

# Sanitary Servicing Study

*3930 – 3950 Sixth Concession Development*

*City of Windsor*

*Our Project No. 23-a175*

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## Executive Summary

The principal objectives of this report are to discuss a sanitary servicing study for the proposed residential development at 3930 & 3950 Sixth Concession Road. The Sanitary servicing study has been conducted to investigate the increase in sanitary flow to the existing 250 mm diameter sanitary sewer constructed under Sixth Concession Road.

The proposed development shall have an overall area of 0.33 hectares and is estimated to accommodate 58 people (2.4 people per unit). The tributary area served by the existing sanitary sewer on Sixth Concession Road was estimated to be 5.0 hectares and the existing sewer is estimated to serve a total population of 250 people. Sanitary flow estimations were made for the existing sewer under Sixth Concession Road based on the tributary areas, property zoning, and the estimation approach provided in the City of Windsor's Development Manual, subsection 9.1.2.

A capacity estimate for the existing sewer on Sixth Concession Road was made using the Manning's equation and data provided in the City of Windsor's Sewer Atlas. Furthermore, by comparing the estimated capacity of the existing sewer with its current estimated flow and the adjusted flow, to account for the proposed development's sanitary flow contribution, HMA assessed the capacity of the existing sanitary sewer to accommodate the proposed development's sanitary service to this existing sewer.

The primary conclusions are:

- The existing 250 mm diameter sanitary main, at a slope of 0.40%, shall accommodate the sanitary flow for the proposed development.
- The proposed development shall have a tributary area of 0.33 hectare, with an estimated population 58 people.
- The existing sewer under Sixth Concession Road is estimated to have a tributary area of 5.0 hectares, with a current estimated population of 250 persons, and is estimated to have a current peak sanitary flow of 7.08 L/s.
- The current peak utilization of the existing sewer under Sixth Concession Road was estimated to be 18%.
- Based on the calculations discussed above, and provided in detail herein, the capacity of the existing 250 mm diameter sewer under Sixth Concession Road shall be sufficient to accommodate the estimated sanitary flows from the proposed residential development at 3930 & 3950 Sixth Concession Road
- The peak utilization for the existing sewer shall be between 7S3228 and 7S1057, and shall achieve a flow of 21% the existing sewer's capacity.

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## 1 Introduction

Haddad Morgan and Associates Ltd. (HMA) was retained to provide a sanitary sewer capacity study for a proposed residential development of 0.33 hectares at 3930 / 3950 Sixth Concession Road. The site currently has a 2-storey single detached dwelling, which is proposed to be converted to a 24-unit infill housing development, accommodating 58 people (based on medium density residential - 72 units per hectare and 2.4 people per unit). As such, HMA has investigated the changes/increase in sanitary flow from the proposed development to the existing Sixth Concession Road sanitary sewer. This report is intended to present the findings of a servicing study for the proposed development, specifically investigating the capacity of the existing Sixth Concession sanitary sewer.

## 2 Approach

The tributary area served by the existing Sixth Concession Road sanitary sewer was estimated through the use of the City of Windsor's Sewer Atlas mapping, available online via the City's website, and is depicted in Appendix A. Tributary areas were utilized to define infiltration flow and, in conjunction with Zoning District Map 14 (Zoning By-Law 8600), to estimate tributary populations. Population estimates were developed based on the population density's prescribed by subsection 9.1.2(c) of the City's development manual for various land uses.

The tributary areas and population estimates, were utilized in the estimation of the flow contribution from the existing development and to estimate the current peak flow in the existing sewer, by means of the design criteria identified in subsection 9.1.2(b) of the City's Development Manual. These calculations are presented, in detail, in Appendix B to this report. The estimation approach can be summarized as follows.

$Q$  (Ultimate) = Residential Sewage Flow x Ultimate Population Served x Ultimate Flow Factor + Infiltration

Where: Residential Sewage Flow = 0.0042 L/s/capita  
Infiltration = 0.156 L/s/Ha

The estimated peak flow from the proposed development and for the existing sewer were then compared to the capacity of the existing Sixth Concession Road sanitary sewer, which was estimated based on Manning's Equation:

$$Q = (1/n) \times A \times Rh^{2/3} \times S^{1/2}$$

Where:

Q	=	Flow Rate (m <sup>3</sup> /s)
n	=	Manning's Coefficient of Roughness (typically taken as 0.013)
A	=	Cross-sectional Area of the Conduit (m <sup>2</sup> )
Rh	=	Hydraulic Radius (m)
S	=	Slope (m/m)

The estimated peak flows to be routed through the existing sewer, with the contribution of the flow from the proposed development, were then divided by the estimated capacity of the existing sewer to define the percentage of the available hydraulic capacity in the sewer utilized during a peak flow event. Furthermore, if the utilization of the sewer's available capacity was found to be less than 100%, including contributions from the proposed development, then the routing of the sanitary flow from the proposed development to the existing Sixth Concession Road sanitary sewer was considered to be viable.

The approach taken for the sizing of the proposed sanitary sewer for the development was to examine the impact of each tributary area on the specific length of sewer serving that area, and then to examine the cumulative impact on the downstream sanitary sewers, which would convey the sanitary flow for the entire site to an existing municipal main sewer. Similar to the hydraulic investigation approach, defined above, each length of sewer and each downstream sewer was analyzed by means of comparing a hydraulic capacity for a given diameter of pipe, defined by the Manning's equation, to a theoretical sanitary effluent rate, estimated by means of the methodology discussed above.

### 3 Observations and Results

The results of the hydraulic investigation of the existing Sixth Concession Road sanitary sewer are presented, in detail, in Appendix B. Moreover, as the proposed routing lands the connection for the new development at municipal manhole 7S3228, the capacity assessments for the lengths of sewers routed between 7S3228 and 7S1057 are of primary concern for discerning viability of routing the proposed development's sanitary flow to the existing Sixth Concession Road sewers.

The maximum capacity utilization found between 7S3228 and 7S1057 was found to be 18% in the current conditions and 21% in the developed condition. Therefore, the capacity of the existing sanitary sewer is deemed to be hydraulically adequate to service the proposed development.

### 4 Conclusion

Based on the findings of this study, as presented in this report and supported by the attached documents, the existing 250 mm diameter Sixth Concession Road sanitary sewer has sufficient capacity to accommodate the sanitary servicing of the proposed residential development at 3930 / 3950 Sixth Concession Road.



**APPENDIX A**  
**Tributary Area Map**



Area 1	0.77 hectares, including right-of-way	7S7904 – 7S3225
Area 2	0.90 hectares, including right-of-way	7S3225 – 7S3226
Area 3	0.92 hectares, including right-of-way	7S3226 – 7S3227
Area 4	0.85 hectares, including right-of-way	7S3227 – 7S3228
Area 5	1.56 hectares, including right-of-way	7S3228 – 7S1057

**Study Area**

**APPENDIX B**  
**Sanitary Calculations**



**SANITARY CALCULATIONS  
SIXTH CONCESSION ROAD SANITARY SEWER - EXISTING CAPACITY STUDY**

**DESIGN CRITERIA**

		<u>Population</u>	<u>Ultimate Flow Factor</u>
		1000	6.00
Q (Ultimate) = Residential Sewage Flow x Ultimate Population Served x Ultimate Flow Factor + Infiltration		1500	5.75
		2000	5.55
RESIDENTIAL SEWAGE FLOW:	0.0042 l/s/person	2500	5.35
INFILTRATION RATE:	0.1560 l/s/hectare	3000	5.20
		4000	4.92
RESIDENTIAL POPULATION DENSITY:	50 persons/hectare	6000	4.50
COMMERCIAL POPULATION DENSITY:	74 persons/hectare	8000	4.15
INDUSTRIAL POPULATION DENSITY:	62 persons/hectare	10000	3.90
INSTITUTIONAL POPULATION DENSITY:	22 persons/hectare	15000	3.40

Location Street	Location From	Location To	Zoning	Individual Area A (hectares)	Individual Pop.	Cumulative Total Pop.	Cumulative Total Area (ha)	Peaking Factor	Area Pop Flow Q(p)	Area. Infil Flow Q(i)	Cum. Pop Flow Q(p)	Cum. Infil Flow Q(i)	Total Area Flow	Cumulative Total Flow	Sewer Length (m)	"From" Invert El. (m)	"To" Invert El. (m)	Existing Sewer Pipe Size	Existing Sewer Type of pipe	Existing Sewer Grade (m/m)	Existing Sewer Capacity (l/s)	Existing Sewer Full flow	Q/Qfull
Area 1	7S7904	7S3225	res	0.77	38	38	0.77	6	0.96	0.12	0.96	0.12	1.08	1.08	26.1	185.91	185.74	250	PVC	0.007	47.99	0.98	2%
Area 2	7S3225	7S3226	res	0.90	45	83	1.66	6	1.13	0.14	2.09	0.26	1.27	2.35	94.0	185.44	185.06	250	PVC	0.004	37.81	0.77	6%
Area 3	7S3226	7S3227	res	0.92	46	129	2.58	6	1.16	0.14	3.25	0.40	1.30	3.65	97.6	185.04	184.61	250	PVC	0.004	39.47	0.80	9%
Area 4	7S3227	7S3228	res	0.85	43	172	3.44	6	1.08	0.13	4.33	0.54	1.22	4.87	119.6	184.62	184.15	250	PVC	0.004	37.28	0.76	13%
Area 5	7S3228	7S1057	res	1.56	78	250	5.00	6	1.97	0.24	6.30	0.78	2.21	7.08	120.0	184.19	183.69	250	PVC	0.004	38.39	0.78	18%

**SANITARY CALCULATIONS  
SIXTH CONCESSION ROAD SANITARY SEWER - PROPOSED CAPACITY STUDY**

**DESIGN CRITERIA**

Q (Ultimate) = Residential Sewage Flow x Ultimate Population Served x Ultimate Flow Factor + Infiltration

RESIDENTIAL SEWAGE FLOW: 0.0042 l/s/person  
INFILTRATION RATE: 0.1560 l/s/hectare

RESIDENTIAL POPULATION DENSITY: 50 persons/hectare  
COMMERCIAL POPULATION DENSITY: 74 persons/hectare  
INDUSTRIAL POPULATION DENSITY: 62 persons/hectare  
INSTITUTIONAL POPULATION DENSITY: 22 persons/hectare

**PROPOSED DEVELOPMENT**

NUMBER OF UNITS 24  
PERSONS PER BEDROOM 2.4  
**POPULATION SERVED 57.6**

Population	Ultimate Flow Factor
1000	6.00
1500	5.75
2000	5.55
2500	5.35
3000	5.20
4000	4.92
6000	4.50
8000	4.15
10000	3.90
15000	3.40

Location Street	Location From	Location To	Zoning	Individual Area A (hectares)	Individual Pop.	Cumulative Total Pop.	Cumulative Total Area (ha)	Peaking Factor	Area Flow Q(p)	Area Flow Q(i)	Cum. Flow Q(p)	Cum. Flow Q(i)	Total Area Flow	Cumulative Total Flow	Sewer Length (m)	"From" Invert El. (m)	"To" Invert El. (m)	Existing Sewer Pipe Size (mm)	Existing Sewer Type of pipe	Existing Sewer Grade (m/m)	Existing Sewer Capacity (L/s)	Existing Sewer Full flow velocity	Q/Qfull
Area 1	7S7904	7S3225	res	0.77	38	38	0.77	6	0.96	0.12	0.96	0.12	1.08	1.08	26.1	185.91	185.74	250	PVC	0.007	47.99	0.98	2%
Area 2	7S3225	7S3226	res	0.90	45	83	1.66	6	1.13	0.14	2.09	0.26	1.27	2.35	94.0	185.44	185.06	250	PVC	0.004	37.81	0.77	6%
Area 3	7S3226	7S3227	res	0.92	46	129	2.58	6	1.16	0.14	3.25	0.40	1.30	3.65	97.6	185.04	184.61	250	PVC	0.004	39.47	0.80	9%
Area 4	7S3227	7S3228	res	0.85	43	172	3.44	6	1.08	0.13	4.33	0.54	1.22	4.87	119.6	184.62	184.15	250	PVC	0.004	37.28	0.76	13%
Area 5 Existing	7S3228	7S1057	res	1.23	62	234	4.67	6	1.56	0.19	5.90	0.73	1.75	6.62	120.0	184.19	183.69	250	PVC	0.004	38.39	0.78	17%
Area 5 Proposed	7S3228	7S1057	res	0.33	57.6	291.6	5.00	6	1.45	0.05	7.35	0.78	1.50	8.13	120.0	184.19	183.69	250	PVC	0.004	38.39	0.78	21%

\*\* Based on medium density residential (72 units per hectare) it was assumed 2.4 people per unit