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PROPOSED MIXED-USE
RESIDENTIAL TOWER DEVELOPMENT
1026 COOKE BOULEVARD
CITY OF BURLINGTON

PROJECT No.: 23208

FUNCTIONAL SERVICING & STORMWATER MANAGEMENT REPORT

Prepared For:

HSCC #416, KD INSTALLATIONS

Prepared By:

The Odan/Detech Group Inc.

Original: November 2023

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APPENDIX A

Existing Site	Aerial view of Site and surrounding area
Site Plan, Floor Plan & Statistics	by Turner Fleischer Architects Inc.

APPENDIX B

1026 Cooke Boulevard Sanitary Sewer Capacity Analysis Report by Civica Infrastructure Ltd.

APPENDIX C

XPSWMM Output File (100-Year Storm)

APPENDIX D

Functional Servicing Plan
Functional Grading Plan

1.0 INTRODUCTION

The subject of this report is a 0.32 Ha parcel of land bound by the following:

- To the east: Cooke Boulevard
- To the south: A parking lot
- To the west: An existing residential house
- To the north: An existing commercial development

Presently the site comprises an existing commercial development.

Refer to the Key Plan in Appendix A for the site's layout and adjacent properties.

It is proposed to demolish the existing commercial development and construct a residential tower development. The proposed development comprises of a tower, on top of a four-level below-grade parking structure. The tower comprises 29 storeys.

Refer to the architectural site plan in Appendix A for the proposed development's layout.

The municipal address of the site comprises 1026 Cooke Boulevard.

For detailed topography of the existing site conditions, as of Nov. 2022, refer to the topographic survey prepared by A.T. McLaren Ltd.

This report evaluates the serviceability of the site with respect to sanitary waste water, water and storm water management (SWM) and will implement the City of Burlington's SWM requirements.

2.0 SCOPE OF WORK

THE ODAN/DETECH GROUP INC. was retained by **HSCC** to review the Site, collect data, evaluate the Site for the proposed use and present the findings in a Functional Servicing and Storm Water Management Report in support of a Rezoning application. The scope of work in brief involves the following:

a) Collecting existing servicing drawings from the CITY in order to establish availability and feasibility of Site servicing;
b) Meetings/conversations with CITY Engineers and Design Team.
c) Evaluation of the data and presentation of the findings in a Functional Servicing and Storm Water Management Report in support of the Rezoning application.

3.0 WATER DISTRIBUTION ASSESSMENT

i) Existing Infrastructure

The following watermain presently exist beneath the street bordering the site. Refer to the Functional Servicing Plan.

- Cooke Boulevard, west side: 300mm watermain

ii) Proposed Servicing

It is proposed to service the Tower with a proposed 250mm fire service connection to the 300mm Cooke Boulevard watermain with a branch 200mm domestic water service. The tower is greater than 84m in height, therefore a second/redundant 250mm fire service connection is additionally proposed. The first connection is installed with a valve chamber on the mainline. Refer to the Functional Servicing Plan.

The tower will be greater than 84m in height, therefore OBC 2006 3.2.9.7 (4) requires the tower to have a secondary/redundant fire service connection.

Refer to the Functional Servicing Plan in Appendix D for proposed service connections.

The water demand for the proposed building is as follows.

a) Average Day domestic demand - As per average sanitary flow 2.25 L/sec

b) Peak day demand - 2.25 x average demand 5.1 L/sec

c) Fire flow as per FUS 1999 manual calculation, below 67 L/sec

TABLE 1 – Total Water Demand for Proposed Building

	L/sec	USGM
Peak Day Demand	5.10	81
Fire Flow Demand	67	1057
Total Water Demand	72	1141
Available Flow at 20 PSI (Cooke Blvd. 300mm WM)	172	2738

Hydrant flow test results as stated above are provided below.

The following assumptions are made in the following Fire Underwriters' Survey fire flow calculation.

- The proposed building is of fire-resistive construction (reinforced concrete).
- The building will be sprinklered for fire protection and the sprinklers will be fully monitored according to NFPA 13.
- The building's contents (residences) will be non-combustible in nature.

- The building's areas in the calculation are as per the architectural floor areas provided in Appendix A.
- The proposed building's vertical openings and exterior vertical communications are properly protected with a one-hour rating.
- The greatest floor area (GFA) occurs in Floor 2, therefore the fire flow given accordingly is taken as the fire flow demand. This is based on the statistics in Appendix A.

The hydrant flow test was conducted as per the NFPA 291 hydrant testing standard on hydrants on Cooke Boulevard. Refer to the test report, below.

The available flow at 20 psi in the Cooke Boulevard 300mm watermain is 2738 USGM which is greater than the proposed development's total water demand (1141 USGM), therefore the existing watermain infrastructure is sufficient to service the proposed development and no watermain infrastructure upgrades are required.

WATER SUPPLY FOR PUBLIC FIRE PROTECTION , FIRE UNDERWRITERS SURVEY GUIDE
FOR DETERMINATION OF REQUIRED FIRE FLOWS

$F = 220 \times C \times \sqrt{A}$

Where:

F = required fire flow in liters per minute
C= Coefficient related to the type of construction
A = the total floor area in square meters (excluding basements) in the building considered

Coefficient related to type of construction	
1.5	Wood Frame
1	Ordinary
0.8	Non combustible
0.6	Fire Resistive

LOCATION: 1026 Cooke Blvd.
OBC OCCUPANCY: Residential Apartment
BUILDING FOOT PRINT (m2): 1472
OF STOREYS: 29

PROJECT: 1026 Cooke Blvd.
PROJECT No: 23208
DATE: Oct-31-2023

Contents	Charge
Non-Combustible	-25%
limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Buring	25%

CONSTRUCTION CLASS: Fire Resistive

AUTOMATED SPRINKLER PROTECTION

		Credit	Total
NFPA 13 sprinkler standard	yes	10%	
Standard Water Supply	yes	30%	50%
Fully Supervised System	yes	10%	
		50%	

CONTENTS FACTOR: Non Combustible — CHARGE: -20%

EXPOSURE 1 (south)Fut. Development	Distance to Exposure Building (m)	25	10%
	Length - Height		
EXPOSURE 2 (east)	Distance to Exposure Building (m)	No Exp	0%
	Length - Height		
EXPOSURE 3 (west) Ex Residential	Distance to Exposure Building (m)	32	5%
	Length - Height		
EXPOSURE 4 (north) Ex. Commercial	Distance to Exposure Building (m)	25	10%
Under Construction	Length - Height		
		Total:	25%

no more than 75%

Separation	Charge
0-3 m	25%
3.1 -10 m	20%
10.1 - 20 m	15%
20.1 - 30 m	10%
30.1 - 45	5%
> 45 m	0%

ARE BUILDINGS CONTIGUOUS: NO

FIRE RESISTANT BUILDING Are vertical openings and exterior vertical communications protected with a minimum one (1) hr ratin: No

CALCULATIONS

C =	0.6			
A =	2135	m2	(Largest Floor + 25% of adjacent)	
F =	6098	L/min		
Round to Nearest 1000 L/min F =	6000	L/min	must be > 2000 L/min	

STOREY AREAS m2	
1423	L3
1423	L4
1423	L5

CORRECTION FACTORS:

OCCUPANCY	-1200	L/min
FIRE FLOW ADJUSTED FOR OCCUPANCY	4800	L/min
REDUCTION FOR SPRINKLER	-2400	L/min
EXPOSURE CHARGE	1200	L/min

REQUIRED FIRE FLOW **F =** 3600 L/min

Round to Nearest 1000 L/min **F =** 4000 L/min 1057 usgm

F = 67 L/sec

Fire Flow Testing Report

SCG | FLOWMETRIX INDU-TECH PROCESS

Residual Hydrant # **HYD5765**
NFPA Colour Code **BLUE**



DATE	August 24, 2023
TIME	03:00 P.M
ADDRESS	1026 Cook Blvd. Burlington L7T 4A8
SIZE-inches/mm	300
MATERIAL	PVC
CONTACT INFO	Mark Harris The Odan/Detech Group Inc. (905) 632-3811 ext 122 mark@odandetech.com

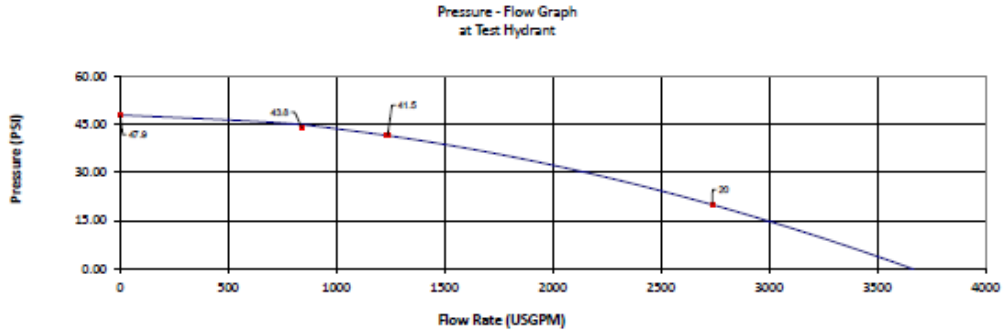
RESIDUAL HYDRANT INFO.

HYDRANT #	HYD5765	
N.F.P.A. COLOUR CODE	BLUE	
STATIC PRESSURE	47.9	psi
RESIDUAL PRESSURE - ONE PORT OPEN	43.8	psi
RESIDUAL PRESSURE - TWO PORTS OPEN	41.5	psi
PRESSURE DROP	6.4	psi
% PRESSURE DROP	13.4	% psi
Flow on Water Main At Test Hydrant	20 psi	2738 USGPM

FLOW HYDRANT(S) INFO.

HYDRANT ASSET ID	HYD. # PORTS	OUTLET DIAMETER (INCHES)	NOZZLE COEFFICIENT	DIFFUSER TYPE	DIFFUSER COEFFICIENT	PITOT READING (psi)	PITOT FLOW (USGPM)	FLOW METER (USGPM)
HYD5661	1	2.5	Round	Swivel	0.90	31.1	842	0
								0
HYD5661	2	2.5	Round	Swivel	0.90	16.3	1238	0
		2.5	Round	Swivel	0.90	17.3		0

FIRE FLOW CHART



COMMENTS

OPERATOR	FMX	Andrew Cheung
OPERATOR	FMX	
OPERATOR		Region of Halton

Fire Flow Testing -ODG-Cook Blvd.-Burlington

"If we don't measure it, how do you manage it?"

4.0 SANITARY SEWERS

i) Existing Infrastructure & Drainage

The following sanitary sewer/wastewater main is located within the street bordering the subject site. Refer to the Functional Servicing Plan in Appendix D, for the layout of the existing sanitary sewers/wastewater mains adjacent to the subject site.

- Cooke Boulevard: Existing 300mm sanitary sewer, which flows southerly and discharges into a sanitary sewer within Plains Road East.

ii) Proposed Servicing

It is proposed to service the proposed Tower with a separate respective 200mm sanitary sewer connection to the 300mm sanitary sewer within Cooke Boulevard.

Refer to the Functional Servicing Plan in Appendix D for the proposed sanitary service connections. Sanitary flows are calculated as follows.

The sanitary sewer design criteria and unit flow is provided in the Regional Municipality of Halton's *Water and Wastewater Linear Design Manual* (April 2019), as follows. The following information is provided in Tables 3-1 and 3-2 of the foregoing manuals.

- Unit flow: q = average daily residential per capita dry weather unit flow = 0.275 m^3/cap/day
- I/I = Unit of peak inflow/infiltration = 0. 286 L/s/ha
- Apartment (over 6-storey): 285 p/Ha and 0.275 m^3/p/day or 0.003183 x 10^{-3} m^3/p/s
- Apartment (6-storeys or less): 135 p/Ha and 0.275 m^3/p/day or 0.003183 x 10^{-3} m^3/p/s
- Notwithstanding the above unit population, however, a unit population of 2.1 P/unit is assumed for the proposed apartment tower development because the Region standard 285 P/Ha unit population (apartments <6-storeys) would result in a unit population of approximately 0.2 Person/unit for the foregoing proposed statistics, which is unrealistic

The proposed sanitary flows are as follows. Refer to the detailed calculation on the following pages.

TABLE 2 – Post-Development Sanitary Flow

Component	Population (P)	Sanitary Flow (l/s)	Groundwater Discharge (l/s)	Inflow & Infiltration (l/s)	Total Flow (l/s)
Residential Flows	704	8.76	N/A	0.09	8.85

The 8.85 L/s total sanitary flow for the proposed Tower will be conveyed to the existing 300mm sanitary sewer within Cooke Boulevard by proposed 200mm at 2.0% (43 L/s capacity) sewer connections. These sewer connections are adequately sized to convey the above flow.

SANITARY & WATER FLOW CALCULATIONS

SCENARIO: PROPOSED DEVELOPMENT

This program calculates the sanitary discharge from various land use

FILL IN COLOURED CELLS AS REQUIRED

COMMERCIAL SITE AREA (ha) =

RESIDENTIAL SITE AREA (ha) =

Project No. 23208

TOTAL SITE AREA (ha) = 0.32

LAND USE	NUMBER OF UNITS	SITE AREA, (ha)	GROSS FLOOR AREA, m2	TOTAL POPULATION	TOTAL DAILY FLOW (LITERS)	AVERAGE DAILY FLOW l/sec	PEAKING FACTOR, M	TOTAL FLOW FROM LAND USE, l/sec
RESIDENTIAL Detached, using 55 person/site area				0	0	0.00	4.50	0.00
RESIDENTIAL Semi Houses, using 100 persons/site area				0	0	0.00	4.50	0.00
RESIDENTIAL Apartments (<6 st), using 135 persons/site area				0	0	0.00	4.50	0.00
RESIDENTIAL Apartments (>6 st), using 285 persons/site area				0	0	0.00	4.50	0.00
RESIDENTIAL Density 3, using 2.1 persons/unit	335			704	193463	2.24	3.89	8.72
COMMERCIAL, Using 90 persons/ha (Floor Ha)		0.04		3	916	0.01	3.56	0.04
COMMERCIAL, Using 0.60 L/sec per ha				0	0	0.00	2.50	0.00

TOTAL V1= 194378

Q1=	8.72
Q2=	0.04
Qinfil	0.09
Qtot	8.85

Q = (MqP/86400) + A * I (L/sec)

Q1= total flow from Residential Land Use (L/sec)
Q2= total flow from Commercial Land Use (L/sec)
Qinfil = total flow from infiltration (L/sec)
Qtot = total flow (Land use + infiltration)

V1= Total Volume from Land Use in liters

where : P is population
q = 0.275 m3/d/p = 0.004 L/sec/person for residential and
q = 0.60 L/sec/ha for commercial and offices
A = gross site area
i = 0.286 L/sec/ha (infiltration rate)

Peaking Factor M = 1 + [14 / (4 + (P/1000,1/2)) (for residential)
Peaking Factor M = 0.8* {1 + [14 / (4 + (P/1000,1/2))]} (for Commercial)

iii) Receiving Downstream Sanitary Sewer (Wastewater Main) Capacity

The proposed development is proposed to discharge into the existing 300mm sanitary sewer which flows southerly within Cooke Boulevard and then westerly within Plains Road. Consideration is required for this sewer's capacity to receive the proposed flows.

It is further noted that the adjacent proposed development project located at 1120 Cooke Boulevard is proposing to improve the Cooke Boulevard and Plains Road local sanitary sewer. This is as per the *Functional Servicing and Stormwater Management Report* by MTE dated November 19, 2021 for 1120 Cooke Boulevard.

Section 3.0 therein proposes to increase the Cooke Boulevard sanitary sewer from 300mm to 375mm, and the Plains Road from 250mm to 450mm-diameter pipes.

In addition there is a proposed development located at 1062-1074 Cooke Blvd. that considers the above improvements and will be further included in assessment of 1026 Cooke Blvd.

An original downstream sanitary sewer analysis has been prepared by Civica Infrastructure Ltd. (Appendix B) to ascertain the operating conditions of the downstream sanitary sewers. Civica's modelling utilizes the Region's base model and considers both dry-weather flow (DWF) and wet-weather flow (WWF) derived from the Region's InfoSewer model. Civica's model and report also considers the conclusions and recommendations made for 1062-1074 Cooke Blvd. and 1120 Cooke Boulevard, as noted above.

The conclusions and recommendations pertaining to the downstream sanitary sewer capacity study completed by CIVICA Infrastructure Ltd. are generally as follows.

- The expected sanitary peak flow, as observed from the outlet, from the proposed site is 8.85 L/s.
- The upgraded sanitary sewer is able to maintain free-flowing conditions during dry-weather flow for the proposed intensification along Cooke Blvd, north of Plains Rd E, including the proposed flows for 1026 Cooke Blvd.
- The upgraded sanitary sewer is able to maintain basement flooding protection during wet-weather flow conditions for the proposed intensification along Cooke Blvd, north of Plains Rd E, including the proposed flows for 1026 Cooke Blvd.
- The existing sanitary sewer system does not have the capacity to accommodate the existing or proposed wet-weather flows without the need for any external upgrades or retrofits.

Based on the analysis and assumptions presented in the report, it is therefore recommended that the development proceeds after the sanitary sewer upgrades along Cooke Blvd. and Plains Rd E. have successfully been completed. Alternatively the Developer can enter into agreements with the City/Region and/or adjacent Developers to complete necessary upgrades in advance of others when approved by the Region/City.

5.0 STORM WATER MANAGEMENT

i) Existing Infrastructure & Drainage

The following storm sewer presently existing beneath the street adjacent to the site

- Cooke Boulevard: there is an existing 750mm concrete storm sewer which flows southerly adjacent to the Site's east frontage. The sewer continues southerly towards Plains Road East

Refer to the Pre-Development Drainage Plan in Figure 1 for existing drainage patterns and functional servicing plan in Appendix D.

Presently the entire site drains by existing catch basins and storm leads to the existing Cooke Boulevard 750mm storm sewer.

The following section describes the strategy for meeting stormwater management requirements of the City of Burlington.

ii) Stormwater Quantity Control Criteria

Storm water management criteria is given in the City of Burlington's manual *Stormwater Management Design Guidelines* (May 21, 2020). Section 6.1 therein provides site-level stormwater management criteria, which applies to site developments such as this.

Section 6.1.1.1 *Design Criteria* states that where an 'end-of-pipe' stormwater management facility is not present and where a site discharges to a storm sewer, the criteria is to control the 100-year return period post-development storm to the allotted capacity of the storm sewer. The manual further states that where the capacity of the storm sewer is unknown, that the 100-year post-development storm should be controlled to the 5-year pre-development storm flow.

The above criteria (control 100-year post-development to 5-year pre-development flows) applies to this development, given that it is proposed to discharge to a storm sewer – the Cooke Boulevard 675mm storm sewer - and that the capacity of this storm sewer is unknown.

Additionally since this development currently drains to Cooke Blvd. local storm sewer a global improvement to the downstream storm sewer system will be achieved.

City of Burlington IDF curves are provided in Appendix B of the above manual. They are provided as follows and will be used in the below hydraulic and hydrologic model.

IDF-Curve	***Intensity when t, time of concentration, is 10 minutes:***
$I_2 = 681.52 / (6 + t)^{0.780}$	$I_2 = 78.4$ mm/hr
$I_5 = 802.04 / (5 + t)^{0.764}$	$I_5 = 101.3$ mm/hr
$I_{10} = 918.28 / (5 + t)^{0.763}$	$I_{10} = 116.3$ mm/hr
$I_{25} = 1065.95 / (5 + t)^{0.762}$	$I_{25} = 135.4$ mm/hr
$I_{50} = 1172.34 / (5 + t)^{0.761}$	$I_{50} = 149.3$ mm/hr
$I_{100} = 1281.34 / (5 + t)^{0.761}$	$I_{100} = 163.2$ mm/hr

iii) Allowable Discharge Flow Rate

Allowable discharge flow rate is calculated to be 45.1 L/s as follows based on the above criteria.

Note that it is proposed to discharge a peak foundation drainage flow rate of 4.0 L/s (based on what is mentioned in the stormwater management report for a residential tower development in the same area) into the storm control maintenance hole (STM CNTRL MH), as shown on the Functional Servicing Plan in Appendix D. The allowable release rate is therefore adjusted to consider these flows. The allowable release rate is then 41 L/s as shown in Table 3.

The actual pre-development site runoff coefficient (C) is 0.80, therefore the allowable release rate is determined based on a runoff coefficient of 0.50 in accordance with City criteria, refer to the Pre-Development Drainage Plan in Figure 1.

TABLE 3 – Allowable Flows (Pre-Development 5-year storm runoff)

Location	Run-off Coefficient	Rainfall Intensity (mm/hr.)	Area of Development (ha)	Site Allowable (L/s)
Allowable Flows	0.5	101.3	0.32 Ha	***45.1***
Allowable Flows less Foundation Drainage Flows	at 4.0 l/sec (100,000 l/day (1.15 l/sec) assumed pump rate of 4.0 l/sec)			***41.1***

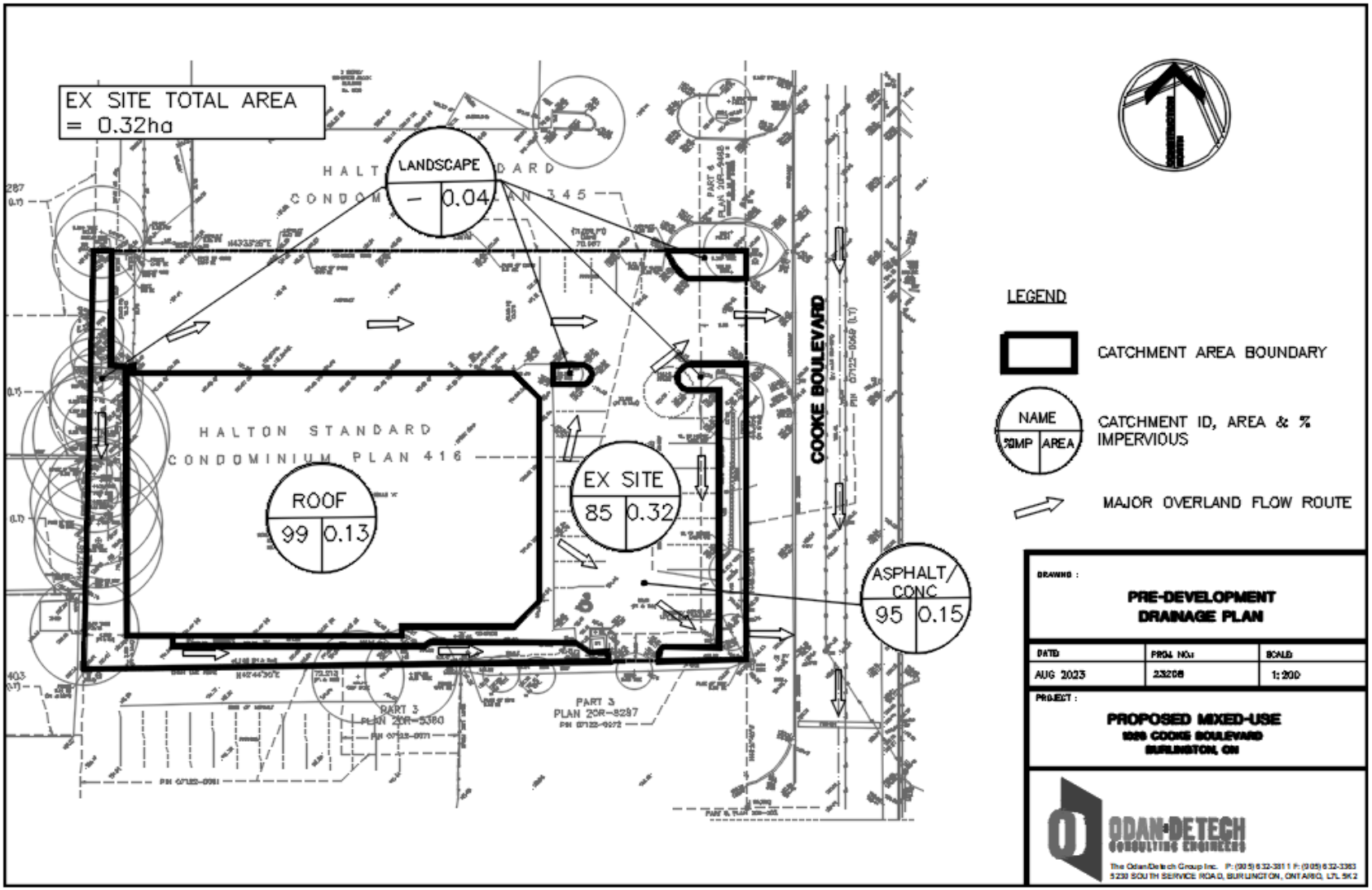


Figure 1 - Pre-Development Drainage Plan

iv) Post Development Flow Analysis

The proposed development will control the post development flows to the allowable flow rate calculated above; on-site storage will be required.

- ***To the West:*** There is an existing residential house lot
- ***To the East:*** There is Cooke Boulevard, which drains by the existing 750mm storm sewer therein.
- ***To the North:*** There is an existing commercial development which appears to drain internally by existing catch basins.
- ***To the South:*** There is an existing parking lot

The proposed development is constructed such that it is almost entirely underlain by the proposed below-grade parking structure. The proposed above-grade building extends almost property-line to property-line.

Storm area drains and storm piping, to be designed by the mechanical engineer at the Building Permit stage, will collect the runoff from the proposed building's roof and ground-level areas and convey it uncontrolled to stormwater detention tanks. The stormwater detention tank is proposed to be installed as a cast-in-place concrete tank, installed within the P1 below-grade levels. Internal piping will be sized to convey the 100 year storm event. Refer to the Functional Servicing Plan in Appendix D.

Stormwater flows will be controlled in accordance with the foregoing allowable release rate by a mechanical storm pump. This solution, rather than a gravity-driven orifice pipe/tube, is necessary due to the shallow depth of the existing 750mm storm sewer within Cooke Boulevard. The following is a discussion of the rationale for this solution.

- The site slopes significantly towards the south (as does the municipal storm sewer), therefore the optimal location for the storm sewer connection is at the southeast corner.
- The invert of the storm sewer connection is given by the depth of the storm sewer in the street. Refer to Cross-Section A-A on the Functional Servicing Plan in Appendix D.
- As shown in Cross-Section A-A on the Functional Servicing Plan, there is less than 1.0m freeboard between the invert of the outgoing storm connection (given by the depth of the street storm sewer) and the roof of the underground level one, which is insufficient depth for the tank.
- A big tank can be constructed in underground level one to capture the runoff from 100-year storm event and it is then necessary to pump storm flows (at no more than the allowable release rate) into the storm control maintenance hole (STM CNTRL MH).

The proposed stormwater detention tank located at the southeast corner of the site will provide stormwater quantity control. It has been sized accordingly as follows. Provision will be made in the mechanical storm drainage to drain to the existing storm tank. Refer to the Functional Servicing Plan in Appendix D for the tank's location.

The 100-year stormwater detention tank will be sized, based on the following SWM quantity control analysis, to provide adequate storage to the 100-year post-development storm event below-grade – such that there is no surface ponding.

Foundation drainage water will be pumped into the storm control maintenance hole (on a long-term basis) at a maximum flow rate of 4.0 L/s. The site's-controlled stormwater release rate is revised accordingly such that the total discharge from the site remains less than allowable, despite the foundation drainage flows. This is considered in Table 6, below, where it is shown that the controlled storm flows are no greater than allowable, considering the foundation drain flows. Any exceedances within the groundwater will be treated prior to release to the City Storm Sewer System.

The stormwater detention design of the tank was modelled using the XPSWMM. The storm catchment areas are delineated on the Post-Development Catchment Plan as shown in Figure 2. The input parameters to the model are summarized in Table 4. The hydrology input parameters were then inputted into the catchment area subbasin Catchment in the XPSWMM model (Figure 3).

It is important to note that the Owner will determine at the detailed design stage if use of a water tight structure is feasible and at such time may remove foundation drains and treatment of ground water at their discretion in-lieu of a water tight structure. The above approach considers additional flow to the storm sewer system and thus a water tight structure would result in a reduction of 4.0 l/sec to the storm sewer system.

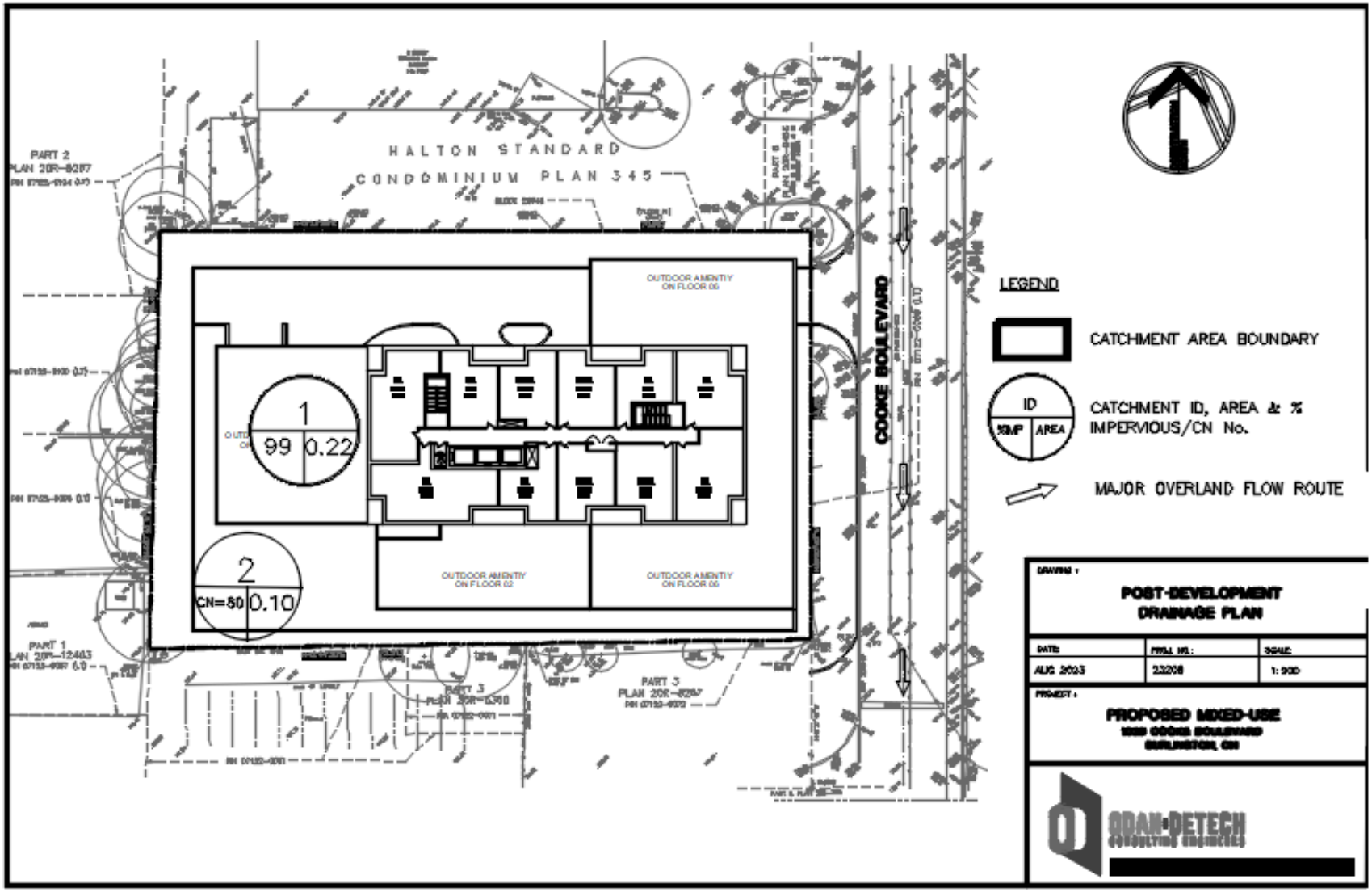


Figure 2 - Post-Development Drainage Plan

Table 4 provides for the parameters used to model the post development conditions in XPSWMM. This approach is conservative as it considers no rooftop controls to delay flows to the proposed stormwater management tank.

TABLE 4 – Post-Development Catchment Characteristics

Catchment ID	Description	Hydrology Method	Tributary Area (Ha)	Width (m)	Initial Abstract (mm)	Infiltration Losses Calculation	% Imperviousness	CN	Catchment Slope (%)	Time to Peak (min)
1	Building & Paved area	XPSWMM *Runoff* Method	0.22	50	1	SCS	99	80	1	-
2	Landscaped Area	XPSWMM *NASH* Method	0.10	-	5	SCS	-	80	1	10



Figure 3 - XPSWMM Schematic Model

The stage-storage-discharge relationship for the proposed storm tank with pumped outlet storm control is as follows. The tank is a proposed 25m^2 footprint.

TABLE 4 – Stage/Storage/Discharge Relationship for Storm Tank

Head (m)	Elevation (m)	Provided Volume (m^3)	Discharge (l/s)	Description
0.00		0	0	Bottom of Tank (Pump On)
0.50		12.5	38	Tank
1.00		25	38	Tank
1.61		***40.3***	***38***	***100-Y Max Volume in Tank***
2.00		60	38	Tank
3.00		85	38	Tank
4.20		120	38	Tank Roof

Actual 100-year Discharge from Pump:
100 Year = 38 l/s

The XP SWMM stormwater detention modelling results are provided below in Figures 6 and 7 for 5-year and 100-year storm events. The detailed output report is provided in Appendix C.

The following Table 6 is a summary of the below results.

TABLE 5 – Stormwater Management Summary

	5 Yr. Storm	**100 Yr. Storm**
Total Flow from The Site (Fig. 4)		
Total Flows Attenuated by 38 L/s Pump (Fig. 5)	38 L/s	38 L/s
Max. Pumped Foundation Drain Flows	4 L/s	4 L/s
Total Flows	42 L/s	42 L/s
Allowable Flow Rate	***45 L/s***	
Required 100-Year Volume	11.4 m^3	40.3 m^3
Provided Tank Volume	***120 m^3***	

The proposed stormwater quantity control is such that the controlled discharge in a 100-year storm is equal to the allowable release rate. The stormwater storage is provided such that the volume provided is greater than the required 100-year storm volume. Stormwater quantity control criteria is therefore satisfied.

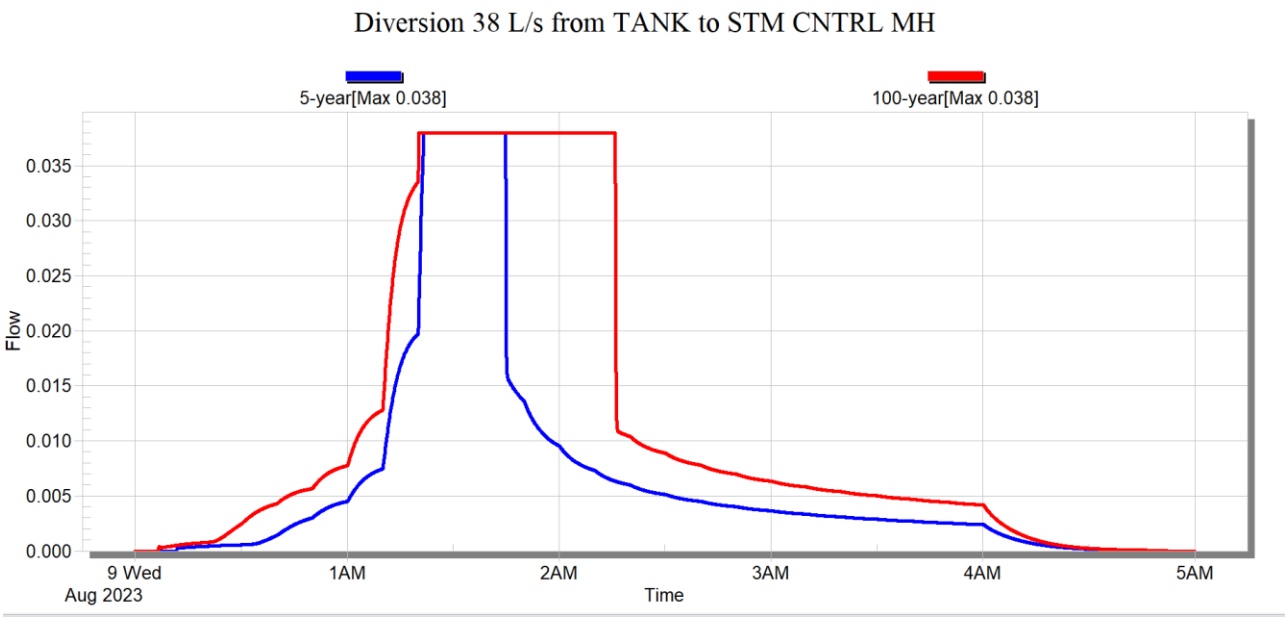


Figure 4 - Flow vs. Time for Pumped Outlet from 100-Year SWM Tank

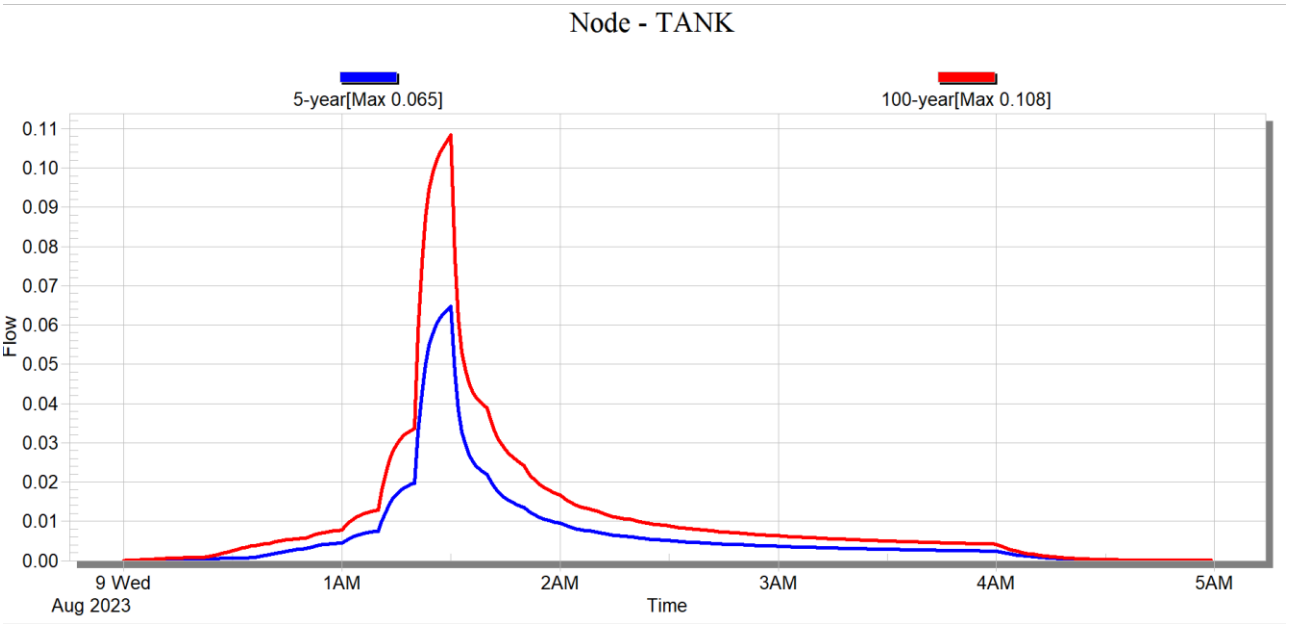


Figure 5 - Flow vs. Time for Storm Runoff into the Tank from the Site

Figure 6 - 5-Year Storm – Dynamic Longitudinal Section

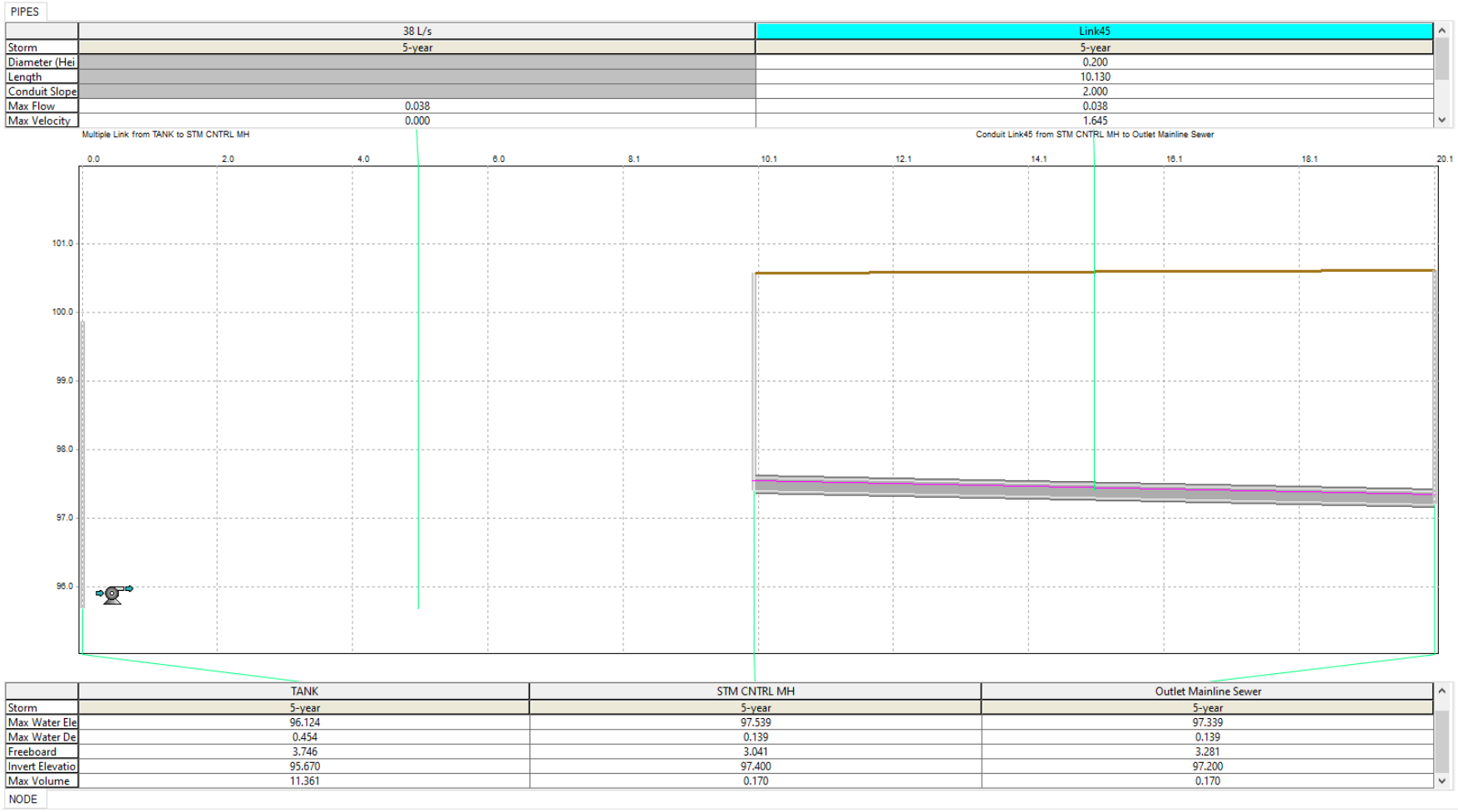
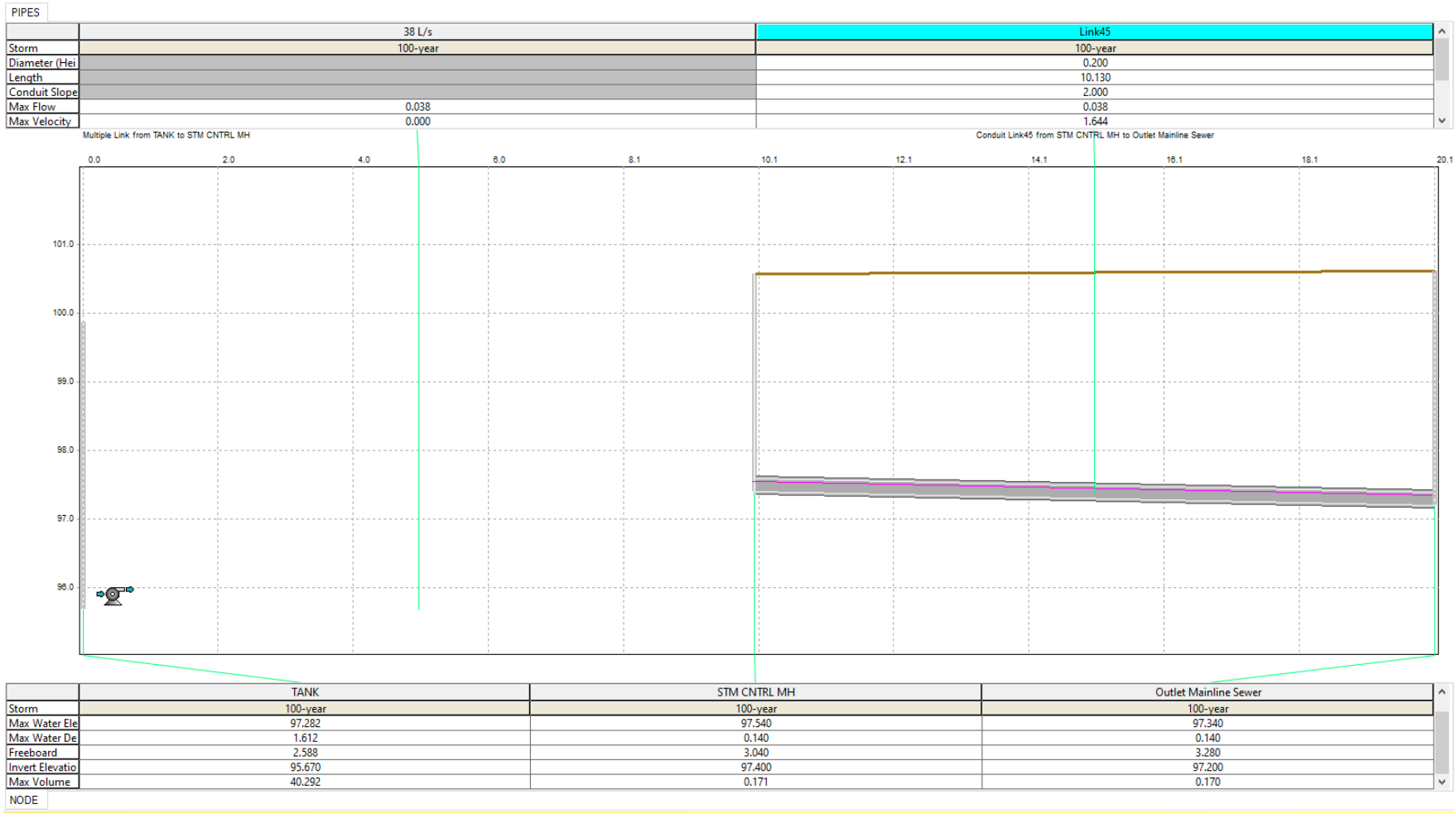


Figure 7 - 100-Year Storm – Dynamic Longitudinal Section



v) Water Budget/Stormwater Retention

The primary objective of the Water Balance/Budget Targets/Criteria is to capture and manage annual rainfall on the development site itself to preserve the pre-development hydrology (or "water balance", which typically consists of three components: runoff, infiltration, and evapotranspiration) through a combination of infiltration, evapotranspiration, landscaping, rainwater reuse and/or other low impact development practices.

Storm water management water budget/retention criteria is given in the City of Burlington's manual *Stormwater Management Design Guidelines* (May 21, 2020). Section 6.1.3 therein provides site-level stormwater management stormwater retention/water budget criteria, which would apply to this development. That section states that proponents are required to maintain the water budget in accordance with a SWS, MDP or MESP that encompasses the subject site, or where not available, maintain pre-development water budget in the proposed development.

We are not aware of a SWS, MDP or MESP which would apply to this site, therefore the criteria given in the third paragraph of Section 6.1.3 has been adopted.

The third paragraph of Section 6.1.3 provides criteria for analysis of the water budget at a minimum the 5mm event should be retained. We assume the criteria at this time is to retain the 5mm event.

The water balance target volume is as follows.

	Initial Abstraction (mm)	Area (m^2)	Volume (m^3)
5mm Volume Whole Site	5	3200	16.00
Less Impervious Surfaces initial abstraction – Catchment 1	1	2200	2.20
Pervious Surfaces initial abstraction – Catchment 2	5	1000	5.00
Required Retention Volume			***8.8***

A cistern of minimum volume $10m^3$ is required to retain the required volume of stormwater. The cistern will function such that in minor storm events, runoff draining from the site's mechanical roof drains will first drain into the cistern for storage and reuse as this water is considered clean water.

In storm events greater than 5mm, the cistern will fill-up and stormwater will spillover into the larger storage area allocated for 100-year storm storage before draining via the site's storm connection. Refer to Cross-Section A-A on the Functional Servicing Plan.

Various alternatives are considered by which the foregoing water balance target might be achieved on this site, as follows.

1) ***Infiltration Gallery (Percolation)***: The proposed development is entirely comprised of the proposed below-grade parking structure below-grade. Infiltration is not feasible because the design criteria – *MOE Stormwater Management Planning & Design* Manual, 2003, as well as the OBC – requires such an infiltration gallery to be located with a minimum 4.00m horizontal

separation from proposed buildings***. There is no such location on this site in which to locate an infiltration gallery, therefore it is not feasible to install an infiltration gallery.***

2) ***Irrigation***: Irrigation shall be explored in future as there are landscaped surfaces including trees at-grade – the capacity to uptake water by irrigation will be determined at the SPA stage. It is anticipated that irrigation alone will not consume the required volume, therefore greywater reuse is also investigated as follows.

3) ***Greywater reuse***: Greywater reuse is feasible, and may be required depending on the volume of water that can be reused by irrigation. Greywater reuse may be feasible as toilet flushing in the commercial or amenity areas only or where public toilets exist.

vi) Water Quality

Storm water management quality control criteria is given in the City of Burlington's manual *Stormwater Management Design Guidelines* (May 21, 2020). Section 6.1.4 *Quality Control* provides criteria which would apply to developments. That section states that a 'treatment train' approach to stormwater quality is required comprising at least two forms of water quality treatment in series to achieve 80% TSS removal, or satisfying the MECP 'Enhanced' criteria.

The site was divided according to surface conditions and the effective TSS removal for each surface condition was considered based on the treatment it would receive. The general basis of the effective TSS removal rates are as follows:

1. Rooftop areas are subject only to airborne particles and insignificant amounts of sediment transported by foot traffic. As such, an effective removal efficiency of 80% is utilized on a conventional roof to reflect the inherent runoff quality from a conventional roof.

2. Balconies and sodded areas are subject to insignificant amounts of sediment transport by foot traffic. An effective removal rate of 80% is used as it is the City limit for roofs.

3. Driving and ground-level pedestrian surfaces which are open-to-above will be subject to winter maintenance, therefore they are assumed to have an effective removal efficiency of 0% and stormwater quality treatment is thus required.

It is proposed to provide an oil grit separator capable of satisfying the 80% TSS removal criteria. The chosen product will be ETV Certified. We appreciate that this is a single-stage stormwater quality solution, rather than treatment-train approach as per the manual, however we provide the following rationale as to why this should be acceptable for this development and request City consideration.

The Burlington manual recognizes conventional Oil-Grit Separators as providing 50% TSS Removal. Section 6.1.4.4 of the City's manual states that the Canadian Environmental Technology Verification (CA-ETV) is the governing authority for storm filters/quality devices.

The CETV certification for the *Stormceptor STC*-model conventional Oil-Grit Separator by Imbrium Systems Inc. concurs with the town manual that the conventional OGS provides 50% TSS removal. Figure 6, as follows, is an excerpt from the CETV *Verification Statement – Imbrium Systems Inc. Stormceptor … Oil-Grit Separators* (November 2017).

Figure 8 shows that the Stormceptor conventional OGS provides typically 50-70% TSS removal, therefore the conclusion holds that a conventional OGS does not satisfactorily address the stormwater quality criteria for this site because it does not provide 80% TSS.

Figure 8 - Excerpt from CETV Verification Statement for Stormceptor OGS

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

Particle size fraction (µm)	Surface loading rate (L/min/m²)						
	40	80	200	400	600	1000	1400
>500	90	58	58	100*	86	72	100*
250 - 500	100*	100*	100	100*	100*	100*	100*
150 - 250	90	82	26	100*	100*	67	90
105 - 150	100*	100*	100*	100*	100*	100*	100
75 - 105	100*	92	74	82	77	68	76
53 - 75	Undefined [a]	56	100*	72	69	50	80
20 - 53	54	100*	54	33	36	40	31
8 - 20	67	52	25	21	17	20	20
5 – 8	33	29	11	12	9	7	19
<5	13	0	0	0	0	0	4
All particle sizes by mass balance	**70.4**	**63.8**	**53.9**	**47.5**	**46.0**	**43.7**	**49.0**

TSS Removal efficiency is ~50%

[a] An outlier in the feed sample sieve data resulted in a negative removal efficiency for this size fraction.
* Removal efficiencies were calculated to be above 100%. Calculated values ranged between 101 and 171% (average 128%).
See text and Bulletin # CETV 2016-11-0001 for more information.

The CETV also provides certification for stormwater quality filters that provide TSS removal by mechanical filtration through a filter media. One such model is the Jellyfish Filter by Imbrium Systems. The CETV verification statement for the Jelllyfish Filter by Imbrium Systems states that it provides a minimum 80% TSS Removal. Figure 7, as follows, is an excerpt from the CETV *Verification Statement – Imbrium Systems Inc. Jellyfish Filter …* (August 2017).

Figure 10 shows that the Jellyfish Filter provides 80% TSS Removal, therefore it addresses the City criteria for 80% TSS Removal. CETV Verification Statement will be provided during detailed design based on the CETV product chosen.

It is accordingly proposed to provide an CETV Certified OGS such as a Jellyfish Filter by Imbrium to address City criteria for 80% TSS Removal. This is in lieu of providing a conventional OGS with a treatment-train approach to providing 80% TSSR. This strategy of using a manufactured treatment device/filter is more practical on a development like this because it is not feasible to install permeable pavers/bioswales etc. in small infill developments such as this which are entirely underlain by the underground parking structure.

An appropriate CETV Certified Oil/Grit Separator will such as Jellyfish Filter will be specified to provide 80% TSS Removal at the SPA stage. Refer to the Functional Servicing Plan for the proposed location of the oil/grit separator which will be detailed further at site plan approval stage.

Figure 9 - Excerpt from CETV Verification Statement for Jellyfish Filter

Table 4. Summary statistics for influent and effluent event mean concentrations for selected constituents

Water Quality Variable	Sampling Location	Min	Max	Median	Range	Mean	SD	Load based removal efficiency (%)
TSS	Influent (mg/L)	16.30	261.00	79.30	244.70	86.26	51.37	87.2
	Effluent (mg/L)	3.20	21.70	11.80	18.50	10.99	4.79	
SSC	Influent (mg/L)	78.20	1401.70	444.50	1323.50	482.26	338.34	98.6
	Effluent (mg/L)	2.80	18.10	7.30	15.30	7.88	3.77	
TP	Influent (µg/L)	887.00	8793.00	3063.00	7906.00	3550.20	1914.50	64.2
	Effluent (µg/L)	472.00	4769.00	1480.00	4297.00	1688.08	1059.98	
TN	Influent (µg/L)	1170.00	10479.00	3110.00	9309.00	3519.32	2161.47	46.3
	Effluent (µg/L)	553.00	6579.00	1610.00	6026.00	2091.76	1613.61	
Zn	Influent (µg/L)	0.005	7600.00	1500.00	7600.00	1792.00	1852.91	76.1
	Effluent (µg/L)	0.005	2760.00	450.00	2760.00	561.64	594.70	
Cu	Influent (µg/L)	0.001	880.40	79.50	880.40	171.28	229.33	92.1
	Effluent (µg/L)	0.001	51.30	6.90	51.30	14.36	17.22	
Oil and Grease	Influent (mg/L)	0.20	4.06	0.93	3.86	1.07	0.82	46.4
	Effluent (mg/L)	0.00	2.32	0.35	2.32	0.50	0.60	

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6.0 GROUNDWATER

i) Introduction

It is proposed to discharge any water collected by the building's foundation drains into the proposed storm sewer connection, as discussed in Section 5.0, above.

Hydrological investigation by B.I.G. Consulting INC. shows that the groundwater elevations range between 92.60-92.72 m within the site boundary, see below the interpreted groundwater contour plan.

Based on functional grading plan the underground elevation will be more than 95.5m which is higher than the highest groundwater elevation 92.72m.

A *Preliminary Hydrogeological Investigation* (dated September 19, 2023) has been prepared for this development by BIG Consulting Inc. to qualitatively and quantitatively characterize the groundwater with respect to City of Burlington and Halton Region guidelines.

The report concludes in Table 5-2 that the short-term construction dewatering volume will be up to 218,000 L/day without a safety factor and with applying a safety factor of 2.5 the dewatering volume will be 545,000 L/day (6.3 L/sec).

The report further concludes in Table 6-2 that the long-term flows into the building's foundation drains will be 100,000 L/day (1.16 L/sec) (including safety factor).

ii) Long-Term Groundwater

The hydrogeological investigation states as above that the peak daily volume entering the foundation drains will be 100,000 L/day, which equates to flows of 1.16 L/s. It is intended to collect this water in a sump installed in the proposed buildings below-grade levels and pump it into the proposed Building's storm control maintenance hole, thereby draining to the storm sewer connection. It is assumed that a peaking factor will be applied in the design of the pump such that the pumped groundwater discharge rate is 4.0 L/s. This is considered in the controlled storm flows compliance, as outlined in Table 6, above. It is discussed above that the site remains within the allowable storm flows notwithstanding the foundation drainage flows.

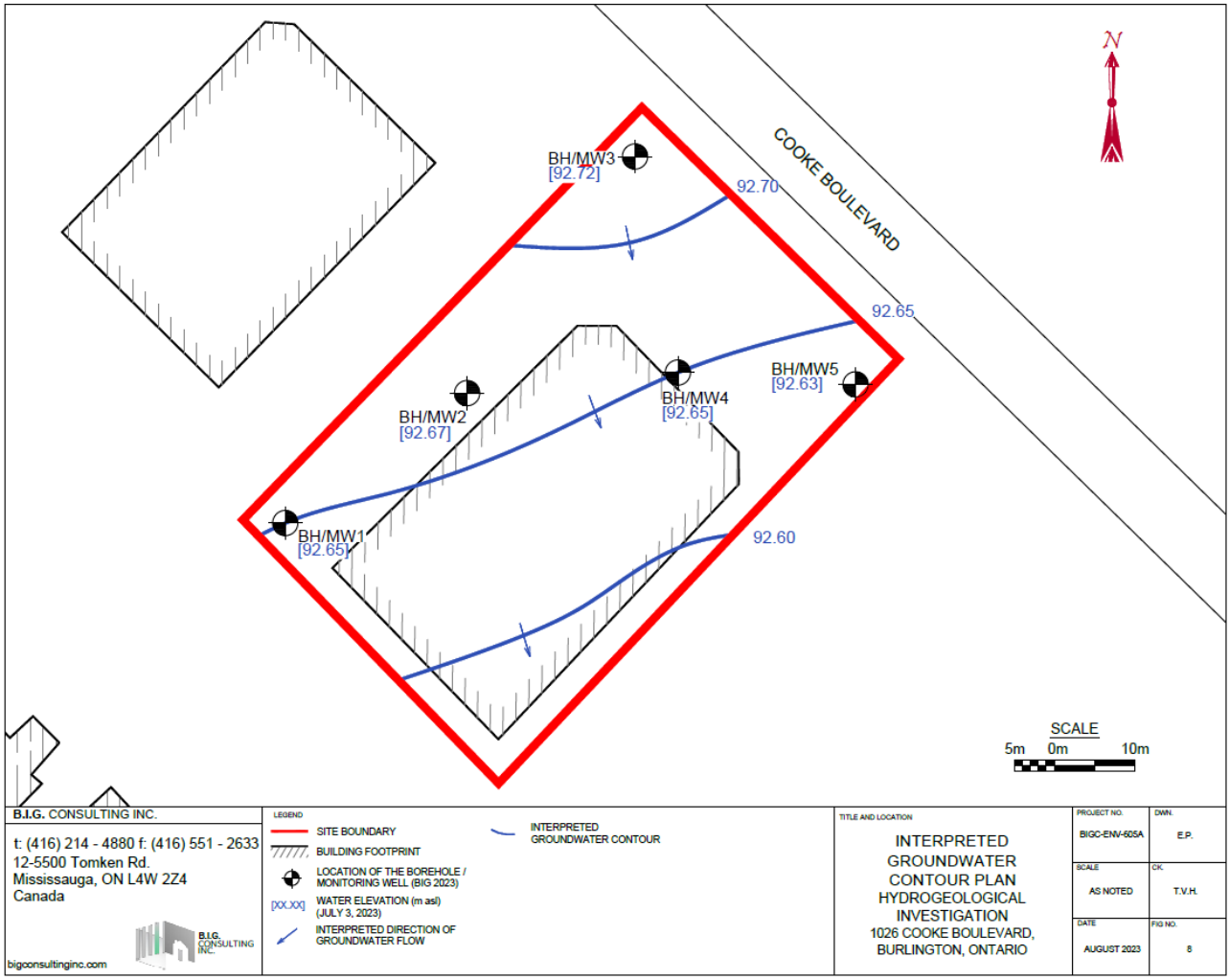
The owner intends to review, in future, the feasibility of discharging the foundation drainage groundwater to the storm sewer connection, relative to the City criteria. If, pending future hydrogeological conclusions, it is unfeasible to filter the water to address such criteria, the building's foundations may then instead be 'bathtubbed' such that there is no groundwater discharge.

iii) Short-Term (Construction) Groundwater

Groundwater collected during the site's excavation and construction by either sumps or wellpoints will need to be discharged to facilitate the excavation-for and construction-of the proposed building.

The short-term groundwater flow rate identified by the Hydrogeological Assessment totals up to 545,000 L/day (6.3 L/s). It is proposed to discharge this flow rate into one of the Site's existing storm sewer laterals (as shown on the Functional Servicing Plan). This temporary groundwater flow rate is less than the allowable storm flow rate (45.0 L/s, as per Table 3), therefore short-term/construction

groundwater flows are within the allowable flow rate. Any storm sewer water quality exceedances will need pretreatment prior to release. This will be completed by the Owner's chosen Dewatering Contractor at the time of construction.



7.0 CONCLUSIONS

From the foregoing investigation, the site is serviceable utilizing existing sanitary/wastewater sewers and watermain infrastructure adjacent to the site. Storm water management can be accommodated with on-site storage as described in this report.

The following table summarizes the SWM and Servicing components of the proposed development.

TABLE 6 - Summary

Peak Sanitary Discharge (L/s)	8.85 L/s
Proposed Sanitary Service	200mm @ 2.0%
Receiving Sanitary Sewer	Cooke Blvd. 300mm Sanitary sewer to be upgraded as per CIVICA recommendations
Development Water Demand (Fire + Domestic)	1141 USGM (Largest fire flow demand is given by largest level area)
Available Flow Rate	2738 USGM
Proposed Fire Service	200mm + redundant 200mm (to be confirmed at SPA with Sprinkler Consultant)
Proposed Domestic Service	Branch 150mm
Allowable release rate from site (L/s)	45.1 L/s
Proposed release rate from site (L/s) (100-year storm)	42.0 L/s
Stormwater Quality	CETV Certified to 80% to be detailed and designed at SPA Stage
Quantity Control	120m^3 Stormwater Detention Storage Tank
Water Balance	5mm (10 cu.m.)

8.0 REFERENCES

1. City of Burlington *Stormwater Management Design Guidelines* (May 21, 2020).

2. Storm water Management Planning and Design Manual, Ontario Ministry of the Environment, March 2003.

3. Halton Region *Water and Wastewater Linear Design Manual* (April 2019)

4. New Jersey Storm Water Best Management Practices Manual, April 2004.

Respectfully Submitted;
The Odan Detech Group Inc.



Mark Harris
Digitally signed by Mark Harris
DN: cn=Mark Harris, o=The Odan/Detech Group Inc., ou, email=mark@odandetech.com, c=CA
Date: 2023.11.15 14:15:21 -05'00'

Paul Hecimovic, P.Eng.

Mark Harris, Dipl.Tech.
Senior Project Manager

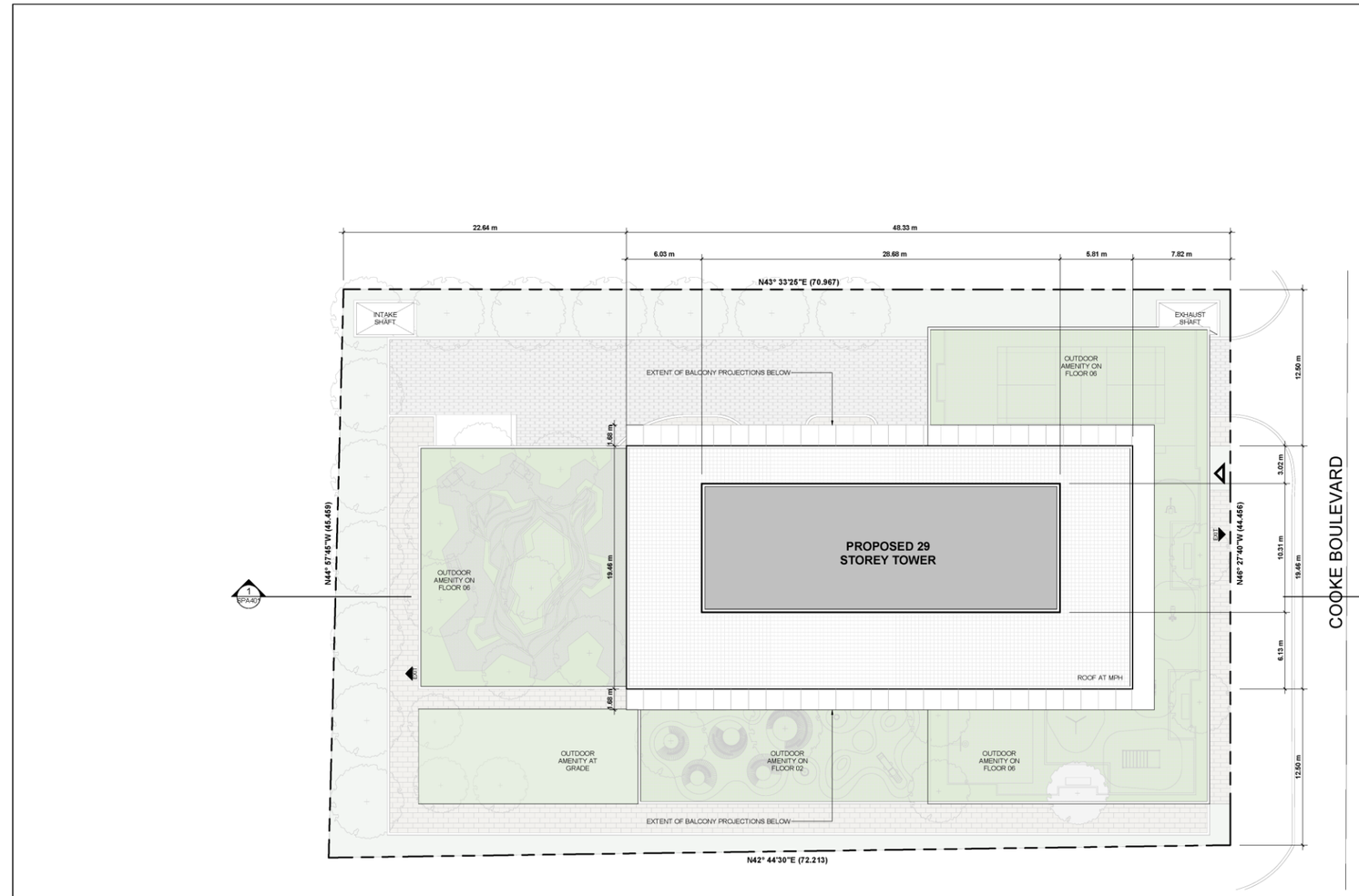
APPENDIX A

Existing Site	Aerial view of Site and surrounding area
Site Plan, Floor Plan & Statistics	by Turner Fleischer Architects Inc.

AERIAL VIEW OF SITE



SITE PLAN



TURNER FLEISCHER

Turner Fleischer Architects Inc.
67 Lesmill Road
Toronto, ON, M3B 2T8
T 416 425 2222
turnerfleischer.com

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LEGEND

	PRIMARY RESIDENTIAL ENTRANCE
	SECONDARY RESIDENTIAL ENTRANCE
	RETAIL ENTRANCE
EXIT	EXIT
FH	FIRE HYDRANT
	SIAMESE CONNECTION
	CONVEX MIRROR
	TRANSFORMER WITH CLEARANCES
	FIRE ROUTE SIGN
000.00	SPOT ELEVATION
GM HM	GAS/HYDRO METER

DRAFT
IN PROGRESS

#	DD/MM/DD DATE	ISSUED FOR REZONING DESCRIPTION	BY
1			

PROJECT
1026 Cooke Blvd, Burlington, ON

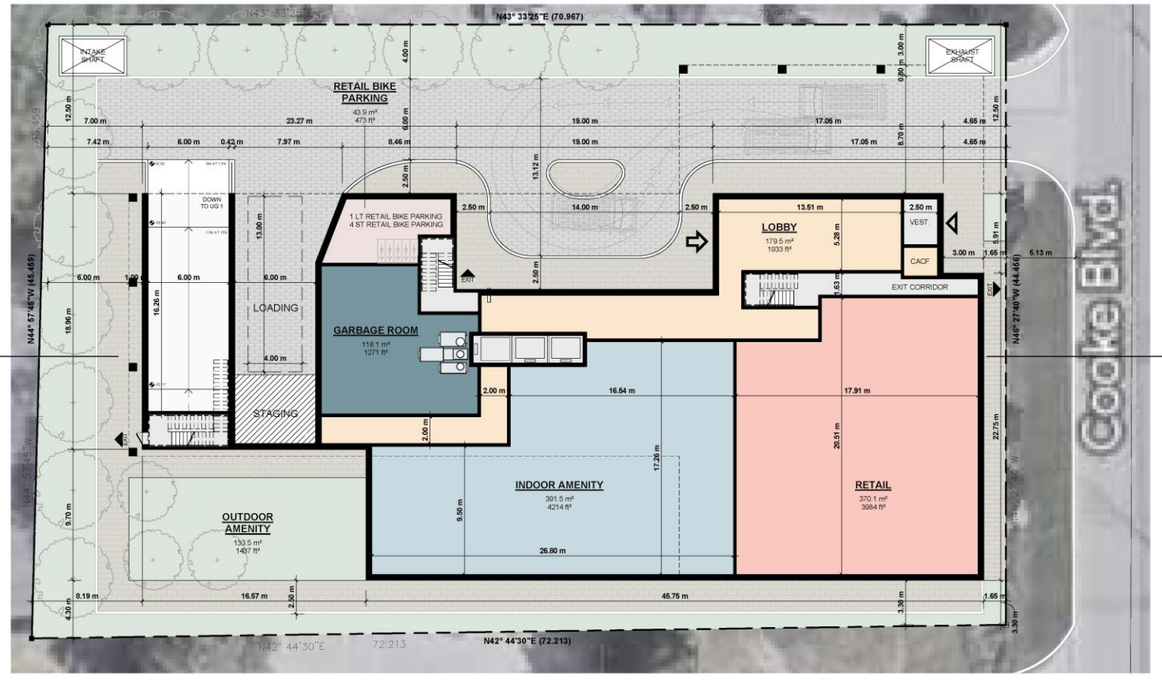
DRAWING
SITE PLAN / ROOF PLAN

PROJECT NO.	22.255P01
PROJECT DATE	2023-09-07
DRAWN BY	NMU
CHECKED BY	RMM
SCALE	1 : 150

DRAWING NO. SPA005 | REV. 1

2023-10-26 5:37:53 PM

GROUND FLOOR PLAN



TURNER FLEISCHER

Turner Fleischer Architects Inc.
67 Lesmill Road
Toronto, ON. M3B 2T8
T 416.426.2222
turnerfleischer.com

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LEGEND

- PRIMARY RESIDENTIAL ENTRANCE
- SECONDARY RESIDENTIAL ENTRANCE
- RETAIL ENTRANCE
- EXIT
- FIRE HYDRANT
- SIAMESE CONNECTION
- CONVEX MIRROR
- TRANSFORMER WITH CLEARANCES
- FIRE ROUTE SIGN
- 000.00 SPOT ELEVATION
- GAS/HYDRO METER

DRAFT IN PROGRESS

#	DESIGNER	DESCRIPTION	BY
1	DATE	ISSUED FOR REZONING	

PROJECT
1026 Cooke Blvd, Burlington, ON

DRAWING
FLOOR 01

PROJECT NO.	22.255P01
PROJECT DATE	2023-09-07
DRAWN BY	NMU
CHECKED BY	RMM
SCALE	1 : 150

DRAWING NO. SPA151 | REV. 1

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SITE STATISTICS

22.255P01 - 1026 Cooke Blvd.
BURLINGTON, ONTARIO

PROJECT SUMMARY

FLOOR AREA RATIO	m²	ft²	%
BUILDING COVERAGE (GROUND FLOOR)	1,472.0	15,844	45.8%
LANDSCAPED OPEN SPACE	1,215.4	13,082	37.8%
PAVED AREA	529.5	5,699	16.5%
TOTAL SITE AREA	3,216.9	34,626	100%

GROSS FLOOR AREA SUMMARY

PARCEL	USE	GFA		FSI
		m²	ft²	
BUILDING 1	RETAIL	370.1	3,984	0.12
	TOTAL NON-RESIDENTIAL	370.1	3,984	0.12
	RESIDENTIAL	22,057.7	237,427	6.86
	INDOOR AMENITY	1,174.8	12,646	0.37
	TOTAL RESIDENTIAL	23,232.5	250,073	7.22
	TOTAL	23,602.7	254,057	7.34

TOTAL FLOOR AREA SUMMARY

FLOORS	TFA	
	m²	ft²
U/G 1 - U/G 4	12,077.4	130,000
FLOOR 1 - FLOOR 29	25,591.1	275,464
TOTAL	37,668.9	405,465

GROSS FLOOR AREA DEFINITION

CITY OF BURLINGTON ZONING BY-LAW 2020

The sum of the areas of each floor of a building but shall include a basement or cellar when used for commercial purposes. Measurement shall be from the exterior face of outside walls, or from the centre line of partition and common walls. Gross Floor Area shall not include floor space devoted to:

(A)Vehicle Parking;
(B)Storage;
(C)Air Handling Equipment;
(D)Enclosed Mall and Hallways, excluding kiosk, stairways;
(E)Elevators and associated equipment;
(F)Washrooms;
(G)Foyers, Lobbies (Not Waiting Rooms)

TOTAL FLOOR AREA DEFINITION

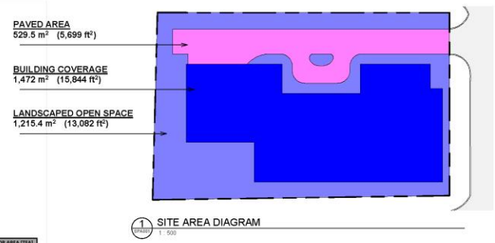
CITY OF BURLINGTON ZONING BY-LAW 2020

The total area of the floor measured to the outside of all outside walls or the centre of common walls, excluding any basement, cellar, garage, car port, unenclosed porch, or unenclosed veranda. A basement associated with a restaurant use, used for storage purposes shall not be included in the calculation of permitted floor area. For Accessory Buildings or Structures, floor area means the total area of all floors measured to the outside of all exterior walls or posts. Storage area may be included within the roofline.

AMENITY DEFINITION

CITY OF BURLINGTON ZONING BY-LAW 2020

The area situated within the boundaries of a project and intended for recreational purposes, which may include open spaces, patios, balconies, communal play areas, lounges, sundecks, and toolsheds, but shall not include the area occupied at grade by the buildings, service areas, parking, and driveways.



1 SITE AREA DIAGRAM (SPA1) 1 : 500

GROSS FLOOR AREA (GFA) BREAKDOWN

BUILDING 1	FLOOR	# OF UNITS	GROSS FLOOR AREA BREAKDOWN: RETAIL		RETAIL GALLERIA		RETAIL SERVICE		TOTAL RETAIL		RESIDENTIAL SALEABLE		RESIDENTIAL NON-SALEABLE		TOTAL RESIDENTIAL		TOTAL GROSS FLOOR AREA [GFA] (TFA - EXCLUSIONS)	
			m²	ft²	m²	ft²	m²	ft²	m²	ft²	m²	ft²	m²	ft²	m²	ft²	m²	ft²
	U/G 4																	
	U/G 3																	
	U/G 2																	
	U/G 1																	
	SUB-TOTAL		370.1	3,984					370.1	3,984			943.4	10,153	943.4	10,153	1,022.0	11,002
	MEZZANINE																	
	2	14									926.8	9,976	115.7	1,246	1,042.6	11,222	1,423.2	15,319
	3	21									1,307.5	14,073	116.0	1,249	1,423.5	15,322	1,423.5	15,322
	4	21									1,307.5	14,073	116.0	1,249	1,423.5	15,322	1,423.5	15,322
	5	21									1,307.5	14,073	116.0	1,249	1,423.5	15,322	1,423.5	15,322
	6	5									342.3	2,609	54.7	589	397.0	3,196	699.7	7,531
	7	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	8	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	9	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	10	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	11	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	12	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	13	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	14	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	15	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	16	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	17	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	18	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	19	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	20	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	21	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	22	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	23	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	24	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	25	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	26	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	27	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	28	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	29	11									642.3	6,914	58.0	625	700.3	7,538	700.3	7,538
	MPH																	
	TOTAL	335	370.1	3,984					370.1	3,984	19,864.2	213,816	2,193.6	23,611	22,057.7	237,427	23,602.7	254,057

AMENITY BREAKDOWN

OUTDOOR AMENITY		INDOOR AMENITY	
m²	ft²	m²	ft²
135.5	1,459	391.1	4,210
285.0	3,068	380.6	4,097
87.3	939		
45.7	491		
45.7	491		
856.4	9,218	402.7	4,335
50.5	543	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
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49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
247.5	2,664	247.5	2,664
4,743.5	51,058	1,174.8	12,646

AREA EXCLUSIONS		TOTAL FLOOR AREA [TFA] (NO EXCLUSIONS)	
TOTAL EXCLUSIONS			
m²	ft²	m2	ft2
3,019.4	32,500	3,019.4	32,500
3,019.4	32,500	3,019.4	32,500
3,019.4	32,500	3,019.4	32,500
3,019.4	32,500	3,019.4	32,500
3,019.4	32,500	3,019.4	32,500
247.5	2,664	1,280.8	13,834
143.1	1,541	1,566.3	16,860
142.8	1,538	1,566.3	16,860
142.8	1,538	1,566.3	16,860
142.8	1,538	1,566.3	16,860
50.5	543	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
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49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
49.6	534	749.9	8,072
247.5	2,664	247.5	2,664
14,457.7	155,621	37,668.9	405,465

AMENITY AREAS - REQUIRED & PROVIDED

BUILDING 1	TYPE	REQUIRED			PROVIDED		
		RATIO	m2	ft2	RATIO	m2	ft2
	ONE BEDROOM UNIT AMENITY BREAKDOWN	20.0 m2/ UNIT	3340.0	35,952	3.5 m2 / UNIT	1,174.8	12,646
	TWO OR MORE BEDROOM UNIT AMENITY BREAKDOWN	35.0 m2/ UNIT	5880.0	63,292	14.2 m2 / UNIT	4,743.5	51,058
	TOTAL AMENITY	27.5 m2/ UNIT	9,220.0	99,244	17.7 m2 / UNIT	5,918.3	63,704

CITY OF BURLINGTON ZONING BY-LAW 2020

UNIT MIX - PROVIDED

FLOOR	UNIT TYPE							TOTAL	AVERAGE UNIT SIZE	
	STUDIO	1B	1B+D	2B	2B+D	3B	3B+D		m²	ft²
1										
2		3		9		2		14	66.2	713
3		4	3	11		3		21	62.3	670
4		4	3	11		3		21	62.3	670
5		4	3	11		3		21	62.3	670
6		3	2					5	48.5	522
7		5	1	4		1		11	58.4	629
8		5	1	4		1		11	58.4	629
9		5	1	4		1		11	58.4	629
10		5	1	4		1		11	58.4	629
11		5	1	4		1		11	58.4	629
12		5	1	4		1		11	58.4	629
13		5	1	4		1		11	58.4	629
14		5	1	4		1		11	58.4	629
15		5	1	4		1		11	58.4	629
16		5	1	4		1		11	58.4	629
17		5	1	4		1		11	58.4	629
18		5	1	4		1		11	58.4	629
19		5	1	4		1		11	58.4	629
20		5	1	4		1		11	58.4	629
21		5	1	4		1		11	58.4	629
22		5	1	4		1		11	58.4	629
23		5	1	4		1		11	58.4	629
24		5	1	4		1		11	58.4	629
25		5	1	4		1		11	58.4	629
26		5	1	4		1		11	58.4	629
27		5	1	4		1		11	58.4	629
28		5	1	4		1		11	58.4	629
29		5	1	4		1		11	58.4	629
SUBTOTAL		133	34	134		34		335		
TOTAL UNITS		167		134		34			59.3	638
UNIT MIX		50%		40%		10%		100.0%		

VEHICULAR PARKING - PROPOSED

BUILDING 1	USE	RATIO (MIN.)	UNITS	SPACES (MIN.)
	RETAIL / VISITOR	0.24 / UNIT	335	80
	RESIDENTIAL	0.71 / UNIT		238
	TOTAL REQUIRED	0.94 / UNIT		318

CITY OF BURLINGTON ZONING BY-LAW 2020

VEHICULAR PARKING - PROVIDED

BUILDING 1	FLOOR	USE: RESIDENTIAL	CAR SHARE (1 SPOT EFFECTIVE 4 SPACES)	VISITOR / RETAIL	TOTAL
	FLOOR 1				
	U/G LEVEL 1			73	73
	U/G LEVEL 2	75		7	82
	U/G LEVEL 3	82			82
	U/G LEVEL 4	81			81
	TOTAL PROVIDED	238		80	318

ACCESSIBLE PARKING - REQUIRED

BUILDING 1	USE	RATIO (MIN.)	PARKING SPACES PROVIDED	SPACES (MIN.)
	RETAIL / VISITOR	53 : 50 SPACES	80	2
	RESIDENTIAL	0.03 / SPACES	238	7
	TOTAL REQUIRED			9

ACCESSIBLE PARKING - PROVIDED

BUILDING 1	FLOOR	USE: RESIDENTIAL	CAR SHARE (1 SPOT EFFECTIVE 4 SPACES)	VISITOR / RETAIL	TOTAL
	FLOOR 1				
	U/G LEVEL 1			2	2
	U/G LEVEL 2	2			2
	U/G LEVEL 3	2			2
	U/G LEVEL 4	3			3
	TOTAL PROVIDED	7		2	9

BICYCLE PARKING - PROPOSED

BUILDING 1	USE	RESIDENTIAL: RATIO	RESIDENTIAL: SPACES	NON-RESIDENTIAL: RATIO	NON-RESIDENTIAL: SPACES	TOTAL
	SHORT TERM	0.05 / UNIT	17	3+ 1.00 / 1000m²	4	21
	LONG TERM	0.50 / UNIT	168	3+ 1.00 / 1000m²	1	169
	TOTAL REQUIRED		185		5	190

CITY OF BURLINGTON ZONING BY-LAW 2020

BICYCLE PARKING - PROVIDED

BUILDING 1	FLOOR	RESIDENTIAL: SHORT TERM	RESIDENTIAL: LONG TERM	RESIDENTIAL: SUB-TOTAL	NON-RESIDENTIAL: SHORT TERM	NON-RESIDENTIAL: LONG TERM	NON-RESIDENTIAL: SUB-TOTAL	TOTAL
	FLOOR 1				4	1	5	5
	U/G LEVEL 1							
	U/G LEVEL 2		16	16				16
	U/G LEVEL 3	17	152	169				169
	U/G LEVEL 4							
	TOTAL PROVIDED	17	168	185	4	1	5	190

TURNER FLEISCHER

Turner Fleischer Architects Inc.
87 Leonid Road
Toronto, ON, M3B 2T6
T 416 425 2222
turnerfleischer.com

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DRAFT
IN PROGRESS

NO.	BY/MM/DD	ISSUED FOR REZONING	BY
1	DATE	DESCRIPTION	

PROJECT
1026 Cooke Blvd, Burlington, ON

DRAWING
STATISTICS

PROJECT NO.: 22.255P01
PROJECT DATE: 2023-09-07
DRAWN BY: NMU
CHECKED BY: RMM
SCALE:

DRAWING NO.: SPA001 | REV.: 1

2023-10-26 5:34:59 PM

APPENDIX B

1026 Cooke Boulevard Sanitary Sewer Capacity Analysis Report by Civica Infrastructure Ltd.

CIVICA
Water Management Solutions

Prepared For
The Odan/Detech Group Ltd.

Report For
1026 Cooke Boulevard
Sanitary Sewer Capacity Analysis

October 26, 2023

330 Rodinea Road, Unit 3
Vaughan, Ontario, Canada L6A 4P5
(905) 417-9792
www.civi.ca

CIVICA
Water Management Solutions

STATEMENT OF QUALIFICATIONS AND LIMITATIONS

The attached Sanitary Capacity Analysis (the "Report") has been prepared by Civica Infrastructure Inc. (the "Consultant") at the request of, and for the exclusive use of, the Odan/Detech Group Ltd. (the "Client") in accordance with the terms of agreement between the Consultant and the Client, including the scope of work detailed therein (the "Agreement").

Please note that the information, data, analysis, recommendations, and conclusions contained in the Report was prepared for the specific purposes described in the Report and the Agreement and may be based upon information which has not been independently verified by the Consultant. The Consultant shall be entitled to rely upon the accuracy and completeness of information that was provided to the Consultant and has no obligation to update such information. The material in this report reflects the Consultant's best professional judgement in the light of the information available to it at the time of preparation and publication.

The Consultant agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement. The Consultant makes no other representations, any guarantees, or warranties whatsoever, whether expressed or implied, with respect to the Report or any part thereof.

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This Statement of Qualifications and Limitations is attached to, and forms part of the Report and any usage of the Report is subject to the terms therein.

CIVICA
Water Management Solutions

October 26, 2023 **CIVICA REF: ODA23-0036**

The Odan/Detech Group Inc.
5230 South Service Road, Unit 107
Burlington, Ontario
L7L 5K2

Attention: Mark Harris, P.Eng.

Dear Mr. Harris,

RE: 1026 Cooke Boulevard Sanitary Capacity Analysis

Civica Infrastructure Inc. (Civica) is pleased to submit the Sanitary Capacity Analysis for the proposed development at 1026 Cooke Blvd in Burlington, Ontario. Civica developed its own model network in InfoWorks ICM to assess the existing and proposed conditions of the sanitary sewer downstream of the proposed development. The model was used for the hydraulic analysis to determine the peak flow and Hydraulic Grade Line (HGL) elevation within the downstream sanitary sewer.

Based on the analysis and assumptions presented in the following report, the findings can be summarized as follows:

1. The expected sanitary peak flow from the proposed development, as observed at the outlet, is anticipated to be 8.85 L/s;
2. The upgraded sanitary sewer is able to maintain free-flowing conditions during dry-weather flow for the proposed intensification along Cooke Blvd, north of Plains Rd E, including the proposed flows for 1026 Cooke Blvd;
3. The upgraded sanitary sewer is able to maintain basement flooding protection during wet-weather flow conditions for the proposed intensification along Cooke Blvd, north of Plains Rd E, including the proposed flows for 1026 Cooke Blvd;
4. The existing sanitary sewer system does not have the capacity to accommodate the existing or proposed wet-weather flows without the need for any external upgrades or retrofits; and,
5. Based on the analysis and assumptions presented in the report, it is recommended that the development proceeds after the sanitary sewer upgrades along Cooke Blvd and Plains Rd E have successfully been completed.

Do not hesitate to contact us for further clarification and/or comment.

Sincerely,

CIVICA INFRASTRUCTURE INC.

Robert Hughson

Project Manager

Encl. 1026 Cooke Blvd Sanitary Capacity Analysis Report

Document History & QA/QC

Prepared by:

Robert Hughson
Project Manager
Civica Infrastructure Inc.

Reviewed by:

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Approved by:

Edward Graham, M.A.Sc.Eng., P.Eng.
President
Civica Infrastructure Inc.

Revision History

Name	Date	Reason for Change	Version
Robert Hughson	**2023-10-26**	**Draft Report**	**Version 1**

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1.0 Introduction

This report summarizes the sanitary servicing analysis for the proposed development located at 1026 Cooke Boulevard, between Masonry Court and Plains Road East, in Burlington, Ontario.

The existing site is currently occupied by a single storey commercial building. The proposed site development consists of a 29-storey mixed use building with a population of approximately 707 persons.

The capacity conditions in the existing sanitary sewer system have been evaluated from the proposed site to the trunk sewer on Waterdown Road. **Figure 1-1** shows the location of the proposed development site and the contributing drainage area.

1.1 Servicing Connections

Sanitary flows from the existing site are currently discharging to the 300-mm sanitary sewer on Cooke Blvd. The sanitary sewer flows south on Cooke Blvd converging with westbound flows in the 250-mm sanitary sewer on Plains Rd E. The flows ultimately discharge into the 675-mm Sanitary Trunk Sewer (STS) at the intersection of Waterdown Rd and Plains Rd E. **Figure 1-2** shows the downstream sewer conveyance flow the outlet.

It is proposed to upgrade three (3) sections of sanitary sewer along Cooke Blvd from 300-mm to 375-mm and three (3) sections of sanitary sewer along Plains Rd E from 250-mm to 450-mm in order to mitigate existing dry-weather flow issues. These proposed upgrades have been sized sufficiently to ensure that the water level (HGL) is less than the existing conditions even after the proposed developments are implemented. See **Figure 1-2** for location of upgrades along the conveyance.

1.2 Capacity Analysis Approach

Initial research performed by the Odan Detech Group revealed that previous work done in the area (1120 Cooke Blvd) had utilized a dynamic model developed using InfoWorks at the request of the Region. A similar approach was used due to a dynamic model being more conservative than the Region's static InfoSewer model. Civica developed its own model network in InfoWorks ICM using data from the Region's InfoSewer model. The drainage area population was estimated using information found in the 1120 Cooke Blvd Sanitary Analysis Report and comparing it with the Region's Linear Design Manual. The dry-weather generation rate used for the drainage area in the model uses a generation rate of 275 L/c/d for both residential and non-residential areas. These generation rates were obtained from the Region's Linear Design Manual. This model was used to assess the sanitary sewer downstream of the proposed site. Further details on the modelling methodology can be found in **Section – Methodology**.

The drainage system was also evaluated to include new and other proposed developments/re-developments in the area. Four (4) new developments were found in the drainage area. **Table 1-1** shows the information of the new developments and **Figure 1-1** shows the location of the proposed development site.

Table 1-1: Proposed Developments in the Drainage area

Number	Site Address	Site Area (ha)	Population	Peak I/I (L/s)	Total Peak Flow (L/s)
1	53 Plains Rd E	0.97	285	0.28	3.98
2	1062-1074 Cooke Blvd	0.70	1705	0.20	19.94
3	1120 Cooke Blvd	1.02	3299	0.29	36.07
4	101 Masonry Crt	3.17	2090	0.91	24.66

Note: Future Developments Assumes a per-capita generation rate of 275 l/c/d for residential and an I/I rate of 0.286 L/s/ha.

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Legend

- Drainage Area
- New Development
- Proposed Site
- Sanitary
- Sanitary
- Trunk

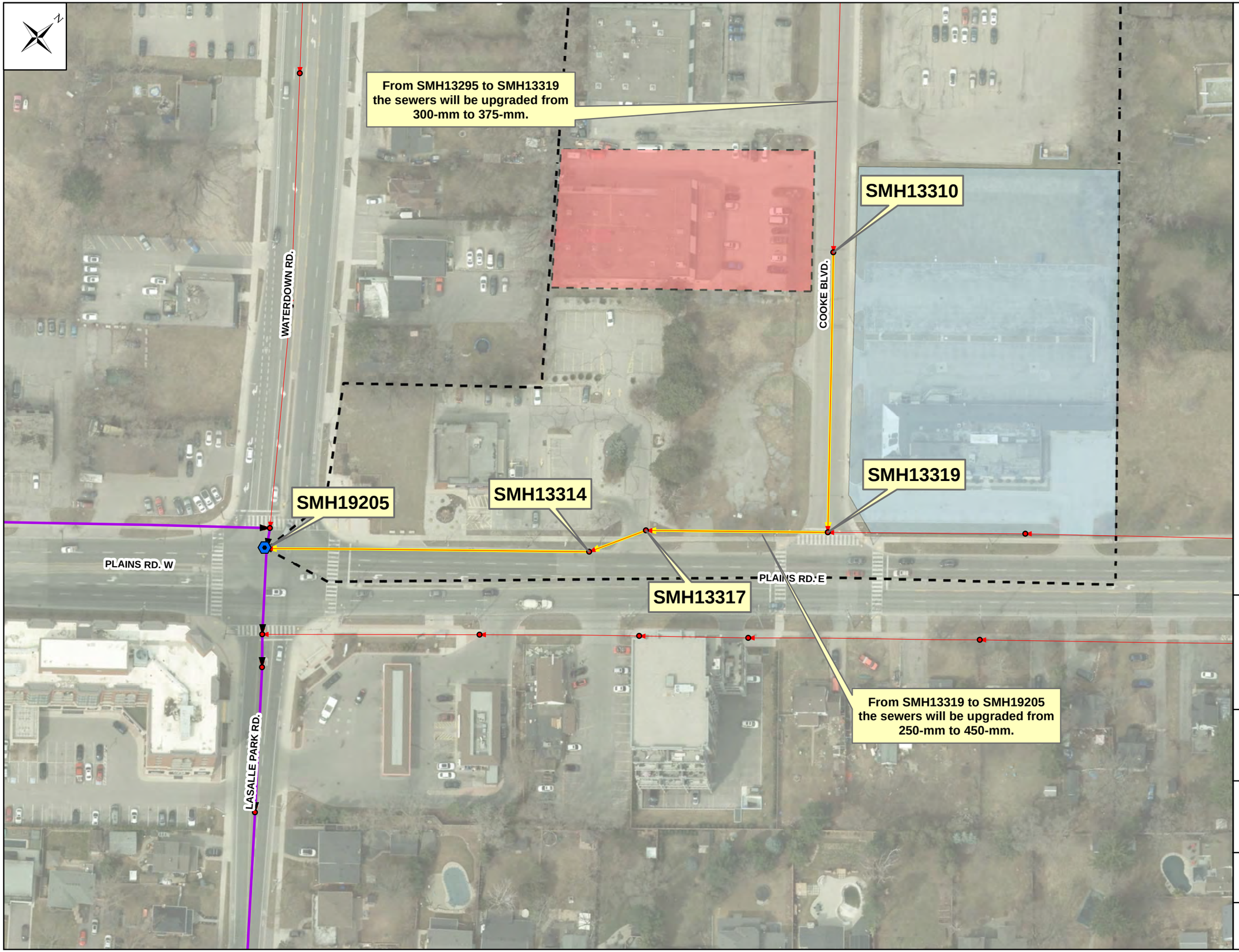
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ODA23-0036
1026 Cooke Boulevard Sanitary Capacity Analysis

Figure 1-1:
Sanitary Sewer Tributary Area

Drawn By: R.H. Date: Oct 25, 2023

0 25 50 100 Meters



Legend

- Drainage Area
- New Development
- Proposed Site

Sewer Infrastructure

Manhole

- Sanitary
- Outlet

Sewerline

- Sanitary
- Conveyance
- Sanitary Trunk

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ODA21-0025
1026 Cooke Boulevard Sanitary Capacity Analysis

Figure 1-2:
Downstream Conveyance of Proposed Sanitary Flows

Drawn By: R.H. Date: Oct 26, 2023

0 10 20 40 Meters

2.0 Design Sanitary Flows

The flow generation for the existing site was calculated based on the land use and in accordance with the October 2019 (Fifth Edition), Halton Region Water and Wastewater Linear Design Manual. **Table 2-1** shows the criteria, assumptions, and flow calculations for both existing and future conditions.

2.1 Existing Sanitary Flows

Total flow into the sanitary sewer under existing condition is 0.22 L/s; this includes dry weather flow and infiltration allowance flow.

2.2 Proposed Sanitary Flows

Total flow into the sanitary sewer under proposed condition is 8.85 L/s; this includes:

- Infiltration Allowance = 0.09 L/s;
- Non-Residential Flow = 0.04 L/s; and,
- Residential Flow = 8.72 L/s.

Table 2-2 shows the difference between the existing flows and proposed flows.

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Table 2-1: Existing and Future Flows from the Site

	Description	Unit	Existing	Proposed
Site Properties	Site Area	ha	0.322	0.322
	Commercial Area	m^2	1,222	370.1
	Office Area	m^2	0	0
	Industrial Floor Area	m^2	0	0
	Number of Units:			
	1BR/1BR+Den Apt	Units	0	179
	2BR/2BR+Den/ Apt	Units	0	122
	3BR/3BR+Den/ Apt	Units	0	34
	Total Units*	Units	0	335
Criteria	Sanitary Flow Generation Rate	L/ca/day	275	
	Harmon peaking factor	-	$1 + 14 / [4+(Pop/1000)^{0.5}]$	
	Commercial Average Flow	L/ha/d	24,750	
	Infiltration	L/s/ha	0.286	
	Retail /Residential Population Criteria:			
	Single Family	persons/ha	55	
	Semi-detached	persons/ha	100	
	Townhouse, Maisonette	persons/ha	135	
	Apartment (over 6 stories high)	persons/ha	285	
	Commercial / Retail (equivalent population)	persons/ha	90	
Population	Residential Population, using 2.1 persons/unit	persons	0	704
	Total Residential Population*	persons	**0**	**704**
	Commercial / Retail (equivalent population)	persons	11	3
	Total Non-Residential Population*	persons	**11**	**3**
DWF Calculation	Harmon Peaking Factor	-	4.50	3.89
	Peaking Factor (ICI)	-	3.53	3.56
	Residential DWF	L/s	0.00	8.72
	ICI DWF	L/s	0.12	0.04
Infiltration Allowance		L/s	0.09	0.09
Design Flow	**DWF + Infiltration + Other Flows**	**L/s**	**0.22**	**8.85**

Table 2-2: Difference of Flows for the Existing and Proposed Conditions

Flow Component	Pre-Development	Proposed	Net Change
Residential Peak Flow (L/s)	0.00	8.72	8.72
Non-Residential Peak Flow (L/s)	0.12	0.04	-0.09
Infiltration allowance (L/s)	0.09	0.09	0.00
Total (L/s)	**0.22**	**8.85**	**8.63**

Note: Total post-development peak flows should not be calculated as proposed + pre-development, due to difference in Harmon Peaking factor at each stage.

3.0 Methodology

The existing residual capacity in the external sewers has been calculated by using design flows, and a detailed pipe-by-pipe hydraulic model of the system.

The work plan consisted of the following general steps:

1) The collection of relevant data for estimating population data and developing subcatchments, sewer asset data, and existing developments;
2) Hydrologic and hydraulic modeling (InfoWorks ICM) and capacity analysis under various scenarios, including:
    a. Dry-Weather Flow (DWF):
        i. Existing Conditions;
        ii. Proposed Conditions;
        iii. Upgraded Conditions;
    b. Wet-Weather Flow (WWF):
        i. Existing Conditions;
        ii. Proposed Conditions;
        iii. Upgraded Conditions.

When calculating the total flow and resulting hydraulic gradelines (HGL) in the sewer system, the population in the existing upstream and downstream areas were estimated using the Region's *Water and Wastewater Linear Design Manual, Section 3 – Wastewater Main Design*. The flow generation from the various tributary areas upstream and downstream from the site were calculated using InfoWorks ICM hydrodynamic model.

The per capita dry-weather flow generation in the model is 275 L/c/d for residential areas and 24,750 L/ha/d for commercial areas. For proposed conditions, the model assumes a residential sewage generation rate of 275 L/c/d. The infiltration rate for each subcatchment area uses a rate of 0.286 L/s/ha. These rates and the applicable peaking factors used were obtained from the *October 2019 (Fifth Edition), Water and Wastewater Linear Design Manual – Section 3: Wastewater Main Design; Table 3-1: Residential Dry Weather Flow* and *Table 3-2: Commercial, Industrial, and Community Dry Weather Flow.*

3.1 Capacity Criteria

Assuming that the typical basement elevation is 1.8 m below the road centerline, different levels of service were established, prior to conducting the sanitary sewer capacity assessment. In general, the targeted level of service can be described as:

- During dry-weather flow conditions, the sanitary sewer will maintain free-flowing conditions; and,
- During wet-weather flow conditions, the maximum Hydraulic Grade Line (HGL) of the sanitary system that shall be maintained below basement elevation (1.8 m below the ground elevation).

3.2 Model Setup

The model was developed in GIS by delineating the sewer network upstream of the outlet. Subcatchments were designed based on natural boundaries (land parcels and manhole to manhole). Conservative population estimates were inferred for each subcatchment and the area in hectares was calculated. This information was utilized to develop the flow generation rate and Harmon Pattern for each area. The drainage network was then imported into InfoWorks ICM and validated by the software's engineering validation to ensure that it is consistent with expected engineering values. Any warnings or errors at this stage were evaluated and resolved before starting the modelling

process. The Harmon Pattern for each wastewater profile in Existing and Proposed Scenarios was then imported into InfoWorks ICM and the subcatchments were assigned their respective wastewater profiles.

3.3 Population Estimates

The population in the existing upstream and downstream areas were estimated using the design criteria found in the Region's *Water and Wastewater Linear Design Manual – Section 3: Wastewater Main Design; Table 3-1: Residential Dry Weather Flow* and *Table 3-2: Commercial, Industrial, and Community Dry Weather Flow.* The manual provides population density estimates based on land use and unit type. Remote sensing data in GIS was utilized to determine the land use and unit counts per land parcel. These two resources allow the population per land parcel to be inferred and the populations from each land parcel are summarized per subcatchment.

3.4 Rainfall Derived Inflow and Infiltration (RDII) Rate

The Region's *Water and Wastewater Linear Design Manual – Section 3: Wastewater Main Design* provides an inflow/infiltration rate allowance of 0.286 L/s/ha for future conditions. However, a rate for the existing conditions was not provided in this manual. In lieu of this, Civica utilized the City of Toronto's *Design Criteria for Sewer's and Watermains, Chapter 2 - Sanitary Sewers; Table 5: Peak Flow Design Parameters* to determine a suitable wet-weather inflow and infiltration rate. According to the table referenced above, an inflow rate of 3 L/s/ha should be used in drainage areas between 10 to 100 ha. Civica has found this rate has been found to be a suitable alternative to the 25-year design storm flows in models where calibration has not been performed. Additionally, the 3 L/s/ha inflow rate is often a slightly more conservative rainfall derived inflow and infiltration rate for sanitary areas when compared to monitoring data.

4.0 Capacity Analysis Results

4.1 Dry-Weather Flow: Design Function

The following section assesses whether the proposed development meets the design function of the existing sewer system. Since this development is in a sanitary sewer drainage area, the City of Toronto's sanitary sewer criteria were used in our assessment. Therefore, the following results are based on of dry-weather flow. The City's Design Function Criteria can be summarized as requiring that during dry-weather flow the sanitary sewer must maintain free-flowing conditions.

Using the above criteria, the findings can be summarized as follows:

- Under existing and proposed conditions, the sanitary sewer system is experiencing a bottleneck at four (4) locations;
- Under the upgraded conditions, the sanitary sewer is operating under free-flowing conditions;
- The peak flow along Cooke Blvd increases 19.8 L/s immediately downstream of the proposed development under the upgraded conditions, from 78.8 L/s to 98.6 L/s;
- Under both the existing and proposed conditions, basement flooding is predicted at five (5) locations downstream of the proposed site;
- Under the upgraded conditions, the freeboard is greater than 1.8 m from the surface at all manholes downstream;
- The peak flow increases 20.8 L/s at the study outlet, from 82.4 L/s to 103.1 L/s; and,
- Based on the above results, the sanitary sewer is only able to maintain free-flowing conditions if the proposed upgrades downstream of the site are completed. After the upgrades are completed, the sanitary sewer will be able to accommodate the proposed flows while maintaining free-flowing conditions.

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Table 4-1 and **Table 4-2** summarize the peak flows and water levels (HGL) under the pre- and post-development conditions. **Figure A-1** to **Figure A-3** show the model results during DWF conditions. **Figure A-7** to **Figure A-9** show the HGL during DWF conditions for all three scenarios.

4.2 Wet-Weather Flow: Basement Flooding Protection

The following section assesses whether the proposed development maintains a freeboard greater than 1.8 m. Freeboard can be defined as the difference in height between the hydraulic gradeline of sewer flows and the surface level of the manhole. Since this development is in a sanitary sewer drainage area, the City of Toronto's sanitary sewer criteria were again used in our assessment. Therefore, the following results are based on the combination of dry-weather flow plus the City's 25-year design storm flows (or equivalent RDII rates, i.e. – 3 L/s/ha).

Using the above criteria, the findings can be summarized as follows:

- Under both the existing and proposed conditions, the sanitary sewer is experiencing a bottleneck at four (4) locations;
- Under the upgraded conditions, the sanitary sewer is operating under free-flowing conditions;
- The peak flow along Cooke Blvd increases 28.8 L/s immediately downstream of the proposed development under the upgraded conditions, from 99.7 L/s to 128.5 L/s;
- Under both the existing and proposed conditions, basement flooding is predicted at five (5) locations downstream of the proposed site;
- Under the upgraded conditions, the freeboard is greater than 1.8 m from the surface at all manholes downstream;
- The peak flow increases 30.7 L/s at the study outlet, from 108.3 L/s to 139.0 L/s; and,
- Based on the above results, the sanitary sewer is only able to maintain basement flooding protection if the proposed upgrades downstream of the site are completed. After the upgrades are completed, the sanitary sewer will be able to accommodate the proposed flows while maintaining free-flowing conditions.

Table 4-1 and **Table 4-2** summarize the peak flows and water levels (HGL) under the pre- and post-development conditions. **Figure A-4** to **Figure A-6** show the model results during DWF conditions. **Figure A-10** to **Figure A-12** show the HGL during DWF conditions for all three scenarios.

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Table 4-1: Peak flows downstream of the proposed development site

Street Name	US node ID	DS node ID	Length (m)	Width (mm)	Upgraded Width (mm)	US invert level (m AD)	DS invert level (m AD)	Slope (%)	Conduit Full capacity (L/s)	DWF									Extreme WWF (May 12 2000)								
										Existing			Proposed			Upgraded			Existing			Proposed			Upgraded		
										Max DS flow (L/s)	Max Water Depth (m)	Surcharge State	Max DS flow (L/s)	Max Water Depth (m)	Surcharge State	Max DS flow (L/s)	Max Water Depth (m)	Surcharge State	Max DS flow (L/s)	Max Water Depth (m)	Surcharge State	Max DS flow (L/s)	Max Water Depth (m)	Surcharge State	Max DS flow (L/s)	Max Water Depth (m)	Surcharge State
Cooke Blvd	SMH13310	SMH13319	74.1	300	**375**	97.000	96.700	0.41%	62	78.8	2.615	>100% (2)	85.7	3.229	>100% (2)	98.6	0.273	73%	99.7	5.043	>100% (2)	105.8	5.725	>100% (2)	128.5	0.356	95%
Plains Rd E	SMH13319	SMH13317	49.0	250	**450**	96.630	96.378	0.51%	43	81.4	2.489	>100% (2)	88.2	3.015	>100% (2)	102.2	0.225	50%	104.6	4.624	>100% (2)	110.5	5.211	>100% (2)	134.8	0.267	59%
	SMH13317	SMH13314	16.2	250	**450**	96.378	96.116	1.62%	77	81.4	1.820	>100% (2)	88.2	2.187	>100% (2)	102.1	0.246	55%	105.6	3.365	>100% (2)	111.5	3.779	>100% (2)	136.0	0.314	70%
	SMH13314	SMH19205	95.0	250	**450**	96.079	95.841	0.25%	30	82.4	1.797	>100% (2)	89.2	2.111	>100% (2)	103.1	0.282	63%	108.3	3.133	>100% (2)	114.2	3.488	>100% (2)	139.0	0.348	77%

(1) Surcharge State is calculated as the ratio of maximum water depth to pipe height and indicates whether the flow rate in the system has exceeded the capacity of the pipe to the extent that levels rise within manholes, i.e. pipe surcharging.
Yellow Bolded Font = Backflow surcharge state
Red Bolded Font = Bottleneck surcharge state

Table 4-2: Hydraulic gradelines downstream of the proposed development site

Street Name	Node ID	Ground level (m)	DWF					Extreme WWF (May 12 2000)				
			Existing Conditions HGL (m)	Proposed Conditions HGL (m)	Upgraded Conditions HGL (m)	Difference Existing vs Upgraded (m)	Freeboard for Upgraded Conditions (m)	Existing Conditions HGL (m)	Proposed Conditions HGL (m)	Upgraded Conditions HGL (m)	Difference Existing vs Upgraded (m)	Freeboard for Upgraded Conditions (m)
Cooke Blvd	SMH13310	100.203	99.621	100.236	97.276	-2.345	2.927	102.051	102.732	97.362	-4.689	2.841
Plains Rd E	SMH13319	99.774	99.132	99.659	96.855	-2.277	2.919	101.270	101.857	96.898	-4.372	2.876
	SMH13317	99.633	98.213	98.582	96.551	-1.662	3.082	99.762	100.177	96.585	-3.177	3.048
	SMH13314	99.730	97.892	98.207	96.362	-1.530	3.368	99.233	99.589	96.430	-2.803	3.300

5.0 Conclusions

Based on the analysis and assumptions presented in the report, the findings can be summarized as follows:

1. The expected sanitary peak flow, as observed from the outlet, from the proposed site is 8.85 L/s;
2. The upgraded sanitary sewer is able to maintain free-flowing conditions during dry-weather flow for the proposed intensification along Cooke Blvd, north of Plains Rd E, including the proposed flows for 1026 Cooke Blvd;
3. The upgraded sanitary sewer is able to maintain basement flooding protection during wet-weather flow conditions for the proposed intensification along Cooke Blvd, north of Plains Rd E, including the proposed flows for 1026 Cooke Blvd; and,
4. The existing sanitary sewer system does not have the capacity to accommodate the existing or proposed wet-weather flows without the need for any external upgrades or retrofits.

6.0 Recommendation

Based on the analysis and assumptions presented in the report, it is recommended that the development proceeds after the sanitary sewer upgrades along Cooke Blvd and Plains Rd E have successfully been completed.

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Appendix A
Sanitary Sewer Performance

October 26, 2023

330 Rodinea Road, Unit 3
Vaughan, Ontario, Canada L6A 4P5
(905) 417-9792
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Legend

Proposed Site

New Development

Drainage Area

Sewer Infrastructure

Sanitary

Sanitary Sewers

Trunk Sewer

Sanitary Manholes

At or Above Surface

Within Basement Level (0 - 1.8 m)

Below Basement (> 1.8 m)

Sanitary Sewers

Surcharge State=2 (Bottleneck)

Surcharge State=1 (Backup)

Within Capacity (No Surcharge)

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ODA23-0036
1026 Cooke Boulevard Sanitary Capacity Analysis

Figure A-1:
Model Results
Existing Conditions under Dry-Weather Flow

Drawn By: R.H. Date: Oct 26, 2023

0 10 20 40 Meters



Legend

Proposed Site

New Development

Drainage Area

Sewer Infrastructure

Sanitary

Sanitary Sewers

Trunk Sewer

Sanitary Manholes

At or Above Surface

Within Basement Level (0 - 1.8 m)

Below Basement (> 1.8 m)

Sanitary Sewers

Surcharge State=2 (Bottleneck)

Surcharge State=1 (Backup)

Within Capacity (No Surcharge)

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1026 Cooke Boulevard Sanitary Capacity Analysis

Figure A-2:
Model Results
Proposed Conditions under Dry-Weather Flow

Drawn By: R.H. Date: Oct 26, 2023

0 10 20 40 Meters



Legend

Proposed Site

New Development

Drainage Area

Sewer Infrastructure

Sanitary

Sanitary Sewers

Trunk Sewer

Sanitary Manholes

At or Above Surface

Within Basement Level (0 - 1.8 m)

Below Basement (> 1.8 m)

Sanitary Sewers

Surcharge State=2 (Bottleneck)

Surcharge State=1 (Backup)

Within Capacity (No Surcharge)

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1026 Cooke Boulevard Sanitary Capacity Analysis

Figure A-3:
Model Results
Upgraded Conditions under Dry-Weather Flow

Drawn By: R.H. Date: Oct 26, 2023

0 10 20 40 Meters



Legend

Proposed Site

New Development

Drainage Area

Sewer Infrastructure

Sanitary

Sanitary Sewers

Trunk Sewer

Sanitary Manholes

At or Above Surface

Within Basement Level (0 - 1.8 m)

Below Basement (> 1.8 m)

Sanitary Sewers

Surcharge State=2 (Bottleneck)

Surcharge State=1 (Backup)

Within Capacity (No Surcharge)

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1026 Cooke Boulevard Sanitary Capacity Analysis

Figure A-4:
Model Results
Existing Conditions under Wet-Weather Flow (3 L/s/ha)

Drawn By: R.H. Date: Oct 26, 2023

0 10 20 40 Meters



Legend

Proposed Site

New Development

Drainage Area

Sewer Infrastructure

Sanitary

Sanitary Sewers

Trunk Sewer

Sanitary Manholes

At or Above Surface

Within Basement Level (0 - 1.8 m)

Below Basement (> 1.8 m)

Sanitary Sewers

Surcharge State=2 (Bottleneck)

Surcharge State=1 (Backup)

Within Capacity (No Surcharge)

CIVICA

ODA23-0036
1026 Cooke Boulevard Sanitary Capacity Analysis

Figure A-5:
Model Results
Proposed Conditions under Wet-Weather Flow (3 L/s/ha)

Drawn By: R.H. Date: Oct 26, 2023

0 10 20 40 Meters



Legend

Proposed Site

New Development

Drainage Area

Sewer Infrastructure

Sanitary

Sanitary Sewers

Trunk Sewer

Sanitary Manholes

At or Above Surface

Within Basement Level (0 - 1.8 m)

Below Basement (> 1.8 m)

Sanitary Sewers

Surcharge State=2 (Bottleneck)

Surcharge State=1 (Backup)

Within Capacity (No Surcharge)

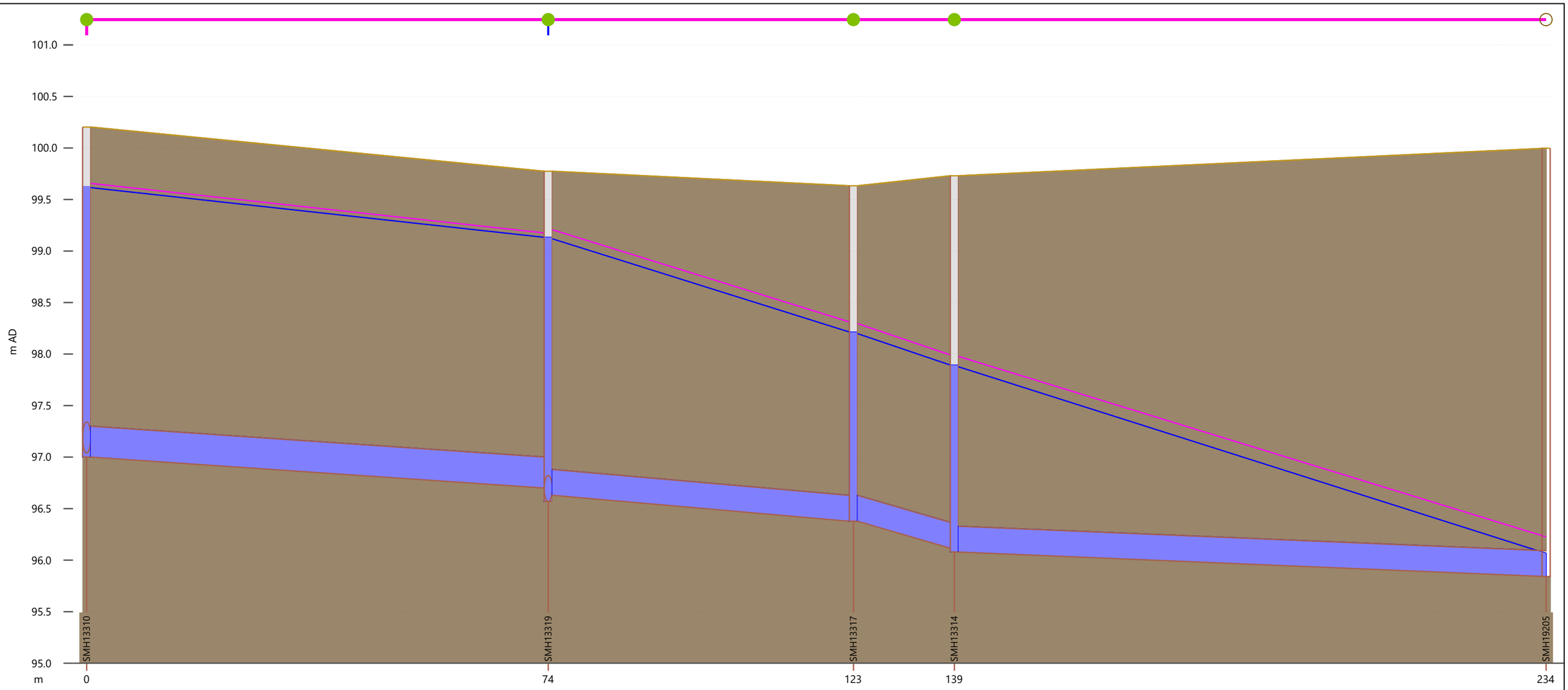
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ODA23-0036
1026 Cooke Boulevard Sanitary Capacity Analysis

Figure A-6:
Model Results
Upgraded Conditions under Wet-Weather Flow (3 L/s/ha)

Drawn By: R.H. Date: Oct 26, 2023

0 10 20 40 Meters



Link	SMH13310.1	SMH13319.1	SMH13317.1	SMH13314.1
length (m)	74.1	49.0	16.2	95.0
width (mm)	300	250	250	250
us inv (m AD)	97.000	96.630	96.378	96.079
ds inv (m AD)	96.700	96.378	96.116	95.841
pfc (l/s)	62	43	77	30
US flow (l/s)	78.90	81.42	81.37	82.37
DS flow (l/s)	78.78	81.41	81.37	82.37

Node	SMH13310	SMH13319	SMH13317	SMH13314	SMH19205
Node ID	SMH13310	SMH13319	SMH13317	SMH13314	SMH19205
ground (m AD)	100.203	99.774	99.633	99.730	99.997

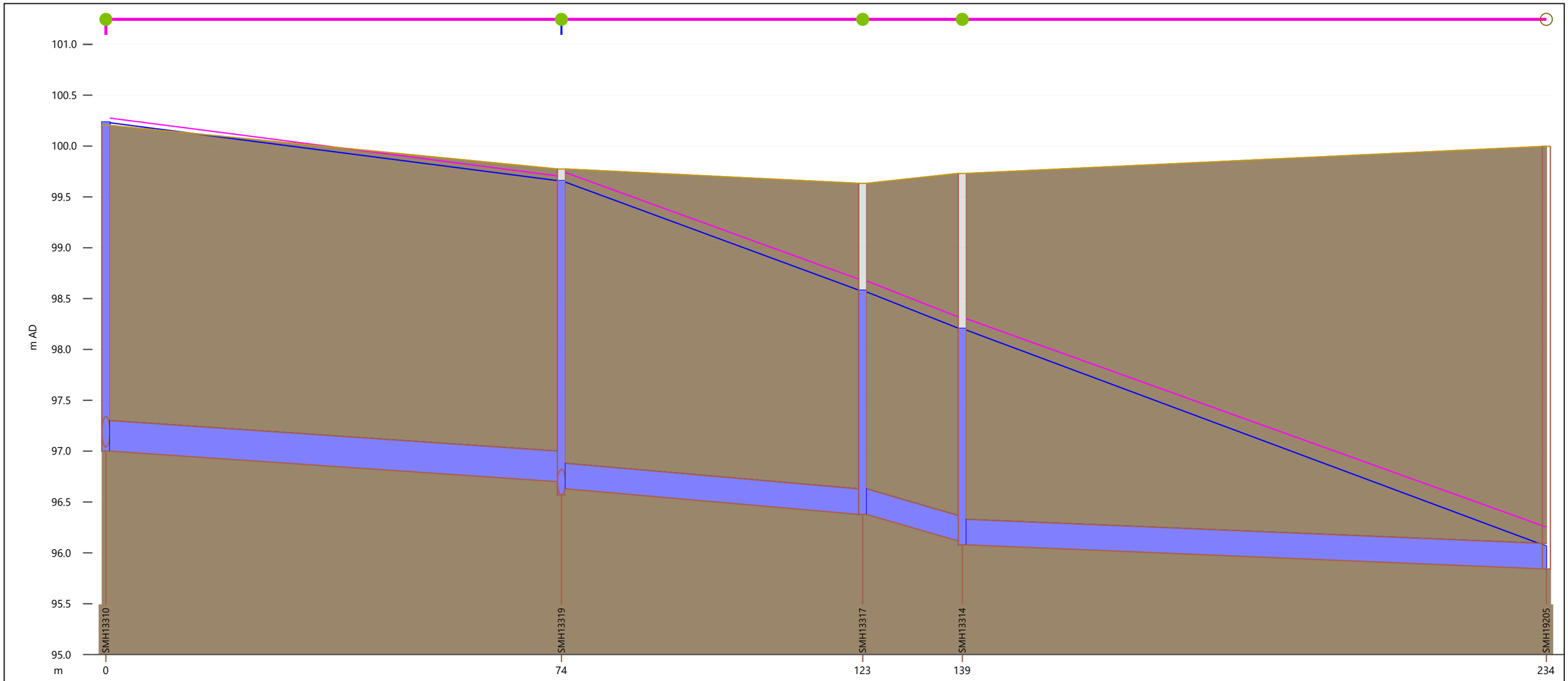
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Project Code: ODA23-0036
Project Name: 1026 Cooke Blvd Downstream Capacity Analysis

SCENARIO:
Existing Conditions - Dry-Weather Flow

DATE: 2023-10-26

FIGURE A-7



Link	SMH13310.1	SMH13319.1	SMH13317.1	SMH13314.1
length (m)	74.1	49.0	16.2	95.0
width (mm)	300	250	250	250
us inv (m AD)	97.000	96.630	96.378	96.079
ds inv (m AD)	96.700	96.378	96.116	95.841
pfc (l/s)	62	43	77	30
US flow (l/s)	85.87	88.23	88.17	89.17
DS flow (l/s)	85.72	88.22	88.17	89.17

Node	SMH13310	SMH13319	SMH13317	SMH13314	SMH19205
Node ID	SMH13310	SMH13319	SMH13317	SMH13314	SMH19205
ground (m AD)	100.203	99.774	99.633	99.730	99.997

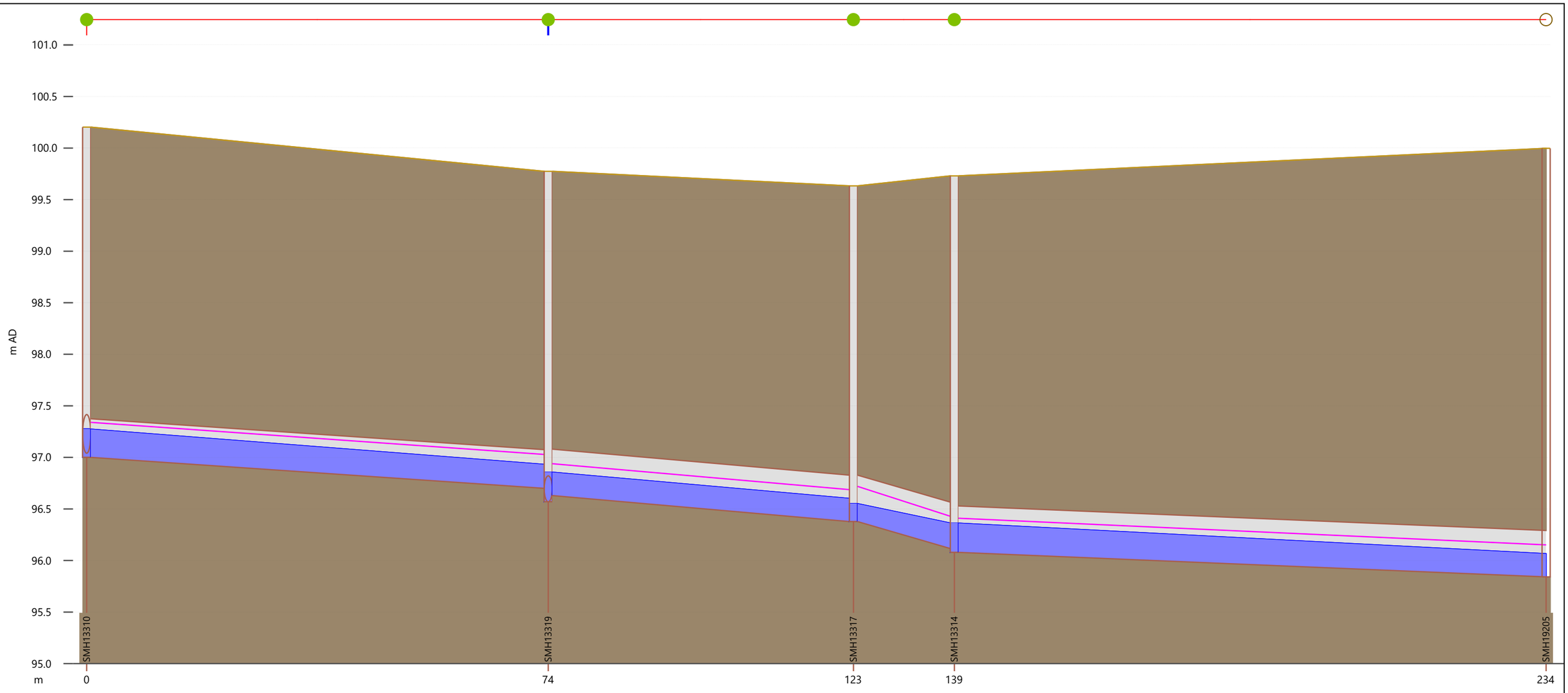
CIVICA
Water Management Solutions

Project Code: ODA23-0036
Project Name: 1026 Cooke Blvd Downstream Capacity Analysis

SCENARIO:
Proposed Conditions - Dry-Weather Flow

DATE: 2023-10-26

FIGURE A-8



Link	SMH13310.1	SMH13319.1	SMH13317.1	SMH13314.1
length (m)	74.1	49.0	16.2	95.0
width (mm)	375	450	450	450
us inv (m AD)	97.000	96.630	96.378	96.079
ds inv (m AD)	96.700	96.378	96.116	95.841
pfc (l/s)	112	205	365	143
US flow (l/s)	98.73	102.16	102.14	103.27
DS flow (l/s)	98.61	102.15	102.11	103.13

Node	SMH13310	SMH13319	SMH13317	SMH13314	SMH19205
Node ID	SMH13310	SMH13319	SMH13317	SMH13314	SMH19205
ground (m AD)	100.203	99.774	99.633	99.730	99.997

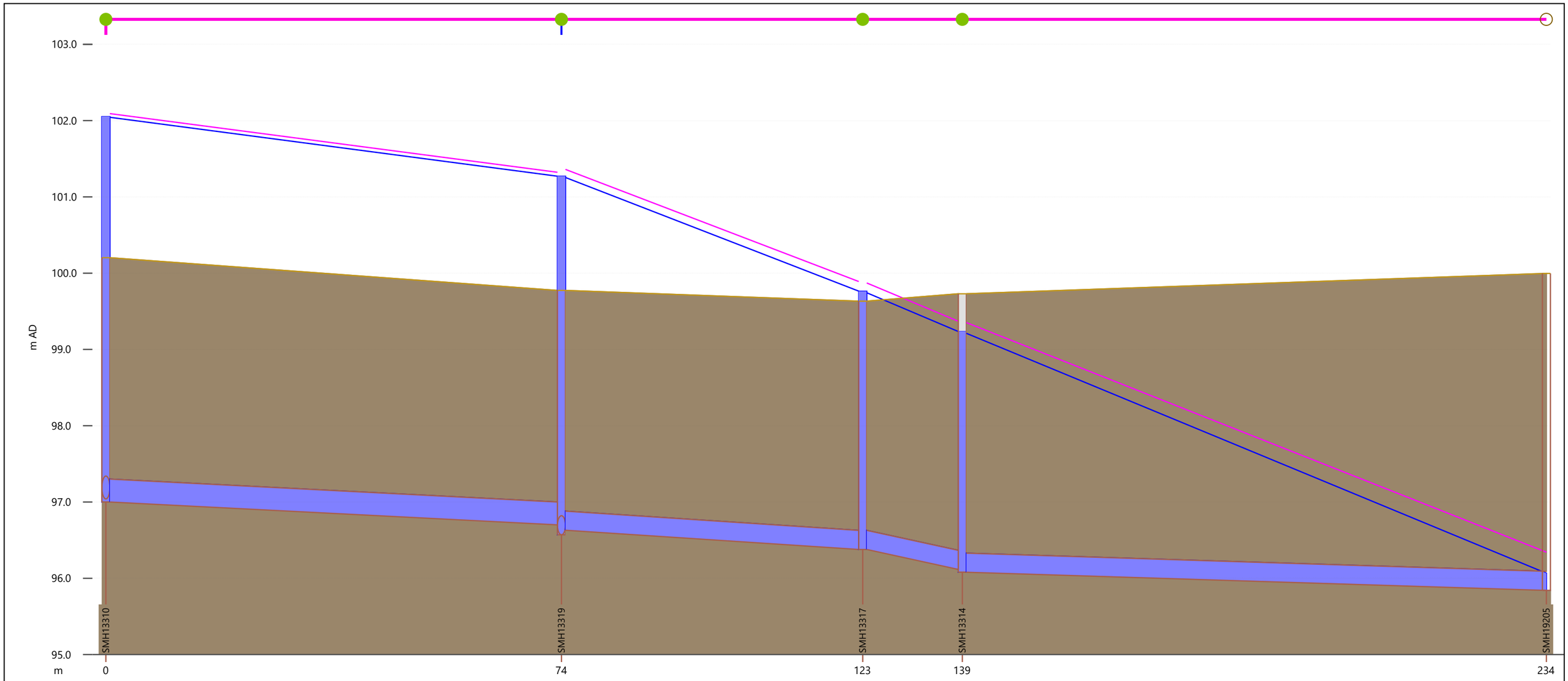
CIVICA
Water Management Solutions

Project Code: ODA23-0036
Project Name: 1026 Cooke Blvd Downstream Capacity Analysis

SCENARIO:
Upgraded Conditions - Dry-Weather Flow

DATE: 2023-10-26

FIGURE A-9



Link	SMH13310.1	SMH13319.1	SMH13317.1	SMH13314.1
length (m)	74.1	49.0	16.2	95.0
width (mm)	300	250	250	250
us inv (m AD)	97.000	96.630	96.378	96.079
ds inv (m AD)	96.700	96.378	96.116	95.841
pfc (l/s)	62	43	77	30
US flow (l/s)	99.87	104.63	105.60	108.28
DS flow (l/s)	99.74	104.61	105.60	108.28

Node	SMH13310	SMH13319	SMH13317	SMH13314	SMH19205
Node ID	SMH13310	SMH13319	SMH13317	SMH13314	SMH19205
ground (m AD)	100.203	99.774	99.633	99.730	99.997

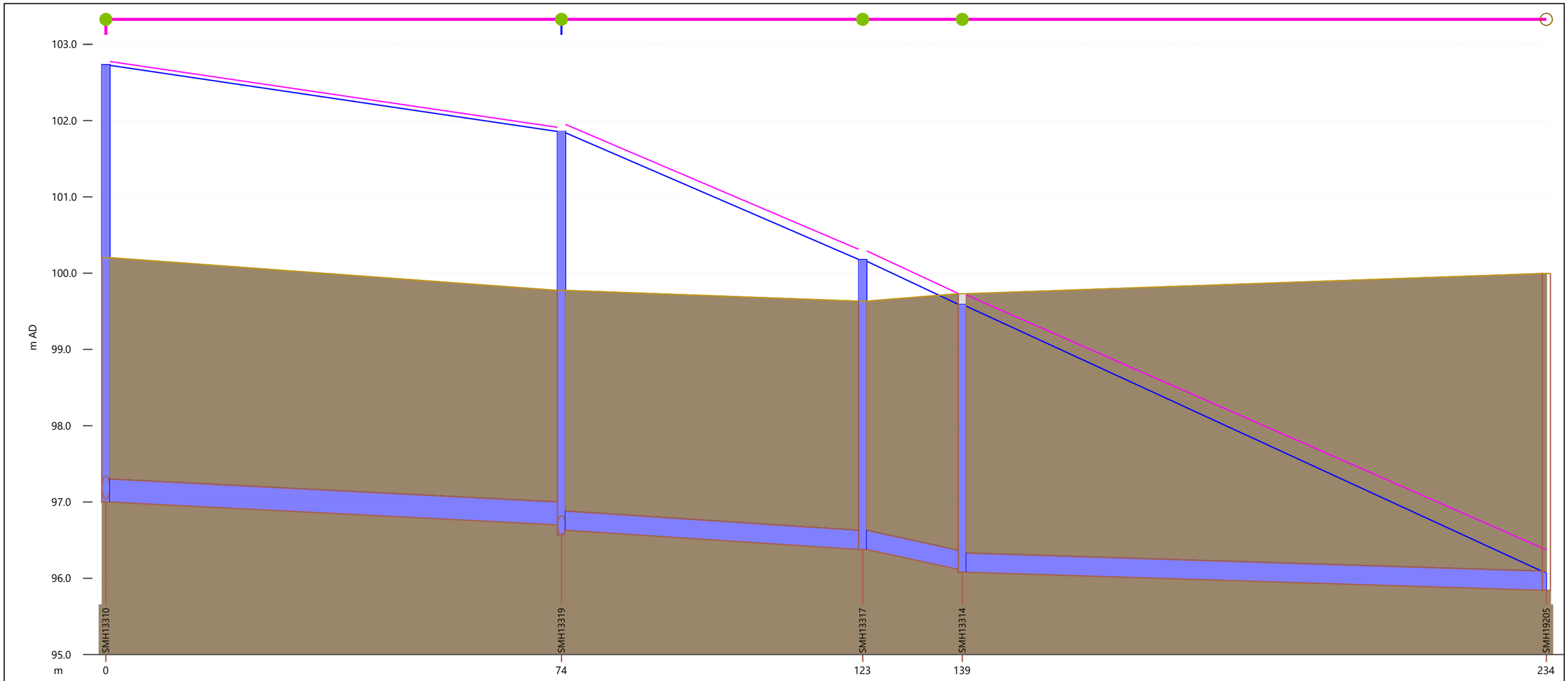
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Project Code: ODA23-0036
Project Name: 1026 Cooke Blvd Downstream Capacity Analysis

SCENARIO:
Existing Conditions - Wet-Weather Flow (3 L/s/ha)

DATE: 2023-10-26

FIGURE A-10



Link	SMH13310.1	SMH13319.1	SMH13317.1	SMH13314.1
length (m)	74.1	49.0	16.2	95.0
width (mm)	300	250	250	250
us inv (m AD)	97.000	96.630	96.378	96.079
ds inv (m AD)	96.700	96.378	96.116	95.841
pfc (l/s)	62	43	77	30
US flow (l/s)	105.92	110.53	111.49	114.16
DS flow (l/s)	105.76	110.52	111.49	114.16

Node	SMH13310	SMH13319	SMH13317	SMH13314	SMH19205
Node ID	SMH13310	SMH13319	SMH13317	SMH13314	SMH19205
ground (m AD)	100.203	99.774	99.633	99.730	99.997

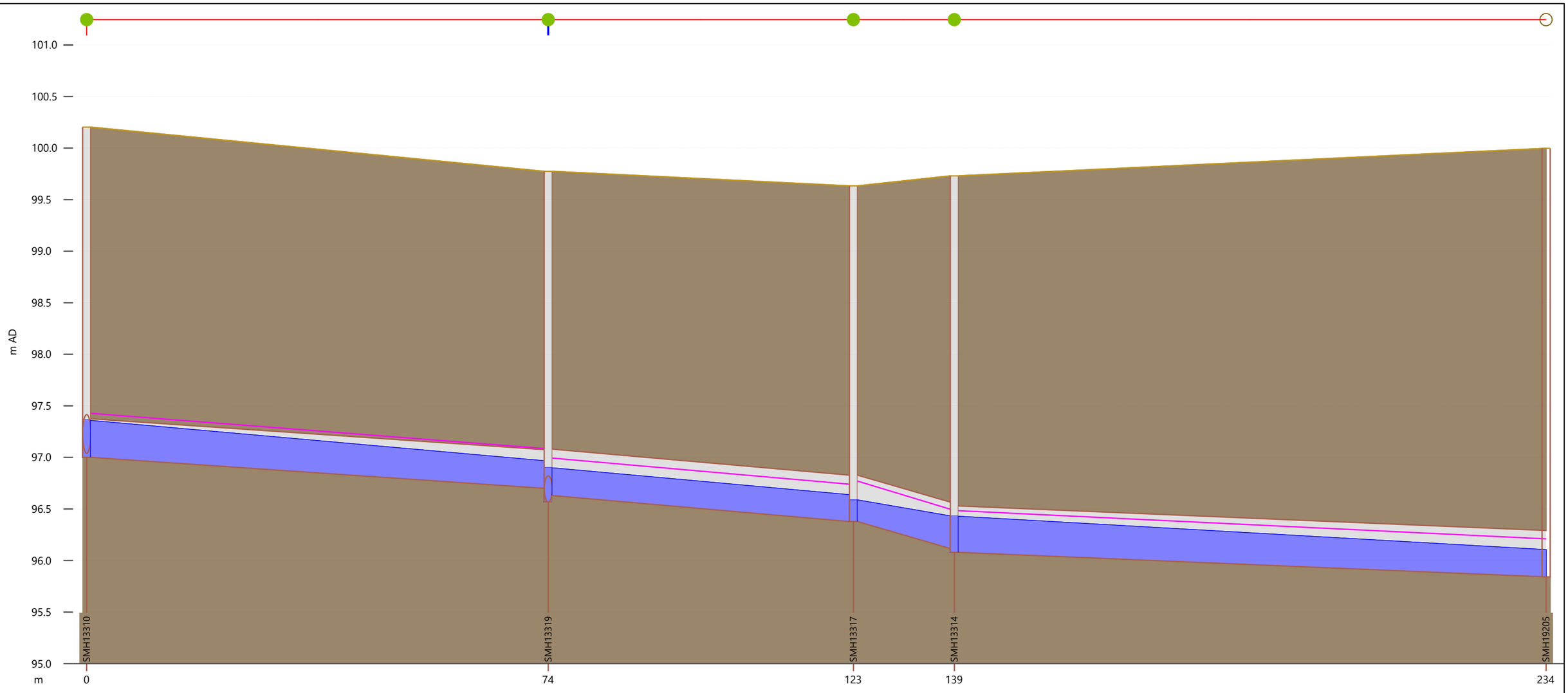
CIVICA
Water Management Solutions

Project Code: ODA23-0036
Project Name: 1026 Cooke Blvd Downstream Capacity Analysis

SCENARIO:
Proposed Conditions - Wet-Weather Flow (3 L/s/ha)

DATE: 2023-10-26

FIGURE A-11



Link	SMH13310.1	SMH13319.1	SMH13317.1	SMH13314.1
length (m)	74.1	49.0	16.2	95.0
width (mm)	375	450	450	450
us inv (m AD)	97.000	96.630	96.378	96.079
ds inv (m AD)	96.700	96.378	96.116	95.841
pfc (l/s)	112	205	365	143
US flow (l/s)	128.59	134.84	135.99	139.12
DS flow (l/s)	128.52	134.83	135.96	139.00

Node	SMH13310	SMH13319	SMH13317	SMH13314	SMH19205
Node ID	SMH13310	SMH13319	SMH13317	SMH13314	SMH19205
ground (m AD)	100.203	99.774	99.633	99.730	99.997

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Water Management Solutions

Project Code: ODA23-0036
Project Name: 1026 Cooke Blvd Downstream Capacity Analysis

SCENARIO:
Upgraded Conditions - Wet-Weather Flow (3 L/s/ha)

DATE: 2023-10-26

FIGURE A-12

APPENDIX C

XPSWMM Output File (5 & 100 Year Storm)

XPSWMM Output File- 5-Year Storm

```
          *================================================*
          |                    xpswmm                      |
          |     Storm and Wastewater Management Model      |
          |             Developed by Innovyze.             |
          |================================================|
          |                                                |
          | Last Update      : Nov 22 2022                 |
          | Interface Version: 2021.4                      |
          | Engine Version   : 12.0                        |
          | Data File Version: 12.62                       |
          |                                                |
          |                                                |
          *================================================*

Engine Name: C:\PROGRA~1\Innovyze\XPSWMM~4.1_X\engine\SWMMEN~2.EXE


*==================================================*
|       Input and Output file names by Layer       |
*==================================================*

 Input File  to Layer #     1 JOT.US
 Output File to Layer #     1 JOT.US
 Input File  to Layer #     2 JOT.US
 Output File to Layer #     2 JOT.US

*============================================================*
|                Configuration Parameters                    |
|  Configuration Parameters, both those that are hardwired   |
|  and those added to the simulation are listed below.       |
|  Configuration Parameters that start with a $ are set in   |
|  the engine as defaults.  The remaining in UPPERCASE       |
|  have been added to the simulation in the Configuration->  |
|  Configuration Parameters dialog or as Engine Defaults in  |
|  the SWMXP.INI file.                                       |
|                                                            |
|  Consult the Help File for the specific meaning/purpose    |
|  of any particular parameter.                              |
|                                                            |
|  Note:                                                     |
|  The second column denotes the value of the parameter.     |
*============================================================*

 $powerstation                        0.0000         1          2
 $perv                                0.0000         0          4
 $oldegg                              0.0000         0          7
 $as                                  0.0000         0         11
 $noflat                              0.0000         0         21
 $oldomega                            0.0000         0         24
 $oldvol                              0.0000         1         28
 $implicit                            0.0000         1         29
 $oldhot                              0.0000         1         31
 $oldscs                              0.0000         0         33
 $flood                               0.0000         1         40
 $nokeys                              0.0000         0         42
 $pzero                               0.0000         0         55
 $oldvol2                             0.0000         2         59
 $storage2                            0.0000         3         62
 $oldhot1                             0.0000         1         63
 $pumpwt                              0.0000         1         70
 $ecloss                              0.0000         1         77
 $exout                               0.0000         0         97
 $spatial = 0.90                      0.9000         5        124
 $djref = -1.0                       -0.1000         3        143
 $weirlen = 50                       50.0000         1        153
 $oldbnd                              0.0000         1        154
 $nogrelev                            0.0000         1        161
 $ncmid                               0.0000         0        164
 $new_nl_97                           0.0000         2        290
 SCSIADEPTH=ON                        0.0000         1        293
 $best97                              0.0000         1        294
 $newbound                            0.0000         1        295
 $q_tol = 0.01                        0.0001         1        316
 $new_storage                         0.0000         1        322
 $old_iteration                       0.0000         1        333
 MINLEN=1                             1.0000         1        346
 $review_elevation                    0.0000         1        383
 $use_half_volume                     0.0000         1        385
 VERT_WALLS=ON                        0.0000         1        389
 $min_ts = 1.0                        1.0000         1        407
 $design_restart = on                 0.0000         1        412
 $zero_value=1.e-05                   0.0000         1        415
 SUBCATCHMENT_RES=ON                  0.0000         1        419
 $relax_depth = on                    0.0000         1        427
 $saveallpts = on                     0.0000         1        434
 PUMP_NEGHD=ON                        0.0000         1        437
 $channel_geometry=1                  0.0000         1        456
 PROJUNITS == METRIC                  0.0000         0        462
```

```
*============================================================*
|   The XPSWMM/XPSTORM engine internally uses object IDs     |
|     instead of full object names to represent objects.     |
|   Included below is a table of these IDs along with the    |
|         name of the object that ID corresponds to.         |
*============================================================*
       Object ID         Object
          Number          Name
================  ====================
             291  TANK
             292  STM CNTRL MH
             293  Outlet Mainline Sewer
             295  Link45
       P{294.1}  38 L/s

*============================================================*
| Parameter Values on the Tapes Common Block.These are the   |
| values read from the data file and dynamically allocated   |
| by the model for this simulation.                          |
*============================================================*

 Number of Subcatchments in the Runoff Block (NW)....      2
 Number of Channel/Pipes in the Runoff Block (NG)....      0
 Runoff Water quality constituents (NRQ).............      0
 Runoff Land Uses per Subcatchment (NLU).............      0
 Number of Elements in the Transport Block (NET).....      0
 Number of Storage Junctions in Transport (NTSE).....      0
 Number of Input Hydrographs in Transport (NTH)......      0
 Number of Elements in the Extran Block (NEE)........      3
 Number of Groundwater Subcatchments in Runoff (NGW).      0
 Number of Interface locations for all Blocks (NIE)..      3
 Number of Pumps in Extran (NEP).....................      1
 Number of Orifices in Extran (NEO)..................      0
 Number of Tide Gates/Free Outfalls in Extran (NTG)..      1
 Number of Extran Weirs (NEW)........................      0
 Number of scs hydrograph points.....................    331
 Number of Extran printout locations (NPO)...........      0
 Number of Tide elements in Extran (NTE).............      1
 Number of Natural channels (NNC)....................      0
 Number of Storage junctions in Extran (NVSE)........      1
 Number of Time history data points in Extran(NTVAL).      0
 Number of Variable storage elements in Extran (NVST)      0
 Number of Input Hydrographs in Extran (NEH).........      0
 Number of Particle sizes in Transport Block (NPS)...      0
 Number of User defined conduits (NHW)...............      2
 Number of Connecting conduits in Extran (NECC)......     20
 Number of Upstream elements in Transport (NTCC).....     10
 Number of Storage/treatment plants (NSTU)...........      1
 Number of Values for R1 lines in Transport (NR1)....      0
 Number of Nodes to be allowed for (NNOD)............      3
 Number of Plugs in a Storage Treatment Unit.........      1


 ######################################################
 #    Entry made to the Runoff Layer(Block) of SWMM    #
 #    Last Updated June, 2014 by Innovyze              #
 ######################################################

 *============================================================*
 |         RUNOFF TABLES IN THE OUTPUT FILE.                  |
 |  These are the more important tables in the output file.   |
 |  You can use your editor to find the table numbers,        |
 |  for example: search for Table R3 to check continuity.     |
 |  This output file can be imported into a Word Processor    |
 |  and printed on US letter or A4 paper using portrait       |
 |  mode, courier font, a size of 8 pt. and margins of 0.75   |
 |                                                            |
 | Table R1  - Physical Hydrology Data                        |
 | Table R2  - Infiltration data                              |
 | Table R3  - Raingage and Infiltration Database Names       |
 | Table R4  - Groundwater Data                               |
 | Table R5  - Continuity Check for Surface Water             |
 | Table R6  - Continuity Check for Channels/Pipes            |
 | Table R7  - Continuity Check for Subsurface Water          |
 | Table R8  - Infiltration/Inflow Continuity Check           |
 | Table R9  - Summary Statistics for Subcatchments           |
 | Table R10 - Sensitivity anlysis for Subcatchments          |
 *============================================================*

                    A1

##########################################
#             RUNOFF JOB CONTROL         #
##########################################

 Snowmelt parameter - ISNOW.......................            0
 Number of rain gages - NRGAG.....................            1
 Quality is not simulated - KWALTY................            0
 Read evaporation data on line(s) F1 (F2) - IVAP..            1
 Hour of day at start of storm - NHR..............            0
 Minute of hour at start of storm - NMN...........            0
 Time TZERO at start of storm (hours).............        0.000
 Use Metric units for I/O - METRIC................            1
```

```
  ===> Ft-sec units used in all internal computations
 Runoff input print control...                                  0
 Runoff graph plot control....                                  0
 Runoff output print control..                                  0
 Limit number of groundwater convergence messages to      10000

 Print headers every 50 lines - NOHEAD (0=yes, 1=no)            0

 Print land use load percentages -LANDUPR (0=no, 1=yes)         0
 Month, day, year of start of storm is:                8/ 9/2023
 Wet time step length (seconds).......                      60.0
 Dry time step length (seconds).......                   86400.0
 Wet/Dry time step length (seconds)...                      60.0
 Simulation length is......                                  5.0 Hours

 If Horton infiltration model is being used
 A mixture of infiltration options may be used in
 XP-SWMM as a watershed specific option.
 Rate for regeneration of infiltration = REGEN * DECAY
 Decay is read in for each subcatchment
 REGEN = ..............................................  0.01000


 Raingage #.................................           1
 KTYPE  - Rainfall input type..............            0
 NHISTO - Total number of rainfall values..           25
 KINC   - Rainfall values(pairs) per line..           10
 KPRINT - Print rainfall(0-Yes,1-No).......            0
 KTIME  - Precipitation time units
 0 --> Minutes  1 --> Hours................            0
 KPREP  - Precipitation unit type
 0 --> Intensity  1 --> Volume.............            0
 KTHIS - Variable rainfall intervals
 0 --> No, >= 1 --> Yes....................            0
 THISTO - Rainfall time interval...........       10.00
 TZRAIN - Starting time(KTIME units).......        0.00


####################################
# Rainfall input summary from Runoff #
####################################

 Total rainfall for gage #     1 is   47.9662 mm

   ############################
   #        Data Group F1     #
   # Evaporation Rate (mm/day) #
   ############################

  JAN.  FEB.  MAR.  APR.  MAY   JUN.  JUL.  AUG.  SEP.  OCT.  NOV  DEC.
  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ---- ----
 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000


  ##################################################
  #  Table R1.  S U B C A T C H M E N T  D A T A    #
  #            Physical Hydrology Data             #
  ##################################################

                                                                                                                  Deprs   Deprs   Prcnt
                                                                                 Per-                             -sion   -sion    Zero
      Subcatchment              Channel              Width      Area       cent    Slope    "n"     "n"   Storge  Storge   Deten
  Number           Name         or inlet               (m)       (Ha)      Imperv     m/m   Imprv    Perv   Imprv    Perv   -tion
  ====== ==================== ==================== ========== ==========   ====== ======= ======= ======= ======= ======= =======

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
       1               TANK#1                TANK   50.000     0.22000     99.00   0.010   0.014   0.410   2.000   5.000  25.000

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
       2               TANK#2                TANK   1.0000     0.10000      1.00   0.010   0.014   0.410   2.000   5.000  25.000


#############################################################################################################
#          Table R2.  SUBCATCHMENT  DATA                                                                    #
#                     Infiltration or Time of Concentration Data                                            #
#                                                                                                           #
# Infiltration Type      Infl #1(#5)       Infl #2(#6)          Infl #3(#7)              Infl #4(#8)      #
# SCS                  ->   Comp CN          Time Conc         Shape Factor        Depth or Fraction      #
# SBUH                 ->   Comp CN          Time Conc                  N/A                      N/A      #
# Green Ampt           ->   Suction          Hydr Cond            Initial MD                     N/A      #
# Horton               ->  Max Rate           Min Rate   Decay Rate (1/sec)      Max. Infilt. Volume      #
# Proportional         ->  Constant                N/A                  N/A                      N/A      #
# Initial/Cont Loss    ->   Initial         Continuing                  N/A                      N/A      #
# Initial/Proportional ->   Initial           Constant                  N/A                      N/A      #
# Laurenson Parameters ->   B Value       Pervious "n"      Impervious Cont                 Exponent      #
# Rational Formula     -> Tc Method   Flow Path Length      Flow Path Slope  Roughness or Retardance      #
#                              (#1 - #4 is Impervious Data / #5 - #8 is Pervious Data)                      #
#                     Rational Formula Tc Method: 1 = Constant                                              #
#                                                 2 = Friend's Equation                                     #
#                                                 3 = Kinematic Wave                                        #
#                                                 4 = Alameda Method                                        #
#                                                 5 = Izzard's Formula                                      #
#                                                 6 = Kerby's Equation                                      #
#                                                 7 = Kirpich's Equation                                    #
```

```
#                                                 8 = Bransby Williams Equation                      #
#                                                 9 = Federal Aviation Authority Equation            #
#####################################################################################################

        Subcatchment           Infl      Infl      Infl      Infl      Infl      Infl      Infl      Infl
  Number            Name       # 1       # 2       # 3       # 4       # 5       # 6       # 7       # 8
  ======================    ========= ========= ========= ========= ========= ========= ========= =========
    1               TANK#1       0.000     0.000     0.000
    2               TANK#2       0.000     0.000     0.000


############################################################
#     Table R3.  SUBCATCHMENT  DATA                        #
#                Rainfall and Infiltration Database Names  #
############################################################

       Subcatchment             Gage  Infiltration       Routing
  Number           Name           No       Type            Type
  ====== ==================== ======= ============ ====================
       1               TANK#1      1 Curve Number  Non-linear reservoir
       2               TANK#2      1 Curve Number                 Nash

 Total Number of Subcatchments...              2
 Total Tributary Area (hectares).           0.32
 Impervious Area (hectares)......           0.22
 Pervious Area (hectares)........           0.10
 Total Width (metres)............          51.00
 Impervious Area (%).............          68.38


  ###################################################
  #          S U B C A T C H M E N T  D A T A       #
  #   Default, Ratio values for subcatchment data   #
  #   Used with the calibrate node in the runoff.   #
  # 1 - width     2 - area       3 - impervious %   #
  # 4 - slope     5 - imp "n"    6 - perv "n"       #
  # 7 - imp ds    8 - perv ds    9 - 1st infil      #
  #10 - 2nd infil               11 - 3rd infil      #
  ###################################################

 Column           1         2         3         4         5         6         7         8         9        10        11
 Default     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 Ratio       1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000

 *********************************************************
 *     Arrangement of Subcatchments and Channel/Pipes    *
 *********************************************************


     Inlet
 TANK                    No Tributary Channel/Pipes
                Tributary Subareas........ TANK#1 TANK#2


 ***********************************************************
 * Hydrographs will be stored for the following   1 INLETS *
 ***********************************************************
  TANK


 ************************************************
 *  Quality Simulation not included in this run *
 ************************************************



 ************************************************
 *  Precipitation Interface File Summary        *
 *  Number of precipitation station....       1 *
 ************************************************

 Location Station Number
 -------- --------------
        1.             1

 XXX End of Header Section XXX

 ########################################################
 #    Entry made to the HYDRAULIC Layer of XP-SWMM      #
 #    Last Updated in June, 2014 by Innovyze            #
 ########################################################

 ########################################################
 #    Entry made to the Runoff Layer(Block) of SWMM     #
 #    Last Updated June, 2014 by Innovyze               #
 ########################################################

 *=========================================================*
 |          RUNOFF TABLES IN THE OUTPUT FILE.              |
 |  These are the more important tables in the output file. |
 |  You can use your editor to find the table numbers,      |
 |  for example: search for Table R3 to check continuity.   |
 |  This output file can be imported into a Word Processor  |
```

```
 |  and printed on US letter or A4 paper using portrait     |
 |  mode, courier font, a size of 8 pt. and margins of 0.75 |
 |                                                          |
 | Table R1  - Physical Hydrology Data                      |
 | Table R2  - Infiltration data                            |
 | Table R3  - Raingage and Infiltration Database Names     |
 | Table R4  - Groundwater Data                             |
 | Table R5  - Continuity Check for Surface Water           |
 | Table R6  - Continuity Check for Channels/Pipes          |
 | Table R7  - Continuity Check for Subsurface Water        |
 | Table R8  - Infiltration/Inflow Continuity Check         |
 | Table R9  - Summary Statistics for Subcatchments         |
 | Table R10 - Sensitivity anlysis for Subcatchments        |
 *==========================================================*

                    A1

##########################################
#             RUNOFF JOB CONTROL         #
##########################################

 Snowmelt parameter - ISNOW.....................            0
 Number of rain gages - NRGAG...................            1
 Quality is not simulated - KWALTY..............            0
 Read evaporation data on line(s) F1 (F2) - IVAP..          1
 Hour of day at start of storm - NHR............            0
 Minute of hour at start of storm - NMN.........            0
 Time TZERO at start of storm (hours)...........        0.000
 Use Metric units for I/O - METRIC..............            1
  ===> Ft-sec units used in all internal computations
 Runoff input print control...                              0
 Runoff graph plot control....                              0
 Runoff output print control..                              0
 Limit number of groundwater convergence messages to    10000

 Print headers every 50 lines - NOHEAD (0=yes, 1=no)        0

 Print land use load percentages -LANDUPR (0=no, 1=yes)     0
 Month, day, year of start of storm is:            8/ 9/2023
 Wet time step length (seconds).....                    60.0
 Dry time step length (seconds).....                86400.0
 Wet/Dry time step length (seconds)...                  60.0
 Simulation length is......                              5.0 Hours

 If Horton infiltration model is being used
 A mixture of infiltration options may be used in
 XP-SWMM as a watershed specific option.
 Rate for regeneration of infiltration = REGEN * DECAY
 Decay is read in for each subcatchment
 REGEN = ..........................................  0.01000


 Raingage #.............................          1
 KTYPE  - Rainfall input type.............          0
 NHISTO - Total number of rainfall values..        25
 KINC   - Rainfall values(pairs) per line..        10
 KPRINT - Print rainfall(0-Yes,1-No).....          0
 KTIME  - Precipitation time units
 0 --> Minutes  1 --> Hours..............          0
 KPREP  - Precipitation unit type
 0 --> Intensity  1 --> Volume...........          0
 KTHIS - Variable rainfall intervals
 0 --> No, >= 1 --> Yes..................          0
 THISTO - Rainfall time interval.........      10.00
 TZRAIN - Starting time(KTIME units).....       0.00


#####################################
# Rainfall input summary from Runoff #
#####################################

 Total rainfall for gage #     1 is   47.9662 mm

   ############################
   #        Data Group F1     #
   # Evaporation Rate (mm/day) #
   ############################

  JAN.  FEB.  MAR.  APR.  MAY   JUN.  JUL.  AUG.  SEP.  OCT.  NOV  DEC.
  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ---- ----
 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000


  ##################################################
  #  Table R1.  S U B C A T C H M E N T  D A T A   #
  #             Physical Hydrology Data            #
  ##################################################

                                                                                                  Deprs   Deprs   Prcnt
                                                                                 Per-             -sion   -sion    Zero
      Subcatchment              Channel              Width      Area            cent    Slope    "n"     "n"   Storge  Storge   Deten
  Number           Name         or inlet               (m)       (Ha)          Imperv     m/m   Imprv    Perv   Imprv    Perv   -tion
  ====== ==================== ==================== ========== ==========      ====== ======= ======= ======= ======= ======= =======
```

```
 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
       1              TANK#1               TANK   50.000     0.22000     99.00   0.010   0.014   0.410   2.000   5.000  25.000

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
       2              TANK#2               TANK   1.0000     0.10000      1.00   0.010   0.014   0.410   2.000   5.000  25.000


##############################################################################################
#          Table R2.  SUBCATCHMENT  DATA                                                     #
#                     Infiltration or Time of Concentration Data                             #
#                                                                                            #
# Infiltration Type      Infl #1(#5)       Infl #2(#6)          Infl #3(#7)              Infl #4(#8)  #
# SCS                 ->   Comp CN          Time Conc         Shape Factor        Depth or Fraction  #
# SBUH                ->   Comp CN          Time Conc                N/A                      N/A  #
# Green Ampt          ->   Suction          Hydr Cond           Initial MD                    N/A  #
# Horton              ->  Max Rate           Min Rate   Decay Rate (1/sec)      Max. Infilt. Volume  #
# Proportional        ->  Constant                N/A                N/A                      N/A  #
# Initial/Cont Loss   ->   Initial         Continuing                N/A                      N/A  #
# Initial/Proportional ->  Initial           Constant                N/A                      N/A  #
# Laurenson Parameters ->  B Value       Pervious "n"      Impervious Cont                Exponent  #
# Rational Formula     -> Tc Method   Flow Path Length      Flow Path Slope  Roughness or Retardance  #
#                              (#1 - #4 is Impervious Data / #5 - #8 is Pervious Data)       #
#                     Rational Formula Tc Method: 1 = Constant                               #
#                                                 2 = Friend's Equation                      #
#                                                 3 = Kinematic Wave                         #
#                                                 4 = Alameda Method                         #
#                                                 5 = Izzard's Formula                       #
#                                                 6 = Kerby's Equation                       #
#                                                 7 = Kirpich's Equation                     #
#                                                 8 = Bransby Williams Equation              #
#                                                 9 = Federal Aviation Authority Equation    #
##############################################################################################

        Subcatchment           Infl      Infl      Infl      Infl      Infl      Infl      Infl      Infl
  Number             Name       # 1       # 2       # 3       # 4       # 5       # 6       # 7       # 8
  ======================    ========= ========= ========= ========= ========= ========= ========= =========
    1               TANK#1       0.000     0.000     0.000
    2               TANK#2       0.000     0.000     0.000


############################################################
#     Table R3.  SUBCATCHMENT  DATA                        #
#                Rainfall and Infiltration Database Names  #
############################################################

       Subcatchment             Gage  Infiltration       Routing
  Number          Name           No       Type            Type
  ====== ==================== ======= ============ ====================
       1               TANK#1      1 Curve Number  Non-linear reservoir
       2               TANK#2      1 Curve Number                 Nash

 Total Number of Subcatchments...              2
 Total Tributary Area (hectares).           0.32
 Impervious Area (hectares)......           0.22
 Pervious Area (hectares)........           0.10
 Total Width (metres)............          51.00
 Impervious Area (%).............          68.38


  ####################################################
  #          S U B C A T C H M E N T  D A T A        #
  #   Default, Ratio values for subcatchment data    #
  #   Used with the calibrate node in the runoff.    #
  # 1 - width     2 - area       3 - impervious %    #
  # 4 - slope     5 - imp "n"    6 - perv "n"        #
  # 7 - imp ds    8 - perv ds    9 - 1st infil       #
  #10 - 2nd infil               11 - 3rd infil       #
  ####################################################

 Column          1         2         3         4         5         6         7         8         9        10        11
 Default    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 Ratio      1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000

 *********************************************************
 *     Arrangement of Subcatchments and Channel/Pipes    *
 *********************************************************


     Inlet
 TANK                    No Tributary Channel/Pipes
               Tributary Subareas........ TANK#1 TANK#2


 ***********************************************************
 * Hydrographs will be stored for the following   1 INLETS *
 ***********************************************************
  TANK


 ***********************************************
 *  Quality Simulation not included in this run *
 ***********************************************
```

```
************************************************
*  Precipitation Interface File Summary        *
*  Number of precipitation station....      1  *
************************************************

Location Station Number
-------- --------------
       1.             1


    A1


*============================================================*
|        HYDRAULICS TABLES IN THE OUTPUT FILE                |
|  These are the more important tables in the output file.   |
|  You can use your editor to find the table numbers,        |
|  for example: search for Table E20 to check continuity.    |
|  This output file can be imported into a Word Processor    |
|  and printed on US letter or A4 paper using portrait       |
|  mode, courier font, a size of 8 pt. and margins of 0.75   |
|                                                            |
| Table E1   - Basic Conduit Data                            |
| Table E2   - Conduit Factor Data                           |
| Table E3a  - Junction Data                                 |
| Table E3b  - Junction Data                                 |
| Table E4   - Conduit Connectivity Data                     |
| Table E4a  - Dry Weather Flow Data                         |
| Table E4b  - Real Time Control Data                        |
| Table E5   - Junction Time Step Limitation Summary         |
| Table E5a  - Conduit Explicit Condition Summary            |
| Table E6   - Final Model Condition                         |
| Table E7   - Iteration Summary                             |
| Table E8   - Junction Time Step Limitation Summary         |
| Table E9   - Junction  Summary  Statistics                 |
| Table E10  - Conduit   Summary  Statistics                 |
| Table E11  - Area assumptions used in the analysis         |
| Table E12  - Mean conduit information                      |
| Table E13  - Channel losses(H) and culvert info            |
| Table E13a - Culvert Analysis Classification               |
| Table E14  - Natural Channel Overbank Flow Information     |
| Table E14a - Natural Channel Encroachment Information      |
| Table E14b - Floodplain Mapping                            |
| Table E15  - Spreadsheet Info List                         |
| Table E15a - Spreadsheet Reach List                        |
| Table E16  - New Conduit Output Section                    |
| Table E17  - Pump Operation                                |
| Table E18  - Junction Continuity Error                     |
| Table E19  - Junction Inflow & Outflow Listing             |
| Table E20  - Junction Flooding and Volume List             |
| Table E21  - Continuity balance at simulation end          |
| Table E22  - Model Judgement Section                       |
*============================================================*

Time Control from Hydraulics Job Control
Year.........    2023 Month.......       8
Day..........       9 Hour........       0
Minute.......       0 Second......       0


Control information for simulation
----------------------------------

Integration cycles.................     18000
Length of integration step is......      1.00 seconds
Simulation length..................      5.00 hours
Do not create equiv. pipes(NEQUAL).         0
Use metric units for I/O...........         1
Printing starts in cycle...........         1
Intermediate printout intervals of.       500 cycles
Intermediate printout intervals of.      8.33 minutes
Summary printout intervals of......       500 cycles
Summary printout time interval of..      8.33 minutes
Hot start file parameter (REDO)....         0
Initial time.......................      0.00 hours

Iteration variables: Flow Tolerance.   0.00010
                     Head Tolerance.   0.00005
    Minimum depth (m or ft).........   0.00001
    Underrelaxation parameter.......   0.85000
    Time weighting parameter........   0.85000
    Conduit roughness factor........   1.00000
    Flow adjustment factor..........   1.00000
    Initial Condition Smoothing.....         0
    Courant Time Step Factor........   1.00000
    Default Expansion/Contraction K.   0.00000
    Default Entrance/Exit K.........   0.00000
    Routing Method..................   Dynamic Wave
Default surface area of junctions...      1.22 square meters.
Minimum Junction/Conduit Depth......   0.00001 meter.
Ponding Area Coefficient............   5000.00
```

```
 Ponding Area Exponent..............    1.0000
 Minimum Orifice Length.............      1.00 meters.
 NJSW input hydrograph junctions.....     0
      or user defined hydrographs....

 *==================================================*
 |          Table E1 - Conduit Data                 |
 *==================================================*

                                                                                    Trapezoid  Hazen
 Inp              Conduit     Length    Conduit      Area    Manning  Max Width      Depth       Side  Williams
 Num                Name        (m)      Class    ( m^2)     Coef.     (m)          (m)      Slopes  c-factor
---- -------------------- ---------- ----------   -------    -------  ---------      -----    -------  -------
    1              Link45    10.1300   Circular    0.0314     0.0130     0.2000     0.2000
 Total length of all conduits ....        10.1300 meters

 *==================================================*
 | If there are messages about (sqrt(g*d)*dt/dx), or |
 | the sqrt(wave celerity)*time step/conduit length  |
 | in the output file all it means is that the       |
 | program will lower the internal time step to      |
 | satisfy this condition (explicit condition).      |
 | You control the actual internal time step by      |
 | using the minimum courant time step factor in the |
 | HYDRAULICS job control.  The message put in words |
 | states that the smallest conduit with the fastest |
 | velocity will control the time step selection.    |
 | You have further control by using the modify      |
 | conduit option in the HYDRAULICS Job Control.     |
 *==================================================*


              Conduit     Courant
                 Name       Ratio
--------------------   ---------
              Link45        0.14

 *==================*
 |  Conduit Volume  |
 *==================*

 Full pipe or full open conduit volume
 Input full depth volume.............    3.1824E-01 cubic meters


 *==================================================*
 |           Table E3a - Junction Data              |
 *==================================================*

 Inp             Junction      Ground     Crown    Invert    Qinst   Initial  Interface
 Num                Name    Elevation Elevation Elevation      cms   Depth-m   Flow (%)
 --- --------------------   --------- --------- --------- -------- ---------  ---------
   1                TANK     99.8700   95.6700   95.6700   0.0000   0.0000    100.0000
   2         STM CNTRL MH    100.5800   97.6000   97.4000   0.0000   0.0000    100.0000
   3              ID*293    100.6200   97.4000   97.2000   0.0000   0.0000    100.0000


 *==================================================*
 |           Table E3b - Junction Data              |
 *==================================================*

 Inp             Junction           X            Y       Type of      Type of  Maximum       Pavement
 Num                Name          Coord.       Coord.    Manhole        Inlet  Capacity    Shape   Slope
---- --------------------    -----------   ----------- ---------- -------------  --------  -------- -------
   1                TANK         0.0000        0.0000 No Ponding       Normal                 0     0.00
   2         STM CNTRL MH         0.0000        0.0000 No Ponding       Normal                 0     0.00
   3              ID*293         0.0000        0.0000 No Ponding       Normal                 0     0.00


 *==================================================*
 |           Table E4 - Conduit Connectivity        |
 *==================================================*

 Input              Conduit               Upstream            Downstream     Upstream  Downstream
Number                Name                   Node                  Node    Elevation   Elevation
====== ====================   ====================  ====================    =========   =========
     1              Link45          STM CNTRL MH                ID*293      97.4000     97.2000   No Design


 *==========================================*
 |          Storage Junction Data           |
 *==========================================*

                                    MAXIMUM OR          PEAK OR         CROWN      DEPTH
      STORAGE JUNCTION  JUNCTION   CONSTANT SURFACE   CONSTANT VOLUME  ELEVATION   STARTS
        NUMBER OR NAME      TYPE      AREA  (M2)       (CUBIC MET.)       (M)       FROM
  --------------------  --------   ----------------   ---------------  --------- -----------
  TANK                  Constant         25.00             105.0      99.87     Node Invert

 *==================================================*
 |           Ordered Pump Data Fields               |
 |        Pump Name/Upstream Node/Dnstream Node     |
 |                DataPt/Depth/Flow                 |
 *==================================================*
```

```
Pump 38 L/s              TANK               STM CNTRL MH
  1     0.000     0.000
  2     0.010     0.038
  3     4.200     0.038



*============================================*
|             In-Line Pump Data              |
*============================================*

                    JUNCTIONS                          PUMP RATES                STAGES
              FROM               TO          = 1 CMS   = 2 CMS   = 3 CMS    = 1  M    = 2  M
            ------------       ------------   -------   -------   -------   -------   -------
  1. TANK      STM CNTRL          0.000     0.000     0.038     0.000     0.000


*============================================*
|   Special Force Main Conduits              |
*============================================*

           Conduit  Diameter    Length     Rough  Entrance      Exit     Valve      Bend      Loss           Preissman
              Name   ft or m   ft or m     -ness    Loss K    Loss K    Loss K     Loss K    Coefft      Sf*L SlotWidth
         ==========   =======   =======    ======    ======    ======    ======    ======    ======    ======    ======

Pump Name            Upstream Node        Dnstream Node        Minor Loss
================================================================================
38 L/s               TANK                 STM CNTRL MH           0.0000

 Pt.  Flow Rate,   Original Head,   Modified Head  Force Main
   1     0.000          0.000          0.000          0.000
   2     0.038          0.010          0.010          0.010
   3     0.038          4.200          4.200          4.200

           Conduit        Maximum # of   Pump Underrelaxation
              Name     Pump Iterations   Parameter(0.25-0.85)
         ==========     ===============   ====================


*================================================*
|          FREE OUTFALL DATA (DATA GROUP I1)     |
|         BOUNDARY CONDITION ON DATA GROUP J1    |
*================================================*

Outfall at Junction....ID*293 has boundary condition number...         1


*================================================*
|        INTERNAL CONNECTIVITY INFORMATION       |
*================================================*

             CONDUIT             JUNCTION             JUNCTION
-------------------- -------------------- --------------------
              38 L/s                 TANK          STM CNTRL MH
             FREE# 1               ID*293             BOUNDARY

*================================================*
|        Boundary Condition Information          |
|                 Data Groups J1-J4              |
*================================================*


BC NUMBER..         1 has no control water surface.

*================================================*
|             XP Note Field Summary              |
*================================================*




*==================================*
|   Conduit Convergence Criteria   |
*==================================*

             Conduit        Full     Conduit
                Name        Flow       Slope
--------------------  ----------  ----------
             Link45       0.0461      0.0197

*==================================*
|    Initial Model Condition       |
| Initial Time =      0.00 hours   |
*==================================*

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.00 /    97.40              ID*293/   0.00 /    97.20

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00               38 L/s/       0.00             FREE# 1/       0.00

            Conduit/   Velocity
             Link45/       0.00
```

```
            Conduit/ Cross Sectional Area
             Link45/       0.00

            Conduit/ Hydraulic Radius
             Link45/       0.00

            Conduit/ Upstream/ Downstream Elevation
             Link45/    97.20/    97.20

Cycle        500      Time          0 Hrs -  8.33 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.00 /    97.40              ID*293/   0.00 /    97.20

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle       1000      Time          0 Hrs - 16.67 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.01 /    97.41              ID*293/   0.01 /    97.21

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle       1500      Time          0 Hrs - 25.00 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.01 /    97.41              ID*293/   0.01 /    97.21

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle       2000      Time          0 Hrs - 33.33 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.02 /    97.42              ID*293/   0.02 /    97.22

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle       2500      Time          0 Hrs - 41.67 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.03 /    97.43              ID*293/   0.03 /    97.23

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle       3000      Time          0 Hrs - 50.00 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.03 /    97.43              ID*293/   0.03 /    97.23

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle       3500      Time          0 Hrs - 58.33 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.04 /    97.44              ID*293/   0.04 /    97.24

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle       4000      Time          1 Hrs -  6.67 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.05 /    97.45              ID*293/   0.05 /    97.25

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.01              38 L/s/       0.01             FREE# 1/       0.01

Cycle       4500      Time          1 Hrs - 15.00 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.08 /    97.48              ID*293/   0.08 /    97.28

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.02              38 L/s/       0.02             FREE# 1/       0.02

Cycle       5000      Time          1 Hrs - 23.33 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.04 /    95.71         STM CNTRL MH/   0.14 /    97.54              ID*293/   0.14 /    97.34

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.04              38 L/s/       0.04             FREE# 1/       0.04

Cycle       5500      Time          1 Hrs - 31.67 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.45 /    96.12         STM CNTRL MH/   0.14 /    97.54              ID*293/   0.14 /    97.34
```

```
            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.04              38 L/s/       0.04             FREE# 1/       0.04

Cycle       6000      Time          1 Hrs - 40.00 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.24 /    95.91         STM CNTRL MH/   0.14 /    97.54              ID*293/   0.14 /    97.34

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.04              38 L/s/       0.04             FREE# 1/       0.04

Cycle       6500      Time          1 Hrs - 48.33 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.08 /    97.48              ID*293/   0.08 /    97.28

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.01              38 L/s/       0.01             FREE# 1/       0.01

Cycle       7000      Time          1 Hrs - 56.67 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.06 /    97.46              ID*293/   0.06 /    97.26

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.01              38 L/s/       0.01             FREE# 1/       0.01

Cycle       7500      Time          2 Hrs -  5.00 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.06 /    97.46              ID*293/   0.06 /    97.26

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.01              38 L/s/       0.01             FREE# 1/       0.01

Cycle       8000      Time          2 Hrs - 13.33 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.05 /    97.45              ID*293/   0.05 /    97.25

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.01              38 L/s/       0.01             FREE# 1/       0.01

Cycle       8500      Time          2 Hrs - 21.67 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.05 /    97.45              ID*293/   0.05 /    97.25

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.01              38 L/s/       0.01             FREE# 1/       0.01

Cycle       9000      Time          2 Hrs - 30.00 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.05 /    97.45              ID*293/   0.04 /    97.24

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.01              38 L/s/       0.01             FREE# 1/       0.01

Cycle       9500      Time          2 Hrs - 38.33 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.04 /    97.44              ID*293/   0.04 /    97.24

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle      10000      Time          2 Hrs - 46.67 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.04 /    97.44              ID*293/   0.04 /    97.24

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle      10500      Time          2 Hrs - 55.00 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.04 /    97.44              ID*293/   0.04 /    97.24

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle      11000      Time          3 Hrs -  3.33 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.04 /    97.44              ID*293/   0.04 /    97.24

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle      11500      Time          3 Hrs - 11.67 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
```

```
              TANK/   0.00 /    95.67         STM CNTRL MH/   0.04 /    97.44              ID*293/   0.04 /    97.24

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle      12000      Time          3 Hrs - 20.00 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.04 /    97.44              ID*293/   0.03 /    97.23

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle      12500      Time          3 Hrs - 28.33 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.03 /    97.43              ID*293/   0.03 /    97.23

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle      13000      Time          3 Hrs - 36.67 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.03 /    97.43              ID*293/   0.03 /    97.23

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle      13500      Time          3 Hrs - 45.00 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.03 /    97.43              ID*293/   0.03 /    97.23

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle      14000      Time          3 Hrs - 53.33 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.03 /    97.43              ID*293/   0.03 /    97.23

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle      14500      Time          4 Hrs -  1.67 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.03 /    97.43              ID*293/   0.03 /    97.23

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle      15000      Time          4 Hrs - 10.00 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.02 /    97.42              ID*293/   0.02 /    97.22

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle      15500      Time          4 Hrs - 18.33 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.01 /    97.41              ID*293/   0.01 /    97.21

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle      16000      Time          4 Hrs - 26.67 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.01 /    97.41              ID*293/   0.01 /    97.21

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle      16500      Time          4 Hrs - 35.00 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.01 /    97.41              ID*293/   0.01 /    97.21

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle      17000      Time          4 Hrs - 43.33 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.01 /    97.41              ID*293/   0.00 /    97.20

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

Cycle      17500      Time          4 Hrs - 51.67 Min
```

```
          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.00 /    97.40              ID*293/   0.00 /    97.20

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00               38 L/s/       0.00              FREE# 1/       0.00

 Cycle      18000      Time          5 Hrs -  0.00 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.00 /    97.40              ID*293/   0.00 /    97.20

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00               38 L/s/       0.00              FREE# 1/       0.00


 *=====================================================*
 | Table E5 - Junction Time Limitation Summary       |
 |              (0.10 or 0.25)* Depth * Area         |
 | Time step = ------------------------------        |
 |                   Sum of Flow                     |
 *=====================================================*
 |  The time this junction was the limiting junction |
 |                 is listed in the third column.    |
 *=====================================================*

             Junction     Time(.10)  Time(.25)  Time(sec)
 --------------------     ---------  ---------  ---------
                  TANK         10.00      10.00    18000.0
         STM CNTRL MH          8.39      10.00        0.0
               ID*293         10.00      10.00        0.0
 The junction requiring the smallest time step was...TANK


 *=========================================================*
 |       Table E5a - Conduit Explicit Condition Summary    |
 |       Courant   =         Conduit Length                |
 |       Time step = ---------------------------------     |
 |                      Velocity + sqrt(g*depth)           |
 |                                                         |
 |                  Conduit Implicit Condition Summary     |
 |       Courant   =         Conduit Length                |
 |       Time step = ---------------------------------     |
 |                            Velocity                     |
 *=========================================================*
 |  The 3rd column is the Explicit time step times the     |
 |      minimum courant time step factor                   |
 |                                                         |
 |  Minimum Conduit Time Step in seconds in the 4th column |
 |  in the list. Maximum possible is 10 * maximum time step|
 |                                                         |
 |  The 5th column is the maximum change at any time step  |
 |  during the simulation. The 6th column is the wobble    |
 |  value which is an indicator of the flow stability.     |
 |                                                         |
 |  You should use this section to find those conduits that|
 |  are slowing your model down.  Use modify conduits to   |
 |  alter the length of the slow conduits to make your     |
 |  simulation faster, or change the conduit name to       |
 |  "CHME?????" where ????? are any characters, this will  |
 |  lengthen the conduit based on the model time step,     |
 |  not the value listed in modify conduits.               |
 *=========================================================*

              Conduit  Time(exp)  Expl*Cmin  Time(imp) Time(min)  Max Qchange   Wobble  Type of Soln
       --------------  ---------  ---------  --------- ---------  -----------  -------  ------------
               Link45      3.61       3.61      6.16     300.0         -0.002     1.659   PBSJ Solutn
 The conduit with the smallest time step limitation was..Link45
 The conduit with the largest wobble was.................Link45
 The conduit with the largest flow change in any
 consecutive time step...................................Link45

 ***********************************************
 *      End of time step DO-loop in Runoff      *
 ***********************************************

 Final Date (Mo/Day/Year)   =             8/ 9/2023
 Total number of time steps =                   300
 Final Julian Date          =               2023221
 Final time of day          =                18000. seconds.
 Final time of day          =                  5.00   hours.
 Final running time         =                 5.0000   hours.
 Final running time         =                 0.2083    days.

 ***************************************************
 *     Extrapolation Summary for Watersheds        *
 * Explains the number of time steps and iterations *
 * used in the solution of the subcatchments.      *
 * # Steps ==> Total Number of Extrapolated Steps  *
 * # Calls ==> Total Number of OVERLND Calls       *
 ***************************************************

         Subcatchment   # Steps  # Calls             Subcatchment   # Steps  # Calls             Subcatchment   # Steps  #
 Calls
```

```
 --------------------   -------  --------     --------------------   -------  --------     --------------------   -------  ------
--
               TANK#1      4537       731                   TANK#2         0         0


##########################################################
# Rainfall input summary from Runoff Continuity Check    #
##########################################################

 Total rainfall read for gage #         1 is        47.97 mm
 Total rainfall duration for gage #     1 is       240.00 minutes

 ************************************************************
 * Table R5. CONTINUITY CHECK FOR SURFACE WATER             *
 *       Any continuity error can be fixed by lowering the  *
 *       wet and transition time step. The transition time   *
 *       should not be much greater than the wet time step. *
 ************************************************************
                                                              Millimeters over
                                                 cubic meters      Total Basin
 Total Precipitation (Rain plus Snow)           1.534917E+02         47.966
 Total Infiltration                             3.028363E+01          9.464
 Total Evaporation                              1.875970E+00          0.586
 Surface Runoff from Watersheds                 1.168470E+02         36.515
 Total Water remaining in Surface Storage       3.427800E+00          1.071
 Infiltration over the Pervious Area...         3.028363E+01         29.925
                    --------
 Infiltration + Evaporation +
 Surface Runoff + Snow removal +
 Water remaining in Surface Storage +
 Water remaining in Snow Cover.........         1.524344E+02         47.636
 Total Precipitation + Initial Storage.         1.534917E+02         47.966


 The error in continuity is calculated as
 ****************************************
 * Precipitation + Initial Snow Cover  *
 *      - Infiltration -               *
 *Evaporation - Snow removal -         *
 *Surface Runoff from Watersheds -     *
 *Water in Surface Storage -           *
 *Water remaining in Snow Cover        *
 *-------------------------------------*
 * Precipitation + Initial Snow Cover  *
 ****************************************
 Percent Continuity Error..............                          0.6889


 ************************************************
 * Table R6. Continuity Check for Channel/Pipes     *
 *           You should have zero continuity error  *
 *           if you are not using runoff hydraulics *
 ************************************************
                                                              Millimeters over
                                                  cubic meters      Total Basin
 Initial Channel/Pipe Storage.................  0.000000E+00          0.000
 Final Channel/Pipe Storage...................  0.000000E+00          0.000
 Surface Runoff from Watersheds...............  1.168470E+02         36.515
 Groundwater Subsurface Inflow or Diversion..   0.000000E+00          0.000
 Evaporation Loss from Channels...............  0.000000E+00          0.000
 Groundwater Flow Diverted Out of Network....   0.000000E+00          0.000
 Channel/Pipe/Inlet Outflow...................  1.168470E+02         36.515
 Initial Storage + Inflow.....................  1.168470E+02         36.515
 Final Storage + Outflow + Diverted GW.......   1.168470E+02         36.515
 ********************************************
 * Final Storage + Outflow + Evaporation  - *
 * Watershed Runoff - Groundwater Inflow  - *
 *     Initial Channel/Pipe Storage         *
 *     ---------------------------------    *
 *  Final Storage + Outflow  + Evaporation  *
 ********************************************
 Percent Continuity Error.....................                  0.0000

        ##################################################
        # Table R9. Summary Statistics for Subcatchments #
        ##################################################

 Note: Total Runoff Depth includes pervious & impervious areas.
       Pervious and Impervious Runoff Depth is only the runoff from those two areas.
       For catchments receiving redirected flow, this flow will only be shown if the flow is not
       directly to the outlet. Flow that is getting redirected is also listed with
       the original subcatchment.


 Subcatchment...........              TANK#1              TANK#2
 Area (hectares)........             0.22000             0.10000
 Percent Impervious.....            99.00000             1.00000
 Total Rainfall (mm)....            47.96617            47.96617
 Max Intensity (mm/hr)..           101.31200           101.31200

 Pervious Area
 -------------
 Total Runoff Depth (mm)            14.33821            16.87757
 Peak Runoff Rate (cms).             0.00028             0.00583
```

```
Total Impervious Area
---------------------
Total Runoff Depth (mm)              1.80442              0.00000
Peak Runoff Rate (cms).              0.06085              0.00000

Impervious Area with depression storage
---------------------------------------
Total Runoff Depth (mm)             33.99929              0.00000
Peak Runoff Rate (cms).              0.04564              0.00000

Impervious Area without depression storage
------------------------------------------
Total Runoff Depth (mm)             11.83300              0.00000
Peak Runoff Rate (cms).              0.01521              0.00000

Total Area
----------
Total Runoff Depth (mm)             45.51735             16.70879
Peak Runoff Rate (cms).              0.06112              0.00583

Rational Formula
----------------
Pervious Tc. (mins)....              0.00000              0.00000
Perv. Intensity (mm/hr)              0.00000              0.00000
Pervious C ............              0.00000              0.00000
Impervious Tc. (mins)..              0.00000              0.00000
Imp. Intensity (mm/hr).              0.00000              0.00000
Impervious C ..........              0.00000              0.00000
Partial Area (Ha)......              0.00000              0.00000
Partial Area Tc........              0.00000              0.00000
Partial Area Intensity.              0.00000              0.00000

UK Methods
-----------
Runoff percentage (%)..              0.00000              0.00000
Effective Area (Ha)....              0.00000              0.00000
Depression Storage (mm)              0.00000              0.00000
Routing coefficient....              0.00000              0.00000

===> Runoff simulation ended normally.

*================================================*
|  Table E6. Final Model Condition               |
|            This table is used for steady state |
|            flow comparison and is the information|
|            saved to the hot-restart file.      |
|            Final Time =     5.000 hours        |
*================================================*

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67/        STM CNTRL MH/   0.00 /    97.40/              ID*293/   0.00 /    97.20/

          Conduit/       Flow   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00 /              38 L/s/       0.00 /             FREE# 1/       0.00 /

             Conduit/   Velocity
             Link45/       0.08 /

        Conduit/      Width
             Link45/       0.08 /

       Junction/        EGL
               TANK/       0.00 /        STM CNTRL MH/       0.00 /              ID*293/       0.00 /

       Junction/  Freeboard
               TANK/       4.20 /        STM CNTRL MH/       3.18 /              ID*293/       3.42 /

       Junction/ Max Volume
               TANK/      11.36 /        STM CNTRL MH/       0.17 /              ID*293/       0.17 /

       Junction/Total Fldng
               TANK/       0.00 /        STM CNTRL MH/       0.00 /              ID*293/       0.00 /

        Conduit/ Cross Sectional Area
             Link45/       0.00 /

        Conduit/  Final Volume
             Link45/       0.00 /

        Conduit/ Hydraulic Radius
             Link45/       0.00 /

        Conduit/ Upstream/ Downstream Elevation
             Link45/    97.40/    97.20


*=========================================================*
|         Table E7 -  Iteration Summary                   |
*=========================================================*

Total number of time steps simulated.............      18000
Total number of passes in the simulation........      18349
Total number of time steps during simulation....      18003
```

```
Ratio of actual # of time steps / NTCYC.........      1.000
Average number of iterations per time step......      1.019
Average  time step size(seconds)................      1.000
Smallest time step size(seconds)................      1.000
Largest  time step size(seconds)................      1.000
Average minimum Conduit Courant time step (sec).      1.000
Average minimum implicit time step (sec)........      1.000
Average minimum junction time step (sec)........      1.000
Average Courant Factor Tf.......................      1.000
Number of times omega reduced...................          7
```

===
| Table E8 - Junction Time Step Limitation Summary |
===
| Not Convr = Number of times this junction did not |
| converge during the simulation. |
| Avg Convr = Average junction iterations. |
| Conv err = Mean convergence error. |
| Omega Cng = Change of omega during iterations |
| Max Itern = Maximum number of iterations |
===

Junction	Not Convr	Avg Convr	Total Itt	Omega Cng	Max Itern	Ittrn >10	Ittrn >25	Ittrn >40
TANK	0	1.00	18061	0	2	0	0	0
STM CNTRL MH	0	1.01	18147	0	4	0	0	0
ID*293	0	1.02	18452	7	83	7	6	3

```
Total number of iterations for all junctions..     54660
Minimum number of possible iterations.........     54009
Efficiency of the simulation..................      1.01
                                                Good Efficiency
```

===
| Extran Efficiency is an indicator of the efficiency of |
| the simulation. Ideal efficiency is one iteration per |
| time step. Altering the underrelaxation parameter, |
| lowering the time step, increasing the flow and head |
| tolerance are good ways of improving the efficiency, |
| another is lowering the internal time step. The lower the|
| efficiency generally the faster your model will run. |
| If your efficiency is less than 1.5 then you may try |
| increasing your time step so that your overall simulation|
| is faster. Ideal efficiency would be around 2.0 |
| |
| Good Efficiency   < 1.5   mean iterations |
| Excellent Efficiency < 2.5 and > 1.5 mean iterations |
| Good   Efficiency < 4.0 and > 2.5 mean iterations |
| Fair   Efficiency < 7.5 and > 4.0 mean iterations |
| Poor Efficiency   > 7.5   mean iterations |
===

===
| Table E9 - JUNCTION SUMMARY STATISTICS |
| The Maximum area is only the area of the node, it |
| does not include the area of the surrounding conduits |
===

Junction Name	Ground Elevation meters	Uppermost PipeCrown Elevation meters	Maximum Junction Elevation meters	Time of Occurence Hr.	Time of Occurence Min.	Meters of Surcharge at Max Elevation	Freeboard of node meters	Maximum Junction Area m^2	Maximum Gutter Depth meters	Maximum Gutter Width meters	Maximum Gutter Velocity m/s
TANK	99.8700	95.6700	96.1244	1	32	0.4544	3.7456	25.0000	0.0000	0.00	0.0000
STM CNTRL MH	100.5800	97.6000	97.5393	1	21	0.0000	3.0407	1.2200	0.0000	0.00	0.0000
ID*293	100.6200	97.4000	97.3390	1	21	0.0000	3.2810	1.2200	0.0000	0.00	0.0000

===
| Table E10 - CONDUIT SUMMARY STATISTICS |
| Note: The peak flow may be less than the design flow |
| and the conduit may still surcharge because of the |
| downstream boundary conditions. |
| |
| * denotes an open conduit that has been overtopped |
| this is a potential source of severe errors |
===

Conduit Name	Design Flow (cms)	Conduit Design Velocity (m/s)	Maximum Vertical Depth (mm)	Maximum Computed Flow (cms)	Time of Occurence Hr.	Time of Occurence Min.	Maximum Computed Velocity (m/s)	Time of Occurence Hr.	Time of Occurence Min.	Ratio of Max. to Design Flow	Maximum Water Elev at Pipe Ends Upstream (m)	Maximum Water Elev at Pipe Ends Dwnstrm (m)	Ratio d/D US	Ratio d/D DS
Link45	0.0461	1.4669	200.0000	0.0382	1	21	1.6449	1	44	0.8286	97.5393	97.3390	0.697	0.695
38 L/s	Undefnd	Undefnd	Undefnd	0.0380	1	21								
FREE# 1	Undefnd	Undefnd	Undefnd	0.0382	1	21								

===
| Table E11. Area assumptions used in the analysis|
| Subcritical and Critical flow assumptions from |
| Subroutine Head. See manual for more information.|
===

	Duration	Duration	Durat. of	Durat. of

Conduit Name	of Dry Flow(min)	of Sub-Critical Flow(min)	Upstream Critical Flow(min)	Downstream Critical Flow(min)	Maximum Hydraulic Radius-m	Maximum X-Sect Area(m^2)	Maximum Vel*D (m^2/s)
Link45	11.67	288.33	0.00	0.00	0.059	0.023	0.228

Table E12. Mean Conduit Flow Information

Conduit Name	Mean Flow (cms)	Total Flow (m^3)	Mean Percent Change	Low Flow Weightng	Mean Froude Number	Mean Hydraulic Radius	Mean Cross Area	Mean Conduit Roughness
Link45	0.0065	116.7524	0.0004	0.9606	1.3368	0.0226	0.0053	0.0130
38 L/s	0.0065	116.7574						
FREE# 1	0.0065	116.7575						

Table E13. Channel losses(H), headwater depth (HW), tailwater depth (TW), critical and normal depth (Yc and Yn). Use this section for culvert comparisons

Conduit Name	Maximum Flow	Head Loss	Friction Loss	Critical Depth	Normal Depth	HW Elevat	TW Elevat	
Link45	0.0382	0.0000	0.1999	0.1671	0.1390	97.5390	97.3390	Max Flow

Table E13a. CULVERT ANALYSIS CLASSIFICATION, and the time the culvert was in a particular classification during the simulation. The time is in minutes. The Dynamic Wave Equation is used for all conduit analysis but the culvert flow classification condition is based on the HW and TW depths.

Conduit Name	Critical D Outlet Control	Mild Slope Outlet Control	Mild Slope TW Control	Steep Slope TW Insignf Entrance Control	Slug Flow Outlet/ Entrance Control	Mild Slope TW > D Outlet Control	Mild Slope TW <= D Outlet Control	Outlet Control	Inlet Control	Inlet Configuration
Link45	0.0000	0.0000	300.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None

Kinematic Wave Approximations Time in Minutes for Each Condition

Conduit Name	Duration of Normal Flow	Slope Criteria	Super-Critical	Roll Waves
Link45	0.4167	0.4167	219.9167	0.0000

Table E15 - SPREADSHEET INFO LIST Conduit Flow and Junction Depth Information for use in spreadsheets. The maximum values in this table are the true maximum values because they sample every time step. The values in the review results may only be the maximum of a subset of all the time steps in the run. Note: These flows are only the flows in a single barrel.

Conduit Name	Maximum Flow (cms)	Total Flow (m^3)	Maximum Velocity (m/s)	Maximum Volume (m^3)	##	Junction Name	Invert Elevation (m)	Maximum Elevation (m)
Link45	0.0382	116.7524	1.6449	0.1640	##	TANK	95.6700	96.1244
38 L/s	0.0380	116.7574	0.0000	0.0000	##	STM CNTRL MH	97.4000	97.5393
FREE# 1	0.0382	116.7575	0.0000	0.0000	##	ID*293	97.2000	97.3390

Table E15a - SPREADSHEET REACH LIST Peak flow and Total Flow listed by Reach or those conduits or diversions having the same upstream and downstream nodes.

Upstream Node	Downstream Node	Maximum Flow (cms)	Total Flow (m^3)
STM CNTRL MH	ID*293	0.0382	116.7524
TANK	STM CNTRL MH	0.0380	116.7574

Table E16. New Conduit Information Section Conduit Invert (IE) Elevation and Conduit Maximum Water Surface (WS) Elevations

Conduit Name	Upstream Node	Downstream Node	IE Up	IE Dn	WS Up	WS Dn	Conduit Type

```
 ------------------- ------------------- ------------------- ---------- ---------- ---------- ---------- -------------
              Link45         STM CNTRL MH               ID*293     97.40      97.20      97.54      97.34     Circular

 ################################################
 # Table E17. Pump Operation Section            #
 ################################################

     Pump Operating Time and Pump General Results
     --------------------------------------------

                                                  Time   # of Times
                       Upstream       Downstream  in hours    Pump    Min HGL   Max HGL    Min Q    Max Q   Totl Q
       Pump Name           Node             Node   Pump On   Goes On    meter     meter      cms      cms      m^3
 --------------- ---------------- ---------------- --------- --------- -------- -------- -------- -------- --------
        P{294.1}              291              292    0.0000       0       0.0000   0.0000   0.0000   0.0000 116.7574

 *==========================================================================*
 |    Table E18 - Junction Continuity Error.   Division by Volume added 11/96  |
 |                                                                            |
 |  Continuity Error = Net Flow + Beginning Volume - Ending Volume            |
 |                     ---------------------------------------------------    |
 |                     Total Flow + (Beginning Volume + Ending Volume)/2      |
 |                                                                            |
 |  Net Flow   = Node Inflow - Node Outflow                                   |
 |  Total Flow = absolute (Inflow + Outflow)                                  |
 |  Intermediate column is a judgement on the node continuity error.          |
 |                                                                            |
 |  Excellent  < 1 percent    Great  1 to  2 percent  Good  2 to  5 percent   |
 |  Fair  5 to 10  percent    Poor  10 to 25 percent  Bad  25 to 50 percent   |
 |  Terrible > 50  percent                                                    |
 *==========================================================================*

             Junction    <------Continuity Error ------->   Remaining   Beginning    Net Flow  Total Flow Failed to
                 Name      Volume  % of Node  % of Inflow     Volume      Volume   Thru Node   Thru Node  Converge
 --------------------    --------  ----------  ----------    --------  ----------  ----------  ---------- ---------
                TANK      0.0905      0.0387      0.0774      0.0000      0.0000      0.0905    233.6032         0
         STM CNTRL MH      0.0019      0.0008      0.0016      0.0009      0.0000      0.0027    233.5097         0
               ID*293      0.0026      0.0011      0.0022      0.0003      0.0000      0.0029    233.5099         0
 The total continuity error was  9.49058E-02 cubic meters
 The remaining total volume was  1.12897E-03 cubic meters
 Your mean node continuity error was   Excellent
 Your worst node continuity error was  Excellent

   *==================================================*
   |  Table E19 - Junction Inflow & Outflow Listing    |
   |              Units are either ft^3 or m^3         |
   |              depending on the units in your model.|
   *==================================================*

                         Constant       User       Interface       DWF         Inflow    RNF Layer     Inflow
             Junction     Inflow       Inflow        Inflow       Inlow       through      Inflow       from        Outflow
Evaporation       Basin
                 Name    to Node     to Node       to Node      to Node      Outfall      to Node    2D Layer     from Node
from Node        Infil.
 --------------------  ----------  ----------  ------------  ----------  ------------  ----------  ----------  ----------  ---
--------  ----------
                TANK      0.0000       0.0000       0.0000       0.0000       0.0000     116.8459       0.0000       0.0000
0.0000         0.00
               ID*293      0.0000       0.0000       0.0000       0.0000       0.0000       0.0000       0.0000     116.7575
0.0000         0.00

   *==================================================*
   | Table E20 - Junction Flooding and Volume Listing.  |
   |             The maximum volume is the total volume |
   |             in the node including the volume in the|
   |             flooded storage area. This is the max  |
   |             volume at any time. The volume in the  |
   |             flooded storage area is the total volume|
   |             above the ground elevation, where the  |
   |             flooded pond storage area starts.      |
   | The fourth column is instantaneous, the fifth is the|
   | sum of the flooded volume over the entire simulation|
   | Units are either ft^3 or m^3 depending on the units.|
   *==================================================*

                                                 Out of                Passed to 2D cell
                                               1D-System               OR  Volume Stored
             Junction    Surcharged   Flooded      (Flooded     Maximum    in allowed Flood
                 Name    Time (min)  Time(min)      Volume)      Volume   Pond of 1D-System
 --------------------    ----------  ---------    ---------    ---------   -----------------
                TANK    299.           0.000       0.000    11.4           0.000
         STM CNTRL MH       0.000       0.000       0.000   0.170           0.000
               ID*293       0.000       0.000       0.000   0.170           0.000

 *==================================*
 | Simulation Specific Information  |
 *==================================*
 Number of Input Conduits..........         1 Number of Simulated Conduits......         3
 Number of Natural Channels........         0 Number of Junctions...............         3
 Number of Storage Junctions.......         1 Number of Weirs...................         0
 Number of Orifices................         0 Number of Pumps...................         1
 Number of Free Outfalls...........         1 Number of Tide Gate Outfalls......         0
```

```
*=========================================================*
| Average % Change in Junction or Conduit is defined as:  |
| Conduit  % Change ==> 100.0 ( Q(n+1) - Q(n) ) / Qfull   |
| Junction % Change ==> 100.0 ( Y(n+1) - Y(n) ) / Yfull   |
*=========================================================*

The Conduit with the largest average change was..              Link45 with     0.000 percent
The Junction with the largest average change was.                TANK with     0.005 percent
The Conduit with the largest sinuosity was.......              Link45 with     1.659


*=================================================================*
| Table E21. Continuity balance at the end of the simulation      |
|            Junction Inflow, Outflow or Street Flooding          |
| Error = Inflow  + Initial Volume - Outflow - Final   Volume     |
*=================================================================*

            Inflow          Inflow       Average
            Junction   Volume, m^3   Inflow, cms
--------------------  ------------  -------------
               TANK      116.8459         0.0065
             ID*293     -116.7575        -0.0065

             Outflow     Outflow         Average
            Junction  Volume m^3    Outflow, cms
--------------------  ------------  ------------
             ID*293      116.7575         0.0065


*=====================================================*
| Initial system volume        =         0.0000 Cu M  |
| Total system inflow volume   =       116.8459 Cu M  |
| Inflow + Initial volume      =       116.8459 Cu M  |
*=====================================================*
| Total system outflow         =       116.7575 Cu M  |
| Volume left (Final volume)   =         0.0011 Cu M  |
| Evaporation                  =         0.0000 Cu M  |
| Basin Infiltration           =         0.0000 Cu M  |
| Outflow + Final Volume       =       116.7586 Cu M  |
*=====================================================*

*================================================*
| Total Model Continuity Error                   |
| Error in Continuity, Percent =         0.0746 |
| Error in Continuity, m^3     =         0.0872 |
| + Error means a continuity loss, - a gain      |
*================================================*


##################################################
# Table E22. Numerical Model judgement section    #
##################################################

Overall error was (minimum of Table E18 & E21)              0.0746 percent
Worst nodal error was in node TANK                 with     0.0387 percent
Of the total inflow this loss was                           0.0774 percent
Your overall continuity error was                  Excellent
                                                  Excellent Efficiency
Efficiency of the simulation                       1.01
Most Number of Non Convergences at one Node        0.
Total Number Non Convergences at all Nodes         0.
Total Number of Nodes with Non Convergences        0.


#########################################################
# Table E23. New Basin Design Information               #
#            Maximum Hydraulic Grade Line,              #
#            Out Conduit Sizes and Maximum Flow         #
#########################################################

A) Resize d/s Pipes based on given HGL
B) Resize Basin based on given HGL
C) Resize d/s Pipes and Basin based on HGL and max discharge
D) Resize d/s pipes based on given max discharge

        Basin Name    Type    Max.HGL        Conduit         Depth   Width   Barrels   Max.Flow
                                (m)                            (m)     (m)               (m^3/s)
-------------------- ------  --------- -------------------- ------- ------- --------- ---------


*============================================================*
|         XPSWMM/XPSTORM Simulation Date and Time Summary     |
*============================================================*
| Starting Date... August     15, 2023  Time...  09:00:20.751  |
|   Ending Date... August     15, 2023  Time...  09:00:28.524  |
|  Elapsed Time...    0.12109 minutes or      7.26562 seconds  |
*============================================================*
```

XPSWMM Output File- 100-Year Storm

```
          *================================================*
          |                   xpswmm                       |
          |     Storm and Wastewater Management Model      |
          |            Developed by Innovyze.              |
          |================================================|
          |                                                |
          | Last Update      : Nov 22 2022                 |
          | Interface Version: 2021.4                      |
          | Engine Version   : 12.0                        |
          | Data File Version: 12.62                       |
          |                                                |
          |                                                |
          *================================================*

Engine Name: C:\PROGRA~1\Innovyze\XPSWMM~4.1_X\engine\SWMMEN~2.EXE


*==================================================*
|       Input and Output file names by Layer       |
*==================================================*

 Input File  to Layer #     1 JOT.US
 Output File to Layer #     1 JOT.US
 Input File  to Layer #     2 JOT.US
 Output File to Layer #     2 JOT.US

*==========================================================*
|               Configuration Parameters                   |
|  Configuration Parameters, both those that are hardwired  |
|  and those added to the simulation are listed below.      |
|  Configuration Parameters that start with a $ are set in  |
|  the engine as defaults.  The remaining in UPPERCASE      |
|  have been added to the simulation in the Configuration-> |
|  Configuration Parameters dialog or as Engine Defaults in |
|  the SWMXP.INI file.                                      |
|                                                           |
|  Consult the Help File for the specific meaning/purpose   |
|  of any particular parameter.                             |
|                                                           |
|  Note:                                                    |
|  The second column denotes the value of the parameter.    |
*==========================================================*

 $powerstation                          0.0000         1         2
 $perv                                  0.0000         0         4
 $oldegg                                0.0000         0         7
 $as                                    0.0000         0        11
 $noflat                                0.0000         0        21
 $oldomega                              0.0000         0        24
 $oldvol                                0.0000         1        28
 $implicit                              0.0000         1        29
 $oldhot                                0.0000         1        31
 $oldscs                                0.0000         0        33
 $flood                                 0.0000         1        40
 $nokeys                                0.0000         0        42
 $pzero                                 0.0000         0        55
 $oldvol2                               0.0000         2        59
 $storage2                              0.0000         3        62
 $oldhot1                               0.0000         1        63
 $pumpwt                                0.0000         1        70
 $ecloss                                0.0000         1        77
 $exout                                 0.0000         0        97
 $spatial = 0.90                        0.9000         5       124
 $djref = -1.0                         -0.1000         3       143
 $weirlen = 50                         50.0000         1       153
 $oldbnd                                0.0000         1       154
 $nogrelev                              0.0000         1       161
 $ncmid                                 0.0000         0       164
 $new_nl_97                             0.0000         2       290
 SCSIADEPTH=ON                          0.0000         1       293
 $best97                                0.0000         1       294
 $newbound                              0.0000         1       295
 $q_tol = 0.01                          0.0001         1       316
 $new_storage                           0.0000         1       322
 $old_iteration                         0.0000         1       333
```

```
MINLEN=1                          1.0000         1       346
$review_elevation                 0.0000         1       383
$use_half_volume                  0.0000         1       385
VERT_WALLS=ON                     0.0000         1       389
$min_ts = 1.0                     1.0000         1       407
$design_restart = on              0.0000         1       412
$zero_value=1.e-05                0.0000         1       415
SUBCATCHMENT_RES=ON               0.0000         1       419
$relax_depth = on                 0.0000         1       427
$saveallpts = on                  0.0000         1       434
PUMP_NEGHD=ON                     0.0000         1       437
$channel_geometry=1               0.0000         1       456
PROJUNITS == METRIC               0.0000         0       462

*============================================================*
|   The XPSWMM/XPSTORM engine internally uses object IDs    |
|     instead of full object names to represent objects.    |
|   Included below is a table of these IDs along with the   |
|         name of the object that ID corresponds to.        |
*============================================================*
       Object ID         Object
          Number          Name
===============  ====================
             291  TANK
             292  STM CNTRL MH
             293  Outlet Mainline Sewer
             295  Link45
        P{294.1}  38 L/s

*============================================================*
| Parameter Values on the Tapes Common Block.These are the |
| values read from the data file and dynamically allocated |
| by the model for this simulation.                        |
*============================================================*

 Number of Subcatchments in the Runoff Block (NW)....     2
 Number of Channel/Pipes in the Runoff Block (NG)....     0
 Runoff Water quality constituents (NRQ).............     0
 Runoff Land Uses per Subcatchment (NLU).............     0
 Number of Elements in the Transport Block (NET).....     0
 Number of Storage Junctions in Transport (NTSE).....     0
 Number of Input Hydrographs in Transport (NTH)......     0
 Number of Elements in the Extran Block (NEE)........     3
 Number of Groundwater Subcatchments in Runoff (NGW).     0
 Number of Interface locations for all Blocks (NIE)..     3
 Number of Pumps in Extran (NEP).....................     1
 Number of Orifices in Extran (NEO)..................     0
 Number of Tide Gates/Free Outfalls in Extran (NTG)..     1
 Number of Extran Weirs (NEW)........................     0
 Number of scs hydrograph points.....................   331
 Number of Extran printout locations (NPO)...........     0
 Number of Tide elements in Extran (NTE).............     1
 Number of Natural channels (NNC)....................     0
 Number of Storage junctions in Extran (NVSE)........     1
 Number of Time history data points in Extran(NTVAL).     0
 Number of Variable storage elements in Extran (NVST)     0
 Number of Input Hydrographs in Extran (NEH).........     0
 Number of Particle sizes in Transport Block (NPS)...     0
 Number of User defined conduits (NHW)...............     2
 Number of Connecting conduits in Extran (NECC)......    20
 Number of Upstream elements in Transport (NTCC).....    10
 Number of Storage/treatment plants (NSTU)...........     1
 Number of Values for R1 lines in Transport (NR1)....     0
 Number of Nodes to be allowed for (NNOD)............     3
 Number of Plugs in a Storage Treatment Unit.........     1


#########################################################
#    Entry made to the Runoff Layer(Block) of SWMM    #
#    Last Updated June, 2014 by Innovyze              #
#########################################################

*============================================================*
|         RUNOFF TABLES IN THE OUTPUT FILE.                  |
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|  for example: search for Table R3 to check continuity.     |
|  This output file can be imported into a Word Processor    |
|  and printed on US letter or A4 paper using portrait       |
|  mode, courier font, a size of 8 pt. and margins of 0.75   |
```

```
 |                                                          |
 | Table R1  - Physical Hydrology Data                      |
 | Table R2  - Infiltration data                            |
 | Table R3  - Raingage and Infiltration Database Names     |
 | Table R4  - Groundwater Data                             |
 | Table R5  - Continuity Check for Surface Water           |
 | Table R6  - Continuity Check for Channels/Pipes          |
 | Table R7  - Continuity Check for Subsurface Water        |
 | Table R8  - Infiltration/Inflow Continuity Check         |
 | Table R9  - Summary Statistics for Subcatchments         |
 | Table R10 - Sensitivity anlysis for Subcatchments        |
 *==========================================================*

                    A1

##########################################
#             RUNOFF JOB CONTROL         #
##########################################

 Snowmelt parameter - ISNOW.....................            0
 Number of rain gages - NRGAG...................            1
 Quality is not simulated - KWALTY..............            0
 Read evaporation data on line(s) F1 (F2) - IVAP..           1
 Hour of day at start of storm - NHR............            0
 Minute of hour at start of storm - NMN.........            0
 Time TZERO at start of storm (hours)...........        0.000
 Use Metric units for I/O - METRIC..............            1
  ===> Ft-sec units used in all internal computations
 Runoff input print control...                              0
 Runoff graph plot control....                              0
 Runoff output print control..                              0
 Limit number of groundwater convergence messages to      10000

 Print headers every 50 lines - NOHEAD (0=yes, 1=no)        0

 Print land use load percentages -LANDUPR (0=no, 1=yes)     0
 Month, day, year of start of storm is:              8/ 9/2023
 Wet time step length (seconds).......                  60.0
 Dry time step length (seconds).......                86400.0
 Wet/Dry time step length (seconds)...                  60.0
 Simulation length is......                              5.0 Hours

 If Horton infiltration model is being used
 A mixture of infiltration options may be used in
 XP-SWMM as a watershed specific option.
 Rate for regeneration of infiltration = REGEN * DECAY
 Decay is read in for each subcatchment
 REGEN = ..........................................  0.01000


 Raingage #.............................          1
 KTYPE  - Rainfall input type..............          0
 NHISTO - Total number of rainfall values..         25
 KINC   - Rainfall values(pairs) per line..         10
 KPRINT - Print rainfall(0-Yes,1-No).......          0
 KTIME  - Precipitation time units
 0 --> Minutes  1 --> Hours................          0
 KPREP  - Precipitation unit type
 0 --> Intensity  1 --> Volume.............          0
 KTHIS - Variable rainfall intervals
 0 --> No, >= 1 --> Yes....................          0
 THISTO - Rainfall time interval...........      10.00
 TZRAIN - Starting time(KTIME units).......       0.00


#####################################
# Rainfall input summary from Runoff #
#####################################

 Total rainfall for gage #     1 is   77.9055 mm

   ############################
   #        Data Group F1     #
   # Evaporation Rate (mm/day) #
   ############################

  JAN.  FEB.  MAR.  APR.  MAY   JUN.  JUL.  AUG.  SEP.  OCT.  NOV  DEC.
  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ---- ----
 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000
```

```
  ###################################################
  #  Table R1.  S U B C A T C H M E N T  D A T A    #
  #             Physical Hydrology Data             #
  ###################################################


Deprs   Deprs   Prcnt                                                                                    -
                                                                                Per-
sion   -sion    Zero
       Subcatchment              Channel              Width      Area       cent    Slope    "n"     "n"
Storge  Storge   Deten
  Number           Name         or inlet               (m)       (Ha)      Imperv     m/m   Imprv    Perv
Imprv    Perv   -tion
  ====== ==================== ==================== ========== ==========   ====== ======= ======= =======
======= ======= =======

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
       1              TANK#1                TANK   50.000     0.22000     99.00   0.010   0.014   0.410
2.000   5.000  25.000

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
       2              TANK#2                TANK   1.0000     0.10000      1.00   0.010   0.014   0.410
2.000   5.000  25.000


#############################################################################################################
#          Table R2.  SUBCATCHMENT  DATA                                                                    #
#                     Infiltration or Time of Concentration Data                                            #
#                                                                                                           #
# Infiltration Type      Infl #1(#5)       Infl #2(#6)          Infl #3(#7)              Infl #4(#8)      #
# SCS                 ->   Comp CN          Time Conc         Shape Factor        Depth or Fraction      #
# SBUH                ->   Comp CN          Time Conc               N/A                     N/A      #
# Green Ampt          ->   Suction          Hydr Cond            Initial MD                 N/A      #
# Horton              ->  Max Rate           Min Rate   Decay Rate (1/sec)      Max. Infilt. Volume      #
# Proportional        ->  Constant               N/A                 N/A                     N/A      #
# Initial/Cont Loss   ->   Initial         Continuing                N/A                     N/A      #
# Initial/Proportional ->   Initial           Constant                N/A                     N/A      #
# Laurenson Parameters ->   B Value       Pervious "n"      Impervious Cont               Exponent      #
# Rational Formula    -> Tc Method   Flow Path Length      Flow Path Slope  Roughness or Retardance      #
#                              (#1 - #4 is Impervious Data / #5 - #8 is Pervious Data)                      #
#                     Rational Formula Tc Method: 1 = Constant                                              #
#                                                 2 = Friend's Equation                                     #
#                                                 3 = Kinematic Wave                                        #
#                                                 4 = Alameda Method                                        #
#                                                 5 = Izzard's Formula                                      #
#                                                 6 = Kerby's Equation                                      #
#                                                 7 = Kirpich's Equation                                    #
#                                                 8 = Bransby Williams Equation                             #
#                                                 9 = Federal Aviation Authority Equation                   #
#############################################################################################################

       Subcatchment           Infl      Infl      Infl      Infl      Infl      Infl      Infl      Infl
  Number            Name      # 1       # 2       # 3       # 4       # 5       # 6       # 7       # 8
  ======================    ========= ========= ========= ========= ========= ========= ========= =========
    1               TANK#1      0.000     0.000     0.000
    2               TANK#2      0.000     0.000     0.000


############################################################
#     Table R3.  SUBCATCHMENT  DATA                        #
#                Rainfall and Infiltration Database Names  #
############################################################

       Subcatchment             Gage  Infiltration       Routing
  Number          Name           No       Type            Type
  ====== ==================== ======= ============ ====================
       1               TANK#1      1 Curve Number  Non-linear reservoir
       2               TANK#2      1 Curve Number                 Nash

 Total Number of Subcatchments...              2
 Total Tributary Area (hectares).           0.32
 Impervious Area (hectares)......           0.22
 Pervious Area (hectares)........           0.10
 Total Width (metres)............          51.00
 Impervious Area (%).............          68.38


  ###################################################
  #          S U B C A T C H M E N T  D A T A       #
```

```
  #   Default, Ratio values for subcatchment data   #
  #   Used with the calibrate node in the runoff.   #
  # 1 - width     2 - area       3 - impervious %   #
  # 4 - slope     5 - imp "n"    6 - perv "n"       #
  # 7 - imp ds    8 - perv ds    9 - 1st infil      #
  #10 - 2nd infil               11 - 3rd infil      #
  ###################################################

 Column           1         2         3         4         5         6         7         8         9        10
11
 Default     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
0.0000
 Ratio       1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
1.0000

 *********************************************************
 *     Arrangement of Subcatchments and Channel/Pipes    *
 *********************************************************


     Inlet
 TANK                     No Tributary Channel/Pipes
                Tributary Subareas........ TANK#1 TANK#2


 ***********************************************************
 * Hydrographs will be stored for the following   1 INLETS *
 ***********************************************************
  TANK


 ************************************************
 *  Quality Simulation not included in this run *
 ************************************************




 ************************************************
 *  Precipitation Interface File Summary        *
 *  Number of precipitation station....      1  *
 ************************************************

 Location Station Number
 -------- --------------
        1.             1

 XXX End of Header Section XXX

 ########################################################
 #    Entry made to the HYDRAULIC Layer of XP-SWMM     #
 #    Last Updated in June, 2014 by Innovyze           #
 ########################################################

 ########################################################
 #    Entry made to the Runoff Layer(Block) of SWMM    #
 #    Last Updated June, 2014 by Innovyze              #
 ########################################################

 *============================================================*
 |         RUNOFF TABLES IN THE OUTPUT FILE.                  |
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 |  mode, courier font, a size of 8 pt. and margins of 0.75   |
 |                                                            |
 | Table R1  - Physical Hydrology Data                        |
 | Table R2  - Infiltration data                              |
 | Table R3  - Raingage and Infiltration Database Names       |
 | Table R4  - Groundwater Data                               |
 | Table R5  - Continuity Check for Surface Water             |
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 | Table R7  - Continuity Check for Subsurface Water          |
 | Table R8  - Infiltration/Inflow Continuity Check           |
 | Table R9  - Summary Statistics for Subcatchments           |
 | Table R10 - Sensitivity anlysis for Subcatchments          |
 *============================================================*
```

A1

```
########################################
#             RUNOFF JOB CONTROL       #
########################################

 Snowmelt parameter - ISNOW.....................          0
 Number of rain gages - NRGAG...................          1
 Quality is not simulated - KWALTY..............          0
 Read evaporation data on line(s) F1 (F2) - IVAP..         1
 Hour of day at start of storm - NHR............          0
 Minute of hour at start of storm - NMN.........          0
 Time TZERO at start of storm (hours)...........      0.000
 Use Metric units for I/O - METRIC..............          1
  ===> Ft-sec units used in all internal computations
 Runoff input print control...                            0
 Runoff graph plot control....                            0
 Runoff output print control..                            0
 Limit number of groundwater convergence messages to    10000

 Print headers every 50 lines - NOHEAD (0=yes, 1=no)      0

 Print land use load percentages -LANDUPR (0=no, 1=yes)   0
 Month, day, year of start of storm is:           8/ 9/2023
 Wet time step length (seconds).......                60.0
 Dry time step length (seconds).......               86400.0
 Wet/Dry time step length (seconds)...                  60.0
 Simulation length is......                              5.0 Hours

 If Horton infiltration model is being used
 A mixture of infiltration options may be used in
 XP-SWMM as a watershed specific option.
 Rate for regeneration of infiltration = REGEN * DECAY
 Decay is read in for each subcatchment
 REGEN = ..........................................  0.01000


 Raingage #.............................          1
 KTYPE  - Rainfall input type...........          0
 NHISTO - Total number of rainfall values..      25
 KINC   - Rainfall values(pairs) per line..      10
 KPRINT - Print rainfall(0-Yes,1-No).......          0
 KTIME  - Precipitation time units
 0 --> Minutes  1 --> Hours.............          0
 KPREP  - Precipitation unit type
 0 --> Intensity  1 --> Volume..........          0
 KTHIS - Variable rainfall intervals
 0 --> No, >= 1 --> Yes.................          0
 THISTO - Rainfall time interval.......      10.00
 TZRAIN - Starting time(KTIME units)....       0.00


####################################
# Rainfall input summary from Runoff #
####################################

 Total rainfall for gage #     1 is   77.9055 mm

   ############################
   #        Data Group F1     #
   # Evaporation Rate (mm/day) #
   ############################

  JAN.  FEB.  MAR.  APR.  MAY   JUN.  JUL.  AUG.  SEP.  OCT.  NOV  DEC.
  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ---- ----
 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000


  ##################################################
  #  Table R1.  S U B C A T C H M E N T  D A T A   #
  #             Physical Hydrology Data            #
  ##################################################


Deprs   Deprs   Prcnt                                                                    Per-                          -
sion   -sion    Zero
       Subcatchment             Channel             Width      Area       cent    Slope    "n"     "n"
Storge  Storge   Deten
```

```
  Number           Name         or inlet               (m)       (Ha)      Imperv     m/m   Imprv    Perv
Imprv    Perv   -tion
  ====== ==================== ==================== ========== ==========   ====== ======= ======= =======
======= ======= =======

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
      1              TANK#1                TANK   50.000     0.22000     99.00   0.010   0.014   0.410
2.000   5.000  25.000

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
      2              TANK#2                TANK   1.0000     0.10000      1.00   0.010   0.014   0.410
2.000   5.000  25.000


##########################################################################################################
#          Table R2.  SUBCATCHMENT  DATA                                                                 #
#                     Infiltration or Time of Concentration Data                                         #
#                                                                                                        #
# Infiltration Type      Infl #1(#5)       Infl #2(#6)          Infl #3(#7)              Infl #4(#8)  #
# SCS                 ->   Comp CN          Time Conc         Shape Factor        Depth or Fraction  #
# SBUH                ->   Comp CN          Time Conc               N/A                      N/A  #
# Green Ampt          ->   Suction          Hydr Cond            Initial MD                  N/A  #
# Horton              ->  Max Rate           Min Rate   Decay Rate (1/sec)      Max. Infilt. Volume  #
# Proportional        ->  Constant                N/A                 N/A                      N/A  #
# Initial/Cont Loss   ->   Initial         Continuing                 N/A                      N/A  #
# Initial/Proportional ->  Initial           Constant                 N/A                      N/A  #
# Laurenson Parameters ->  B Value       Pervious "n"      Impervious Cont                Exponent  #
# Rational Formula    -> Tc Method   Flow Path Length      Flow Path Slope  Roughness or Retardance  #
#                              (#1 - #4 is Impervious Data / #5 - #8 is Pervious Data)                   #
#                     Rational Formula Tc Method: 1 = Constant                                           #
#                                                 2 = Friend's Equation                                  #
#                                                 3 = Kinematic Wave                                     #
#                                                 4 = Alameda Method                                     #
#                                                 5 = Izzard's Formula                                   #
#                                                 6 = Kerby's Equation                                   #
#                                                 7 = Kirpich's Equation                                 #
#                                                 8 = Bransby Williams Equation                          #
#                                                 9 = Federal Aviation Authority Equation                #
##########################################################################################################

       Subcatchment            Infl      Infl      Infl      Infl      Infl      Infl      Infl      Infl
  Number             Name       # 1       # 2       # 3       # 4       # 5       # 6       # 7       # 8
  ========================    ========= ========= ========= ========= ========= ========= ========= =========
    1               TANK#1       0.000     0.000     0.000
    2               TANK#2       0.000     0.000     0.000


############################################################
#     Table R3.  SUBCATCHMENT  DATA                        #
#                Rainfall and Infiltration Database Names  #
############################################################

       Subcatchment             Gage  Infiltration       Routing
  Number          Name           No       Type            Type
  ====== ==================== ======= ============ ====================
       1               TANK#1      1 Curve Number  Non-linear reservoir
       2               TANK#2      1 Curve Number                 Nash

 Total Number of Subcatchments...              2
 Total Tributary Area (hectares).           0.32
 Impervious Area (hectares)......           0.22
 Pervious Area (hectares)........           0.10
 Total Width (metres)............          51.00
 Impervious Area (%).............          68.38


  ###################################################
  #          S U B C A T C H M E N T  D A T A       #
  #   Default, Ratio values for subcatchment data   #
  #   Used with the calibrate node in the runoff.   #
  # 1 - width     2 - area       3 - impervious %   #
  # 4 - slope     5 - imp "n"    6 - perv "n"       #
  # 7 - imp ds    8 - perv ds    9 - 1st infil      #
  #10 - 2nd infil              11 - 3rd infil      #
  ###################################################

 Column           1         2         3         4         5         6         7         8         9        10
11
 Default     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
0.0000
```

```
 Ratio       1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
1.0000

 *********************************************************
 *     Arrangement of Subcatchments and Channel/Pipes    *
 *********************************************************


     Inlet
 TANK                     No Tributary Channel/Pipes
                Tributary Subareas........ TANK#1 TANK#2


 *********************************************************
 * Hydrographs will be stored for the following   1 INLETS *
 *********************************************************
  TANK


 ***********************************************
 *  Quality Simulation not included in this run *
 ***********************************************




 ***************************************************
 *  Precipitation Interface File Summary           *
 *  Number of precipitation station....        1   *
 ***************************************************

 Location Station Number
 -------- --------------
        1.             1


     A1


 *============================================================*
 |        HYDRAULICS TABLES IN THE OUTPUT FILE                |
 |  These are the more important tables in the output file.   |
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 |  for example: search for Table E20 to check continuity.    |
 |  This output file can be imported into a Word Processor    |
 |  and printed on US letter or A4 paper using portrait       |
 |  mode, courier font, a size of 8 pt. and margins of 0.75   |
 |                                                            |
 | Table E1   - Basic Conduit Data                            |
 | Table E2   - Conduit Factor Data                           |
 | Table E3a  - Junction Data                                 |
 | Table E3b  - Junction Data                                 |
 | Table E4   - Conduit Connectivity Data                     |
 | Table E4a  - Dry Weather Flow Data                         |
 | Table E4b  - Real Time Control Data                        |
 | Table E5   - Junction Time Step Limitation Summary         |
 | Table E5a  - Conduit Explicit Condition Summary            |
 | Table E6   - Final Model Condition                         |
 | Table E7   - Iteration Summary                             |
 | Table E8   - Junction Time Step Limitation Summary         |
 | Table E9   - Junction  Summary  Statistics                 |
 | Table E10  - Conduit   Summary  Statistics                 |
 | Table E11  - Area assumptions used in the analysis         |
 | Table E12  - Mean conduit information                      |
 | Table E13  - Channel losses(H) and culvert info            |
 | Table E13a - Culvert Analysis Classification               |
 | Table E14  - Natural Channel Overbank Flow Information     |
 | Table E14a - Natural Channel Encroachment Information      |
 | Table E14b - Floodplain Mapping                            |
 | Table E15  - Spreadsheet Info List                         |
 | Table E15a - Spreadsheet Reach List                        |
 | Table E16  - New Conduit Output Section                    |
 | Table E17  - Pump Operation                                |
 | Table E18  - Junction Continuity Error                     |
 | Table E19  - Junction Inflow & Outflow Listing             |
 | Table E20  - Junction Flooding and Volume List             |
 | Table E21  - Continuity balance at simulation end          |
 | Table E22  - Model Judgement Section                       |
 *============================================================*
```

```
 Time Control from Hydraulics Job Control
 Year.........    2023 Month.......       8
 Day..........       9 Hour........       0
 Minute.......       0 Second......       0


 Control information for simulation
 ----------------------------------

 Integration cycles.................     18000
 Length of integration step is......      1.00 seconds
 Simulation length..................      5.00 hours
 Do not create equiv. pipes(NEQUAL).         0
 Use metric units for I/O...........         1
 Printing starts in cycle...........         1
 Intermediate printout intervals of.       500 cycles
 Intermediate printout intervals of.      8.33 minutes
 Summary printout intervals of......       500 cycles
 Summary printout time interval of..      8.33 minutes
 Hot start file parameter (REDO)....         0
 Initial time.......................      0.00 hours

 Iteration variables: Flow Tolerance.   0.00010
                      Head Tolerance.   0.00005
     Minimum depth (m or ft).........   0.00001
     Underrelaxation parameter.......   0.85000
     Time weighting parameter........   0.85000
     Conduit roughness factor........   1.00000
     Flow adjustment factor..........   1.00000
     Initial Condition Smoothing.....         0
     Courant Time Step Factor........   1.00000
     Default Expansion/Contraction K.   0.00000
     Default Entrance/Exit K.........   0.00000
     Routing Method..................   Dynamic Wave
 Default surface area of junctions...      1.22 square meters.
 Minimum Junction/Conduit Depth......   0.00001 meter.
 Ponding Area Coefficient............   5000.00
 Ponding Area Exponent...............    1.0000
 Minimum Orifice Length..............      1.00 meters.
 NJSW input hydrograph junctions.....      0
      or user defined hydrographs....

 *==================================================*
 |          Table E1 - Conduit Data                 |
 *==================================================*

                                                                                                  Trapezoid  Hazen
  Inp              Conduit     Length    Conduit      Area    Manning  Max Width      Depth       Side
Williams
  Num                 Name        (m)      Class    ( m^2)      Coef.     (m)          (m)      Slopes  c-
factor
---- -------------------- ---------- ----------   -------    -------  ---------      -----    -------  -------
   1               Link45    10.1300   Circular    0.0314     0.0130     0.2000     0.2000
 Total length of all conduits ....        10.1300 meters

 *==================================================*
 | If there are messages about (sqrt(g*d)*dt/dx), or |
 | the sqrt(wave celerity)*time step/conduit length  |
 | in the output file all it means is that the       |
 | program will lower the internal time step to      |
 | satisfy this condition (explicit condition).      |
 | You control the actual internal time step by      |
 | using the minimum courant time step factor in the |
 | HYDRAULICS job control.  The message put in words |
 | states that the smallest conduit with the fastest |
 | velocity will control the time step selection.    |
 | You have further control by using the modify      |
 | conduit option in the HYDRAULICS Job Control.     |
 *==================================================*


              Conduit     Courant
                 Name       Ratio
 --------------------   ---------
              Link45        0.14

 *==================*
 |  Conduit Volume  |
 *==================*
```

```
 Full pipe or full open conduit volume
 Input full depth volume.............    3.1824E-01 cubic meters


 *==================================================*
 |           Table E3a - Junction Data              |
 *==================================================*

  Inp            Junction      Ground     Crown    Invert    Qinst   Initial  Interface
  Num                Name   Elevation Elevation Elevation      cms   Depth-m   Flow (%)
  --- ------------------   --------- --------- --------- -------- ---------  ---------
    1                TANK     99.8700   95.6700   95.6700   0.0000   0.0000   100.0000
    2        STM CNTRL MH    100.5800   97.6000   97.4000   0.0000   0.0000   100.0000
    3              ID*293    100.6200   97.4000   97.2000   0.0000   0.0000   100.0000


 *==================================================*
 |           Table E3b - Junction Data              |
 *==================================================*

  Inp            Junction           X             Y       Type of      Type of  Maximum       Pavement
  Num                Name       Coord.        Coord.    Manhole        Inlet  Capacity    Shape   Slope
 ---- --------------------    ----------   ---------- ---------- ------------  --------  -------- -------
    1                TANK       0.0000        0.0000 No Ponding       Normal                 0     0.00
    2        STM CNTRL MH       0.0000        0.0000 No Ponding       Normal                 0     0.00
    3              ID*293       0.0000        0.0000 No Ponding       Normal                 0     0.00


 *==================================================*
 |           Table E4 - Conduit Connectivity        |
 *==================================================*

 Input             Conduit               Upstream            Downstream     Upstream  Downstream
Number                Name                   Node                  Node    Elevation   Elevation
====== ==================== ====================  ====================    =========   =========
     1              Link45          STM CNTRL MH                ID*293      97.4000     97.2000   No Design


 *==========================================*
 |          Storage Junction Data           |
 *==========================================*

                                    MAXIMUM OR          PEAK OR        CROWN      DEPTH
      STORAGE JUNCTION  JUNCTION   CONSTANT SURFACE   CONSTANT VOLUME  ELEVATION   STARTS
        NUMBER OR NAME      TYPE      AREA  (M2)        (CUBIC MET.)       (M)       FROM
  --------------------  --------   ----------------   ---------------  --------- -----------
  TANK                  Constant         25.00             105.0      99.87     Node Invert

 *==================================================*
 |            Ordered Pump Data Fields              |
 |        Pump Name/Upstream Node/Dnstream Node     |
 |                DataPt/Depth/Flow                 |
 *==================================================*
 Pump 38 L/s              TANK                STM CNTRL MH
   1     0.000     0.000
   2     0.010     0.038
   3     4.200     0.038



 *==========================================*
 |             In-Line Pump Data            |
 *==========================================*

                     JUNCTIONS                          PUMP RATES               STAGES
               FROM               TO          = 1 CMS   = 2 CMS   = 3 CMS    = 1  M    = 2  M
            ------------       ----------   -------   -------   -------   -------   -------
  1. TANK      STM CNTRL          0.000     0.000     0.038     0.000     0.000


 *==========================================*
 |   Special Force Main Conduits            |
 *==========================================*

             Conduit  Diameter    Length     Rough  Entrance      Exit     Valve      Bend      Loss
Preissman
                Name   ft or m   ft or m     -ness    Loss K    Loss K    Loss K     Loss K    Coefft      Sf*L
SlotWidth
```

```
          ==========   =======   =======    ======    ======    ======    ======    ======    ======    ======
======

 Pump Name            Upstream Node        Dnstream Node        Minor Loss
 ============================================================================
 38 L/s               TANK                 STM CNTRL MH            0.0000

  Pt.  Flow Rate,   Original Head,   Modified Head  Force Main
    1     0.000          0.000          0.000          0.000
    2     0.038          0.010          0.010          0.010
    3     0.038          4.200          4.200          4.200

             Conduit        Maximum # of   Pump Underrelaxation
                Name     Pump Iterations   Parameter(0.25-0.85)
           ==========     ===============   ====================


 *================================================*
 |          FREE OUTFALL DATA (DATA GROUP I1)     |
 |         BOUNDARY CONDITION ON DATA GROUP J1    |
 *================================================*

 Outfall at Junction....ID*293 has boundary condition number...         1


 *================================================*
 |        INTERNAL CONNECTIVITY INFORMATION       |
 *================================================*

              CONDUIT             JUNCTION             JUNCTION
 -------------------- -------------------- --------------------
               38 L/s                 TANK         STM CNTRL MH
              FREE# 1               ID*293             BOUNDARY

 *================================================*
 |        Boundary Condition Information          |
 |                Data Groups J1-J4               |
 *================================================*


 BC NUMBER..         1 has no control water surface.

 *================================================*
 |             XP Note Field Summary              |
 *================================================*




 *================================*
 |   Conduit Convergence Criteria  |
 *================================*

              Conduit        Full     Conduit
                 Name        Flow       Slope
 --------------------  ----------  ----------
               Link45       0.0461      0.0197

 *================================*
 |    Initial Model Condition     |
 | Initial Time =      0.00 hours  |
 *================================*

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   0.00 /    95.67         STM CNTRL MH/   0.00 /    97.40               ID*293/   0.00 /
97.20

             Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
              Link45/       0.00               38 L/s/       0.00              FREE# 1/       0.00

             Conduit/   Velocity
              Link45/       0.00

             Conduit/ Cross Sectional Area
              Link45/       0.00

             Conduit/ Hydraulic Radius
              Link45/       0.00

             Conduit/ Upstream/ Downstream Elevation
```

```
             Link45/    97.20/    97.20

 Cycle        500      Time          0 Hrs -  8.33 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   0.00 /    95.67         STM CNTRL MH/   0.01 /    97.41               ID*293/   0.01 /
97.21

             Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
              Link45/       0.00              38 L/s/       0.00              FREE# 1/       0.00

 Cycle       1000      Time          0 Hrs - 16.67 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   0.00 /    95.67         STM CNTRL MH/   0.02 /    97.42               ID*293/   0.02 /
97.22

             Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
              Link45/       0.00              38 L/s/       0.00              FREE# 1/       0.00

 Cycle       1500      Time          0 Hrs - 25.00 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   0.00 /    95.67         STM CNTRL MH/   0.02 /    97.42               ID*293/   0.02 /
97.22

             Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
              Link45/       0.00              38 L/s/       0.00              FREE# 1/       0.00

 Cycle       2000      Time          0 Hrs - 33.33 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   0.00 /    95.67         STM CNTRL MH/   0.04 /    97.44               ID*293/   0.04 /
97.24

             Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
              Link45/       0.00              38 L/s/       0.00              FREE# 1/       0.00

 Cycle       2500      Time          0 Hrs - 41.67 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   0.00 /    95.67         STM CNTRL MH/   0.04 /    97.44               ID*293/   0.04 /
97.24

             Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
              Link45/       0.00              38 L/s/       0.00              FREE# 1/       0.00

 Cycle       3000      Time          0 Hrs - 50.00 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   0.00 /    95.67         STM CNTRL MH/   0.05 /    97.45               ID*293/   0.05 /
97.25

             Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
              Link45/       0.01              38 L/s/       0.01              FREE# 1/       0.01

 Cycle       3500      Time          0 Hrs - 58.33 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   0.00 /    95.67         STM CNTRL MH/   0.05 /    97.45               ID*293/   0.05 /
97.25

             Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
              Link45/       0.01              38 L/s/       0.01              FREE# 1/       0.01

 Cycle       4000      Time          1 Hrs -  6.67 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   0.00 /    95.67         STM CNTRL MH/   0.07 /    97.47               ID*293/   0.07 /
97.27

             Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
              Link45/       0.01              38 L/s/       0.01              FREE# 1/       0.01

 Cycle       4500      Time          1 Hrs - 15.00 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   0.01 /    95.68         STM CNTRL MH/   0.12 /    97.52               ID*293/   0.12 /
97.32
```

```
            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.03              38 L/s/       0.03              FREE# 1/       0.03

 Cycle       5000      Time          1 Hrs - 23.33 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   0.24 /    95.91         STM CNTRL MH/   0.14 /    97.54               ID*293/   0.14 /
97.34

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.04              38 L/s/       0.04              FREE# 1/       0.04

 Cycle       5500      Time          1 Hrs - 31.67 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   1.45 /    97.12         STM CNTRL MH/   0.14 /    97.54               ID*293/   0.14 /
97.34

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.04              38 L/s/       0.04              FREE# 1/       0.04

 Cycle       6000      Time          1 Hrs - 40.00 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   1.61 /    97.28         STM CNTRL MH/   0.14 /    97.54               ID*293/   0.14 /
97.34

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.04              38 L/s/       0.04              FREE# 1/       0.04

 Cycle       6500      Time          1 Hrs - 48.33 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   1.45 /    97.12         STM CNTRL MH/   0.14 /    97.54               ID*293/   0.14 /
97.34

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.04              38 L/s/       0.04              FREE# 1/       0.04

 Cycle       7000      Time          1 Hrs - 56.67 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   1.12 /    96.79         STM CNTRL MH/   0.14 /    97.54               ID*293/   0.14 /
97.34

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.04              38 L/s/       0.04              FREE# 1/       0.04

 Cycle       7500      Time          2 Hrs -  5.00 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   0.68 /    96.35         STM CNTRL MH/   0.14 /    97.54               ID*293/   0.14 /
97.34

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.04              38 L/s/       0.04              FREE# 1/       0.04

 Cycle       8000      Time          2 Hrs - 13.33 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   0.18 /    95.85         STM CNTRL MH/   0.14 /    97.54               ID*293/   0.14 /
97.34

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.04              38 L/s/       0.04              FREE# 1/       0.04

 Cycle       8500      Time          2 Hrs - 21.67 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   0.00 /    95.67         STM CNTRL MH/   0.06 /    97.46               ID*293/   0.06 /
97.26

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.01              38 L/s/       0.01              FREE# 1/       0.01

 Cycle       9000      Time          2 Hrs - 30.00 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   0.00 /    95.67         STM CNTRL MH/   0.06 /    97.46               ID*293/   0.06 /
97.26
```

```
            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.01              38 L/s/       0.01             FREE# 1/       0.01

 Cycle       9500      Time          2 Hrs - 38.33 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.06 /    97.46               ID*293/   0.06 /
97.26

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.01              38 L/s/       0.01             FREE# 1/       0.01

 Cycle      10000      Time          2 Hrs - 46.67 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.05 /    97.45               ID*293/   0.05 /
97.25

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.01              38 L/s/       0.01             FREE# 1/       0.01

 Cycle      10500      Time          2 Hrs - 55.00 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.05 /    97.45               ID*293/   0.05 /
97.25

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.01              38 L/s/       0.01             FREE# 1/       0.01

 Cycle      11000      Time          3 Hrs -  3.33 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.05 /    97.45               ID*293/   0.05 /
97.25

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.01              38 L/s/       0.01             FREE# 1/       0.01

 Cycle      11500      Time          3 Hrs - 11.67 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.05 /    97.45               ID*293/   0.05 /
97.25

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.01              38 L/s/       0.01             FREE# 1/       0.01

 Cycle      12000      Time          3 Hrs - 20.00 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.05 /    97.45               ID*293/   0.05 /
97.25

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.01              38 L/s/       0.01             FREE# 1/       0.01

 Cycle      12500      Time          3 Hrs - 28.33 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.04 /    97.44               ID*293/   0.04 /
97.24

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.01              38 L/s/       0.01             FREE# 1/       0.01

 Cycle      13000      Time          3 Hrs - 36.67 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.04 /    97.44               ID*293/   0.04 /
97.24

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

 Cycle      13500      Time          3 Hrs - 45.00 Min

          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
```

```
              TANK/   0.00 /    95.67         STM CNTRL MH/   0.04 /    97.44               ID*293/   0.04 /
97.24

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

 Cycle      14000      Time          3 Hrs - 53.33 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
              TANK/   0.00 /    95.67         STM CNTRL MH/   0.04 /    97.44               ID*293/   0.04 /
97.24

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

 Cycle      14500      Time          4 Hrs -  1.67 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
              TANK/   0.00 /    95.67         STM CNTRL MH/   0.04 /    97.44               ID*293/   0.04 /
97.24

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

 Cycle      15000      Time          4 Hrs - 10.00 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
              TANK/   0.00 /    95.67         STM CNTRL MH/   0.03 /    97.43               ID*293/   0.03 /
97.23

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

 Cycle      15500      Time          4 Hrs - 18.33 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
              TANK/   0.00 /    95.67         STM CNTRL MH/   0.02 /    97.42               ID*293/   0.02 /
97.22

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

 Cycle      16000      Time          4 Hrs - 26.67 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
              TANK/   0.00 /    95.67         STM CNTRL MH/   0.01 /    97.41               ID*293/   0.01 /
97.21

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

 Cycle      16500      Time          4 Hrs - 35.00 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
              TANK/   0.00 /    95.67         STM CNTRL MH/   0.01 /    97.41               ID*293/   0.01 /
97.21

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

 Cycle      17000      Time          4 Hrs - 43.33 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
              TANK/   0.00 /    95.67         STM CNTRL MH/   0.01 /    97.41               ID*293/   0.00 /
97.20

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

 Cycle      17500      Time          4 Hrs - 51.67 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
              TANK/   0.00 /    95.67         STM CNTRL MH/   0.00 /    97.40               ID*293/   0.00 /
97.20

            Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
             Link45/       0.00              38 L/s/       0.00             FREE# 1/       0.00

 Cycle      18000      Time          5 Hrs -  0.00 Min
```

```
          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
               TANK/   0.00 /    95.67         STM CNTRL MH/   0.00 /    97.40               ID*293/   0.00 /
97.20

             Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
              Link45/       0.00               38 L/s/       0.00              FREE# 1/       0.00


 *=====================================================*
 | Table E5 - Junction Time Limitation Summary         |
 |              (0.10 or 0.25)* Depth * Area           |
 | Time step = ------------------------------          |
 |                  Sum of Flow                        |
 *=====================================================*
 |  The time this junction was the limiting junction   |
 |                is listed in the third column.       |
 *=====================================================*

            Junction     Time(.10)  Time(.25)  Time(sec)
 --------------------     ---------  ---------  ---------
                 TANK         10.00      10.00    18000.0
         STM CNTRL MH          6.98      10.00        0.0
               ID*293         10.00      10.00        0.0
 The junction requiring the smallest time step was...TANK


 *=========================================================*
 |       Table E5a - Conduit Explicit Condition Summary    |
 |       Courant   =         Conduit Length                |
 |       Time step = ---------------------------------     |
 |                       Velocity + sqrt(g*depth)          |
 |                                                         |
 |                  Conduit Implicit Condition Summary     |
 |       Courant   =         Conduit Length                |
 |       Time step = ---------------------------------     |
 |                             Velocity                    |
 *=========================================================*
 |  The 3rd column is the Explicit time step times the     |
 |      minimum courant time step factor                   |
 |                                                         |
 |  Minimum Conduit Time Step in seconds in the 4th column |
 |  in the list. Maximum possible is 10 * maximum time step|
 |                                                         |
 |  The 5th column is the maximum change at any time step  |
 |  during the simulation. The 6th column is the wobble    |
 |  value which is an indicator of the flow stability.     |
 |                                                         |
 |  You should use this section to find those conduits that|
 |  are slowing your model down.  Use modify conduits to   |
 |  alter the length of the slow conduits to make your     |
 |  simulation faster, or change the conduit name to       |
 |  "CHME?????" where ????? are any characters, this will  |
 |  lengthen the conduit based on the model time step,     |
 |  not the value listed in modify conduits.               |
 *=========================================================*

              Conduit  Time(exp)  Expl*Cmin  Time(imp) Time(min)  Max Qchange   Wobble  Type of Soln
       --------------  ---------  ---------  --------- ---------  -----------  -------  ------------
               Link45      3.60       3.60       6.16     300.0         -0.002    1.668   PBSJ Solutn
 The conduit with the smallest time step limitation was..Link45
 The conduit with the largest wobble was.................Link45
 The conduit with the largest flow change in any
 consecutive time step...................................Link45

 ***********************************************
 *      End of time step DO-loop in Runoff     *
 ***********************************************

 Final Date (Mo/Day/Year)   =             8/ 9/2023
 Total number of time steps =                   300
 Final Julian Date          =               2023221
 Final time of day          =                 18000. seconds.
 Final time of day          =                   5.00   hours.
 Final running time         =                 5.0000   hours.
 Final running time         =                 0.2083    days.

 ***************************************************
 *     Extrapolation Summary for Watersheds        *
 * Explains the number of time steps and iterations *
 * used in the solution of the subcatchments.      *
```

```
 * # Steps ==> Total Number of Extrapolated Steps   *
 * # Calls ==> Total Number of OVERLND Calls        *
 ************************************************

         Subcatchment   # Steps  # Calls              Subcatchment   # Steps  # Calls              Subcatchment
# Steps  # Calls
 --------------------   -------  --------     ---------------------   -------  --------     ---------------------
-------  --------
               TANK#1      4750       750                   TANK#2         0         0


#########################################################
# Rainfall input summary from Runoff Continuity Check   #
#########################################################

 Total rainfall read for gage #         1 is        77.91 mm
 Total rainfall duration for gage #     1 is       240.00 minutes

 ************************************************************
 * Table R5. CONTINUITY CHECK FOR SURFACE WATER              *
 *       Any continuity error can be fixed by lowering the  *
 *       wet and transition time step. The transition time  *
 *       should not be much greater than the wet time step. *
 ************************************************************
                                                                    Millimeters over
                                                  cubic meters      Total Basin
 Total Precipitation (Rain plus Snow)            2.492976E+02        77.905
 Total Infiltration                              3.875862E+01        12.112
 Total Evaporation                               1.875970E+00         0.586
 Surface Runoff from Watersheds                  2.037272E+02        63.665
 Total Water remaining in Surface Storage        3.446902E+00         1.077
 Infiltration over the Pervious Area...          3.875862E+01        38.299
                    --------
 Infiltration + Evaporation +
 Surface Runoff + Snow removal +
 Water remaining in Surface Storage +
 Water remaining in Snow Cover.........          2.478087E+02        77.440
 Total Precipitation + Initial Storage.          2.492976E+02        77.905


 The error in continuity is calculated as
 ****************************************
 * Precipitation + Initial Snow Cover  *
 *      - Infiltration -               *
 *Evaporation - Snow removal -         *
 *Surface Runoff from Watersheds -     *
 *Water in Surface Storage -           *
 *Water remaining in Snow Cover        *
 *--------------------------------------*
 * Precipitation + Initial Snow Cover  *
 ****************************************
 Percent Continuity Error...............                          0.5972


 ***************************************************
 * Table R6. Continuity Check for Channel/Pipes    *
 *           You should have zero continuity error *
 *           if you are not using runoff hydraulics *
 ***************************************************
                                                                    Millimeters over
                                                  cubic meters      Total Basin
 Initial Channel/Pipe Storage.................    0.000000E+00         0.000
 Final Channel/Pipe Storage...................    0.000000E+00         0.000
 Surface Runoff from Watersheds...............    2.037272E+02        63.665
 Groundwater Subsurface Inflow or Diversion..     0.000000E+00         0.000
 Evaporation Loss from Channels...............    0.000000E+00         0.000
 Groundwater Flow Diverted Out of Network....     0.000000E+00         0.000
 Channel/Pipe/Inlet Outflow...................    2.037272E+02        63.665
 Initial Storage + Inflow.....................    2.037272E+02        63.665
 Final Storage + Outflow + Diverted GW.......     2.037272E+02        63.665
 ******************************************
 * Final Storage + Outflow + Evaporation  - *
 * Watershed Runoff - Groundwater Inflow  - *
 *     Initial Channel/Pipe Storage         *
 *     ---------------------------------    *
 *  Final Storage + Outflow  + Evaporation  *
 ******************************************
 Percent Continuity Error.....................                   -0.0000

         ################################################
```

```
        # Table R9. Summary Statistics for Subcatchments #
        ##################################################

 Note: Total Runoff Depth includes pervious & impervious areas.
       Pervious and Impervious Runoff Depth is only the runoff from those two areas.
       For catchments receiving redirected flow, this flow will only be shown if the flow is not
       directed directly to the outlet. Flow that is getting redirected is also listed with
       the original subcatchment.


 Subcatchment...........              TANK#1              TANK#2
 Area (hectares)........             0.22000             0.10000
 Percent Impervious.....            99.00000             1.00000
 Total Rainfall (mm)....            77.90550            77.90550
 Max Intensity (mm/hr)..           163.17700           163.17700

 Pervious Area
 -------------
 Total Runoff Depth (mm)            36.30460            38.25581
 Peak Runoff Rate (cms).             0.00064             0.01385

 Total Impervious Area
 ---------------------
 Total Runoff Depth (mm)             2.98358             0.00000
 Peak Runoff Rate (cms).             0.09844             0.00000

 Impervious Area with depression storage
 ---------------------------------------
 Total Runoff Depth (mm)            56.46228             0.00000
 Peak Runoff Rate (cms).             0.07383             0.00000

 Impervious Area without depression storage
 ------------------------------------------
 Total Runoff Depth (mm)            19.32069             0.00000
 Peak Runoff Rate (cms).             0.02461             0.00000

 Total Area
 ----------
 Total Runoff Depth (mm)            75.38818            37.87325
 Peak Runoff Rate (cms).             0.09909             0.01385

 Rational Formula
 ----------------
 Pervious Tc. (mins)....             0.00000             0.00000
 Perv. Intensity (mm/hr)             0.00000             0.00000
 Pervious C ............             0.00000             0.00000
 Impervious Tc. (mins)..             0.00000             0.00000
 Imp. Intensity (mm/hr).             0.00000             0.00000
 Impervious C ..........             0.00000             0.00000
 Partial Area (Ha)......             0.00000             0.00000
 Partial Area Tc........             0.00000             0.00000
 Partial Area Intensity.             0.00000             0.00000

 UK Methods
 -----------
 Runoff percentage (%)..             0.00000             0.00000
 Effective Area (Ha)....             0.00000             0.00000
 Depression Storage (mm)             0.00000             0.00000
 Routing coefficient....             0.00000             0.00000

 ===> Runoff simulation ended normally.

 *================================================*
 |  Table E6. Final Model Condition               |
 |            This table is used for steady state |
 |            flow comparison and is the information|
 |            saved to the hot-restart file.      |
 |            Final Time =     5.000 hours        |
 *================================================*

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
                TANK/   0.00 /    95.67/        STM CNTRL MH/   0.00 /    97.40/              ID*293/   0.00 /
97.20/

           Conduit/       Flow   ===> "*" Conduit uses the normal flow option.
              Link45/       0.00 /              38 L/s/       0.00 /             FREE# 1/       0.00 /

              Conduit/   Velocity
              Link45/       0.09 /
```

```
         Conduit/      Width
              Link45/       0.08 /

        Junction/        EGL
                TANK/       0.00 /        STM CNTRL MH/       0.00 /             ID*293/       0.00 /

        Junction/  Freeboard
                TANK/       4.20 /        STM CNTRL MH/       3.18 /             ID*293/       3.42 /

        Junction/ Max Volume
                TANK/      40.29 /        STM CNTRL MH/       0.17 /             ID*293/       0.17 /

        Junction/Total Fldng
                TANK/       0.00 /        STM CNTRL MH/       0.00 /             ID*293/       0.00 /

         Conduit/ Cross Sectional Area
              Link45/       0.00 /

         Conduit/  Final Volume
              Link45/       0.00 /

         Conduit/ Hydraulic Radius
              Link45/       0.00 /

         Conduit/ Upstream/ Downstream Elevation
              Link45/    97.40/    97.20
```

```
*=========================================================*
|         Table E7 -  Iteration Summary                   |
*=========================================================*

Total number of time steps simulated.............      18000
Total number of passes in the simulation........      18378
Total number of time steps during simulation....      18003
Ratio of actual # of time steps / NTCYC.........      1.000
Average number of iterations per time step......      1.021
Average  time step size(seconds)................      1.000
Smallest time step size(seconds)................      1.000
Largest  time step size(seconds)................      1.000
Average minimum Conduit Courant time step (sec).      1.000
Average minimum implicit time step (sec)........      1.000
Average minimum junction time step (sec)........      1.000
Average Courant Factor Tf.......................      1.000
Number of times omega reduced...................          5


*=========================================================*
|     Table E8 - Junction Time Step Limitation Summary    |
*=========================================================*
|   Not Convr = Number of times this junction did not     |
|               converge during the simulation.           |
|   Avg Convr = Average junction iterations.              |
|   Conv err  = Mean convergence error.                   |
|   Omega Cng = Change of omega during iterations         |
|   Max Itern = Maximum number of iterations              |
*=========================================================*
            Junction Not Convr Avg Convr Total Itt Omega Cng  Max Itern  Ittrn >10  Ittrn >25  Ittrn >40
-------------------- --------- --------- ---------  --------  ---------  ---------  ---------  ---------
                TANK         0      1.00     18021         0          2          0          0          0
        STM CNTRL MH         0      1.00     18077         0          4          0          0          0
              ID*293         0      1.02     18414         5        112          4          4          3
Total number of iterations for all junctions..     54512
Minimum number of possible iterations.........     54009
Efficiency of the simulation..................      1.01
                                                Good Efficiency

*=========================================================*
| Extran Efficiency is an indicator of the efficiency of  |
| the simulation.  Ideal efficiency is one iteration per  |
| time step.  Altering the underrelaxation parameter,     |
| lowering the time step, increasing the flow and head    |
| tolerance are good ways of improving the efficiency,    |
| another is lowering the internal time step. The lower the|
| efficiency generally the faster your model will run.    |
| If your efficiency is less than 1.5 then you may try    |
| increasing your time step so that your overall simulation|
| is faster.  Ideal efficiency would be around 2.0        |
|                                                         |
| Good Efficiency      < 1.5           mean iterations    |
```

```
 | Excellent Efficiency < 2.5 and > 1.5 mean iterations     |
 | Good      Efficiency < 4.0 and > 2.5 mean iterations     |
 | Fair      Efficiency < 7.5 and > 4.0 mean iterations     |
 | Poor Efficiency      > 7.5           mean iterations     |
 *=====================================================*
```

```
 *=====================================================*
 |        Table E9 - JUNCTION SUMMARY STATISTICS        |
 | The Maximum area is only the area of the node, it    |
 | does not include the area of the surrounding conduits|
 *=====================================================*
```

Junction Name	Ground Elevation meters	Uppermost PipeCrown Elevation meters	Maximum Junction Elevation meters	Time of Occurence Hr.	Time of Occurence Min.	Meters of Surcharge at Max Elevation	Freeboard of node meters	Maximum Junction Area m^2	Maximum Gutter Depth meters	Maximum Gutter Width meters	Maximum Gutter Velocity m/s
TANK	99.8700	95.6700	97.2817	1	40	1.6117	2.5883	25.0000	0.0000	0.00	0.0000
STM CNTRL MH	100.5800	97.6000	97.5402	1	20	0.0000	3.0398	1.2200	0.0000	0.00	0.0000
ID*293	100.6200	97.4000	97.3395	1	20	0.0000	3.2805	1.2200	0.0000	0.00	0.0000

```
 *=====================================================*
 |        Table E10 - CONDUIT SUMMARY STATISTICS        |
 | Note: The peak flow may be less than the design flow |
 | and the conduit may still surcharge because of the   |
 | downstream boundary conditions.                      |
 |                                                      |
 | * denotes an open conduit that has been overtopped   |
 |   this is a potential source of severe errors        |
 *=====================================================*
```

Conduit Name	Design Flow (cms)	Conduit Design Velocity (m/s)	Maximum Vertical Depth (mm)	Maximum Computed Flow (cms)	Time of Occurence Hr.	Time of Occurence Min.	Maximum Computed Velocity (m/s)	Time of Occurence Hr.	Time of Occurence Min.	Ratio of Max. to Design Flow	Maximum Elev at Pipe Upstream (m)	Water Ends US	Ratio d/D Dwnstrm DS (m)
Link45	0.0461	1.4669	200.0000	0.0384	1	20	1.6444	1	20	0.8327	97.5402	97.3395	0.701 0.698
38 L/s	Undefnd	Undefnd	Undefnd	0.0380	1	20							
FREE# 1	Undefnd	Undefnd	Undefnd	0.0384	1	20							

```
 *=====================================================*
 | Table E11.  Area assumptions used in the analysis|
 | Subcritical and Critical flow assumptions from   |
 | Subroutine Head. See manual for more information.|
 *=====================================================*
```

Conduit Name	Duration of Dry Flow(min)	Duration of Sub-Critical Flow(min)	Durat. of Upstream Critical Flow(min)	Durat. of Downstream Critical Flow(min)	Maximum Hydraulic Radius-m	Maximum X-Sect Area(m^2)	Maximum Vel*D (m^2/s)
Link45	6.37	293.63	0.00	0.00	0.059	0.023	0.229

```
          *=========================================*
          | Table E12. Mean Conduit Flow Information  |
          *=========================================*
```

Conduit Name	Mean Flow (cms)	Total Flow (m^3)	Mean Percent Change	Low Flow Weightng	Mean Froude Number	Mean Hydraulic Radius	Mean Cross Area	Mean Conduit Roughness
Link45	0.0113	203.6551	0.0004	0.9783	1.3751	0.0295	0.0082	0.0130
38 L/s	0.0113	203.6766						
FREE# 1	0.0113	203.6529						

| Table E13. Channel losses(H), headwater depth (HW), tailwater depth (TW), critical and normal depth (Yc and Yn). Use this section for culvert comparisons |

Conduit Name	Maximum Flow	Head Loss	Friction Loss	Critical Depth	Normal Depth	HW Elevat	TW Elevat	
Link45	0.0384	0.0000	0.2000	0.1674	0.1395	97.5395	97.3395	Max Flow

| Table E13a. CULVERT ANALYSIS CLASSIFICATION, and the time the culvert was in a particular classification during the simulation. The time is in minutes. The Dynamic Wave Equation is used for all conduit analysis but the culvert flow classification condition is based on the HW and TW depths. |

Conduit Name	Critical D Outlet Control	Mild Slope Outlet Control	Steep Slope TW Insignf Entrance Control	Slug Flow Outlet/ Entrance Control	Mild Slope TW > D Outlet Control	Mild Slope TW <= D Outlet Control	Outlet Control	Inlet Control	Inlet Configuration
Link45	0.0000	0.0000	300.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None

| Kinematic Wave Approximations
Time in Minutes for Each Condition |

Conduit Name	Duration of Normal Flow	Slope Criteria	Super-Critical	Roll Waves
Link45	0.4500	0.4500	229.6667	0.0000

| Table E15 - SPREADSHEET INFO LIST
Conduit Flow and Junction Depth Information for use in spreadsheets. The maximum values in this table are the true maximum values because they sample every time step. The values in the review results may only be the maximum of a subset of all the time steps in the run.
Note: These flows are only the flows in a single barrel. |

Conduit Name	Maximum Flow (cms)	Total Flow (m^3)	Maximum Velocity (m/s)	Maximum Volume (m^3)	##	Junction Name	Invert Elevation (m)	Maximum Elevation (m)
Link45	0.0384	203.6551	1.6444	0.1653	##	TANK	95.6700	97.2817
38 L/s	0.0380	203.6766	0.0000	0.0000	##	STM CNTRL MH	97.4000	97.5402
FREE# 1	0.0384	203.6529	0.0000	0.0000	##	ID*293	97.2000	97.3395

| Table E15a - SPREADSHEET REACH LIST
Peak flow and Total Flow listed by Reach or those conduits or diversions having the same upstream and downstream nodes. |

Upstream Node	Downstream Node	Maximum Flow (cms)	Total Flow (m^3)
STM CNTRL MH	ID*293	0.0384	203.6551
TANK	STM CNTRL MH	0.0380	203.6766

```
 ##########################################################
 # Table E16. New Conduit Information Section             #
 #            Conduit Invert (IE) Elevation and Conduit   #
 #            Maximum Water Surface (WS) Elevations       #
 ##########################################################

         Conduit Name        Upstream Node      Downstream Node      IE Up      IE Dn      WS Up      WS Dn
Conduit Type
 -------------------- -------------------- -------------------- ---------- ---------- ---------- ---------- ---
----------
              Link45         STM CNTRL MH               ID*293     97.40      97.20      97.54      97.34
Circular

 ##################################################
 # Table E17. Pump Operation Section              #
 ##################################################

     Pump Operating Time and Pump General Results
     --------------------------------------------

                                                      Time   # of Times
                          Upstream       Downstream  in hours    Pump    Min HGL   Max HGL    Min Q    Max Q
Totl Q
       Pump Name             Node             Node   Pump On   Goes On    meter     meter      cms      cms
m^3
 --------------- ---------------- ---------------- ---------  --------- --------- --------- --------- --------- ---
-----
        P{294.1}              291              292    0.0000       0       0.0000   0.0000   0.0000   0.0000
203.6766

 *=============================================================================*
 |    Table E18 - Junction Continuity Error.   Division by Volume added 11/96  |
 |                                                                             |
 |  Continuity Error = Net Flow + Beginning Volume - Ending Volume             |
 |                     -----------------------------------------------         |
 |                     Total Flow + (Beginning Volume + Ending Volume)/2       |
 |                                                                             |
 |  Net Flow   = Node Inflow - Node Outflow                                    |
 |  Total Flow = absolute (Inflow + Outflow)                                   |
 |  Intermediate column is a judgement on the node continuity error.           |
 |                                                                             |
 |  Excellent  < 1 percent    Great  1 to  2 percent  Good  2 to  5 percent    |
 |  Fair  5 to 10  percent    Poor  10 to 25 percent  Bad  25 to 50 percent    |
 |  Terrible > 50  percent                                                     |
 *=============================================================================*

             Junction    <------Continuity Error ------->   Remaining   Beginning    Net Flow  Total Flow
Failed to
                Name      Volume  % of Node  % of Inflow      Volume      Volume   Thru Node   Thru Node
Converge
 --------------------    --------  ----------  ----------    --------  ----------  ----------  ---------- -----
----
                TANK      0.0514      0.0126      0.0252      0.0000      0.0000      0.0514    407.4022
0
        STM CNTRL MH      0.0196      0.0048      0.0096      0.0013      0.0000      0.0209    407.3318
0
              ID*293      0.0106      0.0026      0.0052      0.0005      0.0000      0.0111    407.3080
0
 The total continuity error was  8.16326E-02 cubic meters
 The remaining total volume was  1.80477E-03 cubic meters
 Your mean node continuity error was   Excellent
 Your worst node continuity error was  Excellent

   *=================================================*
   |  Table E19 - Junction Inflow & Outflow Listing  |
   |              Units are either ft^3 or m^3       |
   |              depending on the units in your model.|
   *=================================================*

                       Constant       User       Interface       DWF         Inflow    RNF Layer     Inflow
             Junction     Inflow      Inflow        Inflow       Inlow       through      Inflow       from
Outflow    Evaporation       Basin
                Name    to Node     to Node       to Node      to Node      Outfall      to Node    2D Layer
from Node    from Node        Infil.
 --------------------  ----------  ----------  ----------  ----------  ----------  ----------  ----------
----------  ----------  ----------
                TANK      0.0000       0.0000       0.0000       0.0000       0.0000     203.7256       0.0000
0.0000       0.0000         0.00
              ID*293      0.0000       0.0000       0.0000       0.0000       0.0000       0.0000       0.0000
203.6529       0.0000         0.00
```

```
  *=====================================================*
  | Table E20 - Junction Flooding and Volume Listing.   |
  |             The maximum volume is the total volume  |
  |             in the node including the volume in the |
  |             flooded storage area. This is the max   |
  |             volume at any time. The volume in the   |
  |             flooded storage area is the total volume|
  |             above the ground elevation, where the   |
  |             flooded pond storage area starts.       |
  | The fourth column is instantaneous, the fifth is the|
  | sum of the flooded volume over the entire simulation|
  | Units are either ft^3 or m^3 depending on the units.|
  *=====================================================*

                                                 Out of                Passed to 2D cell
                                               1D-System               OR  Volume Stored
           Junction    Surcharged   Flooded      (Flooded     Maximum    in allowed Flood
               Name    Time (min)  Time(min)      Volume)      Volume   Pond of 1D-System
--------------------   ----------  ---------    ---------   ---------   -----------------
               TANK    299.          0.000       0.000    40.3           0.000
       STM CNTRL MH       0.000       0.000       0.000   0.171           0.000
             ID*293       0.000       0.000       0.000   0.170           0.000

*==================================*
| Simulation Specific Information  |
*==================================*
Number of Input Conduits.........         1 Number of Simulated Conduits......         3
Number of Natural Channels........         0 Number of Junctions...............         3
Number of Storage Junctions.......         1 Number of Weirs...................         0
Number of Orifices................         0 Number of Pumps...................         1
Number of Free Outfalls...........         1 Number of Tide Gate Outfalls......         0


*=========================================================*
| Average % Change in Junction or Conduit is defined as:  |
| Conduit  % Change ==> 100.0 ( Q(n+1) - Q(n) ) / Qfull   |
| Junction % Change ==> 100.0 ( Y(n+1) - Y(n) ) / Yfull   |
*=========================================================*

The Conduit with the largest average change was..              Link45 with     0.000 percent
The Junction with the largest average change was.                TANK with     0.018 percent
The Conduit with the largest sinuosity was.......              Link45 with     1.668


*=====================================================================*
| Table E21. Continuity balance at the end of the simulation        |
|            Junction Inflow, Outflow or Street Flooding            |
| Error = Inflow  + Initial Volume - Outflow - Final   Volume       |
*=====================================================================*

            Inflow          Inflow       Average
            Junction   Volume, m^3   Inflow, cms
--------------------  ------------  -------------
               TANK      203.7256         0.0113
             ID*293     -203.6529        -0.0113

             Outflow     Outflow         Average
            Junction  Volume m^3    Outflow, cms
--------------------  ------------  ------------
             ID*293      203.6529         0.0113


*=====================================================*
| Initial system volume        =         0.0000 Cu M  |
| Total system inflow volume   =       203.7256 Cu M  |
| Inflow + Initial volume      =       203.7256 Cu M  |
*=====================================================*
| Total system outflow         =       203.6529 Cu M  |
| Volume left (Final volume)   =         0.0018 Cu M  |
| Evaporation                  =         0.0000 Cu M  |
| Basin Infiltration           =         0.0000 Cu M  |
| Outflow + Final Volume       =       203.6547 Cu M  |
*=====================================================*

*=============================================*
| Total Model Continuity Error                |
| Error in Continuity, Percent =         0.0348 |
| Error in Continuity, m^3     =         0.0709 |
| + Error means a continuity loss, - a gain     |
```

```
 *============================================*


 ##################################################
 # Table E22. Numerical Model judgement section   #
 ##################################################

 Overall error was (minimum of Table E18 & E21)             0.0348 percent
 Worst nodal error was in node TANK                with     0.0126 percent
 Of the total inflow this loss was                          0.0252 percent
 Your overall continuity error was                 Excellent
                                                  Excellent Efficiency
 Efficiency of the simulation                      1.01
 Most Number of Non Convergences at one Node       0.
 Total Number Non Convergences at all Nodes        0.
 Total Number of Nodes with Non Convergences       0.


 ##########################################################
 # Table E23. New Basin Design Information                #
 #            Maximum Hydraulic Grade Line,               #
 #            Out Conduit Sizes and Maximum Flow          #
 ##########################################################

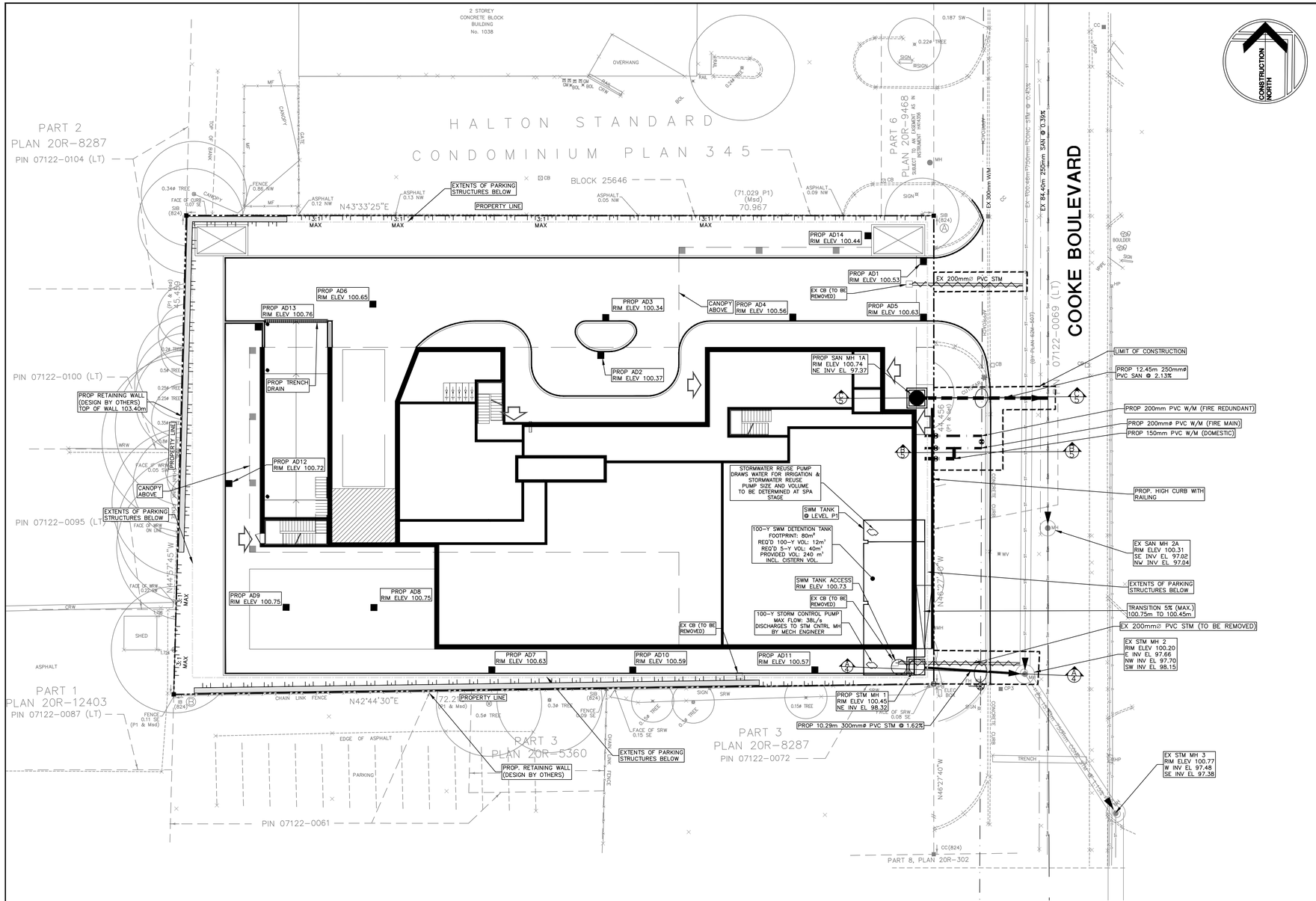
 A) Resize d/s Pipes based on given HGL
 B) Resize Basin based on given HGL
 C) Resize d/s Pipes and Basin based on HGL and max discharge
 D) Resize d/s pipes based on given max discharge

        Basin Name    Type    Max.HGL        Conduit          Depth   Width   Barrels   Max.Flow
                                (m)                            (m)     (m)               (m^3/s)
 -------------------- ------  --------- -------------------- ------- ------- --------- ---------

*============================================================*
 |         XPSWMM/XPSTORM Simulation Date and Time Summary      |
 *============================================================*
 | Starting Date... August     15, 2023  Time...  09:00:29.817  |
 |   Ending Date... August     15, 2023  Time...  09:00:43.127  |
 |  Elapsed Time...    0.20807 minutes or     12.48438 seconds  |
 *============================================================*
```

APPENDIX D

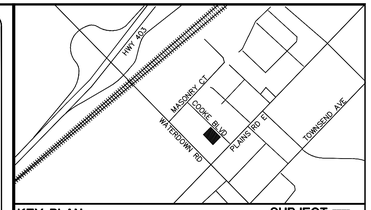
Functional Servicing Plan – Ground
Functional Servicing Plan – P1
Functional Servicing Plan – Roof
Functional Grading Plan
Cross Sections



SERVICING LEGEND:

- DENOTES EXISTING STORM MANHOLE
- DENOTES PROPOSED STORM MANHOLE
- DENOTES EXISTING CATCH BASIN
- DENOTES PROPOSED CATCHBASIN
- DENOTES PROPOSED STORMCEPTOR
- DENOTES PROPOSED INLET CONTROL DEVICE (ICD)
- DENOTES EXISTING STORM SEWER
- DENOTES PROPOSED STORM SEWER
- DENOTES EXISTING SANITARY MANHOLE
- DENOTES PROPOSED SANITARY MANHOLE
- DENOTES PROPOSED SANITARY SEWER
- DENOTES EXISTING SANITARY SEWER
- DENOTES PROPOSED HYDRANT
- DENOTES EXISTING HYDRANT
- DENOTES PROPOSED WATER VALVE & BOX
- DENOTES EXISTING WATER VALVE & BOX
- DENOTES PROPOSED WATER METER
- DENOTES EXISTING WATER MAIN
- DENOTES PROPOSED WATER MAIN
- DENOTES PROPOSED F/D CONNECTION
- DENOTES PROPOSED CAP FOR SANITARY, STORM, AND/OR WATER AS NOTED
- DENOTES PROPOSED ENTRANCE LOCATION
- DENOTES PROPOSED LIMIT OF CONSTRUCTION
- DENOTES PROPOSED HEAVY DUTY ASPHALT AREA

CONTRACTOR TO VERIFY ALL INVERTS, SIZE, MATERIAL, AND LOCATION OF ALL SERVICES PRIOR TO CONSTRUCTION AND REPORT ANY DISCREPANCIES TO THE ODAN/DETECH GROUP



KEY PLAN Scale : N.T.S. — **SUBJECT LANDS**

NOTES:

THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND UNDERGROUND AND ABOVE GROUND UTILITIES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING THE WORK, THE CONTRACTOR SHALL CONFIRM OF THE EXACT LOCATION OF ALL UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

THE CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS ON THE JOB AND REPORT ANY DISCREPANCY TO THE ARCHITECTS/ENGINEERS BEFORE PROCEEDING WITH THE WORKS.

ALL DRAWINGS AND SPECIFICATIONS ARE INSTRUMENTS OF SERVICE AND THE PROPERTY OF THE ENGINEER WHICH MUST BE RETURNED AT THE COMPLETION OF WORK.

THIS DRAWING IS NOT TO BE SCALED. CONTRACTOR TO USE DIGITAL FILES FOR LAYOUT PROVIDED BY ENGINEER. THIS PLAN MUST NOT BE USED TO SITE THE PROPOSED BUILDINGS.

THE APPROVAL OF THIS PLAN DOES NOT EXEMPT THE OWNER'S CONTRACTOR FROM OBTAINING, BUT NOT LIMITED TO THE FOLLOWING PERMITS: ROAD CUT, SEWER PERMITS, RELOCATION OF SERVICES, ENCROACHMENT AGREEMENTS, APPROACH APPROVAL PERMITS, ETC..

EXISTING TOPOGRAPHICAL INFORMATION SUPPLIED BY A.T. MCLAREN LIMITED ON THE 8TH DAY OF MAY, 2023

BENCH MARK:

MONUMENT 3488
MAPLEHURST SCHOOL, 481 PLAINS ROAD EAST (HIGHWAY 2) 1.92km NORTHEAST OF WATERDOWN ROAD, TABLET IN THE FRONT OF SOUTHEAST CONCRETE FOUNDATION WALL, 1.5m SOUTHWEST OF THE MOST EASTERLY OF TWO ENTRANCES, 0.1m BELOW RED BRICK SIDING
ELEVATION: 98.754m

BEARING NOTE:

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

METRIC NOTE:

DISTANCES AND ELEVATIONS ON THIS PLAN ARE TYPICALLY SHOWN IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

NO.	REVISIONS	DATE	BY
2	ISSUED FOR OPA/ZBA	2023/11/15	RG
1	ISSUED FOR REVIEW & COORDINATION	2023/11/09	RG

SCALE(S): 1:200

0 5 10 20

DRAWING TITLE:

FUNCTIONAL SERVICING PLAN - GROUND

PROJECT:

PROPOSED MIXED-USE DEVELOPMENT
1026 COOKE BOULEVARD
BURLINGTON, ON

CLIENT:

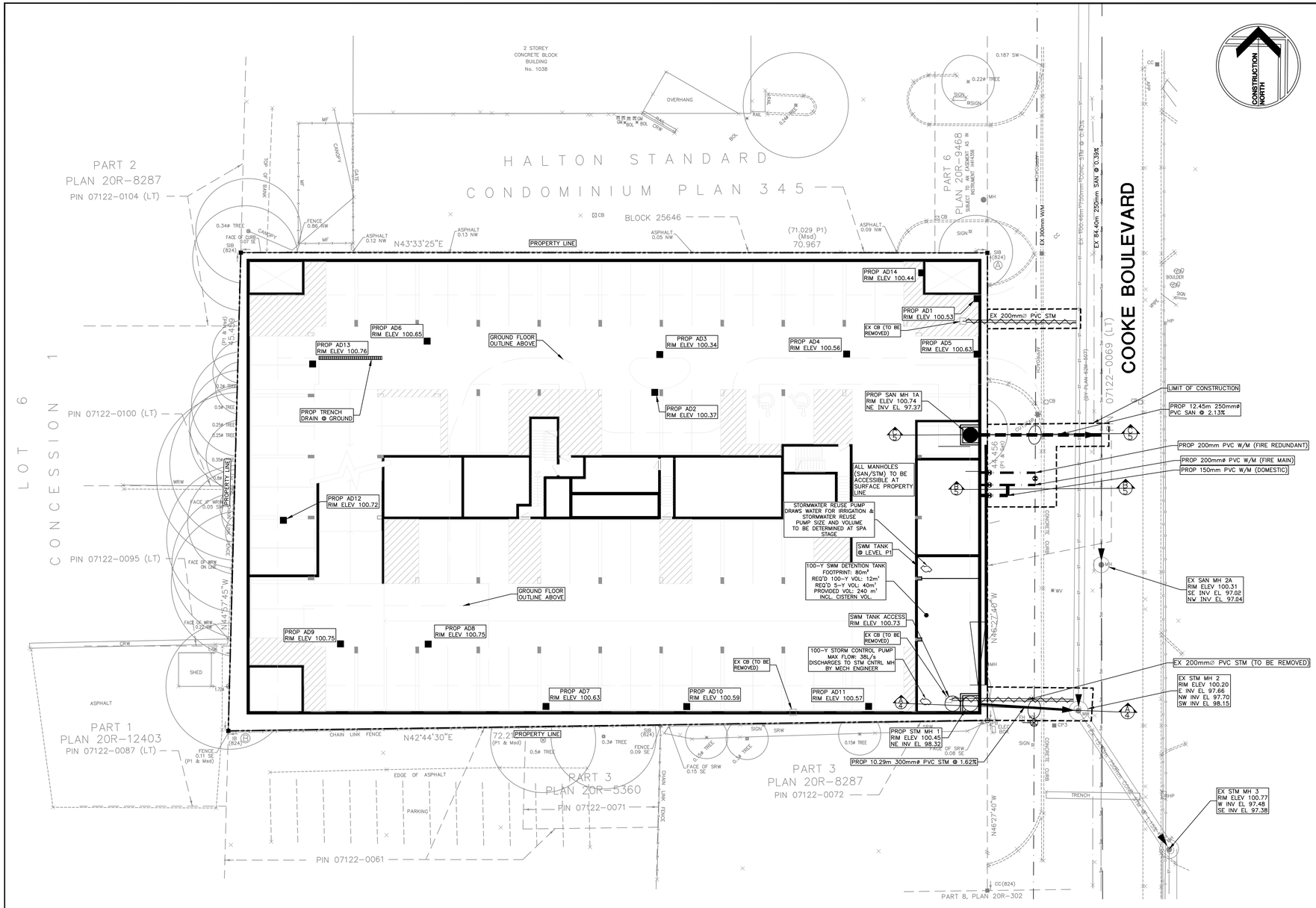
HSCC#416 KD

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ENGINEER

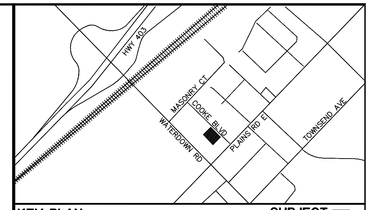
DESIGNED BY:	PROJECT No.:
P.H.	23208
DRAWN BY: R.G.	
CHECKED BY: M.H.H.	DATE: AUG 2023
APPROVED BY: P.H.	DRAWING No.: 1 OF 5



SERVICING LEGEND:

- DENOTES EXISTING STORM MANHOLE
- DENOTES PROPOSED STORM MANHOLE
- DENOTES EXISTING CATCH BASIN
- DENOTES PROPOSED CATCHBASIN
- DENOTES PROPOSED STORMCEPTOR
- DENOTES PROPOSED INLET CONTROL DEVICE (ICD)
- DENOTES EXISTING STORM SEWER
- DENOTES PROPOSED STORM SEWER
- DENOTES EXISTING SANITARY MANHOLE
- DENOTES PROPOSED SANITARY MANHOLE
- DENOTES PROPOSED SANITARY SEWER
- DENOTES EXISTING SANITARY SEWER
- DENOTES PROPOSED HYDRANT
- DENOTES EXISTING HYDRANT
- DENOTES PROPOSED WATER VALVE & BOX
- DENOTES EXISTING WATER VALVE & BOX
- DENOTES PROPOSED WATER METER
- DENOTES EXISTING WATER MAIN
- DENOTES PROPOSED WATER MAIN
- DENOTES PROPOSED F/D CONNECTION
- DENOTES PROPOSED CAP FOR SANITARY, STORM, AND/OR WATER AS NOTED
- DENOTES PROPOSED ENTRANCE LOCATION
- DENOTES PROPOSED LIMIT OF CONSTRUCTION
- DENOTES PROPOSED HEAVY DUTY ASPHALT AREA

CONTRACTOR TO VERIFY ALL INVERTS, SIZE, MATERIAL, AND LOCATION OF ALL SERVICES PRIOR TO CONSTRUCTION AND REPORT ANY DISCREPANCIES TO THE ODAN/DETECH GROUP



KEY PLAN Scale : N.T.S.

SUBJECT LANDS

NOTES:

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EXISTING TOPOGRAPHICAL INFORMATION SUPPLIED BY A.T. MCLAREN LIMITED ON THE 8TH DAY OF MAY, 2023

BENCH MARK:

MONUMENT 3488
MAPLEHURST SCHOOL, 481 PLAINS ROAD EAST (HIGHWAY 2) 1.92km NORTHEAST OF WATERDOWN ROAD, TABLET IN THE FRONT OF SOUTHEAST CONCRETE FOUNDATION WALL, 1.5m SOUTHWEST OF THE MOST EASTERLY OF TWO ENTRANCES, 0.1m BELOW RED BRICK SIDING
ELEVATION: 98.754m

BEARING NOTE:

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

METRIC NOTE:

DISTANCES AND ELEVATIONS ON THIS PLAN ARE TYPICALLY SHOWN IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

NO.	REVISIONS	DATE	BY
2	ISSUED FOR OPA/ZBA	2023/11/15	RG
1	ISSUED FOR REVIEW & COORDINATION	2023/11/09	RG

SCALE(S): 1:200

0 5 10 20

DRAWING TITLE:

FUNCTIONAL SERVICING PLAN - P1

PROJECT:

PROPOSED MIXED-USE DEVELOPMENT
1026 COOKE BOULEVARD
BURLINGTON, ON

CLIENT:

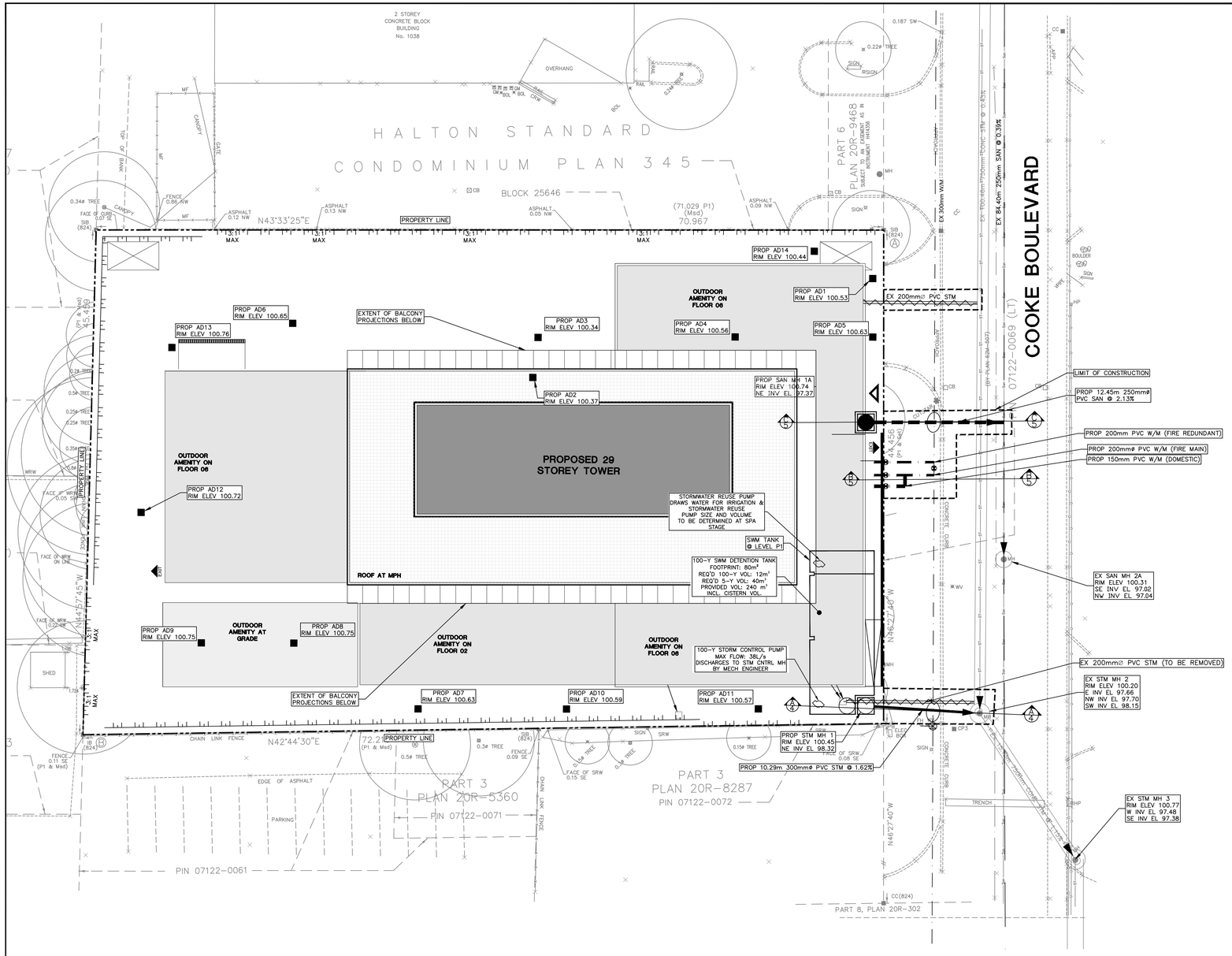
HSCC#416 KD

ODAN·DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

LICENSED PROFESSIONAL ENGINEER — NOV. 15/23 — P.J. HECIMOVIC — 100128980 — PROVINCE OF ONTARIO

ENGINEER

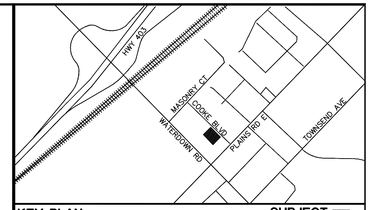
DESIGNED BY:	PROJECT No.:
P.H.	23208
DRAWN BY: R.G.	
CHECKED BY: M.H.H.	DATE: AUG 2023
APPROVED BY: P.H.	DRAWING No.: 2 OF 5



SERVICING LEGEND:

- DENOTES EXISTING STORM MANHOLE
- DENOTES PROPOSED STORM MANHOLE
- DENOTES EXISTING CATCH BASIN
- DENOTES PROPOSED CATCHBASIN
- DENOTES PROPOSED STORMCEPTOR
- DENOTES PROPOSED INLET CONTROL DEVICE (ICD)
- DENOTES EXISTING STORM SEWER
- DENOTES PROPOSED STORM SEWER
- DENOTES EXISTING SANITARY MANHOLE
- DENOTES PROPOSED SANITARY MANHOLE
- DENOTES PROPOSED SANITARY SEWER
- DENOTES EXISTING SANITARY SEWER
- DENOTES PROPOSED HYDRANT
- DENOTES EXISTING HYDRANT
- DENOTES PROPOSED WATER VALVE & BOX
- DENOTES EXISTING WATER VALVE & BOX
- DENOTES PROPOSED WATER METER
- DENOTES EXISTING WATER MAIN
- DENOTES PROPOSED WATER MAIN
- DENOTES PROPOSED F/D CONNECTION
- DENOTES PROPOSED CAP FOR SANITARY, STORM, AND/OR WATER AS NOTED
- DENOTES PROPOSED ENTRANCE LOCATION
- DENOTES PROPOSED LIMIT OF CONSTRUCTION
- DENOTES PROPOSED HEAVY DUTY ASPHALT AREA

CONTRACTOR TO VERIFY ALL INVERTS, SIZE, MATERIAL, AND LOCATION OF ALL SERVICES PRIOR TO CONSTRUCTION AND REPORT ANY DISCREPANCIES TO THE ODAN/DETECH GROUP



KEY PLAN Scale : N.T.S. — **SUBJECT LANDS**

NOTES:

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EXISTING TOPOGRAPHICAL INFORMATION SUPPLIED BY A.T. MCLAREN LIMITED ON THE 8TH DAY OF MAY, 2023

BENCH MARK:

MONUMENT 3488
MAPLEHURST SCHOOL, 481 PLAINS ROAD EAST (HIGHWAY 2) 1.92km NORTHEAST OF WATERDOWN ROAD, TABLET IN THE FRONT OF SOUTHEAST CONCRETE FOUNDATION WALL, 1.5m SOUTHWEST OF THE MOST EASTERLY OF TWO ENTRANCES, 0.1m BELOW RED BRICK SIDING
ELEVATION: 98.754m

BEARING NOTE:

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

METRIC NOTE:

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NO.	REVISIONS	DATE	BY
2	ISSUED FOR OPA/ZBA	2023/11/15	RG
1	ISSUED FOR REVIEW & COORDINATION	2023/11/09	RG

SCALE(S): 1:200

0 5 10 20

DRAWING TITLE:

FUNCTIONAL SERVICING PLAN - ROOF

PROJECT:

PROPOSED MIXED-USE DEVELOPMENT
1026 COOKE BOULEVARD
BURLINGTON, ON

CLIENT:

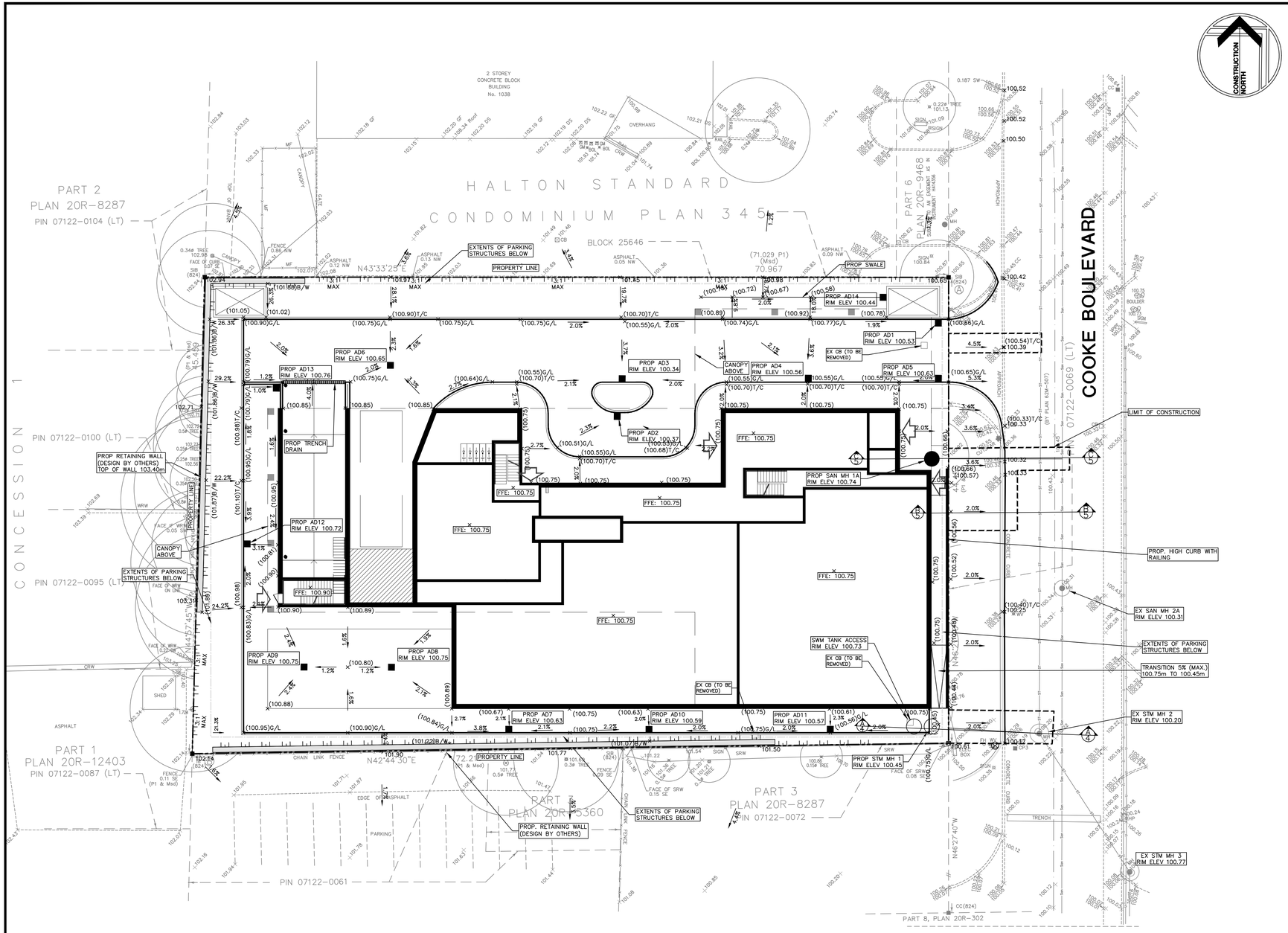
HSCC#416 KD

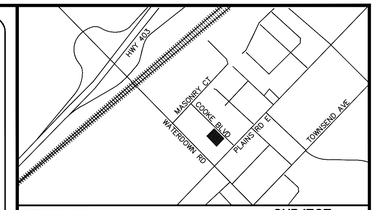
ODAN·DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

LICENSED PROFESSIONAL ENGINEER — NOV. 15/23 — P.J. HECIMOVIC — 100128980 — PROVINCE OF ONTARIO

ENGINEER

DESIGNED BY:	PROJECT No.:
P.H.	23208
DRAWN BY:	
R.G.	
CHECKED BY:	DATE:
M.H.H.	AUG 2023
APPROVED BY:	DRAWING No.:
P.H.	3 OF 5





KEY PLAN Scale : N.T.S.

SUBJECT LANDS

GRADING LEGEND:

- DENOTES EXISTING STORM MANHOLE
- DENOTES PROPOSED STORM MANHOLE
- DENOTES EXISTING CATCH BASIN
- DENOTES PROPOSED CATCHBASIN
- DENOTES PROPOSED STORMCEPTOR
- DENOTES EXISTING SANITARY MANHOLE
- DENOTES PROPOSED SANITARY MANHOLE
- DENOTES PROPOSED HYDRANT
- DENOTES EXISTING HYDRANT
- DENOTES PROPOSED WATER VALVE & BOX
- DENOTES EXISTING WATER VALVE & BOX
- DENOTES PROPOSED WATER METER
- DENOTES PROPOSED SIAMESE CONNECTION
- DENOTES EXISTING SPOT ELEVATION
- (100.00) DENOTES PROPOSED ELEVATION
- (100.00)T/C DENOTES PROPOSED TOP OF CURB ELEVATION
- (100.00)G/L DENOTES PROPOSED GUTTER LINE ELEVATION
- (100.00) HP DENOTES PROPOSED HIGH POINT
- [100.00] DENOTES PROPOSED SWALE INVERT ELEVATION
- [100.00] DENOTES PROPOSED ELEVATION BY OTHERS
- DENOTES PROPOSED FLOW ARROW AND SLOPE
- DENOTES PROPOSED FLOW ARROW
- DENOTES EMERGENCY OVERLAND FLOW
- DENOTES PROPOSED SLOPE (3:1 OR HIGHER)
- DENOTES EXISTING CONTOUR
- DENOTES PROPOSED SILT FENCE
- DENOTES PROPOSED ENTRANCE LOCATION
- DENOTES EXTENT OF MAX. PONDING (0.30m) 100 YEAR STORM
- DENOTES PROPOSED LIMIT OF CONSTRUCTION
- DENOTES PROPOSED HEAVY DUTY ASPHALT AREA
- DENOTES PROPERTY LINE

NOTES:

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EXISTING TOPOGRAPHICAL INFORMATION SUPPLIED BY A.T. MCLAREN LIMITED ON THE 8TH DAY OF MAY, 2023

BENCH MARK:

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ELEVATION: 98.754m

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1	ISSUED FOR REVIEW & COORDINATION	2023/11/09	RG

SCALE(S): 1:200

0 5 10 20

DRAWING TITLE:

FUNCTIONAL GRADING PLAN

PROJECT:

PROPOSED MIXED-USE DEVELOPMENT
1026 COOKE BOULEVARD
BURLINGTON, ON

CLIENT:

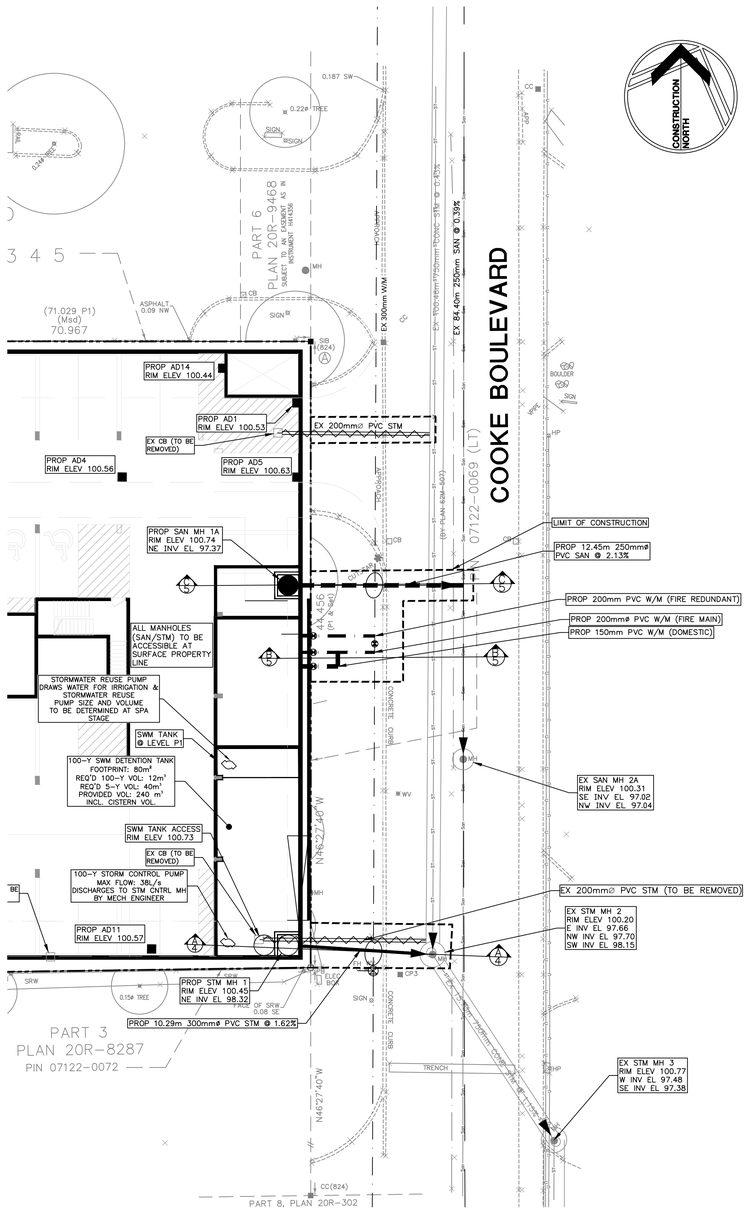
HSCC#416 KD

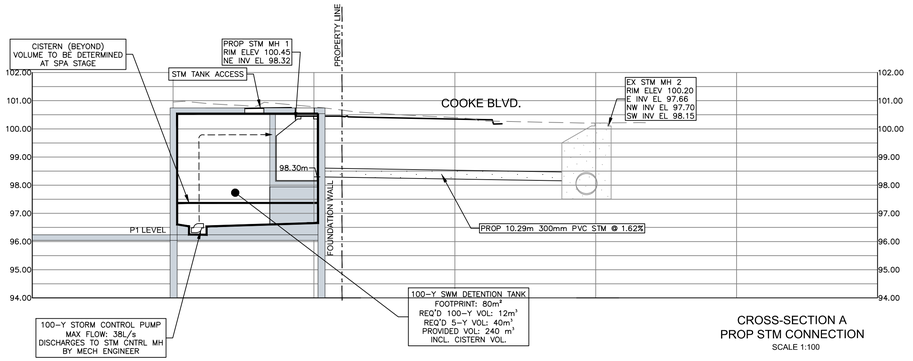
ODAN·DETECH CONSULTING ENGINEERS
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5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

LICENSED PROFESSIONAL ENGINEER
NOV. 15/23
P.J. HECIMOVIC
100126960
PROVINCE OF ONTARIO

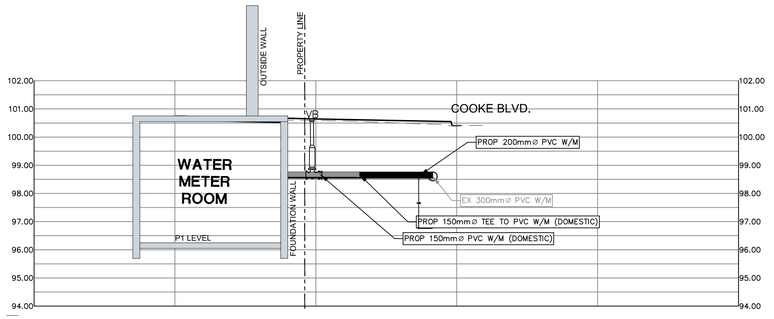
ENGINEER

DESIGNED BY: P.H.	PROJECT No.: 23208
DRAWN BY: R.G.	
CHECKED BY: M.H.H.	DATE: AUG 2023
APPROVED BY: P.H.	DRAWING No.: 4 OF 5

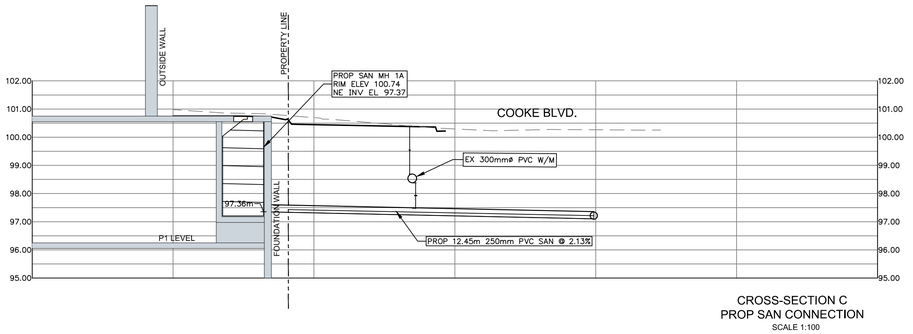




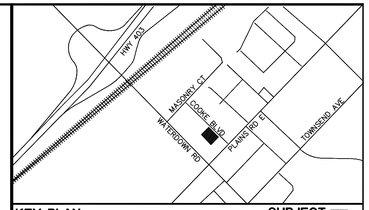
CROSS-SECTION A
PROP STM CONNECTION
SCALE 1:100



CROSS-SECTION B
PROP WAT CONNECTION
SCALE 1:100



CROSS-SECTION C
PROP SAN CONNECTION
SCALE 1:100



KEY PLAN
Scale : N.T.S.

SUBJECT LANDS

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1	ISSUED FOR REVIEW & COORDINATION	2023/11/09	RG

SCALE(S): 1:200

0 5 10 20

DRAWING TITLE:

CROSS SECTIONS

PROJECT:

PROPOSED MIXED-USE DEVELOPMENT
1026 COOKE BOULEVARD
BURLINGTON, ON

CLIENT:

HSCC#416 KD

ODAN·DETECH
CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

LICENSED PROFESSIONAL ENGINEER
NOV. 15/23
P.J. HECIMOVIC
100128980
PROVINCE OF ONTARIO

ENGINEER

DESIGNED BY:	PROJECT No.:
P.H.	23208
DRAWN BY: R.G.	
CHECKED BY: M.H.H.	DATE: AUG 2023
APPROVED BY: P.H.	DRAWING No.: 5 OF 5