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PROPOSED TRANSPORTATION DEPOT

12363 DIXIE ROAD, TOWN OF CALEDON

Functional Servicing & Stormwater Management Report

Town of Caledon, ON

June 16, 2023

Project: 22011

Civil Consultant:
Urban Watershed Group Ltd.

15955 Airport Road, Suite 304, Caledon East, Ontario, Canada, L7C 1H9

TEL: 905 584-1458 FAX: 905 584-1461 E-MAIL: urbanwater@grnland.com
WEBSITE: www.grnland.com

PROPOSED TRANSPORTATION DEPOT
12363 DIXIE ROAD, Caledon, Ontario

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Functional Servicing & Stormwater Management Report
PROPOSED TRANSPORTATION DEPOT

1.0 INTRODUCTION

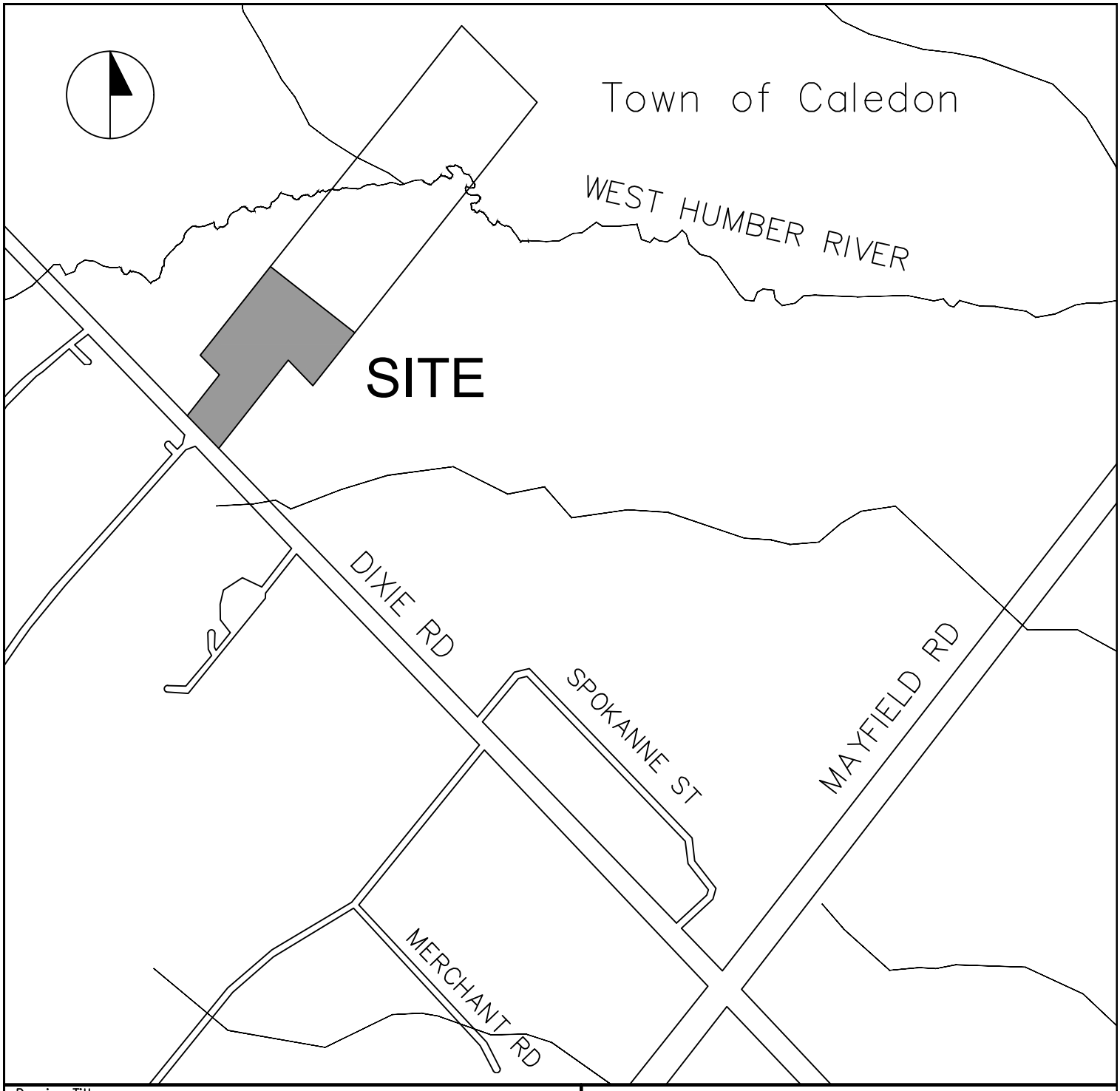
The following Functional Servicing and Stormwater Management Report has been prepared by Urban Watershed Group Limited. (UWGL), in support of the Proposed Transportation Depot located on 12363 Dixie Road in the Town of Caledon, Region of Peel. The 9.15 hectare property is located north of the Dixie Road, between Mayfield Road and Old School Road (See **Figure No. 1**), and is legally described as Part of Lot 19, Concession 4, in the Geographic Township of Chinguacousy.

The property is bounded by existing residential properties to the north, agricultural lands to the east, a landscape/garden center to the south, and Dixie Road to the west. The subject site is currently under active agricultural use, and proposed to be rezoned to permit the proposed commercial/ industrial development.

A tributary of the West Humber River watershed and its associated flood plain traverses the property and bisects the lot. To preserve the Environmental Protection Areas associated with the watercourse, the rear 7.98 ha of the total parcel shall be left as existing agricultural and natural feature land uses. The remaining 1.17 ha parcel of land outside of the Green Belt shall be the subject of the proposed development plan.

It is proposed to construct one one-storey industrial Building (office & repair building) along with 190 parking spaces which will comprise the Transportation Depot. The proposed building gross floor area is approximately 616 sq.m, of which one quarter will be office space, and the remaining area will be for the truck service/repair bays and storage space. At the front of the development truck trailer parking will be provided on an asphalt surface. Additional parking for truck cabs will be provided on a gravel surface located near the rear of the development site. Site access will be provided onto Dixie Road through a proposed commercial/ industrial driveway.

This report aims to identify the existing municipal services (storm, sanitary and water) available, and demonstrate there is sufficient capacity to accommodate the proposed development. As well, this report puts forward a stormwater management (SWM) plan which adheres to the criteria set out by the governing agencies (Town of Caledon, Toronto and Region Conservation Authority (TRCA) and Peel Region).



Drawing Title

SITE LOCATION PLAN

PROPOSED TRANSPORTATION DEPOT
12363 DIXIE ROAD
TOWN OF CALEDON, ONTARIO

15955 AIRPORT ROAD, SUITE 304
CALEDON EAST, ONTARIO, L7C 1H9
PHONE: (905) 584-1458 FAX: (905) 584-1461
rban Watershed Group Ltd.
A Member of the GREENLAND Group of Companies
urbanwater@grnland.com

Client

XXX

Drawn By	Checked By	Drawing No.
X. ZHANG	A. MCEWEN	FIG1
Scale: N.T.S.	Project No.: 22011	

2.0 SANITARY SERVICING

2.1 Existing Sanitary Servicing

The site is currently vacant and believed to be un-serviced through either private septic or municipal sanitary sewers. Drawings provided by the Region of Peel indicate an existing 600mm concrete southerly flowing sanitary sewer is located within the west boulevard of Dixie Road. Plan and profiles of the existing municipal sewers can be found in **Appendix A**.

2.2 Proposed Sanitary Servicing and Peak Discharge Rates

Sanitary servicing is to be provided consistent with the Region of Peel Public Works Sanitary Sewer Design Criteria (2017). It is proposed to connect the property to the existing 600mm diameter municipal sanitary sewer on Dixie Road. A new connection is proposed via a 150mm diameter PVC sanitary lateral at minimum 2% slope complete with sampling manhole located at the limit of the road widening. The general arrangement of the proposed sanitary sewer has been indicated on the Site Servicing & Grading Plan (**Drawing 22011-SS1**).

The proposed peak sanitary discharge generated from the development has been calculated in accordance with Region of Peel Design Criteria as follows:

Proposed Sanitary Peak Discharge

Population = 50 persons/hectare
Site Area = 1.17 hectares

Equivalent Population = 50 persons/hectare x 1.17 hectares
= 58.5 (59) persons

Domestic sewage flow is based upon a unit rate of 302.8 L/capita/day, therefore:

Domestic Sewage Flow = 59 persons x 302.8L/capita/day
= 17,865.2 L/day
= 0.207 L/sec

The Harmon Peaking Factor (M) must be applied for Dry Weather Flows, and for a population below 450 persons is restricted to a maximum of 4.0:

$M = 1 + 14 / (4 + P^{0.5})$
$= 1 + 14 / (4 + (59/1000)^{0.5})$
$= 4.30$

Maximum Dry Weather Flow = 0.207 L/sec x 4
= 0.827 L/sec

Infiltration Amount = 0.0002 m^3 /sec/ha x 1.17 ha
= 0.000234 m^3 /sec
= 0.234 L/sec

Total Prop. Peak Discharge = Commercial Flow + Infiltration Amount
= 0.827 L/sec + 0.234 L/sec
= 1.061 L/sec

The internal 150mm diameter pipe with a minimum fall of 2.0% has a capacity of 22.5 l/sec, and will be more than sufficient to convey the proposed flows to the municipal sewers. A Connection Demand Table has been included in **Appendix B**, in which a more detailed analysis of water and wastewater demand from the proposed development has been completed.

3.0 WATER SERVICING

3.1 Existing Water Services

The property does not have an existing municipal water service or private well. Drawings provided by the Region of Peel indicate there is an existing 400mm diameter PVC municipal feeder watermain and a 150mm diameter PVC local watermain on Dixie Road. Municipal hydrants are connected to the 400mm diameter watermain. Plan and profiles of the existing municipal watermain can be found in **Appendix A**.

3.2 Proposed Water Services & Peak Water Demands

It is proposed to provide a new fireline/domestic connection per Region of Peel Standard 1-6-4. A new connection to the 150mm diameter municipal watermain of Dixie Road is proposed via a 150mm diameter PVC water service installed cut in tee. The proposed domestic service size is 50mm, and will branch off the proposed 150mm diameter water service connection immediately before the limit of the road widening. A new water meter shall be provided within the mechanical room of the building. The general arrangement of the fire and domestic water services has been indicated on the Site Servicing & Grading Plan (**Drawing 22011-SS1**).

3.2.1 Domestic Flow

Domestic water demands have been estimated using the Region of Peel Public Works Watermain Design Criteria (2010). For the 59 persons (calculated for proposed peak sanitary flow), average ICI consumption rate of 300 L/day/cap has been used. A max day factor of 1.4 and a peak hour factor of 3.0 have been applied.

Peak Water Demand

Daily Water Consumption = 59 persons x 300 L/capita/day
= 17,700L/day
= 0.205 L/sec

Maximum Daily Demand = Daily Water Consumption x Max Day Factor
= 17,700 L/day x 1.4
= 24,780 L/day
= 0.287 L/s

Peak Hourly Demand = Daily Water Consumption x Peak Hour Factor
= 17,700 L/day x 3.0 / 24 hours/day
= 2,212.5 L/hour
= 0.615 L/s

3.2.2 Fire Flow Demands

Regional standards require watermains to be sized to meet a minimum pressure of 140 KPA (20 PSI) under the maximum day demand plus fire flow. The fire flow requirements for the building have been estimated using the NFPA Fire Underwriters Survey's Water Supply for Public Fire Protection (1999). The proposed 736 sq.m gross floor area, has been used in calculation of fire flow requirements for combustible building construction with a high occupancy hazard classification (repair garage) and a fully supervised sprinkler system. The total required fire flow demand has been calculated as 4,255 L/min (70.91 L/s). Detailed calculations of the fire flow demand are included in **Appendix B**, along with a Connection Demand Table.

The proposed development shall be connected to the local 150mm diameter municipal watermain. Hydrant flow testing of this local watermain is not possible, as the existing hydrants are connected to the 400mm diameter municipal feeder main in front of the site. Region of Peel staff should confirm the adequacy of the watermain to service the development based on regional watermain modelling.

4.0 STORMWATER MANAGEMENT

4.1 Stormwater Management Criteria

The property is located within a regulated area of the Toronto and Region Conservation Authority (TRCA) Watershed. A portion of the property is within the Regulatory floodplain of a tributary of the West Humber River at an elevation of 256.80 metres. The existing runoff from the property is primarily conveyed by sheet flow directly into the watercourse across the agricultural lands.

The proposed structure will have a finished floor elevation of 263.15, and therefore be sufficiently situated above the Regional Floodplain elevation.

The policies set out in the TRCA Stormwater Management Criteria (August 2012), outline the below applicable SWM criteria for the development which are to be followed:

- **Flood Protection**
  - Post to Pre for up to and including 100-year storms (Town of Caledon)
  - Unit Flow Rates for pre-development conditions (TRCA)
- **Erosion Control**
  - Extended detention of 25mm event for 48 hours (TRCA)
  - At minimum retain 5mm on site (TRCA and Town of Caledon)
- **Water Quality**
  - Enhanced Level of Protection (80% Total Suspended Solids Removal) per MECP criteria (TRCA and Town of Caledon)
- **Water Balance / Groundwater Recharge**
  - Site specific water balance analyses and maintenance of recharge (TRCA and Town of Caledon)

The criteria above will be defined in detail and addressed within the succeeding sections of the report.

4.2 Site Statistics

The total development area outside of the Greenbelt is 1.17 ha and is comprised of agricultural land. The land generally slopes in a north easterly direction, across a change in grade of approximately 3.25 meters with an average slope of 2.7%. The existing time of concentration using the airport method is considered approximately 30 minutes.

The proposed 0.11 ha SWM Facility will be located within the Greenbelt limits, but outside of any site specific environmental or natural hazard features identified. In the existing conditions, the SWM facility has a total 0.46 ha catchment area of agricultural land within the Greenbelt which shall be considered as such for the purposes of the SWM analysis.

The drainage characteristics and imperviousness of the remaining lot outside the development limits will not be altered, and are therefore excluded from the SWM analysis. Runoff from the 1,554 sq.m north and east perimeter landscape area identified on the post-development drainage area plan (**Figure No. 3**), is to be conveyed via sheet flow directly toward the watercourse at an uncontrolled rate, and similarly will not be considered in the catchment area as they will not generate an increase in runoff from the existing conditions.

The proposed SWM Facility has been considered to have a runoff coefficient of 1.0 during all storm events.

An external drainage of 0.23 ha from the adjacent lot to the south is also observed to traverses the subject property, will be allowed to flow through the site overland unimpeded. The external area has been considered in SWM analysis were doing so will not result in a non-conformant condition for the property should the neighbouring site self-contain this drainage.

The subject site's existing and proposed conditions have been summarized in the following tables:

Existing Condition (**Figure No. 2**)

Land Use	Area	C	AC
Development Area	11,769	0.25	2,942.3
SWM Facility Ex. Catchment Area	4,622	0.25	1,155.5
External Drainage Area	2,344	0.25	586.0
Total Existing Conditions Area	**18,735**	**0.25**	**4,683.8**

Proposed Conditions (**Figure No. 3)**

Land Use	Area	C	AC
Building Area	616	0.90	554.4
Impervious Area	8,536	0.90	7,682.4
Pervious Area	942	0.25	235.5
SWM Facility Area	1,120	1.00	1,120.0
SWM Facility Ex. Catchment Area	3,502	0.25	875.5
External Drainage Area	2,344	0.25	586.0
Total Catchment Area	**17,060**	**0.65**	**11,053.8**
Uncontrolled Pervious Area	1,675	0.25	418.8
Total Proposed Conditions Area	**18,735**	**0.61**	**11,472.6**

% Impervious of Catchment Area = (616 + 8,536 + 1,120) / 17,060
= 10,272 sq.m / 17,060 sq.m
= 60.2%

TRCA and Town criteria require runoff controls be implemented to maintain the peak flow rate generated from the property under existing conditions.

DIXIE ROAD

12,062
0.25
PERVIOUS

3,502
0.25
SWM FACILITY
EX. CATCHMENT

FUTURE DEVELOPMENT
(EXISTING AGRICULTURAL)

2,344
0.25
EXTERNAL

LEGEND:

- PROPERTY LINE
- EXISTING DRAINAGE BOUNDARY
- EXISTING MAJOR SYSTEM FLOW DIRECTION
- 2,344 / 0.25 — CATCHMENT AREA (m^2) / RUNOFF COEFFICIENT

FIGURE 2

PROPOSED TRANSPORTATION DEPOT

12363 DIXIE RD
CALEDON, ONTARIO

15955 AIRPORT ROAD, SUITE 304
CALEDON EAST, ONTARIO, L7C 1H9
PHONE: (905) 584-1458 FAX: (905) 584-1461
rban Watershed Group Ltd.
A Member of the GREENLAND Group of Companies
urbanwater@grnland.com

PRE DEVELOPMENT DRAINAGE AREA PLAN

SCALE 1:750

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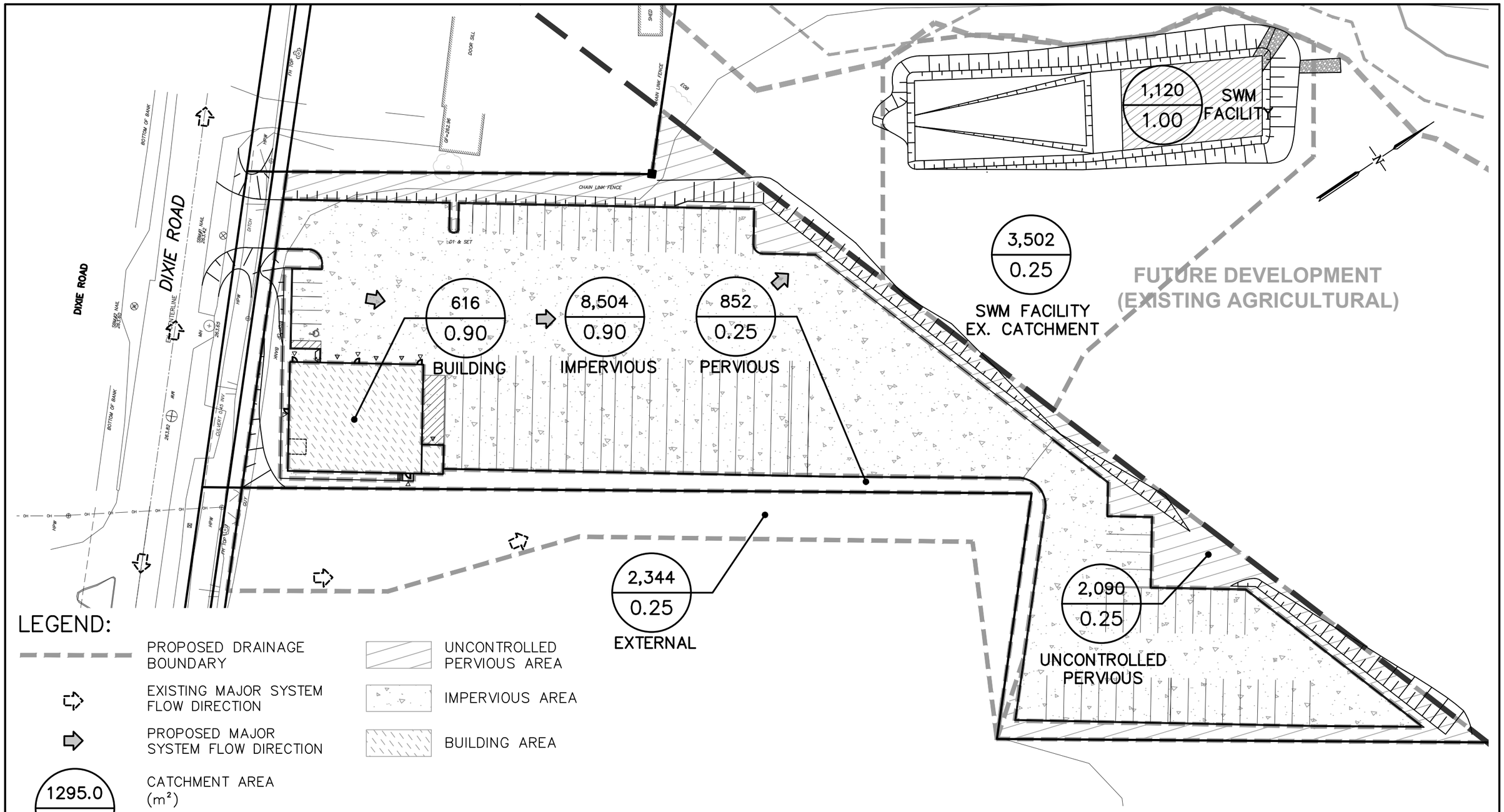

FIGURE 3

PROPOSED TRANSPORTATION DEPOT

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POST DEVELOPMENT DRAINAGE AREA PLAN

SCALE 1:750

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4.3 Native Soils Conditions and Water Table Elevations

The native soil generally comprises an average 150 topsoil layer underlain by a native sandy silt deposit (up to depths of 0.05 to 0.8mbgs). A sandy silt till to sandy clayey silt was encountered beneath the sandy silt and extending to the full exploration depth (4.5 to 6.0 mbgs), as described in the Small-Scale Hydrogeological Assessment (May 2023) by A & A Environmental Consultants Inc. Excerpts from this report have been included in **Appendix C**. Three (3) monitoring wells were installed on site at depths between 4.5 and 6.0 meters. Groundwater was observed in monitoring well MW-1, MW-2 and MW-3 at depths of 1.71 and 0.411 and 0.61 meters respectively, on January 13, 2023 after a 3 month period.

Based on literature the estimated coefficient of permeability for the native silt and clay material is 10^{-5} cm/sec. Using the correlation of hydraulic conductivity to percolation time presented in Appendix C of the CVC Low Impact Development Stormwater Management Planning and Design Guide, an infiltration rate for the native soils can be calculated as follows:

Hydraulic Conductivity = 6e-11 x (Infiltration Rate)$^{3.7363}$
Infiltration Rate = (HC / 6e-11)$^{1/3.7363}$
= (10^{-5} / 6e-11)$^{1/3.7363}$
= 30 mm/hr

Design Infiltration Rate = Measured Infiltration Rate / Safety Factor
= 30 mm/hr / 2.5
= 12 mm/hr

The design infiltration rate of 12 mm/hr is near the MECP recommended 15mm/hr for infiltration SWM facilities, and shall be used for LID sizing calculations, where applicable.

4.4 Flood Protection

As per the TRCA's Stormwater Management Criteria, the subject site falls within the Sub-Basin 36 of the Humber River watershed, and the formulas presented in Table E.1 shall be used. The 0.23 ha external drainage area shall be excluded from allowable release rate calculations to ensure the SWM control devices do not become oversized should the drainage patterns on the adjacent land be altered in the future. The 100-year allowable flow rate for the 14,716 sq.m (17,060 sq.m – 2,344 sq.m) total catchment area located within the property limits has been calculated below:

$Q_{100\text{-YR}}$ = [29.912 – 2.316ln(A)] x A
= [29.912 – 2.316ln(1.4716 ha)] x 1.4716 ha
= 29.02 L/s/ha x 1.4716 ha
= 42.7 L/s

The unitary flow rates for the 2-year to 100-year events have also been calculated using the provided formulas and are summarized below:

Return Period	Unit Flow Rate Equation	Unit Flow Rate
100-Year	Q= 29.912-2.316*ln(A) x A	**42.7 L/s**
50-Year	Q= 26.566-2.082*ln(A) x A	**37.9 L/s**
25-Year	Q= 22.639-1.741*ln(A) x A	**32.3 L/s**
10-Year	Q= 17.957-1.373*ln(A) x A	**25.6 L/s**
5-Year	Q= 14.652-1.136*ln(A) x A	**20.9 L/s**
2-Year	Q= 9.506-0.719*ln(A) x A	**13.6 L/s**

The 2-year existing release rates from the subject development has also been calculated below utilizing the Town of Caledon IDF curve (Guelph O.A.C) and a 30 minute time of concentration for comparison.

$I_{2\text{-YEAR}}$ $= 1070 / (t + 7.85)^{0.8759}$
$= 1070 / (30 + 7.85)^{0.8759}$
$= 44.4$ mm/hr

$Q_{2\text{-YR, PRE}}$ $= CIA / 3600$
$= 0.25 \times 44.4$ mm/hr $\times$ 14,716 sq.m / 3600
$= 45.4$ L/s

As with the unit flow rates, the 2-year to 100-year existing release rates, are also summarized below:

Return Period	Rainfall Intensity	Existing Peak Flow Rate
100-Year	115.3 mm/hr	**117.8 L/s**
50-Year	102.5 mm/hr	**104.7 L/s**
25-Year	90.4 mm/hr	**92.4 L/s**
10-Year	74.6 mm/hr	**76.2 L/s**
5-Year	60.9 mm/hr	**62.3 L/s**
2-Year	44.4 mm/hr	**45.4 L/s**

The catchment area must be controlled to no more than a peak release rate of 13.6 L/s under a 2-year storm event, and 42.7 L/s under a 100-year storm event in accordance with the TRCA's SWM criteria. The TRCA Unit Flow Rate criteria yield a lower peak flow rate for each design storm, and therefore meeting this criterion will satisfy the Town requirements as well.

Runoff from the site is to be collected by proposed catchbasins, and controlled by a proposed standpipe upstream of the proposed outfall. Detention storage will be provided on the surface above the proposed catchbasin tops for the required reduction is peak flow rates as discussed in the following sections.

4.4.1 SWM Detention Volumes

Detention storage volumes will be provided within a proposed flood protection pool of the dry pond component in the SWM facility. The Modified Rational Method has been utilized to determine the required stormwater detention volumes to satisfy the peak flow rate control criteria developed above. Refer to **Appendix D** - **Figure Nos. 4 to 10** for the 2-year through 100-year storm event calculations. Detention storage requirements to be provided as part of the proposed design are as follows:

Design Storm	TRCA Storage Requirement	Town of Caledon Storage Requirement	Provided Storage Volume
2-year	284.8 cu.m	200.2 cu.m	406.5 cu.m
5-year	403.7 cu.m	284.8 cu.m	520.7 cu.m
10-year	483.1 cu.m	345.3 cu.m	625.5 cu.m
25-year	590.6 cu.m	426.2 cu.m	696.0 cu.m
50-year	661.8 cu.m	483.5 cu.m	703.6 cu.m
100-year	743.7 cu.m	545.0 cu.m	748.3 cu.m

4.5 Stormwater Volume and Erosion Control

TRCA criteria require stormwater runoff from a 25mm rainfall event volume be captured and retained on site through infiltration, evapotranspiration, re-use, etc to the maximum extent practical with a minimum of 5mm. Any remaining volume from the 25mm event must be detained on site for a period of 48 hours. For the 11,769 sq.m development site the minimum required retention and detention volumes are calculated as follows:

25mm Erosion Control Volume = 11,769 sq.m x 25mm
= 294.2 cu.m

5mm Retention Volume = 11,769 sq.m x 5mm
= 58.8 cu.m

Any proposed infiltration features on site will be drastically constrained by the existing shallow groundwater table, believed to be within less than 1 meter of existing grade in the vicinity of the proposed SWM Facility as discussed in **Section 4.3**. Extended detention is proposed to be utilized per TRCA's erosion control criteria to overcome the sites reduced retention potential.

4.5.1 5mm Retention Strategy

Impervious surfaces, such as the building roof and asphalt parking, can be commonly considered to evaporate up to 20% of frequent rainfall events (rainfall events 5mm or less comprises roughly 50% of the average annual rainfall volume). The first 1mm (5mm x 20%) of rainfall onto impervious surfaces will be considered to evaporate as follows:

Impervious Surface Evaporation Volume	= Building Roof Area + Asphalt Parking x 1mm = (616 sq.m + 8,536 sq.m) x 1mm = 9.1 cu.m

Pervious surfaces, such as landscaping/ sod, are also considered to retain frequent rainfall events through evapotranspiration and infiltration. The additional retention volume provided from these surfaces is calculated as follows:

Pervious Surface Retention Volume	= Landscaped Area x 5mm = (942 sq.m + 1,675 sq.m) x 5mm = 13.1 cu.m

The initial abstraction volume available on site is thus calculated as 22.2 cu.m (9.1 cu.m + 13.1 cu.m). An additional 37.0 cu.m of stormwater retention is provided from the proposed infiltration basin (refer to **Section 4.6.3**). Therefore, a total of 59.2 cu.m (22.2 cu.m + 37.0 cu.m) will be retained on site to meet the 5mm criteria.

4.5.2 24 to 48 hour Extended Detention

The remaining runoff volume from a 25mm rainfall event which is not retained on site must be collected and controlled on site for a gradual release over a 48 hour period. The required extended detention volume has been calculated as 294.2 cu.m.

The falling head equation for a constant storage area (Equation 4.10 of the 2003 MOE Stormwater Planning and Design Manual), has been used to verify the extended detention criteria will be met based on the proposed SWM Facility geometry. Detailed calculations have been included in **Appendix E**, and concluded the proposed stand pipe must be made up of five (5) 25mm diameter orifices at an equal elevation to achieve a 46.3 hour extended detention period. To achieve the necessary volumes and draw down time the active storage within the SWM Pond facility must have a constant surface area of 1,120 sq.m at a total depth of 0.26m.

4.6 SWM Control Structure Sizing

The proposed SWM facility must provide the required 2-year through 100-year peak flow rate controls developed in **Section 4.3**, and 48 hour extended detention for the volume from the 25mm event per the volume reduction criteria developed in **Section 4.4**.

The stand pipe structure configuration necessary to achieve the extended detention criteria was found to limit the release rates below the 2-year allowable of 13.6 L/s, and a larger diameter orifice has been provided above the extended detention pool to achieve the flood protection criteria. An additional overland flow weir has been provided above the 10-year ponding elevation to allow larger storms to discharge at a higher rate. A stage storage discharge table (**Appendix E**) has been prepared to identify the total release rate from the SWM facility and associate water level during each design storm.

The extended detention pool will be provided within the bottom portion of the dry pond, between the elevations 259.20 and 259.46m. The bottom of the extended detention pool will start above the spring line of the five (5) 25mm diameter perforations on the proposed stand pipe.

The 2-year to 10-year storage will be provided below the overflow weir between the elevations 259.46 and 259.78m. The open top of the 125mm diameter standpipe will be installed at the elevation 259.50m and act as the secondary orifice.

The 25-year to 100-year storage will be provided above the overflow weir between the elevations 259.78m and 259.80m. The top of proposed SWM Facility berm shall be constructed to a minimum elevation 260.00m.

The stand pipe outlet will discharge to existing grade at an elevation of 258.28 and will be above the 100-year floodplain of the downstream watercourse, which is at an elevation of 256.03m.

4.7 Water Quality Control

Storm drainage for this site discharges to the natural environment via the SWM facility outlet to the West Humber River. A multi-component analysis has been developed for the proposed site to meet the TRCA and Town water quality objectives. The overall site shall provide an Enhanced Level (80% TSS Removal) of treatment per MECP criteria. Runoff from the proposed parking lot shall be pre-treated by an Oil Grit Separator to removal any spilled oils or grease, and to provide initial TSS removal. The proposed SWM Facility will provide final polishing via a sediment forebay and infiltration facility.

4.7.1 Oil Grit Separator

An Oil Grit Separator (OGS) has been proposed to treat stormwater runoff from the proposed storm sewer prior to discharge into the SWM Facility to ensure spilled oils or grease is adequately contained. A proposed FD-5HC OGS unit has been certified through ETV testing protocols to provide a TSS removal efficiency of 45% minimum and capture of >90% of annual runoff volumes. A detailed size report for this system has been included in **Appendix F**.

4.7.2 Forebay Pre-Treatment

A sediment forebay is proposed at the upstream end of the SWM facility to promote the settling of sediments, and reduce long-term maintenance requirements for the remainder of the SWM facility. The forebay will have a maximum permanent depth of 0.85 metres. The minimum recommended forebay length is calculated utilizing by determining the settling length per Equation 4.5 of the 2003 MOE Stormwater Planning and Design Manual. A 25mm design storm shall be considered for forebay sizing, the resulting rainfall intensity and peak flow rate determine utilizing Equation 4.9.

I_{25mm} = 43(C) + 5.9
= 43(0.65) + 5.9
= 33.9 mm.hr

Q_{25mm} = CIA / 3600
= 0.65 x 33.9 mm/hr x 17,060 sq.m / 3600
= 161 L/s

r = length-to-width ratio of forebay (minimum 2:1)
Q_p = peak flow rate from pond during design quality storm
V_s = particle settling velocity (recommended 0.0003 m/s)

Minimum Forebay Settling Distance = $\sqrt{rQ_p/V_s}$
= $(3 \times 0.161 / 0.0003)^{1/2}$
= 32.8 m

A total volume of the forebay has been design to accommodate 10-years of sediment accumulation based on the contributing drainage area and Table 6.3 of the 2003 MOE Stormwater Planning and Design Manual. For the contributing drainage area with an overall imperviousness of 60.2% the forebay will accumulate and annual loading of 2.2 cu.m/ ha. Thus, total forebay volume of 37.4 cu.m (2.2 cu.m/ha x 1.7 ha x 10 yrs), is required.

The proposed forebay geometry will be 33m long, 0.85m deep with a top and bottom width of 16m and 4m, respectively, and the available volume is calculated below:

Forebay Volume = [(4m + 16m)/2] x 0.85m /2 x 33m
= 140 cu.m

Therefore, to proposed forebay will provide more than adequate settling length and volume to provide the necessary pre-treatment to the SWM facility.

4.7.3 Infiltration Basin

The proposed infiltration basin has been designed to reduce the flow of sediment latent runoff from the site to achieve 80% TSS removal from captured stormwater runoff. The water quality storage requirements have for the proposed facility have been determined utilizing Table 3.2 of the MOE Stormwater Planning and Design Manual (2003). For the 1.7 ha contributing drainage area with an overall imperviousness of 60.2% the infiltration basin can provide 70% TSS removal if 21.7 cu.m/ha of storage is provided. The provided infiltration basin must have a volume of 36.9 cu.m (21.7 cu.m/ha x 1.70 ha).

To achieve the desired water quality objectives the infiltration facility will be filled with 150mm deep layer of 50mm clear stone beneath a 100mm deep sand filter layer. The total volume of the 528 sq.m infiltration facility is calculated below:

Infiltration Basin Storage Volume = (Clear Stone Depth x Void Ratio + Sand Filter Depth x Void Ratio)
…x Infiltration Basin Footprint
= (150mm x 0.40 + 100mm x 0.10) x 528 sq.m
= 37.0 cu.m

The draw down time and footprint of the infiltration basin have also been checked to verify the facility will operate as intended.

P = infiltration rate (mm/hr), t = draw down time (hrs), V = Retention volume (m^3) n = void ratio

Equation 4.2 depth = Pt
= 12 mm/hr x 20.8 hr
= 250 mm

Equation 4.3 Area = 1000V / (Pnt),
= 1000 x 36.9 / (12 x 0.28 x 24)
= 458 sq.m

Therefore, the proposed 250mm deep and 528 sq.m infiltration basin will infiltrate the full 36.9 cu.m within a 20.8 hour period. The infiltration basin will be provided beneath the extended detention pool between the elevations 258.95 and 259.20m.

The observed seasonal high water table elevation in the vicinity of the SWM Facility was recorded as 258.60masl. Due to constraints to maintain the existing grade on site, further raising the bottom of the facility to provide additional vertical separation above the water table is not feasible.

4.7.4 Suspended Solids Removal

The combined TSS removal rate for two features which operate in series (R = A + B – (A x B)), has been utilized in to determine the net TSS removal efficiency of the site and verify the net 80% TSS removal criteria will be met for the proposed development.

Water Quality Device	TSS Removal Efficiency	Notes
Oil Grit Separator	45%	per ETV Certification
Infiltration Basin	70%	per MOE Table 3.2
Net TSS Removal	83.5%	

The proposed treatment train for the site will provide an 83.5% reduction is the annual post-development sediment loading.

4.7.5 Construction Phase Erosion and Sediment Control

A temporary silt fence as per OPSD 219.130 is to be installed along all property lines where there is a risk of sediment runoff onto the adjacent property during construction. Double row silt fence shall be provided along the limits of the development site where runoff may discharge directly to the watercourse. This fencing shall be installed prior to site grading and shall be maintained throughout the construction period. A mud mat per Town standards shall be constructed at the onset of the works at proposed site entrance to prevent sediment from being tracked onto the street, and street sweeping shall be carried out as necessary. A concrete washout station shall be set up by the contractor to manage waste water from the cleaning of tools and equipment

Temporary interceptor swales (complete with sock check dams) are to be used to capture and convey runoff from the destabilized site into sediment basins (sized to provide 125 cu.m/ha settling storage volume). The complete erosion control plan has been illustrated on Dwg. **22011-ESC1**, and shall be inspected and maintained until all exposed soil is stabilized on the site.

4.8 Water Balance Analysis

4.8.1 Pre-Development Conditions

The existing level of groundwater recharge for the proposed 11,769 sq.m development area has been estimated using the model presented in the Ministry of the Environment's (MOE), Stormwater Management Planning and Design Manual (2003), and calibrated for rainfall data from the Bowmanville Mostert weather station and local ground cover.

Station Information: Orangeville MOE, Ontario								
Latitude:	43°55'06 N	**Longitude:**	80°05'11 W		**Elevation:**	411.50 m		
Climate ID:	6155790	**WMO ID:**			**TC ID:**			
Average Annual Precipitation			901.5 mm					
Annual Events > 5mm	57	**Annual Events 0 – 5mm**	94		**Total Annual Events**	151		

The Thornthwaite-Mather methodology has been applied to determine the potential evapotranspiration, infiltration and runoff from the site, considering the local climate and land use types. To determine the developments effects on the water balance pre- and post- development models have been prepared with the following consideration:

- The pre- and post-development topography of pervious areas is flat at an average 2-4% slope;
- The native soil underlying the site are understood to be predominately a silt and clay till material of decent drainage qualities. In-situ soils investigations completed are further discussed in **Section 4.3;**
- The land use type of the site considered cultivated; and,
- Impervious areas will contribute no infiltration, and be subject to a 20% evaporation factor.

Hydrological cycle component values used to calculate the pre- and post-development water balance are summarized below. Detailed calculations of each value are included in **Appendix G**.

Hydrological Cycle Component Values	Precipitation	Evapo-transpiration	Runoff	Infiltration
Pre/Post-Development Pervious Surfaces	901.6	472.3	171.7	257.6
Impervious Surfaces (Buildings, Driveway, etc.)	901.6	180.3	721.3	0.0

The average annual pre-development infiltration loss is then calculated as:

Pre-Development Infiltration = Pervious Area x Average Annual Infiltration Depth
= 11,769 sq.m x 0.2576 m
= 3,032 cu.m

Post-Development Infiltration = Pervious Area x Average Annual Infiltration Depth
= 2,617 sq.m x 0.2576 m
= 674 cu.m

Infiltration Deficit = 3,032 cu.m – 674 cu.m
= 2,357 cu.m/ year

Therefore, the infiltration deficit volume of 2,357 cu.m per year must be restored in the post-development scenario through Low Impact Development (LID) techniques. To offset the reduction in infiltration levels, an infiltration trench is proposed within the SWM facility. This feature will allow stormwater runoff from frequent storm events to infiltrate into the ground surface to mitigate the impacts to the annual water balance.

4.8.2 Mitigation Plan

The available volume of from impervious surface towards the SWM facility has been calculated below, considering the total pavement and building area of 9,152 sq.m is captured and conveyed to the facility via the storm sewer system.

Runoff Available for Infiltration = [Total Impervious Area x Annual Rainfall Depth x Evaporation Factor]
= [9,152 sq.m x 0.9016m x 0.80]
= 6,601 cu.m / yr

By capturing and infiltrating 36% (2,357 cu.m / 6,601 cu.m) of this net surplus, the infiltration deficit for the site will be sufficiently offset. A 2.5mm rainfall event is consider approximately 36% of average annual rainfall (based on the Percentage of Rainfall VS Daily Rainfall Depth relationship for the Toronto area), and will meet this criterion. Therefore, to ensure sufficient retention storage within the SWM facility, a retention volume of 22.9 cu.m (9,152 sq.m x 0.0025m), must be provided.

The proposed infiltration trench within the SWM Facility has a retention volume of 37 cu.m and will be adequate to meet the groundwater recharge criteria.

4.9 Catchbasin Inlet Capacity Analysis

The inlet capacity of the proposed catchbasin frames has been analyzed during a 100-year storm event based on the typical OPSD 400.020 configuration (0.121 sq.m inlet area), and assuming 50% of the inlet area is blocked to ensure the proposed storm sewer system can adequately capture and convey runoff to the SWM Facility. The maximum ponding depths overtop each catchbasin are summarized below based on the contributing drainage area.

Structure ID	Drainage Area (sq.m)	100-year Peak Flow Rate (L/s)	Maximum Ponding Depth (cm)	50% Blockage Depth (cm)
CB1	108	6	0.0	0.1
CB2	1,234	67	3.9	15.4
DCB3	1,590	87	1.6	6.4
DCB4	3,050	166	5.9	23.6
CBMH1	740	40	1.4	5.5
CBMH2	840	46	1.8	7.1
CB5	980	53	2.4	9.7

4.10 Inspection & Maintenance

It is encouraged that emergent species of vegetation (tall grasses which can withstand prolonged wet periods) be incorporated within the SWM facility, to increase survivability and reduce the need for regular trimming. Vegetation density should be maintained at a minimum of 80% coverage and replanted as necessary. Regular watering may be required during the first two years to establish the desired vegetation coverage.

The owner is to carry out annual inspections of the SWM facilities (during the early spring or late fall), for erosion or accumulated sediment and debris. Removal of sediment, regrading and replanting is to occur during a dry period immediately in any areas which are observed to be inundated with sediment (accumulated depth greater than 100mm). Cleaning of the sediment forebay is recommended when the depth of accumulated sediment results in a forebay depth below 0.5m.

Inspection of the outlet weir and standpipe should also be completed at the same time for blockage or obstructions. Additional inspections of all facilities should be carried out following periods of intense rainfall (>25mm in 24 hours). Signs of erosion are to be repaired with appropriate measures (such as rip-rap or replanting), during a dry period immediately upon being observed.

The infiltration basin sub-drain should be inspected from the provided clean-outs for accumulated sediment and flushed via hydro-vacuum truck if depth of sediment greater then 25mm are observed. A maintenance valve connecting the infiltration basin sub-drain to the SWM facility outlet has been provided to help facilitate draining the pond during maintenance activities. The valve should be kept in the closed position during normal operating conditions.

Vehicle and equipment access to the SWM facility can be provided through the proposed curb depression. A temporary mud-mat and access road can be constructed between the asphalt surface and work area to use of permit heavy equipment and prevent sediment tracking off-site as required. Future work within the SWM facility needs to be pre-approved and permitted by TRCA, and all site conditions should be returned to the approved conditions upon completion.

5.0 CLOSURE

The proposed Stormwater Management Plan demonstrates that the development will meet the established criteria with respect to stormwater management set forth in governing documents. The SWM facility will control the release rate to the existing levels for all storms up to and including the 100-year event. On-site stormwater detention storage has been provided up to a quantity of 748.3 cu.m in order to facilitate the proposed SWM controls, included peak flow control and 24 hour extended detention of the first 25mm of any rainfall event. Water quality control is to be primarily provided by the infiltration basin which receives runoff from the proposed impervious surfaces, and will be augmented by an oil grit separator for spill protection. Water balance criteria will be achieved through infiltration which occurs within the infiltration basin of the SWM facility.

The existing municipal water supply will be utilized to provide domestic and fire water servicing to the proposed building. A proposed sanitary service connection to existing municipal infrastructure constructed to address sanitary wastewater generated from the development.

In conclusion, the proposed servicing and stormwater management plan demonstrates that the development will meet the established criteria set forth in governing documents and the sufficient infrastructure will be provided to support the site.

Please do not hesitate to contact us with any questions pertaining to the enclosed.

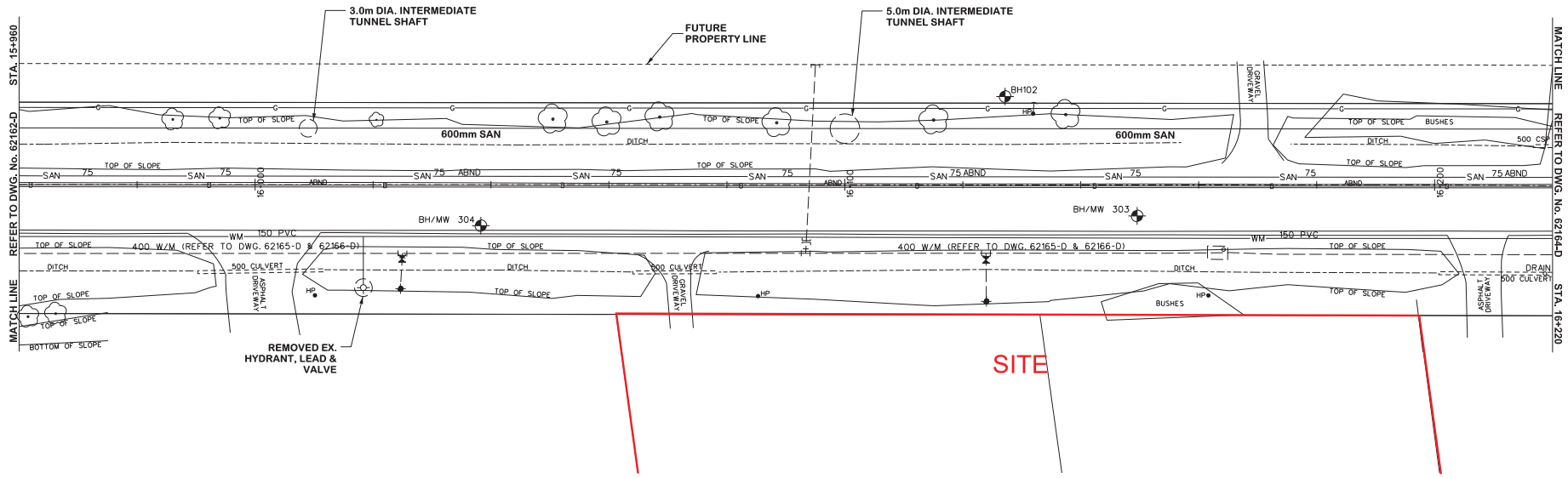
Yours truly,

Urban Watershed Group Limited

Appendix A

Record Drawings for Dixie Road

DIXIE ROAD



THIS DRAWING TO BE USED FOR SANITARY SEWER RECORDS ONLY

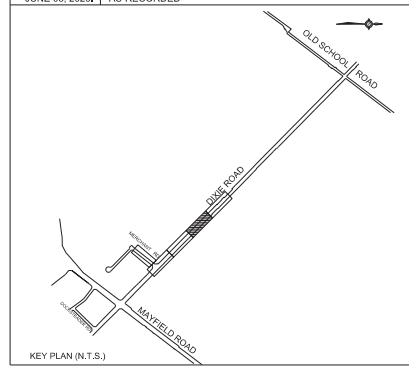
THIS DRAWING HAS BEEN REVISED BY THE ENGINEER BASED ON AS-RECORDED INFORMATION PROVIDED BY THE INSPECTOR. THE ENGINEER DOES NOT IN ANY WAY REPRESENT OR WARRANT THAT SUCH INFORMATION PROVIDED BY THE INSPECTOR IS ACCURATE AND THE ENGINEER ASSUMES NO RESPONSIBILITY FOR ANY ERRORS OR OMISSIONS CONTAINED THEREIN.

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS	SEPT. 1, 16	A.M.	GAS MAINS	SEPT. 1, 16	A.M.
STORM SEWERS	SEPT. 1, 16	A.M.	BELL U/G CABLE	SEPT. 1, 16	A.M.
WATERMAINS	SEPT. 1, 16	A.M.	HYDRO U/G CABLE	SEPT. 1, 16	A.M.
TRANSIT			HYDRO ONE	SEPT. 1, 16	A.M.
PARKS & REC.			CTV	SEPT. 1, 16	A.M.
ONT. CLEAN WATER			COMMUNIC. CABLES	SEPT. 1, 16	A.M.

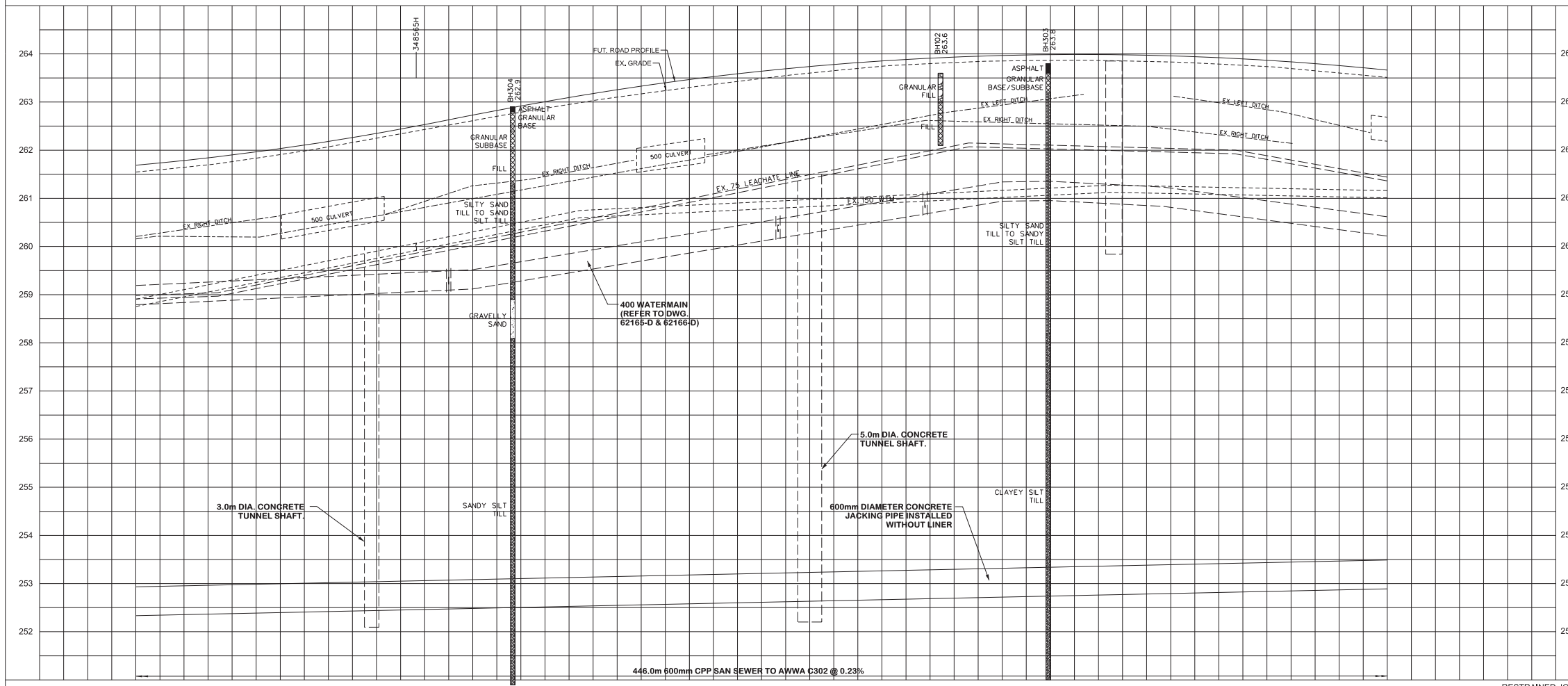
REVISIONS

DATE	DETAILS	INIT.
SEPT. 01, 2017.	ISSUED FOR TENDER	C.S.
SEPT. 22, 2017.	REV. 1, SANITARY SEWER-ADDENDUM 4	C.S.
NOV. 17, 2017.	ISSUED FOR CONSTRUCTION	C.S.
JUNE 05, 2020.	AS-RECORDED	A.M.



NOTES:

1. FOR GENERAL NOTES, DETAILS AND LEGEND SEE DWG. 62158-D



RESTRAINED JOINTS														
BOT.EL. OF WM.	261.50	261.71	261.99	262.34	262.70	263.01	263.28	263.52	263.69	263.78	263.77	263.71	263.59	263.45
EX. ROAD ELEV.														
ROAD CHAINAGE	15+960	15+980	16+000	16+020	16+040	16+060	16+080	16+100	16+120	16+140	16+160	16+180	16+200	16+220

Stantec

General Notes

All Driveways Are ASPHALT Unless Otherwise Noted
All Water And Sanitary Service Locations Are Approximate And Must Be Located Accurately In The Field
All Horizontal And Vertical Bends Are In Degrees
All Pipes Size In mm
20C Existing Water Service, Size In mm
WS20 Proposed Water Service, Size In mm
B.M. No. Elev.
Description
Location

The Contractor Is Responsible For Locating And Protecting All Existing Utilities Prior To And During Construction. Location Of Existing Utilities Approximate Only, To Be Verified In Field By Contractor.

Designed by
Chkd.
Approved by

NOTICE TO CONTRACTOR

48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING

THE REGIONAL MUNICIPALITY OF PEEL
CITY OF MISSISSAUGA WORKS DEPT.
CITY OF BRAMPTON WORKS DEPT.
TOWN OF CALEDON WORKS DEPT.
BELL CANADA
ENBRIDGE INCORPORATED-GAS DISTRIBUTION
ONTARIO MINISTRY OF TRANSPORTATION
ONTARIO CLEAN WATER AGENCY
HYDRO ONE NETWORKS
ENERSOURCE, HYDRO MISSISSAUGA
HYDRO ONE BRAMPTON

CABLE TELEVISION/FIBREOPTIC PROVIDERS:
BELL CANADA
ENERSOURCE TELECOM
HYDRO ONE TELECOM
ROGERS CABLE
ALLSTREAM
PSN (PUBLIC SECTOR NETWORK)
FUTUREWAY (FCI BROADBAND)

10m 0 10 20 30m — HORIZONTAL SCALE
1m 0 1 2 3m — VERTICAL SCALE

Region of Peel
Working for you

DIXIE ROAD

(MERCHANT ROAD TO 1.3 KM NORTH OF MAYFIELD ROAD)

400mm WATERMAIN AND 600mm SANITARY SEWER

STA. 15+960 TO STA. 16+220

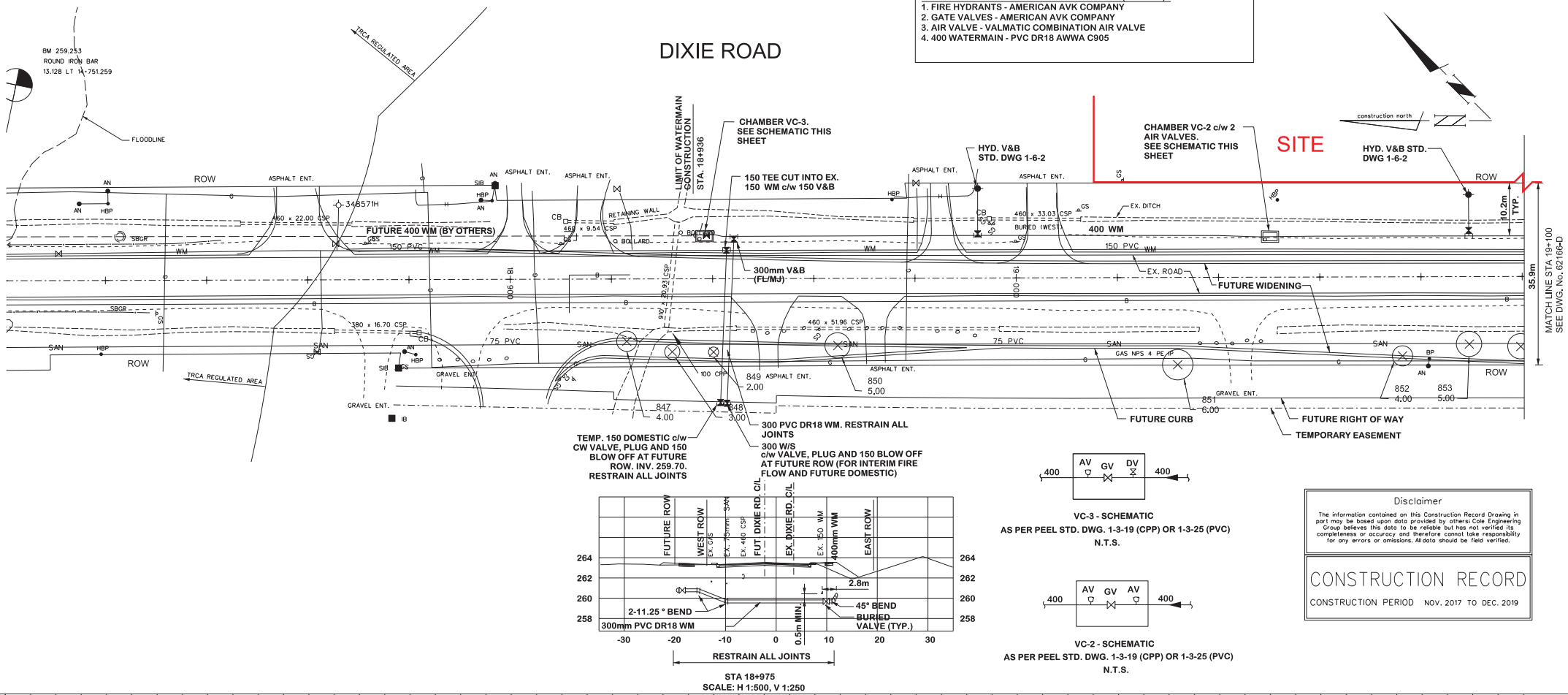
CAD Area		Area	C-06
Checked by	C.S.	Drawn by	D.P.
Date	NOV. 17, 2017.	Sheet	7 of 34

Project No. 12-1183, 13-1392, 11-2101

Plan No. **62163-D**

DIXIE ROAD

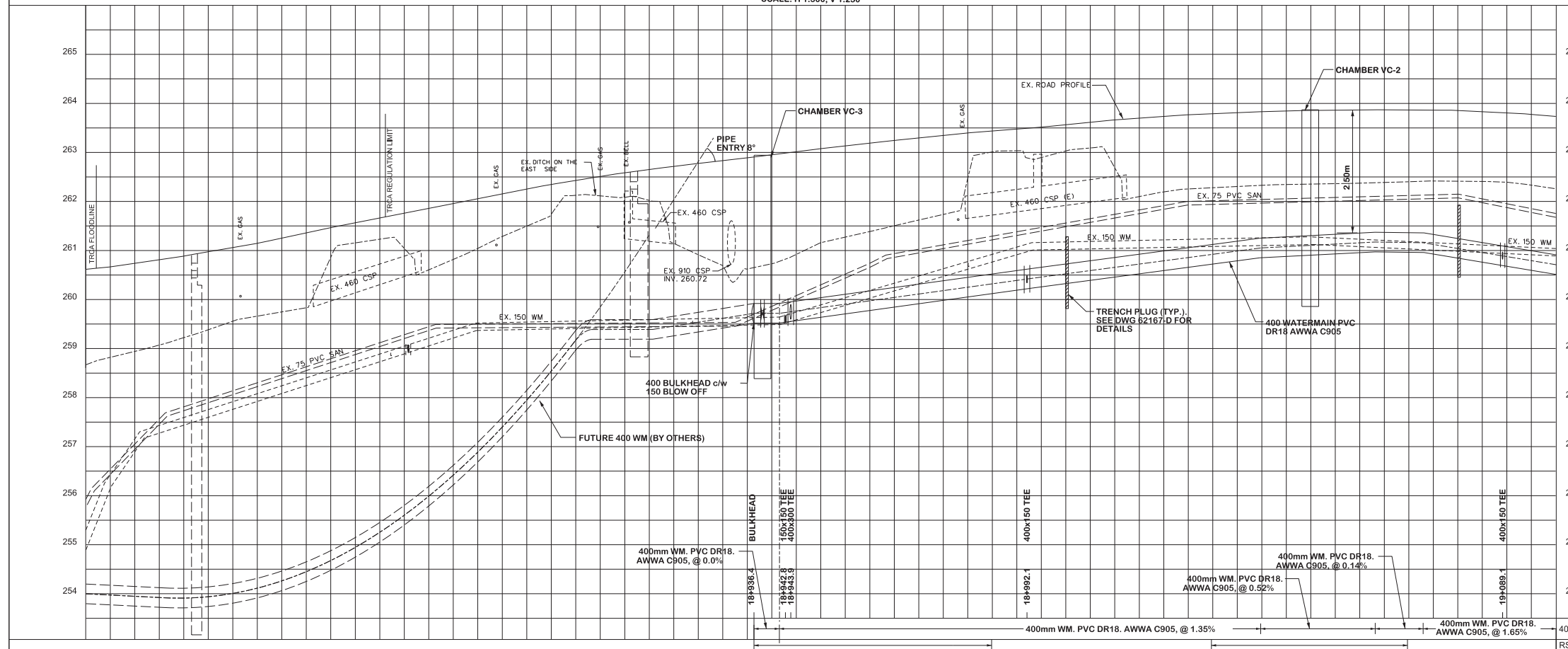
SPECIFICATION FOR HYDRANTS AND VALVES (TYPICAL):
1. FIRE HYDRANTS - AMERICAN AVK COMPANY
2. GATE VALVES - AMERICAN AVK COMPANY
3. AIR VALVE - VALMATIC COMBINATION AIR VALVE
4. 400 WATERMAIN - PVC DR18 AWWA C905



STA 18+975
SCALE: H 1:500, V 1:250

VC-3 - SCHEMATIC
AS PER PEEL STD. DWG. 1-3-19 (CPP) OR 1-3-25 (PVC)
N.T.S.

VC-2 - SCHEMATIC
AS PER PEEL STD. DWG. 1-3-19 (CPP) OR 1-3-25 (PVC)
N.T.S.

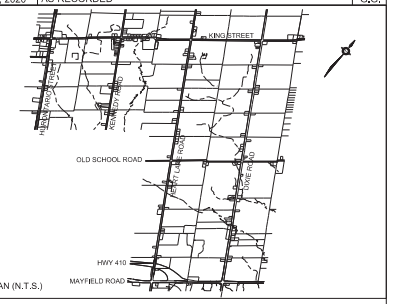


SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS	MAY 27, 13	H.K.	GAS MAINS	APRIL 18, 13	H.K.
STORM SEWERS	MAY 27, 13	H.K.	BELL U/G CABLE	APRIL 26, 13	H.K.
WATERMAINS	MAY 27, 13	H.K.	HYDRO U/G CABLE	MAY 15, 13	H.K.
TRANSIT	-	-	HYDRO ONE	APRIL 17, 13	H.K.
PARKS & REC.	-	-	CTV	APRIL 12, 13	H.K.
ONT. CLEAN WATER	-	-	COMMUNIC. CABLES	MAY 15, 13	H.K.

REVISIONS

DATE	DETAILS	INIT.
FEB 23, 2017	ISSUED FOR 90% REVIEW	K.A.
AUG. 30, 2017	ISSUED FOR TENDER	K.A.
NOV. 22, 2017	ISSUED FOR CONSTRUCTION	K.A.
JULY 24, 2020	AS-RECORDED	G.G.



KEY PLAN (N.T.S.)

LEGEND:

- PROPOSED WATERMAIN
- EXISTING TREE WITH NUMBER AND DRIP LINE DIAMETER (m)
- PROP. GATE VALVE WITH VALVE STEM EXTENSION IN VALVE BOX (PER STD. 1-3-8)
- PROP. HYDRANT

Disclaimer

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CONSTRUCTION RECORD
CONSTRUCTION PERIOD NOV. 2017 TO DEC. 2019

PRESSURE RATINGS psi/kPa & PIPE CLASS	
CONDITION	400 PVC
WORKING	100/689
TEST	150/1034
SURGE+WORKING	150/1034
DR18 PIPE CLASS	235

COLE

GENERAL NOTES

1. REFER TO DRAWING No. 62158-D FOR GENERAL NOTES.
2. BEDDING, SURROUND AND BACKFILL SHALL BE AS DETAILED ON DRAWING No. 62178-D.
3. RESTORATION SHALL BE IN ACCORDANCE WITH DRAWING No. 62158-D.
4. ALL HORIZONTAL AND VERTICAL BENDS ARE IN DEGREES.
5. ALL PIPE SIZES IN mm.

B.M. No. Elev.
Description
Location

The Contractor Is Responsible For Locating And Protecting All Existing Utilities Prior To And During Construction, Location Of Existing Utilities Approximate Only, To Be Verified In Field By Contractor.

Designed by Chkd.
Approved by

NOTICE TO CONTRACTOR

48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING

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TOWN OF CALEDON WORKS DEPT.
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ENBRIDGE INCORPORATED-GAS DISTRIBUTION
ONTARIO MINISTRY OF TRANSPORTATION
ONTARIO CLEAN WATER AGENCY
HYDRO ONE NETWORKS
ENERSOURCE, HYDRO MISSISSAUGA
HYDRO ONE BRAMPTON

CABLE TELEVISION/FIBREOPTIC PROVIDERS:
ENERSOURCE TELECOM
HYDRO ONE TELECOM
ROGERS CABLE
ALLSTREAM
PSN (PUBLIC SECTOR NETWORK)
FUTUREWAY (FCI BROADBAND)

10m 0 10 20 30m HORIZONTAL SCALE 1:500
1m 0 1 2 3m VERTICAL SCALE 1:50

Region of Peel
Working for you

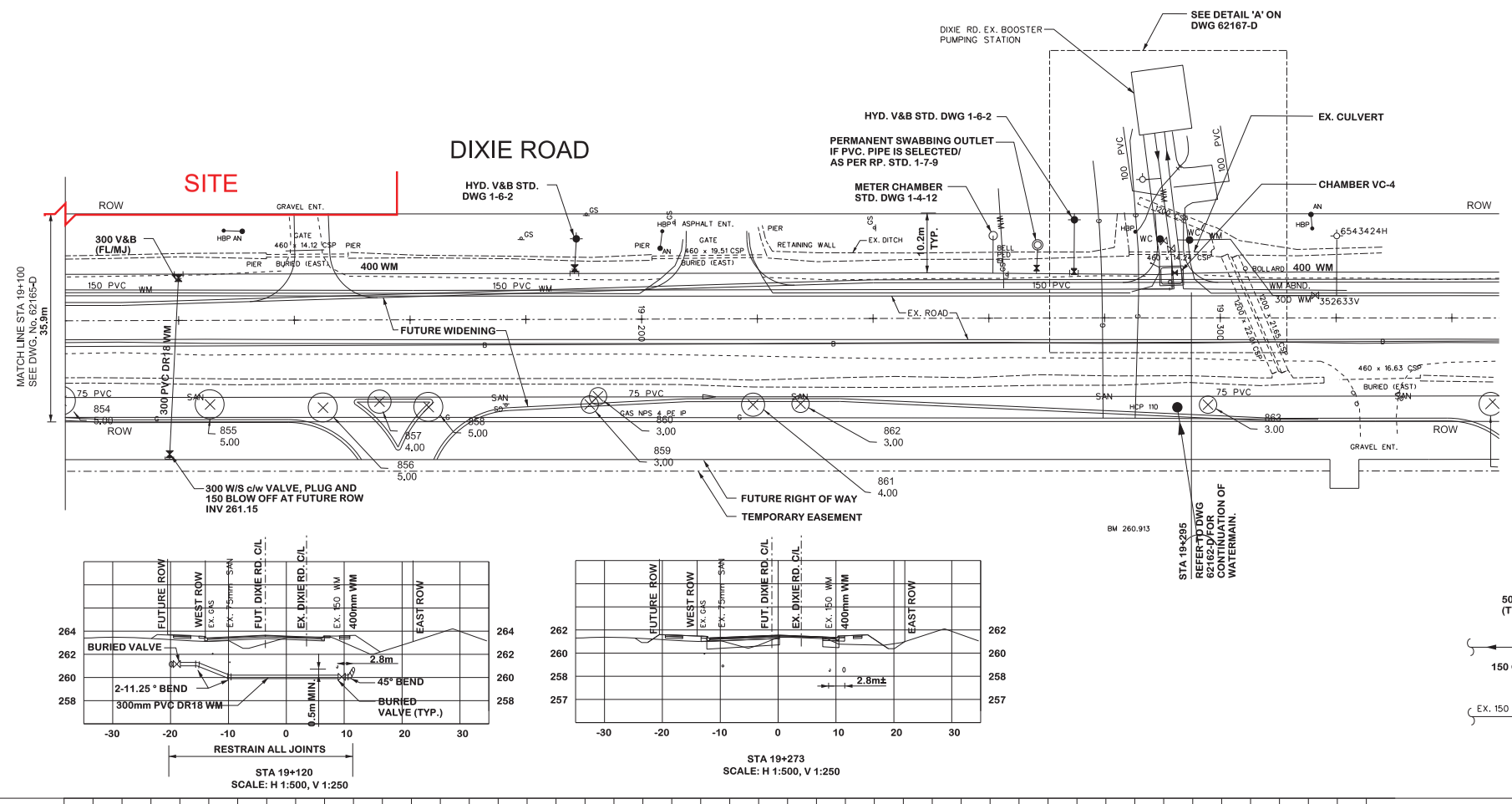
VICTORIA FEEDERMAIN - CONTRACT 4

DIXIE ROAD

400mm DISTRIBUTION WATERMAIN

STA 18+936 TO STA 19+100

CAD Area	Area - C06	Project No.	13-1392
Checked by A.M.	Drawn by H.K.		
Date FEBRUARY 2015	Sheet 9 of 34	Plan No.	62165-D



SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
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WATERMAINS	MAY 27, 13	H.K.	HYDRO U/G CABLE	MAY 15, 13	H.K.
TRANSIT	-	-	HYDRO ONE	APRIL 17, 13	H.K.
PARKS & REC.	-	-	CTV	APRIL 12, 13	H.K.
ONT. CLEAN WATER	-	-	COMMUNIC. CABLES	MAY 15, 13	H.K.

REVISIONS

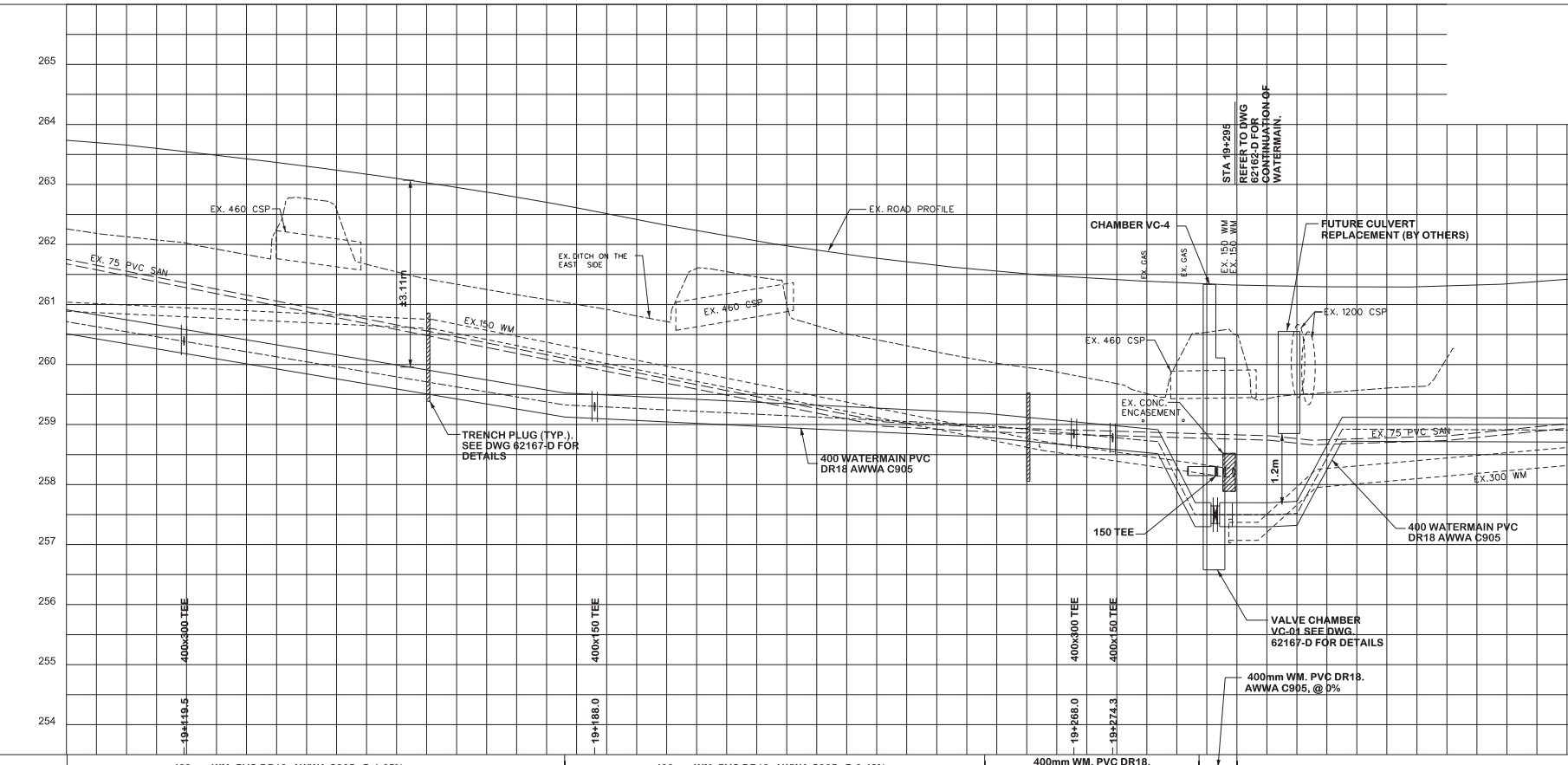
DATE	DETAILS	INIT.
FEB 23, 2017	ISSUED FOR 90% REVIEW	K.A.
AUG. 30, 2017	ISSUED FOR TENDER	K.A.
NOV. 22, 2017	ISSUED FOR CONSTRUCTION	K.A.
JULY 24, 2020	AS-RECORDED	G.G.

LEGEND:

- PROPOSED WATERMAIN
- EXISTING TREE WITH NUMBER AND DRIP LINE DIAMETER (m)
- PROP. GATE VALVE WITH VALVE STEM EXTENSION IN VALVE BOX (PER STD. 1-3-8)
- PROP. HYDRANT

PRESSURE RATINGS psi/kPa & PIPE CLASS	
CONDITION	400 PVC
WORKING	100/689
TEST	150/1034
SURGE+WORKING	150/1034
DR18 PIPE CLASS	235

COLE



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CONSTRUCTION RECORD

CONSTRUCTION PERIOD NOV. 2017 TO DEC. 2019

GENERAL NOTES

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2. BEDDING, SURROUND AND BACKFILL SHALL BE AS DETAILED ON DRAWING No. 62178-D.
3. RESTORATION SHALL BE IN ACCORDANCE WITH DRAWING No. 62158-D.
4. ALL HORIZONTAL AND VERTICAL BENDS ARE IN DEGREES.
5. ALL PIPE SIZES IN mm.

B.M. No. Elev.
Description
Location

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Designed by — Chkd. —

Approved by

NOTICE TO CONTRACTOR

48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING

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CITY OF MISSISSAUGA WORKS DEPT.
CITY OF BRAMPTON WORKS DEPT.
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ONTARIO MINISTRY OF TRANSPORTATION
ONTARIO CLEAN WATER AGENCY
HYDRO ONE NETWORKS
ENERSOURCE, HYDRO MISSISSAUGA
HYDRO ONE BRAMPTON

CABLE TELEVISION/FIBREOPTIC PROVIDERS:
ENERSOURCE TELECOM
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ALLSTREAM
PSN (PUBLIC SECTOR NETWORK)
FUTUREWAY (FCI BROADBAND)

10m 0 10 20 30m — HORIZONTAL SCALE 1:500
1m 0 1 2 3m — VERTICAL SCALE 1:50

Region of Peel
Working for you

VICTORIA FEEDERMAIN - CONTRACT 4
400mm DISTRIBUTION WATERMAIN
DIXIE ROAD
400mm DISTRIBUTION WATERMAIN
STA 19+100 TO STA 19+295

CAD Area	Area - C06	Project No.	13-1392
Checked by A.M.	Drawn by H.K.		
Date FEBRUARY 2015	Sheet 10 of 34	Plan No.	62166-D

Appendix B

Connection Demand Table

Connection Demand Table

WATER CONNECTION

Connection point [3]			
12363 Dixie Road			
Pressure zone of connection point		Pressure Zone 7	
Total equivalent population to be serviced [1]		59 (50 cap/ha)	
Total lands to be serviced		1.17 ha	
Hydrant flow test			
Hydrant flow test location			
TBD			
	Pressure (kPa)	Flow (in l/s)	Time
Minimum water pressure	TBD	TBD	TBD
Maximum water pressure	TBD	TBD	TBD

No.	Water demands		
	Demand type	**Demand**	**Units**
1	Average day flow	0.205	l/s
2	Maximum day flow	0.287	l/s
3	Peak hour flow	0.615	l/s
4	Fire flow [2]	70.91	l/s
Analysis			
5	Maximum day plus fire flow	71.197	l/s

WASTEWATER CONNECTION

Connection point [4]		150mm PVC
Total equivalent population to be serviced [1]		96
Total lands to be serviced		1.17 ha
6	Wastewater sewer effluent (in l/s)	1.061 l/s

[1] Please refer to design criteria for population equivencies

[2] Please reference the Fire Underwriters Survey Document

[3] Please specify the connection point ID

[4] Please specify the connection point (wastewater line or manhole ID)
Also, the "total equivalent popopulation to be serviced" and the "total lands to be serviced" should reference the connection point. (The FSR should contain one copy of Site Servicing Plan)

Please include the graphs associated with the hydrant flow test information table
Please provide Professional Engineer's signature and stamp on the demand table
All required calculations must be submitted with the demand table submission.

WATER SUPPLY FOR PUBLIC FIRE PROTECTION - 1999
FIRE UNDERWRITERS SURVEY

Job No.: 22011
Date: 12/05/2023

DIXIE TRANSPORT DEPOT – PROPOSED INDUSTRIAL BUILDING

1. Required Fire Flow Calculation

F=220C(A)^0.5

F= the required fire flow in litres per minute
C= coefficient related to the type of construction
= 1.5 for wood frame construction (structure essentially all combustible)
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls)
= 0.6 for fire resistive construction (fully protected frame, floors, roof)
A= the total floor area in square metres in the buidling being considered

F= 5968 l/min

Type of Construction = Both
C= 1.0

Total GFA = 736 m²

2. Determine if occupancy type has a low contents fire hazard or high contents fire hazard.

Contents Classification	
1) Non-Combustible	-25%
2) Limited Combustible	-15%
3) Combustible	0%
4) Free Burning	15%
5) Rapid Burning	25%

F= 6863 l/min

Repair Garage Occupancy is Considered High Fire Hazard

0	0%
0	0%
0	0%
1	15%
0	0%
Total	15%

3. Automatic Sprinkler Protection Reduction

Sprinkler Reduction Ratings	
1) Sprinkler System Conforms to NFPA 13 and other NFPA Sprinkler Standards	-30%
2) Water supply standard for both the sprinkler system and fire department hose lines	-10%
3) Fully supervised sprinkler system	-5%

F= -3088 l/min

Sprinkler Reduction Ratings - Building is Sprinklered

1	-30%
1	-10%
1	-5%
Total	-45%

4. Exposure to adjacent buildings

Separation	Charge
1) 0 to 3.0m	25%
2) 3.1 to 10.0m	20%
3) 10.1 to 20.0m	15%
4) 20.1 to 30.0m	10%
5) 30.1 to 45.0m	5%

The total % shall be the sum of the % of all sides but shall not exceed 75%.

F= 343 l/min

Number of Walls within Exposure Limits

0	0%
0	0%
0	0%
0	0%
1	5%
Total	5%

THEREFORE TOTAL FIRE FLOW REQUIRED = 4255 l/min
or 70.91 l/s

Appendix C

Hydrogeological Report Excerpts

Figure 5 – Groundwater Contour Map

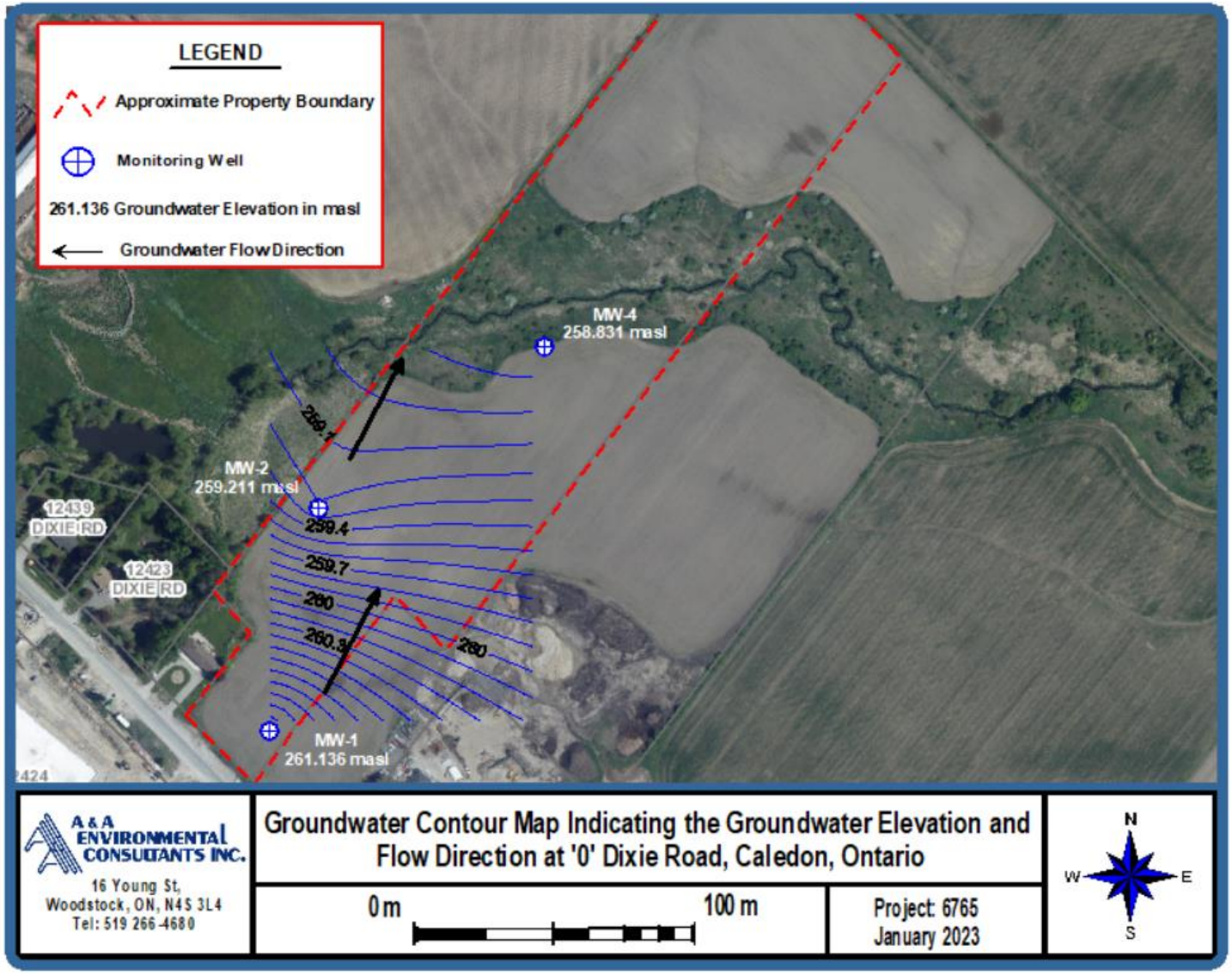


table level tape. The total depth of each well was measured and recorded. The groundwater elevations are shown in the well logs (see Tables 1-2 below). These show the highest elevation near MW-1 near the south end of the site and the lowest at MW-4 near the middle of the subject site.

Groundwater flow direction was determined using the groundwater elevation on site from the January 13, 2023 groundwater monitoring event.

Table 1 – Monitoring Well Details January 13, 2023

Project #6765-Gill Caledon 0' Dixie Road, Caledon, Ontario			
Date Logged: January 13, 2023	**Logged by: J. Osborne**		
Monitoring Well #	**MW-1**	**MW-2**	**MW-4**
Location	Southeast Area of Subject Site	Northeast Area of the Subject Site	North Middle Area of the Subject Site
Pipe Size (mm)	51	30.5	30.5
UTM Zone	17T	17T	17T
Easting	596423	596428	596603
Northing	4847045	4847184	4847276
Top of Pipe (masl)	262.849	259.622	259.437
Water Level (m)	1.713	0.411	0.606
Water Level (masl)	261.136	259.211	258.831
Total Depth (m)	6.548	4.964	6.728
BM = 264.00 masl, Ground surface near Fire Hydrant, South Corner of Subject Site			

Table 2 – Groundwater Monitoring Program Levels

Monitoring Well	**Elevation (masl)**	**Groundwater Elevations (masl)**					
		22-Oct-22	**10-Nov-22**	**02-Dec-22**	**16-Dec-22**	**29-Dec-22**	**13-Jan-23**
MW-1	262.849	258.715	258.835	258.910	259.055	259.114	261.136
MW-2	259.622	258.187	258.243	258.271	258.714	258.864	259.211
MW-4	259.437	258.034	258.309	258.361	258.632	258.594	258.831

The seasonal change in groundwater hydraulic gradient due to rainfall and spring runoff have a significant influence on the groundwater flow velocities. The groundwater flow velocities were calculated using a hydraulic gradient of 0.0136 m/m (MW-1 to MW-4), using January 13, 2023 groundwater elevation and the hydraulic conductivity of 1 x 10^{-5} cm/s for silt and clay materials,

PROJECT: Geotech/hydroGeo	**BH LOCATION:** Within industrial building footprint	**BOREHOLE NO: BH/MW1**
PROJECT NO: 6765	**LOCATION:** 0 Dixie Road, Caledon ON	
PROJECT MANAGER: T. Demers	**COMPANY NAME:** A&A Environmental Consutants Inc	

SAMPLE TYPE SHELBY TUBE CORE SAMPLE SPT SAMPLE GRAB SAMPLE NO RECOVERY

BACKFILL TYPE BENTONITE PEA GRAVEL SLOUGH GROUT DRILL CUTTINGS

DEPTH (ft)	DEPTH (m)	Soil Description	SAMPLE NO	BLOWS / 150 mm	Blowcount / PPM
0.0	0.0	Ground Surface			
0.0	0.0	Topsoil			
1.0		Silty clay Medium brown, Damp, No odour, Some gravel	1		
2.0			2		
3.0	1.0		3		7, 9
4.0			4		
5.0		Silty Clay Trace Gravel	5		9, 11
6.0	2.0		6		
7.0			7		12, 16
8.0			8		
9.0			9		10, 15
10.0	3.0		10		
11.0			11		14, 18
12.0			12		
13.0	4.0				
14.0		Silty Clay Grey, Moist, Trace Gravel	13		5, 13
15.0			14		
16.0	5.0				
17.0		Silty Clay Wet	15		16, 17
18.0					
19.0			16		
20.0	6.0	End of Log			
21.0					
22.0					
23.0	7.0				
24.0					
25.0					

Monitoring Well: Concrete; Bentonite Seal; Silica Sand; Flush Mount; 10 ft Well Screen

Notes

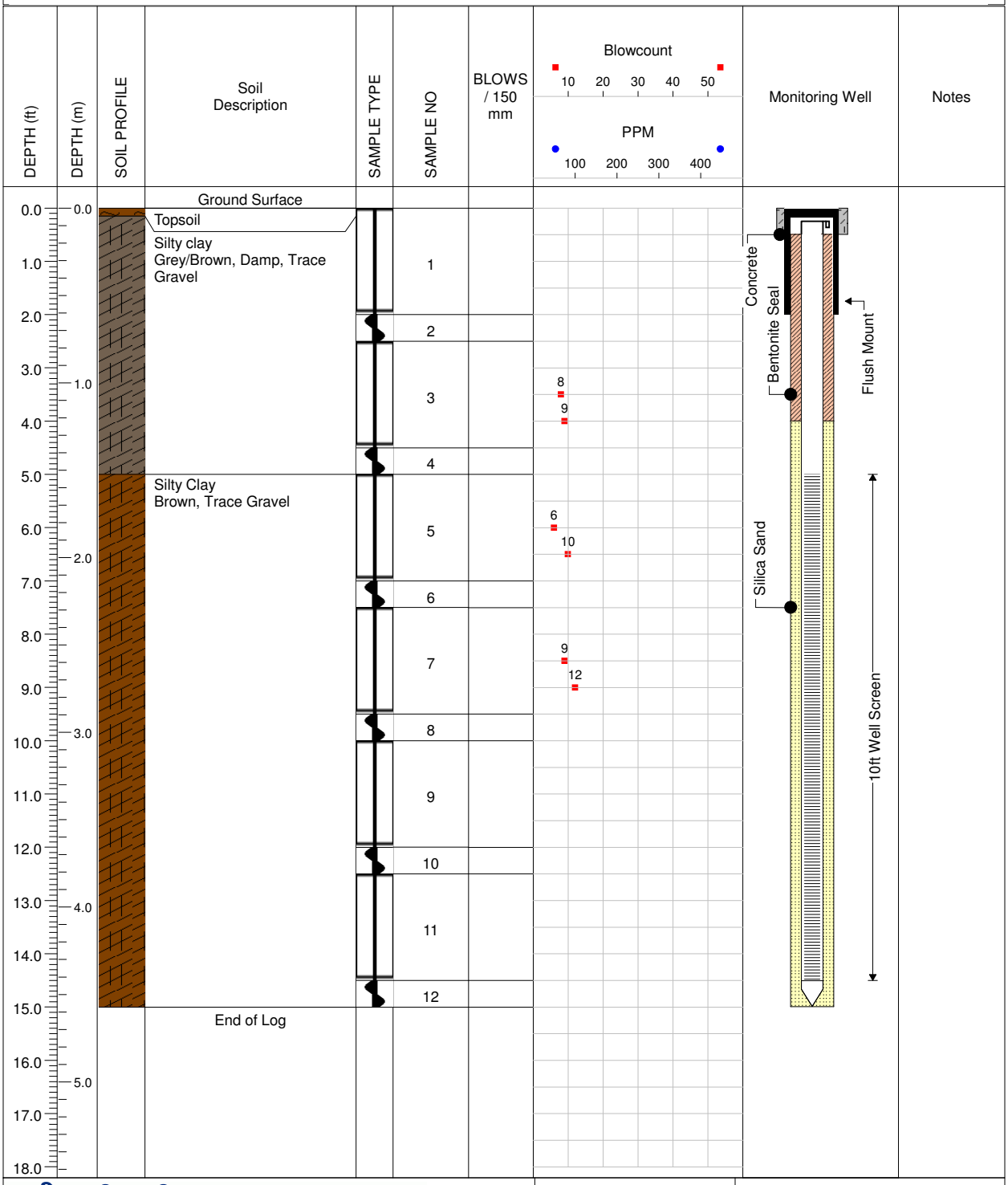
A & A ENVIRONMENTAL CONSULTANTS INC.
16 Young Street Woodstock, ON

LOGGED BY: E. Fulsom	**COMPLETION DEPTH:** 20ft
REVIEWED BY: A. Rasoul	**DRILL METHOD:** Split spoon/HSA
DRILL DATE: Oct 3, 2022	**PAGE:** 1 of 1

PROJECT: Geotech/hydroGeo	**BH LOCATION:** Central W boundary	**BOREHOLE NO: BH/MW2**
PROJECT NO: 6765	**LOCATION:** 0 Dixie Road, Caledon ON	
PROJECT MANAGER: T. Demers	**COMPANY NAME:** A&A Environmental Consutants Inc	

SAMPLE TYPE SHELBY TUBE CORE SAMPLE SPT SAMPLE GRAB SAMPLE NO RECOVERY

BACKFILL TYPE BENTONITE PEA GRAVEL SLOUGH GROUT DRILL CUTTINGS



LOGGED BY: E. Fulsom	**COMPLETION DEPTH:** 15
REVIEWED BY: A. Rasoul	**DRILL METHOD:** Split spoon/HSA
DRILL DATE: Oct 3, 2022	**PAGE:** 1 of 1

A&A ENVIRONMENTAL CONSULTANTS INC.
16 Young Street Woodstock, ON

PROJECT: Geotech/hydroGeo	**BH LOCATION:** Proposed truck/trailer parking	**BOREHOLE NO: BH/MW4**
PROJECT NO: 6765	**LOCATION:** 0 Dixie Road, Caledon ON	
PROJECT MANAGER: T. Demers	**COMPANY NAME:** A&A Environmental Consutants Inc	

SAMPLE TYPE SHELBY TUBE CORE SAMPLE SPT SAMPLE GRAB SAMPLE NO RECOVERY

BACKFILL TYPE BENTONITE PEA GRAVEL SLOUGH GROUT DRILL CUTTINGS

DEPTH (ft)	DEPTH (m)	Soil Description	SAMPLE NO	BLOWS / 150 mm
0.0	0.0	Ground Surface		
		Topsoil		
1.0		Silty clay Brown/Grey, Damp, No odour	1	
2.0			2	
3.0	1.0		3	8, 9
4.0			4	
5.0		Silty Clay Trace Gravel	5	15, 15
6.0	2.0		6	
7.0			7	8, 11
8.0			8	
9.0			9	
10.0	3.0		10	
11.0			11	
12.0			12	
13.0	4.0			
14.0				
15.0		Silty Clay Grey, Mosit, Some silt	13	
16.0	5.0		14	
17.0				
18.0		Silty Clay Moist to wet	15	
19.0				
20.0	6.0		16	
21.0		End of Log		
22.0				
23.0	7.0			
24.0				
25.0				

Blowcount: 10 20 30 40 50

PPM: 100 200 300 400

Monitoring Well: Concrete Seal; Bentonite Seal; Silica Sand; Flush Mount; 10 ft Well Screen

Notes

A & A ENVIRONMENTAL CONSULTANTS INC.
16 Young Street Woodstock, ON

LOGGED BY: E. Fulsom	**COMPLETION DEPTH:** 20ft
REVIEWED BY: A. Rasoul	**DRILL METHOD:** Split spoon/HSA
DRILL DATE: Oct 3, 2022	**PAGE:** 1 of 1

Appendix D

Figure No. 4 to 10
Modified Rational Method Calculations

STORMWATER MANAGEMENT ANALYSIS - FIGURE No. 4

PROJECT NUMBER:	22011
CLIENT:	DIXIE TRANSPORT DEPOT
LOCATION:	12363 Dixie Road
IDF STATION:	Guelph O.A.C.

SITE INFORMATION

Number of Catchment Areas: 1

This Analysis is for Subcatchment Area: 1

	AREA (m2)	RUNOFF COEFFICIENT
Building Area	616.0	0.90
Impervious Area	8,536.0	0.90
Pervious Area	942.0	0.25
SWM Facility Area	1,120.0	1.00
Undeveloped Area	3,502.0	0.25
External Area	2,344.0	0.25
Total Sub-Catchment Area	**17,060.0**	**0.65**

	TRCA	Town of Caledon
Allowable 2-yr Release Rate =	**13.6 L/s**	**45.4 L/s**
Allowable 5-yr Release Rate =	**20.9 L/s**	**62.3 L/s**
Allowable 10-yr Release Rate =	**25.6 L/s**	**76.2 L/s**
Allowable 25-yr Release Rate =	**32.3 L/s**	**92.4 L/s**
Allowable 50-yr Release Rate =	**37.9 L/s**	**104.7 L/s**
Allowable 100-yr Release Rate =	**42.7 L/s**	**117.8 L/s**

Time of Concentration (tc) = 10.00 min

Urban Watershed Group Ltd.
A member of the Greenland Group of Companies

DETERMINATION OF NECESSARY STORAGE VOLUME - FIGURE No. 5

This Analysis is for Sub-Catchment Area #1

Modified Rational Method used to determine storage volume:

Q=CiA/360, i= A / (t/60)^B

and for: A = 1070, B = 0.8759, C = 7.85 2-YR

DURATION	i	INFLOW (m3/sec)	ACCUMULATED RUNOFF VOLUME (m3)	ALLOWABLE RELEASE VOL. (m3)		REQ'D STORAGE (m3)	
(t)	(mm/hr)	(Q=CiA/360)	(Vacc = Q x tc)	(Vrel = Q100yr x (t + tc)/2		(Vreq'd = Vacc - Vrel)	
(MIN.)	100-YR	100-Yr	100-Yr	TRCA	Caledon	TRCA	Caledon
1	158.5	0.487	29.2	4.5	15.0	24.7	14.2
2	144.3	0.443	53.2	4.9	16.3	48.3	36.8
3	132.6	0.407	73.3	5.3	17.7	68.0	55.6
4	122.7	0.377	90.4	5.7	19.1	84.7	71.4
5	114.3	0.351	105.3	6.1	20.4	99.2	84.9
6	107.1	0.329	118.3	6.5	21.8	111.8	96.5
7	100.7	0.309	129.9	6.9	23.2	122.9	106.7
8	95.1	0.292	140.2	7.3	24.5	132.8	115.7
9	90.2	0.277	149.5	7.8	25.9	141.7	123.6
10	85.7	0.263	157.9	8.2	27.2	149.8	130.7
15	69.0	0.212	190.8	10.2	34.1	180.6	156.8
20	58.1	0.178	213.9	12.2	40.9	201.7	173.1
25	50.2	0.154	231.4	14.3	47.7	217.1	183.7
30	44.4	0.136	245.3	16.3	54.5	228.9	190.8
35	39.8	0.122	256.7	18.4	61.3	238.3	195.4
40	36.1	0.111	266.3	20.4	68.1	245.9	198.2
50	30.6	0.094	281.9	24.5	81.7	257.4	200.2
60	26.6	0.082	294.2	28.6	95.3	265.6	198.9
90	19.3	0.059	320.2	40.8	136.2	279.4	184.0
120	15.3	0.047	337.8	53.0	177.1	284.8	160.7
240	8.6	0.026	378.3	102.0	340.5	276.3	37.8
360	6.1	0.019	401.6	151.0	503.9	250.6	0.0
720	3.3	0.010	441.8	297.8	994.3	143.9	0.0
1440	1.8	0.006	483.8	591.6	1974.9	0.0	0.0

DETERMINATION OF NECESSARY STORAGE VOLUME - FIGURE No. 6

This Analysis is for Sub-Catchment Area #1

Modified Rational Method used to determine storage volume:

Q=CiA/360, i= A / (t/60)^B

and for: A = 1593, B = 0.8789, C = 11 5-YR

DURATION	i	INFLOW (m3/sec)	ACCUMULATED RUNOFF VOLUME (m3)	ALLOWABLE RELEASE VOL. (m3)		REQ'D STORAGE (m3)	
(t)	(mm/hr)	(Q=CiA/360)	(Vacc = Q x tc)	(Vrel = Q100yr x (t + tc)/2		(Vreq'd = Vacc - Vrel)	
(MIN.)	100-YR	100-Yr	100-Yr	TRCA	Caledon	TRCA	Caledon
1	179.4	0.551	33.0	6.9	20.6	26.1	12.5
2	167.2	0.513	61.6	7.5	22.4	54.1	39.2
3	156.6	0.481	86.6	8.2	24.3	78.4	62.3
4	147.4	0.453	108.6	8.8	26.2	99.9	82.5
5	139.3	0.428	128.3	9.4	28.0	118.9	100.3
6	132.1	0.405	146.0	10.0	29.9	135.9	116.1
7	125.6	0.386	162.0	10.7	31.8	151.3	130.2
8	119.8	0.368	176.5	11.3	33.6	165.2	142.9
9	114.5	0.352	189.8	11.9	35.5	177.9	154.3
10	109.7	0.337	202.1	12.5	37.4	189.5	164.7
15	90.9	0.279	251.2	15.7	46.7	235.5	204.5
20	77.9	0.239	287.0	18.8	56.1	268.2	230.9
25	68.3	0.210	314.5	21.9	65.4	292.6	249.1
30	60.9	0.187	336.7	25.1	74.8	311.6	261.9
35	55.1	0.169	355.0	28.2	84.1	326.8	270.9
40	50.3	0.154	370.6	31.4	93.5	339.2	277.1
50	43.0	0.132	395.7	37.6	112.1	358.1	283.6
60	37.6	0.115	415.6	43.9	130.8	371.7	284.8
90	27.6	0.085	457.3	62.7	186.9	394.6	270.4
120	21.9	0.067	485.2	81.5	243.0	403.7	242.2
240	12.4	0.038	547.9	156.8	467.3	391.2	80.7
360	8.8	0.027	583.0	232.0	691.5	351.0	0.0
720	4.8	0.015	642.4	457.7	1364.4	184.7	0.0
1440	2.7	0.008	703.3	909.2	2710.1	0.0	0.0

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DETERMINATION OF NECESSARY STORAGE VOLUME - FIGURE No. 7

This Analysis is for Sub-Catchment Area #1

Modified Rational Method used to determine storage volume:

Q=CiA/360, i= A / (t/60)^B

and for: A = 2221, B = 0.908, C = 12 10-YR

DURATION	i	INFLOW (m3/sec)	ACCUMULATED RUNOFF VOLUME (m3)	ALLOWABLE RELEASE VOL. (m3)		REQ'D STORAGE (m3)	
(t)	(mm/hr)	(Q=CiA/360)	(Vacc = Q x tc)	(Vrel = Q100yr x (t + tc)/2		(Vreq'd = Vacc - Vrel)	
(MIN.)	100-YR	100-Yr	100-Yr	TRCA	Caledon	TRCA	Caledon
1	216.3	0.664	39.9	8.4	25.1	31.4	14.7
2	202.2	0.621	74.5	9.2	27.4	65.3	47.1
3	190.0	0.583	105.0	10.0	29.7	95.0	75.3
4	179.1	0.550	132.0	10.8	32.0	121.3	100.0
5	169.6	0.521	156.2	11.5	34.3	144.7	121.9
6	161.0	0.494	177.9	12.3	36.6	165.7	141.4
7	153.3	0.471	197.7	13.1	38.9	184.6	158.8
8	146.3	0.449	215.6	13.8	41.1	201.8	174.5
9	140.0	0.430	232.0	14.6	43.4	217.5	188.6
10	134.2	0.412	247.2	15.4	45.7	231.8	201.4
15	111.4	0.342	307.8	19.2	57.2	288.6	250.7
20	95.5	0.293	351.8	23.0	68.6	328.7	283.2
25	83.7	0.257	385.4	26.9	80.0	358.5	305.4
30	74.6	0.229	412.2	30.7	91.4	381.5	320.8
35	67.3	0.207	434.2	34.6	102.9	399.7	331.4
40	61.4	0.189	452.7	38.4	114.3	414.3	338.4
50	52.4	0.161	482.4	46.1	137.2	436.3	345.2
60	45.7	0.140	505.4	53.8	160.0	451.6	345.3
90	33.3	0.102	552.5	76.8	228.6	475.7	323.9
120	26.4	0.081	582.9	99.8	297.2	483.1	285.7
240	14.7	0.045	648.1	192.0	571.5	456.1	76.6
360	10.3	0.032	682.6	284.2	845.8	398.4	0.0
720	5.6	0.017	738.4	560.6	1668.8	177.7	0.0
1440	3.0	0.009	792.9	1113.6	3314.7	0.0	0.0

DETERMINATION OF NECESSARY STORAGE VOLUME - FIGURE No. 8

This Analysis is for Sub-Catchment Area #1

Modified Rational Method used to determine storage volume:

Q=CiA/360, i= A / (t/60)^B

and for: A = 3158, B = 0.9335, C = 15 25-YR

DURATION	i	INFLOW (m3/sec)	ACCUMULATED RUNOFF VOLUME (m3)	ALLOWABLE RELEASE VOL. (m3)		REQ'D STORAGE (m3)	
(t)	(mm/hr)	(Q=CiA/360)	(Vacc = Q x tc)	(Vrel = Q100yr x (t + tc)/2		(Vreq'd = Vacc - Vrel)	
(MIN.)	100-YR	100-Yr	100-Yr	TRCA	Caledon	TRCA	Caledon
1	237.3	0.729	43.7	10.7	30.5	33.1	13.2
2	224.3	0.689	82.6	11.6	33.3	71.0	49.4
3	212.6	0.653	117.5	12.6	36.0	104.9	81.5
4	202.2	0.621	149.0	13.6	38.8	135.4	110.2
5	192.7	0.592	177.5	14.5	41.6	163.0	135.9
6	184.1	0.565	203.5	15.5	44.4	188.0	159.2
7	176.3	0.541	227.4	16.5	47.1	210.9	180.2
8	169.1	0.519	249.3	17.4	49.9	231.8	199.4
9	162.5	0.499	269.5	18.4	52.7	251.1	216.9
10	156.5	0.480	288.3	19.4	55.4	268.9	232.8
15	132.0	0.405	364.7	24.2	69.3	340.5	295.4
20	114.3	0.351	421.1	29.1	83.2	392.1	338.0
25	100.9	0.310	464.7	33.9	97.0	430.8	367.7
30	90.4	0.278	499.6	38.8	110.9	460.8	388.7
35	81.9	0.252	528.3	43.6	124.7	484.7	403.5
40	75.0	0.230	552.3	48.5	138.6	503.9	413.7
50	64.1	0.197	590.7	58.1	166.3	532.6	424.4
60	56.1	0.172	620.2	67.8	194.0	552.4	426.2
90	41.0	0.126	679.6	96.9	277.2	582.7	402.4
120	32.4	0.100	716.6	126.0	360.4	590.6	356.3
240	17.9	0.055	791.6	242.3	693.0	549.3	98.6
360	12.5	0.038	828.4	358.5	1025.6	469.8	0.0
720	6.7	0.020	883.9	707.4	2023.6	176.6	0.0
1440	3.5	0.011	934.5	1405.1	4019.4	0.0	0.0

DETERMINATION OF NECESSARY STORAGE VOLUME - FIGURE No. 9

This Analysis is for Sub-Catchment Area #1

Modified Rational Method used to determine storage volume:

Q=CiA/360, i= A / (t/60)^B

and for: A = 3886, B = 0.9495, C = 16 50-YR

DURATION	i	INFLOW (m3/sec)	ACCUMULATED RUNOFF VOLUME (m3)	ALLOWABLE RELEASE VOL. (m3)		REQ'D STORAGE (m3)	
(t)	(mm/hr)	(Q=CiA/360)	(Vacc = Q x tc)	(Vrel = Q100yr x (t + tc)/2		(Vreq'd = Vacc - Vrel)	
(MIN.)	100-YR	100-Yr	100-Yr	TRCA	Caledon	TRCA	Caledon
1	263.7	0.810	48.6	12.5	34.6	36.1	14.0
2	249.8	0.767	92.0	13.6	37.7	78.4	54.4
3	237.3	0.729	131.2	14.8	40.8	116.4	90.3
4	226.0	0.694	166.6	15.9	44.0	150.7	122.6
5	215.8	0.663	198.8	17.1	47.1	181.7	151.7
6	206.5	0.634	228.2	18.2	50.3	210.0	178.0
7	197.9	0.608	255.3	19.3	53.4	235.9	201.9
8	190.1	0.584	280.2	20.5	56.5	259.7	223.6
9	182.9	0.562	303.2	21.6	59.7	281.6	243.5
10	176.2	0.541	324.6	22.7	62.8	301.9	261.8
15	149.1	0.458	412.0	28.4	78.5	383.6	333.5
20	129.4	0.397	476.6	34.1	94.2	442.5	382.4
25	114.3	0.351	526.6	39.8	109.9	486.8	416.6
30	102.5	0.315	566.5	45.5	125.6	521.0	440.9
35	92.9	0.285	599.2	51.2	141.3	548.1	457.9
40	85.0	0.261	626.6	56.9	157.1	569.8	469.6
50	72.8	0.223	670.2	68.2	188.5	601.9	481.7
60	63.6	0.195	703.4	79.6	219.9	623.8	483.5
90	46.4	0.142	769.3	113.7	314.1	655.6	455.2
120	36.6	0.112	809.6	147.8	408.3	661.8	401.2
240	20.1	0.062	888.1	284.3	785.3	603.8	102.8
360	13.9	0.043	924.8	420.7	1162.2	504.1	0.0
720	7.4	0.023	977.5	830.0	2292.9	147.4	0.0
1440	3.9	0.012	1022.8	1648.7	4554.5	0.0	0.0

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DETERMINATION OF NECESSARY STORAGE VOLUME - FIGURE No. 10

This Analysis is for Sub-Catchment Area #1

Modified Rational Method used to determine storage volume:

Q=CiA/360, i= A / (t/60)^B

and for: A = 4688, B = 0.9624, C = 17 100-YR

DURATION	i	INFLOW (m3/sec)	ACCUMULATED RUNOFF VOLUME (m3)	ALLOWABLE RELEASE VOL. (m3)		REQ'D STORAGE (m3)	
(t)	(mm/hr)	(Q=CiA/360)	(Vacc = Q x tc)	(Vrel = Q100yr x (t + tc)/2		(Vreq'd = Vacc - Vrel)	
(MIN.)	100-YR	100-Yr	100-Yr	TRCA	Caledon	TRCA	Caledon
1	290.3	0.892	53.5	14.1	38.9	39.4	14.6
2	275.6	0.846	101.6	15.4	42.4	86.2	59.1
3	262.3	0.806	145.0	16.7	45.9	128.3	99.1
4	250.3	0.769	184.5	17.9	49.5	166.5	135.0
5	239.4	0.735	220.5	19.2	53.0	201.3	167.5
6	229.3	0.704	253.5	20.5	56.5	233.0	197.0
7	220.1	0.676	283.9	21.8	60.1	262.1	223.8
8	211.6	0.650	311.9	23.1	63.6	288.9	248.3
9	203.8	0.626	337.9	24.3	67.1	313.6	270.8
10	196.5	0.603	362.1	25.6	70.7	336.5	291.4
15	166.9	0.512	461.2	32.0	88.4	429.2	372.8
20	145.1	0.446	534.7	38.4	106.0	496.3	428.7
25	128.5	0.394	591.7	44.8	123.7	546.8	468.0
30	115.3	0.354	637.2	51.2	141.4	585.9	495.8
35	104.6	0.321	674.4	57.6	159.0	616.8	515.4
40	95.7	0.294	705.6	64.1	176.7	641.5	528.9
50	82.0	0.252	754.9	76.9	212.0	678.1	542.9
60	71.7	0.220	792.4	89.7	247.4	702.7	545.0
90	52.2	0.160	866.0	128.1	353.4	737.9	512.6
120	41.2	0.126	910.2	166.5	459.4	743.7	450.8
240	22.5	0.069	993.7	320.3	883.5	673.4	110.2
360	15.5	0.048	1030.8	474.0	1307.6	556.8	0.0
720	8.2	0.025	1081.5	935.1	2579.8	146.4	0.0
1440	4.2	0.013	1122.5	1857.5	5124.3	0.0	0.0

Appendix E

SWM Facility Design Calculations

Falling Head Orifice Equation for Constant Storage Area (eq 4.10)

t = 2As / (CAo(2g)^0.5 x (h1^0.5 - h2^0.5)

As = storage area footprint (sq.m)
Cd = coefficient of discharge
Do = orifice diameter (mm)
Ao = cross sectional area of orifice (sq.m)
g = gravitational constant (9.81 m/s2)
h1 = starting height of water over orifice centroid (m)
h2 = ending height of water over orifice centroid (m)

Variable	Value	Unit
As:	1120.0	sq.m
Cd:	0.63	
Do:	25	mm
Ao:	0.0005	sq.m
#O:	5	
AO:	0.0025	sq.m
h1:	0.26	m
h2:	0.00	m

t:	**166765**	**seconds**
	46.3	**hours**

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SWM FACILITY - Control Structure Discharge Curve

Outlet / Storage Type	Elevation (masl)	Water Depth (m)	Orifice 1 h1 (m)	Orifice 1 dh1 (m)	Orifice 1 Cd1	Orifice 2 h2 (m)	Orifice 2 dh2 (m)	Orifice 2 Cd2	Overflow Weir hw (m)	Overflow Weir v (m/s)	Q1 (L/s)	Q2 (L/s)	Qweir (L/s)	**Total Flow (L/s)**	Storage (cu.m)	Notes
Orifice 1 (Invert)	259.19	-0.01	0.00		0.56						0.00	0.00		**0.00**	0.0	
Orifice 1 (Springline)	259.20	0.00	0.01		0.58						0.14	0.00		**0.14**	0.0	
Orifice 1 / Bottom of Storage	259.20	0.00	0.01		0.58						0.14	0.00		**0.14**	0.0	
Orifice 1 / Extended Detention	259.25	0.05	0.06	0.05	0.63						1.53	0.00		**1.53**	56.3	
Orifice 1 / Extended Detention	259.30	0.10	0.11	0.10	0.63						2.17	0.00		**2.17**	113.1	
Orifice 1 / Extended Detention	259.35	0.15	0.16	0.15	0.63						2.65	0.00		**2.65**	170.5	
Orifice 1 / Extended Detention	259.40	0.20	0.21	0.20	0.63						3.06	0.00		**3.06**	228.4	
Orifice 1 / Extended Detention	259.46	0.26	0.27	0.26	0.63						3.49	0.00		**3.49**	298.6	Extended Detention
Orifice 1 & Orifice 2 (Centroid)	259.50	0.30	0.31	0.30	0.63	0.00		0.56			3.75	0.00		**3.75**	345.9	
Orifice 1 & 2/ Flood Protection	259.55	0.35	0.36	0.35	0.63	0.05	0.05	0.80			4.04	9.56		**13.60**	403.5	2yr Allowable
Orifice 1 & 2/ Flood Protection	259.64	0.44	0.45	0.44	0.63	0.14	0.14	0.80			4.55	16.35		**20.90**	515.8	5yr Allowable
Orifice 1 & 2/ Flood Protection	259.73	0.53	0.54	0.53	0.63	0.23	0.23	0.80			4.96	20.64		**25.60**	618.6	10yr Allowable
Orifice 1, 2 & Overflow Weir	259.78	0.58	0.59	0.58	0.63	0.28	0.28	0.80	0.00		5.22	23.01	0.00	**28.23**	686.6	
Orifice 1, 2 & Weir / Flood Protection	259.79	0.59	0.60	0.59	0.63	0.29	0.29	0.80	0.01	0.12	5.25	23.32	3.73	**32.30**	696.0	25yr Allowable
Orifice 1, 2 & Weir / Flood Protection	259.79	0.59	0.61	0.59	0.63	0.29	0.29	0.80	0.01	0.17	5.28	23.56	9.06	**37.90**	703.6	50yr Allowable
Orifice 1, 2 & Weir / Flood Protection	259.80	0.60	0.61	0.60	0.63	0.30	0.30	0.80	0.02	0.19	5.30	23.73	13.67	**42.70**	748.3	100yr Allowable

Weir Discharge Below Centroid

Q = Cd((10.12(h/d)^1.975 - 2.66(h/d)^3.78))d^(5/2)

Q = Discharge rate through circular weir (L/s)
Cd = coefficient of discharge = 0.555 + (1/110(h/d)) + 0.041(h/d)
h = height of water over weir bottom (m)
d = diameter of circular weir (m)

Orifice Discharge Above Centroid

Q = Cd*Ao*SQRT(2g*h)

Q = discharge rate through orifice (L/s)
Cd = coefficient of discharge (0.63 for orifice plate or 0.80 for orifice tube)
Ao = cross sectional area of orifice (sq.m)
g = gravitational constant (9.81 m/s2)
dh = height of water over orifice centroid (m)

Broad Crest Weir Discharge

Q = 0.55 x C x L x H^1.5 x kt x 1000

Q = Discharge over broad crest weir (L/s)
Cw = Weir Coefficient
L = Weir Length (m)
H = upstream water level over weir (m)

Input Parameters

Orifice 1 diameter:	25 mm x5	Orifice 1 Cd:	0.63
Orifice 2 diameter:	125 mm	Orifice 2 Cd:	0.80
Weir Breadth:	1 m	Weir Coef.	2.6
Weir Length:	4 m	kt	1

Bottom of storage elevation:	259.20 masl	Dry pond storage footprint =	1120.0 sq.m
Invert of Orifice 1 elevation:	259.19 masl	Dry pond storage water surface =	1296.0 sq.m
Invert of Orifice 2 elevation:	259.50 masl	Storage depth =	0.80 m
Overflow weir elevation:	259.78 masl	Storage porosity =	N/A

Calculated Parameters

Orifice 1 Springline:	259.20 masl
Orifice 2 Centroid:	259.50 masl
Orifice 1 Area:	0.0025 sq.m
Orifice 2 Area:	0.0123 sq.m

Appendix F

Oil Grit Separator Specifications

Hydro First Defense® - HC

Rev. 12.2

Project Name:	**Dixie Transport Depot**	*Report Date:*	Paste
Street:	**12363 Dixie Road**	*City:*	**Caledon**
Province:	**ON**	*Country:*	**CA**
Designer:		*email:*	

Treatment Parameters:

Structure ID:	FD-6HC	
TSS Goal:	50	% Removal
TSS Particle Size:	ETV	
Area:	1.0094	ha
Percent Impervious:	91%	
Rational C value:	0.85	Calc. Cn
Rainfall Station:	Toronto, ONT	MAP
Peak Storm Flow:	467	L/s

RESULTS SUMMARY

Model	TSS	Volume
FD-3HC	39.0%	>90%
FD-4HC	43.0%	>90%
FD-5HC	**45.0%**	**>90%**
FD-6HC	48.0%	>90%
FD-8HC	51.0%	>90%
FD-10HC	54.0%	>90%

Model Specification:

Model:	**FD-5HC**	
Diameter:	1500	mm
Peak Flow Capacity:	566.00	L/s
Sediment Storage:	0.84	m^3
Oil Storage:	1136.00	L

Installation Configuration:

Placement:	Online		
Outlet Pipe Size:	450	mm	*OK*
Inlet Pipe 1 Size:	375	mm	*OK*
Inlet Pipe 2 Size:	375	mm	*OK*
Inlet Pipe 3 Size:		mm	*OK*
Rim Level:	261.100	m	Calc Invs.
Outlet Pipe Invert:	259.350	m	*OK*
Invert Pipe 1:	259.430	m	*OK*
Invert Pipe 2:	259.430	m	*OK*
Invert Pipe 3:		m	

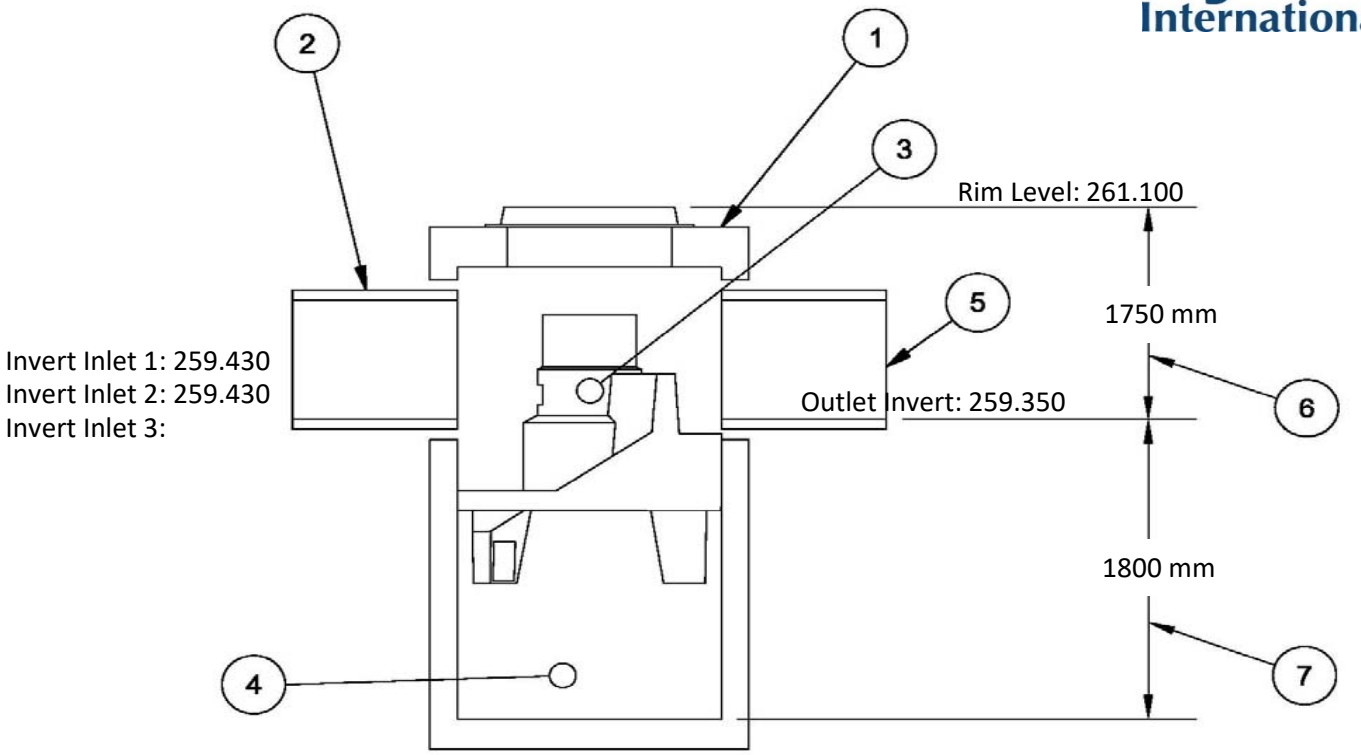
Net Annual Removal Model: FD-5HC

Intensity[1]	Fraction of Rainfall[1]	FD-5HC Removal Efficiency[2]	Weighted Net Annual Efficiency
(mm/hr)	(%)	(%)	(%)
0.50	0.2%	64.8%	0.1%
1.00	14.8%	59.8%	8.8%
1.50	15.1%	56.9%	8.6%
2.00	13.6%	54.8%	7.5%
2.50	3.9%	53.2%	2.1%
3.00	1.3%	51.9%	0.7%
3.50	8.9%	50.7%	4.5%
4.00	5.3%	49.8%	2.6%
4.50	1.2%	48.9%	0.6%
5.00	5.2%	48.2%	2.5%
6.00	4.2%	46.9%	2.0%
7.00	4.6%	45.8%	2.1%
8.00	3.1%	44.8%	1.4%
9.00	2.3%	43.9%	1.0%
10.00	2.2%	43.2%	1.0%
20.00	9.3%	0.0%	0.0%
30.00	2.7%	0.0%	0.0%
40.00	1.1%	0.0%	0.0%
50.00	0.5%	0.0%	0.0%
100.00	0.6%	0.0%	0.0%
150.00	0.1%	0.0%	0.0%
200.00	0.0%	0.0%	0.0%
Total Net Annual Removal Efficiency:			**45.0%**
Total Annual Runoff Volume Treated:			**>90%**

1. Rainfall Data: 1953:2007, HLY03, Toronto , ON, 6158350 & 6158355
2. Canada ETV PSD & Test Protocols - ISO14034 Certifed
3. Rainfall adjusted to 5 min peak intensity based on hourly average.

Designer Notes:

Hydro First Defense® - HC



All drawing elevations are metres.

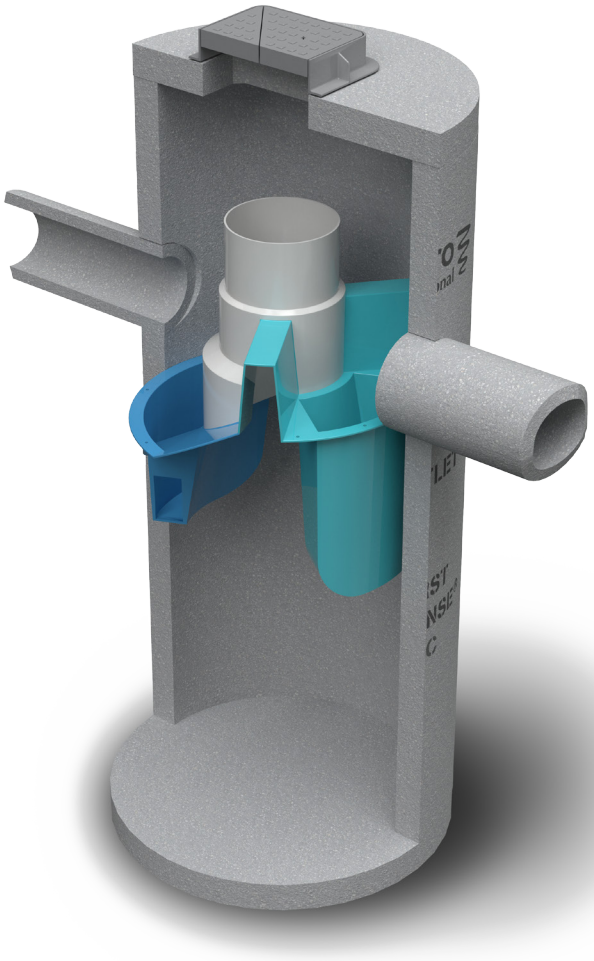
FD-5HC Specification

1	Vortex Chamber Diameter	1500	mm
2	Inlet Pipe Diameter	375	mm
3	Oil Storage Capacity	1136.00	L
4	Min. Provided Sediment Storage Capacity	0.84	m^3
5	Outlet Pipe Diameter	450	mm
6	Height(Final Grade to Outlet Invert)	1750	mm
7	Sump Depth(Outlet Invert to Sump)	1800	mm
	Total Depth	**3550**	**mm**

Notes:

Extend oil port to minimum 260.00

Hydro International



Operation and Maintenance Manual

First Defense® and First Defense® High Capacity

Vortex Separator for Stormwater Treatment

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I. First Defense® by Hydro International

Introduction

The First Defense® is an enhanced vortex separator that combines an effective and economical stormwater treatment chamber with an integral peak flow bypass. It efficiently removes total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® is available in several model configurations (refer to *Section II. Model Sizes & Configurations*, page 4) to accommodate a wide range of pipe sizes, peak flows and depth constraints.

Operation

The First Defense® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The First Defense® has been designed to allow for easy and safe access for inspection, monitoring and clean-out procedures. Neither entry into the unit nor removal of the internal components is necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the First Defense® have been designed to optimize pollutant capture. Sediment is captured and retained in the base of the unit, while oil and floatables are stored on the water surface in the inner volume (Fig.1).

The pollutant storage volumes are isolated from the built-in bypass chamber to prevent washout during high-flow storm events. The sump of the First Defense® retains a standing water level between storm events. This ensures a quiescent flow regime at the onset of a storm, preventing resuspension and washout of pollutants captured during previous events.

Accessories such as oil absorbent pads are available for enhanced oil removal and storage. Due to the separation of the oil and floatable storage volume from the outlet, the potential for washout of stored pollutants between clean-outs is minimized.

Applications

- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for “offline” arrangements using separate junction manholes
- Proven to prevent pollutant washout at up to 500% of its treatment flow
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

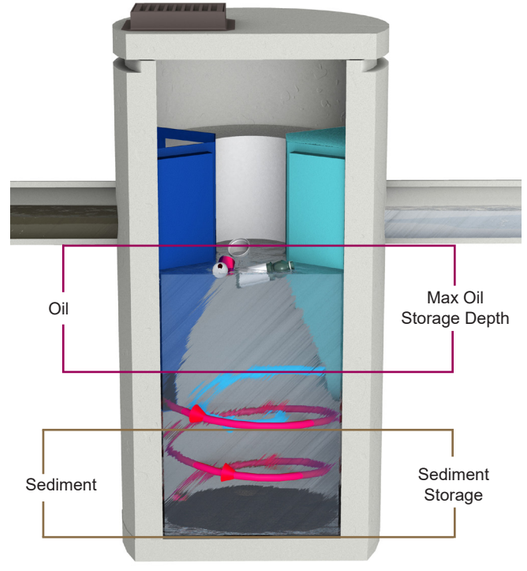


Fig.1 Pollutant storage volumes in the First Defense®.

II. Model Sizes & Configurations

The First Defense® inlet and internal bypass arrangements are available in several model sizes and configurations. The components of the First Defense®-4HC and First Defense®-6HC have modified geometries as to allow greater design flexibility needed to accommodate various site constraints.

All First Defense® models include the internal components that are designed to remove and retain total suspended solids (TSS), gross solids, floatable trash and hydrocarbons (Fig.2a - 2b). First Defense® model parameters and design criteria are shown in Table 1.

First Defense® Components

1. **Built-In Bypass**
2. **Inlet Pipe**
3. **Inlet Chute**
4. **Floatables Draw-off Port**
5. **Outlet Pipe**
6. **Floatables Storage**
7. **Sediment Storage**
8. **Inlet Grate or Cover**

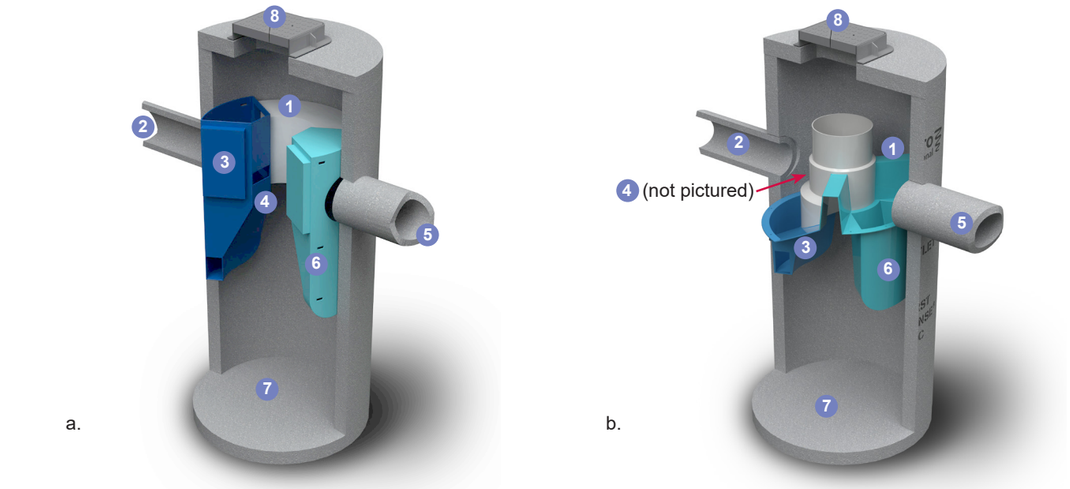


Fig.2a) First Defense®-4 and First Defense®-6; b) First Defense®-4HC and First Defense®-6HC, with higher capacity dual internal bypass and larger maximum pipe diameter.

First Defense® High Capacity Model Number	Diameter	Typical TSS Treatment Flow Rates NJDEP Certified	Peak Online Flow Rate	Maximum Pipe Diameter[1]	Oil Storage Capacity	Typical Sediment Storage Capacity[2]	Minimum Distance from Outlet Invert to Top of Rim[3]	Chamber Depth
	(ft / m)	(cfs / L/s)	(cfs / L/s)	(in / mm)	(gal / L)	(yd^3 / m^3)	(ft / m)	(ft / m)
FD-3HC	3 / 0.9	0.85 / 24.0	15 / 424	18 / 457	125 / 473	0.4 / 0.3	2.0 - 3.5 / 0.6 - 1.0	3.75 / 1.14
FD-4HC	4 / 1.2	1.50 / 42.4	18 / 510	24 / 600	191 / 723	0.7 / 0.5	2.3 - 3.9 / 0.7 - 1.2	5.00 / 1.52
FD-5HC	5 / 1.5	2.35 / 66.2	20 / 566	24 / 609	300 / 1135	1.1 / .84	2.5 - 4.5 / 0.7 - 1.3	5.25 / 1.60
FD-6HC	6 / 1.8	3.38 / 95.7	32 / 906	30 / 750	496 / 1878	1.6 / 1.2	3.0 - 5.1 / 0.9 - 1.6	6.25 / 1.90
FD-7HC	7 / 2.1	4.60 / 130.2	40 / 1133	42 / 1067	750 / 2839	2.1 / 1.9	3.0 - 5.5 / 0.9 - 1.7	7.25 / 2.20
FD-8HC	8 / 2.4	6.00 / 169.9	50 / 1,415	48 / 1219	1120 / 4239	2.8 / 2.1	3.0 - 6.0 / 0.9 -1.8	8.00 / 2.43

[1]Contact Hydro International when larger pipe sizes are required.
[2]Contact Hydro International when custom sediment storage capacity is required.
[3]Minimum distance for models depends on pipe diameter.

III. Maintenance

Overview

The First Defense® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the First Defense®. The First Defense® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the First Defense® will no longer be able to store removed sediment and oil. Maximum pollutant storage capacities are provided in Table 1.

The First Defense® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the First Defense®, nor do they require the internal components of the First Defense® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Maintenance Equipment Considerations

The internal components of the First Defense®-HC have a centrally located circular shaft through which the sediment storage sump can be accessed with a sump vac hose. The open diameter of this access shaft is 15 inches in diameter (Fig.3). Therefore, the nozzle fitting of any vactor hose used for maintenance should be less than 15 inches in diameter.

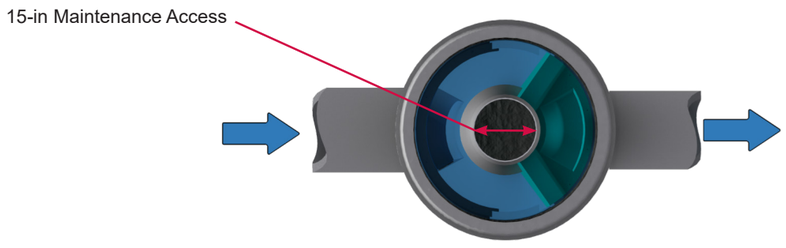


Fig.3 The central opening to the sump of the First Defense®-HC is 15 inches in diameter.

Determining Your Maintenance Schedule

The frequency of clean out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge-Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil / flotables removal, for a 6-ft First Defense® typically takes less than 30 minutes and removes a combined water/oil volume of about 765 gallons.

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. Fig.4 shows the standing water level that should be observed.

4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the components and water surface.

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel.

6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.

7. Securely replace the grate or lid.

8. Take down safety equipment.

9. Notify Hydro International of any irregularities noted during inspection.

Floatables and Sediment Clean Out

Floatables clean out is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.5).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose and skimmer pole to be lowered to the base of the sump.

Scheduling

- Floatables and sump clean out are typically conducted once a year during any season.

- Floatables and sump clean out should occur as soon as possible following a spill in the contributing drainage area.

Fig.4 Floatables are removed with a vactor hose (First Defense model FD-4, shown).

Recommended Equipment

- Safety Equipment (traffic cones, etc)

- Crow bar or other tool to remove grate or lid

- Pole with skimmer or net (if only floatables are being removed)

- Sediment probe (such as a Sludge Judge®)

- Vactor truck (flexible hose recommended)

- First Defense® Maintenance Log

Floatables and sediment Clean Out Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.

4. Remove oil and floatables stored on the surface of the water with the vactor hose (Fig.5) or with the skimmer or net (not pictured).

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (page 9).

6. Once all floatables have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris off the sump floor (Fig.5).

7. Retract the vactor hose from the vessel.

8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components, blockages, or irregularly high or low water levels.

9. Securely replace the grate or lid.

Fig.5 Sediment is removed with a vactor hose (First Defense model FD-4, shown).

Maintenance at a Glance

Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- Once per year or as needed - Following a spill in the drainage area
NOTE: For most clean outs the entire volume of liquid does not need to be removed from the manhole. Only remove the first few inches of oils and floatables from the water surface to reduce the total volume of liquid removed during a clean out.	

First Defense® Installation Log

HYDRO INTERNATIONAL REFERENCE NUMBER:	
SITE NAME:	
SITE LOCATION:	
OWNER:	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

MODEL SIZE (CIRCLE ONE): **FD-4** **FD-4HC** **FD-6** **FD-6HC**

INLET (CIRCLE ALL THAT APPLY): **GRATED INLET (CATCH BASIN)** **INLET PIPE (FLOW THROUGH)**

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

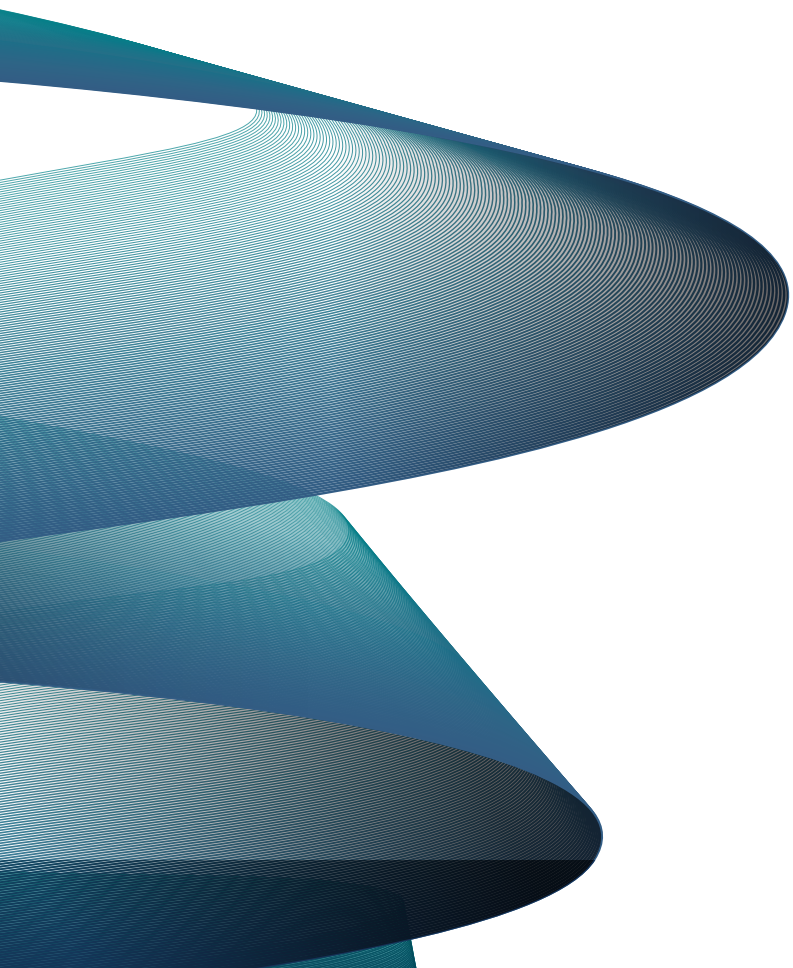
First Defense® Inspection and Maintenance Log

Date	Initials	Depth of Floatables and Oils	Sediment Depth Measured	Volume of Sediment Removed	Site Activity and Comments

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

Notes

Hydro International®



Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

Turning Water Around...®

FDHC_O+M_H_1703

Appendix G

Thornthwaite-Mather Water Balance Calculation

Potential Evapotransipiration - Orangeville MOE

Month	Avg. Monthly Temparture (C)	Heat Index	Potential ET (mm)	Daylight Correction	Adjusted PET (mm)	Percipitation (mm)	Surplus (mm)	Deficit (mm)
January	-7.5	0.0	0.0	0.81	0.0	64.3	64.3	0.0
February	-6.5	0.0	0.0	0.81	0.0	54.5	54.5	0.0
March	-2.1	0.0	0.0	1.02	0.0	60.9	60.9	0.0
April	5.3	1.1	25.9	1.12	29.0	70.1	41.1	0.0
May	11.7	3.6	58.4	1.27	74.2	86.6	12.4	0.0
June	16.9	6.3	85.1	1.29	109.8	81.3	0.0	28.5
July	19.4	7.8	98.1	1.30	127.5	80.8	0.0	46.7
August	18.4	7.2	92.9	1.20	111.5	88.2	0.0	23.3
September	14.3	4.9	71.7	1.04	74.6	87.0	12.4	0.0
October	7.8	2.0	38.5	0.95	36.6	76.6	40.0	0.0
November	2.0	0.2	9.5	0.80	7.6	87.1	79.5	0.0
December	-4.1	0.0	0.0	0.74	0.0	64.2	64.2	0.0
Total		**33.1**	**480.2**		**570.9**	**901.6**	**429.3**	**98.6**

alpha = 1.03

WATER SURPLUS = 429.3 mm

Average Annual Percp. (mm)	901.6	Annual Events > 5mm	57
Annual Events > 25mm	4.5	Annual Events 0 - 5mm	94
Annual Events > 10mm	25	Total Annual Events	151

Water Balance Assement

Catchment Designation	PRE		POST				Pre to Post Difference
	Agricultural	Total	Lawn	Paved	Building	Total	
Area (sq.m)	11,769.0				11,769.0		
Pervious (sq.m)	11,769.0	11,769.0	2,617.0			2,617.0	
Impervious (sq.m)		0.0		8,536.0	616.0	9,152.0	
Infiltration Factors							
Topography Infiltration Factor	0.30		0.30	-	-		
Soil Infiltration Factor	0.20		0.20	-	-		
Land Cover Infiltration Factor	0.10		0.10	-	-		
MECP Infiltration Factor	0.60		0.60	0.00	0.00		
Runoff Coefficient	0.40		0.40	1.00	1.00		
Impervious Surface Evaporation Factor	0.00		0.00	0.20	0.20		
Inputs (per Unit Area)							
Percipitation (mm/yr)	901.6	901.6	901.6	901.6	901.6	901.6	
Total Inputs (mm/yr)	**901.6**	**901.6**	**901.6**	**901.6**	**901.6**	**901.6**	
Outputs (per Unit Area)							
Percipitation Surplus (mm/yr)	429.3	429.3	429.3	721.3	721.3	656.4	227.0
Net Suplus (mm/yr)	429.3	429.3	429.3	721.3	721.3	656.4	227.0
Evapotransipration (mm/yr)	472.3	472.3	472.3	180.3	180.3	245.2	-227.0
Infiltration (mm/yr)	257.6	257.6	257.6	0.0	0.0	57.3	-200.3
Secondary Infiltration (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Infiltration (mm/yr)	257.6	257.6	257.6	0.0	0.0	57.3	-200.3
Total Runoff (mm/yr)	171.7	171.7	171.7	721.3	721.3	599.1	427.4
Total Outputs (mm/yr)	**901.6**	**901.6**	**901.6**	**901.6**	**901.6**	**901.6**	0.0
difference (inputs - outputs)	0	0	0	0	0	0	
Inputs (Volume)							
Percipitation (cu.m/yr)	10,611	10,611	2,359	7,696	555	10,611	
Total Inputs (cu.m/yr)	**10,611**	**10,611**	**2,359**	**7,696**	**555**	**10,611**	
Outputs (Volume)							
Percipitation Surplus (cu.m/yr)	5,053	5,053	1,124	6,157	444	7,725	2,672
Net Suplus (mm/yr)	5,053	5,053	1,124	6,157	444	7,725	2,672
Evapotransipration (cu.m/yr)	5,558	5,558	1,236	1,539	111	2,886	-2,672
Infiltration (cu.m/yr)	3,032	3,032	674	0	0	674	-2,357
Secondary Infiltration (cu.m/yr)	0	0	0	0	0	0	0
Total Infiltration (cu.m/yr)	3,032	3,032	674	0	0	674	-2,357
Total Runoff (cu.m/yr)	2,021	2,021	449	6,157	444	7,051	5,030
Total Outputs (cu.m/yr)	**10,611**	**10,611**	**2,359**	**7,696**	**555**	**10,611**	**0**
difference (inputs - outputs)	0	0	0	0	0	0	

Urban Watershed Group Ltd.
A member of the Greenland Group of Companies