Ottawa Train Yards
200, 230, 260 Steamline Street
Ottawa, Ontario

Servicing Report & Stormwater Management

Type of Document
Site Plan Submission

Client:
Controlex Corporation

Project Number
OTT-00243332-A0

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Date Submitted
January 2018
Revised June 2018

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Legal Notification

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1.0 Introduction

Exp Services Inc. (**exp**) was retained by Ottawa Train Yards Inc. to prepare a servicing and stormwater management report for the proposed phased residential development located at 200, 230, 260 Steamline Street in the Ottawa Train Yards. The proposed development covers an area of 4.25ha, including 0.75ha of Steamline Street ROW. The project will be developed in multiple phases and is located east of Sandford Fleming Road and south of Terminal Avenue. Road access to the development will be provided by Steamline Street that will be connected to Sandford Fleming Road at the west end and Terminal Road on the north-east end. Since road access to the proposed development will primarily be from Steamline Street, design and construction of the Steamline Street will be completed as part of the residential development.

2.0 Steamline Street Design

Steamline Street will be a public local road with a 20m ROW. Design of the Steamline Street has been completed in accordance with the City of Ottawa design guidelines and will be submitted to the city together with the site plan control application for the residential development. The design of Steamline Street includes a 200mm diameter water main that will be connected to the existing 300mm diameter municipal watermain on Sandford Fleming Ave and to the existing 300mm diameter municipal watermain on Terminal Avenue. This water main will be the primary source of water supply for the proposed development. The Steamline Street design also includes a 600, 750 and 825mm diameter storm sewer that will convey storm water flows from the proposed development to the existing 900mm diameter storm sewer north of Steamline Street. The sanitary service for the development will be provided by a new 250mm diameter sanitary sewer along Steamline Street. The sanitary sewer will be connected to the 250mm diameter municipal sanitary sewer on Sandford Fleming Road at the west end of the Street and to the 250mm diameter municipal sanitary sewer at Terminal Avenue at the north-east end.

Due to limited capacity of the existing sanitary sewer on Sandford Fleming Road, only sanitary flows from phases 1 and 2 of the residential development will be conveyed to the municipal sewer along Sandford Fleming Ave. Sanitary flows from phase 3 of the proposed development will be conveyed to the existing sanitary sewer on Terminal Ave.

Capacity analysis of the existing municipal sanitary sewers on Sandford Fleming Road and Terminal Avenue are included in this report. Refer to Appendix C.

3.0 Water Servicing

The master servicing report for the subdivision completed in 2002 included a watermain hydraulic analysis that demonstrated that there was adequate water supply to support development of the subject site. The development will primarily be serviced by the new 200 mm diameter watermain along Steamline Street.

In order to lower the risk of water supply interruption each building will be provided with two 200mm diameter water services, separated by an isolation valve. Building # 100 will be serviced from the municipal water main along Sanford Fleming Road. The remaining buldings will be serviced from the new water main along Steamline Street. Water distribution system pressures were checked under maximum day conditions for all three phases of the development and fire water demand for building # 200. Results of analysis indicate that the water distribution system has residual pressure in excess of 140kPa (20psi) which is the minimum pressure required under the city of Ottawa water distribution guidelines.

The residential water demands for the proposed development was calculated based on City of Ottawa Water Distribution Design Guidelines (WDG001 2010) and Technical Bulletins ISDTB-2014-02 and ISTB-2018-02. Based on the proposed number and type of apartments, the proposed development will have 3389 residents. The total number of residents is calculated as follows:

Apartment Type	Persons per Unit	# of Units Phase 1	# of Units Phase 2	# of Units Phase 3	Total # of Units	Total Persons per Unit
Bachelor	1.4	47			47	66
1 Bedroom	1.4	185			185	259
2 Bedroom	2.1	184			184	386
3 Bedroom	3.1	4			4	12
Avg Apt	1.8		865	605	1 470	2645
					Total Pers:	**3368**

The domestic water demand for the proposed residential development is calculated as follows:

Water Demand:

Average daily demand:
=3368pers * 280 L/pers/day
=943 040 L/day x (1/86,400 sec/day)
= 10.9 L/sec

Maximum daily demand:
=2.5 x avg. day
=2.5 x 10.9 L/sec
=27.3 L/sec

Maximum hourly daily demand:
=2.2 x max.day
=2.2 x 27.3 L/sec
=60.1 L/sec

Fire water demand was calculated using the Fire Underwriters Survey criteria from the Office of the Fire Marshall, Ontario. A fire demand of 100 L/s was calculated for building # 200 which is the largest building in the proposed development. Refer to Appendix C for the fire flow calculations and boundary conditions. Fire flow demand was calculated assuming that the building is sprinklered, of fire-resistive construction with limited combustible contents. Refer to Appendix B for fir flow demand calculations.

The City of Ottawa provided boundary conditions at two locations under maximum day for all phases of development and fire water demand of 100L/s. The two boundary condition locations are at the intersection of Steamline Street and Terminal Avenue and intersection of Steamline Street and Sanford Fleming Road. Refer to Appendix B. The boundary conditions are as follows:

<u>Terminal Ave and Steamline Street intersection:</u>

Minimum HGL = 109.3m

Maximum HGL = 118.9m

Maximum Day + Fire Flow (100 L/s) HGL= 114.2m

<u>Sanford Fleming Road and Steamline intersection:</u>

Minimum HGL = 108.8m

Maximum HGL = 118.9m

Maximum Day + Fire Flow (100 L/s) HGL= 113.5m

Pressure checks were performed at the mid point of Steamline Street to check that whether adequate pressure will be available for the proposed development under maximum day + fire flow conditions. Pressure losses have been calculated from the two intersections to the mid point of Steamline Street. Refer to Appendix B for water pressure analysis.

<u>Terminal Ave and Steamline Street intersection:</u>

Road Elevation at the water main on Terminal Avenue is 65.46m

Pressure head at Terminal Avenue under the Max day + Fire scenario will be 114.2 – 65.46 = 48.74m

Water pressure at Terminal Avenue = 68.3psi

Length of 200mm diameter water service from 305mm municipal water main on Terminal Ave to the midpoint of Steamline Street= 201.3m

Hydraulic losses in 200m length of water main = 35.8psi

Pressure at midpoint of Steamline Street= 68.3 – 35.8 = 32.5psi

Available pressure at the building under maximum day + fire flow demand of 135.65 L/sec. is greater than 20psi.

<u>Sandford Fleming Ave and Steamline intersection:</u>

HGL at the 305mm diameter watermain on Sandford Fleming Ave intersection with Steamline Street:

Road Elevation at the water main on Sandford Fleming Ave is 65.55m

Pressure head at Sanford Fleming Avenue under the Max day + Fire scenario will be 113.5 – 65.55 = 47.95m

Water pressure at Sandford Fleming Ave = 69.2psi

Length of 200mm diameter water service from 305mm municipal water main on Sandford Fleming Ave to the middle of Steamline Street= 201.3m

Hydraulic losses in 200m length of water main = 27.8psi

Pressure at midpoint of Steamline Street= 69.2 – 27.8 = 41.4psi

Available pressure along Steamline Street under maximum day + fire flow demand of 135.65 L/sec is greater than 20psi.

Therefore, the existing 200mm diameter water main on Steamline Street will have adequate capacity to service the proposed buildings.

Steamline street is designed to be the fire access route for the proposed development. Fire hydrants are located along the south side of Steamline street with a maximum spacing of 90m as per City of Ottawa design guidelines. For phase I, the fire hydrant at the Sanford Fleming and Steamline intersection is to be reocated and will be within an unobstructed 45m from building 100's Siamese connection. Similarly, the fire hydrant north of building 200 will be within an unobstructed 45m to the Siamese connection as per the Onatrio Building Code.

4.0 Sanitary Sewer Servicing

Sanitary Sewer flows for the proposed development have been calculated in accordance with the City of Ottawa Sewer Design Guidelines (SDG002) and technical bulletin ISTB-2018-01. Refer to Appendix C for the Sanitary Sewer Design sheets. Sewage flows from phases 1 and 2 of the development will be conveyed to the existing 250mm diameter municipal sanitary sewer on Sanford Fleming Road. Due to limited capacity of sanitary sewer on Sanford Fleming Road, sewage flows from phase 3 will be directed to the municipal sanitary sewer on Terminal Avenue. Refer to the Sanitary Drainage Area Plan Figure SA-1 in Appendix C. The municipal sanitary sewers on Sanford Flemig Road and Terminal Avenue have adequate capacity to receive the flows from the proposed development. Capacity analysis of the existing municipal sanitary sewers is included in Appendix C.

The peak flow for phases 1 and 2 is estimated to be 22.39 L/s. The 250mm sanitary sewer on Steamline Street at a grade of 0.5% has a maximum capacity of 42 L/s, based on Manning's equation under full flow conditions. Therefore, the 250mm sanitary sewer on Steamline Street will be adequate to convey the estimated peak sewage flows from Phase 1 and Phase 2 of the development. The sewer design sheet and sanitary drainage area plan included in Appendix C confirm that the existing 250mm sanitary sewer on Sandform Fleming Ave has the capacity to convey the flows from existing developments on Sandform Fleming Ave as well as the flows from the Phase 1 and Phase 2 of the proposed development on Steamline street.

The estimated peak flow from Phase 3 of the development is of 11.36 L/s. The 250mm diameter sewer on Steamline Street at a grade of 0.3% has a maximum capacity of 32.6 L/s. Therefore, the 250mm sanitary sewer on Steamline Street will be adequate to convey the estimated peak sewage flows from Phase 3 to the sewer on Terminal Ave. The sewer design sheet and sanitary drainage area plan included in Appendix C confirm that the existing 250mm sanitary sewer on Terminal Ave has the capacity to convey the flows from existing developments on Terminal Ave as well as the flows from the Phase 3 of the proposed development on Steamline street.

5.0 Storm Servicing

5.1 Storm Servicing Criteria

The design criteria for storm servicing design is summarized below.

- Storm sewers have been designed and sized based on the rational formula and Manning's Equation under free flow conditions for the 5-year storm using a 15-minute inlet time.
- The City of Ottawa IDF curve was used for design purposes.
- Average runoff coefficients were calculated for each inlet drainage area using a runoff coefficient of 0.20 for pervious surfaces and 0.90 for impervious surfaces.
- Runoff coefficients for the 100-year storm were increased by 25% to a maximum of 1.00.

5.2 Storm Sewer Design

The storm water management for the proposed development will be completed in accordance with the design criteria established in the master site servicing report for the subdivision. A new storm sewer will be constructed along Steamline Street which will convey the storm water flows from the proposed development to the existing 900mm diameter storm sewer north of Steamline Street near the intersection with Sandford Fleming Ave, which outlets into the 1200 mm municipal sewer on Terminal Avenue.

6.0 Storm Water Management

6.1 Design Criteria

The major system design for the site development is summarized below.

- The major system has been designed to accommodate on-site detention with sufficient capacity to attenuate the 100-year storm water flows to 5-year pre-development levels. Overland flow routes are provided to convey overland flows towards Terminal Ave and Sandford Fleming Ave.
- On-site storage is provided and calculated for up to the 100-year design storm with maximum ponding depth of 300mm. Calculation of the required on-site storage volumes has been supported by calculations in Appendix A.
- The required storage volumes have been calculated based on the Modified Rational Method.
- The finished floor elevations of the proposed residential buildings are a minimum of 300mm above the overland flow route spill elevations.

6.1 Pre-Development Conditions

In the existing condition, the majority of the 3.5 ha site drains to the 900mm diameter storm sewer north of Steamline through a storm sewer network on the property. The master servicing report for the Ottawa Trainyards states that the release rate up to the 100-year event is to be controlled to the 5-year pre-development release rate, using a pre-development runoff coefficient of 0.4. This allowable release rate corresponds to an allowable release rate of 92.92 L/s/ha. The allowable release for each phase of the proposed residential development is calculated as follows:

Allowable Runoff Coefficient: 0.40 (C)
Rainfall Intensity: $I_{(5year,\ 15\ min)}$ = 83.56 mm/hr
Allowable Runoff Rate: Q = 2.78CiA = 2.78(0.4)83.56
Q = 92.92 L/s/ha

Phase 1 Site Area: 1.08 hectares (A)
Allowable Release Rate: Q = 1.08 ha x 92.92 L/s/ha = 100.3 L/s

Phase 2 Site Area: 1.46 hectares (A)
Allowable Release Rate: Q = 1.46 ha x 92.92 L/s/ha = 135.7 L/s

Phase 3 Site Area: 0.98 hectares (A)
Allowable Release Rate: Q = 0.98 ha x 92.92 L/s/ha = 91.1 L/s

Total allowable release rate for the Site: Q=100.3 L/s + 135.7 L/s + 91.1 L/s
Q=327.1 L/s

6.2 Storage Requirements

The allowable release rate from the 3.5ha site is 327.1 L/s. Runoff from the surface will be captured using deck drains that will drain into the storm water retention tanks which will be located below grade within the parking garage. The storm water tanks will be equipped with ICDs and backwater valves. Run off from the roof will be controlled using flow control roof drains.

The storm water retention tanks will be sized to provide the required storage for the 100-year storm event. The maximum ponding depth on the roof shall be limited to 150mm. The storage required was determined using the Modified Rational Method. Calculations are provided in Appendix A. Table 6.1 below summarizes the storage provided on rooftops and in storage tanks within the underground parking, for each phase of development.

Table 6. 1 Summary of 100-Year Storage Requirements

	# of Buildings	100 Year Allowable Release Rate (L/s)	100 Year Minimum Storage Required (m^3)	100 Year Rooftop Storage Volume Provided (m^3)	100 Year Storage Tanks Total Volume Required (m^3)
Phase 1	2	100.3	316	100	216
Phase 2	3	135.7	427	150	277
Phase 3	2	91.1	287	100	187
TOTALS:	7	327.1	1 030	350	680

Total storage volume required to restrict flows from the site to **327.1 L/s** was calculated to be **1030 m³** for the 100-year event.

Storage requirements for Phase 1 of development were determined assuming that 50 m^3 of storage will be provided on each of the roofs of Building 100 and Building 200. Each of the two storage tanks in Phase 1 was sized to receive half of the runoff from the surface, captured in the deck drains. Table 6.2 below summarizes the controlled release rates and storage requirements for Phase 1 of the development. It was determined that each retention tank will provide 112 m^3 of working storage volume.

Table 6. 2 Phase 1 Summary of 100-Year Storage Requirements

Phase 1 Area ID	Area (ha)	100 Year Controlled Release Rate (L/s)	100 Year Minimum Storage Required (m^3)	100 Year Minimum Storage Provided (m^3)
Building 100	0.13	6.4	50	65
Building 200	0.14	8.4	50	70
Cistern #1	0.41	42.5	112	112
Cistern #2	0.41	42.5	112	112
Total:	1.08	99.8	323.4	359

A 120mm plug type orifice will be provided at the outlet of each storage tank. With a maximum head of 2m the 120mm plug type orifice will have a maximum release rate of 42.5L/s during the 100-year event. Refer to Appendix A for orifice sizing calculations. Flow control roof drains with attenuate the 100-Year flows from Building 100 and Building 200 to 6.4 L/s and 8.4 L/s respectively. The controlled release rate from Phase 1 will be 99.8L/s during the 100-year event which is less than the allowable 100.3 L/s.

The roof drains will be equipped with flow control devices located on the roof. Refer to architect's roof layout plan for exact roof drain locations and to the mechanical consultant's plans for the specifications of the roof drain flow control devices. The storm water retention tanks will be located north of building 100 and 200 and will be equipped with overflow drains which will allow the stormwater runoff exceeding the 100-year event to bypass the plug type orifice. Storm services will connect building 100's renention tank to storm manhole 110 and building 200's rentention tank to storm manhole 109, respectively. Refer to the Legend, Notes & Details plan (LN) andf the locations and a cross section of the proposed retention tanks.

Surface storage on the site will not be provided since the deck drains will not be equipped with flow control devices. In the event that deck drains at the surface of the site become blocked, overland flow routes are provided across the site from south to north discharging to Steamline Street. Overland flow routes from Steamline Street are provide towards Terminal Ave and Sandford Fleming Ave. The finished floor elevations of the proposed buildings have been set to a minimum of 0.3m above the highest spill elevation of the overland flow routes.

7.0 Erosion and Sediment Controls during Construction

During all construction activities, erosion and sedimentation shall be controlled by the following techniques:

- limiting the extent of exposed soils at any given time,
- re-vegetation of exposed areas as soon as possible,
- installation of filter cloth between frame and cover on all proposed catch basins and catch basin manholes,
- silt fence to be installed 0.3 meters inside and along the site property lines,
- visual inspection shall be completed daily on sediment control barriers and any damage repaired immediately. Care will be taken to prevent damage during construction operations,
- in some cases barriers may be removed temporarily to accommodate the construction operations. The affected barriers will be reinstated at night when construction is completed,
- sediment control devices will be cleaned of accumulated silt as required. The deposits will be disposed of as per the requirements of the contract,
- during the course of construction, if the engineer believes that additional prevention methods are required to control erosion and sedimentation, the contractor will install additional silt fences or other methods as required to the satisfaction of the engineer, and
- construction and maintenance requirements for erosion and sediment controls are to comply with Ontario Provincial Standard Specification (OPSS) OPSS 805.

8.0 Summary

This servicing brief outlines the rationale which will be used to service the proposed development. The following summarizes the design for the site:

- The Steamline Street storm sewer system is sized to accommodate the 5-year design storm under free flow conditions.
- The allowable release rate from the proposed residential development site was based on the pre-development runoff coefficient of 0.4 and was determined to be 327.1 L/sec in a 5-year storm event.
- Flow from the site will be attenuated to the allowable release rate by two methods described below:
    - Runoff from the surface will be captured using decks drains that will drain to storage tanks equipped with inlet control devices, located below grade within the parking garage.
    - Flows from the roof of the building will be controlled using flow control roof drains
- An overland flow route is provided for the major storm events from south to north across the site, out letting onto Steamline Street. Overland flow routes are provided from Steamline Street to Terminal Ave and Sandford Fleming Ave.
- A 200mm looped watermain along Steamline Street connected to the the existing 300mm diameter municipal swatermain on Terminal Ave and Sandford Fleming Ave will meet the domestic and fire water requirements for the proposed development. Each building will be provided with two 200mm diameter services.
- Each Building will have a 250mm sanitary sewer service connected to the 250mm diameter sanitary sewer along Terminal Ave. Sanitary flows from Phase 1 and Phase 2 will be conveyed to the 250mm sanitary sewer on Sandford Fleming Ave. Sanitary flows from Phase 3 of the proposed development will be conveyed to the 250mm sanitary sewer on Terminal Ave.

Appendix A: Stormwater Management Design

Stormsewer Design Sheet

Storm Drainage Plan

Stormwater Management Design Sheets

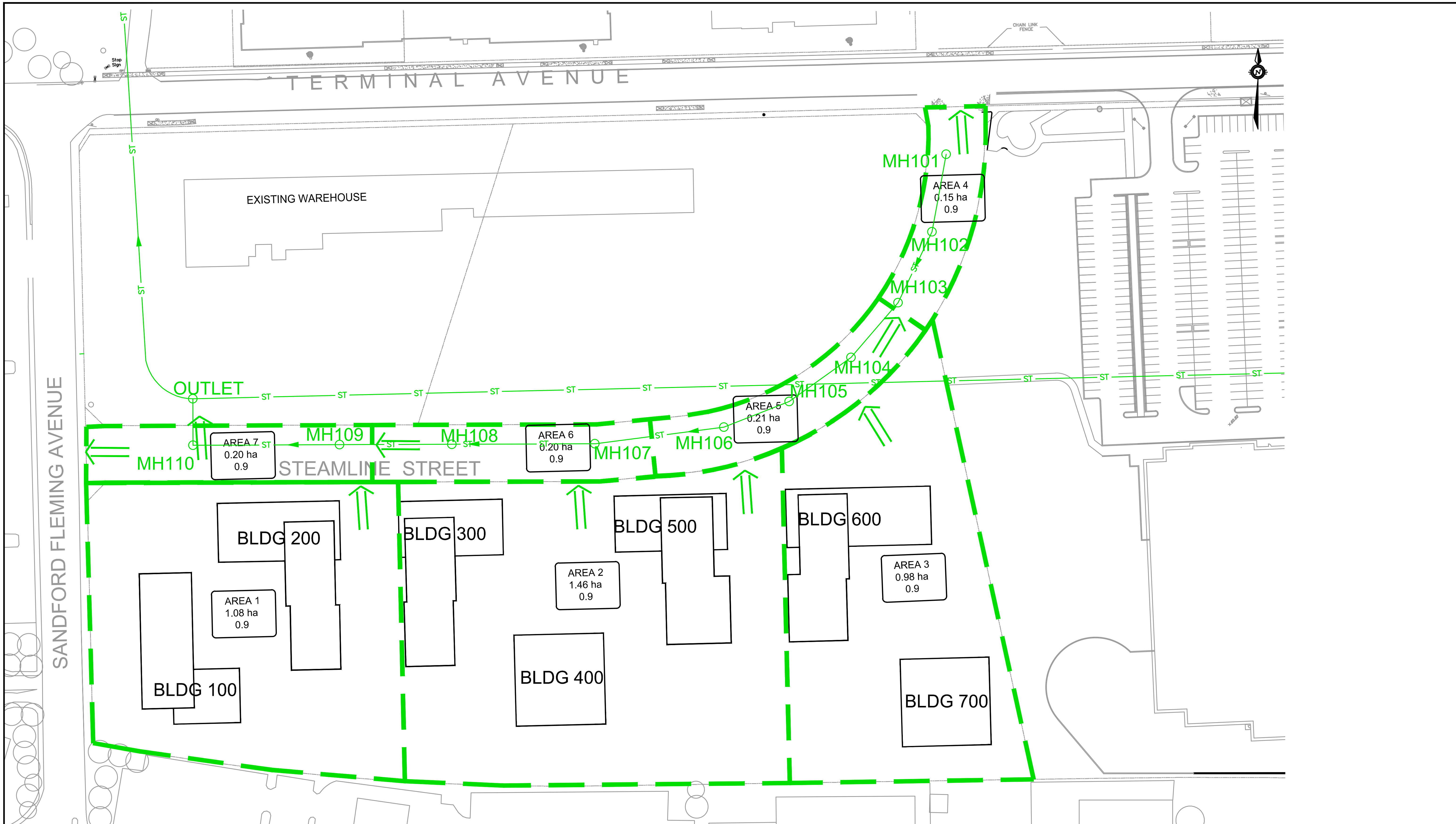
Stormwater Storage Tank Cross Section

Ottawa Trainyards - Steamline Street
Client: Controlex Realty Management
Project: OTT-00243332-A0
Date: January 2018

5 year Free Flow Storm Sewer Design Sheet

LOCATION FROM	LOCATION TO	Area (ha)	R=	INDIV 2.78 AR	ACCUM 2.78 AR	TIME OF CONC.	RAINFALL INTENSITY I	BLDG FLOW Q (l/s)	PEAK FLOW Q (l/s)	PIPE SIZE (mm)	PIPE SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW (min.)	EXCESS CAPACITY (l/s)	Q/Qfull
TRUNK A																	
STM101	STM102	0.15	0.90	0.39	0.39	10.00	104.19		40.15	600.0	0.70	27.6	514.24	1.82	0.25	474.09	0.08
STM102	STM103	0.00	0.90	0.00	0.39	10.25	102.87		39.64	600.0	0.70	27.5	514.24	1.82	0.25	474.60	0.08
Phase 3 Stub		0.49	0.90	1.23	1.23	10.00	104.19		127.74	375.0	1.00	10.0	175.51	1.59	0.10	47.77	0.73
Phase 3 Stub		0.49	0.90	1.23	1.23	10.00	104.19		127.74	375.0	1.00	10.0	175.51	1.59	0.10	47.77	0.73
STM103	STM104	0.00	0.90	0.00	2.84	10.51	101.60		288.26	600.0	0.70	25.3	514.24	1.82	0.23	225.98	0.56
STM104	STM105	0.00	0.00	0.00	2.84	10.74	100.45		285.01	600.0	0.70	26.6	514.24	1.82	0.24	229.23	0.55
STM105	STM106	0.21	0.90	0.52	3.36	10.98	99.28		333.35	600.0	0.70	24.6	514.24	1.82	0.23	180.89	0.65
STM106	STM107	0.00	0.90	0.00	3.74	11.21	98.22		367.64	600.0	0.70	46.0	514.24	1.82	0.42	146.60	0.71
Phase 2 Stub		0.73	0.90	1.83	1.83	10.00	104.19		190.30	450.0	1.00	10.00	285.39	1.79	0.09	95.09	0.67
Phase 2 Stub		0.73	0.90	1.83	1.83	10.00	104.19		190.30	450.0	1.00	10.00	285.39	1.79	0.09	95.09	0.67
STM107	STM108	0.00	0.90	0.00	7.40	11.63	96.31		712.28	750.0	0.70	44.00	932.37	2.11	0.35	220.09	0.76
STM108	STM109	0.20	0.90	0.49	7.89	11.98	94.79		747.80	750.0	0.70	45.10	932.37	2.11	0.36	184.57	0.80
Phase 1 Stub		0.54	0.90	1.35	1.35	10.00	104.19		140.77	375.0	1.00	10.00	175.51	1.59	0.10	34.73	0.80
Phase 1 Stub		0.54	0.90	1.35	1.35	10.00	104.19		140.66	375.0	1.00	10.00	175.51	1.59	0.10	34.85	0.80
STM109	STM110	0.20	0.90	0.50	11.09	12.33	93.29		1034.65	825.0	0.70	51.53	1202.18	2.25	0.38	167.53	0.86
STM110	Outlet	0.00	0.90	0.00	11.09	12.72	91.74		1017.47	825.0	0.91	15.40	1370.70	2.56	0.10	353.23	0.74
TOTAL		**4.28**		**10.70**		**12.82**						**393.7**					

Notes:
Rainfall Intensity = $998.071/(T+6.053)^{-0.814}$ T= time in minutes



LEGEND

AREA 1 0.76 ha 0.9	STORM DRAINAGE AREA NUMBER AREA IN HECTARES RUN-OFF COEFFICIENT
⇒	OVERLAND FLOW DIRECTION

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DESIGN ML	OTTAWA TRAIN YARDS 200, 230, 260 STEAMLINE ST	SCALE 1:1250
DRAWN ML		SKETCH NO
DATE JAN 2018	POST DEVELOPMENT STORM DRAINAGE PLAN	SWM-1
FILE NO OTT-00243332		

Ottawa Train Yards - 200, 230, 260 Steamline Street
Client: Controlex Realty Management
exp Project: OTT-00224645-A0
Date: January 2018

ALLOWABLE RELEASE RATE PER PHASE

QUANTITY STORAGE REQUIREMENTS - 100 Year

Phase 1

5 Year Event

	C	Intensity	Area
5 Year	0.40	83.56	1.080
2.78CIA=	100.35		
	100.3	L/s	

**Use a 15 minute time of concentration

1.080 = Area(ha)
1.00 = *C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	10	178.56	536.1	100.3	435.8	261.5
	20	119.95	360.1	100.3	259.8	311.7
100 YEAR	30	91.87	275.8	100.3	175.5	315.9
	40	75.15	225.6	100.3	125.3	300.6
	50	63.95	192.0	100.3	91.7	275.0
					Max =	**315.9**

Phase 2

5 Year Event

	C	Intensity	Area
5 Year	0.40	83.56	1.460
2.78CIA=	135.66		
	135.7	L/s	

1.460 = Area(ha)
1.00 = *C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	10	178.56	724.7	135.7	589.1	353.4
	20	119.95	486.9	135.7	351.2	421.4
100 YEAR	30	91.87	372.9	135.7	237.2	427.0
	40	75.15	305.0	135.7	169.3	406.4
	50	63.95	259.6	135.7	123.9	371.8
					Max =	**427.0**

Phase 3

5 Year Event

	C	Intensity	Area
5 Year	0.40	83.56	0.980
2.78CIA=	91.06		
	91.1	L/s	

0.980 = Area(ha)
1.00 = *C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	10	178.56	486.5	91.1	395.4	237.2
	20	119.95	326.8	91.1	235.7	282.9
100 YEAR	30	91.87	250.3	91.1	159.2	286.6
	40	75.15	204.7	91.1	113.7	272.8
	50	63.95	174.2	91.1	83.2	249.5
					Max =	**286.6**

Equations:
Flow Equation
Q = 2.78 x C x I x A
Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Ottawa Train Yards - 200, 230, 260 Steamline Street
Client: Controlex Realty Management
exp Project: OTT-00224645-A0
Date: June 2018

Phase 1 - Stormwater Management Summary

Sub Area I.D.	Sub Area (ha)	Composite C	100 Year Controlled Release (L/s)	100 year Storage Required (m^3)	100 Year Storage Provided (m^3)
Building 100	0.13	0.90	6.40	50	65
Building 200	0.14	0.90	8.4	50	70
Cistern #1	0.41	0.90	42.5	112	112
Cistern #2	0.41	0.90	42.5	112	112
TOTAL	**1.08**		**99.8**	**323.4**	**359.0**
	Total Allowable Release (L/s):		**100.3**		

Ottawa Train Yards - 200, 230, 260 Steamline Street
Client: Controlex Realty Management
exp Project: OTT-00224645-A0
Date: January 2018

Building 100 Roof Storage

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.13 = Area(ha)
1.00 = *C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd (m^3)	Storage Available (m^3)
100 YEAR	10	178.56	64.5	6.4	58.1	34.9	65.0
	20	119.95	43.4	6.4	37.0	44.3	65.0
	30	91.87	33.2	6.4	26.8	48.2	65.0
	40	75.15	27.2	6.4	20.8	49.8	65.0
	50	**63.95**	**23.1**	**6.4**	**16.7**	**50.1**	**65.0**
	60	55.89	20.2	6.4	13.8	49.7	65.0
	70	49.79	18.0	6.4	11.6	48.7	65.0

* Storage available is calculated using the building area mulitplied by the maximum ponding depth of 0.15m, and divided by 3 for a conical pond.

Equations:

Flow Equation
Q = 2.78 x C x I x A
Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Sample Calc:

Storage Available= $\frac{0.13 \times 10000 \times 0.15}{3}$ = 65 m3

Ottawa Train Yards - 200, 230, 260 Steamline Street
Client: Controlex Realty Management
exp Project: OTT-00224645-A0
Date: January 2018

Building 200 Roof Storage

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.14 = Area(ha)
1.00 = *C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd (m^3)	Storage Available (m^3)
100 YEAR	10	178.56	69.5	8.4	61.1	36.7	70.0
	20	119.95	46.7	8.4	38.3	45.9	70.0
	30	91.87	35.8	8.4	27.4	49.2	70.0
	40	**75.15**	**29.2**	**8.4**	**20.8**	**50.0**	**70.0**
	50	63.95	24.9	8.4	16.5	49.5	70.0
	60	55.89	21.8	8.4	13.4	48.1	70.0
	70	49.79	19.4	8.4	11.0	46.1	70.0

* Storage available is calculated using the building area mulitplied by the maximum ponding depth of 0.15m, and divided by 3 for a conical pond.

Equations:

Flow Equation
Q = 2.78 x C x I x A
Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Sample Calc:

Storage Available= $\frac{0.14 \times 10000 \times 0.15}{3}$ = 70 m3

Ottawa Train Yards - 200, 230, 260 Steamline Street
Client: Controlex Realty Management
exp Project: OTT-00224645-A0
Date: January 2018

Phase 1 Storage Tank Release Rates and Storage Requirements

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.41 = Area(ha) per storage tank
1.00 = *C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
100 YEAR	10	178.56	201.0	42.5	158.5	95.1
	15	142.89	160.9	42.5	118.4	106.5
	20	119.95	135.1	42.5	92.5	111.1
	25	103.85	116.9	42.5	74.4	111.6
	30	91.87	103.4	42.5	60.9	109.7
	35	82.58	93.0	42.5	50.5	106.0
	40	75.15	84.6	42.5	42.1	101.0

Orifice Sizing

Event	Flow (L/s)	Head (m)	ORIFICE AREA(m^2)	SQUARE (1-side mm)	CIRC (mmØ)
100 Year	42.5	2.00	0.011	106	120

Orifice Control Sizing
Q = 0.6 x A x (2gh)1/2
Where:
Q is the release rate in m^3/s
A is the orifice area in m^2
g is the acceleration due to gravity, 9.81m/s^2
h is the head of water above the orifice centre in m
d is the diameter of the orifice in m

Equations:

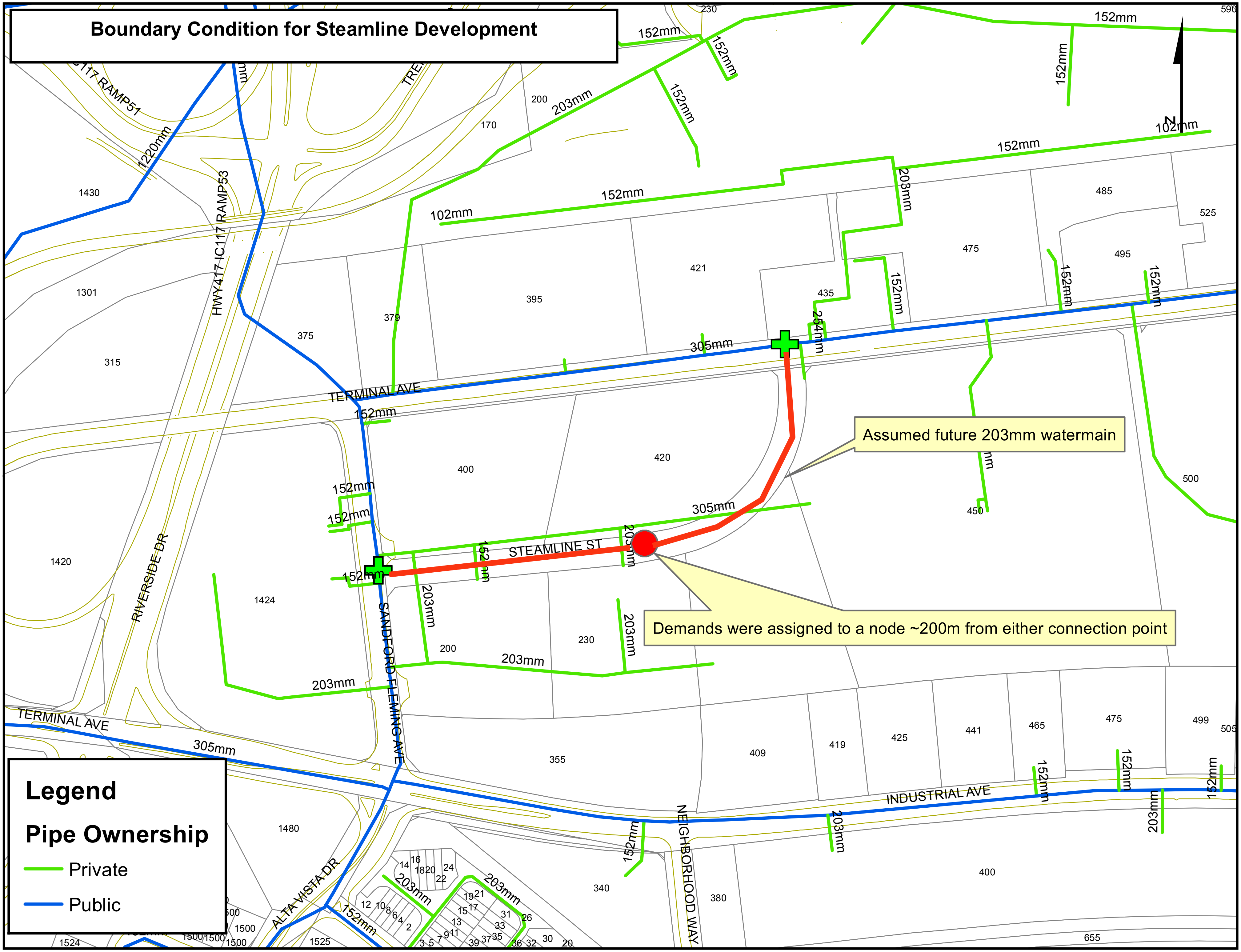
Flow Equation
Q = 2.78 x C x I x A
Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Appendix B: Water

Boundary Conditions

Fire Flow Calculations

Water Pressure Analysis


Boundary Condition for Steamline Development
Assumed future 203mm watermain
Demands were assigned to a node ~200m from either connection point
Legend
Pipe Ownership
Private
Public
TERMINAL AVE
STEAMLINE ST
SANDFORD FLEMING AVE
INDUSTRIAL AVE
NEIGHBORHOOD WAY
RIVERSIDE DR
ALTA VISTA DR
HWY417-IC117 RAMP53
IC117 RAMP51
305mm
203mm
152mm
102mm
254mm
1220mm
N

Marc Alain Lafleur

From: Oram, Cody <Cody.Oram@ottawa.ca>
Sent: Wednesday, December 20, 2017 10:28 AM
To: Marc Alain Lafleur
Cc: Alam Ansari
Subject: RE: Steamline Residential Development - Request for Water Boundary Conditions
Attachments: Steamline Development Dec 2017.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

The following are boundary conditions, HGL, for hydraulic analysis at Steamline Development (zone 1E) assumed to be connected to the 305mm on Terminal and 305mm on Sandford Flemming (see attached PDF for location).

	305mm on Terminal	305mm on Sandford Flemming
	HGL (m)	HGL (m)
Min HGL	109.3	108.8
Max HGL	118.9	118.9
Max Day + Fire Flow (100 L/s)	114.2	113.5

Assumed a future 200mm watermain (loop, ~400m long) on Steamline between both connection points. Demands were assigned at the middle of this future watermain

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

Cody Oram, P.Eng. Senior Engineer
Development Review, South Services
Planning, Infrastructure and Economic Development Department | Services de planification, d'infrastructure et de développement économique
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West. Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1

613.580.2424 ext./poste **13422**, fax/téléc:613-580-2576, cody.oram@ottawa.ca

From: Marc Alain Lafleur [mailto:MarcAlain.Lafleur@exp.com]
Sent: Wednesday, December 13, 2017 4:59 PM
To: Oram, Cody <Cody.Oram@ottawa.ca>
Cc: Alam Ansari <alam.ansari@exp.com>
Subject: RE: Steamline Residential Development - Request for Water Boundary Conditions

Hi Cody,

Please find attached FUS calculation sheet for the fireflow calculation.

We have revised the domestic demands to include the 3 phases of residential development along Steamline Street, as well as the future commercial development north of Steamline.
The revised demands are as follows:

Average day:	14.6L/s	(13.7L/s Residential and 0.94L/s Commercial)
Max day:	35.65L/s	(34.25L/s Residential and 1.4L/s Commercial)
Peak Hour:	77.85L/s	(75.35L/s Residential and 2.5L/s Commercial)
Max Day + Fire	135.65L/s	

Please let me know if you would like to discuss.

Thank you

Marc Alain Lafleur, M.Eng., P.Eng.
Project Engineer, Infrastructure
exp Services Inc.
t: +1.613.688.1899 x3298 | e: marcalain.lafleur@exp.com
100-2650 Queensview Drive
Ottawa, ON K2B 8H6
Canada

From: Oram, Cody [mailto:Cody.Oram@ottawa.ca]
Sent: Wednesday, December 13, 2017 4:08 PM
To: Marc Alain Lafleur <MarcAlain.Lafleur@exp.com>
Cc: Alam Ansari <alam.ansari@exp.com>
Subject: RE: Steamline Residential Development - Request for Water Boundary Conditions

Hi Marc,

Will the property north of Steamline be serviced from this watermain in the future? If so an estimated water demand based on future use should be included when designing the watermain.

Also the fire flow seems low. Please provide calculations to support. When calculating the fire flow requirements and affected pipe sizing, designers shall use the FUS method.

Regards,
Cody

From: Marc Alain Lafleur [mailto:MarcAlain.Lafleur@exp.com]
Sent: Wednesday, December 13, 2017 1:33 PM
To: Oram, Cody <Cody.Oram@ottawa.ca>
Cc: Alam Ansari <alam.ansari@exp.com>
Subject: Steamline Residential Development - Request for Water Boundary Conditions

Hi Cody,

Can you please provide the boundary conditions for the proposed Residential development on Steamline Street in the Ottawa Train Yards?

The attached map identifies the locations of the proposed watermain connections. Water looping will be provided from the 300mm diameter watermain on Terminal Ave and the 300mm diameter watermain on Sandford Fleming Ave.

The water demands are as follows:
Average Day demand: 1.9L/s
Max Day: 4.8L/s
Peak Hour: 10.6L/s
Max Day + Fire: 104.8L/s

Please let me know if you require any further information.

Thank you.

Marc Alain Lafleur, M.Eng., P.Eng.
Project Engineer, Infrastructure
exp Services Inc.
t: +1.613.688.1899 x3298 | e: marcalain.lafleur@exp.com
100-2650 Queensview Drive
Ottawa, ON K2B 8H6
Canada

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This e-mail originates from the City of Ottawa e-mail system. Any distribution, use or copying of this e-mail or the information it contains by other than the intended recipient(s) is unauthorized. Thank you.

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'

TABLE 1: FIRE FLOW REQURIEMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
MODIFIED AS PER TECHNICAL BULLETIN ISTB-2018-02
PROJECT: OTY Steamline Multi Residence

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input	Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Fire Resistive Construction	0.6	
	Ordinary Construction	1			
	Non-combustible Construction	0.8			
	Fire Resistive Construction	0.6			
Input Building Floor Areas (A)	Floor 3-8		3695	6495.0 m²	
	Floor 2		1400		
	Floor 1		1400		
	Basement (At least 50% below grade, not included)		0		
Fire Flow (F)	F = 220 * C * SQRT(A)				10,638
Fire Flow (F)	Rounded to nearest 1,000				**11,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,650	9,350
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	Adequate Sprinkler Conforms to NFPA13	-30%	-2,805	6,545
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	-1,100	5,445
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-1,100	4,345
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	36	5	30.1 to 45	Type B	50	16	800	5E	5%	20%	1,870	6,215
	Side 2	85	6	> 45.1	Type B	51	1	51	6	0%			
	Side 3	24	4	20.1 to 30	Type B	54	30	1620	4E	10%			
	Side 4	45	5	30.1 to 45	Type B	36.8	2	73.6	5C	5%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**6,000**
	Total Required Fire Flow, L/s =												**100**

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

Ottawa Train Yards
200, 230, 260 Steamline Street
Client: Controlex
exp Project: Ott-00243332-A0
Date: January 2018

Pressure check at Building 590 for Max Day + Fireflow

Max day35.65L/s) + FireFlow(100L/s) HGL=	**113.5 m**	**Terminal Ave**
Max day35.65L/s) + FireFlow(100L/s) HGL=	**114.2 m**	**Sanford Fleming Ave**

Description	From	To	Flow (L/sec)	Pipe Dia (mm)	Dia (m)	Q (m³/sec)	Area (m2)	C	Vel (m/s)	Slope of HGL (m/m)	Pipe Length (m)	Frictional Head Loss hf (m)	Equivalent Pipe Length of Fittings (m)	Minor Loss of Fittings hb (m)	Total Losses (m) hb + hf	Start Ground Elev(m)	End Ground Elev (m)	Static Head (m)	Pressure From kPa	(psi)	Pressure To kPa	(psi)	Pressure Drop (psi)
Max Day + Fire Flow	Main Terminal Ave	0+210	135.65	200	0.200	0.13565	0.0314159	125	4.3179	0.0875	201.3	17.60462331	84.8	7.41616	25.02078	65.46	65.60	-0.14	471.1	(68.3)	224.4	(32.5)	35.8
Max Day + Fire Flow	Main Sandford Flemming	0+210	135.65	200	0.200	0.13565	0.0314159	125	4.3179	0.0875	201.3	17.60462331	21.8	1.90651	19.51113	65.55	65.60	-0.05	477.1	(69.2)	285.3	(41.4)	27.8

Resistance of Fittings and Valves for 200mm WM from Terminal to 0+200

Fittings	Loss in Equiv. Length in Pipe Diameters	Equiv. Length (metres)	Quantity (each)	Total Equiv. Length (m)
Standard 90^0 Elbow	32	6.40	9	57.6
11.25 Degree Elbow	4	0.80	8	6.4
45 Degree Elbow	16	3.20	0	0
Gate Valve Full -Open	13	2.60	8	20.8
		Total:	**25**	**84.8**

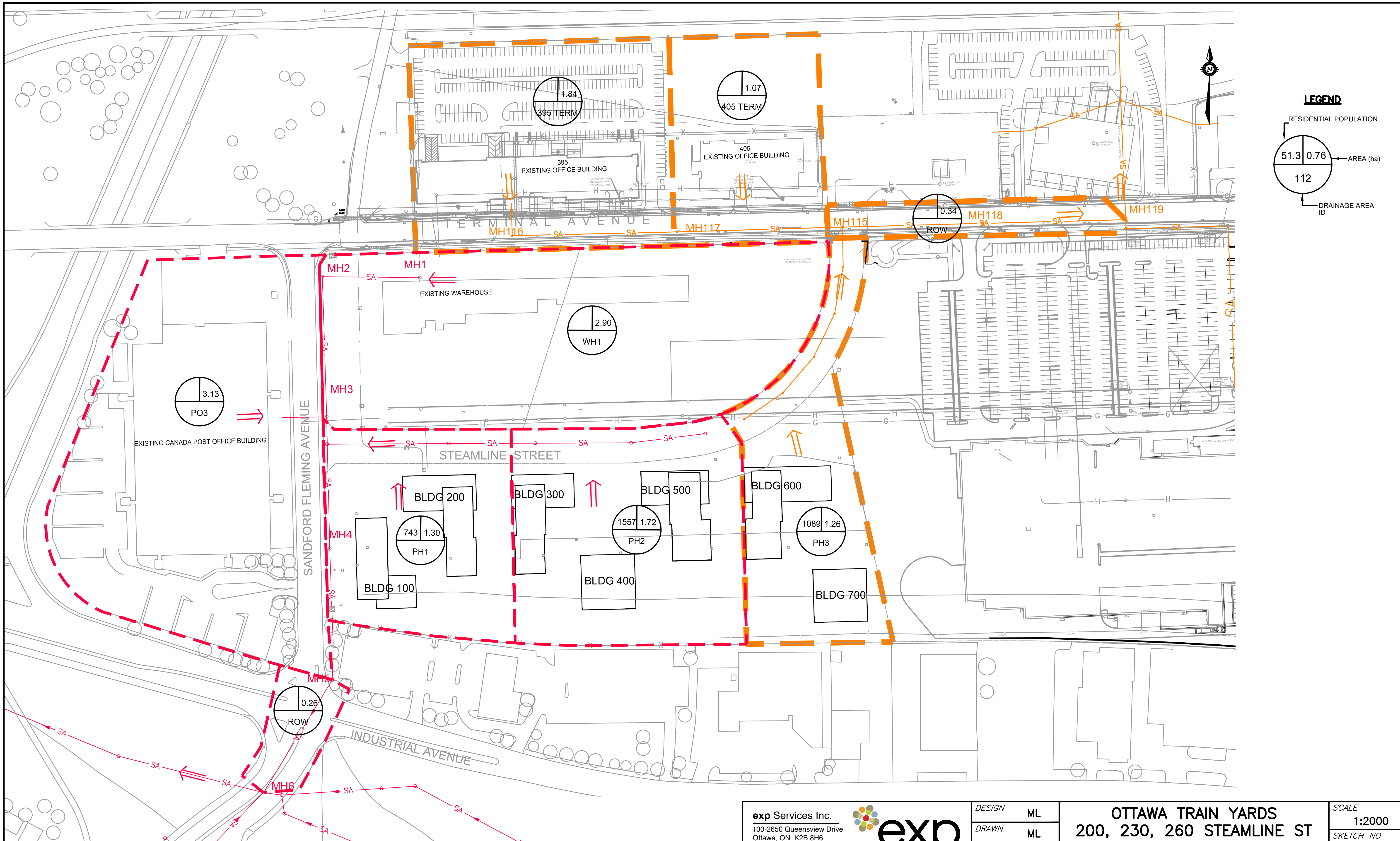
Resistance of Fittings and Valves for 200mm WM from Sanford Fleming to 0+200

Fittings	Loss in Equiv. Length in Pipe Diameters	Equiv. Length (metres)	Quantity (each)	Total Equiv. Length
Standard 9(	32	6.40	2	12.8
11.25 Degre	4	0.80	0	0
45 Degree E	16	3.20	2	6.4
Gate Valve	13	2.60	1	2.6
		Total:	**5**	**21.8**

Appendix C: Sanitary Sewer Design

Sanitary Drainage Area Plan

Sanitary Sewer Design Sheets



exp Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6
www.exp.com

DESIGN ML	OTTAWA TRAIN YARDS 200, 230, 260 STEAMLINE ST	SCALE 1:2000	
DRAWN ML		SKETCH NO	
DATE JAN 2018	SANITARY DRAINAGE AREA PLAN	SA–1	
FILE NO OTT–00243332			

exp.

SANITARY SEWER CALCULATION SHEET - Sandford Fleming Ave 250mm Dia. Sewer

LOCATION				RESEDENTIAL AREAS AND POPULAITONS										COMMERCIAL			INSTITUTIONAL		INFILTRATION				SEWER DATA						
										POPULATION				AREA (ha)					AREA (ha)										
Street	MH From	MH To	ID	Area (ha)**	Bachelor	1-Bed Apt.	2-Bed Apt.	3-Bed Apt.	Avg. Apt.	INDIV	ACCU	Peak Factor	Peak Flow (L/sec)	INDIV	ACCU	Peak Flow (L/sec)	AREA (Ha)	ACCU AREA (Ha)	INDIV	ACCU	INFILT FLOW (L/s)	TOTAL FLOW (L/s)	Nom Dia (mm)	Actual Dia (mm)	Slope (%)	Length (m)	Capacity (L/sec)	Q/Q_{CAP} (%)	Full Velocity (m/s)
380 Terminal Ave	MH1	MH2	WH1	2.9000										2.260	2.26	1.0986111			2.900	2.900	0.96	1.10	250	251.46	0.25	57.000	30.2	4%	0.606575756
	MH2	MH3													2.26	1.0986111				2.900	0.96	1.10	250	251.46	0.50	82.000	42.7	3%	0.86
															2.26	1.0986111				2.900	0.96	1.10							
BLD 100/200 - Steamline Rd		MH3	PH1	0.2000	47.00	185	184	4		723.6	723.6	3.31	7.76		2.26	1.0986111			0.200	3.100	1.02	8.86							
BLD 300/400/500 - Steamline Rd		MH3	PH2	0.2700					865	1557	2280.6	3.03	22.39		2.26	1.0986111			0.270	3.370	1.11	23.49							
1424 Sandford Fleming	MH3	MH4	PO3	3.1300							2280.6	3.03	22.39	2.600	4.86	2.3625			3.130	6.500	2.15	24.76	250	251.46	0.81	77.000	54.4	46%	1.09
											2280.6	3.03	22.39		4.86	2.3625				6.500	2.15	24.76	250	251.46	0.86	77.000	56.0	44%	1.13
	MH4	MH5									2280.6	3.03	22.39		4.86	2.3625				6.500	2.15	24.76	250	251.46	0.44	15.868	40.1	62%	0.81
Intersection Sandford Flemming & Industrial	MH5	MH6	ROW	0.26							2280.6	3.03	22.39		4.86	2.3625			0.260	6.760	2.23	26.99	250	251.46	0.42	77.000	39.1	69%	0.79
				6.760		**185**			**865**	**2281**									**6.760**			**136.91**							

Residential Avg. Daily Flow, q (L/p/day) = 280
Commercial Avg. Daily Flow (L/gross ha/day) = 28,000
or L/gross ha/sec = 0.324
Institutianal Avg. Daily Flow (L/s/ha) = 35,000
or L/gross ha/sec = 0.405
Light Industrial Flow (L/gross ha/day) = 35,000
or L/gross ha/sec = 0.405093
Light Industrial Flow (L/gross ha/day) = 55,000
or L/gross ha/sec = 0.637

Commercial Peak Factor = 1.5 (when area >20%)
1.0 (when area <20%)
Institutional Peak Factor = 1.5 (when area >20%)
1.0 (when area <20%)
Residential Correction Factor, K = 0.80
Manning N = 0.013
Peak extraneous flow, I (L/s/ha) = 0.33 (Total I/I)

Peak Population Flow, (L/sec) = P*q*M/86.4
Peak Extraneous Flow, (L/sec) = I*Ac
Residential Peaking Factor, M = 1 + (14/(4+P^0.5)) * K
A_c = Cumulative Area (hectares)
P = Population (thousands)
Sewer Capacity, Qcap (L/sec) = $1/N \; S^{1/2} R^{2/3} A_c$
(Manning's Equation)

Unti Type	Persons/Unit
Bachelor	1.4
Single Apt. Unit	1.4
2-bed Apt. Unit	2.1
3-bed Apt. Unit	3.1
Average Apt. Unit	1.8

**Infiltration areas do not include areas consisting of undeground parking structures.

Designed:	Project:
M.A. Lafleur, P.Eng.	Steamline Rd Multi- Res Project
Checked:	Location:
A. Ansari, P.Eng.	Ottawa, Ontario
File Reference:	Page No:
243332 SAN Design Sheet Sanford Fleming.xlsx	**1 of 1**

User Input Requried
Formula that user will need to copy down and UPDATE as requried.
Formula that user will need to copy down as requried
Project Information to be updated
Design Parameter that user should review

SANITARY SEWER CALCULATION SHEET - Terminal Ave 250mm Dia. Sewer

LOCATION				RESEDENTIAL AREAS AND POPULAITONS										COMMERCIAL			INSTITUTIONAL		INFILTRATION				SEWER DATA						
										POPULATION				AREA (ha)					AREA (ha)										
Street	MH From	MH To	ID	Area (ha)**	Bachelor	1-Bed Apt.	2-Bed Apt.	3-Bed Apt.	Avg. Apt.	INDIV	ACCU	Peak Factor	Peak Flow (L/sec)	INDIV	ACCU	Peak Flow (L/sec)	AREA (Ha)	ACCU AREA (Ha)	INDIV	ACCU	INFILT FLOW (L/s)	TOTAL FLOW (L/s)	Nom Dia (mm)	Actual Dia (mm)	Slope (%)	Length (m)	Capacity (L/sec)	Q/Q_{CAP} (%)	Full Velocity (m/s)
395 Terminal	MH116	MH117	395 Term	1.8400								4.00		1.500	1.5	0.73			1.84	1.84	0.61	0.73	250	251.46	0.28	96.400	32.0	2%	0.64
												4.00			1.5	0.73				1.84	0.61	0.73							
405 Terminal	MH117	MH115	405 Term	0.2000								4.00		0.870	2.37	1.15			0.20	2.04	0.67	1.15	250	251.46	0.28	96.400	32.0	4%	0.64
												4.00			2.37	1.15				2.04	0.67	1.15							
Steamline - Phase 3		MH115	PH3	0.1800					605	1089	1089	3.22	11.36		2.37	1.15			0.18	2.22	0.73	12.52							
	MH118	MH119	ROW	0.3400							1089	3.22	11.36		2.37	1.15			0.34	2.56	0.84	12.52	250	251.46	0.28	81.800	32.0	39%	0.64
				2.560					**605**	**1089**									**2.560**			**28.79**							

Residential Avg. Daily Flow, q (L/p/day) =	280	Commercial Peak Factor =	1.5	(when area >20%)	Peak Population Flow, (L/sec) =	P*q*M/86.4	Unti Type / Persons/Unit
Commercial Avg. Daily Flow (L/gross ha/day) =	28,000		1.0	(when area <20%)	Peak Extraneous Flow, (L/sec) =	I*Ac	Bachelor 1.4
or L/gross ha/sec =	0.324				Residential Peaking Factor, M =	1 + (14/(4+P^0.5)) * K	Single Apt. Unit 1.4
Institutianal Avg. Daily Flow (L/s/ha) =	35,000	Institutional Peak Factor =	1.5	(when area >20%)	A_c = Cumulative Area (hectares)		2-bed Apt. Unit 2.1
or L/gross ha/sec =	0.405		1.0	(when area <20%)	P = Population (thousands)		3-bed Apt. Unit 3.1
Light Industrial Flow (L/gross ha/day) =	35,000						Average Apt. Unit 1.8
or L/gross ha/sec =	0.405093	Residential Correction Factor, K =	0.80		Sewer Capacity, Qcap (L/sec) =	$1/N \; S^{1/2} \; R^{2/3} \; A_c$	
Light Industrial Flow (L/gross ha/day) =	55,000	Manning N =	0.013		(Manning's Equation)		
or L/gross ha/sec =	0.637	Peak extraneous flow, I (L/s/ha) =	0.33	(Total I/I)			

**Infiltration areas do not include areas consisting of undeground parking structures.

Designed:	Project:
M.A. Lafleur, P.Eng.	Steamline Rd Multi- Res Project
Checked:	Location:
A. Ansari, P.Eng.	Ottawa, Ontario
File Reference:	Page No:
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User Input Requried
Formula that user will need to copy down and UPDATE as requried.
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Project Information to be updated
Design Parameter that user should review