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**PROPOSED MIXED-USE RESIDENTIAL
CONDOMINIUM TOWER & COMMERCIAL DEVELOPMENT
25 & 35 QUEENS QUAY EAST
'PIER 27', PHASE 3 – BUILDINGS A AND F
CITY OF TORONTO**

PROJECT No.: 18212

SERVICING & STORMWATER MANAGEMENT REPORT

Prepared For:

PIER 27 TORONTO (NORTHEAST) INC.

Prepared By:

The Odan/Detech Group Inc.

Original: March 15, 2021

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1.0 INTRODUCTION

The subject of this report is a 0.757 Ha (1.87 acre) parcel of land.

The subject site and proposed development is Phase 3 of a larger development comprising five buildings (Buildings B, D, A, F and G). The subject of this report is Buildings A and F. Buildings B and D were constructed in Phase 1 of the development and are on a separate site (adjacent, to the south). Building G is known as Phase 2 and was previously constructed.

The site was previously rezoned based on submissions made to City Planning in 2010 allowing Buildings A and F to be constructed as 13-storey buildings.

The site is bounded by the following.

- To the east: the existing northeast portion of Phase 1 of this development (Building B) and the Redpath Sugar Plant, beyond.
- To the south: the existing Phase 1 of this development (Buildings B and D).
- To the west: there is an existing paved parking lot.
- To the north: There is Queens Quay East

Presently the western area of the site comprises the existing four-level below-grade parking structure (to remain) which is beneath an existing 35-Storey (plus mechanical penthouse) mixed-use tower (Building G) which is presently occupied.

Presently the eastern area of the site comprises the existing access driveway serving Phase 1 and a one-storey sales centre building.

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

It is presently proposed to construct Building A as an 11-storey building and Building F as a 45-storey building with a four-level common below-grade parking structure beneath. The existing north-south access driveway through the subject site (Phase 3) to Phase 1 will be reconstructed.

Note that part of Phase 3's underground parking structure extends beyond the extents of Phase 3's at-grade property line, as shown on the Servicing Plan.

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

The municipal addresses of the site comprise 25 & 35 Queens Quay East. The postal code is M5E 0A4.

Note that a *Limit of Application* line is provided in the Servicing and Grading Plans in accordance with the architectural plans, however consideration is made herein with respect to catchment areas established in the prior Servicing and Stormwater Management Reports for this site, below.

Servicing and Stormwater Management for both this site (Phase 3) and the related Phase 1 were established in the following reports:

- Phase 1 Stormwater Management Report by Al Underhill & Associates (Rev. December 2007)

- Phase 2 Functional Servicing Report by Al Underhill & Associates (original Nov. 2011, rev. October 2016)
- Phase 2 Stormwater Management Report by Al Underhill & Associates (original August 2015, rev. October 2016)
- Phase 2 Stormwater Management Report – Building G by Al Underhill & Associates (original June 2016, rev. October 2016)

The existing site servicing connections for Buildings A and F – as well as Building G – were previously installed under a Municipal Infrastructure Agreement (MIA) in 2019, along with the receiving sewer and water mains in the street.

For detailed topography of the existing site conditions, as of December 2017, refer to the topographic survey prepared by KRCMAR Surveyors 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 Toronto's SWM requirements and Wet Weather Flow Management Guidelines (WWFMG).

2.0 SCOPE OF WORK

THE ODAN/DETECH GROUP INC. was retained by **Pier 27 Toronto (Northeast) Inc.** 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 Zoning Bylaw Amendment, Official Plan Amendment and Site Plan Control 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 and Site Plan applications.

3.0 WATER DISTRIBUTION ASSESSMENT

i) Existing Infrastructure

The following watermains presently exist beneath the streets bordering the site. Refer to the Servicing Plan.

- Queens Quay East: There is an existing 300mm watermain beneath the north side of the street, which was extended to the south side of the street in 2019. The following water service connections were installed under MIA in 2019 from the 300mm watermain, to the subject site..
    - Building G (existing)
        - 2 x 200mm temporary fire services (to be abandoned when Buildings A and F are constructed as per agreement between the City of Toronto and Cityzen Developments)
        - 2 x 200mm permanent fire services, to be used after the temporary fire services are abandoned.
        - 1 x 150mm temporary domestic water service to be abandoned when Buildings A and F are constructed as per agreement between the City of Toronto and Cityzen Developments)
        - 1 x 150mm permanent domestic water service, to be used after temporary domestic water service is abandoned
    - Buildings A and F
        - 2 x 200mm fire services
        - 2 x 150mm domestic water services

ii) Design Criteria

The City of Toronto's *Notice to Applicants* policy (2016) states, in regards to point tower developments, *Every point tower shall have its own independent service connection to the municipal potable water and sewer services.*

The water and fire service connection have been installed as an 'h' connection in accordance with City standards.

The unit rate and peaking factors of water consumption, minimum pipe size and allowable pressure in line were established from the City Design Manual Standards. The pressures and volumes must be sufficient for peak hour conditions and under fire conditions as established by the Ontario Building Code 2006. The minimal residual pressure under fire conditions is 140 kpa. (or 20.3 psi).

iii) Proposed Servicing

The existing Building G temporary 2 x fire and domestic water services are to be removed as per existing agreements between the City of Toronto and Cityzen Developments. Building G will be serviced by the domestic water and fire connections which were installed to service Building G permanently.

Buildings A and F will have separate domestic water services (thus, separate water meters) in accordance with City criteria. Buildings A and F, sharing a common below-grade structure, will share fire service connections.

Building A will be less than 85m in height, therefore the development does not require two fire services on account of Building A.

Building F will be 150m in height, therefore because it is greater than 85m in height, OBC 2006 3.2.9.7 (4) requires two fire services from separate watermains. Building G is 113m in height and thus has the same requirement.

There is only one watermain adjacent to the site – the Queens Quay 300mm watermain – and mainline valves have been installed between Building G's two fire services and between the Building G and Building A/F connections. A mainline isolation valve has not been installed between the two fire services for Building A and F because it was thought in the prior servicing design that each tower would have a separate fire service and that A and F would be less than 85m in height and require only one fire service.

It is therefore proposed to utilize what was initially intended to be Building G's secondary fire service as Building A/F's secondary fire service, and likewise utilize Building A/F's secondary fire service as Building G's secondary fire service. This satisfies the requirement of providing two fire services for Building F (being greater than 85m in height) which are separated by an isolation valve on the Queens Quay 300mm watermain for redundancy. Building G will similarly be provided two fire services which are separated by an isolation valve.

Refer to the Servicing Plan for proposed service connections.

The water demand for the proposed towers are as follows.

a)	Average Day domestic demand -	using 191L/cap/day (235+809=1044 persons – Table 2)	2.3 L/sec
b)	Max day demand -	1.3 x daily demand	3.0 L/sec
c)	Peak hour demand -	2.5 x daily demand	5.8 L/sec
d)	Fire flow as per FUS 1999 manual		133 L/sec

TABLE 1 – Total Water Demand for Proposed Tower

	L/sec	USGM
Max Day Demand	3.0	48
Fire Flow Demand – Building A	133	2113
Fire Flow Demand – Building F	117	1849
Total Water Demand (Largest of A & F + Max Day)	136	2161
Available Flow at 20 PSI (Queens Qy. E. 300mm WM)	250	3968

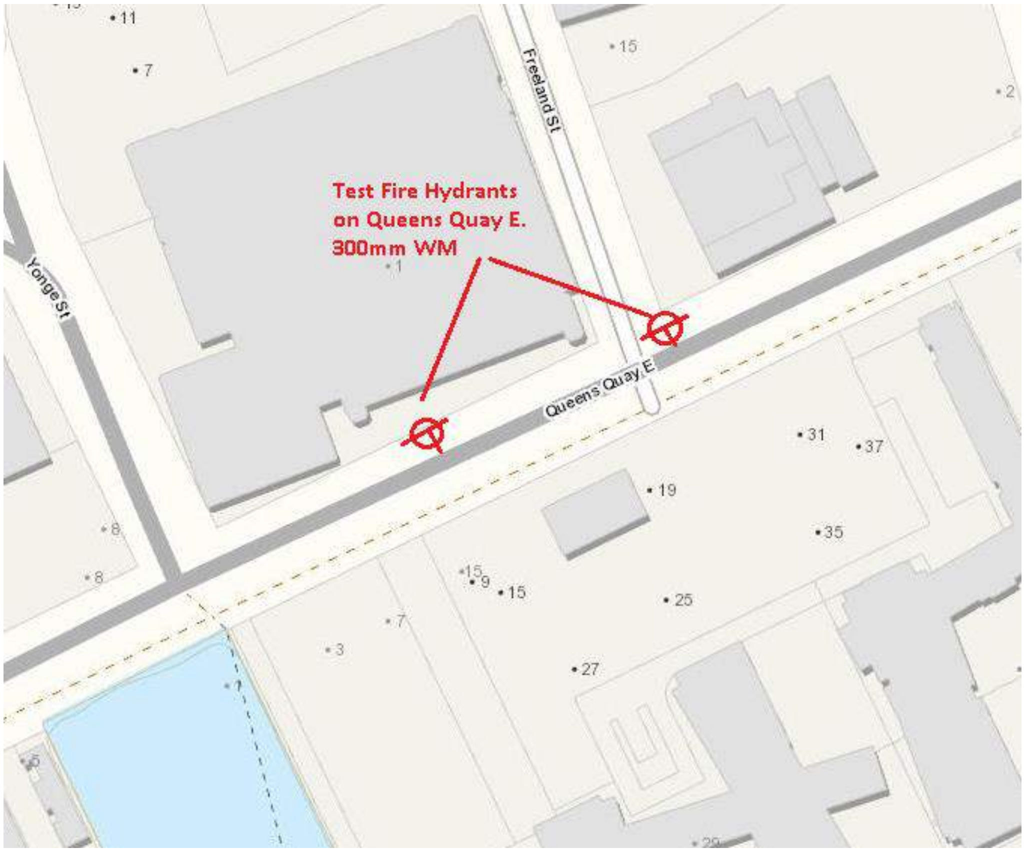
Hydrant flow test results as stated above are provided below.

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

- The proposed towers are 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 and retail) 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 available flow at 20 psi in the Queens Quay 300mm watermain (3968 USGM) is greater than the proposed development's total water demand (2161 USGM), therefore the existing watermain infrastructure is sufficient to service the proposed development and no watermain infrastructure upgrades are required.

A hydrant flow test was conducted by SCG in September 2020 – provided on the following page. The location of the two hydrants which were used to conduct the NFPA 291 test are as follows.



SCG FLOWMETRIX

Fire Flow Testing Report and Colour Code

Hydrant # **HY 1361075**

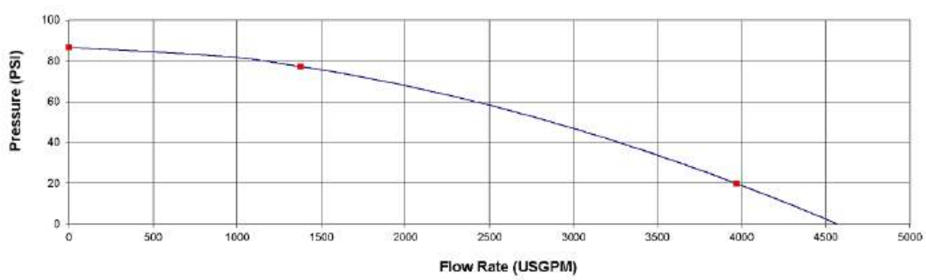
NFPA Colour Code **BLUE**

TEST HYDRANT INFO.			**CLIENT**	The Odan/Detech Group
HYDRANT #	HY 1361075		**CUSTOMER NAME**	Daniel Bancroft
N.F.P.A. COLOUR CODE	BLUE			P: 905 632 3811 ext 133
				E: daniel@odandetech.com
STATIC PRESSURE	86.7	psi		
RESIDUAL PRESSURE	77.3	psi	**LOCATION**	Yonge St & Queens Quay
				Toronto ON
PRESSURE DROP	9.38	psi		M5E 1R4
% PRESSURE DROP	10.8	% psi		
			DATE	September 14, 2020
Flow At Test Hydrant at -	20 psi	3968 USGPM	**TIME**	9:40 AM

FLOW HYDRANT(S) INFO.

	HYDRANT #	# PORTS FLOWED	OUTLET DIAMETER (INCHES)	FLOW METER OR DIFFUSER	NOZZLE COEFFICIENT (~0.9)	PITOT READING (psi)	DISCHARGE FLOW (USGPM)
1	HY1357181	2	2.5	DIFFUSER	0.90	24.3	1375.8
2							
3							
4							
					Total Flow (USGPM)		1376

Pressure - Flow Graph
at Test Hydrant



COMMENTS			
	OPERATOR	FM	Ryan Ritchie
	OPERATOR	FM	Brendan Howatt
	OPERATOR		Toronto Water
	PRESSURE ZONE		
	TOWER LEVEL	ft	n/a
	PUMPS (ON/OFF)		

Copy of FFT Toronto Sept 14 "If we don't measure it, how do you manage it?"

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

F = 220 x C x √ 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:	Building A
OBC OCCUPANCY:	Residential + Commercial
BUILDING FOOT PRINT (m2):	1072
# OF STOREYS	11

PROJECT: 25 Queens Quay East

PROJECT No 18212

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%	50%
Standard Water Supply	yes	30%	
Fully Supervised System	yes	10%	
		50%	

CONTENTS FACTOR: Non Combustible — CHARGE: -20%

EXPOSURE 1 (south) Building B	Distance to Exposure Building (m) / Length - Height	19.2	15%
EXPOSURE 2 (east) Building B	Distance to Exposure Building (m) / Length - Height	33.7	5%
EXPOSURE 3 (west) Building F	Distance to Exposure Building (m) / Length - Height	8.15	20%
EXPOSURE 4 (north) Ex Commercial	Distance to Exposure Building (m) / Length - Height	40.8	5%
		Total:	45%

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) h No

CALCULATIONS

	C =	0.6		
	A =	5586	m2	(2 largest floors + 50% floors above)
	F =	9865	L/min	
Round to Nearest 1000 L/min	F =	10000	L/min	must be > 2000 L/min

CORRECTION FACTORS:

OCCUPANCY	-2000	L/min
FIRE FLOW ADJUSTED FOR OCCUPANCY	8000	L/min
REDUCTION FOR SPRINKLER	-4000	L/min
EXPOSURE CHARGE	3600	L/min

REQUIRED FIRE FLOW	**F =**	7600	L/min		
Round to Nearest 1000 L/min	**F =**	8000	L/min	2113	usgm
	F =	133	L/sec		

STOREY AREAS m2	
1072	L1
1003	L2
1003	L3
1003	L4
1003	L5
1003	L6
1003	L7
1003	L8
1003	L9
1003	L10

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

F = 220 x C x √ 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: Building F
OBC OCCUPANCY: Residential + Commercial
BUILDING FOOT PRINT (m2): 1076
OF STOREYS 45

PROJECT: 25 Queens Quay East
PROJECT No 18212

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%	50%
Standard Water Supply	yes	30%	
Fully Supervised System	yes	10%	
		50%	

CONTENTS FACTOR: Non Combustible CHARGE: -20%

EXPOSURE 1 (south) Building B	Distance to Exposure Building (m) Length - Height	19.2	15%
EXPOSURE 2 (east) Building A	Distance to Exposure Building (m) Length - Height	29.5	10%
EXPOSURE 3 (west) Building G	Distance to Exposure Building (m) Length - Height	31.9	5%
EXPOSURE 4 (north) Ex Commercial	Distance to Exposure Building (m) Length - Height	40.8	5%
		Total:	35%

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) h No

CALCULATIONS

	C =	0.6		
	A =	5592	m2	(2 largest floors + 50% floors above)
	F =	9871	L/min	
Round to Nearest 1000 L/min	F =	10000	L/min	must be > 2000 L/min

CORRECTION FACTORS:

OCCUPANCY	-2000	L/min
FIRE FLOW ADJUSTED FOR OCCUPANCY	8000	L/min
REDUCTION FOR SPRINKLER	-4000	L/min
EXPOSURE CHARGE	2800	L/min

STOREY AREAS m2	
1076	L4
1076	L5
1076	L6
1076	L7
1076	L8
1076	L9
1076	L10
750	L11
750	L12
750	L13

REQUIRED FIRE FLOW

	F =	6800	L/min		
Round to Nearest 1000 L/min	**F =**	7000	L/min	1849	usgm
	F =	117	L/sec		

4.0 SANITARY SEWERS

i) Existing Infrastructure & Drainage

The following sanitary sewers are located within the streets bordering the subject site. Refer to the Servicing Plan for the layout of the existing sanitary sewers adjacent to the subject site. The City's DMOG/PUCC drawing, the sanitary system analysis by TMIG (discussed below) and the City's plan-profile drawings describe these sewers as sanitary sewers. There are no combined sewers in the area of the subject site.

- Queens Quay East: there is an existing 300mm V.P. sanitary sewer flowing westerly across the site's frontage, which continues northerly beneath Yonge Street and ultimately discharges into the Scott Street Sanitary Pumping Station. This sewer and the downstream sanitary sewers were analyzed in the Al Underhill FSR for this site of 2016 as well as by XCG and more recently by TMIG in their memorandum titled *Lower Yonge Precinct Sanitary Servicing Capacity Analysis* (January 2020) which was submitted as an appendix of the FSR by R.V. Anderson for 1 Yonge Street.

- Existing sanitary sewer sewers connections were installed in 2019 under MIA to service the subject site, 25 Queens Quay East (Phase 3), described as follows:

    - An existing 300mm municipal sanitary sewer was installed commencing at Ex. SAN MH4A, which flows easterly across the site's frontage to Ex. SAN MH3A and Ex. SAN MH2A, before flowing northerly beneath Queens Quay and discharging into the existing 300mm municipal sanitary sewer at Ex SAN MH1A. This 300mm municipal sanitary sewer (installed 2019) replaced a previous twin-200mm sanitary sewer at the same location and alignment.

    - Building G is presently serviced by a 250mm @ 3.0% connection to Ex SAN MH4A

    - Two 250mm sanitary service connections were installed connecting to Ex SAN MH 3A and 2A to service Buildings F and A, respectively

The subject site falls within Basement Flooding Environmental Assessment (EA) study area 62, which has not been completed. No conclusions can therefore be provided with respect to the EA.

Downstream sanitary sewer capacity is addressed in Section 4.0 iii, below.

ii) Proposed Servicing

The City of Toronto's *Notice to Applicants* policy (2016) states that each point tower and podium on a development shall be serviced by separate respective sanitary service connections. The subject development – which comprises two proposed point towers – is accordingly proposed to be serviced by the two existing 250mm service connections to the 300mm sanitary sewer beneath Queens Quay.

The following City standards for population densities and flow rates will be used.

Residential
- 1.4 persons/unit for bachelor and one bedroom units
- 2.1 persons/unit for two bedroom units
- 3.1 persons/unit for three bedroom units
- flow rate of 450 L / day per capita

Commercial
- 1.1 person/100m^2 GFA Commercial

Inflow/Infiltration
- 0.26 L/s/ha

The proposed sanitary flows are as follows.

A post-development groundwater pumped flow rate of0.95 L/s is included in post-development sanitary flow for the proposed tower, as follows. Refer to Section 6.0 for the pumped flow rate of groundwater.

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)
Building A	231+4 = 235	4.97+0.13 = 5.10	-	0.10	5.2
Building F	807+2 = 809	8.65+0.01 = 8.66	0.95	0.10	9.7

The 9.7 L/s total sanitary flow for the proposed Building F will be conveyed to the existing 250mm sanitary sewer beneath Queens Quay East by the existing 250mm @ 2.09% sanitary service connection (capacity 86.0 L/s). This existing sewer connection, which was installed for the purpose of servicing Tower F in the installation of the mainline 250mm sanitary sewer in 2019, is adequately sized for the proposed flows.

The 5.2 L/s total sanitary flow for the proposed Building A will be conveyed to the existing 250mm sanitary sewer beneath Queens Quay East by the existing 250mm @ 1.32% sanitary service connection (capacity 68.3 L/s). This existing sewer connection, which was installed for the purpose of servicing Tower A in the installation of the mainline 250mm sanitary sewer in 2019, is adequately sized for the proposed flows.

Detailed sanitary flow calculations are provided on the following pages. Discussion and conclusions regarding downstream sanitary sewer capacity are provided in Section 4.0 iii), below.

SANITARY FLOW CALCULATIONS

SCENARIO: Building A

This program calculates the sanitary discharge from various land use

As per the City of Toronto Guidelines

FILL IN COLOURED CELLS AS REQUIRED

RESIDENTIAL SITE AREA (ha) =	0.38
COMMERCIAL SITE AREA (ha) =	0
TOTAL SITE AREA (ha) =	0.38

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 Density 1, using 86 person/site area				0	0	0.00		
RESIDENTIAL Density 2, using 170 persons/site area				0	0	0.00		
RESIDENTIAL Density 3, using 270 persons/site area				0	0	0.00		
RESIDENTIAL Density 4, using 400person/site area				0	0	0.00		
RESIDENTIAL Density 5, using 1.4 persons/unit	96			134	60480	0.70	4.21	2.94
RESIDENTIAL Density 6, using 2.1 persons/unit	27			57	25515	0.30	4.30	1.27
RESIDENTIAL Density 7, using 3.1 persons/unit	13			40	18135	0.21	4.33	0.91
Total Residential	136			231	104130	1.21	4.12	4.97
COMMERCIAL, Using 100 persons/ha				0	0	0.00	1.00	0.00
RETAIL, Using 1.1 persons/100 m2			402	4	1990	0.02	1.00	0.02
Day Care, Using 180,000 L/Fl Ha/d			532		9576	0.11	1.00	0.11
INSTITUTIONAL, Using 1.1 persons/unit				0	0	0.00	1.00	0.00
OFFICES/COMMERCIAL, Using, 3.3 persons/100m2				0	0	0.00	1.00	0.00
TOTAL		**0.000**		V1=	115696		Q1=	4.97
							Q2=	0.13
							Qinfil	0.10
							Qtot	5.20

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

where : P is population

Q1= total flow from Residential Land Use (L/sec) — q = 450 L/cap/day

Q2= total flow from Commercial Land Use (L/sec) — q = 450 L/cap/day

Qinfil = total flow from infiltration (L/sec)

Qtot = total flow (Land use + infiltration) — A = gross site area

i = 0.26 L/sec/ha (infiltration rate)

V1= Total Volume from Land Use in liters — Peaking Factor M = 1 + [14 / (4 + (P/1000,1/2))]

SANITARY FLOW CALCULATIONS				**SCENARIO:**		Building F		
This program calculates the sanitary discharge from various land use								
As per the City of Toronto Guidelines					FILL IN COLOURED CELLS AS REQUIRED			
RESIDENTIAL SITE AREA (ha) =	0.38							
COMMERCIAL SITE AREA (ha) =	0							
TOTAL SITE AREA (ha) =	0.38							
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 Density 1, using 86 person/site area				0	0	0.00		
RESIDENTIAL Density 2, using 170 persons/site area				0	0	0.00		
RESIDENTIAL Density 3, using 270 persons/site area				0	0	0.00		
RESIDENTIAL Density 4, using 400person/site area				0	0	0.00		
RESIDENTIAL Density 5, using 1.4 persons/unit	268			375	90048	1.04	4.04	4.21
RESIDENTIAL Density 6, using 2.1 persons/unit	129			271	65016	0.75	4.10	3.08
RESIDENTIAL Density 7, using 3.1 persons/unit	52			161	38688	0.45	4.18	1.87
Total Residential	449			807	193752	2.24	3.86	8.65
COMMERCIAL, Using 100 persons/ha				0	0	0.00	1.00	0.00
RETAIL, Using 1.1 persons/100 m2			199	2	547	0.01	1.00	0.01
Community Hub, Using 180,000 L/Fl Ha/d					0	0.00	1.00	0.00
INSTITUTIONAL, Using 1.1 persons/unit				0	0	0.00	1.00	0.00
OFFICES/COMMERCIAL, Using, 3.3 persons/100m2				0	0	0.00	1.00	0.00
TOTAL		**0.000**		V1=	194299		Q1=	8.65
							Q2=	0.01
Q = (MqP/86400) + A * I (L/sec)							Qinfil	0.10
			where :	P is population			Qtot	8.76
Q1= total flow from Residential Land Use (L/sec)				q = 240 L/cap/day				
Q2= total flow from Commercial Land Use (L/sec)				q = 250 L/cap/day				
Qinfil = total flow from infiltration (L/sec)								
Qtot = total flow (Land use + infiltration)				A = gross site area				
				i = 0.26 L/sec/ha (infiltration rate)				
V1= Total Volume from Land Use in liters				Peaking Factor M = 1 + [14 / (4 + (P/1000,1/2))]				

iii) Receiving Downstream Sanitary Sewer Capacity

The proposed development (Buildings A and F) will drain proposed sanitary flows into the existing 300mm sanitary sewer flowing northerly and then westerly beneath Queens Quay East, as discussed above and shown on the Servicing Plan. Sanitary servicing is by the existing sanitary service connections which were previously installed under MIA in 2019.

The 2016 FSR by Al Underhill concluded that there was adequate downstream sanitary sewer capacity for the proposed flows considered in that report. The development therefore has sewer capacity allocation commensurate with the flows considered in that report – that is, the 13-storey iteration of Buildings A and F. As discussed above, the proposal for Buildings A and F for which this report was prepared comprises marginal additional density beyond the flows which the site has allocation for as per the Al Underhill report. The allocated and presently-proposed flows are compared in Table 3 below.

The additional proposed sanitary flows from Buildings A and F results in the flows from the entire Pier 27 site being 12% greater than allocated (a total of 31 L/s was allocated whereas 35 L/s is proposed from the entire site – as per Table 3 below). This is a marginal additional capacity and the reasonable conclusion is that the prior conclusion by Al Underhill should still hold for the proposed density.

Nonetheless, we appreciate that consideration is typically required for sewer capacity for any additional sewage flows beyond which was allocated in the prior report. To satisfy this requirement, an original downstream sanitary sewer analysis has been provided.

The subject site is part of the same sanitary sewer shed as the neighbouring developments north of Queen's Quay East. An analysis was undertaken by TMIG titled the Lower Yonge Precinct Sanitary Sewer Master Plan in January 2020 in support of those developments (northeast of Yonge St. and Queens Quay East). This analysis was based on a prior Master Plan servicing analysis undertaken by the City for the sewer-shed.

TMIG has prepared an update to this analysis considering the subject site, with updated memorandum, included here (Appendix C).

TMIG's analysis concludes that the existing downstream sanitary sewers to the Scott Street Pumping Station have available capacity for the proposed development. Refer to Appendix C.

The updated analysis concludes that there is available capacity for the proposed flows, therefore it follows that no infrastructure upgrades are required to accommodate the proposed development.

TABLE 3 - Existing, Allocated and Proposed Sanitary Flows

	Approved at Zoning (AUA Report Oct. 2016)					Proposed Stats (March 2021)				
Bedrooms	Bldg. B as-built	Bldg. D as-built	Bldg. A	Bldg. F	Bldg. G	Bldg. B as-built	Bldg. D as-built	Bldg. A	Bldg. F	Bldg. G
1 BR	306	131	150	152	205	306	131	96	268	204
2 BR	94	164	44	42	193	94	164	27	129	190
3 BR	10	11	0	0	29	10	11	13	52	27
Total Units	410	306	194	194	427	410	306	136	449	421
Commercial	0	0	178	705	944	0	0	935	199	402
Daycare	0	0	611	0	0	0	0	0	0	532
Population	656.8	561.9	324.7	308.8	792.6	656.8	561.9	241.7	809.5	790.5
Sanitary Flow (L/s) (@ 240/250 L/c/d)	7.13	6.16	3.44	3.50	8.51	7.13	6.16	2.68	8.66	8.26
Groundwater Flow (L/s)	0.00	0.00	0.46	0.60	0.96	0.00	0.00	0.95		0.96
Sanitary + GW Flows (L/s) (@ 240/250)	7.13	6.16	3.90	4.10	9.47	7.13	6.16	3.15	8.66	9.22
Infiltration (L/s)			0.06	0.10	0.13			0.06	0.10	0.13
Population	2644.76					3060.33				
Total Flow (L/s) (@ 240/250 L/c/d)	13.30		17.75			13.30		21.32		
Sewer Connection Capacity (L/s)			15.20	15.20	15.20			15.20	15.20	15.20

5.0 STORM WATER MANAGEMENT

i) Existing Infrastructure & Drainage

The following separated storm sewers are located within the streets bordering the subject site. Refer to the Pre-Development Drainage Plan on the following page, and the Servicing Plan, for the layout of the existing storm sewers adjacent to the subject site.

- Queens Quay East: There is a 900mm storm sewer flowing westerly beneath the north side of Queens Quay. A segment of this sewer previously existed as an 825mm concrete pipe and was replaced as a 900mm PVC pipe under MIA in 2019 to accommodate the 300mm sanitary sewer crossing Queens Quay northerly from Ex SAN MH1A to Ex SAN MH2A (discussed above). This sewer commences northeast of the subject site and flows westerly beneath Queens Quay before discharging into Lake Ontario at the bottom of Yonge Street.

- Queens Quay East: In addition to the above mainline storm sewer, the following local municipal storm sewers were installed when Phase 1 and Building G were constructed:

  - A 250mm storm sewer (serving Building G) commencing at Ex STM MH2, which flows easterly and discharges into the following storm sewer,

  - A 3x200mm storm sewer commencing at Ex STM MH1 and flowing northerly beneath Queens Quay before discharging into the above 900mm storm sewer.

  - Building G is presently serviced by a 250mm storm service connection to Ex. STM MH2.

  - An existing storm manhole – Ex STM MH1A – was installed at the site's northern property line at the upstream end of the above 3x200mm storm sewer to be the storm outlet for Building A and F.

  - An existing 2 x 375mm storm service connection was installed servicing Phase 1 (Building B and D) which is located at the northeast corner of Phase 3.

- Within the Phase 3 site, presently: There is a system of private storm sewers providing outlet for existing catchbasins (EX CB1-EX CB5). Refer to the Pre-Development Drainage Plan.

Presently the Phase 3 site provides conveyance for both minor (2-year storm) and major (>2-year, to 100-year storms) storms for Phase 1. Phase 1's minor and major storm outlets which rely on Phase 3 are as follows:

- Minor system: Phase 1 (Ex. Building B & D - offsite) minor storms drain by mechanical storm drains to a storm sump within the Phase 1 underground levels and then pumped at 277 L/s to an existing 2x375mm storm service connection which is within a portion of the Phase 1 underground levels which falls within Phase 3, as shown on the Servicing Plan.

- Minor system: The east-west private driveway within Phase 1 (Catchment EX-BD) drains to EX CB1, EX CB2, EX CB3, EX CB4 and EX CB5 located at the north gutterline of the driveway (at the border of Phase 1 and Phase 3), which then drain by a system of private storm sewers through Phase 3, to the existing storm sewer connection. Refer to the Pre-Development Drainage Plan and the field investigation by Markit (Appendix B).

- Major system: Phase 1 pre-dates stormwater quantity control criteria established by the WWFMG (the SWM Report by Al Underhill was prepared in 2006), therefore Phase 1 was not required to detain storm events up-to the 100-year storm on site. Instead, Phase 1 was designed to spill out of Phase 1, over Phase 3's driveway, to Queens Quay East. Easements were established over Phase 3, in favor of Phase 1, respecting this.

The subject site falls within Basement Flooding Environmental Assessment (EA) study area 62, which has not been completed. No conclusions can therefore be provided with respect to the EA.

Refer to the Pre-Development Drainage Plan on the following page for existing drainage patterns and outlets.

ii) Stormwater Quantity Control Criteria

Storm water management for the proposed development will follow the storm water criteria as set out by the City of Toronto's Wet Weather Flow Management Guidelines for quantity control. The allowable post-development peak flow for the proposed development up to the 100 year storm event will be set to the 2-year pre-development flow rate using a rational runoff coefficient (C) of 0.5. This, given as shown on the Pre-Development Drainage Plan, that the site presently comprises impervious roof surfaces with C-values of 0.9.

Design storm data for the City of Toronto 2 year and 100 year storms are shown below.

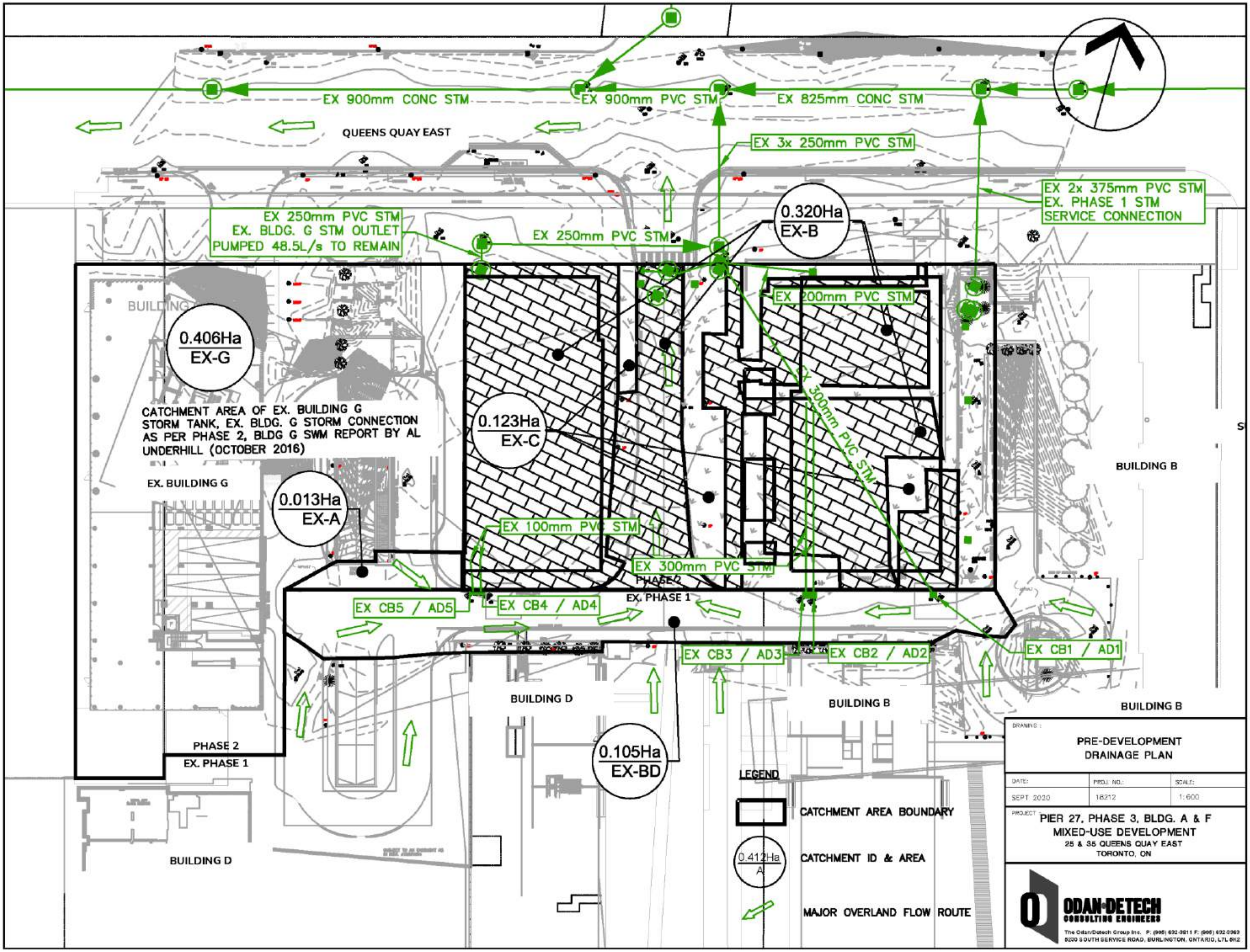
2 Year Storm:	$I_2 = 21.8 / (T)^{(0.780)}$	where: I = intensity (mm/hr)
100 Year Storm:	$I_{100} = 57.7 / (T)^{(0.800)}$	T= time of concentration (hours)

$I_2 = ((21.8) \times (1/60)^{(-0.780)}) / (T)^{(0.780)}$

$\mathbf{I_2 = 531.9 / (T)^{(0.780)}}$

$I_{100} = ((59.7) \times (1/60)^{(-0.800)}) / (T)^{(0.800)}$

$\mathbf{I_{100} = 1579.4 / (T)^{(0.800)}}$


EX 900mm CONC STM
EX 900mm PVC STM
EX 825mm CONC STM
QUEENS QUAY EAST
EX 3x 250mm PVC STM
EX 2x 375mm PVC STM
EX. PHASE 1 STM
SERVICE CONNECTION
EX 250mm PVC STM
EX. BLDG. G STM OUTLET
PUMPED 48.5L/s TO REMAIN
EX 250mm PVC STM
0.320Ha
EX-B
EX 200mm PVC STM
BUILDING
0.406Ha
EX-G
CATCHMENT AREA OF EX. BUILDING G STORM TANK, EX. BLDG. G STORM CONNECTION AS PER PHASE 2, BLDG G SWM REPORT BY AL UNDERHILL (OCTOBER 2016)
0.123Ha
EX-C
EX 300mm PVC STM
EX. BUILDING G
0.013Ha
EX-A
BUILDING B
EX 100mm PVC STM
EX 300mm PVC STM
PHASE 2
EX. PHASE 1
EX CB5 / AD5
EX CB4 / AD4
EX CB3 / AD3
EX CB2 / AD2
EX CB1 / AD1
BUILDING D
BUILDING B
BUILDING B
PHASE 2
EX. PHASE 1
0.105Ha
EX-BD
BUILDING D
LEGEND
CATCHMENT AREA BOUNDARY
0.412Ha
A
CATCHMENT ID & AREA
MAJOR OVERLAND FLOW ROUTE
DRAWING:
PRE-DEVELOPMENT
DRAINAGE PLAN
DATE:
SEPT 2020
PROJ. NO.:
18212
SCALE:
1:600
PROJECT:
PIER 27, PHASE 3, BLDG. A & F
MIXED-USE DEVELOPMENT
25 & 35 QUEENS QUAY EAST
TORONTO, ON
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

iii) Allowable Discharge Flow Rate

The allowable discharge from the site – Phase 3, Buildings A & F – is determined as follows. Consideration is required for the previous allowable release rate criteria given by the prior Stormwater Management Reports prepared and approved for this site (discussed above).

As noted above, Buildings A and F are part of the same site as Building G, hence consideration is required for Building G.

Typically, allowable release rate is determined by calculating the pre-development flow for the 2-year design storms using the rational method. The WWFM Guidelines state that the allowable release rate shall be calculated based on a C-value which is the lesser of 0.5 and the pre-development C-value. The site presently comprises impervious surfaces with a C-value of 0.9 or greater (refer to the Pre-Development Drainage Plan). A C-value of 0.5 is therefore used to establish the allowable release rate, as follows. This yields an allowable release rate of 105 L/s, considering the area of Phase 3 at-grade.

Notwithstanding the above discussion, it was determined in the Phase 3 SWM Report by Al Underhill & Associates (October 2016) that the allowable release rate for all of Phase 3 should be 91.5 L/s.

The allowable release rate for the portion of Phase 3 comprising Building A and F is thus taken as 43.0 L/s, as this is the remaining allowable flow rate for all of Phase 3 (91.5 L/s) less the controlled flow rate of Building G (48.5 L/s).

TABLE 4 – Allowable Flows

Location	Run-off Coefficient	Rainfall Intensity (mm/hr)	Area of Development (ha)	Site Allowable (L/s)
Entire Phase 2/3 Site (@ C=0.50)	0.50	88.2	0.86	105.4
Entire Phase 2/3 Allowable Release Rate	As given by SWM Report for 25 Queens Quay East (page 10) by Al Underhill, 2016			91.5
Ex. Building G Pumped Controlled Discharge	Building G Area = 0.406 Ex. Pumped flow rate given as 48.5 L/s as per Section G-G in Site Servicing Plan (Phase 2, Building G) by Al Underhill, October 2016			48.5
Remaining Allowable Flows for Phase 3 (Building A and F)				**43.0** *(91.5-48.5)*

iv) Post Development Storm Drainage Design and Analysis

The proposed storm drainage and stormwater quantity controls are described as follows. This considers external tributary areas which are tributary to the subject site. Refer to the Post-Development Catchment Plan on the following page for the catchment areas.

<u>Building A and F – Catchment A-F</u>

Storm runoff from the roofs of Buildings A and F will drain uncontrolled by mechanical roof drains to the storm tank located in the P1 and P2 levels of the underground parking garage.

Storm runoff from the ground-levels surrounding Buildings A and F will drain uncontrolled by mechanical area drains and mechanical piping to the storm tank located in the P1 and P2 levels of the underground parking garage.

<u>External Area – Catchment EX-A</u>

A portion of the driveway to Building G (Catchment EX-A) presently drains off Phase 2, onto Phase 1, by overland flow. Catchment EX-A thereafter drains by overland flow into Phase 1's east-west driveway, in the area of Catchment EX-BD (discussed below).

<u>External Area – Phase 1 east-west driveway – Catchment EX-BD</u>

Catchment EX-BD is the existing east-west driveway within Phase 3 which presently drains (in all storm events) from Phase 1, onto Phase 3. Presently EX-BD drains by EX CB1-CB5 and the existing private storm sewers within Phase 3 (refer to the Pre-Development Drainage Plan and site investigation by Markit, Appendix D). Those existing CB's and private storm sewers will necessarily be removed and replaced by the proposed mechanical area drains draining into the proposed below-grade structure, thereafter draining to the storm tank located in the P1 and P2 levels of the underground parking garage.

<u>External Area – Phase 1 major system spillover into Phase 3</u>

Phase 1 was designed to spill over the driveway within Phase 3 to Queens Quay in storm events greater than the 2-year storm, to the 100-year storm. Provision is made to receive this surplus storm runoff from Phase 1 up to the 100-year storm within Phase 3. In such storms, as it does presently, stormwater will spill onto the driveway through Phase 3.

Given that the driveway will be reconstructed ontop of the Building A and F underground parking structure, which will necessarily drain by mechanical storm drains to the stormwater quantity controls within the proposed underground, the spill from Phase 1 will need to be accommodated by the proposed stormwater controls. Consideration (storage volume) is therefore provided whereby the major system storm flows from Phase 1 (that is, flows greater than 2-year storms), will drain into the Building A-F storm tank via the driveway area drains.

Also note that Catchment EX-BD, which is within Phase 1, drains directly into Phase 3 in minor and major storms, therefore consideration is required for Catchment EX-BD in the Phase 3 tank design.

This addresses the criteria given by the City of Toronto's WWFMG, Section 2.2.3.8 (4) for external runoff and how it must be considered in subject site stormwater management design. The operative phrases of that part of the WWFMG are:

- …the subject development shall be designed to ***accommodate and/or convey*** the major storm…
    - ***That is, either <u>accommodating</u> or <u>conveying</u> the major storm is acceptable***
- …major storm flow, <u>that is</u>, the rainfall runoff resulting from the subject site and any external tributary areas using the City's 100-year design storm…
    - ***That is, the major storm flow (to which the above point applies) is the City's <u>100-year storm (and no greater)</u>***

Stormwater detention volume is therefore provided in Stage 2's 100-Y storm tank commensurate with the 100-year storm flow from Phase 1, thereby satisfying the above criteria.

Note that the controlled discharge flow rate from Building A-F's storm tank (43 L/s) is not impacted by this external runoff; that is, storage is provided to accommodate the external 100-year flows.

Easements were granted over Phase 3 for Phase 1's storm drainage when Phase 1 was developed.

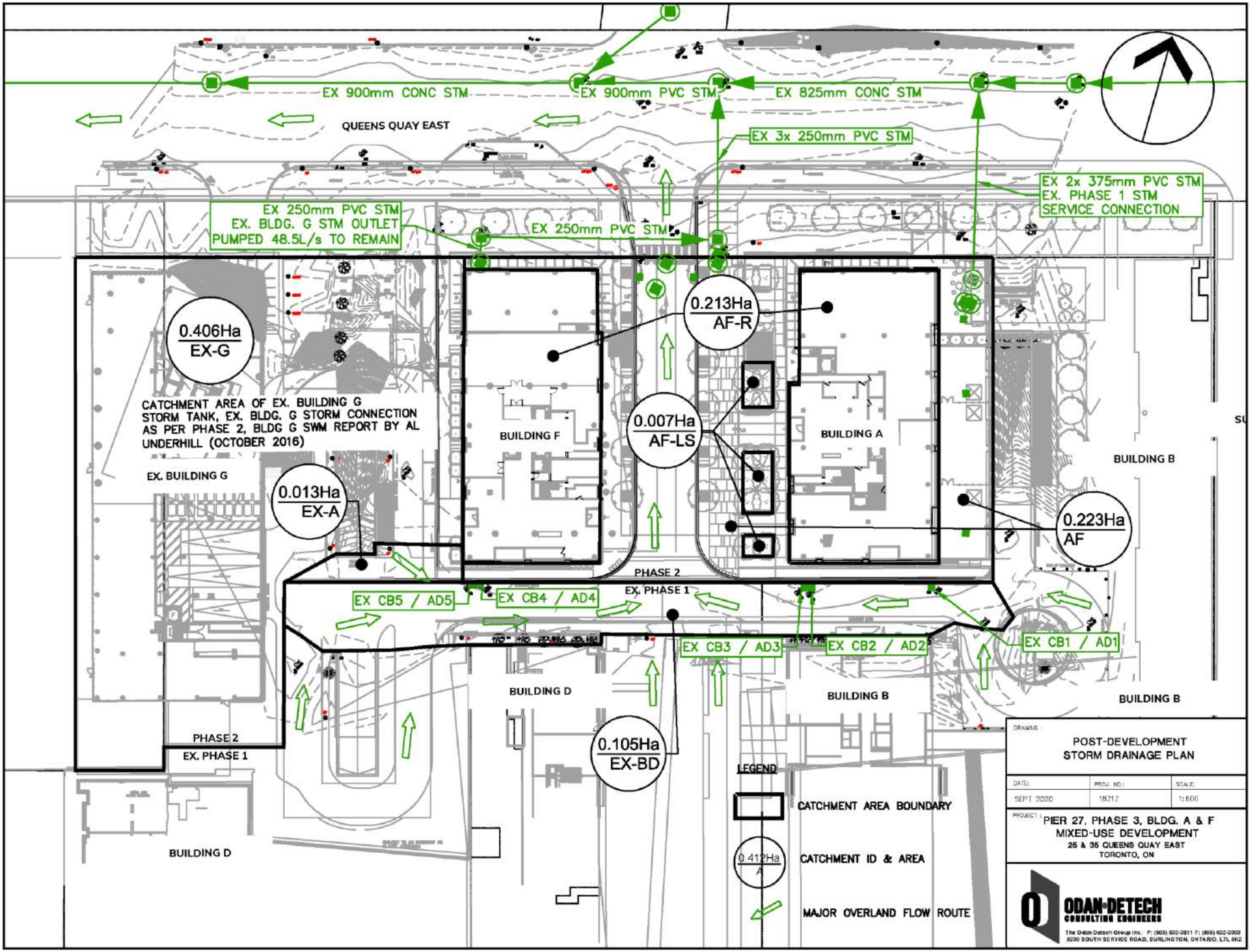
No other external areas drain into the subject site.

Analysis

The above-described catchment areas are outlined on the Post-Development Catchment Plan on the following page and their hydrology parameters identified as follows. The following hydrology parameters were inputted into the hydrology/hydraulics model for the site prepared using the computer software *XPSWMM 2019.1.3* by Innovyze – discussed below.

TABLE 5 – Post-Development Receiving Storm Sewer Catchment Characteristics

Catchment ID	Inlet Structure	Hydrology Method	Trib Area (m^2)	Length (m)	Width (m)	Infiltration Losses Calculation	% Imperviousness	Catchment Slope	Trib Area (Ha)
Catchment AF-R	Roof Drains	XPSWMM *Runoff* Method	2130	69	15	SCS	99	1%	0.213
Catchment AF	Ground Area Drains		2230	71	16		90	1%	0.223
Catchment AF-LS	Ground Area Drains		70	13	3		10	1%	0.007
Catchment EX-A	AD4 & AD5		130	17	4		90	1%	0.013
Catchment EX-BD	AD1, AD2, AD3, AD4, AD5		1,050	49	11		90	1%	0.105
Catchment EX-PH1 – Phase 1 Ground Surfaces (spillover from Phase 1 in major storms)	Minor storms: Phase 1 (B& D) Major storms: AD1-AD5		11,330	160	35		64	1%	1.133



EX 900mm CONC STM
EX 900mm PVC STM
EX 825mm CONC STM
QUEENS QUAY EAST
EX 3x 250mm PVC STM
EX 2x 375mm PVC STM
EX. PHASE 1 STM
SERVICE CONNECTION
EX 250mm PVC STM
EX. BLDG. G STM OUTLET
PUMPED 48.5L/s TO REMAIN
EX 250mm PVC STM
0.406Ha
EX-G
0.213Ha
AF-R
CATCHMENT AREA OF EX. BUILDING G STORM TANK, EX. BLDG. G STORM CONNECTION AS PER PHASE 2, BLDG G SWM REPORT BY AL UNDERHILL (OCTOBER 2016)
BUILDING F
0.007Ha
AF-LS
BUILDING A
BUILDING B
EX. BUILDING G
0.013Ha
EX-A
0.223Ha
AF
PHASE 2
EX. PHASE 1
EX CB5 / AD5
EX CB4 / AD4
EX CB3 / AD3
EX CB2 / AD2
EX CB1 / AD1
BUILDING D
BUILDING B
BUILDING B
PHASE 2
EX. PHASE 1
0.105Ha
EX-BD
BUILDING D
LEGEND
CATCHMENT AREA BOUNDARY
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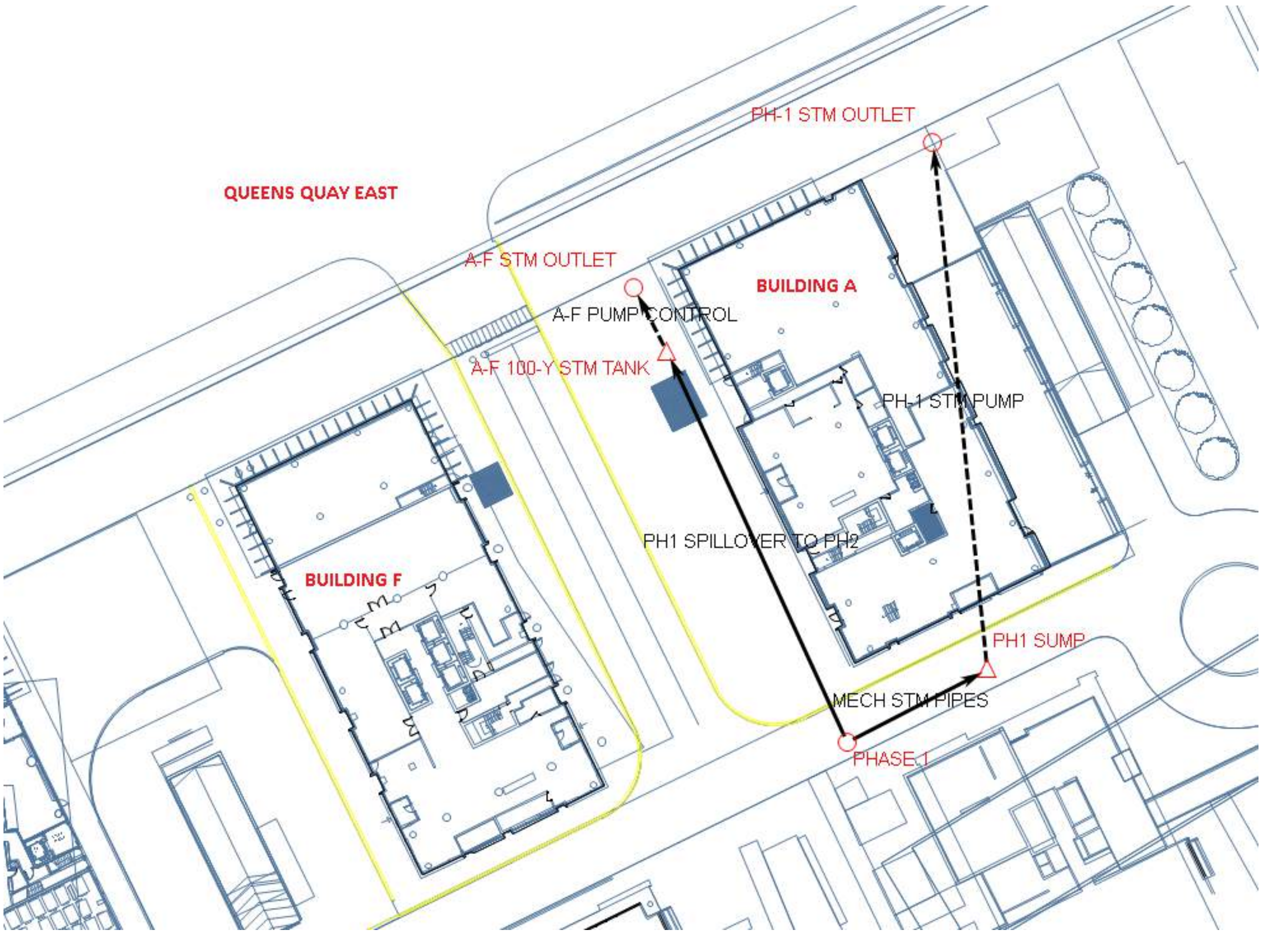
A
CATCHMENT ID & AREA
MAJOR OVERLAND FLOW ROUTE
DRAWING:
POST-DEVELOPMENT
STORM DRAINAGE PLAN
DATE:
SEPT 2020
PROJ. NO.:
18212
SCALE:
1:600
PROJECT:
PIER 27, PHASE 3, BLDG. A & F
MIXED-USE DEVELOPMENT
25 & 35 QUEENS QUAY EAST
TORONTO, ON
ODAN-DETECH
CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

A hydrology/hydraulic model was prepared using the computer modelling software *XPSWMM 2019.1.3* by Innovyze to model the stormwater detention and controlled release. This approach is required to accurately model the effects of the spill from Phase 1 into Phase 3 which occurs when the runoff from Phase 1 exceeds Phase 1's storm pump flow rate. That is, a conventional model could not be utilized to consider such effects.

The model is as follows.

Figure 1 – XPSWMM Model

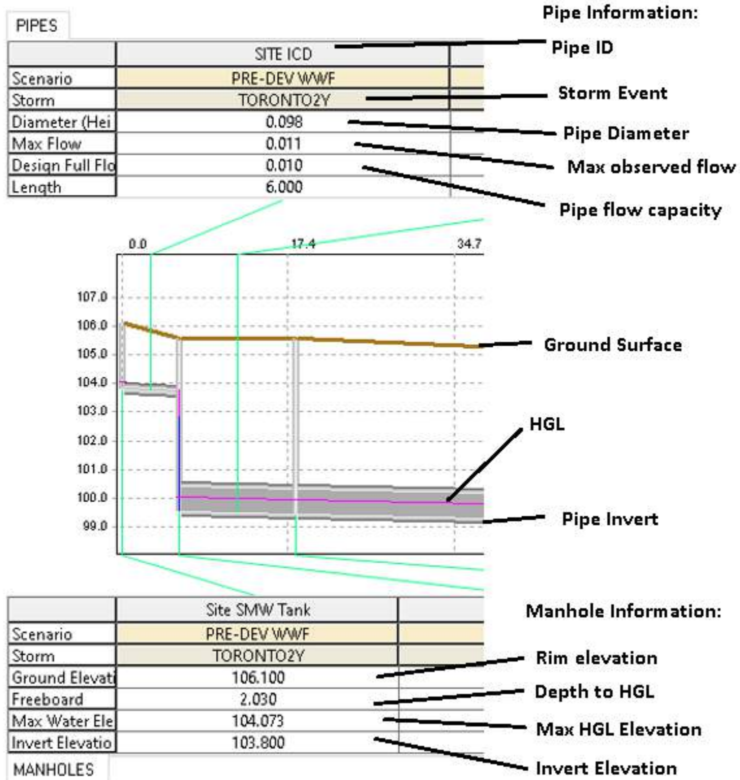


Legend: Δ - storage node, o –node/MH,
Link (pipe or open channel) Tan colour shows existing
Pumped Flow

The results of the XPSWMM analysis are provided in the HGL Profile Plots and hydrograph results plots on the following pages – Figures 2-6. The XPSWMM output file is also provided in Appendix C. Those results are as follows and are summarized in the following tables.

Figure 2: 2-Year Storm HGL Plot from Phase 1 through SWM Tank and pumped outlet
Figure 3: 100-year Storm HGL Plot from Phase 1 through SWM Tank and pumped outlet
Figure 4: 2-Year and 100-Year Storm Hydrograph of pumped flows in Phase 1 outlet
Figure 5: 2-Year and 100-Year Storm Hydrograph of surplus flows from Phase 1 into Phase 3
Figure 6: 2-Year and 100-Year Storm Hydrograph of 43 L/s pump outlet from Phase 3 SWM Tank

The legend for reading the HGL Plots is as follows:



The subject site (Phase 3; Building A and F, as well as Building G) quantity control analysis is summarized as follows.

TABLE 6 - Summary of Flows from Site		
	2 Yr. Storm (L/s)	**100 Yr. Storm** (L/s)
Attenuated by 43 L/s Storm Pump	43	43
Allowable Flow Rate (Table 3)	***43***	

The stormwater storage that occurs in 2-year and 100-year storms is as follows based on the XPSWMM analysis. The storage required to accommodate the 100-year storm flows from both the subject site (Phase 3; Buildings A, F and G) as well as the overflow from Phase 1 is 380m^3, whereas 449m^3 is provided, therefore the tank is adequately designed.

TABLE 7 - Stormwater Storage		
	2 Yr. Storm (m^3)	**100 Yr. Storm** (m^3)
Required Storage Volume	49	380
Provided Volume (100-Y Storm tank)	449	

The structural engineer has confirmed in the letter provided in Appendix C that the proposed storm tank shall be structurally designed to withstand the loading of the tank being full.

The following discussion is drawn from the below results of the XPSWMM stormwater quantity control analysis.

- The existing 277 L/s pump within Phase 1 provides outlet for the entire 2-year storm runoff from Phase 1 – there is no spill to Phase 3.

- In the 100-year storm, there is a flow rate of 242 L/s spilling from Phase 1, into Phase 3 based on this analysis, as per Figure 3.

- The road surface within Phase 3 will have sufficient conveyance capacity to convey the 242 L/s flow spilling from Phase 1, into Phase 3 where it will drain uncontrolled by mechanical storm drains to the 100-Y storm tank

- The 100-Y high-water-level (HWL) within the Phase 3 stormwater tank as given by Figure 3 is 74.20m – which is below the invert of the mechanical inlet to the 100-year storm tank.

- The 43 L/s pump which controls flows prior to discharge into the Phase 3 storm service connection pumps for the as long as is required to empty the Phase 3 100-year storm tank in the City of Toronto 4-hour, 100-Year storm.

Figure 2 - 2-Year Storm HGL Plot from Phase 1 through SWM Tank and pumped outlet

PIPES

	PH1 SPILLOVER TO PH2	A-F PUMP.1
Storm	TORONTO2Y	TORONTO2Y
Diameter (Hei	1.000	
Max Flow	0.000	0.043
Design Full Flo	2.400	0.000
Length	10.000	

This result is for the 2-year storm

Pumped Flow Rate

	PHASE 1	A-F 100-Y STM TANK	A-F STM OUTLET
Storm	TORONTO2Y	TORONTO2Y	TORONTO2Y
Ground Elevati	78.100	78.000	76.780
Freeboard	2.670	7.250	1.780
Max Water Ele	75.433	70.748	75.000
Invert Elevatio	75.200	70.330	75.000
Max Volume	0.285	48.897	0.000

2-Year STM HWL

Tank Invert

2-Year STM Volume

MANHOLES HYDROLOGY

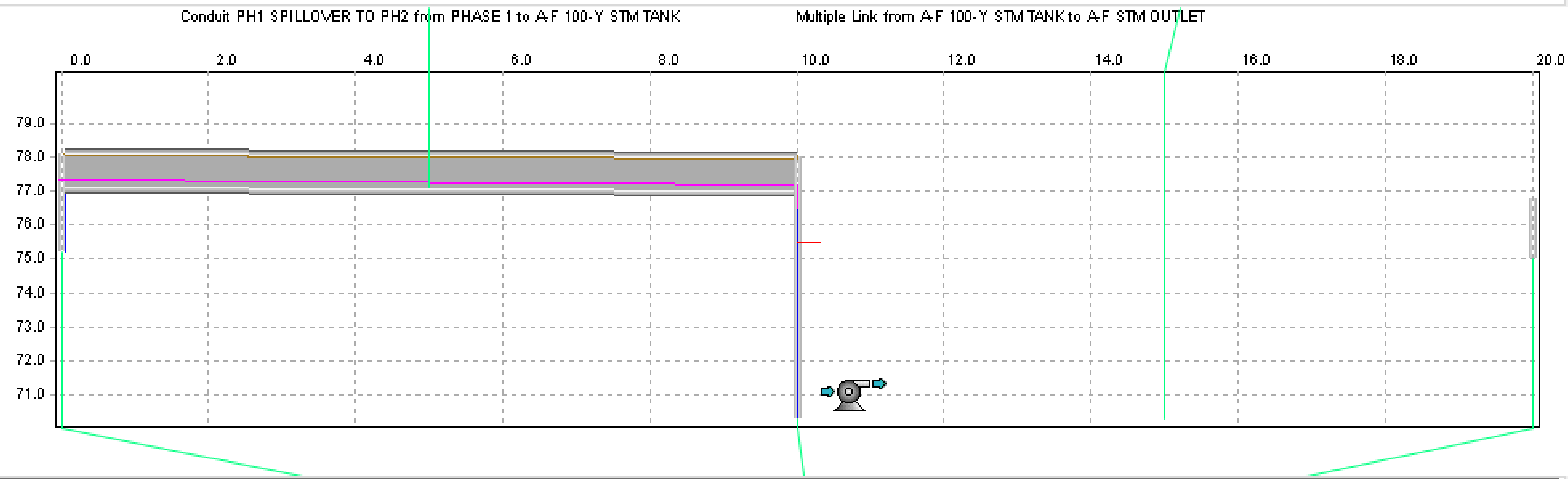
Figure 3 - 100-year Storm HGL Plot from Phase 1 through SWM Tank and pumped outlet

PIPES

	PH1 SPILLOVER TO PH2	A-F PUMP.1
Storm	TORONTO100Y	TORONTO100Y
Diameter (Hei	1.000	
Max Flow	0.242	0.043
Design Full Flo	2.400	0.000
Length	10.000	

This result is for the 100-year storm

Max pump flow rate



	PHASE 1	A-F 100-Y STM TANK	A-F STM OUTLET
Storm	TORONTO100Y	TORONTO100Y	TORONTO100Y
Ground Elevati	78.100	78.000	76.780
Freeboard	0.780	3.800	1.780
Max Water Ele	77.316	74.203	75.000
Invert Elevatio	75.200	70.330	75.000
Max Volume	2.581	379.607	0.000

100Y HWL

Tank invert

100Y Volume

MANHOLES HYDROLOGY

Figure 4 - 2-Year and 100-Year Storm Hydrograph of pumped flows in Phase 1 (Building B & D) outlet

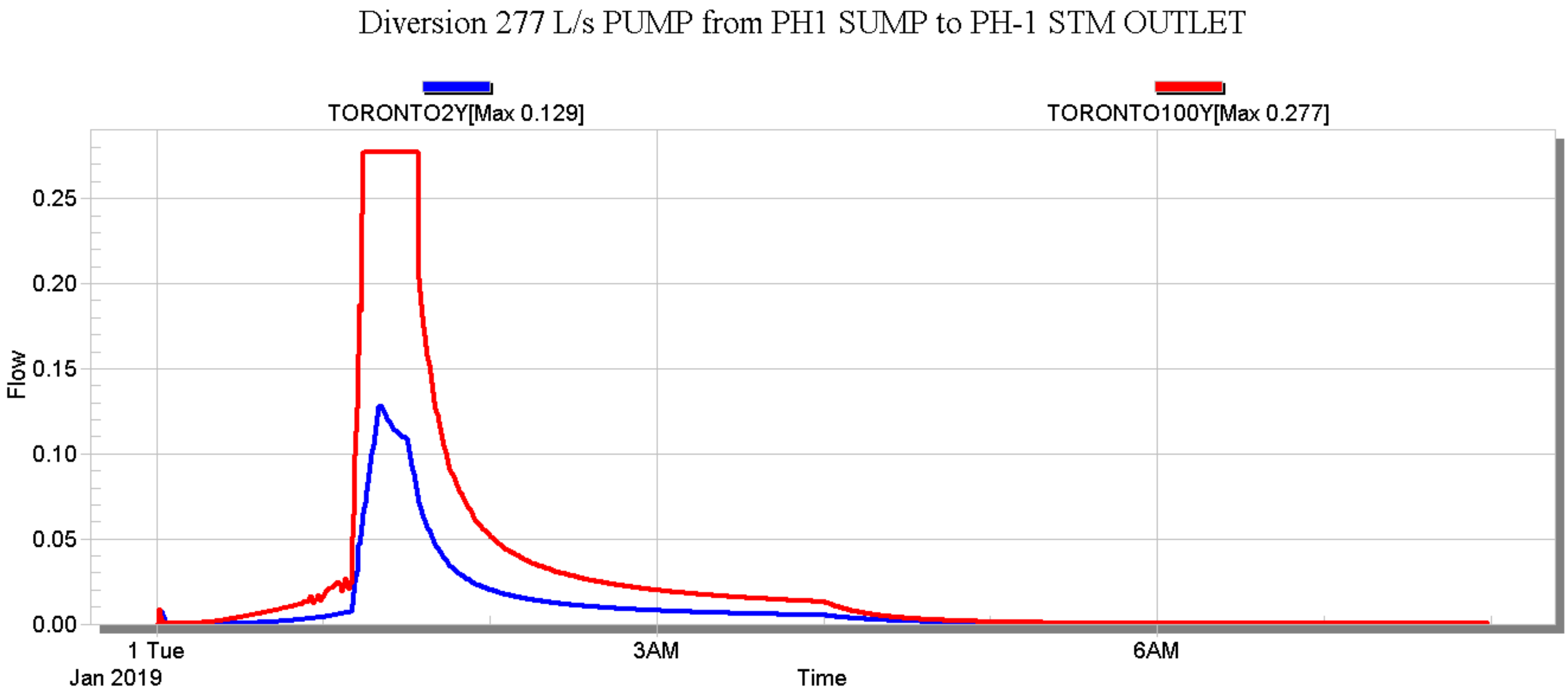


Figure 5 - 2-Year and 100-Year Storm Hydrograph of surplus flows from Phase 1 into Phase 3

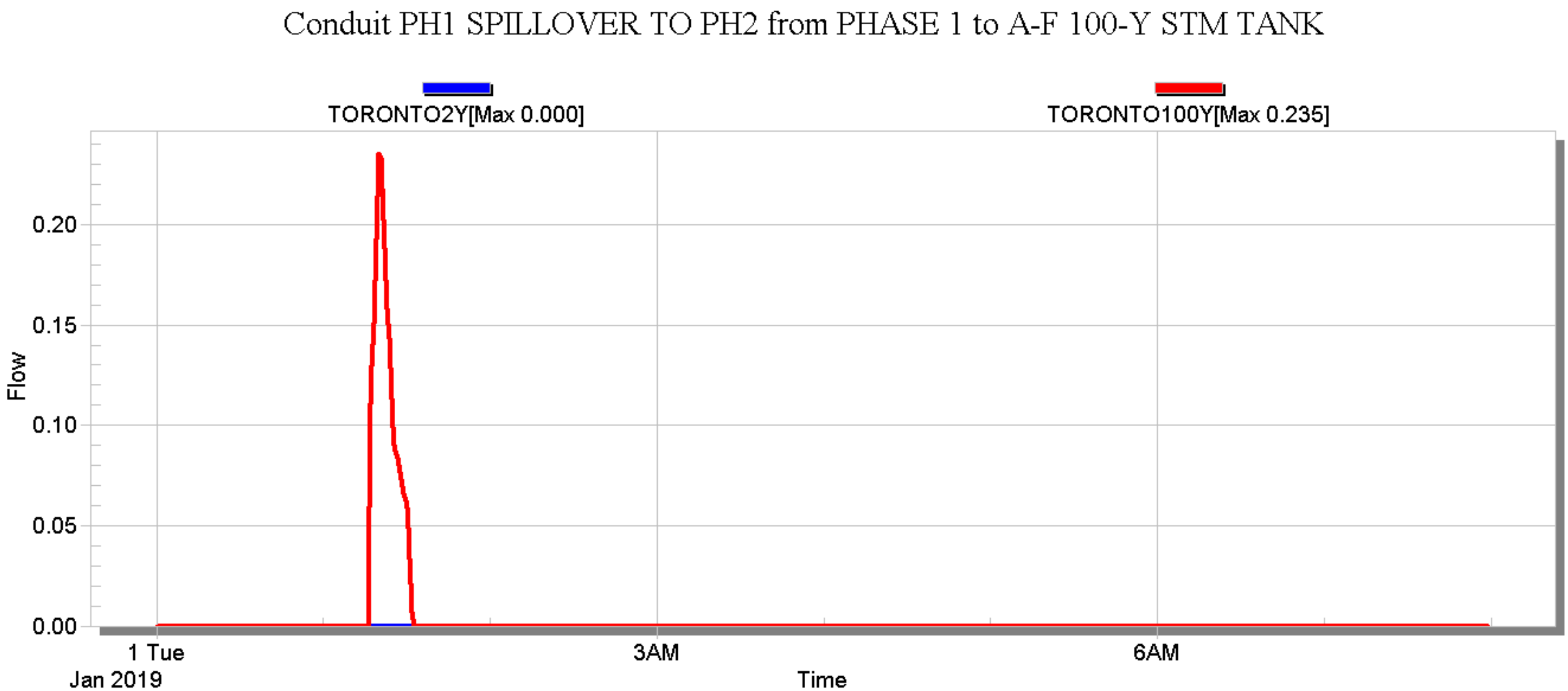
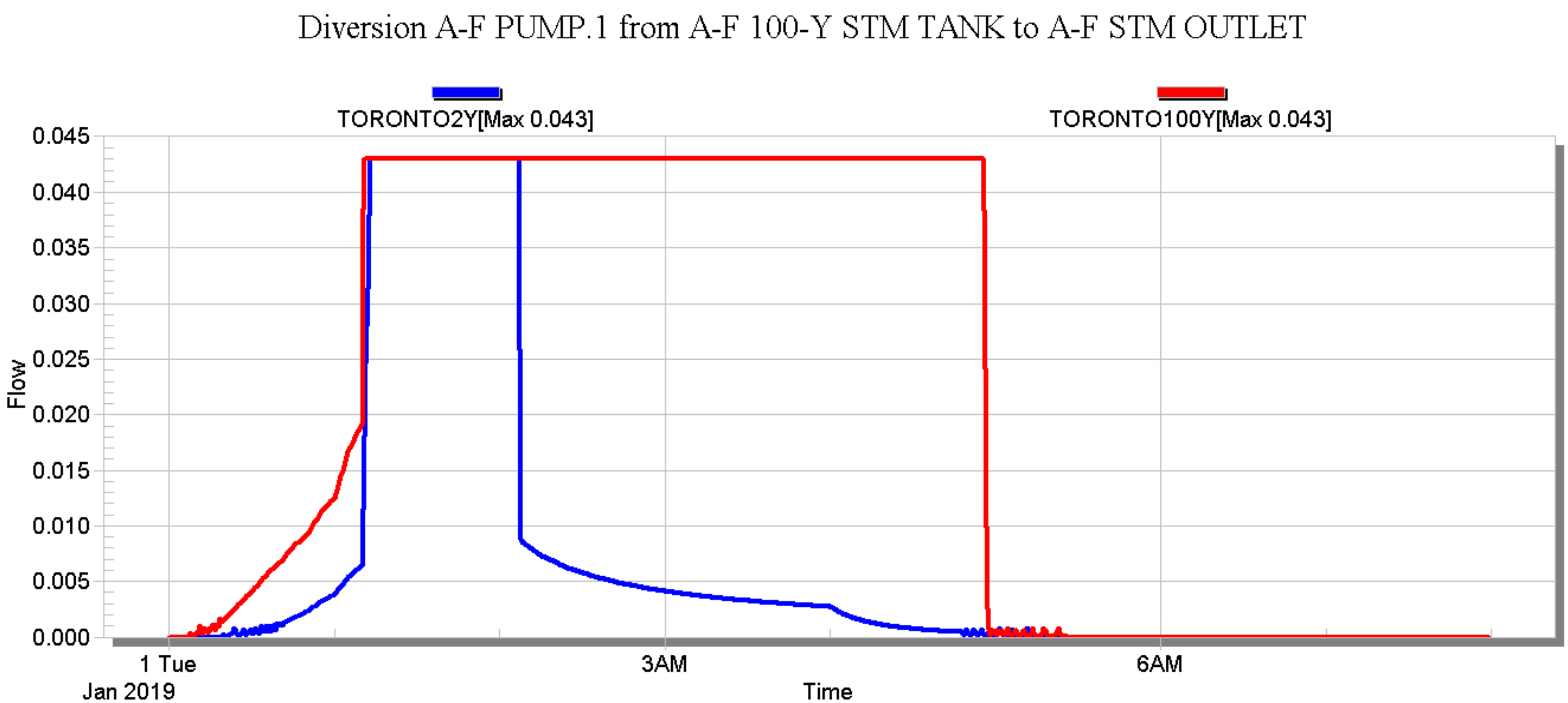


Figure 6 - 2-Year and 100-Year Storm Hydrograph of 43 L/s pump outlet from Phase 3 SWM Tank



v) Water Balance

The primary objective of the Water Balance 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.

Criteria

In most cases, the minimum on-site runoff retention requires the proponent to retain all runoff from a small design rainfall event – typically 5mm (In Toronto, storms with 24-hour volumes of 5mm or less contribute about 50% of the total average annual rainfall volume) through infiltration, evapotranspiration and rainwater reuse.

The proposed development is categorized as Category 2 in Table 7 of the WWFM Guideline - Small New Developments (residential & non-residential) with total site area < 5.0 ha. Thus, water balance criteria applies.

The water balance target volume is as follows, for Buildings A and F. Water balance for Building G was addressed in the SWM Report for that building by Al Underhill.

TABLE 8 – Water Balance

	Initial Abstraction (mm)	Area (m^2)	Volume (m^3)
5mm Volume Whole Site	5	4430	22.2
Less Tree Planters @ Grade	5	70	0.4
Less Bldg A & F Green Roofs	5	41	0.2
Less Impervious Surfaces	1	4319	4.3
Required Cistern (Retention) Volume			***17.3***
Irrigation reuse capacity			5.1
Greywater Toilets Reuse Capacity			12.2

A cistern of volume 17.5m^3 is proposed as shown on the Servicing Plan and Sections. The cistern will function such that in minor storm events, runoff draining from the site's mechanical roof drains (the runoff will not include salt/grit from winter maintenance) will first drain into the cistern for storage and reuse. A pump in the cistern will draw water for greywater reuse and irrigation.

In storm events greater than 5mm, the cistern will fill-up and stormwater will occupy the larger storage area allocated for 100-year storm storage before draining via the site's 43 L/s pump.

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.

2) ***Irrigation***: There are trees and landscape features on the ground level which will require irrigation. An irrigation designer has provided an irrigation design sheet on the following page identifying that the typical irrigation demand is $5.1m^3$/72-hours. The irrigation system will be designed to draw water from the greywater cistern for reuse by irrigation.

3) ***Greywater reuse***: Following irrigation, there is a need to reuse $12.2m^3$ of stormwater per 72-hours. It is proposed to reuse this water by greywater reuse fixtures (toilets) in the retail, amenity and residential suite areas. The mechanical engineer, Able Engineering, has provided the letter on the following page confirming that this will be provided.

Given the above discussion, the required volume of stormwater will be retained on-site by irrigation and mechanical reuse in greywater fixtures.

Pier 27 - Phase 3

Irrigation Water Requirement

Planting Description	Area (m2)	Species Factor (Ks)	Density Factor (Kd)	Micriclimate Factor (Kmc)	Kl (Kl=KsxKdxKmc)	ETl (mm)/ Day (Etl=ET0xKl)	Water Reqt (m3) per day	Irrig. Eff (%) Drip	Gross Water Reqt (m3) per day
Ground Floor									
Shrub Area	211.06	0.5	1.0	1.0	0.5	2.3	0.47	90	0.53
Large Trees (12x28.3)	339.60	0.5	1.0	1.0	0.5	2.3	0.76	90	0.85
Ornamental Trees (31x12.6)	390.60	0.5	1.0	1.0	0.5	2.3	0.88	90	0.98
Total Water Requirement For July:	**941.26**								**2.35**

ET0 is the evepotranspiration rate for peek period (Month of July in Toronto). This value is 138.2 mm for the month @ 4.5 mm/ day

Seasonal Water Requirement (M3)

Month	Evapotranspiration Factor	Water Req/Day (M3)	Water Req./72 Hours (M3)
May	74%	1.74	5.22
June	90%	2.12	6.35
July	100%	**2.35**	**7.06**
August	80%	1.88	5.65
September	52%	1.22	3.67
October	40%	0.94	2.82
Seasonal Average/ 72 hours:			**5.13**

ABLEngineering
Making theory work.

December 21, 2020

Chief Engineer and Executive Director
Engineering and Construction Services
c/o Manager, Development Engineering
55 John St 16th Fl, Toronto ON M5V 3C6

General Manager, Toronto Water
c/o Manager
Environmental Monitoring & Protection Unit
30 Dee Ave, Toronto ON M9N 1S9

Reference: **Storm Water Reuse**
Pier 27 Phase 3 - Buildings A&F
Toronto, Ontario
Our Project No. 20-010

Dear Sir:

Based on the rain water reuse requirement, after deduction of the irrigation reuse volume, an additional 12.2m^3 of rain water will need to be consumed within a 72 hour period after rainfall. This volume will be utilized in retail, amenity and residential suite toilet flushing.

Yours truly
ABLE ENGINEERING INC.

Michael D'Arpino, P. Eng.
MD/tb

LICENSED PROFESSIONAL ENGINEER
M. A. D'ARPINO
100176629
21/12/20
PROVINCE OF ONTARIO

Able Engineering Inc.
20 Densley Avenue
Toronto Canada M6M 2R1
Telephone 416-235-1170 Facsimile 416-235-1870
e-mail: design@ABLEngineering.com
www.ABLEngineering.com

vi) Water Quality

(a) The wet weather flow (WWF) water quality target is the long term-average removal of 80% of the Total Suspended Solids (TSS) on an annual loading basis from all runoff leaving the proposed development site based on the post-development level of imperviousness.

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 filtration is thus required.

A Jellyfish Model No. JF4-2-1 filter by Imbrium Systems is specified to provide 80% TSS Removal for storm runoff from the driveway which will be subject to winter maintenance. Refer to the Jellyfish Filter's location on the Servicing Plan as well as the Jellyfish specification on the following page. The Jellyfish filter has NJDEP certification to provide 80% TSS Removal. The NJDEP Certification is provided here in Appendix C.

imbrium

STANDARD OFFLINE
Jellyfish Filter Sizing Report

Project Information

Date	Thursday, October 29, 2020
Project Name	Pier 27 Ph 2 - Queens Quay E
Project Number	Bldgs A & F
Location	Toronto

Jellyfish Filter Design Overview

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

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

Jellyfish Filter System Recommendation

The Jellyfish Filter model JF4-2-1 is recommended to meet the water quality objective by treating a flow of 12.6 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 18 years of TORONTO CENTRAL rainfall data for this site. This model has a sediment capacity of 142 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-2-1	2	1	1.2	12.6	142

The Jellyfish Filter System

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

Maintenance

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

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

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

Jellyfish® Filter

Performance

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

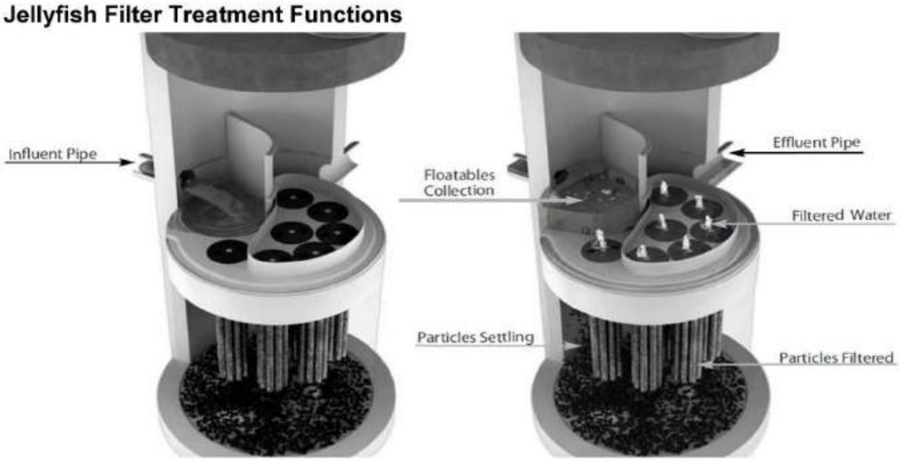
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 59% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash and debris

Field Proven Peformance

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

- A median TSS removal efficiency of 89%, and a median SSC removal of 99%;
- The ability to capture fine particles as indicated by an effluent d50 median of 3 microns for all monitotred storm events, and a median effluent turbidity of 5 NTUs;
- A median Total Phosphorus removal of 59%, and a median Total Nitrogen removal of 51%.

Jellyfish Filter Treatment Functions



Pre-treatment and Membrane Filtration

Jellyfish® Filter

Project Information

Date:	Thursday, October 29, 2020
Project Name:	Pier 27 Ph 2 - Queens Quay E
Project Number:	Bldgs A & F
Location:	Toronto

Designer Information

Company:	Odan Detech
Contact:	Daniel Bancroft
Phone #:	

Notes

Rainfall

Name:	TORONTO CENTRAL
State:	ON
ID:	100
Record:	1982 to 1999
Co-ords:	45°30'N, 90°30'W

Drainage Area

Total Area:	0.288 ha
Imperviousness:	100%

Upstream Detention

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

Design System Requirements

Flow Loading	90% of the Average Annual Runoff based on 18 years of TORONTO CENTRAL rainfall data:	8.4 L/s
Sediment Loading	Treating 90% of the average annual runoff volume, 1725 m³, with a suspended sediment concentration of 60 mg/L.	104 kg

Recommendation

The Jellyfish Filter model JF4-2-1 is recommended to meet the water quality objective by treating a flow of 12.6 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 18 years of TORONTO CENTRAL rainfall data for this site. This model has a sediment capacity of 142 kg, which meets or exceeds the estimated average annual sediment load.

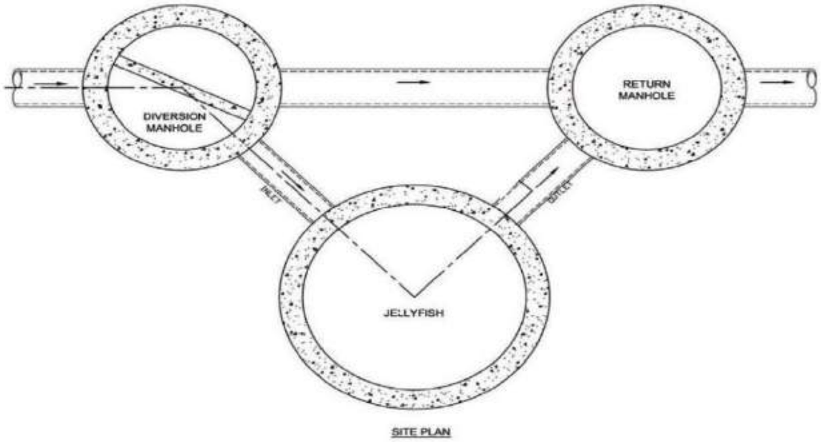
Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Wet Vol Below Deck (L)	Sump Storage (m^3)	Oil Capacity (L)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1	1	1	1.2	2313	0.34	379	7.6	85
JF4-2-1	**2**	**1**	**1.2**	**2313**	**0.34**	**379**	**12.6**	**142**
JF6-3-1	3	1	1.8	5205	0.79	848	17.7	199
JF6-4-1	4	1	1.8	5205	0.79	848	22.7	256
JF6-5-1	5	1	1.8	5205	0.79	848	27.8	313
JF6-6-1	6	1	1.8	5205	0.79	848	28.6	370
JF8-6-2	6	2	2.4	9252	1.42	1469	35.3	398
JF8-7-2	7	2	2.4	9252	1.42	1469	40.4	455
JF8-8-2	8	2	2.4	9252	1.42	1469	45.4	512
JF8-9-2	9	2	2.4	9252	1.42	1469	50.5	569
JF8-10-2	10	2	2.4	9252	1.42	1469	50.5	626
JF10-11-3	11	3	3.0	14456	2.21	2302	63.1	711
JF10-12-3	12	3	3.0	14456	2.21	2302	68.2	768
JF10-12-4	12	4	3.0	14456	2.21	2302	70.7	796
JF10-13-4	13	4	3.0	14456	2.21	2302	75.7	853
JF10-14-4	14	4	3.0	14456	2.21	2302	78.9	910
JF10-15-4	15	4	3.0	14456	2.21	2302	78.9	967
JF10-16-4	16	4	3.0	14456	2.21	2302	78.9	1024
JF10-17-4	17	4	3.0	14456	2.21	2302	78.9	1081
JF10-18-4	18	4	3.0	14456	2.21	2302	78.9	1138
JF10-19-4	19	4	3.0	14456	2.21	2302	78.9	1195
JF12-20-5	20	5	3.6	20820	3.2	2771	113.6	1280
JF12-21-5	21	5	3.6	20820	3.2	2771	113.7	1337
JF12-22-5	22	5	3.6	20820	3.2	2771	113.7	1394
JF12-23-5	23	5	3.6	20820	3.2	2771	113.7	1451
JF12-24-5	24	5	3.6	20820	3.2	2771	113.7	1508
JF12-25-5	25	5	3.6	20820	3.2	2771	113.7	1565
JF12-26-5	26	5	3.6	20820	3.2	2771	113.7	1622
JF12-27-5	27	5	3.6	20820	3.2	2771	113.7	1679

CDN/Int'l: 1 (800) 565-4801 | US: 1 (888) 279-8826 3 www.ImbriumSystems.com

Jellyfish® Filter

Jellyfish Filter Design Notes

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



Jellyfish Filter Typical Layout

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

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

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

6.0 GROUNDWATER

i) Introduction

Groundwater from the subject development will be discharged to municipal combined sewers on a permanent basis, because groundwater will enter the future foundation drains. Groundwater from the subject development will be discharged to municipal combined sewers on a temporary basis, during construction.

A *Hydrogeological Review Report* (November, 2020) has been prepared for this development by McClymont & Rak to qualitatively and quantitatively characterize the groundwater with respect to City of Toronto guidelines.

The report concludes that the short-term construction dewatering volume will be 459,000 L/day (including storm flows).

The report concludes that the peak long-term discharge will be 46,000 L/day.

The report concludes in Section 7 that the groundwater meets all criteria for discharge to the combined/sanitary sewer, but there are two exceedances for discharge to the storm sewer. There is no separated storm sewer in the area of the subject site, however, therefore this result (storm sewer discharge) may be disregarded.

ii) Long-Term Groundwater

Given the Hydrogeological conclusions, the mechanical engineer has stated that the groundwater sump pump will be sized 0.95 L/s. The pump flow rate of groundwater is included in Section 4.0 ii (Table 2), above, whereby conclusions are provided regarding downstream combined sewer capacity.

A groundwater sampling port is specified as shown on the Servicing Plan.

Foundation drainage for the entire development will be one system.

iii) Short-Term (Construction) Groundwater

The groundwater will be discharged short-term to the existing building's sanitary connection to the Queens Quay East 300mm sanitary sewer.

The short-term groundwater flow rate identified by the Hydrogeological Assessment totals 459,000 L/d (5.3 L/s), above. This temporary groundwater flow rate is less than the post-development sanitary discharge rate (Table 2), therefore given that Section 4.0 concludes that the receiving sanitary sewers have capacity for the proposed development, it follows that ***the receiving combined sewers have capacity for the proposed temporary groundwater discharge***.

Applications will be made to Toronto Water for this permanent and temporary groundwater discharge in the future.

ABLEngineering
Making theory work

October 5, 2020

Chief Engineer and Executive Director
Engineering and Construction Services
c/o Manager, Development Engineering
Metro Hall
55 John Street, 16th Floor
Toronto ON M5V 3C6

Attention: Mr. Avi Bachar, P. Eng.

c: General Manager, Toronto Water
c/o Manager, Environmental Monitoring and Protection Unit
30 Dee Avenue
Toronto ON M9N 1S9

Attention: Mr. Dhiren Barot

Reference: Pier 27 - Phase 4
Toronto, Ontario
Our Project No. 20-011

Dear Sir or Madam:

This letter is to confirm that ground water from the private water drainage system at the above noted building will be collected and discharged into the sanitary control manhole.

The ground water sump pumps will be sized at 0.946 L/s (15 GPM).

This peak flow rate will be used for assessing capacity for the peak discharge flow into the City's sanitary sewer system.

Should there be any amendment to the peak flow rate of 0.946 L/s (15 GPM) in future, the property owner shall resubmit either the updated pump schedule or a revised letter to ECS. In addition, the sewer capacity will need to be reassessed.

Yours truly
ABLE ENGINEERING INC.

Michael D'Arpino, P. Eng.
MD/tb

LICENSED PROFESSIONAL ENGINEER
M. A. D'ARPINO
100176629
10/05/20
PROVINCE OF ONTARIO

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Telephone 416 235 1170 Facsimile 416 235 1870
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www.ABLEngineering.com

7.0 CONCLUSIONS

From the foregoing investigation, the site is serviceable utilizing existing sanitary sewer 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 9 - Summary

	Building A	***Building F***
Peak Sanitary Discharge (L/s)	5.2	9.7
Proposed Sanitary Service	Ex. 250mm @ 1.32%	Ex. 250mm @ 2.09%
Receiving Sanitary Sewer	Ex. 250mm sewer beneath south side of Queens Quay E., which drains to Ex. 300mm sewer beneath north side	
Development Water Demand (Fire + Domestic)	2161 USGM	
Available Flow Rate	3968 USGM	
Proposed Fire Service	Ex. 200mm + 200mm	
Proposed Domestic Service	Ex. Branch 150mm	Ex. Branch 150mm
Allowable release rate from site (L/s)	43 L/s	
Proposed release rate from site (L/s) (100 year storm)	43 L/s	
Stormwater Quality	Jellyfish JF4-2-1 Filter	
Quantity Control	43 L/s Pump	

8.0 REFERENCES

1. City of Toronto **"Wet Weather Flow Management Guidelines"**, November 2006.

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

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

4. Visual OTTHYMO v2.0 Reference Manual, July 2002

Respectfully Submitted;
The Odan Detech Group Inc.

Daniel Bancroft, P.Eng.

APPENDIX A

Existing Site	Aerial view of Site and surrounding area
Site Plan & Statistics	by architectsAlliance

LEGEND

PROPERTY LINE

DRAWING :

KEY PLAN

DATE:	PROJ. NO.:	SCALE:
SEPT 2020	18312	N.T.S.

PROJECT : PIER 27, PHASE 3, BLDG. A & F
MIXED-USE DEVELOPMENT
25 & 35 QUEENS QUAY EAST
TORONTO, ON

ODAN·DETECH
CONSULTING ENGINEERS

The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 6K2

1. Copyright of this drawing is reserved by the Architect. The drawing and all associated documents are an instrument of service by the Architect. The drawing and the information contained therein may not be reproduced in whole or in part without prior written permission of the Architect.

2. These Contract Documents are the property of the Architect. The Architect bears no responsibility for the interpretation of these documents by the Contractor. Upon written application, the Architect will provide written/graphic clarification or supplementary information regarding the intent of the Contract Documents. The Architect will review Shop Drawings submitted by the Contractor for design conformance only.

3. Drawings are not to be scaled for construction. The Contractor is to verify all existing conditions and dimensions required to perform the work and report any discrepancies with the Contract Documents to the Architect before commencing any work.

4. Positions of exposed finished mechanical or electrical devices, fittings, and fixtures are indicated on architectural drawings. The locations shown on the architectural drawings govern over the Mechanical and Electrical drawings. Those items not clearly located will be located as directed by the Architect.

5. These drawings are not to be used for construction unless noted below as "Issuance: For Construction"

6. All work is to be carried out in conformance with the Code and Bylaws of the authorities having jurisdiction.

7. The Architect of these plans and specifications gives no warranty or representation to any party about the constructability of the building(s) represented by them. All contractors or subcontractors must satisfy themselves when bidding and at all times ensure that they can properly construct the work represented by these plans.

NO	ISSUANCE	DATE
1	SPA/OPA/ZBA	March 2021
2	-	-
3	-	-
4	-	-
5	-	-

aA
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Pier 27 Phase 3
(buildings F and A)
25&35 Queens Quay East

Pier 27 Toronto (Northeast) Inc.
56 The Esplanade, suite 308
Toronto M5E 1A7

Ground

Project No.

1:200

March 2021

A.1.10

DRAWING LIST

NO.	DRAWING NAME
A.0.1	Cover
A.0.2	Renderings
A.0.3	Renderings
A.0.4	Statistics
A.0.5	Statistics for Phase 1 & 2
A.0.6	Context
A.0.7	Survey
A.1.1	P4
A.1.2	P3
A.1.3	P2
A.1.4	P1
A.1.5	Site Plan
A.1.6	P4
A.1.7	P3
A.1.8	P2
A.1.9	P1
A.1.10	Ground
A.1.11	Mezzanine
A.1.12	Level 2
A.1.13	Level 3
A.1.14	Level 4-6
A.1.15	Level 7 - 10
A.1.16	Level 11 Amenity
A.1.17	Level 12
A.1.18	Levels 13-32
A.1.19	Level 33 - 45
A.1.20	MPH
A.1.21	Roof Plan
A.2.1	East Elevation Context
A.2.2	East Elevation Building F
A.2.3	East Elevation Building A
A.2.4	South Elevation
A.2.5	West Elevation Building F
A.2.6	West Elevation Building A
A.2.7	North Elevation
A.3.1	Section
A.3.2	Section
A.5.1	East Elevation Building F
A.5.2	North Elevation Building F
A.5.3	West Elevation Building A
A.5.4	North Elevation Building A
A.6.1	Tower Floor Plate L2 - L11
A.6.2	Tower Floor Plate L12 - L21
A.6.3	Tower Floor Plate L22 - L31
A.6.4	Tower Floor Plate L32 - L41
A.6.5	Tower Floor Plate L42 - L45

Statistics Template - Toronto Green Standard Version 3.0

Mid to High Rise Residential and all New Non-Residential Development

The Toronto Green Standard Version 3.0 Statistics Template is submitted with Site Plan Control Applications and stand alone Zoning Bylaw Amendment applications. Complete the table and copy it directly onto the Site Plan submitted as part of the application.

For Zoning Bylaw Amendment applications: complete General Project Description and Section 1.

For Site Plan Control applications: complete General Project Description, Section 1 and Section 2.

For further information, please visit www.toronto.ca/greendevelopment

General Project Description	Proposed
Total Gross Floor Area	44438 m2
Breakdown of project components (m²)	
Residential	43305m2
Retail	
Commercial	601 m2
Industrial	
Institutional/Other	532 m2
Total number of residential units	585

Section 1: For Stand Alone Zoning Bylaw Amendment Applications and Site Plan Control Applications

Automobile Infrastructure	Required	Proposed	Proposed %
Number of Parking Spaces	265	362	100%
Number of parking spaces dedicated for priority LEV parking			
Number of parking spaces with EVSE	73	73	20%

Cycling Infrastructure	Required	Proposed	Proposed %
Number of long-term bicycle parking spaces (residential)	527	528	100%
Number of long-term bicycle parking spaces (all other uses)	1	1	100%
Number of long-term bicycle parking (all uses) located on:			
a) first storey of building		0	
b) second storey of building		0	
c) first level below-ground		145	
d) second level below-ground		384	
e) other levels below-ground		0	

Cycling Infrastructure	Required	Proposed	Proposed %
Number of short-term bicycle parking spaces (residential)	59	59	100%
Number of short-term bicycle parking spaces (all other uses)	5	5	100%
Number of male shower and change facilities (non-residential)			
Number of female shower and change facilities (non-residential)			

Tree Planting & Soil Volume	Required	Proposed	Proposed %
Total Soil Volume (40% of the site area ÷ 66 m² x 30 m³).	1020	960	

Section 2: For Site Plan Control Applications

Cycling Infrastructure	Required	Proposed	Proposed %
Number of short-term bicycle parking spaces (all uses) at-grade or on first level below grade		64	

UHI Non-roof Hardscape	Required	Proposed	Proposed %
Total non-roof hardscape area (m²)		3243.59	
Total non-roof hardscape area treated for Urban Heat Island (minimum 50%) (m²)	1621.79	2969.31	91.54%
Area of non-roof hardscape treated with: (indicate m²)			
a) high-albedo surface material		2969.31	91.54%
b) open-grid pavement			
c) shade from tree canopy			
d) shade from high-albedo structures			
e) shade from energy generation structures			
Percentage of required car parking spaces under cover (minimum 75%)(non-residential only)			

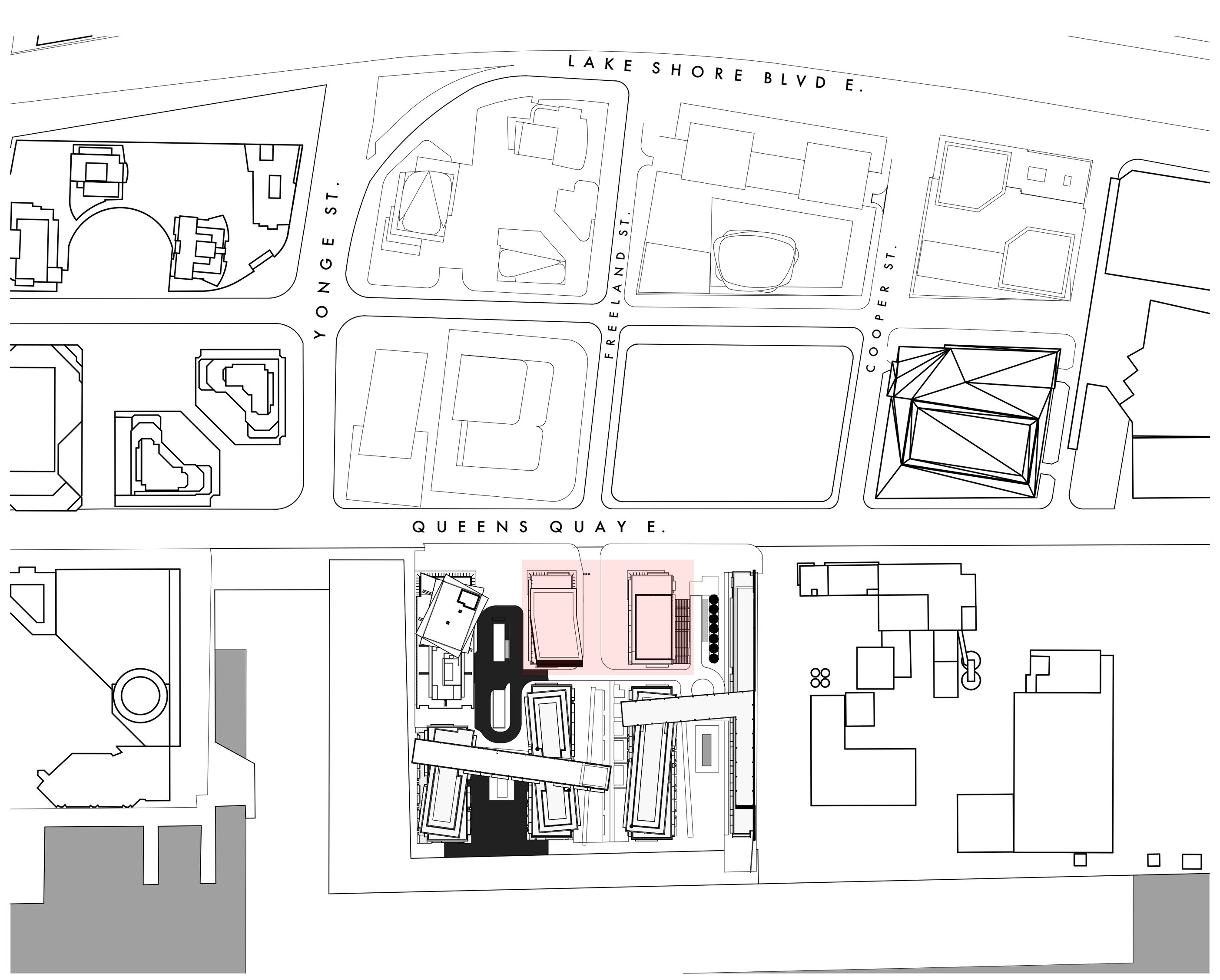
Green & Cool Roofs	Required	Proposed	Proposed %
Available Roof Space (m²)		67.55 m2	
Available Roof Space provided as Green Roof (m²)	40.53 m2	40.53 m2	60%
Available Roof Space provided as Cool Roof (m²)			
Available Roof Space provided as Solar Panels (m²)			

Water Efficiency	Required	Proposed	Proposed %
Total landscaped site area (m²)		392.51	
Landscaped site area planted with drought-tolerant plants (minimum 50%) (m² and %) (if applicable)	196.25	197.10	50.25%

Tree Planting Areas & Soil Volume	Required	Proposed	Proposed %
Total site area (m²)		5689.18	
Total Soil Volume (40% of the site area ÷ 66 m²x 30 m³)	1020	960	
Total number of planting areas (minimum of 30m³ soil)		7	
Total number of trees planted	34	32	
Number of surface parking spaces (if applicable)			
Number of shade trees located in surface parking area interior (minimum 1 tree for 5 parking spaces)		N/A	N/A

Native and Pollinator Supportive Species	Required	Proposed	Proposed %
Total number of plants		39	
Total number of native plants and % of total plants (min.50%)	20	21	53.84%

Bird Friendly Glazing	Required	Proposed	Proposed %
Total area of glazing of all elevations within 12m above grade (including glass balcony railings)		3763 m2	
Total area of treated glazing (minimum 85% of total area of glazing within 12m above grade) (m²)	3199 m2	3292 m2	87%
Percentage of glazing within 12m above grade treated with:			
a) Low reflectance opaque materials			
b) Visual markers		3292 m2	100%
c) Shading			



Pier 27 Ph 3 *2021-02-24*

Floor Area											
Level	Total Levels	GCA / Level	Total GCA	Interior Residential Amenity	Exterior Residential Amenity	GFA Deductions	Total Residential GFA	Interior Daycare	Exterior Daycare	Commercial GFA	Total GFA
P4	1	4,342	4,342			4,342					0
P3	1	4,342	4,342			4,342					0
P2	1	4,342	4,342			4,342					0
P1	1	4,342	4,342			4,342					0
Subtotal Below Grade	4		**17,368**			17,368					**0**
BUILDING A											
Ground	1	1,072	1,072	9		20	343	298	290	402	1,043
Mezzanine	1	576	576			341	0	235			235
level 2	1	1,003	1,003			24	979				979
level 3	1	1,003	1,003			24	979				979
level 4	1	1,003	1,003			24	979				979
level 5	1	1,003	1,003			24	979				979
level 6	1	1,003	1,003			24	979				979
level 7	1	1,003	1,003			24	979				979
level 8	1	1,003	1,003			24	979				979
level 9	1	1,003	1,003			24	979				979
level 10	1	1,003	1,003			24	979				979
level 11 amenity/mech	1	674	674	273	279	674	0			0	0
Subtotal Above Grade	12		11,352	282	279	1,252	9,157	532	290	402	**10,091**
BUILDING F											
Ground	1	1,032	1,032	371		34	427			199	626
Mezzanine	1	453	453			453					
level 2	1	1,005	1,005			44	961				961
level 3	1	1,005	1,005			44	961				961
level 4	1	1,076	1,076			44	1,032				1,032
level 5	1	1,076	1,076			44	1,032				1,032
level 6	1	1,076	1,076			44	1,032				1,032
level 7	1	1,076	1,076			44	1,032				1,032
level 8	1	1,076	1,076			44	1,032				1,032
level 9	1	1,076	1,076			44	1,032				1,032
level 10	1	1,076	1,076			44	1,032				1,032
level 11 amenity	1	750	750	581	395	44	124				124
level 12	1	750	750			44	706				706
level 13 - 32	20	750	15,000			608	14,392				14,392
level 33 - 45	13	750	9,750			395	9,355				9,355
Mechanical	0	750	750			750	0				0
Subtotal Above Grade	46		38,027	953	395	2,726	34,149			199	**34,348**
Totals	**12, 46**		**49,378**	**1,234**	**674**	**3,978**	**43,305**	**532**	**290**	**601**	**44,438**

478,344 sf

Parking						
Level	Resident Vehicle Parking	Commercial Parking	Vistor Parking	Daycare Parking	Visitor Bike Parking	Resident Bike Parking
P4	104					
P3	104					
P2	19	66				384
P1	0	31	36	2	59	144
Totals	**227**	**97**	**36**	**2**	**59**	**528**

Residential Units													
Level	S per level	S total	1b per level	1b total	1b + d per level	1b + d total	2b per level	2b total	2b + d per level	2b + d total	3b per level	3b total	Total Units
A													
level 2	2	2	4	4	6	6	3	3	0	0	1	1	16
level 3	2	2	4	4	6	6	3	3	0	0	1	1	16
level 4	2	2	4	4	6	6	3	3	0	0	1	1	16
level 5	2	2	4	4	6	6	3	3	0	0	1	1	16
level 6	2	2	4	4	6	6	3	3	0	0	1	1	16
level 7	0	0	3	3	6	6	2	2	1	1	2	2	14
level 8	0	0	3	3	6	6	2	2	1	1	2	2	14
level 9	0	0	3	3	6	6	2	2	1	1	2	2	14
level 10	0	0	3	3	6	6	2	2	1	1	2	2	14
Subtotal Above Grade		10		32		54		23		4		13	**136**
		7%		24%		40%		17%		3%		10%	
F													
level 2	5	5	1	1	4	4	3	3	2	2	0	0	15
level 3	5	5	1	1	4	4	3	3	2	2	0	0	15
level 4	3	3	0	0	7	7	3	3	2	2	0	0	15
level 5	3	3	0	0	7	7	3	3	2	2	0	0	15
level 6	3	3	0	0	7	7	3	3	2	2	0	0	15
level 7	3	3	0	0	7	7	3	3	2	2	0	0	15
level 8	3	3	0	0	7	7	3	3	2	2	0	0	15
level 9	3	3	0	0	7	7	3	3	2	2	0	0	15
level 10	3	3	0	0	7	7	3	3	2	2	0	0	15
level 12	1	1	4	4	1	1	4	4	0	0	0	0	10
level 13 - 32	0	0	4	80	2	40	4	80	0	0	0	0	200
level 33 - 45	0	0	2	26	2	26	0	0	0	0	4	52	104
Subtotal Above Grade		32		112		124		111		18		52	**449**
		7%		25%		28%		25%		4%		12%	
Totals		**42**		**144**		**178**		**134**		**22**		**65**	**585**
		7%		**25%**		**30%**		**23%**		**4%**		**11%**	

Floor Area Summary	
	Provided
Total Residential Units	585
Res GFA	43,305
Commercial GFA	601
Total GFA	44,438
Interior Residential Amenity	1,234
Exterior Residential Amenity	674
Total Residential Amenity	1,908

All areas in square metres

	Provided Amenity		
	Indoor	Outdoor	Total
Building A	282	279	560.69
Building F	953	395	1347.27
Totals	1234	674	1908

Low-end-of-market Housing		
Building A	unit type	number
	S	10
	1 b	70
	2 b	32
	3br	8
Building F	unit type	number
	S	10
	1 b	32
	2 b	14
	3b	0
Total required	30%	176
Total provided	30%	176

Vehicular Parking Summary		
Vehicular Parking	Provided	Req|Per.
Resident Vehicle Parking	227	227
Commercial Parking	97	
Vistor Parking	36	36
Daycare Parking	2	2
Totals	**362**	

0.06

Bike Parking Summary		
Bike Parking	Provided	Req|Per.
Resident Bike Parking	528	527
Visitor Bike Parking	59	59
Totals	**587**	**586**

		s	1b	1b+d	2b	2b+d	3B	Total
Target Units	%	10%	22%	29%	26%	3%	10%	
	Units	59	129	170	152.1	18	59	**585**
Required Parking	Ratio	0.15	0.3	0.3	0.5	0.5	0.7	
	Stalls	6.3	43.2	53.4	67	11	45.5	**227**

visitor required	35.1

NO	ISSUANCE	DATE
1	SPA/OPA/ZBA	March 2021
2	-	-
3	-	-
4	-	-
5	-	-

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Pier 27 Phase 3
(buildings F and A)
25&35 Queens Quay East

Pier 27 Toronto (Northeast) Inc.
56 The Esplanade, suite 308
Toronto M5E 1A7

Statistics

Project No.

1:3000

March 2021

A.0.4

PIER 27 REZONING/SPA/OPA - PHASE I + PHASE II

STATISTICS

AREAS — PHASE 1

Floor #	Building D GCA	D deductions	D amenity	D Residential GFA	Building B GCA	B deductions	B amenity	B community services	B Residential GFA	PHASE 1 TOTALS (res. GFA)
1	3,839	98	661	3,080	3,615	71	205	224	3,115	6,195
2	2,869	98	126	2,645	3,200	79	244	273	2,604	5,249
3	2,691	98		2,593	3,327	74			3,253	5,846
4	3,201	98		3,103	3,327	74			3,253	6,356
5	3,201	98		3,103	3,465	74			3,391	6,494
6	3,201	98		3,103	3,465	74			3,391	6,494
7	3,201	98		3,103	3,465	74			3,391	6,494
8	3,201	98		3,103	3,465	74			3,391	6,494
9	3,201	98		3,103	3,465	74			3,391	6,494
10	3,201	98		3,103	3,465	73			3,392	6,495
11	3,201	98		3,103	2,729	74			2,655	5,758
12	2,880	98		2,782	2,256	52			2,204	4,986
13	1,430	52		1,378	1,437	50			1,387	2,765
14	1,430	52		1,378	1,437	50			1,387	2,867
	-									
	-				-					
TOTAL GCA	40,747				42,118					82,865
Deductions		1,280	787			967	449			3,483
RESIDENTIAL GFA				38,680					40,205	78,885
NON RESIDENTIAL GFA								497		497
RESIDENTIAL SUITE COUNT	306				410					716
AMENITY AREAS										
(total interior amenity required)	612				810					1422
TOTAL INTERIOR AMENITY PROVIDED	1230	**			1100 **					2330
(total exterior amenity required)	612				810					1422
TOTAL EXTERIOR AMENITY PROVIDED	612				810					1,422
DAYCARE OUTDOOR PLAY AREA										

PHASE 2 (A + F + G) — BUILDING A

Floor #	GCA	deductions	non- residential GFA (commercial)	amenity	daycare	Residential GFA	studio	1 Bdrm	1 Bdrm +Den	2 Bdrm	2 Bdrm + Den	3 bdrm Units	
1	1,072	20	402	9	298	343							
	576	341			235								
2	1,003	24				979	2	4	6	3	0	1	
3	1,003	24				979	2	4	6	3	0	1	
4	1,003	24				979	2	4	6	3	0	1	
5	1,003	24				979	2	4	6	3	0	1	
6	1,003	24				979	2	4	6	3	0	1	
7	1,003	24				979	0	3	6	2	1	2	
8	1,003	24				979	0	3	6	2	1	2	
9	1,003	24				979	0	3	6	2	1	2	
10	1,003	24				979	0	3	6	2	1	2	
11	674	400		273		0							
TOTAL GCA	11,352												
Deductions		979		282									
RESIDENTIAL GFA						9,157							
NON RESIDENTIAL GFA			402		532								934
							10	32	54	23	4	13	
RESIDENTIAL SUITE COUNT													136
(total interior amenity required)				272									
TOTAL INTERIOR AMENITY PROVIDED				282									
(total exterior amenity required)				272									
TOTAL EXTERIOR AMENITY PROVIDED				279									
DAYCARE OUTDOOR PLAY AREA					290								

BUILDING F

Floor #	GCA	deductions	non- residential GFA (commercial)	amenity	Residential GFA	studio	1 Bdrm	1 Bdrm +Den	2 Bdrm	2 Bdrm +Den	3 bdrm Units	
1	1,032	34	199	371	427							
	453	453										
2	1,005	44			961	5	1	4	3	2	0	
3	1,005	44			961	5	1	4	3	2	0	
4	1,076	44			1,032	3	0	7	3	2	0	
5	1,076	44			1,032	3	0	7	3	2	0	
6	1,076	44			1,032	3	0	7	3	2	0	
7	1,076	44			1,032	3	0	7	3	2	0	
8	1,076	44			1,032	3	0	7	3	2	0	
9	1,076	44			1,032	3	0	7	3	2	0	
10	1,076	44			1,032	3	0	7	3	2	0	
11	750	44		581	124							
12	750	44			706	1	4	1	4	0	0	
13-32	15,000	608			14,392	0	80	40	80	0	0	
33-44	9,750	395			9,355	0	26	26	0	0	52	
MPH	750	750										
TOTAL GCA	38,027											
Deductions		2,726		953								
RESIDENTIAL GFA					34,149							
NON RESIDENTIAL GFA			199									199
						32	112	124	111	18	52	
RESIDENTIAL SUITE COUNT												449
(total interior amenity required)				898								
TOTAL INTERIOR AMENITY PROVIDED				953								
(total exterior amenity required)				898								
TOTAL EXTERIOR AMENITY PROVIDED				395								

BUILDING G

FLOOR #	GCA	deductions	non- residential GFA (comm)	amenity	Residential GFA	1 Bdrm	2 Bdrm	3 bdrm Units	
1	1,918	528	1,039	0	351	0	0	0	
2 (mezz)	359	359							
3	1,863	37	0	111	1,715	19	5	0	
4	1,863	37	0	111	1,715	19	5	0	
5	1,863	37	0	111	1,715	19	5	0	
6	1,863	37	0	111	1,715	19	5	0	
7	1,863	37	0	111	1,715	19	5	0	
8	1,863	37	0	111	1,715	19	5	0	
9	1,863	37	0	111	1,715	19	5	0	
10	1,863	37	0	111	1,715	19	5	0	
11	1,166	23	0	0	1,143		5	5	
12	1,166	23	0		1,143	1	13	0	
13	707	14	0	85	608	1	6	0	
14	707	14			693	2	6	1	
15-16	2,121	42		0	2,079	9	21	0	
17	707	14		0	693	4	6	0	
18,-27 + 29	7,777	156			7,621	33	77	1	
28	707	14			693	2	6	0	
30-33	2,828	57			2,771		8	16	
34	707	14		0	693		2	4	
LMPH	506	506							
UMPH	240	240							
TOTAL GCA	36,520								
Deductions		2,300		973					
RESIDENTIAL GFA					32,208				
NON RESIDENTIAL GFA			1,039						1,039
						204	190	27	
RESIDENTIAL SUITE COUNT									421
(total interior amenity required)				842					
TOTAL INTERIOR AMENITY PROVIDED				973					
(total exterior amenity required)				842					
TOTAL EXTERIOR AMENITY PROVIDED				842					

NOTE: Building G Exterior amenity includes 459 sq m at the 13th floor and 383 sq m at grade

PHASE 1 + 2 TOTALS

	PHASE 1 + 2 TOTALS
TOTAL GCA	168,763 s.m.
Deductions	11,696
RESIDENTIAL GFA	154,398 s.m.
NON RESIDENTIAL GFA	2,669 s.m.
RESIDENTIAL SUITE COUNT	1,722 suites
(total interior amenity required)	3,434 s.m.
TOTAL INTERIOR AMENITY PROVIDED	4,537 s.m.
(total exterior amenity required)	3,434 s.m.
TOTAL EXTERIOR AMENITY PROVIDED	2,938 s.m.

VEHICULAR PARKING CALCULATIONS*	D	B	Total	A	F	G	Total
total residential parking required	259	316	575	49.9	176.5	175.1	401.5
TOTAL RESIDENTIAL PARKING PROVIDED	499	358	857	50	177	245	472
total visitor parking required	18	24	42	8.16	26.94	25.26	60.36
TOTAL VISITOR PARKING PROVIDED	18	24	42	9	27	0	36
DAYCARE PARKING	0	0	0	2	0	0	2
COMMERCIAL PARKING	0	0	0	97	0	329	426
TOTAL PARKING PROVIDED PER PHASE			899				936

BICYCLE PARKING CALCULATIONS*	D	B	Total	A	F	G	Total
total residential bike parking required	160	160	320	122.4	404.1	378.9	905.4
TOTAL RES. BIKE PARKING PROVIDED	160	160	320	123	405	337	865
total visitor bike parking required	40	40	80	13.6	44.9	42.1	100.6
TOTAL VISITOR BIKE PARKING PROVIDED	40	40	80	14	44	84	142
total commercial bike parking required	0	0	0	0	6	0	6
TOTAL COMM. BIKE PARKING PROVIDED	0	0	0	0	6	20	26
TOTAL PARKING PROVIDED PER PHASE			400				1033

PHASE 1 AND 2 SUMMARY

Original Site Area	35,662	sm
Total Allowable Site GFA	142,616	sm
Total Residential GFA	154,398	sm
Total Non residential GFA	2,669	sm
Proposed Overall Site GFA	157,068	sm
FSI	4.40	

	Phase 1 (B, D)	Phase 2 (G,F,A)	Total
Number of Suites	716	1,006	1,722
S	5	42	47
1BD	432	526	958
2BD	258	346	604
3BD	21	92	113
TOTAL PARKING PROVIDED	899	936	1835
TOTAL BICYCLE PARKING PROVIDED	400	1,033	1,433

Low-end-of-market Housing	Phase 1 (B, D)	Phase 2 (G, F, A	Total
Number of units	307	558	865
S / 1BD		326	
2BD		223	
3BD		9	

note: Total Non residential includes deductios, amenity, commercial and daycare area

*note: building A, F, G are connected at the P1 level and are therefore considered one building with respect to bicycle parking counts proposed

** note: Building B + D total amenity also includes amenity space at the P1 level

*** note: total for Building A, F and G. Visitor spaces may be included in commercial parking

**** Building G parking - 210 spaces included in Building B and D parking

NO	ISSUANCE	DATE
1	SPA/OPA/ZBA	March 2021
2	-	-
3	-	-
4	-	-
5	-	-

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Pier 27 Phase 3
(buildings F and A)
25&35 Queens Quay East

Pier 27 Toronto (Northeast) Inc.
56 The Esplanade, suite 308
Toronto M5E 1A7

Statistics for Phase 1 & 2

Project No.

March 2021

A.0.5

APPENDIX B

Downstream Sanitary Sewer Analysis by TMIG

TMIG

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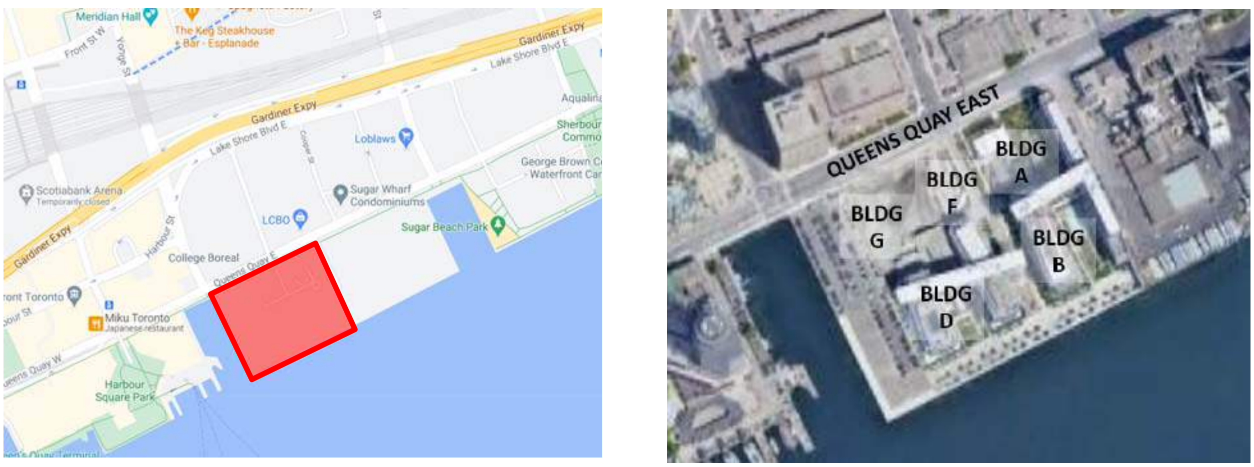
MEMORANDUM

DATE	November 3, 2020
TO	**Odan-Detech:** Daniel Bancroft
CC	
SUBJECT	25 Queens Quay East Sanitary Servicing Capacity Analysis
FROM	Cassandra Leal, P.Eng.
PROJECT NUMBER	10048

1 Purpose

This memorandum describes the processes followed to assess the sanitary sewer servicing capacity for the development at 25 Queens Quay East (Pier 27). The site is bounded by Queens Quay East to the north, Lake Ontario to the west and south, and Redpath Factory to the east, as shown in Figure 1-1.

FIGURE 1-1 LOCATION PLAN



The ultimate development will consist of five buildings:

- Buildings B and D built in 2012.
- A rezoning application had previously been submitted for buildings A, F, and G, contemplating 815 residential units and 1,827 m^2 of commercial/retail space. This has been approved.
- Building G has been constructed
- The rezoning application for buildings A, F and G is being amended and is now contemplating 1,006 residential units and 1,849 m^2 of commercial/retail space.

The purpose of this memorandum is to support the amended rezoning application for building A and F.

2 Existing and Planned Servicing

The Study Area lies within the Scott Street Sewage Pumping Station sewershed.

According to the *Toronto Waterfront Sanitary Servicing Master Plan (Cole, 2017 Update),* several overall collection system upgrades will be required to service the full buildout of the Scott Street SPS service area, some of which are downstream of this development:

1. Yonge Street Sewer Upgrade:
    - Complete Yonge St. sewer upgrade by replacing 350 m of 600 mm sanitary sewer with 900 mm sanitary sewer.
    - Planned to be in-service by 2022 (based on Master Plan).
2. Scott Street SPS Upgrades:
    - Increase firm capacity to approximately 990 L/s through changes to pumping equipment.
    - Construct “high-level bypass” sewer from Scott/Esplanade chamber to Scott-Victoria inter-connect to allow for gravity operation.
    - Bypass planned to be in-service by 2020 and Scott Street SPS upgrades planned for 2021 (based on Master Plan).

3 Planning Projections

3.1 Central Waterfront Master Plan

Within TM No.1 of the Master Plan, a traffic zone map detailing the residential and population employment projections is provided. The development lands lie within area 310 on Figure A.1 (from TM No. 1), shown below. The corresponding table of populations allocated for area 310 is also included below.

FIGURE 2 – SANITARY DRAINAGE PLAN (FROM CENTRAL WATERFRONT MASTER PLAN)

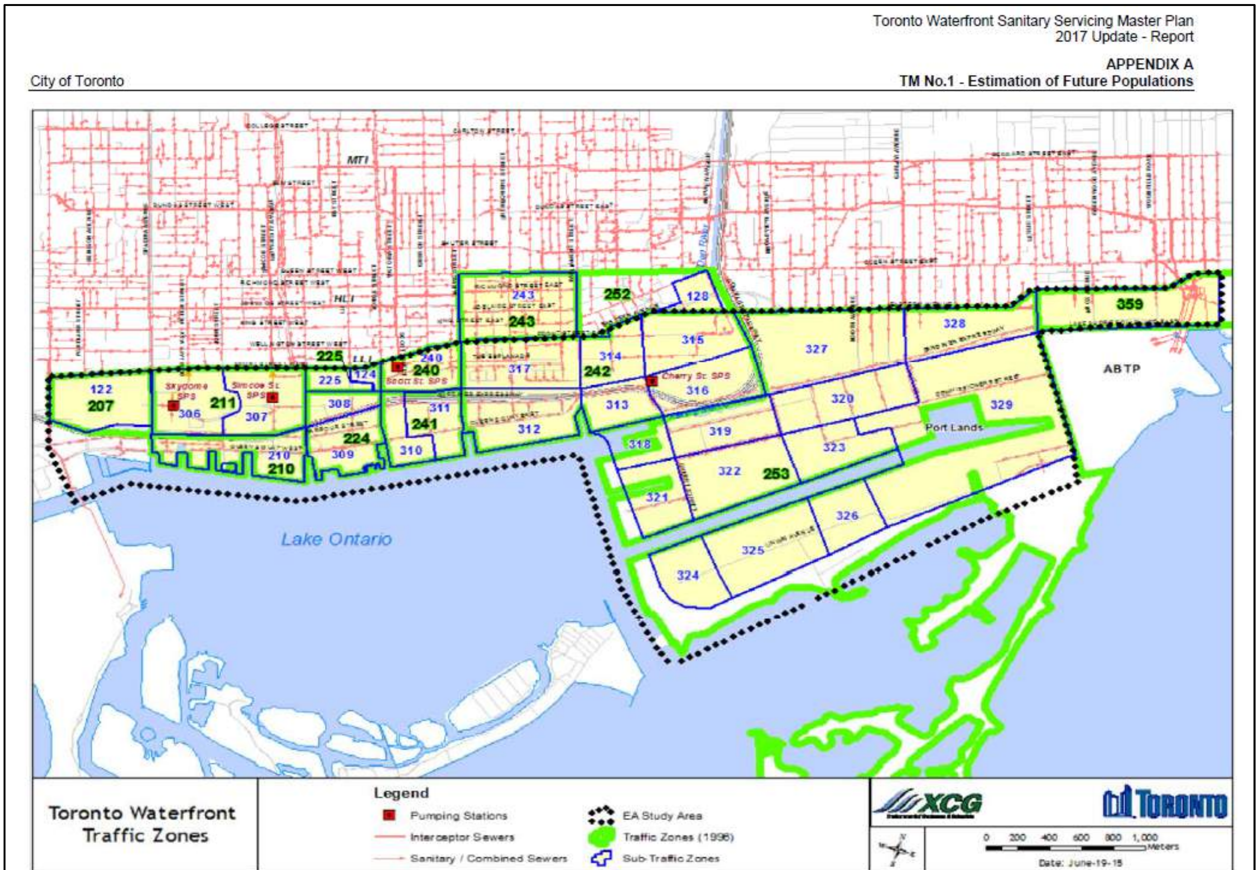


Figure A.1 Traffic Zones (TZ) and Traffic Sub-Zone Boundaries within the WSSMP Study

Traffic Zone	Traffic Sub-zone	Planning precinct	RESIDENTIAL at Year 2011 per census (persons)	EMPLOYMENT Estimated at Year 2014 (jobs)	FUTURE FULL BUILD-OUT	
					RESIDENTIAL (persons)	EMPLOYMENT (jobs)
241	310	Lower Yonge Precinct	0	2,200	**10,600**	**9,200**

As shown, the total residential population currently planned for under full build-out equates to 10,600 residents and a total employment (jobs) of 9,200. Area 310 includes the 25 Queens Quay East (25QQE) development and a portion of the Lower Yonge Precinct Plan (LYPP).

3.2 Traffic Zone 241 Planning Details

What is shown as Traffic Zone 241 (above) includes 25 QQE, LYPP lands, and the Redpath lands. The following table details the current planning details, including the updated proposed ultimate LYPP statistics, plus those from amended details from 25 QQE.

TABLE 3-1 UPDATED PLANNING STATISTICS – TRAFFIC ZONE 241

Owner	Site	Area [ha]	Residential Population	Peaking Factor	Employment Population	Employment Flow (L/s)[1]	Groundwater Flow (L/s)	Trade Flow (L/s)[2]
Pinnacle (North)	Phase 1	0.56	1,084	3.77	65	0.188	1.3	1.488
	Phase 2	0.42	1,590	3.66	530	1.533	1.3	2.834
	Phase 3	0.26	1,680	3.64	55	0.159	1.3	1.459
Pinnacle (South)	Phases 4 & 5	0.93	0	4.5	4,650	13.455	4[3]	17.455
Menkes	Block 1	0.75	0	4.5	1,630	4.716	2	6.716
Menkes	Block 2	0.75	3,000	3.44	500	1.447	0.5	1.946
Menkes	Block 3	1.00	0	4.5	0	0	-	0
Menkes	Block 4	1.26	5,050	3.24	250	0.723	0.5	1.223
Choice	North	0.59	3,300	3.40	0	0	1.5	1.500
Choice	South	0.65	0	4.5	1,600	4.629	1.5	6.130
25 QQE (revised)	Bldg A, F & G		1,807	2.92	20	0.06	1.91	1.97
	TOTAL	**7.17**	**17,511**		**9,300**	**26.91**	**15.81**	**42.662**

Notes:
1. Employment flow = employment population @ 250 Lpcd
2. Trade flow = employment flow + groundwater flow
3. The groundwater flow for the Pinnacle Phase 4/5 development is 2.0 L/s. An additional 2.0 L/s is added at this point to account for existing groundwater flow from the existing building that will remain.

The current projections for TZ 241 (17,511 residents and 9,300 jobs) are below the values carried in the Central Waterfront Wastewater Master Plan (21,500 residents and 19,300 jobs). As such, the proposed development densities are within the City's planning growth projections.

4 Analysis Methodology

Since the proposed development might proceed in advance of the planned system upgrades along Yonge Street (currently scheduled to be in-service in 2022), the City has advised that the servicing capacity analysis shall demonstrate the following:

1. Design flow conditions during the interim infrastructure stage:
   - To ensure that the sewers do not surcharge under the design flow condition
2. Hydraulic Grade Line (HGL) under May 12, 200 storm event during the interim infrastructure stage:
   - To ensure that the HGL remains at least 1.8 m below road grade
3. CSO control during the interim infrastructure stage under 2, 5, 10 year storm events:
   - To ensure that there will be no increase in Combined Sewer Overflows (CSOs) during the interim infrastructure stage

This servicing review is being completed using the City's Infoworks ICM model for the Scott Street Sewage Pumping Station service area, as provided by the City. This model was used in the WSSMP EA 2017 Update. The model is a design flow model, with Existing Conditions (2017 population and employment).

4.1 Adjustment to Existing Conditions Scenario

As part of the City's modelling guidelines, TMIG, being the user of the InfoWorks model in this instance, updated the model with the approved City projects that were not included during model development. The WSSMP EA model received was last modified in March 2017. As the model did not appear to have the most recent approved projects included, TMIG requested a list of project that were approved after February 2016 within the Scott Street SPS Area. This information was provided in April 2019 from City Planning, Strategic Initiatives, Policy & Analysis, Research & Information department. They were added to the model.

Table 4-1 shows the approved projects with the estimated flow created by each project. The assumptions utilized are as follows:

- All Units are Residential Units
- Unit density = 2.1 people per unit
- Average Residential Flow = 240 Lpcd
- Average Employment Flow = 250 Lpcd
- Residential flow is peaked; Peaking factor is calculated using Harmon
- Employment flow is not peaked
- Non-residential area is assumed to be 50% office and 50% retail
- Office Density: 3.3 people / 100m^2
- Retail Density: 1.1 people / 100m^2
- Lot Area is determined by using the City of Toronto Development Application Website
- Inflow/Infiltration = 0.26 L/s/ha

TABLE 4-1 SCOTT STREET SPS DRAINAGE AREA – RECENT DEVELOPMENT APPROVALS

ID	Address	Res GFA [m^2]	Non-Res GFA [m^2]	Units	Res. Pop.	Res Peak Flow [L/s]	Empl. Pop.	Empl. Flow [L/s]	Site Area [ha]	Design Flow [L/s]
1	125 Queens Quay E		37,852				833	2.41	0.46	2.41
2	141 Bay St		124,485				2739	7.92	22.25	7.92
3	143 Lake Shore Blvd E	63,328	6,730	963	2,022	20.12	148	0.43	0.67	20.55
4	45 Bay St		143,362				3154	9.13	3.39	9.13
5	261 Queens Quay E (Ph 1)	31,318	2,807	227	477	5.28	62	0.18	0.56	5.46
6	261 Queens Quay E (Ph 2)	24,312	1,418	174	365	4.10	31	0.09		4.19
7	177 Front St E	107,480	18,129	1,531	3,215	30.51	399	1.15		31.67
8	75 The Esplanade	21,876	1,086	308	647	7.03	24	0.07	0.24	7.10
9	130 Queens Quay E	-	42,683			0.00	939	2.72	0.51	2.72
					6,726	67.04		24.10	28.08	91.15

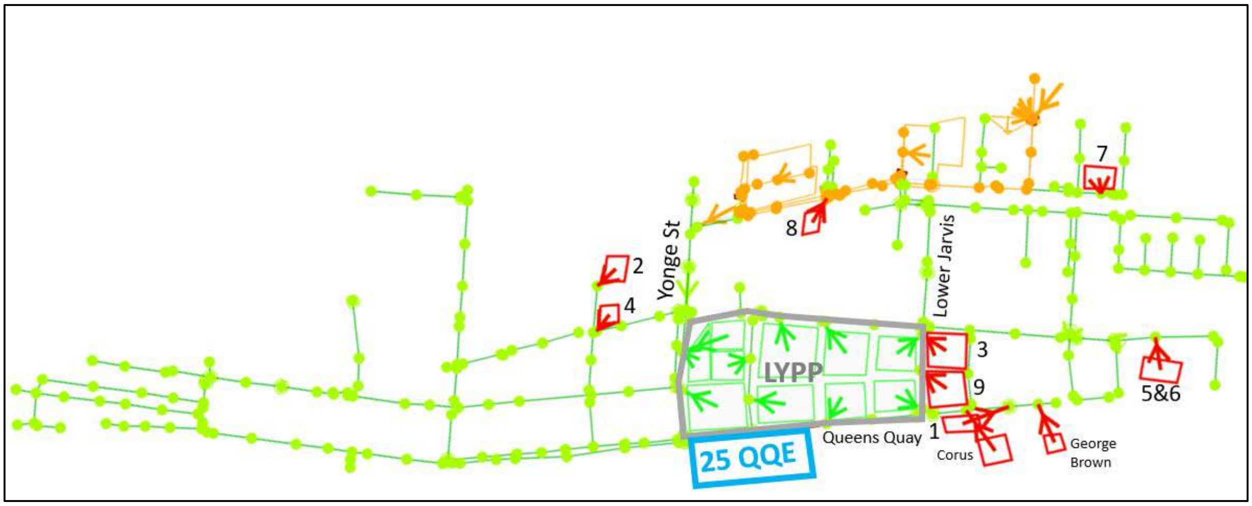
Note:
1. Inflow/Infiltration is included in the existing conditions subcatchments.

In addition to the projects listed above, two other projects were added to the model:

- Corus Building (East Bayfront): Design sewer flow of 5.0 L/s
- George Brown College (East Bayfront): Design sewer flow of 5.0 L/s

Figure 4-1 shows the location of the recent development approvals. They are all within the Scott St SPS drainage area.

FIGURE 4-1 DEVELOPMENT PROJECTS ADDED TO MODEL



Note: The ID numbers in **Figure 4-1** above refers to the ID in **Table 4-1**.

It is assumed that the pre-development land use and impact to the sanitary system from any of these areas is negligible and therefore was not removed from the model. As the model was provided to TMIG without details regarding how the inputs were determined, it would be difficult to ensure the appropriate sanitary sewer flow impact would be removed and modified to represent the development. As the vast majority of the existing land use is parking lots or 1 storey buildings, it was considered to be of minimal impact and would result in a conservative analysis. Subcatchments representing each approved project was added individually to the model with the appropriate sanitary flow and discharge point.

4.2 Methodology for Extreme Wet-Weather Flow Analysis

The City's Basement Flooding Directive identifies the appropriate methods for assessing the extreme wet-weather flows into the system, depending on the available information. These are summarised below.

i) Determine the I/I value for May 12, 2000 storm based on the available calibrated sanitary sewer system models from the City.
ii) Where a calibrated sewer model is not available from the City, the applicant may estimate the *I/I of the May 12, 2000 storm for existing development drainage areas* using flow monitoring data.
iii) In the absence of a calibrated sewer model or monitored data, the I/I value shall be conservatively estimated, for the sewershed, as follows:
   - where the gross sewer shed area is:
   - less than 50 ha: I/I = 3.0 L/s/gross ha
   - equal or greater than 50 ha: I/I = 2.0 L/s/gross ha

In this instance, a calibrated sanitary sewer system model is not available.

Building off the Lower Yonge Precinct Plan project report (TMIG, 2020), an acceptable extreme wet-weather flow analysis has been completed. The report analyzed various I/I values to replicate the flow monitoring data available. The report highlighted using a 3.0 L/s/ha for areas in the west of the Scott St. drainage area, and 7.0 L/s/ha for the areas in the east of the Scott St. drainage area, and this methodology was accepted by Toronto Water.

5 Analysis Results

5.1 Design Flow Condition – Existing Infrastructure Stage

This scenario utilizes the existing sewer network in the received model from the City.

The "existing infrastructure stage" refers to the infrastructure in place before the Master Plan recommendations are implemented. This is a "design flow" simulation, with no storm input. A design allowance for inflow and infiltration is included in the existing subcatchments at 0.26 L/s/ha.

The Design Flow conditions includes the existing subcatchments, including the approved projects, the ultimate LYPP development in this scenario and the approved rezoning details for 25 QQE. It utilizes an inflow/infiltration rate of 0.26 L/s/ha for all new areas (or the rate provided in the model for existing subcatchments). Table 5-1 shows the 25 QQE development details applied to the various scenarios.

TABLE 5-1 25 QUEENS QUAY EAST DEVELOPMENT

Owner	Site	Scenario	Residential Population	Peaking Factor	Employment Population	Employment Flow (L/s)[1]	Groundwater Flow (L/s)	Trade Flow (L/s)[2]	DESIGN FLOW (L/s)
25 QQE (approved)	Bldg A, F & G	Existing	1,275	3.73	54	0.156	-	0.156	13.4
25 QQE (revised 2020)	Bldg A, F & G	Full Buildout	1,807	2.92	20	0.06	1.91	1.97	16.6

Notes:
1. Employment flow = employment population @ 250 Lpcd
2. Trade flow = employment flow + groundwater flow

Under the 25 Queens Quay East full buildout condition, the Yonge St segments experience slight surcharging (flow greater than capacity) and the HGL raises to just above the pipe obvert by 0.11m. The HGL remains well below the 1.8m from ground surface requirement. The surcharging along the Yonge St route is negligible as those pipes typically flow under surcharged condition due to the pump operation at Scott St SPS. This surcharging will have no real adverse impacts to the operation of the collection system.

The design conditions model was also simulated with the addition of the full buildout of the 25 Queens Quay East development. The HGL profile provided shows the existing sanitary sewer on Freeland St to Queens Quay East, Queens Quay East between Freeland St and Yonge St and Yonge Street from Queens Quay East to the Scott St SPS.

The HGL profiles are included in Attachment 1 and the results are summarized as follows:

TABLE 5-2 DESIGN FLOW CONDITION – INTERIM INFRASTRUCTURE

	LYPP Ultimate and approved 25 QQE Development	With Amended 25 QQE Development
Total Peak Flow Rate to Scott St SPS (assuming sewer free discharge to Scott St SPS)	521 L/s	527 L/s
Total Peak Flow (From Yonge St)	321 L/s	327 L/s
Assumed I/I Rate	Provided in Model, or 0.26 L/s/ha if new	Provided in Model, or 0.26 L/s/ha if new
Residential Population (upstream of Scott St SPS at Yonge St)	28,779 people	29,311 people
Employment Flow (upstream of Scott St SPS at Yonge St)	104.45 L/s	106.36 L/s
Do all sewers have capacity > Design flow	No	No
Sewers where capacity < Design flow	Yonge Street north of Harbour St	Yonge Street north of Harbour St

5.2 Wet Weather Flow Conditions – Interim Infrastructure Stage

As mentioned, there is no inflow and infiltration rate analysis as part of this project. A similar analysis was completed for the Lower Yonge Precinct Plan Project that has been reviewed and accepted by the City of Toronto for this same area.

Utilizing the previous analysis, the wet-weather flow condition will utilize an I/I rate of 3.0 L/s/ha in the western portion of the drainage area and 7.0 L/s/ha in the eastern portion of the drainage area (which includes some combined and partially-separated sewers). This analysis uses the May 12, 2000 storm, with results summarized in Table 5-3. The HGL profiles are included in Attachment 1.

TABLE 5-3 WET WEATHER CONDITION - INTERIM INFRASTRUCTURE

	Full Buildout of 25QQE and LYPP
Total Peak Flow Rate to Scott St SPS (assuming sewer free discharge to Scott St SPS)	1,154 L/s
Total Peak Flow (From Yonge St)	533 L/s
Residential Population (upstream of Scott St SPS at Yonge St)	29,311
Employment Flow (upstream of Scott St SPS at Yonge St)	106.36 L/s
Do all sewers have capacity > Design flow	No
Sewers where capacity < Design flow	Yonge Street north of Harbour St, with backwater condition to Freeland St.

As shown in the provided HGL profile along Yonge Street, the HGL does raise to levels above the obvert of the sewer. Due to the depth of the sewers along this route, the HGL remains 2.2m or deeper from surface, which satisfies the minimum 1.8m below ground surface criterion. This surcharging will no longer occur once the proposed sewer improvements are implemented (scheduled for 2022).

6 CSO Control – Interim Stage

There are three sewer overflow structures within the Scott Street SPS area. They are located at:

- Scott St and The Esplanade,
- Market St and the Esplanade, and

- Frederick St and Front St E.

Table 6-1 below, provides a brief description of these three CSO structures:

TABLE 6-1 CSO OVERVIEW

CSO Location	Description
Scott Street at The Esplanade	▪ 300 mm overflow pipe at an invert of 75.66 m ▪ Overflow goes to the 375 mm storm sewer on The Esplanade and flows west to the Yonge Street storm sewer
Market Street at The Esplanade	▪ Weir crest at 75.68 m ▪ Overflow goes to the 375 mm storm sewer on The Esplanade, and flows eastward to the Jarvis Street storm sewer, which then flows to the Sherbourne Street storm sewer
Frederick Street, sewer south of Front Street East	▪ Weir crest at 76.33 m ▪ Overflow goes to 375 mm storm sewer on Frederick Street and flows to the Sherbourne Street storm sewer

The CSO results from all runs are summarized in **Table 6-2**. The table identifies the HGL observed at the overflow manhole, as well as the overflow volume in the overflow pipe, under existing, and ultimate development conditions.

TABLE 6-2 OVERFLOW MANHOLE DETAILS

		Scott St and the Esplanade		Market St and the Esplanade		Frederick St and Front St	
	Wet Well Level	71.69m		71.69 m		71.69m	
	Assumed I/I Rates	3.0 L/s/ha		7.0 L/s/ha		7.0 L/s/ha	
		HGL (m)	**Vol (m^3)**	**HGL (m)**	**Vol (m^3)**	**HGL (m)**	**Vol (m^3)**
2 Year	Ultimate LYPP	72.062	0	74.850	0	76.414	113.283
	Full 25QQE and LYPP	72.065	0	74.850	0	76.414	113.283
5 Year	Ultimate LYPP	72.128	0	75.063	0	76.707	175.335
	Ultimate 25QQE and LYPP	72.131	0	75.063	0	76.707	175.335
10 Year	Ultimate LYPP	72.175	0	75.692	0.81	76.873	205.911
	Ultimate 25QQE and LYPP	72.178	0	75.692	0.84	76.873	205.911

The scenarios utilised in the CSO review above includes existing infrastructure and does not include the planned sewer improvements on Yonge St.

The HGL and volume at the CSO's had minimal differences between existing conditions (ultimate LYPP) and ultimate 25 QQE development. The CSO's are not impacted by the increased development.

7 Infrastructure Planning

Building on the information provided in the sanitary analysis completed for the Lower Yonge Precinct Plan, infrastructure planning graphs were created to assist the City with estimating when improvements are required.

This phasing detail drawing identified approximate building permit application/approval dates for each development block. Occupancy is typically 2-3 years after the building permit dates. This phasing drawing is included in Attachment 2.

7.1 Yonge Street

The critical pipe on Yonge Street has a capacity of 257 L/s. Under existing conditions (design flow, pre-LYPP or 25QQE development), the critical pipe has a maximum flow of 183 L/s. Under LYPP full buildout, this sewer has a maximum flow of 314 L/s. The addition of the 25 QQE development, the maximum flow is increased to Table 7-1 outlines the development blocks with LYPP that drains to Yonge Street

TABLE 7-1 DEVELOPMENT BLOCKS TO YONGE STREET

Development Block	Approx. Building Permit Date	Approx. Building Occupancy Date	Res. Pop.	Peaking Factor	Residential Peak Flow (L/s)[1]	Employment Population	Employment Flow (L/s)[2]	GW Flow (L/s)	Design Flow (L/s)[3]
Pinnacle Phase 2	2021	2022	1590	3.66	16.17	530	1.533	1.3	19
Pinnacle Phase 3	2022	2024	1680	3.64	17.00	55	0.159	1.3	18.46
Pinnacle Phase 4/5	2022	2026/2028	-	4.5	-	4,650	13.45	2	15.45
Menkes Block 3	2021	2021	-	4.5	-	-	-	0	0
Menkes Block 4	2021	2027	5050	3.24	45.46	250	0.723	0.5	46.69

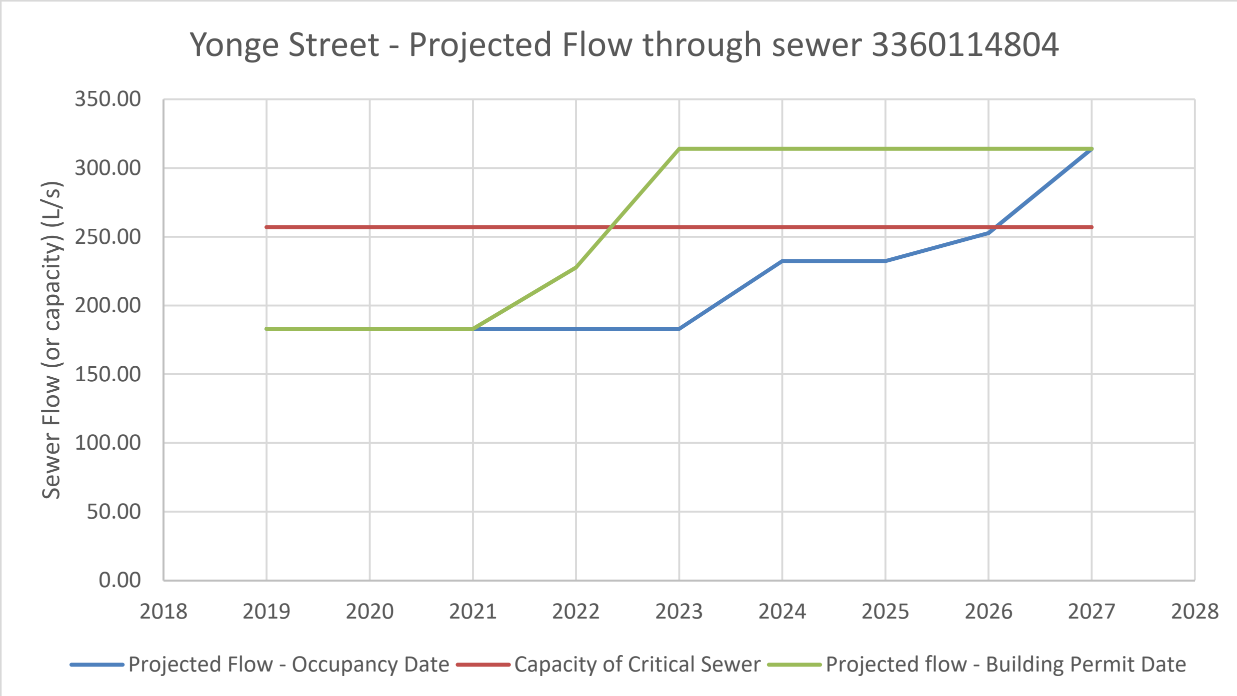
Note:
[1] Residential Peak Flow = Residential Population X Peaking Factor X 240 Lpcd
[2] Employment Flow = Employment Population X 250 Lpcd
[3] Design Flow = Residential Peak Flow + Employment Flow + GW (groundwater) Flow
[4] 25 QQE building permit date approximated for 2021, with approximate building occupancy date of 2023.

Pinnacle Phase 1 is considered "existing conditions", and as such, is not included in the table above.

Under existing conditions (pre-LYPP), the critical sewer has a remaining capacity of 74 L/s. Pinnacle Phase 1 – 4 are able to discharge to the Yonge Street sewers without triggering sewer upgrades. The Lower Yonge Development will be adding close to 100 L/s at full buildout, and as such, the critical sewer will require improvements by 2026, as shown in Figure 7-1.

Based on the timeline provided in the Toronto Waterfront Sanitary Servicing Master Plan, this sewer will be in service by 2022. The addition of the full buildout of the 25 Queens Quay East development will likely occur after the planned sewer upgrades have occurred.

FIGURE 7-1 YONGE STREET TIMELINE



8 Conclusion

Based on the results of the updated modelling for the 25 Queens Quay East development, the following observations are provided:

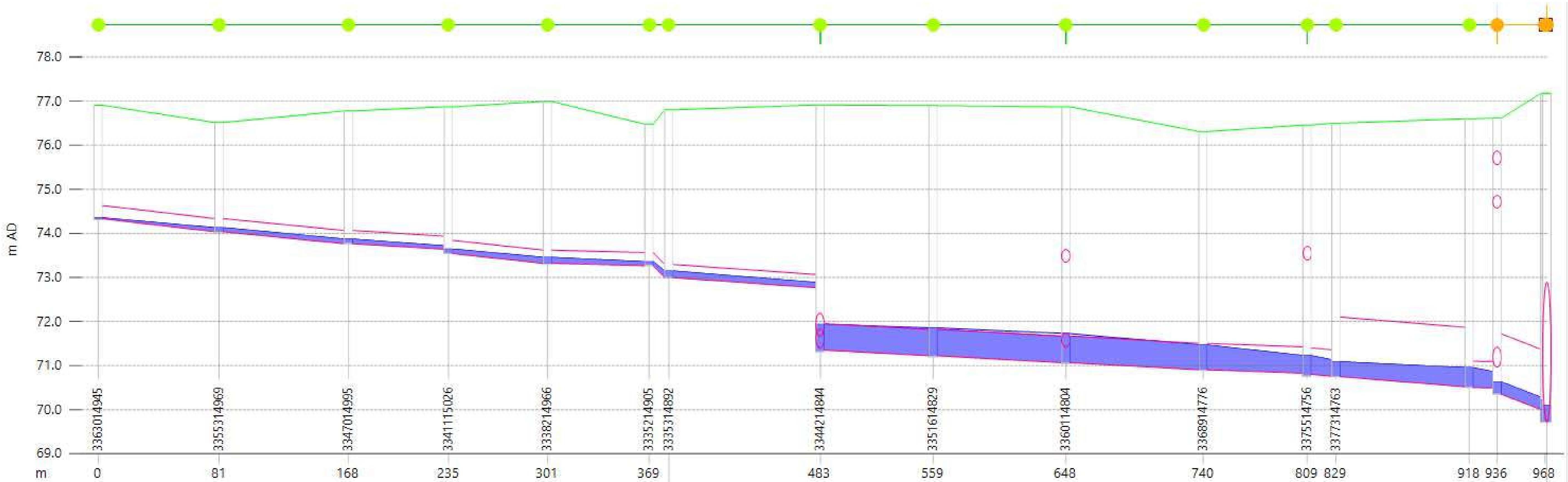
- Sanitary sewers along Yonge Street will be surcharged by 2026 based on the proposed occupancy dates and projected flows (flow from the proposed population increases) as a result of the LYPP and 25 QQE developments, if the planned upgrades are not implemented. The sewer upgrades are planned for 2022.
- Since the rezoning application is being finalized in late-2020 for 25 QQE, it is likely that the planned sewer upgrades on Yonge St will be in place providing additional sewer capacity prior to approximate building occupancy for 25 QQE.

Attachment 1

HGL Profiles

DESIGN CONDITION – EXISTING (LYPP Full Buildout with existing approval for 25 QQE)

FREELAND STREET, QUEENS QUAY AND YONGE STREET TO SCOTT ST SPS



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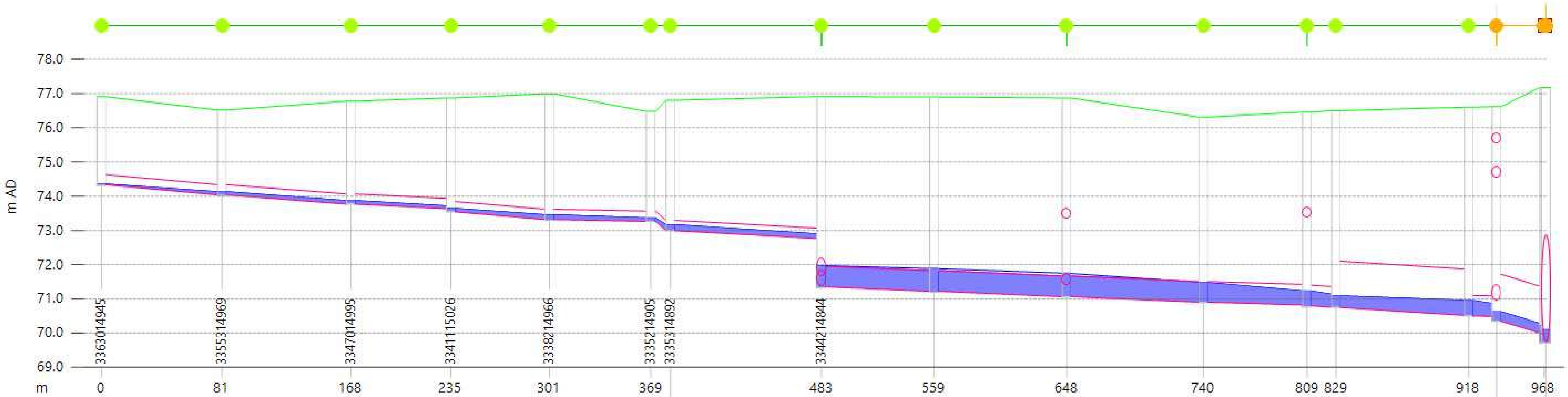
width (mm)	300	300	300	300	300	-	300	600	600	600	600	600	1350	600	1219
us inv (m AD)	74.332	74.036	73.765	73.542	73.320	-	72.994	71.351	71.223	71.067	70.906	-	70.750	-	70.348
ds inv (m AD)	74.036	73.765	73.637	73.320	73.265	-	72.768	71.223	71.067	70.906	70.826	-	70.520	-	70.003
pfc (m3/s)	0.059	0.054	0.042	0.056	0.028	-	0.046	0.253	0.257	0.257	0.208	-	2.712	-	5.454
surc	0.30	0.35	0.35	0.45	0.45	-	0.50	1.00	1.00	2.00	0.93	-	0.32	-	0.20
DS flow (m3/s)	-0.00002	0.01049	0.01048	0.01237	0.01236	-	0.02296	0.19695	0.22682	0.31739	0.31738	-	0.32105	-	-

Node	-	3355314969	3347014995	3341115026	3338214966	-	-	3344214844	3351614829	3360114804	3368914776	-	-		-	-	-

DESIGN CONDITION – EXISTING (LYPP Full Buildout and Full Buildout for 25 Queens Quay East development)

FREELAND STREET, QUEENS QUAY AND YONGE STREET TO SCOTT ST SPS



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width (mm)		300	300	300	300	300	-	300	600	600	600	600	600	1350	600	1219
us inv (m AD)		74.332	74.036	73.765	73.542	73.320	-	72.994	71.351	71.223	71.067	70.906	-	70.750	-	70.348
ds inv (m AD)		74.036	73.765	73.637	73.320	73.265	-	72.768	71.223	71.067	70.906	70.826	-	70.520	-	70.003
pfc (m3/s)		0.059	0.054	0.042	0.056	0.028	-	0.046	0.253	0.257	0.257	0.208	-	2.712	-	5.454
surc		0.30	0.35	0.35	0.45	0.45	-	0.58	1.00	1.00	2.00	0.95	-	0.32	-	0.20
DS flow (m3/s)		-0.00002	0.01049	0.01048	0.01237	0.01237	-	0.02908	0.20289	0.23271	0.32327	0.32327	-	0.32693	-	-

Node	-	3355314969	3347014995	3341115026	3338214966	-	-	3344214844	3351614829	3360114804	3368914776	-	-	-	-	-

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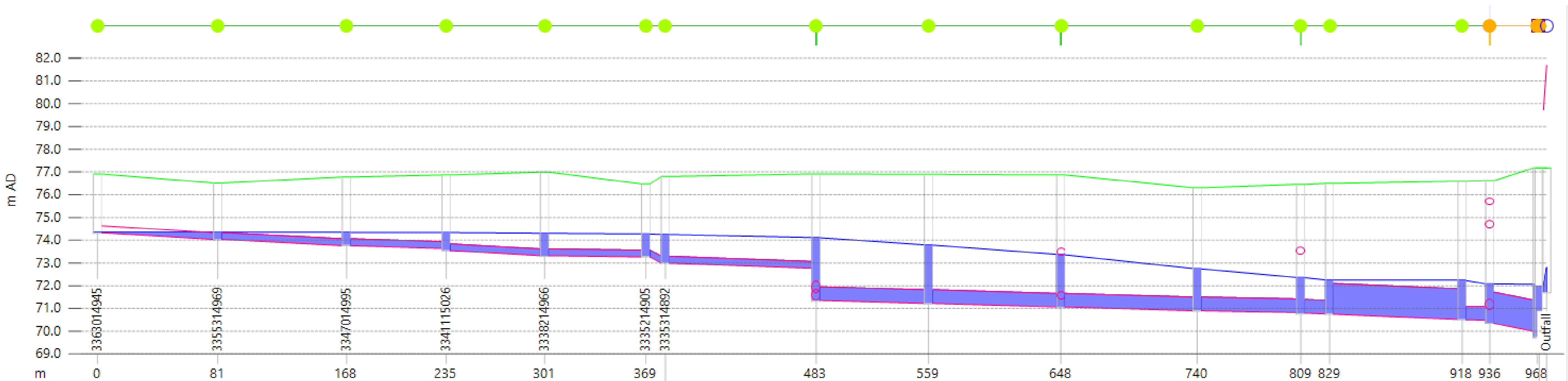
FREELAND STREET, QUEENS QUAY AND YONGE STREET TO SCOTT ST SPS



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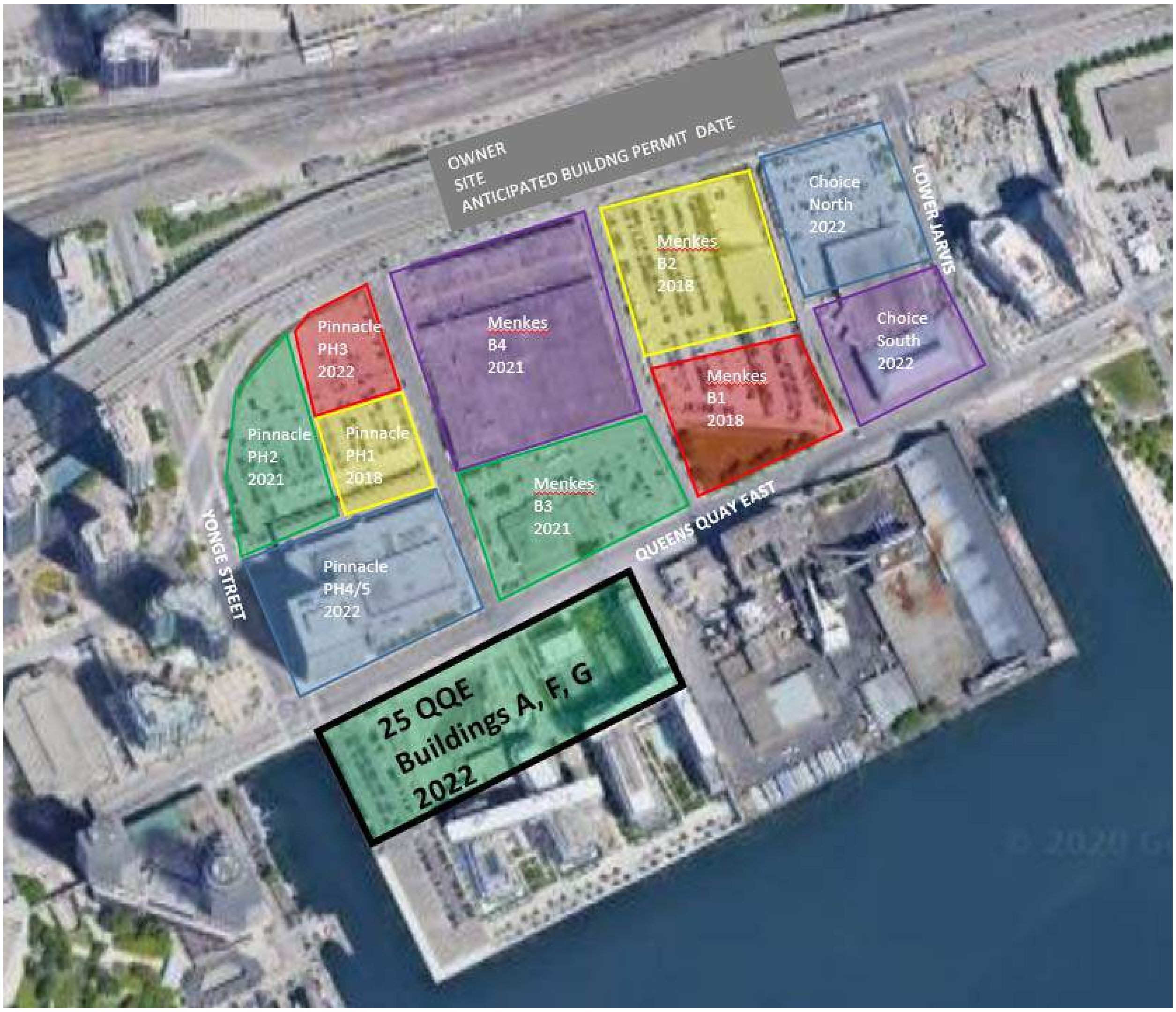
width (mm)	300	300	300	300	300	-	300	600	600	600	600	600	1350	600	1219
us inv (m AD)	74.332	74.036	73.765	73.542	73.320	-	72.994	71.351	71.223	71.067	70.906	-	70.750	-	70.348
ds inv (m AD)	74.036	73.765	73.637	73.320	73.265	-	72.768	71.223	71.067	70.906	70.826	-	70.520	-	70.003
pfc (m3/s)	0.059	0.054	0.042	0.056	0.028	-	0.046	0.253	0.257	0.257	0.208	-	2.712	-	5.454
surc	1.00	1.00	1.00	1.00	1.00	-	1.00	2.00	2.00	2.00	2.00	-	1.00	-	1.00
DS flow (m3/s)	-0.00151	0.00941	0.00949	0.02101	0.02109	-	0.03596	0.38871	0.41531	0.49304	0.49304	-	0.53378	-	-
Node	-	3355314969	3347014995	3341115026	3338214966	-	-	3344214844	3351614829	3360114804	3368914776	-	-	-	-

Attachment 2

Approximate Building Permit Date for LYPP and 25 QQE


OWNER
SITE
ANTICIPATED BUILDNG PERMIT DATE
Choice North 2022
LOWER JARVIS
Menkes B2 2018
Pinnacle PH3 2022
Menkes B4 2021
Choice South 2022
Menkes B1 2018
Pinnacle PH2 2021
Pinnacle PH1 2018
Menkes B3 2021
QUEENS QUAY EAST
YONGE STREET
Pinnacle PH4/5 2022
25 QQE Buildings A, F, G 2022

APPENDIX C

XPSWMM Output

Jellyfish Filter NJDEP Certification

Letter from Structural Engineer regarding Storm Tank Structural Design

XPSWMM Output

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          *================================================*
          |                     xpswmm                     |
          |     Storm and Wastewater Management Model      |
          |            Developed by Innovyze.              |
          |================================================|
          |                                                |
          | Last Update      : Apr 10 2020                 |
          | Interface Version: 2019.1.3                    |
          | Engine Version   : 12.0                        |
          | Data File Version: 12.62                       |
          |                                                |
          |                                                |
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|       Input and Output file names by Layer          |
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 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=5                           5.0000        1       346
 $review_elevation                  0.0000        1       383
 $use_half_volume                   0.0000        1       385
 VERT_WALLS=ON                      0.0000        1       389
 MIN_TS=0.2                         0.2000        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
 ================  ====================
             214  PHASE 1
             215  A-F 100-Y STM TANK
             216  A-F STM OUTLET
             217  PH-1 STM OUTLET
             221  PH1 SUMP
             219  PH1 SPILLOVER TO PH2
             222  MECH STM PIPES
        P{218.1}  277 L/s PUMP
        P{220.1}  A-F PUMP.1

*==========================================================*
| 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)....      6
 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)........      6
 Number of Groundwater Subcatchments in Runoff (NGW).      0
 Number of Interface locations for all Blocks (NIE)..      6
 Number of Pumps in Extran (NEP).....................      2
 Number of Orifices in Extran (NEO)..................      0
 Number of Tide Gates/Free Outfalls in Extran (NTG)..      2
 Number of Extran Weirs (NEW)........................      0
 Number of scs hydrograph points.....................    145
 Number of Extran printout locations (NPO)...........      0
 Number of Tide elements in Extran (NTE).............      2
 Number of Natural channels (NNC)....................      0
 Number of Storage junctions in Extran (NVSE)........      2
 Number of Time history data points in Extran(NTVAL).      0
 Number of Variable storage elements in Extran (NVST)      3
 Number of Input Hydrographs in Extran (NEH).........      0
 Number of Particle sizes in Transport Block (NPS)...      0
 Number of User defined conduits (NHW)...............      6
 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)............      6
 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:              1/ 1/2019
 Wet time step length (seconds).......                   300.0
 Dry time step length (seconds).......                  3600.0
 Wet/Dry time step length (seconds)...                   300.0
 Simulation length is......                                8.0 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..        24
 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   35.8375 mm

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

  JAN.  FEB.  MAR.  APR.  MAY   JUN.  JUL.  AUG.  SEP.  OCT.  NOV  DEC.
  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ---- ----
 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000


  ###################################################
  #  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          PHASE 1#1             PHASE 1   35.000      1.1330     64.00   0.010   0.014   0.030   1.000   5.000
25.000

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
      2   A-F 100-Y STM TA#1   A-F 100-Y STM TANK   15.000     0.21300     99.00   0.010   0.014   0.030   1.000   5.000
25.000

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
      3   A-F 100-Y STM TA#2   A-F 100-Y STM TANK   16.000     0.22300     90.00   0.010   0.014   0.030   1.000   5.000
25.000

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
      4   A-F 100-Y STM TA#3   A-F 100-Y STM TANK   3.0000     0.70000E-02 10.00   0.010   0.014   0.030   1.000   5.000
25.000

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
      5   A-F 100-Y STM TA#4   A-F 100-Y STM TANK   4.0000     0.13000E-01 90.00   0.010   0.014   0.030   1.000   5.000
25.000

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
      6   A-F 100-Y STM TA#5   A-F 100-Y STM TANK   11.000     0.10500     90.00   0.010   0.014   0.030   1.000   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           PHASE 1#1      0.000     0.000     0.000
    2   A-F 100-Y STM TA#1     0.000     0.000     0.000
    3   A-F 100-Y STM TA#2     0.000     0.000     0.000
    4   A-F 100-Y STM TA#3     0.000     0.000     0.000
    5   A-F 100-Y STM TA#4     0.000     0.000     0.000
    6   A-F 100-Y STM TA#5     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            PHASE 1#1      1 Curve Number  Non-linear reservoir
      2   A-F 100-Y STM TA#1      1 Curve Number  Non-linear reservoir
      3   A-F 100-Y STM TA#2      1 Curve Number  Non-linear reservoir
      4   A-F 100-Y STM TA#3      1 Curve Number  Non-linear reservoir
      5   A-F 100-Y STM TA#4      1 Curve Number  Non-linear reservoir
      6   A-F 100-Y STM TA#5      1 Curve Number  Non-linear reservoir

 Total Number of Subcatchments...             6
 Total Tributary Area (hectares).          1.69
 Impervious Area (hectares)......          1.24
 Pervious Area (hectares)........          0.45
 Total Width (metres)............         84.00
 Impervious Area (%).............         73.41


  ###################################################
  #        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
 PHASE 1                 No Tributary Channel/Pipes
              Tributary Subareas........ PHASE 1#1
 A-F 100-Y STM TANK      No Tributary Channel/Pipes
              Tributary Subareas........ A-F 100-Y STM TA#1 A-F 100-Y STM TA#2 A-F 100-Y STM TA#3 A-F 100-Y STM TA#4 A-F 100-
Y STM TA#5


 ***********************************************************
 * Hydrographs will be stored for the following   2 INLETS *
 ***********************************************************
  PHASE 1             A-F 100-Y STM 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:               1/ 1/2019
 Wet time step length (seconds).......                   300.0
 Dry time step length (seconds).......                  3600.0
 Wet/Dry time step length (seconds)...                   300.0
 Simulation length is......                                8.0 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..        24
 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   35.8375 mm

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

  JAN.  FEB.  MAR.  APR.  MAY   JUN.  JUL.  AUG.  SEP.  OCT.  NOV  DEC.
  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ---- ----
 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

  ##################################################
  #  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            PHASE 1#1              PHASE 1   35.000      1.1330     64.00   0.010   0.014   0.030   1.000   5.000
25.000

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
      2   A-F 100-Y STM TA#1   A-F 100-Y STM TANK   15.000     0.21300     99.00   0.010   0.014   0.030   1.000   5.000
25.000

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
      3   A-F 100-Y STM TA#2   A-F 100-Y STM TANK   16.000     0.22300     90.00   0.010   0.014   0.030   1.000   5.000
25.000

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
      4   A-F 100-Y STM TA#3   A-F 100-Y STM TANK   3.0000     0.70000E-02 10.00   0.010   0.014   0.030   1.000   5.000
25.000

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
      5   A-F 100-Y STM TA#4   A-F 100-Y STM TANK   4.0000     0.13000E-01 90.00   0.010   0.014   0.030   1.000   5.000
25.000

 ###> Warning !! One of more of the infiltration parameters have not been set to non-zero values
      6   A-F 100-Y STM TA#5   A-F 100-Y STM TANK   11.000     0.10500     90.00   0.010   0.014   0.030   1.000   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             PHASE 1#1    0.000     0.000     0.000
    2   A-F 100-Y STM TA#1    0.000     0.000     0.000
    3   A-F 100-Y STM TA#2    0.000     0.000     0.000
    4   A-F 100-Y STM TA#3    0.000     0.000     0.000
    5   A-F 100-Y STM TA#4    0.000     0.000     0.000
    6   A-F 100-Y STM TA#5    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            PHASE 1#1      1 Curve Number  Non-linear reservoir
      2   A-F 100-Y STM TA#1      1 Curve Number  Non-linear reservoir
      3   A-F 100-Y STM TA#2      1 Curve Number  Non-linear reservoir
      4   A-F 100-Y STM TA#3      1 Curve Number  Non-linear reservoir
      5   A-F 100-Y STM TA#4      1 Curve Number  Non-linear reservoir
      6   A-F 100-Y STM TA#5      1 Curve Number  Non-linear reservoir

 Total Number of Subcatchments...            6
 Total Tributary Area (hectares).         1.69
 Impervious Area (hectares)......         1.24
 Pervious Area (hectares)........         0.45
 Total Width (metres)............        84.00
 Impervious Area (%).............        73.41

  ##################################################
  #         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
PHASE 1                  No Tributary Channel/Pipes
              Tributary Subareas........ PHASE 1#1
A-F 100-Y STM TANK       No Tributary Channel/Pipes
              Tributary Subareas........ A-F 100-Y STM TA#1 A-F 100-Y STM TA#2 A-F 100-Y STM TA#3 A-F 100-Y STM TA#4 A-F 100-
Y STM TA#5


************************************************************
* Hydrographs will be stored for the following   2 INLETS *
************************************************************
 PHASE 1             A-F 100-Y STM 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.........    2019 Month.......       1
Day..........       1 Hour........       0
Minute.......       0 Second......       0


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

Integration cycles................      5760
Length of integration step is......      5.00 seconds
Simulation length..................       8.00 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.     41.67 minutes
Summary printout intervals of......       500 cycles
Summary printout time interval of..     41.67 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                  |
*===================================================*
```

Inp Num	Conduit Name	Length (m)	Conduit Class	Area (m^2)	Manning Coef.	Max Width (m)	Depth (m)	Trapezoid Side Slopes	Hazen Williams c-factor
1	PH1 SPILLOVER TO PH2	10.0000	Circular	0.7854	0.0130	1.0000	1.0000		
2	MECH STM PIPES	5.0000	Circular	0.0707	0.0130	0.3000	0.3000		

Total length of all conduits ....   15.0000 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 Name	Courant Ratio	
PH1 SPILLOVER TO PH2	1.57	===> Warning ! (sqrt(wave celerity)*time step/conduit length)
MECH STM PIPES	1.72	===> Warning ! (sqrt(wave celerity)*time step/conduit length)

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

Full pipe or full open conduit volume
Input full depth volume............    8.2074E+00 cubic meters


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

Inp Num	Junction Name	Ground Elevation	Crown Elevation	Invert Elevation	Qinst cms	Initial Depth-m	Interface Flow (%)
1	PHASE 1	78.1000	78.1000	75.2000	0.0000	0.0000	100.0000
2	A-F 100-Y STM TANK	78.0000	78.0000	70.3300	0.0000	0.0000	100.0000
3	A-F STM OUTLET	76.7800	75.0000	75.0000	0.0000	0.0000	100.0000
4	PH-1 STM OUTLET	76.8100	73.5000	73.5000	0.0000	0.0000	100.0000
5	PH1 SUMP	78.1000	75.4000	74.1000	0.0000	0.0000	100.0000

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

Inp Num	Junction Name	X Coord.	Y Coord.	Type of Manhole	Type of Inlet	Maximum Capacity	Pavement Shape	Pavement Slope
1	PHASE 1	0.0000	0.0000	Flooded	Normal		0	0.00
2	A-F 100-Y STM TANK	0.0000	0.0000	No Ponding	Normal		0	0.00
3	A-F STM OUTLET	0.0000	0.0000	No Ponding	Normal		0	0.00
4	PH-1 STM OUTLET	0.0000	0.0000	No Ponding	Normal		0	0.00
5	PH1 SUMP	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 PH1 SPILLOVER TO PH2               PHASE 1    A-F 100-Y STM TANK     77.1000     77.0000   No Design
     2       MECH STM PIPES               PHASE 1              PH1 SUMP     75.2000     75.1000   No Design

 ====> Warning !!! Node: 215            Area decreases between stages      0.000 and      2.310


 *==========================================*
 |         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
   --------------------  --------  ----------------   ---------------  --------- -----------
   A-F 100-Y STM TANK  Stage/Area         89.00             717.5      78.00     Node Invert
   PH1 SUMP              Constant         1.100             4.400      78.10     Node Invert

      *==================================*
      |   Variable storage data for node |A-F 100-Y STM TANK
      *==================================*
       Data     Elevation     Depth         Area         Volume
      Point       meters     meters          m^2            m^3
      =====     =========    ======    ===========    ============
         1        70.3300    0.0000     120.0000          0.0000
         2        72.6400    2.3100      89.0000        240.5025
         3        76.8000    6.4700      89.0000        610.7425
         4        78.0000    7.6700      89.0000        717.5425

 *=======================================================*
 |             Ordered Pump Data Fields                  |
 |        Pump Name/Upstream Node/Dnstream Node          |
 |                DataPt/Depth/Flow                      |
 *=======================================================*
 Pump 277 L/s PUMP         PH1 SUMP            PH-1 STM OUTLET
   1     0.000     0.010
   2     0.010     0.277
   3     3.000     0.277


 *=======================================================*
 |             Ordered Pump Data Fields                  |
 |        Pump Name/Upstream Node/Dnstream Node          |
 |                DataPt/Depth/Flow                      |
 *=======================================================*
 Pump A-F PUMP.1           A-F 100-Y STM TANK  A-F STM OUTLET
   1     0.000     0.000
   2     0.001     0.043
   3     4.000     0.043



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

                    JUNCTIONS                          PUMP RATES                  STAGES
                 FROM              TO          = 1 CMS   = 2 CMS   = 3 CMS    = 1  M    = 2  M
              ------------     ------------   -------   -------   -------   -------   -------
   1. PH1 SUMP  PH-1 STM          0.000     0.000     0.277     0.000     0.000
   2. A-F 100-Y A-F STM O         0.000     0.000     0.043     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
 ==========================================================================
 277 L/s PUMP         PH1 SUMP             PH-1 STM OUTLET         0.0000

  Pt.  Flow Rate,   Original Head,   Modified Head  Force Main
    1     0.010          0.000          0.000          0.000
    2     0.277          0.010          0.010          0.010
    3     0.277          3.000          3.000          3.000


 *=============================================*
 |   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
 ==========================================================================
 A-F PUMP.1           A-F 100-Y STM TANK   A-F STM OUTLET          0.0000

  Pt.  Flow Rate,   Original Head,   Modified Head  Force Main
    1     0.000          0.000          0.000          0.000
```

```
    2     0.043          0.001          0.001          0.001
    3     0.043          4.000          4.000          4.000

           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....A-F STM OUTLET has boundary condition number...         1
 Outfall at Junction....PH-1 STM OUTLET has boundary condition number...         2


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

             CONDUIT             JUNCTION             JUNCTION
 -------------------- -------------------- --------------------
         277 L/s PUMP             PH1 SUMP      PH-1 STM OUTLET
           A-F PUMP.1   A-F 100-Y STM TANK       A-F STM OUTLET
              FREE# 1       A-F STM OUTLET             BOUNDARY
              FREE# 2      PH-1 STM OUTLET             BOUNDARY

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


 BC NUMBER..         1 has no control water surface.
 BC NUMBER..         2 has no control water surface.

 ===> WARNING ! Junction A-F STM OUTLET is not associated with any conduit.

 ===> WARNING ! Junction PH-1 STM OUTLET is not associated with any conduit.

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




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

              Conduit        Full     Conduit
                 Name        Flow       Slope
 --------------------  ----------  ----------
 PH1 SPILLOVER TO PH2      2.3976      0.0100
       MECH STM PIPES      0.1368      0.0200

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

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
             PHASE 1/   0.00 /    75.20   A-F 100-Y STM TANK/   0.00 /    70.33       A-F STM OUTLET/   0.00 /    75.00
      PH-1 STM OUTLET/   0.00 /    73.50             PH1 SUMP/   0.00 /    74.10

             Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
PH1 SPILLOVER TO PH2/       0.00       MECH STM PIPES/       0.00         277 L/s PUMP/       0.00
          A-F PUMP.1/       0.00              FREE# 1/       0.00              FREE# 2/       0.00

             Conduit/   Velocity
PH1 SPILLOVER TO PH2/       0.00       MECH STM PIPES/       0.00

             Conduit/ Cross Sectional Area
PH1 SPILLOVER TO PH2/       0.00       MECH STM PIPES/       0.00

             Conduit/ Hydraulic Radius
PH1 SPILLOVER TO PH2/       0.00       MECH STM PIPES/       0.00

             Conduit/ Upstream/ Downstream Elevation
PH1 SPILLOVER TO PH2/    70.33/    70.33      MECH STM PIPES/    74.10/    74.10

 Cycle        500      Time          0 Hrs - 41.67 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
             PHASE 1/   0.02 /    75.22   A-F 100-Y STM TANK/   0.00 /    70.33       A-F STM OUTLET/   0.00 /    75.00
      PH-1 STM OUTLET/   0.00 /    73.50             PH1 SUMP/   0.00 /    74.10

             Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
PH1 SPILLOVER TO PH2/       0.00       MECH STM PIPES/       0.00         277 L/s PUMP/       0.00           A-F PUMP.1/
0.00
             FREE# 1/       0.00              FREE# 2/       0.00

 Cycle       1000      Time          1 Hrs - 23.33 Min

           Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
             PHASE 1/   0.22 /    75.42   A-F 100-Y STM TANK/   0.24 /    70.57       A-F STM OUTLET/   0.00 /    75.00
      PH-1 STM OUTLET/   0.00 /    73.50             PH1 SUMP/   0.00 /    74.10

             Conduit/       FLOW   ===> "*" Conduit uses the normal flow option.
```

```
PH1 SPILLOVER TO PH2/      0.00      MECH STM PIPES/      0.12*       277 L/s PUMP/      0.12          A-F PUMP.1/
0.04
             FREE# 1/      0.04            FREE# 2/      0.12

 Cycle      1500      Time         2 Hrs -  5.00 Min

           Junction / Depth  / Elevation   ===>  "*" Junction is Surcharged.
             PHASE 1/   0.07 /   75.27   A-F 100-Y STM TANK/   0.04 /   70.37      A-F STM OUTLET/   0.00 /   75.00
     PH-1 STM OUTLET/   0.00 /   73.50             PH1 SUMP/   0.00 /   74.10

             Conduit/      FLOW   ===> "*" Conduit uses the normal flow option.
PH1 SPILLOVER TO PH2/      0.00      MECH STM PIPES/      0.02        277 L/s PUMP/      0.02          A-F PUMP.1/
0.04
             FREE# 1/      0.04            FREE# 2/      0.02

 Cycle      2000      Time         2 Hrs - 46.67 Min

           Junction / Depth  / Elevation   ===>  "*" Junction is Surcharged.
             PHASE 1/   0.05 /   75.25   A-F 100-Y STM TANK/   0.00 /   70.33      A-F STM OUTLET/   0.00 /   75.00
     PH-1 STM OUTLET/   0.00 /   73.50             PH1 SUMP/   0.00 /   74.10

             Conduit/      FLOW   ===> "*" Conduit uses the normal flow option.
PH1 SPILLOVER TO PH2/      0.00      MECH STM PIPES/      0.01        277 L/s PUMP/      0.01          A-F PUMP.1/
0.00
             FREE# 1/      0.00            FREE# 2/      0.01

 Cycle      2500      Time         3 Hrs - 28.33 Min

           Junction / Depth  / Elevation   ===>  "*" Junction is Surcharged.
             PHASE 1/   0.04 /   75.24   A-F 100-Y STM TANK/   0.00 /   70.33      A-F STM OUTLET/   0.00 /   75.00
     PH-1 STM OUTLET/   0.00 /   73.50             PH1 SUMP/   0.00 /   74.10

             Conduit/      FLOW   ===> "*" Conduit uses the normal flow option.
PH1 SPILLOVER TO PH2/      0.00      MECH STM PIPES/      0.01        277 L/s PUMP/      0.01          A-F PUMP.1/
0.00
             FREE# 1/      0.00            FREE# 2/      0.01

 Cycle      3000      Time         4 Hrs - 10.00 Min

           Junction / Depth  / Elevation   ===>  "*" Junction is Surcharged.
             PHASE 1/   0.03 /   75.23   A-F 100-Y STM TANK/   0.00 /   70.33      A-F STM OUTLET/   0.00 /   75.00
     PH-1 STM OUTLET/   0.00 /   73.50             PH1 SUMP/   0.00 /   74.10

             Conduit/      FLOW   ===> "*" Conduit uses the normal flow option.
PH1 SPILLOVER TO PH2/      0.00      MECH STM PIPES/      0.00        277 L/s PUMP/      0.00          A-F PUMP.1/
0.00
             FREE# 1/      0.00            FREE# 2/      0.00

 Cycle      3500      Time         4 Hrs - 51.67 Min

           Junction / Depth  / Elevation   ===>  "*" Junction is Surcharged.
             PHASE 1/   0.02 /   75.22   A-F 100-Y STM TANK/   0.00 /   70.33      A-F STM OUTLET/   0.00 /   75.00
     PH-1 STM OUTLET/   0.00 /   73.50             PH1 SUMP/   0.00 /   74.10

             Conduit/      FLOW   ===> "*" Conduit uses the normal flow option.
PH1 SPILLOVER TO PH2/      0.00      MECH STM PIPES/      0.00        277 L/s PUMP/      0.00          A-F PUMP.1/
0.00
             FREE# 1/      0.00            FREE# 2/      0.00

 Cycle      4000      Time         5 Hrs - 33.33 Min

           Junction / Depth  / Elevation   ===>  "*" Junction is Surcharged.
             PHASE 1/   0.01 /   75.21   A-F 100-Y STM TANK/   0.00 /   70.33      A-F STM OUTLET/   0.00 /   75.00
     PH-1 STM OUTLET/   0.00 /   73.50             PH1 SUMP/   0.00 /   74.10

             Conduit/      FLOW   ===> "*" Conduit uses the normal flow option.
PH1 SPILLOVER TO PH2/      0.00      MECH STM PIPES/      0.00        277 L/s PUMP/      0.00          A-F PUMP.1/
0.00
             FREE# 1/      0.00            FREE# 2/      0.00

 Cycle      4500      Time         6 Hrs - 15.00 Min

           Junction / Depth  / Elevation   ===>  "*" Junction is Surcharged.
             PHASE 1/   0.01 /   75.21   A-F 100-Y STM TANK/   0.00 /   70.33      A-F STM OUTLET/   0.00 /   75.00
     PH-1 STM OUTLET/   0.00 /   73.50             PH1 SUMP/   0.00 /   74.10

             Conduit/      FLOW   ===> "*" Conduit uses the normal flow option.
PH1 SPILLOVER TO PH2/      0.00      MECH STM PIPES/      0.00        277 L/s PUMP/      0.00          A-F PUMP.1/
0.00
             FREE# 1/      0.00            FREE# 2/      0.00

 Cycle      5000      Time         6 Hrs - 56.67 Min

           Junction / Depth  / Elevation   ===>  "*" Junction is Surcharged.
             PHASE 1/   0.01 /   75.21   A-F 100-Y STM TANK/   0.00 /   70.33      A-F STM OUTLET/   0.00 /   75.00
     PH-1 STM OUTLET/   0.00 /   73.50             PH1 SUMP/   0.00 /   74.10

             Conduit/      FLOW   ===> "*" Conduit uses the normal flow option.
PH1 SPILLOVER TO PH2/      0.00      MECH STM PIPES/      0.00        277 L/s PUMP/      0.00          A-F PUMP.1/
0.00
             FREE# 1/      0.00            FREE# 2/      0.00

 Cycle      5500      Time         7 Hrs - 38.33 Min

           Junction / Depth  / Elevation   ===>  "*" Junction is Surcharged.
             PHASE 1/   0.01 /   75.21   A-F 100-Y STM TANK/   0.00 /   70.33      A-F STM OUTLET/   0.00 /   75.00
     PH-1 STM OUTLET/   0.00 /   73.50             PH1 SUMP/   0.00 /   74.10

             Conduit/      FLOW   ===> "*" Conduit uses the normal flow option.
PH1 SPILLOVER TO PH2/      0.00      MECH STM PIPES/      0.00        277 L/s PUMP/      0.00          A-F PUMP.1/
0.00
             FREE# 1/      0.00            FREE# 2/      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)
 --------------------    ---------  ---------  ---------
             PHASE 1        50.00      50.00    28800.0
   A-F 100-Y STM TANK       50.00      50.00        0.0
       A-F STM OUTLET       50.00      50.00        0.0
      PH-1 STM OUTLET       50.00      50.00        0.0
             PH1 SUMP        1.10       2.75        0.0
 The junction requiring the smallest time step was...PHASE 1

 *=========================================================*
 |       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
       --------------  ---------  ---------  --------- ---------  -----------  -------  ------------
 PH1 SPILLOVER TO PH2      50.00      50.00      50.00      41.0        0.000    0.000   Normal Soln
       MECH STM PIPES       1.35       1.35       2.27     439.0        0.001    1.901   Normal Soln
The conduit with the smallest time step limitation was..MECH STM PIPES
The conduit with the largest wobble was................MECH STM PIPES
The conduit with the largest flow change in any
consecutive time step..................................MECH STM PIPES

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

 Final Date (Mo/Day/Year)   =           1/ 1/2019
 Total number of time steps =                  96
 Final Julian Date          =             2019001
 Final time of day          =              28800. seconds.
 Final time of day          =                8.00   hours.
 Final running time         =              8.0000   hours.
 Final running time         =              0.3333    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
 --------------------  -------  --------    --------------------  -------  --------    --------------------  -------  ----
----
           PHASE 1#1      1232       228       A-F 100-Y STM TA#1      1430       218       A-F 100-Y STM TA#2      1240
220
   A-F 100-Y STM TA#3      2028       220       A-F 100-Y STM TA#4      1366       218       A-F 100-Y STM TA#5      1245
219

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

 Total rainfall read for gage #        1 is        35.84 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)          6.070876E+02        35.838
 Total Infiltration                            1.296599E+02         7.654
 Total Evaporation                             0.000000E+00         0.000
 Surface Runoff from Watersheds                4.591101E+02        27.102
 Total Water remaining in Surface Storage      2.239100E+01         1.322
 Infiltration over the Pervious Area...        1.296599E+02        28.787
                      --------
 Infiltration + Evaporation +
 Surface Runoff + Snow removal +
 Water remaining in Surface Storage +
 Water remaining in Snow Cover.........        6.111610E+02        36.078
 Total Precipitation + Initial Storage.        6.070876E+02        35.838


 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..............                          -0.6710


 ****************************************************
 * 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..............    4.591101E+02       27.102
 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..................    4.591101E+02       27.102
 Initial Storage + Inflow....................    4.591101E+02       27.102
 Final Storage + Outflow + Diverted GW.......    4.591101E+02       27.102
 ********************************************
 * 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...........            PHASE 1#1   A-F 100-Y STM TA#1   A-F 100-Y STM TA#2   A-F 100-Y STM TA#3   A-F 100-Y STM
TA#4
 Area (hectares)........              1.13302              0.21300              0.22300              0.00700
0.01300
 Percent Impervious.....             64.00000             99.00000             90.00000             10.00000
90.00000
 Total Rainfall (mm)....             35.83752             35.83752             35.83752             35.83752
35.83752
 Max Intensity (mm/hr)..             88.27340             88.27340             88.27340             88.27340
88.27340

 Pervious Area
 -------------
 Total Runoff Depth (mm)              4.36368              5.08561              4.92162              4.85919
5.06174
 Peak Runoff Rate (cms).              0.00249              0.00004              0.00028              0.00007
0.00002

 Total Impervious Area
 ---------------------
 Total Runoff Depth (mm)              1.38817              1.39240              1.39348              1.38061
1.39827
 Peak Runoff Rate (cms).              0.12953              0.04298              0.04217              0.00017
0.00286

 Impervious Area with depression storage
 ---------------------------------------
 Total Runoff Depth (mm)             26.25924             26.33963             26.36010             26.11374
26.45026
 Peak Runoff Rate (cms).              0.09694              0.03221              0.03161              0.00013
0.00214

 Impervious Area without depression storage
 ------------------------------------------
 Total Runoff Depth (mm)              9.00039              9.02742              9.03437              8.95380
9.06588
 Peak Runoff Rate (cms).              0.03260              0.01077              0.01056              0.00004
0.00071

 Total Area
 ----------
 Total Runoff Depth (mm)             24.13709             35.06423             32.34719              7.88003
32.47070
 Peak Runoff Rate (cms).              0.12953              0.04298              0.04217              0.00017
0.00286

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

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


 Subcatchment...........   A-F 100-Y STM TA#5
 Area (hectares)........              0.10500
 Percent Impervious.....             90.00000
 Total Rainfall (mm)....             35.83752
 Max Intensity (mm/hr)..             88.27340

 Pervious Area
 -------------
 Total Runoff Depth (mm)              4.96968
 Peak Runoff Rate (cms).              0.00014

 Total Impervious Area
 ---------------------
 Total Runoff Depth (mm)              1.39654
 Peak Runoff Rate (cms).              0.02143

 Impervious Area with depression storage
 ---------------------------------------
 Total Runoff Depth (mm)             26.41800
 Peak Runoff Rate (cms).              0.01607

 Impervious Area without depression storage
 ------------------------------------------
 Total Runoff Depth (mm)              9.05420
 Peak Runoff Rate (cms).              0.00536

 Total Area
 ----------
 Total Runoff Depth (mm)             32.42195
 Peak Runoff Rate (cms).              0.02143

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

 UK Methods
 -----------
 Runoff percentage (%)..              0.00000
 Effective Area (Ha)....              0.00000
 Depression Storage (mm)              0.00000
 Routing coefficient....              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 = 8.000 hours

```
          Junction / Depth  / Elevation    ===>  "*" Junction is Surcharged.
            PHASE 1/   0.00 /    75.20/  A-F 100-Y STM TANK/   0.00 /    70.33/      A-F STM OUTLET/   0.00 /    75.00/
    PH-1 STM OUTLET/   0.00 /    73.50/            PH1 SUMP/   0.00 /    74.10/

          Conduit/       Flow   ===> "*" Conduit uses the normal flow option.
PH1 SPILLOVER TO PH2/       0.00 /      MECH STM PIPES/       0.00 /        277 L/s PUMP/       0.00 /
          A-F PUMP.1/       0.00 /             FREE# 1/       0.00 /             FREE# 2/       0.00 /

             Conduit/   Velocity
PH1 SPILLOVER TO PH2/       0.00 /      MECH STM PIPES/       0.11 /

        Conduit/      Width
PH1 SPILLOVER TO PH2/       0.00 /      MECH STM PIPES/       0.12 /

       Junction/        EGL
            PHASE 1/       0.00 /  A-F 100-Y STM TANK/       0.00 /      A-F STM OUTLET/       0.00 /
    PH-1 STM OUTLET/       0.00 /            PH1 SUMP/       1.00 /

       Junction/  Freeboard
            PHASE 1/       2.90 /  A-F 100-Y STM TANK/       7.67 /      A-F STM OUTLET/       1.78 /
    PH-1 STM OUTLET/       3.31 /            PH1 SUMP/       4.00 /

       Junction/ Max Volume
            PHASE 1/       0.28 /  A-F 100-Y STM TANK/      48.90 /      A-F STM OUTLET/       0.00 /
    PH-1 STM OUTLET/       0.00 /            PH1 SUMP/       0.02 /

       Junction/Total Fldng
            PHASE 1/       0.00 /  A-F 100-Y STM TANK/       0.00 /      A-F STM OUTLET/       0.00 /
    PH-1 STM OUTLET/       0.00 /            PH1 SUMP/       0.00 /

        Conduit/ Cross Sectional Area
PH1 SPILLOVER TO PH2/       0.00 /      MECH STM PIPES/       0.00 /

        Conduit/  Final Volume
PH1 SPILLOVER TO PH2/       0.00 /      MECH STM PIPES/       0.00 /

        Conduit/ Hydraulic Radius
PH1 SPILLOVER TO PH2/       0.00 /      MECH STM PIPES/       0.00 /

        Conduit/ Upstream/ Downstream Elevation
PH1 SPILLOVER TO PH2/    70.33/    70.33      MECH STM PIPES/    75.20/    75.10
```

Table E7 - Iteration Summary

Total number of time steps simulated............	5760
Total number of passes in the simulation........	10450
Total number of time steps during simulation....	9780
Ratio of actual # of time steps / NTCYC.........	1.698
Average number of iterations per time step......	1.069
Average time step size(seconds)................	2.945
Smallest time step size(seconds)................	1.250
Largest time step size(seconds)................	5.000
Average minimum Conduit Courant time step (sec).	3.963
Average minimum implicit time step (sec)........	2.245
Average minimum junction time step (sec)........	2.245
Average Courant Factor Tf.......................	2.245
Number of times omega reduced...................	22

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
PHASE 1	0	1.08	10589	8	65	8	8	7
A-F 100-Y STM TANK	0	1.01	9871	0	2	0	0	0
A-F STM OUTLET	0	1.04	10139	0	3	0	0	0
PH-1 STM OUTLET	0	1.14	11184	0	3	0	0	0
PH1 SUMP	0	1.11	10834	14	83	9	6	5

Total number of iterations for all junctions.. 52617
Minimum number of possible iterations......... 48900
Efficiency of the simulation................. 1.08
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.	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
PHASE 1	78.1000	78.1000	75.4332	1	20	0.0000	2.6668	1.2200	0.0000	0.00	0.0000
A-F 100-Y STM TANK	78.0000	78.0000	70.7479	1	34	0.0000	7.2521	120.0000	0.0000	0.00	0.0000
A-F STM OUTLET	76.7800	75.0000	75.0000	0	0	0.0000	1.7800	1.2200	0.0000	0.00	0.0000
PH-1 STM OUTLET	76.8100	73.5000	73.5000	0	0	0.0000	3.3100	1.2200	0.0000	0.00	0.0000
PH1 SUMP	78.1000	75.4000	74.1175	1	20	0.0000	3.9825	1.1000	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.	Min.	Maximum Computed Velocity (m/s)	Time of Occurence Hr.	Min.	Ratio of Max. to Design Flow	Maximum Water Elev at Pipe Ends Upstream (m)	Dwnstrm (m)	Ratio d/D US	DS
PH1 SPILLOVER TO PH2	2.3976	3.0527	1000.000	0.0000	0	0	0.0000	0	0	0.0000	70.7479	70.7479	.0000	.0000
MECH STM PIPES	0.1368	1.9347	300.0000	0.1295	1	20	2.2038	1	20	0.9470	75.4332	75.3329	0.777	0.776
277 L/s PUMP	Undefnd	Undefnd	Undefnd	0.1603	1	20								
A-F PUMP.1	Undefnd	Undefnd	Undefnd	0.0430	1	12								
FREE# 1	Undefnd	Undefnd	Undefnd	0.0430	1	12								
FREE# 2	Undefnd	Undefnd	Undefnd	0.1603	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)
PH1 SPILLOVER TO PH2	480.00	0.00	0.00	0.00	0.000	0.000	0.000
MECH STM PIPES	0.67	0.00	0.00	479.33	0.091	0.059	0.512

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
PH1 SPILLOVER TO PH2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0130
MECH STM PIPES	0.0095	273.4704	0.0002	0.9978	1.4595	0.0303	0.0110	0.0130
277 L/s PUMP	0.0096	275.4427						
A-F PUMP.1	0.0064	184.9049						
FREE# 1	0.0064	184.9059						
FREE# 2	0.0096	275.5333						

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	
PH1 SPILLOVER TO PH2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Max Flow
MECH STM PIPES	0.1285	0.0000	0.1000	0.2698	0.2312	75.4312	75.3313	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	Mild Slope Critical D Outlet Control	Mild Slope TW Control 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
PH1 SPILLOVER TO PH2	0.0000	0.0000	480.0000	0.0000	0.0000	0.0000	0.0000	0.0000	None
MECH STM PIPES	0.0000	0.0000	445.5000	0.0000	0.0000	0.0000	34.5000	0.0000	None

```
*=====================================*
|    Kinematic Wave Approximations    |
|  Time in Minutes for Each Condition |
*=====================================*
```

Conduit Name	Duration of Normal Flow	Slope Criteria	Super-Critical	Roll Waves
PH1 SPILLOVER TO PH2	0.0000	0.0000	0.0000	0.0000
MECH STM PIPES	9.0972	9.0972	478.2500	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)
PH1 SPILLOVER TO PH2	0.0000	0.0000	0.0000	0.0000	##	PHASE 1	75.2000	75.4332
MECH STM PIPES	0.1295	273.4704	2.2038	0.2944	##	A-F 100-Y STM TANK	70.3300	70.7479
277 L/s PUMP	0.1603	275.4427	0.0000	0.0000	##	A-F STM OUTLET	75.0000	75.0000
A-F PUMP.1	0.0430	184.9049	0.0000	0.0000	##	PH-1 STM OUTLET	73.5000	73.5000
FREE# 1	0.0430	184.9059	0.0000	0.0000	##	PH1 SUMP	74.1000	74.1175
FREE# 2	0.1603	275.5333	0.0000	0.0000	##			

```
*====================================================*
|     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)
PHASE 1	PH1 SUMP	0.1295	273.4704
PH1 SUMP	PH-1 STM OUTLET	0.1603	275.4427
A-F 100-Y STM TANK	A-F STM OUTLET	0.0430	184.9049

```
#########################################################
# 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
PH1 SPILLOVER TO PH2	PHASE 1	A-F 100-Y STM TANK	77.10	77.00	70.75	70.75	Circular
MECH STM PIPES	PHASE 1	PH1 SUMP	75.20	75.10	75.43	75.33	Circular

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

Pump Operating Time and Pump General Results

Pump Name	Upstream Node	Downstream Node	Time in hours Pump On	# of Times Pump Goes On	Min HGL meter	Max HGL meter	Min Q cms	Max Q cms	Totl Q m^3
P{218.1}	221	217	0.0000	0	0.0000	0.0000	0.0000	0.0000	275.4427
P{220.1}	215	216	0.0000	0	0.0000	0.0000	0.0000	0.0000	184.9049

```
*=========================================================================*
|   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 Name	<------Continuity Error Volume	% of Node	% of Inflow ------->	Remaining Volume	Beginning Volume	Net Flow Thru Node	Total Flow Thru Node	Failed to Converge
PHASE 1	-0.0388	-0.0071	0.0084	0.0015	0.0000	-0.0373	546.9131	0
A-F 100-Y STM TANK	0.7381	0.1992	0.1608	0.0001	0.0000	0.7381	370.5392	0
A-F STM OUTLET	-0.0010	-0.0003	0.0002	0.0000	0.0000	-0.0010	369.8108	0
PH-1 STM OUTLET	-0.0906	-0.0164	0.0197	0.0000	0.0000	-0.0906	550.9760	0
PH1 SUMP	-2.0415	-0.3719	0.4447	0.0001	0.0000	-2.0414	548.9131	0

The total continuity error was -1.4338   cubic meters
The remaining total volume was 1.66544E-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.|
*==================================================*
```

Junction Name	Constant Inflow to Node	User Inflow to Node	Interface Inflow to Node	DWF Inlow to Node	Inflow through Outfall	RNF Layer Inflow to Node	Inflow from 2D Layer	Outflow from Node	Evaporation from Node	Basin Infil.
PHASE 1	0.0000	0.0000	0.0000	0.0000	0.0000	273.4084	0.0000	0.0000	0.0000	0.00
A-F 100-Y STM TANK	0.0000	0.0000	0.0000	0.0000	0.0000	185.5861	0.0000	0.0000	0.0000	0.00
A-F STM OUTLET	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	184.9059	0.0000	0.00
PH-1 STM OUTLET	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	275.5333	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.|
*====================================================*
```

Junction Name	Surcharged Time (min)	Flooded Time(min)	Out of 1D-System (Flooded Volume)	Maximum Volume	Passed to 2D cell OR Volume Stored in allowed Flood Pond of 1D-System
PHASE 1	0.000	0.000	0.000	0.285	0.000
A-F 100-Y STM TANK	0.000	0.000	0.000	48.9	0.000
A-F STM OUTLET	0.000	0.000	0.000	0.000	0.000
PH-1 STM OUTLET	0.000	0.000	0.000	0.000	0.000
PH1 SUMP	0.000	0.000	0.000	2.080E-02	0.000

```
*==================================*
| Simulation Specific Information  |
*==================================*
```

Number of Input Conduits..........	2	Number of Simulated Conduits......	6
Number of Natural Channels........	0	Number of Junctions..............	5
Number of Storage Junctions.......	2	Number of Weirs..................	0
Number of Orifices...............	0	Number of Pumps..................	2
Number of Free Outfalls..........	2	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..   FREE# 2 with   0.002 percent
The Junction with the largest average change was.   PH1 SUMP with   0.005 percent
The Conduit with the largest sinuosity was.......   MECH STM PIPES with   1.901

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

Inflow Junction	Inflow Volume, m^3	Average Inflow, cms
PHASE 1	273.4427	0.0095
A-F 100-Y STM TANK	185.6343	0.0064
A-F STM OUTLET	-184.9059	-0.0064
PH-1 STM OUTLET	-275.5333	-0.0096

Outflow Junction	Outflow Volume m^3	Average Outflow, cms
A-F STM OUTLET	184.9059	0.0064
PH-1 STM OUTLET	275.5333	0.0096

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

```
 | Initial system volume        =        0.0000 Cu M  |
 | Total system inflow volume   =      458.9945 Cu M  |
 | Inflow + Initial volume      =      458.9945 Cu M  |
 *====================================================*
 | Total system outflow         =      460.4392 Cu M  |
 | Volume left (Final volume)   =        0.0017 Cu M  |
 | Evaporation                  =        0.0000 Cu M  |
 | Basin Infiltration           =        0.0000 Cu M  |
 | Outflow + Final Volume       =      460.4409 Cu M  |
 *====================================================*

 *================================================*
 | Total Model Continuity Error                   |
 | Error in Continuity, Percent =        -0.3151 |
 | Error in Continuity, m^3     =        -1.4464 |
 | + Error means a continuity loss, - a gain     |
 *================================================*


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

 Overall error was (minimum of Table E18 & E21)            -0.3124 percent
 Worst nodal error was in node PH1 SUMP             with    -0.3719 percent
 Of the total inflow this loss was                          0.4448 percent
 Your overall continuity error was                  Excellent
                                                   Excellent Efficiency
 Efficiency of the simulation                       1.08
 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)
 -------------------- ------  --------- -------------------- ------- ------- --------- ---------

 ===> Hydraulic model simulation ended normally.
 ===> XP-SWMM Simulation ended normally.
 ===> Your input file was named  : P:\2018\18212\Buildings A & F - Phase 4\Design and Reports\Computer Analysis\XPSWMM Storm -
r1 - JK\Rev0\1D\SWM ANALYSIS_TORONTO2Y\SWM ANALYSIS_TORONTO2Y.DAT
 ===> Your output file was named : P:\2018\18212\Buildings A & F - Phase 4\Design and Reports\Computer Analysis\XPSWMM Storm -
r1 - JK\Rev0\1D\SWM ANALYSIS_TORONTO2Y\SWM ANALYSIS_TORONTO2Y.out

 *=============================================================*
 |         XPSWMM/XPSTORM Simulation Date and Time Summary      |
 *=============================================================*
 | Starting Date... November    4, 2020  Time...  15:00:33.631  |
 |   Ending Date... November    4, 2020  Time...  15:00:37.303  |
 |  Elapsed Time...    0.05443 minutes or      3.26562 seconds  |
 *=============================================================*
```

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
401-02B
Post Office Box 420
Trenton, New Jersey 08625-0420
609-633-7021 Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

May 14, 2012

Joel Garbon
Product Manager
7564 Standish Place
Suite 112
Rockville, MD 20855

Re: Final Certification
Jellyfish® Filter by Imbrium Systems

Expiration Date: December 1, 2016
TSS Removal Rate: 80%

Dear Mr. Garbon:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Imbrium Systems. has requested a Final Certification for the Jellyfish® Filter.

This project falls under the "Transition for Manufactured Treatment Devices July 15, 2011". The Jellyfish Filter by Imbrium Systems qualified for Category C. Manufactured Treatment Devices Seeking Final Certifications - In Process which are MTDs that have commenced field testing on or before August 1, 2011.

NJDEP received the required information from signed statement sby the NJCAT Technical Director and the manufacturer listing the indicating that the requirements of the 2009 NJDEP Field Testing Protocols have been met or exceeded. NJDEP also received a signed statement from the third party testing entity, University of Florida, indicating that the testing requirements have been met or exceeded. The NJCAT letter also includes a recommended certification TSS removal rate and the required maintenance plan.

The NJDEP certifies the use of the Jellyfish Filter by Imbrium Systems at TSS removal rate of 80%, subject to the following conditions:

1. The Jellyfish Filter is designed according to the NJ Water Quality Design Storm in N.J.A.C. 7:8-5.5.
2. The peak inflow of the water quality design storm is limited to the following:

For each hi-flow cartridge, the maximum inflow is 1.48 gpm and a maximum inflow drainage area is 0.012 impervious acres, for each inch of cartridge length.

For each draindown cartridge, the maximum inflow 0.74 gpm and the maximum inflow drainage area is 0.006 impervious acres for each inch of cartridge length.

Example: For a 54-inch hi-flo cartridge length, the maximum inflow is 80 gpm and the maximum inflow drainage area is 0.65 impervious acres.

Maximum treatment flow rates for typical Jellyfish Filter models are provided in Table 1.

Maximum treatment flow rates and maximum inflow drainage areas for various cartridge lengths are provided in Table 2.

3. The bottom of the Jellyfish tentacles is a minimum of 2 feet above the bottom of the vault. The sedimentation area in the vault shall be a minimum of 4 ft^2 per cartridge.
4. The Jellyfish Filter is certified as an off-line system only.
5. The Jellyfish Filter cannot be used in series with a settling chamber (such as a hydrodynamic separator) or a media filter (such as a sand filter), to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.
6. The maintenance plan for sites using this device shall incorporate, at a minimum, the maintenance requirements for the Jellyfish Filter shown in Appendix A below.

In addition to the attached, any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8, must include a detailed maintenance plan. The detailed maintenance plan must include all of the items identified in Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance of the New Jersey Stormwater Best Management Manual.

NJDEP anticipates proposing further adjustments to this process through the readoption of the Stormwater Management Rules. Additional information regarding the implementation of the Stormwater Management Rules, N.J.A.C. 7:8, are available at www.njstormwater.org. If you have any questions regarding the above information, please contact Ms. Sandra Blick of my office at (609) 633-7021.

Sincerely,

Ed Frankel, P.P., Section Chief
Bureau of Nonpoint Pollution Control

C: Chron File
Richard Magee, NJCAT
Mark Pedersen, DLUR
Elizabeth Dragon, BNPC

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Table 1
Maximum Treatment Flow Rates for
Standard (54" Cartridge Length) Jellyfish® Filter Models

Manhole Diameter (ft)	Model No.	Hi-Flo Cartridges (54" Length)	Draindown Cartridges (54" Length)	Maximum Treatment Flow Rate (gpm / cfs)
Catch Basin		varies	varies	varies
4	JF4-2-1	2	1	200 / 0.45
6	JF6-3-1	3	1	280 / 0.62
	JF6-4-1	4	1	360 / 0.80
	JF6-5-1	5	1	440 / 0.98
	JF6-6-1	6	1	520 / 1.16
8	JF8-6-2	6	2	560 / 1.25
	JF8-7-2	7	2	640 / 1.43
	JF8-8-2	8	2	720 / 1.60
	JF8-9-2	9	2	800 / 1.78
	JF8-10-2	10	2	880 / 1.96
10 [1]	JF10-11-3	11	3	1000 / 2.23
	JF10-12-3	12	3	1080 / 2.41
	JF10-13-3	13	3	1160 / 2.58
	JF10-14-3	14	3	1240 / 2.76
	JF10-15-3	15	3	1320 / 2.94
	JF10-16-3	16	3	1400 / 3.12
12 [2]	JF12-17-4	17	4	1520 / 3.39
	JF12-18-4	18	4	1600 / 3.57
	JF12-19-4	19	4	1680 / 3.74
	JF12-20-4	20	4	1760 / 3.92
	JF12-21-4	21	4	1840 / 4.10
	JF12-22-4	22	4	1920 / 4.28
	JF12-23-4	23	4	2000 / 4.46
	JF12-24-4	24	4	2080 / 4.63
Vault		varies	varies	varies

[1] The MTFR for a 10-ft diameter unit occurs with Model JF10-16-3. Since this leaves 4 unoccupied cartridge receptacles in the 10-ft diameter deck, the design engineer has the option to add up to 4 additional cartridges to increase the sediment capacity of the system, however may not increase the MTFR above that of the JF10-16-3.

[2] The MTFR for a 12-ft diameter unit occurs with Model JF12-24-4. Since this leaves 4 unoccupied cartridge receptacles in the 12-ft diameter deck, the design engineer has the option to add up to 4 additional cartridges to increase the sediment capacity of the system, however may not increase the MTFR above that of the JF12-24-4.

Table 2
Maximum Treatment Flow Rate and
Maximum Inflow Drainage Area
for Various Jellyfish® Cartridge Lengths

Cartridge Length (inches)	Maximum Treatment Flow Rate (gpm)	Maximum Inflow Drainage Area (impervious acres)
15	Hi-Flo 22 Draindown 11	Hi-Flo 0.18 Draindown 0.09
27	Hi-Flo 40 Draindown 20	Hi-Flo 0.32 Draindown 0.16
40	Hi-Flo 60 Draindown 30	Hi-Flo 0.48 Draindown 0.24
54	Hi-Flo 80 Draindown 40	Hi-Flo 0.65 Draindown 0.32

March 1, 2021

Kristine Zwicker
Cityzen Development Group
56 The Esplanade, Suite 308
Toronto, ON M5E 1A7
Client Address

Re: Pier 27 Phase 3 – 25 & 35 Queens Quay East, Toronto ON
Structural Engineering of Stormwater Tank

Dear Kristine,

As required for the upcoming Zoning By-Law Amendment (ZBA), Official Plan Amendment (OPA) and Site Plan Application (SPA) submissions for Phase 3 of the Pier 27 development at 25 & 35 Queens Quay East, we hereby confirm that:

- The reinforced concrete floor slab and sidewalls of the stormwater tank will be designed for the most critical loading including the full weight of the water for the maximum volume of the stormwater tank.

- The building's below-grade structure will be designed to support the weight of the storm water storage tank under the most critical loading (i.e., overflow elevation).

We trust that this is satisfactory for your purposes. If you have any questions or if further information is required, please contact us.

Regards,

Anthony Mirvish, P. Eng.
Principal
anthony.mirvish@honeycombgroup.ca
416-451-9806

APPENDIX D

Site Existing Storm Sewers Investigation by Markit Locates

MARK IT Locates Inc.

www.markitlocates.com
E-mail: info@markitlocates.com
Tel: 289-337-9202

Primary Locate Report

Page 1 of 2

M.I.L. Project # 2020-10444

OOC Ticket #

A paper copy of this Locate Report must be on site and in possession of the machine operator during work operations

Customer: CITYZEN DEVELOPMENT **Locate Address:** 25 QUEENS QUAY E

Contact Name: JEFF UIOLA **Phone:** 647-687-0932 **City:** TORONTO

P.O.#: 25 QUEENS QUAY **Type of Work:**

UTILITY	Gas	Electrical	Irrigation	Steam	Water	Sanitary Sewer	Storm Sewer
Requested	✓	✓	✓	✓	✓	✓	✓
	NR	NR	NR	NR	NR	NR	M

UTILITY	Fiber	Cable TV	Street Lights	Traffic Lights	Bell	Communications	Other/Unknown
Requested	✓	✓	✓	✓	✓	✓	✓
	NR	NR	NR	NR	NR	NR	NR

*Status: M - Marked on site C - Clear for all locate areas NL - Not Locatable (see terms & conditions) NR - Not Requested
PL - Marked By Public Locater

WARNING STICKERS/NOTES

1. LOCATED ONLY VISIBLE + ACCESSIBLE UTILITIES. ANY ABANDONED / UNTONABLE UTILITIES NOT MARKED.
2. CB4 + CB5 ARE FULL OF WATER AND PIPES ARE NOT VISIBLE. UNABLE TO SONDE PIPES

2.0 M ALLOWANCE FROM CENTRE OF ALL MARKED / LOCATED SEWER LINES

CAUTION

- ☐ Hand dig within 3 metres of all terminal poles, splice pits + pad mounted equipment (transformers, etc)
- Exposed or damaged utilities must be immediately reported to Mark It at (289) 337-9202 and the utility owner as soon as possible
- Each Locate Sketch is only valid for 30 days from the date of completion
- The markings may disappear or be misplaced. Should sketch markings not coincide, a new stakeout must be obtained.
- The CLIENT must not work outside the indicated Locate Area without a new locate.

INFO

Start Time ___ am/pm	End Time ___ am/pm	Locate It ___ hrs	GPS-Survey ___ hrs	Cad it ___ hrs	Sum It ✓ hrs	Call It ___ hrs	Report It ___ hrs	Camera It ___ hrs
Scan Noggin ___ hrs	Scan Conquest ___ hrs	Traffic It ___ hrs	CSE It ___ hrs	Record It ___ hrs	Vac/Flush It ___ hrs	PM It ___ hrs	FM It ___ hrs	
Mob It 1 #	Crew size: 2	Mark & Fax ☑ Yes	Photos 1992-2026 AC					

36 / AC
Locator I.D. / Initials

28 / 09 / 20
(dd / mm / yy)
Date

Client Company Acknowledgement

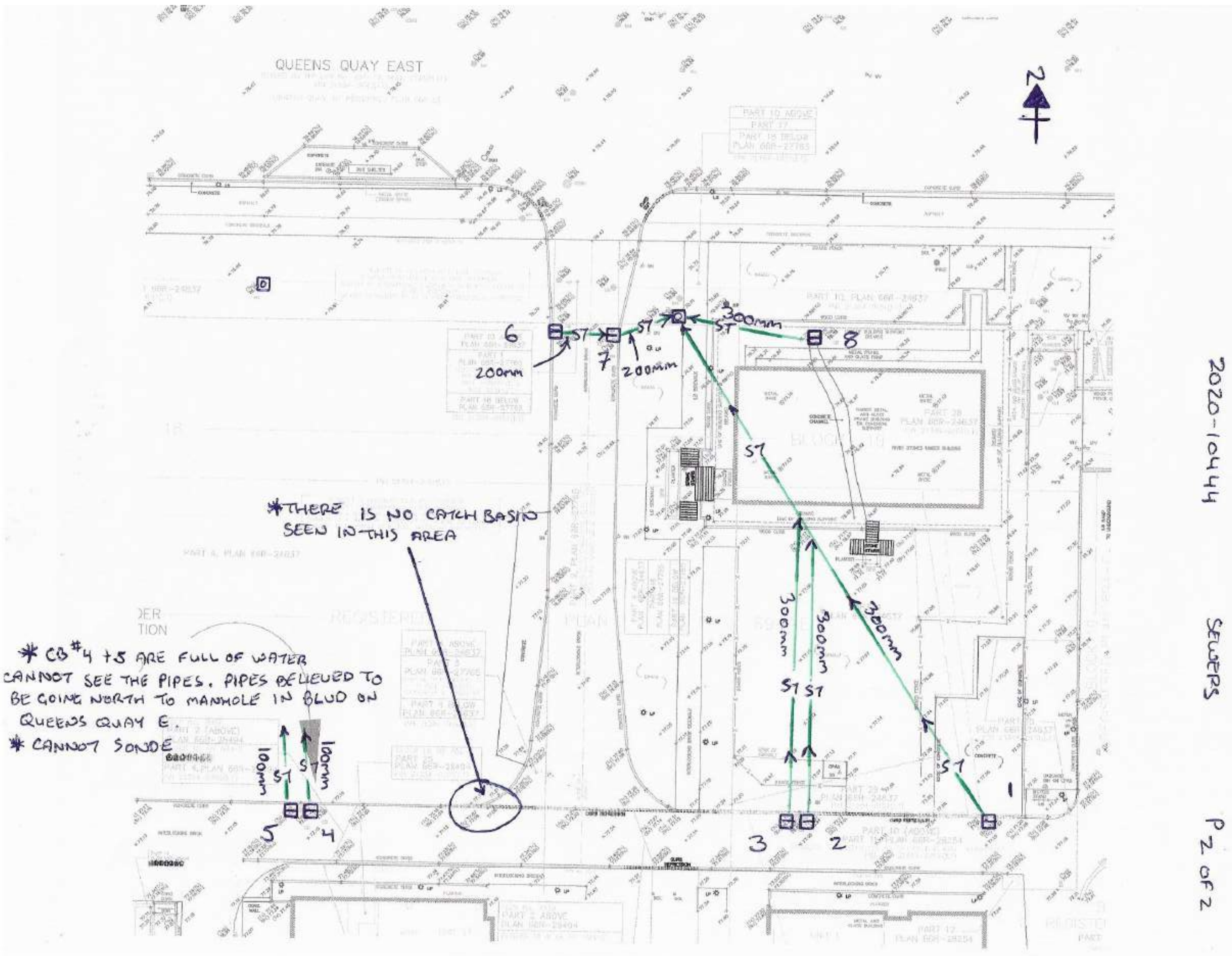
I have read and fully understand the Terms and Conditions shown on the reverse side of this form under which this information was provided. I further understand that this information is provided only for the convenience of the Client and does not relieve the Client for any claims or damages associated with subsequent activities and that Mark It Locates Inc. shall not be liable for any amount in excess of the fees paid by the Client under any circumstances. I understand that this information does not substitute for an authorized location by the owners of any underground plant. Mark It Locates Inc. cannot locate underground facilities unless the Client provides direct physical access to each individual underground facility.

Print name of client company representative

Client company representative signature

Revision Date October / 2017

White - Excavator Yellow - Customer Pink - Mark It


QUEENS QUAY EAST
N
6
7
8
200mm
200mm
300mm
ST
*THERE IS NO CATCH BASIN SEEN IN THIS AREA
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300mm
300mm
ST ST
* CB #4 + 5 ARE FULL OF WATER CANNOT SEE THE PIPES. PIPES BELIEVED TO BE GOING NORTH TO MANHOLE IN BLVD ON QUEENS QUAY E.
* CANNOT SONDE
100mm
100mm
5
4
3
2
1
2020-10444
SEWERS
P 2 OF 2