Ganatchio Gardens Inc.

Official Plan and Zoning By-Law Amendments

Functional Servicing Report

Southwest Corner of Florence Avenue & Wyandotte Street East

Windsor, Ontario

March 2023 – 21-1691

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1.0 Introduction

Dillon Consulting Limited (Dillon) was retained by Ganatchio Gardens Inc. to develop a Functional Servicing Report (FSR) for a residential development located at the southwest corner of Wyandotte Street East at Florence Avenue in the City of Windsor. This document outlines the servicing strategy for the site development and identifies the supporting studies and related information for the transportation, sanitary, stormwater management, and watermain servicing for the site.

The proposed development area is approximately 3.30 ha and is currently in operation as agricultural lands. When fully developed, the land use will consist of 7 multi-unit residential complexes, and one (1) multi-unit residential dwelling with an elevated terrace.

1.1 Reference Documents

The following documents and drawings were referenced when completing this study:

- City of Windsor – Development Manual (Windsor, 2015);
- City of Windsor – Interactive Mapping (City of Windsor);
- Design Guidelines for Sewage Works (MOE, 2008); and
- Windsor/Essex Region Stormwater Management Standards Manual (ERCA, 2018).

2.0 Transportation Servicing

2.1 Existing Conditions

Currently, no access points to the development exists. The property is bounded on the west limit by green space and the Ganatchio Trail, on the east limit by a residential development, on the north by Wyandotte Street East, and on the south by a stormwater management pond and green space.

2.2 Proposed Roadways

The proposed development will have two access points both on the future extension of Florence Avenue, south of Wyandotte Street East. The first entrance will be near the north limit and the second entrance will be near the south limit of the proposed development.

The internal road network for this site is proposed to be a parking lot with 7.5m wide drive isles and a total of 488 parking spaces. The proposed parking lot layout is shown in Figure 3 (in Appendix A).

The pavement structure of the proposed paved areas will be consistent with geotechnical recommendations.

3.0 Sanitary Servicing

3.1 Existing Conditions

Currently, there are no sanitary services to this property. There is a sanitary sewer network east of the proposed development at Wyandotte Street East and Elinor Street, as well as an existing trunk sewer south of the proposed development, which leads directly to the Little River Pollution Control Plant (LRPCP).

3.2 Design Criteria

The following sanitary sewer design criteria for this property are outlined in Table 1.0. The design criteria was established by the City of Windsor Development Manual (2015).

Table 1: Sanitary Sewer Design Criteria

Criteria	City of Windsor Development Manual
Hydraulic Sewer Sizing	Manning's Equation
Minimum Sewer Size (mm)	250 diameter
Maximum Manhole Spacing	90m preferred, maximum 120m
Manning's Roughness Coefficient 'n'	0.013
Velocity: Minimum (m/s) Maximum (m/s)	 0.75 3.00
Manning's Roughness Coefficient	0.013 (Smooth Wall Pipe)
Extraneous Flow	0.156 L/s/ha
Peaking Factor	6 (Population under 1,000)
Population Density For: Residential High Density Residential	 50 person/ha 2 persons/unit
Average Daily Sewage	0.0042 L/second/capita

3.3 Proposed Servicing

Refer to the attached Figure 1 and Figure 2 (in Appendix A) which illustrates the proposed sanitary servicing plan. The sanitary servicing for the proposed development is as follows:

- All sanitary flows from within the development will be conveyed via proposed 250mm sanitary sewers on private property, connecting to a proposed 250mm sanitary sewer on Florence Avenue.

- The proposed sanitary sewers on Florence Avenue will connect to a future 450mm sanitary sewer (design by others), which is being designed to re-route the existing sanitary sewer system in that area. Please see Figure 2 (in Appendix A) for an illustration.
- The re-routed sanitary sewer system (to be completed by others) will convey flows to the existing trunk 1500mm sewer south of the proposed development, which leads directly to the LRPCP.

The sanitary sewer functional design sheets are provided in Appendix B and assumes a full development build out. Criteria used in flow calculation is listed in Table 1.0.

The connection to the future manhole south of the proposed development allows for adequate cover at the upstream end of the proposed sanitary sewers. However, proposed inverts and ground elevations are subject to change during detailed design. All serviced buildings where the bottom of the footings are below the sewer and the hydraulic grade line is less than 300mm below the basement floor elevation shall be equipped with a sewage ejector pump. It is recommended that all serviced buildings install sewage ejector pumps to provide a hydraulic break between the sewer and the building lot.

In addition to servicing the proposed development, the services to the building lots on the east side of Florence will be provided. Discussions with the property owner on locations will happen during detailed design.

The future detailed design of the sanitary sewers and services are to be consistent with the requirements of the Ontario Building Code.

4.0 Stormwater Servicing

4.1 Existing Conditions

Currently, there is a 1950mm storm sewer that runs along the north frontage of the proposed development on Wyandotte Street East and outlets into the stormwater pond to the south-west of the development. This 1950mm storm sewer has been designed to be the outlet for the proposed site.

4.2 Design Criteria

The following storm sewer design criteria for this property are outlined in Table 2.0. The design criteria were established by the City of Windsor Development Manual (2015).

Table 2: Storm Sewer Design Criteria

Criteria	City of Windsor Development Manual
Design Method	Rational Method
Standard Return Period	1 in 5 years Storm Event
Rainfall Intensity	I = a / (t+b)^c a=1259.0 b=8.80 c=0.838
Minimum Cover Depth (m)	1.00
Manning's Roughness Coefficient 'n'	0.013
Velocity: Minimum (m/s) Maximum (m/s)	 0.76 3.00
Maximum Manhole Spacing	675mm diameter or less: 120 metres 750 to 1350mm diameter: 150 metres
Inlet Times: Residential	20 minutes (maximum)
Runoff Coefficients: Residential Single Family	 0.60
Minimum Manhole Size	1200mm
Pipe Material Main Lines	450mm or less: PVC or Reinforced Concrete Greater than 450mm: Reinforced Concrete (65-D min.)

4.3 Proposed Servicing

Refer to Figure 1 (in Appendix A) for the proposed servicing. The stormwater servicing for the proposed development is as follows:

- The proposed buildings and parking lot will be serviced through a new storm sewer network constructed within the proposed development.
- The proposed storm sewer network will outlet into the existing 1950mm storm sewer along Wyandotte Street East, which then outlets to the storm management pond to the south-west of the site. Refer to the stormwater management report in Appendix C for details.
- Details for stormwater quality control can be found in the stormwater management report (Appendix C).

5.0 Watermain Servicing

5.1 Existing Conditions

The site is not currently connected to a watermain service. There is an existing 400mm diameter watermain located to the north of the proposed development within the north side of the right-of-way of Wyandotte Street East.

5.2 Proposed Servicing

Please refer to the attached Figure 1 (in Appendix A) which illustrates the proposed watermain servicing. The watermain servicing for the proposed development is as follows:

- The existing 400mm diameter watermain within the right-of-way of Wyandotte Street East will be used to service all of the proposed townhomes on the north side of the proposed development.
- A new watermain will connect to the existing 300mm diameter main located within the Florence Avenue right-of-way and be installed along the extension of Florence to service the proposed buildings on the east side of the proposed development.
- The new 200mm watermain servicing the multi-unit residential building will connect to the proposed 300mm watermain on Florence.

No pressure/flow testing has been completed for this development. During detailed design, pressure testing of the existing watermain on Wyandotte Street East may be required.

The detailed design of the watermain services are to be consistent with the requirements of Windsor Utility Commissions (W.U.C.) and will be coordinated with W.U.C. during the detailed design process.

6.0 Utilities

6.1 Gas

Existing natural gas mainline is caped at the intersection of Wyandotte Street East and Florence Avenue. During detailed design, future conversation on loading will be required with Enbridge.

6.2 Bell

Existing Bell service is available along Wyandotte St E. During detailed design, future conversation will be required for servicing the proposed development.

6.3 Cogeco

Existing Cogeco service is available along Wyandotte St E. During detailed design, future conversation will be required for servicing the proposed development.

6.4 MNSi

Existing MNSi service is available along Wyandotte St E. During detailed design, future conversation will be required for servicing the proposed development.

7.0 Conclusion

The review of the adjacent services has been found to be sufficient for the proposed development. The design of the proposed internal services will be finalized during detailed design.

Yours sincerely,

DILLON CONSULTING LIMITED

Kyle Edmunds, P.Eng.
Project Engineer

Kailee Dickson, E.I.T.
Civil Designer

Appendix A

Functional Servicing Plans

NOTES:

1. THE OWNER AND DILLON CONSULTING LIMITED DO NOT GUARANTEE THE ACCURACY OF THE UTILITIES SHOWN ON THE DRAWINGS. OTHER UTILITIES MAY BE PRESENT OR THE UTILITIES SHOWN MAY DIFFER IN SIZE OR LOCATION FROM THOSE SHOWN. THE CONTRACTOR SHALL NOTE THAT SERVICES FROM THE MAIN LINES ARE NOT SHOWN. THE CONTRACTOR [illegible] RESPONSIBILITY TO CONTACT THE VARIOUS UTILITY COMPANIES AND TO REPAIR ANY DAMAGE IT MAY CAUSE TO THESE UTILITIES OR TO [illegible] CONTRACTOR AGREES TO INDEMNIFY THE OWNER AND DILLON CONSULTING LIMITED AGAINST ANY CLAIMS WHICH MAY ARISE FROM THE CONTRACTOR'S ACTIONS.
2. ALL [illegible] CONSTRUCTED TO A TOLERANCE OF [illegible]mm ±.
3. ALL DIMENSIONS AND [illegible] TO CONSTRUCTION BASELINE OR EDGE OF PAVEMENT.
4. CHAINAGES SHOWN REFER TO CONSTRUCTION BASELINE.
5. SEWER BEDDING TO BE CLASS 'B' (EXCEPT CLASS 'A' TO FIRST PIPE JOINT OUTSIDE OF MANHOLE [illegible]).
6. BACKFILL OF SEWER AND UTILITY TRENCHES SHALL BE IN ACCORDANCE WITH AS-539 (SEE DETAILS SHEET). IF GRANULAR 'B' TYPE I IS USED, IT SHALL BE APPROVED PRIOR TO USE UNDER THE CITY'S RECYCLED AGGREGATE POLICY.
7. ALL SEWERS SHALL HAVE A MINIMUM OUTSIDE EDGE OF PIPE/OUTSIDE EDGE OF PIPE SEPARATION OF 2.50m.
8. CONNECTIONS TO CONCRETE PIPE:
ALL PLANT OR FIELD MANUFACTURED TEES SHALL CONSIST OF AN ASBESTOS CEMENT [illegible] IN PLACE WITH A NON-SHRINK GROUT. ALL GROUTED STOP COUPLERS SHALL BE ALLOWED TO CURE FOR A MINIMUM OF 12 HOURS BEFORE USE. [illegible] COUPLERS ARE TO HAVE A MINIMUM [illegible] INTERNAL MONOLITHIC STOPPER AS WELL AS AN INTERNAL RUBBER GASKET WHICH IS TO BE [illegible] P.V.C. SAND COATED BELLS WILL NOT BE PERMITTED IN TAPPING CONCRETE PIPE.
9. [illegible] SEPARATION OF [illegible] SHALL BE MAINTAINED WHEN A WATERMAIN PASSES UNDERNEATH A STORM OR SANITARY SEWER.
10. NON-SEAL BOOTS ARE REQUIRED FOR ALL PVC PIPE AT MANHOLE CONNECTIONS.
11. CONTRACTOR TO USE IPEX LIFE SAVER LIFT RINGS FOR MANHOLES.
12. THE CITY OF WINDSOR DEVELOPMENT MANUAL STANDARDS APPLY.
13. CONTRACTOR TO PAY FOR ALL PERMITS AND FEES REQUIRED FOR SERVICE INSTALLATION.

STORM SEWERS

14. ALL STORM SEWERS 375mm DIA. OR SMALLER TO BE PVC DR-35. ALL STORM SEWERS [illegible] DIA. OR LARGER TO BE PVC OR CONCRETE A257.2 65-D UNLESS SHOWN OTHERWISE.
15. ALL STORM MANHOLES TO HAVE A MINIMUM 450mm DEEP SUMP.
16. CONTRACTOR TO SUPPLY AND INSTALL ALL REQUIRED UTILITY SUPPORTS ADHERING TO UTILITY REQUIREMENTS. ANY SHOP DRAWINGS REQUIRED BY THE UTILITY COMPANY SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

NEW UTILITIES LEGEND:

REFER TO NOTES ON SHEET C8 FOR ADDITIONAL INFORMATION

(green dashed line)	STORM SEWER
ST	STORM CONNECTION WITH CLEANOUT
(symbol)	STORM MAINTENANCE HOLE
(red dashed line)	SANITARY SEWER
SY	SANITARY CONNECTION WITH CLEANOUT
(symbol)	SANITARY MAINTENANCE HOLE
CB	CATCH BASIN AT MOUNTABLE CURB (OPSD 705.010 WITH FRAME & COVER AS PER OPSD 400.030)
CICB	CURB INLET CATCH BASIN AT BARRIER CURB (OPSD 705.010 WITH FRAME & COVER AS PER OPSD 610.030)
(symbol)	REAR YARD CATCH BASIN
(green line)	CATCHBASIN LEAD
(blue dashed line)	WATERMAIN
W	WATER SERVICE INCLUDING CURB STOP
FH	FIRE HYDRANT
WV	WATER VALVE

Conditions of Use

Verify elevations and/or dimensions on drawing prior to use. Report any discrepancies to Dillon Consulting Limited.

Do not scale dimensions from drawing.

Do not modify drawing, re-use it, or use it for purposes other than those intended at the time of its preparation without prior written permission from Dillon Consulting Limited.

DILLON CONSULTING

No.	ISSUED FOR	DATE	BY
1	FOR SUBMISSION TO CITY OF WINDSOR	20230301	KYD

DESIGN: KYD | REVIEWED BY: KNE
DRAWN: KYD | CHECKED BY: [illegible]
DATE: March 1, 2023
SCALE: 1:500 (11x17) 1:250 (22x34)

GANATCHIO GARDENS

SERVICING PLAN

PROJECT NO. 21-1581

SHEET NO. 01

Conditions of Use

Verify elevations and/or dimensions on drawing prior to use. Report any discrepancies to Dillon Consulting Limited.

Do not scale dimensions from drawing.

Do not modify drawing, re-use it, or use it for purposes other than those intended at the time of its preparation without prior written permission from Dillon Consulting Limited.

DILLON CONSULTING

No.	Issue/Revision	Date	By
1	FOR SUBMISSION TO CITY OF WINDSOR	2023/03/01	KYD

Designed	KYD
Reviewed	KNE
Drawn	KYD
Checked	MMB
Date	March 1, 2023
Scale	1:500 (11x17) 1:250 (22x34)

GANATCHIO GARDENS

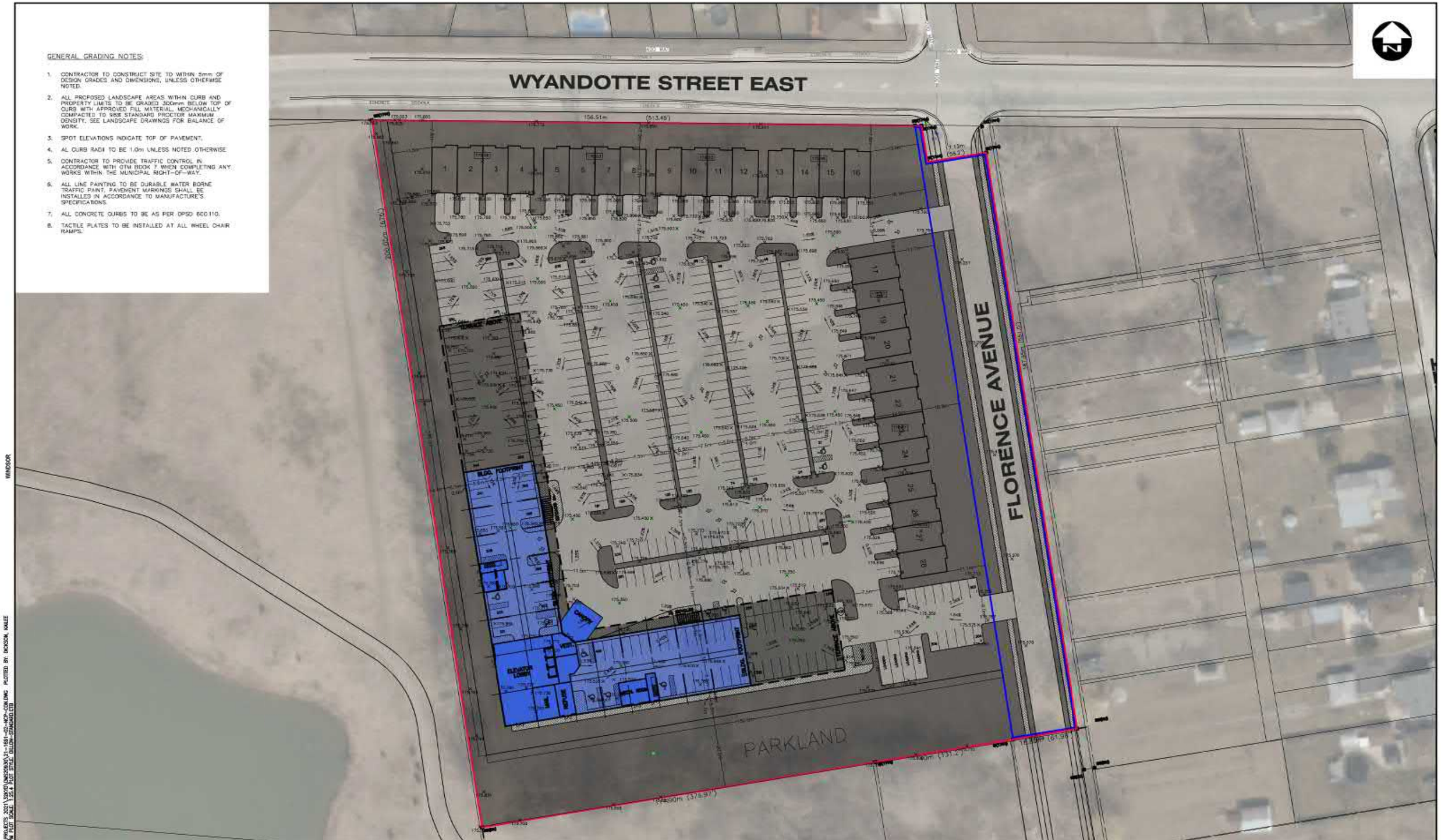
SANITARY SEWER RE-ROUTING PLAN

Project No. 21-1691

Sheet No. 02

GENERAL GRADING NOTES:

1. CONTRACTOR TO CONSTRUCT SITE TO WITHIN 5mm OF DESIGN GRADES AND DIMENSIONS, UNLESS OTHERWISE NOTED.
2. ALL PROPOSED LANDSCAPE AREAS WITHIN CURB AND PROPERTY LIMITS TO BE GRADED 300mm BELOW TOP OF CURB WITH APPROVED FILL MATERIAL, MECHANICALLY COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DENSITY. SEE LANDSCAPE DRAWINGS FOR BALANCE OF WORK.
3. SPOT ELEVATIONS INDICATE TOP OF PAVEMENT.
4. AL CURB RADII TO BE 1.0m UNLESS NOTED OTHERWISE.
5. CONTRACTOR TO PROVIDE TRAFFIC CONTROL IN ACCORDANCE WITH OTM BOOK 7 WHEN COMPLETING ANY WORKS WITHIN THE MUNICIPAL RIGHT-OF-WAY.
6. ALL LINE PAINTING TO BE DURABLE WATER BORNE TRAFFIC PAINT. PAVEMENT MARKINGS SHALL BE INSTALLED IN ACCORDANCE TO MANUFACTURE'S SPECIFICATIONS.
7. ALL CONCRETE CURBS TO BE AS PER OPSD 600.110.
8. TACTILE PLATES TO BE INSTALLED AT ALL WHEEL CHAIR RAMPS.



Conditions of Use

Verify elevations and/or dimensions on drawing prior to use. Report any discrepancies to Dillon Consulting Limited.

Do not scale dimensions from drawing.

Do not modify drawing, re-use it, or use it for purposes other than those intended at the time of its preparation without prior written permission from Dillon Consulting Limited.

DILLON CONSULTING

No.				
1	FOR SUBMISSION TO CITY OF WINDSOR	2023/03/01	KYD	

DESIGN: KYD	RECOMMENDED: KNE
DRAWN: KYD	CHECKED: MWM
DATE: March 1, 2023	
SCALE: 1:500 (11x17) 1:250 (22x34)	

GANATCHIO GARDENS

PROJECT NO: 21-1691

LOT GRADING

SHEET NO: 03

FILENAME: C:\PW_WORKING_DIRECTORY\PROJECTS_2021\21691\DWG\ENGR\21-1691-02-MCH-CONCEPT_PLOTTED BY: BICKSON, KAILEE
PLOT DATE: 2023-03-01 @ 1:53:45 PM PLOT SCALE: 1:25.4 PLOT STYLE: DILLON-STANDARD.CTB
WINDSOR

Appendix B

Sanitary Sewer and Storm Sewer Design Sheets

GANATCHIO GARDENS
SANITARY SEWER DESIGN SHEET

Project Name: Ganatchio Gardens
Project No: 21-1691

City of Windsor

The Peaking Factor was derived:
Using Harmon Formula= N (Y or N)
From a Table= Y
Value from table= 6.000

Residential Average Daily Flow= 363 L/Cap.D
Peak Extraneous Flow= 0.156 L/Ha.S

Outlet Invert Elevation= 169.935
Mannings 'n'= 0.013
Total Area= 4.570

Basement Floor Elevation =
or
Hydraulic Grade Line Cover = 2.40

Location			Flow Characteristics								Sewer Design/Profile									Cover		
ROAD/STN	LOCATION FROM MH	LOCATION TO MH	INDIVIDUAL POP	INDIVIDUAL AREA (ha.)	CUMULATIVE POP	CUMULATIVE AREA (ha.)	PEAKING FACTOR M	POP FLOW Q(p) (L/s)	PEAK EXTR. FLOW Q(i) (L/s)	PEAK DESIGN FLOW Q(d) (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE DIA. (mm)	SLOPE (%)	UPPER INVERT (m)	LOWER INVERT (m)	FALL (m)	VELOCITY (m/s)	DROP IN LOWER MANHOLE (m)	Ground Elevation Upper MH	Cover @ Up MH (m)	Cover @ Low MH (m)
	A	B	16	0.31	16	0.31	6.000	0.394	0.049	**0.44**	**59.47**	64.6	250	1.00	173.059	172.413	0.646	1.21	0.000	175.850	2.522	3.068
	B	C	18	0.36	34	0.68	6.000	0.853	0.106	**0.96**	**37.61**	94.5	250	0.40	172.413	172.035	0.378	0.77	0.060	175.750	3.068	3.186
	C	D	71	1.41	104	2.09	6.000	2.633	0.326	**2.96**	**37.61**	117.0	250	0.40	171.975	171.507	0.468	0.77	0.500	175.490	3.246	3.804
	CAP	D	550	1.63	550	1.63	6.000	13.860	0.254	**14.11**	**59.47**	84.3	250	1.00	172.349	171.507	0.843	1.21	0.500	175.500	2.881	3.804
	D	E	43	0.86	697	4.57	6.000	17.571	0.713	**18.28**	**42.05**	114.3	250	0.50	171.007	170.435	0.572	0.86	0.500	175.580	4.304	4.875

GANATCHIO GARDENS
STORM SEWER DESIGN SHEET

Project Name: Ganatchio Gardens
Project Number: 21-1691

Intensity Option # 1

1) Intensity (i) = a/(t+b)^c **2) Intensity (i) = a*t^b** **3) Insert Intensity**

Based on 1:5 Year Storm Event
Windsor, Ontario

a= 1259.000 **a=**
b= 8.800 **b=**
c= 0.838 **i=**

Manning's n = 0.013

Total Area (ha)= 3.28 Outlet Invert Elevation= 171.285 Ground Elevation @ Outlet = 175.58

Location											Sewer Design / Profile									Cover		
From MH	To MH	Area (ha)	Run. Coef.	2.78AC	Accum. 2.78AC	T of In (min)	T of F (min)	T of Conc. (min)	Intensity (mm/hr)	Exp. Flow (L/s)	Capacity (L/s)	Velocity (m/s)	Length (m)	Pipe Dia. (mm)	Slope (%)	Invert Up MH	Invert Low MH	Fall (m)	Drop Across Low MH (m)	Ground Elev Up MH	Cover @ Up MH (m)	Cover @ Low MH (m)
1	2	1.00	0.58	1.62	1.62	20.0	1.36	20.00	75.35	**121.83**	**133.73**	0.84	68.4	450	0.22	173.451	173.300	0.15	0.075	175.519	1.62	1.95
2	3	0.43	0.79	0.95	2.56	20.0	1.34	21.36	72.50	**185.84**	**201.72**	0.93	75.1	525	0.22	173.225	173.060	0.17	0.025	175.696	1.95	2.15
3	4	0.13	0.68	0.25	2.81	20.0	0.64	22.70	69.90	**196.35**	**210.69**	0.97	37.1	525	0.24	173.035	172.946	0.09	0.075	175.734	2.17	2.27
4	6	0.27	0.64	0.48	3.29	20.0	0.61	23.33	68.74	**226.17**	**300.80**	1.06	39.2	600	0.24	172.871	172.777	0.09	0.025	175.743	2.27	2.35
5	6	0.35	0.84	0.82	0.82	20.0	1.74	20.00	75.35	**61.58**	**87.67**	0.79	82.9	375	0.25	173.184	172.977	0.21	0.225	175.600	2.04	2.38
6	8	0.11	0.70	0.22	4.33	30.0	0.59	30.00	58.69	**254.13**	**313.09**	1.11	39.2	600	0.26	172.752	172.650	0.10	0.075	175.730	2.38	2.50
7	8	0.79	0.70	1.54	1.54	20.0	1.58	20.00	75.35	**115.83**	**127.50**	0.80	75.9	450	0.20	172.952	172.800	0.15	0.225	175.622	2.22	2.50
8	9	0.19	0.66	0.35	6.22	20.0	0.24	30.59	57.95	**360.24**	**436.78**	1.22	17.7	675	0.27	172.575	172.527	0.05	0.025	175.753	2.50	2.39
9	10 (CTRL)	0.00	0.70	0.00	6.22	20.0	0.53	30.83	57.66	**358.51**	**436.78**	1.22	38.7	675	0.27	172.502	172.398	0.10	0.025	175.597	2.42	2.52
10 (CTRL)	11 (OGS)	0.00	0.70	0.00	6.22	20.0	0.18	31.36	57.02	**354.67**	**436.78**	1.22	13.2	675	0.27	172.373	172.337	0.04	0.025	175.593	2.55	2.49
11 (OGS)	6R3878	0.00	0.70	0.00	6.22	20.0	0.14	31.54	56.81	**353.45**	**436.78**	1.22	10.0	675	0.27	172.312	172.285	0.03	1.000	175.500	2.51	2.62

Appendix C

Stormwater Management Report

Ganatchio Gardens Inc.

Official Plan and Zoning By-Law Amendments

Stormwater Management Report

Southwest Corner of Florence Avenue & Wyandotte Street East

Windsor, Ontario

June 2022, Revised March 2023 – 21-1691

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Appendices

1.0 Introduction

Dillon Consulting Limited (Dillon) has been retained by Ganatchio Gardens Inc. to complete the detailed design for a proposed multi-storey residential development in the City of Windsor. This Stormwater Management Report has been prepared to support the detailed design of the proposed development.

The proposed development consists of 275 multi-unit residential buildings and 28 townhome residential buildings. The total site area is 3.30 ha (8.15 ac) and is located in the City of Windsor at the south west corner of Wyandotte Street and the proposed Florence Avenue extension. The proposed development will drain into the existing 1.95 m diameter storm sewer main along the west boundary of the site that conveys flows south and drains into a storm water management pond south west of the development site. Under existing conditions, the site is undeveloped and consists of grassed land cover. The general slope of the ground directs flows northwards. The location and the layout of the site boundary is shown in Figure 1 and the site plan is in Appendix A

Figure 1: Project Site Location

The purpose of this report is to assess the storm water management requirements for the proposed development while restricting the peak outflow from the site to an allowable release rate. Storage on-site is to be recommended to attenuate peak flow rates for all events, including the governing 1:100 year event and the Urban Stress Test.

1.1 Background

In 2018, Dillon completed a storm water assessment study of the North Neighbourhood Development for the City of Windsor (the City). The details of the previously completed study can be found in the North Neighbourhood Development Storm Water Management Analysis Report (Dillon 2018). The current development was part of the ultimate future build out area considered in the 2018 study. As such, the currently proposed development was assessed to the North Neighbourhood SWM Pond and the Wyandotte Street storm sewer.

1.2 SWM Design Criteria

Design criteria for the stormwater design and servicing were based on review of the following reference documents:

- Stormwater Management Planning and Design Manual (Ministry of the Environment [MECP], 2003);
- Windsor/Essex Region Stormwater Management Standards Manual (WERSMSM) (2018); and
- North Neighbourhood Stormwater Management Study (Dillon, 2018).

The corresponding criteria are described below.

1.2.1 Quantity Control

1.2.1.1 Minor System Conveyance

Hydraulic Grade Lines in the minor system have been assessed for the 1:5 year 4 hour storm (with 15 minute time intervals and using the Chicago distribution). Storm sewers have been designed to allow minimal surcharging, where the HGL is below the lowest catch-basin (CB) grate elevation.

1.2.1.2 Climate Change Resiliency Assessment

The stormwater management system's performance has been examined under conditions more intense than the 1:100 year design storm event to assess potential impacts of climate change and the system's resiliency using the Urban Stress Test design storm event. As far as possible, provided surrounding grades allow, the site grading is designed to contain the runoff generated from this design storm event without overflowing onto neighbouring properties or right-of-way (ROW).

The following design storm events were used for the analysis:

- 1:5 year 4 hour design storm using Chicago distribution with a 15 minute time interval and a total rainfall depth of 49.5 mm.
- 1:100 year 4 hour design storm using Chicago distribution with 15 minute time interval with a total rainfall depth of 81.6 mm. Used to assess the major system HGL corresponds to a maximum surface ponding of 0.3 m depth.
- 1:100 year 24 hour design storm using SCS Type-II distribution with a 2 hour time interval and a total rainfall depth of 108 mm. Used to assess the major system HGL corresponds to a maximum surface ponding of 0.3 m depth.
- 1:100 year 24 hour design storm using Chicago distribution with 15 minute time interval and an additional 42 mm uniformly distributed, with a total rainfall depth of 150 mm - Urban Stress Test Storm.

1.2.2 Quality Control

Since the subject development lands result in an increase in paved surface in the development area, measures have to be undertaken to treat the quality of the stormwater runoff being discharged into receiving watercourses/sewers. Stormwater quality treatment will be provided using an oil-grit separator (OGS) positioned upstream of the outlet storm sewer. The OGS unit is designed to meet the Ministry of Environment, Conservation and Parks (MECP) design requirements for 70% TSS removal (normal level of protection).

2.0 Allowable Release Rate

The subject development lands were assessed to the Wyandotte Street storm sewer in the 2018 North Neighbourhood Study. In the proposed conditions PCSWMM model set up as part of this study, the development lands were included with an imperviousness percentage of 55%.

As such, the release rate of the proposed site was estimated considering a percentage imperviousness of 55% in the modelling analysis. The estimated maximum allowable stormwater flow release rates for the subject site is 457 L/s. This is the 1:5 year, 4 hour design storm event, post-development peak flow rate from the subject site.

In order to prevent any adverse impacts on the downstream system due to the proposed development, the maximum flow rate from the site is expected to be maintained at or below the allowable release rate for all events up to and including the 1:100 year event.

2.1 Downstream Capacity Analysis

The PCSWMM model developed as part of the North Neighbourhood Stormwater Management Study (Dillon, 2018) was utilized to determine upstream and downstream impacts on the Wyandotte Street storm sewer system. The model was simulated using the 1:100 year 4 hour, 1:100 year 24 hour and the 1:5 year, 4 hour design storm events, with and without the inflow from the proposed development. Comparing the Hydraulic Grade Lines (HGLs) along Wyandotte, there was no observed increase in HGLs during the 1:5 year or the 1:100 year event simulations.

This is understood to be because the flows from the proposed development are a much smaller value compared to the peak flows in the larger Wyandotte Street storm sewer. Additionally, the proposed development is near the downstream end of the Wyandotte Street storm sewer system. The peak flow from the development occurs before the peak flows and HGLs in the Wyandotte St storm sewer occur due to a larger upstream drainage area of the 1.95 m diameter storm sewer on Wyandotte Street.

Therefore, it was concluded that the release rate from the proposed site will not have a significant impact on the receiving sewer system. Profiles of the Wyandotte Street sewer showing HGLs in the sewer, with and without the new development inflow, are included in Appendix C

3.0 Proposed Condition Analysis

3.1 Proposed Condition Hydrologic Assessment

Under proposed conditions, the 3.3 ha site area consists of 275 multi-unit residential buildings and 28 townhome residential buildings. Sub catchment attributes for the proposed development were selected based on the ERCA SWM standard and are summarized in below Table 1. Additional details of the modelling parameters and other model details for proposed conditions are provided in Appendix B

Table 1: Post Development Sub-Catchment Parameters for the Site

Attribute	Development
Land Use	Residential
Area (ha)	3.3
Flow Length* (m)	340
Imperviousness (%)	90
Slope (%)	1
Manning's n Impervious	0.013
Manning's n Pervious	0.24
Depression Storage Impervious (mm)	2.5
Depression Storage Pervious (mm)	7.5
Maximum Infiltration Rate (mm/hr)	75
Minimum Infiltration Rate (mm/hr)	0.5
Decay Constant (mm/hr)	4
Drying Time (days)	7

*Maximum flow path to outlet

3.1.1 Tail Water Conditions

The impact of downstream tailwater conditions occurring due to high Hydraulic Grade Line (HGL) elevations in the receiving Wyandotte Street storm sewer, on the site's stormwater management system was accounted for in the PCSWMM model. Head time-series were extracted from the North Neighbourhood Model for the 1:5 year, 4 hour; 1:100 year, 4 hour; 1:100 year, 24 hour and UST events, for the node MH 6R3879. These time-series were then applied to the outfall node in the proposed condition PCSWMM model to represent tail water conditions.

The head time series used to simulate tailwater conditions for different storm events are shown in Figure 2.

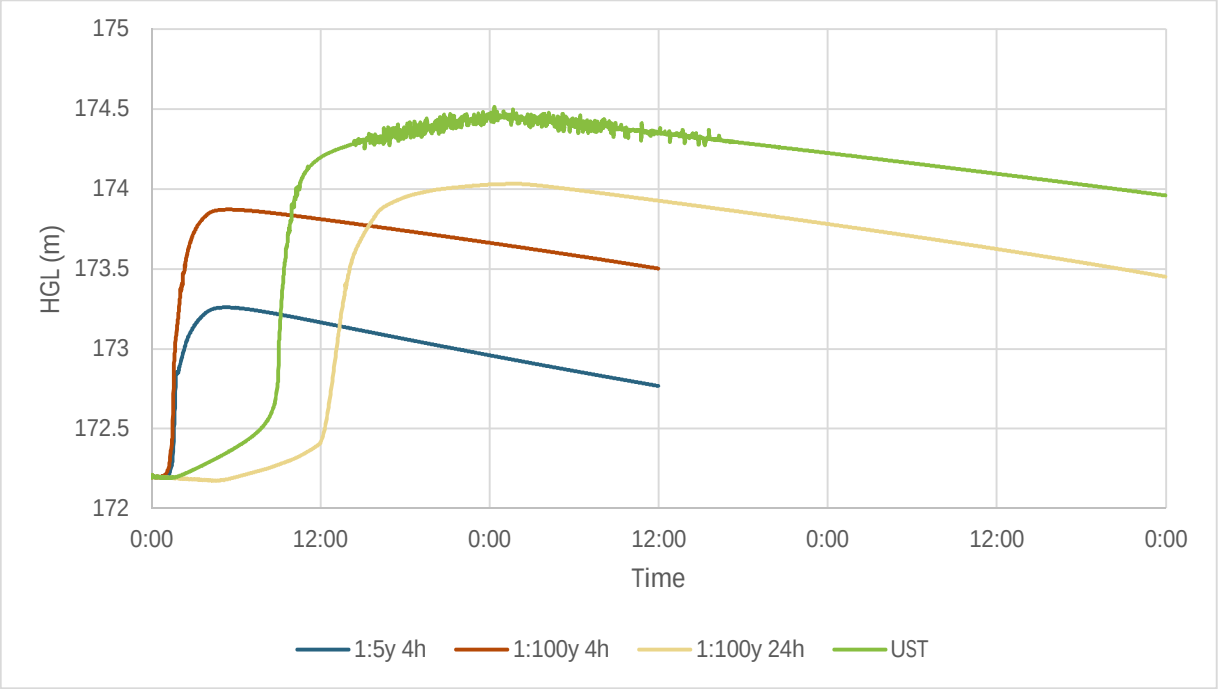


Figure 2: TW Time series for different storm events

3.2 Quantity Control

Stormwater storage on the site is proposed in the parking lot at catch-basin (CB) locations. A 675 mm diameter pipe and 480 mm circular orifice is proposed from the site to the outlet node (6R3879) to restrict the flow within the allowable rate.

The parking lot areas will be graded to include local sags at catch basin locations to allow for surface ponding during large storm events. Storage in the storm sewers and sewer structures has been taken into account in this analysis and incorporated into the stage-storage curve used to simulate on-site storage in the model.

The proposed condition model was simulated for different storm events. A summary of the surface storage depth and the on-site storage volume, along with the release rate for different storm event simulations is provided in below Table 2.

Table 2: Onsite Storage Depth, Storage Volume and Release for different Storms

Storm Type	Release Rate (m^3/s)	Surface Storage Depth (m)	Storage Volume (m^3)
1:5 year 4 hour Chicago	0.41	0	540
1:100 year 4 hour Chicago	0.45	0.18	980
1:100 year 24 hour SCS Type-II	0.22	0	510
Urban Stress Test	0.45	0.20	1082

Based on the modelling analysis summarized in Table 2, it is observed that the available surface storage provides adequate storage for the site to restrict the flow rate within the allowable release rate and restrict estimated surface ponding depth to less than 0.3 m during 1:100 year storm events.

From the above table, it is also observed that the 1:100 year, 4 hour storm (Chicago) event is the governing 1:100 year return period event regarding storage requirements. The maximum volume of storm water estimated to be stored on-site is 980 m^3, during the 1:100 year simulation. This corresponds to a maximum surface ponding depth of 0.18 m at CB locations. The details of the model inputs and outputs are provided in Appendix B

The Urban Stress Test (UST) storm event was also simulated to account for impacts of climate change. The estimated depth of storage during the UST event simulation shown in Table 3 is higher than the maximum estimated depth during the governing 1:100 year simulation and is estimated to be 0.20 m from the lowest CB grate elevation.

The flow from the site is conveyed via a 675 mm diameter conduit to the outfall (6R3879) of the Wyandotte Street East storm sewer system. Additionally, a 480 mm circular orifice is required to restrict the flow within the allowable limit.

3.3 Quality Control

As discussed in Section 1.2.2, the site will be required to meet Normal Protection Level water quality treatment (70% TSS removal). It is proposed that an oil and grit separator (OGS) unit be used to meet this target. The FD-4HC model supplied by ADS, or approved equivalent is recommended for this site. The details of this OGS sizing is provided in Appendix D

4.0 Conclusions

The stormwater management design for the proposed development meets the established SWM criteria for the overall site, and no negative impacts due to the site development are anticipated in the existing system.

Based on the analysis performed, the conclusions are listed as follows:

- The allowable release rate for this proposed development is estimated to be 0.457 m^3/s. This is based on a 1:5 year post-development release from the development area, assuming a post-development percentage imperviousness of 55% for the site.
- Available parking lot storage and pipe storage is adequate for the site to restrict the flow within the allowable release rate during the 1:100 year storm event simulation without surface ponding exceeding 0.30 m.
- A 675 mm diameter circular pipe and 480 mm diameter circular orifice is proposed at the outlet to provide flow restriction for maintaining outflow within the allowable release rate.
- On-site storage volume of 980 m^3 is required for the 1:100 year event to restrict flows from the site to the allowable release rate. This corresponds to a maximum estimated surface ponding depth of 0.18 m during this simulation.
- From the outlet capacity assessment analysis, no significant change in HGLs in the Wyandotte Street storm sewers, downstream of the development, is observed. Therefore, no negative impact to the hydraulic conditions of the downstream municipal sewer is expected due to the proposed development.
- Water quality control will be achieved through the use of an FD-4HC OGS unit to achieve 70% TSS removal over an average annual basis.

This report is respectfully submitted for review and approval. Should you have any questions, we would be pleased to discuss the results of our evaluation in further detail.

Yours sincerely,

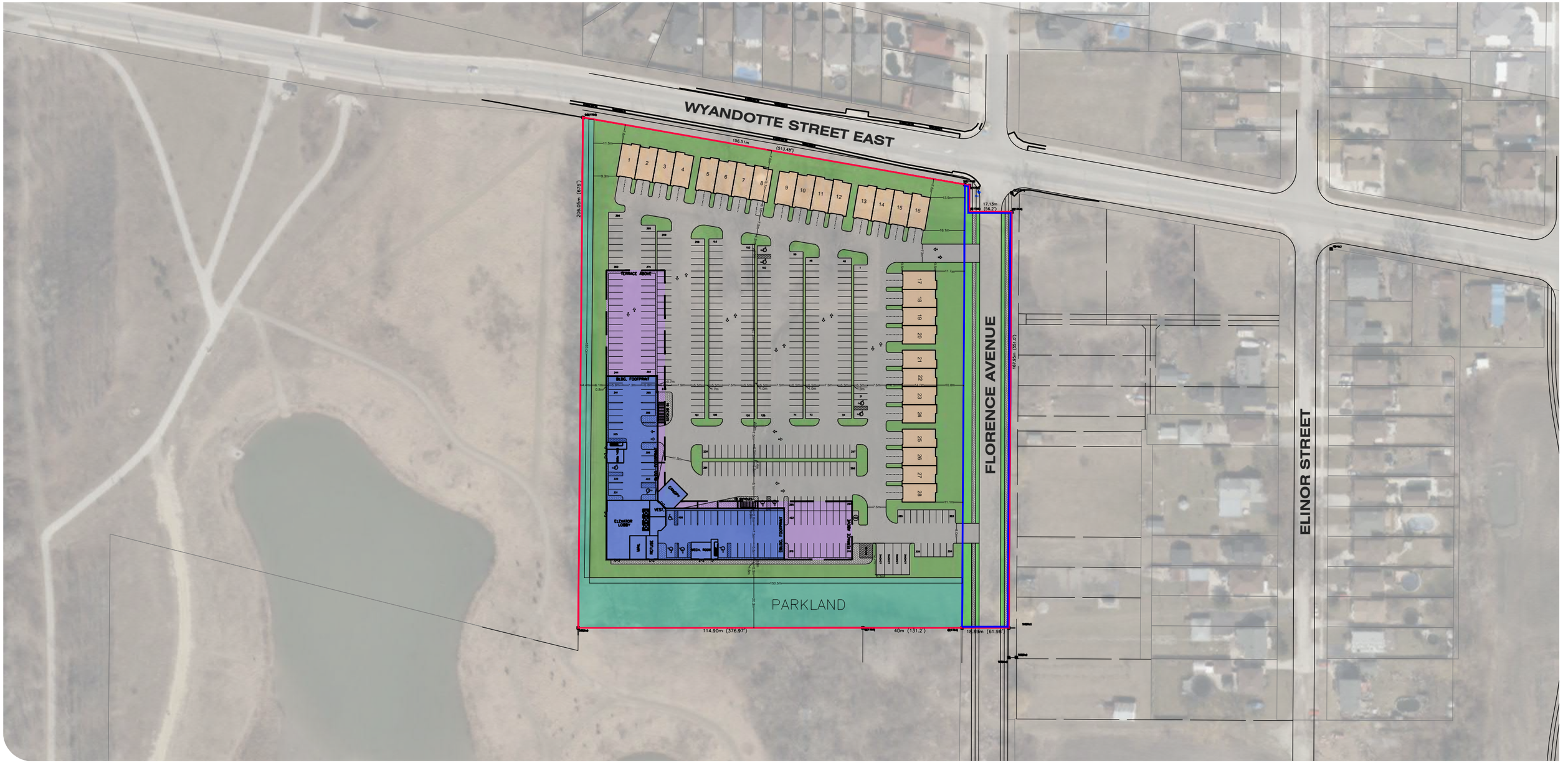
DILLON CONSULTING LIMITED

Aakash Bagchi, P.Eng. M.Eng.,
Water Resources Engineer

Monika Saha, EIT
Water Resources Designer

Appendix A

Ganatchio Garden Site Plan



GANATCHIO GARDENS INC.
WYANDOTTE STREET EAST
AT FLORENCE AVENUE

CONCEPTUAL DEVELOPMENT PLAN
FEBRUARY 16, 2023

SUBJECT AREA (± 3.30ha / 8.15ac)

LAND CONVEYANCE (± 0.32ha / 0.79ac)

PROPOSED TOWNHOME UNITS (28 UNITS)

PROPOSED PARKLAND

PROPOSED MULTI-UNIT RESIDENTIAL BUILDING (275 UNITS)

PROPOSED LANDSCAPING

PROPOSED ELEVATED TERRACE

PROPOSED SIDEWALK

UNIT COUNT

MULTI- UNIT RESIDENTIAL:	275 units
TOWNHOME:	28 units
TOTAL:	303 units

PARKING COUNT:

PARKING MULTI-UNIT:	: 432 SPACES
TOWNHOME (GARAGE, 2 / UNIT)	: 56 SPACES
TOWNHOME (SURFACE, 2 / UNIT)	: 56 SPACES
TOTAL	: 544 SPACES

PARKING DETAILS:

PARKING/UNIT RATIO (MULTI-UNIT)	: 1.57 SPACES / UNIT
PARKING/UNIT RATIO (TOWNHOME) (GARAGE + SURFACE PARKING)	: 4 SPACES / UNIT
LOADING SPACES	: 4 SPACES
ACCESSIBLE SPACES PROVIDED (TYPE A/TYPE B)	: 12 SPACES

File Location:
c:\pw working directory\projects 2021\dillon_32mru\dms20930\21-1691 - ganatchio gardens - concept plan - feb 2023.dwg
February, 16, 2023 3:08 PM

SOURCE: THE COUNTY OF ESSEX INTERACTIVE MAPPING (2019)

MAP/DRAWING INFORMATION
THIS DRAWING IS FOR INFORMATION PURPOSES ONLY. ALL DIMENSIONS AND BOUNDARY INFORMATION SHOULD BE VERIFIED BY AN O.L.S PRIOR TO CONSTRUCTION.
CREATED BY: MRU
CHECKED BY: MAM
DESIGNED BY: MRU

SCALE: 1:1500 (11x17)

N W E S

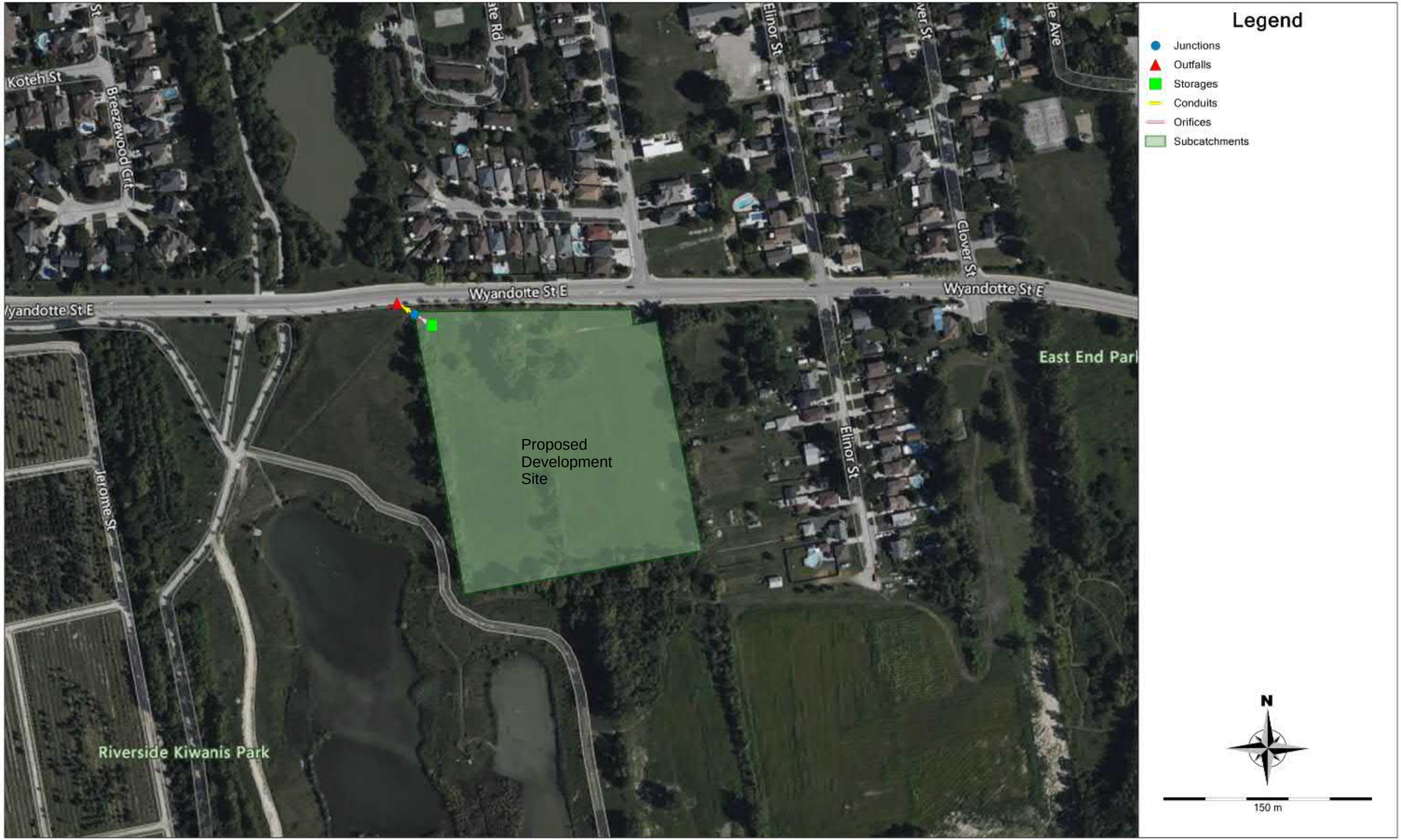
DILLON CONSULTING

PROJECT: 21-1691
STATUS: DRAFT
DATE: 2023/02/10

Appendix B

Modelling Input and Output Reports

Model Schematic



PCSWMM Input Report

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           CMS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           04/11/2022
START_TIME           00:00:00
REPORT_START_DATE    04/11/2022
REPORT_START_TIME    00:00:00
END_DATE             04/12/2022
END_TIME             12:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         1
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
Raingage1        INTENSITY 0:15     1.0      TIMESERIES 5y4h15mDistribution

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
S1               Raingage1        SU1              3.2978   90       96.994   1        0

[SUBAREAS]
```

```
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
S1               0.013      0.24       2.5        7.5        25         OUTLET

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
S1               75         0.5        4          7          0

[JUNCTIONS]
;;Name           Elevation  MaxDepth   InitDepth  SurDepth   Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
J1               174.07     1.74       0          0          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
6R3879           174.05     TIMESERIES TW_5y4h_NorthNeighbourhood NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap    Psi      Ksat     IMD
;;-------------- -------- ---------- ---------- ---------- ---------------------------- -------- -------- -------- -------- --------
SU1              174.1    1.7        0          TABULAR    pipe_storage                 0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow   MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----------
C1_2             J1               6R3879           14.951     0.013      0          0          0          0

[ORIFICES]
;;Name           From Node        To Node          Type         Offset     Qcoeff     Gated    CloseTime
;;-------------- ---------------- ---------------- ------------ ---------- ---------- -------- ----------
C1_1             SU1              J1               SIDE         0          0.63       NO       0

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
C1_2             CIRCULAR     0.525            0          0          0          1
C1_1             CIRCULAR     0.48             0          0          0

[LOSSES]
;;Link           Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------
C1_2             0.5        0.5        0          YES        0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
1                Storage    0          0.1
1                           1          0.1
1                           1.01       0.1
1                           1.4        0.1
1                           1.401      0.1
1                           1.7        8400

pipe_storage     Storage    0          800
pipe_storage                0.675      800
pipe_storage                0.676      0.7
```

```
pipe_storage                1.4         0.7
pipe_storage                1.7         8400

pipe_storage_2   Storage     0          800
pipe_storage_2               1          800
pipe_storage_2               1.01       0.7
pipe_storage_2               1.4        0.7
pipe_storage_2               1.7        8400

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
100y24h2hDistribution            0:00       0
100y24h2hDistribution            2:00       1.08
100y24h2hDistribution            4:00       1.62
100y24h2hDistribution            6:00       1.62
100y24h2hDistribution            8:00       2.16
100y24h2hDistribution            10:00      3.24
100y24h2hDistribution            12:00      25.92
100y24h2hDistribution            14:00      8.64
100y24h2hDistribution            16:00      3.24
100y24h2hDistribution            18:00      2.16
100y24h2hDistribution            20:00      1.62
100y24h2hDistribution            22:00      1.62
100y24h2hDistribution            24:00      1.08

100y4h15mDistribution            0:00       3.95
100y4h15mDistribution            0:15       4.87
100y4h15mDistribution            0:30       6.36
100y4h15mDistribution            0:45       9.19
100y4h15mDistribution            1:00       16.45
100y4h15mDistribution            1:15       46.45
100y4h15mDistribution            1:30       143.67
100y4h15mDistribution            1:45       32.45
100y4h15mDistribution            2:00       17.25
100y4h15mDistribution            2:15       11.53
100y4h15mDistribution            2:30       8.62
100y4h15mDistribution            2:45       6.87
100y4h15mDistribution            3:00       5.71
100y4h15mDistribution            3:15       4.89
100y4h15mDistribution            3:30       4.28
100y4h15mDistribution            3:45       3.81
100y4h15mDistribution            4:00       0

5y4h15mDistribution            0:00       2.58
5y4h15mDistribution            0:15       3.13
5y4h15mDistribution            0:30       4.02
5y4h15mDistribution            0:45       5.66
5y4h15mDistribution            1:00       9.76
5y4h15mDistribution            1:15       26.72
5y4h15mDistribution            1:30       88.4
5y4h15mDistribution            1:45       18.73
5y4h15mDistribution            2:00       10.21
5y4h15mDistribution            2:15       6.99
5y4h15mDistribution            2:30       5.33
5y4h15mDistribution            2:45       4.31
5y4h15mDistribution            3:00       3.64
```

5y4h15mDistribution	3:15	3.15
5y4h15mDistribution	3:30	2.78
5y4h15mDistribution	3:45	2.49
5y4h15mDistribution	4:00	0

5y4h-6R3879	10:30:00	171.937119
5y4h-6R3879	10:35:00	171.937286
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5y4h-6R3879	10:50:00	171.937805
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5y4h-6R3879	11:05:00	171.940491
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5y4h-6R3879	12:15:00	172.158936
5y4h-6R3879	12:20:00	172.175262
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5y4h-6R3879	13:55:00	172.33699
5y4h-6R3879	14:00:00	172.339127
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TW_100y24h	6:25:00	172.04538
TW_100y24h	6:30:00	172.046173
TW_100y24h	6:35:00	172.047394
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TW_100y24h	6:45:00	172.05101
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TW_100y24h	6:55:00	172.053543
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TW_100y24h	7:05:00	172.056015
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TW_100y24h	7:15:00	172.059647
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TW_100y24h	7:25:00	172.062057
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TW_100y24h	7:35:00	172.064896
TW_100y24h	7:40:00	172.066284
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TW_100y24h	7:50:00	172.069351
TW_100y24h	7:55:00	172.070572
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TW_100y24h	8:05:00	172.073914

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TW_100y24h	8:20:00	172.078644
TW_100y24h	8:25:00	172.08046
TW_100y24h	8:30:00	172.082047
TW_100y24h	8:35:00	172.08432
TW_100y24h	8:40:00	172.086609
TW_100y24h	8:45:00	172.088959
TW_100y24h	8:50:00	172.090302
TW_100y24h	8:55:00	172.092651
TW_100y24h	9:00:00	172.095062
TW_100y24h	9:05:00	172.097809
TW_100y24h	9:10:00	172.098969
TW_100y24h	9:15:00	172.10112
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TW_100y24h	9:30:00	172.107544
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TW_100y24h	9:40:00	172.111893
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TW_100y24h	9:55:00	172.117676
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TW_100y24h	10:10:00	172.136948
TW_100y24h	10:15:00	172.141449
TW_100y24h	10:20:00	172.159821
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TW_100y24h	11:15:00	172.348785
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TW_100y24h	12:20:00	172.552948
TW_100y24h	12:25:00	172.561722
TW_100y24h	12:30:00	172.566635
TW_100y24h	12:35:00	172.573837
TW_100y24h	12:40:00	172.579285
TW_100y24h	12:45:00	172.584915
TW_100y24h	12:50:00	172.591782

TW_100y24h	12:55:00	172.597778
TW_100y24h	13:00:00	172.603683
TW_100y24h	13:05:00	172.609573
TW_100y24h	13:10:00	172.617432
TW_100y24h	13:15:00	172.620926
TW_100y24h	13:20:00	172.628357
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TW_100y24h	13:40:00	172.649323
TW_100y24h	13:45:00	172.655685
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TW_100y24h	13:55:00	172.668976
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TW_100y24h	14:05:00	172.678284
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TW_100y24h	14:30:00	172.692841
TW_100y24h	14:35:00	172.694992
TW_100y24h	14:40:00	172.697037
TW_100y24h	14:45:00	172.699585
TW_100y24h	14:50:00	172.700302
TW_100y24h	14:55:00	172.702408
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TW_100y24h	15:15:00	172.708908
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TW_100y24h	15:50:00	172.719513
TW_100y24h	15:55:00	172.720993
TW_100y24h	16:00:00	172.722565
TW_100y24h	16:05:00	172.723618
TW_100y24h	16:10:00	172.725067
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TW_100y24h	16:25:00	172.728073
TW_100y24h	16:30:00	172.72905
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TW_100y24h	16:45:00	172.731186
TW_100y24h	16:50:00	172.732025
TW_100y24h	16:55:00	172.732483
TW_100y24h	17:00:00	172.733154
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TW_100y24h	17:10:00	172.734528
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TW_100y24h	17:35:00	172.737305

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TW_100y24h	17:55:00	172.739227
TW_100y24h	18:00:00	172.740295
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TW_100y24h	19:15:00	172.7435
TW_100y24h	19:20:00	172.743591
TW_100y24h	19:25:00	172.743668
TW_100y24h	19:30:00	172.744141
TW_100y24h	19:35:00	172.743729
TW_100y24h	19:40:00	172.744019
TW_100y24h	19:45:00	172.744049
TW_100y24h	19:50:00	172.744186
TW_100y24h	19:55:00	172.744095
TW_100y24h	20:00:00	172.744202
TW_100y24h	20:05:00	172.744278
TW_100y24h	20:10:00	172.745148
TW_100y24h	20:15:00	172.744034
TW_100y24h	20:20:00	172.744431
TW_100y24h	20:25:00	172.744537
TW_100y24h	20:30:00	172.744629
TW_100y24h	20:35:00	172.744446
TW_100y24h	20:40:00	172.744492
TW_100y24h	20:45:00	172.744614
TW_100y24h	20:50:00	172.744553
TW_100y24h	20:55:00	172.744415
TW_100y24h	21:00:00	172.744583
TW_100y24h	21:05:00	172.74472
TW_100y24h	21:10:00	172.744553
TW_100y24h	21:15:00	172.744644
TW_100y24h	21:20:00	172.744522
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TW_100y24h	21:45:00	172.744598
TW_100y24h	21:50:00	172.744171
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TW_100y24h	22:05:00	172.744324
TW_100y24h	22:10:00	172.744034
TW_100y24h	22:15:00	172.743805
TW_100y24h	22:20:00	172.743713

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TW_100y24h                  22:25:00   172.743637
TW_100y24h                  22:30:00   172.742966
TW_100y24h                  22:35:00   172.743011
TW_100y24h                  22:40:00   172.742477
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TW_100y24h                  23:05:00   172.740417
TW_100y24h                  23:10:00   172.740112
TW_100y24h                  23:15:00   172.740051
TW_100y24h                  23:20:00   172.738983
TW_100y24h                  23:25:00   172.738708
TW_100y24h                  23:30:00   172.738266
TW_100y24h                  23:35:00   172.737946
TW_100y24h                  23:40:00   172.737289
TW_100y24h                  23:45:00   172.736847
TW_100y24h                  23:50:00   172.736374
TW_100y24h                  23:55:00   172.73584
TW_100y24h                  24:00:00   172.735413

TW_100y24h_Northneighbourhood 4/11/2022  0:00       172.1956
TW_100y24h_Northneighbourhood 4/11/2022  0:02       172.1925
TW_100y24h_Northneighbourhood 4/11/2022  0:04       172.2101
TW_100y24h_Northneighbourhood 4/11/2022  0:06       172.1977
TW_100y24h_Northneighbourhood 4/11/2022  0:08       172.2034
TW_100y24h_Northneighbourhood 4/11/2022  0:10       172.1968
TW_100y24h_Northneighbourhood 4/11/2022  0:12       172.1996
TW_100y24h_Northneighbourhood 4/11/2022  0:14       172.2007
TW_100y24h_Northneighbourhood 4/11/2022  0:16       172.1944
TW_100y24h_Northneighbourhood 4/11/2022  0:18       172.1977
TW_100y24h_Northneighbourhood 4/11/2022  0:20       172.1961
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Too many data points (2160 in total).

TW_100Y4h                   0:00:00    171.937119
TW_100Y4h                   0:05:00    171.937424
TW_100Y4h                   0:10:00    171.938034
TW_100Y4h                   0:15:00    171.937683
TW_100Y4h                   0:20:00    171.938492
TW_100Y4h                   0:25:00    171.940002
TW_100Y4h                   0:30:00    171.94194
TW_100Y4h                   0:35:00    171.943878
TW_100Y4h                   0:40:00    171.946487
TW_100Y4h                   0:45:00    171.949646
TW_100Y4h                   0:50:00    171.9534
TW_100Y4h                   0:55:00    171.959442
TW_100Y4h                   1:00:00    171.962891
TW_100Y4h                   1:05:00    171.97084
TW_100Y4h                   1:10:00    171.978561
TW_100Y4h                   1:15:00    171.98642
TW_100Y4h                   1:20:00    172.012711
TW_100Y4h                   1:25:00    172.034943
TW_100Y4h                   1:30:00    172.058777
TW_100Y4h                   1:35:00    172.154663
TW_100Y4h                   1:40:00    172.251862
TW_100Y4h                   1:45:00    172.347977
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TW_100Y4h	1:50:00	172.358475
TW_100Y4h	1:55:00	172.36882
TW_100Y4h	2:00:00	172.403534
TW_100Y4h	2:05:00	172.428757
TW_100Y4h	2:10:00	172.456833
TW_100Y4h	2:15:00	172.485352
TW_100Y4h	2:20:00	172.506775
TW_100Y4h	2:25:00	172.528168
TW_100Y4h	2:30:00	172.548935
TW_100Y4h	2:35:00	172.564743
TW_100Y4h	2:40:00	172.579163
TW_100Y4h	2:45:00	172.592468
TW_100Y4h	2:50:00	172.602844
TW_100Y4h	2:55:00	172.616302
TW_100Y4h	3:00:00	172.624084
TW_100Y4h	3:05:00	172.632553
TW_100Y4h	3:10:00	172.641678
TW_100Y4h	3:15:00	172.649323
TW_100Y4h	3:20:00	172.656235
TW_100Y4h	3:25:00	172.662628
TW_100Y4h	3:30:00	172.668274
TW_100Y4h	3:35:00	172.673706
TW_100Y4h	3:40:00	172.678406
TW_100Y4h	3:45:00	172.683319
TW_100Y4h	3:50:00	172.688583
TW_100Y4h	3:55:00	172.691223
TW_100Y4h	4:00:00	172.695435
TW_100Y4h	4:05:00	172.698303
TW_100Y4h	4:10:00	172.701523
TW_100Y4h	4:15:00	172.703033
TW_100Y4h	4:20:00	172.7052
TW_100Y4h	4:25:00	172.706787
TW_100Y4h	4:30:00	172.707245
TW_100Y4h	4:35:00	172.707733
TW_100Y4h	4:40:00	172.708191
TW_100Y4h	4:45:00	172.708664
TW_100Y4h	4:50:00	172.708618
TW_100Y4h	4:55:00	172.708664
TW_100Y4h	5:00:00	172.708466
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TW_100Y4h	5:15:00	172.707794
TW_100Y4h	5:20:00	172.707352
TW_100Y4h	5:25:00	172.706894
TW_100Y4h	5:30:00	172.706467

TW_100y4h_NorthNeighbourhood	4/11/2022	0:00	172.1956
TW_100y4h_NorthNeighbourhood	4/11/2022	0:02	172.1925
TW_100y4h_NorthNeighbourhood	4/11/2022	0:04	172.2101
TW_100y4h_NorthNeighbourhood	4/11/2022	0:06	172.1977
TW_100y4h_NorthNeighbourhood	4/11/2022	0:08	172.2034
TW_100y4h_NorthNeighbourhood	4/11/2022	0:10	172.1968
TW_100y4h_NorthNeighbourhood	4/11/2022	0:12	172.1996
TW_100y4h_NorthNeighbourhood	4/11/2022	0:14	172.2007
TW_100y4h_NorthNeighbourhood	4/11/2022	0:16	172.1944
TW_100y4h_NorthNeighbourhood	4/11/2022	0:18	172.1977
TW_100y4h_NorthNeighbourhood	4/11/2022	0:20	172.1961

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Too many data points (1080 in total).

TW_5y4h_NorthNeighbourhood 4/11/2022  0:00       172.1956
TW_5y4h_NorthNeighbourhood 4/11/2022  0:02       172.1925
TW_5y4h_NorthNeighbourhood 4/11/2022  0:04       172.2101
TW_5y4h_NorthNeighbourhood 4/11/2022  0:06       172.1977
TW_5y4h_NorthNeighbourhood 4/11/2022  0:08       172.2034
TW_5y4h_NorthNeighbourhood 4/11/2022  0:10       172.1968
TW_5y4h_NorthNeighbourhood 4/11/2022  0:12       172.1996
TW_5y4h_NorthNeighbourhood 4/11/2022  0:14       172.2007
TW_5y4h_NorthNeighbourhood 4/11/2022  0:16       172.1944
TW_5y4h_NorthNeighbourhood 4/11/2022  0:18       172.1977
TW_5y4h_NorthNeighbourhood 4/11/2022  0:20       172.1961
......
Too many data points (1080 in total).

TW_UST_Northneighbourhood 4/11/2022  0:00       172.1956
TW_UST_Northneighbourhood 4/11/2022  0:02       172.1925
TW_UST_Northneighbourhood 4/11/2022  0:04       172.2101
TW_UST_Northneighbourhood 4/11/2022  0:06       172.1977
TW_UST_Northneighbourhood 4/11/2022  0:08       172.2034
TW_UST_Northneighbourhood 4/11/2022  0:10       172.1968
TW_UST_Northneighbourhood 4/11/2022  0:12       172.1996
TW_UST_Northneighbourhood 4/11/2022  0:14       172.2007
TW_UST_Northneighbourhood 4/11/2022  0:16       172.1944
TW_UST_Northneighbourhood 4/11/2022  0:18       172.1977
TW_UST_Northneighbourhood 4/11/2022  0:20       172.1961
......
Too many data points (2160 in total).

UST                       0:00       2.41
UST                       0:15       2.43
UST                       0:30       2.45
UST                       0:45       2.46
UST                       1:00       2.48
UST                       1:15       2.51
UST                       1:30       2.53
UST                       1:45       2.55
UST                       2:00       2.58
UST                       2:15       2.61
UST                       2:30       2.64
UST                       2:45       2.67
UST                       3:00       2.71
UST                       3:15       2.74
UST                       3:30       2.79
UST                       3:45       2.83
UST                       4:00       2.88
UST                       4:15       2.94
UST                       4:30       3
UST                       4:45       3.07
UST                       5:00       3.15
UST                       5:15       3.23
UST                       5:30       3.33
UST                       5:45       3.45
UST                       6:00       3.59
UST                       6:15       3.75
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UST	6:30	3.94
UST	6:45	4.18
UST	7:00	4.49
UST	7:15	4.89
UST	7:30	5.43
UST	7:45	6.2
UST	8:00	7.41
UST	8:15	9.56
UST	8:30	14.29
UST	8:45	32.01
UST	9:00	145.13
UST	9:15	48.51
UST	9:30	23.13
UST	9:45	15.08
UST	10:00	11.35
UST	10:15	9.23
UST	10:30	7.88
UST	10:45	6.94
UST	11:00	6.25
UST	11:15	5.73
UST	11:30	5.32
UST	11:45	4.99
UST	12:00	4.72
UST	12:15	4.49
UST	12:30	4.29
UST	12:45	4.12
UST	13:00	3.98
UST	13:15	3.85
UST	13:30	3.74
UST	13:45	3.63
UST	14:00	3.54
UST	14:15	3.46
UST	14:30	3.39
UST	14:45	3.32
UST	15:00	3.26
UST	15:15	3.2
UST	15:30	3.15
UST	15:45	3.1
UST	16:00	3.05
UST	16:15	3.01
UST	16:30	2.97
UST	16:45	2.93
UST	17:00	2.9
UST	17:15	2.87
UST	17:30	2.84
UST	17:45	2.81
UST	18:00	2.78
UST	18:15	2.76
UST	18:30	2.73
UST	18:45	2.71
UST	19:00	2.69
UST	19:15	2.67
UST	19:30	2.65
UST	19:45	2.63
UST	20:00	2.61
UST	20:15	2.59
UST	20:30	2.57

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UST                     20:45      2.56
UST                     21:00      2.54
UST                     21:15      2.53
UST                     21:30      2.51
UST                     21:45      2.5
UST                     22:00      2.49
UST                     22:15      2.47
UST                     22:30      2.46
UST                     22:45      2.45
UST                     23:00      2.44
UST                     23:15      2.43
UST                     23:30      2.42
UST                     23:45      2.41

WaterQualityTest        00:00      1.78
WaterQualityTest        00:15      2.13
WaterQualityTest        00:30      2.7
WaterQualityTest        00:45      3.72
WaterQualityTest        01:00      6.21
WaterQualityTest        01:15      16.41
WaterQualityTest        01:30      57.83
WaterQualityTest        01:45      11.58
WaterQualityTest        02:00      6.48
WaterQualityTest        02:15      4.53
WaterQualityTest        02:30      3.51
WaterQualityTest        02:45      2.88
WaterQualityTest        03:00      2.45
WaterQualityTest        03:15      2.14
WaterQualityTest        03:30      1.91
WaterQualityTest        03:45      1.72
WaterQualityTest        04:00      0

[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS       341763.63845     4688380.22915    342012.07455     4688622.75385
UNITS            Meters

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
J1               341797.404         4688593.489
6R3879           341784.931         4688601.73
SU1              341810.01          4688585.16

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[POLYGONS]
```

```
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
S1                341796.575         4688595.46
S1                341954.176         4688593.45
S1                341955.354         4688582.553
S1                341972.053         4688584.903
S1                342000.782         4688419.018
S1                341828.818         4688391.253
S1                341796.575         4688595.46

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
```

PCSWMM Output Report: 1:5 year 4 hour

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
--------------------------------------------------------------


*************
Element Count
*************
Number of rain gages ...... 1
Number of subcatchments ... 1
Number of nodes ........... 3
Number of links ........... 2
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
------------------------------------------------------------------------
Raingage1            5y4h15mDistribution         INTENSITY   15 min.


*******************
Subcatchment Summary
*******************
Name                        Area     Width    %Imperv    %Slope Rain Gage           Outlet
-----------------------------------------------------------------------------------------------------
S1                          3.30     96.99     90.00    1.0000 Raingage1           SU1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
------------------------------------------------------------------------
J1                   JUNCTION       174.07      1.74       0.0
6R3879               OUTFALL        174.05      0.53       0.0
SU1                  STORAGE        174.10      1.70       0.0


************
Link Summary
************
Name             From Node        To Node          Type             Length    %Slope Roughness
-------------------------------------------------------------------------------------------
C1_2             J1               6R3879           CONDUIT            15.0    0.1338    0.0130
C1_1             SU1              J1               ORIFICE


*********************
Cross Section Summary
*********************
                                     Full     Full     Hyd.     Max.   No. of     Full
```

Conduit	Shape	Depth	Area	Rad.	Width	Barrels	Flow
C1_2	CIRCULAR	0.53	0.22	0.13	0.53	1	0.16

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CMS
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 04/11/2022 00:00:00
Ending Date 04/12/2022 12:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step ..... 1.00 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	0.163	49.475
Evaporation Loss	0.000	0.000
Infiltration Loss	0.010	2.889
Surface Runoff	0.149	45.068
Final Storage	0.006	1.698
Continuity Error (%)	-0.363	

**********	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
**********	---------	---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.149	1.486
Groundwater Inflow	0.000	0.000

RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.149	1.486
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	0.001
Continuity Error (%)	-0.017	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	0.50 sec
Average Time Step	:	1.00 sec
Maximum Time Step	:	1.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.01
Time Step Frequencies	:	
1.000 - 0.871 sec	:	100.00 %
0.871 - 0.758 sec	:	0.00 %
0.758 - 0.660 sec	:	0.00 %
0.660 - 0.574 sec	:	0.00 %
0.574 - 0.500 sec	:	0.00 %

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
S1	49.47	0.00	0.00	2.89	42.99	2.07	45.07	1.49	0.66	0.911

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.05	0.81	174.88	0 01:49	0.77
6R3879	OUTFALL	0.03	0.43	174.48	0 01:50	0.43
SU1	STORAGE	0.05	1.40	175.50	0 01:50	1.40

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.000	0.412	0 01:50	0	1.49	-0.014
6R3879	OUTFALL	0.000	0.412	0 01:50	0	1.49	0.000
SU1	STORAGE	0.665	0.665	0 01:45	1.49	1.49	-0.002

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
J1	JUNCTION	0.16	0.285	0.930

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	0.035	2	0	0	0.541	30	0 01:50	0.412

****

Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
6R3879	75.58	0.015	0.412	1.486
System	75.58	0.015	0.412	1.486

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1_2	CONDUIT	0.412	0	01:50	1.99	2.62	0.91
C1_1	ORIFICE	0.412	0	01:50			1.00

****
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
C1_2	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C1_2	0.01	0.16	0.01	0.93	0.01

Analysis begun on: Thu Jun 30 09:27:17 2022
Analysis ended on: Thu Jun 30 09:27:17 2022
Total elapsed time: < 1 sec

PCSWMM Output Report: 1:100 year 4 hour

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
--------------------------------------------------------------


*************
Element Count
*************
Number of rain gages ...... 1
Number of subcatchments ... 1
Number of nodes ........... 3
Number of links ........... 2
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Raingage1            100y4h15mDistribution       INTENSITY   15 min.


*******************
Subcatchment Summary
*******************
Name                         Area     Width    %Imperv    %Slope Rain Gage           Outlet
-------------------------------------------------------------------------------------------------
S1                           3.30     96.99     90.00    1.0000 Raingage1           SU1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------
J1                   JUNCTION       174.07      1.74       0.0
6R3879               OUTFALL        174.05      0.53       0.0
SU1                  STORAGE        174.10      1.70       0.0


************
Link Summary
************
Name             From Node        To Node          Type             Length    %Slope Roughness
-----------------------------------------------------------------------------------------------
C1_2             J1               6R3879           CONDUIT            15.0    0.1338    0.0130
C1_1             SU1              J1               ORIFICE


*********************
Cross Section Summary
*********************
                                     Full     Full     Hyd.     Max.   No. of     Full
```

Conduit	Shape	Depth	Area	Rad.	Width	Barrels	Flow
C1_2	CIRCULAR	0.53	0.22	0.13	0.53	1	0.16

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CMS
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 04/11/2022 00:00:00
Ending Date 04/12/2022 12:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step ..... 1.00 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	0.269	81.587
Evaporation Loss	0.000	0.000
Infiltration Loss	0.010	2.908
Surface Runoff	0.255	77.317
Final Storage	0.006	1.698
Continuity Error (%)	-0.410	

**********	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
**********	---------	---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.255	2.550
Groundwater Inflow	0.000	0.000

RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.253	2.531
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	0.001
Continuity Error (%)	0.707	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	0.50 sec
Average Time Step	:	1.00 sec
Maximum Time Step	:	1.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00
Time Step Frequencies	:	
1.000 - 0.871 sec	:	100.00 %
0.871 - 0.758 sec	:	0.00 %
0.758 - 0.660 sec	:	0.00 %
0.660 - 0.574 sec	:	0.00 %
0.574 - 0.500 sec	:	0.00 %

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
S1	81.59	0.00	0.00	2.91	72.02	5.30	77.32	2.55	1.19	0.948

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.06	1.01	175.08	0 01:38	0.86
6R3879	OUTFALL	0.04	0.45	174.50	0 01:57	0.45
SU1	STORAGE	0.07	1.58	175.68	0 01:57	1.58

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.000	0.446	0 01:57	0	2.53	0.002
6R3879	OUTFALL	0.000	0.446	0 01:57	0	2.53	0.000
SU1	STORAGE	1.188	1.188	0 01:45	2.55	2.55	0.711

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
J1	JUNCTION	0.91	0.483	0.732

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	0.050	3	0	0	0.984	55	0 01:57	0.446

****

Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
6R3879	76.32	0.026	0.446	2.531
System	76.32	0.026	0.446	2.531

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1_2	CONDUIT	0.446	0	01:57	2.13	2.83	0.93
C1_1	ORIFICE	0.446	0	01:57			1.00

****
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
C1_2	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C1_2	0.01	0.91	0.01	1.41	0.01

Analysis begun on: Thu Jun 30 09:26:52 2022
Analysis ended on: Thu Jun 30 09:26:53 2022
Total elapsed time: 00:00:01

PCSWMM Output Report: 1:100 year 24 hour

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
--------------------------------------------------------------


*************
Element Count
*************
Number of rain gages ...... 1
Number of subcatchments ... 1
Number of nodes ........... 3
Number of links ........... 2
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
------------------------------------------------------------------------
Raingage1            100y24h2hDistribution       INTENSITY  120 min.


*******************
Subcatchment Summary
*******************
Name                        Area     Width    %Imperv    %Slope Rain Gage           Outlet
-----------------------------------------------------------------------------------------------------
S1                          3.30     96.99     90.00    1.0000 Raingage1           SU1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
------------------------------------------------------------------------
J1                   JUNCTION       174.07      1.74       0.0
6R3879               OUTFALL        174.05      0.53       0.0
SU1                  STORAGE        174.10      1.70       0.0


************
Link Summary
************
Name             From Node        To Node          Type             Length    %Slope Roughness
-------------------------------------------------------------------------------------------
C1_2             J1               6R3879           CONDUIT            15.0    0.1338    0.0130
C1_1             SU1              J1               ORIFICE


*********************
Cross Section Summary
*********************
                                     Full     Full     Hyd.     Max.   No. of     Full
```

Conduit	Shape	Depth	Area	Rad.	Width	Barrels	Flow
C1_2	CIRCULAR	0.53	0.22	0.13	0.53	1	0.16

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CMS
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 04/11/2022 00:00:00
Ending Date 04/12/2022 12:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step ..... 2.00 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	0.356	108.000
Evaporation Loss	0.000	0.000
Infiltration Loss	0.010	3.121
Surface Runoff	0.339	102.841
Final Storage	0.007	2.078
Continuity Error (%)	-0.036	

**********	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
**********	---------	---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.339	3.392
Groundwater Inflow	0.000	0.000

RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.339	3.387
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	0.004
Continuity Error (%)	0.000	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	1.50 sec
Average Time Step	:	2.00 sec
Maximum Time Step	:	2.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00
Time Step Frequencies	:	
2.000 - 1.516 sec	:	100.00 %
1.516 - 1.149 sec	:	0.00 %
1.149 - 0.871 sec	:	0.00 %
0.871 - 0.660 sec	:	0.00 %
0.660 - 0.500 sec	:	0.00 %

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
S1	108.00	0.00	0.00	3.12	95.50	7.34	102.84	3.39	0.24	0.952

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.11	0.47	174.54	0 14:01	0.47
6R3879	OUTFALL	0.08	0.32	174.37	0 14:01	0.32
SU1	STORAGE	0.11	0.64	174.74	0 14:01	0.64

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.000	0.224	0 14:01	0	3.39	0.001
6R3879	OUTFALL	0.000	0.224	0 14:01	0	3.39	0.000
SU1	STORAGE	0.237	0.237	0 14:00	3.39	3.39	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	0.090	5	0	0	0.509	28	0 14:01	0.224

****
Outfall Loading Summary
****

	Flow Freq	Avg Flow	Max Flow	Total Volume

Outfall Node	Pcnt	CMS	CMS	10^6 ltr
6R3879	92.32	0.028	0.224	3.387
System	92.32	0.028	0.224	3.387

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1_2	CONDUIT	0.224	0	14:01	1.28	1.42	0.75
C1_1	ORIFICE	0.224	0	14:01			1.00

****
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
C1_2	1.00	0.06	0.00	0.00	0.94	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C1_2	0.01	0.01	0.01	1.75	0.01

Analysis begun on: Thu Jun 30 09:27:45 2022
Analysis ended on: Thu Jun 30 09:27:45 2022
Total elapsed time: < 1 sec

PCSWMM Output Report: Urban Stress Test

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
--------------------------------------------------------------


*************
Element Count
*************
Number of rain gages ...... 1
Number of subcatchments ... 1
Number of nodes ........... 3
Number of links ........... 2
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Raingage1            UST                         INTENSITY   15 min.


*******************
Subcatchment Summary
*******************
Name                         Area     Width    %Imperv    %Slope Rain Gage           Outlet
-------------------------------------------------------------------------------------------------
S1                           3.30     96.99     90.00    1.0000 Raingage1           SU1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
------------------------------------------------------------------------
J1                   JUNCTION       174.07      1.74       0.0
6R3879               OUTFALL        174.05      0.53       0.0
SU1                  STORAGE        174.10      1.70       0.0


************
Link Summary
************
Name             From Node        To Node          Type             Length    %Slope Roughness
-----------------------------------------------------------------------------------------------
C1_2             J1               6R3879           CONDUIT            15.0    0.1338    0.0130
C1_1             SU1              J1               ORIFICE


*********************
Cross Section Summary
*********************
                                     Full     Full     Hyd.     Max.   No. of     Full
```

Conduit	Shape	Depth	Area	Rad.	Width	Barrels	Flow
C1_2	CIRCULAR	0.53	0.22	0.13	0.53	1	0.16

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CMS
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 04/11/2022 00:00:00
Ending Date 04/12/2022 12:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step ..... 2.00 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	0.495	149.985
Evaporation Loss	0.000	0.000
Infiltration Loss	0.011	3.380
Surface Runoff	0.478	144.918
Final Storage	0.007	2.003
Continuity Error (%)	-0.211	

**********	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
**********	---------	---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.478	4.779
Groundwater Inflow	0.000	0.000

RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.457	4.573
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	0.019	0.195
Continuity Error (%)	0.232	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
Link C1_1 (54)

****
Routing Time Step Summary
****
Minimum Time Step	:	1.50 sec
Average Time Step	:	2.00 sec
Maximum Time Step	:	2.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.01
Time Step Frequencies	:	
2.000 - 1.516 sec	:	100.00 %
1.516 - 1.149 sec	:	0.00 %
1.149 - 0.871 sec	:	0.00 %
0.871 - 0.660 sec	:	0.00 %
0.660 - 0.500 sec	:	0.00 %

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
S1	149.98	0.00	0.00	3.38	133.55	11.37	144.92	4.78	1.21	0.966

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.27	0.95	175.02	0 09:08	0.84
6R3879	OUTFALL	0.27	0.46	174.51	1 00:20	0.46
SU1	STORAGE	0.28	1.60	175.70	0 09:32	1.60

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.000	0.449	0 09:32	0	4.57	-0.102
6R3879	OUTFALL	0.000	0.449	0 09:32	0	4.57	0.000
SU1	STORAGE	1.211	1.211	0 09:15	4.78	4.78	0.369

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
J1	JUNCTION	1.11	0.427	0.788

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	0.216	12	0	0	1.082	60	0 09:32	0.449

****

Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
6R3879	63.06	0.056	0.449	4.573
System	63.06	0.056	0.449	4.573

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1_2	CONDUIT	0.449	0	09:32	2.15	2.86	0.93
C1_1	ORIFICE	0.449	0	09:32			1.00

****
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
C1_2	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

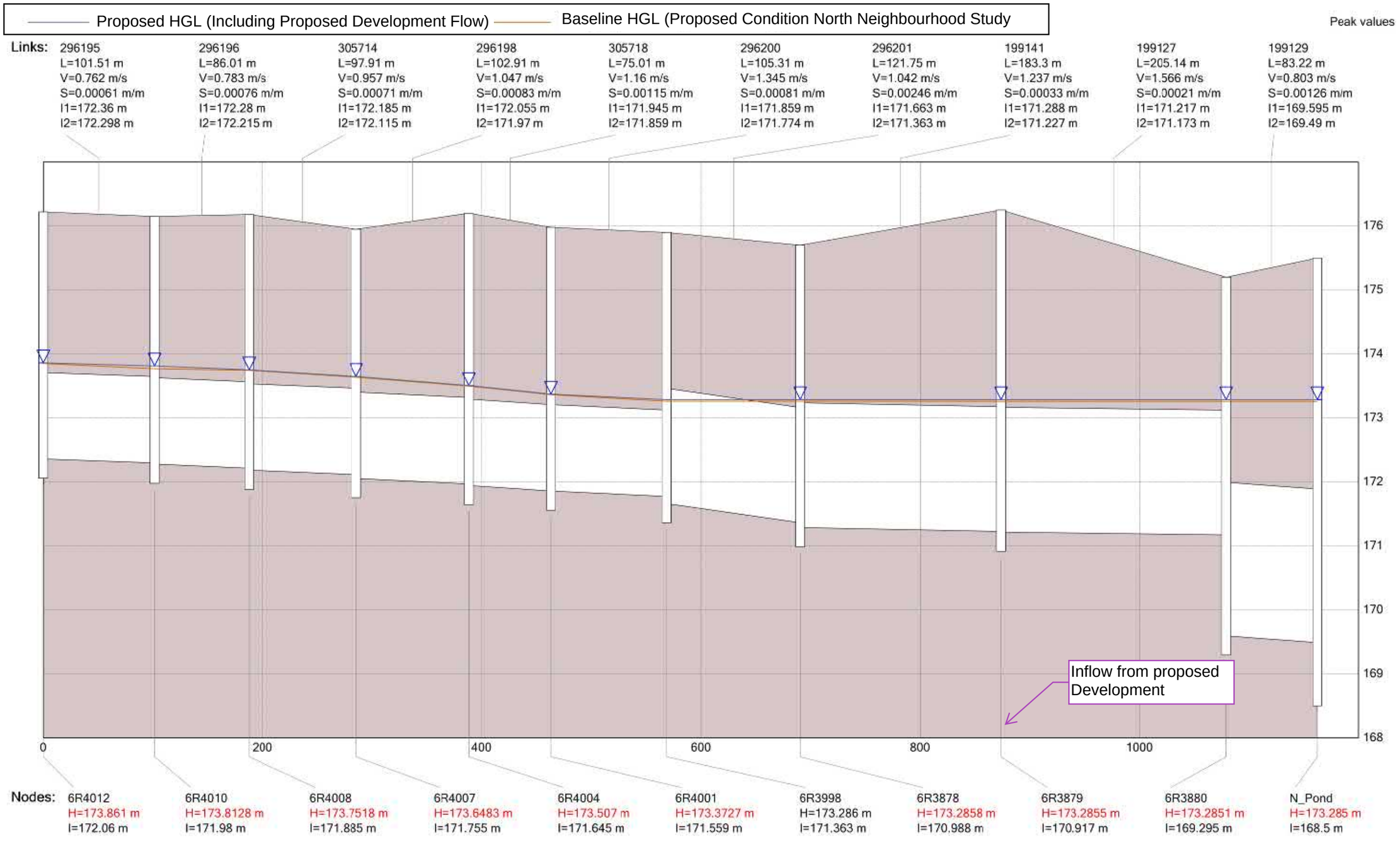
Conduit	Hours Full: Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C1_2	0.01	1.11	0.01	1.66	0.01

Analysis begun on: Thu Jun 30 09:28:59 2022
Analysis ended on: Thu Jun 30 09:29:00 2022
Total elapsed time: 00:00:01

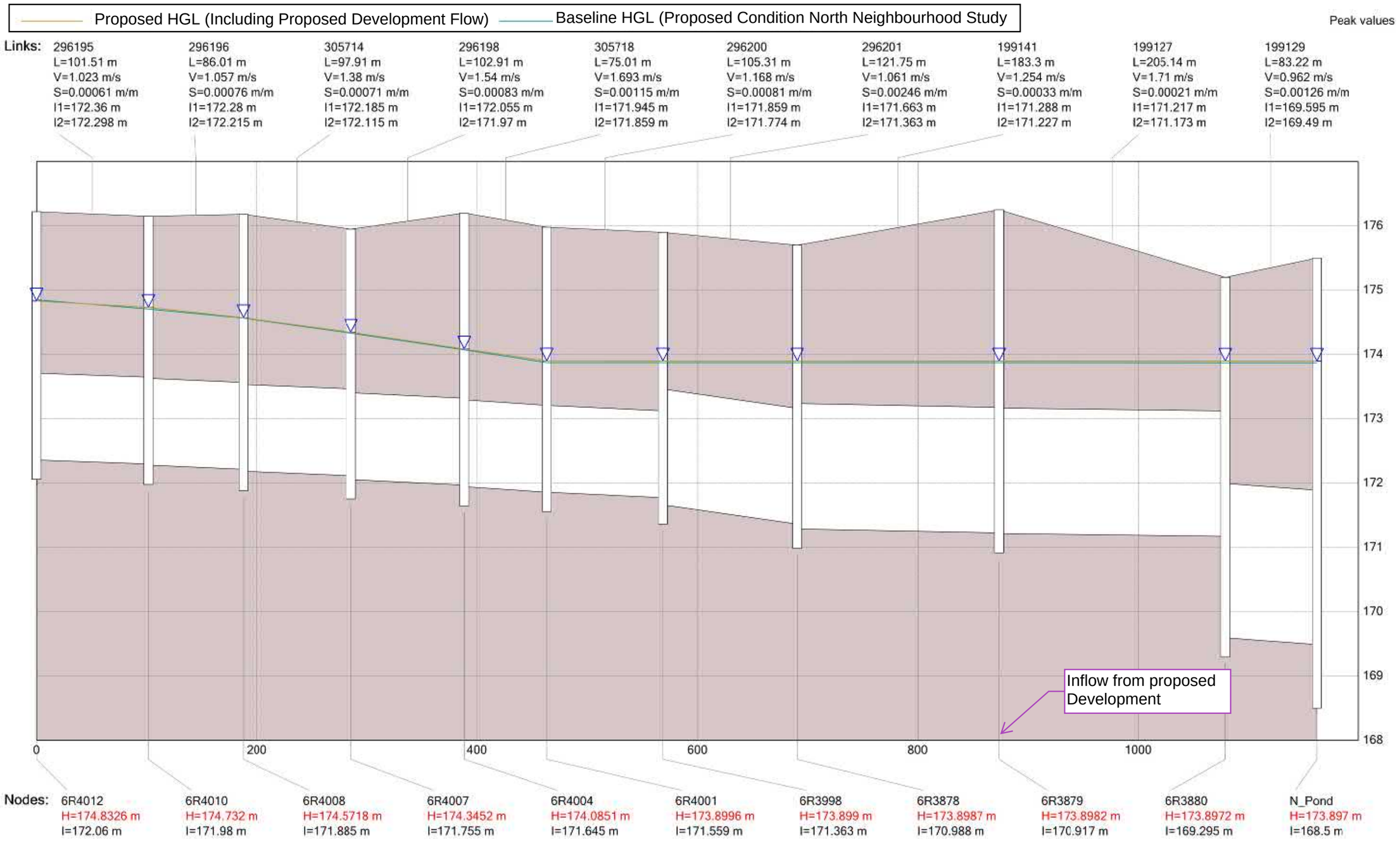
Appendix C

Wyandotte Street East Sewer Profile Comparison

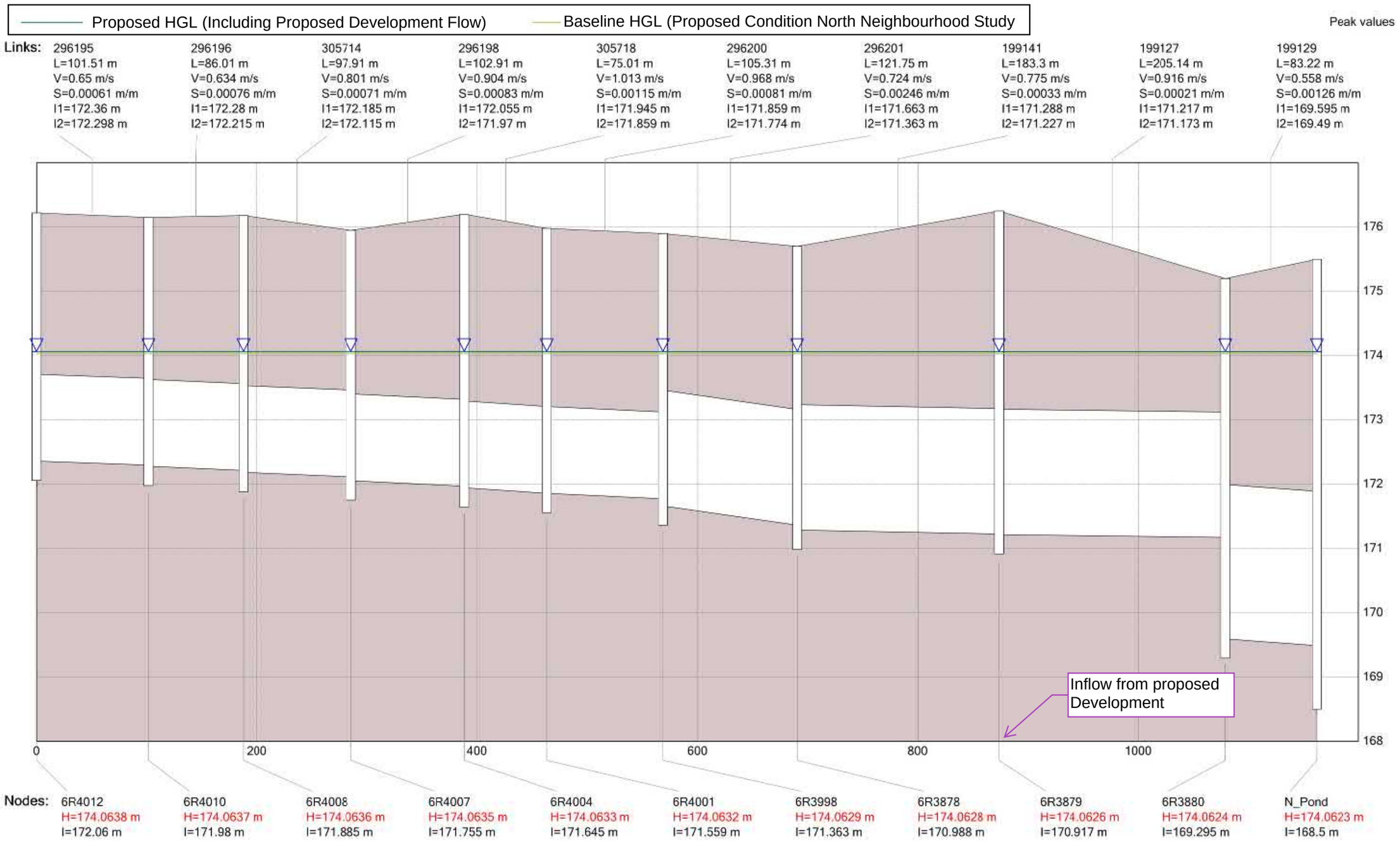
Wyandotte Sewer HGL Profile Comparison (1:5 year 4 hour)



Wyandotte Sewer HGL Profile Comparison (1:100 year 4 hour)



Wyandotte Sewer HGL Profile Comparison (1:100 year 24 hour)



Appendix D

Details of the OGS Unit

ADS OGS Sizing Summary

Project Name: Ganatchio Gardens

Consulting Engineer: Dillon

Location: Windsor, ON

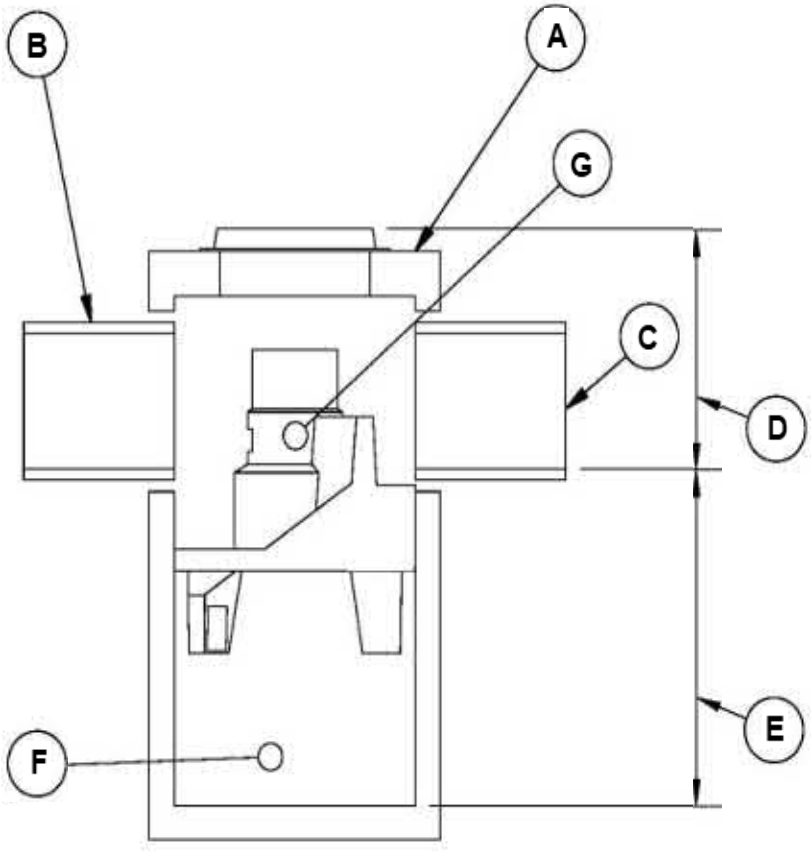
Sizing Completed By: C. Neath **Email:** cody.neath@ads-pipe.com

Treatment Requirements		
Treatment Goal:	Normal (MOE)	
Selected Parameters:	70% TSS	90% Volume
Selected Unit:	**FD-5HC**	

Site Details	
Site Area:	3.3 ha
% Impervious:	90%
Rational C:	0.84
Rainfall Station:	Windsor, ONT
Particle Size Distribution:	Fine
Peak Flowrate:	417 L/s

Summary of Results		
Model	**TSS Removal**	**Volume Treated**
FD-4HC	69.0%	78.2%
FD-5HC	72.0%	>90%
FD-6HC	74.0%	>90%
FD-8HC	79.0%	>90%
FD-10HC	82.0%	>90%

FD-5HC Specification	
Unit Diameter (A):	1,500 mm
Inlet Pipe Diameter (B):	300 mm
Outlet Pipe Diameter (C):	300 mm
Height, T/G to Outlet Invert (D):	2000 mm
Height, Outlet Invert to Sump (E):	1780 mm
Sediment Storage Capacity (F):	1.29 m³
Oil Storage Capacity (G):	1,135 L
Recommended Sediment Depth for Maintenance:	475 mm
Max. Pipe Diameter:	600 mm
Peak Flow Capacity:	566 L/s



Site Elevations:	
Rim Elevation:	100.00
Inlet Pipe Elevation:	98.00
Outlet Pipe Elevation:	98.00

Notes:

Removal efficiencies are based on NJDEP Test Protocols and independently verified.

All units supplied by ADS have numerous local, provincial, and international certifications (copies of which can be provided upon request). The design engineer is responsible for ensuring compliance with applicable regulations.

Project Name:	Ganatchio Gardens
Consulting Engineer:	Dillon
Location:	Windsor, ON

Net Annual Removal Efficiency Summary: FD-5HC

Rainfall Intensity[(1)]	Rational Equation Flowrate	Surface Loading Rate	Fraction of Rainfall[(1)]	FD-5HC Removal Efficiency	Weighted Net-Annual Removal Efficiency
mm/hr	L/s	L/min/m^2	%	%	%
3.00	23.1	784	13.2%	81%	10.7%
4.00	30.8	1046	9.6%	79%	7.6%
5.00	38.5	1307	7.5%	78%	5.8%
6.00	46.2	1569	6.0%	76%	4.6%
7.00	53.9	1830	4.8%	75%	3.6%
8.00	61.6	2092	4.1%	74%	3.0%
9.00	69.3	2353	3.6%	73%	2.6%
10.00	77.0	2614	3.2%	73%	2.3%
11.00	84.7	2876	2.8%	72%	2.0%
12.00	92.4	3137	2.5%	71%	1.8%
15.00	115.5	3922	6.6%	70%	4.6%
20.00	154.0	5229	8.3%	68%	5.7%
25.00	192.5	6536	5.8%	67%	3.9%
30.00	231.0	7843	4.6%	66%	3.0%
35.00	269.5	9150	3.8%	65%	2.5%
40.00	308.0	10458	2.9%	64%	1.9%
45.00	346.5	11765	2.4%	63%	1.5%
50.00	385.0	13072	1.8%	63%	1.1%
65.00	500.5	16994	6.6%	61%	4.0%
				Total Net Annual Removal Efficiency:	72.0%
				Total Runoff Volume Treated:	99.9%

Notes:

(1) Based on Windsor/Essex Region Stormwater Manual 2018, Table 3.4.1.5

(2) Based on third party verified data and appoximating the removal of a PSD similar to the STC Fine distribution