SITE SERVICING
AND
STORMWATER MANAGEMENT REPORT

Proposed Marriott Hotel

AT
12476 Highway 50
Town of Caledon

Prepared for
Antrix Architects Inc.

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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 addition of five-storey Hotel development to the partially developed site located at 12476 Highway 50, 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) and minor Zoning By-Law Amendment Application (ZBL) 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 subject property is approximately 12,602 m^2 (1.26 hectares) in size. The subject site consists of one building: Retail Fuel Outlet (Gas Station) and associated convenience store located in the south-east corner of the property, and vacant unoccupied land in the remaining portions of the property. An existing Robinson Creek tributary runs through the property along the east property limits. The property is located in a commercial/industrial area, bounded as follows:

- Robinson Creek to the north
- George Bolton Parkway to the south
- An existing industrial development to the west, and
- An existing gas station and Highway 50 to the east.

3.0 SITE PROPOSAL

The Site Plan Application proposes a five-storey hotel building and associated parking area on the vacant unoccupied land. 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 hotel building roof and the portion of site area considered under this development proposal will be collected by the on-site private storm sewer network. The entire major and minor system flows from the site will be discharged to an existing 450 mm dia storm sewer located within the municipal road allowance of George Bolton Parkway through an existing 375 mm dia service.

The sanitary discharge from the site will be conveyed by an existing 250 mm dia sanitary sewer located within the municipal road allowance of George Bolton Parkway through a new 200 mm dia. service connected to an existing SAN MH#10A.

The water supply requirements for this development will be fulfilled by an existing 300 mm dia watermain located within the municipal road allowance of George Bolton Parkway through a new 300 mm dia. fire and domestic combined service.

The Owner has retained C.F. Crozier & Associates Consulting Engineers (Crozier) to prepare Flood Plain Modelling and Cut/Fill Analysis for the existing Robinson Creek tributary in support of this development proposal. Crozier's scope of work also includes preparation of required documents for Natural Heritage Assessment, Geomorphological Assessment and Landscape design in compliance with TRCA's requirements for the development approval.

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 Standard No.104 are to be used for analysis **(Appendix "B")**.
- 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 5-year rainfall event.
- The on-site storm sewer network is sized to convey minor system flows.
- An overland flow route is 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 partially developed. An existing gas station development is located on a small portion of approximate 0.20 ha site area at the south-east corner of the lot. The remaining portion of site area is vegetated undeveloped land. The topographic survey indicates the property has split drainage where approximately half of the undeveloped portion of the property slopes towards Robinson Creek, while the other half slopes towards George Bolton Parkway. Based on the mapping provided by TRCA, the regional floodplain of Robinson Creek tributary extends onto approximately one third of the property.

However, for the calculations of the post-development allowable discharge rates from the portion of site area considered in current development proposal in line with the proposed development concept, the pre-development site area is subdivided as follows:

1. The sub catchment area CA-1-Pre is considered to be discharging to the municipal sewer located with the road allowance of George Bolton Parkway through an existing 375mm dia storm service.
2. The site area occupied by an existing Robinson Creek tributary (CA-2-Pre) is considered to drain similar to the existing condition without any alteration to the surface treatment and drainage pattern. Therefore, this portion of site area is excluded in the post-development stormwater management modelling.
3. The portion of existing developed site area occupied by an existing gas station (CA-3-Pre) is considered to have well established storm controls in accordance with the Town standards. Therefore, this portion of site area is excluded in the post-development stormwater management modelling.

The pre-development surface condition and drainage area for this site has been illustrated in **Appendix "B"**.

Table-1 Pre-development Input Parameters

Drainage System	**Catchment #**	**Drainage Area** (ha)	**Runoff Coefficient** (C)	**Time of Concentration** (Tc)
Controlled	CA-1-Pre	0.79	0.28	10
Uncontrolled	CA-2-Pre	0.27	0.25	10
Excluded	CA-3-Pre	0.21	0.77	10
TOTAL		**1.26**	**0.35**	**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)	
	5-year	**100-year**
CA-1-Pre	0.067	0.121
CA-2-Pre	0.021	0.037
CA-3-Pre	0.049	0.088

4.3 Stormwater Management

In the post-development condition, the site area occupied by an existing Robinson Creek tributary (CA-2-Post) is considered to drain similar to the existing condition without any alteration to the surface treatment and drainage pattern.

Similarly, the portion of existing developed site area occupied by an existing gas station (CA-3-Post) is considered to have well established storm controls in accordance with the Town standards. Therefore, both of this catchment areas are excluded in the post-development stormwater management modelling.

The site grading for the controlled portion of site area (CA-1-Post) is designed to restrict stormwater flow from the external catchment areas from entering to this site. Therefore, only the portion of land occupied by proposed hotel development (CA-1-Post) is considered for the stormwater management design for this development proposal. 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-3** below and detailed calculations have been illustrated in **Appendix "B"**.

Table-3 Post-development Input Parameters

Drainage System	Catchment #	Drainage Area (ha)	Runoff Coefficient (C)	Time of Concentration (Tc)
Controlled	CA-1-Post	0.79	0.83	10
Uncontrolled	CA-2-Post	0.27	0.25	10
Excluded	CA-3-Post	0.21	0.77	10
TOTAL		**1.26**	**0.70**	**10**

Results of the post-development unmitigated peak flow calculations by considering minimum Tc and IDF data similar to the pre-development flow calculations are provided in **Table-4** below, and detailed post-development flow calculations have been illustrated in **Appendix "B".**

Table-4 Post-development Peak Flows

Catchment #	Unmitigated Peak Flow (m^3/s)	
	5-year	**100-year**
CA-1-Post	0.200	0.358
CA-2-Post	0.021	0.037
CA-3-Post	0.049	0.088

The post-development peak flow targets will be achieved using a combination of surface storage and detention storage in the storm sewer system and underground storage system (UG-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 tube installed at the outlet of MH#5, the storm sewer system will surcharge and the excess runoff volume will

be stored within the storm sewer pipes and underground storage system (UG-1). A summary of the stage and storage volumes available on site are provided in **Table-5** below and detailed calculations have been illustrated in **Appendix "B".**

Table-5 Available Stage Storage Summary

Stage Elevation	Stage Storage Volume (m^3)				
	CB-MH	Pipe	Surface	UG-1	Total
238.20	5.59	20.19	0.00	51.75	**77.53**
238.95	13.20	21.70	0.00	78.85	**113.76**
239.20	14.80	21.77	263.43	78.85	**378.85**

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 peak flow resulting from the target pre-development condition during 5-year storm event.

The site grading is designed such that, no external areas from the adjoining catchments shall affect the stormwater flow from the site considered under this development proposal.

Modified Rational Method calculations were undertaken to determine the peak flows and required storage volume from the proposed site during 5-Year and 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 is provided in **Table-6** below and detailed calculations have been illustrated in **Appendix "B".**

Table-6 Post-development Peak Flow and Quantity Control Analysis

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)	Water Surface Elevation (m)
5-year	0.067	0.052	0.000	0.052	113.76	108.88	238.85
100-year	0.067	0.057	0.000	0.057	378.85	282.71	239.11

The post-development peak flow targets will be achieved by controlling discharge from the site area using 125mm dia orifice tube installed at the

outlet of MH#5. Detailed calculations for orifice ratings and stage storage on the site have been illustrated in **Appendix "B".**

A total of 113.76 m^3 storage volume is provided below the lowest surface elevation of 238.95 through the CB/MH, Storm Sewer and UG Storage Chambers. A total of 108.88 m^3 storage volume is used during 5-year storm event, which is less than the available storage volume below lowest surface elevation. The storage used summary confirms that the surface ponding will not occur within any portion of the site area during minor storm events up to and including 5-year event.

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.

In the post-development condition, the site area occupied by an existing Robinson Creek tributary (CA-2-Post) is considered to drain uncontrolled similar to the existing condition without any alteration to the surface treatment and drainage pattern. Similarly, the portion of existing developed site area occupied by an existing gas station (CA-3-Post) is considered to have well established storm controls in accordance with the Town standards. Therefore, only 0.79 ha site area occupied by CA-1-Post having 89.00 % imperviousness that contributes to the proposed quality control unit are accounted in the quality control modelling.

A spreadsheet table is prepared to calculate the TSS removal for the entire site area. The site area is divided according to surface condition, and an effective TSS removal value is derived for each surface condition based on a number of criteria (i.e. surface characteristics, IA values, where the flows are directed, etc.). Each TSS removal value is multiplied by its fraction/percentage of the total site area to determine the TSS removal rate for each surface condition in accordance with the recommendations provided in the "Sample Application of the WWFM Guidelines, October 19, 2007 – Page-21" (Illustrated in **Appendix "B"**). The sum of all TSS removal rates for each surface condition is equal to the TSS removal over the entire site. The general basis of the effective TSS removal rates are as follows:

- Rooftop areas are subject to airborne particles only. There is no vehicular traffic anticipated on the roof. In addition, the roof flow is diverted to the on-site storm sewer network, which will be treated by proposed OGS before discharging from the site. As such, an effective removal efficiency of 90% is inherent on a traditional roof.

- Uncontrolled vegetated, grassed and planted areas have been assigned an effective and inherent 90% removal efficiency considering no vehicular traffic on this area.
- Controlled vegetated, grassed and mulch landscaped areas have been assigned an effective and inherent 95% removal efficiency considering flow from this area will be treated by proposed OGS before discharging from the site.
- A Storm Filter System (OGS) is proposed to treat the stormwater runoff from the entire controlled portion of the site area (CA-1-Post). As per the Oil/Grit Separator Guidelines provided by the TRCA, the filtration system operating on their own at the design capacities are capable of achieving a TSS removal efficiency of 80%. Therefore, the asphalt and other paved areas have been assigned as 80% removal efficiency.

A summary of the surface conditions, TSS removal efficiencies corresponding to the particular surface areas and overall TSS removal efficiency for the site is provided in **Table-7** below.

Table-7 Water Quality Calculations

Surface	Area (m^2)	% of Site Area	Effective % of TSS Removal	Overall TSS Removal
Perimeter Landscape (Uncontrolled)	2686.14	25.48	90	22.93
Asphalt & Other Paved Area (Uncontrolled)	0.00	0.00	0	0.00
Landscape Islands (Controlled)	864.29	8.20	95	7.79
Conventional Roof	1279.22	12.14	90	10.92
Asphalt & Other Paved Area (By OGS)	5711.59	54.18	80	43.35
TOTAL	**10541.24**	**100.00**		**84.99**

Based on the rationale of the effective TSS reduction inherent in green surfaces, combined with the use of a filtration system for the hard-vehicular traveled surfaces, the required TSS removal criteria will be achieved. Storm Filter Model SFPD0814 Oil-Grit Separator Sizing and relevant calculations for TSS removal efficiency provided by Echelon Environmental has been illustrated in **Appendix "B"**.

The Storm Filter unit is sized to achieve 80% removal of the long-term average total suspended sediment load considering entire controlled portion of the 0.79 ha site area (CA-1-Post) having 89.00 % imperviousness. The Storm Filter will be installed at the downstream of the orifice and Manhole-5. Therefore, the Storm Filter will receive controlled release through the orifice tube and hence it will not operate in a surcharged condition.

An ongoing maintenance program consisting of periodic inspection and cleaning of the Storm Filter and 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 portion of site area considered under this development application equates to a required site balance volume of 52.71 m^3. In order to meet water balance requirement, Initial Abstractions were selected for the various surfaces within the subject site area based on WWFMG 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 1.5mm is considered for roof area.
- Uncontrolled grassed areas have been assigned an IA of 5.0mm.
- Landscape islands 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-8** below.

Table-8 Water Balance Calculations

Surface	Area (m^2)	% of Site Area	IA (mm)	Effective IA (mm)
Perimeter Landscape (Uncontrolled)	2686.14	25.48	5.00	1.27
Asphalt & Other Paved Area (Uncontrolled)	0.00	0.00	1.00	0.00
Landscape Islands (Controlled)	864.29	8.20	5.00	0.41
Conventional Roof	1279.22	12.14	1.50	0.18
Asphalt & Other Paved Area	5711.59	54.18	1.00	0.54
TOTAL	**10541.24**	**100.00**		**2.41**

Above calculated total value of 2.41 mm of initial abstraction and infiltration over the site, equates to the retention of 25.38 m^3 of rainfall within the soils for infiltration and evapotranspiration, which will result in 27.33 m^3 deficient in the required site balance volume.

To meet the water balance requirement for this site, an irrigation cistern of 30.83 m^3 volume will be provided that equates to a balance of another 2.92mm of rainfall from the site area. The storm runoff from the roof will be diverted to the cistern tank and overflow from the cistern tank will be discharged to the on-site storm sewer system. Considering fully utilised cistern volume in the water balance calculations, a total of 5.33mm IA will be achieved and a total of 56.21 m^3 volume retained on site.

The location and size of proposed cistern tank is shown on site servicing drawing. Detailed design for the reuse of stored water for irrigation purpose within 48-hour time will be completed at detailed design stage with building permit submission.

4.4 Downstream Capacity

The site area occupied by this development is considered to contributing to the existing municipal sewer in the pre-development condition. Since, the post-development peak flows from this site are controlled in line with the peak flow resulting from the target pre-development condition during 5-year storm event, 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 **Siltsoxx** along with silt fence on north and east.

- 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 & Siltsoxx 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 portion of the site area considered under this development proposal is vacant currently and not services by the regional infrastructure of existing sanitary sewers. A 150mm dia sanitary service is provided at the property line to serve the future development on this lot.

6.1 Proposed Population Density

In the post-development condition, the maximum anticipated population accountable are 386 persons as provided by Architect in OBC matrix. Detailed population density calculations have been illustrated in **Appendix "C".**

6.2 Proposed Sanitary Drainage System

The proposed sanitary discharge from this site is estimated at 13.35 L/s in accordance with the Sanitary Sewer Design Criteria Manual provided by the Region of Peel.

The alternate calculation of proposed sanitary discharge from this site is estimated at 5.70 L/s in accordance with the actual population density and per capita sanitary flow. Detailed post-development sanitary flow calculations has been illustrated in **Appendix "C".**

6.3 Proposed Sanitary Service

This development application proposes to remove existing 150mm dia sanitary service and provide a new 200mm dia sanitary service from the existing regional infrastructure of 250 mm dia sanitary sewer located within the municipal road allowance of George Bolton Parkway.

6.4 Downstream Capacity

The site area occupied by this development is accounted to contribute to the existing regional infrastructure of 250 mm dia sanitary sewer located within the municipal road allowance of George Bolton Parkway.

7.0 WATER SUPPLY SYSTEM

The portion of the site area considered under this development proposal is vacant currently and not serviced by the regional infrastructure of existing sanitary sewers. The region of Peel has provided a 150 mm dia fire and domestic combined service with Detector Check Valve in chamber at property line to serve future development on the vacant portion of lot.

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 1.34 L/s with a peak hourly demand of 4.02 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 hotel development is estimated at 116.67 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 Cortese Design Inc. on the Region of Peel hydrants connected to an existing 300mm dia watermain located within the municipal allowance of George Bolton Parkway. The test report is included in **Appendix "D".** A flow of 68 L/s (1075 USgpm) was measured at the 3rd Hydrant at West side of HWY 50 on George Bolton Parkway using one 2.5" orifice, that resulted in a residual pressure of 497 kPa (72 psi) at the 2nd Hydrant at West side of HWY 50 on George Bolton Parkway. Based on actual pressure test on nearby municipal hydrants, a maximum flow of 252 L/s (1,550 USgpm) can be achieved while maintaining a water pressure of 20 psi (140 kPa), that is in compliance with the minimum requirements for fire suppression outlined in the FUS and the Region of Peel guidelines. Detailed calculations for the projected fire flow at 20 psi residual pressure is included in **Appendix "D"**.

7.2 Proposed Water Service

This development application proposes to remove existing 150mm dia water service including detector check valve and chamber and provide a new 300mm dia. fire and domestic combined service with Detector Check Valve in chamber at property line as per the Region of Peel Standards from the existing 300mm dia. municipal watermain located within road allowance of George Bolton Parkway. The proposed combined service will split at the property line into fire and domestic services. An internal network of 200 mm dia. fire main and 100 mm dia domestic watermain is proposed in accordance with the Region of Peel Standard Drawing 1-8-3 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 five-storey Hotel development located at 12476 Highway 50, Town of Caledon, Ontario.

8.1 STORM

1. Only the portion of land occupied by proposed hotel development (CA-1-Post) is considered for the stormwater management design for this development proposal.
2. The post-development peak flow targets will be achieved using a combination of surface storage and detention storage in the storm sewer system and underground storage system (UG-1).
3. The post-development peak flow targets will be achieved by controlling discharge from the site area using 125mm dia orifice tube installed at the outlet of MH#5.
4. Total 282.71 m^3 of storage is used out of 378.85 m^3 storage volume provided during 100-year storm event.
5. The storage used summary confirms that the surface ponding will not occur within any portion of the site area during minor storm events up to and including 5-year event.
6. An effective TSS removal of 84.99% will be achieved using green surface in conjunction with Storm Filter Model SFPD0814.

7. Water balance target will be achieved with the help of an initial abstraction and infiltration of 2.41mm of rainfall and a cistern tank of 30.83 m^3 volume.
8. An ongoing maintenance program consists of periodic inspection and cleaning of the Storm Filter Unit and Catch basins are recommended (minimum once per year).
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 maximum anticipated population accountable are 386 persons based on type of development as provided by Architect in OBC Matrix.
2. The proposed peak sanitary discharge from the site is calculated as 13.35 L/s.
3. This development application proposes to remove existing 150mm dia sanitary service and provide a new 200mm dia sanitary service from the existing regional infrastructure of 250 mm dia sanitary sewer located within the municipal road allowance of George Bolton Parkway.

8.3 WATER

1. The estimated water consumption of approximately 1.34 L/s with a peak hourly demand of 4.02 L/s will be required to service proposed development with domestic water.
2. The fire flow required for proposed development is estimated at 116.67 L/s for 4 hours, delivered with a residual pressure of not less then 140 kilopascals.
3. This development application proposes to remove existing 150mm dia. Water service and provide a new 300mm dia. fire and domestic combined service from the existing 300mm dia. Municipal watermain located within road allowance of George Bolton Parkway.
4. The proposed combined service will split at the property line into fire 200mm dia. and 100mm dia. domestic services.
5. A flow and pressure test conducted on the municipal hydrants confirms that a maximum flow of 252 L/s can be achieved while maintaining a water pressure of 20 psi (140 kPa).

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.

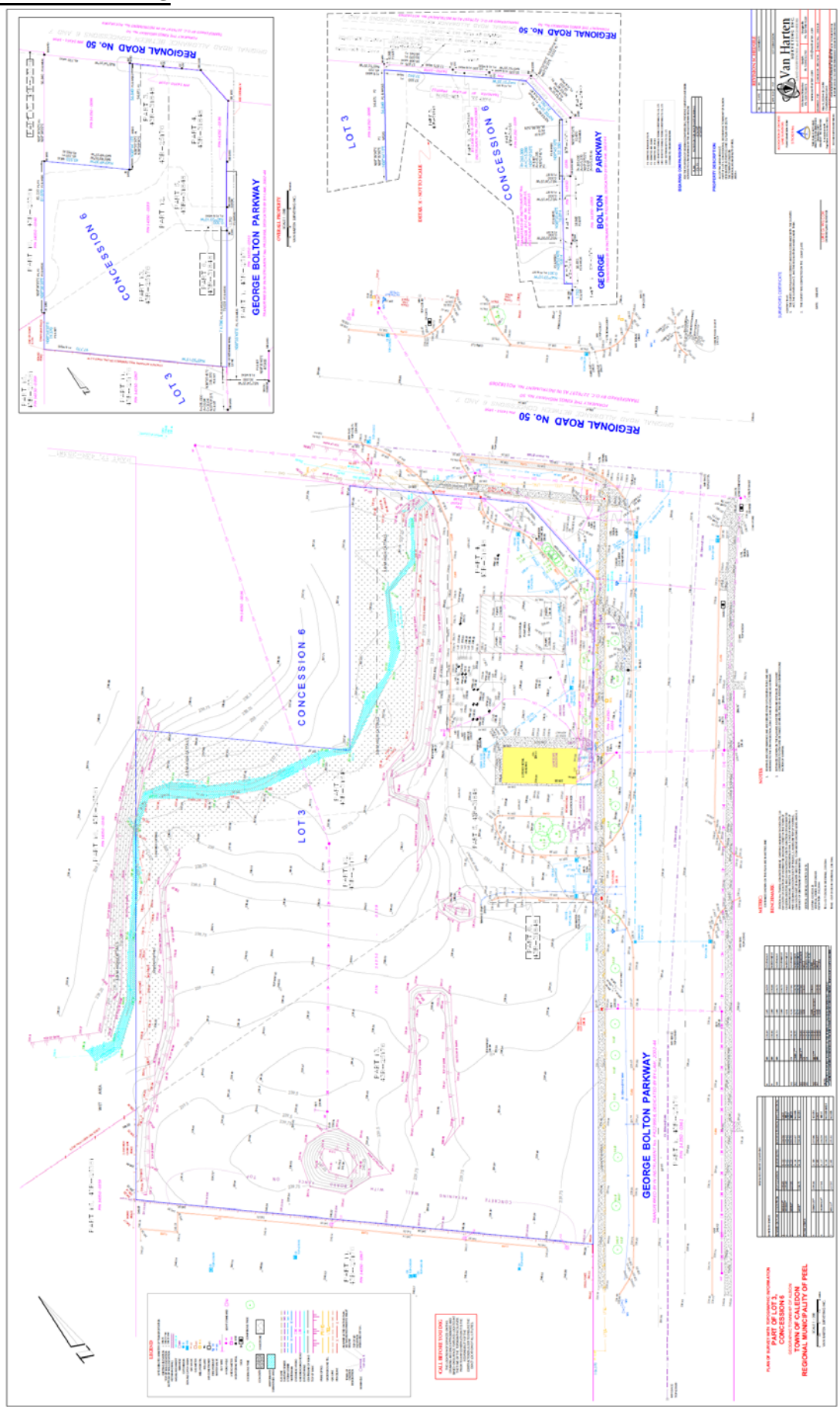
Chirag C. Patel, P.Eng, PMP
Senior Project Manager

Appendix "A" Plans

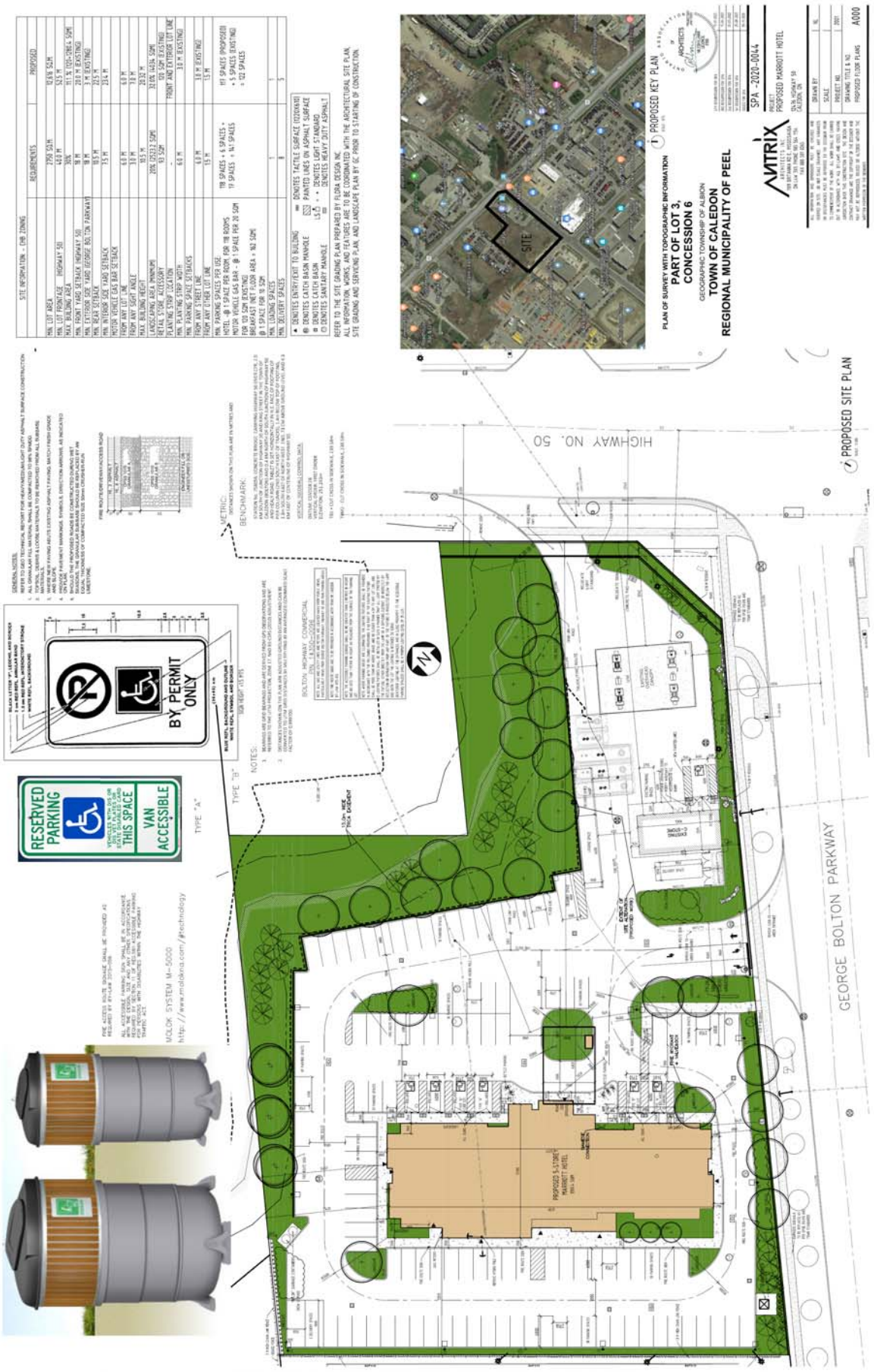
- Location Map
- Site Survey Drawing
- Architectural Site Plan
- Architectural Building Elevations

LOCATION MAP (NTS)

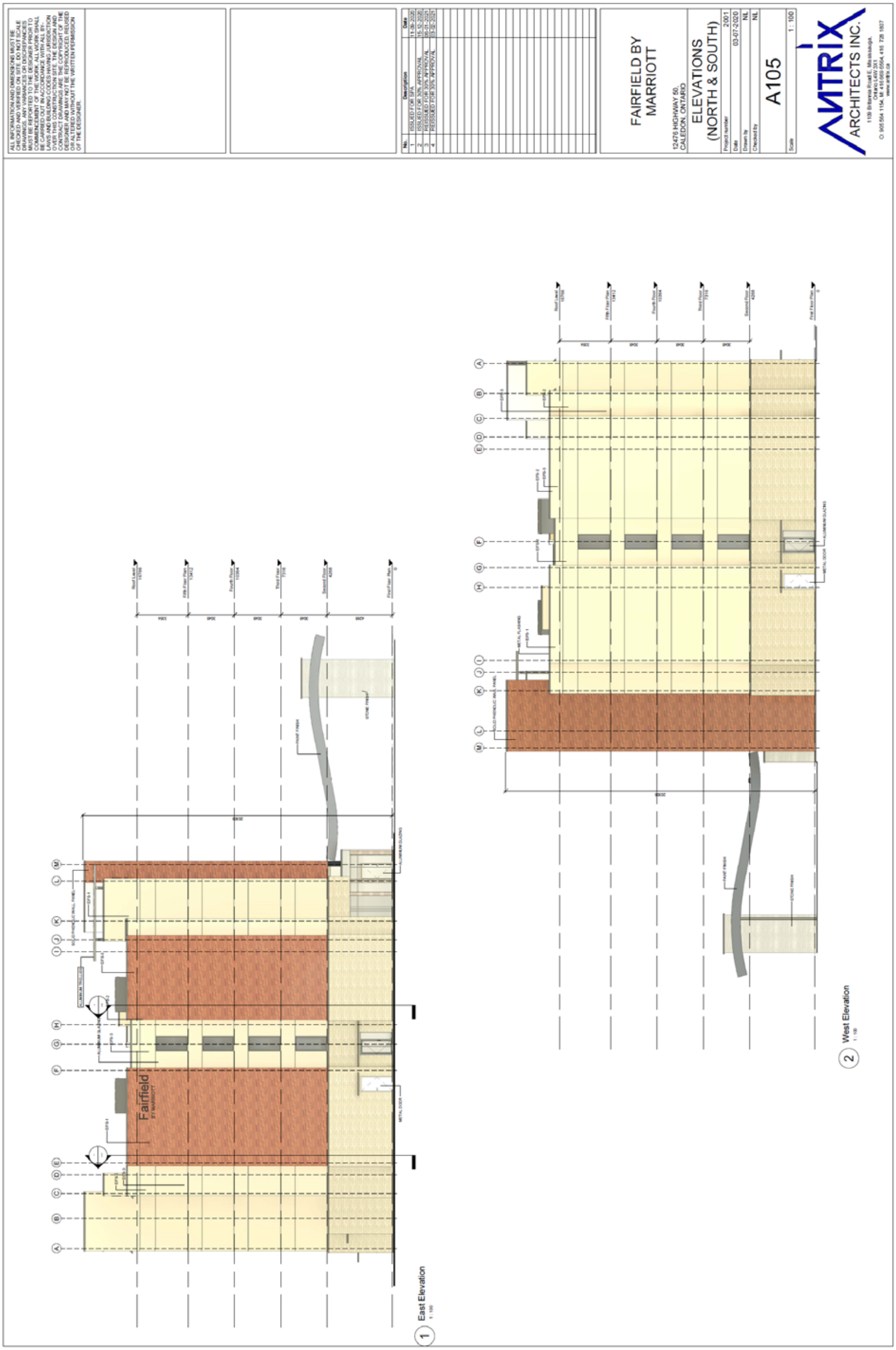
SITE SURVEY DRAWING (NTS)



ARCHITECTURAL SITE PLAN (NTS)



ARCHITECTURAL BUILDING ELEVATIONS (NTS)

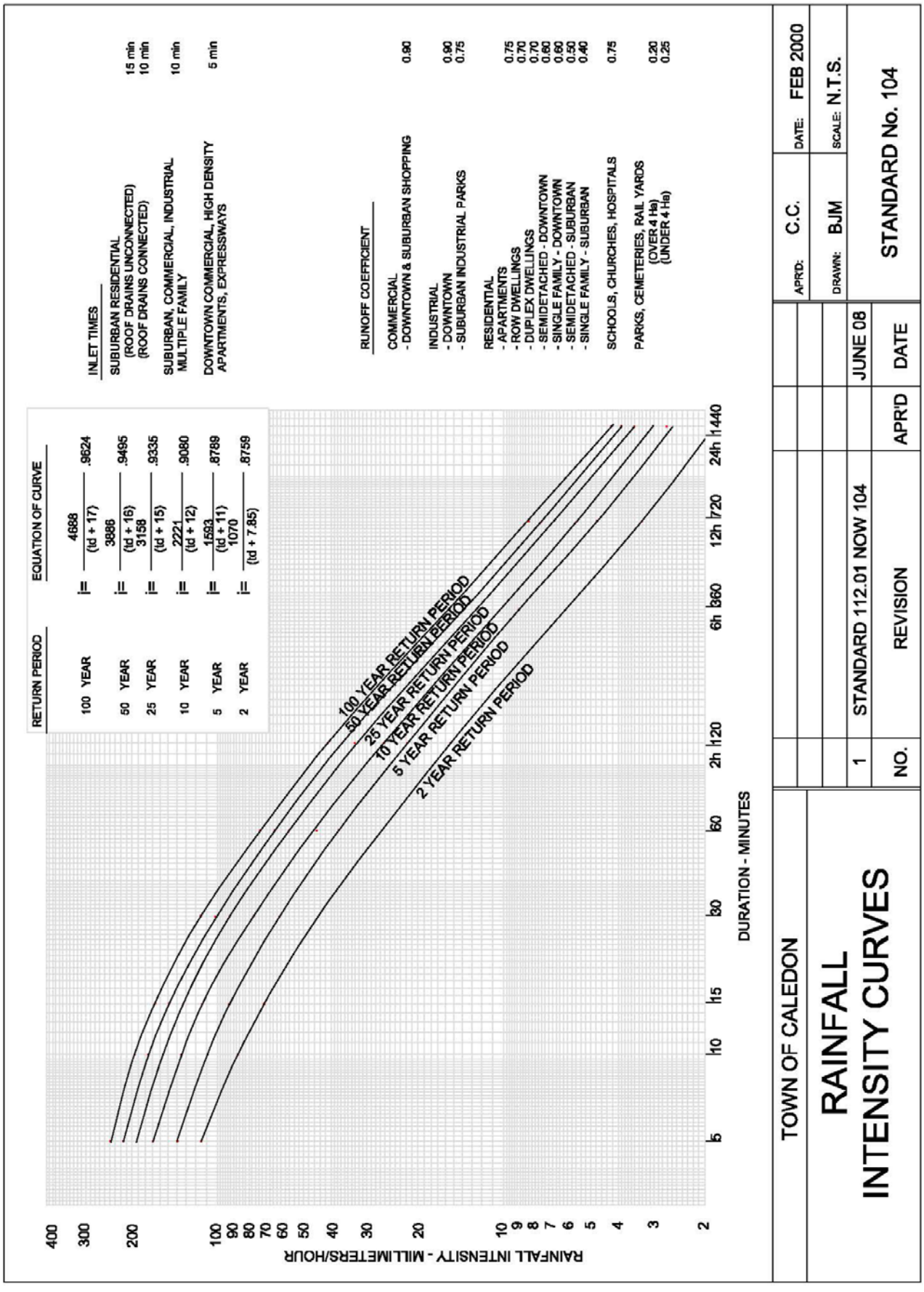

FAIRFIELD BY MARRIOTT
12476 HIGHWAY 50, CALEDON, ONTARIO
ELEVATIONS (NORTH & SOUTH)
2001
03-07-2020
NL
A105
1 : 100
ARCHITECTS INC.
Fairfield
East Elevation
West Elevation

Appendix "B" Stormwater Management

- IDF Curve – Town of Caledon
- Runoff Coefficient Calculations
- Existing Storm Drainage Plan
- Pre-Development Peak Flow Calculations
- Proposed Storm Drainage Plan
- Proposed Sub-Catchment Area Plan
- Post-Development Peak Flow Calculations
- ADS Sanitite Underground Storage Calculations (UG-1)
- Stage Storage Calculations
- Post-Development Site Flow and Storage Used Summary – 5-Year Storm
- Post-Development Site Flow and Storage Used Summary – 100-Year Storm
- Orifice Rating Calculations
- Storm Sewer Design Sheet
- Storm Filter Model SFPD0814 – Sizing Report
- Storm Filter Model SFPD0814 – Typical Drawing
- Wilkinson 36,000 Litre Holding Tank – Typical Drawing

IDF CURVE - TOWN OF CALEDON

(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

Drainage System	Catchment #	Area (m^2)		Area (ha)		% Imp.	Runoff Coeff. "C"
		Imp.	Total	Imp.	Total		
Controlled	**CA-1-Pre**	335.70	7855.10	0.03	0.79	4.27	0.28
Uncontrolled	**CA-2-Pre**	0.00	2686.14	0.00	0.27	0.00	0.25
Excluded	**CA-3-Pre**	1652.42	2060.95	0.17	0.21	80.18	0.77
Total Site		**1988.12**	**12602.19**	**0.20**	**1.26**	**15.78**	**0.35**

Post-Development Drainage Area

Drainage System	Catchment #	Area (m^2)		Area (ha)		% Imp.	Runoff Coeff. "C"
		Imp.	Total	Imp.	Total		
Controlled	**CA-1-Post**	6990.81	7855.10	0.70	0.79	89.00	0.83
Uncontrolled	**CA-2-Post**	0.00	2686.14	0.00	0.27	0.00	0.25
Excluded	**CA-3-Post**	1652.42	2060.95	0.17	0.21	80.18	0.77
Total Site		**8643.23**	**12602.19**	**0.86**	**1.26**	**68.59**	**0.70**

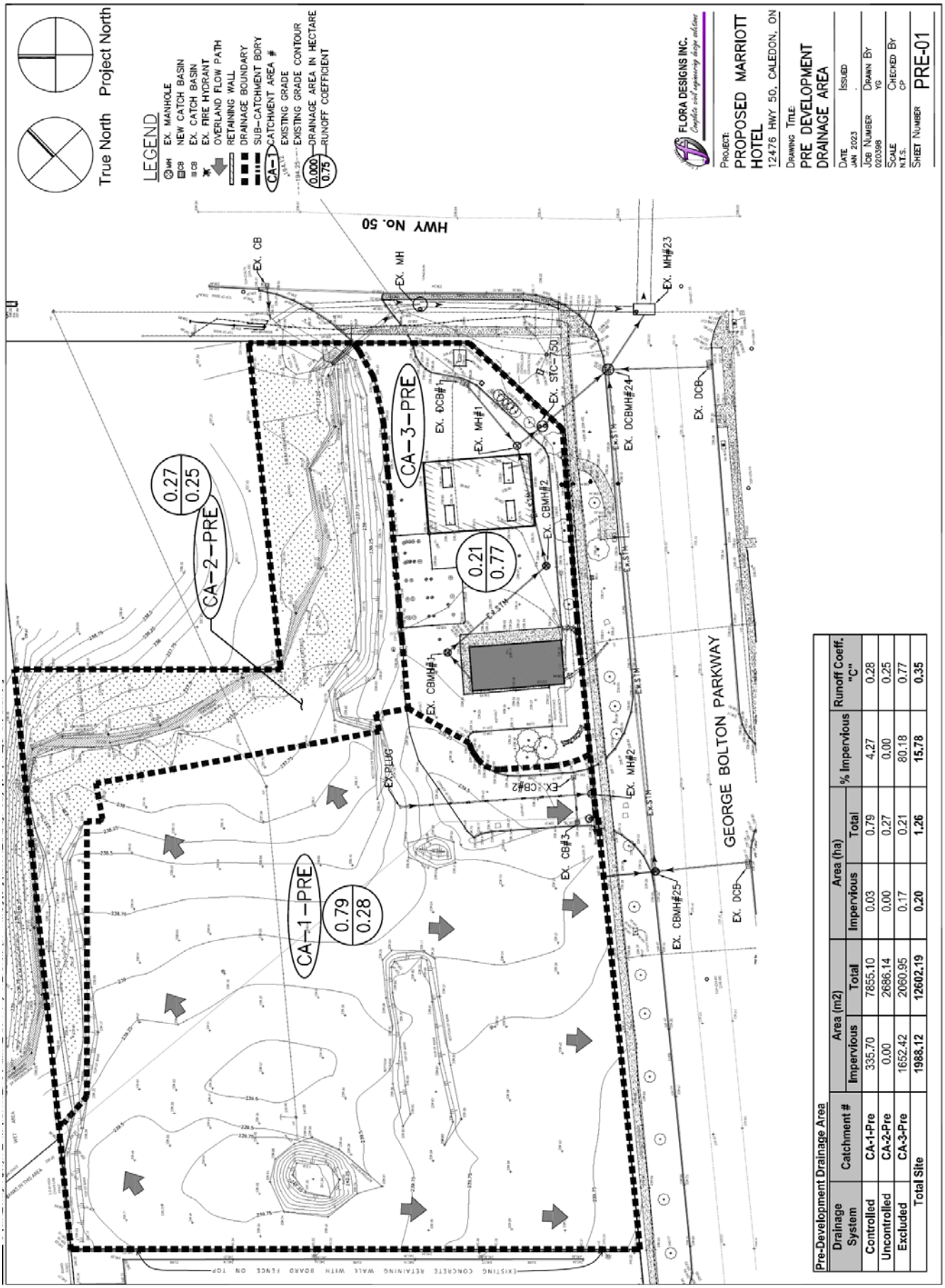
Runoff Coefficient (C)

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)		% Imp.	Runoff Coeff. "C"
		Imp.	Total	Imp.	Total		
Controlled	**CB-1**	731.12	859.36	0.07	0.09	85.08	0.80
	CB-2	819.70	827.22	0.08	0.08	99.09	0.89
	CBMH-1	472.42	486.88	0.05	0.05	97.03	0.88
	CB-3	620.40	682.47	0.06	0.07	90.91	0.84
	ROOF	1279.22	1279.22	0.13	0.13	100.00	0.90
	CB-4	1074.40	1188.50	0.11	0.12	90.40	0.84
	CB-5	871.61	977.99	0.09	0.10	89.12	0.83
	CB-6	362.19	570.24	0.04	0.06	63.52	0.66
	CB-7	587.52	769.04	0.06	0.08	76.40	0.75
	CBMH-4/CB-3A	172.23	214.18	0.02	0.02	80.41	0.77
Sub Total - Controlled		**6990.81**	**7855.10**	**0.70**	**0.79**	**89.00**	**0.83**

EXISTING STORM DRAINAGE PLAN (NTS)



Pre-Development Drainage Area

Drainage System	Catchment #	Area (m2)		Area (ha)		% Impervious	Runoff Coeff. "C"
		Impervious	Total	Impervious	Total		
Controlled	CA-1-Pre	335.70	7855.10	0.03	0.79	4.27	0.28
Uncontrolled	CA-2-Pre	0.00	2686.14	0.00	0.27	0.00	0.25
Excluded	CA-3-Pre	1652.42	2060.95	0.17	0.21	80.18	0.77
Total Site		1988.12	12602.19	0.20	1.26	15.78	0.35

PRE-DEVELOPMENT PEAK FLOW CALCULATIONS

Catchment #	Drainage Area	Runoff Coefficient	Time of Concentration
	"A" in Hector	"C"	"Tc" in Minute
CA-1-Pre	0.79	0.28	10
CA-2-Pre	0.27	0.25	10
CA-3-Pre	0.21	0.77	10

Where: Q = Runoff Quantity (Flow) in litre/sec
A = Drainage Area in Hectors
C = Runoff Coefficient
I = Average Rainfall Intensity - mm/h

Event 5 yr

IDF Data Set, Town of Caledon

Coefficient, a =	1593.00
Coefficient, b =	11.00
Exponent, c =	-0.879

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

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Pre	0.79	109.68	0.28	67.44	0.067
CA-2-Pre	0.27	109.68	0.25	20.58	0.021
CA-3-Pre	0.21	109.68	0.77	49.30	0.049

Event 100 yr

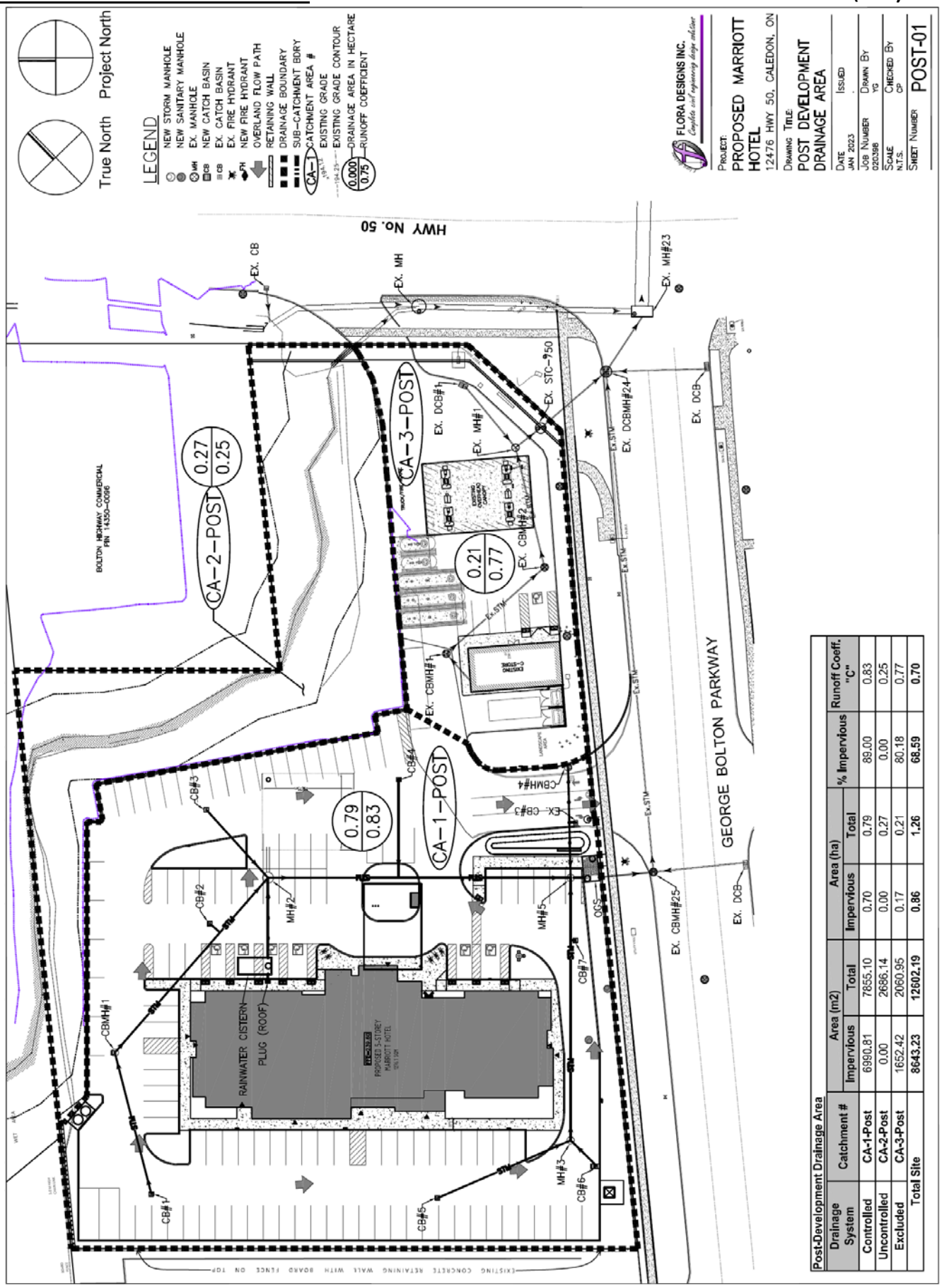
IDF Data Set, Town of Caledon

Coefficient, a =	4688.00
Coefficient, b =	17.00
Exponent, c =	-0.962

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

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Pre	0.79	196.54	0.28	120.86	0.121
CA-2-Pre	0.27	196.54	0.25	36.88	0.037
CA-3-Pre	0.21	196.54	0.77	88.35	0.088

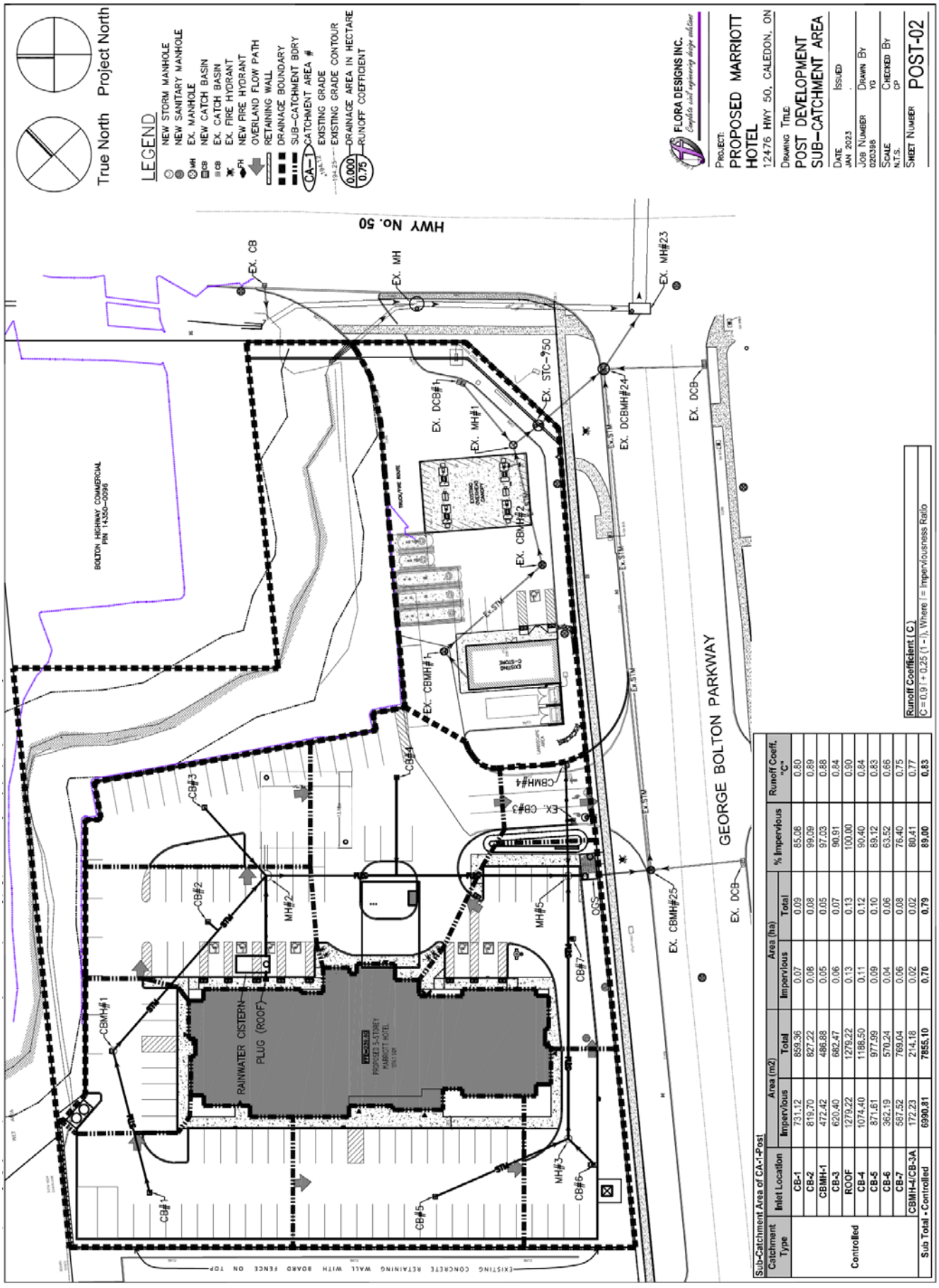
PROPOSED STORM DRAINAGE PLAN (NTS)



Post-Development Drainage Area

Drainage System	Catchment #	Area (m2)		Area (ha)		% Impervious	Runoff Coeff. "C"
		Impervious	Total	Impervious	Total		
Controlled	CA-1-Post	6990.81	7855.10	0.70	0.79	89.00	0.83
Uncontrolled	CA-2-Post	0.00	2686.14	0.00	0.27	0.00	0.25
Excluded	CA-3-Post	1652.42	2060.95	0.17	0.21	80.18	0.77
Total Site		8643.23	12602.19	0.86	1.26	68.59	0.70

PROPOSED SUB-CATCHMENT AREA PLAN (NTS)



Sub-Catchment Area of CA-1-Post

Catchment Type	Inlet Location	Area (m2)		Area (ha)		% Impervious	Runoff Coeff. "C"
		Impervious	Total	Impervious	Total		
Controlled	CB-1	731.12	859.36	0.07	0.09	85.08	0.80
	CB-2	819.70	827.22	0.08	0.08	99.09	0.89
	CBMH-1	472.42	486.88	0.05	0.05	97.03	0.88
	CB-3	620.40	682.47	0.06	0.07	90.91	0.84
	ROOF	1279.22	1279.22	0.13	0.13	100.00	0.90
	CB-4	1074.40	1198.50	0.11	0.12	90.40	0.84
	CB-5	871.61	977.99	0.09	0.10	89.12	0.83
	CB-6	362.19	570.24	0.04	0.06	63.52	0.66
	CB-7	587.52	769.04	0.06	0.08	76.40	0.75
	CBMH-4/CB-3A	172.23	214.18	0.02	0.02	80.41	0.77
Sub Total - Controlled		6990.81	7855.10	0.70	0.79	89.00	0.83

Runoff Coefficient (C)
C = 0.9 / + 0.25 (1 - i), Where I = Imperviousness Ratio

POST-DEVELOPMENT PEAK FLOW CALCULATIONS

Catchment #	Drainage Area	Runoff Coefficient	Time of Concentration
	"A" in Hector	"C"	"Tc" in Minute
CA-1-Post	0.79	0.83	10
CA-2-Post	0.27	0.25	10
CA-3-Post	0.21	0.77	10

Where: Q = Runoff Quantity (Flow) in litre/sec
A = Drainage Area in Hectors
C = Runoff Coefficient
I = Average Rainfall Intensity - mm/h

Event 5 yr

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

IDF Data Set, Town of Caledon

Coefficient, a =	1593.00
Coefficient, b =	11.00
Exponent, c =	-0.879

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Post	0.79	109.68	0.83	199.93	0.200
CA-2-Post	0.27	109.68	0.25	20.58	0.021
CA-3-Post	0.21	109.68	0.77	49.30	0.049

Event 100 yr

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

IDF Data Set, Town of Caledon

Coefficient, a =	4688.00
Coefficient, b =	17.00
Exponent, c =	-0.962

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Post	0.79	196.54	0.83	358.26	0.358
CA-2-Post	0.27	196.54	0.25	36.88	0.037
CA-3-Post	0.21	196.54	0.77	88.35	0.088

ADS SANITITE UNDERGROUND STORAGE CALCULATION (UG-1)

Diameter of Pipe	**900**	mm	**900**	mm
Normal O.D.	1067	mm	1067	mm
Typical Length of Each Pipe	**6000**	mm	**3000**	mm
Cross Section Area of Pipe	0.636	m^2	0.636	m^2
Volume in each Pipe	3.815	m^3	1.908	m^3
Typical Length Header-L	1150	mm	1150	mm
Volume in Header-L	0.731	m^3	0.731	m^3
Typical Length Header-T	1950	mm	1950	mm
Volume in Header-T	1.240	m^3	1.240	m^3
Typical Length Header-CAP	1250	mm	1250	mm
Volume in Header-CAP	0.795	m^3	0.795	m^3
Number of Lengths	**2**		**0**	
Number of Rows	**8**		**0**	
Number of header-L Required	**4**			
Number of header-T Required	**12**			
Number of header-CAP Required	**0**			
Total Volume Provided	**78.85**	**m^3**		
	System Dimension			
Total Length of Pipes	14.834	m		
Total Width of Pipes	12.267	m		
Clear Spacing between Pipes	0.533	m		
Total Length of Stone Later	**15.75**	**m**		
Total Width of Stone Later	**13.18**	**m**		
Pipe Outer Top	238.65	m		
Pipe Obvert	238.48	m		
Pipe Invert	**237.58**	m		

STAGE STORAGE CALCULATIONS

Orifice Invert = 237.35
Stage = 238.20
Storage Depth = 0.85 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	238.95	238.17	238.20	0.03	CB	N/A	0.36	0.011
CB-2	239.05	237.87	238.20	0.33	CB	N/A	0.36	0.119
CB-3	238.95	237.89	238.20	0.31	CB	N/A	0.36	0.112
CB-4	238.95	237.68	238.20	0.52	CB	N/A	0.36	0.187
CB-5	238.95	237.79	238.20	0.41	CB	N/A	0.36	0.148
CB-6	238.95	237.69	238.20	0.51	CB	N/A	0.36	0.184
CB-7	239.00	237.55	238.20	0.65	CB	N/A	0.36	0.234
CB-3A	239.13	237.68	238.20	0.52	CB	N/A	0.36	0.187
CBMH-1	239.05	237.96	238.20	0.24	1200	1.22	1.17	0.280
MH-2	239.22	237.61	238.20	0.59	1800	1.82	2.60	1.534
MH-3	239.14	237.58	238.20	0.62	1200	1.22	1.17	0.724
CBMH-4	239.13	237.45	238.20	0.75	1200	1.22	1.17	0.876
MH-5	239.19	237.35	238.20	0.85	1200	1.22	1.17	0.993
Total CB & MH Storage Volume								**5.589**

Pipe Storage:

Pipe Dia. (m)	Pipe Length (m)	From ID	From Invert Elevation (m)	From Water Depth (m)	From Area (m^2)	To ID	To Invert Elevation (m)	To Water Depth (m)	To Area (m^2)	Storage Volume (m^3)
0.250	25.24	CB-1	238.17	0.03	0.00	CBMH-1	238.04	0.16	0.03	0.379
0.250	2.32	CB-2	237.87	0.25	0.05	Lead	237.85	0.25	0.05	0.116
0.300	40.16	CBMH-1	237.96	0.24	0.06	MH-2	237.76	0.30	0.07	2.610
0.250	13.88	Roof	238.05	0.15	0.03	MH-2	237.81	0.25	0.05	0.555
0.250	15.85	CB-3	237.89	0.25	0.05	MH-2	237.81	0.25	0.05	0.793
0.450	4.40	UG-1	237.63	0.45	0.16	MH-2	238.61	0.00	0.00	0.352
0.250	17.00	CB-4	237.68	0.25	0.05	Lead	237.60	0.25	0.05	0.850
0.450	52.18	MH-2	237.61	0.45	0.16	MH-5	237.35	0.45	0.16	8.349
0.250	25.00	CB-5	237.79	0.25	0.05	MH-3	237.66	0.25	0.05	1.250
0.250	6.40	CB-6	237.69	0.25	0.05	MH-3	237.66	0.25	0.05	0.320
0.250	1.00	CB-7	237.55	0.25	0.05	Lead	237.54	0.25	0.05	0.050
0.300	45.41	MH-3	237.58	0.30	0.07	MH-5	237.35	0.30	0.07	3.179
0.250	1.10	CB-3A	237.68	0.25	0.05	Lead	237.40	0.25	0.05	0.055
0.300	19.10	CBMH-4	237.45	0.30	0.07	MH-5	237.35	0.30	0.07	1.337
Total Pipe Storage Volume										**20.194**

Surface Storage:

ID	RIM Elevation (m)	HWL (m)	Surface Area @ HWL (m^2)	Stage Elevation (m)	Ponding Depth (m)	Storage Volume (m^3)
CB-1	238.95	239.20	571.42	238.20	0.00	0.000
CB-2	239.05	239.20	339.06	238.20	0.00	0.000
CB-3	238.95	239.20	473.66	238.20	0.00	0.000
CB-4	238.95	239.20	626.32	238.20	0.00	0.000
CB-5	238.95	239.20	630.64	238.20	0.00	0.000
CB-6	238.95	239.20	248.83	238.20	0.00	0.000
CB-7	239.00	239.20	291.94	238.20	0.00	0.000
CBMH-1	239.05	239.20	226.84	238.20	0.00	0.000
CBMH-4	239.13	239.20	132.75	238.20	0.00	0.000
Total Surface Storage Volume						**0.000**

ADS Sanitite UG Storage:

ID	Top Elevation (m)	INV Elevation (m)	Stage Elevation (m)	Depth (m)	Storage Volume (m^3)
UG-1	238.53	237.63	238.20	0.57	51.745
Total Tank Storage Volume					**51.745**

TOTAL STAGE STORAGE AT ELEVATION	238.20	=	77.529	m^3

Orifice Invert =	237.35	
Stage =	238.95	
Storage Depth =	1.60	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	238.95	238.17	238.95	0.78	CB	N/A	0.36	0.281
CB-2	239.05	237.87	238.95	1.08	CB	N/A	0.36	0.389
CB-3	238.95	237.89	238.95	1.06	CB	N/A	0.36	0.382
CB-4	238.95	237.68	238.95	1.27	CB	N/A	0.36	0.457
CB-5	238.95	237.79	238.95	1.16	CB	N/A	0.36	0.418
CB-6	238.95	237.69	238.95	1.26	CB	N/A	0.36	0.454
CB-7	239.00	237.55	238.95	1.40	CB	N/A	0.36	0.504
CB-3A	239.13	237.68	238.95	1.27	CB	N/A	0.36	0.457
CBMH-1	239.05	237.96	238.95	0.99	1200	1.22	1.17	1.157
MH-2	239.22	237.61	238.95	1.34	1800	1.82	2.60	3.484
MH-3	239.14	237.58	238.95	1.37	1200	1.22	1.17	1.601
CBMH-4	239.13	237.45	238.95	1.50	1200	1.22	1.17	1.753
MH-5	239.19	237.35	238.95	1.60	1200	1.22	1.17	1.869
Total CB & MH Storage Volume								**13.205**

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)	
0.250	25.24	CB-1	238.17	0.25	0.05	CBMH-1	238.04	0.25	0.05	1.262
0.250	2.32	CB-2	237.87	0.25	0.05	Lead	237.85	0.25	0.05	0.116
0.300	40.16	CBMH-1	237.96	0.30	0.07	MH-2	237.76	0.30	0.07	2.811
0.250	13.88	Roof	238.05	0.25	0.05	MH-2	237.81	0.25	0.05	0.694
0.250	15.85	CB-3	237.89	0.25	0.05	MH-2	237.81	0.25	0.05	0.793
0.450	4.40	UG-1	237.63	0.45	0.16	MH-2	238.61	0.34	0.13	0.638
0.250	17.00	CB-4	237.68	0.25	0.05	Lead	237.60	0.25	0.05	0.850
0.450	52.18	MH-2	237.61	0.45	0.16	MH-5	237.35	0.45	0.16	8.349
0.250	25.00	CB-5	237.79	0.25	0.05	MH-3	237.66	0.25	0.05	1.250
0.250	6.40	CB-6	237.69	0.25	0.05	MH-3	237.66	0.25	0.05	0.320
0.250	1.00	CB-7	237.55	0.25	0.05	Lead	237.54	0.25	0.05	0.050
0.300	45.41	MH-3	237.58	0.30	0.07	MH-5	237.35	0.30	0.07	3.179
0.250	1.10	CB-3A	237.68	0.25	0.05	Lead	237.40	0.25	0.05	0.055
0.300	19.10	CBMH-4	237.45	0.30	0.07	MH-5	237.35	0.30	0.07	1.337
Total Pipe Storage Volume										**21.703**

Surface Storage:

ID	RIM Elevation (m)	HWL (m)	Surface Area @ HWL (m^2)	Stage Elevation (m)	Ponding Depth (m)	Storage Volume (m^3)
CB-1	238.95	239.20	571.42	238.95	0.00	0.000
CB-2	239.05	239.20	339.06	238.95	0.00	0.000
CB-3	238.95	239.20	473.66	238.95	0.00	0.000
CB-4	238.95	239.20	626.32	238.95	0.00	0.000
CB-5	238.95	239.20	630.64	238.95	0.00	0.000
CB-6	238.95	239.20	248.83	238.95	0.00	0.000
CB-7	239.00	239.20	291.94	238.95	0.00	0.000
CBMH-1	239.05	239.20	226.84	238.95	0.00	0.000
CBMH-4	239.13	239.20	132.75	238.95	0.00	0.000
Total Surface Storage Volume						**0.000**

ADS Sanitite UG Storage:

ID	Top Elevation (m)	INV Elevation (m)	Stage Elevation (m)	Depth (m)	Storage Volume (m^3)
UG-1	238.53	237.63	238.95	0.90	78.850
Total Tank Storage Volume					**78.850**

TOTAL STAGE STORAGE AT ELEVATION	**238.95**	**=**	**113.758**	**m^3**

Orifice Invert = 237.35
Stage = 239.20
Storage Depth = 1.85 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	238.95	238.17	238.95	0.78	CB	N/A	0.36	0.281
CB-2	239.05	237.87	239.05	1.18	CB	N/A	0.36	0.425
CB-3	238.95	237.89	238.95	1.06	CB	N/A	0.36	0.382
CB-4	238.95	237.68	238.95	1.27	CB	N/A	0.36	0.457
CB-5	238.95	237.79	238.95	1.16	CB	N/A	0.36	0.418
CB-6	238.95	237.69	238.95	1.26	CB	N/A	0.36	0.454
CB-7	239.00	237.55	239.00	1.45	CB	N/A	0.36	0.522
CB-3A	239.13	237.68	239.13	1.45	CB	N/A	0.36	0.522
CBMH-1	239.05	237.96	239.05	1.09	1200	1.22	1.17	1.274
MH-2	239.22	237.61	239.20	1.59	1800	1.82	2.60	4.134
MH-3	239.14	237.58	239.14	1.56	1200	1.22	1.17	1.823
CBMH-4	239.13	237.45	239.13	1.68	1200	1.22	1.17	1.963
MH-5	239.19	237.35	239.19	1.84	1200	1.22	1.17	2.150
Total CB & MH Storage Volume								**14.803**

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)	
0.250	25.24	CB-1	238.17	0.25	0.05	CBMH-1	238.04	0.25	0.05	1.262
0.250	2.32	CB-2	237.87	0.25	0.05	Lead	237.85	0.25	0.05	0.116
0.300	40.16	CBMH-1	237.96	0.30	0.07	MH-2	237.76	0.30	0.07	2.811
0.250	13.88	Roof	238.05	0.25	0.05	MH-2	237.81	0.25	0.05	0.694
0.250	15.85	CB-3	237.89	0.25	0.05	MH-2	237.81	0.25	0.05	0.793
0.450	4.40	UG-1	237.63	0.45	0.16	MH-2	238.61	0.45	0.16	0.704
0.250	17.00	CB-4	237.68	0.25	0.05	Lead	237.60	0.25	0.05	0.850
0.450	52.18	MH-2	237.61	0.45	0.16	MH-5	237.35	0.45	0.16	8.349
0.250	25.00	CB-5	237.79	0.25	0.05	MH-3	237.66	0.25	0.05	1.250
0.250	6.40	CB-6	237.69	0.25	0.05	MH-3	237.66	0.25	0.05	0.320
0.250	1.00	CB-7	237.55	0.25	0.05	Lead	237.54	0.25	0.05	0.050
0.300	45.41	MH-3	237.58	0.30	0.07	MH-5	237.35	0.30	0.07	3.179
0.250	1.10	CB-3A	237.68	0.25	0.05	Lead	237.40	0.25	0.05	0.055
0.300	19.10	CBMH-4	237.45	0.30	0.07	MH-5	237.35	0.30	0.07	1.337
Total Pipe Storage Volume										**21.769**

Surface Storage:

ID	RIM Elevation (m)	HWL (m)	Surface Area @ HWL (m^2)	Stage Elevation (m)	Ponding Depth (m)	Storage Volume (m^3)
CB-1	238.95	239.20	571.42	239.20	0.25	47.618
CB-2	239.05	239.20	339.06	239.20	0.15	16.953
CB-3	238.95	239.20	473.66	239.20	0.25	39.472
CB-4	238.95	239.20	626.32	239.20	0.25	52.193
CB-5	238.95	239.20	630.64	239.20	0.25	52.553
CB-6	238.95	239.20	248.83	239.20	0.25	20.736
CB-7	239.00	239.20	291.94	239.20	0.20	19.463
CBMH-1	239.05	239.20	226.84	239.20	0.15	11.342
CBMH-4	239.13	239.20	132.75	239.20	0.07	3.097
Total Surface Storage Volume						**263.428**

ADS Sanitite UG Storage:

ID	Top Elevation (m)	INV Elevation (m)	Stage Elevation (m)	Depth (m)	Storage Volume (m^3)
UG-1	238.53	237.63	239.20	0.90	78.850
Total Tank Storage Volume					**78.850**

TOTAL STAGE STORAGE AT ELEVATION	239.20	=	378.85	m^3

Stage Storage Summary - CA-1-Post

Stage Elevation	Stage Storage Volume (m^3)				
	CB-MH	Sewer Pipe	Surface	UG Storage	Total
238.20	5.59	20.19	0.00	51.75	**77.53**
238.95	13.20	21.70	0.00	78.85	**113.76**
239.20	14.80	21.77	263.43	78.85	**378.85**

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

Actual Release Rate (RR)				0.052	m^3/s
Actual Release Volume per 5-min. Interval				15.54	m^3
5-year Design Storm				**Catchment #**	**CA-1-Post**
a =	1593.00			Area (ha) =	0.79
b =	11.00			C =	0.83
c =	-0.879			Tc (min.)=	10
i =	a * (Tc + b)^c				
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	0.200	119.86	31.08	88.78
15	90.91	0.166	149.02	46.62	102.40
20	77.89	0.142	170.23	62.16	108.07
25	68.29	0.124	186.58	77.70	**108.88**
30	60.92	0.111	199.72	93.24	106.48
35	55.06	0.100	210.59	108.78	101.81
40	50.28	0.092	219.81	124.32	95.49
45	46.32	0.084	227.77	139.86	87.91
50	42.96	0.078	234.75	155.40	79.35
55	40.09	0.073	240.95	170.94	70.01
60	37.60	0.068	246.52	186.48	60.04
65	35.41	0.065	251.56	202.02	49.54
70	33.48	0.061	256.15	217.56	38.59
75	31.77	0.058	260.38	233.10	27.28
80	30.23	0.055	264.28	248.64	15.64
85	28.84	0.053	267.90	264.18	3.72
90	27.58	0.050	271.28	279.72	0.00
95	26.43	0.048	274.44	295.26	0.00
100	25.39	0.046	277.42	310.80	0.00
105	24.42	0.044	280.23	326.34	0.00
110	23.53	0.043	282.88	341.88	0.00
115	22.71	0.041	285.40	357.42	0.00
120	21.95	0.040	287.79	372.96	0.00
125	21.23	0.039	290.08	388.50	0.00
130	20.57	0.037	292.26	404.04	0.00
135	19.95	0.036	294.34	419.58	0.00
140	19.37	0.035	296.34	435.12	0.00
145	18.82	0.034	298.26	450.66	0.00
150	18.31	0.033	300.11	466.20	0.00
155	17.82	0.032	301.89	481.74	0.00
160	17.36	0.032	303.61	497.28	0.00
165	16.93	0.031	305.26	512.82	0.00
170	16.52	0.030	306.86	528.36	0.00
175	16.13	0.029	308.41	543.90	0.00
180	15.75	0.029	309.91	559.44	0.00

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

Actual Release Rate (RR)				0.057	m^3/s
Actual Release Volume per 5-min. Interval				16.98	m^3
100-year Design Storm				**Catchment #**	**CA-1-Post**
a =	4688.00			Area (ha) =	0.79
b =	17.00			C =	0.83
c =	-0.962			Tc (min.)=	10
i =	a * (Tc + b)^c				
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	0.358	214.78	33.96	180.82
15	166.89	0.304	273.58	50.94	222.64
20	145.13	0.264	317.20	67.92	249.28
25	128.46	0.234	350.97	84.90	266.07
30	115.28	0.210	377.95	101.88	276.07
35	104.59	0.191	400.06	118.86	281.20
40	95.75	0.174	418.55	135.84	**282.71**
45	88.31	0.161	434.27	152.82	281.45
50	81.95	0.149	447.81	169.80	278.01
55	76.47	0.139	459.63	186.78	272.85
60	71.69	0.131	470.04	203.76	266.28
65	67.47	0.123	479.29	220.74	258.55
70	63.74	0.116	487.58	237.72	249.86
75	60.40	0.110	495.05	254.70	240.35
80	57.40	0.105	501.84	271.68	230.16
85	54.69	0.100	508.02	288.66	219.36
90	52.23	0.095	513.69	305.64	208.05
95	49.98	0.091	518.92	322.62	196.30
100	47.93	0.087	523.74	339.60	184.14
105	46.03	0.084	528.22	356.58	171.64
110	44.29	0.081	532.39	373.56	158.83
115	42.67	0.078	536.29	390.54	145.75
120	41.17	0.075	539.94	407.52	132.42
125	39.78	0.072	543.36	424.50	118.86
130	38.47	0.070	546.59	441.48	105.11
135	37.25	0.068	549.63	458.46	91.17
140	36.11	0.066	552.50	475.44	77.06
145	35.04	0.064	555.23	492.42	62.81
150	34.03	0.062	557.82	509.40	48.42
155	33.08	0.060	560.27	526.38	33.89
160	32.18	0.059	562.62	543.36	19.26
165	31.33	0.057	564.85	560.34	4.51
170	30.52	0.056	566.98	577.32	0.00
175	29.75	0.054	569.02	594.30	0.00
180	29.03	0.053	570.98	611.28	0.00

ORIFICE-WEIR RATING CALCULATIONS

Orifice-1 (At Outlet of MH-5)

Orifice TUBE Diameter, D_O =	125	mm
Orifice Invert =	237.35	m
Orifice Coefficient, C =	0.80	
Orifice sectional area, A_O =	0.01227	m^2
Elev at Centre of Orifice =	237.41	m
Acceleration due to gravity, g =	9.81	m/s^2

Stage Elevation (m)	Head (m)	Storage Provided (m^3)	Orifice Flow (m^3/s)
237.35	0.00	0.00	0.0000
238.20	0.79	77.53	0.0386
238.95	1.54	113.76	0.0539
239.20	1.79	378.85	0.0581

STORM SEWER DESIGN SHEET

MUNICIPALITY:	Town of Caledon					**STORM SEWER DESIGN SHEET**										DESIGNER:	Flora Designs Inc.			
PROJECT NAME:	Proposed Marriott Hotel															PROJECT No:	20398			
RAINFALL PARAMETERS:		A =	1593.00			Pipe Capacity Q :	$1/n * A * R^{2/3} * S^{1/2}$									Pipe Roughness ("n" Value):	0.013	Plastic		
Event:	5 Year Rainfall	B =	11.00			Pipe Velocity V :	Q / A										0.013	Concrete		
IDF Data:	Town of Caledon	C =	-0.8789			Time of Flow:	$(L/V_{act})/60$										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	CBMH-1	0.09	0.80	0.07	0.07	10.0	109.68	21.95	0.87	25.24	250	0.50%	PVC	0.013	41.99	0.86	52.28%	0.5	10.5
	CB-2	Lead	0.08	0.89	0.07	0.07	10.0	109.68	21.71	1.12	2.32	250	1.00%	PVC	0.013	59.38	1.21	36.56%	0.0	10.0
	CBMH-1	MH-2	0.05	0.88	0.04	0.19	10.5	107.43	55.91	1.07	40.16	300	0.50%	PVC	0.013	68.28	0.97	81.88%	0.6	11.1
	CB-3	MH-2	0.07	0.84	0.06	0.06	10.0	109.68	17.93	0.82	15.85	250	0.50%	PVC	0.013	41.99	0.86	42.70%	0.3	10.3
	ROOF	MH-2	0.13	0.90	0.12	0.12	10.0	109.68	35.67	1.56	13.88	250	1.75%	PVC	0.013	78.56	1.60	45.41%	0.1	10.1
	CB-4	Lead	0.12	0.84	0.10	0.10	10.0	109.68	30.73	0.93	17.00	250	0.50%	PVC	0.013	41.99	0.86	73.19%	0.3	10.3
	MH-2	MH-5				0.46	11.1	104.86	135.21	1.35	52.18	450	0.50%	CONC	0.013	201.35	1.27	67.15%	0.6	11.7
	CB-5	MH-3	0.10	0.83	0.08	0.08	10.0	109.68	25.31	0.89	25.00	250	0.50%	PVC	0.013	41.99	0.86	60.27%	0.5	10.5
	CB-6	MH-3	0.06	0.66	0.04	0.04	10.0	109.68	12.07	0.73	6.40	250	0.50%	PVC	0.013	41.99	0.86	28.76%	0.1	10.1
	CB-7	Lead	0.08	0.75	0.06	0.06	10.0	109.68	18.29	1.05	1.00	250	1.00%	PVC	0.013	59.38	1.21	30.81%	0.0	10.0
	MH-3	MH-5				0.18	10.5	107.43	54.54	1.06	45.41	300	0.50%	PVC	0.013	68.28	0.97	79.87%	0.7	11.2
	CBMH-4/CB-3A	MH-5	0.02	0.77	0.02	0.02	10.0	109.68	4.70	0.54	19.10	300	0.50%	PVC	0.013	68.28	0.97	6.88%	0.6	10.6
	OGS	Ex.CBMH-25	100-Year Max Flow from Orifice-1						56.60	1.34	9.50	375	0.89%	CONC	0.013	165.19	1.50	34.26%	0.1	0.1

FLORA DESIGNS INC.
Complete civil engineering design solutions

STORM FILTER MODEL SFPD0814 – SIZING REPORT

CONTECH® ENGINEERED SOLUTIONS

Determining Number of Cartridges for Flow Based Systems

Date	**2022-02-28**	**Black Cells =**	**Calculation**

Site Information

Project Name	**12476 Hwy. 50 (Marriott Hotel)**		
Project Location	**Caledon, ON**		
OGS ID	**OGS**		
Drainage Area, Ad	**1.95**	ac	(0.79 ha)
Impervious Area, Ai	**1.74**	ac	
Pervious Area, Ap	**0.21**		
% Impervious	**89%**		
Runoff Coefficient, Rc	**0.83**		
Treatment storm flow rate, Q_{treat}	**0.82**	cfs	(23.33 L/s)
Peak storm flow rate, Q_{peak}	**2.05**	cfs	(58 L/s)

Filter System

Filtration brand	**StormFilter**	
Cartridge height	**18**	in
Specific Flow Rate	**2.00**	gpm/ft^2
Flow rate per cartridge	**15.00**	gpm

SUMMARY

Number of Cartridges	25
Media Type	Perlite

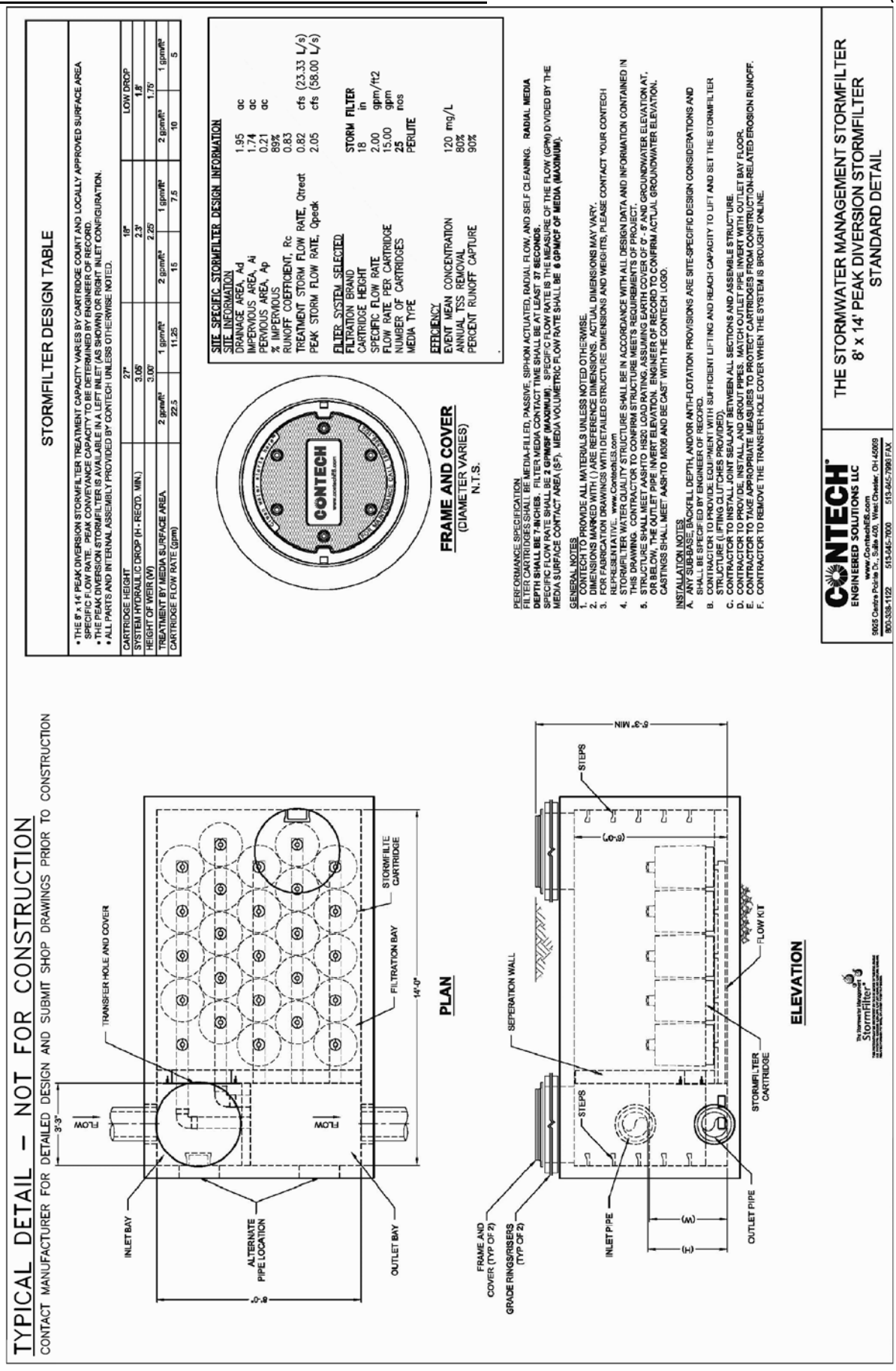
Event Mean Concentration (EMC)	**120**	mg/L
Annual TSS Removal	**80%**	
Percent Runoff Capture	**90%**	

Recommend SFPD0814 vault or cast in place

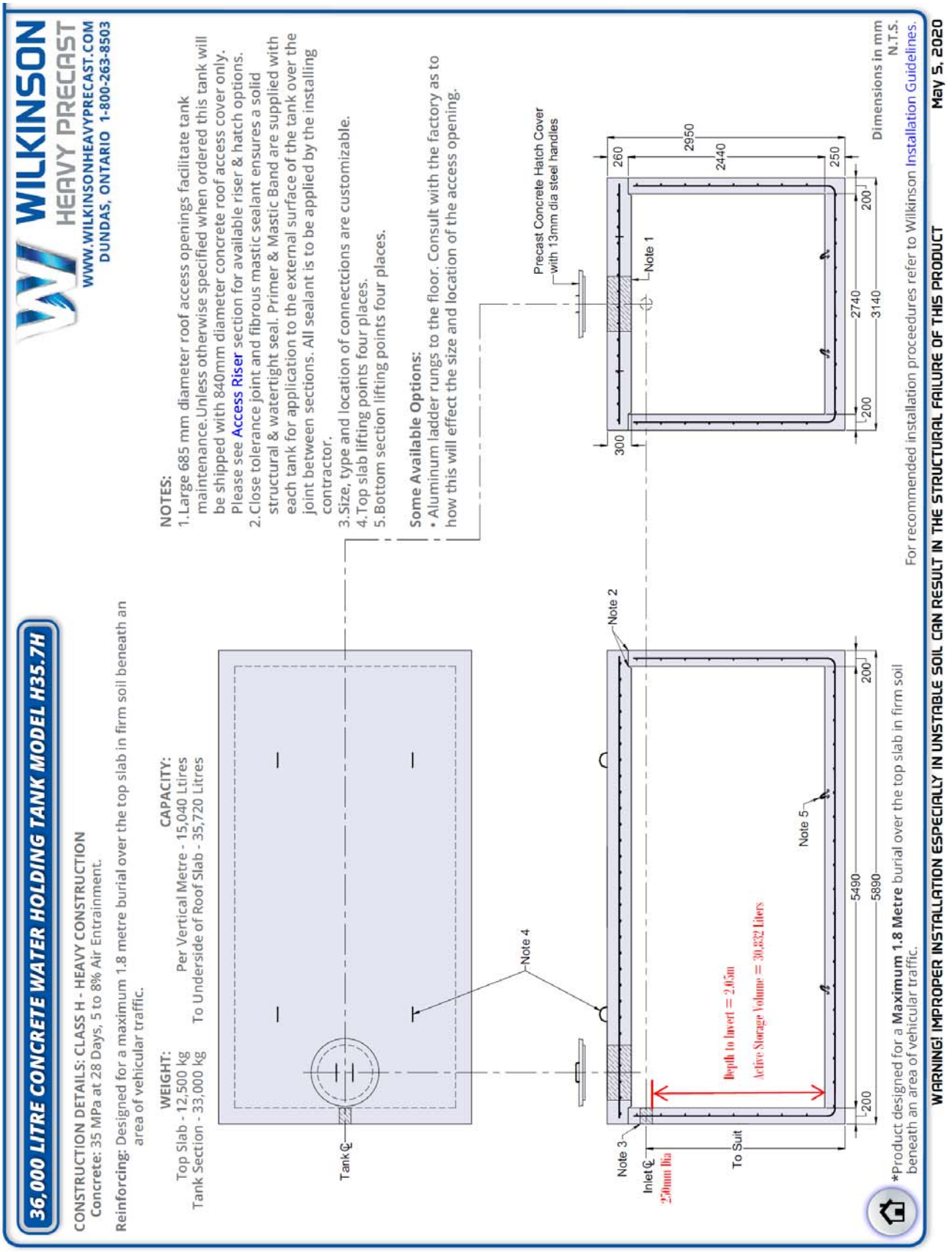
200 Enterprise Drive
Scarborough, ME 04074
Phone 877-907-8676
Fax 207-885-9825

1 of 1

STORM FILTER MODEL SFPD0814 - TYPICAL DRAWING (NTS)



WILKINSON 36,000 LITRE HOLDING TANK - TYPICAL DRAWING (NTS)



Appendix "C" Sanitary Drainage System

- Population Density Calculations
- Sanitary Flow Calculations
- Sanitary Service Capacity Calculation

POPULATION DENSITY CALCULATIONS

Post-development population density
(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	1.26	63

Post-development population density
(As provided by Architect in OBC Matrix)

Development Type	**Population** (Persons)
Hotel	386

SANITARY FLOW CALCULATIONS

Post-development Condition

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

Equivalent Design Population (P) =	0.386	In thousand
Average Daily Per Capita Flow (q) =	302.8	L/cap. Day
Infiltration Allowance (I) =	0.20	L/ha. Sec
Tributary Area (A) =	1.26	ha

Average Flow =	((P * q) / 86.4)	
(Q) =	**1.35**	L/Sec

Harmon Peaking Factor (M) =	1 + (14 / (4 + P^0.5))	
(M) =	4.029	

Peak Design Flows (Q) =	((P * q * M) / 86.4) + (I * A)	
(Q) =	**5.70**	L/Sec

Post-development Condition

(According to Standard DWG 2-9-2, Region of Peel)

Domestic Sewage Flow for less then 1000 persons	0.013	m^3/sec

Infiltration Allowance (I) =	0.00028	m^3/ha. Sec

Gross Area of Site (ha) =	1.26	ha

Design Flows (Q) =	Based on Equivalent Population	+	Infiltration Allowance (I)

Design Flows (Q) =	**0.01335**	**m^3/sec**
	13.35	**L/sec**

SANITARY SERVICE CAPACITY CALCULATION

Pipe Capacity Q = $1/n * A * R^{2/3} * S^{1/2}$

Where:
n = Manning's Roughness Coeff. (For PVC Pipe = 0.013)
R = Hydraulic Radius (m) = Area/Wetted Perimeter
S = Slope (m/m)
A = Cross Sectional Area of Flow (m^2)

Pipe Capacities - Existing and New Sanitary Sewers

From MH	To MH	Pipe Dia (mm)	Length (m)	Slope (%)	Pipe Capacity (m^3/s)	Pipe Capacity (L/s)	Maximum Velocity (m/s)
Bldg	MH-1A	200	6.38	2.00%	0.046	**46.31**	**1.47**
MH-1A	MH-2A	200	9.32	2.00%	0.046	**46.31**	**1.47**
MH-2A	Ex.MH-10A	200	17.01	2.00%	0.046	**46.31**	**1.47**

Appendix "D" Water Supply System

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

POST-DEVELOPMENT WATER SUPPLY REQUIREMENT CALCULATIONS

Water Supply Requirements

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	386

No.	Demand Type	Demand	Units
1	Average day flow	1.34	L/Sec
2	Maximum day flow	1.88	L/Sec
3	Peak hour flow	4.02	L/Sec
4	Fire flow	116.67	L/Sec
Analysis			
5	Maximum day plus fire flow	118.54	L/Sec
6	Peak hour flow	4.02	L/Sec
7	**Maximum demand flow**	**118.54**	L/Sec

POST-DEVELOPMENT FIRE FLOW REQUIREMENT CALCULATIONS

The Fire Underwriters Survey 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	For non-combustible construction

Determining "A"

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

Largest Floor Area =	1280.40	m^2	Ground Floor
Adjoining Floor Area =	4864.40	m^2	2nd to 5th Floor
A =	6144.80	m^2	

So that,	**F =**	**14,000.00**	**L/min.**	(Rounded per FUS Guide Page # 20)

2 Addition / Reduction for occupancy type

Reduced by	-25%	For the occupancies having low contents of fire hazard

So that,	**F =**	**10,500.00**	**L/min.**

3 Reduction for sprinkler system

Reduced by	-30%	Adequately designed sprinkler system per NFPA

4 Addition for structures exposed within distance of fire area

Side	Distance (m)	% Addition
North	None	0%
South	None	0%
East	51.9	0%
West	58.00	0%
Total		**0%**

Shall not exceed 75%

Net Reduction / Addition for step 3 & 4

Reduced by	-30%

So that,	**F =**	**7000.00**	**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 =	**7000.00**	L/min.
	116.67	L/sec
	1849.20	USGPM
	1541.00	Imp. GPM

WATER 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 MARRIOTT HOTEL
12476 HIGHWAY 50 AT GEORGE BOLTON PKWY
CALEDON, ONTARIO

DATE : JUNE 10, 2020

TEST DONE BY FRANK CORTESE
REPRESENTATIVE OF CORTESE DESIGN INC.
WITNESS REGION OF PEEL

TIME : 11:30 AM

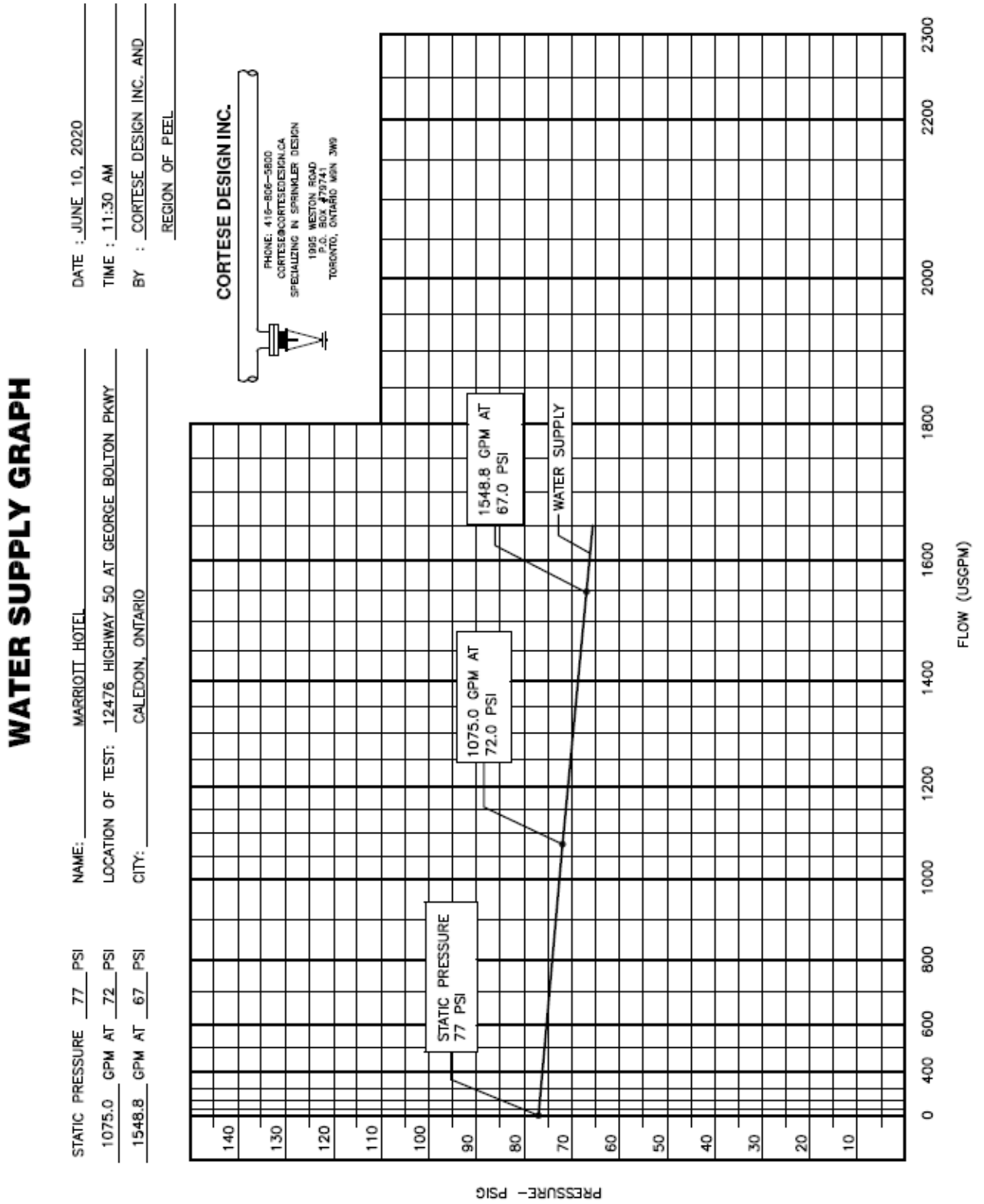
FLOW HYDRANT:

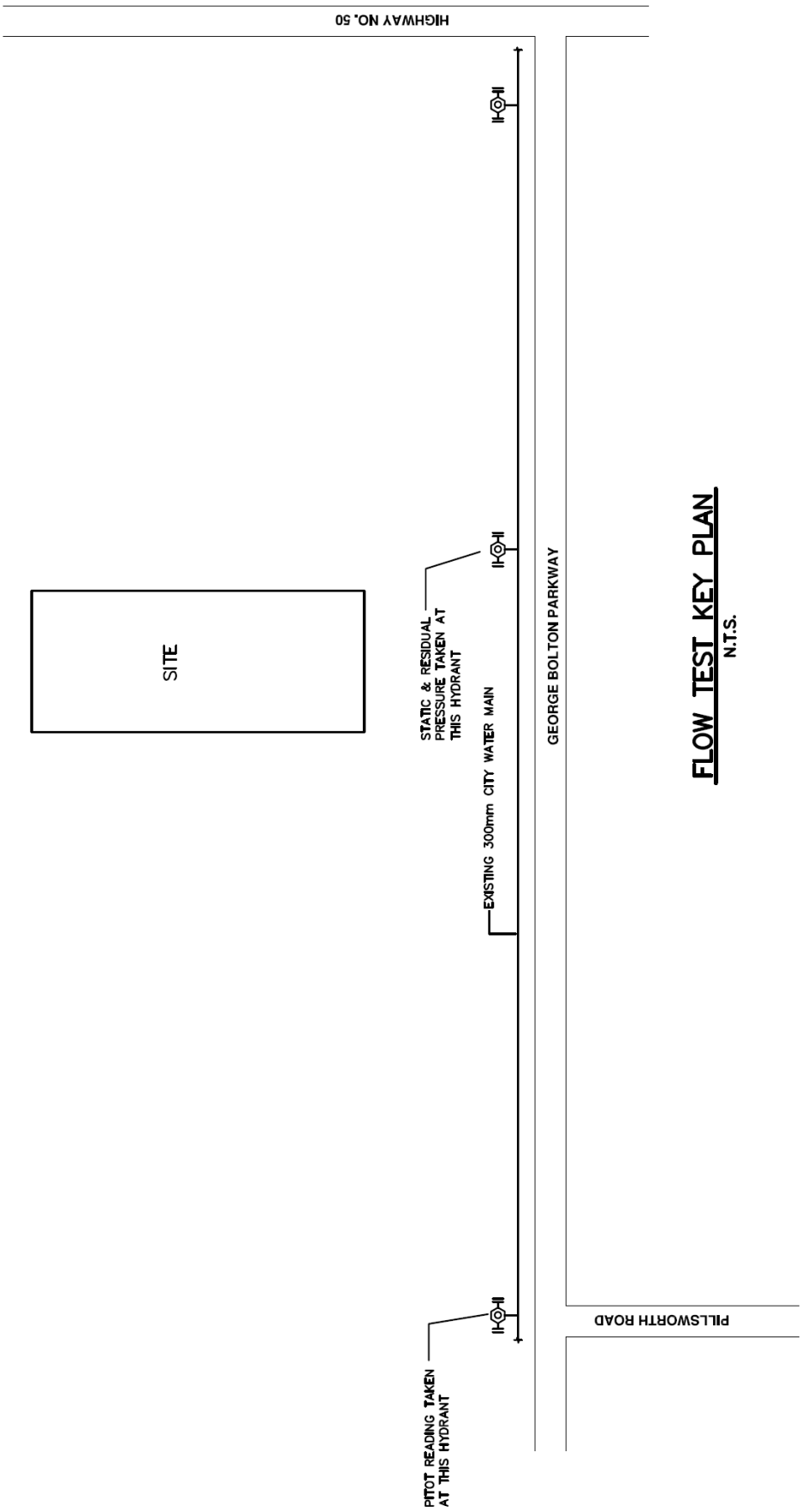
NOZZLE SIZE 2 1/2" POLLARD DIFFUSER
MODEL #LPD-250A

DISCHARGE COEFFICIENT 0.80

STATIC PRESSURE 77 PSI

NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S. GPM)	RESIDUAL PRESSURE
1 X 2 1/2"	50	1075.0	72
1 X 2 1/2"	26	774.4	
1 X 2 1/2"	26	774.4	
		1548.8	67


WATER SUPPLY GRAPH
STATIC PRESSURE 77 PSI
1075.0 GPM AT 72 PSI
1548.8 GPM AT 67 PSI
NAME: MARRIOTT HOTEL
LOCATION OF TEST: 12476 HIGHWAY 50 AT GEORGE BOLTON PKWY
CITY: CALEDON, ONTARIO
DATE : JUNE 10, 2020
TIME : 11:30 AM
BY : CORTESE DESIGN INC. AND
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 77 PSI
1075.0 GPM AT 72.0 PSI
1548.8 GPM AT 67.0 PSI
WATER SUPPLY
PRESSURE- PSIG
FLOW (USGPM)
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
400
600
800
1000
1200
1400
1600
1800
2000
2200
2300



FLOW TEST KEY PLAN
N.T.S.

FIRE PROTECTION CALCULATIONS

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

MUNICIPALITY:	Town of Caledon
PROJECT NAME:	Proposed Marriott Hotel
PROJECT ADDRESS:	12476 HWY 50, Caledon, Ontario
PROJECT No:	20398
Flow Test Conducted By	Cortese Design Inc.
Location of Test (FLOW)	3rd Hydrant at West side of HWY 50 on George Bolton Parkway
Location of Test (RESIDUAL)	2nd Hydrant at West side of HWY 50 on George Bolton Parkway
Mainline Pipe Size	300 mm Ø

Observed Flow From Hydrant Test $Q_f = 29.83 * c * (d^2)*(p^{1/2})$								**Projected Fire Flow** $Q_r = Q_f*((P_s-P_{rd})/(P_s-P_{ra})$		
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	0.815	77	50	72	1075	20	4001	253
2	1	2.5	0.815	77	26	67	775	20	1984	126
	1	2.5	0.815	77	26	67	775	20	1984	126
							1550			**252**

REGION OF PEEL DEMAND TABLE

DEMAND TABLE

Project : Proposed Marriott Hotel
Project Address : 12476 HWY 50, Caledon, Ontario
SPA No. : SPA-2020-0044

WATER CONNECTION

Connection Point :	From the existing 300mm dia watermain located within road allowance of George Bolton Parkway at an approximate distance of 104.0m west of centreline of HWY 50	
Pressure zone of connection point		
Total equivalent population to be serviced [1)]		386
Total lands to be serviced		1.26 ha
Hydrant Flow Test:	Performed by Cortese Design Inc.	
Hydrant flow test location	3rd Hydrant at West side of HWY 50 on George Bolton Parkway	
Hydrant residual test location	2nd Hydrant at West side of HWY 50 on George Bolton Parkway	
	Pitot Pressure (kPa)	Time
Minimum water pressure	345	11:30 AM
Maximum water pressure		

WATER DEMANDS

No.	Demand Type	Demand	Units
1	Average day flow	1.34	L/Sec
2	Maximum day flow	1.88	L/Sec
3	Peak hour flow	4.02	L/Sec
4	Fire flow [2)]	116.67	L/Sec
Analysis			
5	Maximum day plus fire flow	118.54	L/Sec

WASTEWATER CONNECTION

Connection Point [3)]**:**	From the existing SAN MH#10A connected to the existing 250mm dia municipal sanitary sewer located within road allowance of George Bolton Parkway		
Total equivalent population to be serviced [1)]			386
Total lands to be serviced			1.26 ha
6	Wastewater sewer effluent	5.70	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)

Appendix "E" 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 "F" Storm Filter Certification and Inspection and Maintenance Procedures

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
Mail Code 401-02B
Post Office Box 420
Trenton, New Jersey 08625-0420
609-633-7021 Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

December 14, 2016

Derek M. Berg
Director - Stormwater Regulatory Management - East
Contech Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Re: MTD Laboratory Certification
Stormwater Management StormFilter® (StormFilter) by Contech Engineered Solutions LLC
Off-line Installation

TSS Removal Rate 80%

Dear Mr. Berg:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Contech Engineered Solutions LLC has requested a Laboratory Certification for the StormFilter System.

This project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the afore-mentioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the StormFilter System by Contech Engineered Solutions LLC at a TSS removal rate of 80%, when designed, operated and maintained in accordance with the information provided in the Verification Appendix and subject to the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5. The MTFR is calculated based on a verified loading rate of 2.12 gpm/sf of effective filtration treatment area.

2. The StormFilter System shall be installed using the same configuration as the unit tested by NJCAT, and sized in accordance with the criteria specified in item 6 below.

3. This device cannot be used in series with another MTD or a media filter (such as a sand filter), to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found on-line at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the StormFilter, which is attached to this document. However, it is recommended to review the maintenance website at http://www.conteches.com/DesktopModules/Bring2mind/DMX/Download.aspx?EntryId=2813&PortalId=0&DownloadMethod=attachment for any changes to the maintenance requirements.

6. Sizing Requirements:

   The example below demonstrates the sizing procedure for a StormFilter System.

   Example: A 0.25 acre impervious site is to be treated to 80% TSS removal using a StormFilter System. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs or 354.58 gpm.

   The calculation of the minimum number of cartridges for use in the StormFilter System is based upon both the MTFR and the maximum inflow drainage area. It is necessary to calculate the required cartridges using both methods and to rely on the method that results in the highest minimum number of cartridges determined by the two methods.

   Inflow Drainage Area Evaluation:

   The drainage area to the StormFilter System in this example is 0.25 acres. Based upon the information in Table 1 below, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the maximum drainage area:

1. Five (5) 12” cartridges,
2. Three (3) 18” cartridges, or
3. Two (2) 27” cartridges

Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was determined based on the following:

time of concentration = 10 minutes
i=3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
c=0.99 (runoff coefficient for impervious)
Q=ciA=0.99x3.2x0.25=0.79 cfs=0.79x448.83 gpm=354.58 gpm

Based on a flow rate of 354.58 gpm, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the MTFR:

1. Thirty-six (36) 12” cartridges,
2. Twenty-four (24) 18” cartridges, or
3. Sixteen (16) 27” cartridges

The MTFR Evaluation results will be used since that method results in the higher minimum number of cartridges determined by the two methods.

The sizing table corresponding to the available system models are noted below:

TABLE 1 STORMFILTER CARTRIDGE HEIGHTS AND NEW JERSEY TREATMENT CAPACITIES

StormFilter Cartridge Heights and New Jersey Treatment Capacities				
StormFilter Cartridge Height	**Filtration Surface Area (sq.ft)**	**MTFR[1] (GPM)**	**Mass Capture Capacity (lbs)**	**Maximum Allowable Inflow Area[2] (acres)**
Low Drop (12")	4.71	10	36.3	0.061
18"	7.07	15	54.5	0.09
27"	10.61	22.5	81.8	0.136

Notes:

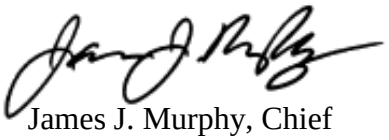
1. *MTFR calculated based on 4.72x10-3 cfs/sf (2.12 gpm/sf) of effective filtration treatment area.*
2. *Based upon the equation found in the NJDEP Filter Protocol Maximum Inflow Drainage Area (acres) = weight of TSS before 10% loss in MTFR (lbs)/600 lbs/acre of drainage area annually.*

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of

indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Shashi Nayak of my office at (609) 633-7021.

Sincerely,



James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP - DLUR
Ravi Patraju, NJDEP - BES
Gabriel Mahon, NJDEP - BNPC
Shashi Nayak, NJDEP - BNPC

CONTECH®
ENGINEERED SOLUTIONS

StormFilter Inspection and Maintenance Procedures

The Stormwater Management StormFilter®

Maintenance Guidelines

The primary purpose of the Stormwater Management StormFilter® is to filter and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. Maintenance activities may be required in the event of a chemical spill or due to excessive sediment loading from site erosion or extreme storms. It is a good practice to inspect the system after major storm events.

Maintenance Procedures

Although there are many effective maintenance options, we believe the following procedure to be efficient, using common equipment and existing maintenance protocols. The following two-step procedure is recommended::

1. **Inspection**
   - Inspection of the vault interior to determine the need for maintenance.
2. **Maintenance**
   - Cartridge replacement
   - Sediment removal

Inspection and Maintenance Timing

At least one scheduled inspection should take place per year with maintenance following as warranted.

First, an inspection should be done before the winter season. During the inspection the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained.

Second, if warranted, a maintenance (replacement of the filter cartridges and removal of accumulated sediments) should be performed during periods of dry weather.

In addition to these two activities, it is important to check the condition of the StormFilter unit after major storms for potential damage caused by high flows and for high sediment accumulation that may be caused by localized erosion in the drainage area. It may be necessary to adjust the inspection/ maintenance schedule depending on the actual operating conditions encountered by the system. In general, inspection activities can be conducted at any time, and maintenance should occur, if warranted, during dryer months in late summer to early fall.

Maintenance Frequency

The primary factor for determining frequency of maintenance for the StormFilter is sediment loading.

A properly functioning system will remove solids from water by trapping particulates in the porous structure of the filter media inside the cartridges. The flow through the system will naturally decrease as more and more particulates are trapped. Eventually the flow through the cartridges will be low enough to require replacement. It may be possible to extend the usable span of the cartridges by removing sediment from upstream trapping devices on a routine as-needed basis, in order to prevent material from being re-suspended and discharged to the StormFilter treatment system.

The average maintenance lifecycle is approximately 1-5 years. Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction may need to be inspected and maintained more often than those with fully stabilized surface conditions.

Regulatory requirements or a chemical spill can shift maintenance timing as well. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after major storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual StormFilter system or site. It is recommended that the site owner develop a database to properly manage StormFilter inspection and maintenance programs..

Inspection Procedures

The primary goal of an inspection is to assess the condition of the cartridges relative to the level of visual sediment loading as it relates to decreased treatment capacity. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

Warning: In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct an inspection:

Important: Inspection should be performed by a person who is familiar with the operation and configuration of the StormFilter treatment unit.

1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the access portals to the vault and allow the system vent.
4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
6. Close and fasten the access portals.
7. Remove safety equipment.
8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
9. Discuss conditions that suggest maintenance and make decision as to weather or not maintenance is needed.

Maintenance Decision Tree

The need for maintenance is typically based on results of the inspection. The following Maintenance Decision Tree should be used as a general guide. (Other factors, such as Regulatory Requirements, may need to be considered)

1. Sediment loading on the vault floor.
   a. If >4" of accumulated sediment, maintenance is required.
2. Sediment loading on top of the cartridge.
   a. If >1/4" of accumulation, maintenance is required.
3. Submerged cartridges.
   a. If >4" of static water above cartridge bottom for more than 24 hours after end of rain event, maintenance is required. (Catch basins have standing water in the cartridge bay.)
4. Plugged media.
   a. If pore space between media granules is absent, maintenance is required.
5. Bypass condition.
   a. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), maintenance is required.
6. Hazardous material release.
   a. If hazardous material release (automotive fluids or other) is reported, maintenance is required.
7. Pronounced scum line.
   a. If pronounced scum line (say ≥ 1/4" thick) is present above top cap, maintenance is required.

Maintenance

Depending on the configuration of the particular system, maintenance personnel will be required to enter the vault to perform the maintenance.

Important: If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flows is occurring.

Replacement cartridges can be delivered to the site or customers facility. Information concerning how to obtain the replacement cartridges is available from Contech Engineered Solutions.

Warning: In the case of a spill, the maintenance personnel should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct cartridge replacement and sediment removal maintenance:

1. If applicable, set up safety equipment to protect maintenance personnel and pedestrians from site hazards.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the doors (access portals) to the vault and allow the system to vent.
4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
5. Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
7. Remove used cartridges from the vault using one of the following methods:

Method 1:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

   Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact Contech Engineered Solutions for suggested attachment devices.

B. Remove the used cartridges (up to 250 lbs. each) from the vault.

Important: Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner.

C. Set the used cartridge aside or load onto the hauling truck.

D. Continue steps a through c until all cartridges have been removed.

Method 2:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

B. Unscrew the cartridge cap.

C. Remove the cartridge hood and float.

D. At location under structure access, tip the cartridge on its side.

E. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.

F. Set the empty, used cartridge aside or load onto the hauling truck.

G. Continue steps a through e until all cartridges have been removed.

8. Remove accumulated sediment from the floor of the vault and from the forebay. This can most effectively be accomplished by use of a vacuum truck.
9. Once the sediments are removed, assess the condition of the vault and the condition of the connectors.
10. Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.
11. Close and fasten the door.
12. Remove safety equipment.
13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used **empty** cartridges to Contech Engineered Solutions.

Related Maintenance Activities - Performed on an as-needed basis

StormFilter units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.

Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads.

Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.

Inspection Report

Date: Personnel:

Location: System Size:

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other ☐

Sediment Thickness in Forebay: Date:

Sediment Depth on Vault Floor:

Structural Damage:

Estimated Flow from Drainage Pipes (if available):

Cartridges Submerged: Yes ☐ No ☐ Depth of Standing Water:

StormFilter Maintenance Activities (check off if done and give description)

☐ Trash and Debris Removal:

☐ Minor Structural Repairs:

☐ Drainage Area Report

Excessive Oil Loading: Yes ☐ No ☐ Source:

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source:

Erosion of Landscaped Areas: Yes ☐ No ☐ Source:

Items Needing Further Work:

Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals.

Other Comments:

Review the condition reports from the previous inspection visits.

StormFilter Maintenance Report

Date: _____ Personnel: _____

Location: _____ System Size: _____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other ☐

List Safety Procedures and Equipment Used: _____

_____

_____

System Observations

Months in Service:

Oil in Forebay (if present): Yes ☐ No ☐

Sediment Depth in Forebay (if present): _____

Sediment Depth on Vault Floor: _____

Structural Damage: _____

Drainage Area Report

Excessive Oil Loading: Yes ☐ No ☐ Source: _____

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: _____

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: _____

StormFilter Cartridge Replacement Maintenance Activities

Remove Trash and Debris: Yes ☐ No ☐ Details: _____

Replace Cartridges: Yes ☐ No ☐ Details: _____

Sediment Removed: Yes ☐ No ☐ Details: _____

Quantity of Sediment Removed (estimate?):

Minor Structural Repairs: Yes ☐ No ☐ Details: _____

Residuals (debris, sediment) Disposal Methods: _____

Notes:

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