TRAFALGAR ENGINEERING

FUNCTIONAL SERVICING REPORT & STORMWATER MANAGEMENT REPORT

Water, Sanitary, and Stormwater Management

11-STOREY RESIDENTIAL/COMMERCIAL DEVELOPMENT

84-104 PLAINS ROAD EAST AND 990 GLENWOOD AVENUE
CITY OF BURLINGTON

OUR FILE: 1861

PREPARED FOR MIURA GROUP

May 12, 2025

(905) 338-3366 #1-481 Morden Road, Oakville, ON, L6K 3W6 www.trafalgareng.com

REVISION HISTORY

DATE	REVISION	SUBMISSION
2025-01-17	1	Issued for Technical Review
2025-05-12	2	Issued for OPA/ZBA Application

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Existing Condition 1
1.2 Proposed Condition 1
2.0 MUNICIPAL WATER AND WASTEWATER 1
2.1 Municipal Water 2
2.1.1 Existing Linear Infrastructure 2
2.1.2 Estimated Flows 2
2.1.3 Proposed Connection 3
2.2 Municipal Wastewater 3
2.2.1 Existing Linear Infrastructure 3
2.2.2 Estimated Flows 3
2.2.3 Proposed Connection 3
2.2.4 Sanitary Sewer Capacity Analysis 4
3.0 STORM DRAINAGE AND STORMWATER MANAGEMENT 4
3.1 Existing Storm Drainage 4
3.2 Proposed Storm Drainage 5
3.3 Stormwater Management 5
3.3.1 Stormwater Quantity Control (Peak Flow Control) 6
3.3.2 Erosion Control 7
3.3.3 Water Balance 7
3.3.4 Stormwater Quality Control 7
3.4 Capacity Analysis 7
4.0 SUMMARY 8

LIST OF TABLES

Table 1: Estimated Water Demands (L/min) 2
Table 2: Fire Hydrant Flow Test Summary (psig) 2
Table 3: Estimated Existing Wastewater Flow (L/s) 3
Table 4: Estimated Proposed Wastewater Flow (L/s) 3
Table 5: Stormwater Flows 6

LIST OF APPENDICES

APPENDIX 'A' - Topographic Survey (A.T.McLaren Limited)

APPENDIX 'B'
- Estimated Water Demand
- Fire Flow Test Results

APPENDIX 'C'
- Existing Wastewater Demand
- Proposed Wastewater Demand
- Sanitary Drainage Plan, Figure 1
- Sanitary Sewer Design Sheet

APPENDIX 'D'
- EPA SWMM Summaries and Results
- Pre-Development Drainage Plan, Figure 2
- Post-Development Drainage Plan, Figure 3
- External Storm Drainage Plan, Figure 4
- Storm Sewer Design Sheet
- Jellyfish Sizing Report
- Jellyfish CA-ETV Verification

APPENDIX 'E'
- Grading Plan, Dwg. G1
- Servicing Plan, Dwg. S1

1.0 INTRODUCTION

The report has been prepared in support of an Official Plan Amendment (OPA) and Zoning By-law Amendment (ZBA) for an eleven–storey mixed-use building located at 84 to 104 Plains Road East and 990 Glenwood Avenue in the City of Burlington, Region of Halton. This report discusses how the site can be serviced by the existing infrastructure for water, wastewater, and stormwater.

This report may be updated and refined as the project moves through the planning process to support the Site Plan Application and Building Permit stages. For the purpose of this report, Plains Road East runs in an east-west direction.

1.1 Existing Condition

The subject lands are approximately 0.47 ha and comprised of 84 and 104 Plains Rd E, and 990 Glenwood Avenue. Each lot contains a one- or two-storey, single-family residential dwelling, fronting onto Birchwood Ave and Glenwood Ave, and a vacant lot between 84 and 104 Plains Road E that consists primarily of grass surfaces. There are existing single-family residential properties to the south of the site.

Plains Road East has a curb-facing sidewalk with a boulevard, while Glenwood Ave and Birchwood Ave have a rural cross-section with no sidewalks or curbs.

1.2 Proposed Condition

The proposed development consists of an eleven-storey, mixed-use building with 253 residential units and at-grade commercial space fronting onto Plains Rd E. There is surface-level parking at the rear of the site, in addition, are two levels of below-grade parking proposed extending over the entire site and a third partial level. The proposed development will have two residential vehicle access driveways at the rear from Birchwood Ave and Glenwood Ave. Outdoor amenity space is provided. As part of the proposed development, there will be proposed sidewalks on the east, west, and north sides of the site, with an upgraded boulevard on Plains Rd E.

2.0 MUNICIPAL WATER AND WASTEWATER

The location of existing services was determined through the review of record drawings provided by the City of Burlington, Region of Halton, and a topographic survey completed by A.T.McLaren Limited. See Appendix ‘A’ for further details of the topographic survey.

All proposed services must be in accordance with the Ontario Building Code, City of Burlington, and Region of Halton standards and requirements. A copy of the proposed servicing plan is included and should be read in conjunction with this report. Existing and proposed servicing is discussed in further detail in the following sections.

2.1 Municipal Water

2.1.1 Existing Linear Infrastructure

Plans obtained from the Region of Halton and the City of Burlington indicate there is an existing 600 mm diameter watermain that runs along the centre of Plains Road E, a 400 mm diameter watermain near the boulevard on the south side and a 300 mm diameter on the north side of the road. There is also an existing 150 mm diameter watermain on Birchwood Ave and a 200 mm diameter watermain on Glenwood Ave.

2.1.2 Estimated Flows

Using the unit count and type together with Table A-4 of the Region of Halton's 2022 Development Charges Background Study population density guidelines for residential dwellings (1.356 persons/unit for less than two bedrooms, and 1.831 persons/unit for 2 or more-bedroom units), the residential population is estimated to be 386 persons. The commercial population is estimated using Page A-21 of the Region of Halton 2022 DC Study population density for commercial developments (37.4 m^2/employee), resulting in a commercial population of 28 persons. The domestic water usage is estimated using a water demand of 265 L/cap/d for residential and 225 L/cap/d for commercial (Table B-1 of Region of Halton's 2022 DC Study). Table 1 below summarized the results (see Appendix 'B' for supporting calculations).

The fire flow was estimated for demand purposes only using the Fire Underwriters Survey methodology. Fire flows should be confirmed at the building permit stage by the sprinkler consultant.

Table 1: Estimated Water Demands (L/min)

Average Daily Demand	75
Minimum Hourly Demand	75
Maximum Hourly Demand	294
Maximum Daily Demand	170
Estimated Fire Demand (FUS 1999)	8000
Maximum Daily Plus Fire Demand	8170

A fire flow test was undertaken (October 2nd, 2024) to confirm adequate firefighting flows. This test was conducted using the fire hydrants on Glenwood Avenue and Birchwood Avenue. The results of the flow test are included in Appendix 'B' and summarized as follows:

Table 2: Fire Hydrant Flow Test Summary (psig)

Static pressure	52
Flow 1, 757 usgpm (48 l/s)	48
Flow 2, 1342 usgpm (85 l/s)	45
Theoretical flow 3600 usgpm (227 l/s)	20
Estimated max. Daily plus fire service pressure	**26**

2.1.3 Proposed Connection

The proposed development will be connected to the existing 200 mm diameter PVC watermain on Glenwood Ave with a 200 mm diameter fire line and a 100 mm diameter domestic for the residential and commercial units. The service connection is located on the east side of the subject lands.

2.2 Municipal Wastewater

2.2.1 Existing Linear Infrastructure

Record drawings indicate there is a 250 mm diameter sanitary sewer running east to west within Plains Road in front of the subject lands. This sewer originates at a manhole approximately 3 m north of the northern property line, in the middle of the subject lands. There is a 450 mm diameter sanitary sewer on Glenwood Ave and a 200 mm diameter sanitary sewer on Birchwood Ave, both draining southwards.

2.2.2 Estimated Flows

Under the existing condition, using the Region of Halton design criteria for single-family homes of 95 persons/ha, the estimated existing sanitary flow is determined with 4 persons and 360 L/cap/d (See Appendix 'C' for supporting calculations).

Table 3: Estimated Existing Wastewater Flow (L/s)

Average Daily Dry Weather Flow	0.02
Modified Harmon Peaking Factor	4.44
Infiltration Allowance (0.286L/s-ha)	0.13
Peak Daily Flow	0.20

Under the proposed condition, based on a residential population of 386 people and a retail population of 28 employees (as determined in Section 2.1.2), and using flow rates of 360 L/cap/d for residential use and 310 L/emp/d for retail use, the proposed sanitary discharge is estimated in Table 4. Supporting calculations are provided in Appendix 'C'.

Table 4: Estimated Proposed Wastewater Flow (L/s)

Average Daily Dry Weather Flow	1.71
Modified Harmon Peaking Factor	4.03
Infiltration Allowance (0.26L/s-ha)	0.13
Peak Daily Flow	7.00

2.2.3 Proposed Connection

The proposed development's sanitary system will be serviced by a new 200 mm diameter sanitary lateral connection to the existing 200 mm diameter sewer on Birchwood Ave, complete with a property line inspection manhole. In addition, due to site constraints, the 3 easterly at-grade

residential units will drain using the existing sanitary service to Glenwood Ave, complete with a property line inspection manhole.

2.2.4 Sanitary Sewer Capacity Analysis

A downstream sanitary sewer capacity analysis was completed to support the sanitary connection to Birchwood Ave. Drainage areas were determined by reviewing record drawings and the Region of Halton's Wastewater Operating Maps. Estimated sanitary flows were then analyzed for the proposed condition using a Sanitary Sewer Design Sheet and Region of Halton criteria.

The sanitary sewer was analyzed from manhole 13343 on Birchwood Ave, as shown on the Region's Operating Maps, including the flows on Fairwood Pl East to the 900 mm diameter trunk sewer on Townsend Ave (manhole 19226). The sewers and associated drainage areas can be seen in Figure 1, Appendix 'C'. The sanitary sewer design sheet (Appendix 'C') provides the expected flows through the sewers.

Under the existing condition, the values for the flow contributed by the single-home families in the studied areas were estimated from the Region of Halton's Linear Design Manual with a population density of 95 person/ha and using flow rates of 360 L/cap/d for residential use. The analysis indicates that the 200 mm diameter sanitary sewer flowing south on Birchwood Ave is approximately 23% full under the existing condition.

The proposed development will contribute 7.0 L/s compared to the pre-development rate of 0.60 L/s. This increase in sewer flows results in the pipe's capacity reaching 39% full. This is not expected to have a significant impact on the downstream sanitary sewer system. See Appendix 'C' for supporting calculations.

The existing sanitary service to Glenwood Ave connects to the existing 450 mm diameter trunk sewer and conveys 0.011 L/s under existing conditions. The proposed 3 residential units will contribute 0.019 L/s under the proposed conditions. This minor increase in flows is not expected to have an impact on the downstream sanitary sewer system.

3.0 STORM DRAINAGE AND STORMWATER MANAGEMENT

3.1 Existing Storm Drainage

A portion of runoff from the subject lands sheet flows north to Plains Rd E. A portion of the site drains toward the southeast, flowing to Glenwood Avenue, and the remainder flows toward the southwest, draining to Birchwood Ave. Most runoff ultimately drains back north towards Plains Road to the existing 450 mm diameter storm sewer along Plains Road E, which flows westward. Through analysis of the topographic survey, there is no meaningful external drainage through the site under existing conditions. Under existing conditions, the subject lands are approximately 18% impervious and have peak runoff rates of 91.6 L/s during the 100-year storm and 49.6 L/s during

the 5-year storm. Refer to the EPA SWMM Model results and Pre-Development Storm Drainage Area Plan in Appendix 'D' for further details.

3.2 Proposed Storm Drainage

Based on the proposed development concept, the majority of the site consists of impervious surface with landscape strips around the site. Runoff from hardscaped areas and roof drainage will be captured and directed to the stormwater management tank located in the parking garage. The controlled areas account for 4276 m^2 of the site's area, leaving 471 m^2 of landscaping areas to flow uncontrolled off the site. The post-development impervious percentage was taken as 100% for a conservative approach.

A 250 mm diameter storm lateral connection to the existing 450 mm diameter storm sewer along Plains Road E is proposed at the northwest corner of the development. Catch basin inlets are located on the south rear parking to intercept the 100-year event and direct flow to the stormwater management tank. Storage is provided to a maximum depth of 150 mm on the roof. Stormwater management requirements are discussed in further detail in Section 3.3.

3.3 Stormwater Management

The City of Burlington's requirements for stormwater management are set out in the City's Stormwater Management Design Guidelines. Erosion control criteria is outlined in the Falcon Creek Hydrology/Hydraulics study as per required by the AMEC 2013 Class EA study.

The following stormwater criteria for the proposed development was identified in the pre-con comments:

1. **Stormwater Quantity Controls (Peak Flow Control)**

   Post Development discharge from the greater of the 100-year or Regional Storm is to be controlled to the 5-year pre-development runoff rate. Pre-development runoff is to be calculated using a maximum imperviousness of 36%.

2. **Erosion Control**

   The first 25 mm of rainfall is to be captured on site and released over the following 24 hours in accordance with the Falcon Creek Hydrology/Hydraulics Study.

3. **Stormwater Quality Control**

   Achieve enhanced 80% TSS removal for a minimum of 90% of the runoff volume. Typical OGS units will only be credited with 50% TSS removal.

4. **Stormwater Runoff Volume Reduction (Water Balance)**

   Provide retention of 5 mm over the entire area of the proposed development in accordance with the Falcon Creek Hydrology/Hydraulics Study.

3.3.1 Stormwater Quantity Control (Peak Flow Control)

The City of Burlington requires developments to manage drainage from either the 100-year storm or Regional Storm, whichever is greater, to the 5-year pre-development peak flow rate. The proposed development results in an increase in impervious area, which therefore increases the peak runoff rate. To manage post-development runoff rates to the required 5-year pre-development peak flow rate, stormwater peak flow attenuation and storage is needed. Stormwater storage will be provided through a combination of roof storage and tank storage in the underground parking garage.

EPA SWMM was used to model pre- and post-development conditions to design the site's stormwater management system. The model includes the controlled roof drains as well as the release rate from the tank in series. See Table 5 below for a summary of the model outputs. Refer to Appendix 'D' for EPA SWMM results and further details.

Table 5: Stormwater Flows

Return	Pre-Dev Peak Flow (L/s)	Post-Dev Uncontrolled (L/s)	Post-Dev Peak Flow (L/s)	Post-Dev Total Peak Flow (L/s)	Roof Storage Required (m^3)	Tank Storage Required (m^3)
25 mm	19.8	1.6	1.4	3.0	3	83
5-yr	49.6	4.4	40.0	44.4	10	88
10-yr	59.6	5.4	40.0	45.4	12	103
25-yr	72.1	6.7	40.0	48.4	15	124
50-yr	81.8	7.7	40.0	47.7	18	141
100-yr	91.6	8.8	40.0	48.8	20	159 ł
Regional	62.0	6.4	40.0	46.4	23 ł	155

ł Denotes maximum storage requirement

To control the post-development peak flow rate to the pre-development 5-year peak flow rate of 48.8 L/s, approximately 159 m^3 of storage is required in the stormwater management tank for quantity control.

The roof will have 7 inlets, each rated for 5 GPM per inch of head (0.32 L/s per 25.4 mm of head) with a maximum of 0.15 m of ponding. The roof area is approximately 800 m^2, resulting in 60 m^3 of storage volume available. Based on the modelling results, there is sufficient available volume on the roof to implement rooftop controls as part of the stormwater management system. In accordance with City of Burlington Stormwater Management Guidelines, rooftop storage should involve either "blue" or "green" rooftop systems. Further details will be provided at Site Plan, along with supporting documentation from the structural engineer.

The stormwater management tank located within the underground parking structure will collect water from the roof and rear parking area and release controlled flows to the proposed stormwater property line manhole. The erosion control will require a max discharge at 1.4 L/s, matching the erosion control guidelines (refer to Section 3.3.2 below). If the erosion control

volume is exceeded, the maximum rate is 40 L/s, to meet the quantity control target. The total volume requirement for erosion control, quantity control, and water balance is 183 m^3. The proposed tank provides a total of 193 m^3.

As the stormwater tank is within the parking structure, as defined by OBC, the mechanical engineer is responsible for the design of the outlet structure, tank, tank access, emergency overflow and any required piping to the outlet structure. The controlled release rate can be achieved through pumps or gravity outlet (i.e. orifice, vortex orifice), or a combination of both.

3.3.2 Erosion Control

The site is located within the Aldershot area and must comply with erosion control criteria outlined in the Falcon Creek Hydrology and Hydraulic Study (December 2012), as per the AMEC 2013 Class EA study. The requirement is to capture runoff from 25 mm rainfall event and release it over a 24-hour period. This results in an allowable release rate of 1.4 L/s and requires 83 m^3 of storage. Storage will be provided within the stormwater management tank and drain at the allowable release rate to the stormwater connection.

3.3.3 Water Balance

As per City of Burlington Guidelines, it is recommended to infiltrate or re-use the first 5 mm of rainfall, this results in 24 m^3 of water to be reused on site. Storage for the re-use volume will be provided in the stormwater management tank. The water may be used for irrigation purposes or other uses. Further details will be provided at the Site Plan stage (by others).

3.3.4 Stormwater Quality Control

The City of Burlington requires the development to meet MECP Enhanced protection (80% long-term removal of TSS). An Imbrium Jellyfish JF4-2-1-40 (or approved equivalent) is proposed to treat TSS-loaded areas from the parking lot. The Jellyfish is to be located in the underground P1 level and is provided with an outlet pipe and an overflow weir. An adequately maintained filtration system provides 80% long-term removal of TSS. Refer to the sizing report and CA-ETV Certification in Appendix 'D' for more details.

3.4 Capacity Analysis

To ensure sufficient capacity in the existing 450 mm diameter storm sewer on Plains Road East flowing westward, an analysis of the contributing drainage areas was completed by preparing a storm sewer design sheet. The analysis covers the storm sewers from Birchwood Avenue (MH2) to Cooke Boulevard (MH12). The analysis assessed the existing drainage areas and future development of the subject lands using the controlled flows that outlet to Plains Rd E storm sewer. Under existing conditions, the 450 mm diameter storm sewer at a slope of 0.57% flows 56% full during the 5-year storm. With the inclusion of the proposed controlled flows from the subject lands the sewer would flow at approximately 59% full. Thus, there is sufficient capacity in

the existing storm sewer to service the subject lands. See Appendix 'D' for supporting calculations and Figure 4 for Stormwater Drainage Plan.

4.0 SUMMARY

The information presented in this Functional Servicing Report demonstrates that the proposed development can be serviced by the existing infrastructure for water, wastewater, and stormwater and can meet the City of Burlington stormwater management criteria. The following is a summary of the report findings:

- The subject lands is currently occupied by single-family dwellings and is proposed to consist of an eleven-storey mixed-use development.
- There is existing municipal water infrastructure adjacent to the site that can service the site's estimated demand. The proposed average daily water demand for the site is 75 L/min and an estimated fire demand of 8,000 L/min. The site's domestic water service connection will be connected to the existing 200 mm diameter watermain on Glenwood Avenue.
- The site's sanitary system will be connected to the existing 200 mm diameter sanitary sewer on Birchwood Avenue using a 200 mm diameter sanitary lateral.
- The 3 easterly at grade residential units will drain by the existing sanitary service on Glenwood Drive.
- All storms greater than the 25 mm event up to the 100-year and Regional storm will be controlled to the 5-year pre-development flow rate. Stormwater storage will consist of roof storage and an underground stormwater management tank.
- All storms up to and including the 25 mm event will be captured and released at 1.4 L/s as per the municipal erosion control guidelines for the subject lands.
- The stormwater tank in the underground parking garage provides the required storage of 183 m^3 with a provided volume of 193 m^3. The building's roof will provide a minimum of 23 m^3 of storage for quantity control.
- Runoff stored within a stormwater tank will outlet to a maximum rate of 40.0 L/s to the storm sewer on Plains Road East.
- Storm drainage for the site will be through a 250 mm diameter storm lateral to the 450 mm diameter storm sewer on Plains Road East.
- Stormwater quality (80% TSS removal) is achieved through a Jellyfish Filtration System located in the underground parking level P1 that will treat all sediment laden runoff from the surface parking areas.

Based on the above, we support the proposed development for OPA/ZBA from a civil engineering perspective.

Should you have any questions, do not hesitate to contact the undersigned.

PREPARED BY TRAFALGAR ENGINEERING LTD.



Anna Duong
Junior Designer

Nicole Sylvester, P.Eng.
Principal, Design Services

Appendix 'A'

SURVEYOR'S REAL PROPERTY REPORT
PART 1, PLAN OF PART OF
LOTS 33, 34, 35, 36, 37 AND 38
REGISTERED PLAN 725PF
IN THE
CITY OF BURLINGTON
REGIONAL MUNICIPALITY OF HALTON

SCALE 1:150 METRIC

3 1.5 0 3 6 9 metres

R.A. McLAREN, O.L.S. – 2024

SURVEYOR'S REAL PROPERTY REPORT (PART 2)

PART OF LOTS 33, 34, 35, 36, 37 AND 38
REGISTERED PLAN 725PF
PIN 07117-0034 IS SUBJECT TO AN EASEMENT AS IN HR1705289 AS ILLUSTRATED ON THE PLAN.

THIS PLAN DOES NOT CERTIFY COMPLIANCE WITH ZONING BY-LAWS.

THIS PLAN WAS PREPARED FOR
DAVID WILLIAM GERRARD, THOMAS GERRARD, DONALD GERRARD AND DEBRA GERRARD FOR PIN 07117-0033 (LT)
JEFFREY KEITH DIBENEDETTO FOR PINS 07117-0034 (LT), 07117-0035 (LT) AND 07117-0036 (LT)

PLAINS ROAD EAST
(ORIGINAL ROAD ALLOWANCE BETWEEN BROKEN FRONT CONCESSION & CONCESSION 1)
(PART 3, INST 1431 DEPARTMENT OF HIGHWAYS PLAN PLAN P-1957-44
ONCDR-N-COUNCIL ROD/RR FORMERLY THE ONCTS HIGHWAY No. 2)
PIN 07122-0002 (LT)

CLEARVIEW AVENUE

BIRCHWOOD AVENUE
(UNOPENED ROAD ALLOWANCE)
PIN 07109-0016 (LT)

GLENWOOD AVENUE
(BY REGISTERED PLAN 725PF)
PIN 07109-0001 (LT)

TOWNSEND AVENUE

PART 6, MISC. PLAN 427
PART 7, MISC. PLAN 427
PART 5, MISC. PLAN 427

SITE BENCHMARK
TOP OF CUT CROSS
ELEV.=101.044

PIN 07117-0033 (LT)
PIN 07117-0034 (LT)
SUBJECT TO AN EASEMENT AS IN HR1705289
PIN 07117-0035 (LT)
PIN 07117-0036 (LT)
PIN 07117-0037 (LT)
PIN 07117-0032 (LT)

LOT 33
LOT 34
LOT 35
LOT 36
LOT 37
LOT 38
LOT 39

REGISTERED PLAN 725PF

1 STOREY DWELLING #990
2 STOREY BRICK DWELLING No. 84
1 STOREY BRICK DWELLING No. 104
2 STOREY BRICK DWELLING No. 990
1 STOREY BRICK DWELLING No. 991
1 1/2 STOREY FRAME DWELLING No. 982

BEARING COMPARISON
FOR BEARING COMPARISONS, A ROTATION OF 02°45'10" COUNTER CLOCKWISE WAS APPLIED TO BEARINGS ON P1 & P4 TO CONVERT TO GRID BEARINGS

BEARING NOTE:
BEARINGS ARE UTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS A AND B, BY REAL TIME NETWORK OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (2010.0)

NOTE:
DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.99967319

INTEGRATION DATA

OBSERVED REFERENCE POINTS (ORP'A) UTM ZONE 17, NAD83 (CSRS) (2010.0). COORDINATES TO URBAN ACCURACY PER SEC. 14(2) OF O.REG. 216/10		
POINT ID	NORTHING	EASTING
ORP A	4790819.197	593346.832
ORP B	4790730.379	593272.800
COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.		

LEGEND:

☐	DENOTES	MONUMENT SET
■	"	MONUMENT FOUND
CC	"	CUT CROSS
CP	"	CONC. PIN
SIB	"	STANDARD IRON BAR
SSIB	"	SHORT STANDARD IRON BAR
4SS	"	A.T. PETERS, O.L.S.
824	"	A.T. McLAREN, O.L.S.
MUR	"	CITY OF BURLINGTON
MMP	"	43CDP MACKAY & PETERS
ORI	"	ORIGIN UNKN.
Meas	"	MEASURED
P1	"	REGISTERED PLAN 725
P2	"	MISC. PLAN 427
P3	"	PLAN BY MACKAY MACKAY & PETERS DATED MARCH 26, 2010
P4	"	PLAN BY A.T. McLAREN, O.L.S. DATED MARCH 26, 2010
P5	"	PLAN BY A.T. McLAREN, O.L.S. DATED OCTOBER 15, 1976
D1	"	INSTRUMENT 744005
D2	"	INSTRUMENT 434146
D3	"	INSTRUMENT 702228
D4	"	INSTRUMENT 823644
APP	"	APPROACH
BK	"	BACK OF BANK
BMON	"	BELL BOX
BH	"	BOREHOLE
CB	"	CATCH BASIN
CBOX	"	CONTROL BOX
CL	"	CENTRELINE
CLF	"	CHAIN LINK FENCE
EOP	"	EDGE OF PAVEMENT
EVG	"	EVERGREEN
FH	"	FIRE HYDRANT
FS	"	FLAG STONE
GF	"	GARAGE FLOOR
GM	"	GAS METER
GW	"	GUY WIRE
HM	"	HYDRO METER
HP	"	HYDRO POLE
HW	"	HEADWALL
ILS	"	INTER-LOCKING STONE
LF	"	LATTICE FENCE
LSA	"	LANDSCAPED AREA
PS	"	PATIO STONES
RF	"	RAIL FENCE
SRW	"	STONE RETAINING WALL
SS	"	STOP SIGN
TF	"	TOP OF BANK
U	"	OVERHEAD UTILITIES
UGG	"	UNDERGROUND GAS
WS	"	WINDOW SILL
WW	"	WINDOW WELL
ø	"	DIAMETER
≈	"	NOT TO SCALE

BENCHMARK:

MONUMENT 44

Maplehurst School, 481 Plains Road East (Highway No. 2) 1.92 km northeast of Waterdown
Road: tablet in the front of southeast concrete foundation wall, 1.5m southwest of the most easterly of two entrances, 1.04m below red brick siding. No. 3488.

ELEVATION: 98.754 metres

NOTE:

UNDERGROUND SERVICE AND UTILITY LOCATIONS WERE DERIVED FROM DRAWINGS BY CITY OF BURLINGTON DRAWING No. 1-1-8, E68 AND E-23-D

UNDERGROUND SERVICE AND UTILITY LOCATIONS MUST BE VERIFIED PRIOR TO CONSTRUCTION

INVERTS MUST BE VERIFIED PRIOR TO CONSTRUCTION

METRIC NOTE:
DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

SURVEYOR'S CERTIFICATE:
1. CERTIFY THAT:
THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE REGULATIONS MADE UNDER THEM
2. THE SURVEY WAS COMPLETED ON THE 17th DAY OF JANUARY, 2024

18 JAN 2024
DATE
ROB A. McLAREN, O.L.S.

THIS PLAN OF SURVEY RELATES TO AOLS PLAN SUBMISSION FORM NUMBER 71646

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A.T. McLaren Limited
LEGAL AND ENGINEERING SURVEYS
69 JOHN STREET SOUTH, SUITE 230
HAMILTON, ONTARIO, L8N 2B9
PHONE (905) 527-8559 FAX (905) 527-0032

No.	DESCRIPTION	DATE	BY
1	REVISED STORM ON PLAINS RD EAST	APRIL 8, 2024	JB

REVISIONS

Drawn	Checked	Crew Chief	Scale
JB	RBM	CW	1:150

Dwg.No. 37632

Appendix 'B'

TRAFALGAR ENGINEERING LTD.

ESTIMATED WATER DEMAND

Project: One Hundred on Plains
Desc: Issued for OBA & ZBA Submission

Project No.: 1861
Prepared By: AD
Checked By: NAS

	Occupancy Data					Peaking Factors			Demand Flow		
Land Use / Occupancy Type	Unit Count / GFA	Population Density (pers/unit)	Eq. Population (cap.)	Per Cap. Demand (L/cap. Day)	Average Daily Demand (L/min)	Min. Hour	Peak Hour	Max. Daily	Min. Hour Demand (L/min)	Max. Hour Demand (L/min)	Max. Daily Demand (L/min)
Apartments - Less than 2 Bedrooms	163	1.356	221	265	41	1.00	4.00	2.25	41	163	92
Apartments - 2 or More Bedrooms	90	1.831	165	265	30	1.00	4.00	2.25	30	121	68
Non-Residential/Retail (sq.m)	1048	37.4	28	225	4	1.00	2.25	2.25	4	10	10
*Per Cap. Demand based on O.B.C. Table 8.2.1.3.B. -- 5 L/1.0m^2 Stores											
TOTAL	**1301**		**414**		**75**				**75**	**294**	**170**

Average Daily Demand: **75 (L/min)**
Minimum Hourly Demand: **75 (L/min)**
Maximum Hourly Demand: **294 (L/min)**
Maximum Daily Demand: **170 (L/min)**
Max. Daily Plus Fire: **8170 (L/min)**

Fire Flow
Using Fire Underwriters Survey Methodology:

1. **An estimate of the fire flow is given by the formula** $F = 220C\sqrt{A}$

Where:
F = The required fire flow in litres per minute
C = Coefficient related to the type of construction
A = The total floor area in square metres (including all storeys but excluding basements at least 50% below grade)

Type of Construction: Fire-Resistive Coefficient: 0.60 Total Floor Area: 5416.95 (m^2)

F = 10000 (L/min) Adequately Protected Vertical Openings: Yes

Area Note: For fire resistive buildings, consider the two largest adjoining floors plus 50% of the remaining floors up to eight, when openings are inadequately protected. For adequately protected vertical openings consider only the area of the largest floor plus 25% of each of the two immediately adjoining floors

2. **Adjust the value in No. 1 for occupancy surcharge/reduction**

Occupancy Contents: Limited Combustible Factor: -15%

F = 8500 (L/min)

3. **Adjust the value in No. 2 for sprinkler**

NFPA 13 Sprinkler:	Yes	Reduction:	20%
Standard Water Supply:	Yes	Reduction:	10%
Fully Supervised:	Yes	Reduction:	10%
		Total Reduction:	**40%**
		Sprinkler Reduction:	**3400 (L/min)**

4. Adjust the value in No. 2 for exposure

	Separation (m)	Charge
North	38	5%
East	30	5%
South	20	10%
West	27	10%
Total Charge:		**30%**
Exposure Charge:		**2550 (L/min)**

5. **Estimated Fire Flow is value in No. 2 less *Sprinkler Reduction* plus *Exposure Charge*, rounded to the nearest 1000**

F = 8000 (L/min)

TRAFALGAR ENGINEERING LTD.

ESTIMATED DEMAND PRESSURE
(AT MAIN)

Project: One Hundred on Plains
Desc: Issued for OBA & ZBA Submission

Project No.: 1861
Prepared By: AD
Checked By: NAS

Hydrant Residual Flow (Refer to Attached Flow Test Results)

Coefficient	$C=$	0.9	
Port Diameter	$D=$	2.5	(inch)
Pitot Pressure	$P_{pit}=$	22	(psig)
Residual Flow	$Q_R=$	787	(us gpm)
Residual Flow	$Q_R=$	2979	(L/min)

Hydrant Theoretical Flow (Refer to Attached Flow Test Results)

Static Pressure	$P_{stat}=$	52	(psig)
Residual Pressure	$P_{res}=$	48	(psig)
Theoretical Pressure	$P_{theo}=$	20	(psig)
Theoretical Flow	$Q_T=$	2419	(us gpm)
Theoretical Flow	$Q_T=$	9156	(L/min)

Max. Demand Pressure

Maximum Demand	$Q_D=$	8170	(L/min)
Maximum Demand	$Q_D=$	2159	(us gpm)
Calculated Pressure	$P=$	26	(psig)

Where:

$$Q_R = 29.84 \times C \times D^2 \times P_{pit}^{0.5}$$

$$Q_T = Q_R \times [(P_{stat} - P_{theo})/(P_{stat} - P_{res})]^{0.54}$$

$$P = P_{stat} - (Q_D/Q_R)^{1.852} \times (P_{stat} - P_{res})$$

Notes:

Refer to attached hydrant flow test results for 300mm main on Church Street prepared by Jackson Waterworks dated May 2, 2016.

Appendix 'C'

From: MacKenzie, Ronald
To: Malcolm Wallace
Subject: RE: PreTechnical Circulation Comments - 100 Plains Road East (1861)
Date: March 21, 2025 10:14:33 AM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png
image006.png
image007.png
image008.png

EXTERNAL SENDER: This email originated outside of Trafalgar Engineering.

Hi Malcolm,

Yes, that would be fine.

Ron

From: Malcolm Wallace <mwallace@trafalgareng.com>
Sent: Thursday, March 20, 2025 2:23 PM
To: MacKenzie, Ronald <Ronald.MacKenzie@halton.ca>
Subject: RE: PreTechnical Circulation Comments - 100 Plains Road East (1861)

CAUTION: This email originated from outside the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe. If you are unsure or need assistance please contact the IT Service Desk.

Hi Ron,

Further to our call last week I just want to get something in writing confirming that continuing to use the unit count to estimate the proposed population is acceptable (as long as it is the more stringent approach).

Thanks,

Malcolm

TRAFALGAR ENGINEERING
www.trafalgareng.com

Malcolm Wallace, EIT
Intermediate Designer
#1 - 481 Morden Road
Oakville, Ontario, L6K 3W6
O: (905) 338-3366
E: mwallace@trafalgareng.com

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From: Malcolm Wallace
Sent: March 12, 2025 4:19 PM
To: MacKenzie, Ronald <Ronald.MacKenzie@halton.ca>
Subject: RE: PreTechnical Circulation Comments - 100 Plains Road East (1861)

Hi Ron,

Looks like we're playing telephone tag, maybe we can sort this out over email as I believe it is a simple misunderstanding. My inquiry is surrounding the comment we received which states we use the population density for single family homes to estimate the proposed sanitary flows:

- Analysis was provided in the FSR that demonstrates what the proposed flows from the development will be, however, this analysis used incorrect population densities. The analysis utilized the new Linear Design Manual (LDM) population densities for single family homes and not for high density multi storey buildings. Also, downstream analysis was not provided in the FSR that shows that the existing downstream sanitary system for the sewer on Birchwood Avenue can accommodate the proposed flows from the development.

The population for single family homes is only used when estimated the existing sanitary flows from the property. The proposed sanitary flow is estimated using proposed unit counts to estimate the population, the same method used to estimate the water demands earlier in the FSR:

> Based on a residential population of 386 people and a retail population of 28 employees (as determined in Section 2.1), and using flow rates of 360 L/cap/d for residential use and 310 L/emp/d for retail use, the proposed sanitary discharge is estimated in Table 4. Supporting calculations are provided in Appendix 'B'.

Table 4: Estimated Proposed Wastewater Flow (L/s)

Average Daily Dry Weather Flow	1.71
Modified Harmon Peaking Factor	4.03
Infiltration Allowance (0.26L/s-ha)	0.13
Peak Daily Flow	9.00

The Region's LDM encourages the use of unit counts to estimate population densities when possible and when they provide a more stringent / conservative result, and in this case they do.

Please advise if it is acceptable for us to continue to use the estimated unit counts to estimate the population for the sanitary and water demands.

Thanks,

Malcolm

TRAFALGAR ENGINEERING LTD.

ESTIMATED EXISTING SANITARY FLOW

Project: One Hundred on Plains
Desc: Issued for OBA/ZBA Submission

Project No.: 1861
Prepared By: AD
Checked By: NAS

Residential

Land Use / Occupancy Type	Area (ha)	Population Density (pers/ha)	Eq. Population (cap.)	Per Cap. Demand (L/cap. Day)	Average Daily Dry Weather Flow (L/s)
Sanitary Flow to Birchwood Connection					
Single family home	0.015*	95.0	1	360	0.006
Sanitary Flow to Glenwood Connection					
Single family home	0.028*	95.0	3	360	0.011
** The house footprint area is used for a more precise estimate of the population density*					
TOTAL	**0**		**4**		**0.02**

Industrial / Commercial / Institutional

Land Use / Occupancy Type	GFA	Population Density (pers/ha)	Eq. Population (cap.)	Per Cap. Demand (L/Ha. Day)	Average Daily Dry Weather Flow (L/s)
			0		0.0
TOTAL	**0**		**0**		**0.0**

Residential Peaking Factor:	4.44	
ICI Peaking Factor:	4.50	
Include ICI Peaking?	No	
Tributary Area:	0.47	(ha)
Infiltration Allowance:	0.286	(L/s ha)
Foundation Drain Allowance:	0.00	(L/s ha)
Residential Average Flow:	0.2	(L/s)
ICI Average Flow:	0.0	(L/s)
Groundwater Discharge:	0.0	(L/s)
Total Average Flow:	**0.2**	**(L/s)**
Residential Peak Flow:	0.2	(L/s)
ICI Peak Flow:	0.0	(L/s)
Groundwater Discharge:	0.0	(L/s)
Total Peak Flow:	**0.2**	**(L/s)**

TRAFALGAR ENGINEERING LTD.

ESTIMATED SANITARY FLOW

Project: One Hundred on Plains
Desc: Issued for OBA/ZBA Submission

Project No.: 1861
Prepared By: AD
Checked By: NAS

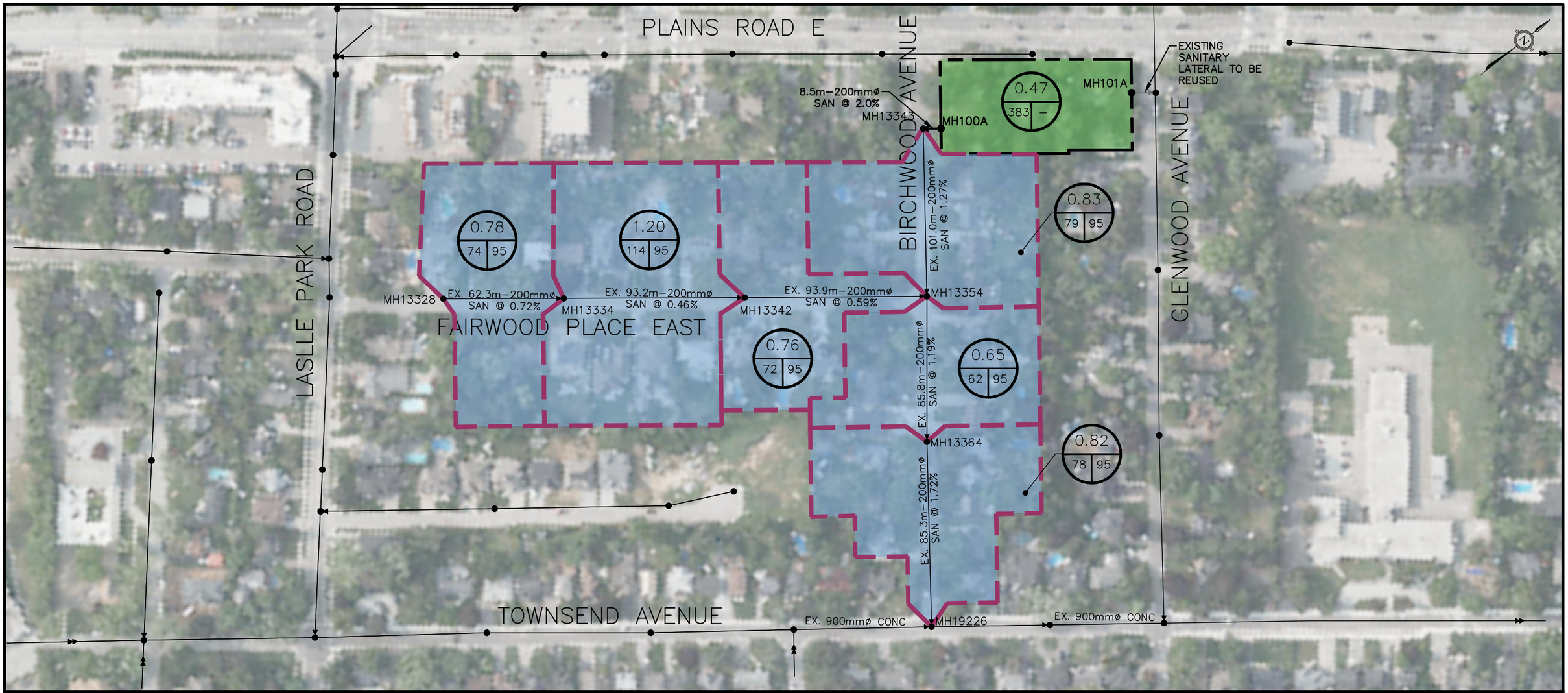
Residential

Land Use / Occupancy Type	Unit Count/ GFA	Population Density (pers/ha)	Eq. Population (cap.)	Per Cap. Demand (L/cap. Day)	Average Daily Dry Weather Flow (L/s)
Sanitary Flow to Birchwood Connection					
Apartments - Less than 2 Bedrooms	161	1.4	218	360	0.9
Apartments - 2 or More Bedrooms	89	1.8	163	360	0.7
Sanitary Flow to Glenwood Connection					
Apartments - Less than 2 Bedrooms	2	1.4	3	360	0.011
Apartments - 2 or More Bedrooms	1	1.8	2	360	0.008
TOTAL	**253**		**386**		**1.61**

Industrial / Commercial / Institutional

Land Use / Occupancy Type	Unit Count/ GFA	Population Density (m^2/pers)	Eq. Population (cap.)	Per Cap. Demand (L/Ha. Day)	Average Daily Dry Weather Flow (L/s)
Non-Residential/Retail (sq.m)	1048	37.4	28	310	0.101
TOTAL	**1048**		**28**		**0.101**

Residential Peaking Factor:	4.03	
ICI Peaking Factor:	4.36	
Include ICI Peaking?	Yes	
Tributary Area:	0.47	(ha)
Infiltration Allowance:	0.29	(L/s ha)
Foundation Drain Allowance:	0.00	(L/s ha)
Residential Average Flow:	1.7	(L/s)
ICI Average Flow:	0.1	(L/s)
Groundwater Discharge:	0.0	(L/s)
Total Average Flow:	**1.8**	**(L/s)**
Residential Peak Flow:	6.6	(L/s)
ICI Peak Flow:	0.4	(L/s)
Groundwater Discharge:	0.0	(L/s)
Total Peak Flow:	**7.0**	**(L/s)**



LEGEND

0.31 / 88 | 285

- DRAINAGE AREA IN HECTARES
- POPULATION PER HECTARE
- EQUIVALENT POPULATION

- SUBJECT LANDS– MID RISE APARTMENT (by units)
- SINGLE FAMILY (95 p/ha)
- DRAINAGE AREA BOUNDARY
- EXISTING SANITARY SEWER AND MANHOLE
- PROPOSED SANITARY SEWER AND MANHOLE

PROJECT TITLE
ONE HUNDRED ON PLAINS
84–104 PLAINS ROAD EAST AND 990 GLENWOOD AVE
BURLINGTON, ONTARIO

DRAWING TITLE
SANITARY DRAINAGE PLAN

TRAFALGAR ENGINEERING
#1-481 MORDEN ROAD, OAKVILLE, ON, L6K 3W6
www.trafalgareng.com

DESIGN BY	AD	SCALE	1:2000
DRAWN BY	AD	DATE	2025/03/06
PROJECT No.	1861		

DRAWING No. FIG 1

FILENAME: P:\1861 Plains Rd East\04-CAD\03-Site Plan\1861F.dwg
PLOTDATE: May 12, 2025 - 3:58pm

TRAFALGAR ENGINEERING

Prepared By: AD
Checked By: NAS
Project No. : 1861

SANITARY SEWER DESIGN SHEET

Regional Municipality of Halton

Project Name : One Hundreds on Plains
Municipal Number:
Date: 2025-03-06
Sheet: 1 of 1

LOCATION	FROM MH	TO MH	TRIBUTARY AND FLOW DATA: Tributary Area: Residential: Area (ha)	Residential: Density (ppha)	ICI: Area (ha)	ICI: Density (ppha)	Total (ha)	Population Tributary: Res (pers.)	ICI (pers.)	Total (pers.)	Average Demand: Res (L/cap. Day)	ICI (L/cap. Day)	Incr. Avg. Q (L/s)	Total Avg. Q (L/s)	Peaking Factor: K_{avg}	M_{avg}	Peak Q, Q_P (L/s)	Infiltr. (L/s)	Design Flow, Q_D (L/s)	PIPE DATA: Length, L (m)	Pipe Dia., D (mm)	Slope, s (%)	Manning's Coeff., n	Full Flow Capacity, Q_F (L/s)	Velocity: Full (m/s)	Velocity: Actual (m/s)	Flow Depth, d (mm)	d/D	Q_d/Q_F (%)	Type	Class
Existing Condition																															
84-102 Plains Rd E		MH13343	0.04	95	0.43		0.47	4		4	360		0.0	0.0	1.0	4.45	0.1	0.1	0.2	101.0	200	1.27	0.013	38.6	1.19	0.34	10	0.05	1%		
Birchwood Ave	MH13343	**MH13354**	0.83	95			1.30	79		79	360		0.3	0.3	1.0	4.27	1.4	0.4	1.8	101.0	200	1.27	0.013	38.6	1.19	0.64	28	0.14	5%		
Fairwood Pl E	MH13328	MH13334	0.78	95			0.78	74		74	360		0.3	0.3	1.0	4.28	1.3	0.2	1.5	62.3	200	0.72	0.013	29.0	0.90	0.51	30	0.15	5%		
	MH13334	MH13342	1.20	95			1.98	114		114	360		0.5	0.8	1.0	4.23	3.3	0.6	3.9	93.2	200	0.46	0.013	23.2	0.72	0.55	55	0.27	17%		
	MH13342	**MH13354**	0.76	95			2.74	72		72	360		0.3	1.1	1.0	4.28	4.6	0.8	5.4	93.9	200	0.59	0.013	26.3	0.81	0.66	61	0.30	21%		
Birchwood Ave	**MH13354**	MH13364	0.65	95			4.69	62		213	360		0.3	1.7	1.0	4.14	6.9	1.3	8.3	85.8	200	1.19	0.013	37.3	1.15	0.96	63	0.31	22%		
	MH13364	MH19226	0.82	95			5.51	78		78	360		0.3	2.0	1.0	4.27	8.5	1.6	10.1	85.3	200	1.72	0.013	44.9	1.38	1.13	65	0.32	23%		
Proposed Condition																															
100 Plains Road E	MH100A	MH13343	0.37		0.10	0.0037	0.47	381	28	409	360	310	1.7	1.7	1.0	3.84	6.5	0.1	7.0	8.5	200	2.0	0.013	48.4	1.49	1.10	51	0.25	14%		
Birchwood Ave	MH13343	**MH13354**	0.83	95			1.30	79		488	360		0.3	2.0	1.0	3.92	7.9	0.4	8.3	101.0	200	1.27	0.013	38.6	1.19	0.97	63	0.31	21%		
Fairwood Pl E	MH13328	MH13334	0.78	95			0.78	74		74	360		0.3	0.3	1.0	4.28	1.3	0.2	1.5	62.3	200	0.72	0.013	29.0	0.90	0.51	30	0.15	5%		
	MH13334	MH13342	1.20	95			1.98	114		114	360		0.5	0.8	1.0	4.23	3.3	0.6	3.9	93.2	200	0.46	0.013	23.2	0.72	0.55	55	0.27	17%		
	MH13342	**MH13354**	0.76	95			2.74	72		72	360		0.3	1.1	1.0	4.28	4.6	0.8	5.4	93.9	200	0.59	0.013	26.3	0.81	0.66	61	0.30	21%		
Birchwood Ave	**MH13354**	MH13364	0.65	95			4.69	62		622	360		0.3	3.4	1.0	3.91	13.1	1.3	14.5	85.8	200	1.19	0.013	37.3	1.15	1.08	87	0.43	39%		
	MH13364	MH19226	0.82	95			5.51	78		78	360		0.3	3.7	1.0	4.27	15.7	1.6	17.3	85.3	200	1.72	0.013	44.9	1.38	1.30	87	0.43	39%		
TRIBUTARY AREA TOTAL			10.49		0.53		**17.49**	1343	28	**1857**																					

Notes:
1) Pipe diameter is nominal
2) Capacity and velocity are based on Imperial I.D. (Nom. Dia x 25.4/25)
3) Cells shaded denote a hard coded value
4) The average daily flow for residential and commercial values are taken from Table B-3 of the Region of Halton's 2022 Development Charges Background Study
5) The slopes of the sanitary sewers are taken from the available record drawings and Region of Halton's operating maps
6) The proposed residential population is estimated based on the unit count and type per Table A-4 of the Region of Halton's 2022 Development Charges Background Study
7) The proposed commercial population is estimated using Page A-21 of the Region of Halton 2022 DC Study population density for commercial developments

Peaking Factor $M = K_{avg} \times (1+14 / (4+P^{1/2}))$
Where P is Total population in thousands
$K_{avg} = (A_R + 0.8 \times A_{ICI}) / (A_{Total})$
Infiltration = 0.286 L/ha/s

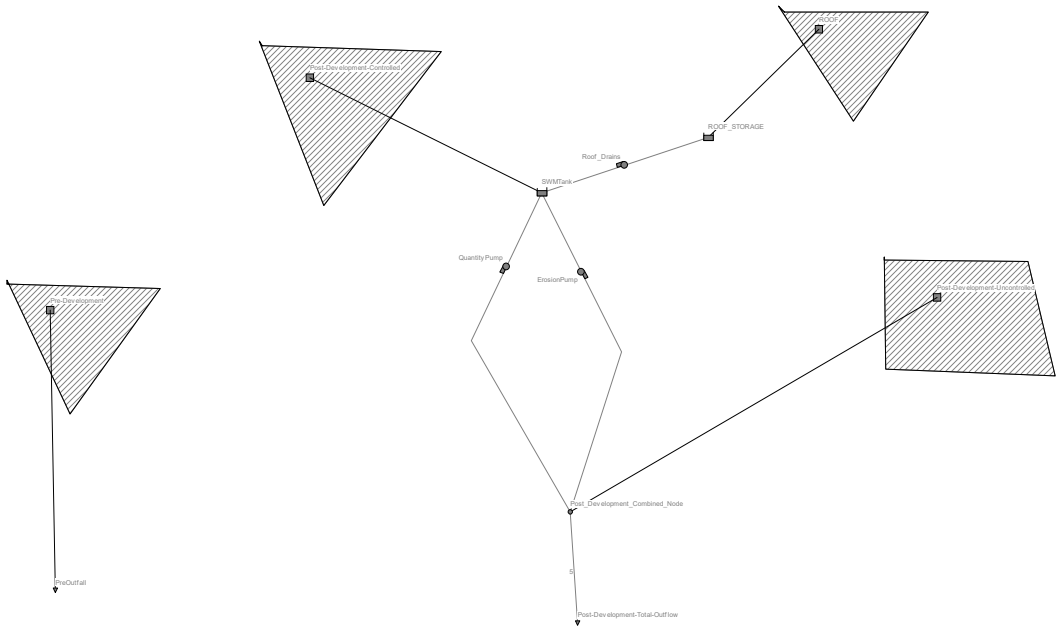
Full Flow Capacity (Manning's Equation), Q_F
$Q_F = (1/n) \times A \times R^{2/3} \times s^{1/2}$
$= (1/n) \times 311.7 \times D^{8/3} \times s^{1/2}$

Avg. Daily Flow Residential 360 L/cap/d
Avg. Daily Flow Commercial 310 L/cap/d

Appendix 'D'

1861 EPA SWMM

09/30/2024 00:10:00



```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.1)
------------------------------------------------------------

1861 EPA SWMM 25-mm Storm

****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 09/30/2024 00:00:00
Ending Date .............. 10/03/2024 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:10:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 20.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.024        25.000
Evaporation Loss .........         0.000         0.000
```

Infiltration Loss	0.003
Surface Runoff	0.021
Final Storage	0.000
Continuity Error (%)	-0.336

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.021	0.211
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.021	0.211
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

Time-Step Critical Elements

Link 5 (44.60%)

Highest Flow Instability Indexes

All links are stable.

Most Frequent Nonconverging Nodes

Convergence obtained at all time steps.

```
  ************************
  Routing Time Step Summary
  ************************
  Minimum Time Step           :     7.98 sec
  Average Time Step           :    15.62 sec
  Maximum Time Step           :    20.00 sec
  % of Time in Steady State   :     0.00
  Average Iterations per Step :     2.00
  % of Steps Not Converging   :     0.00
  Time Step Frequencies       :
     20.000 -  9.564 sec      :    94.39 %
      9.564 -  4.573 sec      :     5.61 %
      4.573 -  2.187 sec      :     0.00 %
      2.187 -  1.046 sec      :     0.00 %
      1.046 -  0.500 sec      :     0.00 %


  ***************************
  Subcatchment Runoff Summary
  ***************************


-------------------------------------------------------------------------------------------------------
--------------------
                             Total      Total      Total      Total     Imperv       Perv      Total
Total     Peak  Runoff
                            Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff
Runoff   Runoff   Coeff
  Subcatchment                mm         mm         mm         mm         mm         mm         mm
10^6 ltr      LPS

-------------------------------------------------------------------------------------------------------
--------------------
  Post-Development-Controlled      25.00       0.00       0.00       0.00      25.12       0.00      25.12
      0.09    47.59   1.005
  Pre-Development           25.00       0.00       0.00       4.75       4.52      15.77      20.29
0.10    19.84   0.811
```

```
  Post-Development-Uncontrolled      25.00       0.00       0.00       4.90       0.00      20.13
20.13        0.01     1.57   0.805
  ROOF                       25.00       0.00       0.00       3.10       6.28      15.68      21.97
0.02     5.75   0.879


  ******************
  Node Depth Summary
  ******************

  ---------------------------------------------------------------------------
                                Average  Maximum  Maximum  Time of Max    Reported
                                  Depth    Depth      HGL   Occurrence   Max Depth
  Node                 Type       Meters   Meters   Meters  days hr:min      Meters
  ---------------------------------------------------------------------------
  Post_Development_Combined_Node JUNCTION     0.00     0.01     0.01     0  01:40        0.01
  Post-Development-Total-Outflow OUTFALL      0.00     0.01     0.01     0  04:12        0.01
  PreOutfall           OUTFALL      0.00     0.00     0.00     0  00:00        0.00
  SWMTank              STORAGE      0.19     0.79     0.79     0  04:12        0.79
  ROOF_STORAGE         STORAGE      0.00     0.03     0.03     0  01:49        0.03


  ******************
  Node Inflow Summary
  ******************

  -------------------------------------------------------------------------------------------------
                                Maximum  Maximum                  Lateral       Total        Flow
                                Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                 Inflow   Inflow   Occurrence      Volume      Volume       Error
  Node                 Type        LPS      LPS  days hr:min    10^6 ltr    10^6 ltr     Percent
  -------------------------------------------------------------------------------------------------
  Post_Development_Combined_Node JUNCTION      1.57     2.97     0  01:40     0.00948       0.114
-0.020
  Post-Development-Total-Outflow OUTFALL       0.00     3.70     0  04:12           0       0.114
0.000
  PreOutfall           OUTFALL      19.84    19.84     0  01:30      0.0963      0.0963       0.000
  SWMTank              STORAGE      47.59    49.74     0  01:30      0.0872       0.105       0.027
  ROOF_STORAGE         STORAGE       5.75     5.75     0  01:30      0.0176      0.0176      -0.001
```

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
SWMTank	0.020	9	0	0	0.083	36	0 04:12	1.40
ROOF_STORAGE	0.000	0	0	0	0.003	5	0 01:49	2.91

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr	
Post-Development-Total-Outflow	44.69	1.53	3.70	0.114	

PreOutfall	20.51	3.13	19.84	0.096
System	32.60	4.67	22.58	0.211

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
5	CONDUIT	3.70	0	04:12	0.18	0.00	0.01
QuantityPump	PUMP	0.00	0	00:00		0.00	
ErosionPump	PUMP	1.40	0	00:35		1.00	
Roof_Drains	PUMP	2.91	0	01:49		0.22	

****
Flow Classification Summary
****

	Adjusted	Fraction of Time in Flow Class								
Conduit	/Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
5	1.00	0.05	0.00	0.00	0.95	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

****
Pumping Summary
****

Pump	Percent Utilized	Number of Start-Ups	Min Flow LPS	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr	Power Usage Kw-hr	% Time Off Pump	Curve Low	Curve High
QuantityPump	0.00	0	0.00	0.00	0.00	0.000	0.00	0.0	0.0	
ErosionPump	29.19	1	0.00	1.39	1.40	0.105	0.12	0.0	0.0	
Roof_Drains	7.84	1	0.00	0.94	2.91	0.018	0.03	0.0	0.0	

Analysis begun on: Tue Jan 7 10:08:12 2025
Analysis ended on: Tue Jan 7 10:08:12 2025
Total elapsed time: < 1 sec

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.1)
------------------------------------------------------------

1861 EPA SWMM 5-Year Storm

****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 09/30/2024 00:00:00
Ending Date .............. 10/03/2024 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:10:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 20.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.070        74.177
Evaporation Loss .........         0.000         0.000
```

Infiltration Loss	0.007	7.309
Surface Runoff	0.064	67.015
Final Storage	0.000	0.018
Continuity Error (%)	-0.224	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.064	0.636
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.063	0.627
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	1.312	

Highest Continuity Errors

Node SWMTank (2.45%)

Time-Step Critical Elements

Link 5 (69.74%)

Highest Flow Instability Indexes

All links are stable.

```
  ********************************
  Most Frequent Nonconverging Nodes
  ********************************
  Convergence obtained at all time steps.


  ************************
  Routing Time Step Summary
  ************************
  Minimum Time Step           :     0.50 sec
  Average Time Step           :    12.90 sec
  Maximum Time Step           :    20.00 sec
  % of Time in Steady State   :     0.00
  Average Iterations per Step :     2.29
  % of Steps Not Converging   :     2.01
  Time Step Frequencies       :
     20.000 -  9.564 sec      :    88.25 %
      9.564 -  4.573 sec      :     6.57 %
      4.573 -  2.187 sec      :     5.13 %
      2.187 -  1.046 sec      :     0.01 %
      1.046 -  0.500 sec      :     0.04 %


  ***************************
  Subcatchment Runoff Summary
  ***************************


-------------------------------------------------------------------------------------------------------
--------------------
                             Total      Total      Total      Total     Imperv       Perv      Total
Total     Peak  Runoff
                            Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff
Runoff   Runoff   Coeff
  Subcatchment                  mm         mm         mm         mm         mm         mm         mm
10^6 ltr      LPS
```

```
---------------------------------------------------------------------------------------------------
--------------------
  Post-Development-Controlled      74.18       0.00       0.00       0.00      74.46       0.00      74.46
       0.26    95.22   1.004
  Pre-Development           74.18       0.00       0.00      11.59      13.38      49.26      62.64
0.30    49.59   0.845
  Post-Development-Uncontrolled      74.18       0.00       0.00      13.62       0.00      60.61
60.61        0.03     4.38   0.817
  ROOF                      74.18       0.00       0.00       9.91      18.60      45.79      64.39
0.05    13.63   0.868


  ******************
  Node Depth Summary
  ******************

  ---------------------------------------------------------------------------
                                Average  Maximum  Maximum  Time of Max    Reported
                                  Depth    Depth      HGL   Occurrence   Max Depth
  Node                 Type       Meters   Meters   Meters  days hr:min      Meters
  ---------------------------------------------------------------------------
  Post_Development_Combined_Node JUNCTION     0.01     0.06     0.06     0  08:12        0.05
  Post-Development-Total-Outflow OUTFALL      0.00     0.04     0.04     0  08:12        0.04
  PreOutfall           OUTFALL      0.00     0.00     0.00     0  00:00        0.00
  SWMTank              STORAGE      0.34     0.84     0.84     0  08:19        0.84
  ROOF_STORAGE         STORAGE      0.00     0.06     0.06     0  08:33        0.06


  ******************
  Node Inflow Summary
  ******************

  ---------------------------------------------------------------------------------------------
                                Maximum  Maximum                  Lateral       Total        Flow
                                Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                 Inflow   Inflow   Occurrence      Volume      Volume       Error
  Node                 Type        LPS      LPS  days hr:min    10^6 ltr    10^6 ltr     Percent
  ---------------------------------------------------------------------------------------------
  Post_Development_Combined_Node JUNCTION      4.38    44.36     0  08:12      0.0285       0.331
```

0.230
  Post-Development-Total-Outflow OUTFALL   0.00   50.02   0 08:12   0   0.33
0.000
  PreOutfall   OUTFALL   49.59   49.59   0 08:10   0.297   0.297   0.000
  SWMTank   STORAGE   95.22   98.96   0 08:10   0.258   0.31   2.509
  ROOF_STORAGE   STORAGE   13.63   13.63   0 08:10   0.0515   0.0515   -0.001

  ****
  Node Surcharge Summary
  ****

  No nodes were surcharged.

  ****
  Node Flooding Summary
  ****

  No nodes were flooded.

  ****
  Storage Volume Summary
  ****

                        Average   Avg Evap Exfil   Maximum   Max   Time of Max   Maximum
                         Volume   Pcnt Pcnt Pcnt   Volume   Pcnt   Occurrence   Outflow
  Storage Unit   1000 m   Full Loss Loss   1000 m   Full   days hr:min   LPS

  SWMTank   0.036   16   0   0   0.088   38   0 08:19   40.00
  ROOF_STORAGE   0.001   1   0   0   0.010   16   0 08:33   5.22

  ****
  Outfall Loading Summary
  ****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr	
Post-Development-Total-Outflow	70.09	3.60	50.02	0.330	
PreOutfall	49.10	4.83	49.59	0.297	
System	59.60	8.43	92.72	0.627	

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
5	CONDUIT	50.02	0 08:12	0.85	0.05	0.05
QuantityPump	PUMP	40.00	0 08:12		1.00	
ErosionPump	PUMP	1.40	0 04:29		1.00	
Roof_Drains	PUMP	5.22	0 08:33		0.39	

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
5	1.00	0.00	0.00	0.00	0.97	0.03	0.00	0.00	0.01	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

****
Pumping Summary
****

Pump	Percent Utilized	Number of Start-Ups	Min Flow LPS	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr	Power Usage Kw-hr	% Time Off Pump	Curve Low	Curve High
QuantityPump	1.12	316	0.00	40.00	40.00	0.116	0.24	0.0	0.0	
ErosionPump	52.74	317	0.00	1.36	1.40	0.184	0.23	0.0	0.0	
Roof_Drains	33.53	1	0.00	0.93	5.22	0.051	0.09	0.0	0.0	

Analysis begun on: Tue Jan 7 10:08:56 2025
Analysis ended on: Tue Jan 7 10:08:56 2025
Total elapsed time: < 1 sec

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.1)
------------------------------------------------------------

1861 EPA SWMM 10-Year Storm

****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 09/30/2024 00:00:00
Ending Date .............. 10/03/2024 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:10:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 20.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.082        86.173
Evaporation Loss .........         0.000         0.000
```

Infiltration Loss	0.007
Surface Runoff	0.075
Final Storage	0.000
Continuity Error (%)	-0.222

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.075	0.748
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.074	0.738
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	1.377	

Highest Continuity Errors

Node SWMTank (3.06%)

Time-Step Critical Elements

Link 5 (70.85%)

Highest Flow Instability Indexes

All links are stable.

```
  ********************************
  Most Frequent Nonconverging Nodes
  ********************************
  Convergence obtained at all time steps.


  ************************
  Routing Time Step Summary
  ************************
  Minimum Time Step           :     0.50 sec
  Average Time Step           :    12.65 sec
  Maximum Time Step           :    20.00 sec
  % of Time in Steady State   :     0.00
  Average Iterations per Step :     2.32
  % of Steps Not Converging   :     2.09
  Time Step Frequencies       :
     20.000 -  9.564 sec      :    85.99 %
      9.564 -  4.573 sec      :     7.52 %
      4.573 -  2.187 sec      :     6.41 %
      2.187 -  1.046 sec      :     0.01 %
      1.046 -  0.500 sec      :     0.07 %


  ***************************
  Subcatchment Runoff Summary
  ***************************


-------------------------------------------------------------------------------------------------------
--------------------
                             Total      Total      Total      Total     Imperv       Perv      Total
Total     Peak  Runoff
                            Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff
Runoff   Runoff   Coeff
  Subcatchment                  mm         mm         mm         mm         mm         mm         mm
10^6 ltr      LPS
```

```
---------------------------------------------------------------------------------------------------
--------------------
  Post-Development-Controlled      86.17       0.00       0.00       0.00      86.50       0.00      86.50
       0.30   110.23   1.004
  Pre-Development           86.17       0.00       0.00      11.82      15.54      58.88      74.42
0.35    59.57   0.864
  Post-Development-Uncontrolled      86.17       0.00       0.00      13.86       0.00      72.39
72.39        0.03     5.40   0.840
  ROOF                       86.17       0.00       0.00      10.06      21.60      54.66      76.26
0.06    16.23   0.885


  ******************
  Node Depth Summary
  ******************

  ---------------------------------------------------------------------------
                                Average  Maximum  Maximum  Time of Max    Reported
                                  Depth    Depth      HGL   Occurrence   Max Depth
  Node                 Type       Meters   Meters   Meters  days hr:min      Meters
  ---------------------------------------------------------------------------
  Post_Development_Combined_Node JUNCTION     0.01     0.05     0.05     0  08:09        0.05
  Post-Development-Total-Outflow OUTFALL      0.00     0.04     0.04     0  08:09        0.04
  PreOutfall           OUTFALL      0.00     0.00     0.00     0  00:00        0.00
  SWMTank              STORAGE      0.36     0.98     0.98     0  08:21        0.98
  ROOF_STORAGE         STORAGE      0.01     0.07     0.07     0  08:34        0.07


  ******************
  Node Inflow Summary
  ******************

  -------------------------------------------------------------------------------------------------
                                Maximum  Maximum                  Lateral       Total        Flow
                                Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                 Inflow   Inflow   Occurrence      Volume      Volume       Error
  Node                 Type        LPS      LPS  days hr:min    10^6 ltr    10^6 ltr     Percent
  -------------------------------------------------------------------------------------------------
  Post_Development_Combined_Node JUNCTION      5.40    45.40     0  08:10      0.0341       0.384
```

-0.197
  Post-Development-Total-Outflow OUTFALL   0.00   48.48   0 08:09   0   0.385
0.000
  PreOutfall   OUTFALL   59.57   59.57   0 08:10   0.353   0.353   0.000
  SWMTank   STORAGE   110.23   114.40   0 08:10   0.3   0.361   3.160
  ROOF_STORAGE   STORAGE   16.23   16.23   0 08:10   0.061   0.061   0.000

  ****
  Node Surcharge Summary
  ****

  No nodes were surcharged.

  ****
  Node Flooding Summary
  ****

  No nodes were flooded.

  ****
  Storage Volume Summary
  ****

                        Average   Avg Evap Exfil   Maximum   Max   Time of Max   Maximum
                         Volume   Pcnt Pcnt Pcnt   Volume   Pcnt   Occurrence   Outflow
  Storage Unit   1000 m   Full Loss Loss   1000 m   Full   days hr:min   LPS

  SWMTank   0.038   16   0   0   0.103   45   0 08:21   40.00
  ROOF_STORAGE   0.001   1   0   0   0.012   20   0 08:34   5.83

  ****
  Outfall Loading Summary
  ****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr	
Post-Development-Total-Outflow	71.33	4.49	48.48	0.385	
PreOutfall	50.08	6.03	59.57	0.353	
System	60.71	10.52	106.88	0.738	

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
5	CONDUIT	48.48	0 08:09	0.85	0.05	0.05
QuantityPump	PUMP	40.00	0 08:09		1.00	
ErosionPump	PUMP	1.40	0 03:39		1.00	
Roof_Drains	PUMP	5.83	0 08:34		0.44	

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
5	1.00	0.00	0.00	0.00	0.96	0.03	0.00	0.00	0.01	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

****
Pumping Summary
****

Pump	Percent Utilized	Number of Start-Ups	Min Flow LPS	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr	Power Usage Kw-hr	% Time Off Pump	Curve Low	Curve High
QuantityPump	1.52	295	0.00	40.00	40.00	0.158	0.35	0.0	0.0	
ErosionPump	53.61	296	0.00	1.37	1.40	0.189	0.24	0.0	0.0	
Roof_Drains	33.93	1	0.00	1.13	5.83	0.061	0.11	0.0	0.0	

Analysis begun on: Tue Jan 7 10:26:16 2025
Analysis ended on: Tue Jan 7 10:26:16 2025
Total elapsed time: < 1 sec

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.1)
------------------------------------------------------------

1861 EPA SWMM 25-Year Storm

****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 09/30/2024 00:00:00
Ending Date .............. 10/03/2024 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:10:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 20.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.095       100.029
Evaporation Loss .........         0.000         0.000
```

Infiltration Loss	0.007
Surface Runoff	0.088
Final Storage	0.000
Continuity Error (%)	-0.223

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.088	0.879
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.087	0.866
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	1.450	

Highest Continuity Errors

Node SWMTank (2.80%)

Time-Step Critical Elements

Link 5 (72.27%)

Highest Flow Instability Indexes

All links are stable.

```
  ********************************
  Most Frequent Nonconverging Nodes
  ********************************
  Convergence obtained at all time steps.


  ************************
  Routing Time Step Summary
  ************************
  Minimum Time Step           :     0.50 sec
  Average Time Step           :    12.36 sec
  Maximum Time Step           :    20.00 sec
  % of Time in Steady State   :     0.00
  Average Iterations per Step :     2.34
  % of Steps Not Converging   :     1.98
  Time Step Frequencies       :
     20.000 -  9.564 sec      :    83.25 %
      9.564 -  4.573 sec      :     8.65 %
      4.573 -  2.187 sec      :     8.03 %
      2.187 -  1.046 sec      :     0.03 %
      1.046 -  0.500 sec      :     0.05 %


  ***************************
  Subcatchment Runoff Summary
  ***************************


-----------------------------------------------------------------------------------------------------
--------------------
                             Total      Total      Total      Total     Imperv       Perv      Total
Total     Peak  Runoff
                            Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff
Runoff   Runoff   Coeff
  Subcatchment                 mm         mm         mm         mm         mm         mm         mm
10^6 ltr      LPS
```

```
---------------------------------------------------------------------------------------------------
--------------------
  Post-Development-Controlled     100.03       0.00       0.00       0.00     100.42       0.00     100.42
       0.35   128.58   1.004
  Pre-Development          100.03       0.00       0.00      12.02      18.04      70.06      88.10
0.42    72.08   0.881
  Post-Development-Uncontrolled     100.03       0.00       0.00      14.06       0.00      86.07
86.07        0.04     6.70   0.860
  ROOF                     100.03       0.00       0.00      10.18      25.07      64.96      90.03
0.07    19.47   0.900


  ******************
  Node Depth Summary
  ******************

  ---------------------------------------------------------------------------
                                Average  Maximum  Maximum  Time of Max    Reported
                                  Depth    Depth      HGL   Occurrence   Max Depth
  Node                 Type       Meters   Meters   Meters  days hr:min      Meters
  ---------------------------------------------------------------------------
  Post_Development_Combined_Node JUNCTION     0.01     0.05     0.05     0  08:07        0.05
  Post-Development-Total-Outflow OUTFALL      0.01     0.04     0.04     0  08:07        0.04
  PreOutfall           OUTFALL      0.00     0.00     0.00     0  00:00        0.00
  SWMTank              STORAGE      0.39     1.18     1.18     0  08:23        1.17
  ROOF_STORAGE         STORAGE      0.01     0.08     0.08     0  08:35        0.08


  ******************
  Node Inflow Summary
  ******************

  -------------------------------------------------------------------------------------------------
                                Maximum  Maximum                  Lateral       Total        Flow
                                Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                 Inflow   Inflow   Occurrence      Volume      Volume       Error
  Node                 Type        LPS      LPS  days hr:min    10^6 ltr    10^6 ltr     Percent
  -------------------------------------------------------------------------------------------------
  Post_Development_Combined_Node JUNCTION      6.70    46.70     0  08:10      0.0405       0.449
```

```
0.218
  Post-Development-Total-Outflow OUTFALL       0.00    48.35     0  08:07           0       0.448
0.000
  PreOutfall           OUTFALL      72.08    72.08     0  08:10       0.418       0.418       0.000
  SWMTank              STORAGE     128.58   133.23     0  08:10       0.349       0.421       2.881
  ROOF_STORAGE         STORAGE      19.47    19.47     0  08:10       0.072       0.072       0.001


  **********************
  Node Surcharge Summary
  **********************

  No nodes were surcharged.


  **********************
  Node Flooding Summary
  **********************

  No nodes were flooded.


  **********************
  Storage Volume Summary
  **********************

  ------------------------------------------------------------------------------------------------
                        Average     Avg  Evap Exfil       Maximum     Max    Time of Max    Maximum
                         Volume    Pcnt  Pcnt  Pcnt        Volume    Pcnt     Occurrence    Outflow
  Storage Unit          1000 m     Full  Loss  Loss       1000 m     Full    days hr:min        LPS
  ------------------------------------------------------------------------------------------------
  SWMTank                 0.041      18     0     0         0.124      54       0  08:23      40.00
  ROOF_STORAGE            0.001       2     0     0         0.015      25       0  08:35       6.53


  **********************
  Outfall Loading Summary
  **********************
```

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr	
Post-Development-Total-Outflow	72.64	5.51	48.35		0.448
PreOutfall	51.29	7.44	72.08	0.418	
System	61.96	12.95	118.75	0.866	

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
5	CONDUIT	48.35	0 08:07	0.85	0.05	0.05
QuantityPump	PUMP	40.00	0 08:06		1.00	
ErosionPump	PUMP	1.40	0 02:44		1.00	
Roof_Drains	PUMP	6.53	0 08:35		0.49	

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
5	1.00	0.00	0.00	0.00	0.96	0.04	0.00	0.00	0.02	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

****
Pumping Summary
****

Pump	Percent Utilized	Number of Start-Ups	Min Flow LPS	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr	Power Usage Kw-hr	% Time Off Pump	Curve Low	Curve High
QuantityPump	2.04	284	0.00	40.00	40.00	0.212	0.52	0.0	0.0	
ErosionPump	54.04	285	0.00	1.38	1.40	0.193	0.25	0.0	0.0	
Roof_Drains	34.28	1	0.00	1.37	6.53	0.072	0.14	0.0	0.0	

Analysis begun on: Tue Jan 7 10:26:52 2025
Analysis ended on: Tue Jan 7 10:26:53 2025
Total elapsed time: 00:00:01

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.1)
------------------------------------------------------------

1861 EPA SWMM 50-Year Storm

****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 09/30/2024 00:00:00
Ending Date .............. 10/03/2024 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:10:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 20.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.105       110.817
Evaporation Loss .........         0.000         0.000
```

Infiltration Loss	0.007
Surface Runoff	0.098
Final Storage	0.000
Continuity Error (%)	-0.221

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.098	0.981
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.097	0.966
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	1.508	

Highest Continuity Errors

Node SWMTank (3.14%)

Time-Step Critical Elements

Link 5 (72.83%)

Highest Flow Instability Indexes

All links are stable.

```
  ********************************
  Most Frequent Nonconverging Nodes
  ********************************
  Convergence obtained at all time steps.


  ************************
  Routing Time Step Summary
  ************************
  Minimum Time Step           :     0.50 sec
  Average Time Step           :    12.19 sec
  Maximum Time Step           :    20.00 sec
  % of Time in Steady State   :     0.00
  Average Iterations per Step :     2.37
  % of Steps Not Converging   :     2.00
  Time Step Frequencies       :
     20.000 -  9.564 sec      :    81.13 %
      9.564 -  4.573 sec      :     9.43 %
      4.573 -  2.187 sec      :     9.36 %
      2.187 -  1.046 sec      :     0.04 %
      1.046 -  0.500 sec      :     0.05 %


  ***************************
  Subcatchment Runoff Summary
  ***************************


-----------------------------------------------------------------------------------------------------
--------------------
                             Total      Total      Total      Total     Imperv       Perv      Total
Total     Peak  Runoff
                            Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff
Runoff   Runoff   Coeff
  Subcatchment                  mm         mm         mm         mm         mm         mm         mm
10^6 ltr      LPS
```

```
---------------------------------------------------------------------------------------------------
--------------------
  Post-Development-Controlled     110.82       0.00       0.00       0.00     111.25       0.00     111.25
       0.39   142.17   1.004
  Pre-Development          110.82       0.00       0.00      12.14      19.98      78.79      98.77
0.47    81.76   0.891
  Post-Development-Uncontrolled     110.82       0.00       0.00      14.19       0.00      96.74
96.74        0.05     7.71   0.873
  ROOF                     110.82       0.00       0.00      10.26      27.78      72.99     100.76
0.08    21.94   0.909


  ******************
  Node Depth Summary
  ******************

  ---------------------------------------------------------------------------
                                Average  Maximum  Maximum  Time of Max    Reported
                                  Depth    Depth      HGL   Occurrence   Max Depth
  Node                 Type       Meters   Meters   Meters  days hr:min      Meters
  ---------------------------------------------------------------------------
  Post_Development_Combined_Node JUNCTION     0.01     0.05     0.05     0  08:05        0.05
  Post-Development-Total-Outflow OUTFALL      0.01     0.04     0.04     0  08:05        0.04
  PreOutfall           OUTFALL      0.00     0.00     0.00     0  00:00        0.00
  SWMTank              STORAGE      0.41     1.34     1.34     0  08:24        1.33
  ROOF_STORAGE         STORAGE      0.01     0.08     0.08     0  08:36        0.08


  ******************
  Node Inflow Summary
  ******************

  ---------------------------------------------------------------------------------------------
                                Maximum  Maximum                  Lateral       Total        Flow
                                Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                 Inflow   Inflow   Occurrence      Volume      Volume       Error
  Node                 Type        LPS      LPS  days hr:min    10^6 ltr    10^6 ltr     Percent
  ---------------------------------------------------------------------------------------------
  Post_Development_Combined_Node JUNCTION      7.71    47.71     0  08:10      0.0456       0.498
```

0.028
  Post-Development-Total-Outflow OUTFALL   0.00   49.22   0 08:05   0   0.498
0.000
  PreOutfall   OUTFALL   81.76   81.76   0 08:10   0.469   0.469   0.000
  SWMTank   STORAGE   142.17   147.17   0 08:10   0.386   0.467   3.241
  ROOF_STORAGE   STORAGE   21.94   21.94   0 08:10   0.0805   0.0805   0.001

  ****
  Node Surcharge Summary
  ****

  No nodes were surcharged.

  ****
  Node Flooding Summary
  ****

  No nodes were flooded.

  ****
  Storage Volume Summary
  ****

                         Average   Avg Evap Exfil   Maximum   Max   Time of Max   Maximum
                          Volume   Pcnt Pcnt Pcnt   Volume   Pcnt   Occurrence   Outflow
  Storage Unit   1000 m   Full Loss Loss   1000 m   Full   days hr:min   LPS

  SWMTank   0.043   18   0   0   0.141   61   0 08:24   40.00
  ROOF_STORAGE   0.001   2   0   0   0.018   29   0 08:36   7.03

  ****
  Outfall Loading Summary
  ****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr	
Post-Development-Total-Outflow	73.30	6.31	49.22	0.498	
PreOutfall	52.12	8.51	81.76	0.469	
System	62.71	14.82	129.43	0.966	

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
5	CONDUIT	49.22	0 08:05	0.85	0.05	0.05
QuantityPump	PUMP	40.00	0 08:05		1.00	
ErosionPump	PUMP	1.40	0 02:03		1.00	
Roof_Drains	PUMP	7.03	0 08:36		0.53	

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
5	1.00	0.00	0.00	0.00	0.95	0.05	0.00	0.00	0.02	0.00

****

Conduit Surcharge Summary
****

No conduits were surcharged.

****
Pumping Summary
****

Pump	Percent Utilized	Number of Start-Ups	Min Flow LPS	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr	Power Usage Kw-hr	% Time Off Pump	Curve Low	Curve High
QuantityPump	2.44	274	0.00	40.00	40.00	0.253	0.69	0.0	0.0	
ErosionPump	54.09	275	0.00	1.39	1.40	0.194	0.25	0.0	0.0	
Roof_Drains	34.49	1	0.00	1.56	7.03	0.080	0.17	0.0	0.0	

Analysis begun on: Tue Jan 7 10:27:27 2025
Analysis ended on: Tue Jan 7 10:27:28 2025
Total elapsed time: 00:00:01

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.1)
------------------------------------------------------------

1861 EPA SWMM 100-Year Storm

****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 09/30/2024 00:00:00
Ending Date .............. 10/03/2024 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:10:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 20.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.115       121.120
Evaporation Loss .........         0.000         0.000
```

Infiltration Loss	0.007	7.699
Surface Runoff	0.108	113.671
Final Storage	0.000	0.018
Continuity Error (%)	-0.221	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.108	1.079
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.106	1.062
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	1.581	

Highest Continuity Errors

Node SWMTank (2.97%)

Time-Step Critical Elements

Link 5 (72.97%)

Highest Flow Instability Indexes

All links are stable.

```
  ********************************
  Most Frequent Nonconverging Nodes
  ********************************
  Convergence obtained at all time steps.


  ************************
  Routing Time Step Summary
  ************************
  Minimum Time Step           :     0.50 sec
  Average Time Step           :    12.09 sec
  Maximum Time Step           :    20.00 sec
  % of Time in Steady State   :     0.00
  Average Iterations per Step :     2.38
  % of Steps Not Converging   :     1.84
  Time Step Frequencies       :
     20.000 -  9.564 sec      :    79.17 %
      9.564 -  4.573 sec      :     9.95 %
      4.573 -  2.187 sec      :    10.73 %
      2.187 -  1.046 sec      :     0.07 %
      1.046 -  0.500 sec      :     0.08 %


  ***************************
  Subcatchment Runoff Summary
  ***************************


-----------------------------------------------------------------------------------------------------
--------------------
                             Total      Total      Total      Total     Imperv       Perv      Total
Total     Peak  Runoff
                            Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff
Runoff   Runoff   Coeff
  Subcatchment                  mm         mm         mm         mm         mm         mm         mm
10^6 ltr      LPS
```

```
---------------------------------------------------------------------------------------------------
--------------------
  Post-Development-Controlled     121.12       0.00       0.00       0.00     121.60       0.00     121.60
       0.42   155.72   1.004
  Pre-Development          121.12       0.00       0.00      12.24      21.83      87.15     108.98
0.52    91.55   0.900
  Post-Development-Uncontrolled     121.12       0.00       0.00      14.29       0.00     106.96
106.96        0.05     8.75   0.883
  ROOF                     121.12       0.00       0.00      10.32      30.35      80.67     111.03
0.09    24.43   0.917


  ******************
  Node Depth Summary
  ******************

  ---------------------------------------------------------------------------
                                Average  Maximum  Maximum  Time of Max    Reported
                                  Depth    Depth      HGL   Occurrence   Max Depth
  Node                 Type       Meters   Meters   Meters  days hr:min      Meters
  ---------------------------------------------------------------------------
  Post_Development_Combined_Node JUNCTION     0.01     0.05     0.05     0  08:03        0.05
  Post-Development-Total-Outflow OUTFALL      0.01     0.04     0.04     0  08:10        0.04
  PreOutfall           OUTFALL      0.00     0.00     0.00     0  00:00        0.00
  SWMTank              STORAGE      0.43     1.51     1.51     0  08:26        1.51
  ROOF_STORAGE         STORAGE      0.01     0.09     0.09     0  08:36        0.09


  ******************
  Node Inflow Summary
  ******************

  ---------------------------------------------------------------------------------------------
                                Maximum  Maximum                  Lateral       Total        Flow
                                Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                 Inflow   Inflow   Occurrence      Volume      Volume       Error
  Node                 Type         LPS      LPS  days hr:min    10^6 ltr    10^6 ltr     Percent
  ---------------------------------------------------------------------------------------------
  Post_Development_Combined_Node JUNCTION      8.75    48.75     0  08:10      0.0504       0.546
```

0.349
  Post-Development-Total-Outflow OUTFALL   0.00   48.77   0 08:10   0   0.544
0.000
  PreOutfall   OUTFALL   91.55   91.55   0 08:10   0.517   0.517   0.000
  SWMTank   STORAGE   155.72   161.05   0 08:10   0.422   0.511   3.056
  ROOF_STORAGE   STORAGE   24.43   24.43   0 08:10   0.0888   0.0888   0.001

  ****
  Node Surcharge Summary
  ****

  No nodes were surcharged.

  ****
  Node Flooding Summary
  ****

  No nodes were flooded.

  ****
  Storage Volume Summary
  ****

                         Average   Avg Evap Exfil   Maximum   Max   Time of Max   Maximum
                          Volume   Pcnt Pcnt Pcnt   Volume   Pcnt   Occurrence   Outflow
  Storage Unit   1000 m   Full Loss Loss   1000 m   Full   days hr:min   LPS

  SWMTank   0.045   19   0   0   0.159   69   0 08:26   40.00
  ROOF_STORAGE   0.002   2   0   0   0.020   33   0 08:36   7.50

  ****
  Outfall Loading Summary
  ****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr	
Post-Development-Total-Outflow	73.50	7.11	48.77	0.544	
PreOutfall	52.75	9.52	91.55	0.517	
System	63.13	16.63	140.25	1.062	

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
5	CONDUIT	48.77	0 08:10	0.85	0.05	0.05
QuantityPump	PUMP	40.00	0 08:03		1.00	
ErosionPump	PUMP	1.40	0 01:30		1.00	
Roof_Drains	PUMP	7.50	0 08:36		0.57	

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
5	1.00	0.00	0.00	0.00	0.94	0.05	0.00	0.00	0.03	0.00

****

Conduit Surcharge Summary

No conduits were surcharged.

Pumping Summary

Pump	Percent Utilized	Number of Start-Ups	Min Flow LPS	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr	Power Usage Kw-hr	% Time Off Pump	% Time Curve Low	% Time Curve High
QuantityPump	2.87	265	0.00	40.00	40.00	0.298	0.88	0.0	0.0	0.0
ErosionPump	53.85	266	0.00	1.39	1.40	0.193	0.25	0.0	0.0	0.0
Roof_Drains	34.67	1	0.00	1.74	7.50	0.089	0.21	0.0	0.0	0.0

Analysis begun on: Tue Jan 7 10:31:50 2025
Analysis ended on: Tue Jan 7 10:31:50 2025
Total elapsed time: < 1 sec

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.1)
------------------------------------------------------------

1861 EPA SWMM Regional Storm

****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 09/30/2024 00:00:00
Ending Date .............. 10/03/2024 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:10:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 20.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.271       285.008
Evaporation Loss .........         0.000         0.000
```

Infiltration Loss	0.014	14.830
Surface Runoff	0.257	270.255
Final Storage	0.000	0.019
Continuity Error (%)	-0.034	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.257	2.566
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.255	2.545
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.812	

Highest Continuity Errors

Node SWMTank (2.67%)

Time-Step Critical Elements

Link 5 (95.49%)

Highest Flow Instability Indexes

All links are stable.

```
  ********************************
  Most Frequent Nonconverging Nodes
  ********************************
  Convergence obtained at all time steps.


  ************************
  Routing Time Step Summary
  ************************
  Minimum Time Step           :     0.50 sec
  Average Time Step           :     8.66 sec
  Maximum Time Step           :    20.00 sec
  % of Time in Steady State   :     0.00
  Average Iterations per Step :     2.93
  % of Steps Not Converging   :     8.09
  Time Step Frequencies       :
     20.000 -  9.564 sec      :    64.54 %
      9.564 -  4.573 sec      :     7.28 %
      4.573 -  2.187 sec      :    27.99 %
      2.187 -  1.046 sec      :     0.03 %
      1.046 -  0.500 sec      :     0.15 %


  ***************************
  Subcatchment Runoff Summary
  ***************************


-----------------------------------------------------------------------------------------------------
--------------------
                             Total      Total      Total      Total     Imperv       Perv      Total
Total     Peak  Runoff
                            Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff
Runoff   Runoff   Coeff
  Subcatchment                  mm         mm         mm         mm         mm         mm         mm
10^6 ltr      LPS
```

```
---------------------------------------------------------------------------------------------------
--------------------
  Post-Development-Controlled     285.01       0.00       0.00       0.00     285.13       0.00     285.13
       0.99    51.17   1.000
  Pre-Development          285.01       0.00       0.00      23.54      51.33     210.18     261.51
1.24    62.03   0.918
  Post-Development-Uncontrolled     285.01       0.00       0.00      27.62       0.00     257.42
257.42        0.12     6.44   0.903
  ROOF                     285.01       0.00       0.00      20.03      71.29     193.76     265.06
0.21    11.53   0.930


  ******************
  Node Depth Summary
  ******************

  ---------------------------------------------------------------------------
                                Average  Maximum  Maximum  Time of Max    Reported
                                  Depth    Depth      HGL   Occurrence   Max Depth
  Node                 Type       Meters   Meters   Meters  days hr:min      Meters
  ---------------------------------------------------------------------------
  Post_Development_Combined_Node JUNCTION     0.02     0.05     0.05     1  22:03        0.05
  Post-Development-Total-Outflow OUTFALL      0.01     0.04     0.04     1  23:00        0.04
  PreOutfall           OUTFALL      0.00     0.00     0.00     0  00:00        0.00
  SWMTank              STORAGE      0.61     1.48     1.48     2  00:01        1.47
  ROOF_STORAGE         STORAGE      0.02     0.09     0.09     2  00:00        0.09


  ******************
  Node Inflow Summary
  ******************

  -------------------------------------------------------------------------------------------------
                                Maximum  Maximum                  Lateral       Total        Flow
                                Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                 Inflow   Inflow   Occurrence      Volume      Volume       Error
  Node                 Type        LPS      LPS  days hr:min    10^6 ltr    10^6 ltr     Percent
  -------------------------------------------------------------------------------------------------
  Post_Development_Combined_Node JUNCTION      6.44    46.44     1  23:00       0.121        1.29
```

-0.870
  Post-Development-Total-Outflow OUTFALL   0.00   46.44   1 23:00   0   1.3
0.000
  PreOutfall   OUTFALL   62.03   62.03   1 23:00   1.24   1.24   0.000
  SWMTank   STORAGE   51.17   58.45   1 23:00   0.991   1.2   2.746
  ROOF_STORAGE   STORAGE   11.53   11.53   1 23:00   0.212   0.212   0.006

  ****
  Node Surcharge Summary
  ****

  No nodes were surcharged.

  ****
  Node Flooding Summary
  ****

  No nodes were flooded.

  ****
  Storage Volume Summary
  ****

                          Average   Avg Evap Exfil   Maximum   Max   Time of Max   Maximum
                           Volume   Pcnt Pcnt Pcnt   Volume   Pcnt   Occurrence   Outflow
  Storage Unit   1000 m   Full Loss Loss   1000 m   Full   days hr:min   LPS

  SWMTank   0.064   28   0   0   0.155   67   2 00:01   40.00
  ROOF_STORAGE   0.003   4   0   0   0.023   38   2 00:00   8.05

  ****
  Outfall Loading Summary
  ****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr	
Post-Development-Total-Outflow	96.27	10.28	46.44	1.304	
PreOutfall	83.94	11.25	62.03	1.242	
System	90.10	21.53	108.46	2.545	

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
5	CONDUIT	46.44	1	23:00	0.86	0.05	0.04
QuantityPump	PUMP	40.00	1	03:20		1.00	
ErosionPump	PUMP	1.40	0	01:25		1.00	
Roof_Drains	PUMP	8.05	2	00:00		0.61	

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
5	1.00	0.01	0.00	0.00	0.91	0.08	0.00	0.00	0.05	0.00

****

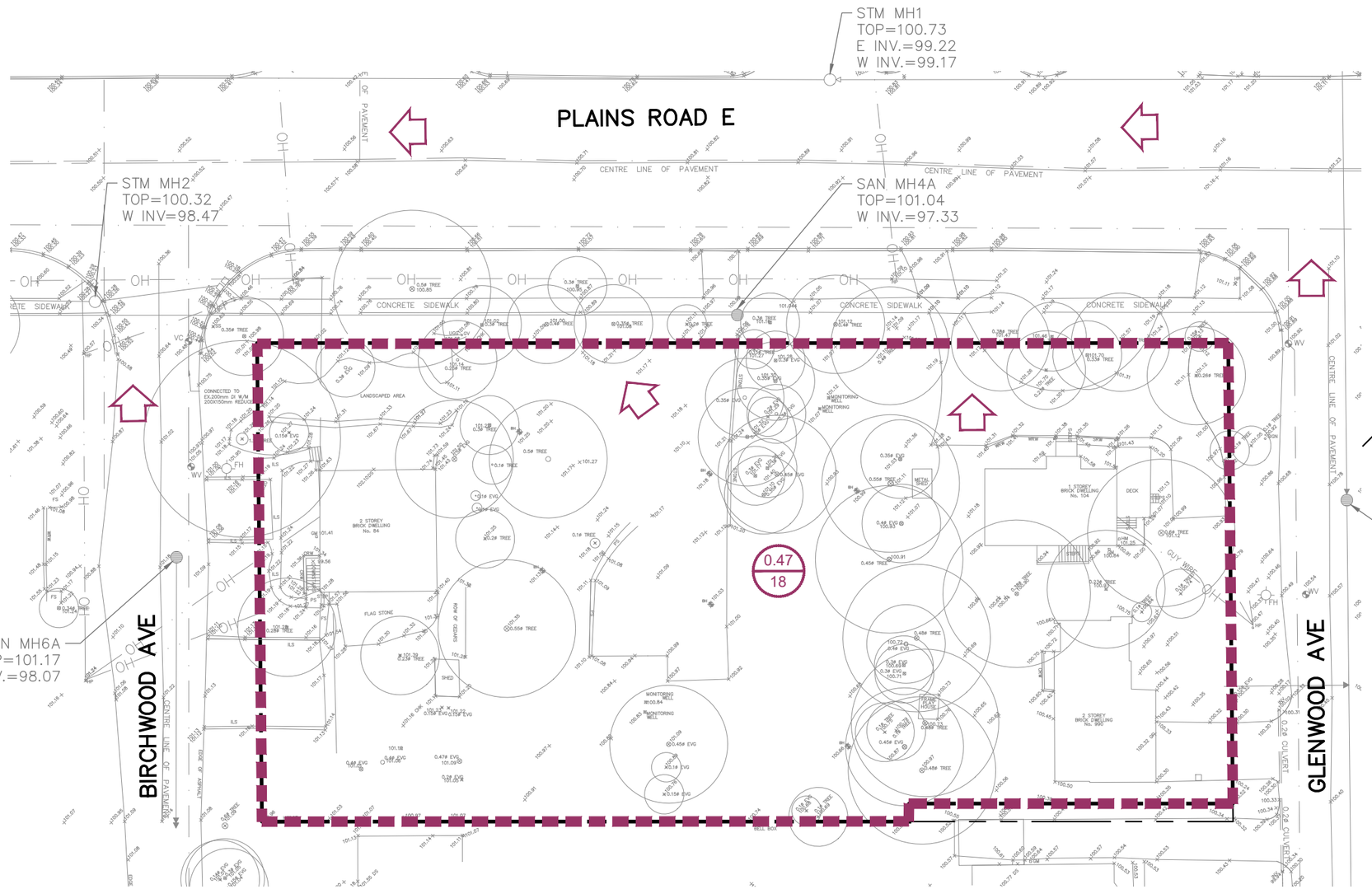
Conduit Surcharge Summary
****

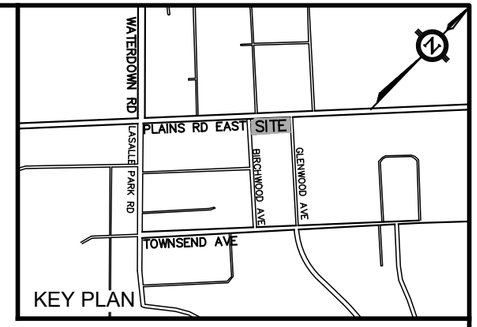
No conduits were surcharged.

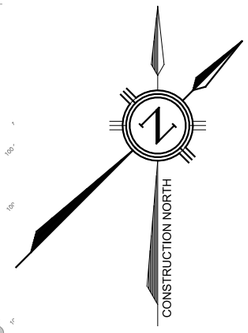
****
Pumping Summary
****

Pump	Percent Utilized	Number of Start-Ups	Min Flow LPS	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr	Power Usage Kw-hr	% Time Off Pump	Curve Low	Curve High
QuantityPump	8.21	2098	0.00	40.00	40.00	0.851	2.22	0.0	0.0	
ErosionPump	83.45	2099	0.00	1.40	1.40	0.302	0.41	0.0	0.0	
Roof_Drains	70.53	1	0.00	1.98	8.05	0.212	0.48	0.0	0.0	

Analysis begun on: Tue Jan 7 10:32:26 2025
Analysis ended on: Tue Jan 7 10:32:26 2025
Total elapsed time: < 1 sec







LEGEND

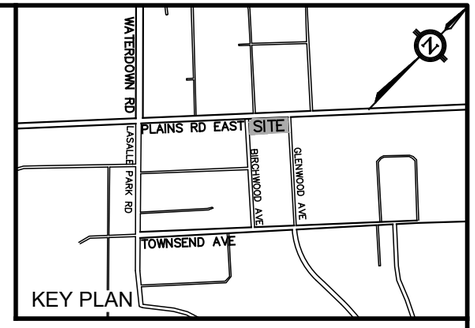
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- DRAINAGE AREA BOUNDARY
- OVERLAND FLOW DIRECTION
- PROPERTY LINE

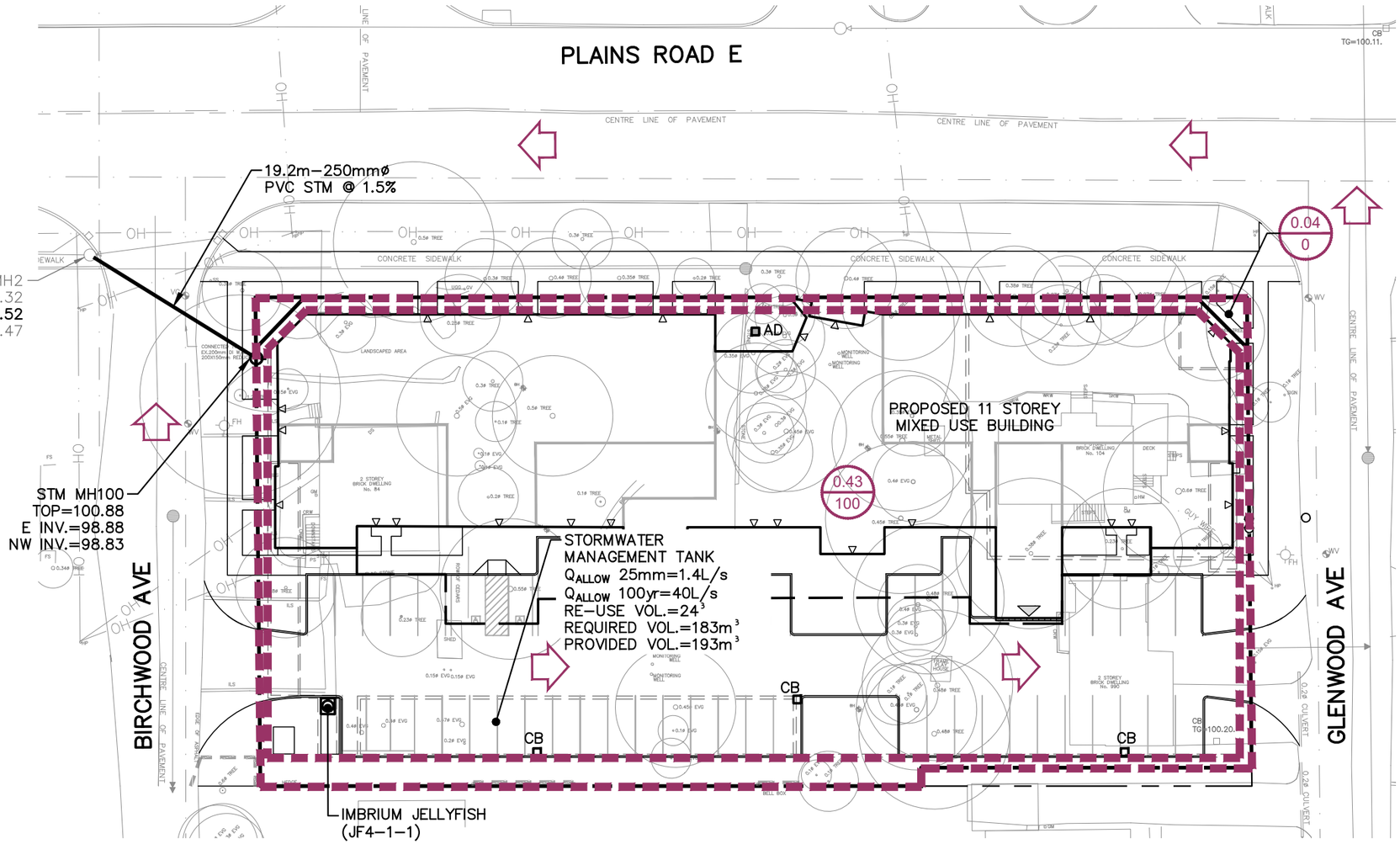
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DRAWING TITLE	PRE–DEVELOPMENT DRAINAGE PLAN

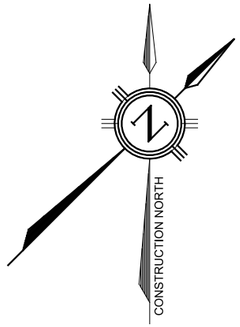
TRAFALGAR ENGINEERING
#1-481 MORDEN ROAD, OAKVILLE, ON, L6K 3W6
www.trafalgareng.com

DESIGN BY	NAS	SCALE	1:500	DRAWING No. FIG. 2
DRAWN BY	ZI	DATE	2024/09/27	

FILENAME: P:\1861 Plains Rd East\04-CAD\03-Site Plan\1861GS.dwg
PLOTDATE: May 12, 2025 - 11:07am







LEGEND

- 0.90 / 90 — AREA IN HECTARES, IMPERVIOUSNESS IN PERCENTAGE
- DRAINAGE AREA BOUNDARY
- OVERLAND FLOW DIRECTION
- PROPERTY LINE

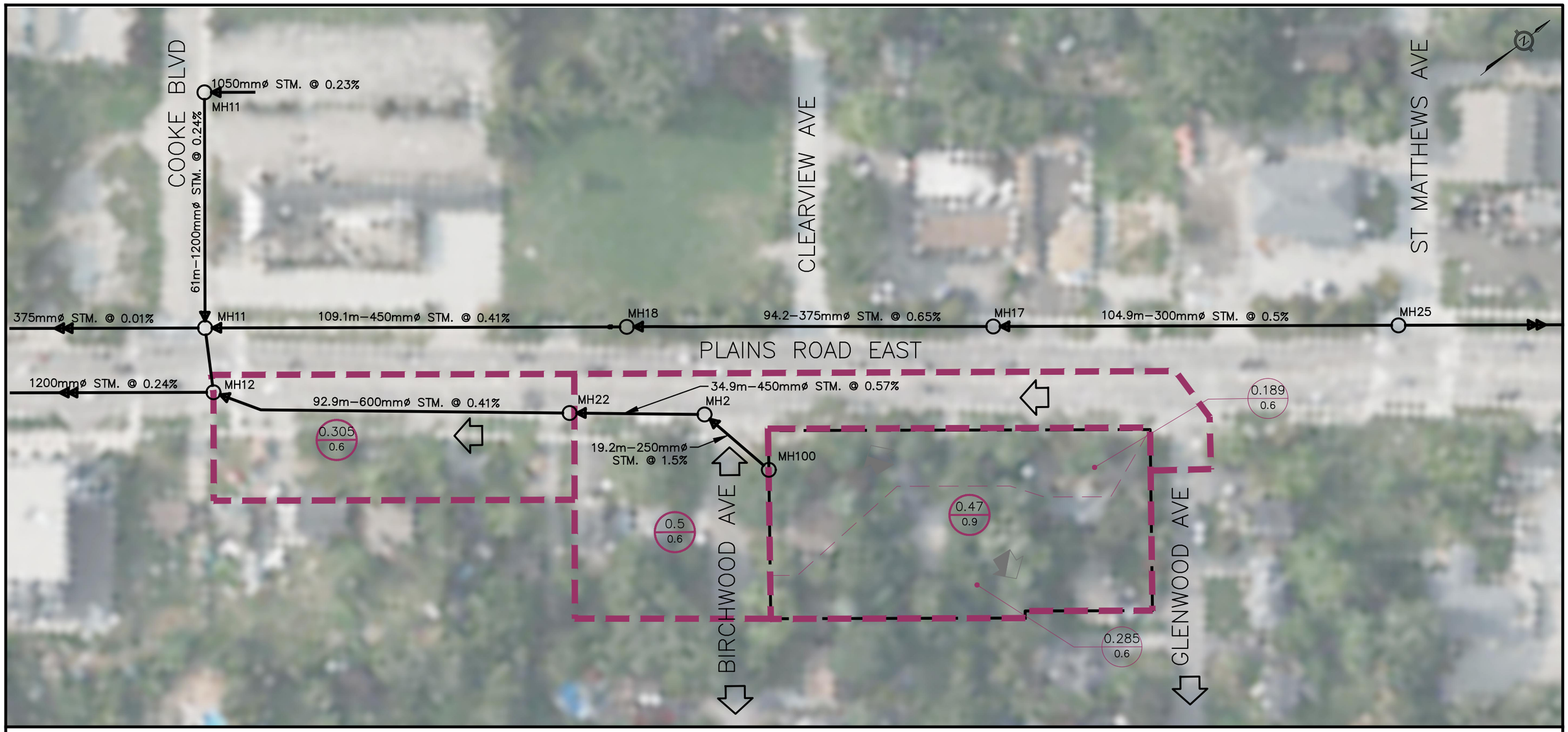
PROJECT TITLE: ONE HUNDRED ON PLAINS
84–104 PLAINS ROAD EAST &
990 GLENWOOD AVENUE,
BURLINGTON ONTARIO

DRAWING TITLE: POST–DEVELOPMENT DRAINAGE PLAN

TRAFALGAR ENGINEERING
#1-481 MORDEN ROAD, OAKVILLE, ON, L6K 3W6
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DESIGN BY	NAS	SCALE	1:500	DRAWING No.	FIG. 3
DRAWN BY	ZI	DATE	2024/09/27		

FILENAME: P:\1861 Plains Rd East\04-CAD\03-Site Plan\1861GS.dwg
PLOTDATE: May 12, 2025 - 2:40pm



LEGEND

- IMP AREA (ha) / RUNOFF COEFFICIENT
- DRAINAGE AREA BOUNDARY
- PROPERTY LINE
- OVERLAND FLOW DIRECTION
- STORM SEWER AND MANHOLE
- EXISTING DRAINAGE AREA BOUNDARY
- EXISTING OVERLAND FLOW DIRECTION

PROJECT TITLE
ONE HUNDRED ON PLAINS
84–104 PLAINS ROAD EAST AND 990 GLENWOOD AVE
BURLINGTON, ONTARIO

DRAWING TITLE
EXTERNAL STORM DRAINAGE PLAN

TRAFALGAR ENGINEERING
#1-481 MORDEN ROAD, OAKVILLE, ON, L6K 3W6
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DESIGN BY AD	SCALE 1:1000	DRAWING No.	FIG 4
DRAWN BY AD	DATE 2025/01/02		
PROJECT No. 1861			

FILENAME: P:\1861 Plains Rd East\04-CAD\03-Site Plan\1861F.dwg
PLOTDATE: May 12, 2025 - 3:56pm

TRAFALGAR ENGINEERING

Prepared By: AD
Checked By: NAS
Project No. : 1861

STORM SEWER DESIGN SHEET

City of Burlington
5-Year Storm

Project Name : One Hundred on Plains
Municipal Number:
Date: 2025-01-02
Sheet: 1 of 1

LOCATION	FROM MH	TO MH	DRAINAGE AREA: Area, A (ha)	Runoff Coeff., C	A x C (ha)	Accum. A x C (ha)	FLOW: Time of Conc., T_c (min)	Intensity, I (mm/h)	Expected Flow, Q (L/s)	SEWER DESIGN: Length, L (m)	Gradient, s (%)	Pipe Dia., D (mm)	Manning's Coeff., n	PIPE HYDRAULICS: Full Flow Capacity, Q_F (L/s)	Full Flow Velocity, V_F (m/s)	d/D	Actual Velocity, V (m/s)	Time of Flow (min)	Q/Q_F
Existing																			
84 - 104 Plains Road East	SITE	MH2	0.19	0.60	0.113	0.113													
Plains Road East	MH2	MH22	0.50	0.60	0.298	0.411	10.00	101.3	**116**	34.9	0.57	450	0.013	**225**	1.37	0.50	1.41	0.41	0.52
Plains Road East	MH22	MH12	0.31	0.60	0.183	0.594	10.41	99.2	**164**	92.9	0.41	600	0.013	**410**	1.41	0.43	1.36	1.13	0.40
Proposed																			
84 - 104 Plains Road East	MH100	MH2	0.47	0.84	0.395	0.395	10.00	101.3	**49**	19.2	1.5	250	0.013	**76**	1.50	0.58	1.61	0.20	0.64
Plains Road East	MH2	MH22	0.50	0.60	0.298	0.298	10.20	100.3	**132**	34.9	0.57	450	0.013	**225**	1.37	0.55	1.43	0.41	0.59
Plains Road East	MH22	MH12	0.31	0.60	0.183	0.481	10.61	98.3	**180**	92.9	0.41	600	0.013	**410**	1.41	0.46	1.37	1.13	0.44
							*expected flow from 84-104 is controlled release rate												

Notes:
1) Pipe diameter is nominal
2) Capacity and velocity are based on Imperial I.D. (Nom. Dia x 25.4/25)
3) Time of Flow is based on Actual Velocity

Intensity, $I = A / (T_c + B)^C$ where:

A= 802.04
B= 5
C= 0.764
t_c= Time of Concentration in minutes

Expected Flow, $Q = 2.778 \times C \times I \times A / 1000$

Full Flow Capacity (Manning's Equation), Q_F

$Q_F = (1/n) \times A \times R^{2/3} \times s^{1/2}$

$= (1/n) \times 311.7 \times D^{8/3} \times s^{1/2}$

STANDARD OFFLINE
Jellyfish Filter Sizing Report

Project Information

Date	Saturday, January 18, 2025
Project Name	84-108 Plains Rd. E
Project Number	1861
Location	Burlington

Jellyfish Filter Design Overview

This report provides information for the sizing and specification of the Jellyfish Filter. When designed properly in accordance to the guidelines detailed in the Jellyfish Filter Technical Manual, the Jellyfish Filter will exceed the performance and longevity of conventional horizontal bed and granular media filters.
Please see ***www.ImbriumSystems.com*** *for more information.*

Jellyfish Filter System Recommendation

The Jellyfish Filter model JF4-2-1-40 is recommended to meet the water quality objective by treating a flow of 9.5 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 34 years of HAMILTON A rainfall data for this site. This model has a sediment capacity of 105 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-2-1-40	2	1	1.2	9.5	105

The Jellyfish Filter System

The patented Jellyfish Filter is an engineered stormwater quality treatment technology featuring unique membrane filtration in a compact stand-alone treatment system that removes a high level and wide variety of stormwater pollutants. Exceptional pollutant removal is achieved at high treatment flow rates with minimal head loss and low maintenance costs. Each lightweight Jellyfish Filter cartridge contains an extraordinarily large amount of membrane surface area, resulting in superior flow capacity and pollutant removal capacity.

Maintenance

Regular scheduled inspections and maintenance is necessary to assure proper functioning of the Jellyfish Filter. The maintenance interval is designed to be a minimum of 12 months, but this will vary depending on site loading conditions and upstream pretreatment measures. Quarterly inspections and inspections after all storms beyond the 5-year event are recommended until enough historical performance data has been logged to comfortably initiate an alternative inspection interval.

Please see ***www.ImbriumSystems.com*** *for more information.*

Thank you for the opportunity to present this information to you and your client.

Performance

Jellyfish efficiently captures a high level of Stormwater pollutants, including:

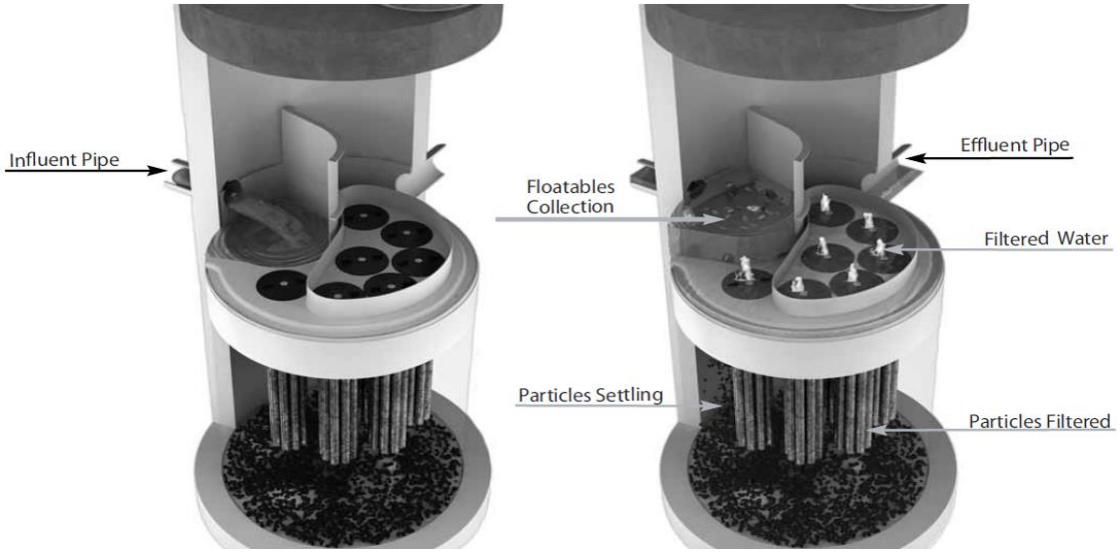
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 77% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash and debris

Field Proven Peformance

The Jellyfish filter has been field-tested on an urban site with 25 TAPE qualifying rain events and field monitored according to the TAPE field test protocol, demonstrating:

- A median TSS removal efficiency of 90%, and a median SSC removal of 99%;
- The ability to capture fine particles as indicated by an effluent d50 median of 3 microns for all monitotred storm events, and a median effluent turbidity of 5 NTUs;
- A median Total Phosphorus removal of 77%, and a median Total Nitrogen removal of 51%.

Jellyfish Filter Treatment Functions



Pre-treatment and Membrane Filtration

Jellyfish® Filter

Project Information

Date:	Saturday, January 18, 2025
Project Name:	84-108 Plains Rd. E
Project Number:	1861
Location:	Burlington

Designer Information

Company:	Trafalgar Engineering Ltd.
Contact:	Anna Duong
Phone #:	

Notes

Rainfall

Name:	HAMILTON A
State:	ON
ID:	3194
Record:	1970 to 2003
Co-ords:	43°10.N'N, 79°56.W'N

Drainage Area

Total Area:	0.2357 ha
Imperviousness:	100%

Upstream Detention

Peak Release Rate:	n/a
Pretreatment Credit:	n/a

Design System Requirements

Flow Loading	90% of the Average Annual Runoff based on 34 years of HAMILTON A rainfall data:	**6.5 L/s**
Sediment Loading	Treating 90% of the average annual runoff volume, 1199 m³, with a suspended sediment concentration of 60 mg/L.	**72 kg**

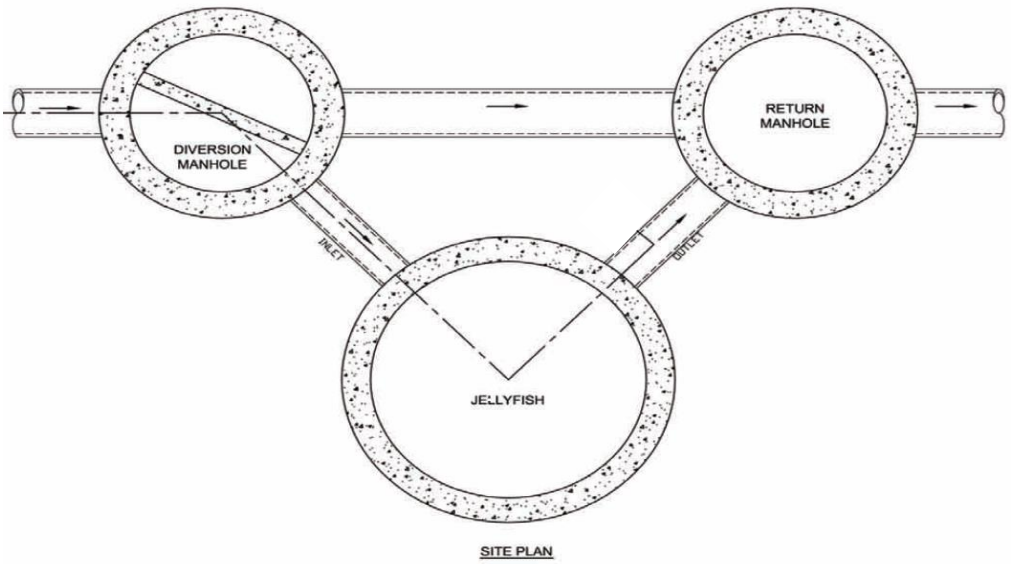
Recommendation

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Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Wet Vol Below Deck (L)	Sump Storage (m³)	Oil Capacity (L)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1-40	1	1	1.2	2313	0.34	379	5.7	63
JF4-2-1-40	**2**	**1**	**1.2**	**2313**	**0.34**	**379**	**9.5**	**105**
JF6-3-1-40	3	1	1.8	5205	0.79	848	13.3	147
JF6-4-1-40	4	1	1.8	5205	0.79	848	17.1	189
JF6-5-1-40	5	1	1.8	5205	0.79	848	20.8	231
JF6-6-1-40	6	1	1.8	5205	0.79	848	24.6	273
JF8-6-2-40	6	2	2.4	9252	1.42	1469	26.5	294
JF8-7-2-40	7	2	2.4	9252	1.42	1469	30.3	336
JF8-8-2-40	8	2	2.4	9252	1.42	1469	34.1	378
JF8-9-2-40	9	2	2.4	9252	1.42	1469	37.9	420
JF8-10-2-40	10	2	2.4	9252	1.42	1469	41.7	462
JF10-11-3-40	11	3	3.0	14456	2.21	2302	47.4	525
JF10-12-3-40	12	3	3.0	14456	2.21	2302	51.2	567
JF10-12-4-40	12	4	3.0	14456	2.21	2302	53.0	588
JF10-13-4-40	13	4	3.0	14456	2.21	2302	56.8	630
JF10-14-4-40	14	4	3.0	14456	2.21	2302	60.6	672
JF10-15-4-40	15	4	3.0	14456	2.21	2302	64.4	714
JF10-16-4-40	16	4	3.0	14456	2.21	2302	68.2	756
JF10-17-4-40	17	4	3.0	14456	2.21	2302	72.0	798
JF10-18-4-40	18	4	3.0	14456	2.21	2302	75.8	840
JF10-19-4-40	19	4	3.0	14456	2.21	2302	78.9	882
JF12-20-5-40	20	5	3.6	20820	3.2	2771	85.3	945
JF12-21-5-40	21	5	3.6	20820	3.2	2771	89.0	987
JF12-22-5-40	22	5	3.6	20820	3.2	2771	92.8	1029
JF12-23-5-40	23	5	3.6	20820	3.2	2771	96.6	1071
JF12-24-5-40	24	5	3.6	20820	3.2	2771	100.4	1113
JF12-25-5-40	25	5	3.6	20820	3.2	2771	104.2	1155
JF12-26-5-40	26	5	3.6	20820	3.2	2771	108.0	1197
JF12-27-5-40	27	5	3.6	20820	3.2	2771	111.8	1239

Jellyfish Filter Design Notes

- Typically the Jellyfish Filter is designed in an offline configuration, as all stormwater filter systems will perform for a longer duration between required maintenance services when designed and applied in off-line configurations. Depending on the design parameters, an optional internal bypass may be incorporated into the Jellyfish Filter, however note the inspection and maintenance frequency should be expected to increase above that of an off-line system. Speak to your local representative for more information.



Jellyfish Filter Typical Layout

- Typically, 18 inches (457 mm) of driving head is designed into the system, calculated as the difference in elevation between the top of the diversion structure weir and the invert of the Jellyfish Filter outlet pipe. Alternative driving head values can be designed as 12 to 24 inches (305 to 610mm) depending on specific site requirements, requiring additional sizing and design assistance.
- Typically, the Jellyfish Filter is designed with the inlet pipe configured 6 inches (150 mm) above the outlet invert elevation. However, depending on site parameters this can vary to an optional configuration of the inlet pipe entering the unit below the outlet invert elevation.
- The Jellyfish Filter can accommodate multiple inlet pipes within certain restrictions.
- While the optional inlet below deck configuration offers 0 to 360 degree flexibility between the inlet and outlet pipe, typical systems conform to the following:

Model Diameter (m)	Minimum Angle Inlet / Outlet Pipes	Minimum Inlet Pipe Diameter (mm)	Minimum Outlet Pipe Diameter (mm)
1.2	**62º**	**150**	**200**
1.8	59º	200	250
2.4	52º	250	300
3.0	48º	300	450
3.6	40º	300	450

- The Jellyfish Filter can be built at all depths of cover generally associated with conventional stormwater conveyance systems. For sites that require minimal depth of cover for the stormwater infrastructure, the Jellyfish Filter can be applied in a shallow application using a hatch cover. The general minimum depth of cover is 36 inches (915 mm) from top of the underslab to outlet invert.
- If driving head caclulations account for water elevation during submerged conditions the Jellyfish Filter will function effectively under submerged condtions.
- Jellyfish Filter systems may incorporate grated inlets depending on system configuration.
- For sites with water quality treatment flow rates or mass loadings that exceed the design flow rate of the largest standard Jellyfish Filter manhole models, systems can be designed that hydraulically connect multiple Jellyfish Filters in series or alternatively Jellyfish Vault units can be designed.

STANDARD SPECIFICATION
STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

Specifies requirements for construction and performance of an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 REFERENCE STANDARDS

ASTM C 891: Specification for Installation of Underground Precast Concrete Utility Structures
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM D 4101: Specification for Copolymer steps construction

CAN/CSA-A257.4-M92
Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections and Fittings Using Rubber Gaskets

CAN/CSA-A257.4-M92
Precast Reinforced Circular Concrete Manhole Sections, Catch Basins and Fittings

Canadian Highway Bridge Design Code

1.3 SHOP DRAWINGS

Shop drawings for the structure and performance are to be submitted with each order to the contractor. Contractor shall forward shop drawing submittal to the consulting engineer for approval. Shop drawings are to detail the structure's precast concrete and call out or note the fiberglass (FRP) internals/components.

1.4 PRODUCT SUBSTITUTIONS

No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the engineer of record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

1.5 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The device shall be a cylindrical or rectangular, all concrete structure (including risers), constructed from precast concrete riser and slab components or monolithic precast structure(s), installed to conform to ASTM C 891 and to any required state highway, municipal or local specifications; whichever is more stringent. The device shall be watertight.

2.1.2 Cartridge Deck The cylindrical concrete device shall include a fiberglass deck. The rectangular concrete device shall include a coated aluminum deck. In either instance, the insert shall be bolted and sealed watertight inside the precast concrete chamber. The deck shall serve as: (a) a horizontal divider between the lower treatment zone and the upper treated effluent zone; (b) a deck for attachment of filter cartridges such that the membrane filter elements of each cartridge extend into the lower treatment zone; (c) a platform for maintenance workers to service the filter cartridges (maximum manned weight = 450 pounds (204 kg)); (d) a conduit for conveyance of treated water to the effluent pipe.

2.1.3 Membrane Filter Cartridges Filter cartridges shall be comprised of reusable cylindrical membrane filter elements connected to a perforated head plate. The number of membrane filter elements per cartridge shall be a minimum of eleven 2.75-inch (70-mm) diameter elements. The length of each filter element shall be a minimum 15 inches (381 mm). Each cartridge shall be fitted into the cartridge deck by insertion into a cartridge receptacle that is permanently mounted into the cartridge deck. Each cartridge shall be secured by a cartridge lid that is threaded onto the receptacle, or similar mechanism to secure the cartridge into the deck. The maximum treatment flow rate of a filter cartridge shall be controlled by an orifice in the cartridge lid, or on the individual cartridge itself, and based on a design flux rate (surface loading rate) determined by the maximum treatment flow rate per unit of filtration membrane surface area. The maximum design flux rate shall be 0.21 gpm/ft² (0.142 lps/m²).

Each membrane filter cartridge shall allow for manual installation and removal. Each filter cartridge shall have filtration membrane surface area and dry installation weight as follows (if length of filter cartridge is between those listed below, the surface area and weight shall be proportionate to the next length shorter and next length longer as shown below):

Filter Cartridge Length (in / mm)	Minimum Filtration Membrane Surface Area (ft2 / m2)	Maximum Filter Cartridge Dry Weight (lbs / kg)
15	106 / 9.8	10.5 / 4.8
27	190 / 17.7	15.0 / 6.8
40	282 / 26.2	20.5 / 9.3
54	381 / 35.4	25.5 / 11.6

2.1.4 Backwashing Cartridges The filter device shall have a weir extending above the cartridge deck, or other mechanism, that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir, or other mechanism, shall collect a pool of filtered water during inflow events that backwashes the high flow rate cartridges when the inflow

event subsides. All filter cartridges and membranes shall be reusable and allow for the use of filtration membrane rinsing procedures to restore flow capacity and sediment capacity; extending cartridge service life.

2.1.5 Maintenance Access to Captured Pollutants The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the deck. Access shall have a minimum clear vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

2.1.6 Bend Structure The device shall be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90-degrees or less in the stormwater conveyance system.

2.1.7 Double-Wall Containment of Hydrocarbons The cylindrical precast concrete device shall provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of fiberglass, to a minimum depth of 12 inches (305 mm) below the cartridge deck, and the precast vessel wall.

2.1.8 Baffle The filter device shall provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The baffle shall serve to protect the membrane filter elements from contamination by floatables and coarse sediment. The baffle shall be flexible and continuous in cylindrical configurations, and shall be a straight concrete or aluminum wall in rectangular configurations.

2.1.9 Sump The device shall include a minimum 24 inches (610 mm) of sump below the bottom of the cartridges for sediment accumulation, unless otherwise specified by the design engineer. Depths less than 24 inches may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be manufactured to a minimum live load of HS-20 truck loading or greater based on local regulatory specifications, unless otherwise modified or specified by the design engineer, and shall be watertight.

2.3 JOINTS All precast concrete manhole configuration joints shall use nitrile rubber gaskets and shall meet the requirements of ASTM C443, Specification C1619, Class D or engineer approved equal to ensure oil resistance. Mastic sealants or butyl tape are not an acceptable alternative.

2.4 GASKETS Only profile neoprene or nitrile rubber gaskets in accordance to CSA A257.3-M92 will be accepted. Mastic sealants, butyl tape or Conseal CS-101 are not acceptable gasket materials.

2.5 FRAME AND COVER Frame and covers must be manufactured from cast-iron or other composite material tested to withstand H-20 or greater design loads, and as approved by the

local regulatory body. Frames and covers must be embossed with the name of the device manufacturer or the device brand name.

2.6 DOORS AND HATCHES If provided shall meet designated loading requirements or at a minimum for incidental vehicular traffic.

2.7 CONCRETE All concrete components shall be manufactured according to local specifications and shall meet the requirements of ASTM C 478.

2.8 FIBERGLASS The fiberglass portion of the filter device shall be constructed in accordance with the following standard: ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks.

2.9 STEPS Steps shall be constructed according to ASTM D4101 of copolymer polypropylene, and be driven into preformed or pre-drilled holes after the concrete has cured, installed to conform to applicable sections of state, provincial and municipal building codes, highway, municipal or local specifications for the construction of such devices.

2.10 INSPECTION All precast concrete sections shall be inspected to ensure that dimensions, appearance and quality of the product meet local municipal specifications and ASTM C 478.

PART 3 – PERFORMANCE

3.1 GENERAL

3.1.1 Verification – The stormwater quality filter must be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV).

3.1.2 Function - The stormwater quality filter treatment device shall function to remove pollutants by the following unit treatment processes; sedimentation, floatation, and membrane filtration.

3.1.3 Pollutants - The stormwater quality filter treatment device shall remove oil, debris, trash, coarse and fine particulates, particulate-bound pollutants, metals and nutrients from stormwater during runoff events.

3.1.4 Bypass - The stormwater quality filter treatment device shall typically utilize an external bypass to divert excessive flows. Internal bypass systems shall be equipped with a floatables baffle, and must avoid passage through the sump and/or cartridge filtration zone.

3.1.5 Treatment Flux Rate (Surface Loading Rate) – The stormwater quality filter treatment device shall treat 100% of the required water quality treatment flow based on a maximum design treatment flux rate (surface loading rate) across the membrane filter cartridges of 0.21 gpm/ft² (0.142 lps/m²).

3.2 FIELD TEST PERFORMANCE

At a minimum, the stormwater quality filter device shall have been field tested and verified with a minimum 25 TARP qualifying storm events and field monitoring shall have been conducted according to the TARP 2009 NJDEP TARP field test protocol, and have received NJCAT verification.

3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median TSS removal efficiency of 85% and a minimum median SSC removal efficiency of 95%.

3.2.2 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

3.2.3 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, an effluent d_{50} of 15 microns or lower for all monitored storm events.

3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce the turbidity from influent from a range of 5 to 171 NTU to an effluent turbidity of 15 NTU or lower.

3.2.5 Nutrient (Total Phosphorus & Total Nitrogen) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Phosphorus removal of 55%, and a minimum median Total Nitrogen removal of 50%.

3.2.6 Metals (Total Zinc & Total Copper) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Zinc removal of 55%, and a minimum median Total Copper removal of 85%.

3.3 INSPECTION and MAINTENANCE

The stormwater quality filter device shall have the following features:

3.3.1 Durability of membranes are subject to good handling practices during inspection and maintenance (removal, rinsing, and reinsertion) events, and site specific conditions that may have heavier or lighter loading onto the cartridges, and pollutant variability that may impact the membrane structural integrity. Membrane maintenance and replacement shall be in accordance with manufacturer's recommendations.

3.3.2 Inspection which includes trash and floatables collection, sediment depth determination, and visible determination of backwash pool depth shall be easily conducted from grade (outside the structure).

3.3.3 Manual rinsing of the reusable filter cartridges shall promote restoration of the flow capacity and sediment capacity of the filter cartridges, extending cartridge service life.

3.3.4 The filter device shall have a minimum 12 inches (305 mm) of sediment storage depth, and a minimum of 12 inches between the top of the sediment storage and bottom of the filter cartridge tentacles, unless otherwise specified by the design engineer. Variances may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

3.3.5 Sediment removal from the filter treatment device shall be able to be conducted using a standard maintenance truck and vacuum apparatus, and a minimum one point of entry to the sump that is unobstructed by filter cartridges.

3.3.6 Maintenance access shall have a minimum clear height that provides suitable vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

3.3.7 Filter cartridges shall be able to be maintained without the requirement of additional lifting equipment.

PART 4 – EXECUTION

4.1 INSTALLATION

4.1.1 PRECAST DEVICE CONSTRUCTION SEQUENCE

The installation of a watertight precast concrete device should conform to ASTM C 891 and to any state highway, municipal or local specifications for the construction of manholes, whichever is more stringent. Selected sections of a general specification that are applicable are summarized below.

4.1.1.1 The watertight precast concrete device is installed in sections in the following sequence:

- aggregate base
- base slab
- treatment chamber and cartridge deck riser section(s)
- bypass section
- connect inlet and outlet pipes
- concrete riser section(s) and/or transition slab (if required)
- maintenance riser section(s) (if required)
- frame and access cover

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

4.1.3 Adjustment of the stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary to restore original condition and watertight seals. Once the stormwater quality treatment device has been constructed, any/all lift holes must be plugged watertight with mortar or non-shrink grout.

4.1.4 Inlet and Outlet Pipes Inlet and outlet pipes should be securely set into the device using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight, and such that any pipe intrusion into the device does not impact the device functionality.

4.1.5 Frame and Cover Installation Adjustment units (e.g. grade rings) should be installed to set the frame and cover at the required elevation. The adjustment units should be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover should be set in a full bed of mortar at the elevation specified.

4.2 MAINTENANCE ACCESS WALL
In some instances the Maintenance Access Wall, if provided, shall require an extension attachment and sealing to the precast wall and cartridge deck at the job site, rather than at the precast facility. In this instance, installation of these components shall be performed according to instructions provided by the manufacturer.

4.3 FILTER CARTRIDGE INSTALLATION Filter cartridges shall be installed in the cartridge deck only after the construction site is fully stabilized and in accordance with the manufacturer's guidelines and recommendations. Contractor to contact the manufacturer to schedule cartridge delivery and review procedures/requirements to be completed to the device prior to installation of the cartridges and activation of the system.

PART 5 – QUALITY ASSURANCE

5.1 FILTER CARTRIDGE INSTALLATION Manufacturer shall coordinate delivery of filter cartridges and other internal components with contractor. Filter cartridges shall be delivered and installed complete after site is stabilized and unit is ready to accept cartridges. Unit is ready to accept cartridges after is has been cleaned out and any standing water, debris, and other materials have been removed. Contractor shall take appropriate action to protect the filter cartridge receptacles and filter cartridges from damage during construction, and in accordance with the manufacturer's recommendations and guidance. For systems with cartridges installed prior to full site stabilization and prior to system activation, the contractor can plug inlet and outlet pipes to prevent stormwater and other influent from entering the device. Plugs must be removed during the activation process.

5.2 INSPECTION AND MAINTENANCE

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

5.2.2 After construction and installation, and during operation, the device shall be inspected and cleaned as necessary based on the manufacturer's recommended inspection and maintenance guidelines and the local regulatory agency/body.

5.3 REPLACEMENT FILTER CARTRIDGES When replacement membrane filter elements and/or other parts are required, only membrane filter elements and parts approved by the manufacturer for use with the stormwater quality filter device shall be installed.

END OF SECTION

STANDARD OFFLINE
Jellyfish Filter Sizing Report

Project Information

Date	Saturday, January 18, 2025
Project Name	84-108 Plains Rd. E
Project Number	1861
Location	Burlington

Jellyfish Filter Design Overview

This report provides information for the sizing and specification of the Jellyfish Filter. When designed properly in accordance to the guidelines detailed in the Jellyfish Filter Technical Manual, the Jellyfish Filter will exceed the performance and longevity of conventional horizontal bed and granular media filters.
Please see ***www.ImbriumSystems.com*** *for more information.*

Jellyfish Filter System Recommendation

The Jellyfish Filter model JF4-2-1-40 is recommended to meet the water quality objective by treating a flow of 9.5 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 34 years of HAMILTON A rainfall data for this site. This model has a sediment capacity of 105 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-2-1-40	2	1	1.2	9.5	105

The Jellyfish Filter System

The patented Jellyfish Filter is an engineered stormwater quality treatment technology featuring unique membrane filtration in a compact stand-alone treatment system that removes a high level and wide variety of stormwater pollutants. Exceptional pollutant removal is achieved at high treatment flow rates with minimal head loss and low maintenance costs. Each lightweight Jellyfish Filter cartridge contains an extraordinarily large amount of membrane surface area, resulting in superior flow capacity and pollutant removal capacity.

Maintenance

Regular scheduled inspections and maintenance is necessary to assure proper functioning of the Jellyfish Filter. The maintenance interval is designed to be a minimum of 12 months, but this will vary depending on site loading conditions and upstream pretreatment measures. Quarterly inspections and inspections after all storms beyond the 5-year event are recommended until enough historical performance data has been logged to comfortably initiate an alternative inspection interval.

Please see ***www.ImbriumSystems.com*** *for more information.*

Thank you for the opportunity to present this information to you and your client.

Performance

Jellyfish efficiently captures a high level of Stormwater pollutants, including:

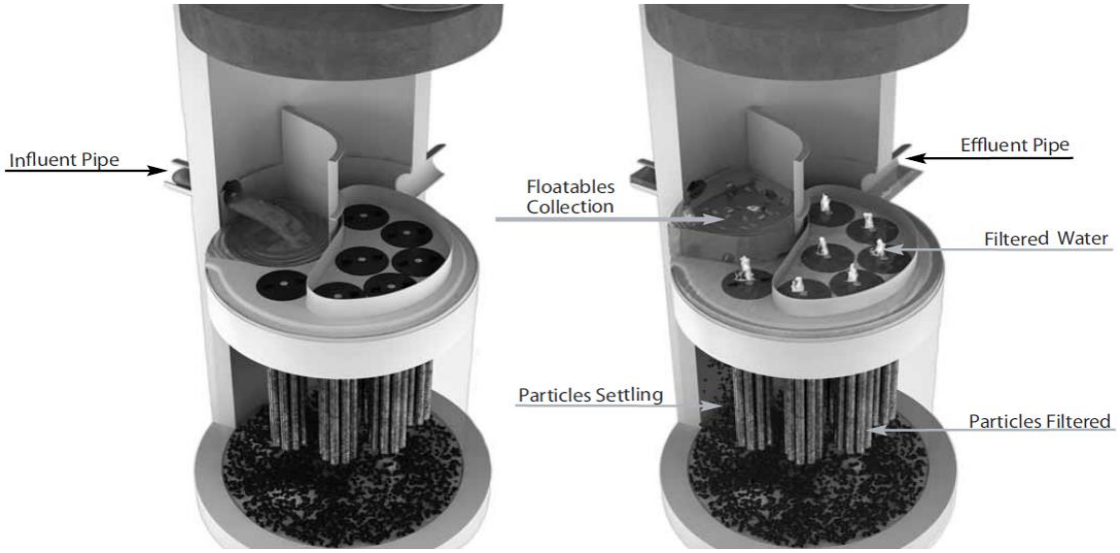
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 77% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash and debris

Field Proven Peformance

The Jellyfish filter has been field-tested on an urban site with 25 TAPE qualifying rain events and field monitored according to the TAPE field test protocol, demonstrating:

- A median TSS removal efficiency of 90%, and a median SSC removal of 99%;
- The ability to capture fine particles as indicated by an effluent d50 median of 3 microns for all monitotred storm events, and a median effluent turbidity of 5 NTUs;
- A median Total Phosphorus removal of 77%, and a median Total Nitrogen removal of 51%.

Jellyfish Filter Treatment Functions



Pre-treatment and Membrane Filtration

Jellyfish® Filter

Project Information

Date:	Saturday, January 18, 2025
Project Name:	84-108 Plains Rd. E
Project Number:	1861
Location:	Burlington

Designer Information

Company:	Trafalgar Engineering Ltd.
Contact:	Anna Duong
Phone #:	

Notes

Rainfall

Name:	HAMILTON A
State:	ON
ID:	3194
Record:	1970 to 2003
Co-ords:	43°10.N'N, 79°56.W'N

Drainage Area

Total Area:	0.2357 ha
Imperviousness:	100%

Upstream Detention

Peak Release Rate:	n/a
Pretreatment Credit:	n/a

Design System Requirements

Flow Loading	90% of the Average Annual Runoff based on 34 years of HAMILTON A rainfall data:	**6.5 L/s**
Sediment Loading	Treating 90% of the average annual runoff volume, 1199 m³, with a suspended sediment concentration of 60 mg/L.	**72 kg**

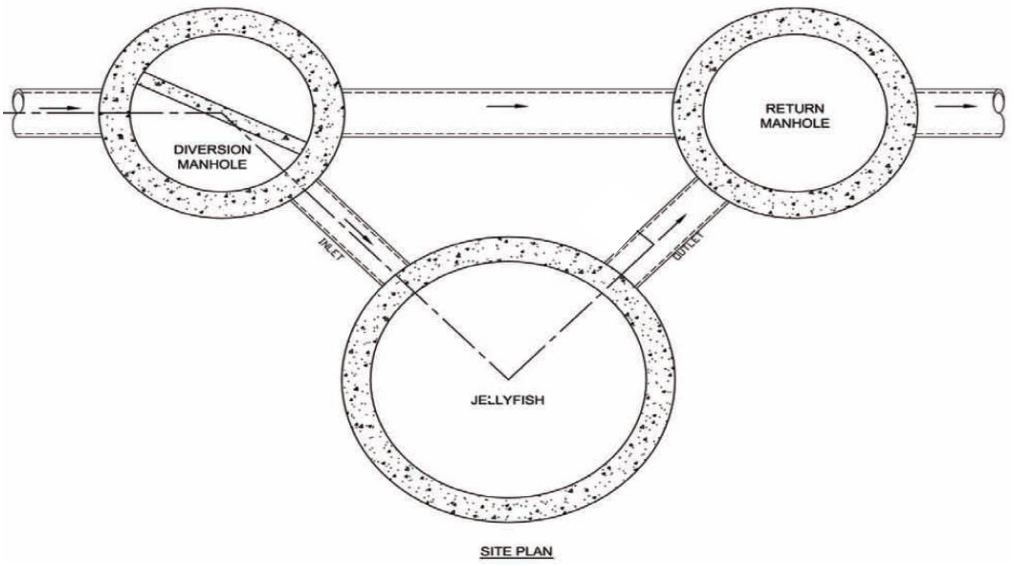
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Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Wet Vol Below Deck (L)	Sump Storage (m³)	Oil Capacity (L)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1-40	1	1	1.2	2313	0.34	379	5.7	63
JF4-2-1-40	**2**	**1**	**1.2**	**2313**	**0.34**	**379**	**9.5**	**105**
JF6-3-1-40	3	1	1.8	5205	0.79	848	13.3	147
JF6-4-1-40	4	1	1.8	5205	0.79	848	17.1	189
JF6-5-1-40	5	1	1.8	5205	0.79	848	20.8	231
JF6-6-1-40	6	1	1.8	5205	0.79	848	24.6	273
JF8-6-2-40	6	2	2.4	9252	1.42	1469	26.5	294
JF8-7-2-40	7	2	2.4	9252	1.42	1469	30.3	336
JF8-8-2-40	8	2	2.4	9252	1.42	1469	34.1	378
JF8-9-2-40	9	2	2.4	9252	1.42	1469	37.9	420
JF8-10-2-40	10	2	2.4	9252	1.42	1469	41.7	462
JF10-11-3-40	11	3	3.0	14456	2.21	2302	47.4	525
JF10-12-3-40	12	3	3.0	14456	2.21	2302	51.2	567
JF10-12-4-40	12	4	3.0	14456	2.21	2302	53.0	588
JF10-13-4-40	13	4	3.0	14456	2.21	2302	56.8	630
JF10-14-4-40	14	4	3.0	14456	2.21	2302	60.6	672
JF10-15-4-40	15	4	3.0	14456	2.21	2302	64.4	714
JF10-16-4-40	16	4	3.0	14456	2.21	2302	68.2	756
JF10-17-4-40	17	4	3.0	14456	2.21	2302	72.0	798
JF10-18-4-40	18	4	3.0	14456	2.21	2302	75.8	840
JF10-19-4-40	19	4	3.0	14456	2.21	2302	78.9	882
JF12-20-5-40	20	5	3.6	20820	3.2	2771	85.3	945
JF12-21-5-40	21	5	3.6	20820	3.2	2771	89.0	987
JF12-22-5-40	22	5	3.6	20820	3.2	2771	92.8	1029
JF12-23-5-40	23	5	3.6	20820	3.2	2771	96.6	1071
JF12-24-5-40	24	5	3.6	20820	3.2	2771	100.4	1113
JF12-25-5-40	25	5	3.6	20820	3.2	2771	104.2	1155
JF12-26-5-40	26	5	3.6	20820	3.2	2771	108.0	1197
JF12-27-5-40	27	5	3.6	20820	3.2	2771	111.8	1239

Jellyfish Filter Design Notes

- Typically the Jellyfish Filter is designed in an offline configuration, as all stormwater filter systems will perform for a longer duration between required maintenance services when designed and applied in off-line configurations. Depending on the design parameters, an optional internal bypass may be incorporated into the Jellyfish Filter, however note the inspection and maintenance frequency should be expected to increase above that of an off-line system. Speak to your local representative for more information.



Jellyfish Filter Typical Layout

- Typically, 18 inches (457 mm) of driving head is designed into the system, calculated as the difference in elevation between the top of the diversion structure weir and the invert of the Jellyfish Filter outlet pipe. Alternative driving head values can be designed as 12 to 24 inches (305 to 610mm) depending on specific site requirements, requiring additional sizing and design assistance.
- Typically, the Jellyfish Filter is designed with the inlet pipe configured 6 inches (150 mm) above the outlet invert elevation. However, depending on site parameters this can vary to an optional configuration of the inlet pipe entering the unit below the outlet invert elevation.
- The Jellyfish Filter can accommodate multiple inlet pipes within certain restrictions.
- While the optional inlet below deck configuration offers 0 to 360 degree flexibility between the inlet and outlet pipe, typical systems conform to the following:

Model Diameter (m)	Minimum Angle Inlet / Outlet Pipes	Minimum Inlet Pipe Diameter (mm)	Minimum Outlet Pipe Diameter (mm)
1.2	**62º**	**150**	**200**
1.8	59º	200	250
2.4	52º	250	300
3.0	48º	300	450
3.6	40º	300	450

- The Jellyfish Filter can be built at all depths of cover generally associated with conventional stormwater conveyance systems. For sites that require minimal depth of cover for the stormwater infrastructure, the Jellyfish Filter can be applied in a shallow application using a hatch cover. The general minimum depth of cover is 36 inches (915 mm) from top of the underslab to outlet invert.
- If driving head caclulations account for water elevation during submerged conditions the Jellyfish Filter will function effectively under submerged condtions.
- Jellyfish Filter systems may incorporate grated inlets depending on system configuration.
- For sites with water quality treatment flow rates or mass loadings that exceed the design flow rate of the largest standard Jellyfish Filter manhole models, systems can be designed that hydraulically connect multiple Jellyfish Filters in series or alternatively Jellyfish Vault units can be designed.

STANDARD SPECIFICATION
STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

Specifies requirements for construction and performance of an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 REFERENCE STANDARDS

ASTM C 891: Specification for Installation of Underground Precast Concrete Utility Structures
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM D 4101: Specification for Copolymer steps construction

CAN/CSA-A257.4-M92
Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections and Fittings Using Rubber Gaskets

CAN/CSA-A257.4-M92
Precast Reinforced Circular Concrete Manhole Sections, Catch Basins and Fittings

Canadian Highway Bridge Design Code

1.3 SHOP DRAWINGS

Shop drawings for the structure and performance are to be submitted with each order to the contractor. Contractor shall forward shop drawing submittal to the consulting engineer for approval. Shop drawings are to detail the structure's precast concrete and call out or note the fiberglass (FRP) internals/components.

1.4 PRODUCT SUBSTITUTIONS

No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the engineer of record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

1.5 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The device shall be a cylindrical or rectangular, all concrete structure (including risers), constructed from precast concrete riser and slab components or monolithic precast structure(s), installed to conform to ASTM C 891 and to any required state highway, municipal or local specifications; whichever is more stringent. The device shall be watertight.

2.1.2 Cartridge Deck The cylindrical concrete device shall include a fiberglass deck. The rectangular concrete device shall include a coated aluminum deck. In either instance, the insert shall be bolted and sealed watertight inside the precast concrete chamber. The deck shall serve as: (a) a horizontal divider between the lower treatment zone and the upper treated effluent zone; (b) a deck for attachment of filter cartridges such that the membrane filter elements of each cartridge extend into the lower treatment zone; (c) a platform for maintenance workers to service the filter cartridges (maximum manned weight = 450 pounds (204 kg)); (d) a conduit for conveyance of treated water to the effluent pipe.

2.1.3 Membrane Filter Cartridges Filter cartridges shall be comprised of reusable cylindrical membrane filter elements connected to a perforated head plate. The number of membrane filter elements per cartridge shall be a minimum of eleven 2.75-inch (70-mm) diameter elements. The length of each filter element shall be a minimum 15 inches (381 mm). Each cartridge shall be fitted into the cartridge deck by insertion into a cartridge receptacle that is permanently mounted into the cartridge deck. Each cartridge shall be secured by a cartridge lid that is threaded onto the receptacle, or similar mechanism to secure the cartridge into the deck. The maximum treatment flow rate of a filter cartridge shall be controlled by an orifice in the cartridge lid, or on the individual cartridge itself, and based on a design flux rate (surface loading rate) determined by the maximum treatment flow rate per unit of filtration membrane surface area. The maximum design flux rate shall be 0.21 gpm/ft² (0.142 lps/m²).

Each membrane filter cartridge shall allow for manual installation and removal. Each filter cartridge shall have filtration membrane surface area and dry installation weight as follows (if length of filter cartridge is between those listed below, the surface area and weight shall be proportionate to the next length shorter and next length longer as shown below):

Filter Cartridge Length (in / mm)	Minimum Filtration Membrane Surface Area (ft2 / m2)	Maximum Filter Cartridge Dry Weight (lbs / kg)
15	106 / 9.8	10.5 / 4.8
27	190 / 17.7	15.0 / 6.8
40	282 / 26.2	20.5 / 9.3
54	381 / 35.4	25.5 / 11.6

2.1.4 Backwashing Cartridges The filter device shall have a weir extending above the cartridge deck, or other mechanism, that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir, or other mechanism, shall collect a pool of filtered water during inflow events that backwashes the high flow rate cartridges when the inflow

event subsides. All filter cartridges and membranes shall be reusable and allow for the use of filtration membrane rinsing procedures to restore flow capacity and sediment capacity; extending cartridge service life.

2.1.5 Maintenance Access to Captured Pollutants The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the deck. Access shall have a minimum clear vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

2.1.6 Bend Structure The device shall be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90-degrees or less in the stormwater conveyance system.

2.1.7 Double-Wall Containment of Hydrocarbons The cylindrical precast concrete device shall provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of fiberglass, to a minimum depth of 12 inches (305 mm) below the cartridge deck, and the precast vessel wall.

2.1.8 Baffle The filter device shall provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The baffle shall serve to protect the membrane filter elements from contamination by floatables and coarse sediment. The baffle shall be flexible and continuous in cylindrical configurations, and shall be a straight concrete or aluminum wall in rectangular configurations.

2.1.9 Sump The device shall include a minimum 24 inches (610 mm) of sump below the bottom of the cartridges for sediment accumulation, unless otherwise specified by the design engineer. Depths less than 24 inches may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be manufactured to a minimum live load of HS-20 truck loading or greater based on local regulatory specifications, unless otherwise modified or specified by the design engineer, and shall be watertight.

2.3 JOINTS All precast concrete manhole configuration joints shall use nitrile rubber gaskets and shall meet the requirements of ASTM C443, Specification C1619, Class D or engineer approved equal to ensure oil resistance. Mastic sealants or butyl tape are not an acceptable alternative.

2.4 GASKETS Only profile neoprene or nitrile rubber gaskets in accordance to CSA A257.3-M92 will be accepted. Mastic sealants, butyl tape or Conseal CS-101 are not acceptable gasket materials.

2.5 FRAME AND COVER Frame and covers must be manufactured from cast-iron or other composite material tested to withstand H-20 or greater design loads, and as approved by the

local regulatory body. Frames and covers must be embossed with the name of the device manufacturer or the device brand name.

2.6 DOORS AND HATCHES If provided shall meet designated loading requirements or at a minimum for incidental vehicular traffic.

2.7 CONCRETE All concrete components shall be manufactured according to local specifications and shall meet the requirements of ASTM C 478.

2.8 FIBERGLASS The fiberglass portion of the filter device shall be constructed in accordance with the following standard: ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks.

2.9 STEPS Steps shall be constructed according to ASTM D4101 of copolymer polypropylene, and be driven into preformed or pre-drilled holes after the concrete has cured, installed to conform to applicable sections of state, provincial and municipal building codes, highway, municipal or local specifications for the construction of such devices.

2.10 INSPECTION All precast concrete sections shall be inspected to ensure that dimensions, appearance and quality of the product meet local municipal specifications and ASTM C 478.

PART 3 – PERFORMANCE

3.1 GENERAL

3.1.1 Verification – The stormwater quality filter must be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV).

3.1.2 Function - The stormwater quality filter treatment device shall function to remove pollutants by the following unit treatment processes; sedimentation, floatation, and membrane filtration.

3.1.3 Pollutants - The stormwater quality filter treatment device shall remove oil, debris, trash, coarse and fine particulates, particulate-bound pollutants, metals and nutrients from stormwater during runoff events.

3.1.4 Bypass - The stormwater quality filter treatment device shall typically utilize an external bypass to divert excessive flows. Internal bypass systems shall be equipped with a floatables baffle, and must avoid passage through the sump and/or cartridge filtration zone.

3.1.5 Treatment Flux Rate (Surface Loading Rate) – The stormwater quality filter treatment device shall treat 100% of the required water quality treatment flow based on a maximum design treatment flux rate (surface loading rate) across the membrane filter cartridges of 0.21 gpm/ft² (0.142 lps/m²).

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At a minimum, the stormwater quality filter device shall have been field tested and verified with a minimum 25 TARP qualifying storm events and field monitoring shall have been conducted according to the TARP 2009 NJDEP TARP field test protocol, and have received NJCAT verification.

3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median TSS removal efficiency of 85% and a minimum median SSC removal efficiency of 95%.

3.2.2 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

3.2.3 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, an effluent d_{50} of 15 microns or lower for all monitored storm events.

3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce the turbidity from influent from a range of 5 to 171 NTU to an effluent turbidity of 15 NTU or lower.

3.2.5 Nutrient (Total Phosphorus & Total Nitrogen) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Phosphorus removal of 55%, and a minimum median Total Nitrogen removal of 50%.

3.2.6 Metals (Total Zinc & Total Copper) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Zinc removal of 55%, and a minimum median Total Copper removal of 85%.

3.3 INSPECTION and MAINTENANCE

The stormwater quality filter device shall have the following features:

3.3.1 Durability of membranes are subject to good handling practices during inspection and maintenance (removal, rinsing, and reinsertion) events, and site specific conditions that may have heavier or lighter loading onto the cartridges, and pollutant variability that may impact the membrane structural integrity. Membrane maintenance and replacement shall be in accordance with manufacturer's recommendations.

3.3.2 Inspection which includes trash and floatables collection, sediment depth determination, and visible determination of backwash pool depth shall be easily conducted from grade (outside the structure).

3.3.3 Manual rinsing of the reusable filter cartridges shall promote restoration of the flow capacity and sediment capacity of the filter cartridges, extending cartridge service life.

3.3.4 The filter device shall have a minimum 12 inches (305 mm) of sediment storage depth, and a minimum of 12 inches between the top of the sediment storage and bottom of the filter cartridge tentacles, unless otherwise specified by the design engineer. Variances may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

3.3.5 Sediment removal from the filter treatment device shall be able to be conducted using a standard maintenance truck and vacuum apparatus, and a minimum one point of entry to the sump that is unobstructed by filter cartridges.

3.3.6 Maintenance access shall have a minimum clear height that provides suitable vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

3.3.7 Filter cartridges shall be able to be maintained without the requirement of additional lifting equipment.

PART 4 – EXECUTION

4.1 INSTALLATION

4.1.1 PRECAST DEVICE CONSTRUCTION SEQUENCE

The installation of a watertight precast concrete device should conform to ASTM C 891 and to any state highway, municipal or local specifications for the construction of manholes, whichever is more stringent. Selected sections of a general specification that are applicable are summarized below.

4.1.1.1 The watertight precast concrete device is installed in sections in the following sequence:

- aggregate base
- base slab
- treatment chamber and cartridge deck riser section(s)
- bypass section
- connect inlet and outlet pipes
- concrete riser section(s) and/or transition slab (if required)
- maintenance riser section(s) (if required)
- frame and access cover

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

4.1.3 Adjustment of the stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary to restore original condition and watertight seals. Once the stormwater quality treatment device has been constructed, any/all lift holes must be plugged watertight with mortar or non-shrink grout.

4.1.4 Inlet and Outlet Pipes Inlet and outlet pipes should be securely set into the device using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight, and such that any pipe intrusion into the device does not impact the device functionality.

4.1.5 Frame and Cover Installation Adjustment units (e.g. grade rings) should be installed to set the frame and cover at the required elevation. The adjustment units should be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover should be set in a full bed of mortar at the elevation specified.

4.2 MAINTENANCE ACCESS WALL
In some instances the Maintenance Access Wall, if provided, shall require an extension attachment and sealing to the precast wall and cartridge deck at the job site, rather than at the precast facility. In this instance, installation of these components shall be performed according to instructions provided by the manufacturer.

4.3 FILTER CARTRIDGE INSTALLATION Filter cartridges shall be installed in the cartridge deck only after the construction site is fully stabilized and in accordance with the manufacturer's guidelines and recommendations. Contractor to contact the manufacturer to schedule cartridge delivery and review procedures/requirements to be completed to the device prior to installation of the cartridges and activation of the system.

PART 5 – QUALITY ASSURANCE

5.1 FILTER CARTRIDGE INSTALLATION Manufacturer shall coordinate delivery of filter cartridges and other internal components with contractor. Filter cartridges shall be delivered and installed complete after site is stabilized and unit is ready to accept cartridges. Unit is ready to accept cartridges after is has been cleaned out and any standing water, debris, and other materials have been removed. Contractor shall take appropriate action to protect the filter cartridge receptacles and filter cartridges from damage during construction, and in accordance with the manufacturer's recommendations and guidance. For systems with cartridges installed prior to full site stabilization and prior to system activation, the contractor can plug inlet and outlet pipes to prevent stormwater and other influent from entering the device. Plugs must be removed during the activation process.

5.2 INSPECTION AND MAINTENANCE

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

5.2.2 After construction and installation, and during operation, the device shall be inspected and cleaned as necessary based on the manufacturer's recommended inspection and maintenance guidelines and the local regulatory agency/body.

5.3 REPLACEMENT FILTER CARTRIDGES When replacement membrane filter elements and/or other parts are required, only membrane filter elements and parts approved by the manufacturer for use with the stormwater quality filter device shall be installed.

END OF SECTION

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

Jellyfish® Filter

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

Registration: GPS-ETV_V2022-03-01

In accordance with

ISO 14034:2016

Environmental Management —
Environmental Technology Verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

March 1, 2022
Vancouver, BC, Canada

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

Technology description and application

The Jellyfish® Filter is an engineered stormwater quality treatment technology designed to remove a variety of stormwater pollutants including floatable trash and debris, oil, coarse and fine suspended sediments, and particulate-bound pollutants such as nutrients, heavy metals, and hydrocarbons. The Jellyfish Filter combines gravitational pre-treatment (sedimentation and floatation) and membrane filtration in a single compact structure. The system utilizes membrane filtration cartridges comprised of multiple detachable pleated filter elements ('filtration tentacles") that provide high filtration surface area with the associated advantages of high flow rate, high sediment capacity, and low filtration flux rate.

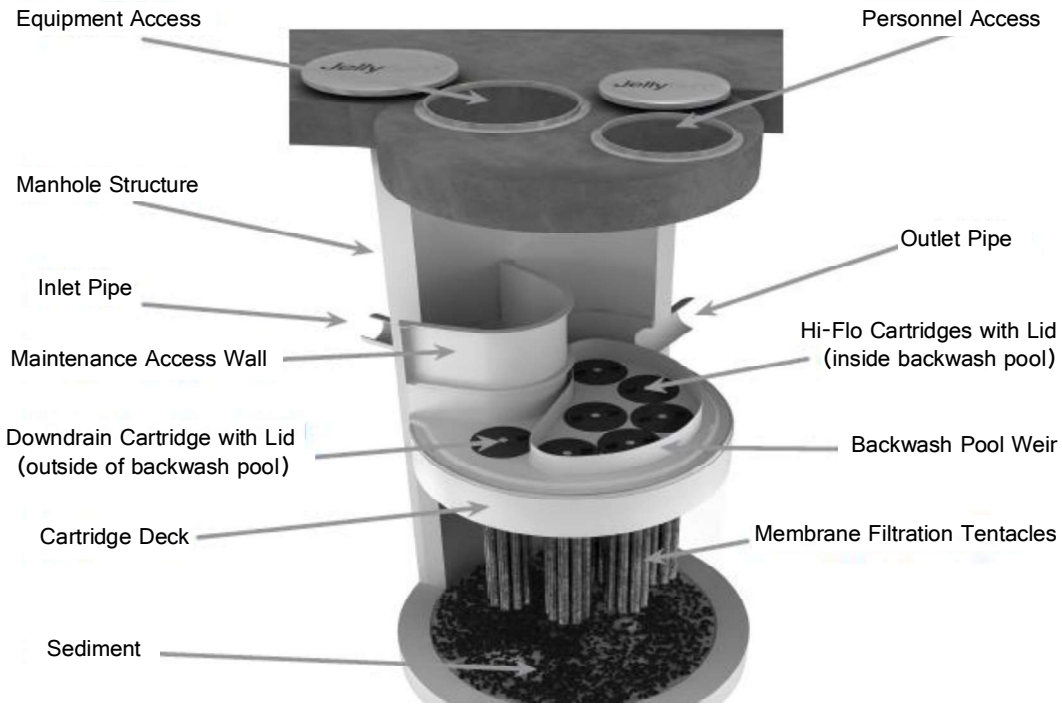


Figure 1. Cut-away graphic of a Jellyfish® Filter manhole with 6 hi-flo cartridges and 1 draindown cartridge

Figure 1 depicts a cut-away graphic of a typical 6-ft diameter Jellyfish® Filter manhole with 6 hi-flo cartridges and 1 draindown cartridge (JF6-6-1). Stormwater influent enters the system through the inlet pipe and builds a pond behind the maintenance access wall, with the pond elevation providing driving head. Flow is channeled downward into the lower chamber beneath the cartridge deck. A flexible separator skirt surrounds the filtration zone where the filtration tentacles of each cartridge are suspended, and the volume between the vessel wall and the outside surface of the separator skirt comprises a pre-treatment channel. As flow spreads throughout the pre-treatment channel, floatable pollutants accumulate at the surface of the pond behind the maintenance access wall and also beneath the cartridge deck in the pre-treatment channel, while coarse sediments settle to the sump. Flow proceeds under the separator skirt and upward into the filtration zone, entering each filtration tentacle and depositing fine suspended sediment and associated particulate-bound pollutants on the outside surface of the membranes. Filtered water proceeds up the center tube of each tentacle, with the flow from each tentacle combining under the cartridge lid, and discharging to the top of the cartridge deck through the cartridge lid orifice. Filtered effluent from the hi-flo cartridges enters a pool enclosed by a 15-cm high weir, and if storm intensity and resultant driving head is sufficient, filtered water overflows the weir and proceeds across the cartridge deck to the outlet pipe. Filtered effluent discharging from the draindown cartridge(s) passes directly to the outlet pipe, and requires only a minimal amount of driving head (2.5 cm) to provide forward flow. As

storm intensity subsides and driving head drops below 15 cm, filtered water within the backwash pool reverses direction and passes backward through the hi-flo cartridges, and thereby dislodges sediment from the membrane which subsequently settles to the sump below the filtration zone. During this passive backwashing process, water in the lower chamber is displaced only through the draindown cartridge(s). Additional self-cleaning processes include gravity, as well as vibrational pulses emitted when flow exits the orifice of each cartridge lid, and these combined processes significantly extend the cartridge service life and maintenance cleaning interval. Sediment removal from the sump by vacuum is required when sediment depths reach 30 cm, and cartridges are typically removed, externally rinsed, and recommissioned on an annual basis, or as site-specific maintenance conditions require. Filtration tentacle replacement is typically required every 3 – 5 years.

Performance conditions

The data and results published in this Verification Statement were obtained from the field testing conducted on a Jellyfish Filter JF6-6-1 (6-ft diameter manhole with 6 hi-flo cartridges and 1 draindown cartridge), in accordance with the requirements outlined by the Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) as written by the Washington State Department of Ecology, (WADOE, 2011). The drainage area providing stormwater runoff to the test unit was 86 acres and was 32% impervious. Throughout the monitoring period (March 2017 – April 2020), a total of 25 individual storm events were sampled. The Basic Treatment standard outlined in the TAPE requires ≥ 80% total suspended solids (TSS) removal at influent TSS concentrations ranging from 100 to 200 mg/L. In addition, the Phosphorus Treatment standard outlined in the TAPE requires ≥ 50% removal of total phosphorus (TP) at influent concentrations ranging from 0.10 to 0.5 mg/L. For this verification, the performance claim for TSS removal is for influent TSS concentration ≥ 100 mg/L, and the performance claim for TP removal is for influent TP concentration ≥ 0.1 mg/L. Based on these requirements, 15 and 18 sample pairs deemed qualified for evaluating the removal performance of TSS and TP, respectively. Prior to starting the performance testing program, a quality assurance project plan (QAPP) was submitted to and approved by the State of Washington Department of Ecology.

Table 1 shows the specified and achieved TAPE criteria for storm selection and sampling.

Table 1. Specified and achieved TAPE criteria for storm selection and sampling

Description	TAPE criteria value	Achieved value
Total rainfall	> 3.8 mm (0.15 in)	> 3.8 mm (0.15 in)[1]
Minimum inter-event period	6 hours	6 hours
Minimum flow-weighted composite sample storm coverage	Minimum 70% including as much of the first 20% of the storm	> 70%
Minimum influent/effluent samples	10, but a minimum of 5 subsamples for composite samples	10, except for two events that had 9 aliquots
Total sampled rainfall	N/A	8.29 in
Number of storms	Minimum 15 (preferably 20)	25

[1]N.B. Storm event depth was greater than the TAPE rainfall depth guideline of 0.15 inches for all events sampled, except for the 3/21/2017, 3/22/2019, 3/26/2019, and 04/13/2019 events. Given the size of the drainage basin, storm events below this threshold produced adequate runoff volume for sampling. Only two of these events were used to evaluate performance, and all had rainfall depths of 0.11 inches or greater. These events were included as their runoff volumes, precipitation durations, and influent TSS concentrations were all within range of the total data set.

The 6-ft diameter test unit has sedimentation surface area of 2.62 m^2 (28.26 ft^2). Each of the seven filter cartridges employed in the test unit uses filtration tentacles of 137 cm (54 in) length, with filter surface area of 35.4 m^2 (381 ft^2) per cartridge, and total filter surface area of 247.8 m^2 (2667 ft^2) for the seven cartridges combined. The design treatment flow rate is 5 L/s (80 gal/min) for each of the six hi-flo

cartridges and 2.5 L/s (40 gal/min) for the single draindown cartridge, for a total design treatment flow rate of 32.5 L/s (520 gal/min) at design driving head of 457 mm (18 in). This translates to a filtration flux rate (flow rate per unit filter surface area) of 0.14 L/s/m^2 (0.21 gal/min/ft^2) for each hi-flo cartridge and 0.07 L/s/m^2 (0.11 gal/min/ft^2) for the draindown cartridge. The design flow rate for each cartridge is controlled by the sizing of the orifice in the cartridge lid. The distance from the bottom of the filtration tentacles to the sump is 61 cm (24 in).

Performance claim(s)

The Jellyfish® Filter demonstrated the removal efficiencies indicated in **Table 2** for TSS and TP during field monitoring conducted in accordance with the Washington State Department of Ecology's Technology Assessment Protocol – Ecology (TAPE), and using the following design parameters:

- System hydraulic loading rate (system treatment flow rate per unit of sedimentation surface area) of 12.5 L/s/m^2 (18.4 gal/min/ft^2) or lower
- Filtration flux rate (flow rate per unit filter surface area) of 0.14 L/s/m^2 (0.21 gal/min/ft^2) or lower for each hi-flo cartridge and 0.07 L/s/m^2 (0.11 gal/min/ft^2) or lower for each draindown cartridge
- Distance from the bottom of the filtration tentacles to the sump of 61 cm (24 in) or greater
- Driving head of 457 mm (18 in) or greater

Table 2. Bootstrapped mean, median, and 95% confidence interval (median) for removal efficiencies of Total Suspended Solids (TSS) and Total Phosphorus (TP)

Parameter	Mean (%)	Median (%)	Median – 95% Lower Limit	Median – 95% Upper Limit
TSS [1]	87.6	90.1	85.1	91.6
TP [2]	77.3	77.5	70.8	85.6

[1] TSS influent concentration ≥ 100 mg/L
[2] TP influent concentration ≥ 0.1 mg/L

N.B. As with any field test of stormwater treatment devices, removal efficiencies will vary based on pollutant influent concentrations and other site-specific conditions.
The performance claims can be applied to other Jellyfish® Filter models smaller or larger than the tested model as long as the untested models are designed in accordance with the design parameters specified in the performance claims.

Performance results

Performance Claims – Removal Efficiency for Total Suspended Solids

Raw data summarizing the percent removal of total suspended solids (TSS) by the Jellyfish® Filter at the design system hydraulic loading rate of 12.5 L/s/m^2 (18.4 gal/min/ft^2) for 15 sample pairs deemed qualified are presented in **Table 3**. Data were analyzed and evaluated using a bootstrap approach of random sampling by replacement to estimate population distribution and thereby the upper and lower limit of the confidence interval.

Table 3. Raw data summarizing the percent removal of total suspended solids (TSS)

Event ID	TSS Influent (mg/L)	TSS Effluent (mg/L)	TSS Removal (%) (Inf ≥ 100 mg/L)
3/21/2017	102.0	22.0	78.4
4/7/2017	201.0	30.8	84.7
4/12/2017	108.0	24.4	77.4
4/19/2017	452.0	44.6	90.1
4/26/2017	257.0	10.0	96.1

6/15/2017	134.0	10.4	92.2
3/8/2018	755.0	47.2	93.8
3/14/2018	181.0	27.0	85.1
3/22/2018	224.0	20.0	91.1
4/5/2019	171.0	23.0	86.6
4/13/2019	117.0	25.0	78.6
5/18/2019	254.0	20.0	92.1
12/7/2019	200.0	17.0	91.5
3/30/2020	605.0	51.0	91.6
4/20/2020	210.0	29.0	86.2
n	15	15	15
Min	102.0	10.0	77.4
Max	755.0	51.0	96.1
Median	201.0	24.4	90.1
Mean	264.7	26.8	87.7
SD	190.9	12.3	5.9

Performance Claims – Removal Efficiency for Total Phosphorus

Raw data summarizing the percent removal of total phosphorus (TP) by the Jellyfish® Filter at the design system hydraulic loading rate of 12.5 L/s/m^2 (18.4 gal/min/ft^2) for 18 sample pairs deemed qualified are presented in **Table 4**. Data were analyzed and evaluated using a bootstrap approach of random sampling by replacement to estimate population distribution and thereby the upper and lower limit of the confidence interval.

Table 4. Raw data summarizing the percent removal of total phosphorus (TP)

Event ID	TP Influent (mg/L)	TP Effluent (mg/L)	TP Removal (%) (Inf ≥ 0.1 mg/L)
4/7/2017	0.706	0.092	87.0
4/12/2017	0.338	0.076	77.5
4/19/2017	0.500	0.036	92.8
4/26/2017	0.504	0.042	91.7
5/13/2017	0.256	0.110	57.0
6/8/2017	0.256	0.104	59.4
6/15/2017	0.362	0.052	85.6
3/8/2018	1.75	0.130	92.6
3/14/2018	0.652	0.094	85.6
3/22/2018	0.364	0.072	80.2
3/27/2019	0.226	0.070	69.1
4/5/2019	0.337	0.092	72.9
4/13/2019	0.249	0.087	65.1
5/18/2019	1.09	0.173	84.1
12/7/2019	0.335	0.105	68.7
12/19/2019	0.211	0.093	56.2
3/30/2020	1.05	0.092	91.2
4/20/2020	0.451	0.112	75.2
n	18	18	18
Min	0.211	0.036	56.2
Max	1.75	0.173	92.8
Median	0.363	0.092	78.9
Mean	0.535	0.091	77.3
SD	0.400	0.032	12.5

Verification

The verification was completed by the Verification Expert, the Centre for Advancement of Water and Wastewater Technologies ("CAWT"), contracted by GLOBE Performance Solutions, using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***. Data and information provided by Imbrium Systems to support the performance claim included the performance monitoring report "General Use Level Designation Technical Evaluation Report" prepared by CONTECH Engineered Solutions, Portland, OR, USA, and dated December 28, 2020. This report is based on a field testing completed by CONTECH personnel at a site in Dundee, Oregon between March 2017 and April 2020 in accordance with the Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) as written by the Washington State Department of Ecology (WADOE, 2011).

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

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

For more information on the Jellyfish® Filter please contact:

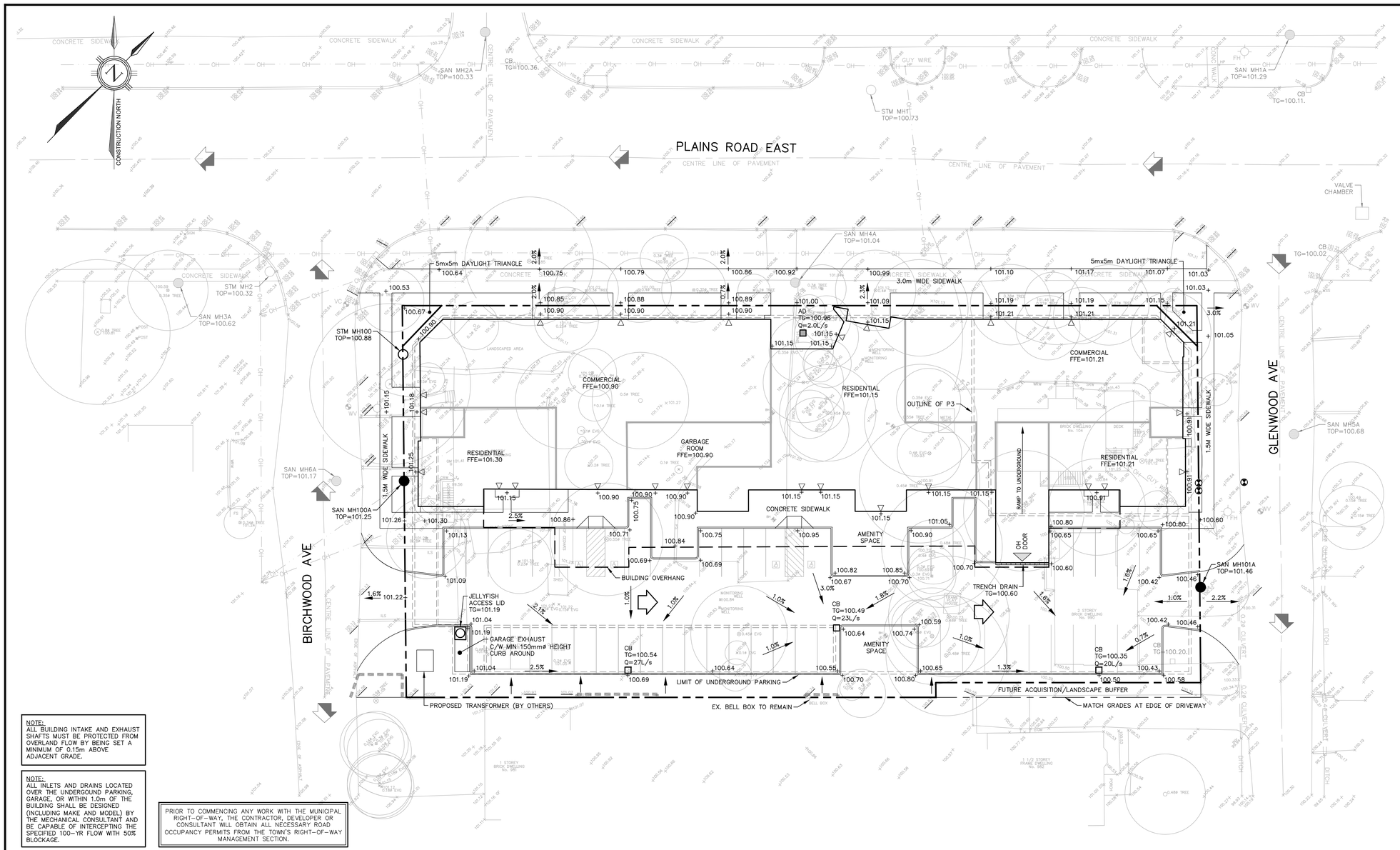
Imbrium Systems Inc.,
407 Fairview Drive
Whitby, Ontario
L1N 3A9, Canada
Tel: 416-960-9900
info@imbriumsystems.com

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

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

Limitation of verification - Registration: GPS-ETV_V2022-03-01
GLOBE Performance Solutions and the Verification Expert provide the verification services solely on the basis of the information supplied by the applicant or vendor and assume no liability thereafter. The responsibility for the information supplied remains solely with the applicant or vendor and the liability for the purchase, installation, and operation (whether consequential or otherwise) is not transferred to any other party as a result of the verification.

Appendix 'E'



NOTE:
ALL BUILDING INTAKE AND EXHAUST SHAFTS MUST BE PROTECTED FROM OVERLAND FLOW BY BEING SET A MINIMUM OF 0.15m ABOVE ADJACENT GRADE.

NOTE:
ALL INLETS AND DRAINS LOCATED OVER THE UNDERGOUND PARKING, GARAGE, OR WITHIN 1.0m OF THE BUILDING SHALL BE DESIGNED (INCLUDING MAKE AND MODEL) BY THE MECHANICAL CONSULTANT AND BE CAPABLE OF INTERCEPTING THE SPECIFIED 100-YR FLOW WITH 50% BLOCKAGE.

PRIOR TO COMMENCING ANY WORK WITH THE MUNICIPAL RIGHT-OF-WAY, THE CONTRACTOR, DEVELOPER OR CONSULTANT WILL OBTAIN ALL NECESSARY ROAD OCCUPANCY PERMITS FROM THE TOWN'S RIGHT-OF-WAY MANAGEMENT SECTION.

GENERAL NOTES

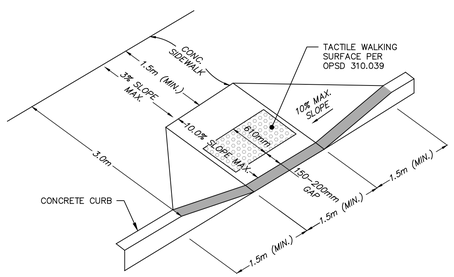
1. ALL THE CONSTRUCTON WORK FOR THIS PROJECT SHALL COMPLY WITH THE STANDARD DRAWINGS AND SPECIFICATIONS OF THE CITY OF BURLINGTON AND THE ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS.
2. ALL SURFACE DRAINAGE SHALL BE COLLECTED AND DISCHARGED AT A LOCATION TO BE APPROVED PRIOR TO THE ISSUANCE OF A BUILDING PERMIT. DRAINAGE OF ABUTTING PROPERTIES SHALL NOT BE ADVERSELY AFFECTED.
3. PROPOSED ELEVATIONS ALONG SITE PROPERTY LINES MUST MATCH EXISTING ELEVATIONS.
4. A SILT FENCE MUST BE PLACED AROUND THE PERIMETER OF THE SITE.
5. AT ALL ENTRANCES TO THE SITE, THE ROAD CURB AND SIDEWALK WILL BE CONTINUOUS THROUGH THE DRIVEWAY. THE DRIVEWAY GRADE WILL BE COMPATIBLE WITH THE EXISTING SIDEWALK AND A CURB DEPRESSION WILL BE PROVIDED FOR AT EACH ENTRANCE.
6. SIDEWALK TO BE REMOVED AND REPLACED AS PER CITY STD. S-121.
7. THE PORTION OF THE DRIVEWAY WITHIN THE MUNICIPAL BOULEVARD MUST BE PAVED WITH 40mm HL3 AND 50mm HL8. BASE TO BE 150mm GRANULAR "A" (OR 130mm OF 20mm CRUSHER RUN LIMESTONE) AND 300mm GRANULAR "B" (OR 225mm OF 50mm CRUSHER RUN LIMESTONE) COMPACTED TO 100% STANDARD PROCTOR DENSITY.
8. A UTILITY CLEARANCE RADIUS OF 1.2 METRES BETWEEN THE PROPOSED DRIVEWAY ENTRANCE CURB RETURN AND ALL ABOVE GROUND UTILITIES MUST BE MAINTAINED.
9. ROAD OCCUPANCY / ACCESS PERMIT MUST BE OBTAINED 48 HOURS PRIOR TO COMMENCING ANY WORKS WITHIN THE MUNICIPAL ROAD ALLOWANCE.
10. THE SERVICE CONNECTION TRENCH WITHIN THE TRAVELED PORTION OF THE ROAD ALLOWANCE SHALL BE BACKFILLED IN ACCORDANCE WITH THE REQUIREMENTS OF THE ROAD OCCUPANCY / ACCESS PERMIT APPLICATION.
11. THE MINIMUM CATCHBASIN LEAD DIAMETER ALLOWED IS 250mm.
12. ALL CATCHBASIN MANHOLES AND MANHOLES WITH INLET CONTROL DEVICES MUST HAVE A MINIMUM 0.3 METRE SUMP AND TOP AS PER MUNICIPAL STANDARDS.
13. RESTORE ROAD AS PER THE CITY OF BURLINGTON ROAD CUT PERMIT.
14. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL, MECHANICAL, AND LANDSCAPE DRAWINGS.

GRADING NOTES

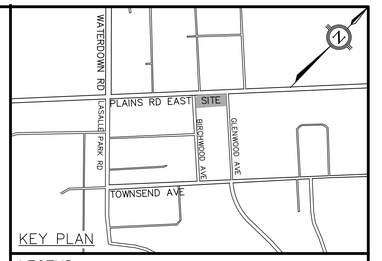
1. ALONG ADJOINING PROPERTIES GRADE TO MEET EXISTING OR PROPOSED ELEVATIONS WITH SODDED SLOPES (MIN. 3H TO 1V) AND/OR RETAINING WALLS AS SPECIFIED.
2. UNLESS OTHERWISE NOTED, THE GROUND BETWEEN PROPOSED ELEVATIONS ON SIDE LOTS SHALL BE GRADED AS A STRAIGHT LINE.
3. ALL FILL PLACED ON LOTS SHALL BE COMPACTED TO A MINIMUM 95% SPD (UNLESS OTHERWISE RECOMMENDED BY THE GEOTECHNICAL ENGINEER). ALL MATERIAL SHALL BE PLACED IN LAYERS NOT EXCEEDING 300mm LIFTS.
4. IF APPLICABLE FOR DELINEATION OF TREE PROTECTION ZONES, BUFFERS, REMOVALS AND PROTECTION SCHEMATICS, ETC., REFER TO TREE PROTECTION PLAN (BY LANDSCAPE ARCHITECT).
5. LOT GRADING SHALL CONFORM STRICTLY WITH THIS PLAN. ANY CHANGES, UNLESS APPROVED PRIOR TO CONSTRUCTION BY THE CITY, SHALL RESULT IN NON ACCEPTANCE BY THE CITY.
6. ALL TOPSOIL SHALL BE STRIPPED PRIOR TO GRADING.
7. ALL DISTRIBUTED AREAS TO BE RESTORED WITH 200mm TOPSOIL AND SOD.
8. DRIVEWAY SLOPE SHALL BE A MINIMUM OF 1.0% AND A MAXIMUM OF 8.0% AS PER CITY OF BURLINGTON STANDARD, UNLESS OTHERWISE INDICATED.

ADDITIONAL NOTES:

1. LOCATION OF ALL EXISTING UTILITIES IN THE FIELD TO BE ESTABLISHED BY THE CONTRACTOR.
2. THE CONTRACTOR(S) SHALL BE SOLELY RESPONSIBLE FOR LOCATES, EXPOSING, SUPPORTING AND PROTECTING OF ALL UNDERGROUND AND OVERHEAD UTILITIES AND STRUCTURES EXISTING AT THE TIME OF CONSTRUCTION IN THE AREA OF HIS WORK. WHETHER SHOWN ON THE PLAN OR NOT, AND FOR ALL REPAIRS AND CONSEQUENCES RESULTING FROM DAMAGE TO SAME.
3. THE CONTRACTOR(S) SHALL BE SOLELY RESPONSIBLE TO GIVE 72 HOURS WRITTEN NOTICE TO UTILITIES PRIOR TO CROSSING SUCH UTILITIES, FOR THE PURPOSE OF INSPECTION BY THE CONCERNED UTILITY. THIS INSPECTION WILL BE FOR THE DURATION OF THE CONSTRUCTION, WITH THE CONTRACTOR RESPONSIBLE FOR ALL COST ARISING FROM SUCH INSPECTION.



BARRIER-FREE CURB RAMP
N.T.S.



KEY PLAN

LEGEND

- PROPERTY BOUNDARY
- 82.51 EXISTING ELEVATION
- + 82.20 PROPOSED FINISHED ELEVATION
- PROPOSED DRAINAGE DIRECTION
- EXISTING FIRE HYDRANT
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING CATCHBASIN
- EXISTING DOUBLE CATCHBASIN
- EXISTING VALVE AND BOX
- EXISTING STORM SEWER
- EXISTING SANITARY SEWER
- EXISTING WATERMAIN
- PROPOSED ENTRANCE
- PROPOSED OVERHEAD ENTRANCE
- PROPOSED OVERLAND FLOW DIRECTION
- EXISTING OVERLAND FLOW DIRECTION
- PROPOSED CATCHBASIN
- PROPOSED SANITARY MANHOLE
- AD PROPOSED AREA DRAIN
- PROPOSED STORM MANHOLE
- PROPOSED VALVE & BOX
- TREE HOARDING

0 2.5 5 7.5 10 12.5

NO.	DATE	BY/DRAWN	REVISIONS
2	25/05/12	NAS/ZI	ISSUED FOR OPA/ZBA APPLICATION
1	25/01/17	NAS/ZI	ISSUED FOR TECHNICAL REVIEW

CAD FILE: 1861GS.dwg | PLOT SCALE: 1:1 | PLOT DATE: May 12, 2025

ELEVATION NOTE:

BEARINGS ARE UTM GRID, DEVIRED FROM OBSEREVED REFERENCE POINTS A & B, BY REAL TIME NETWROK OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (2010.0)

LOCAL BENCHMARK:

MONUMENT 44 - MAPLEHURST SCHOOL, 481 PLAINS ROAD EAST (HIGHWAY NO. 2) 1.92 KM NORTHEAST OF WATERDOWN ROAD: TABLET IN THE FRONT OF THE SOUTHEAST CONCRETE FOUNDATION WALL, 1.5m SOUTHWEST OF THE MOST EASTERLY OF TWO ENTRANCES, 1.04m BELOW RED BRICK SIDING. NO. 3488.
ELEVATION: 98.754 METRES

THE TOPOGRAPHIC DETAIL SHOWN HERON WAS AQUIRED ON JANUARY 17, 2024 BY A.T. MCLAREN LIMITED (DWG NO. 37632).

LICENSED PROFESSIONAL ENGINEER N. A. SYLVESTER 100199487 MAY 12 2025 PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT
TRAFALGAR ENGINEERING
#1-481 MORDEN ROAD, OAKVILLE, ON, L6K 3W6
www.trafalgareng.com

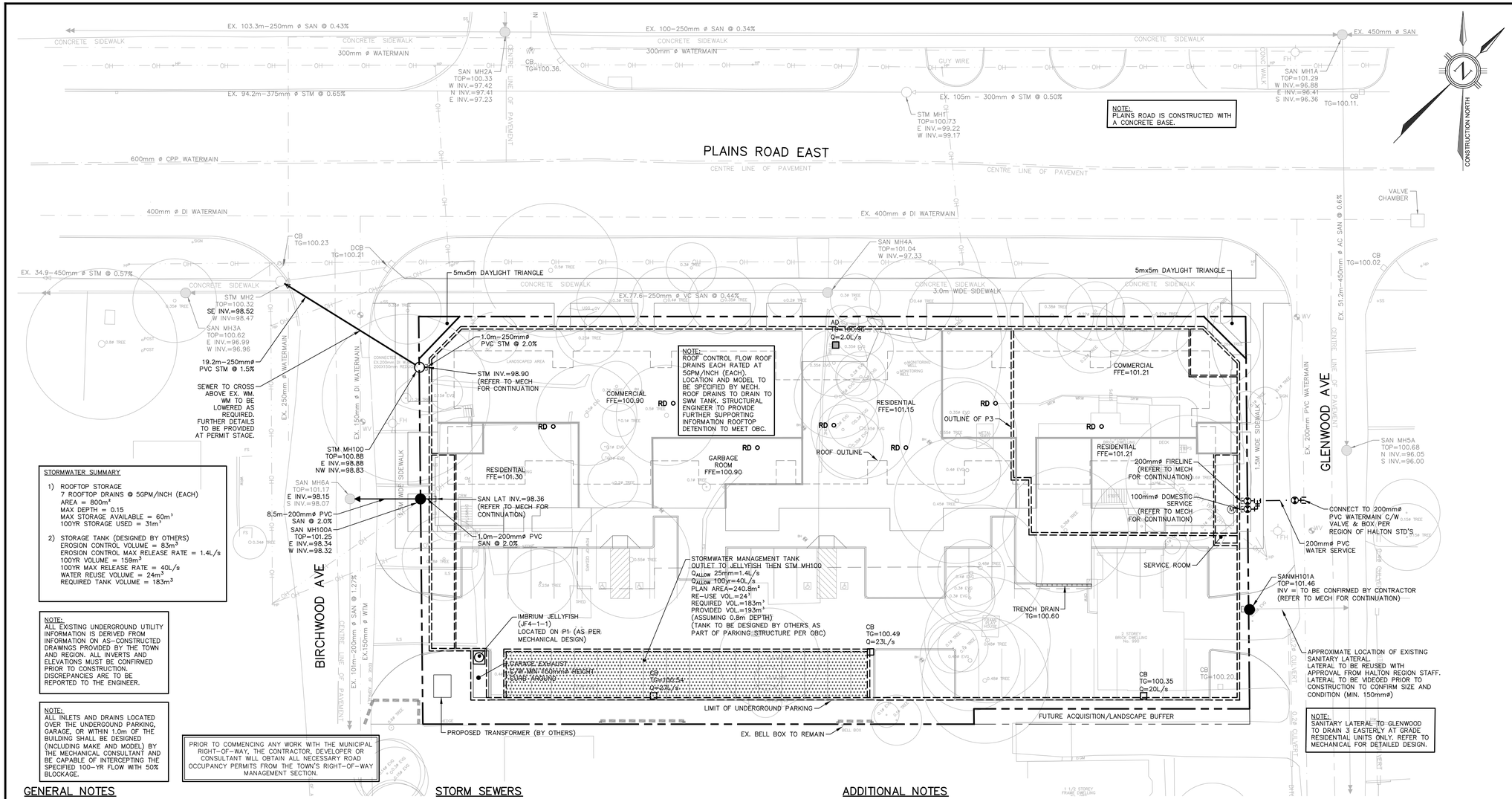
PROJECT TITLE
ONE HUNDRED ON PLAINS

LOCATION
84-104 PLAINS ROAD EAST & 990 GLENWOOD AVENUE
BURLINGTON, ONTARIO

DRAWING TITLE
GRADING PLAN

SCALE 1:250	DESIGN BY NAS	PROJECT No. 1861	
DRAWN BY ZI	CHECKED BY NAS	PLAN No. G1	
DATE 2024/10/01	SHEET 1 OF 1		

FILENAME: P:\1861 Plains Rd East\04-CAD\03-Site Plan\1861GS.dwg
PLOTDATE: May 12, 2025 - 10:59am



STORMWATER SUMMARY

1) ROOFTOP STORAGE
7 ROOFTOP DRAINS @ 5GPM/INCH (EACH)
AREA = 800m²
MAX DEPTH = 0.15
MAX STORAGE AVAILABLE = 60m³
100YR STORAGE USED = 31m³

2) STORAGE TANK (DESIGNED BY OTHERS)
EROSION CONTROL VOLUME = 83m³
EROSION CONTROL MAX RELEASE RATE = 1.4L/s
100YR VOLUME = 159m³
100YR MAX RELEASE RATE = 40L/s
WATER REUSE VOLUME = 24m³
REQUIRED TANK VOLUME = 183m³

NOTE:
ALL EXISTING UNDERGROUND UTILITY INFORMATION IS DERIVED FROM INFORMATION ON AS–CONSTRUCTED DRAWINGS PROVIDED BY THE TOWN AND REGION. ALL INVERTS AND ELEVATIONS MUST BE CONFIRMED PRIOR TO CONSTRUCTION. DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER.

NOTE:
ALL INLETS AND DRAINS LOCATED OVER THE UNDERGROUND PARKING, GARAGE, OR WITHIN 1.0m OF THE BUILDING SHALL BE DESIGNED (INCLUDING MAKE AND MODEL) BY THE MECHANICAL CONSULTANT AND BE CAPABLE OF INTERCEPTING THE SPECIFIED 100–YR FLOW WITH 50% BLOCKAGE.

PRIOR TO COMMENCING ANY WORK WITH THE MUNICIPAL RIGHT–OF–WAY, THE CONTRACTOR, DEVELOPER OR CONSULTANT WILL OBTAIN ALL NECESSARY ROAD OCCUPANCY PERMITS FROM THE TOWN'S RIGHT–OF–WAY MANAGEMENT SECTION.

GENERAL NOTES

1. ALL THE CONSTRUCTON WORK FOR THIS PROJECT SHALL COMPLY WITH THE STANDARD DRAWINGS AND SPECIFICATIONS OF THE CITY OF BURLINGTON AND THE ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS.
2. ALL SURFACE DRAINAGE SHALL BE COLLECTED AND DISCHARGED AT A LOCATION TO BE APPROVED PRIOR TO THE ISSUANCE OF A BUILDING PERMIT. DRAINAGE OF ABUTTING PROPERTIES SHALL NOT BE ADVERSELY AFFECTED.
3. PROPOSED ELEVATIONS ALONG SITE PROPERTY LINES MUST MATCH EXISTING ELEVATIONS.
4. A SILT FENCE MUST BE PLACED AROUND THE PERIMETER OF THE SITE.
5. AT ALL ENTRANCES TO THE SITE, THE ROAD CURB AND SIDEWALK WILL BE CONTINUOUS THROUGH THE DRIVEWAY. THE DRIVEWAY GRADE WILL BE COMPATIBLE WITH THE EXISTING SIDEWALK AND A CURB DEPRESSION WILL BE PROVIDED FOR AT EACH ENTRANCE.
6. SIDEWALK TO BE REMOVED AND REPLACED AS PER CITY STD. S–121.
7. THE PORTION OF THE DRIVEWAY WITHIN THE MUNICIPAL BOULEVARD MUST BE PAVED WITH 40mm HL3 AND 50mm HL8. BASE TO BE 150mm GRANULAR "A" (OR 130mm OF 20mm CRUSHER RUN LIMESTONE) AND 300mm GRANULAR "B" (OR 225mm OF 50mm CRUSHER RUN LIMESTONE) COMPACTED TO 100% STANDARD PROCTOR DENSITY.
8. A UTILITY CLEARANCE RADIUS OF 1.2 METRES BETWEEN THE PROPOSED DRIVEWAY ENTRANCE CURB RETURN AND ALL ABOVE GROUND UTILITIES MUST BE MAINTAINED.
9. ROAD OCCUPANCY / ACCESS PERMIT MUST BE OBTAINED 48 HOURS PRIOR TO COMMENCING ANY WORKS WITHIN THE MUNICIPAL ROAD ALLOWANCE.
10. THE SERVICE CONNECTION TRENCH WITHIN THE TRAVELED PORTION OF THE ROAD ALLOWANCE SHALL BE BACKFILLED IN ACCORDANCE WITH THE REQUIREMENTS OF THE ROAD OCCUPANCY / ACCESS PERMIT APPLICATION.
11. THE MINIMUM CATCHBASIN LEAD DIAMETER ALLOWED IS 250mm.
12. ALL CATCHBASIN MANHOLES AND MANHOLES WITH INLET CONTROL DEVICES MUST HAVE A MINIMUM 0.3 METRE SUMP AND TOP AS PER MUNICIPAL STANDARDS.
13. RESTORE ROAD AS PER THE CITY OF BURLINGTON ROAD CUT PERMIT.
14. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL, MECHANICAL, AND LANDSCAPE DRAWINGS.

SANITARY SEWERS

1. ALL SANITARY SEWERS SHALL BE SDR–28 PVC PIPE.
2. ALL BEDDING FOR SANITARY SEWERS SHALL BE IN ACCORDANCE WITH REGION OF HALTON STD. DWG. WITH GRANULAR COVER MATERIAL HAVING STONE SIZE NO GREATER THAN 25mm COMPACTED TO 95% SPMDD.
3. ALL MANHOLES SHALL BE IN ACCORDANCE WITH OPSD 701.010, OPSD 401.010 TYPE–A CLOSED COVER AND STAMPED "DANGER–SANITARY" AND BENCHING THROUGHOUT TO THE CROWN OF ALL PIPES ON A VERTICAL PROJECTION FROM SPRING LINE.

STORM SEWERS

1. SEWER BEDDING AS PER OPSD 802.010 OR 802.013 FOR FLEXIBLE PIPES AND OPSD 802.030 OR 802.013 FOR RIGID PIPES, CLASS 'B' BEDDING OR APPROVED BY CITY ENGINEER.
2. ALL MANHOLES AND CATCH BASINS SHALL BE:
   A. OPSD 701.010 (1200mmø)
3. MANHOLE AND CATCH BASIN (LANDSCAPE) COVER/ GRATING SHALL BE AS FOLLOWS:
   A. OPSD 401.010, TYPE 'A' – CLOSED COVER FOR MANHOLE AND STAMPED "DANGER–STORM"
   B. CITY STD. S–176 – BEEHIVE CATCH BASIN FRAME AND COVER FOR CB ON LANDSCAPE AREAS
4. ALL MANHOLES AND CATCHBASIN MANHOLES TO BE BENCHED THROUGHOUT THE SPRING LINE UNLESS NOTED OTHERWISE.
5. SURROUND ALL MANHOLES AND CATCHBASINS WITH A MINIMUM OF 1.0 METRE GRANULAR 'A' OR APPROVED EQUAL BY THE CITY ENGINEER COMPACTED TO 100% S.P.D.

WATERMAINS

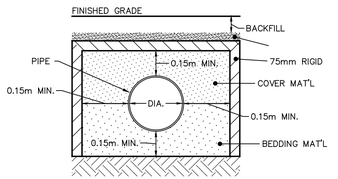
1. ALL MATERIALS AND CONSTRUCTION METHODS MUST CORRESPOND TO THE CURRENT REGION OF HALTON WORKS STANDARDS AND SPECIFICATIONS.
2. WATERMAIN AND / OR WATER SERVICE MATERIALS 100mm (4") AND LARGER MUST BE AWWA C–900–75 POLYVINYL CHLORIDE (PVC) DR18 INSTALLED WITH A 12 GAUGE TWH SOLID COPPER LIGHT COLOURED PLASTIC COATED TRACER WIRE BROUGHT TO THE SURFACE AT EACH VALVE BOX. SIZE 50mm (2") AND SMALLER COPPER TYPE "K" SOFT COPPER TUBING.
3. WATERMAINS AND / OR WATER SERVICES ARE TO HAVE A MINIMUM COVER OF 1.7m (5'6") WITH A MINIMUM HORIZONTAL SPACING OF 1.2m (4") FROM THEMSELVES AND ALL OTHER UTILITIES.
4. PROVISIONS FOR FLUSHING WATER LINE PRIOR TO TESTING, ETC. MUST BE PROVIDED WITH AT LEAST A 50mm (2") OUTLET ON 100mm (4") AND LARGER LINES. COPPER LINES ARE TO HAVE FLUSHING POINTS AT THE END, THE SAME SIZE AS THE LINE. THEY MUST ALSO BE HOSED OR PIPED TO ALLOW THE WATER TO DRAIN ONTO THE PARKING LOT OR DOWN THE DRAIN. ON FIRE LINES, FLUSHING OUTLET TO BE 100mm (4") DIAMETER MINIMUM ON A HYDRANT.
5. ALL CURB STOPS TO BE 3.0m (10') OFF THE FACE OF THE BUILDING UNLESS OTHERWISE NOTED.
6. WATERMAINS TO BE INSTALLED TO GRADES AS SHOWN ON APPROVED SITE PLAN. COPY OF GRADE SHEET MUST BE SUPPLIED TO INSPECTOR PRIOR TO COMMENCEMENT OF WORK, WHERE REQUESTED BY INSPECTOR.
7. WATERMAINS MUST HAVE A MINIMUM VERTICAL CLEARANCE OF 0.30m (12") OVER / 0.50m (20") UNDER SEWERS AND ALL OTHER UTILITIES WHEN CROSSING.
8. ALL PROPOSED WATER PIPING MUST BE ISOLATED FROM EXISTING LINES IN ORDER TO ALLOW INDEPENDENT PRESSURE TESTING AND CHLORINATING FROM EXISTING SYSTEMS.
9. ALL LIVE TAPPING AND OPERATION OF REGION OF WATER VALVES SHALL BE ARRANGED THROUGH THE REGIONAL INSPECTOR ASSIGNED OR BY CONTACTING THE OPERATIONS AND MAINTENCE DIVISION.
10. WATER SERVICES/MAINS SHALL BE TESTED & DISINFECTED AS PER AMSI/AWWA C651–99 AND REGION OF HALTON REQUIREMENTS.
11. CONNECTIONS TO EXISTING WATERMAIN SHALL BE PER REGION OF HALTON STD RH 409.01.
12. BEDDING ON WATER SERVICE SHALL BE PER OPSD 802.010.

ADDITIONAL NOTES

1. LOCATION OF ALL EXISTING UTILITIES IN THE FIELD TO BE ESTABLISHED BY THE CONTRACTOR.
2. THE CONTRACTOR(S) SHALL BE SOLELY RESPONSIBLE FOR LOCATES, EXPOSING, SUPPORTING AND PROTECTING OF ALL UNDERGROUND AND OVERHEAD UTILITIES AND STRUCTURES EXISTING AT THE TIME OF CONSTRUCTION IN THE AREA OF HIS WORK. WHETHER SHOWN ON THE PLAN OR NOT, AND FOR ALL REPAIRS AND CONSEQUENCES RESULTING FROM DAMAGE TO SAME.
3. THE CONTRACTOR(S) SHALL BE SOLELY RESPONSIBLE TO GIVE 72 HOURS WRITTEN NOTICE TO UTILITIES PRIOR TO CROSSING SUCH UTILITIES, FOR THE PURPOSE OF INSPECTION BY THE CONCERNED UTILITY. THIS INSPECTION WILL BE FOR THE DURATION OF THE CONSTRUCTION, WITH THE CONTRACTOR RESPONSIBLE FOR ALL COST ARISING FROM SUCH INSPECTION.

SERVICING NOTES

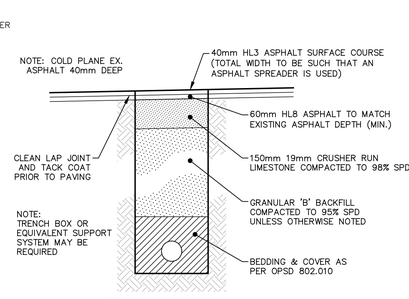
1. ALL UTILITIES SHALL BE BACKFILLED WITH GRANULAR BACKFILL COMPACTED TO 98% S.P.M.D.D. NATIVE BACKFILL MAY BE USED WITH THE PERMISSION OF THE GEOTECHNICAL CONSULTANT. BEDDING AND COVER MATERIAL SHALL BE PER THE GEOTECHNICAL CONSULTANT'S RECOMMENDATIONS.
2. BACKFILLING AND RESTORATION WITHIN THE PUBLIC ROW SHALL BE IN ACCORDANCE WITH THE CITY OF BURLINGTON ROAD CUT PERMIT AND TO THE SATISFACTION OF THE ENGINEERING & CONSTRUCTION DEPARTMENT.
3. SURROUND ALL MANHOLES WITH A MINIMUM OF 1.5m COMPACTED GRANULAR 'C' BACKFILL.



PIPE INSULATION DETAIL

N.T.S.

NOTE:
1. DETAIL TO BE READ IN CONJUNCTION WITH OPSD 1109.030
2. INSULATION REQUIRED WHERE DEPTH OF COVER IS <1.2m (SEWER) or <1.7m (WATER)

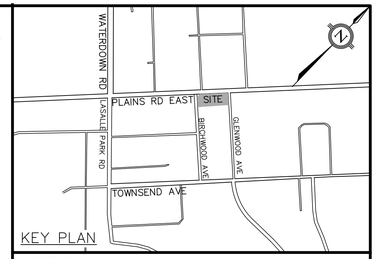


NOTE:

1. PLACE HL8 ASPHALT TO MATCH EX SURFACE.
2. IN FOLLOWING CONSTRUCTION SEASON GRIND ASPHALT 40mm DEEP AND PLACE 40mm HL3 ASPHALT

TYPICAL TRENCH RESTORATION

N.T.S.



KEY PLAN

LEGEND

- PROPERTY BOUNDARY
- EXISTING FIRE HYDRANT
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING CATCHBASIN
- EXISTING DOUBLE CATCHBASIN
- EXISTING VALVE AND BOX
- EXISTING STORM SEWER
- EXISTING SANITARY SEWER
- EXISTING WATERMAIN
- PROPOSED ENTRANCE ARROW
- PROPOSED OVERHEAD ENTRANCE ARROW
- RD PROPOSED ROOF DRAIN
- PROPOSED CATCHBASIN
- PROPOSED SANITARY MANHOLE
- PROPOSED STORM MANHOLE
- PROPOSED VALVE & BOX
- AD PROPOSED AREA DRAIN
- PROPOSED SANITARY SEWER
- PROPOSED STORM SEWER
- PROPOSED WATERMAIN
- PROPOSED WATER METER
- TREE HOARDING

0 2.5 5 7.5 10 12.5

NO.	DATE	BY/DRAWN	REVISIONS
2	25/05/12	NAS/ZI	ISSUED FOR OPA/ZBA APPLICATION
1	25/01/17	NAS/ZI	ISSUED FOR TECHNICAL REVIEW

CAD FILE: 1861GS.dwg | PLOT SCALE: 1:1 | PLOT DATE: May 12, 2025

ELEVATION NOTE:

BEARINGS ARE UTM GRID, DEVIRED FROM OBSERVED REFERENCE POINTS A & B, BY REAL TIME NETWORK OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (2010.0)

LOCAL BENCHMARK:

MONUMENT 44 – MAPLEHURST SCHOOL, 481 PLAINS ROAD EAST (HIGHWAY NO. 2) 1.92 KM NORTHEAST OF WATERDOWN ROAD: TABLET IN THE FRONT OF THE SOUTHEAST CONCRETE FOUNDATION WALL, 1.5m SOUTHWEST OF THE MOST EASTERLY OF TWO ENTRANCES, 1.04m BELOW RED BRICK SIDING. NO. 3488.
ELEVATION: 98.754 METRES

THE TOPOGRAPHIC DETAIL SHOWN HERON WAS AQUIRED ON JANUARY 17, 2024 BY A.T. MCLAREN LIMITED (DWG NO. 37632).

LICENSED PROFESSIONAL ENGINEER
N. A. SYLVESTER
100199487
MAY 12, 2025
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT
TRAFALGAR ENGINEERING
#1-481 MORDEN ROAD, OAKVILLE, ON, L6K 3W6
www.trafalgareng.com

PROJECT TITLE
ONE HUNDRED ON PLAINS

LOCATION
84–104 PLAINS ROAD EAST & 990 GLENWOOD AVENUE
BURLINGTON, ONTARIO

DRAWING TITLE
SERVICING PLAN

SCALE	1:250	DESIGN BY	NAS
DRAWN BY	ZI	CHECKED BY	NAS
DATE	2024/10/01	SHEET	1 OF 1
PROJECT No.	1861	PLAN No.	S1

FILENAME: P:\1861 Plains Rd East\04-CAD\03-Site Plan\1861GS.dwg
PLOTDATE: May 12, 2025 - 3:09pm