D.B. Gray Engineering Inc.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

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SITE SERVICING STUDY & STORMWATER MANAGEMENT REPORT

3130 WOODROFFE AVENUE
OTTAWA, ONTARIO

REPORT NO. 20055

MARCH 17, 2022

CONTENTS

LIST OF APPENDICES

1.0 INTRODUCTION

This report describes the servicing and stormwater management requirements for a proposed dental clinic and four semi-detached dwellings located on a 3,829 sq.m. property at 3130 Woodroffe Avenue in Ottawa, Ontario. This report has been prepared in support of the Site Plan Control application for the proposed development. The property is currently occupied by an existing single family dwelling to be demolished.

This report forms part of the servicing and stormwater management design for the proposed development. Also refer to drawings C-1 to C-5 prepared by D.B. Gray Engineering Inc.

2.0 WATER SERVICING

2.1 WATER SUPPLY FOR FIREFIGHTING

The proposed dental clinic will have a sprinkler system with the fire department connection (FDC) located at the southwest corner of the dental clinic building. There is an existing municipal Class AA fire hydrant located at the northwest of the Woodroffe Avenue / Deerfox Drive intersection. It is 41 m unobstructed distance to the proposed FDC, which is less than the maximum 45 m required by the Ontario Building Code (OBC); therefore, a private fire hydrant is not required for dental clinic building. The existing municipal fire hydrant is also 85 m unobstructed distance to the far side of the front façade of the north semi-detached dwelling, which is less than the maximum 90 m required by the OBC; therefore, a private fire hydrant is not required for the residential buildings.

As per City of Ottawa Technical Bulletin ISTB-2021-03, when calculating the required fire flow where pipe sizing is affected, the Fire Underwriters Survey (FUS) method is to be used. Using the FUS method the required fire flow was calculated to be 3,000 L/min (50 L/s) for the dental clinic, and 9,000 L/min (150 L/s) for one block of semi-detached dwellings. Refer to calculations in Appendix A.

The boundary conditions in the 200 mm Deerfox Drive watermain provided by the City of Ottawa for the 150 L/s fire flow at the subject property indicate a hydraulic grade line (HGL) of 117.8 m prior to the SUC zone reconfiguration and 144.0 m following the SUC zone reconfiguration. Refer to Appendix A. These HGLs calculate to 232 kPa (34 psi) prior to the SUC zone reconfiguration and 489 kPa (71 psi) following the SUC zone reconfiguration. Since the pressures are above the required minimum pressure of 140 kPa (20 psi), there is an adequate water supply for firefighting from the existing municipal water distribution system.

As per City of Ottawa Technical Bulletin ISTB-2018-02, the aggregate flow of all contributing fire hydrants within 150 m of the building shall not be less than the required fire flow. There are three existing municipal Class AA fire hydrants within between 75 m and 150 m of the proposed semi-detached dwellings. As indicated above, one is located northwest of the intersection of Woodroffe Avenue and Deerfox Drive. Another is located in front of 15 Deerfox Drive and the third is located in front of 3112 Woodroffe Avenue. As per Table 1 of ISTB-2018-02 each can contribute 3800 L/min (63.3 L/s). Therefore, the aggregate flow of the three contributing fire hydrants is 11,400 L/min (190 L/s), which is greater than the required fire flow of 9,000 L/min (150 L/s).

2.2 DOMESTIC WATER SUPPLY

A proposed 150 mm private water main connecting to the 200 mm municipal watermain in Deerfox Drive will service the development. A 50 mm private water main connecting to the 150 mm private water main will service the proposed residential buildings. Each semi-detached unit will have a 19 mm water service connecting to the proposed 50 mm private watermain. A 150 mm water service connecting to the proposed 150 mm private watermain is proposed to service the sprinkler system of the dental clinic; which is adequate for the domestic water demand.

As per;

i. the City of Ottawa Water Design Guidelines for the residential population, commercial consumption rate and commercial peaking factors;
ii. City of Ottawa Technical Bulletin ISTB-2021-03 for the residential consumption rate; and
iii. the Ministry of the Environment Water Design Guidelines for residential peaking factors;

the average daily demand was calculated to be 0.2 L/s, the maximum daily demand was calculated to be 0.6 L/s and the maximum hourly demand was calculated to be 1.0 L/s. Refer to calculations in Appendix A.

The boundary conditions in the 200 mm Deerfox Drive watermain provided by the City of Ottawa at the subject property indicate a minimum HGL of 141.6 m and a maximum HGL of 157.4 m prior to the SUC zone reconfiguration, and a minimum HGL of 145.5 m and a maximum HGL of 147.7 m following the SUC zone reconfiguration. Refer to Appendix A. Based on these boundary conditions the pressure at the water meter is calculated to vary between 446 kPa (65 psi) and 601 kPa (87 psi) prior to the SUC zone reconfiguration and 484 kPa (70 psi) and 506 kPa (73 psi) following to the SUC zone reconfiguration. This is an acceptable range for the proposed development. Since the water pressure may be above 80 psi at times it is recommended that a pressure test be conducted at the completion of construction to determine if a pressure reducing valve is required. If required, the pressure reducing valve is to be installed immediately after the water meter.

3.0 SANITARY SERVICING

As per;

i. the City of Ottawa Sewer Design Guidelines for the residential population and commercial peaking factor;
ii. City of Ottawa Technical Bulletin ISTB-2018-01 for the consumption rates, Harmon Formula correction factor and infiltration allowance; and
iii. the Harmon Formula for the residential peaking factor;

the post-development sanitary flow rate was calculated to be 0.52 L/s.

A 200 mm private sanitary sewer at 0.77% slope (29.17 L/s capacity) is proposed to connect to the proposed 250 mm municipal sanitary sewer in Deerfox Drive, which at 0.60% slope will have a capacity of 46.56 L/s (reference Stoneway Drive / Woodroffe Avenue / Deerfox Drive Municipal Sanitary Sewer Extension Report and drawings prepared by D. B. Gray Engineering Inc.). At the design flow rate the 200 mm sanitary sewer will only be at 2% of its capacity. The post development flow is expected to have an acceptable impact on the 250 mm Deerfox Drive sanitary sewer. Refer to calculations in Appendix B.

A 135 mm sanitary service at 2% slope (15.63 L/s capacity) is proposed to service each semi-detached dwelling unit. A 150 mm building sanitary service at 2% slope (20.41 L/s capacity) is proposed to service

the dental clinic building. The proposed building sanitary services will connect to the proposed 200 mm private sanitary sewer system.

4.0 STORMWATER MANAGEMENT

4.1 QUALITY CONTROL

Drainage from 3130 Woodroffe Avenue is conveyed to the Longfields Davidson Heights Stormwater Management Facility (SWMF) which provides quality control. Although on-site quality control measure are not required quantity control measures includes underground storage chambers surrounded by clear stone wrapped in geotextile fabric (see below) which will promote stormwater infiltration into the ground. As per the geotechnical report the long-term groundwater level is expected to be 3 to 4 m depth (or about 1 to 2m below the bottom of the clear stone); and bedrock is estimated to be 5 to 15 m deep (or about 3 to 13 m below the bottom of the clear stone). Therefore, since bedrock and groundwater are at least 1 m below the bottom of the infiltration trench neither are expected to be an issue.

An Erosion & Sediment Control Plan has been developed to be implemented during construction. Refer to drawing C-3 and notes 2.1 to 2.6 on drawing C-5. In summary, to filter out construction sediment: a silt fence barrier is to be installed at the perimeter of the site where runoff will drain off the site; sediment capture filter sock inserts are to be installed in all existing catch-basins adjacent to the site and in all new catch basins as they are installed; and any material deposited on a public road is to be removed as required.

4.2 QUANTITY CONTROL

It was calculated that the pre-development conditions reflect a 5-year composite runoff coefficient of 0.35. The individual runoff coefficients were each increased by 25% to a maximum of 1.00 to calculate the pre-development conditions during the 100-year event. Using the Bransby-Williams Formula the pre-development time of concentration was calculated to be 5 minutes. Using the Rational Method with a time of concentration of 10 minutes, the pre-development flow rates were calculated to be 78.98 L/s during the 100-year event and 39.32 L/s during the 5-year event

As per the Longfields Davidson Heights Serviceability Study (Update Report (1998) (Report # R-0135)), the stormwater quantity control criterion for the subject development is to control the post-development flow rate to 64 L/s/ha, up to and including the 100-year storm event. Therefore, the maximum allowable release rate for the 3,829 sq.m. property was calculated to be 24.51 L/s

The Modified Rational Method was used to calculate the post development flow rates and corresponding storage volumes. The runoff coefficients for the 100-year event are increased by 25% to maximum 1.00. Refer to calculations in Appendix C.

Drainage Area I (Dental Clinic Roof – 532 sq.m.)
The two roof drains are to be flow control type roof drains which will restrict the flow of stormwater and cause it to pond on the roof. Each roof drain is to be installed with a single-slotted weir with the slot having a parabolic shape releasing 0.0124 L/s/mm (5 USgpm/in). Roof drains are to be Watts with an Accutrol Weir RD-100-A1 or approved equal. The opening at the top of the flow control weir is to be a minimum 50 mm in diameter. A minimum of four scuppers each a minimum 400 mm wide are to be installed 150 mm above the roof drains. Refer to architectural for exact locations and details. The roof is

to be designed to carry the load of water having a 50 mm depth at the scuppers or 200 mm depth at the roof drains (refer to structural).

	100-Year Event	5-Year Event
Maximum Release Rate	3.35 L/s	2.56 L/s
Maximum Depth at Roof Drains	135 mm	103 mm
Maximum Volume Stored	18.64 cu.m.	8.32 cu.m.

Drainage Area II (2,040 sq.m.)

An inlet control device (ICD) located in the outlet pipe of catch-basin / manhole CB/MH-2 will restrict the flow of stormwater and cause it to backup into the upstream infrastructure and pond in the rear and side yards of the residential buildings above ditch-inlet DI-1 and pond in the asphalted area above CB/MH-2. The ICD will be a vortex style ICD manufactured by Hydrovex or approved equal and shall be sized by the manufacturer of 6.00 L/s at 2.09 m. (The City of Ottawa's minimum recommended release rate is 6.00 L/s.) It was calculated that an orifice area of 4,418 sq.mm (75 mm diam.) with a discharge coefficient of 0.212 will achieve the release rate of 6.00 L/s at 2.09 m. Based on this orifice the maximum release rate for the 5-year storm event is calculated to be 5.82 L/s at 1.97 m.

	100-Year Event	5-Year Event
Maximum Release Rate	6.00 L/s	5.82 L/s
Maximum Ponding Elevation	94.16 m	94.03 m
Maximum Volume Stored	52.81 cu.m.	21.13 cu.m.

Drainage Area III (1,257 sq.m.)

An inlet control device (ICD) located in the outlet pipe of catch-basin / manhole CB/MH-5 will restrict the flow of stormwater and cause it to backup into the upstream infrastructure and into underground storage chambers. The ICD will be a plug style with a round orifice located at the bottom of the plug with a trash basket manufactured by Pedro Plastics (or approved equal) and shall be sized by the manufacturer for a release rate of 15.17 L/s at 1.28 m. It was calculated that an orifice area of 4,953 sq.mm (79 mm diam.) with a discharge coefficient of 0.61 will achieve the release rate of 15.17 L/s at 1.28 m. Based on this orifice the maximum release rate for the 5-year storm event is calculated to be 11.23 L/s at 0.70 m. Since stormwater is proposed to be stored underground, a release rate equal to 50% of the maximum release rate was used to calculate the required storage volumes. The underground storage will consist of six Soleno HydroStor HS180 chambers (or approved equal) surrounded by clear stone wrapped in geotextile fabric.

	100-Year Event	5-Year Event
Maximum Release Rate	15.17 L/s	11.23 L/s
Maximum Ponding Elevation	93.18 m	92.60 m
Maximum Volume Stored	30.62 cu.m.	13.34 cu.m.

Entire Site

	100-Year Event	5-Year Event
Pre-Development Flow Rate	78.98 L/s	39.32 L/s
Maximum Allowable Release Rate	24.51 L/s	24.51 L/s
Maximum Release Rate	24.51 L/s	19.61 L/s
Maximum Volume Required & Stored	102.07 cu.m.	42.79 cu.m.

The maximum post-development release rate during the 100-year event was calculated to be 24.51 L/s, which is 69% less than the pre-development flow rate and equal to the maximum allowable release rate. To achieve the maximum allowable release rate, a maximum storage volume of 102.07 cu.m. is required and provided. The maximum post-development release rate during the 5-year event was calculated to be 19.61 L/s, which is 50% less than the pre-development flow rate and 20% less than the maximum allowable release rate.

4.3 STORM SERVICING

Two private storms sewer system are proposed for the development. One is free flowing and serves the foundation drains of each building and the flow control roof drains of the dental clinic building. ICDs restrict the flow in the other private storm sewer system.

A 200 mm storm sewer connection at 1% slope (33.24 L/s capacity) is proposed to service the dental clinic building. At the 5-year unrestricted roof flow rate of 13.87 L/s the storm sewer connection would be at 42% of its capacity. However, the 5-year restricted roof flow rate (through the flow control roof drains) was calculated to be 2.56 L/s; therefore, the storm sewer will only be at about 8% of its capacity. Refer to calculations in Appendix D. The proposed 200 mm storm service will connect to the proposed free flowing private storm sewer system.

Each semi-detached unit will have 100 mm storm service at 1% slope connecting to the proposed free flowing private storm sewer system. The roof drains on the residential buildings will discharge to grade.

The free flowing storm sewer is 250 mm at 0.43% slope (39.41 L/s capacity) and is proposed to connect to the existing 300 mm municipal storm sewer in Deerfox Drive. At the calculated unrestricted 5-year flow rate of 13.77 L/s the 250 mm storm sewer would be at 35% of its capacity; however, at the 5-year restricted flow rate of 2.56 L/s (through the flow control roof drains) the storm sewer will only be at 6% capacity. The post-development flow is expected to have an acceptable impact on the 300 mm Deerfox Drive storm sewer; which at a 1.45% slope has a capacity of 116.44 L/s. Refer to calculations in Appendix D.

The other private storm sewer system is proposed to connect to an existing ditch inlet lead which connects to an existing 1200 mm municipal storm sewer in Woodroffe Avenue (the ditch inlet will be removed and replaced with catch basin manhole CB/MH-7). The existing ditch inlet lead is 200 mm at 1.0% slope (33.24 L/s capacity). At the calculated unrestricted 5-year flow rate of 53.19 L/s the existing 200 mm ditch inlet lead would be at 160% of its capacity; however, at the 5-year restricted flow rate of 17.05 L/s (through the ICDs) ditch inlet lead will only be at 51% capacity. Upstream of the ditch inlet lead the unrestricted 5-year flow rate in each pipe segment varies from 9% to 42% capacity, with the last pipe segment (450 mm at 0.195% slope - 131.19 L/s capacity) at 42%. However, at the 5-year restricted flow rate of 17.05 L/s (through the ICDs) the last pipe segment will only be at 13% capacity. The existing

1200 mm Woodroffe Avenue storm sewer, which at a 0.25% slope, has a capacity of 2,033 L/s. The reduction in flows due to quantity control is expected to have a positive impact on the 1200 mm Woodroffe Avenue storm sewer. Refer to calculations in Appendix D.

5.0 CONCLUSIONS

1. A private fire hydrant is not required.

2. There is an adequate water supply for firefighting from the existing municipal water distribution system.

3. The aggregate flow of the three contributing fire hydrants is greater than the required fire flow.

4. The proposed private watermains and water service connections are adequate for the domestic demand.

5. The range of water pressures is acceptable for the proposed development.

6. Since the water pressure may be above 80 psi at times, it is recommended a pressure test be conducted at the completion of construction to determine if a pressure reducing valve is required.

7. The post-development sanitary flow rate will be adequately handled by the proposed sanitary sewer service connections and private sanitary sewer system.

8. The post development sanitary flow is expected to have an acceptable impact on the proposed 250 mm municipal sanitary sewer in Deerfox Drive.

9. Stormwater drainage from 3130 Woodroffe Avenue is conveyed to the Longfields Davidson Heights SWMF which provides quality control. Although on-site quality control measure are not required underground storage chambers will promote stormwater infiltration into the ground.

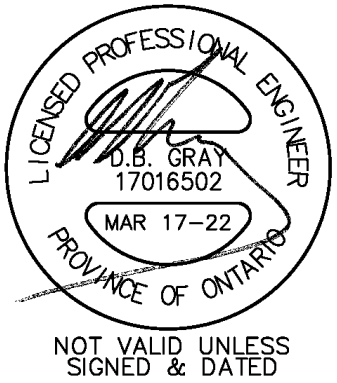
10. An Erosion & Sediment Control Plan has been developed to be implemented during construction.

11. The maximum post-development stormwater release rate during the 100-year event is 69% less than the pre-development flow rate and equal to the maximum allowable release rate. The maximum post-development release rate during the 5-year event is 50% less than the pre-development flow rate during the 5-year event and 20% less than the maximum allowable release rate.

12. The post-development storm flow rates will be adequately handled by the proposed storm service connections and private storm sewer system.

13. The post-development stormwater flows is expected to have an acceptable impact on the existing municipal storm sewer in Deerfox Drive.

14. The post-development reduction in stormwater flows is expected to have a positive impact on the existing municipal storm sewer in Woodroffe Avenue.


LICENSED PROFESSIONAL ENGINEER
D.B. GRAY
17016502
MAR 17-22
PROVINCE OF ONTARIO
NOT VALID UNLESS
SIGNED & DATED

APPENDIX A

WATER SERVICING

D.B. Gray Engineering Inc.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

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03-Dec-21

Dental Clinic Building
3130 Woodroffe Avenue
Ottawa, Ontario

Fire Flow Requirements

Fire flow requirement as calculated as per Fire Underwriters Survey "Water Supply For Fire Protection".

F = 220 C $A^{0.5}$ = the required fire flow in litres per minute

C = coefficient related to the type of construction
= 0.8 Non-combustible Construction (unprotected structural components)

A = total floor area (all storeys excluding basements at least 50% below grade)

TOTAL FIRE AREA: 532 sq.m.

F = 4,059 L/min
= 4,000 L/min (rounded off to the nearest 1,000 L/min)

-15% Charge for Limited-combustible Occupancy

= 3,400 L/min

40% Reduction for Sprinkler System

= 1,360 L/min

Increase for Separation Exposed Buildings

			Adjacent Building			Length-Height
			Construction	Length m	Storeys	Factor
8%	North	20.1 to 30m	W-F	13	2	26
0%	East	>45m				0
0%	South	>45m				0
9%	West	20.1 to 30m	W-F	25	3	75
17%	Total Increase for Exposure (maximum 75%)					

= 578 L/min Increase

= 2,618 L/min
F = 3,000 L/min (rounded off to the nearest 1,000 L/min)
= 50.0 L/s

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03-Dec-21

Revised 22-Feb-22

Semi-Detached Residential Building
3130 Woodroffe Avenue
Ottawa, Ontario

Fire Flow Requirements

Fire flow requirement as calculated as per Fire Underwriters Survey "Water Supply For Fire Protection".

$F = 220\ C\ A^{0.5}$ = the required fire flow in litres per minute

C = coefficient related to the type of construction
= 1.5 Wood Frame Construction

A = total floor area (all storeys excluding basements at least 50% below grade)

2nd Floor	196	sq.m.
Ground Floor	196	sq.m.
Basement	196	sq.m.
TOTAL FIRE AREA:	588	sq.m.

F = 8,002 L/min
= 8,000 L/min (rounded off to the nearest 1,000 L/min)

-15% Charge for Limited-combustible Occupancy

= 6,800 L/min

0% Reduction: No Sprinkler System

= - L/min

Increase for Separation Exposed Buildings

			Adjacent Building			Length-Height Factor
			Construction	Length m	Storeys	
0%	North	>45m				0
8%	East	20.1 to 30m	Non-C	15	1	15
18%	South	3.1 to 10m	Ordinary	18	3	54
13%	West	10.1 to 20m	W-F	15	3	45
39%	Total Increase for Exposure (maximum 75%)					

= 2,652 L/min Increase

= 9,452 L/min
F = 9,000 L/min (rounded off to the nearest 1,000 L/min)
= 150.0 L/s

Elevation at Fire Hydrant 94.1 m ASL

Existing Conditions

			Static Pressure at Fire Hydrant			
150 L/s FIRE FLOW:	117.8	m ASL	34	psi	232	kPa

SUC Zone Reconfiguration

			Static Pressure at Fire Hydrant			
150 L/s FIRE FLOW:	144.0	m ASL	71	psi	489	kPa

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03-Dec-21
Revised 22-Feb-22

Dental Clinic Building + Two Semi-Detached Residential Buildings
3130 Woodroffe Avenue
Ottawa, Ontario

Water Demand

	Number of Units	Persons Per Unit	Population
UNIT TYPE:			
Single Family:	0	3.4	0
Semi- detached:	4	2.7	11
Duplex:	0	2.3	0
Townhouse:	0	2.7	0
TOTAL:	4		11

APARTMENTS:

DAILY AVERAGE:	280	litres / person / day				
	2.1	L/min	0.04	L/s	0.6	USgpm
MAXIMUM DAILY DEMAND:	9.5	(Peaking Factor for a equivalent population of <30: Table 3-3 MOE Design Guidelines for Drinking-Water Systems)				
	20.0	L/min	0.3	L/s	5	USgpm
MAXIMUM HOURLY DEMAND:	14.3	(Peaking Factor for a equivalent population of <30: Table 3-3 MOE Design Guidelines for Drinking-Water Systems)				
	30.0	L/min	0.5	L/s	8	USgpm

COMMERCIAL (Dental Clinic):

DAILY AVERAGE:	28,000	L /gross ha / day (as per Ottawa Design Guidelines)				
	0.1915	ha (approximately 1/2 of land area)				
	5361	L/day				
	8	hour day				
	11.2	L/min	0.2	L/s	3.0	USgpm
MAXIMUM DAILY DEMAND:	1.5	(Peaking Factor as per Ottawa Design Guidelines)				
	16.8	L/min	0.3	L/s	4.4	USgpm
MAXIMUM HOURLY DEMAND:	1.8	(Peaking Factor as per Ottawa Design Guidelines)				
	30.2	L/min	0.5	L/s	8.0	USgpm
TOTAL DAILY AVERAGE:	13.3	L/min	0.2	L/s	3.5	USgpm
TOTAL MAXIMUM DAILY DEMAND:	36.7	L/min	0.6	L/s	9.7	USgpm
TOTAL MAXIMUM HOURLY DEMAND:	60.2	L/min	1.0	L/s	15.9	USgpm

Elevation of Water Meter: 96.1 m ASL
Finish Floor Elevation: 95.2 m ASL

Existing Conditions

			Static Pressure at Water Meter			
MINIMUM HGL:	141.6	m ASL	65	psi	446	kPa
MAXIMUM HGL:	157.4	m ASL	87	psi	601	kPa

SUC Zone Reconfiguration

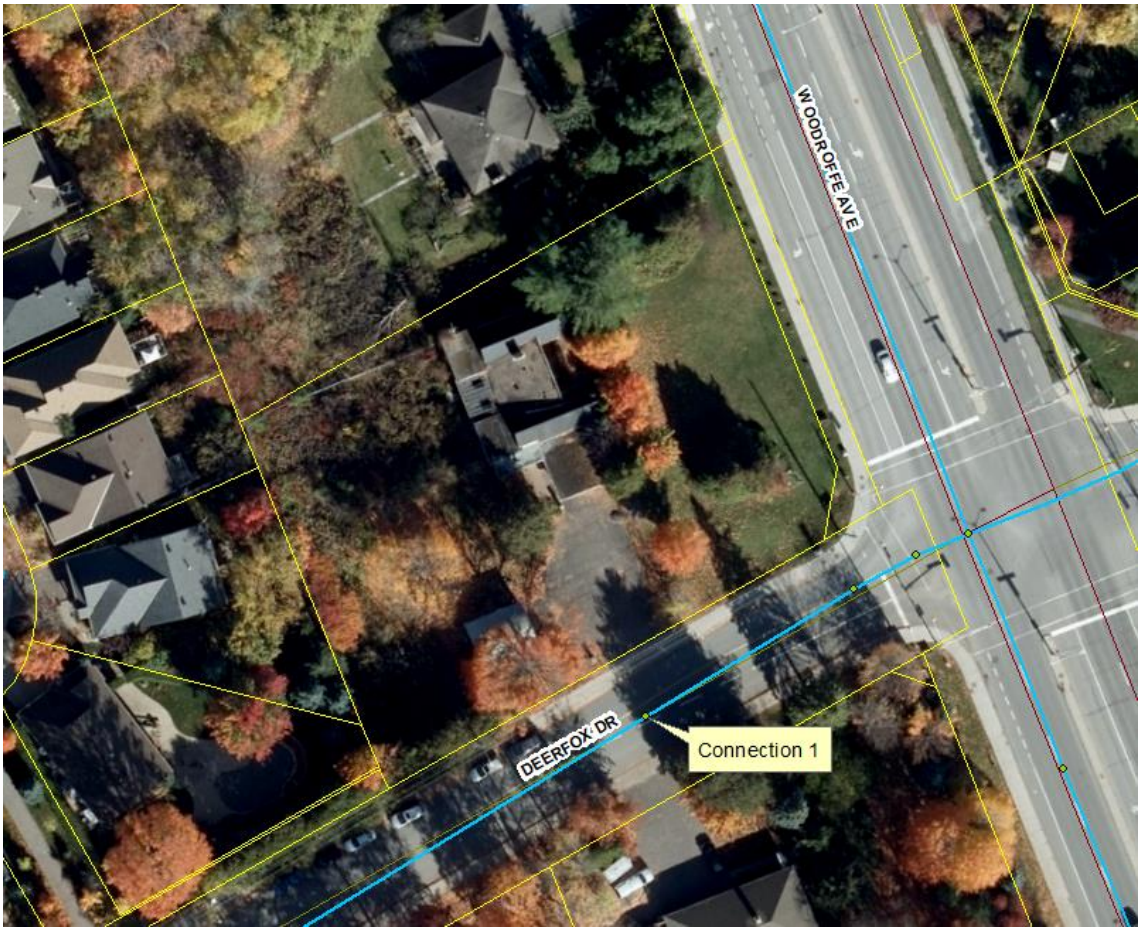
			Static Pressure at Water Meter			
MINIMUM HGL:	145.5	m ASL	70	psi	484	kPa
MAXIMUM HGL:	147.7	m ASL	73	psi	506	kPa

Boundary Conditions
3130 Woodroffe Ave

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	12	0.20
Maximum Daily Demand	36	0.60
Peak Hour	60	1.00
Fire Flow Demand #1	9,000	150.00

Location



Results – Existing Conditions

Connection 1 – Deerfox Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	157.4	89.9
Peak Hour	141.6	67.5
Max Day plus Fire 1	117.8	33.6

Ground Elevation = 94.1 m

Results – SUC Zone Reconfiguration

Connection 1 – Deerfox Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	147.7	76.1
Peak Hour	145.5	73.0
Max Day plus Fire 1	144.0	70.9

Ground Elevation = 94.1 m

Notes

1. As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
    a. If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
    b. Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

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. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

APPENDIX B

SANITARY SERVICING

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SANITARY SEWER CALCULATIONS

3130 Woodroffe Avenue
Dental Clinic and Semi-Detached Dwellings
Ottawa, Ontario

February 22, 2022

Residential Average Daily Flow:	280	L/capita/day	Residential Peaking Factor:	Harmon Formula
Commercial Average Daily Flow:	28,000	L/ha/day	Harmon Formula Correction Factor:	0.8
Institutional Average Daily Flow:	28,000	L/ha/day	Commercial Peaking Factor:	1.5
Light Industrial Average Daily Flow:	35,000	L/ha/day	Institutional Peaking Factor:	1.5
Heavy Industrial Average Daily Flow:	55,000	L/ha/day	Industrial Peaking Factor:	Ministry of the Environment
Infiltration Allowance:	0.33	L/s/ha	Manning's Roughness Coefficient:	0.013

		Residential													Non-Residential				Infiltration			Q	Sewer Data						
		Individual									Cumulative				Individual			Cumulative	Individual	Cumulative		Total							
Location		Single	Semi		Apartment				Area	Population	Area	Population	Peaking	Flow Rate	Area	Daily Flow	Peaking	Flow Rate	Area	Area	Flow Rate	Flow Rate	Length	Nominal Diameter	Actual Diameter	Slope	Velocity	Q_{Full} Capacity	
From	To	Family	Detached	Duplex	(1 Bed)	(2 Bed)	(3 Bed)	(Average)	(ha)		(ha)		Factor	(L/s)	(ha)	L/ha/day	Factor	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(m)	(mm)	(mm)	(%)	(m/s)	(L/s)	Q / Q_{Full}
		ppu = 3.4	ppu = 2.7	ppu = 2.3	ppu = 1.4	ppu = 2.1	ppu = 3.1	ppu = 1.8																					
MH SA.1	250 SAN		4						0.1915	11	0.1915	11	3.2	0.11	0.1915	28,000	4.5	0.28	0.3829	0.3829	0.13	0.52	50.5	200	201	0.77	0.92	29.17	0.02
																				250 mm Deerfox Drive Sanitary Sewer:				250	251	0.60	0.94	46.56	

APPENDIX C

STORMWATER MANAGEMENT & STORM SERVICING

STORMWATER MANAGEMENT CALCULATIONS

The orifice calculations are based on the following formula:

$$Q = C_d \times A_o \sqrt{2gh} \times 1000$$

where:

Q = flowrate in litres per second
C_d = coefficient of discharge
A_o = orifice area in sq.m.
g = 9.81 m/s2
h = head above orifice in meters

Flow control roof drain calculations are based on the following formula:

$$Q = N \times S \times d \times F$$

where:

Q = flowrate in litres per second
N = number of roof drains
S = slots per weir
d = pond depth at roof drain in mm
F = flowrate through each slot
0.0124 litres per second per mm pond depth (5 USgpm per inch)

Surface storage calculations on the roof, asphalted and landscaped area are based on the following formula for volume of a cone:

$$V = (A \times d)/3$$

where:

V = volume in cu.m.
A = ponding area in sq.m.
d = ponding depth in meters

Summary Tables

ONE-HUNDRED-YEAR EVENT

Drainage Area	Pre-Development Flow Rate (L/s)	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Roof)	-	-	3.35	18.64	18.64
AREA II	-	-	6.00	52.81	52.81
AREA III	-	-	15.17	30.62	30.62
TOTAL	78.98	24.51	24.51	102.07	102.07

FIVE-YEAR EVENT

Drainage Area	Pre-Development Flow Rate (L/s)	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Roof)	-	-	2.56	8.32	8.32
AREA II	-	-	5.82	21.13	21.13
AREA III	-	-	11.23	13.34	13.34
TOTAL	39.32	24.51	19.61	42.79	42.79

February 22, 2022

3130 Woodroffe Avenue

Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS
Rational Method

PRE-DEVELOPMENT CONDITIONS

100-Year Flow Rate

			C
Roof Area:	395	sq.m	1.00
Asphalt/Concrete Area:	450	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	2984	sq.m	0.25
Total Catchment Area:	3829	sq.m	0.42

Bransby William Formula

$$Tc = \frac{0.057 \bullet L}{Sw^{0.2} \bullet A^{0.1}} \text{ min}$$

Sheet Flow Distance (L):	95	m
Slope of Land (Sw):	2.5	%
Area (A):	0.3829	ha
Time of Concentration (Sheet Flow):	5	min
Area (A):	3829	sq.m
Time of Concentration:	10	min
Rainfall Intensity (i):	179	mm/hr
Runoff Coeficient (C):	0.42	
100-Year Pre-Development Flow Rate (2.78AiC):	78.98	L/s

5-Year Flow Rate

			C
Roof Area:	395	sq.m	0.90
Asphalt/Concrete Area:	450	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	2984	sq.m	0.20
Total Catchment Area:	3829	sq.m	0.35

Area (A):	3829	sq.m
Time of Concentration:	10	min
Rainfall Intensity (i):	104	mm/hr
Runoff Coeficient (C):	0.35	

5-Year Pre-Development Flow Rate (2.78AiC): 39.32 L/s

Maximum Allowable Release Rate

* As per Longfields Davidson Heights Serviceability Study

Area (A):	3829	sq.m
Release Rate:	64	L/s/ha

Maximum Allowable Release Rate (2.78AiC): 24.51 L/s

ONE-HUNDRED-YEAR EVENT

DRAINAGE AREA I (Dental Clinic Roof)

(ONE-HUNDRED-YEAR EVENT)

			C
Total Catchment Area:	532	sq.m	1.00

No. of Roof Drains:	2				
Slots per Wier:	1	0.0124 L/s/mm/slot (5 USGPM/in/slot)			
Depth at Roof Drain:	135	mm	Pond Area:	414	sq.m
Maximum Release Rate:	3.35	L/s	Achieved Volume:	18.64	cu.m
			Maximum Volume Required:	18.64	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	243	35.89	3.35	32.55	9.76
10	179	26.41	3.35	23.06	13.84
15	143	21.13	3.35	17.79	16.01
20	120	17.74	3.35	14.39	17.27
25	104	15.36	3.35	12.01	18.02
30	92	13.59	3.35	10.24	18.43
35	83	12.21	3.35	8.87	18.62
40	75	11.11	3.35	7.77	18.64
45	69	10.21	3.35	6.87	18.54
50	64	9.46	3.35	6.11	18.33
55	60	8.82	3.35	5.47	18.05
60	56	8.27	3.35	4.92	17.71
65	53	7.79	3.35	4.44	17.31
70	50	7.36	3.35	4.02	16.87
75	47	6.99	3.35	3.64	16.39
80	45	6.65	3.35	3.31	15.87
85	43	6.35	3.35	3.01	15.33
90	41	6.08	3.35	2.73	14.76
95	39	5.83	3.35	2.49	14.17
100	38	5.61	3.35	2.26	13.55
105	36	5.40	3.35	2.05	12.92
110	35	5.21	3.35	1.86	12.27
115	34	5.03	3.35	1.68	11.61
120	33	4.87	3.35	1.52	10.93

DRAINAGE AREA II

(ONE-HUNDRED-YEAR EVENT)

			C
Roof Area:	405	sq.m	1.00
Asphalt/Concrete Area:	685	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	950	sq.m	0.25
Total Catchment Area:	2040	sq.m	0.65

Water Elevation:	94.16	m
Invert of Outlet Pipe - CB/MH-2:	92.03	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-2)	92.07	m
Head:	2.09	m
Orifice Diameter:	75	mm
Orifice Area:	4418	sq.mm
Coefficient of Discharge:	0.212	
Maximum Release Rate:	6.00	L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
DI-1	205	0.49	33.48	cu.m
CB/MH-2	290	0.20	19.33	cu.m
		Achieved Volume:	52.81	cu.m
		Maximum Volume Required:	52.81	cu.m

DRAINAGE AREA II (Continued)

(ONE-HUNDRED-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	243	89.57	6.00	83.57	25.07
10	179	65.90	6.00	59.90	35.94
15	143	52.73	6.00	46.73	42.06
20	120	44.27	6.00	38.27	45.92
25	104	38.32	6.00	32.32	48.48
30	92	33.90	6.00	27.90	50.22
35	83	30.48	6.00	24.47	51.40
40	75	27.73	6.00	21.73	52.15
45	69	25.48	6.00	19.48	52.60
50	64	23.60	6.00	17.60	52.80
55	60	22.00	6.00	16.00	52.81
60	56	20.63	6.00	14.63	52.66
65	53	19.43	6.00	13.43	52.37
70	50	18.37	6.00	12.37	51.97
75	47	17.44	6.00	11.44	51.47
80	45	16.60	6.00	10.60	50.89
85	43	15.85	6.00	9.85	50.24
90	41	15.17	6.00	9.17	49.52
95	39	14.55	6.00	8.55	48.75
100	38	13.99	6.00	7.99	47.92
105	36	13.47	6.00	7.47	47.05
110	35	12.99	6.00	6.99	46.14
115	34	12.55	6.00	6.55	45.18
120	33	12.14	6.00	6.14	44.20

DRAINAGE AREA III

(ONE-HUNDRED-YEAR EVENT)

			C
Roof Area:	0	sq.m	1.00
Asphalt/Concrete Area:	865	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	392	sq.m	0.25
Total Catchment Area:	1257	sq.m	0.77

Water Elevation:	93.18	m
Invert of Outlet Pipe - CB/MH-5:	91.86	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-5)	91.90	m
Head:	1.28	m
Orifice Diameter:	79	mm
Orifice Area:	4953	sq.mm
Coefficient of Discharge:	0.61	
Maximum Release Rate:	15.17	L/s

Chamber Storage

# Chambers	Volume Per Chamber	# End Caps	Volume Per End Cap	Rows	Chamber & End Cap Length	Chamber & End Cap Volume
6	3.220	4	0.430	2	7.577	21.04

Clear Stone Storage

Clear Stone Length	Clear Stone Width	Clear Stone Storage Depth	Clear Stone Volume	40% Voids
8.177	4.852	1.134	23.951	9.58

Achieved Volume:	30.62	cu.m
Maximum Volume Required:	30.62	cu.m

DRAINAGE AREA III (Continued)

(ONE HUNDRED YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	243	64.98	7.58	57.39	17.22
10	179	47.80	7.58	40.22	24.13
15	143	38.25	7.58	30.67	27.60
20	120	32.11	7.58	24.53	29.44
25	104	27.80	7.58	20.22	30.33
30	92	24.59	7.58	17.01	30.62
35	83	22.11	7.58	14.52	30.50
40	75	20.12	7.58	12.53	30.08
45	69	18.49	7.58	10.90	29.44
50	64	17.12	7.58	9.54	28.62
55	60	15.96	7.58	8.38	27.65
60	56	14.96	7.58	7.38	26.57
65	53	14.09	7.58	6.51	25.40
70	50	13.33	7.58	5.75	24.14
75	47	12.65	7.58	5.07	22.81
80	45	12.04	7.58	4.46	21.42
85	43	11.50	7.58	3.92	19.98
90	41	11.01	7.58	3.42	18.49
95	39	10.56	7.58	2.97	16.95
100	38	10.15	7.58	2.56	15.39
105	36	9.77	7.58	2.19	13.79
110	35	9.42	7.58	1.84	12.15
115	34	9.10	7.58	1.52	10.50
120	33	8.81	7.58	1.22	8.81

FIVE-YEAR EVENT

DRAINAGE AREA I (Dental Clinic Roof)

(FIVE-YEAR EVENT)

			C
Total Catchment Area:	532	sq.m	0.90

No. of Roof Drains:	2				
Slots per Wier:	1	0.0124 L/s/mm/slot (5 USGPM/in/slot)			
Depth at Roof Drain:	103	mm	Pond Area:	242	sq.m
Maximum Release Rate:	2.56	L/s	Achieved Volume:	8.32	cu.m
			Maximum Volume Required:	8.32	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	141	18.79	2.56	16.23	4.87
10	104	13.87	2.56	11.31	6.79
15	84	11.12	2.56	8.56	7.71
20	70	9.35	2.56	6.79	8.15
25	61	8.11	2.56	5.55	8.32
30	54	7.18	2.56	4.62	8.32
35	49	6.46	2.56	3.90	8.19
40	44	5.88	2.56	3.32	7.98
45	41	5.41	2.56	2.85	7.69
50	38	5.01	2.56	2.45	7.36
55	35	4.68	2.56	2.12	6.99
60	33	4.38	2.56	1.83	6.58
65	31	4.13	2.56	1.57	6.14
70	29	3.91	2.56	1.35	5.68
75	28	3.71	2.56	1.15	5.19
80	27	3.54	2.56	0.98	4.69
85	25	3.38	2.56	0.82	4.17
90	24	3.23	2.56	0.67	3.64
95	23	3.10	2.56	0.54	3.10
100	22	2.98	2.56	0.42	2.55
105	22	2.87	2.56	0.31	1.98
110	21	2.77	2.56	0.21	1.41
115	20	2.68	2.56	0.12	0.83
120	19	2.59	2.56	0.03	0.24

DRAINAGE AREA II

(FIVE-YEAR EVENT)

			C
Roof Area:	405	sq.m	0.90
Asphalt/Concrete Area:	685	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	950	sq.m	0.20
Total Catchment Area:	2040	sq.m	0.57

Water Elevation:	94.03	m
Invert of Outlet Pipe - CB/MH-2:	92.03	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-2)	92.07	m
Head:	1.97	m
Orifice Diameter:	75	mm
Orifice Area:	4418	sq.mm
Coefficient of Discharge:	0.212	
Maximum Release Rate:	5.82	L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
DI-1	165	0.36	20.10	cu.m
CB/MH-2	41	0.07	1.03	cu.m
		Achieved Volume:	21.13	cu.m
		Maximum Volume Required:	21.13	cu.m

DRAINAGE AREA II (Continued)

(FIVE-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	141	45.96	5.82	40.14	12.04
10	104	33.92	5.82	28.10	16.86
15	84	27.20	5.82	21.38	19.24
20	70	22.87	5.82	17.05	20.46
25	61	19.82	5.82	14.01	21.01
30	54	17.56	5.82	11.74	21.13
35	49	15.79	5.82	9.98	20.95
40	44	14.38	5.82	8.56	20.56
45	41	13.23	5.82	7.41	20.00
50	38	12.26	5.82	6.44	19.32
55	35	11.43	5.82	5.62	18.53
60	33	10.72	5.82	4.91	17.66
65	31	10.11	5.82	4.29	16.72
70	29	9.56	5.82	3.74	15.72
75	28	9.08	5.82	3.26	14.67
80	27	8.65	5.82	2.83	13.57
85	25	8.26	5.82	2.44	12.44
90	24	7.91	5.82	2.09	11.27
95	23	7.59	5.82	1.77	10.08
100	22	7.29	5.82	1.48	8.85
105	22	7.03	5.82	1.21	7.60
110	21	6.78	5.82	0.96	6.33
115	20	6.55	5.82	0.73	5.04
120	19	6.34	5.82	0.52	3.73

DRAINAGE AREA III

(FIVE-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Asphalt/Concrete Area:	865	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	392	sq.m	0.20
Total Catchment Area:	1257	sq.m	0.68

Water Elevation:	92.60	m
Invert of Outlet Pipe - CB/MH-5:	91.86	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-5)	91.90	m
Head:	0.70	m
Orifice Diameter:	79	mm
Orifice Area:	4953	sq.mm
Coefficient of Discharge:	0.61	
Maximum Release Rate:	11.23	L/s

Chamber Storage

Measured Chamber Area	Chamber & End Cap Length	Chamber & End Cap Volume
1.00 at 92.60	7.577	7.58

Clear Stone Storage

Clear Stone Length	Clear Stone Width	Clear Stone Storage Depth	Clear Stone Volume	40% Voids
8.177	4.852	0.55	14.415	5.77

Achieved Volume:	13.34	cu.m
Maximum Volume Required:	13.34	cu.m

DRAINAGE AREA III (Continued)

(FIVE YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	141	33.63	5.62	28.01	8.40
10	104	24.82	5.62	19.20	11.52
15	84	19.90	5.62	14.29	12.86
20	70	16.74	5.62	11.12	13.34
25	61	14.51	5.62	8.89	13.34
30	54	12.85	5.62	7.23	13.01
35	49	11.56	5.62	5.94	12.48
40	44	10.53	5.62	4.91	11.78
45	41	9.68	5.62	4.06	10.97
50	38	8.97	5.62	3.35	10.06
55	35	8.37	5.62	2.75	9.08
60	33	7.85	5.62	2.23	8.03
65	31	7.40	5.62	1.78	6.94
70	29	7.00	5.62	1.38	5.80
75	28	6.64	5.62	1.03	4.62
80	27	6.33	5.62	0.71	3.41
85	25	6.04	5.62	0.43	2.18
90	24	5.79	5.62	0.17	0.92
95	23	5.55	5.55	0.00	0.00
100	22	5.34	5.34	0.00	0.00
105	22	5.14	5.14	0.00	0.00
110	21	4.96	4.96	0.00	0.00
115	20	4.79	4.79	0.00	0.00
120	19	4.64	4.64	0.00	0.00

D.B. Gray Engineering Inc.

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STORM SEWER CALCULATIONS

Rational Method — FIVE YEAR EVENT

3130 Woodroffe Avenue
Dental Clinic and Semi-Detached Dwellings
Ottawa, Ontario

February 22, 2022 — Manning's Roughness Coefficient: 0.013

Location		Individual					Cumulative				Sewer Data							
From	To	Roof C = 0.90 (ha)	Hard C = 0.90 (ha)	Gravel C = 0.70 (ha)	Soft C = 0.20 (ha)	2.78AC	2.78AC	Time (min)	Rainfall Intensity (mm/hr)	Flow Rate (L/s)	Length (m)	Nominal Diameter (mm)	Actual Diameter (mm)	Slope (%)	Velocity (m/s)	Q_{Full} Capacity (L/s)	Time (min)	Q / Q_{Full}
DI-1	CB/MH-2	0.0405			0.0845	0.1483	0.1483	10.00	104	15.45	34.9	250	251	0.43	0.80	39.41	0.73	0.39
CB/MH-2	MH-6		0.0685		0.0105	0.1772	0.3255	10.73	100	32.71	25.2	450	457	0.195	0.80	131.19	0.53	0.25
						Flow through inlet control device:				5.82	25.2	450	457	0.195	0.80	131.19	0.53	0.04
DI-3	CB/MH-4		0.0105		0.0135	0.0338	0.0338	10.00	104	3.52	15.3	250	251	0.43	0.80	39.41	0.32	0.09
CB/MH-4	CB/MH-5		0.0080		0.0105	0.0259	0.0596	10.32	103	6.11	19	300	299	0.34	0.80	55.89	0.40	0.11
CB/MH-5	CB/MH-6		0.0680		0.0152	0.1786	0.2382	10.72	101	23.95	1.7	450	457	0.195	0.80	131.19	0.04	0.18
						Flow through inlet control device:				11.23	1.7	450	457	0.195	0.80	131.19	0.04	0.09
MH-6	CB/MH-7						0.5638	11.26	98	55.25	39.7	450	457	0.195	0.80	131.19	0.83	0.42
						Flow through inlet control devices:				17.05	39.7	450	457	0.195	0.80	131.19	0.83	0.13
CB/MH-7	Existing			Existing Ditch Inlet Lead			0.5638	12.08	94	53.19	23.5	200	201	1.00	1.05	33.24	0.37	1.60
	1200 ST					Flow through inlet control devices:				17.05	23.5	200	201	1.00	1.05	33.24	0.37	0.51
							Existing 1,200 mm Woodroffe Avenue Storm Sewer:				1,200	1,220	0.25	1.74	2,037		
Roof	MH-9	0.0532				0.1331	0.1331	10.00	104	13.87	9.1	200	201	1.00	1.05	33.24	0.14	0.42
						Flow through flow control roof drains:				2.56	9.1	200	201	1.00	1.05	33.24	0.14	0.08
MH-9	Existing						0.1331	10.14	103	13.77	51.1	250	251	0.43	0.80	39.41	1.07	0.35
	300 ST					Flow through flow control roof drains:				2.56	51.1	250	251	0.43	0.80	39.41	1.07	0.06
							Existing 300 mm Deerfox Drive Storm Sewer:				300	300	1.45	1.65	116.44		

APPENDIX D

CITY OF OTTAWA SERVICING STUDY CHECKLIST

CITY OF OTTAWA SERVICING STUDY CHECKLIST

GENERAL CONTENT

Executive Summary: **N/A**

Date and revision number of report: **Included**

Location map and plan showing municipal address, boundary and layout of proposed development: **Included**

Plan showing site and location of all existing services: **Included**

Development statistics, land use, density, adherence to zoning and Official Plan and reference to applicable watershed and subwatershed plans: **N/A**

Summary of Pre-Application Consultation meetings with City of Ottawa and other approval agencies: **N/A**

Confirmation of conformance with higher level studies: **Included**

Statement of objectives and servicing criteria: **Included**

Identification of existing and proposed infrastructure available in the immediate area: **Included**

Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development: **N/A**

Concept level master grading plan to confirm existing and proposed grades in the proposed development: **Included**

Identification of potential impacts of proposed piped services on private services on adjacent lands: **N/A**

Proposed phasing of proposed development: **N/A**

Reference to geotechnical studies: **Included**

All preliminary and formal site plan submissions should have the following information:

- Metric scale: **Included**
- North arrow: **Included**
- Key plan: **Included**
- Name and contact information of applicant and property owner: **N/A**
- Property limits: **Included**
- Existing and proposed structures and parking areas: **Included**
- Easements, road widenings and right-of-ways: **Included**
- Street names: **Included**

WATER SERVICING

Confirmation of conformance with Master Servicing Study: **N/A**
Availability of public infrastructure to service proposed development: **Included**

Identification of system constraints: **Included**

Identification of boundary conditions: **Included**

Confirmation of adequate domestic supply: **Included**

Confirmation of adequate fire flow: **Included**

Check of high pressures: **Included**

Definition of phasing constraints: **N/A**

Address reliability requirements: **N/A**

Check on necessity of a pressure zone boundary modification: **N/A**

Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for proposed development: **Included**

Description of proposed water distribution network: **Included**

Description of required off-site infrastructure to service proposed development: **N/A**

Confirmation that water demands are calculated based on the City of Ottawa Water Design Guidelines: **Included**

Provision of a model schematic showing the boundary conditions locations, streets, parcels and building locations: **Included**

SANITARY SERVICING

Summary of proposed design criteria: **Included**

Confirmation of conformance with Master Servicing Study: **N/A**

Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the City of Ottawa Sewer Design Guidelines: **N/A**

Description of existing sanitary sewer available for discharge of wastewater from proposed development: **Included**

Verification of available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service proposed development: **N/A**

Calculations related to dry-weather and wet-weather flow rates: **Included**

Description of proposed sewer network: **Included**

Discussion of previously identified environmental constraints and impact on servicing: **N/A**

Impacts of proposed development on existing pumping stations or requirements for new pumping station: **N/A**

Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity: **N/A**

Identification and implementation of emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding: **N/A**

Special considerations (e.g. contamination, corrosive environment): **N/A**

STORMWATER MANAGEMENT & STORM SERVICING

Description of drainage outlets and downstream constraints: **Included**

Analysis of available capacity in existing public infrastructure: **N/A**

Plan showing subject lands, its surroundings, receiving watercourse, existing drainage pattern and proposed drainage pattern: **Included**

Water quantity control objective: **Included**

Water quality control objective: **Included**

Description of the stormwater management concept: **Included**

Setback from private sewage disposal systems: **N/A**

Watercourse and hazard lands setbacks: **N/A**

Record of pre-consultation with the Ministry of the Environment, Conservation and Parks and the Conservation Authority having jurisdiction on the affected watershed: **N/A**

Confirmation of conformance with Master Servicing Study: **N/A**

Storage requirements and conveyance capacity for minor events (5-year return period) and major events (100-year return period): **Included**

Identification of watercourses within the proposed development and how watercourses will be protected or if necessary altered by the proposed development: **N/A**

Calculation of pre-development and post-development peak flow rates: **Included**

Any proposed diversion of drainage catchment areas from one outlet to another: **N/A**

Proposed minor and major systems: **Included**

If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event: **N/A**

Identification of potential impacts to receiving watercourses: **N/A**

Identification of municipal drains: **N/A**

Description of how the conveyance and storage capacity will be achieved for the proposed development: **Included**

100-year flood levels and major flow routing: **Included**

Inclusion of hydraulic analysis including hydraulic grade line elevations: **N/A**

Description of erosion and sediment control during construction: **Included**

Obtain relevant floodplain information from Conservation Authority: **N/A**

Identification of fill constraints related to floodplain and geotechnical investigation: **N/A**

APPROVAL AND PERMIT REQUIREMENTS

Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act: **N/A**

Application for Certificate of Approval (CofA) under the Ontario Water Resources Act: **N/A**

Changes to Municipal Drains: **N/A**

Other permits (e.g. National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation): **N/A**

CONCLUSIONS

Clearly stated conclusions and recommendations: **Included**

Comments received from review agencies: **N/A**

Signed and stamped by a professional Engineer registered in Ontario: **Included**