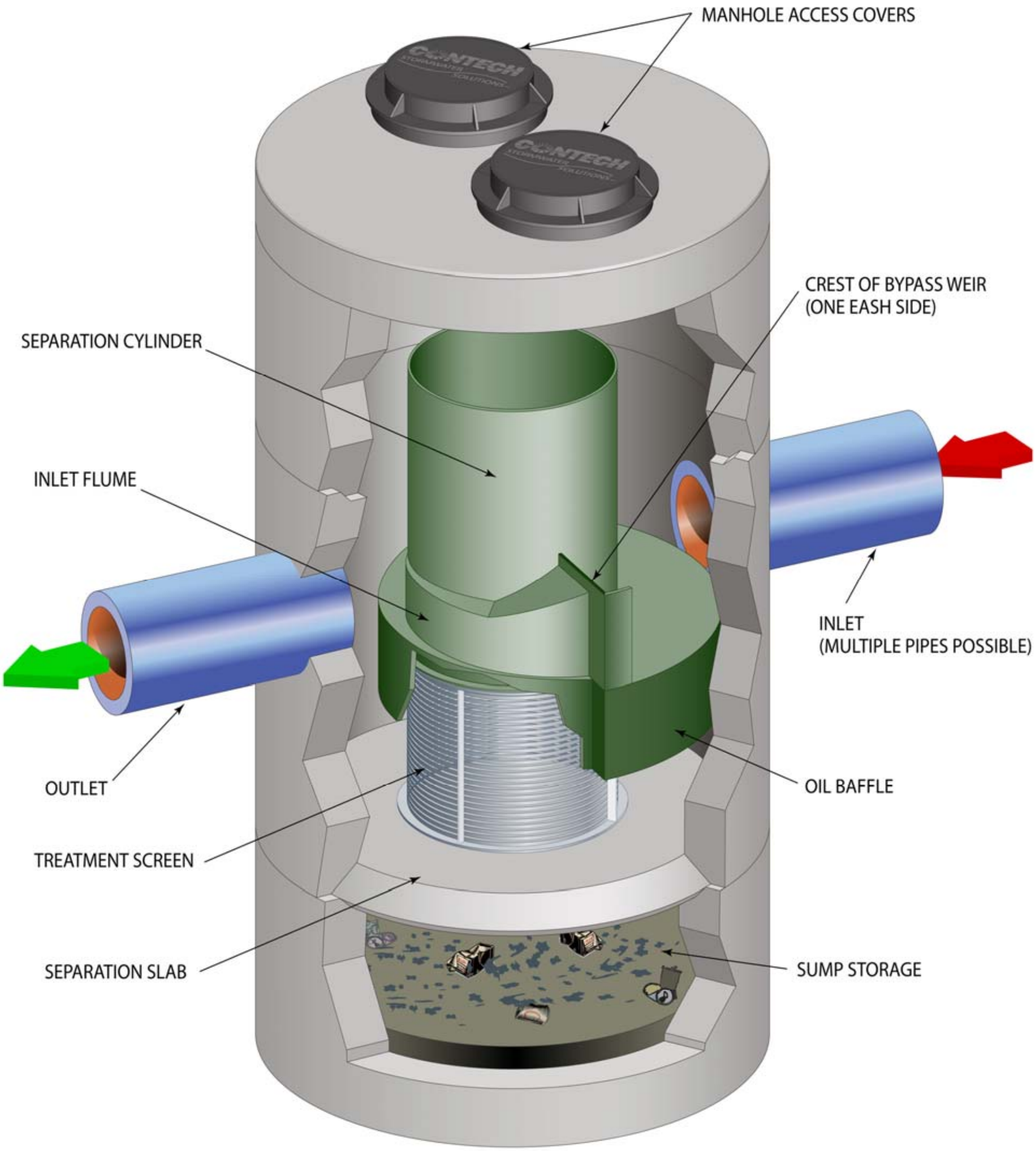
The CDS® unit is a non-mechanical hydraulically driven technology that will function any time there is flow in the storm drainage system. Stormwater enters the CDS® System (Figure 1) where the bypass weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated. Flows in excess of the treatment capacity spill over the bypass weir and exit the system through the outlet pipe.

Stormwater entering the CDS® System circulates in a torriodial flow path. This flow pattern helps to maintain the non-blocking attributes of the treatment screen as well as creating a hydraulic condition at the screen surface that effects pollutant separation. Treated stormwater passes through the screen into the outer volute area where it moves toward the outlet pipe and out of the system.

The separation chamber is shrouded by an integral oil baffle that traps free oil and grease that floats to the water surface during treatment.

During normal operation captured grit will fall by gravity into the lower storage sump located beneath the treatment chamber. Floatables will be captured at the water surface inside the separation chamber and oil, if present, will be located at the water surface underneath the integral oil baffle.

Figure One: In-Line CDS® Systems



3. INSPECTION OVERVIEW

The frequency of cleaning for the CDS® unit will depend upon the generation of trash and debris and sediments in each application. Cleanout and preventive maintenance schedules will be determined based on operating experience unless precise pollutant loadings have been determined. The unit should be periodically inspected to determine the amount of accumulated pollutants and to ensure that the cleanout frequency is adequate to handle the predicted pollutant load being processed by the CDS® unit. The recommended cleanout of solids within the CDS® unit's sump should occur at 85% of the sump capacity. Note that the sump may be completely full with no impact on the CDS® unit's performance.

Access to the CDS® unit is typically achieved through two manhole access covers – one allows inspection and cleanout of the separation chamber (screen/cylinder) & sump and another allows inspection and cleanout of sediment captured and retained behind the screen. The PSW & PSWC off-line models have an additional access cover over the weir of the diversion vault. Inspections of the internal components and cleanout maintenance can, in most cases, be accomplished from the ground surface without requiring entry into the unit.

IMPORTANT - CONFINED SPACE

The CDS® unit is a confined space environment and only properly trained personnel possessing the necessary safety equipment should enter the unit to perform maintenance and/or inspection. Personnel inspecting the system or performing maintenance must have proper training certification in Fall Protection and Confined Space entry as a minimum.

4. MAINTENANCE

Contech Engineered Solutions recommends the following:

NEW INSTALLATIONS – Check the condition of the unit after every runoff event for the first 30 days. The visual inspection should ascertain that the unit is functioning properly (no blockages or obstructions to inlet and/or separation screen), and should measure the amount of solid materials that have accumulated in the sump, the amount of fine sediment accumulated behind the screen, and determining the amount of floating trash and debris in the separation chamber. This can be done with a calibrated "dip stick" so that the depth of deposition can be tracked. Refer to the "Inspection Schematic" **(Appendix C)** for allowable deposition depths and critical distances. Schedules for inspections and cleanout should be based on storm events and pollutant accumulation.

ONGOING OPERATION – Once the site is established, the inspection frequency should be based on historical pollutant loading. In general, CDS sumps are sized for a cleanout frequency in the order of 12 to 24 months. If floatables accumulate more rapidly than the settleable solids, the floatables should be removed using a vactor truck or dip net before the layer thickness exceeds one to two feet.

Cleanout of the CDS® unit at the end of a rainfall season is recommended because of the nature of pollutants collected and the potential for odor generation from the decomposition of material collected and retained. This end of season cleanout will assist in preventing the discharge of pore water from the CDS® unit during summer months.

It is recommended to pump down the CDS® unit and remove pollutants at least one time per year. (This may be extended for fully developed sites that generate small pollutant loadings.) During cleanout, the internal components normally below the water line should be inspected. If any parts appear to be damage please contact Contech Engineered Solutions or Echelon Environmental to make arrangements to have the damaged items repaired or replaced:

CONTECH ENGINEERED SOLUTIONS
200 Enterprise Drive
Scarborough, ME 04074
Phone: 877-907-8676
www.conteches.com

ECHELON ENVIRONMENTAL
505 Hood Road, Unit #26
Markham, ON L3R 5V6
Phone: 905-948-0000
Email: info@echelonenvironmental.ca

CLEANOUT AND DISPOSAL

A vactor truck is recommended for cleanout of the CDS® unit and can be easily accomplished in less than 30-40 minutes for most installations. Cleanout should be conducted by a licensed waste management company. Disposal of material from the CDS® unit should be in accordance with the local municipality's requirements. During cleanout the vactor truck will evacuate all stormwater and pollutants from the CDS® unit. (Local waste receiving stations may require the solids to have minimal water content. If decanting of stormwater from the vactor truck is required then the local permitting and regulatory authority should be contacted to determine if this is permissible.) Vactor trucks are typically equipped with a power wash system that may be used to wash the screen if required.

If oil is present in the CDS® unit it should be removed separately by a licensed liquid waste hauler. The CDS® unit should be cleaned immediately if a hydrocarbon spill has occurred. CDS® Technologies only recommends the addition of sorbents to the separation chamber if there are specific land use activities in the catchment watershed that could produce exceptionally large concentrations of hydrocarbons. Alternatively, the local regulator may allow the use of sorbents to capture and remove hydrocarbons from the CDS® system. Disposal of sorbents may be less costly and disposing of an oily-water mixture creating by vacuum removal.

5. OPTIONAL FEATURES

USE OF SORBENTS FOR ENHANCED OIL CAPTURE

It should be emphasized that the addition of sorbents is not a requirement for CDS® units to effectively capture oil and grease from storm water runoff. The CDS® unit separation chamber effectively captures free oil and grease and CDS® units are also equipped with a conventional oil baffle for the capture of gross quantities. However, the addition of sorbents is a unique capability of CDS® units that enables enhanced oil and grease capture efficiencies beyond that obtainable by conventional oil baffle systems as well as permanent retention of captured oil and grease in solid form that prevents emulsification and conveyance.

Under normal operations, CDS® units will provide effluent concentrations of oil and grease that are less than 15 parts per million (ppm) for all dry weather spills where the volume is less than or equal to the spill capture volume of the CDS® unit. During wet weather flows, the oil baffle system can be expected to remove between 40 and 70% of the free oil and grease from the storm water runoff.

Contech Engineered Solutions only recommends the addition of sorbents to the separation chamber if there are specific land use activities in the catchment watershed that could produce exceptionally large concentrations of oil and grease in the runoff, or for large amounts that may be subjected to extended periods of inattention. If site evaluations merit an increased control of free oil and grease then oil sorbents can be added to the CDS® unit to thoroughly address these particular pollutants of concern.

Recommended Oil Sorbents - Rubberizer® Particulate 8-4 mesh or OARS™ Particulate for Filtration, HPT4100, or equal, available from Haz-Mat Response Technologies, Inc. 4626 Santa Fe Street, San Diego, CA 92109 (800) 542-3036. OARS™ is supplied by AbTech Industries, 4110 N. Scottsdale Road, Suite 235, Scottsdale, AZ 85251 (800) 545-8999.

The amount of sorbent to be added to the CDS® separation chamber can be determined if sufficient information is known about the concentration of oil and grease in the runoff. Frequently the actual concentrations of oil and grease are too variable and the amount to be added and frequency of cleaning will be determined by periodic observation of the sorbent. As an initial application, CDS® recommends that approximately 4 to 8 pounds of sorbent material be added to the separation chamber of the CDS® units per acre of parking lot or road surface per year. Typically this amount of sorbent results in a ½ inch to one (1") inch depth of sorbent material on the liquid surface of the separation chamber. The oil and grease loading of the sorbent material should be observed after major storm events. Oil Sorbent material may also be furnished in pillow or boom configurations.

The sorbent material should be replaced when it is fully discolored by skimming the sorbent from the surface. The sorbent may require disposal as a special or hazardous waste, but will depend on local and state regulatory requirements.

VECTOR CONTROL

Most CDS® units do not readily facilitate vector infestation. However, for CDS® units that may experience extended periods of non-operation (stagnant flow conditions for more than approximately one week) there may be the potential for vector infestation. In the event that these conditions exist, the CDS® unit may be designed to minimize potential vector habitation through the use of physical barriers (such as seals, plugs and/or netting) to seal out potential vectors. The CDS® unit may also be configured to allow drain-down under favorable soil conditions where infiltration of storm water runoff is permissible. For standard CDS® units that show evidence of mosquito infestation, the application of larvicide is one control strategy that is recommended. Typical larvicide applications are as follows:

> SOLID B.t.i. LARVICIDE: ½ to 1 briquet (typically treats 50-100 sq. ft.) one time per month (30-days) or as directed by manufacturer.
>
> SOLID METHOPRENE LARVICIDE (not recommended for some locations): ½ to 1 briquet (typically treats 50-100 sq. ft.) one time per month (30-days) to once every 4-½ to 5-months (150-days) or as directed by manufacturer.

6. RECORDS OF OPERATION AND MAINTENANCE

Contech Engineered Solutions recommends that the owner maintain annual records of the operation and maintenance of the CDS® unit to document the effective maintenance of this important component of your storm water management program. The attached **Annual Record of Operations and Maintenance** form (see **Appendix A**) is suggested and should be retained for a minimum period of three years.

APPENDIX A

CDS® UNIT RECORD OF

OPERATIONS & MAINTENANCE

ECHELON ENVIRONMENTAL

CDS

CONTECH® ENGINEERED SOLUTIONS

CDS® UNIT RECORD OF OPERATION & MAINTENANCE

OWNER ____________________

ADDRESS ____________________

OWNER REPRESENTATIVE ____________ **PHONE** ____________

CDS® INSTALLATION:

MODEL DESIGNATION ____________ DATE ____________
SITE LOCATION ____________________
DEPTH FROM COVER TO BOTTOM OF SUMP (SUMP INVERT) ____________
VOLUME OF SUMP ________ CUBIC METERS

INSPECTIONS:

DATE/INSPECTOR	SCREEN/INLET INTEGRITY	FLOATABLES DEPTH	DEPTH TO SEDIMENT (meters)	SEDIMENT VOLUME* (cubic meters)	SORBENT DISCOLORATION

***Calculate Sediment Volume = (Depth to Sump Invert – Depth to Sediment)*(Volume/meter)**

OBSERVATIONS OF FUNCTION: ____________________

____

____

____

CLEANOUT:

DATE	VOLUME FLOATABLES	VOLUME SEDIMENTS	METHOD OF DISPOSAL OF FLOATABLES, SEDIMENTS, DECANT AND SORBENTS

SCREEN MAINTENANCE:
Note is Power Washing Performed: ____________________

CERTIFICATION: ____________ **TITLE:** ____________

DATE: ____________

APPENDIX B

CDS® UNIT

INSPECTION CHECKLIST

Date: ______________________

INSPECTION CHECKLIST

1. During initial rainfall season, inspect and check condition of unit once every 30 days (as needed, thereafter) ☐
2. Ascertain that unit is functioning properly (no blockages or obstructions to inlet and/or separation screen) ☐
3. Measure amount of solid materials that have accumulated in sump ☐
4. Measure amount of fine sediment accumulated behind screen ☐
5. Measure amount of floating trash and debris in separation chamber ☐

MAINTENANCE CHECKLIST

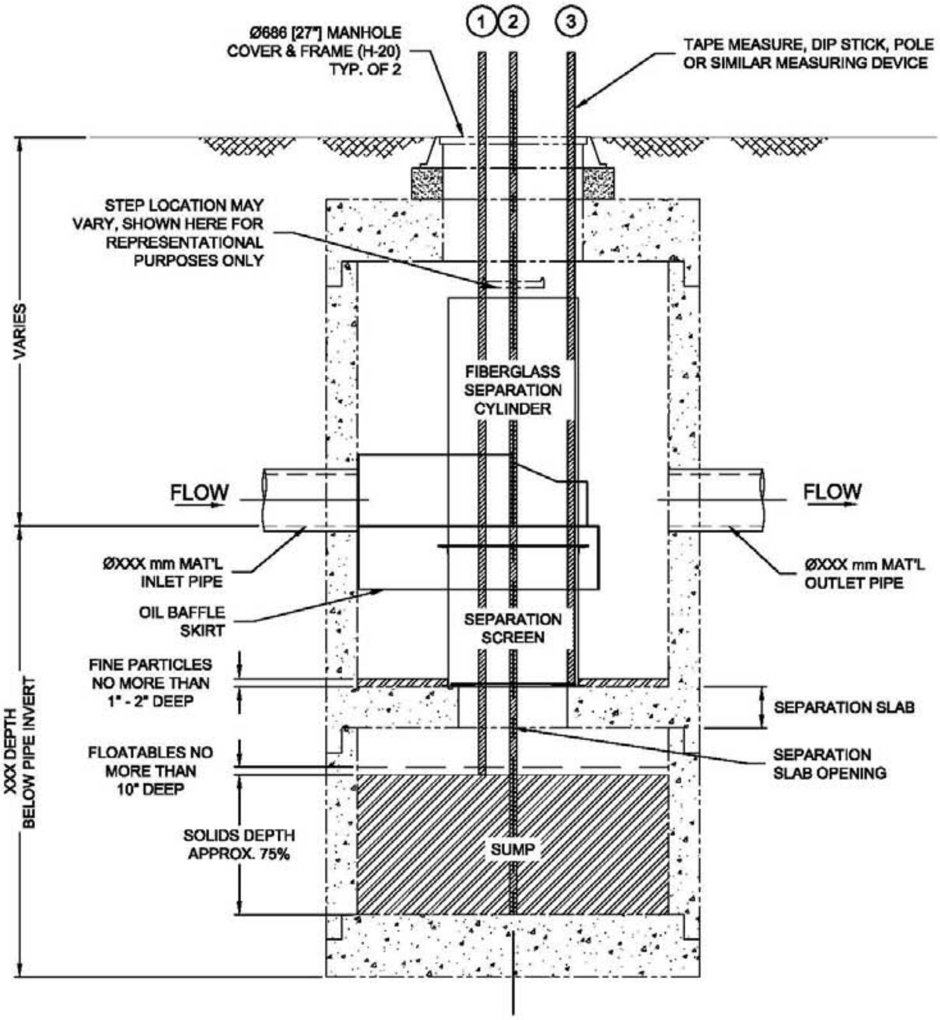
1. Cleanout unit at beginning and end of rainfall season ☐
2. Pump down unit (at least once a year) and thoroughly inspect separation chamber, separation screen and oil baffle ☐
3. No visible signs of damage to internal components observed ☐

APPENDIX C

INSPECTION SCHEMATIC

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 6,511,595; 6,581,783; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

ELEVATION VIEW



CDS MODEL
STORM WATER TREATMENT UNIT
INSPECTION SCHEMATIC

ALL UNITS IN mm UNLESS NOTED OTHERWISE.

CONTECH ENGINEERED SOLUTIONS LLC www.contechES.com 200 Enterprise Drive, Scarborough, ME 04074 877-907-8676 207-885-9830 207-885-9825 FAX	PROJECT NAME CITY, PROVINCE SITE DESIGNATION: OGS ID	JOB No.: ###-####-### DATE: XX/XX/XXXX DRAWN: — APPROV.:	SCALE: 1:30 SHEET: 1

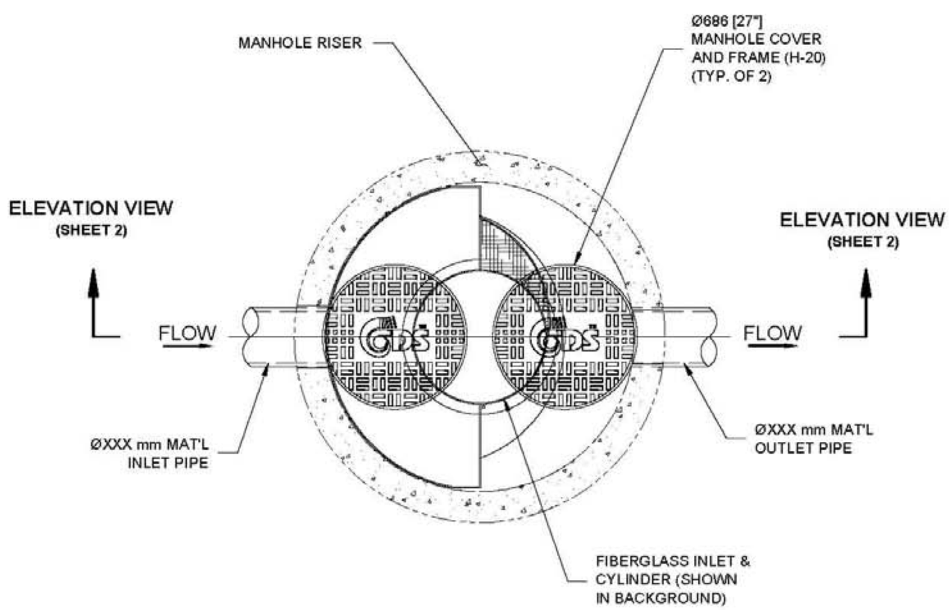
Echelon Environmental, 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577

APPENDIX D

CLEANOUT SCHEMATIC

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 6,511,595; 6,581,783; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

PLAN VIEW



CDS MODEL
STORM WATER TREATMENT UNIT
CLEANOUT SCHEMATIC

ALL UNITS IN mm UNLESS NOTED OTHERWISE.

CONTECH ENGINEERED SOLUTIONS LLC www.contechES.com 200 Enterprise Drive, Scarborough, ME 04074 877-907-8676 207-885-9830 207-885-9825 FAX	PROJECT NAME CITY, PROVINCE SITE DESIGNATION: OGS ID	JOB No.: ###-####-###	SCALE: 1:30
		DATE: XX/XX/XXXX	SHEET: 1
		DRAWN: —	
		APPROV.:	

Echelon Environmental, 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577

ELEVATION VIEW

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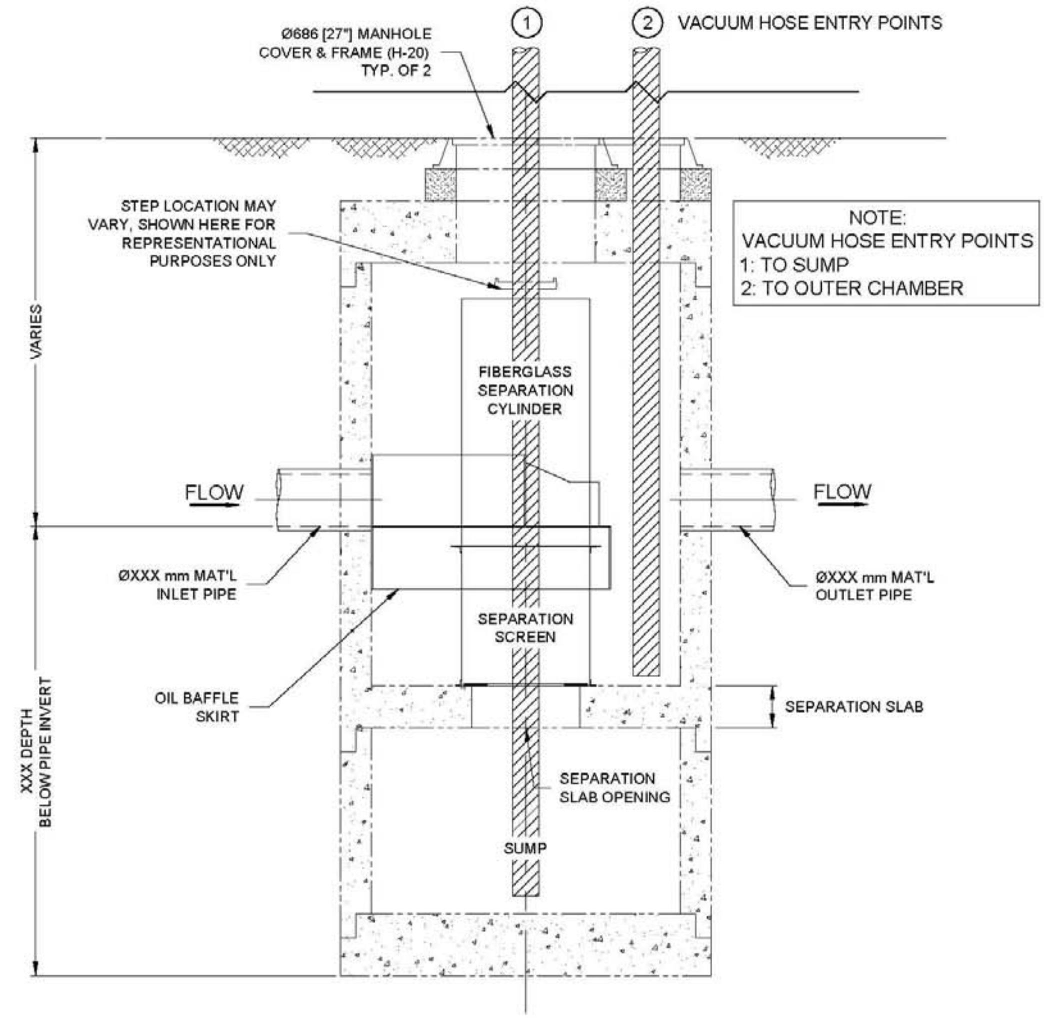

CDS MODEL
STORM WATER TREATMENT UNIT
CLEANOUT SCHEMATIC

ALL UNITS IN mm UNLESS NOTED OTHERWISE.

CONTECH® ENGINEERED SOLUTIONS LLC www.contechES.com 200 Enterprise Drive, Scarborough, ME 04074 877-907-8676 207-885-9830 207-885-9825 FAX	PROJECT NAME CITY, PROVINCE SITE DESIGNATION: OGS ID	JOB No.: ###-####-### DATE: XX/XX/XXXX DRAWN: --- APPROV.:	SCALE: 1:30 SHEET: 2

Echelon Environmental, 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577