MEMO

TO: John Henderson, P.Eng., Manager, Engineering Services
CC: Phil Bartnik, P.Eng, Director Public Works & Environmental Services
FROM: Flavio Forest, P.Eng.
DATE: June 26, 2019
SUBJECT: 12300 County Rd 42 Sanitary Assessment
OUR FILE: 15-2160

The existing vacant lot located along at the northeast corner of County Road 42 and Lesperance Road intersection is currently zoned neighbourhood-commercial and is located within the St. Alphonse sanitary pump station service area. The subject site is proposed to be rezoned to medium density residential and developed to include a total of 24 units.

The Town of Tecumseh has requested that Dillon Consulting Limited (Dillon) assess the impact of changes to the sanitary sewage flow requirements on the existing sanitary sewer collection system based on the land use change and proposed development. The latest update to the Town's XPSWMM sanitary sewer model will be used for this assessment based on calibrated wet weather flow conditions. The results of our assessment are summarized below.

XPSWMM Model Background

The Town's sanitary sewer model was developed on the basis of three sanitary drainage areas; namely the Tecumseh Hamlet (TH) area located south of County Road 22, Tecumseh Town (TE) area located north of County Road 22 and west of Manning Road, and St. Clair Beach (SB) area located east of Manning Road.

The Tecumseh Town and St. Clair Beach components of the model were updated and calibrated by Dillon in 2011 following a storm event on June 5-6, 2010 that resulted in widespread basement flooding. A hydrologic model was developed based on a 1:5 year, 24-hour design storm to simulate Rainfall Derived Inflow and Infiltration (RDII) for Wet Weather Flow (WWF) in the sanitary sewer system. Calibration of the model was completed based on the measured flows from six flow monitoring stations (three in Tecumseh Town and three in St. Clair Beach). Dry Weather Flow (DWF) was also established to represent diurnal Base Wastewater Flow (BWF) patterns. The WWF was then calibrated by subtracting out the DWF from the total monitored hydrograph over the runoff period. The resulting RDII was calibrated to water level readings for a large event that occurred on September 9, 2011, using three parameters for RDII estimation as follows:

- R: the fraction of rainfall volume that enters the sewer system;
- T: the time from the onset of rainfall to the peak of the hydrograph; and
- K: the ratio of the time to recession to the time to peak.

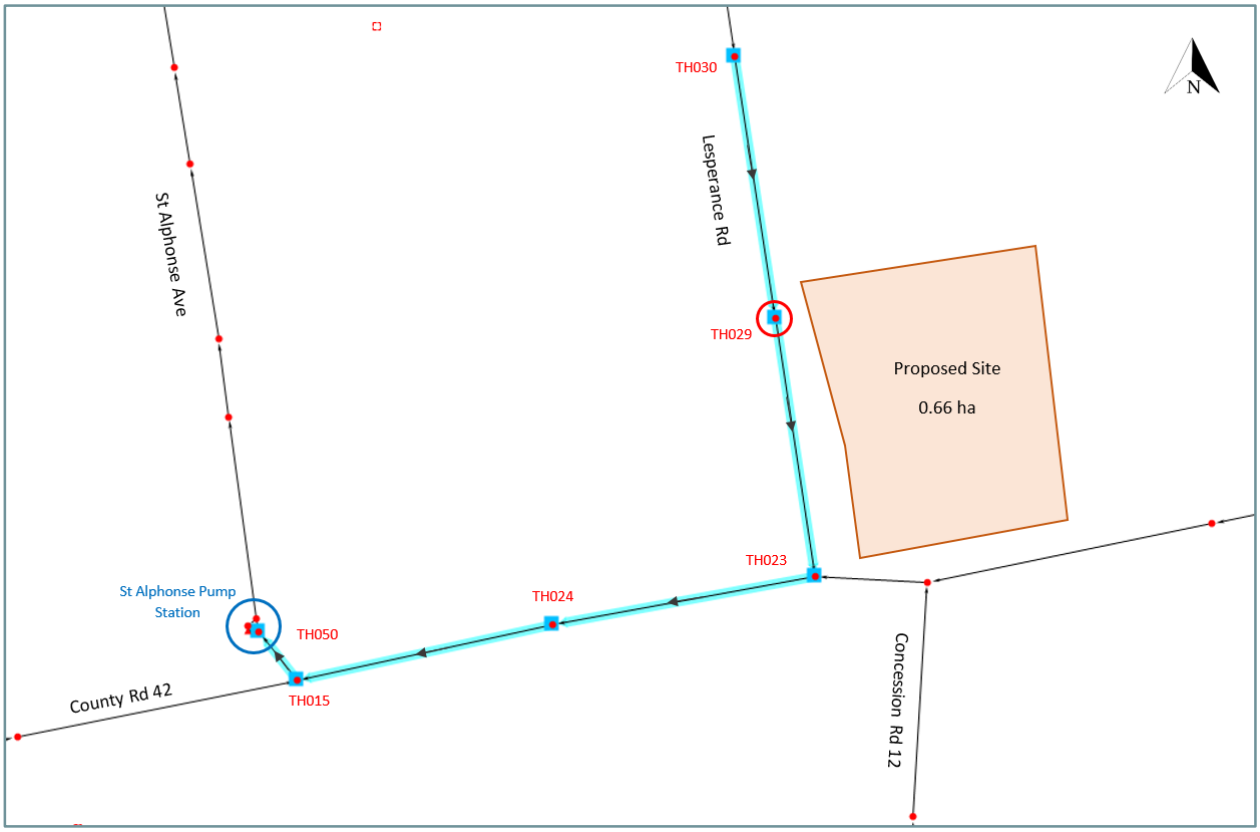
Since this model was developed, the Town has been undertaking an annual program to address extraneous flows in the sanitary sewer system, which has reportedly improved the wet weather flow conditions in the sanitary sewer system. Though the existing model has not been recalibrated to reflect these conditions, these measures will be qualitatively considered in interpreting the results of our evaluation.

XPSWMM Model Inputs

The 2011-based wet weather conditions results from the XPSWMM sanitary sewer model are illustrated below in **Figure 1**. Each node has been colour-coded to indicate the degree of surcharging in the sanitary sewer system, as described in the legend of each figure. As illustrated below, this part of the sanitary sewer system generally experiences high water levels (surcharging) that are within 1.5m of the ground surface under the design wet weather conditions.

For the proposed developed conditions, sanitary flows were introduced in the model at node **TH029,** as identified in **Figure 1**.

FIGURE 1: XPSWMM MODEL SCHEMATIC AND WET WEATHER SURCHARGE CONDITIONS



MH Colour Code	Description	Wet Weather Sanitary Surcharge Levels
	High Water Levels	Less than 1.5 m from ground surface
	Moderate Water Levels	1.5 m to 3.0 m from ground surface
	Low Water Levels	Greater than 3.0 m from ground surface

The sanitary flow parameters identified in **Table 1A** and **Table 1B** compare the current zoning to the proposed zoning based on Town of Tecumseh standards (2008 Water Wastewater Master Plan) and the Ministry of the Environment, Conservation and Parks (MECP) sewer guidelines. As may be noted below, the proposed zoning would result in a slightly greater total population compared with the current zoning.

TABLE 1A: CURRENT ZONING CONDITION SANITARY FLOW PARAMETERS

Parameter	Value
Current Zoning: Neighbourhood Commercial	0.66 ha @ 62 persons/ ha = 41
Domestic Unit Sewage Flow Rate	450 L/person-day
Peak Flow Factor	Harmon Formula
Infiltration	13.48 m^3/day/ha

TABLE 1B: PROPOSED ZONING CONDITION SANITARY FLOW PARAMETERS

Parameter	Value
Proposed Zoning: Medium Density Residential – Population	24 units @ 2 persons/unit = 48 persons
Domestic Unit Sewage Flow Rate	450 L/person-day
Peak Flow Factor	Harmon Formula
Infiltration	13.48 m^3/day/ha

The calculation of the total sewage flow for the existing and proposed site conditions is summarized in **Table 2**:

TABLE 2: SANITARY SEWER DESIGN CHART

Condition	Land Use	Basis for Determining Population	Population Density	Total Population	Peak Flow Factor	Peak Domestic Sanitary Flow (L/s)	Infiltration		Peak Sanitary Flow (L/s)
							(ha)	(m^3/day) (L/s)	
Current Zoning	Neighbourhood Commercial	0.66 ha	62 ppl/ha	41	4.3	0.9	0.66	(8.90) (0.1)	1.0
Proposed Zoning	Medium Density Residential	24 units	2 ppl/unit	48	4.3	1.1	0.66	(8.90) (0.1)	1.2

Sanitary Sewer Dry-Weather Flow Capacity

From a dry-weather sanitary flow perspective, the existing site is currently vacant, with a current zoning that would allow for a sewage flow of 1.0 L/s, which represents approximately 3% of the existing full flow pipe capacity of the local 250 mm diameter sanitary sewer on Lesperance Road. The proposed site development would result in a slight increase from the peak sanitary flow based on the current zoning.

XPSWMM Model Results

The XPSWMM model was utilized to assess the sanitary sewer system under wet weather conditions to quantify the impact of adding the sanitary flows from the proposed development (which would be slightly greater than what has been allowed for based on the current zoning) for the 1:5 year, 24-hour design storm event.

The modelled wet weather conditions in this sanitary sewer indicate that the system is currently surcharged within 1.5m from the ground surface in the area of this site. The wet weather conditions hydraulic grade line (HGL) for the Lesperance Road, County Road 42 and St. Alphonse Avenue sanitary sewers are shown in **Figure 2A and 2B**.

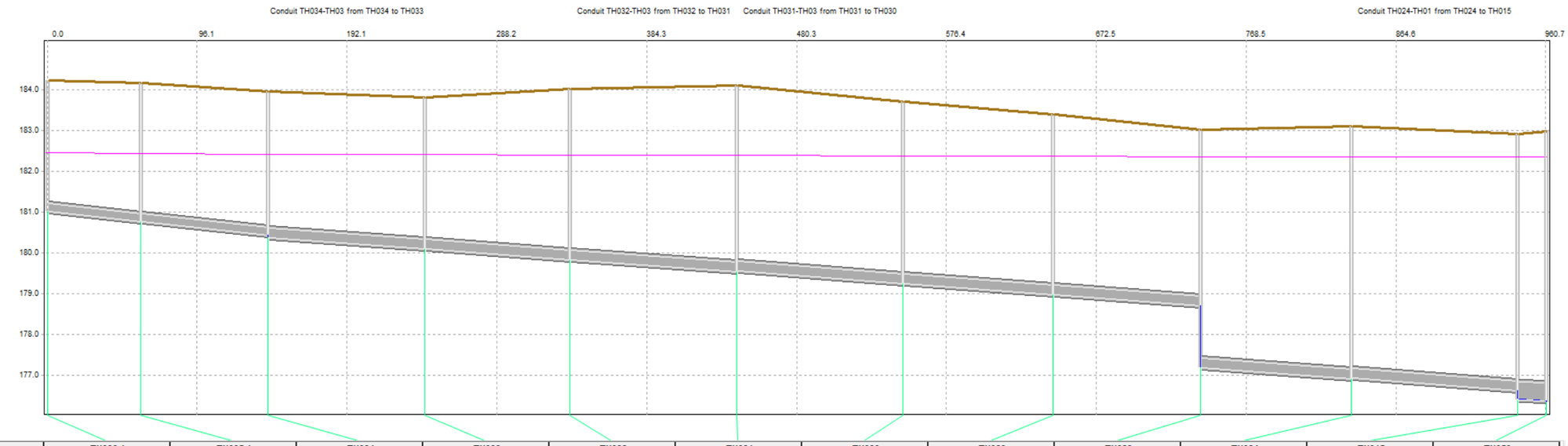
The resulting changes to the wet weather HGL are summarized in **Table 3**.

TABLE 3: COMPARISON OF HGL AND FREEBOARD FOR EXISTING CONDITIONS, AND PROPOSED ZONING CONDITIONS ALONG LESPERANCE RD AND COUNTY RD 42 TO ST. ALPHONSE PUMP STATION

Road Name	Lesperance Road									County Road 42		St. Alphonse Ave.
Scenario	TH036[1]	TH035	TH034	TH033	TH032	TH031	TH030	TH029[2]	TH23[3]	TH024	TH015	TH050[4]
Existing Conditions HGL (m)	182.466	182.447	182.422	182.413	182.404	182.394	182.384	182.376	182.364	182.363	182.361	182.352
Proposed Zoning HGL (m)	182.468	182.449	182.424	182.415	182.406	182.497	182.387	182.378	182.366	182.365	182.363	182.354
Existing Conditions Freeboard (m)	1.77	1.73	1.54	1.40	1.62	1.72	1.34	1.03	0.66	0.75	0.57	0.64
Proposed Zoning Freeboard (m)	1.77	1.73	1.54	1.40	1.61	1.71	1.33	1.03	0.65	0.75	0.57	0.64
Difference in HGL - Existing vs Proposed (mm)	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**2**	**2**

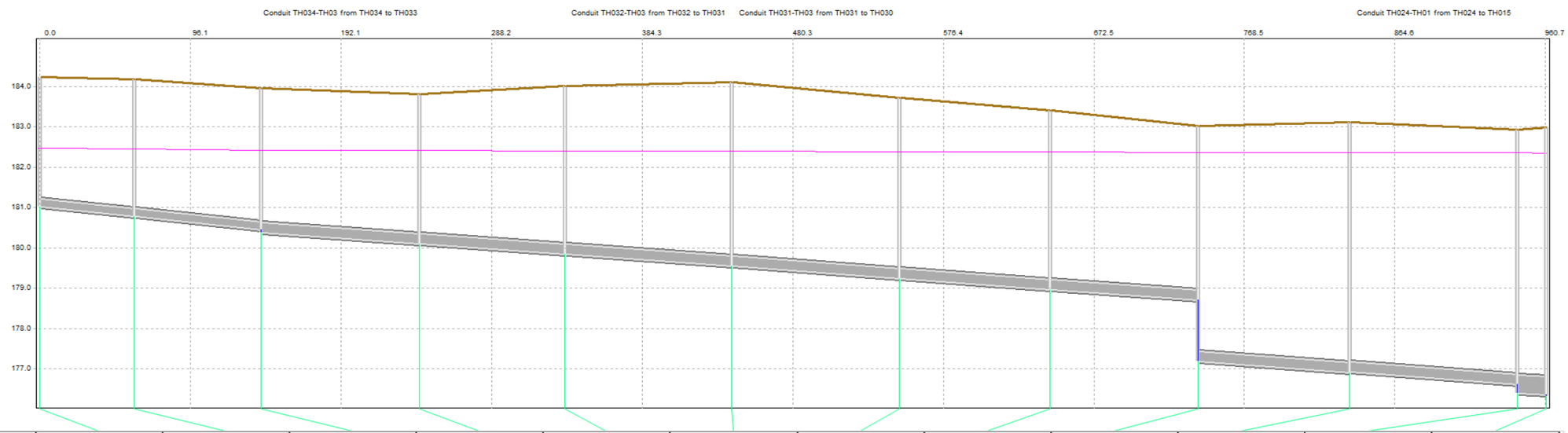
(1) MH connection to Docherty Drive Sanitary Sewer
(2) Input Node of Proposed Development North of CR42 Sanitary Sewer
(3) MH connection to CR42 Sanitary Sewer
(4) MH connection to St Alphonse Sanitary Pump Station

With the addition of the proposed development, the increase in HGL is 3 mm or less along Lesperance Road, County Road 42 and St. Alphonse Ave.



	TH036.1	TH035.1	TH034	TH033	TH032	TH031	TH030	TH029	TH023	TH024	TH015	TH050
Ground Eleva	184.240	184.180	183.960	183.810	184.020	184.110	183.720	183.410	183.020	183.110	182.930	182.990
Max Water El	182.466	182.447	182.422	182.413	182.404	182.394	182.384	182.376	182.364	182.363	182.361	182.352
Freeboard	1.770	1.730	1.540	1.400	1.620	1.720	1.340	1.030	0.660	0.750	0.570	0.640

FIGURE 2A: EXISTING CONDITIONS HGL ALONG LESPERANCE RD AND COUNTY RD 42 TO ST. ALPHONSE PUMP STATION



	TH036.1	TH035.1	TH034	TH033	TH032	TH031	TH030	TH029	TH023	TH024	TH015	TH050
Ground Eleva	184.240	184.180	183.960	183.810	184.020	184.110	183.720	183.410	183.020	183.110	182.930	182.990
Max Water El	182.468	182.449	182.424	182.415	182.406	182.397	182.387	182.378	182.366	182.365	182.363	182.354
Freeboard	1.770	1.730	1.540	1.400	1.610	1.710	1.330	1.030	0.650	0.750	0.570	0.640

FIGURE 2B: PROPOSED DEVELOPMENT CONDITIONS HGL ALONG LESPERANCE RD AND COUNTY RD 42 TO ST. ALPHONSE PUMP STATION

Conclusions and Recommendations

The proposed development is within the sanitary drainage area boundary for the existing sanitary sewer system. The peak dry weather sewage flows resulting from this proposed development are slightly greater than what would have resulted from the development of this site under the current zoning. It is expected that the proposed development can be accommodated within the available dry-weather flow capacity of the existing sanitary sewer system.

Under wet weather conditions, this part of the sanitary sewer system has been known to experience significant surcharging. The increased wet weather HGL is not considered to be significant relative to the existing surcharge conditions. Based on the nominal peak sewage flow contribution from this site, including the proposed development peak flow the resulting changes to the wet weather HGL would be considered insignificant.

In addition, this evaluation does not account for the improvements that have been completed by the Town in this part of the sanitary sewer system since 2011 when this model was developed. Based on discussions with the Town, it is expected that the wet weather flow conditions in the sanitary sewer system have been improved, thereby further limiting any potential impacts from this proposed development.

Although the development of this site will not significantly impact the sanitary system, it is recommended that the Town continue with the planning and implementation of improvements proposed in the area, including:

- Continue to eliminate excess extraneous flows from the sanitary sewer system;
- Continue to update and calibrate their sanitary collection system model to confirm the degree of improvements realized in the sanitary sewer system, based on which the model may be used to more accurately assess development opportunities in the future; and
- Decommission the St. Alphonse pump station and complete the diversion of sanitary flows from the Lesperance Road and County Road 42 sanitary sewer to the proposed 1200mm diameter Tecumseh Hamlet trunk sanitary sewer.

We trust that this evaluation provides the Town with the necessary information to consider the approval of the proposed development at 12300 County Road 42 from a sanitary system perspective. Should you have any further questions, we would be pleased to discuss the results of our evaluation in further detail.

Yours sincerely,

DILLON CONSULTING LIMITED

Flavio R. Forest, P. Eng.,
Project Manager