ANNEX F - SERVICING STUDY

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November 5, 2021

Mr. Shawn Chaisson
First Mutual Properties
175 Main Street #203
Dartmouth, NS
B2X 1S1

Re: 70 First Lake Drive, Lower Sackville Nova Scotia – Downstream Wastewater Sewer Analysis

First Mutual Properties is proposing to add three (3) apartment buildings with a total of 450 units to their property at 70 First Lake Drive in Lower Sackville. A sketch of this development (Figure 1) is in the appendix. Based on a density of 2.25 people per unit, this equates in an additional 1013 people. The project incorporates existing commercial spaces in addition to the proposed multi-unit buildings. As per Halifax Water Design and Construction Specifications (2020), Section 4.2.1 and at the request of First Mutual Properties, SDMM has prepared the following capacity analysis for the sewer systems immediately downstream of the proposed development.

Tributary Drainage Areas & Population

The downstream terminus of this analysis was established based on correspondence with Halifax Water Development staff and was determined to be the existing pump station located near the Salvation Army at the corner of First Lake Drive and Metropolitan Avenue. This required seven (7) sections of gravity sewer directly downstream of the redevelopment to be analyzed. Existing and proposed tributary areas for these sewers are depicted in Figure 2 of the appendix.

SDMM determined equivalent populations for the existing sewer sheds based on the following resources:

- Halifax Water Design & Construction Specifications (2020)
- Atlantic Canada Wastewater Guidelines Manual for Collection, Treatment and Disposal (2006)
- Zoning information from the HRM Land-Use By-Law for Sackville
- Correspondence with Halifax Water – Figure 3 (Population Densities & Terminus Point)

A summary of the density calculations is presented in Table 1 of the appendix. Tributary areas and population calculations, including the proposed development are presented in Table 2 of the appendix.

Estimated Wastewater Flow Calculations

Estimated wastewater flows were calculated based on the hydraulic design formula outlined in Section 4.2.2 of the Halifax Water Design & Construction Specifications (2020). Flows calculated include the Halifax Water safety factor of 1.25 with allowances of 0.30m^3 per person per day for residential development and 24m^3 per gross hectare per day for infiltration/inflow.

Existing flows for each section of sewer downstream from the development were calculated. A summary of the theoretical existing flows is presented in Table 3A. The flows for each pipe reach were recalculated to include the proposed development and are presented in Table 3B of the appendix.

Existing Pipe Capacity

Existing pipe capacities were calculated using Manning's Equation for each reach of downstream sewer utilizing pipe characteristics provided by Halifax Water GIS information. A summary of the existing pipe capacities is presented in Table 4 of the appendix.

Existing Pump Station Flows

Existing pump station flow monitoring data from August 2020 to August 2021 was received from Halifax Water. Flows were recorded every five minutes during this time. Based on this data, average flows for each month were calculated and are shown in Table 5 of the appendix. Average flows range from 336.44 m^3/day (August 2020) to 701.65 m^3/day (February 2021).

Conclusion

Comparisons between the estimated flows including the proposed development, calculated in Table 3B of the appendix and existing pipe capacities in Table 4 indicate that the downstream sewer has sufficient capacity to accommodate the anticipated wastewater flows generated by this proposed development. The largest wastewater percentage capacity of the pipe reaches analyzed is 70%.

Existing pump station flows recorded by Halifax Water in Table 5 are much lower than the theoretical calculated flows. This is evident by referring to Table 3A and noting that the last pipe prior to the pump station, 'Pipe G' has an estimated flow of 6476 m^3/day and then comparing this flow to the actual average daily flows in Table 5. The highest flow recorded was 42.33 L/s on September 23, 2020 at 9:30am with that day averaging a daily flow of 1493.16 m^3. Rainfall data provided by Halifax Water as well as data from Environment Canada show that September 22nd and 23rd, 2020 were significant rainfall events (51mm and 38mm respectively), therefore it is expected infiltration was the cause of the higher flows recorded on

this day. Some of this approximately 4 times difference in theoretical to actual flow can be attributed to densities we used to estimate flows on areas of land that may not be currently developed.

We reviewed the feasibility of increasing the residential unit count for the development without exceeding the theoretical pipe capacity. Table 4 indicates our most critical pipe downstream from the development is 'Pipe D' with the largest theoretical wastewater percentage capacity of 70%. We determined an additional 382 units could be added to the proposed 450 units before 80% of the pipe's capacity was exceeded. Flow monitoring will be required to exceed 80% pipe capacity, as per Halifax Water. This is without calibrating our theoretical flow model to the lower actual monitored flows.

In conclusion, the estimated flows from the existing tributary areas with the addition of the proposed development will not exceed the existing downstream wastewater main pipe's capacities.

For additional information or comment please contact the undersigned.

Regards,

Servant, Dunbrack, McKenzie & MacDonald Ltd.

Original Signed

Ray Landry, MASc., P.Eng.
Project Engineer
Z:\SDMM\36000-36999\36600\36615\Design\Sanitary\36615 Wastewater Anaylsis Report.docx

APPENDIX

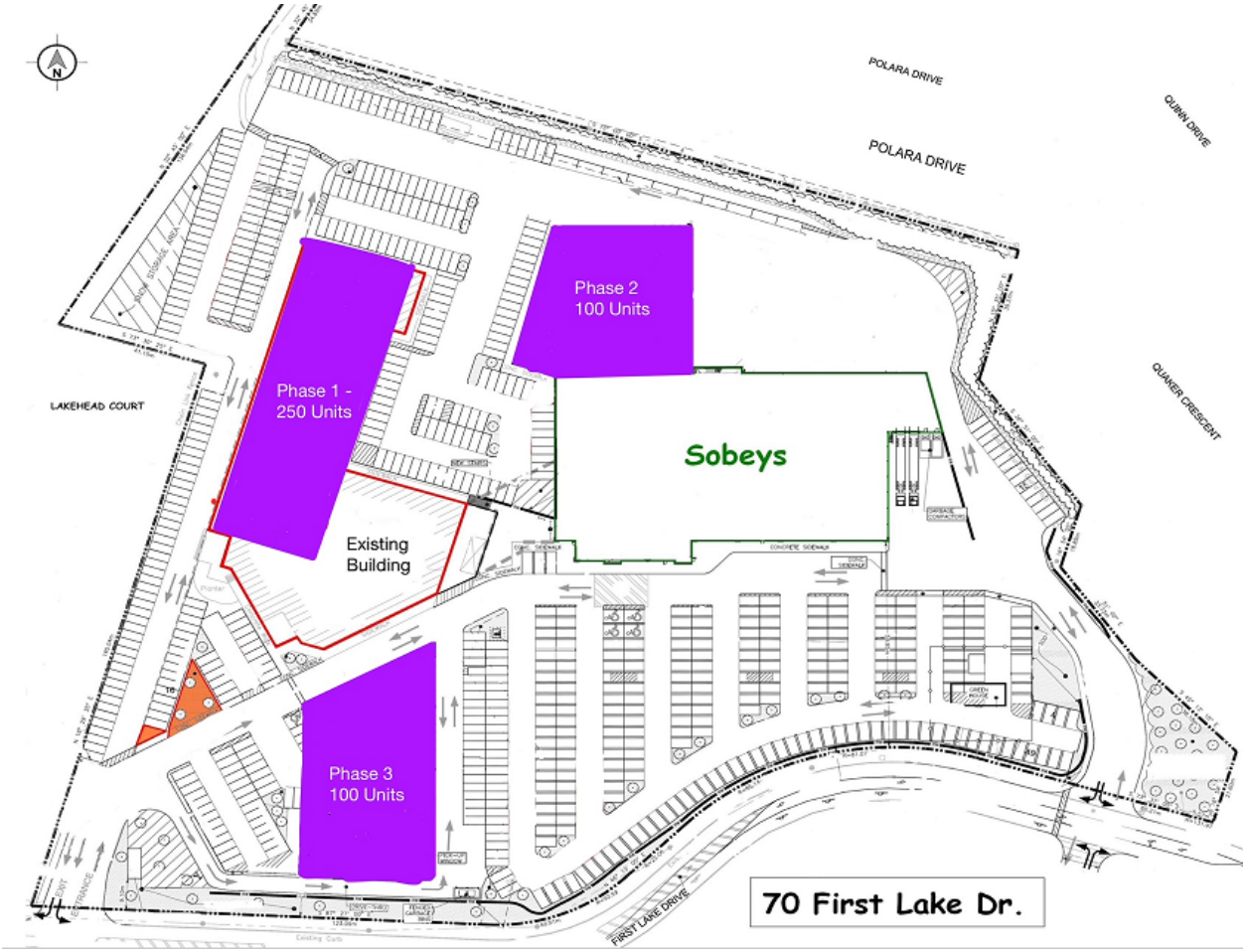

Figure 1: Proposed Development Sketch

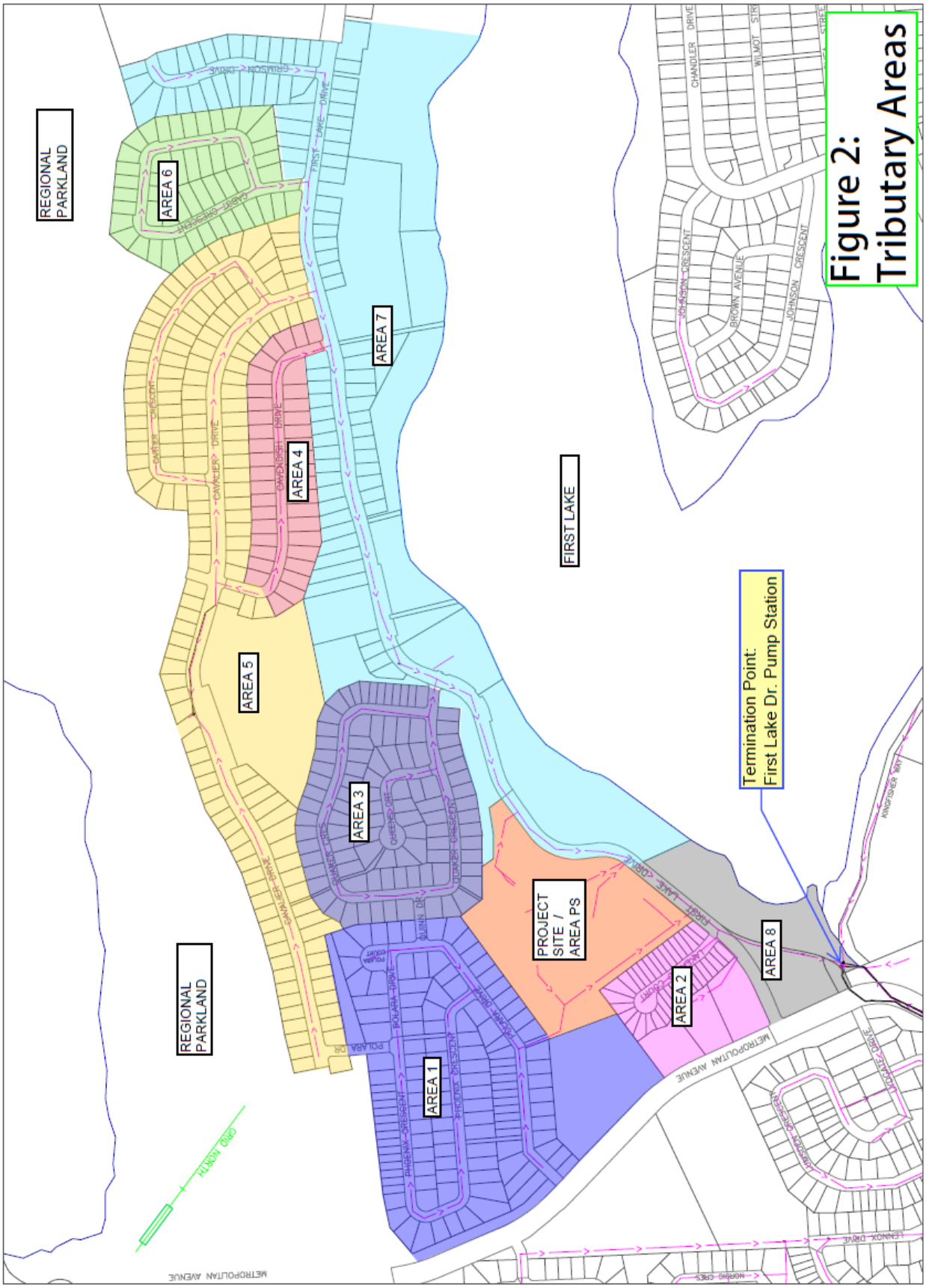
Figure 2:
Tributary Areas
REGIONAL PARKLAND
AREA 6
AREA 7
AREA 4
AREA 5
AREA 3
AREA 1
AREA 2
AREA 8
FIRST LAKE
PROJECT SITE / AREA PS
Termination Point:
First Lake Dr. Pump Station
REGIONAL PARKLAND
GRID NORTH
METROPOLITAN AVENUE

From: Meghan Woszczynski
Sent: Monday, October 25, 2021 10:23 AM
To: 'Justin MacCallum' <jmaccallum@sdmm.ca>
Cc: Ray Landry <rlandry@sdmm.ca>
Subject: RE: First Lake Drive Downstream Sanitary Analysis

Hello Justin,

Just wanted to let you know that I am currently looking into this.

The end point of the analysis will be around the First Lake Drive PS. I am looking into the curtain capacity for the First lake Drive PS in order to determine if a analysis of the pump station is also required. In addition there is flow monitoring data in the area for consideration.

I will get back to you soon,
Thanks again
Meghan

Meghan Woszczynski, M.A.Sc., P.Eng
Development Engineer, Halifax Water
450 Cowie Hill Rd, PO Box 8388 RPO CSC Halifax, NS B3K 5M1
C: 902-209-3915 E: **meghanw@halifaxwater.ca**

Figure 3: Email from Halifax Water Regarding Terminus

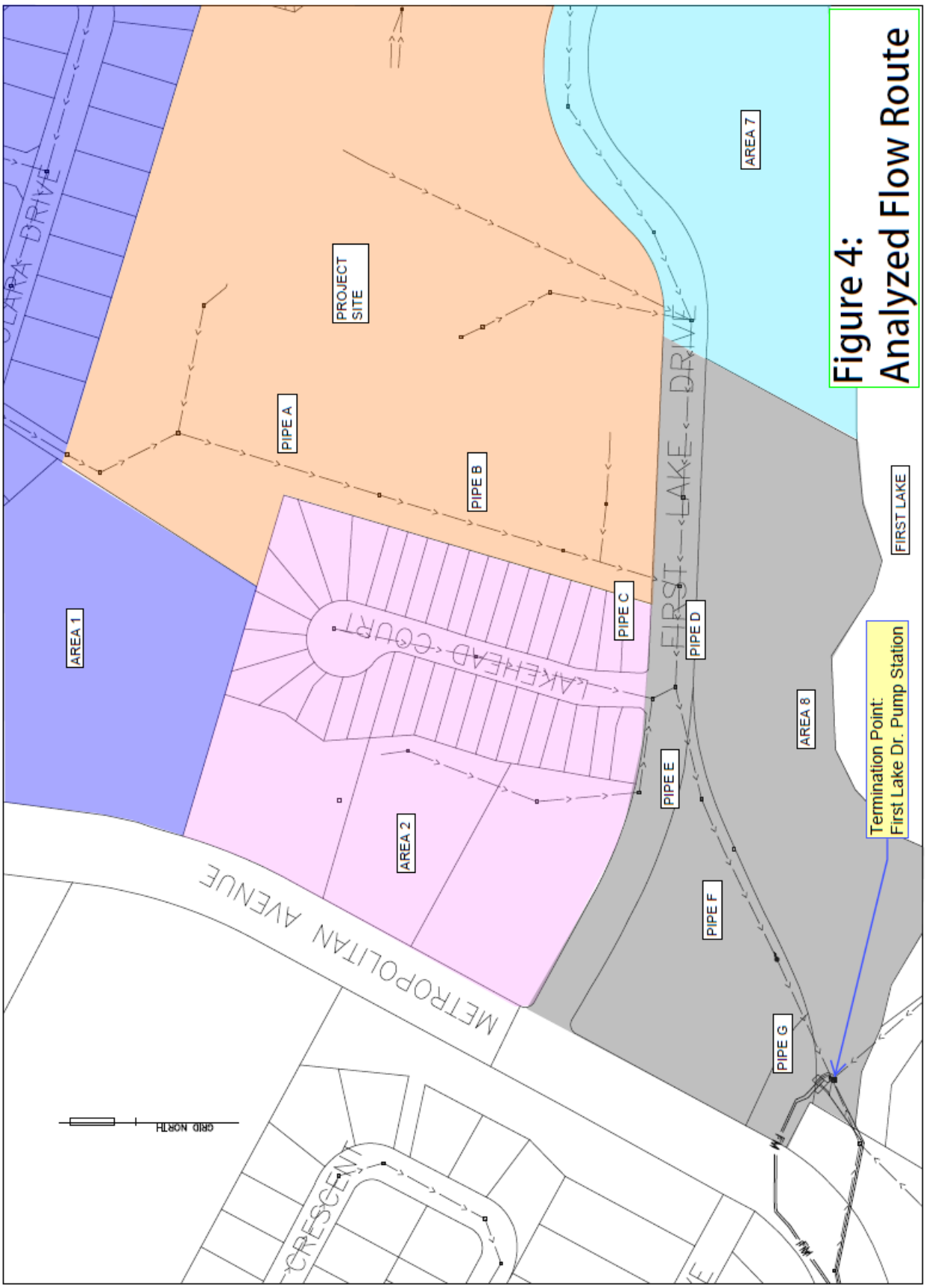
Figure 4:
Analyzed Flow Route
PROJECT SITE
AREA 1
AREA 2
AREA 7
AREA 8
PIPE A
PIPE B
PIPE C
PIPE D
PIPE E
PIPE F
PIPE G
FIRST LAKE
Termination Point:
First Lake Dr. Pump Station
CLARA DRIVE
LAKEHEAD COURT
FIRST LAKE DRIVE
METROPOLITAN AVENUE
CRESCENT
GRID NORTH
FM
FM

Table 1 - By-Law Density Values					
Zoning	Number of Units	People per unit (HW)	Min. Lot Area (ft^2 | Ha)		People per Hectare
R-1 - Single Family Dwelling Zone					
	1	3.35	6,000.00	0.06	60
R-2 - Two Family Dwelling Zone					
	2	3.35	7,000.00	0.07	103
R-4 - Multiple Dwelling Zone					
	*By-Law (75 people per acre)				185
C-2 - Community Commercial Zone					
	*Atlantic Canada Wastewater Guidelines				85
P-1 - Open Space Zone					
	*Atlantic Canada Wastewater Guidelines				0
P-2 - Community Facility Zone					
	*Atlantic Canada Wastewater Guidelines				85
Sackville Land-Use By-Law					

Table 2 - Tributary Areas and Population						
Area	Sub-Area	Number of Units	People Per Unit	People per Hectare	Tributary Area (ha)	Equivalent Population
P (Project Site)						
	Prop. Bld. 1	250	2.25	-	0.26	563
	Prop. Bld. 2	100	2.25	-	0.19	225
	Prop. Bld. 3	100	2.25	-	0.21	225
	Ex. Site (C-2)	-	-	85	4.67	397
				Sub-Totals	**5.33**	**1,410**
1						
	R-1 Zone	97	3.35	-	7.24	325
	R-2 Zone	26	3.35	-	1.02	87
	P-1 Zone	-	-	-	0.28	-
	P-2 Zone	-	-	85	1.99	169
	Street	-	-	-	2.12	-
				Sub-Totals	**12.65**	**581**
2						
	R-2 Zone	36	3.35	-	1.23	121
	R-4 Zone	-	-	185	1.42	263
	Street	-	-	-	0.27	-
				Sub-Totals	**2.92**	**383**
3						
	R-1 Zone	96	3.35	-	5.86	322
	Street	-	-	-	1.60	
				Sub-Totals	**7.46**	**322**
4						
	R-1 Zone	39	3.35	-	2.83	131
	Street	-	-	-	0.60	
				Sub-Totals	**3.43**	**131**
5						
	R-1 Zone	152	3.35	-	10.26	509
	P-2 Zone	-	-	85	3.36	286
	Street	-	-	-	3.51	-
				Sub-Totals	**17.13**	**795**
6						
	R-1 Zone	49	3.35	-	3.52	164
	Street	-	-	-	0.89	-
				Sub-Totals	**4.41**	**164**
7						
	R-1 Zone	86	3.35	-	6.97	288
	R-1 Zone	-	-	60	2.72	163
	P-1 Zone	-	-	-	9.31	-
	P-2 Zone	-	-	85	1.53	130
	Street	-	-	-	3.88	-
				Sub-Totals	**24.41**	**581**
8						
	P-2 Zone	-	-	85	2.78	236
				Sub-Totals	**2.78**	**236**
			Total Area (ha.)	**80.52**	**Total Pop.**	**4,603**

**R1 and R2 zoned properties with existing buildings use a population density of 3.35 people per unit. Properties with multi-unit buildings and undeveloped land use the associated population density shown above of people per hectare.*

Table 3A - Estimated Existing Wastewater Flows in Pipes					
	Pipes				
	A,B,C	D	E	F	G
Area Number(s)	1+0.5PS	All - 2 - (2/3)8	All - (1/2)8	All - (1/3)8	All
Tributary Area (ha)	15.32	75.75	79.13	79.59	80.52
Equivalent Population	780	3049	3241	3512	3590
Average Dry Weather Flow, a (m^3/d)	233.9	914.8	972.3	1053.5	1077.1
Harmon Peaking Factor, M	3.87	3.44	3.41	3.38	3.37
Infiltration/Inflow Allowance, b (m^3/d)	367.6	1817.9	1899.1	1910.2	1932.5
Peak Dry Weather Flow, a x M (m^3/d)	904.5	3143.7	3319.2	3564.3	3635.1
Peak Design Flow, (a x M) + b, (m^3/d)	1272.1	4961.6	5218.3	5474.5	5567.6
Safety Factor	1.25	1.25	1.25	1.25	1.25
Estimated Flow, Q (m^3/d)	**1498**	**5748**	**6048**	**6366**	**6476**

Table 3B - Estimated Proposed Wastewater Flows in Pipes							
	Pipe						
	A	B	C	D	E	F	G
Area Number(s)	1+0.5PS+Bldg(2)	1+0.5PS+Bldgs(1+2)	1+0.5PS+Bldgs(1+2+3)	All - 2 - (2/3)8	All - (1/2)8	All - (1/3)8	All
Tributary Area (ha)	15.25	15.44	15.65	75.75	79.13	77.85	80.52
Equivalent Population	1005	1568	1793	4062	4485	4525	4603
Average Dry Weather Flow, a (m^3/d)	301.4	470.3	537.8	1218.7	1345.5	1357.4	1381.0
Harmon Peaking Factor, M	3.80	3.67	3.62	3.33	3.29	3.28	3.28
Infiltration/Inflow Allowance, b (m^3/d)	365.9	370.4	375.5	1817.9	1899.1	1868.5	1932.5
Peak Dry Weather Flow, a x M (m^3/d)	1144.9	1723.9	1948.1	4055.1	4424.7	4458.8	4527.0
Peak Design Flow, (a x M) + b, (m^3/d)	1510.8	2094.4	2323.5	5873.0	6323.8	6327.3	6459.5
Safety Factor	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Estimated Flow, Q (m^3/d)	**1797**	**2525**	**2811**	**6887**	**7430**	**7442**	**7591**

Table 4 - Existing Pipe Capacity							
	Pipe						
	A	B	C	D	E	F	G
Sewer Type	Sanitary	Sanitary	Sanitary	Sanitary	Sanitary	Sanitary	Sanitary
Pipe Shape	Round	Round	Round	Round	Round	Round	Round
Pipe Diameter (mm)	250	250	250	300	300	300	300
Material	PVC	PVC	PVC	Asbestos Cement	Concrete	Concrete	Concrete
Slope (%)	1.1	5.7	8.1	1.0	1.9	4.6	5.0
Mannings Coefficient, n	0.010	0.010	0.010	0.011	0.013	0.013	0.013
Manning's Capacity, Qc (m^3/d)	**6941**	**15933**	**19033**	**9775**	**11516**	**17919**	**18645**
Wastewater Percentage of Capacity	26%	16%	15%	70%	65%	42%	41%

Table 5 - Existing Flows at Pump Station	
Flow Monitor Data Received from Halifax Water (FG539) At First Lake Drive/Metropolitan Avenue Pump Station	
Month	**Average Flow (m3/day)**
20-Aug	336.44
20-Sep	397.71
20-Oct	395.8
20-Nov	586.76
20-Dec	570.16
20-Jan	536.87
21-Feb	701.65
21-Mar	540.05
21-Apr	528.45
21-May	444.38
21-Jun	442.01
21-Jul	382.22
21-Aug	403.32
Maximum Flow recorded 42.33 L/s (9/23/2020) at 9:30	**1493.16**

Table 6 - Maximum Units for 80% Capacity in Pipe D	
Pipe D capacity with proposed units	70%
80% of Pipe D	7820
Available Flow in Pipe D (m^3/day)	933
Equivalent Population	860
Additional Units to reach 80% capacity in Pipe D	**382**

ANNEX G - SANITARY FLOW CONFIRMATIONS

Servant, Dunbrack, McKenzie & MacDonald Ltd.
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ADAM J. PATTERSON, P.Eng., NSLS

August 3, 2022

Halifax Water
450 Cowie Hill Road
Halifax, NS

From: Ray Landry, MASc., P.Eng. File No. 37341

Re: **Lot TC-2E, First Lake Development, First Lake Drive, Sackville, Nova Scotia**
Residential Building Sanitary Lateral Size Confirmation

Project Summary:

	Commercial	Residential (Townhouses)	Residential (Multi-Unit)	Lot Area
Building A	0 m^2	0 Units	186 Units	8,037 m^2
From First Mutual Properties				

References:

1. Halifax Water (HW) Design & Supplementary Specifications, 2020 Edition, Section 4.2.2:

   Where;

   Q = Sanitary sewer flow.
   1.25 = Safety factor.
   a = Average dry weather flow.
   M = Peaking factor using Harmon Formula; $M = 1 + [14 / (4 + P^{0.5})]$
   b = Long-term infiltration/inflow allowance.
   P = Population in thousands

   - Residential Average Dry Weather Flow: 300 L/day per person
   - Townhouse Dwelling Population: 3.35 people per unit
   - Multi-Unit Dwelling Population: 2.25 people per unit
   - Infiltration allowance: 0.28 L/ha_{gross}/s

2. Atlantic Canada Wastewater Guidelines Manual (AWG), 2006 Edition, Section 2.3.

Calculation Summary:

<u>Population Estimate (P)</u>

Reference:

P_1: AWG Section 2.3.4.2 Commercial/Retail: 85 people per hectare

P_2: HW Section 4.2.1 Residential (Townhouse): 3.35 people per unit

P_3: HW Section 4.2.1 Residential (Multi-Unit): 2.25 people per unit

P_1 = 85 people per hectare x 0.000 hectares = 0

P_2 = 3.35 people per unit x 0 units = 0

P_3 = 2.25 people per unit x 186 units = 419

$P = P_1 + P_2 + P_3$ = 419 people or = 0.419

Dry Weather Flow (a)

Reference:

a: HW Section 4.2.2: Residential: 300 L/day per person

a: ACWG Section 2.3.4.3, Table 2.1: Commercial/Retail: 6 L/m2

a residential=	300 L/day	x	419	=	125,700 L/day	or	1.45	L/s
a commercial=	6 L/m^2	x	0	=	0 L/day	or	0.00	L/s

Total a= residential + commercial = 125,700 or 1.45 L/s

Infiltration (b)

Reference:

HW Section 4.2.2: Infiltration allowance: 0.28 $L/ha_{gross}/s$

Lot Area= 8,037 m^2 = 0.80 ha

b: 0.28 $L/ha_{gross}/s$ x 0.80 = 0.23 L/s

Peaking Factor (M)

$M = 1 + [14 / (4 + P^{0.5})]$

$M = 1 + [14 / (4 + (0.419)^{0.5})]$

M = 4.01

Sanitary Sewer Flow (Q)

Q = [1.25 x (a x M)] + b

Q = [1.25 x (1.45 x 4.01)] + 0.23 L/s

Q = 7.52 L/s

Sanitary Lateral Size Confirmation:

A 200 mm diameter PVC lateral at 2.00% slope has a capacity of 60.3 L/s. With Q =7.52 L/s, the proposed lateral will have sufficient flow capacity. For additional information or discussion regarding these findings please contact the undersigned.

Servant, Dunbrack, McKenzie & MacDonald Ltd.

Original Signed

Ray Landry, MASc., P.Eng.
Project Engineer

Servant, Dunbrack, McKenzie & MacDonald Ltd.
NOVA SCOTIA LAND SURVEYORS & CONSULTING ENGINEERS

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August 3, 2022

Halifax Water
450 Cowie Hill Road
Halifax, NS

From: Ray Landry, MASc., P.Eng. File No. 37341

Re: Lot TC-2E, First Lake Development, First Lake Drive, Sackville, Nova Scotia
Residential & Commercial Building Sanitary Lateral Size Confirmation

Project Summary:

	Commercial	Residential (Townhouses)	Residential (Multi-Unit)	Lot Area
Building B	700 m^2	0 Units	300 Units	9,171 m^2
From First Mutual Properties				

References:

1. Halifax Water (HW) Design & Supplementary Specifications, 2020 Edition, Section 4.2.2:

Where;

Q = Sanitary sewer flow.
1.25 = Safety factor.
a = Average dry weather flow.
M = Peaking factor using Harmon Formula; M = 1 + [14 / (4 + $P^{0.5}$)]
b = Long-term infiltration/inflow allowance.
P = Population in thousands

- Residential Average Dry Weather Flow: 300 L/day per person
- Townhouse Dwelling Population: 3.35 people per unit
- Multi-Unit Dwelling Population: 2.25 people per unit
- Infiltration allowance: 0.28 L/ha_{gross}/s

2. Atlantic Canada Wastewater Guidelines Manual (AWG), 2006 Edition, Section 2.3.

Calculation Summary:

<u>Population Estimate (P)</u>

Reference:

P_1: AWG Section 2.3.4.2 Commercial/Retail: 85 people per hectare

P_2: HW Section 4.2.1 Residential (Townhouse): 3.35 people per unit

P_3: HW Section 4.2.1 Residential (Multi-Unit): 2.25 people per unit

P_1 = 85 people per hectare x 0.070 hectares = 6

P_2 = 3.35 people per unit x 0 units = 0

P_3 = 2.25 people per unit x 300 units = 675

$P = P_1 + P_2 + P_3$ = 681 people or = 0.681

Dry Weather Flow (a)

Reference:

a: HW Section 4.2.2: Residential: 300 L/day per person

a: ACWG Section 2.3.4.3, Table 2.1: Commercial/Retail: 6 L/m2

a residential= 300 L/day x 675 = 202,500 L/day or 2.34 L/s

a commercial= 6 L/m² x 700 = 4,200 L/day or 0.05 L/s

Total a= residential + commercial = 206,700 or 2.39 L/s

Infiltration (b)

Reference:

HW Section 4.2.2: Infiltration allowance: 0.28 $L/ha_{gross}/s$

Lot Area= 9,171 m^2 = 0.92 ha

b: 0.28 $L/ha_{gross}/s$ x 0.92 = 0.26 L/s

Peaking Factor (M)

$M = 1 + [14 / (4 + P^{0.5})]$

$M = 1 + [14 / (4 + (0.681)^{0.5})]$

M = 3.90

Sanitary Sewer Flow (Q)

$Q = [1.25 \times (a \times M)] + b$

Q = [1.25 x (2.39 x 3.90)] + 0.26 L/s

Q = 11.92 L/s

Sanitary Lateral Size Confirmation:

A 200 mm diameter PVC lateral at 2.00% slope has a capacity of 60.3 L/s. With Q =11.92 L/s, the proposed lateral will have sufficient flow capacity. For additional information or discussion regarding these findings please contact the undersigned.

Servant, Dunbrack, McKenzie & MacDonald Ltd.

Original Signed

Ray Landry, MASc., P.Eng.
Project Engineer

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ADAM J. PATTERSON, P.Eng., NSLS

August 16, 2022

Halifax Water
450 Cowie Hill Road
Halifax, NS

From: Ray Landry, MASc., P.Eng. File No. 37341

Re: **Lot TC-2E, First Lake Development, First Lake Drive, Sackville, Nova Scotia**
Commercial Building Sanitary Lateral Size Confirmation

Project Summary:

	Commercial	Residential (Townhouses)	Residential (Multi-Unit)	Lot Area
Building C	230 m^2	0 Units	0 Units	1,848 m^2
From First Mutual Properties				

References:

1. Halifax Water (HW) Design & Supplementary Specifications, 2020 Edition, Section 4.2.2:

Where;

Q = Sanitary sewer flow.

1.25 = Safety factor.

a = Average dry weather flow.

M = Peaking factor using Harmon Formula; M = 1 + [14 / (4 + $P^{0.5}$)]

b = Long-term infiltration/inflow allowance.

P = Population in thousands

- Residential Average Dry Weather Flow: 300 L/day per person
- Townhouse Dwelling Population: 3.35 people per unit
- Multi-Unit Dwelling Population: 2.25 people per unit
- Infiltration allowance: 0.28 L/ha_{gross}/s

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Calculation Summary:

<u>Population Estimate (P)</u>

Reference:

P_1: AWG Section 2.3.4.2 Commercial/Retail: 85 people per hectare

P_2: HW Section 4.2.1 Residential (Townhouse): 3.35 people per unit

P_3: HW Section 4.2.1 Residential (Multi-Unit): 2.25 people per unit

P_1 = 85 people per hectare x 0.023 hectares = 2

P_2 = 3.35 people per unit x 0 units = 0

P_3 = 2.25 people per unit x 0 units = 0

$P = P_1 + P_2 + P_3$ = 2 people or = 0.002

Dry Weather Flow (a)

Reference:

a: HW Section 4.2.2: Residential: 300 L/day per person

a: ACWG Section 2.3.4.3, Table 2.1: Commercial/Retail: 6 L/m2

a residential=	300 L/day	x	0	=	0 L/day	or	0.00	L/s
a commercial=	6 L/m^2	x	230	=	1,380 L/day	or	0.02	L/s

Total a= residential + commercial = 1,380 or 0.02 L/s

Infiltration (b)

Reference:

HW Section 4.2.2: Infiltration allowance: 0.28 $L/ha_{gross}/s$

Lot Area= 1,848 m^2 = 0.18 ha

b: 0.28 $L/ha_{gross}/s$ x 0.18 = 0.05 L/s

Peaking Factor (M)

$M = 1 + [14 / (4 + P^{0.5})]$

$M = 1 + [14 / (4 + (0.002)^{0.5})]$

M = 4.46

Sanitary Sewer Flow (Q)

Q = [1.25 x (a x M)] + b

Q = [1.25 x (0.02 x 4.46)] + 0.05 L/s

Q = 0.14 L/s

Sanitary Lateral Size Confirmation:

A 150 mm diameter PVC lateral at 2.00% slope has a capacity of 28.0 L/s. With Q =0.14 L/s, the proposed lateral will have sufficient flow capacity. For additional information or discussion regarding these findings please contact the undersigned.

Servant, Dunbrack, McKenzie & MacDonald Ltd.

Original Signed

Ray Landry, MASc., P.Eng.
Project Engineer

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August 3, 2022

Halifax Water
450 Cowie Hill Road
Halifax, NS

From: Ray Landry, MASc., P.Eng. File No. 37341

Re: Lot TC-2E, First Lake Development, First Lake Drive, Sackville, Nova Scotia
Residential & Commercial Building Sanitary Lateral Size Confirmation

Project Summary:

	Commercial	Residential (Townhouses)	Residential (Multi-Unit)	Lot Area
Building D	1219 m^2	0 Units	314 Units	9,420 m^2
From First Mutual Properties				

References:

1. Halifax Water (HW) Design & Supplementary Specifications, 2020 Edition, Section 4.2.2:

Where;

Q = Sanitary sewer flow.

1.25 = Safety factor.

a = Average dry weather flow.

M = Peaking factor using Harmon Formula; M = 1 + [14 / (4 + $P^{0.5}$)]

b = Long-term infiltration/inflow allowance.

P = Population in thousands

- Residential Average Dry Weather Flow: 300 L/day per person
- Townhouse Dwelling Population: 3.35 people per unit
- Multi-Unit Dwelling Population: 2.25 people per unit
- Infiltration allowance: 0.28 L/ha_{gross}/s

2. Atlantic Canada Wastewater Guidelines Manual (AWG), 2006 Edition, Section 2.3.

Calculation Summary:

<u>Population Estimate (P)</u>

Reference:

P_1: AWG Section 2.3.4.2 Commercial/Retail: 85 people per hectare

P_2: HW Section 4.2.1 Residential (Townhouse): 3.35 people per unit

P_3: HW Section 4.2.1 Residential (Multi-Unit): 2.25 people per unit

P_1 = 85 people per hectare x 0.122 hectares = 11

P_2 = 3.35 people per unit x 0 units = 0

P_3 = 2.25 people per unit x 314 units = 707

$P = P_1 + P_2 + P_3$ = 718 people or = 0.718

Dry Weather Flow (a)

Reference:

a: HW Section 4.2.2: Residential: 300 L/day per person

a: ACWG Section 2.3.4.3, Table 2.1: Commercial/Retail: 6 L/m2

a residential= 300 L/day x 707 = 212,100 L/day or 2.45 L/s

a commercial= 6 L/m^2 x 1219 = 7,314 L/day or 0.08 L/s

Total a= residential + commercial = 219,414 or 2.54 L/s

Infiltration (b)

Reference:

HW Section 4.2.2: Infiltration allowance: 0.28 $L/ha_{gross}/s$

Lot Area= 9,420 m^2 = 0.94 ha

b: 0.28 $L/ha_{gross}/s$ x 0.94 = 0.26 L/s

Peaking Factor (M)

$M = 1 + [14 / (4 + P^{0.5})]$

$M = 1 + [14 / (4 + (0.718)^{0.5})]$

M = 3.89

Sanitary Sewer Flow (Q)

$Q = [1.25 \times (a \times M)] + b$

Q = [1.25 x (2.54 x 3.89)] + 0.26 L/s

Q = 12.61 L/s

Sanitary Lateral Size Confirmation:

A 200 mm diameter PVC lateral at 2.00% slope has a capacity of 60.3 L/s. With Q =12.61 L/s, the proposed lateral will have sufficient flow capacity. For additional information or discussion regarding these findings please contact the undersigned.

Servant, Dunbrack, McKenzie & MacDonald Ltd.

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Project Engineer