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# 4791 Highway 28, Burleigh Falls

## FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

Burleigh Falls Inn

# Document Control

File:

525016

Date:

June  
23, 2026

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| Issue | Date          | Description                   |
|-------|---------------|-------------------------------|
| 1     | June 10, 2026 | First Submission for Approval |
| 2     | June 23, 2026 | Final Report                  |



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# 1 Introduction

Tatham Engineering Limited (Tatham) was retained by Burleigh Falls Inn to prepare a Functional Servicing and Stormwater Management (FSSWM) report in support of a site plan for a proposed resort and spa development located at 4791 Highway 28 (site) in the Township of North Kawartha (Township).

## 1.1 OBJECTIVES

This report has been prepared to demonstrate the servicing feasibility of the proposed development with respect to civil servicing, including site grading and drainage, sewage collection and treatment, and water supply and distribution.

## 1.2 GUIDELINES AND BACKGROUND INFORMATION

This report is prepared recognizing municipal and provincial guidelines on water resources and the environment, including the following publications:

- Ministry of the Environment, Conservation and Parks (MECP), *Stormwater Management Practices Planning and Design Manual* (2003);
- MECP, Design Guidelines for Drinking-Water Systems (2008);
- MECP, Design Guidelines for Sewage Works (2008);
- MECP, Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized Under an Environmental Compliance Approval (2023);
- Ministry of Transportation (MTO), *MTO Drainage Management Manual* (1997);
- Ministry of Municipal Affairs and Housing, *Ontario Building Code (OBC)* (2024);
- Ministry of Municipal Affairs and Housing, *Provincial Planning Statement* (2024); and
- Credit Valley Conservation Authority, et al., *Low Impact Development Stormwater Management Planning and Design Guide* (2010).

The following background reports pertaining to the site have also been referenced in the preparation of this report:

- Redstone Engineering Inc. (Redstone), *Geotechnical Investigation Report* (December 2025).



### 1.3 SITE DESCRIPTION

The development area forms part of a larger existing hotel complex. The total site area under this application consists of approximately 0.6 ha with shoreline frontages on Burleigh Falls on the south and east sides. The site consists of a few existing building structures, existing pavement, wooded areas, and landscaped areas. The site is bound by Highway 28 to the west, and Burley Falls Bridge and the Burleigh River to the south, Fire Route 2 and Burleigh Falls Inn to the north, Burleigh Falls to the east. Site runoff drains ultimately to Burleigh River (identified as the outlet).

The property is legally described as:

Part 1 – Plan of Survey and  
Plan of Topography of  
Part of Large Burleigh Island  
Geographic Township of Burleigh  
Now in the Township of North Kawartha  
County of Peterborough

Refer to the Site Location Plan on Figure 1.

### 1.4 TOPOGRAPHY

Information related to existing topography, ground cover, and drainage was obtained through a review of detailed topography of the site completed by Richmond Surveying Inc. in December 2025, relevant base mapping, and relevant background studies and plans. The site splits to three drainage reference points: southwest to Highway 28 then to the Burleigh River, southeast to the Burleigh River, and northeast through existing lands then to the Burleigh River. Generally, the site slopes at an average grade of 5% slope.

### 1.5 GEOTECHNICAL INVESTIGATION

A *Geotechnical Investigation* was completed by Redstone (December 2025), to identify the subsurface conditions and determine the engineering properties of in-situ soils for the design and construction of the proposed development. A total of 7 test pits (TP1 through TP7) were drilled to bedrock at depths 0 mbgs to 1.32 mbgs.

The report describes the existing stratigraphy as a layer of surficial topsoil (5 mm to 150 mm depth), underlain by engineered fill material (19% gravel, 75% sand, and 6% silt and clay-sized particles) extending to depths ranging from 0.46 mbgs to 0.97 mbgs, and buried organics (dark brown to black organics with roots, some gravel in a moist and loose in-situ state), at depths ranging from 0.46 mbgs to 0.97 mbgs and extending to depths of 0.81 mbgs to 1.32 mbgs.

Refer to the *Geotechnical Investigation* under separate cover for additional information.



The presence of shallow bedrock and organic materials significantly restrict infiltration of stormwater runoff. Consistent with the criteria for Hydrologic Soil Group (HSG) 'D', these in-situ conditions indicate a high runoff potential and very low infiltration capacity. Therefore, HSG 'D' was selected for hydrologic modeling and SWM design.

## **1.6 PROPOSED DEVELOPMENT**

The proposed development consists of demolishing the existing building structures to construct a 6-storey 55-unit hotel, paved covered and uncovered parking areas, paved loading areas, paved driveways, and landscaped areas. Fire Route 2 will be improved and will continue to provide access to the site, inclusive of the new development area, from Highway 28.

There are no municipal services (water and sanitary) in proximity to the proposed development area. It is understood the property is serviced from private communal water and sewage systems and both systems are underutilized. As such, it is assumed that the proposed development will be serviced via the existing systems.

Refer to the Site Plan prepared by EcoVue dated June 2025 in Appendix A for reference.



## 2 Communal Water and Sewage Systems

The site is serviced by an existing communal water treatment plant (WTP) and sewage treatment plant (STP) housed in the same building, as well as internal watermains and an internal sanitary collection system. The WTP and STP are owned by Burleigh Falls Inn and operated by Inn staff under the supervision of Envirosearch Operations Inc.

The proposed hotel will be serviced by a 150 mm water service connected to the existing 150 mm internal watermain from the WTP. A 150 mm sanitary service from the hotel will discharge to a new maintenance hole on the existing 150 mm sewer to the STP.

### 2.1 HISTORICAL FLOWS

Historical water demands and sewage flows were analyzed to establish existing water and sewer usage for the site. Flow data for the years 2020 to 2024 from the water treatment plant's raw water flow meter and for 2021 to 2025 for the sewage treatment plant's effluent flow meter, are summarized in the tables below.

**Table 1: Summary of WTP Raw Water Taking (2020 to 2024) in m<sup>3</sup>/day**

| YEAR                   | AVERAGE DAY FLOW (ADF) | ADF – MAY TO OCTOBER | ADF – NOV TO APRIL | MAXIMUM DAY FLOW (MDF) |
|------------------------|------------------------|----------------------|--------------------|------------------------|
| 2020                   | 8.3                    | 12.8                 | 3.8                | 52.0                   |
| 2021                   | 7.2                    | 9.9                  | 4.4                | 44.9                   |
| 2022                   | 8.2                    | 13.0                 | 3.3                | 83.8                   |
| 2023                   | 9.9                    | 15.4                 | 4.4                | 76.5                   |
| 2024                   | 9.5                    | 14.3                 | 4.7                | 70.9                   |
| <b>Overall Avg/Max</b> | <b>8.6</b>             | <b>13.1</b>          | <b>4.1</b>         | <b>83.8</b>            |

Based on our review of the flow data and discussions with operations staff at the Inn, our analysis is summarized as follows:

- Water usage is highest from May to October due to the seasonal nature of the site. Maximum day WTP and STP flows typically occur in July or August corresponding with high seasonal occupancy at the Inn.



- Overall, average water taking at the WTP is approximately 4 times higher than effluent flows from the STP. WTP flows from May to October are impacted by water used to: fill the outdoor pool (typically in May or June), run lawn sprinklers, and supply outdoor water taps used by boaters.
- There are no sewage services available for boaters. Boaters use water from the outdoor taps but do not contribute sewage flows to the STP. This accounts for some of the differences between the WTP and STP flows from May to October.
- During the off season (November to April), average WTP flows remain about 5 times higher than average STP flows. This discrepancy could be due to factors such as flow meter inaccuracy or water distribution system leakage.

**Table 2: Summary of STP Effluent Flows (2021 to 2025) in m<sup>3</sup>/day**

| YEAR                   | AVERAGE DAY FLOW (ADF) | ADF - MAY TO OCTOBER | ADF - NOV TO APRIL | MAXIMUM DAY FLOW (MDF) |
|------------------------|------------------------|----------------------|--------------------|------------------------|
| 2021                   | 3.9                    | 5.8                  | 2.0                | 22.5                   |
| 2022                   | 0.8                    | 1.4                  | 0.2                | 11.1                   |
| 2023                   | 1.3                    | 2.2                  | 0.4                | 6.7                    |
| 2024                   | 1.5                    | 2.6                  | 0.4                | 7.4                    |
| 2025                   | 3.5                    | 6.2                  | 0.8                | 21.1                   |
| <b>Overall Avg/Max</b> | <b>2.2</b>             | <b>3.7</b>           | <b>0.8</b>         | <b>22.5</b>            |

## 2.2 DESIGN WATER DEMANDS

During the high occupancy season of May to October for the years 2020 to 2024, the average daily WTP flow was 13.1 m<sup>3</sup>/day. For the same period, the maximum day WTP flow was 83.8 m<sup>3</sup>/day, which corresponds to a maximum day factor of 6.4. Excluding water usage for lawn sprinklers, outdoor taps, and filling the outdoor pool, the MDD is estimated to be 25 L/s, corresponding to a maximum day factor of 1.9.

The estimated water demands for the proposed hotel are calculated as follows:

- Design criteria, hotels: 225 L/day/bed, (Table 3.2 MECP Guidelines Drinking Water)
- Number of hotel beds: 100 (15 x 1-bedroom, 35 x 2-bedroom, and 5 x 3-bedroom)
- Maximum day demand (MDD): 225 L/day/bed x 100 beds, (all beds occupied)

$$\text{MDD} = 22,500 \text{ L/day or } 22.5 \text{ m}^3/\text{day}$$



- Maximum day factor: 2
- Average day demand (ADD):  $22.5 \text{ m}^3/\text{day} / 2$ , (50% of beds occupied)  

$$\text{ADD} = 11.3 \text{ m}^3/\text{day}$$

The total design ADD and MDD for the site are  $24.4 \text{ m}^3/\text{day}$  and  $106 \text{ m}^3/\text{day}$ , respectively. These demands exclude any reductions that may occur due to demolition of the existing buildings on the site of the proposed hotel.

### 2.3 COMMUNAL WATER TREATMENT PLANT

The WTP draws raw water from Stoney Lake under Permit to Take Water (PTTW) number 1545-C9SSZ9, dated April 6, 2022. The PTTW allows for a maximum water taking rate of  $143 \text{ m}^3/\text{day}$ .

The WTP consists of the following main components:

- A 100 mm diameter intake pipe.
- Two low lift pumps, Grundfos model 22SQ/SQE03A-40 submersible pumps with 1/3 HP motors, installed horizontally in the low lift well.
- Treatment consists of micro-filtration, chlorination, and UV disinfection.
- A package micro-filtration treatment system manufactured by Pall Corporation, with space to accommodate up to 6 micro-filter modules. Currently 2 filter modules are installed.
- Primary disinfection is provided by a UV disinfection system, Viqua model number PRO20.
- A chlorination system provides secondary disinfection, consisting of one chlorine dosing pump, drawing from a 20L carboy of sodium hypochlorite, and a chlorine analyzer.
- Treated water is stored in a 2-cell clear well underneath the floor slab of the WTP building. The clear well provides storage for fire protection as well as domestic usage.
- Two high lift pumps, Grundfos model 40S30-9 submersible pumps with 3 HP motors, installed horizontally in the clear well.
- A fire pump provides water supply for fire protection to the Inn, Fairbanks Morse model 11M-700F, 4 stage vertical turbine pump with 60 HP, 1770 RPM, 575 V, 3 Phase, 60 Hz, USEM vertical motor.

The Inn has an emergency generator which provides standby power to the Inn, the WTP, and the STP.



### WTP Operation and Maintenance

The WTP was originally constructed in 2002. The WTP is owned by Burleigh Falls Inn and operated by Inn staff under the supervision of Envirosearch Operations Inc.

A site visit was completed to review the WTP and to discuss any operation and maintenance challenges with Inn staff responsible for day-to-day operation. The following maintenance items were identified:

- One of the two high lift pumps has failed and requires replacement.
- The clear well requires cleaning to remove an accumulation of iron deposits.

Daily water sampling and testing are completed during the summer season. Treated water sample results for microbiology were reviewed and no concerns with treated water quality were identified.

During the summer season, the WTP draws water every 24 hours. In the off season, the WTP draws water every few weeks, as the level in the clear well is lowered.

The clear well typically operates between 85% and 99% full to provide domestic demand. A minimum clear well level of 70% is maintained to provide water supply for the fire protection system.

### WTP Capacity

The proposed ADD and MDD for the site are 24.4 m<sup>3</sup>/day and 106 m<sup>3</sup>/day, respectively. The MDD is within the maximum water taking permitted of 143 m<sup>3</sup>/day. The capacities of the main WTP components are summarized in the table below.

The package microfiltration system will need upgrades to have sufficient capacity to supply the proposed MDD. The total number of filter modules will need to be expanded from two to three. It is our understanding that one of the original filter modules has been replaced recently. The second module has been in service since 2002 and is anticipated to need replacement. A review of process data should be completed, including flux, temperature, pressure, and flow, to determine the current filter capacity and confirm the filter upgrades required.

The clear well provides storage for fire protection, domestic demand, and backwash cycles for the package microfiltration system, as follows:

- Fire protection: 70% of 275 m<sup>3</sup> = 193 m<sup>3</sup>.
- Domestic demand and backwash: 30% of 275 m<sup>3</sup> = 82 m<sup>3</sup>.

For small systems, MECP design guidelines recommend minimum storage for domestic use equal to the ADD of 24.4 m<sup>3</sup>/day. The O&M Manual for the microfiltration system indicates that the



backwash cycle requires approximately 200 Gallons (0.8 m<sup>3</sup>). There is sufficient clear well storage for the ADD and backwash cycle.

For fire protection, 193 m<sup>3</sup> provides approximately 1.5 hours of water supply at the fire pump design flow of 35 L/s. The water supply requirements for the fire protection system for the proposed hotel will need to be confirmed during the design phase.

**Table 3: WTP Component Capacities in m<sup>3</sup>/day**

| DESCRIPTION                                | CAPACITY                                                                               | NOTES                                                                                                                                          |
|--------------------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| 100 mm Dia. Intake                         | 143 m <sup>3</sup> /day                                                                | PTTW max. daily water taking                                                                                                                   |
| Low Lift Pumps - LLP 1<br>LLP 2            | 136 m <sup>3</sup> /day (25 USGM)<br>38 m <sup>3</sup> /day (7 USGM)                   | O&M Manual pump curves and Treatment System Label                                                                                              |
| Package Microfiltration System (2 modules) | Max: 91 m <sup>3</sup> /day (16.7 USGM)<br>Current: 75 m <sup>3</sup> /day (13.8 USGM) | Manufacturer phone discussion: max. capacity of 50 USGM with 6 filter modules installed. Operations staff phone discussion re current capacity |
| UV System                                  | 109 m <sup>3</sup> /day (20 USGM)                                                      | Product Spec Sheet from manufacturer's website                                                                                                 |
| High Lift Pumps<br>HLP 1 & HLP 2 - Each    | 218 m <sup>3</sup> /day (40 USGM)                                                      | O&M Manual pump curve                                                                                                                          |
| Fire Pump                                  | 35 L/s (549 USGM) at 70 m TDH                                                          | O&M Manual pump curve                                                                                                                          |
| Clear Well - Cell 1<br>Cell 2<br>Total     | 125 m <sup>3</sup><br>150 m <sup>3</sup><br>275 m <sup>3</sup>                         | Email from Envirosearch                                                                                                                        |

## 2.4 DESIGN SEWAGE FLOWS

The seasonal average daily STP flow from May to October for the years 2021 to 2025 was 3.7 m<sup>3</sup>/day. The maximum day flow for the same period was 22.5 m<sup>3</sup>/day.

The estimated sewage flows for the proposed hotel are calculated using the same design criteria as for water demands: 225 L/day/bed, (Table 5.3 MECP Guidelines Sewage Works).

The estimated average daily flow (ADF) and maximum day sewage flow (MDF) for the proposed hotel are 11.3 m<sup>3</sup>/day and 22.5 m<sup>3</sup>/day.

The total design ADF and MDF for the site are 15 m<sup>3</sup>/day and 45 m<sup>3</sup>/day, respectively.



## 2.5 COMMUNAL SEWAGE TREATMENT PLANT

Sewage from the site is collected and conveyed to the tertiary STP and treated effluent is discharged to Stoney Lake. The STP operates under amended Environmental Compliance Approval (ECA) number 1882-CJ4K3K, dated September 29, 2022, and is rated for an average daily flow (ADF) of 84 m<sup>3</sup>/day.

The STP consists of the following main components:

- Primary settlement chamber (clarifier) with a volume of 79 m<sup>3</sup>.
- Rotating Biological Contactor (RBC) treatment system with total media contact area of 3,344 m<sup>2</sup>.
- Secondary settlement chamber (clarifier) with a volume of 17.3 m<sup>3</sup> and equipped with air lift pumps to return settled sludge to the primary clarifier.
- Effluent filtration tank with granular media in 2 parallel chambers and equipped with air lift backwash system.
- Effluent pump tank with a volume of 10,000 L and equipped with duty/standby effluent pumps.
- UV disinfection system.
- Alum dosing system.

### STP Operation and Maintenance

The STP was originally constructed in 2001 and needs significant repair to replace failing components and restore system capacity. Current operations and maintenance challenges were discussed with Inn staff responsible for day-to-day operation of the STP. The wastewater treatment system annual reports were reviewed, as well as a recent maintenance inspection report by the Inn's STP equipment service provider.

To support long-term system performance and regulatory compliance, the following upgrades are recommended: replacement of the RBC treatment system, and improvements to the air lift pumping systems, alum dosing system, and UV disinfection system. The annual operational reports indicate that the effluent ammonia levels have periodically been elevated. Likely contributing factors including sensor calibration issues, deteriorating RBC media, and seasonal fluctuations in wastewater flows. A detailed review and evaluation of options for upgrading the STP is recommended.



**STP Capacity**

The rated capacity of the STP is 84 m<sup>3</sup>/day. The proposed maximum day sewage flow for the site is 45 m<sup>3</sup>/day. Therefore, the STP will have sufficient capacity to accommodate the proposed development, provided the equipment upgrades needed to restore treatment system capacity are completed.



### 3 Stormwater Management Plan

This stormwater management (SWM) plan has been prepared in support of the proposed development to mitigate adverse impacts to downstream surface water features in accordance with MECP and Township standards.

#### 3.1 PRE-DEVELOPMENT HYDROLOGIC ASSESSMENT

A Pre-Development Drainage Plan (Drawing DP.1) for the site is enclosed in Appendix D. Under pre-development conditions, the development is modelled as three catchments and described below:

- Catchment 101A has an area of 0.21 ha, comprising of existing pavement and building rooftops, wooded areas, and landscaped areas. A runoff coefficient (RC) 0.40 was calculated. Runoff from this catchment will drain southwest overland via sheet flow to a low point between the Highway 28 road centerline and the southwest site property line, then to existing landscaped areas prior to draining to the outlet.
- Catchment 101B has an area of 0.27 ha, comprising of existing pavement and building rooftops, wooded areas, and landscaped areas. A runoff coefficient (RC) 0.30 was calculated. Runoff from this catchment will drain southeast overland via sheet flow directly to the outlet.
- Catchment 101C has an area of 0.15 ha, comprising of existing pavement and building rooftops, wooded areas, and landscaped areas. A runoff coefficient (RC) 0.60 was calculated. Runoff from this catchment will drain northeast overland via sheet flow through existing lands owned by Burleigh Falls Inn and drain to the outlet.

Using Rational Method, Catchments 101A through 101C were combined as Catchment 101 with a total area of 0.63 ha, weighted average RC of 0.40, and a time of concentration ( $t_c$ ) of 16.71 min. Intensity-duration-frequency (IDF) values from the MTO IDF Curve Look-up Tool were applied in the analysis.

A summary of site-generated peak flows for the 1:2-year through 1:100-year return frequency is provided in Table 4 below. Calculations are provided in Appendix D of this report.



**Table 4: Pre-Development Peak Flow Summary – Outlet (Burleigh River)**

| STORM      | PEAK FLOW (m <sup>3</sup> /s) |
|------------|-------------------------------|
| 1:2-year   | 0.037                         |
| 1:5-year   | 0.049                         |
| 1:10-year  | 0.057                         |
| 1:25-year  | 0.073                         |
| 1:50-year  | 0.089                         |
| 1:100-year | 0.102                         |

### 3.2 STORMWATER MANAGEMENT DESIGN CRITERIA

The SWM plan is designed in accordance with MECP and Township standards as follows:

- Post-development peak flows must be controlled to pre-development rates for the 1:2-year through 1:100-year return frequency at all site outlets to prevent negative impacts to downstream flooding, except where the outlet has a direct connection to a larger water body (i.e., Burleigh River);
- Recognizing Highway 28 is under MTO jurisdiction, post-development peak flow rates directed toward the highway drainage system must not exceed pre-development peak flow rates for all storm events;
- Maximum peak flow rate generated on site must be safely conveyed through the development to the site outlet to prevent on-site flooding;
- Stormwater quality controls must be provided to satisfy the MECP's *Stormwater Management Practices Planning and Design Manual* for enhanced level stormwater quality protection in the form of 80% total suspended solids removal; and
- Provide an Erosion and Sediment Control (ESC) strategy to be implemented during all construction activities.



### 3.3 POST-DEVELOPMENT HYDROLOGIC ASSESSMENT

A Post-Development Drainage Plan (Drawing DP.2) for the site is enclosed in Appendix D. Under post-development conditions, the development is modelled as four catchments and described below:

- Catchment 201A has an area of 0.10 ha, comprising of the proposed development (pavement and landscaped areas). A RC of 0.75 was calculated. Runoff from this catchment drains southwest to a low point between the Highway 28 road centerline the southwest site property line, then through landscaped areas prior to draining to the outlet.
- Catchment 201B has an area of 0.29 ha, comprising of the proposed development (pavement, rooftop, and landscaped areas). A RC of 0.90 was calculated. Runoff from this catchment drains through internal storm sewer network prior to discharging southeast to the outlet.
- Catchment 201C has an area of 0.14 ha, comprising of landscaped areas to be maintained. A RC of 0.15 was calculated. Runoff from this catchment drains southeast overland via sheet flow to the outlet.
- Catchment 201D has an area of 0.10 ha, comprising of the proposed development (pavement and landscaped areas). A RC of 0.65 was calculated. Runoff from this catchment will drain northeast overland via sheet flow through existing lands owned by Burleigh Falls Inn and drain to the outlet.

Using the Rational Method calculations, Catchments 201A through 201D were combined as Catchment 201 with a total area of 0.63 ha, weighted average RC of 0.67, and a time of concentration ( $t_c$ ) of 10 min. The Township's intensity-duration-frequency (IDF) values were applied in the analysis.

A summary of site-generated peak flows for the 1:2-year through 1:100-year return frequency is provided in the table below. Calculations are provided in Appendix D of this report.



**Table 5: Post-Development Peak Flow Summary**

| STORM      | PEAK FLOW (m <sup>3</sup> /s) |
|------------|-------------------------------|
| 1:2-year   | 0.088 ( <i>0.037</i> )        |
| 1:5-year   | 0.117 ( <i>0.049</i> )        |
| 1:10-year  | 0.136 ( <i>0.057</i> )        |
| 1:25-year  | 0.176 ( <i>0.073</i> )        |
| 1:50-year  | 0.213 ( <i>0.089</i> )        |
| 1:100-year | 0.244 ( <i>0.102</i> )        |

Note: values in (*italics*) denote pre-development conditions.

### 3.4 STORMWATER QUANTITY CONTROL

As mentioned previously, typical SWM criteria require all post-development peak flows must be controlled to pre-development rates for the 1:2-year through 1:100-year return frequency at all site outlets to prevent negative impacts to downstream flooding. However, as runoff under pre- and post-development conditions drain to Burleigh River (i.e., a larger water body) immediately downstream of the development, stormwater quantity control for the development is not required. Table 5 above demonstrates incidental peak flow increase due to the proposed development.

### 3.5 DRAINAGE TO HIGHWAY 28

As mentioned previously, a portion of the site under pre-development conditions (Catchment 101A) drains to a low point between the Highway 28 road centerline and the southwest property boundary. Flows from this location drain south to Burleigh River. This drainage area under post-development conditions (Catchment 202A) will generally maintain this existing drainage condition.

Recognizing that Highway 28 falls under MTO jurisdiction, the proposed grading design limits drainage directed to the highway to the maximum extent possible. Refer to Table 6 below for a comparison between peak flows from Catchments 101A and 201A.



**Table 6: Pre- and Post-Development Peak Flow Summary – Highway 28**

| STORM      | PEAK FLOW<br>(m <sup>3</sup> /s) |
|------------|----------------------------------|
| 1:2-year   | 0.015 ( <i>0.015</i> )           |
| 1:5-year   | 0.020 ( <i>0.021</i> )           |
| 1:10-year  | 0.024 ( <i>0.024</i> )           |
| 1:25-year  | 0.031 ( <i>0.031</i> )           |
| 1:50-year  | 0.037 ( <i>0.037</i> )           |
| 1:100-year | 0.042 ( <i>0.043</i> )           |

Note: values in (*italics*) denote pre-development conditions.

### 3.6 STORMWATER CONVEYANCE

Minor storms (up to and including the 1:5-year return frequency) and major storms (up to and including the 1:100-year return frequency) from Catchments 201A, 201C, and 201D will drain overland to the outlet via sheet flow.

Minor storms from Catchment 201B will drain to the internal storm sewer network discharge to a riprap splash pad prior to the outlet. Flows in excess of this event will spill through a curb cut and outlet swale and drain overland via sheet flow to the outlet.

Refer to Appendix D of this report for the storm sewer design sheet, outlet swale capacity, riprap sizing calculations, and curb cut capacity calculations.

### 3.7 STORMWATER QUALITY TREATMENT

Enhanced level stormwater quality control corresponding to 80% TSS removal is required for the developed areas of the site.

Due to grading constraints, water quality treatment for Catchments 201A and 201D is not feasible. However, as the impervious areas in these catchments are generally consistent with pre-development conditions, impacts to the water quality due to the proposed development is marginal. Additionally, runoff from these catchments will drain through grassed areas prior to draining to the outlet, providing an additional form of treatment prior to draining to the outlet.



Catchment 201C will also not be provided with water quality treatment as the drainage area is comprised of existing landscaped areas which are considered clean from a water quality perspective and therefore not subject to treatment.

Stormwater quality control for Catchment 201B will be provided via a treatment train approach to achieve the required 80% TSS removal:

- Stormceptor EFO4 oil-grit-separator (OGS) unit, with an assigned 60% TSS removal rate; and
- Vegetated filter strips, with an assigned 50% TSS removal rate.

A treatment train calculation is provided in Appendix D for reference and demonstrates 80% TSS removal is achieved on site.

### **3.8 OPERATION AND MAINTENANCE**

To ensure the SWM plan is operating effectively, a regular inspection and maintenance program of each element of the plan is recommended. Monitoring and maintenance provide a variety of important functions. Specifically, monitoring and maintenance ensures the systems implemented are operating continuously and effectively. Monitoring can yield early warnings to provide time to address problems before they become larger, more costly issues.

The manufacturer O&M manual and product information for the OGS unit is included in Appendix D for reference. The manufacturer should be consulted on proper inspection and maintenance techniques.

### **3.9 EROSION AND SEDIMENT CONTROL**

Siltation and erosion control measures will be implemented for all construction activities within the site including vegetation clearing, topsoil stripping, grading, and stockpiling of materials. The basic principles considered to minimize erosion, sedimentation and resultant negative environmental impacts include:

- All erosion control devices to be specified in accordance with the Erosion and Sediment Control Guide for Urban Construction (Sustainable Technologies Evaluation Program, 2019);
- Silt control fences to be erected before the commencement of any grading operations to control sediment movement;
- A designated construction vehicle entrance(s) with a stone mud mat will be specified to reduce off-site tracking of material;
- Temporary swales, and earth berms will be constructed to control runoff during construction by lowering velocities and promoting settling of particulates;



- All topsoil and fill piles are to be surrounded with heavy duty silt fence and are to be seeded immediately upon completion of earthworks;
- Expose the smallest possible land area to erosion for the shortest possible time;
- Long term siltation and erosion control will be enhanced with a re-vegetation strategy for disturbed areas;
- Confine refuelling and servicing of equipment to areas well away from the drainage systems and the lake; and
- Regular inspection of control measures to be instituted through a monitoring and mitigation plan and repairs will be made, as necessary. Bi-weekly inspections of the site erosion and sediment control should be completed.

Regular inspection of control measures is to be instituted through a monitoring and mitigation plan and repairs will be made, as necessary. Refer to the Siltation and Erosion Control Plan (Drawing SC-1) in Appendix D.



## 4 Summary

The proposed 6-storey, 55-unit hotel development is feasible from a water treatment and supply, sanitary sewage collection and treatment, and stormwater management and conveyance perspective. Upgrades to the existing private communal water and wastewater treatment plants will be required to accommodate the development.





**4791 Highway 28, Burleigh Falls**

Figure 1: Site Location Plan



## Appendix A: Site Plan

4791 ON-28  
THE BURLEIGH FALLS INN



3 KEY MAP  
A-004 N. T. S.

#### GENERAL NOTES

- ALL FOOTING FORMWORK ELEVATIONS AND SETBACKS ARE TO BE CONFIRMED BY A REGISTERED PROFESSIONAL ENGINEER, OR A REGISTERED ONTARIO LAND SURVEYOR, PRIOR TO PLACING OF ANY CONCRETE.
- ALL RAINWATER LEADERS TO BE DIRECTED TO SIDEYARD SWALES AND TO ROAD.
- A 0.30m WIDE UNDISTURBED STRIP IS TO BE PROVIDED ALONG ALL BOUNDARIES WITH ADJACENT OWNERS.
- ALL PERIMETER GRADES TO REMAIN AS EXISTING.

#### NOTE:

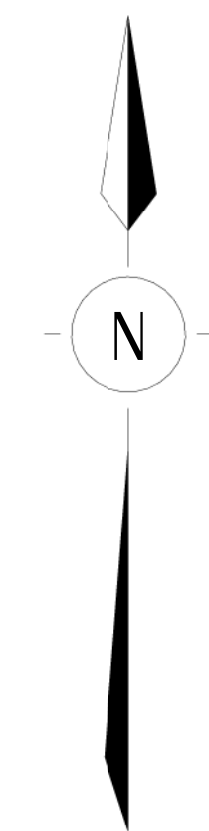
ALL EXISTING TREES, STRUCTURE AND COMPONENTS NOT INDICATED TO BE DEMOLISHED TO BE PROTECTED DURING CONSTRUCTION

BUILDER MUST VERIFY THE EXISTING STORM AND SANITARY INVERT ELEVATIONS. BUILDER TO CONFIRM TO CONSULTING ENGINEER THAT MINIMUM 2% SLOPE CAN BE ACHIEVED PRIOR TO PLACING CONCRETE FOOTINGS.

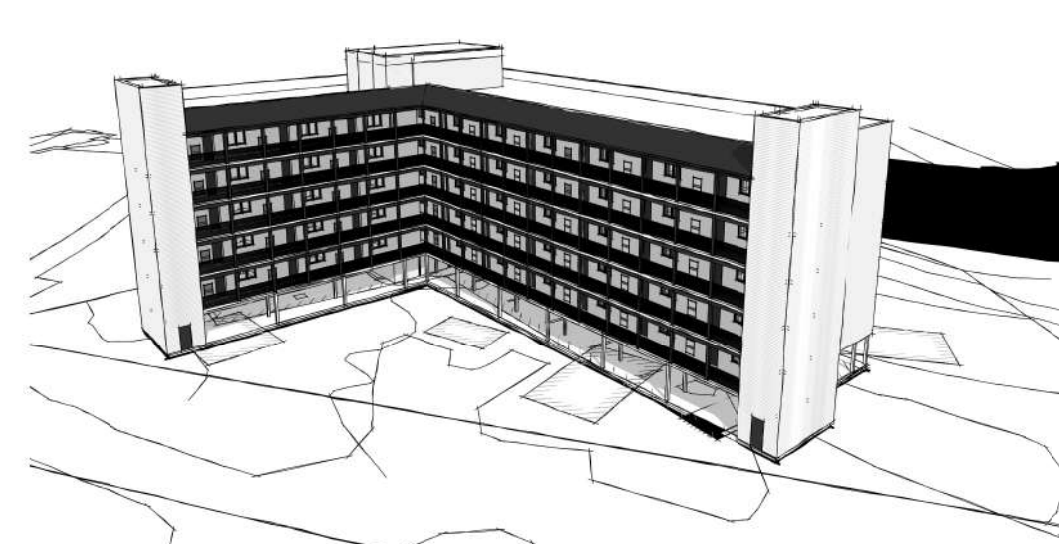
#### SITE PLAN and BUILDING STATISTICS

| 1  | ZONING                 | SHORELINE COMMERCIAL (CS) ZONE |                                   |
|----|------------------------|--------------------------------|-----------------------------------|
|    |                        | REQUIRED                       | PROPOSED                          |
| 2  | LOT AREA               | 1,390m <sup>2</sup> (MIN.)     | 4,615.80m <sup>2</sup> (EXISTING) |
| 3  | LOT FRONTAGE           | 46m (MIN.)                     | 93.63m                            |
| 4  | LOT COVERAGE           | 30% (MAX.)                     | 1,301.45m <sup>2</sup>   28.20%   |
| 5  | WATER SETBACK          | 30.0m (MIN.)                   | +/- 30.16m                        |
| 6  | FRONT YARD SETBACK     | 15.0m (MIN.)                   | +/- 2.00m                         |
| 7  | REAR YARD SETBACK      | 12.0m (MIN.)                   | N/A                               |
| 8  | INT. SIDE YARD SETBACK | 4.5m (MIN.)                    | +/- 2.18m                         |
| 9  | EXT. SIDE YARD SETBACK | 15.0m (MIN.)                   | +/- 18.40m                        |
| 10 | BUILDING HEIGHT        | 11.0m (MAX.)                   | 19.0m                             |
| 11 | PARKING SPACES         | 55 SPACES (1 SPACE PER ROOM)   | 59 SPACES                         |
| 12 | GROSS FLOOR AREA       |                                |                                   |
|    |                        | 1ST FLOOR                      | 373.58m <sup>2</sup>              |
|    |                        | 2ND FLOOR                      | 1,073.45m <sup>2</sup>            |
|    |                        | 3RD FLOOR                      | 1,073.45m <sup>2</sup>            |
|    |                        | 4TH FLOOR                      | 1,073.45m <sup>2</sup>            |
|    |                        | 5TH FLOOR                      | 1,073.45m <sup>2</sup>            |
|    |                        | 6TH FLOOR                      | 1,073.45m <sup>2</sup>            |
|    |                        | ROOF TOP                       | 158.14m <sup>2</sup>              |
|    |                        | TOTAL                          | 5,898.97m <sup>2</sup>            |
| 13 | TOTAL NUMBER OF UNITS  |                                | 55 UNITS                          |
|    |                        | 1 BEDROOM                      | 15                                |
|    |                        | 2 BEDROOM                      | 35                                |
|    |                        | 3 BEDROOM                      | 5                                 |

HIGHWAY No. 28



1 SITE PLAN  
A-004 1 : 250



S+H STAMP & HAMMER

STAMP & HAMMER  
1135 STELLAR DRIVE  
NEWMARKET ON L3Y 7B8  
905-235-3933  
info@stampandhammer.com

| NO. | DESCRIPTION       | DATE | BY |
|-----|-------------------|------|----|
| 1   | REVISION SCHEDULE |      |    |

NOTE: CONSULTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND CHECK ALL CONDITIONS ON THE JOB SITE BEFORE PROCEEDING WITH ANY WORK.

ON THE FALLS  
4791 ON-28  
LAKEFIELD ON K0L 2H0  
TOWNSHIP OF NORTH KAWARTHA  
COUNTY OF PETERBOROUGH

SCALE: As indicated

DATE: DECEMBER 2025

TITLE: SITE PLAN

A-004

## **Appendix B: Water and Sanitary Design Flows**

|         |                                     |      |          |
|---------|-------------------------------------|------|----------|
| PROJECT | 4791 Highway 28, Burleigh Falls Inn | FILE | 121273   |
|         |                                     | DATE | 2/2/2026 |
| SUBJECT | Water and Sanitary Design Flows     | NAME | WL/JRC   |
|         |                                     | PAGE | 1 OF 2   |

## 1 BACKGROUND

- A 55-unit hotel is proposed at 4791 Highway 28 and will be serviced by the communal water and wastewater system. The hotel is expected to operate year round and will consist of:
    - 15 1-bedroom units
    - 35 2-bedroom units
    - 5 3-bedroom units
- As per Site and Floor Plans  
(Dec 2025)*
- In support of the proposed development, Tatham completed a review of the historical water demands and sanitary flows over a 5-year period to assess the available capacities of the existing WTP and STP.

## 2 EXISTING COMMUNAL WTP

### Summary of Raw Water Flow (2020-2024)

| Year                | ADD (m3/day) | ADD May to Oct (m3/day) | ADD Nov to Apr (m3/day) | MDD (m3/day) |
|---------------------|--------------|-------------------------|-------------------------|--------------|
| 2020                | 8.3          | 12.8                    | 3.8                     | 52.0         |
| 2021                | 7.2          | 9.9                     | 4.4                     | 44.9         |
| 2022                | 8.2          | 13.0                    | 3.3                     | 83.8         |
| 2023                | 9.9          | 15.4                    | 4.4                     | 76.5         |
| 2024                | 9.5          | 14.3                    | 4.7                     | 70.9         |
| Avg/Max             | 8.6          | 13.1                    | 4.1                     | 83.8         |
| Avg/Max<br>(2021-4) | 8.7          | 13.1                    | 4.2                     | 83.8         |

- As per PTTW 1545-C9SSZ9, the maximum permitted water taking from Stoney Lake is: 143 m3/day.
- Therefore, additional water taking permitted under the PTTW is: 59.2 m3/day.

## 3 EXISTING COMMUNAL STP

### Summary of Effluent Flows (2021-2025)

| Year                     | ADF (m3/day) | ADF May to Oct (m3/day) | ADF Nov to Apr (m3/day) | Max. DF (m3/day) |
|--------------------------|--------------|-------------------------|-------------------------|------------------|
| 2021                     | 3.9          | 5.8                     | 2.0                     | 22.5             |
| 2022                     | 0.8          | 1.4                     | 0.2                     | 11.1             |
| 2023                     | 1.3          | 2.2                     | 0.4                     | 6.7              |
| 2024                     | 1.5          | 2.6                     | 0.4                     | 7.4              |
| 2025                     | 3.5          | 6.2                     | 0.8                     | 21.1             |
| Avg/Max<br>/Min          | 2.2          | 3.7                     | 0.8                     | 22.5             |
| Avg/Max /Min<br>(2021-4) | 1.9          | 3.0                     | 0.7                     | 22.5             |

- As per ECA 1882-CJ4K3K (2022), the STP has a rated capacity of: 84 m3/day.
- The STP treats flows from the Burleigh Island Lodge consisting of 11 hotel rooms, 100 seat lounge, 50 seat restaurant, 144 m2 shopping plaza, a marina, 21-unit motel, and 6 laundry machines.
- Therefore, the existing STP has spare capacity of: 61.5 m3/day.

|         |                                     |      |          |
|---------|-------------------------------------|------|----------|
| PROJECT | 4791 Highway 28, Burleigh Falls Inn | FILE | 121273   |
|         |                                     | DATE | 2/2/2026 |
| SUBJECT | Water and Sanitary Design Flows     | NAME | WL/JRC   |
|         |                                     | PAGE | 2 OF 2   |

#### 4 PROPOSED DEVELOPMENT - WATER DEMANDS AND SEWAGE FLOWS

##### Water Demands

|                                |      |                      |                                          |
|--------------------------------|------|----------------------|------------------------------------------|
| Design Criteria - Hotels       | 225  | L/bed/day            | Table 3.2 MECP Guidelines Drinking Water |
| Number of Beds                 | 100  |                      |                                          |
| Maximum day demand, MDD:       | 22.5 | m <sup>3</sup> /day. | Assumes all beds are occupied            |
| Total existing + proposed MDD: | 106  | m <sup>3</sup> /day. |                                          |

##### Sewage Flows

|                                |      |                      |                                        |
|--------------------------------|------|----------------------|----------------------------------------|
| Design Criteria - Hotels       | 225  | L/bed/day            | Table 5.3 MECP Guidelines Sewage Works |
| Maximum day sewage flow, MDF:  | 22.5 | m <sup>3</sup> /day. | Equivalent to MDD                      |
| Total existing + proposed MDF: | 45   | m <sup>3</sup> /day. | Equivalent to MDD                      |

#### 4 CONCLUSIONS

- The PTTW allows for a maximum water taking rate of 143 m<sup>3</sup>/day. Between 2020 and 2024, the maximum daily demand was 83.8 m<sup>3</sup>/day. Therefore, the additional water taking permitted under the PTTW is: 59.2 m<sup>3</sup>/day.
- The estimated MDD for the existing and proposed development is: 106 m<sup>3</sup>/day. Therefore, the additional water demand can be accommodated under the existing PTTW.
- The existing STP has a rated capacity of 84 m<sup>3</sup>/day.
- The estimated MDF for the existing and proposed development is: 45 m<sup>3</sup>/day. Therefore, the STP will need to be expanded to accommodate the additional sewage flows.

#### 5 NOTES

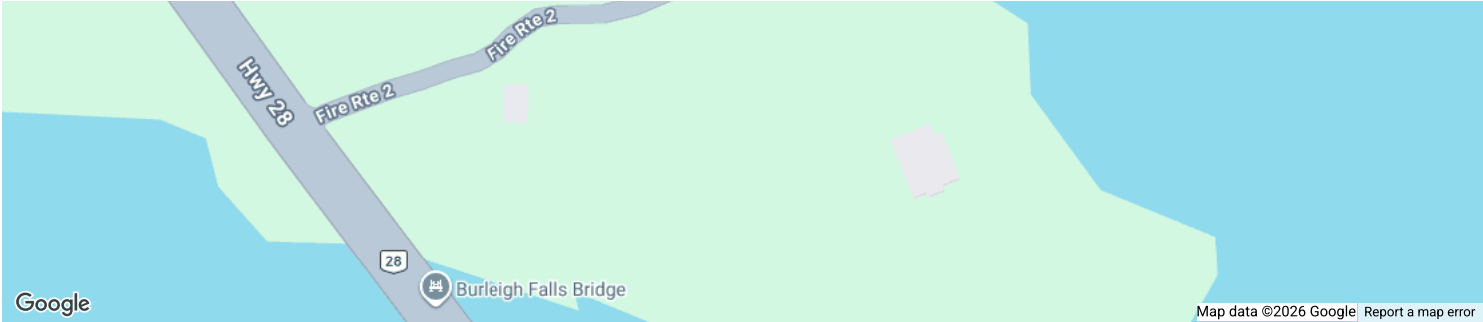
- The WTP supply is used to: fill the pool (typically in May or June), run lawn sprinklers, and to supply outdoor water taps used by boaters for drinking water and to wash their boats.
- The historical water demands are significantly greater than effluent flows from Nov to Apr.
- The WWTP annual reports note that the flow meter has not been calibrated since 2021.

## **Appendix C: Stormwater Management Calculations**

Active coordinate

44° 33' 15" N, 78° 12' 14" W (44.554167,-78.204167)

Retrieved: Fri, 05 Jun 2026 15:12:13 GMT



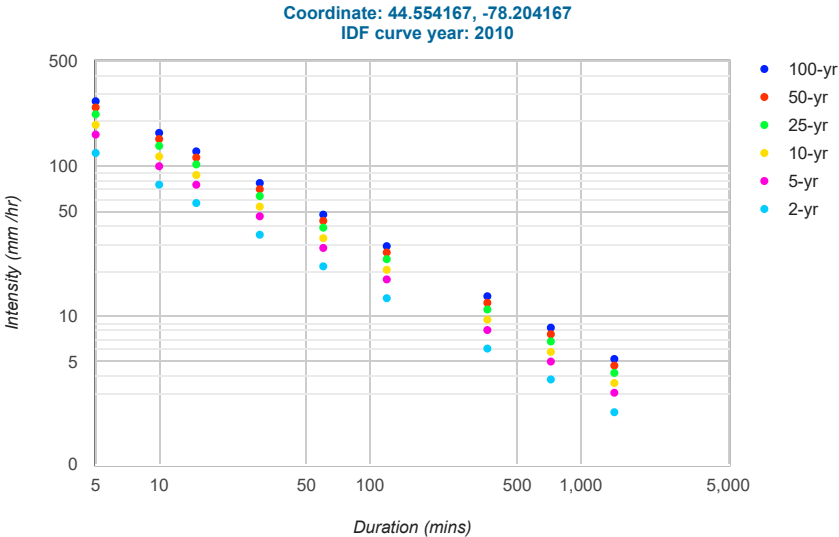
Location summary

These are the locations in the selection.

IDF Curve: 44° 33' 15" N, 78° 12' 14" W (44.554167,-78.204167)

Results

An IDF curve was found.



Coefficient summary

IDF Curve: 44° 33' 15" N, 78° 12' 14" W (44.554167,-78.204167)

Retrieved: Fri, 05 Jun 2026 15:12:13 GMT

Data year: 2010

IDF curve year: 2010

| Return period | 2-yr   | 5-yr   | 10-yr  | 25-yr  | 50-yr  | 100-yr |
|---------------|--------|--------|--------|--------|--------|--------|
| A             | 21.5   | 28.5   | 33.1   | 38.9   | 43.2   | 47.5   |
| B             | -0.699 | -0.699 | -0.699 | -0.699 | -0.699 | -0.699 |

Statistics

Rainfall intensity (mm hr<sup>-1</sup>)

| Duration | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 6-hr | 12-hr | 24-hr |
|----------|-------|--------|--------|--------|------|------|------|-------|-------|
| 2-yr     | 122.1 | 75.2   | 56.7   | 34.9   | 21.5 | 13.2 | 6.1  | 3.8   | 2.3   |
| 5-yr     | 161.9 | 99.7   | 75.1   | 46.3   | 28.5 | 17.6 | 8.1  | 5.0   | 3.1   |
| 10-yr    | 188.0 | 115.8  | 87.2   | 53.7   | 33.1 | 20.4 | 9.5  | 5.8   | 3.6   |
| 25-yr    | 221.0 | 136.1  | 102.5  | 63.1   | 38.9 | 24.0 | 11.1 | 6.8   | 4.2   |
| 50-yr    | 245.4 | 151.2  | 113.8  | 70.1   | 43.2 | 26.6 | 12.3 | 7.6   | 4.7   |
| 100-yr   | 269.8 | 166.2  | 125.2  | 77.1   | 47.5 | 29.3 | 13.6 | 8.4   | 5.2   |

Rainfall depth (mm)

| Duration | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 6-hr | 12-hr | 24-hr |
|----------|-------|--------|--------|--------|------|------|------|-------|-------|
| 2-yr     | 10.2  | 12.5   | 14.2   | 17.5   | 21.5 | 26.5 | 36.9 | 45.4  | 56.0  |
| 5-yr     | 13.5  | 16.6   | 18.8   | 23.1   | 28.5 | 35.1 | 48.9 | 60.2  | 74.2  |
| 10-yr    | 15.7  | 19.3   | 21.8   | 26.9   | 33.1 | 40.8 | 56.8 | 69.9  | 86.2  |
| 25-yr    | 18.4  | 22.7   | 25.6   | 31.6   | 38.9 | 47.9 | 66.7 | 82.2  | 101.2 |
| 50-yr    | 20.4  | 25.2   | 28.5   | 35.1   | 43.2 | 53.2 | 74.1 | 91.3  | 112.4 |
| 100-yr   | 22.5  | 27.7   | 31.3   | 38.6   | 47.5 | 58.5 | 81.5 | 100.4 | 123.6 |

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|         |                                                  |      |           |
|---------|--------------------------------------------------|------|-----------|
| PROJECT | 4791 Highway 28, Burleigh Falls                  | FILE | 525016    |
|         |                                                  | DATE | 6/15/2026 |
| SUBJECT | Pre-Development Land Use Allocation Calculations | NAME | LJC       |
|         |                                                  | PAGE | 1 OF 1    |

| Runoff Coefficient: Catchment 101A                                                                       |           |                    |           | Runoff Coefficient: Catchment 101B                                                                       |           |                    |           |
|----------------------------------------------------------------------------------------------------------|-----------|--------------------|-----------|----------------------------------------------------------------------------------------------------------|-----------|--------------------|-----------|
| Land Use Type                                                                                            | Soil Type | Runoff Coefficient | Area (ha) | Land Use Type                                                                                            | Soil Type | Runoff Coefficient | Area (ha) |
| Asphalt/Rooftop                                                                                          | D         | 0.95               | 0.06      | Asphalt/Rooftop                                                                                          | D         | 0.95               | 0.02      |
| Woodland, 0-5%                                                                                           | D         | 0.35               | 0.02      | Woodland, 0-5%                                                                                           | D         | 0.35               | 0.12      |
| Lawn, 2-7%                                                                                               | D         | 0.15               | 0.13      | Lawn, 2-7%                                                                                               | D         | 0.15               | 0.13      |
|                                                                                                          |           | Total:             | 0.21      |                                                                                                          |           | Total:             | 0.27      |
| Composite Runoff Coefficient (RC): 0.40                                                                  |           |                    |           | Composite Runoff Coefficient (RC): 0.30                                                                  |           |                    |           |
| Source: Design Chart 1.07: Runoff Coefficients, from: MTO Drainage Manual (2003).                        |           |                    |           | Source: Design Chart 1.07: Runoff Coefficients, from: MTO Drainage Manual (2003).                        |           |                    |           |
| Runoff Coefficient: Catchment 101C                                                                       |           |                    |           | Weighted Average Runoff Coefficient: Catchment 101                                                       |           |                    |           |
| Land Use Type                                                                                            | Soil Type | Runoff Coefficient | Area (ha) | Catchment ID                                                                                             | Soil Type | Runoff Coefficient | Area (ha) |
| Asphalt/Rooftop                                                                                          | D         | 0.95               | 0.08      | Catchment 101A                                                                                           | D         | 0.40               | 0.21      |
| Woodland, 0-5%                                                                                           | D         | 0.35               | 0.02      | Catchment 101B                                                                                           | D         | 0.30               | 0.27      |
| Lawn, 2-7%                                                                                               | D         | 0.15               | 0.05      | Catchment 101C                                                                                           | D         | 0.60               | 0.15      |
|                                                                                                          |           | Total:             | 0.15      |                                                                                                          |           | Total:             | 0.63      |
| Composite Runoff Coefficient (RC): 0.60                                                                  |           |                    |           | Composite Runoff Coefficient (RC): 0.40                                                                  |           |                    |           |
| Source: Design Chart 1.07: Runoff Coefficients, from: MTO Drainage Manual (2003).                        |           |                    |           | Source: Design Chart 1.07: Runoff Coefficients, from: MTO Drainage Manual (2003).                        |           |                    |           |
| Time of Concentration: Catchment 101A                                                                    |           |                    |           | Overall Time of Concentration                                                                            |           |                    |           |
| Maximum Elevation (m):                                                                                   |           | 242.75             |           | Maximum Elevation (m):                                                                                   |           | 242.00             |           |
| Minimum Elevation (m):                                                                                   |           | 241.50             |           | Minimum Elevation (m):                                                                                   |           | 238.00             |           |
| Catchment Length (m):                                                                                    |           | 50                 |           | Catchment Length (m):                                                                                    |           | 120                |           |
| Catchment Slope (%):                                                                                     |           | 2.50 %             |           | Catchment Slope (%):                                                                                     |           | 3.33 %             |           |
| Runoff Coefficient:                                                                                      |           | 0.40               |           | Runoff Coefficient:                                                                                      |           | 0.40               |           |
| Airport:                                                                                                 |           | 11.97 min          |           | Airport:                                                                                                 |           | 16.71 min          |           |
| Bransby Williams:                                                                                        |           | 2.87 min           |           | Bransby Williams:                                                                                        |           | 5.63 min           |           |
| Time of Concentration Method:                                                                            |           | Airport            |           | Time of Concentration Method:                                                                            |           | Airport            |           |
| Time of Concentration (min):                                                                             |           | 11.97 min          |           | Time of Concentration (min):                                                                             |           | 16.71 min          |           |
| Note: Where calculated T <sub>C</sub> is less than MTO standard of 10 minutes, 10 minutes has been used. |           |                    |           | Note: Where calculated T <sub>C</sub> is less than MTO standard of 10 minutes, 10 minutes has been used. |           |                    |           |
| Source: MTO Drainage Management Manual (1997).                                                           |           |                    |           | Source: MTO Drainage Management Manual (1997).                                                           |           |                    |           |

|         |                                                   |      |           |
|---------|---------------------------------------------------|------|-----------|
| PROJECT | 4791 Highway 28, Burleigh Falls                   | FILE | 525016    |
|         |                                                   | DATE | 6/15/2026 |
| SUBJECT | Post-Development Land Use Allocation Calculations | NAME | LJC       |
|         |                                                   | PAGE | 1 OF 2    |

| Runoff Coefficient: Catchment 201A                                                      |           |                    |           | Runoff Coefficient: Catchment 201B                                                      |           |                                                                                                    |           |
|-----------------------------------------------------------------------------------------|-----------|--------------------|-----------|-----------------------------------------------------------------------------------------|-----------|----------------------------------------------------------------------------------------------------|-----------|
| Land Use Type                                                                           | Soil Type | Runoff Coefficient | Area (ha) | Land Use Type                                                                           | Soil Type | Runoff Coefficient                                                                                 | Area (ha) |
| Asphalt                                                                                 | D         | 0.95               | 0.07      | Asphalt, Rooftop                                                                        | D         | 0.95                                                                                               | 0.27      |
| Lawn, 2-7%                                                                              | D         | 0.15               | 0.03      | Lawn, 2-7%                                                                              | D         | 0.15                                                                                               | 0.02      |
|                                                                                         |           | Total:             | 0.10      |                                                                                         |           | Total:                                                                                             | 0.29      |
| Composite Runoff Coefficient (RC): 0.75                                                 |           |                    |           | Composite Runoff Coefficient (RC): 0.90                                                 |           |                                                                                                    |           |
| Source: Design Chart 1.07: Runoff Coefficients, from <i>MTO Drainage Manual</i> (2003). |           |                    |           | Source: Design Chart 1.07: Runoff Coefficients, from <i>MTO Drainage Manual</i> (2003). |           |                                                                                                    |           |
| Runoff Coefficient: Catchment 201C                                                      |           |                    |           | Runoff Coefficient: Catchment 201D                                                      |           |                                                                                                    |           |
| Land Use Type                                                                           | Soil Type | Runoff Coefficient | Area (ha) | Land Use Type                                                                           | Soil Type | Runoff Coefficient                                                                                 | Area (ha) |
| Lawn, 2-7%                                                                              | D         | 0.15               | 0.14      | Asphalt                                                                                 | D         | 0.95                                                                                               | 0.06      |
|                                                                                         |           | Total:             | 0.14      | Lawn, 2-7%                                                                              | D         | 0.15                                                                                               | 0.04      |
| Composite Runoff Coefficient (RC): 0.15                                                 |           |                    |           | Composite Runoff Coefficient (RC): 0.65                                                 |           |                                                                                                    |           |
| Source: Design Chart 1.07: Runoff Coefficients, from <i>MTO Drainage Manual</i> (2003). |           |                    |           | Source: Design Chart 1.07: Runoff Coefficients, from <i>MTO Drainage Manual</i> (2003). |           |                                                                                                    |           |
| Weighted Average Runoff Coefficient: Catchment 201                                      |           |                    |           | Time of Concentration: Catchment 201A                                                   |           |                                                                                                    |           |
| Land Use Type                                                                           | Soil Type | Runoff Coefficient | Area (ha) | Maximum Elevation (m):                                                                  |           | 242.50                                                                                             |           |
| Catchment 201A                                                                          | D         | 0.75               | 0.10      | Minimum Elevation (m):                                                                  |           | 241.30                                                                                             |           |
| Catchment 201B                                                                          | D         | 0.90               | 0.29      | Catchment Length (m):                                                                   |           | 50                                                                                                 |           |
| Catchment 201C                                                                          | D         | 0.15               | 0.14      | Catchment Slope (%):                                                                    |           | 2.40 %                                                                                             |           |
| Catchment 201D                                                                          | D         | 0.654              | 0.10      | Runoff Coefficient:                                                                     |           | 0.75                                                                                               |           |
|                                                                                         |           | Total:             | 0.63      | Airport:                                                                                |           | 6.08 min                                                                                           |           |
| Composite Runoff Coefficient (RC): 0.67                                                 |           |                    |           | Bransby Williams:                                                                       |           | 3.01 min                                                                                           |           |
| Source: Design Chart 1.07: Runoff Coefficients, from <i>MTO Drainage Manual</i> (2003). |           |                    |           | Time of Concentration Method:                                                           |           | Bransby Williams                                                                                   |           |
|                                                                                         |           |                    |           | Time of Concentration (min):                                                            |           | 3.01 min                                                                                           |           |
|                                                                                         |           |                    |           | Note:                                                                                   |           | Where calculated T <sub>C</sub> is less than MTO standard of 10 minutes, 10 minutes has been used. |           |
|                                                                                         |           |                    |           | Source:                                                                                 |           | MTO Drainage Management Manual (1997).                                                             |           |

|         |                                                   |      |               |      |
|---------|---------------------------------------------------|------|---------------|------|
| PROJECT | 4791 Highway 28, Burleigh Falls                   | FILE | 525016        |      |
|         |                                                   | DATE | June 15, 2026 |      |
| SUBJECT | Post-Development Land Use Allocation Calculations | NAME | LJC           |      |
|         |                                                   | PAGE | 2             | OF 2 |

| Overall Time of Concentration |                                                                                           |  |
|-------------------------------|-------------------------------------------------------------------------------------------|--|
| Maximum Elevation (m):        | 242.00                                                                                    |  |
| Minimum Elevation (m):        | 238.00                                                                                    |  |
| Catchment Length (m):         | 120                                                                                       |  |
| Catchment Slope (%):          | 3.33 %                                                                                    |  |
| Runoff Coefficient:           | 0.67                                                                                      |  |
| Airport:                      | 10.28 min                                                                                 |  |
| Bransby Williams:             | 5.63 min                                                                                  |  |
| Time of Concentration Method: | Bransby Williams                                                                          |  |
| Time of Concentration (min):  | 5.63 min                                                                                  |  |
| Note:                         | Where calculated $T_C$ is less than MTO standard of 10 minutes, 10 minutes has been used. |  |
| Source:                       | MTO Drainage Management Manual (1997).                                                    |  |

# Outlet - Rational Method Calculation

**Project Details**

|                                 |        |
|---------------------------------|--------|
| 4791 Highway 28, Burleigh Falls | 525016 |
|---------------------------------|--------|

**Prepared By**

|     |           |
|-----|-----------|
| LJC | 6/15/2026 |
|-----|-----------|

**Municipality**

|                        |
|------------------------|
| MTO - IDF Curve Lookup |
|------------------------|

**Pre-Development Analysis**

|                             |       |
|-----------------------------|-------|
| Catchment ID                | 101   |
| Catchment Area (ha)         | 0.63  |
| 1:5-Year Runoff Coefficient | 0.40  |
| Time of Concentration (min) | 16.71 |

**Post-Development Analysis**

|       |
|-------|
| 201   |
| 0.63  |
| 0.67  |
| 10.00 |

**Rational Method Calculations**

| Design Storm          |   | 2     | 5     | 10    | 25    | 50    | 100   | Design Storm          |   | 2    | 5    | 10   | 25   | 50   | 100  |
|-----------------------|---|-------|-------|-------|-------|-------|-------|-----------------------|---|------|------|------|------|------|------|
| IDF Curve             | A | 22    | 29    | 33    | 39    | 43    | 48    | i (mm/hr)             |   | 75   | 100  | 116  | 136  | 151  | 166  |
|                       | B | -0.70 | -0.70 | -0.70 | -0.70 | -0.70 | -0.70 | 201                   | C | 0.67 | 0.67 | 0.67 | 0.74 | 0.80 | 0.84 |
|                       | C | -     | -     | -     | -     | -     | -     | Q (m <sup>3</sup> /s) |   | 0.09 | 0.12 | 0.14 | 0.18 | 0.21 | 0.24 |
| i (mm/hr)             |   | 53    | 70    | 81    | 95    | 106   | 116   |                       |   |      |      |      |      |      |      |
| 101                   | C | 0.40  | 0.40  | 0.40  | 0.44  | 0.48  | 0.50  |                       |   |      |      |      |      |      |      |
| Q (m <sup>3</sup> /s) |   | 0.04  | 0.05  | 0.06  | 0.07  | 0.09  | 0.10  |                       |   |      |      |      |      |      |      |

**Peak Flow Summary (m<sup>3</sup>/s)**

| Storm | Q <sub>existing</sub> | Q <sub>proposed</sub> | Q <sub>proposed</sub> - Q <sub>existing</sub> |
|-------|-----------------------|-----------------------|-----------------------------------------------|
| 2     | 0.037                 | 0.088                 | 0.051                                         |
| 5     | 0.049                 | 0.117                 | 0.068                                         |
| 10    | 0.057                 | 0.136                 | 0.079                                         |
| 25    | 0.073                 | 0.176                 | 0.102                                         |
| 50    | 0.089                 | 0.213                 | 0.124                                         |
| 100   | 0.102                 | 0.244                 | 0.142                                         |

# Highway 28 - Rational Method Calculation

**Project Details**

|                                 |        |
|---------------------------------|--------|
| 4791 Highway 28, Burleigh Falls | 525016 |
|---------------------------------|--------|

**Prepared By**

|     |           |
|-----|-----------|
| LJC | 6/15/2026 |
|-----|-----------|

**Municipality**

|                        |
|------------------------|
| MTO - IDF Curve Lookup |
|------------------------|

**Pre-Development Analysis**

|                             |       |
|-----------------------------|-------|
| Catchment ID                | 101A  |
| Catchment Area (ha)         | 0.21  |
| 1:5-Year Runoff Coefficient | 0.40  |
| Time of Concentration (min) | 11.97 |

**Post-Development Analysis**

|       |
|-------|
| 201A  |
| 0.10  |
| 0.75  |
| 10.00 |

**Rational Method Calculations**

| Design Storm |                       | 2     | 5     | 10    | 25    | 50    | 100   | Design Storm          |  | 2    | 5    | 10   | 25   | 50   | 100  |
|--------------|-----------------------|-------|-------|-------|-------|-------|-------|-----------------------|--|------|------|------|------|------|------|
| IDF Curve    | A                     | 22    | 29    | 33    | 39    | 43    | 48    | i (mm/hr)             |  | 75   | 100  | 116  | 136  | 151  | 166  |
|              | B                     | -0.70 | -0.70 | -0.70 | -0.70 | -0.70 | -0.70 | 201A C                |  | 0.75 | 0.75 | 0.75 | 0.83 | 0.90 | 0.94 |
|              | C                     | -     | -     | -     | -     | -     | -     | Q (m <sup>3</sup> /s) |  | 0.02 | 0.02 | 0.02 | 0.03 | 0.04 | 0.04 |
| 101A         | i (mm/hr)             | 66    | 88    | 102   | 120   | 133   | 147   |                       |  |      |      |      |      |      |      |
|              | C                     | 0.40  | 0.40  | 0.40  | 0.44  | 0.48  | 0.50  |                       |  |      |      |      |      |      |      |
|              | Q (m <sup>3</sup> /s) | 0.02  | 0.02  | 0.02  | 0.03  | 0.04  | 0.04  |                       |  |      |      |      |      |      |      |

**Peak Flow Summary (m<sup>3</sup>/s)**

| Storm | Q <sub>existing</sub> | Q <sub>proposed</sub> | Q <sub>proposed</sub> - Q <sub>existing</sub> |
|-------|-----------------------|-----------------------|-----------------------------------------------|
| 2     | 0.015                 | 0.015                 | 0.000                                         |
| 5     | 0.021                 | 0.020                 | 0.000                                         |
| 10    | 0.024                 | 0.024                 | 0.000                                         |
| 25    | 0.031                 | 0.031                 | 0.000                                         |
| 50    | 0.037                 | 0.037                 | 0.000                                         |
| 100   | 0.043                 | 0.042                 | 0.000                                         |

## Catchment 201B - Rational Method Calculation

### Project Details

|                                 |        |
|---------------------------------|--------|
| 4791 Highway 28, Burleigh Falls | 525016 |
|---------------------------------|--------|

### Municipality

|                        |
|------------------------|
| MTO - IDF Curve Lookup |
|------------------------|

### Prepared By

|     |           |
|-----|-----------|
| LJC | 6/15/2026 |
|-----|-----------|

### Rational Method Calculations

| Design Storm |                       | 2     | 5     | 10    | 25    | 50    | 100   |
|--------------|-----------------------|-------|-------|-------|-------|-------|-------|
| IDF Curve    | A                     | 22    | 29    | 33    | 39    | 43    | 48    |
|              | B                     | -0.70 | -0.70 | -0.70 | -0.70 | -0.70 | -0.70 |
|              | C                     | -     | -     | -     | -     | -     | -     |
| Design Storm |                       | 2     | 5     | 10    | 25    | 50    | 100   |
| 201B         | i (mm/hr)             | 75    | 100   | 116   | 136   | 151   | 166   |
|              | C                     | 0.90  | 0.90  | 0.90  | 0.99  | 1.00  | 1.00  |
|              | Q (m <sup>3</sup> /s) | 0.05  | 0.07  | 0.08  | 0.11  | 0.12  | 0.13  |

### Post-Development Analysis

|       |
|-------|
| 201B  |
| 0.29  |
| 0.90  |
| 10.00 |

### Peak Flow Summary (m<sup>3</sup>/s)

| Storm | Q <sub>proposed</sub> |
|-------|-----------------------|
| 2     | 0.055                 |
| 5     | 0.072                 |
| 10    | 0.084                 |
| 25    | 0.109                 |
| 50    | 0.122                 |
| 100   | 0.134                 |

*Peak flows to minor system (parking lot storm sewers).*

*Peak flows to major system (curb cut and outlet swale with riprap)*

|         |                                      |      |          |
|---------|--------------------------------------|------|----------|
| PROJECT | 4791 Highway 28, Burleigh Falls      | FILE | 525016   |
|         |                                      | DATE | 6/9/2026 |
| SUBJECT | Stormwater Quality - Treatment Train | NAME | LJC      |
|         |                                      | PAGE | 1 OF 1   |

### Water Quality Treatment Train Calculation

| Device              |                         | Target Total Suspended Solids (TSS) Removal |
|---------------------|-------------------------|---------------------------------------------|
| Primary Treatment   | Stormceptor EFO4        | 60%                                         |
| Secondary Treatment | Vegetated Filter Strips | 50%                                         |

$$TSS\ Removal = (1 - ((1 - R_P) * (1 - R_S) * (1 - R_T)))$$

where:

$R_P$  = % TSS Removal provided by Primary Treatment Strategy

$R_S$  = % TSS Removal provided by Secondary Treatment Strategy

$R_T$  = % TSS Removal provided by Tertiary Treatment Strategy

**TSS Removal Provided By Controls = 80%**

**Note:**

- TRCA/CVC LID SWM Planning and Design Guide specifies vegetated filter strips to have TSS removal ranging from 20% to 80%. An average of 50% was assigned for the site.

## Imbrium® Systems

## ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

06/15/2026

|                                                   |                    |                   |                         |
|---------------------------------------------------|--------------------|-------------------|-------------------------|
| Province:                                         | Ontario            | Project Name:     | 4791 Highway 28         |
| City:                                             | Burleigh Falls     | Project Number:   | 525016                  |
| Nearest Rainfall Station:                         | PETERBOROUGH       | Designer Name:    | Lawrence Carretas       |
| Climate Station Id:                               | 6166456            | Designer Company: | Tatham Engineering      |
| Years of Rainfall Data:                           | 15                 | Designer Email:   | lcarretas@tathameng.com |
|                                                   |                    | Designer Phone:   | 705-733-9037            |
| Site Name:                                        | Burleigh Falls Inn | EOR Name:         |                         |
|                                                   |                    | EOR Company:      |                         |
| Drainage Area (ha):                               | 0.29               | EOR Email:        |                         |
| Runoff Coefficient 'c':                           | 0.90               | EOR Phone:        |                         |
|                                                   |                    |                   |                         |
| Particle Size Distribution:                       | CA ETV             |                   |                         |
| Target TSS Removal (%):                           | 60.0               |                   |                         |
| Required Water Quality Runoff Volume Capture (%): | 90.00              |                   |                         |
| Estimated Water Quality Flow Rate (L/s):          | 9.42               |                   |                         |
| Oil / Fuel Spill Risk Site?                       | Yes                |                   |                         |
| Upstream Flow Control?                            | No                 |                   |                         |
| Peak Conveyance (maximum) Flow Rate (L/s):        | 72.00              |                   |                         |
| Influent TSS Concentration (mg/L):                | 100                |                   |                         |
| Estimated Average Annual Sediment Load (kg/yr):   | 117                |                   |                         |
| Estimated Average Annual Sediment Volume (L/yr):  | 95                 |                   |                         |

| Net Annual Sediment (TSS) Load Reduction Sizing Summary |                          |
|---------------------------------------------------------|--------------------------|
| Stormceptor Model                                       | TSS Removal Provided (%) |
| EFO4                                                    | 60                       |
| EFO5                                                    | 63                       |
| EFO6                                                    | 65                       |
| EFO8                                                    | 68                       |
| EFO10                                                   | 69                       |
| EFO12                                                   | 70                       |

|                                                         |      |
|---------------------------------------------------------|------|
| Recommended Stormceptor EFO Model:                      | EFO4 |
| Estimated Net Annual Sediment (TSS) Load Reduction (%): | 60   |
| Water Quality Runoff Volume Capture (%):                | > 90 |

### THIRD-PARTY TESTING AND VERIFICATION

► **Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

### PERFORMANCE

► **Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

### PARTICLE SIZE DISTRIBUTION (PSD)

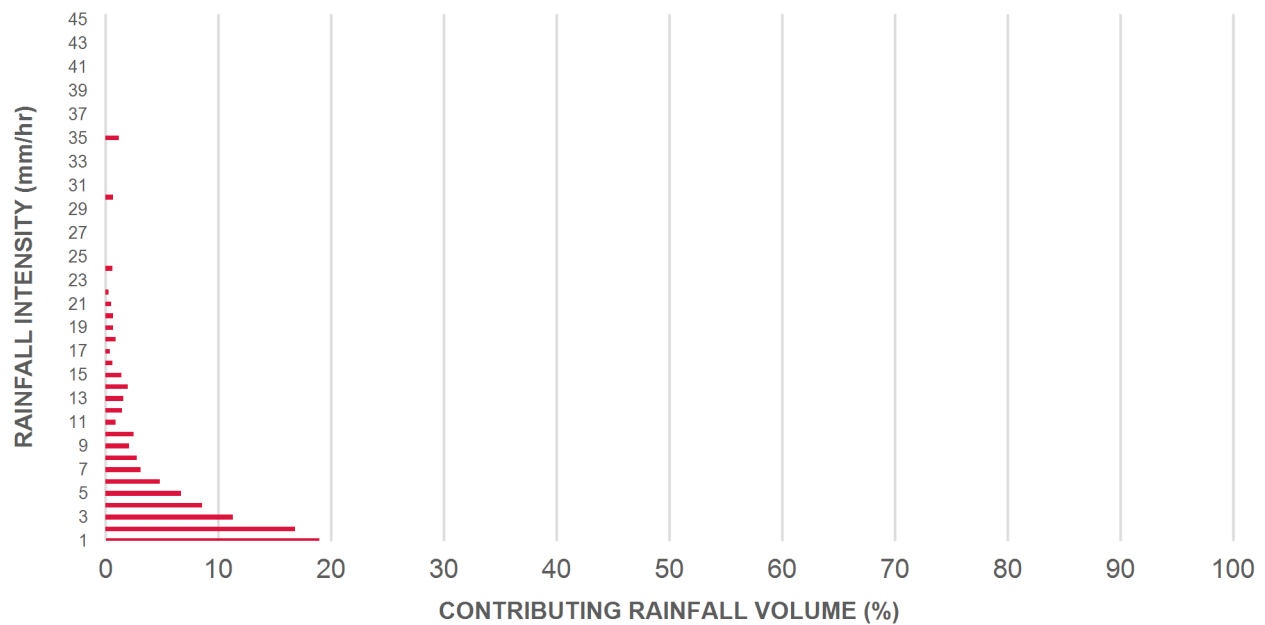
► The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

| Particle Size (µm) | Percent Less Than | Particle Size Fraction (µm) | Percent |
|--------------------|-------------------|-----------------------------|---------|
| 1000               | 100               | 500-1000                    | 5       |
| 500                | 95                | 250-500                     | 5       |
| 250                | 90                | 150-250                     | 15      |
| 150                | 75                | 100-150                     | 15      |
| 100                | 60                | 75-100                      | 10      |
| 75                 | 50                | 50-75                       | 5       |
| 50                 | 45                | 20-50                       | 10      |
| 20                 | 35                | 8-20                        | 15      |
| 8                  | 20                | 5-8                         | 10      |
| 5                  | 10                | 2-5                         | 5       |
| 2                  | 5                 | <2                          | 5       |

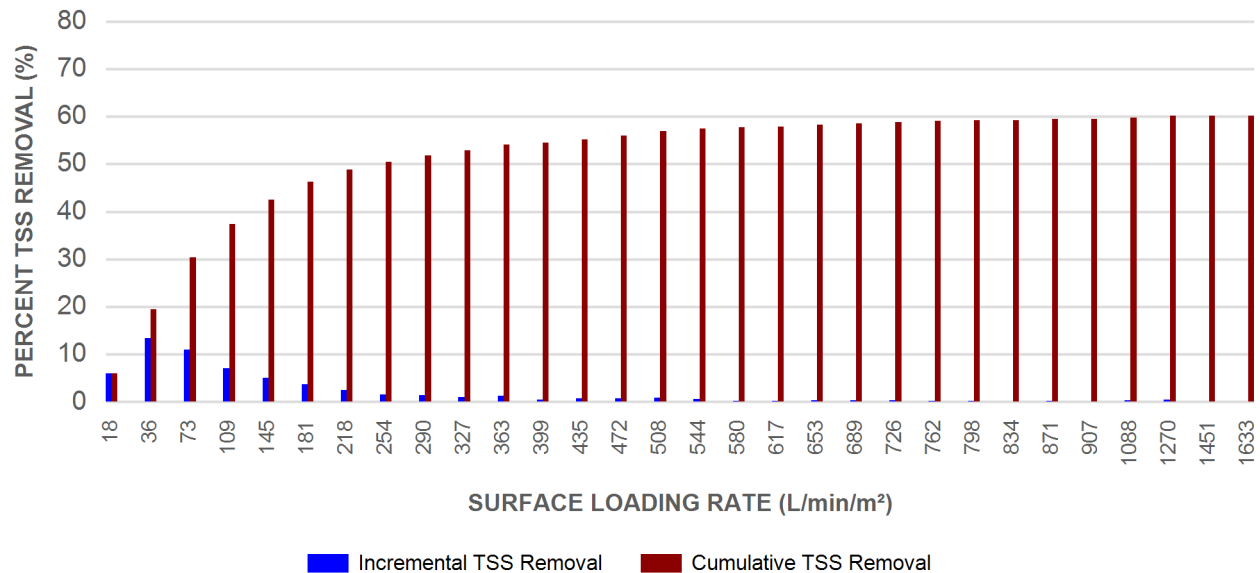
| Rainfall Intensity (mm / hr)                         | Percent Rainfall Volume (%) | Cumulative Rainfall Volume (%) | Flow Rate (L/s) | Flow Rate (L/min) | Surface Loading Rate (L/min/m²) | Removal Efficiency (%) | Incremental Removal (%) | Cumulative Removal (%) |
|------------------------------------------------------|-----------------------------|--------------------------------|-----------------|-------------------|---------------------------------|------------------------|-------------------------|------------------------|
| 0.50                                                 | 8.5                         | 8.5                            | 0.36            | 22.0              | 18.0                            | 70                     | 6.0                     | 6.0                    |
| 1.00                                                 | 19.0                        | 27.5                           | 0.73            | 44.0              | 36.0                            | 70                     | 13.4                    | 19.4                   |
| 2.00                                                 | 16.8                        | 44.3                           | 1.45            | 87.0              | 73.0                            | 66                     | 11.0                    | 30.4                   |
| 3.00                                                 | 11.3                        | 55.6                           | 2.18            | 131.0             | 109.0                           | 62                     | 7.0                     | 37.4                   |
| 4.00                                                 | 8.6                         | 64.2                           | 2.90            | 174.0             | 145.0                           | 59                     | 5.1                     | 42.5                   |
| 5.00                                                 | 6.7                         | 70.9                           | 3.63            | 218.0             | 181.0                           | 56                     | 3.7                     | 46.2                   |
| 6.00                                                 | 4.8                         | 75.6                           | 4.35            | 261.0             | 218.0                           | 54                     | 2.6                     | 48.8                   |
| 7.00                                                 | 3.1                         | 78.7                           | 5.08            | 305.0             | 254.0                           | 53                     | 1.6                     | 50.4                   |
| 8.00                                                 | 2.8                         | 81.5                           | 5.80            | 348.0             | 290.0                           | 51                     | 1.4                     | 51.8                   |
| 9.00                                                 | 2.1                         | 83.6                           | 6.53            | 392.0             | 327.0                           | 50                     | 1.0                     | 52.9                   |
| 10.00                                                | 2.5                         | 86.1                           | 7.26            | 435.0             | 363.0                           | 49                     | 1.2                     | 54.1                   |
| 11.00                                                | 0.9                         | 87.0                           | 7.98            | 479.0             | 399.0                           | 48                     | 0.4                     | 54.5                   |
| 12.00                                                | 1.5                         | 88.5                           | 8.71            | 522.0             | 435.0                           | 47                     | 0.7                     | 55.2                   |
| 13.00                                                | 1.6                         | 90.0                           | 9.43            | 566.0             | 472.0                           | 46                     | 0.7                     | 55.9                   |
| 14.00                                                | 2.0                         | 92.0                           | 10.16           | 609.0             | 508.0                           | 45                     | 0.9                     | 56.9                   |
| 15.00                                                | 1.4                         | 93.5                           | 10.88           | 653.0             | 544.0                           | 44                     | 0.6                     | 57.5                   |
| 16.00                                                | 0.6                         | 94.1                           | 11.61           | 697.0             | 580.0                           | 43                     | 0.2                     | 57.7                   |
| 17.00                                                | 0.4                         | 94.5                           | 12.33           | 740.0             | 617.0                           | 42                     | 0.2                     | 57.9                   |
| 18.00                                                | 0.9                         | 95.3                           | 13.06           | 784.0             | 653.0                           | 42                     | 0.4                     | 58.3                   |
| 19.00                                                | 0.7                         | 96.0                           | 13.79           | 827.0             | 689.0                           | 42                     | 0.3                     | 58.5                   |
| 20.00                                                | 0.7                         | 96.7                           | 14.51           | 871.0             | 726.0                           | 41                     | 0.3                     | 58.8                   |
| 21.00                                                | 0.5                         | 97.2                           | 15.24           | 914.0             | 762.0                           | 41                     | 0.2                     | 59.1                   |
| 22.00                                                | 0.3                         | 97.5                           | 15.96           | 958.0             | 798.0                           | 41                     | 0.1                     | 59.2                   |
| 23.00                                                | 0.0                         | 97.5                           | 16.69           | 1001.0            | 834.0                           | 41                     | 0.0                     | 59.2                   |
| 24.00                                                | 0.6                         | 98.1                           | 17.41           | 1045.0            | 871.0                           | 41                     | 0.2                     | 59.4                   |
| 25.00                                                | 0.0                         | 98.1                           | 18.14           | 1088.0            | 907.0                           | 41                     | 0.0                     | 59.4                   |
| 30.00                                                | 0.7                         | 98.8                           | 21.77           | 1306.0            | 1088.0                          | 39                     | 0.3                     | 59.7                   |
| 35.00                                                | 1.2                         | 100.0                          | 25.40           | 1524.0            | 1270.0                          | 36                     | 0.4                     | 60.1                   |
| 40.00                                                | 0.0                         | 100.0                          | 29.02           | 1741.0            | 1451.0                          | 33                     | 0.0                     | 60.1                   |
| 45.00                                                | 0.0                         | 100.0                          | 32.65           | 1959.0            | 1633.0                          | 29                     | 0.0                     | 60.1                   |
| Estimated Net Annual Sediment (TSS) Load Reduction = |                             |                                |                 |                   |                                 |                        |                         | <b>60 %</b>            |

Climate Station ID: 6166456 Years of Rainfall Data: 15

### RAINFALL DATA FROM PETERBOROUGH RAINFALL STATION



### INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



## Maximum Pipe Diameter / Peak Conveyance

| Stormceptor<br>EF / EFO | Model Diameter |      | Min Angle Inlet /<br>Outlet Pipes | Max Inlet Pipe<br>Diameter |      | Max Outlet Pipe<br>Diameter |      | Peak Conveyance<br>Flow Rate |       |
|-------------------------|----------------|------|-----------------------------------|----------------------------|------|-----------------------------|------|------------------------------|-------|
|                         | (m)            | (ft) |                                   | (mm)                       | (in) | (mm)                        | (in) | (L/s)                        | (cfs) |
| EF4 / EFO4              | 1.2            | 4    | 90                                | 609                        | 24   | 609                         | 24   | 425                          | 15    |
| EF5 / EFO5              | 1.5            | 5    | 90                                | 762                        | 30   | 762                         | 30   | 710                          | 25    |
| EF6 / EFO6              | 1.8            | 6    | 90                                | 914                        | 36   | 914                         | 36   | 990                          | 35    |
| EF8 / EFO8              | 2.4            | 8    | 90                                | 1219                       | 48   | 1219                        | 48   | 1700                         | 60    |
| EF10 / EFO10            | 3.0            | 10   | 90                                | 1828                       | 72   | 1828                        | 72   | 2830                         | 100   |
| EF12 / EFO12            | 3.6            | 12   | 90                                | 1828                       | 72   | 1828                        | 72   | 2830                         | 100   |

## SCOUR PREVENTION AND ONLINE CONFIGURATION

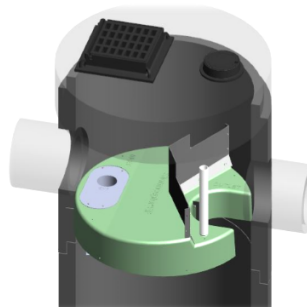
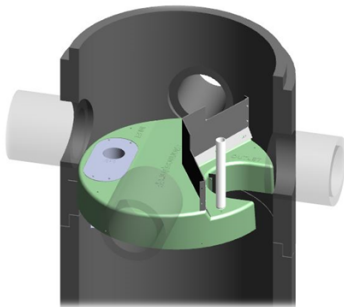
► **Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

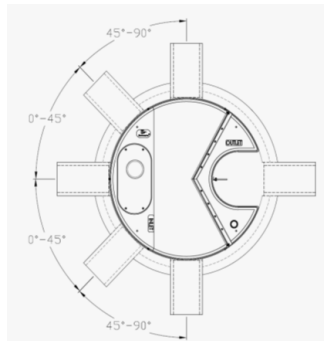
## DESIGN FLEXIBILITY

► **Stormceptor® EF and EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

## OIL CAPTURE AND RETENTION

► While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.



**INLET-TO-OUTLET DROP**

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

**HEAD LOSS**

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1.

For submerged conditions the applicable K value is 3.0.

**Pollutant Capacity**

| Stormceptor EF / EFO | Model Diameter |      | Depth (Outlet Pipe Invert to Sump Floor) |      | Oil Volume |       | Recommended Sediment Maintenance Depth * |      | Maximum Sediment Volume * |       | Maximum Sediment Mass ** |        |
|----------------------|----------------|------|------------------------------------------|------|------------|-------|------------------------------------------|------|---------------------------|-------|--------------------------|--------|
|                      | (m)            | (ft) | (m)                                      | (ft) | (L)        | (Gal) | (mm)                                     | (in) | (L)                       | (ft³) | (kg)                     | (lb)   |
| EF4 / EFO4           | 1.2            | 4    | 1.52                                     | 5.0  | 265        | 70    | 203                                      | 8    | 1190                      | 42    | 1904                     | 5250   |
| EF5 / EFO5           | 1.5            | 5    | 1.62                                     | 5.3  | 420        | 111   | 305                                      | 10   | 2124                      | 75    | 2612                     | 5758   |
| EF6 / EFO6           | 1.8            | 6    | 1.93                                     | 6.3  | 610        | 160   | 305                                      | 12   | 3470                      | 123   | 5552                     | 15375  |
| EF8 / EFO8           | 2.4            | 8    | 2.59                                     | 8.5  | 1070       | 280   | 610                                      | 24   | 8780                      | 310   | 14048                    | 38750  |
| EF10 / EFO10         | 3.0            | 10   | 3.25                                     | 10.7 | 1670       | 440   | 610                                      | 24   | 17790                     | 628   | 28464                    | 78500  |
| EF12 / EFO12         | 3.6            | 12   | 3.89                                     | 12.8 | 2475       | 655   | 610                                      | 24   | 31220                     | 1103  | 49952                    | 137875 |

\*Increased sump depth may be added to increase sediment storage capacity

\*\* Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

| Feature                                                                 | Benefit                                           | Feature Appeals To                                  |
|-------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------------------------|
| Patent-pending enhanced flow treatment and scour prevention technology  | Superior, verified third-party performance        | Regulator, Specifying & Design Engineer             |
| Third-party verified light liquid capture and retention for EFO version | Proven performance for fuel/oil hotspot locations | Regulator, Specifying & Design Engineer, Site Owner |
| Functions as bend, junction or inlet structure                          | Design flexibility                                | Specifying & Design Engineer                        |
| Minimal drop between inlet and outlet                                   | Site installation ease                            | Contractor                                          |
| Large diameter outlet riser for inspection and maintenance              | Easy maintenance access from grade                | Maintenance Contractor & Site Owner                 |

**STANDARD STORMCEPTOR EF/EFO DRAWINGS**

For standard details, please visit <http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef>

**STANDARD STORMCEPTOR EF/EFO SPECIFICATION**

For specifications, please visit <http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef>

**Table of TSS Removal vs Surface Loading Rate Based on Third-Party Test Results**  
**Stormceptor® EFO**

| SLR<br>(L/min/m <sup>2</sup> ) | TSS %<br>REMOVAL | SLR<br>(L/min/m <sup>2</sup> ) | TSS %<br>REMOVAL | SLR<br>(L/min/m <sup>2</sup> ) | TSS %<br>REMOVAL | SLR<br>(L/min/m <sup>2</sup> ) | TSS %<br>REMOVAL |
|--------------------------------|------------------|--------------------------------|------------------|--------------------------------|------------------|--------------------------------|------------------|
| 1                              | 70               | 660                            | 42               | 1320                           | 35               | 1980                           | 24               |
| 30                             | 70               | 690                            | 42               | 1350                           | 35               | 2010                           | 24               |
| 60                             | 67               | 720                            | 41               | 1380                           | 34               | 2040                           | 23               |
| 90                             | 63               | 750                            | 41               | 1410                           | 34               | 2070                           | 23               |
| 120                            | 61               | 780                            | 41               | 1440                           | 33               | 2100                           | 23               |
| 150                            | 58               | 810                            | 41               | 1470                           | 32               | 2130                           | 22               |
| 180                            | 56               | 840                            | 41               | 1500                           | 32               | 2160                           | 22               |
| 210                            | 54               | 870                            | 41               | 1530                           | 31               | 2190                           | 22               |
| 240                            | 53               | 900                            | 41               | 1560                           | 31               | 2220                           | 21               |
| 270                            | 52               | 930                            | 40               | 1590                           | 30               | 2250                           | 21               |
| 300                            | 51               | 960                            | 40               | 1620                           | 29               | 2280                           | 21               |
| 330                            | 50               | 990                            | 40               | 1650                           | 29               | 2310                           | 21               |
| 360                            | 49               | 1020                           | 40               | 1680                           | 28               | 2340                           | 20               |
| 390                            | 48               | 1050                           | 39               | 1710                           | 28               | 2370                           | 20               |
| 420                            | 47               | 1080                           | 39               | 1740                           | 27               | 2400                           | 20               |
| 450                            | 47               | 1110                           | 38               | 1770                           | 27               | 2430                           | 20               |
| 480                            | 46               | 1140                           | 38               | 1800                           | 26               | 2460                           | 19               |
| 510                            | 45               | 1170                           | 37               | 1830                           | 26               | 2490                           | 19               |
| 540                            | 44               | 1200                           | 37               | 1860                           | 26               | 2520                           | 19               |
| 570                            | 43               | 1230                           | 37               | 1890                           | 25               | 2550                           | 19               |
| 600                            | 42               | 1260                           | 36               | 1920                           | 25               | 2580                           | 18               |
| 630                            | 42               | 1290                           | 36               | 1950                           | 24               | 2600                           | 26               |

## STANDARD PERFORMANCE SPECIFICATION FOR “OIL GRIT SEPARATOR” (OGS) STORMWATER QUALITY TREATMENT DEVICE

### PART 1 – GENERAL

#### 1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

#### 1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

#### 1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

### PART 2 – PRODUCTS

#### 2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

|       |                                     |                                             |
|-------|-------------------------------------|---------------------------------------------|
| 2.1.1 | 4 ft (1219 mm) Diameter OGS Units:  | 1.19 m <sup>3</sup> sediment / 265 L oil    |
|       | 5 ft (1524 mm) Diameter OGS Units:  | 1.95 m <sup>3</sup> sediment / 420 L oil    |
|       | 6 ft (1829 mm) Diameter OGS Units:  | 3.48 m <sup>3</sup> sediment / 609 L oil    |
|       | 8 ft (2438 mm) Diameter OGS Units:  | 8.78 m <sup>3</sup> sediment / 1,071 L oil  |
|       | 10 ft (3048 mm) Diameter OGS Units: | 17.78 m <sup>3</sup> sediment / 1,673 L oil |
|       | 12 ft (3657 mm) Diameter OGS Units: | 31.23 m <sup>3</sup> sediment / 2,476 L oil |

### PART 3 – PERFORMANCE & DESIGN

#### 3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

### 3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m<sup>2</sup> to 1400 L/min/m<sup>2</sup>, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m<sup>2</sup> and 1400 L/min/m<sup>2</sup> shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m<sup>2</sup> shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m<sup>2</sup>. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m<sup>2</sup>.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m<sup>2</sup> shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m<sup>2</sup>, and shall be calculated using a simple proportioning formula, with 1400 L/min/m<sup>2</sup> in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m<sup>2</sup>.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

### 3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**.

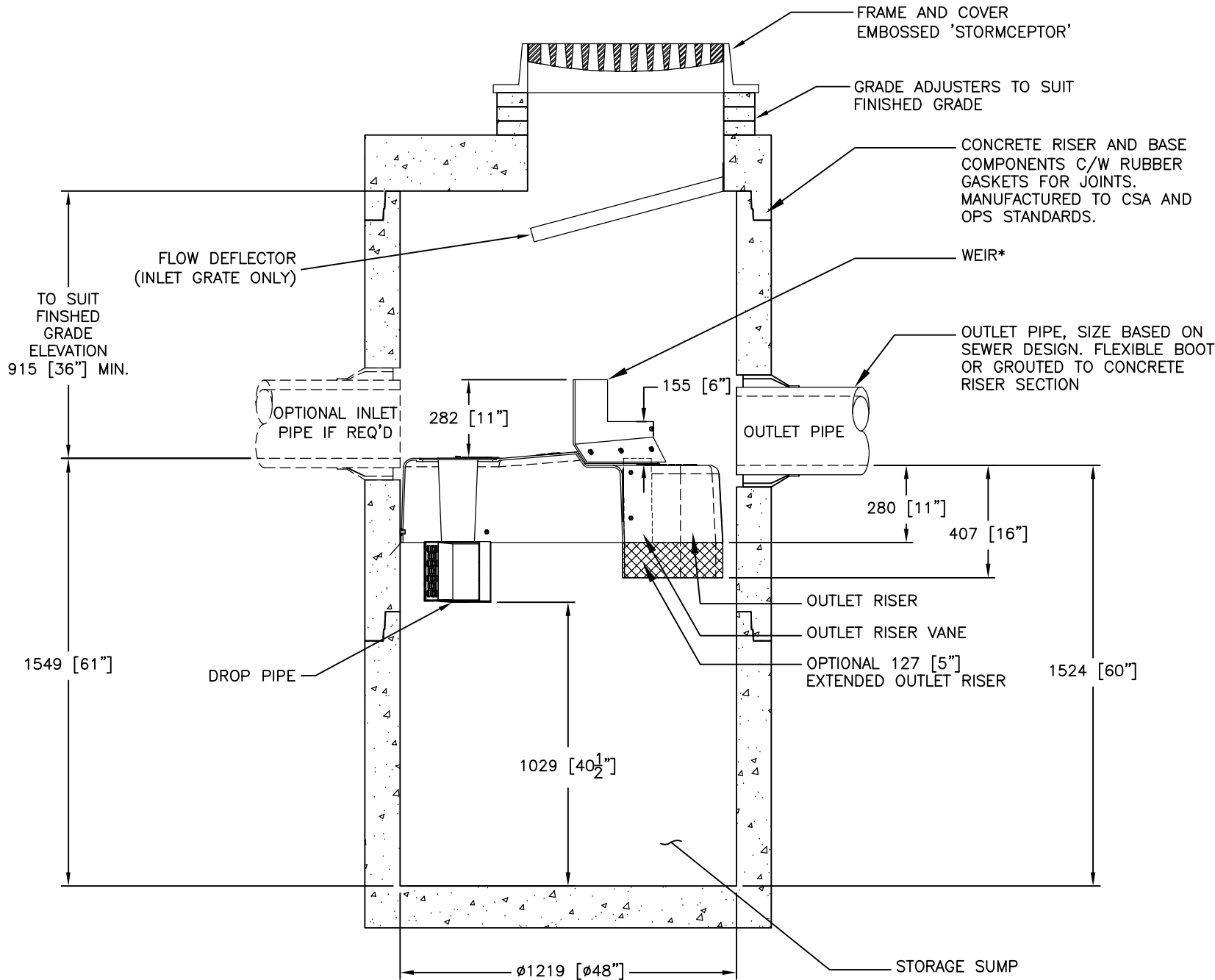
3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m<sup>2</sup>.

### 3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators**, with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-

entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m<sup>2</sup> to 2600 L/min/m<sup>2</sup>) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.



SECTION VIEW

GENERAL NOTES:

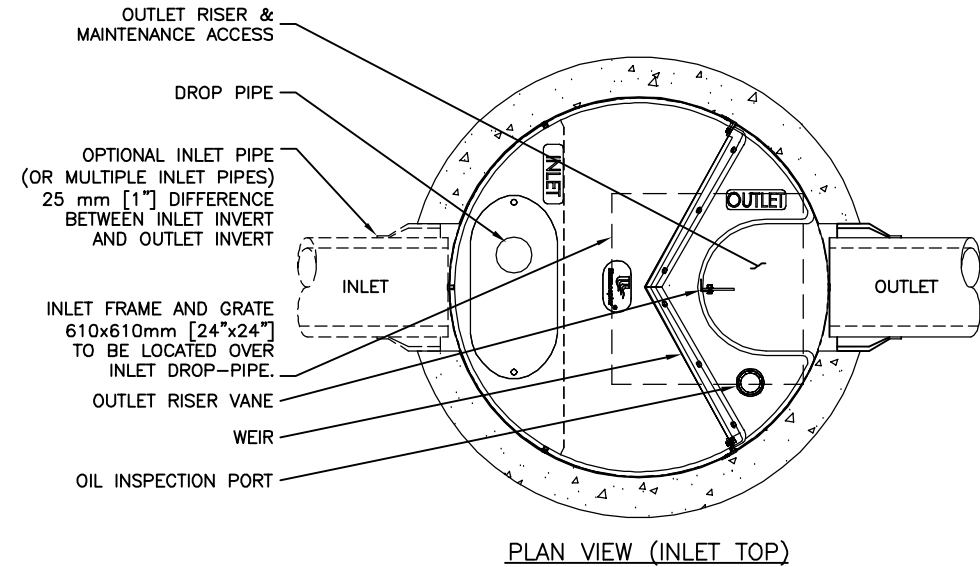
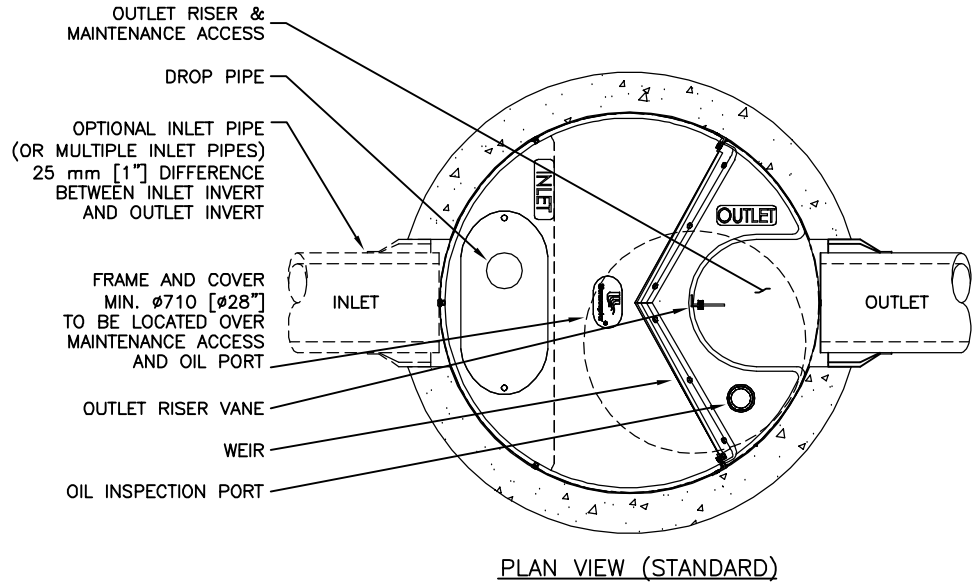
- \* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m<sup>2</sup> (27.9 gpm/ft<sup>2</sup>) FOR STORMCEPTOR EF4 AND 535 L/min/m<sup>2</sup> (13.1 gpm/ft<sup>2</sup>) FOR STORMCEPTOR EFO4 (OIL CAPTURE CONFIGURATION). WEIR HEIGHT IS 150 mm (6 INCH) FOR EF04.
1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. STORMCEPTOR STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE STORMCEPTOR SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

INSTALLATION NOTES

- A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
- C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
- D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT THE DEVICE FROM CONSTRUCTION-RELATED EROSION RUNOFF.
- E. DEVICE ACTIVATION, BY CONTRACTOR, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE STORMCEPTOR UNIT IS CLEAN AND FREE OF DEBRIS.

# STANDARD DETAIL

# NOT FOR CONSTRUCTION



FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL STORMCEPTOR REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE (IF REQUIRED).

SITE SPECIFIC DATA REQUIREMENTS

| STORMCEPTOR MODEL                |       |     |         |     |   |
|----------------------------------|-------|-----|---------|-----|---|
| EFO4                             |       |     |         |     |   |
| STRUCTURE ID                     |       |     |         |     |   |
| *                                |       |     |         |     |   |
| HYDROCARBON STORAGE REQ'D (L)    |       |     |         |     |   |
| *                                |       |     |         |     |   |
| WATER QUALITY FLOW RATE (L/s)    |       |     |         |     |   |
| *                                |       |     |         |     |   |
| PEAK FLOW RATE (L/s)             |       |     |         |     |   |
| *                                |       |     |         |     |   |
| RETURN PERIOD OF PEAK FLOW (yrs) |       |     |         |     |   |
| *                                |       |     |         |     |   |
| DRAINAGE AREA (HA)               |       |     |         |     |   |
| *                                |       |     |         |     |   |
| DRAINAGE AREA IMPERVIOUSNESS (%) |       |     |         |     |   |
| *                                |       |     |         |     |   |
| PIPE DATA:                       |       |     |         |     |   |
| I.E.                             | MAT'L | DIA | SLOPE % | HGL |   |
| INLET #1                         | *     | *   | *       | *   | * |
| INLET #2                         | *     | *   | *       | *   | * |
| OUTLET                           | *     | *   | *       | *   | * |

\* PER ENGINEER OF RECORD

This design and information shall be the property of Imbrium Systems, Inc. and shall be provided as a service to the project owner, engineer, and contractor by Imbrium Systems, Inc. ("Imbrium"). Neither this drawing, nor any part thereof, may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage and retrieval system, without the prior written consent of Imbrium. Imbrium expressly disclaims any liability or responsibility for such use.

| REVISION DESCRIPTION |         |      |                      |
|----------------------|---------|------|----------------------|
| BY                   | DATE    | MARK | REVISION DESCRIPTION |
| JSK                  | 6/8/18  | 1    | UPDATES              |
| JSK                  | 5/26/17 | 0    | INITIAL RELEASE      |

Stormceptor® EF

407 FAIRVIEW DRIVE, WHITBY, ON L1N 3A9  
TEL: 800-385-4801 CA: 416-860-9600 INTL: +1-416-860-9600  
The Stormceptor system is designed for use on lots or properties where the following conditions exist:  
1. The property is zoned for residential use.  
2. The property is not a commercial or industrial site.  
3. The property is not a public or private utility site.  
4. The property is not a public or private water treatment plant.  
5. The property is not a public or private sewer treatment plant.  
6. The property is not a public or private stormwater management facility.  
7. The property is not a public or private parking lot.  
8. The property is not a public or private road.  
9. The property is not a public or private airport.  
10. The property is not a public or private military installation.

|                      |                    |
|----------------------|--------------------|
| DATE:<br>10/13/2017  |                    |
| DESIGNED:<br>JSK     | DRAWN:<br>JSK      |
| CHECKED:<br>BSF      | APPROVED:<br>SP    |
| PROJECT No.:<br>EFO4 | SEQUENCE No.:<br>* |
| SHEET:<br>1 OF 1     |                    |

# VERIFICATION STATEMENT

## GLOBE Performance Solutions

Verifies the performance of

### Stormceptor® EF4 and EFO4 Oil-Grit Separators

Developed by Imbrium Systems, Inc.,  
Whitby, Ontario, Canada

In accordance with

**ISO 14034:2016**

**Environmental management —  
Environmental technology verification (ETV)**



John D. Wiebe, PhD  
Executive Chairman  
GLOBE Performance Solutions



November 10, 2017  
Vancouver, BC, Canada

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

## Technology description and application

The Stormceptor® EF4 and EFO4 are treatment devices designed to remove oil, sediment, trash, debris, and pollutants attached to particulates from Stormwater and snowmelt runoff. The device takes the place of a conventional manhole within a storm drain system and offers design flexibility that works with various site constraints. The EFO4 is designed with a shorter bypass weir height, which accepts lower surface loading rate into the sump, thereby reducing re-entrainment of captured free floating light liquids.

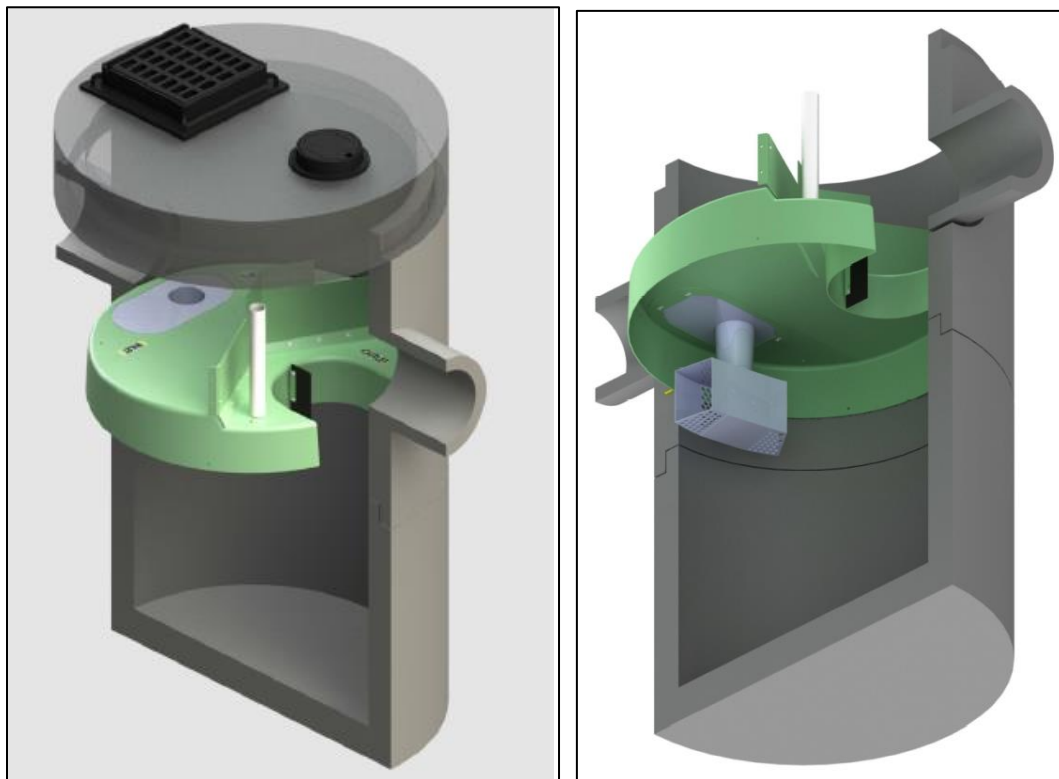


Figure 1. Graphic of typical inline Stormceptor® unit and core components.

Stormwater and snowmelt runoff enters the Stormceptor® EF/EFO's upper chamber through the inlet pipe(s) or a surface inlet grate. An insert divides the unit into lower and upper chambers and incorporates a weir to reduce influent velocity and separate influent (untreated) from effluent (treated) flows. Influent water ponds upstream of the insert's weir providing driving head for the water flowing downwards into the drop pipe where a vortex pulls the water into the lower chamber. The water diffuses at lower velocities in multiple directions through the drop pipe outlet openings. Oil and other floatables rise up and are trapped beneath the insert, while sediments undergo gravitational settling to the sump's bottom. Water from the sump can exit by flowing upward to the outlet riser onto the top side of the insert and downstream of the weir, where it discharges through the outlet pipe.

Maximum flow rate into the lower chamber is a function of weir height and drop pipe orifice diameter. The Stormceptor® EF and EFO are designed to allow a surface loading rate of 1135 L/min/m<sup>2</sup> (27.9 gal/min/ft<sup>2</sup>) and 535 L/min/m<sup>2</sup> (13.1 gal/min/ft<sup>2</sup>) into the lower chamber, respectively. When prescribed surface loading rates are exceeded, ponding water can overtop the weir height and bypass the lower treatment chamber, exiting directly through the outlet pipe. Hydraulic testing and scour testing demonstrate that the internal bypass effectively prevents scour at all bypass flow rates. Increasing the bypass flow rate does not increase the orifice-controlled flow rate into the lower treatment chamber where sediment is stored. This internal bypass feature allows for in-line installation, avoiding the cost of

additional bypass structures. During bypass, treatment continues in the lower chamber at the maximum flow rate. The Stormceptor® EFO's lower design surface loading rate is favorable for minimizing re-entrainment and washout of captured light liquids. Inspection of Stormceptor® EF and EFO devices is performed from grade by inserting a sediment probe through the outlet riser and an oil dipstick through the oil inspection pipe. The unit can be maintained by using a vacuum hose through the outlet riser.

## Performance conditions

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

## Performance claim(s)

### Capture test<sup>a</sup>:

During the capture test, the Stormceptor® EF OGS device, with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removes 70, 64, 54, 48, 46, 44, and 49 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, and 1400 L/min/m<sup>2</sup>, respectively.

Stormceptor® EFO, with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removes 70, 64, 54, 48, 42, 40, and 34 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, and 1400 L/min/m<sup>2</sup>, respectively.

### Scour test<sup>a</sup>:

During the scour test, the Stormceptor® EF and Stormceptor® EFO OGS devices, with 10.2 cm (4 inches) of test sediment pre-loaded onto a false floor reaching 50% of the manufacturer's recommended maximum sediment storage depth, generate corrected effluent concentrations of 4.6, 0.7, 0, 0.2, and 0.4 mg/L at 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m<sup>2</sup>, respectively.

### Light liquid re-entrainment test<sup>a</sup>:

During the light liquid re-entrainment test, the Stormceptor® EFO OGS device with surrogate low-density polyethylene beads preloaded within the lower chamber oil collection zone, representing a floating light liquid volume equal to a depth of 50.8 mm over the sedimentation area, retained 100, 99.5, 99.8, 99.8, and 99.9 percent of loaded beads by mass during the 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m<sup>2</sup>.

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<sup>a</sup> The claim can be applied to other units smaller or larger than the tested unit as long as the untested units meet the scaling rule specified in the Procedure for Laboratory Testing of Oil Grit Separators (Version 3.0, June 2014)

## Performance results

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

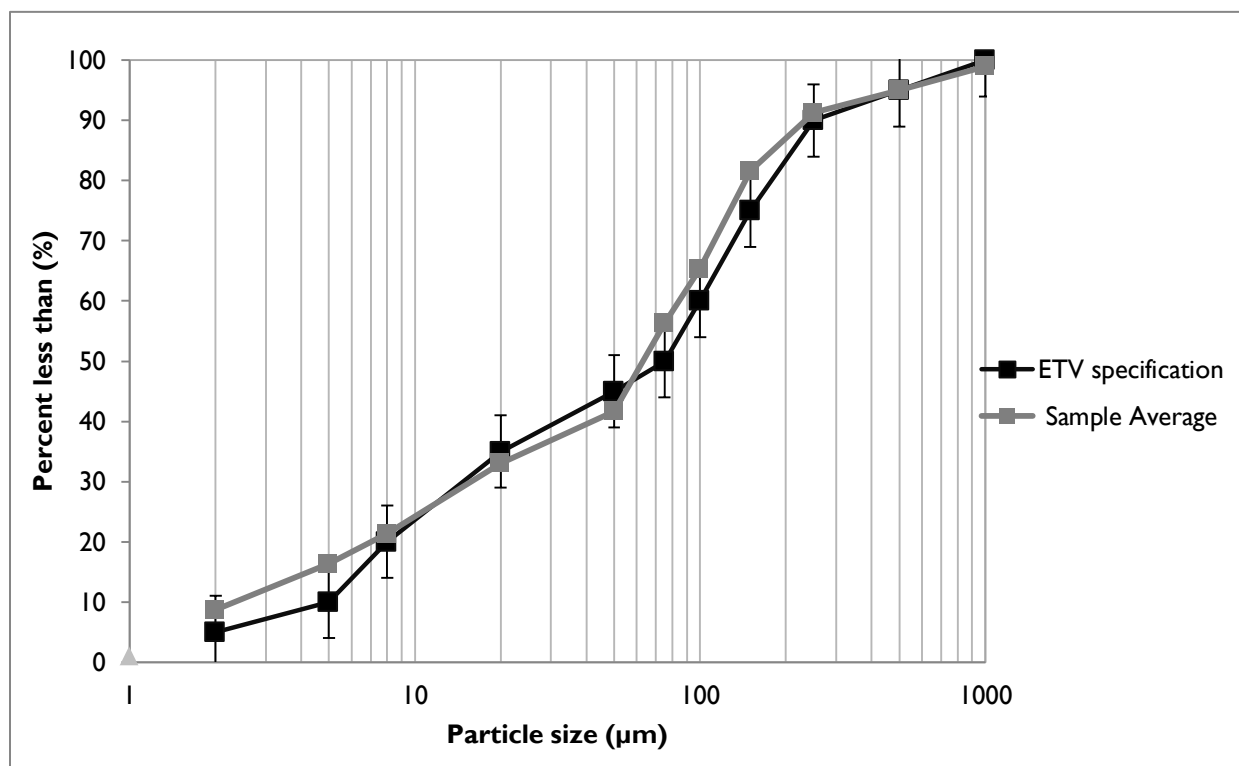


Figure 2. The three sample average particle size distribution (PSD) of the test sediment used for the capture and scour test compared to the specified PSD.

The capacity of the device to retain sediment was determined at seven surface loading rates using the modified mass balance method. This method involved measuring the mass and particle size distribution of the injected and retained sediment for each test run. Performance was evaluated with a false floor simulating the technology filled to 50% of the manufacturer's recommended maximum sediment storage depth. The test was carried out with clean water that maintained a sediment concentration below 20 mg/L. Based on these conditions, removal efficiencies for individual particle size classes and for the test sediment as a whole were determined for each of the tested surface loading rates (Table 1). Since the EF and EFO models are identical except for the weir height, which bypasses flows from the EFO model at a surface loading rate of 535 L/min/m<sup>2</sup> (13.1 gpm/ft<sup>2</sup>), sediment capture tests at surface loading rates from 40 to 400 L/min/m<sup>2</sup> were only performed on the EF unit. Surface loading rates of 600, 1000, and 1400 L/min/m<sup>2</sup> were tested on both units separately. Results for the EFO model at these higher flow rates are presented in Table 2.

In some instances, the removal efficiencies were above 100% for certain particle size fractions. These discrepancies are not unique to any one test laboratory and may be attributed to errors relating to the blending of sediment, collection of representative samples for laboratory submission, and laboratory

analysis of PSD. Due to these errors, caution should be exercised in applying the removal efficiencies by particle size fraction for the purposes of sizing the tested device (see [Bulletin # CETV 2016-11-0001](#)). The results for “all particle sizes by mass balance” (see Table 1 and 2) are based on measurements of the total injected and retained sediment mass, and are therefore not subject to blending, sampling or PSD analysis errors.

Table 1. Removal efficiencies (%) of the EF4 at specified surface loading rates

| Particle size fraction (µm)               | Surface loading rate (L/min/m <sup>2</sup> ) |             |             |             |             |             |             |
|-------------------------------------------|----------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                                           | 40                                           | 80          | 200         | 400         | 600         | 1000        | 1400        |
| >500                                      | 90                                           | 58          | 58          | 100*        | 86          | 72          | 100*        |
| 250 - 500                                 | 100*                                         | 100*        | 100         | 100*        | 100*        | 100*        | 100*        |
| 150 - 250                                 | 90                                           | 82          | 26          | 100*        | 100*        | 67          | 90          |
| 105 - 150                                 | 100*                                         | 100*        | 100*        | 100*        | 100*        | 100*        | 100         |
| 75 - 105                                  | 100*                                         | 92          | 74          | 82          | 77          | 68          | 76          |
| 53 - 75                                   | Undefined <sup>a</sup>                       | 56          | 100*        | 72          | 69          | 50          | 80          |
| 20 - 53                                   | 54                                           | 100*        | 54          | 33          | 36          | 40          | 31          |
| 8 - 20                                    | 67                                           | 52          | 25          | 21          | 17          | 20          | 20          |
| 5 - 8                                     | 33                                           | 29          | 11          | 12          | 9           | 7           | 19          |
| <5                                        | 13                                           | 0           | 0           | 0           | 0           | 0           | 4           |
| <b>All particle sizes by mass balance</b> | <b>70.4</b>                                  | <b>63.8</b> | <b>53.9</b> | <b>47.5</b> | <b>46.0</b> | <b>43.7</b> | <b>49.0</b> |

<sup>a</sup> An outlier in the feed sample sieve data resulted in a negative removal efficiency for this size fraction.

\* Removal efficiencies were calculated to be above 100%. Calculated values ranged between 101 and 171% (average 128%). See text and [Bulletin # CETV 2016-11-0001](#) for more information.

Table 2. Removal efficiencies (%) of the EFO4 at surface loading rates above the bypass rate of 535 L/min/m<sup>2</sup>

| Particle size fraction (µm)               | Surface loading rate (L/min/m <sup>2</sup> ) |             |             |
|-------------------------------------------|----------------------------------------------|-------------|-------------|
|                                           | 600                                          | 1000        | 1400        |
| >500                                      | 89                                           | 83          | 100*        |
| 250 - 500                                 | 90                                           | 100*        | 92          |
| 150 - 250                                 | 90                                           | 67          | 100*        |
| 105 - 150                                 | 85                                           | 92          | 77          |
| 75 - 105                                  | 80                                           | 71          | 65          |
| 53 - 75                                   | 60                                           | 31          | 36          |
| 20 - 53                                   | 33                                           | 43          | 23          |
| 8 - 20                                    | 17                                           | 23          | 15          |
| 5 - 8                                     | 10                                           | 3           | 3           |
| <5                                        | 0                                            | 0           | 0           |
| <b>All particle sizes by mass balance</b> | <b>41.7</b>                                  | <b>39.7</b> | <b>34.2</b> |

\* Removal efficiencies were calculated to be above 100%. Calculated values ranged between 103 and 111% (average 107%). See text and [Bulletin # CETV 2016-11-0001](#) for more information.

Figure 3 compares the particle size distribution (PSD) of the three sample average of the test sediment to the PSD of the sediment retained by the EF4 at each of the tested surface loading rates. Figure 4 shows the same graph for the EFO4 unit at surface loading rates above the bypass rate of 535 L/min/m<sup>2</sup>.

As expected, the capture efficiency for fine particles in both units was generally found to decrease as surface loading rates increased.

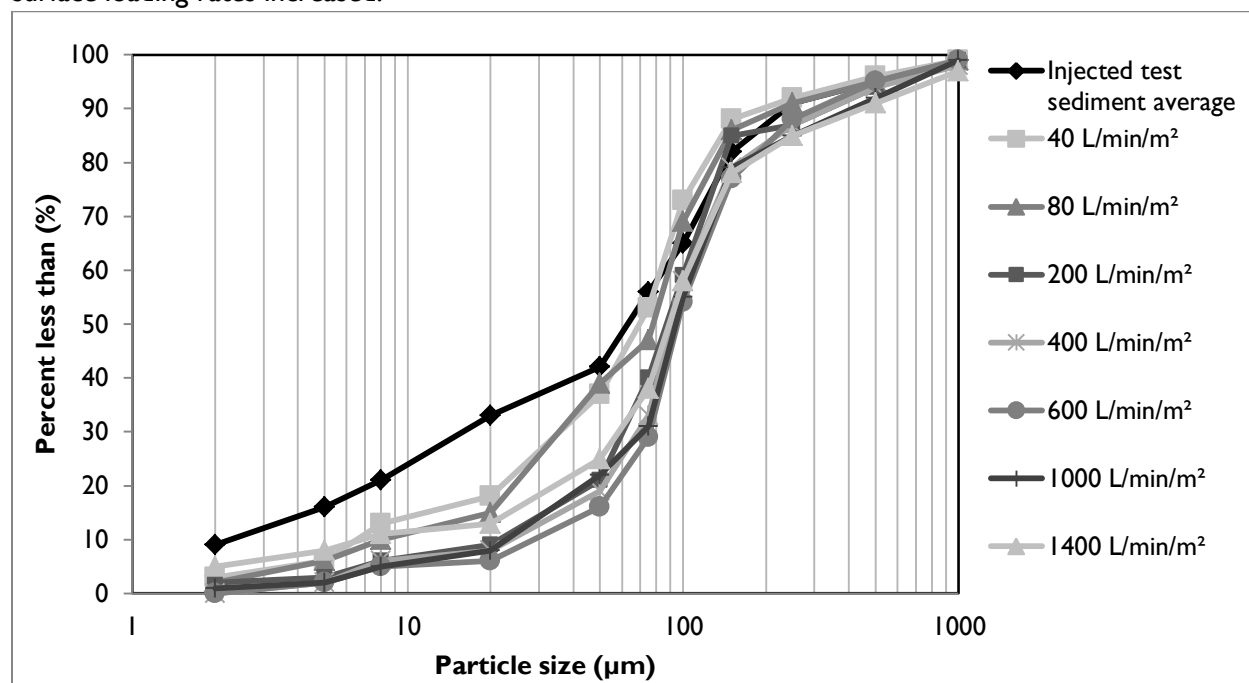


Figure 3. Particle size distribution of sediment retained in the EF4 in relation to the injected test sediment average.

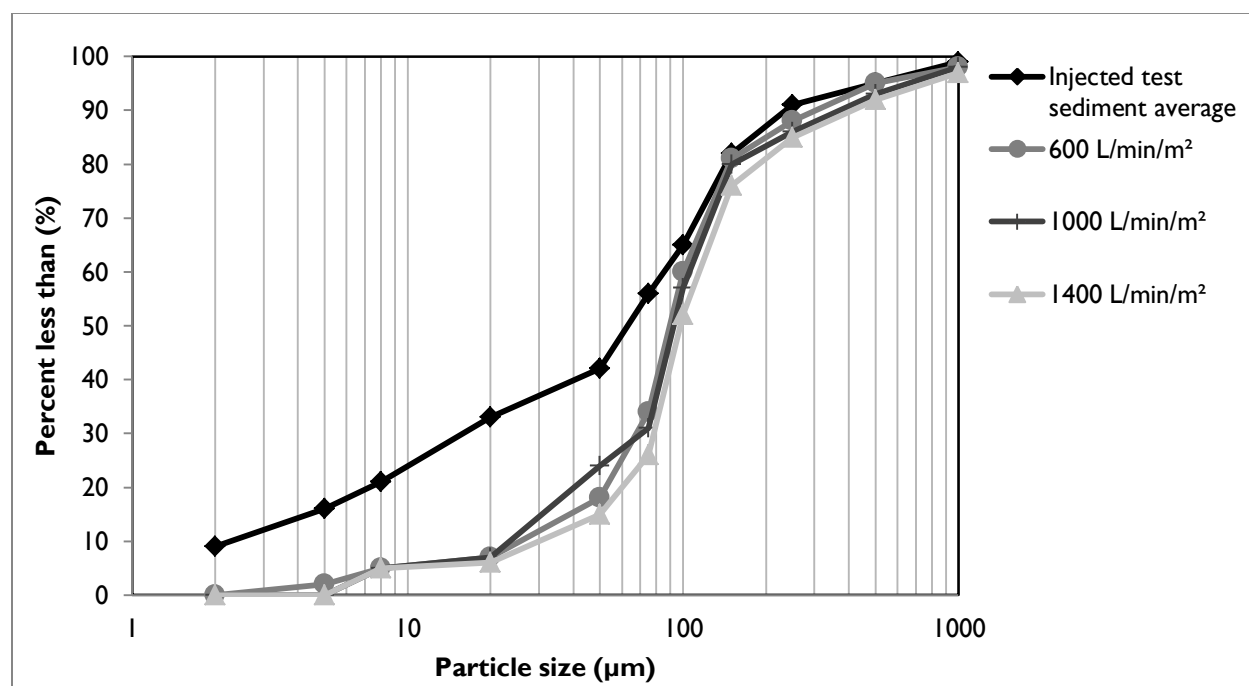


Figure 4. Particle size distribution of sediment retained in the EFO4 in relation to the injected test sediment average at surface loading rates above the bypass rate of 535 L/min/m²

Table 4 shows the results of the sediment scour and re-suspension test for the EF4 unit. The EFO4 was not tested as it was reasonably assumed that scour rates would be lower given that flow bypass occurs at a lower surface loading rate. The scour test involved preloading 10.2 cm of fresh test sediment into

the sedimentation sump of the device. The sediment was placed on a false floor to mimic a device filled to 50% of the maximum recommended sediment storage depth. Clean water was run through the device at five surface loading rates over a 30 minute period. Each flow rate was maintained for 5 minutes with a one minute transition time between flow rates. Effluent samples were collected at one minute sampling intervals and analyzed for Suspended Sediment Concentration (SSC) and PSD by recognized methods. The effluent samples were subsequently adjusted based on the background concentration of the influent water. Typically, the smallest 5% of particles captured during the 40 L/min/m<sup>2</sup> sediment capture test is also used to adjust the concentration, as per the method described in [Bulletin # CETV 2016-09-0001](#). However, since the composites of effluent concentrations were below the Reporting Detection Limit of the Laser Diffraction PSD methodology, this adjustment was not made. Results showed average adjusted effluent sediment concentrations below 5 mg/L at all tested surface loading rates.

It should be noted that the EF4 starts to internally bypass water at 1135 L/min/m<sup>2</sup>, potentially resulting in the dilution of effluent concentrations, which would not normally occur under typical field conditions because the field influent concentration would contain a much higher sediment concentration than during the lab test. Recalculation of effluent concentrations to account for dilution at surface loading rates above the bypass rate showed sediment effluent concentrations to be below 1.6 mg/L.

Table 4. Scour test adjusted effluent sediment concentration.

| Run | Surface loading rate (L/min/m <sup>2</sup> ) | Run time (min) | Background sample concentration (mg/L) | Adjusted effluent suspended sediment concentration (mg/L) <sup>a</sup> | Average (mg/L) |
|-----|----------------------------------------------|----------------|----------------------------------------|------------------------------------------------------------------------|----------------|
| 1   | 200                                          | 1:00           | <RDL                                   | 11.9                                                                   | 4.6            |
|     |                                              | 2:00           |                                        | 7.0                                                                    |                |
|     |                                              | 3:00           |                                        | 4.4                                                                    |                |
|     |                                              | 4:00           |                                        | 2.2                                                                    |                |
|     |                                              | 5:00           |                                        | 1.0                                                                    |                |
|     |                                              | 6:00           |                                        | 1.2                                                                    |                |
| 2   | 800                                          | 7:00           | <RDL                                   | 1.1                                                                    | 0.7            |
|     |                                              | 8:00           |                                        | 0.9                                                                    |                |
|     |                                              | 9:00           |                                        | 0.6                                                                    |                |
|     |                                              | 10:00          |                                        | 1.4                                                                    |                |
|     |                                              | 11:00          |                                        | 0.1                                                                    |                |
|     |                                              | 12:00          |                                        | 0                                                                      |                |
| 3   | 1400                                         | 13:00          | <RDL                                   | 0                                                                      | 0              |
|     |                                              | 14:00          |                                        | 0.1                                                                    |                |
|     |                                              | 15:00          |                                        | 0                                                                      |                |
|     |                                              | 16:00          |                                        | 0                                                                      |                |
|     |                                              | 17:00          |                                        | 0                                                                      |                |
|     |                                              | 18:00          |                                        | 0                                                                      |                |
| 4   | 2000                                         | 19:00          | 1.2                                    | 0.2                                                                    | 0.2            |
|     |                                              | 20:00          |                                        | 0                                                                      |                |
|     |                                              | 21:00          |                                        | 0                                                                      |                |
|     |                                              | 22:00          |                                        | 0.7                                                                    |                |
|     |                                              | 23:00          |                                        | 0                                                                      |                |

|   |      |       |     |     |     |
|---|------|-------|-----|-----|-----|
|   |      | 24:00 |     | 0.4 |     |
| 5 | 2600 | 25:00 | 1.6 | 0.3 | 0.4 |
|   |      | 26:00 |     | 0.4 |     |
|   |      | 27:00 |     | 0.7 |     |
|   |      | 28:00 |     | 0.4 |     |
|   |      | 29:00 |     | 0.2 |     |
|   |      | 30:00 |     | 0.4 |     |

<sup>a</sup> The adjusted effluent suspended sediment concentration represents the actual measured effluent concentration minus the background concentration. For more information see [Bulletin # CETV 2016-09-0001](#).

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

Table 5. Light liquid re-entrainment test results for the EFO4.

| Surface Loading Rate (L/min/m <sup>2</sup> ) | Time Stamp | Amount of Beads Re-entrained |                         |                                   |                               |
|----------------------------------------------|------------|------------------------------|-------------------------|-----------------------------------|-------------------------------|
|                                              |            | Mass (g)                     | Volume (L) <sup>a</sup> | % of Pre-loaded Mass Re-entrained | % of Pre-loaded Mass Retained |
| 200                                          | 62         | 0                            | 0                       | 0.00                              | 100                           |
| 800                                          | 247        | 168.45                       | 0.3                     | 0.52                              | 99.48                         |
| 1400                                         | 432        | 51.88                        | 0.09                    | 0.16                              | 99.83                         |
| 2000                                         | 617        | 55.54                        | 0.1                     | 0.17                              | 99.84                         |
| 2600                                         | 802        | 19.73                        | 0.035                   | 0.06                              | 99.94                         |
| Total Re-entrained                           |            | 295.60                       | 0.525                   | 0.91                              | --                            |
| Total Retained                               |            | 32403                        | 57.78                   | --                                | 99.09                         |
| Total Loaded                                 |            | 32699                        | 58.3                    | --                                | --                            |

<sup>a</sup> Determined from bead bulk density of 0.56074 g/cm<sup>3</sup>

## Variances from testing Procedure

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

- During the capture test, the 40 L/min/m<sup>2</sup> and 80 L/min/m<sup>2</sup> surface loading rates were evaluated over 3 and 2 days respectively due to the long duration needed to feed the required minimum of 11.3 kg of test sediment into the unit at these lower flow rates. Pumps were shut down at the end of each intermediate day, and turned on again the following morning. The target flow rate was re-established within 30 seconds of switching on the pump. This procedure may have allowed sediments to be captured that otherwise may have exited the unit if the test was

continuous. On the basis of practical considerations, this variance was approved by the verifier prior to testing.

2. During the scour test, the coefficient of variation (COV) for the lowest flow rate tested (200 L/min/m<sup>2</sup>) was 0.07, which exceeded the specified limit of 0.04 target specified in the OGS Procedure. A pump capable of attaining the highest flow rate of 3036 L/min had difficulty maintaining the lowest flow of 234 L/min but still remained within +/- 10% of the target flow and is viewed as having very little impact on the observed results. Similarly, for the light liquid re-entrainment test the COV for the flow rate of the 200 L/min/m<sup>2</sup> run was 0.049, exceeding the limit of 0.04, but is believed to introduce negligible bias.
3. Due to pressure build up in the filters, the runs at 1000 L/min/m<sup>2</sup> for the Stormceptor® EF4 and 1000 and 1400 L/min/m<sup>2</sup> for the Stormceptor® EFO4 were slightly shorter than the target. The run times were 54, 59 and 43 minutes respectively, versus targets of 60 and 50 minutes. The final feed samples were timed to coincide with the end of the run. Since >25 lbs of sediment was fed, the shortened time did not invalidate the runs.

## Verification

The verification was completed by the Verification Expert, Toronto and Region Conservation Authority, contracted by GLOBE Performance Solutions, using the International Standard **ISO 14034:2016 Environmental management – Environmental technology verification (ETV)**. Data and information provided by Imbrium Systems Inc. to support the performance claim included the following: Performance test report prepared by Good Harbour Laboratories, and dated September 8, 2017; the report is based on testing completed in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014).

## What is ISO 14034:2016 Environmental management – Environmental technology verification (ETV)?

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

### For more information on the Stormceptor® EF4 and EFO4 please contact:

Imbrium Systems, Inc.  
407 Fairview Drive  
Whitby, ON  
L1N 3A9, Canada  
Tel: 416-960-9900  
info@imbriumsystems.com

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

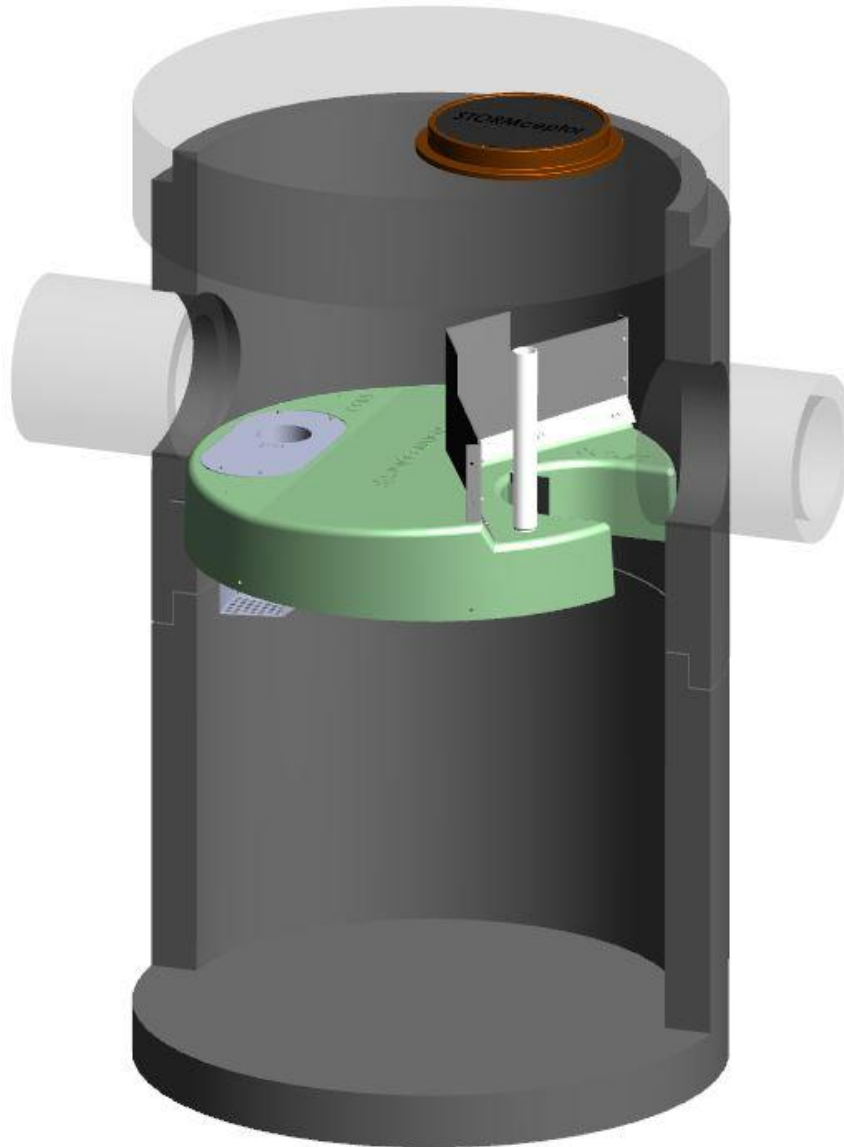
GLOBE Performance Solutions  
World Trade Centre  
404 – 999 Canada Place  
Vancouver, BC  
V6C 3E2 Canada  
Tel: 604-695-5018 / Toll Free: 1-855-695-5018  
etv@globeperformance.com

### Limitation of verification

GLOBE Performance Solutions and the Verification Expert provide the verification services solely on the basis of the information supplied by the applicant or vendor and assume no liability thereafter. The responsibility for the information supplied remains solely with the applicant or vendor and the liability for the purchase, installation, and operation (whether consequential or otherwise) is not transferred to any other party as a result of the verification.

# *Stormceptor*<sup>®</sup> **EF**

## Owner's Manual



*Stormceptor is protected by one or more of the following patents:*

Canadian Patent No. 2,137,942  
Canadian Patent No. 2,180,305  
Canadian Patent No. 2,327,768  
Canadian Patent No. 2,694,159  
Canadian Patent No. 2,697,287  
U.S. Patent No. 6,068,765  
U.S. Patent No. 6,371,690  
U.S. Patent No. 7,582,216  
U.S. Patent No. 7,666,303  
Australia Patent No. 693.164  
Australia Patent No. 729,096  
Australia Patent No. 2008,279,378  
Australia Patent No. 2008,288,900  
Japanese Patent No. 5,997,750  
Japanese Patent No. 5,555,160  
Korean Patent No. 0519212  
Korean Patent No. 1451593  
New Zealand Patent No. 583,008  
New Zealand Patent No. 583,583  
South African Patent No. 2010/00682  
South African Patent No. 2010/01796  
Patent pending

## **Table of Contents:**

**1 - Stormceptor EF Overview**

**2 - Stormceptor EF Operation, Components**

**3 - Stormceptor EF Model Details**

**4 - Stormceptor EF Identification**

**5 - Stormceptor EF Inspection & Maintenance**

**6 – Stormceptor Contacts**

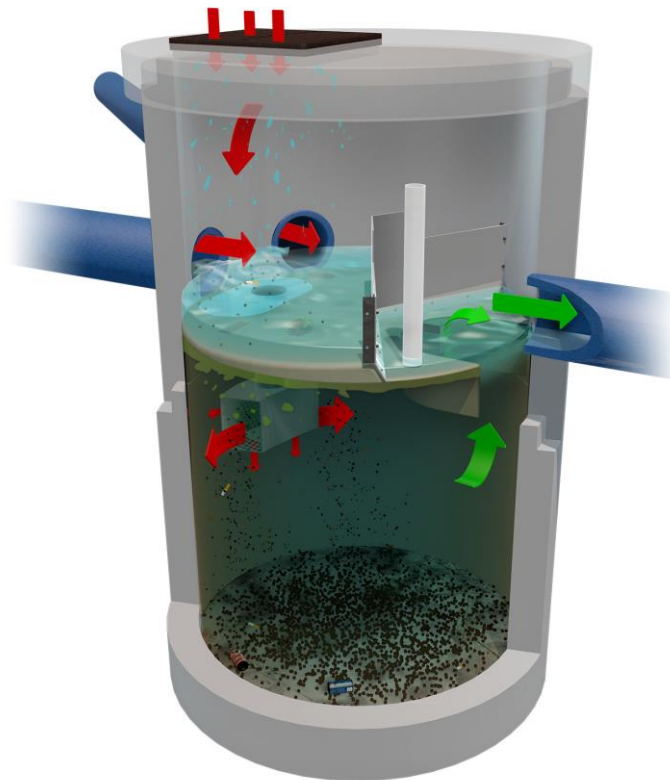
## OVERVIEW

**Stormceptor® EF** is a continuation and evolution of the most globally recognized oil grit separator (OGS) stormwater treatment technology - **Stormceptor®**. Also known as a hydrodynamic separator, the enhanced flow Stormceptor EF is a high performing oil grit separator that effectively removes a wide variety of pollutants from stormwater and snowmelt runoff at flow rates higher than the original Stormceptor. Stormceptor EF captures and retains sediment (TSS), free oils, gross pollutants and other pollutants that attach to particles, such as nutrients and metals. Stormceptor EF's patent-pending treatment and scour prevention platform ensures sediment is retained during all rainfall events.

Stormceptor EF offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe, multiple inlet pipes, and/or from the surface through an inlet grate. Stormceptor EF can also serve as a junction structure, accommodate a 90-degree inlet to outlet bend angle, and be modified to ensure performance in submerged conditions. With its scour prevention and internal bypass, Stormceptor EF can be installed online, eliminating the need for costly additional bypass structures.

## OPERATION

- Stormwater enters the Stormceptor upper chamber through the inlet pipe(s) or a surface inlet grate. A specially designed insert reduces the influent velocity by creating a pond upstream of the insert's weir. Sediment particles immediately begin to settle. Swirling flow sweeps water, sediment, and floatables across the sloped surface of the insert to the inlet opening of the drop pipe, where a strong vortex draws water, sediment, oil, and debris down the drop pipe cone.
- Influent exits the cone into the drop pipe duct. The duct has two large rectangular outlet openings as well as perforations in the backside and floor of the duct. Influent is diffused through these various opening in multiple directions and at low velocity into the lower chamber.
- Free oils and other floatables rise up within the channel surrounding the central riser pipe and are trapped beneath the insert, while sediment settles to the sump. Pollutants are retained for later removal during maintenance cleaning.
- Treated effluent enters the outlet riser, moves upward, and discharges to the top side of the insert downstream of the weir, where it flows out the outlet pipe.
- During intense storm events with very high influent flow rates, the pond height on the upstream side of the weir may exceed the height of the weir, and the excess flow passes over the top of the weir to the downstream side of the insert, and exits through the outlet pipe. This internal bypass feature allows for in-line installation, avoiding the cost of additional bypass structures. During bypass, the pond separates sediment from all incoming flows, while full treatment in the lower chamber continues at the maximum flow rate.
- Stormceptor EF's patent-pending enhanced flow and scour prevention technology ensures pollutants are captured and retained, allowing excess flows to bypass during infrequent, high intensity storms.



## COMPONENTS

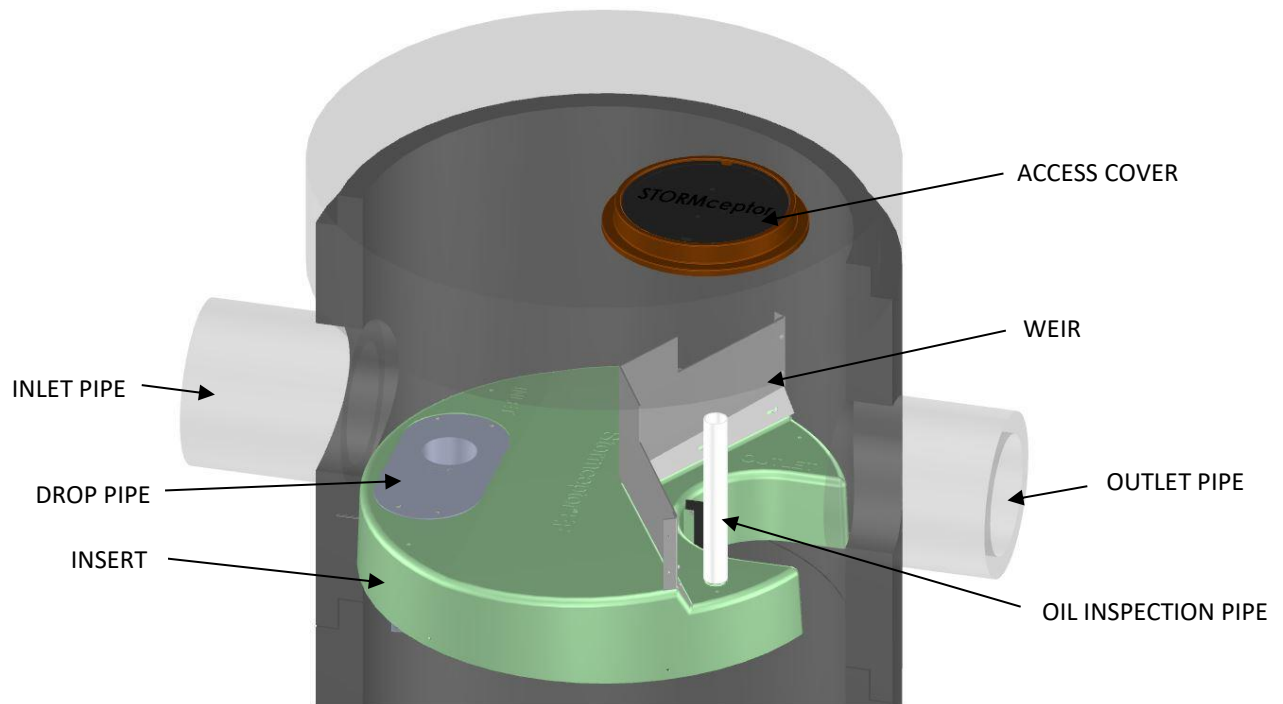


Figure 1

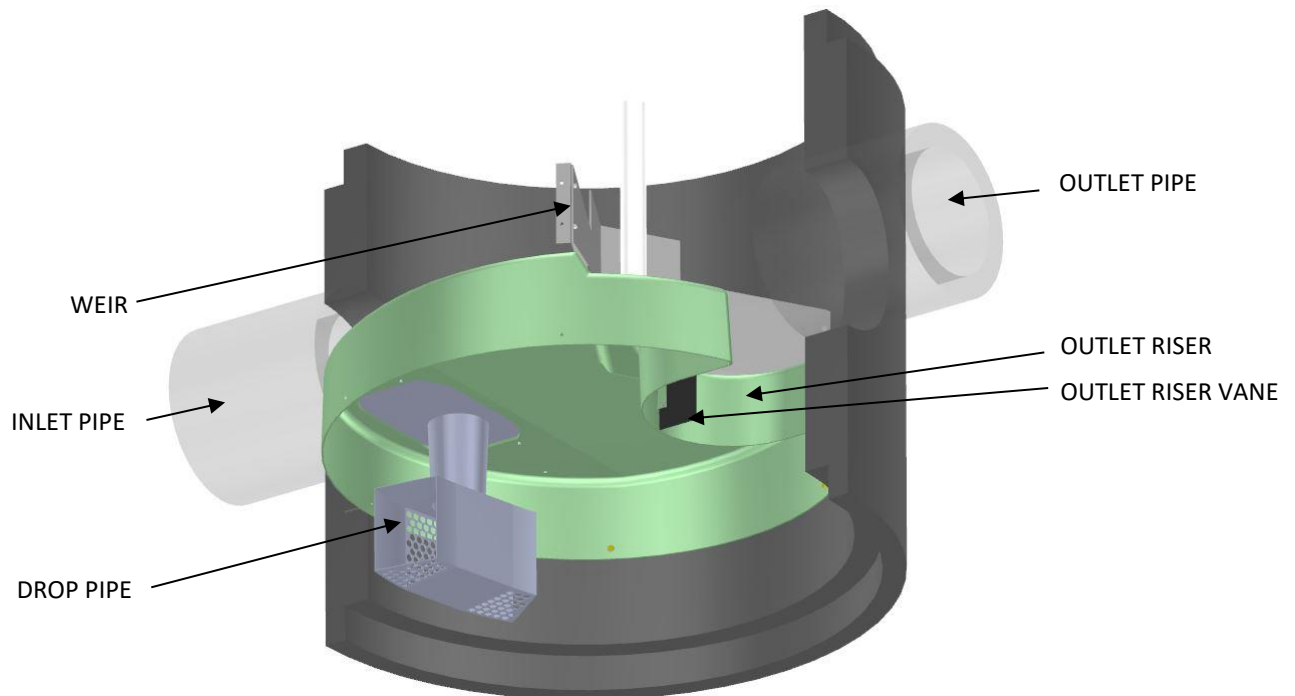


Figure 2

OUTLET PLATFORM (UP position)

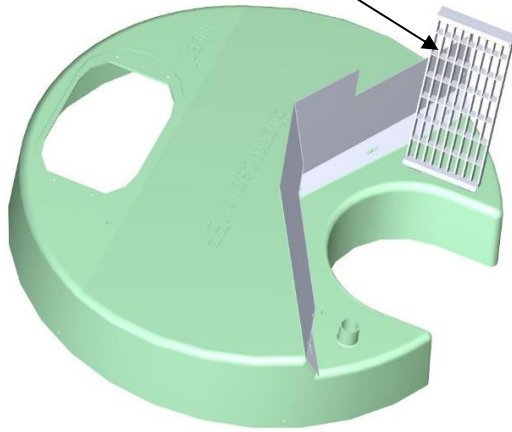


Figure 3A

OUTLET PLATFORM (DOWN position)

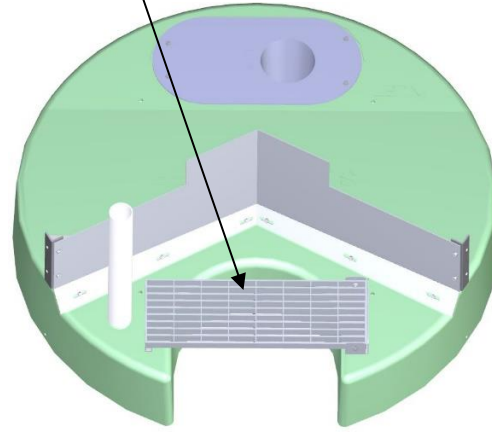


Figure 3B

- **Insert** – separates vessel into upper and lower chambers, and provides double-wall containment of hydrocarbons
- **Weir** – creates stormwater ponding and driving head on top side of insert
- **Drop pipe** – conveys stormwater and pollutants into the lower chamber
- **Outlet riser** – conveys treated stormwater from the lower chamber to the outlet pipe, and provides primary inspection and maintenance access into the lower chamber
- **Outlet riser vane** – prevents formation of a vortex in the outlet riser during high flow rate conditions
- **Outlet platform (optional)** – safety platform in the event of manned entry into the unit
- **Oil inspection pipe** – primary access for measuring oil depth

## PRODUCT DETAILS

### METRIC DIMENSIONS AND CAPACITIES

Table 1

| Stormceptor Model | Inside Diameter (m) | Minimum Surface to Outlet Invert Depth (mm) | Depth Below Outlet Pipe Invert (mm) | Wet Volume (L) | Sediment Capacity <sup>1</sup> (m <sup>3</sup> ) | Hydrocarbon Storage Capacity <sup>2</sup> (L) | Maximum Flow Rate into Lower Chamber <sup>3</sup> (L/s) | Peak Conveyance Flow Rate <sup>4</sup> (L/s) |
|-------------------|---------------------|---------------------------------------------|-------------------------------------|----------------|--------------------------------------------------|-----------------------------------------------|---------------------------------------------------------|----------------------------------------------|
| EF4 / EFO4        | 1.22                | 1219/914                                    | 1524                                | 1780           | 1.19                                             | 265                                           | 22.1 / 10.4                                             | 425                                          |
| EF5/EFO5          | 1.52                | 1219                                        | 1626                                | 3150           | 1.95                                             | 420                                           | 34.6 / 16.2                                             | 708                                          |
| EF6 / EFO6        | 1.83                | 1219                                        | 1930                                | 5070           | 3.47                                             | 610                                           | 49.6 / 23.4                                             | 990                                          |
| EF8 / EFO8        | 2.44                | 1219                                        | 2591                                | 12090          | 8.78                                             | 1070                                          | 88.3 / 41.6                                             | 1700                                         |
| EF10 / EFO10      | 3.05                | 1219                                        | 3251                                | 23700          | 17.79                                            | 1670                                          | 138 / 65                                                | 2830                                         |
| EF12 / EFO12      | 3.66                | 1219                                        | 3886                                | 40800          | 31.22                                            | 2475                                          | 198.7 / 93.7                                            | 2830                                         |

<sup>1</sup> Sediment Capacity is measured from the floor to the bottom of the drop pipe duct. Sediment Capacity can be increased to accommodate specific site designs and pollutant loads. Contact your local representative for assistance.

<sup>2</sup> Hydrocarbon Storage Capacity is measured from the bottom of the outlet riser to the underside of the insert. Hydrocarbon Storage Capacity can be increased to accommodate specific site designs and pollutant loads. Contact your local representative for assistance.

<sup>3</sup> EF Maximum Flow Rate into Lower Chamber is based on a maximum surface loading rate (SLR) into the lower chamber of 1135 L/min/m<sup>2</sup>. EFO Maximum Flow Rate into Lower Chamber is based on a maximum surface loading rate (SLR) into the lower chamber of 535 L/min/m<sup>2</sup>.

<sup>4</sup> Peak Conveyance Flow Rate is limited by a maximum velocity of 1.5 m/s.

### U.S. DIMENSIONS AND CAPACITIES

Table 2

| Stormceptor Model | Inside Diameter (ft) | Minimum Surface to Outlet Invert Depth (in) | Depth Below Outlet Pipe Invert (in) | Wet Volume (gal) | Sediment Capacity <sup>1</sup> (ft <sup>3</sup> ) | Hydrocarbon Storage Capacity <sup>2</sup> (gal) | Maximum Flow Rate into Lower Chamber <sup>3</sup> (cfs) | Peak Conveyance Flow Rate <sup>4</sup> (cfs) |
|-------------------|----------------------|---------------------------------------------|-------------------------------------|------------------|---------------------------------------------------|-------------------------------------------------|---------------------------------------------------------|----------------------------------------------|
| EF4 / EFO4        | 4                    | 48 / 36                                     | 60                                  | 471              | 42                                                | 70                                              | 0.78 / 0.37                                             | 15                                           |
| EF5 / EFO5        | 5                    | 48                                          | 64                                  | 833              | 75                                                | 111                                             | 1.22 / 0.57                                             | 25                                           |
| EF6 / EFO6        | 6                    | 48                                          | 76                                  | 1339             | 123                                               | 160                                             | 1.75 / 0.83                                             | 35                                           |
| EF8 / EFO8        | 8                    | 48                                          | 102                                 | 3194             | 310                                               | 280                                             | 3.12 / 1.47                                             | 60                                           |
| EF10 / EFO10      | 10                   | 48                                          | 128                                 | 6261             | 628                                               | 440                                             | 4.87 / 2.30                                             | 100                                          |
| EF12 / EFO12      | 12                   | 48                                          | 153                                 | 10779            | 1103                                              | 655                                             | 7.02 / 3.31                                             | 100                                          |

<sup>1</sup> Sediment Capacity is measured from the floor to the bottom of the drop pipe duct. Sediment Capacity can be increased to accommodate specific site designs and pollutant loads. Contact your local representative for assistance.

<sup>2</sup> Hydrocarbon Storage Capacity is measured from the bottom of the outlet riser to the underside of the insert. Hydrocarbon Storage Capacity can be increased to accommodate specific site designs and pollutant loads. Contact your local representative for assistance.

<sup>3</sup> EF Maximum Flow Rate into Lower Chamber is based on a maximum surface loading rate (SLR) into the lower chamber of 27.9 gpm/ft<sup>2</sup>. EFO Maximum Flow Rate into Lower Chamber is based on a maximum surface loading rate (SLR) into the lower chamber of 13.1 gpm/ft<sup>2</sup>.

<sup>4</sup> Peak Conveyance Flow Rate is limited by a maximum velocity of 5 fps.

## IDENTIFICATION

Each Stormceptor EF/EFO unit is easily identifiable by the trade name **Stormceptor®** embossed on the access cover at grade as shown in **Figure 3**. The tradename **Stormceptor®** is also embossed on the top of the insert upstream of the weir as shown in **Figure 3**.

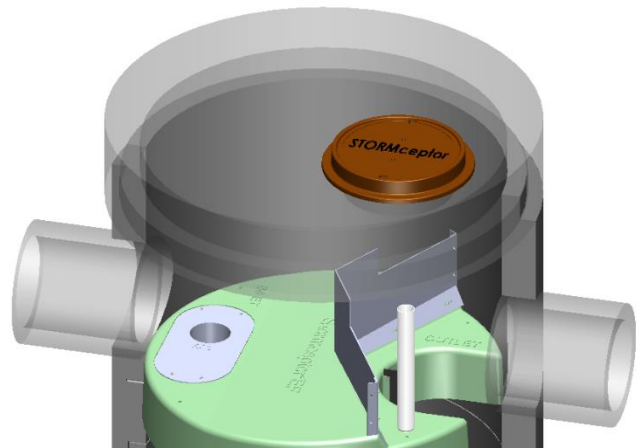


Figure 4

The specific Stormceptor EF/EFO model number is identified on the top of the aluminum Drop Pipe as shown in **Figure 4**. The unit serial number is identified on the top of the insert upstream of the weir as shown in **Figure 4**.

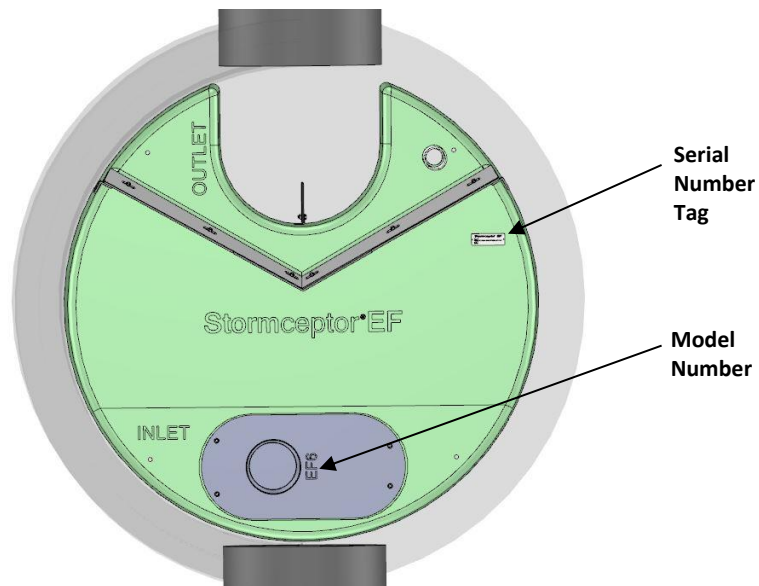


Figure 5

## INSPECTION AND MAINTENANCE

It is very important to perform regular inspection and maintenance. Regular inspection and maintenance ensures maximum operation efficiency, keeps maintenance costs low, and provides continued of natural waterways.

### Quick Reference

- Typical inspection and maintenance is performed from grade
- Remove manhole **cover(s)** or **inlet grate** to access insert and lower chamber  
NOTE: EF4/EFO4 & EF5/EFO5 require the removal of a **flow deflector** beneath inlet grate
- Use Sludge Judge® or similar sediment probe to check sediment depth through the **outlet riser**
- Oil dipstick can be inserted through the **oil inspection pipe**
- Visually inspect the **insert** for debris, remove debris if present
- Visually inspect the **drop pipe** opening for blockage, remove blockage if present
- Visually inspect **insert** and **weir** for damage, schedule repair if needed
- Insert vacuum hose and jetting wand through the outlet riser and extract sediment and floatables
- Replace flow deflector (EF4/EFO4 & EF5/EFO5), inlet grate, and cover(s)
- **NOTE:** If the unit has an **outlet platform**, the outlet platform is typically in the UP position (see Figure 3A) for normal treatment conditions, and for inspection and maintenance. If manned entry into the unit is required, the outlet platform must first be placed in the DOWN position (see Figure 3B). After manned entry is completed, return the outlet platform to the UP position for treatment.

### *When is inspection needed?*

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess pollutant accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

### *What equipment is typically required for inspection?*

- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

### ***When is maintenance cleaning needed?***

- If the post-construction inspection indicates presence of construction sediment of a depth greater than a few inches, maintenance is recommended at that time.
- For optimum performance and normal operation the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, see **Table 3**.
- Maintain immediately after an oil, fuel, or other chemical spill.

**Table 3**

| <b>Recommended Sediment Depths for Maintenance Service*</b> |                        |
|-------------------------------------------------------------|------------------------|
| MODEL                                                       | Sediment Depth (in/mm) |
| EF4 / EFO4                                                  | 8 / 203                |
| EF5 / EFO5                                                  | 12 / 305               |
| EF6 / EFO6                                                  | 12 / 305               |
| EF8 / EFO8                                                  | 24 / 610               |
| EF10 / EFO10                                                | 24 / 610               |
| EF12 / EFO12                                                | 24 / 610               |

\* Based on a minimum distance of 41 inches (1,041 mm) from bottom of outlet riser to top of sediment bed

The frequency of inspection and maintenance may need to be adjusted based on site conditions to ensure the unit is operating and performing as intended. Maintenance costs will vary based on the size of the unit, site conditions, local requirements, disposal costs, and transportation distance.

### ***What equipment is typically required for maintenance?***

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, and safety harness for specially trained personnel if confined space entry is required (adhere to all OSHA / CCOSH standards)

### ***What conditions can compromise Stormceptor performance?***

- Presence of construction sediment and debris in the unit prior to activation
- Excessive sediment depth beyond the recommended maintenance depth
- Oil spill in excess of the oil storage capacity
- Clogging or restriction of the drop pipe inlet opening with debris
- Downstream blockage that results in a backwater condition

## Maintenance Procedures

- Maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is maintained from grade through a standard surface manhole access cover or inlet grate.
- In the case of submerged or tailwater conditions, extra measures are likely required, such as plugging the inlet and outlet pipes prior to conducting maintenance.
- Inspection and maintenance of upstream catch basins and other stormwater conveyance structures is also recommended to extend the time between future maintenance cycles.
- Sediment depth inspections are performed through the **Outlet Riser** and oil presence can be determined through the **Oil Inspection Pipe**.
- Oil presence and sediment depth are determined by inserting a Sludge Judge® or measuring stick to quantify the pollutant depths.

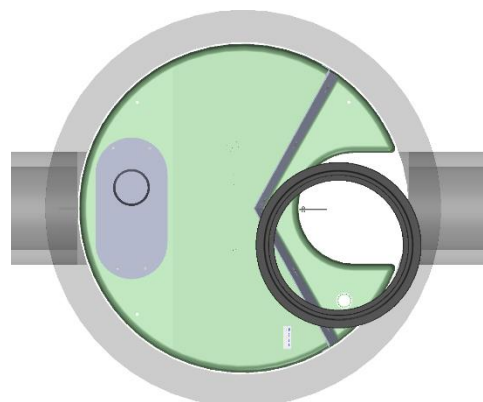


Figure 6

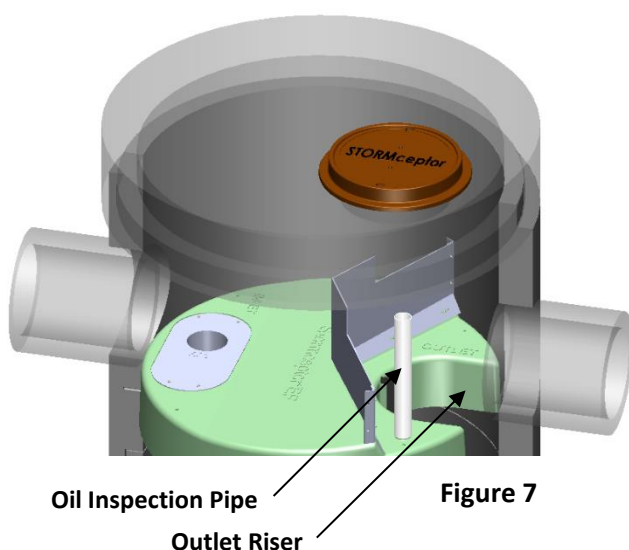


Figure 7



Figure 8

- Visually inspect the insert, weir, and drop pipe inlet opening to ensure there is no damage or blockage.
- **NOTE:** If the unit has an **outlet platform**, the outlet platform is typically in the UP position (see Figure 3A) for normal treatment conditions, and for inspection and maintenance. If manned entry into the unit is required, the outlet platform must first be placed in the DOWN position (see Figure 3B). After manned entry is completed, return the outlet platform to the UP position for treatment.

- When maintenance is required, a standard vacuum truck is used to remove the pollutants from the lower chamber of the unit through the **Outlet Riser**.



**Figure 9**

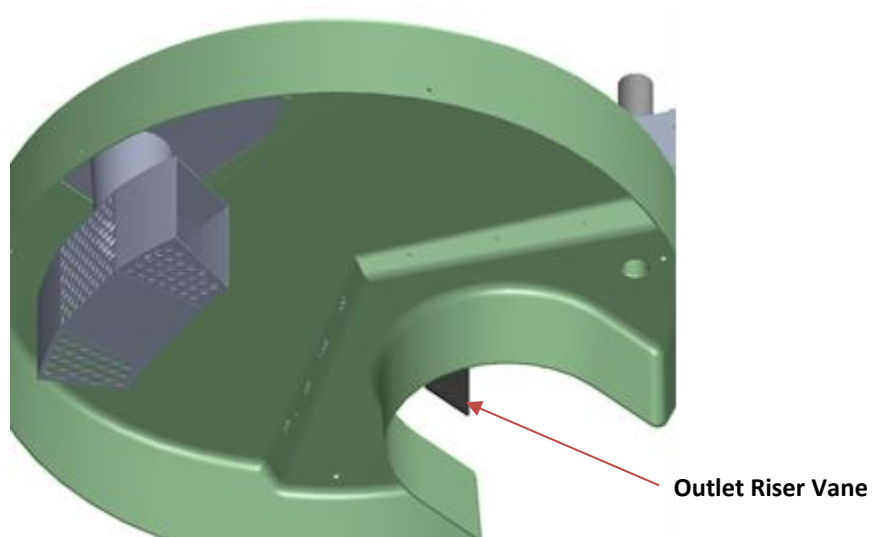


**Figure 10**

NOTE: The Outlet Riser Vane is durable and flexible and designed to allow maintenance activities with minimal, if any, interference.

## Removable Flow Deflector

- Top grated inlets for the Stormceptor EF4/EFO4 & EF5/EFO5 models require a removable flow deflector staged underneath a 24-inch x 24-inch (600 mm x 600 mm) square inlet grate to direct flow towards the inlet side of the insert, and avoid flow and pollutants from entering the outlet side of the insert from grade. The EF6/EFO6 and larger models do not require the flow deflector.

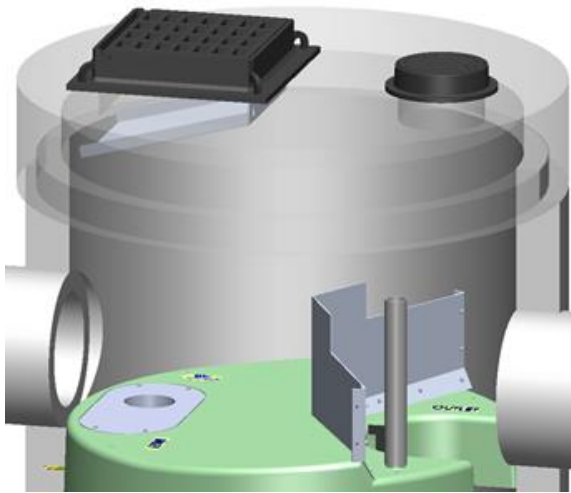
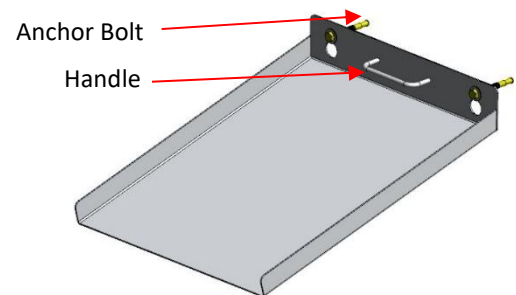


Figure 11

### How to Remove:

1. Loosen anchor bolts
2. Pull up and out using the handle



Removable Flow Deflector

## Hydrocarbon Spills

Stormceptor is often installed on high pollutant load hotspot sites with vehicular traffic where hydrocarbon spill potential exists. Should a spill occur, or presence of oil be identified within a Stormceptor EF/EFO, it should be cleaned immediately by a licensed liquid waste hauler.

## Disposal

Maintenance providers are to follow all federal, state/ provincial, and local requirements for disposal of material.

## Oil Sheens

When oil is present in stormwater runoff, a sheen may be noticeable at the Stormceptor outlet. An oil rainbow or sheen can be noticeable at very low oil concentrations ( $< 10 \text{ mg/L}$ ). Despite the appearance of a sheen, Stormceptor EF/EFO may still be functioning as intended.

## Oil Level Alarm

To mitigate spill liability with 24/7 detection, an electronic monitoring system can be employed to trigger a visual and audible alarm when a pre-set level of oil is captured within the lower chamber or when an oil spill occurs. The oil level alarm is available as an optional feature to include with Stormceptor EF/EFO as shown in **Figure 11**. For additional details about the Oil Level Alarm please visit <http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-systems>.

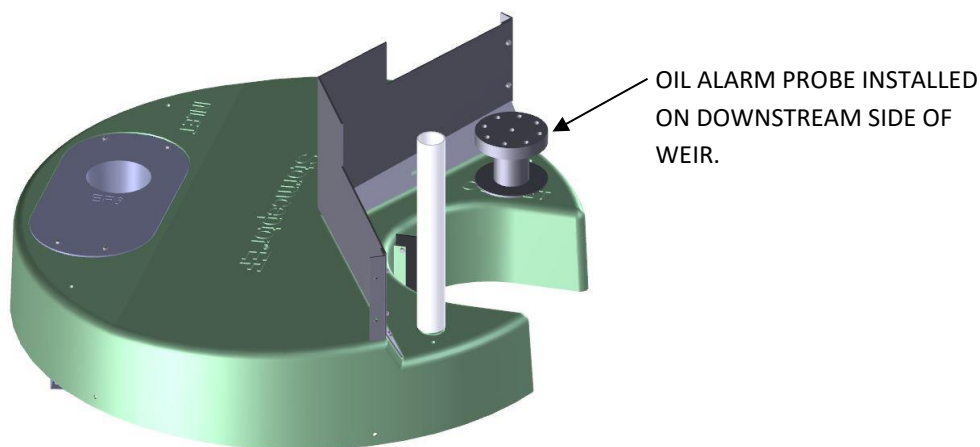


**Figure 12**

## Replacement Parts

Stormceptor has no moving parts to wear out. Therefore inspection and maintenance activities are generally focused on pollutant removal. Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. However, if replacement parts are necessary, they may be purchased by contacting your local Stormceptor representative.

## Stormceptor Inspection and Maintenance Log

Stormceptor Model No: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Installation Date: \_\_\_\_\_

Location Description of Unit: \_\_\_\_\_

Recommended Sediment Maintenance Depth: \_\_\_\_\_

| DATE | SEDIMENT<br>DEPTH<br>(inch or mm) | OIL<br>DEPTH<br>(inch or mm) | SERVICE<br>REQUIRED<br>(Yes / No) | MAINTENANCE<br>PERFORMED | MAINTENANCE<br>PROVIDER | COMMENTS |
|------|-----------------------------------|------------------------------|-----------------------------------|--------------------------|-------------------------|----------|
|      |                                   |                              |                                   |                          |                         |          |
|      |                                   |                              |                                   |                          |                         |          |
|      |                                   |                              |                                   |                          |                         |          |
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|      |                                   |                              |                                   |                          |                         |          |
|      |                                   |                              |                                   |                          |                         |          |

Other Comments:

## Contact Information

Questions regarding Stormceptor EF/EFO can be addressed by contacting your local Imbrium representative or by visiting our website at [www.imbriumsystems.com](http://www.imbriumsystems.com).

### Imbrium Systems Inc. & Imbrium Systems LLC

|               |                                   |
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| Canada        | 1-416-960-9900 / 1-800-565-4801   |
| United States | 1-301-279-8827 / 1-888-279-8826   |
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# STANDARD SPECIFICATION FOR “OIL GRIT SEPARATOR” (OGS) STORMWATER QUALITY TREATMENT DEVICE WITH THIRD-PARTY VERIFIED LIGHT LIQUID RE-ENTRAINMENT SIMULATION PERFORMANCE TESTING RESULTS

## PART 1 – GENERAL

### 1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, designing, maintaining, and constructing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, **specifically an OGS device that has been third-party tested for oil and fuel retention capability using a protocol for light liquid re-entrainment simulation testing, with testing results and a Statement of Verification in accordance with all the provisions of ISO 14034 Environmental Management – Environmental Technology Verification (ETV).** Work includes supply and installation of concrete bases, precast sections, and the appropriate precast section with OGS internal components correctly installed within the system, watertight sealed to the precast concrete prior to arrival to the project site.

### 1.2 REFERENCE STANDARDS

#### 1.2.1 For Canadian projects only, the following reference standards apply:

CAN/CSA-A257.4-14: Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections, and Fittings Using Rubber Gaskets

CAN/CSA-A257.4-14: Precast Reinforced Circular Concrete Manhole Sections, Catch Basins, and Fittings

CAN/CSA-S6-00: Canadian Highway Bridge Design Code

#### 1.2.2 For ALL projects, the following reference standards apply:

ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks

ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections

ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

ASTM C 891: Standard Practice for Installation of Underground Precast Concrete Utility Structures

ASTM D2563: Standard Practice for Classification of Visual Defects in Reinforced Plastics

### 1.3 SHOP DRAWINGS

1.3.1 Shop drawings shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail the precast concrete components and OGS internal components prior to shipment, including the sequence for installation.

1.3.2 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record. Any and all changes to project cost estimates, bonding amounts, plan check fees for revision of approved documents, or design impacts due to regulatory requirements as a result of a product substitution shall be coordinated by the Contractor with the Engineer of Record.

### 1.4 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

1.4.1 OGS internal components supplied by the Manufacturer for attachment to the precast concrete vessel shall be pre-fabricated, bolted to the precast and watertight sealed to the precast vessel surface prior to site delivery to ensure Manufacturer's internal assembly process and quality control processes are fully adhered to, and to prevent materials damage on site.

1.4.2 Follow all instructions including the sequence for installation in the shop drawings during installation.

## **PART 2 – PRODUCTS**

### **2.1 GENERAL**

2.1.1 The OGS vessel shall be cylindrical and constructed from precast concrete riser and slab components.

2.1.2 The precast concrete OGS internal components shall include a fiberglass insert bolted and watertight sealed inside the precast concrete vessel, prior to site delivery. Primary internal components that are to be anchored and watertight sealed to the precast concrete vessel shall be done so only by the Manufacturer prior to arrival at the job site to ensure product quality.

2.1.3 The OGS shall be allowed to be specified and have the ability to function as a 240-degree bend structure in the stormwater drainage system, or as a junction structure.

2.1.4 The OGS to be specified shall have the capability to accept influent flow from an inlet grate and an inlet pipe.

### **2.2 PRECAST CONCRETE SECTIONS**

All precast concrete components shall be designed and manufactured to meet highway loading conditions per State/Provincial or local requirements.

### **2.3 GASKETS**

Only profile neoprene or nitrile rubber gaskets that are oil resistant shall be accepted. For Canadian projects only, gaskets shall be in accordance to CSA A257.4-14. Mastic sealants, butyl tape/rope or Conseal CS-101 alone are not acceptable gasket materials.

### **2.4 JOINTS**

The concrete joints shall be watertight and meet the design criteria according to ASTM C-990. For projects where joints require gaskets, the concrete joints shall be watertight and oil resistant and meet the design criteria according to ASTM C-443. Mastic sealants or butyl tape/rope alone are not an acceptable alternative.

### **2.5 FRAMES AND COVERS**

Frames and covers shall be manufactured in accordance with State/Provincial or local requirements for inspection and maintenance access purposes. A minimum of one cover, at least 22-inch (560 mm) in diameter, shall be clearly embossed with the OGS manufacturer's product name to properly identify this asset's purpose is for stormwater quality treatment.

### **2.6 PRECAST CONCRETE**

All precast concrete components shall conform to the appropriate CSA or ASTM specifications.

### **2.7 FIBERGLASS**

The fiberglass portion of the OGS device shall be constructed in accordance with ASTM D2563, and in accordance with the PS15-69 manufacturing standard, and shall only be installed, bolted and watertight sealed to the precast concrete by the Manufacturer prior to arrival at the project site to ensure product quality.

## 2.8 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a fiberglass insert for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The total sediment storage capacity shall be a minimum 40 ft<sup>3</sup> (1.1 m<sup>3</sup>). The total petroleum hydrocarbon storage capacity shall be a minimum 50 gallons (189 liters). The access opening to the sump of the OGS device for periodic inspection and maintenance purposes shall be a minimum 16 inches (406 mm) in diameter.

## 2.9 LADDERS

Ladder rungs shall be provided upon request or to comply with State/Provincial or local requirements.

## 2.10 INSPECTION

All precast concrete sections shall be level and inspected to ensure dimensions, appearance, integrity of internal components, and quality of the product meets State/Provincial or local specifications and associated standards.

## 2.11 WEIR

Weir shall be constructed of 5052 aluminum alloy and shall be installed, bolted and watertight sealed by the Manufacturer prior to shipment to the project site to ensure product quality.

## 2.12 DROP PIPE

Drop pipe shall be constructed of 5052 aluminum alloy and shall be watertight sealed to the insert with silicone adhesive. Based on assessment of the dimensions of the precast riser section containing the fiberglass insert and the dimensions of the drop pipe, the drop pipe may be installed by the Manufacturer prior to shipment to the project site, or may be installed at the project site by the Contractor, at the Manufacturer's discretion.

## 2.13 OUTLET RISER VANE

Outlet riser vane shall be constructed of ¼-inch 60 durometer EPDM rubber and shall be installed by the Manufacturer prior to shipment to the site.

## 2.14 SAFETY GRATE

Safety grate shall be constructed of 6061-T6 aluminum alloy and shall be installed by the Manufacturer prior to shipment to the site.

## 2.15 FASTENERS

All fasteners for component attachment shall be constructed of stainless steel. These include bolts, washers, and nuts used for attachment of the fiberglass insert, weir, drop pipe, outlet riser vane, and safety grate.

## 2.16 OIL INSPECTION PIPE

Oil inspection pipe shall be constructed of 3-inch diameter Schedule 40 PVC and shall be watertight sealed to the oil inspection port with Sikaflex 1a adhesive. Oil inspection pipe shall be installed by the Manufacturer prior to shipment to the site.

## PART 3 – PERFORMANCE & DESIGN

### 3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

### 3.2 HYDROLOGY AND RUNOFF VOLUME

The OGS device shall be engineered, designed and sized to treat a minimum of 90 percent of the average annual runoff volume, unless otherwise stated by the Engineer of Record, using historical rainfall data. Rainfall data sets should be comprised of a minimum 15-years of rainfall data or a longer continuous period if available for a given location, but in all cases a minimum 5-year period of rainfall data.

### 3.3 ANNUAL (TSS) SEDIMENT LOAD AND STORAGE CAPACITY

The OGS device shall be capable of removing and have sufficient storage capacity for the calculated annual total suspended solids (TSS) mass load and volume without scouring previously captured pollutants prior to maintenance being required. The annual (TSS) sediment load and volume transported from the drainage area should be calculated and compared to the OGS device's available storage capacity by the specifying Engineer to ensure adequate capacity between maintenance cycles. Sediment loadings shall be determined by land use and defined as a minimum of 450 kg (992 lb) of sediment (TSS) per impervious hectare of drainage area per year, or greater based on land use, as noted in Table 1 below.

Annual sediment volume calculations shall be performed using the projected average annual treated runoff volume, a typical sediment bulk density of 1602 kg/m<sup>3</sup> (100 lbs/ft<sup>3</sup>) and an assumed Event Mean Concentration (EMC) of 125 mg/L TSS in the runoff, or as otherwise determined by the Engineer of Record.

Example calculation for a 1.3-hectares parking lot site:

- 1.28 meters of rainfall depth, per year
- 1.3 hectares of 100% impervious drainage area
- EMC of 125 mg/L TSS in runoff
- Treatment of 90% of the average annual runoff volume
- Target average annual TSS removal rate of 60% by OGS

#### Annual Runoff Volume:

- 1.28 m rain depth x 1.3 ha x 10,000 m<sup>2</sup>/ha = 16,640 m<sup>3</sup> of runoff volume
- 16,640 m<sup>3</sup> x 1000 L/m<sup>3</sup> = 16,640,000 L of runoff volume
- 16,640,000 L x 0.90 = 14,976,000 L to be treated by OGS unit

#### Annual Sediment Mass and Sediment Volume Load Calculation:

- 14,976,000 L x 125 mg/L x kg/1,000,000 mg = 1,872 kg annual sediment mass
- 1,872 kg x m<sup>3</sup>/1602 kg = 1.17 m<sup>3</sup> annual sediment volume
- 1.17 m<sup>3</sup> x 60% TSS removal rate by OGS = 0.70 m<sup>3</sup> minimum expected annual storage requirement in OGS

As a guideline, the U.S. EPA has determined typical annual sediment loads per drainage area for various sites by land use (see Table 1). Certain States, Provinces and local jurisdictions have also established such guidelines.

| Table 1 – Annual Mass Sediment Loading by Land Use |            |             |             |      |     |          |            |                 |
|----------------------------------------------------|------------|-------------|-------------|------|-----|----------|------------|-----------------|
|                                                    | Commercial | Parking Lot | Residential |      |     | Highways | Industrial | Shopping Center |
|                                                    |            |             | High        | Med. | Low |          |            |                 |
| (lbs/acre/yr)                                      | 1,000      | 400         | 420         | 250  | 10  | 880      | 500        | 440             |
| (kg/hectare/yr)                                    | 1,124      | 450         | 472         | 281  | 11  | 989      | 562        | 494             |

Source: U.S. EPA Stormwater Best Management Practice Design Guide Volume 1, Appendix D, Table D-1, Burton and Pitt 2002

### 3.4 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in Table 2, Section 3.5, and based on third-party performance testing conducted in accordance with the Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol *Procedure for Laboratory Testing of Oil-Grit Separators*, as follows:

3.4.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m<sup>2</sup> to 1400 L/min/m<sup>2</sup>, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.4.2 Sediment removal efficiency for surface loading rates between 40 L/min/m<sup>2</sup> and 1400 L/min/m<sup>2</sup> shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.4.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m<sup>2</sup> shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m<sup>2</sup>. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m<sup>2</sup>.

3.4.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m<sup>2</sup> shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m<sup>2</sup>, and shall be calculated using a simple proportioning formula, with 1400 L/min/m<sup>2</sup> in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m<sup>2</sup>.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 3.3.

3.4.5 The Peclet Number is not an approved method or model for calculating TSS removal, sizing, or scaling OGS devices.

3.4.6 If an alternate OGS device is proposed, supporting documentation shall be submitted that demonstrates:

- Canadian ETV or ISO 14034 ETV Verification Statement which verifies third-party performance testing conducted in accordance with the **Procedure for Laboratory Testing of Oil-Grit Separators**, including the Light Liquid Re-entrainment Simulation Testing.
- Equal or better sediment (TSS) removal of the PSD specified in Table 2 at equivalent surface loading rates, as compared to the OGS device specified herein.

- Equal or better Light Liquid Re-entrainment Simulation Test results (using low-density polyethylene beads as a surrogate for light liquids such as oil and fuel) at equivalent surface loading rates, as compared to the OGS device specified herein. However, an alternative OGS device shall not be allowed as a substitute if the Light Liquid Re-entrainment Simulation Test was performed with screening components within the OGS device that are effective at retaining the low-density polyethylene beads, but would not be expected to retain light liquids such as oil and fuel.
- Equal or greater sediment storage capacity, as compared to the OGS device specified herein.
- Supporting documentation shall be signed and sealed by a local registered Professional Engineer. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

### 3.5 PARTICLE SIZE DISTRIBUTION (PSD) FOR SIZING

The OGS device shall be sized to achieve the Engineer-specified average annual percent sediment (TSS) removal based solely on the test sediment used in the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. This test sediment is comprised of inorganic ground silica with a specific gravity of 2.65, uniformly mixed, and containing a broad range of particle sizes as specified in Table 2. No alternative PSDs or deviations from Table 2 shall be accepted.

| <b>Table 2</b><br><b>Canadian ETV Program Procedure for Laboratory</b><br><b>Testing of Oil-Grit Separators</b><br><b>Particle Size Distribution (PSD) of Test Sediment</b> |                                   |                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------------------|
| <b>Particle Diameter<br/>(Microns)</b>                                                                                                                                      | <b>% by Mass of All Particles</b> | <b>Specific Gravity</b> |
| 1000                                                                                                                                                                        | 5%                                | 2.65                    |
| 500                                                                                                                                                                         | 5%                                | 2.65                    |
| 250                                                                                                                                                                         | 15%                               | 2.65                    |
| 150                                                                                                                                                                         | 15%                               | 2.65                    |
| 100                                                                                                                                                                         | 10%                               | 2.65                    |
| 75                                                                                                                                                                          | 5%                                | 2.65                    |
| 50                                                                                                                                                                          | 10%                               | 2.65                    |
| 20                                                                                                                                                                          | 15%                               | 2.65                    |
| 8                                                                                                                                                                           | 10%                               | 2.65                    |
| 5                                                                                                                                                                           | 5%                                | 2.65                    |
| 2                                                                                                                                                                           | 5%                                | 2.65                    |

### 3.6 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party scour testing conducted and have in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. This scour testing is conducted with the device pre-loaded with test sediment comprised of the particle size distribution (PSD) illustrated in Table 2.

3.6.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m<sup>2</sup>.

Data generated from laboratory scour testing performed with an OGS device pre-loaded with a coarser PSD than in Table 2 (i.e. the coarser PSD has no particles in the 1-micron to 50-micron size range, or the D<sub>50</sub> of the test sediment exceeds 75 microns) shall not be acceptable for the determination of the device's suitability for on-line installation.

### 3.7 DESIGN ACCOUNTING FOR BYPASS

3.7.1 The OGS device shall be specified to achieve the TSS removal performance and water quality objectives without washout of previously captured pollutants. The OGS device shall also have sufficient hydraulic conveyance capacity to convey the peak storm event, in accordance with hydraulic conditions per the Engineer of Record. To ensure this is achieved, there are two design options with associated requirements:

3.7.1.1 The OGS device shall be placed **off-line** with an upstream diversion structure (typically in an upstream manhole) that only allows the water quality volume to be diverted to the OGS device, and excessive flows diverted downstream around the OGS device to prevent high flow washout of pollutants previously captured. This design typically incorporates a triangular layout including an upstream bypass manhole with an appropriately engineered weir wall, the OGS device, and a downstream junction manhole, which is connected to both the OGS device and bypass structure. In this case with an external bypass required, the OGS device manufacturer must provide calculations and designs for all structures, piping and any other required material applicable to the proper functioning of the system, stamped by a Professional Engineer.

3.7.1.2 Alternatively, OGS devices in compliance with Section 3.6 shall be acceptable for an **on-line** design configuration, thereby eliminating the requirement for an upstream bypass manhole and downstream junction manhole.

3.7.2 The OGS device shall also have sufficient hydraulic conveyance capacity to convey the peak storm event, in accordance with hydraulic conditions per the Engineer of Record. If an alternate OGS device is proposed, supporting documentation shall be submitted that demonstrates equal or better hydraulic conveyance capacity as compared to the OGS device specified herein. This documentation shall be signed and sealed by a local registered Professional Engineer. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

### 3.8 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**, with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.8.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m<sup>2</sup> to 2600 L/min/m<sup>2</sup>) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

### 3.9 PETROLEUM HYDROCARBONS AND FLOATABLES STORAGE CAPACITY

Petroleum hydrocarbons and floatables storage capacity in the OGS device shall be a minimum 50 gallons (189 Liters), or more as specified.

3.9.1 The OGS device shall have gasketed precast concrete joints that are watertight, and oil resistant and meet the design criteria according to ASTM C-443 to provide safe oil and other hydrocarbon materials storage and ground water protection. Mastic sealants or butyl tape/rope alone are not an acceptable alternative.

### 3.10 SURFACE LOADING RATE SCALING OF DIFFERENT MODEL SIZES

The reference device for scaling shall be an OGS device that has been third-party tested in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. Other model sizes of the tested device shall only be scaled such that the claimed TSS removal efficiency of the scaled device shall be no greater than the TSS removal efficiency of the tested device at identical **surface loading rates** (flow rate divided by settling surface area). The depth of other model sizes of the tested device shall be scaled in accordance with the depth scaling provisions within Section 6.0 of the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**.

3.10.1 The Peclet Number and volumetric scaling are not approved methods for scaling OGS devices.

## **PART 4 – INSPECTION & MAINTENANCE**

The OGS manufacturer shall provide an Owner's Manual upon request.

Maintenance shall be performed by a professional service provider who has experience in cleaning OGS devices and has been trained and certified in applicable health and safety practices, including confined space entry procedures.

- 4.1 A Quality Assurance Plan that provides inspection for a minimum of 5 years shall be included with the OGS stormwater quality device, and written into the Environmental Compliance Approval (ECA) or the appropriate State/Provincial or local approval document.
- 4.2 OGS device inspection shall include determination of sediment depth and presence of petroleum hydrocarbons below the insert. Inspection shall be easily conducted from finished grade through a frame and cover of at least 22 inch (560 mm) in diameter.
- 4.3 Inspection and pollutant removal shall be conducted periodically. For routine maintenance cleaning activities, pollutant removal shall typically utilize a truck equipped with vacuum apparatus, and shall be easily conducted from finished grade through a frame and cover of at least 22-inches (560 mm) in diameter.
- 4.4 Diameter of the maintenance access opening to the lower chamber and sump shall be scaled consistently across all model sizes, and shall be 1/3 the inside diameter of the OGS structure, or larger.
- 4.5 No confined space entry shall be required for routine inspection and maintenance cleaning activities.
- 4.6 For OGS model sizes of diameter 72 inches (1828 mm) and greater, the access opening to the OGS device's lower chamber and sump shall be large enough to allow a maintenance worker to enter the lower chamber to facilitate non-routine maintenance cleaning activities and repairs, as needed.
- 4.7 The orifice-containing component (i.e. drop pipe, duct, chute, etc.) of the OGS device used to control flow rate into the lower chamber shall be removable from the insert to facilitate cleaning, repair, or replacement of the orifice-containing component, as needed.

## **PART 5 – EXECUTION**

### 5.1 PRECAST CONCRETE INSTALLATION

The installation of the precast concrete OGS stormwater quality treatment device shall conform to ASTM C 891, ASTM C 478, ASTM C 443, CAN/CSA-A257.4-14, CAN/CSA-A257.4-14, CAN/CSA-S6-00 and all highway, State/Provincial, or local specifications for the construction of manholes. Selected sections of a general specification that are applicable are summarized below. The Contractor shall furnish all labor, equipment and materials necessary to offload, assemble as needed the OGS internal components as specified in the Shop Drawings.

## 5.2 EXCAVATION

5.2.1 Excavation for the installation of the OGS stormwater quality treatment device shall conform to highway, State/Provincial or local specifications. Topsoil that is removed during the excavation for the OGS stormwater quality treatment device shall be stockpiled in designated areas and not be mixed with subsoil or other materials. Topsoil stockpiles and the general site preparation for the installation of the OGS stormwater quality device shall conform to highway, State/Provincial or local specifications.

5.2.2 The OGS device shall not be installed on frozen ground. Excavation shall extend a minimum of 12 inch (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

5.2.3 In areas with a high water table, continuous dewatering shall be provided to ensure that the excavation is stable and free of water.

## 5.3 BACKFILLING

Backfill material shall conform to highway, State/Provincial or local specifications. Backfill material shall be placed in uniform layers not exceeding 12 inches (300 mm) in depth and compacted to highway, State/Provincial or local specifications.

## 5.4 OGS WATER QUALITY DEVICE CONSTRUCTION SEQUENCE

5.4.1 The precast concrete OGS stormwater quality treatment device is installed and leveled in sections in the following sequence:

- aggregate base
- base slab, or base
- riser section(s) (if required)
- riser section w/ pre-installed fiberglass insert
- upper riser section(s)
- internal OGS device components
- connect inlet and outlet pipes
- riser section, top slab and/or transition (if required)
- frame and access cover

5.4.2 The precast concrete base shall be placed level at the specified grade. The entire base shall be in contact with the underlying compacted granular material. Subsequent sections, complete with oil resistant, watertight joint seals, shall be installed in accordance with the precast concrete manufacturer's recommendations.

5.4.3 Adjustment of the OGS stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets shall be repaired or replaced as necessary. Once the OGS stormwater quality treatment device has been constructed, any lift holes must be plugged with mortar.

## 5.5 DROP PIPE AND OIL INSPECTION PIPE

Once the upper precast concrete riser has been attached to the lower precast concrete riser section, the OGS device Drop Pipe and Oil Inspection Pipe must be attached, and watertight sealed to the fiberglass insert using Sikaflex 1a. Installation instructions and required materials shall be provided by the OGS manufacturer.

## 5.6 INLET AND OUTLET PIPES

Inlet and outlet pipes shall be securely set using grout or approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight. Non-secure inlets and outlets will result in improper performance.

#### 5.7 FRAME AND COVER OR FRAME AND GRATE INSTALLATION

Precast concrete adjustment units shall be installed to set the frame and cover/grate at the required elevation. The adjustment units shall be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover/grate should be set in a full bed of mortar at the elevation specified.

5.7.1 A minimum of one cover, at least 22-inch (560 mm) in diameter, shall be clearly embossed with the OGS device brand or product name to properly identify this asset's purpose is for stormwater quality treatment.

|                    |        |
|--------------------|--------|
| Burleigh Falls Inn | 525016 |
|--------------------|--------|

|              |            |
|--------------|------------|
| 525016 STM-1 | June 08/26 |
|--------------|------------|

|           |            |
|-----------|------------|
| Haoran Yu | June 08/26 |
|-----------|------------|

|               |            |
|---------------|------------|
| Bryan Stanton | June 09/26 |
|---------------|------------|

## Township of North Kawartha

|          |   |
|----------|---|
| Equation | 1 |
|----------|---|

| Year | A    | B    |
|------|------|------|
| 10   | 1.00 | 0.00 |
| 25   | 1.10 | 0.00 |
| 50   | 1.20 | 0.00 |
| 100  | 1.25 | 0.00 |

## 10 mins

| Year | A | B | C |
|------|---|---|---|
|------|---|---|---|

|            |        |      |      |
|------------|--------|------|------|
| <b>2</b>   | 376.15 | 0.00 | 0.70 |
| <b>5</b>   | 498.62 | 0.00 | 0.70 |
| <b>10</b>  | 579.10 | 0.00 | 0.70 |
| <b>25</b>  | 680.58 | 0.00 | 0.70 |
| <b>50</b>  | 755.81 | 0.00 | 0.70 |
| <b>100</b> | 831.04 | 0.00 | 0.70 |

| Material | Value |
|----------|-------|
|----------|-------|

|          |       |
|----------|-------|
| CSP      | -     |
| Concrete | 0.013 |
| PVC      | 0.013 |

**Version Number:**

**Engineer Stamp**

|  |
|--|
|  |
|--|

[illegible]

# Trapezoidal Weir Discharge Calculation

**Project Details**

4791 Highway 28

525016

**Prepared By:**

LJC

6/15/2026

**Source:**

Hydraulic Structures, C.D.Smith, University of Saskatchewan  
Trapezoidal Broad Crested Weir

The trapezoidal weir is a combination of the rectangular weir and the triangular weir

**Parameters:**

|                            |     |      |
|----------------------------|-----|------|
| Weir Bottom Width (m)      | W = | 1.00 |
| Head (m)                   | H = | 0.15 |
| Weir Downstream Length (m) | L = | 0.30 |
| Side Slope (H:V)           | S = | 5.0  |

**Rectangular Weir**

$$Q = CWH^{3/2}$$

|       |       |
|-------|-------|
| H/L = | 0.500 |
| C =   | 1.687 |

|                                           |     |              |
|-------------------------------------------|-----|--------------|
| Rectangular Weir Flow (m <sup>3</sup> /s) | Q = | <b>0.098</b> |
|-------------------------------------------|-----|--------------|

**Triangular Weir**

$$Q = CH^{5/2} \tan(\theta/2)$$

|                        |             |         |
|------------------------|-------------|---------|
| Notch Angle (one side) | 78.690      | degrees |
| Notch Angle (one side) | 1.373400767 | radians |

|                                    |          |
|------------------------------------|----------|
| <b><math>\tan(\theta/2)</math></b> | 5.000000 |
|------------------------------------|----------|

|                |       |
|----------------|-------|
| Triangular H/L | 0.500 |
| C              | 1.258 |

|                                          |     |              |
|------------------------------------------|-----|--------------|
| Triangular Weir Flow (m <sup>3</sup> /s) | Q = | <b>0.055</b> |
|------------------------------------------|-----|--------------|

**Total Rectangular + Triangular Weir**

|                                           |     |              |
|-------------------------------------------|-----|--------------|
| Trapezoidal Weir Flow (m <sup>3</sup> /s) | Q = | <b>0.153</b> |
|-------------------------------------------|-----|--------------|

|                                           |      |             |
|-------------------------------------------|------|-------------|
| Average Flow Velocity (m <sup>3</sup> /s) | V =  | <b>0.58</b> |
| Flow Top Width (m)                        | TW = | <b>2.50</b> |
| Flow Area (m <sup>2</sup> )               | A =  | <b>0.26</b> |

**Catchment 201B Flows:**
**0.134 m<sup>3</sup>/s**

## Manning's Equation Flow Calculations

### Project Details

|                 |        |
|-----------------|--------|
| 4791 Highway 28 | 525016 |
|-----------------|--------|

### Prepared By

|     |           |
|-----|-----------|
| LJC | 6/15/2026 |
|-----|-----------|

Manning's Equation: 
$$Q = \frac{1}{n} \cdot A \cdot R^{\frac{2}{3}} \cdot S^{\frac{1}{2}}$$

Where:

Q = flow (m<sup>3</sup>/s)

n = Manning's roughness coefficient

A = area of flow (m<sup>2</sup>)

R = hydraulic radius (m) equal to flow area divided by wetted perimeter

S = channel slope (m/m)

### Overland Flow Channel

|                    |       |          |                                       |
|--------------------|-------|----------|---------------------------------------|
| Manning's n =      | 0.035 |          |                                       |
| Slope =            | 0.100 | m/m      | Design Flow = 0.134 m <sup>3</sup> /s |
| Right Side Slope = | 3.0   | :1 (H:V) | Area = 0.087 m <sup>2</sup>           |
| Left Side Slope =  | 3.0   | :1 (H:V) | Wetted Perimeter = 1.075 m            |
| Depth =            | 0.17  | m        | Hydraulic Radius = 0.081 m            |
| Bottom Width =     | 0.00  | m        | Capacity = 0.146 m <sup>3</sup> /s    |
|                    |       |          | Velocity = 1.686 m/s                  |

|         |                                                                      |          |           |
|---------|----------------------------------------------------------------------|----------|-----------|
| PROJECT | 4791 Highway 28, Burleigh Falls                                      | FILE     | 525016    |
|         |                                                                      | DATE     | 6/15/2026 |
| SUBJECT | Rip Rap Sizing - US DOT FHA<br>Hydraulic Engineering Circular No. 15 | DESIGNED | LJC       |
|         |                                                                      | CHECKED  | JN        |

Required Channel Bottom Rip Rap Size,  $D_{50B} \geq (S_f * d * s) / [F * (SG - 1)]$

(US DOT FHA Hydraulic Engineering Circular No. 15, Chapter 6: Riprap, Cobble and Gravel Lining Design, Eq. 6.8)

where:

- $D_{50}$  = mean rip rap diameter (m)
- $S_f$  = factor of safety (unitless)
- $d$  = depth of flow (m)
- $s$  = channel slope (m/m)
- $F$  = Shield's parameter (unitless)
- $SG$  = specific gravity of rip rap (unitless)

#### Notes

where:

- $S_f$  = 1.10
- $d$  = 0.17 m
- $s$  = 0.10 m/m
- $SG$  = 2.65
- $F$  = 0.047

$D_{50B}$  = 0.24 m  
241 mm Channel Bottom Spec: 250 mm

Required Channel Side Slope Rip Rap Size,  $D_{50SS} \geq (K_1 / K_2) * D_{50B}$

where:

- $D_{50SS}$  =  $D_{50}$  required for a stable side slope (m)
- $K_1$  = ratio of channel side to bottom shear stress (unitless)
- $K_2$  = tractive force ratio (unitless)
- $D_{50B}$  =  $D_{50}$  required for a stable channel bottom (m)

#### Notes

where:

- $K_1$  = 0.87
- $K_2$  = 0.87

where:  $K_1$  = 0.77,  $Z \leq 1.5$   
0.066\*Z+0.67,  $1.5 < Z < 5$   
1.0,  $Z \geq 5$

where:  $K_2$  =  $[1 - (\sin\theta / \sin\phi)^2]^{1/2}$

$\theta$  = angle of side slope = 18.4 °  
 $\phi$  = angle of repose = 40.0 °

Z = horizontal dimension of side slope, 1:Z (V:H)  
Z = 3

$D_{50SS}$  = 0.24 m  
240 mm Channel Side Spec: 250 mm

**Mean riprap dia.:** 250 mm  
**Specification:** R50  
**Thickness:** 375 mm

## Storm Sewer System Outlet Erosion Protection - Apron Sizing

$$D_{50} = 0.2 D (Q / ( \sqrt{g} D^{2.5} ) )^{4/3} ( D / TW )$$

(U.S. Department of Transportation, Federal Highway Administration, HEC-14, Equation 10.4)

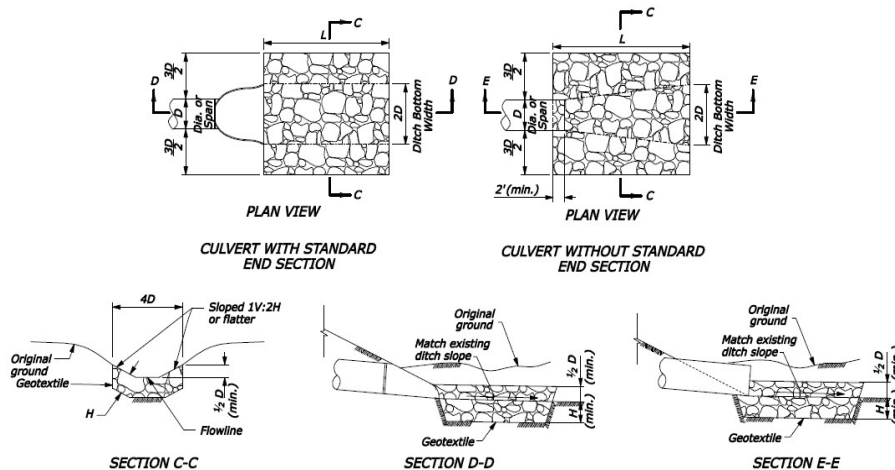
Where:

|          |   |                                   |                                 |
|----------|---|-----------------------------------|---------------------------------|
| $D_{50}$ | = | riprap size                       | (mm)                            |
| $D$      | = | culvert diameter                  | (m)                             |
| $Q$      | = | design discharge                  | (m <sup>3</sup> /s)             |
| $g$      | = | acceleration due to gravity, 9.81 | (m/s <sup>2</sup> )             |
| $TW$     | = | tailwater depth                   | (m) limited between 0.4D and 1D |

### Riprap at Outlet

|          |      |                     |                       |      |   |
|----------|------|---------------------|-----------------------|------|---|
| $D =$    | 0.30 | m                   | Required $D_{50} =$   | 0.05 | m |
| $Q =$    | 0.07 | (m <sup>3</sup> /s) | Apron Bottom Length = | 1.20 | m |
| $TW^* =$ | 0.12 | m                   | Apron Bottom Width =  | 1.20 | m |
|          |      |                     | Apron Bottom Depth =  | 0.44 | m |

\*minimum tailwater assumed to yield maximum  $D_{50}$



### PROTECTIVE APRON AT CULVERT OUTLET WITH DITCH

| Class | $D_{50}$ (mm) | Apron Length | Apron Depth  |
|-------|---------------|--------------|--------------|
| 1     | 125           | 4D           | 3.5 $D_{50}$ |
| 2     | 150           | 4D           | 3.3 $D_{50}$ |
| 3     | 250           | 5D           | 2.4 $D_{50}$ |
| 4     | 350           | 6D           | 2.2 $D_{50}$ |
| 5     | 500           | 7D           | 2.0 $D_{50}$ |
| 6     | 550           | 8D           | 2.0 $D_{50}$ |

## Manning's Equation Flow Calculations

### Project Details

|                 |        |
|-----------------|--------|
| 4791 Highway 28 | 525016 |
|-----------------|--------|

### Prepared By

|     |           |
|-----|-----------|
| LJC | 6/15/2026 |
|-----|-----------|

Manning's Equation: 
$$Q = \frac{1}{n} \cdot A \cdot R^{\frac{2}{3}} \cdot S^{\frac{1}{2}}$$

Where:

Q = flow (m<sup>3</sup>/s)

n = Manning's roughness coefficient

A = area of flow (m<sup>2</sup>)

R = hydraulic radius (m) equal to flow area divided by wetted perimeter

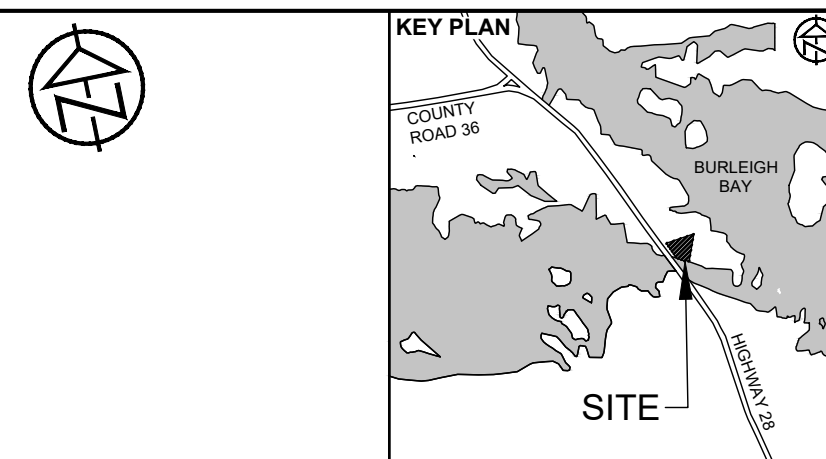
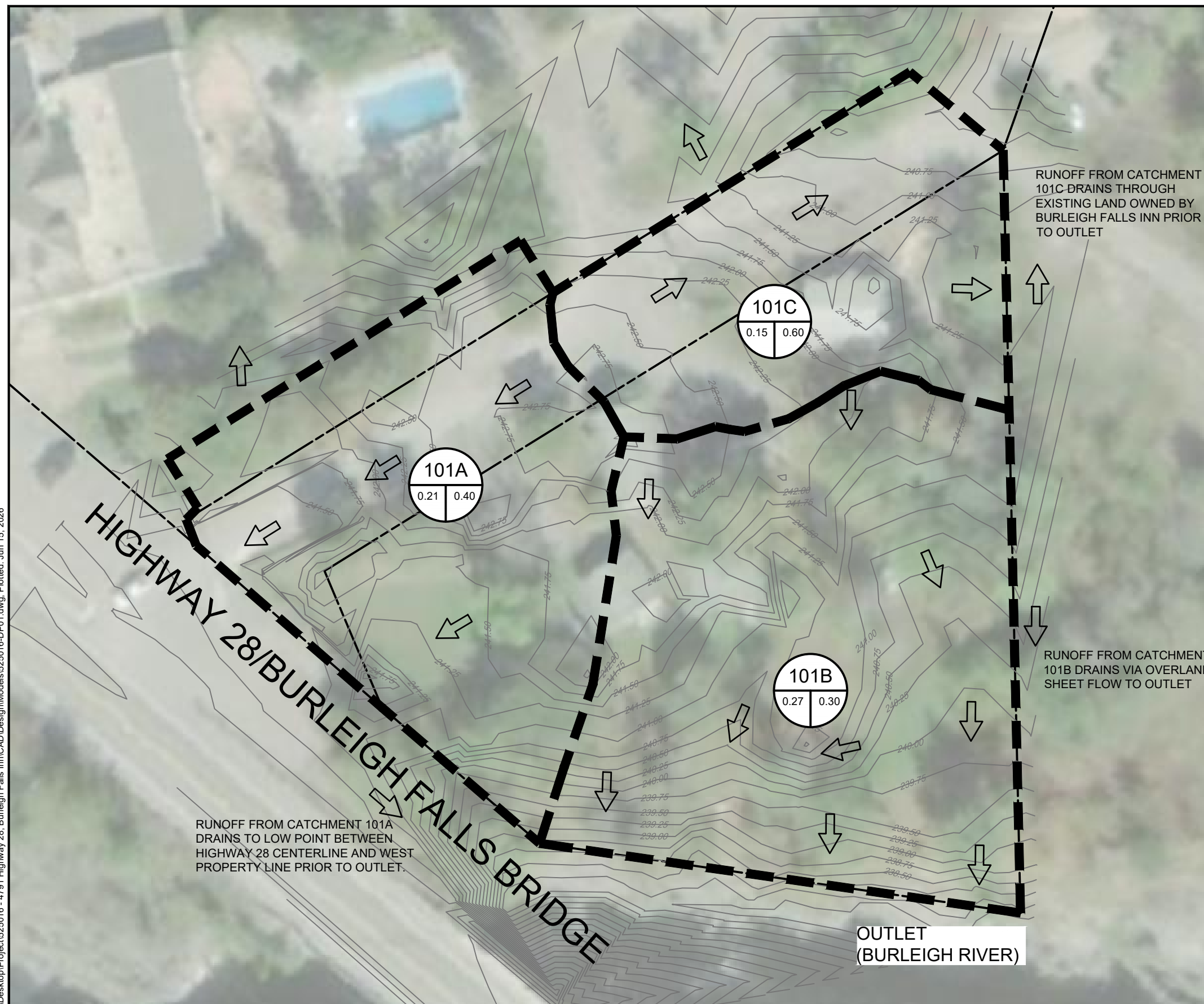
S = channel slope (m/m)

East Grass Swale

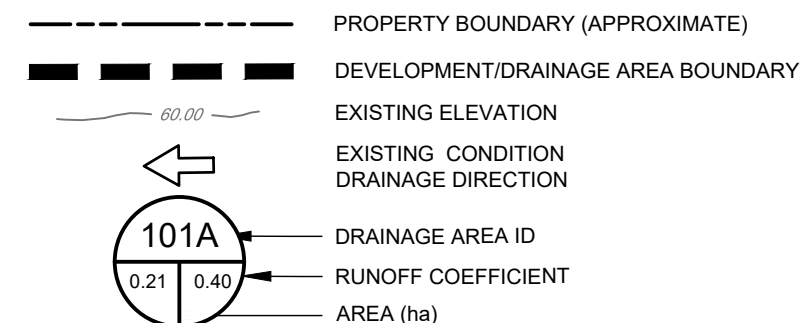
|                    |       |          |                                       |
|--------------------|-------|----------|---------------------------------------|
| Manning's n =      | 0.035 |          |                                       |
| Slope =            | 0.015 | m/m      | Design Flow = 0.037 m <sup>3</sup> /s |
| Right Side Slope = | 3.0   | :1 (H:V) | Area = 0.068 m <sup>2</sup>           |
| Left Side Slope =  | 3.0   | :1 (H:V) | Wetted Perimeter = 0.949 m            |
| Depth =            | 0.15  | m        | Hydraulic Radius = 0.071 m            |
| Bottom Width =     | 0.00  | m        | Capacity = 0.041 m <sup>3</sup> /s    |

|                                  |                         |
|----------------------------------|-------------------------|
| <b>Catchment 201B Flow Rate:</b> | 0.134 m <sup>3</sup> /s |
| <b>Total Area:</b>               | 0.29 ha                 |
| <b>Drainage Area:</b>            | 0.08 ha                 |
| <b>% of Catchment to Swale:</b>  | 28%                     |
| <b>Design Flow:</b>              | 0.037                   |

## Appendix D: Drawings

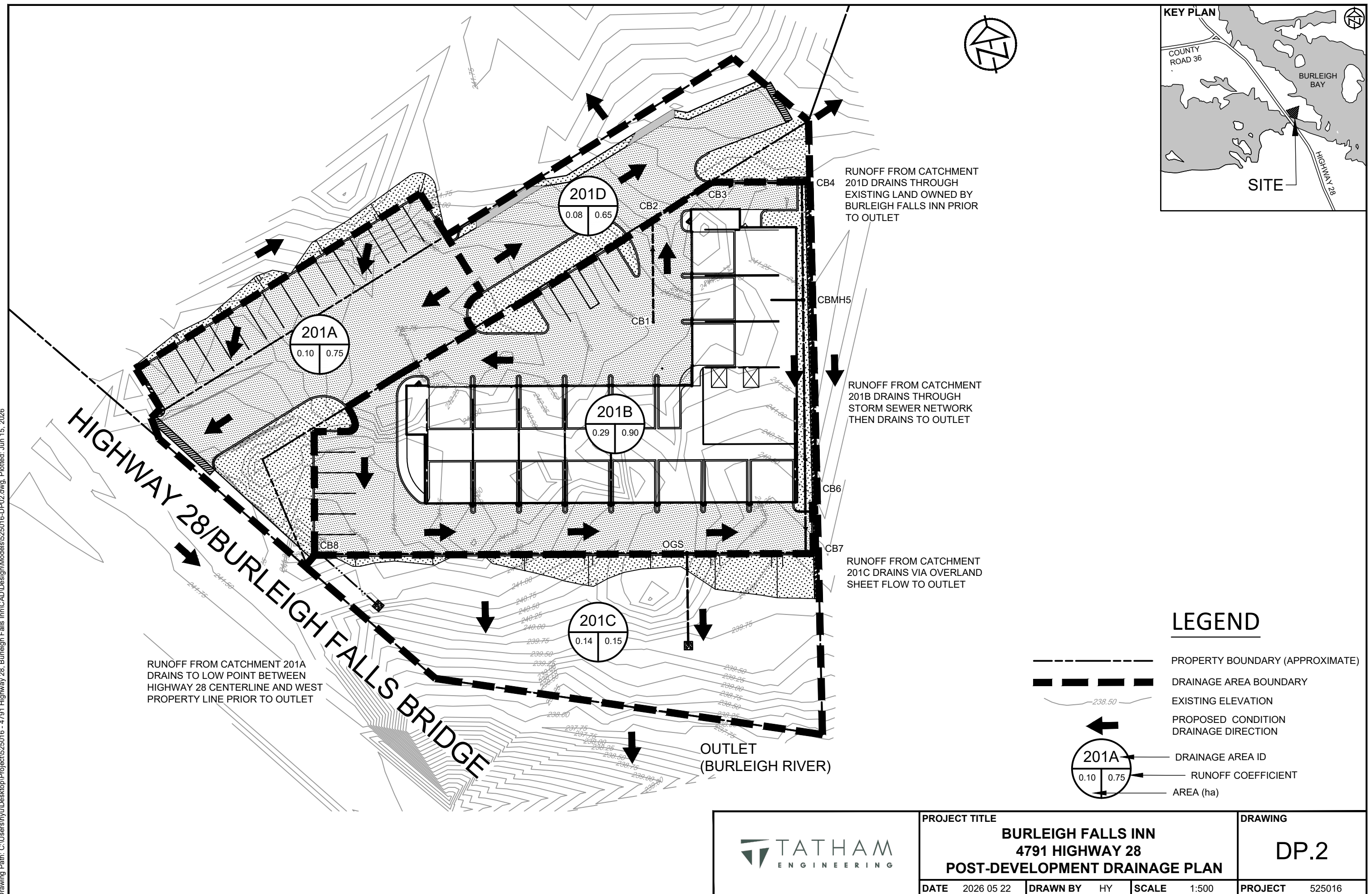


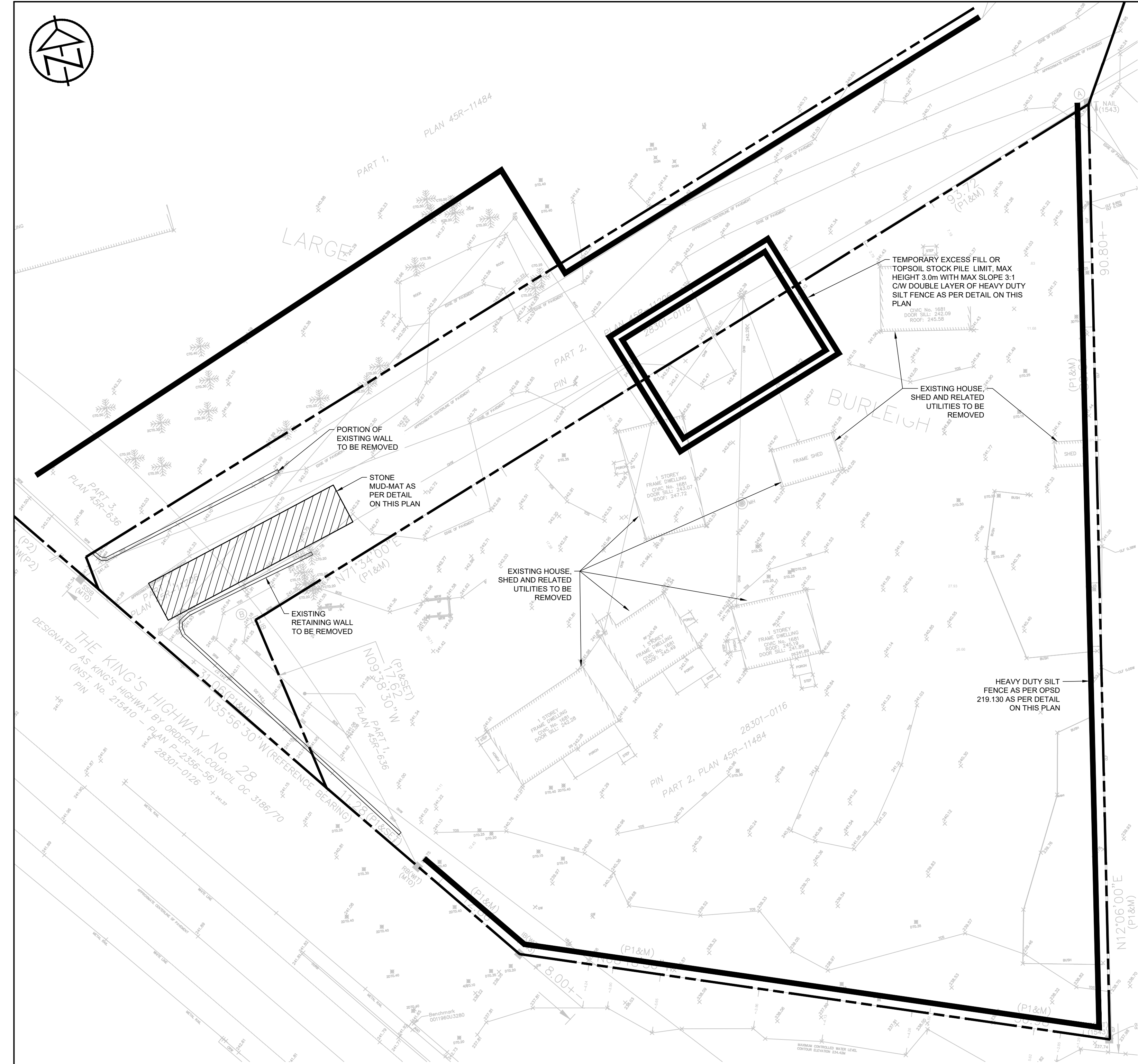
## LEGEND



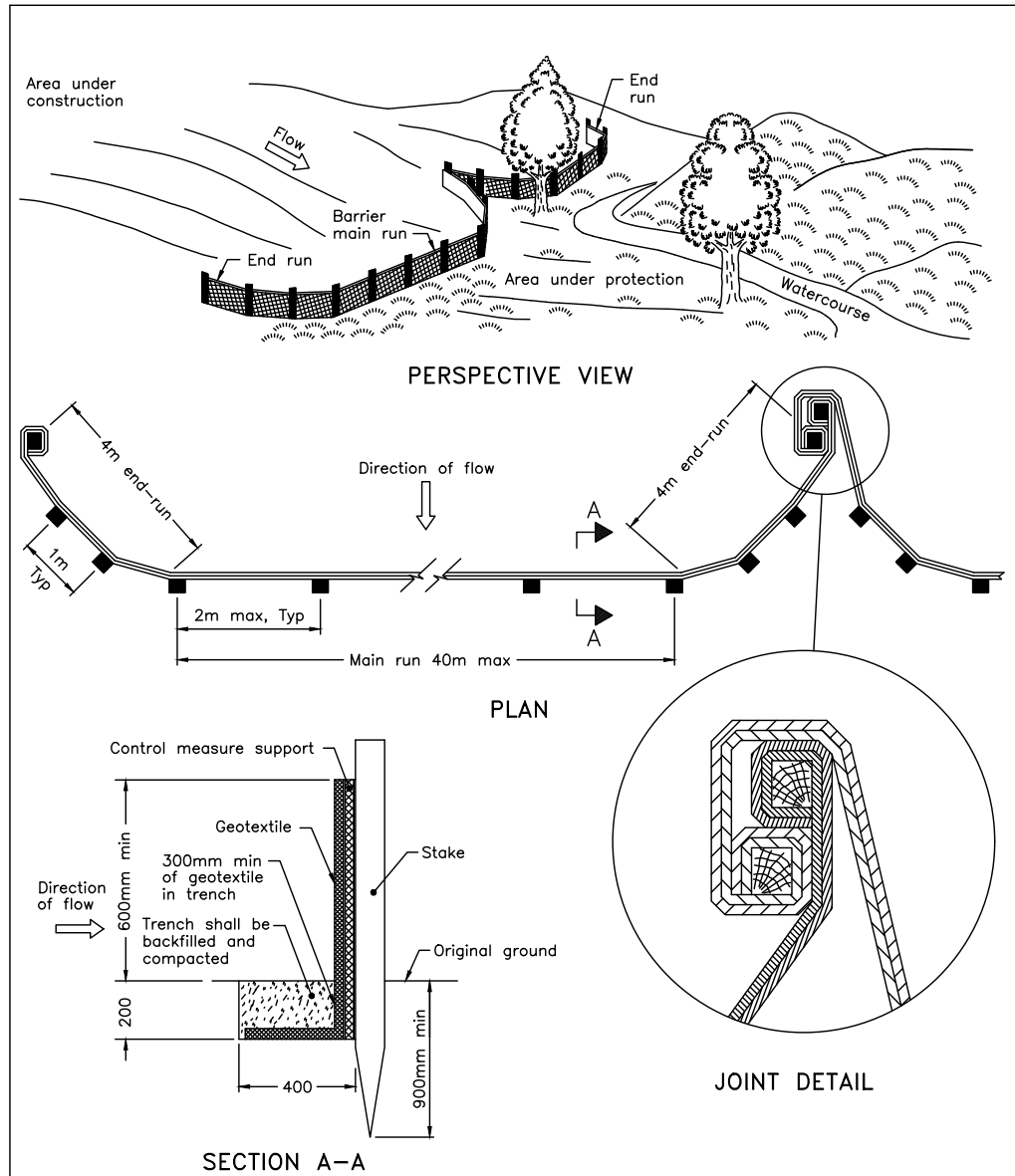
|               |                                                                                                            |
|---------------|------------------------------------------------------------------------------------------------------------|
| PROJECT TITLE | <p><b>BURLEIGH FALLS INN</b></p> <p><b>4791 HIGHWAY 28</b></p> <p><b>PRE-DEVELOPMENT DRAINAGE PLAN</b></p> |
|---------------|------------------------------------------------------------------------------------------------------------|

|         |        |
|---------|--------|
| DRAWING |        |
| DP.1    |        |
| PROJECT | 525016 |



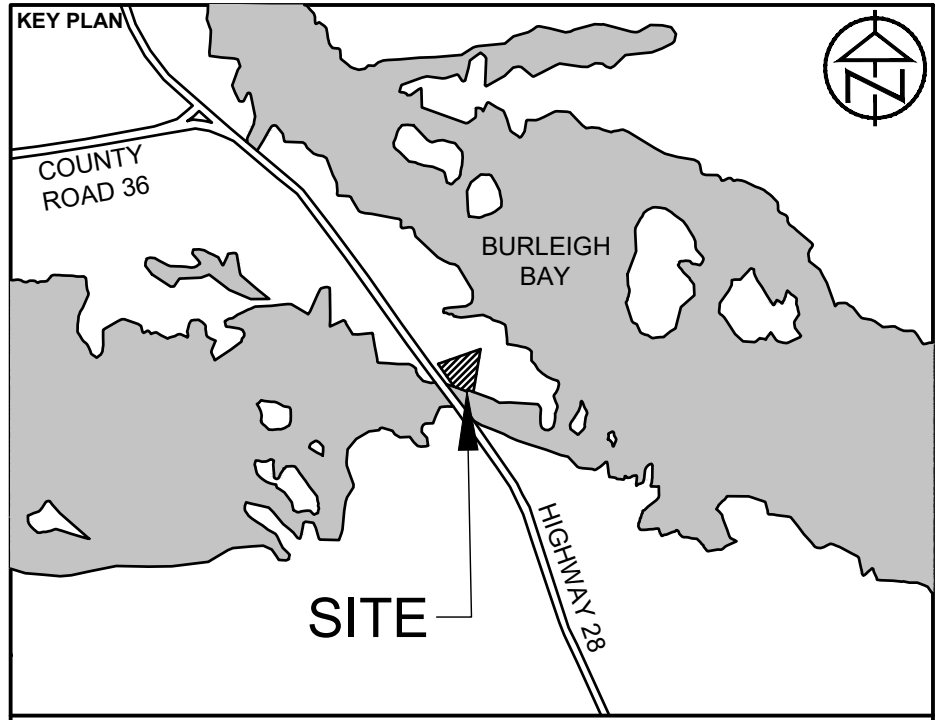


- GENERAL NOTES**
1. CONTRACTOR TO INSTALL AND MAINTAIN SILT FENCE AT LOCATIONS SHOWN OR AS DIRECTED BY THE ENGINEER.
  2. CONTRACTOR TO ARRANGE PRE-CONSTRUCTION MEETING WITH ENGINEER AFTER PLACING ALL SILTATION CONTROL WORKS.
  3. SILTATION AND EROSION CONTROL WORKS MUST BE INSTALLED PRIOR TO CONSTRUCTION.
  4. ALL SEDIMENT CONTROL WORKS MUST BE CLEANED AND MAINTAINED AFTER EACH MAJOR STORM EVENT OR AS DEEMED NECESSARY BY THE ENGINEER.
  5. THE CONTRACTOR WILL INSPECT THE SEDIMENT AND EROSION CONTROL MEASURES WEEKLY AND AFTER EACH MAJOR STORM EVENT. THE CONTRACTOR WILL NOTIFY THE ENGINEER OF CORRECTIVE ACTIONS REQUIRED AS SOON AS DEFICIENCIES ARE NOTED. THE CONTRACTOR MAINTAINS ULTIMATE RESPONSIBILITY TO ENSURE PROPER SEDIMENT AND EROSION CONTROL MEASURES ARE IMPLEMENTED AND MAINTAINED. ALL DEFICIENCIES AND CORRECTIVE MEASURES WILL BE DOCUMENTED IN A WEEKLY INSPECTION REPORT. A COPY OF THE WEEKLY INSPECTION REPORT WILL BE PROVIDED TO THE ENGINEER.
  6. IF CONSTRUCTION IS INTERRUPTED AND/OR INACTIVITY EXCEEDS 30 DAYS, THEN STOCKPILED, STRIPPED OR EXPOSED AREAS MUST BE STABILIZED BY HYDROSEEDING AND ANY OTHER APPROPRIATE GEOTEXTILE MATERIAL. IF REQUIRED, REMOVAL OF ALL SILT FENCES AT THE END OF CONSTRUCTION TO BE APPROVED BY THE ENGINEER AFTER THE SITE HAS STABILIZED.
  7. ALL SILT FENCE TO OPSD 219.130.
  8. CLEARING OF VEGETATION AND TREE COVER IS TO OCCUR OUTSIDE OF BIRD BREEDING SEASON AS RECOMMENDED BY ENVIRONMENT CANADA (APRIL 15 - AUGUST 15)
  9. ALL SIDE SLOPES 3:1 OR GREATER ARE TO BE STABILIZED IMMEDIATELY WITH HYDROSEED (USING A NATIVE SEED MIX) UNLESS OTHERWISE NOTED. USE OF AN EROSION CONTROL BLANKET SUCH AS TERRAFIX S-100 (OR APPROVED EQUAL) IS RECOMMENDED IF CONSTRUCTION OCCURS OUTSIDE OF THE GROWING SEASON.
  10. THE EROSION SEDIMENT CONTROL PLAN TO BE CONSIDERED A "LIVING DOCUMENT" WHICH MAY BE MODIFIED IN THE EVENT THE CONTROL MEASURES ARE INSUFFICIENT.



NOTE:  
A All dimensions are in millimetres unless otherwise shown.

|                                     |          |       |
|-------------------------------------|----------|-------|
| ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2015 | Rev 2 |
| HEAVY-DUTY<br>SILT FENCE BARRIER    |          |       |
| OPSD 219.130                        |          |       |



**LEGEND**

|  |                                           |
|--|-------------------------------------------|
|  | STRAW BALE CHECK DAM AS PER OPSD 219.180  |
|  | HEAVY DUTY SILT FENCE AS PER OPSD 219.130 |
|  | PROPERTY BOUNDARY                         |

**SURVEY**  
TOPOGRAPHIC SURVEY COMPLETED BY RICHMOND SURVEYING INC. ON DECEMBER 28, 2025.  
BENCHMARK 0011960U3280 BURLEIGH FALLS - HIGHWAY NO. 28 HIGH LEVEL BRIDGE OVER OTONABEE RIVER IN VILLAGE, TABLE IN NORTHEAST FACE OF CONCRETE WALL ON TOP OF NORTH NORTHWEST ABUTMENT, ON NORTHEAST SIDE OF BRIDGE, 30CM SOUTH EAST OF NORTHWEST END OF WALL, 21 CM BELOW TOP. ELEVATION: 241.648m. DATUM: CGVD2013

**DISCLAIMER & COPYRIGHT**  
CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.  
TATHAM ENGINEERING LIMITED CLAIMS COPYRIGHT TO THIS DRAWING WHICH MAY NOT BE USED FOR ANY PURPOSE OTHER THAN THAT PROVIDED IN THE CONTRACT BETWEEN THE OWNER/CLIENT AND THE ENGINEER WITHOUT THE EXPRESS CONSENT OF TATHAM ENGINEERING LIMITED.

| VERSION                         | DATE       |
|---------------------------------|------------|
| 1 FIRST SUBMISSION FOR APPROVAL | 2026 06 22 |
|                                 |            |
|                                 |            |
|                                 |            |

|              |             |               |
|--------------|-------------|---------------|
| DESIGN BY HY | DRAWN BY HY | CHECKED BY JA |
|--------------|-------------|---------------|

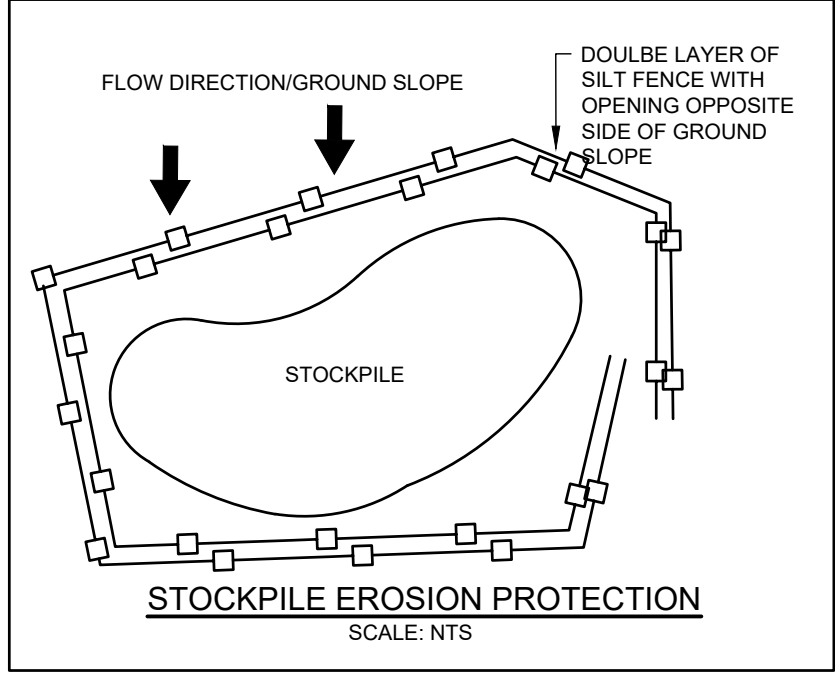
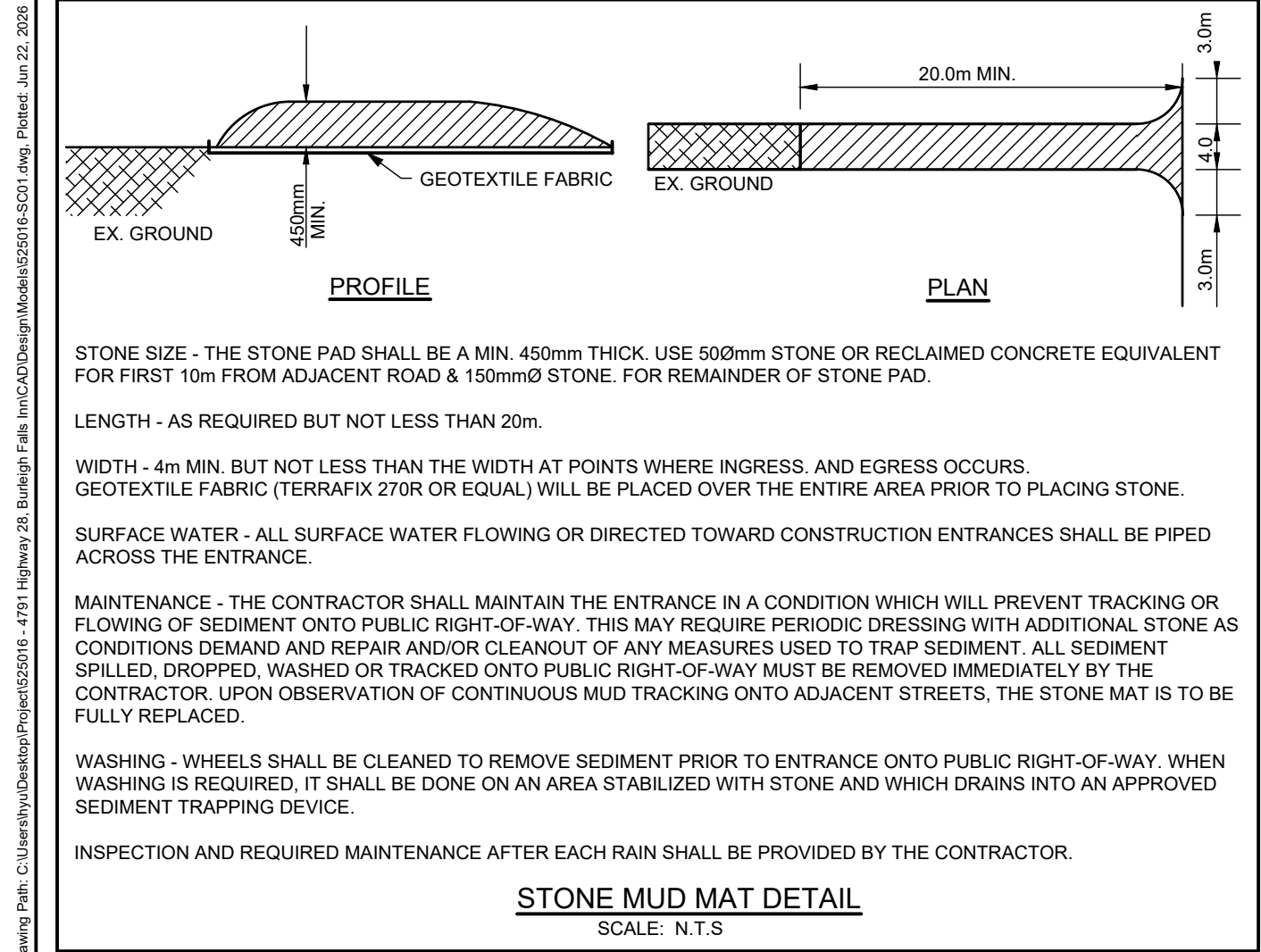


COLLINGWOOD - BRACEBRIDGE - ORILLIA - BARRIE - OTTAWA - GUELPH

**PROJECT TITLE**  
**BURLEIGH FALLS INN**  
**4791 HIGHWAY 28**  
**TOWNSHIP OF NORTH KAWARTHA**

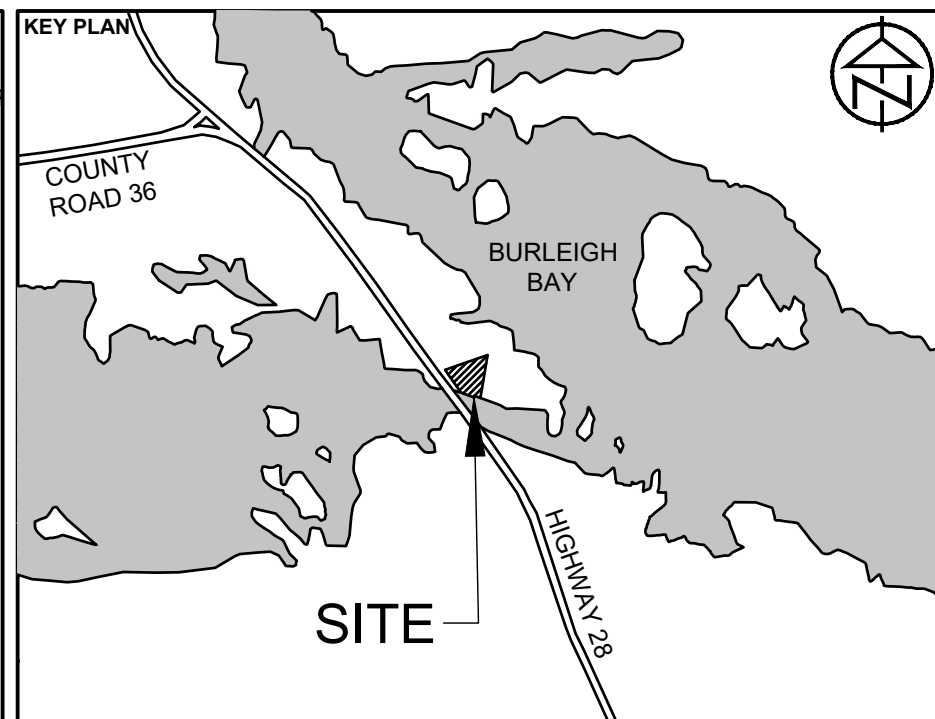
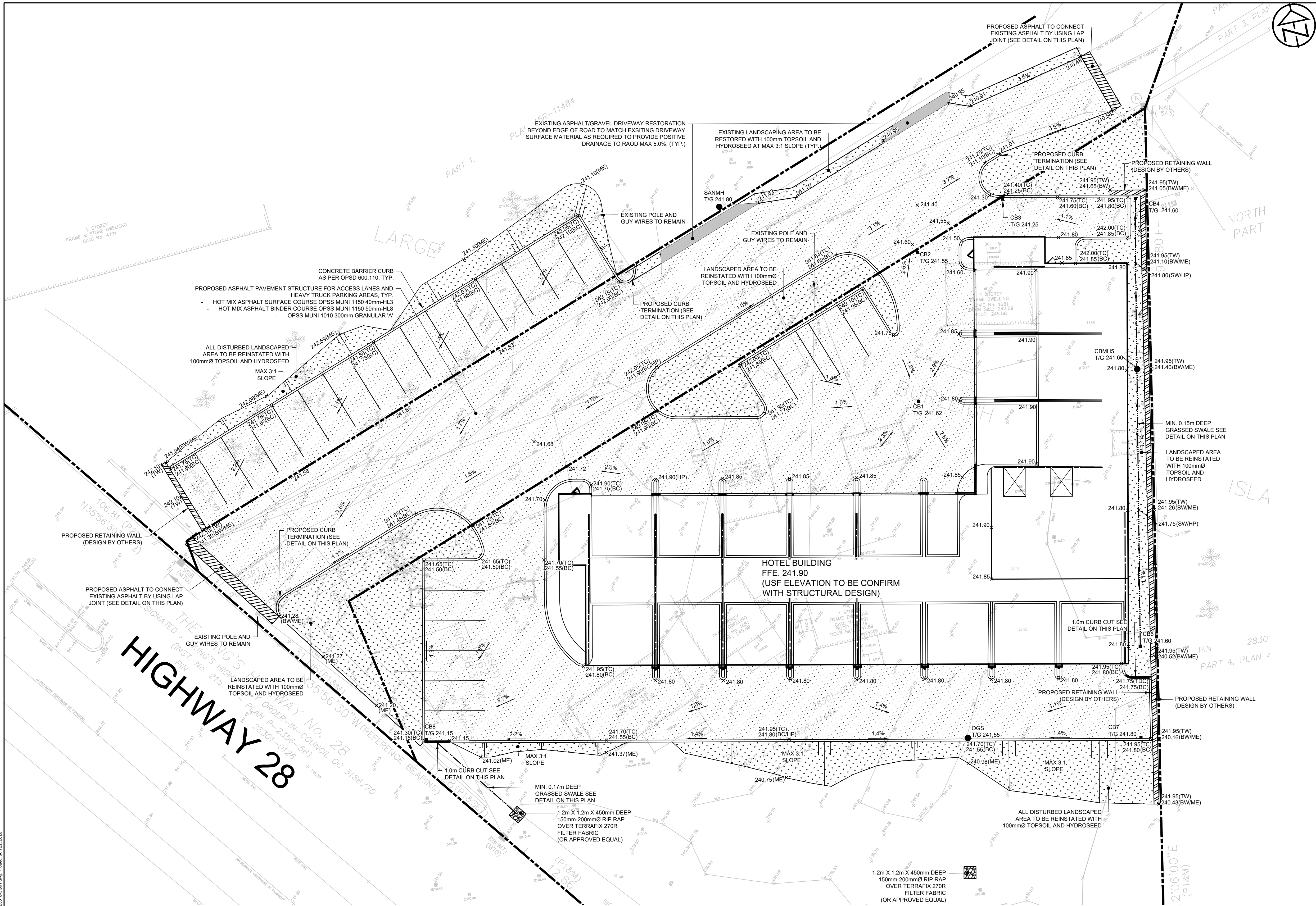
**DRAWING TITLE**  
**SILTATION AND EROSION**  
**CONTROL PLAN**

|         |       |         |
|---------|-------|---------|
| PROJECT | SCALE | DRAWING |
| 525021  | 1:250 | SC-1    |



**SCHEDULE OF CONSTRUCTION WORKS**

1. IMPLEMENTATION OF EROSION CONTROL MEASURES AS SPECIFIED ON THIS PLAN
2. REMOVALS AS SPECIFIED ON THIS PLAN
3. TOPSOIL STRIPPING AND STOCKPILING
4. EARTH EXCAVATION AND GRADING



| LEGEND       |                                   |
|--------------|-----------------------------------|
| x 262.25     | PROPOSED ELEVATION                |
| x 262.25(ME) | PROPOSED ELEVATION MATCH EXISTING |
| x 262.25(TC) | PROPOSED TOP OF CURB              |
| x 262.25(BC) | PROPOSED BOTTOM OF CURB           |
| x 262.25(SW) | PROPOSED BOTTOM OF SWALE          |
| CB           | PROPOSED CATCHBASIN               |
| CBMH         | PROPOSED CATCHBASIN MANHOLE       |
| SANMH        | PROPOSED SANITARY MANHOLE         |
| OGS          | PROPOSED OIL GRIT SEPARATOR       |
| ---          | SUBJECT PROPERTY BOUNDARY         |

**SURVEY**  
TOPOGRAPHIC SURVEY COMPLETED BY RICHMOND SURVEYING INC. ON DECEMBER 28, 2025.  
BENCHMARK 0011960U3280 BURLEIGH FALLS - HIGHWAY NO. 28 HIGH LEVEL BRIDGE OVER OTONABEE RIVER IN VILLAGE, TABLET IN NORTHEAST FACE OF CONCRETE WALL ON TOP OF NORTH NORTHWEST ABUTMENT, ON NORTHEAST SIDE OF BRIDGE, 30CM SOUTH EAST OF NORTHWEST END OF WALL, 21 CM BELOW TOP. ELEVATION: 241.64m. DATUM: CGVD2013

**DISCLAIMER & COPYRIGHT**  
CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.  
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| VERSION                         | DATE       |
|---------------------------------|------------|
| 1 FIRST SUBMISSION FOR APPROVAL | 2026 06 22 |
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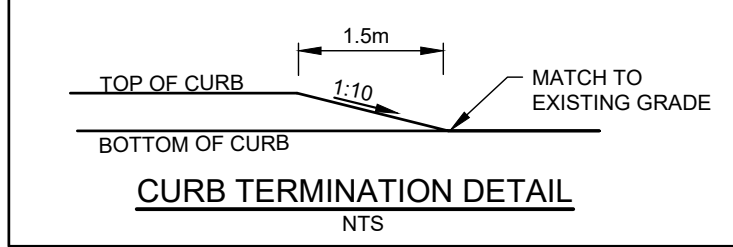
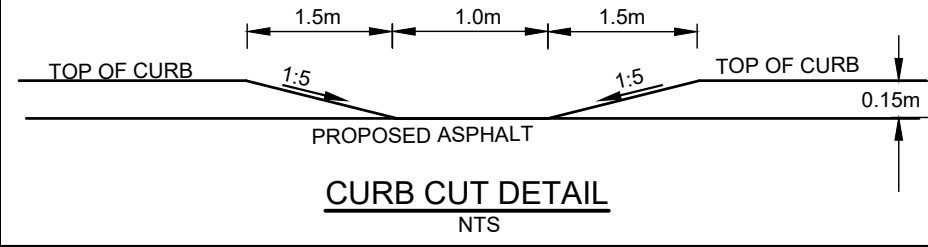
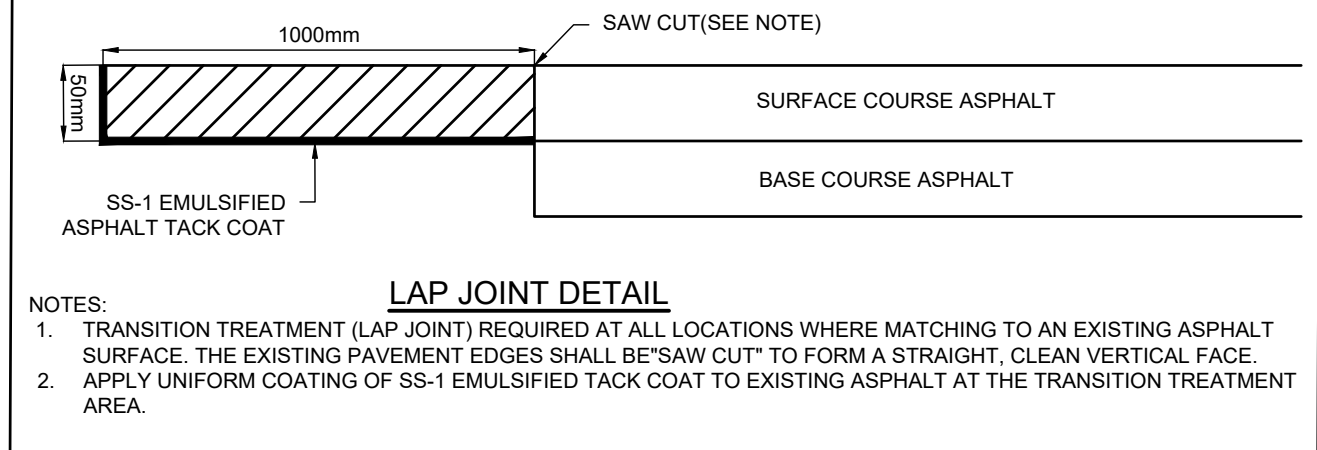
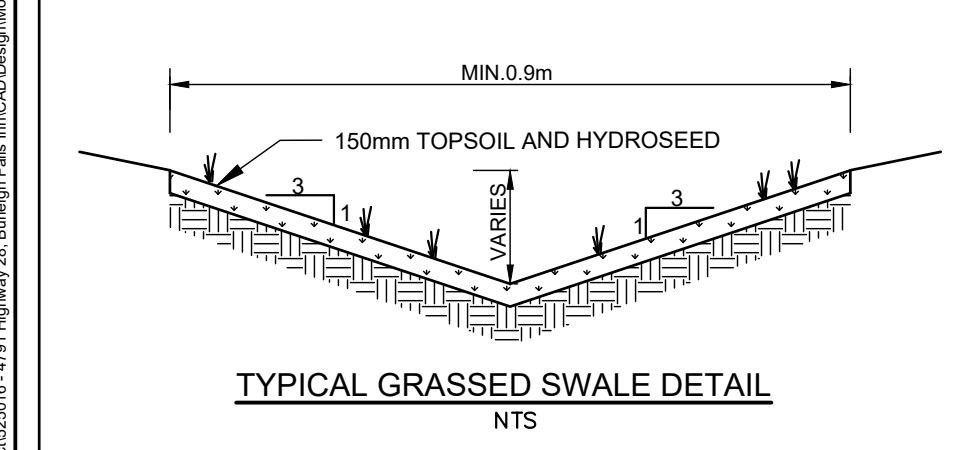


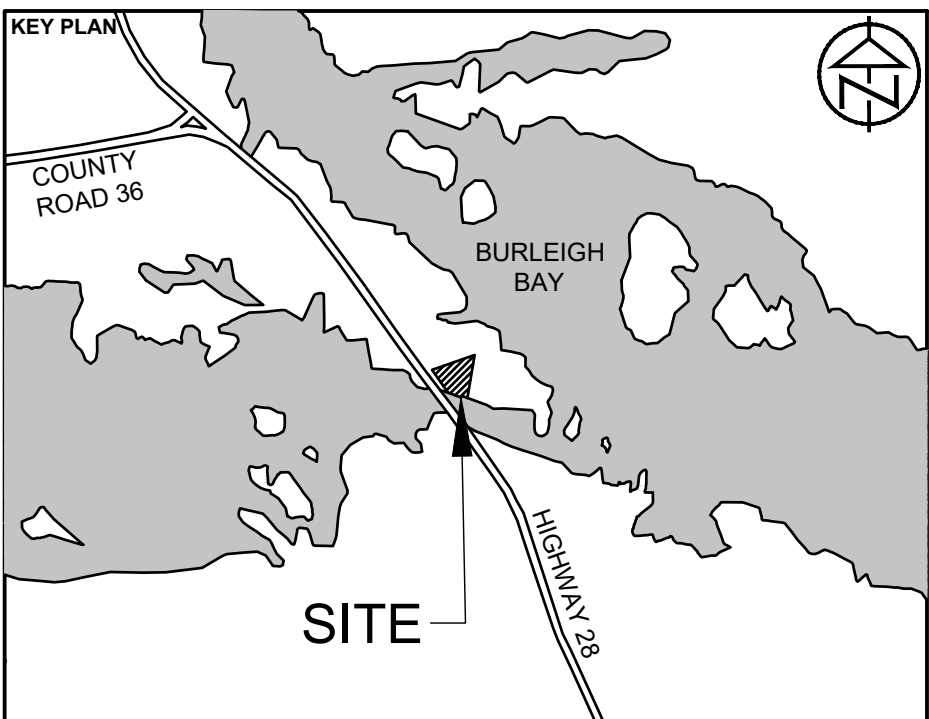
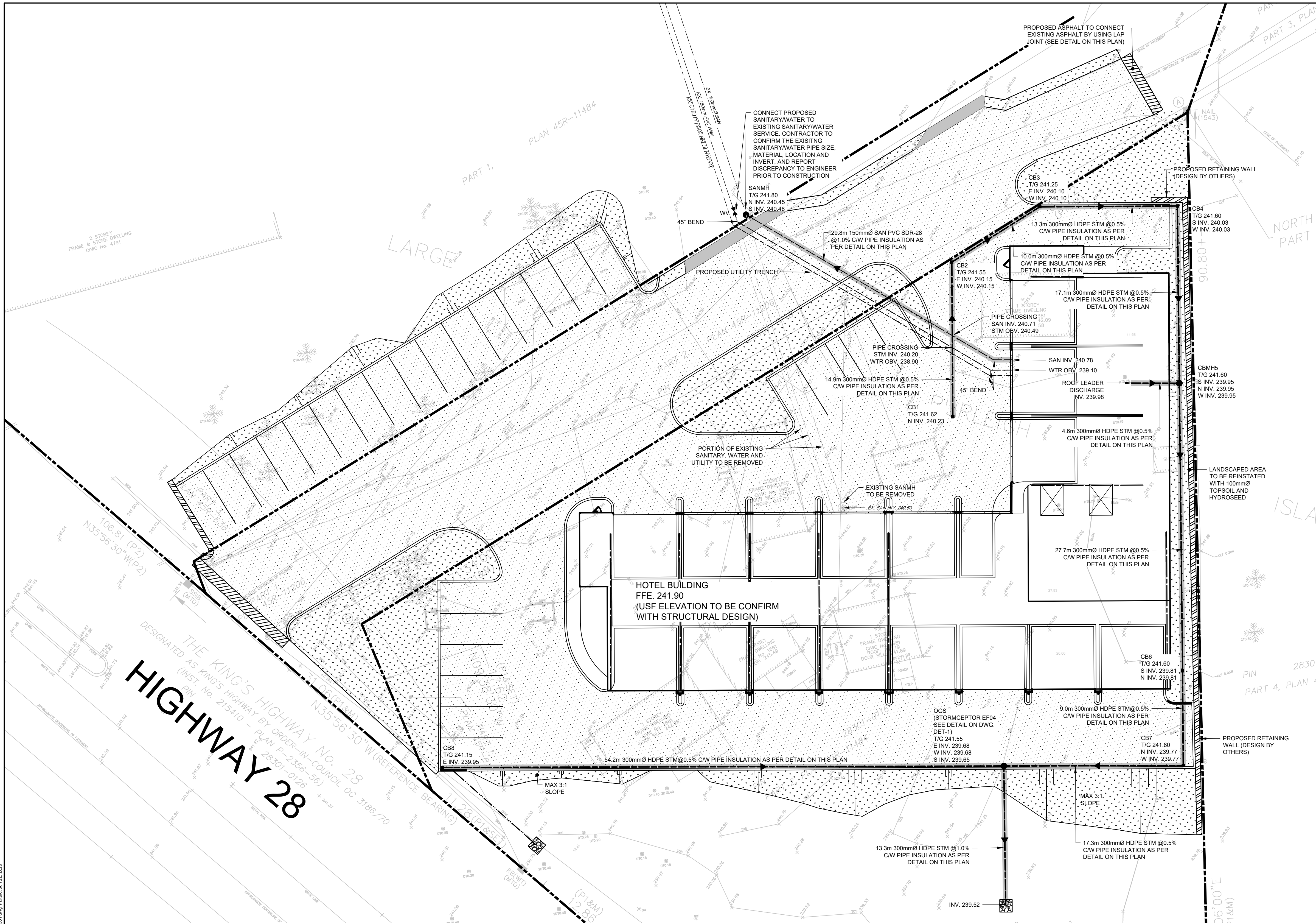
COLLINGWOOD - BRACEBRIDGE - ORILLIA - BARRIE - OTTAWA - GUELPH

**PROJECT TITLE**  
**BURLEIGH FALLS INN**  
**4791 HIGHWAY 28**  
**TOWNSHIP OF NORTH KAWARTHA**

**DRAWING TITLE**  
**SITE GRADING PLAN**

|         |       |         |
|---------|-------|---------|
| PROJECT | SCALE | DRAWING |
| 525016  | 1:200 | SG-1    |





| LEGEND |                          |
|--------|--------------------------|
|        | EXISTING WATER SERVICE   |
|        | EXISTING SANITARY SEWER  |
|        | PROPOSED WATER SERVICE   |
|        | PROPOSED STORM SEWER     |
|        | PROPOSED SANITARY SEWER  |
|        | PROPOSED PIPE INSULATION |
|        | PROPERTY BOUNDARY        |

**SURVEY**  
TOPOGRAPHIC SURVEY COMPLETED BY RICHMOND SURVEYING INC. ON DECEMBER 28, 2025.  
BENCHMARK 0011960U3280 BURLEIGH FALLS - HIGHWAY NO. 28 HIGH LEVEL BRIDGE OVER OTONABEE RIVER IN VILLAGE, TABLET IN NORTHEAST FACE OF CONCRETE WALL ON TOP OF NORTH NORTHWEST ABUTMENT, ON NORTHEAST SIDE OF BRIDGE, 30CM SOUTH EAST OF NORTHWEST END OF WALL, 21 CM BELOW TOP. ELEVATION: 241.648m. DATUM: CGVD2013

**DISCLAIMER & COPYRIGHT**  
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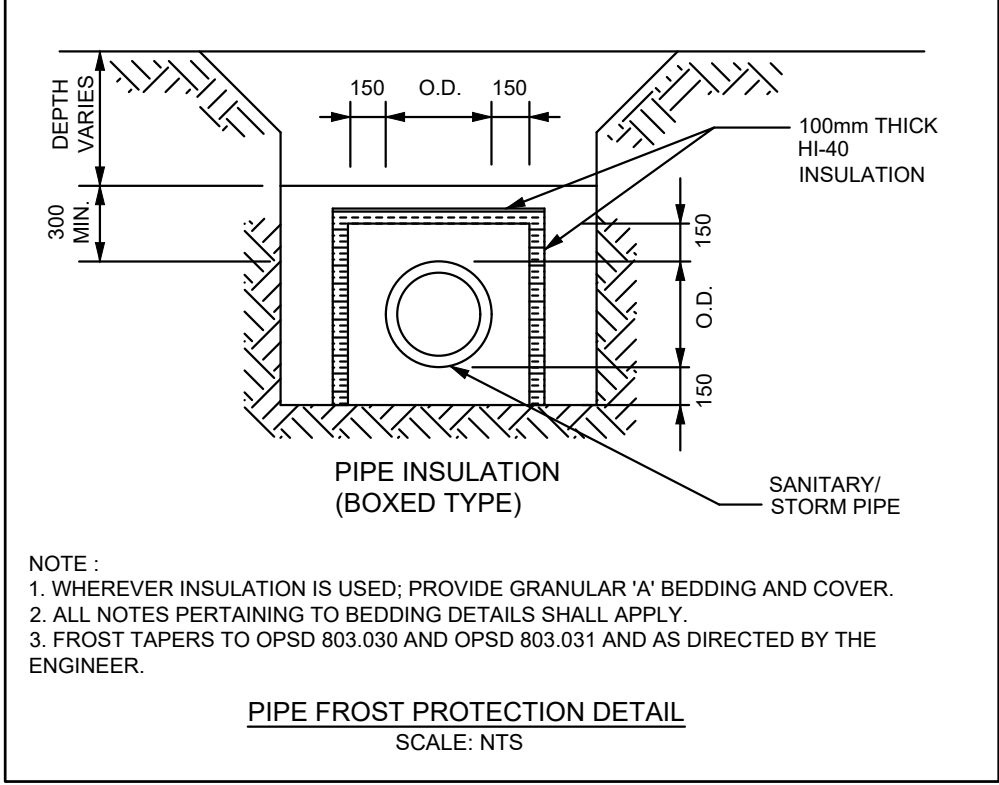


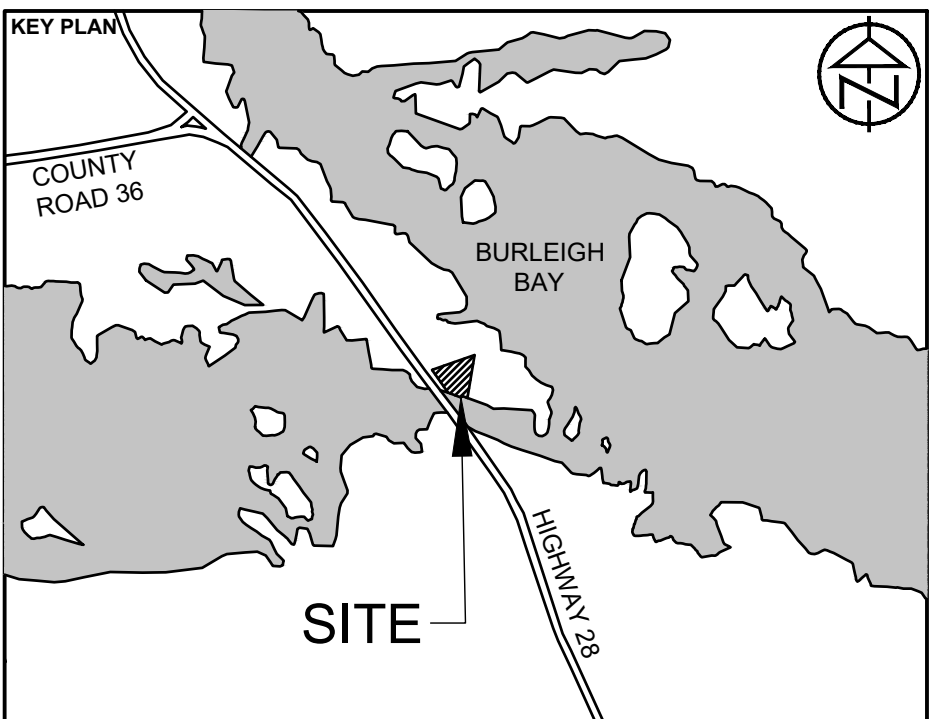
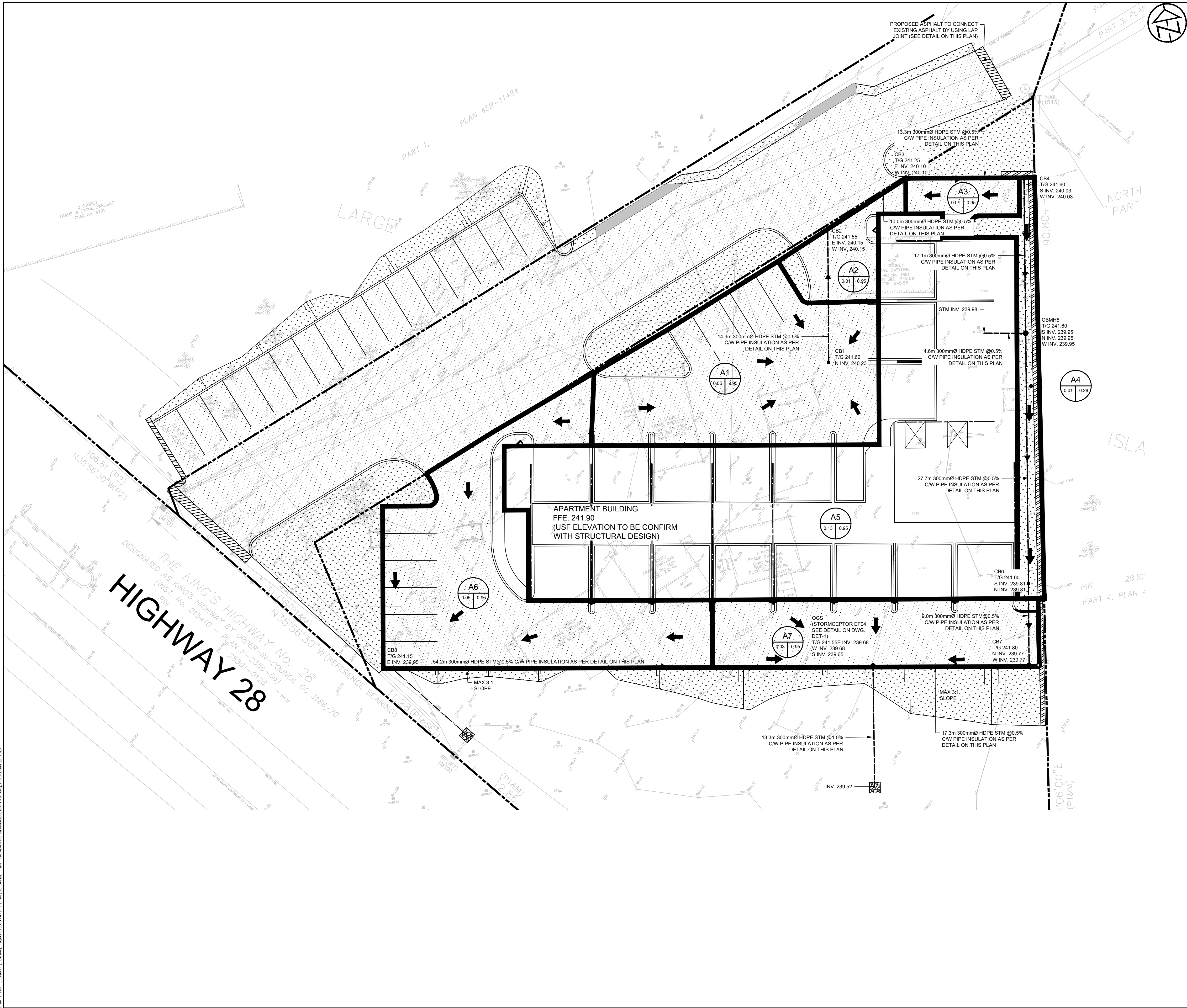
COLLINGWOOD - BRACEBRIDGE - ORILLIA - BARRIE - OTTAWA - GUELPH

**PROJECT TITLE**  
**BURLEIGH FALLS INN**  
**4791 HIGHWAY 28**  
**TOWNSHIP OF NORTH KAWARTHA**

**DRAWING TITLE**  
**SITE SERVICING PLAN**

|         |       |         |
|---------|-------|---------|
| PROJECT | SCALE | DRAWING |
| 525016  | 1:200 | SS-1    |





### LEGEND

CATCHMENT AREA BOUNDARY

DRAINAGE DIRECTION

A1

0.06 0.95

DRAINAGE AREA ID

RUNOFF COEFFICIENT

AREA (ha.)

**SURVEY**  
TOPOGRAPHIC SURVEY COMPLETED BY RICHMOND SURVEYING INC. ON DECEMBER 28, 2025.  
BENCHMARK 0011960U3280 BURLEIGH FALLS - HIGHWAY NO. 28 HIGH LEVEL BRIDGE OVER OTONABEE RIVER IN VILLAGE, TABLET IN NORTHEAST FACE OF CONCRETE WALL ON TOP OF NORTH NORTHWEST ABUTMENT, ON NORTHEAST SIDE OF BRIDGE, 30CM SOUTH EAST OF NORTHWEST END OF WALL, 21 CM BELOW TOP.  
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| DESIGN BY                                                                                                                                   | HY | DRAWN BY | HY | CHECKED BY | JA |
|---------------------------------------------------------------------------------------------------------------------------------------------|----|----------|----|------------|----|
| STAMP                                                                                                                                       |    |          |    |            |    |
| <div><div>PROFESSIONAL ENGINEER</div><div>B.F. STANTON</div><div>90415795</div><div>June 22, 2026</div><div>PROVINCE OF ONTARIO</div></div> |    |          |    |            |    |

COLLINGWOOD - BRACEBRIDGE - ORILLIA - BARRIE - OTTAWA - GUELPH

PROJECT TITLE

**BURLEIGH FALLS INN**  
**4791 HIGHWAY 28**  
**TOWNSHIP OF NORTH KAWARTHA**

DRAWING TITLE

**STORM CATCHMENT PLAN**

| PROJECT | SCALE | DRAWING |
|---------|-------|---------|
| 525016  | 1:200 | STM-1   |

- A. THE NOTES ON THIS SHEET APPLY TO ALL WORKS UNDER THIS CONTRACT UNLESS OTHERWISE NOTED ON THE PLAN AND PROFILE DRAWINGS AND/OR SPECIFIC DETAIL DRAWINGS.
- B. THE STANDARDS OF THE COUNTY OF PETERBOROUGH, TOWNSHIP OF NORTH KAWARTHA, ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS (OPSS), THE ONTARIO PROVINCIAL STANDARDS DRAWINGS (OPSD) AND ELECTRICAL SAFETY AUTHORITY (ESA) CONSTITUTE PART OF THE PLANS OF THIS CONTRACT.
- C. ORDER OF PRECEDENCE OF STANDARDS IS FIRSTLY TOWNSHIP OF NORTH KAWARTHA.
- D. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH OCCUPATIONAL HEALTH AND SAFETY ACT.
- E. THE STANDARD DRAWINGS INCLUDED WITH THESE PLANS ARE PROVIDED FOR CONVENIENCE ONLY AND ARE NOT TO BE CONSIDERED A COMPLETE SET OF THE STANDARD DRAWINGS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN ALL RELEVANT STANDARD DRAWINGS AND SPECIFICATIONS AS REQUIRED FOR THIS CONTRACT.

A. ALL DIMENSIONS ARE IN METRES, EXCEPT PIPE AND STRUCTURE DIAMETERS, WHICH ARE IN MILLIMETRES.

B. ALL DIMENSIONS SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION. ANY DISCREPANCIES SHALL BE REPORTED IMMEDIATELY TO THE ENGINEER.

A. PIPES TO BE CONSTRUCTED WITH BEDDING, COVER AND BACKFILL OR EMBEDMENT AND BACKFILL CONFORMING TO OPSD 802.010, 802.011, 802.014, 802.030, 802.031, 802.032, 802.033 and 802.034 AS APPLICABLE BASED ON PIPE MATERIAL AND SOIL CONDITIONS. BEDDING, COVER, AND EMBEDEMMENT MATERIAL SHALL BE MANUFACTURED IN EMBEDMENT BEDDING, COVER AND BACKFILL MATERIAL TO BE COMPACTED TO A DRY DENSITY OF AT LEAST 100% OF THE MATERIALS SPMD. IN WET AREAS, EMBEDEMMENT MATERIAL TO BE 9.5 MM CLEAR LIMESTONE WRAPPED IN AN APPROVED GEOTEXTILE (TERRAFIX 270R OR APPROVED EQUIVALENT).

B. ALL DISTURBED AREAS ARE TO BE REINSTATED TO THEIR ORIGINAL CONDITION OR BETTER, AS DETERMINED BY THE TOWNSHIP OR COUNTY ENGINEERING DEPARTMENT. ALL DISTURBED AREAS WITHIN THE CITY RIGHT-OF-WAY TO BE SOODED.

C. EXISTING SERVICES AND UTILITIES SHOWN ON THESE CONTRACT DRAWINGS ARE APPROXIMATE ONLY. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL UTILITIES DURING CONSTRUCTION.

D. EXISTING BELL DUCT BANKS, HYDRO BANKS AND GAS MAINS IN PAVEMENT OR BOULEVARD (AS LOCATED BY UTILITY PROVIDER) TO BE EXPOSED AT CONTRACTOR'S COST PRIOR TO INSTALLATION OF SANITARY OR STORM SEWER. CULVERTS, WATERMAIN OR SERVICES WHICH CROSS DUCT BANK OR GAS MAINS, ALL UTILITY DUCT BANKS ARE TO BE PROPERLY SUPPORTED WHEN SEWERS OR SERVICES ARE INSTALLED UNDERNEATH. SPACE BETWEEN DUCT BANK AND SEWER OR SERVICE TO BE BACKFILLED WITH UNSHRINKABLE FILL.

E. THE CONTRACTOR IS RESPONSIBLE TO PROVIDE TEMPORARY SUPPORT OF EXISTING CULVERTS, SEWER AND WATERMAIN AT ALL CROSSINGS.

F. THE CONTRACTOR SHALL OBTAIN ROAD OCCUPANCY AND ACCESS PERMITS FOR ALL WORK IN THE MUNICIPAL ROW. THE PERMIT(S) OBTAINED SHALL BE TAKEN OUT IN THE NAME OF THE CONTRACTOR.

G. THE CONTRACTOR SHALL PROTECT SURVEY MONUMENTS AND BENCHMARKS ENCOUNTERED DURING THE WORK. ALL SURVEY MONUMENTS AND BENCHMARKS DISTURBED DURING CONSTRUCTION SHALL BE REPLACED BY AN ONTARIO LAND SURVEYOR, AT THE CONTRACTOR'S EXPENSE.

H. THE CONTRACTOR TO SUBMIT SHOP DRAWINGS FOR ALL MATERIALS TO CONTRACT ADMINISTRATOR FOR REVIEW PRIOR TO ORDERING.

I. THE CONTRACTOR IS REQUIRED TO CONFIRM EXISTING GRADES AND PIPE INVERTS AT CONNECTIONS AND REPORT ANY DISCREPANCIES TO THE CONTRACT ADMINISTRATOR BEFORE COMMENCING WORK.

J. THE CONTRACTOR SHALL SUPPLY ALL NECESSARY WATER AND/OR CALCIUM CHLORIDE AS REQUIRED FOR COMPACTION AND/OR DUST CONTROL.

K. TREES/SHRUBS THAT MUST BE REMOVED SHALL BE IDENTIFIED AND PERMISSION FOR REMOVAL SHALL BE OBTAINED FROM THE CONTRACT ADMINISTRATOR.

L. CONTRACTOR IS TO NOTIFY THE CITY OF ALL CONSTRUCTION ACTIVITIES A MINIMUM OF 72 HOURS PRIOR TO COMMENCEMENT OF CONSTRUCTION.

M. TRAFFIC CONTROL AND SIGNAGE DURING CONSTRUCTION SHALL CONFORM TO THE MOST CURRENT ONTARIO CONSTRUCTION REGULATIONS INCLUDING REGULATION NO. 213 UNDER OHSA AND REFERENCE TO MTO TEMPORARY CONDITIONS MANUAL BOOK NO. 7.

N. ALL EARTH GRADING TO OPSD 206.

O. EXCESS STOCKPILED OR UNSUITABLE MATERIALS TO BE DISPOSED OF BY THE CONTRACTOR AT AN APPROVED OFFSITE LOCATION.

P. FOR THE DURATION OF THE CONTRACT, MATERIAL THAT BECOMES CONTAMINATED DUE TO CONTRACTOR'S ACTIVITY SHALL BE REMOVED AND REPLACED AT THE CONTRACTOR'S EXPENSE.

- A. ALL TOPSOIL MUST BE STRIPPED FROM LANEWAY AND PARKING AREAS PRIOR TO CONSTRUCTION.
- B. CONTRACTOR TO REMOVE ALL TOPSOIL AND ORGANIC MATERIAL LOCATED BELOW EXISTING FILL MATERIAL WITHIN THE LANEWAY AND PARKING AREAS. BACKFILL TO BE APPROVED ENGINEERED FILL OR NATIVE MATERIAL COMPACTED TO 95% SPMD. THE SUBGRADE SHOULD BE COMPACTED. PROOF ROLLED AND INSPECTED BY A GEOTECHNICAL ENGINEER.
- C. GRANULAR 'B' SUBBASE TO BE PLACED IN 150mm MAXIMUM LOOSE LIFTS AND COMPACTED TO 100% OF MATERIAL'S SPMD.
- D. GRANULAR 'A' BASE TO BE PLACED IN 150mm MAXIMUM LOOSE LIFTS AND COMPACTED TO 100% OF MATERIAL'S SPMD.
- E. ALL ASPHALT MATERIAL AND PLACEMENT TO BE IN ACCORDANCE WITH OPSS MUNI 310.
- F. PAVEMENT AND GRANULAR STRUCTURES SHALL BE AS PER PAVEMENT STRUCTURE TABLE ON DRAWING SG-1 AND GEOTECHNICAL RECOMMENDATIONS.
- G. FROST TREATMENT FOR ALL STORM SEWERS IN ACCORDANCE WITH OPSD 803.030.
- H. BOULDER TREATMENT TO OPSD 204.010.
- I. TRANSITION TREATMENT FOR EARTH/ROCK CUT/FILL OPERATIONS TO OPSD 205.010, 205.020, 205.040, 205.050 ACCORDINGLY.

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A. | PIPE MATERIAL TO BE PVC SDR 35 CERTIFIED TO C.S.A. STANDARDS B182.2 AND B182.4 OR CONCRETE REINFORCED PIPE, CONFORMING TO CSA STANDARD A257.1 OR HDPE (DOUBLE WALLED 320KPA) WITH A STRENGTH AS INDICATED ON THE DRAWINGS OR APPROVED EQUIVALENTS.                                                                                                                                                                                                                                                                                                                                              |
| B. | STORM SEWERS SHALL BE CONSTRUCTED WITH EMBEDMENT AND BACKFILL AS PER OPSD 802.010 (GRANULAR 'A' EMBEDMENT MATERIAL) FOR FLEXIBLE PIPES AND BEDDING, COVER AND BACKFILL AS PER OPSD 802.030, 802.031 OR 802.032 CLASS B (GRANULAR 'A' BEDDING AND COVER MATERIAL) FOR RIGID PIPES UNLESS OTHERWISE APPROVED BY THE TOWNSHIP ENGINEER. IN WET AREAS BEDDING AND EMBEDMENT MATERIAL TO BE 9.5 mm CLEAR LIMESTONE WRAPPED IN AN APPROVED GEOTEXTILE (TERRAFIX 270R OR APPROVED EQUAL).                                                                                                              |
| C. | ALL PIPE HANDLING AND INSTALLATION MUST BE IN STRICT COMPLIANCE WITH MANUFACTURERS INSTALLATION GUIDES AND THE O.C.P.A. OR UNIBELL GUIDELINES.                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| D. | PRECAST MAINTENANCE HOLES SHALL BE 1200 mm DIA. UNLESS OTHERWISE SPECIFIED, AND SHALL BE IN ACCORDANCE WITH OPSD 701.010, 701.011, 701.012. PRECAST MAINTENANCE HOLES GREATER THAN 5.0 m DEEP SHALL BE CONSTRUCTED WITH A SAFETY PLATFORM IN ACCORDANCE WITH OPSD 404.020. ADJUSTABLE MAINTENANCE HOLE FRAMES AS PER LIFESAVER HOPE GRADE ADJUSTMENT RINGS BY IPX OR APPROVED EQUAL ARE REQUIRED. COVER SHALL BE IN ACCORDANCE WITH OPSD 401.010, TYPE 'A' COVER SHALL HAVE THE WORK 'STORM' ON IT. CATCHBASIN MAINTENANCE HOLE COVERS SHALL BE IN ACCORDANCE WITH OPSD 401.010 TYPE 'B' COVER. |
| E. | SINGLE CATCHBASINS TO BE 600 mm SQUARE PRECAST CONCRETE TO OPSD 705.010. FRAME AND GRATE TO OPSD 400.100.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| F. | STORM SEWER WITH LESS THAN 1.5 m COVER REQUIRES INSULATION AS PER DETAIL ON DWG.SS-1 AND AS DIRECTED BY THE ENGINEER.                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

- A. SANITARY SERVICE TO BE 150 mm DIA. GREEN P/Vc SDR28, RUBBER GASKET TYPE JOINTS AND SHALL CONFORM TO C.S.A. SPECIFICATIONS.
- B. MAXIMUM DEFLECTION FROM COMBINED LIVE AND DEAD LOADING SHALL NOT EXCEED ANY C.S.A., O.P.S OR MANUFACTURERS RECOMMENDED SPECIFICATIONS.
- D. PRECAST MAINTENANCE HOLES SHALL BE 1200mmØ UNLESS OTHERWISE SPECIFIED AND SHALL BE IN ACCORDANCE WITH OPSD 701.010 AND 701.011. ADJUSTABLE MAINTENANCE HOLE FRAMES AS PER LIFESAVER HDPE GRATE. ADJUSTMENT RINGS BY IPX OR APPROVED EQUAL ARE REQUIRED. COVER SHALL BE IN ACCORDANCE WITH OPSD 401.010. TYPE 'A' COVER SHALL HAVE THE WORD "SANITARY" ON IT.
- E. MAINTENANCE HOLE STEPS TO BE SOLID AND IN ACCORDANCE WITH OPSD 405.020.
- F. ALL PIPE CONNECTIONS TO STRUCTURES TO BE SUPPORTED AS PER OPSD 708.020.
- G. MANHOLE BENCHING SHALL CONFORM WITH OPSD 701.021.
- H. SANITARY MANHOLE TO BE TESTED FOR LEAKAGE AS PER OPSD 407.07.24.

- A. THE CONTRACTOR IS RESPONSIBLE FOR ALL DEWATERING THAT MAY BE REQUIRED TO PRODUCE A DRY AND STABLE TRENCH FOR CONSTRUCTION OF THE WORKS. WORK TO BE IN ACCORDANCE WITH ONTARIO REGULATION 63/16, OPSS MUNI 518.
- B. DURING NORMAL OPERATIONS, THE MAXIMUM VOLUME OF WATER TO BE DISCHARGED FROM THE DE-WATERING OPERATION ON A DAILY BASIS WITHOUT A MECP PERMIT TO TAKE WATER IS 400,000 L/DAY.
- C. ALL WATER DISCHARGED FROM THE DEWATERING OPERATION SHALL BE DISCHARGED TO AN APPROVED OUTLET AS DETERMINED BY THE CONTRACT ADMINISTRATOR.
- D. DEWATERING PUMPS SHALL DISCHARGE TO A GEOTECHNICAL FILTER BAG LOCATED ON A GENTLY SLOPING GRASSED SURFACE TO THE APPROVED OUTLET.
- E. WHERE REQUIRED, SUPPLEMENTARY SEDIMENT AND EROSION CONTROL WORKS, SUCH AS SILT FENCE AND STRAW BALE CHECK DAMS, SHALL BE INSTALLED DOWN GRADIENT OF THE FILTER BAGS TO ENSURE DISCHARGE WATER IS FREE OF SEDIMENT AND TO PREVENT EROSION.
- F. TO MINIMIZE THE VOLUME OF WATER TO BE REMOVED FROM EXCAVATIONS, THE WORK AREA SHALL BE GRADED TO DIRECT SURFACE RUNOFF AROUND AND AWAY FROM OPEN EXCAVATIONS.
- G. THE CONTRACTOR SHALL MEASURE AND RECORD, ON A DAILY BASIS, THE TOTAL VOLUME OF WATER DISCHARGED (L/DAY) AND THE AVERAGE DISCHARGE RATE (L/S). THE CONTRACTOR SHALL SUBMIT COPIES OF THE DEWATERING DISCHARGE FLOW RECORDS TO THE CONTRACT ADMINISTRATOR ON A WEEKLY BASIS OR UPON REQUEST. THE METHOD OF MEASURING THE VOLUME OF WATER DISCHARGED SHALL BE APPROVED BY THE CONTRACT ADMINISTRATOR PRIOR TO COMMENCING DEWATERING OPERATIONS.
- H. DEWATERING OPERATIONS ARE TO BE SUSPENDED DURING SEVERE STORM EVENTS.



| SITE SPECIFIC DATA REQUIREMENTS  |      |      |      |         |    |
|----------------------------------|------|------|------|---------|----|
| STORMCOURSE MODEL                |      |      | EFO4 |         |    |
| STRUCTURE ID                     |      |      |      |         | *  |
| HYDROCARBON STORAGE REQ'D (L)    |      |      |      |         | *  |
| WATER QUALITY FLOW RATE (L/s)    |      |      |      |         | *  |
| PEAK FLOW RATE (L/s)             |      |      |      |         | *  |
| RETURN PERIOD OF PEAK FLOW (yrs) |      |      |      |         | *  |
| DRAINAGE AREA (HA)               |      |      |      |         | *  |
| DRAINAGE AREA IMPERVIOUSNESS (%) |      |      |      |         | *  |
| PIPE DATA:                       | I.E. | MATL | DIA  | SLOPE % | HC |
| NILET #1                         | *    | *    | *    | *       | *  |
| NILET #2                         | *    | *    | *    | *       | *  |
| OUTLET                           | *    | *    | *    | *       | *  |

PER ENGINEER OF RECORD



BENCHMARK 0011960U3280 BURLEIGH FALLS - HIGHWAY NO. 28 HIGH LEVEL BRIDGE OVER OTONABEE RIVER IN VILLAGE, TABLET IN NORTHEAST FACE OF CONCRETE WALL ON TOP OF NORTH NORTHWEST ABUTMENT, ON NORTHEAST SIDE OF BRIDGE, 30CM SOUTH EAST OF NORTHWEST END OF WALL, 21 CM BELOW TOP.  
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COLLINGWOOD - BRACEBRIDGE - ORILLIA - BARRIE - OTTAWA - GUELPH

**BURLEIGH FALLS INN**  
**4791 HIGHWAY 28**  
**SHIP OF NORTH KAWARTHA**

## NOTES AND DETAILS

|         |       |         |
|---------|-------|---------|
| PROJECT | SCALE | DRAWING |
| 525016  | N/A   | DET-1   |