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

Servicing Report & Stormwater Management

Type of Document
Site Plan Submission

Client:
Ottawa Train Yards Inc.

Project Number
OTT-00243332-A0

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Canada

Date Submitted
January 2018

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Date Submitted:
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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 300mm diameter municipal watermain on Sandford Fleming Ave and to the 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 and 750mm 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). 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	52			52	73
1 Bedroom	1.4	155			155	217
2 Bedroom	2.1	189			189	397
3 Bedroom	3.1	18			18	56
Avg Apt	1.8		865	605	1 470	2645
					Total Pers:	**3389**

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

Water Demand:

Average daily demand:
=3389pers * 350 L/pers/day
=1 186 150L/day x (1/86,400 sec/day)
= 13.7 L/sec

Maximum daily demand:
=2.5 x avg. day
=2.5 x 13.7 L/sec
=34.25 L/sec

Maximum hourly daily demand:
=2.2 x max.day
=2.2 x 34.25 L/sec
=75.35 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:

Terminal Ave and Steamline Street intersection:

Minimum HGL = 109.3m

Maximum HGL = 118.9m

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

Sanford Fleming Road and Steamline intersection:

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.

Terminal Ave and Steamline Street intersection:

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.

Sandford Fleming Ave and Steamline intersection:

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.

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). 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 32.98 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 Streetwill be adequate to convey the estimated peak sewage flows from Phase 1 and Phase 2 of development. The sewer design sheet and sanitary drainage area plan included in Appendix C confirm that the 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 16.7L/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 Streetwill 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 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 storm water retention tanks will be equipped with overflow drains which will allow the stormwater runoff exceeding the 100-year event to bypass the plug type orifice. Refer to Appendix A for 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 150mm 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.

exp Services Inc.

Controlex Corporation
Ottawa Train Yards
200, 230, 260 Steamline Street
OTT-00243332-A0
January 2018

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		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
FROM	TO																
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 = $998.071/(T+6.053)^{\wedge -0.814}$ T= time in minutes

TERMINAL AVENUE

SANDFORD FLEMING AVENUE

STEAMLINE STREET

EXISTING WAREHOUSE

CHAIN LINK FENCE

Stop Sign

OUTLET

MH101

MH102

MH103

MH104

MH105

MH106

MH107

MH108

MH109

MH110

AREA 1
1.08 ha
0.9

AREA 2
1.46 ha
0.9

AREA 3
0.98 ha
0.9

AREA 4
0.15 ha
0.9

AREA 5
0.21 ha
0.9

AREA 6
0.20 ha
0.9

AREA 7
0.20 ha
0.9

BLDG 100

BLDG 200

BLDG 300

BLDG 400

BLDG 500

BLDG 600

BLDG 700

ST

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
DRAWN	ML
DATE	JAN 2018
FILE NO	OTT–00243332

OTTAWA TRAIN YARDS
200, 230, 260 STEAMLINE ST

POST DEVELOPMENT STORM DRAINAGE PLAN

SCALE 1:1250

SKETCH NO SWM–1

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

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

Phase 2

5 Year Event

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

Phase 3

5 Year Event

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

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

QUANTITY STORAGE REQUIREMENTS - 100 Year

Phase 1

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

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

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**

Ottawa Train Yards - 200, 230, 260 Steamline Street
Client: Controlex Realty Management
exp Project: OTT-00224645-A0
Date: January 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**	**223.2**
	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)
	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
100 YEAR	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

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)
	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
100 YEAR	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

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
	10	178.56	201.0	42.5	158.5	95.1
	15	142.89	160.9	42.5	118.4	106.5
100 YEAR	**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, $9.81 m/s^2$

h is the head of water above the orifice centre in m

d is the diameter of the orifice in m

Equations:

Flow Equation

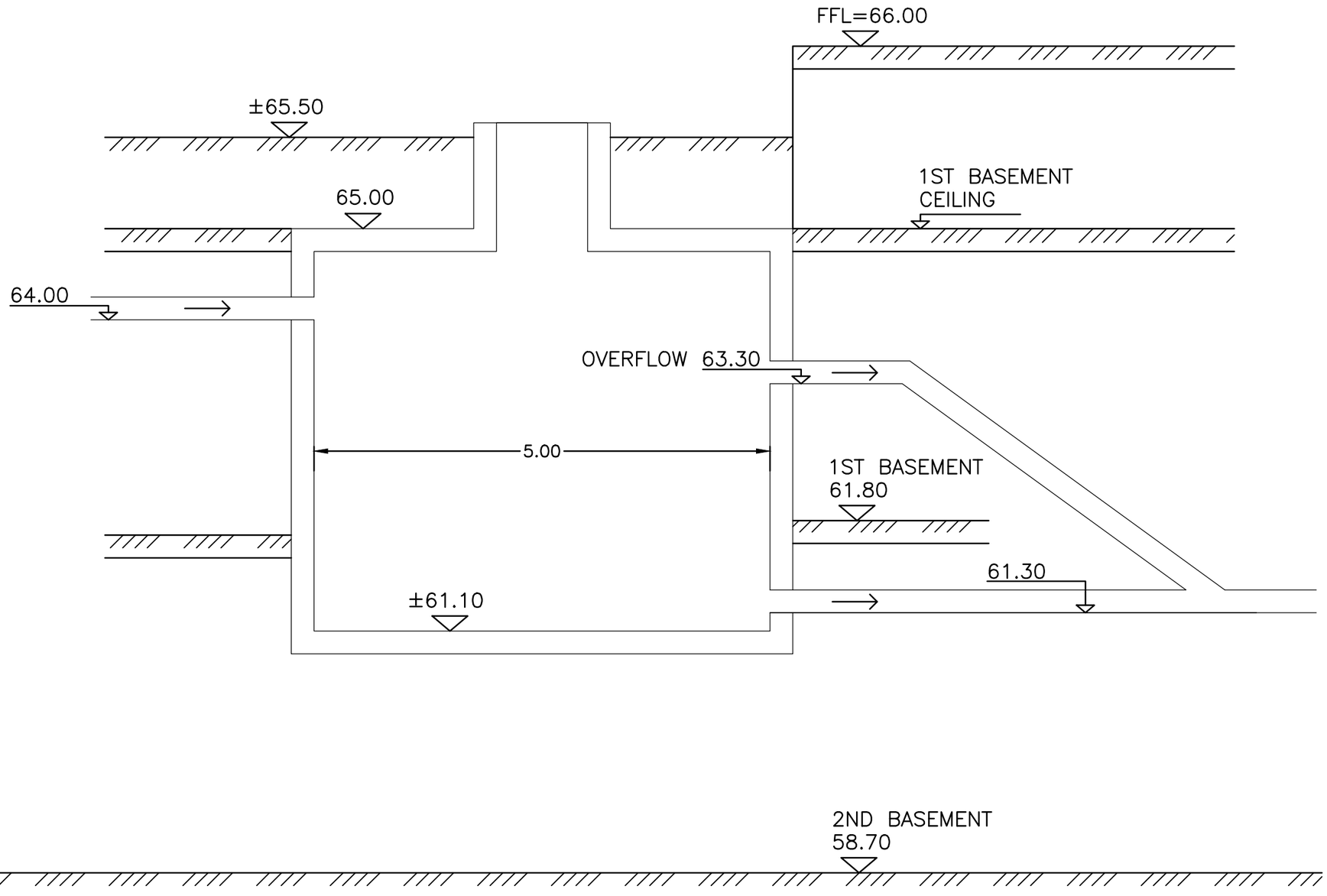
Q = 2.78 x C x I x A

Where:

C is the runoff coefficient

I is the intensity of rainfall, City of Ottawa IDF

A is the total drainage area



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

DESIGN	AA
DRAWN	AE
DATE	DEC 2017
PROJECT NO	OTT-000243332-A0

STEAMLINE STREET
MULTI RESIDENTIAL BUILDINGS

STORM WATER STORAGE TANK

SCALE: N.T.S
SKETCH NO: FIG 1

exp Services Inc.

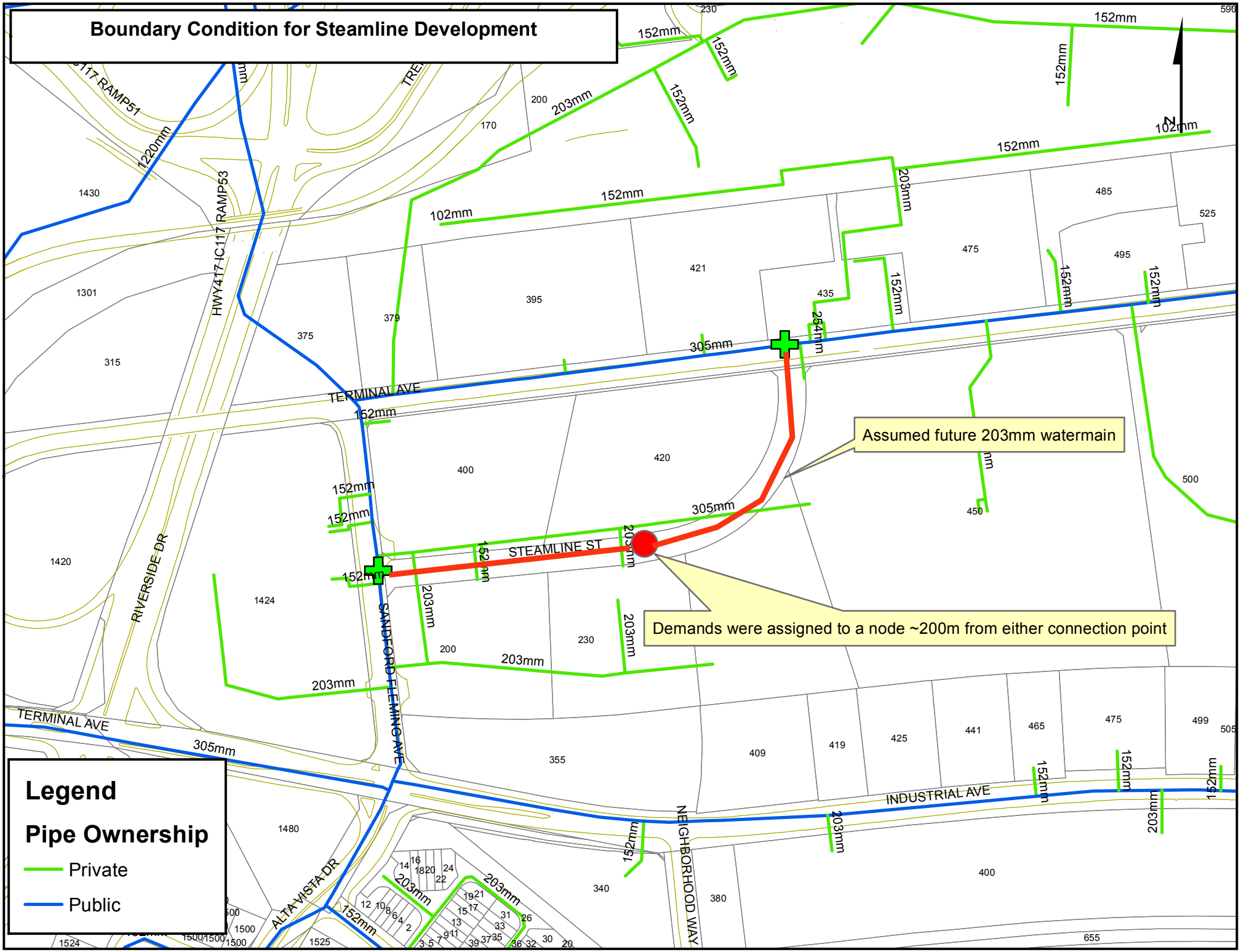
Controlex Corporation
Ottawa Train Yards
200, 230, 260 Steamline Street
OTT-00243332-A0
January 2018

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
TERMINAL AVE
STEAMLINE ST
INDUSTRIAL AVE
SANDFORD FLEMING AVE
RIVERSIDE DR
ALTA VISTA DR
NEIGHBORHOOD WAY
HWY417-IC117 RAMP53
IC117 RAMP51
Legend
Pipe Ownership
Private
Public

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

exp.com | *legal disclaimer*

keep it green, read from the screen

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.
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Canada

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FIRE FLOW CALCULATION

Date Printed: 1/18/2018

Client	Controlex
Project	OTY Steamline
Project No.	OTT-000243332-A0
Date	13-Dec-17
Prepared By	ML
Reviewed By	AA

ORDINARY CONSTRUCTION

1. An estimate of the Fire Flow required for a given fire area may be estimated by: $F = 220\ C\ \sqrt{A}$

F = required fire flow in litres per minute
C = coefficient related to the type of construction
- 1.5 for wood construction (structure essentially combustible)
- 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
- 0.8 for noncombustible construction (unprotected metal structural components, masonary or metal walls)
- 0.6 for fire-resistive construction (fully protected frame, floors, roof)

A = total floor area in square metres (including all storeys, but excluding basements at least 50% below grade)

A = 6495 m^2 <==
C = 0.6 <== Noncombustible construction
F = 10638.1 L/min

rounded off to 11,000 L/min (min value of 2000 L/min)

2. The value obtained in 1. may be reduced by as much as 25% for occupancies having a low contents fire hazard.

Non-combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

(apartments are considered Low Hazard Occupancies)

Reduction due to low occupancy hazard -15% x 11,000 = 9,350 L/min

3. The value obtained in 2. may be reduced by up to 50% for complete automatic sprinkler protection depending on the adequacy of the system.

Adequately Designed System	-30%
Standard Water Supply	-10%
Fully Supervised System	-10%

Decrease due to sprinkler system -50% x 9,350 = -4,675 L/min

Flow required = 9,350 + -4675 = 4,675 L/min

4. The value obtained in 2. may be increased for structures exposed within 45 metres by the fire area under consideration.

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

Side 1	19	15%	(Side 1 - Front in following in clockwise manner)
Side 2	52	0%	
Side 3	23	10%	
Side 4	100	0%	
		25%	(Total shall not exceed 75%)

Increase due to separation 25% x 4,675 = 5,844 L/min

The fire flow requirement is 6,000 L/min
or **100 L/sec**
or 1,585 gpm (us)
or 1,320 gpm (uk)

Based on method described in:
"Water Supply for Public Fire Protection - A Guide to Recommended Practice", 1999
by Fire Underwriters Survey

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 (m^3/sec)	Area (m2)	C	Vel (m/s)	Slope of HGL (m/m)	Pipe Length (m)	Frictional Head Loss h_f (m)	Equivalent Pipe Length of Fittings (m)	Minor Loss of Fittings h_b (m)	Total Losses (m) $h_b + h_f$	Start Ground Elev(m)	End Ground Elev (m)	Static Head (m)	Pressure From kPa	Pressure From (psi)	Pressure To kPa	Pressure To (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 90	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**

exp Services Inc.

Controlex Corporation
Ottawa Train Yards
200, 230, 260 Steamline Street
OTT-00243332-A0
January 2018

Appendix C: Sanitary Sewer Design

Sanitary Drainage Area Plan

Sanitary Sewer Design Sheets

LEGEND

RESIDENTIAL POPULATION

51.3 | 0.76 — AREA (ha)

112 — DRAINAGE AREA ID

1.84
395 TERM

1.07
405 TERM

395
EXISTING OFFICE BUILDING

405
EXISTING OFFICE BUILDING

TERMINAL AVENUE

MH116 — SA — MH117 — SA — MH115 — SA — MH118 — SA — MH119

0.34
ROW

MH2 — SA — MH1

EXISTING WAREHOUSE

2.90
WH1

MH3

3.13
PO3

EXISTING CANADA POST OFFICE BUILDING

SANDFORD FLEMING AVENUE

STEAMLINE STREET

BLDG 200

BLDG 300

BLDG 500

BLDG 600

743 | 1.30
PH1

1557 | 1.72
PH2

1089 | 1.26
PH3

MH4

BLDG 100

BLDG 400

BLDG 700

MH5

0.26
ROW

INDUSTRIAL AVENUE

MH6

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www.exp.com

DESIGN	ML
DRAWN	ML
DATE	JAN 2018
FILE NO	OTT-00243332

OTTAWA TRAIN YARDS
200, 230, 260 STEAMLINE ST

SANITARY DRAINAGE AREA PLAN

SCALE 1:2000

SKETCH NO SA-1

SANITARY SEWER CALCULATION SHEET - Sandford Fleming Ave 250mm diameter sewer

Location	Area ID	MH From	MH To	Area (Description)	RESIDENTIAL AREA AND POPULATION									COMMERCIAL / INSTITUTIONAL							INFILTRATION			TOTAL FLOW (L/s)	SEWER DATA						
					POPULATION							Peak Factor	Peak Flow (L/sec)	COMM AREA (Ha)	CUMUL COMM AREA (Ha)	INSTIT AREA (Ha)	CUMUL INSTIT AREA (Ha)	PARK AREA (Ha)	CUMUL PARK AREA (Ha)	PEAK FLOW (L/s)	AREA (ha)	ACCU AREA (Ha)	INFILT FLOW (L/s)		Dia.		Slope	Length	Capacity	Reserve Capacity	Full Velocity (m/s)
					Bachelor	1 Bedroom	2 Bedroom	3 Bedroom	Avg Apt	Indiv Pop	Cumul Pop														(mm)	actual	(%)	(m)	(L/s)	(L/s)	
380 Terminal Ave (MH3)	WH1	MH1	MH2	Commercial Development										2.26	2.26					1.96	2.90	2.90	0.81	2.77	254	254	0.25	57.0	31.02	28.25	0.61
		MH2	MH3																					2.77	254	254	0.50	82.0	43.87	41.09	0.86
Steamline Rd Multi - Res	PH1		MH3	Building 100/200	52	155	189	18		743	743	3.88	11.68								**0.20	3.10	0.87	14.51							
Steamline Rd Multi - Res	PH2		MH3	Building 300/400/500					865	1557	2300	3.54	32.98								**0.27	3.37	0.94	35.89							
1424 Sandform Flemming Ave (MH4)	PO3	MH3	MH4	Canada Post Commercial Dev										2.60	4.86					4.22	3.13	6.50	1.82	39.02	254	254	0.81	77.0	55.83	16.81	1.09
		MH4	MH5																					39.02	254	254	0.86	77.0	57.53	18.51	1.13
Intersection Sandford Flemming & Industrial (MH6)	ROW	MH5	MH6	ROW																	0.26	6.76	1.89	39.09	254	254	0.42	77.0	40.21	1.11	0.79

Average Daily Flow =	350	L/person/day	**Population Density**	Persons Per Unit	Q(p) = Peak Population Flow = PqM/86.4 + Iac
Equivalent Commercial Flow =	50000	L/ha/day			Q(i) = Peak Extraneous Flow = I * Ac
Institutional Flow =	50000	L/ha/day	Bachelor	1.4	A_i = Individual; Area (hectares)
Park Flow =	9300	L/ha/day	1 bedroom	1.4	A_c = Cumulative Area (hectares)
Max .Res Peak Factor =	4.0		2 bedroom	2.1	M = Peaking Factor = 1 + (14/(4+P^0.5))
Commercial/Institutional Peak Factor =	1.5		average apt	1.8	P = Population (thousands)
Manning N =	0.013		3 bedroom	3.1	I = Peak Extran Flow (L/s/ha) = 0.28

** Infiltration Areas do not include areas consisting of underground parking structures

Designed: **M. Lafleur P.Eng.**	Project: **Steamline Rd Multi-Res Project**	
Checked: **A. Ansari, P.Eng.**	Location: **Steamline Rd Ottawa ON**	
Dwg Reference: **Figure SA-2**	File Ref:	Sheet No: **1 of 1**

SANITARY SEWER CALCULATION SHEET - Terminal Ave 250mm diameter sanitary sewer

Location	Area ID	MH From	MH To	Area (Description)	RESIDENTIAL AREA AND POPULATION								COMMERCIAL / INSTITUTIONAL							INFILTRATION			TOTAL FLOW (L/s)	SEWER DATA						
					POPULATION						Peak Factor	Peak Flow (L/sec)	COMM AREA (Ha)	CUMUL COMM AREA (Ha)	INSTIT AREA (Ha)	CUMUL INSTIT AREA (Ha)	PARK AREA (Ha)	CUMUL PARK AREA (Ha)	PEAK FLOW (L/s)	AREA (ha)	ACCU AREA (Ha)	INFILT FLOW (L/s)		Dia.		Slope	Length	Capacity	Reserve Capacity	Full Velocity (m/s)
					Bachelor	1 Bedroom	2 Bedroom	Avg Apart	Indiv Pop	Cumul Pop														(mm)	actual	(%)	(m)	(L/s)	(L/s)	
395 Terminal	395 Term	MH116	MH117	Existing Commercial									1.50	1.50					*1.30*	1.84	1.84	0.52	1.8	254	254	0.28	96.4	32.83	31.01	0.64
405 Terminal	405 Term	MH117	MH115	Existing Commercial									0.87	2.37					*2.06*	**0.20	2.04	0.57	2.6	254	254	0.28	96.4	32.83	30.20	0.64
Steamline St Phase 3	PH3		MH115	Building 600/700				605	1089	1089	3.78	16.68							*2.60*	0.18	2.22	0.62	19.9							
	ROW	MH118	MH119	ROW Infiltration																0.34	2.56	0.72	20.0	254	254	0.28	81.8	32.83	12.84	0.64

Average Daily Flow =	350 L/person/day	**Population Density**	Persons Per Unit
Equivalent Commercial Flow =	50000 L/ha/day		
Institutional Flow =	50000 L/ha/day	Bachelor	1.4
Park Flow =	9300 L/ha/day	1 bedroom	1.4
Max .Res Peak Factor =	4.0	2 bedroom	2.1
Commercial/Institutional Peak Factor =	1.5	average apt	1.8
Manning N =	0.013		

** Infiltration Areas do not include areas consisting of underground parking structures

Q(p) = Peak Population Flow = PqM/86.4 + Iac
Q(i) = Peak Extraneous Flow = I * Ac
A_I = Individual; Area (hectares)
A_c = Cumulative Area (hectares)
M = Peaking Factor = 1 + (14/(4+P^0.5))
P = Population (thousands)
I = Peak Extran Flow (L/s/ha) = 0.28

Designed: **M. Lafleur P.Eng.**
Checked: **A. Ansari, P.Eng.**
Dwg Reference: **SA-1**
Project: **Steamline Rd Multi-Res Project**
Location: **Steamline Rd Ottawa ON**
File Ref:
Sheet No: **1 of 1**