TECHNICAL MEMORANDUM

Date: December 20, 2022

To: Municipality of Southwest Middlesex

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From: Antoine Lahaie & Charlotte Xie, WSP

Project: Southwest Middlesex W&WW Master Servicing Study

Subject: Glencoe Industrial Park Sanitary Sewage Pumping Station Analysis

1. Overview

WSP completed the Water and Wastewater Master Servicing Study for the Municipality of Southwest Middlesex in September 2022. With the available information at the time of the study, the Glencoe Industrial Park Sanitary Sewage/Wastewater Pumping Station (WWPS) tying into the 250mm forcemain to the lagoon was not included in the SewerGEMs model built by WSP; however, the expected wastewater flows from the station's catchment was explicitly considered by adding them as non-pressure dependent loads on the forcemain, and therefore, the impact of the station was considered and the project recommendations presented in the W&WW Master Servicing Report reflects them. This technical memorandum aims to conduct a hydraulic analysis of the Glencoe Industrial Park WWPS, examine any capacity constraint and provide recommendations as needed. This Technical Memorandum serves as an addendum to the Southwest Middlesex W&WW Master Servicing Study Report submitted by WSP in September 2022.

The Industrial Park WWPS is located at the north end of Industrial Road, collecting the wastewater loads from the sanitary sewers along Industrial Road and connecting to the 250mm forcemain from Victoria Street Pumping Station via a 150mm forcemain. Figure 1 shows the model layout for the sewer system in the Village of Glencoe.

The Industrial Rd. WWPS is approximately 6.7 m below ground and consists of a 2.4m diameter wet well located on the south side of Industrial Road and is currently equipped with two submersible pumps, each rated at 10 L/s with 9.1m of dynamic head. The depth of the station was set to 213.3m (i.e., roughly 6.7m (22ft) below ground) based on the information provided in the email conversation and data received on October 27th, 2022; however, the operating level of the wet well was not provided, and therefore, it was assumed to be 1.5m. Since the invert elevations on the existing gravity sewers along Industrial Rd. were not available, the maintenance hole and sewer inverts were assumed 3 meters below ground elevation.

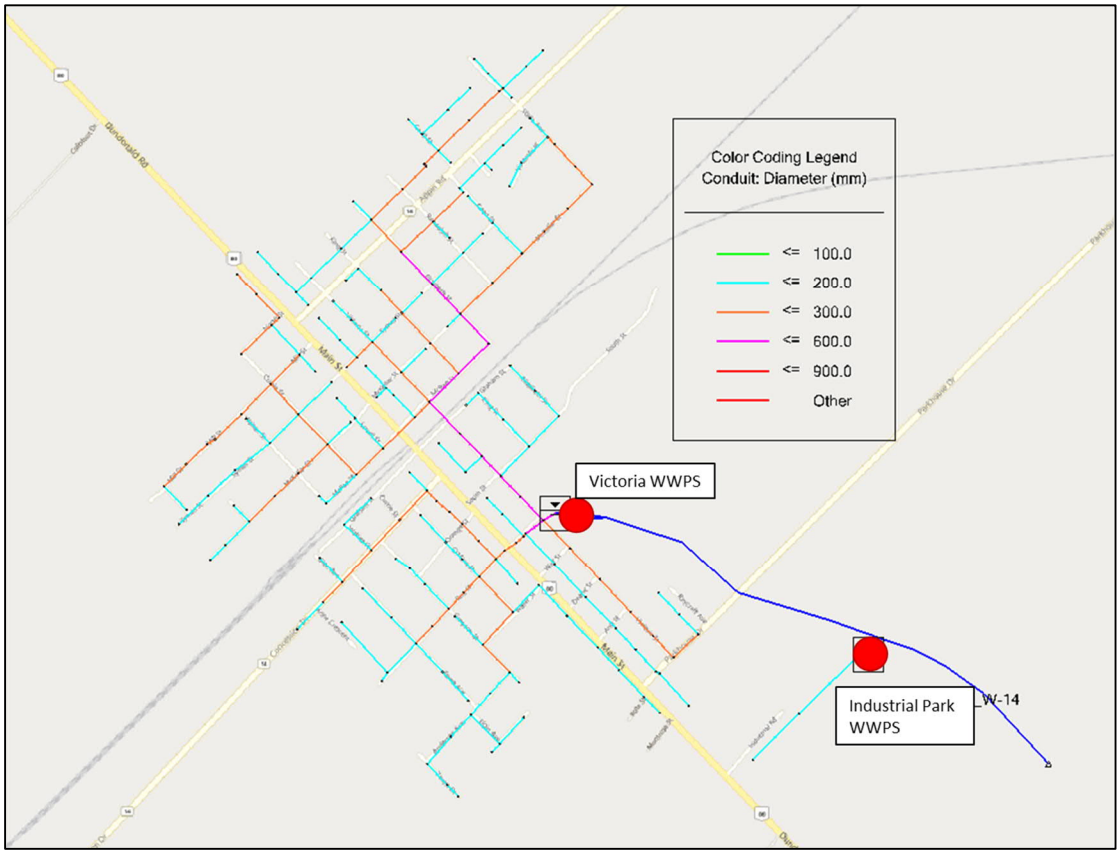

Figure 1 – Model Layout for the Sewer System in the Village of Glencoe

2. Wastewater Flow

The wastewater loading for the existing Industrial Park located north of Industrial Road was determined by measuring the footprint area of the building in Google Earth and converting it to the equivalent population based on the Southwest Middlesex Municipal Design and Construction Standards 2021. The existing wastewater load to the Industrial Park WWPS was determined to be 0.12 L/s under the Dry Weather Flow (DWF) condition and 0.9 L/s under the Wet Weather Peak Flow (WWF_Peak) condition. Based on the email conversations with Spriet on October 28th, 2022, the average inflow to the Industrial Park WWPS was approximately 12 m^3/day (0.14 L/s). Comparing the simulated station inflow of 0.12 L/s to the average station inflow provided, the estimated flow in the model was lower by 0.02 L/s. For the model to be conservative, the existing wastewater loading under the DWF condition was adjusted from 0.12 L/s to 0.14 L/s.

Under the future condition, the wastewater loadings for all nearby developments were included. In addition, the wastewater design flow for the industrial park development with a total area of approximately 5.2 hectares was calculated and allocated to the closest maintenance hole in the model. The dry and wet weather flows for the development were determined using a design rate of 22500 L/Ha/day and an I/I rate of 0.1 L/Ha/s from the Southwest Middlesex Municipal Design and Construction Standards (2021), which were calculated to be 1.6 L/s under the DWF condition and 7.9 L/s under WWF_Peak condition. Table 2–1 summarizes the wastewater loading along Industrial Rd. in the model under all scenarios.

Table 2–1: Wastewater Loading in Model along Industrial Road

	DWF (L/S)	WWF (L/S)	WWF_PEAK (L/S)
EXISTING (2021)	0.14	0.25	0.90
FUTURE (2041)	1.74	2.48	8.83

3. Simulations

Model simulations were completed for the DWF, WWF, and WWF_Peak for the existing (2021) and future (2041) planning horizons to assess the conveyance capacity of the sewage system for the Industrial Park WWPS.

3.1 Existing Condition

Figure 2 shows the profile of the gravity sewers along Industrial Road between Main St. and the Industrial Park WWPS. As shown in the figure, the q/Q ratio was simulated under 50% for all sewers, and no surcharge was simulated on the maintenance holes under existing conditions.

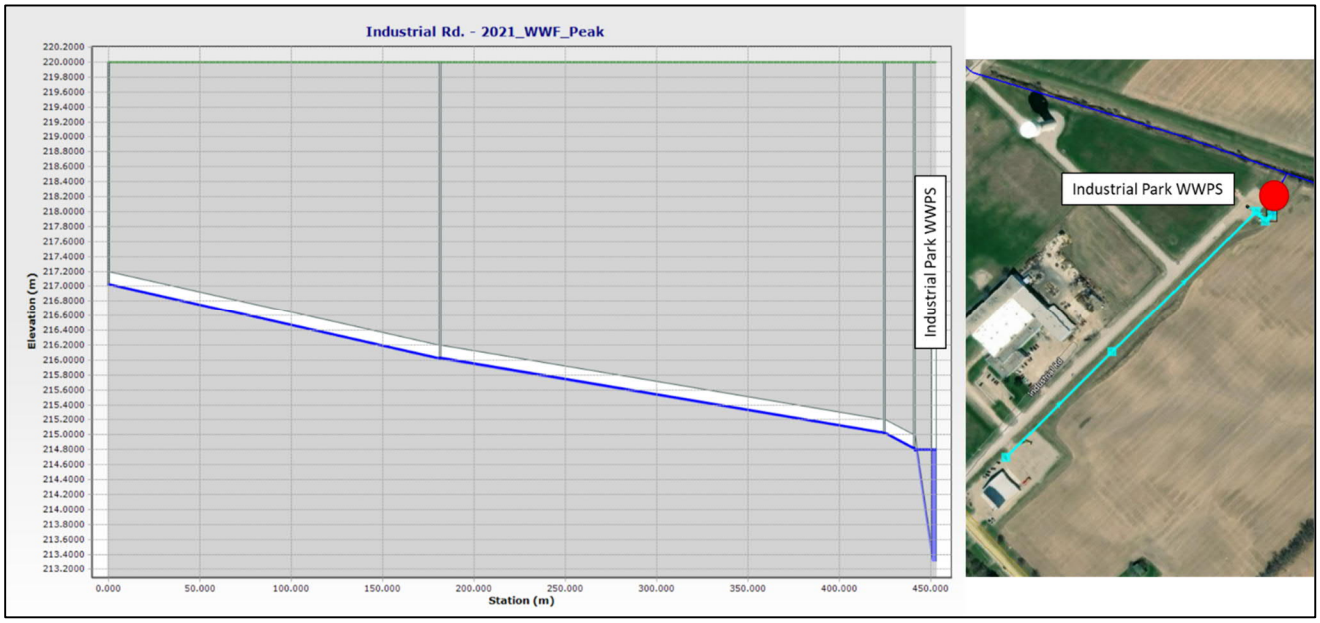

Figure 2 – HGL Profile for the Industrial Road Sewer under 2021 WWF_Peak Condition

Figure 3 presents the simulated pump curve and operational point of pumps at the Industrial Park WWPS under the existing WW_Peak condition. The simulated inflow to the wet well was approximately 1 L/s, and the pump was operating almost at 100% efficiency during the simulation and provided an outflow of approximately 6.7 L/s at 12.5m of head with one pump ON, indicating

that the existing wet well and pump size is sufficient to accommodate the existing wastewater flows from the catchment.

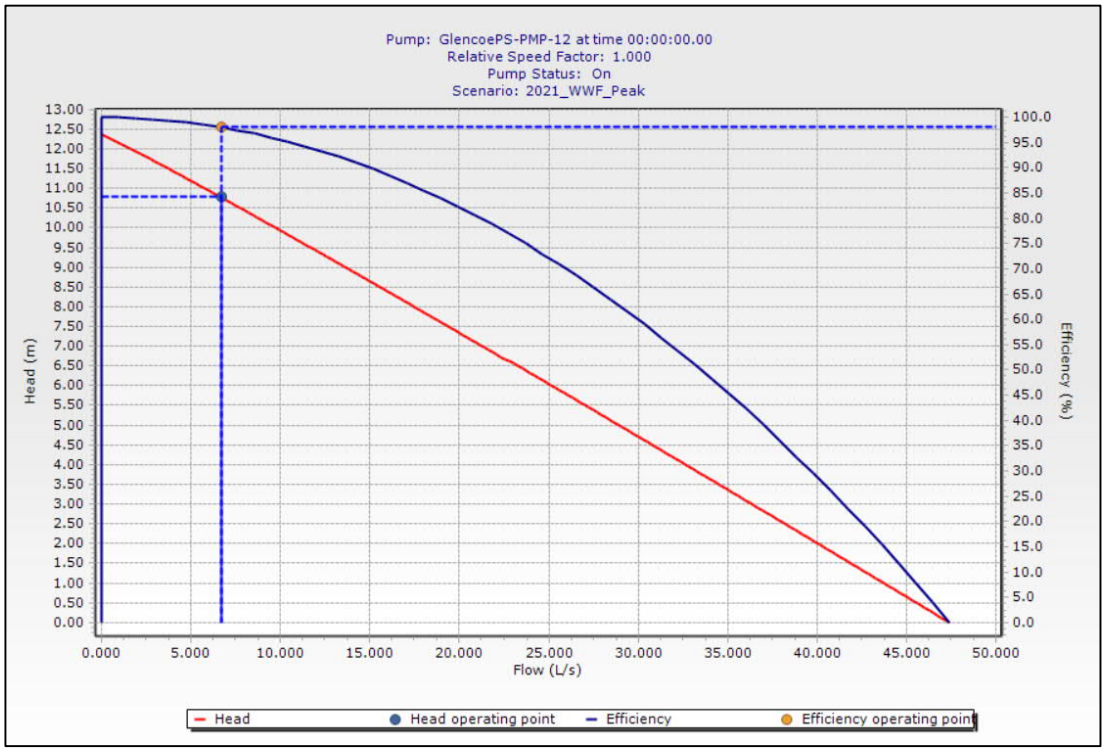

Figure 3 – Simulated Pump Curve at the Industrial Park WWPS under 2021 WWF_Peak Condition

The velocity in the 150mm forcemain connecting the Industrial Park WWPS to the 250mm forcemain of the Victoria St. WWPS forcemain was simulated to be 0.38 m/s, which is less than the minimum scouring velocity of 0.6 m/s. The low velocity in the pipe can potentially cause sedimentation since it fails to maintain particle suspension in the pipe. To maintain, the minimum scoring velocity in the forcemain, the minimum discharge from the station was determined to be approximately 10.6 L/s (916 m^3/day). This can be resolved by increasing the volume of water stored in the wet well (i.e., for the steady-state model to result in this minimum outflow, the initial water level in the wet well should increase). Currently, the initial water level in the wet well is set to 214.8 m which indicates that the wet well is 22% full. Assuming that the wet well is 54% full (i.e., initial water level at 216.93m), an outflow of 10.6 L/s will be obtained, and the scouring velocity of 0.6 m/s will be met.

In terms of pump cycling, WSP performed an analytical solution and concluded that if the inflow to the wet well is 1 L/s and the outflow is 10.6 L/s (i.e., the required minimum outflow to meet the scouring velocity criteria of 0.6 m/s in the forcemain), and assuming that the live volume of wet well is 28 m3 (diameter: 2.4m, height: 6.2m) and the dead volume is 2m^3 (diameter: 2.4m, height: 0.5m), pumps should be off for 7.7 hr and should be ON for 0.8 hr. **Figure 4** shows the pump cycles and the volume of water in the wet well. Here, it is assumed that the pumps are ON as soon as the wet well gets full and are OFF as soon as the volume of water in the wet well is equal to the dead volume of the wet well. However, the steady-state model assumes the station continuously discharges flow assuming there is 22% storage in the model. By increasing the water level in the wet well, the storage becomes higher, and there is no storage in the wet well and the pumps are not cycling.

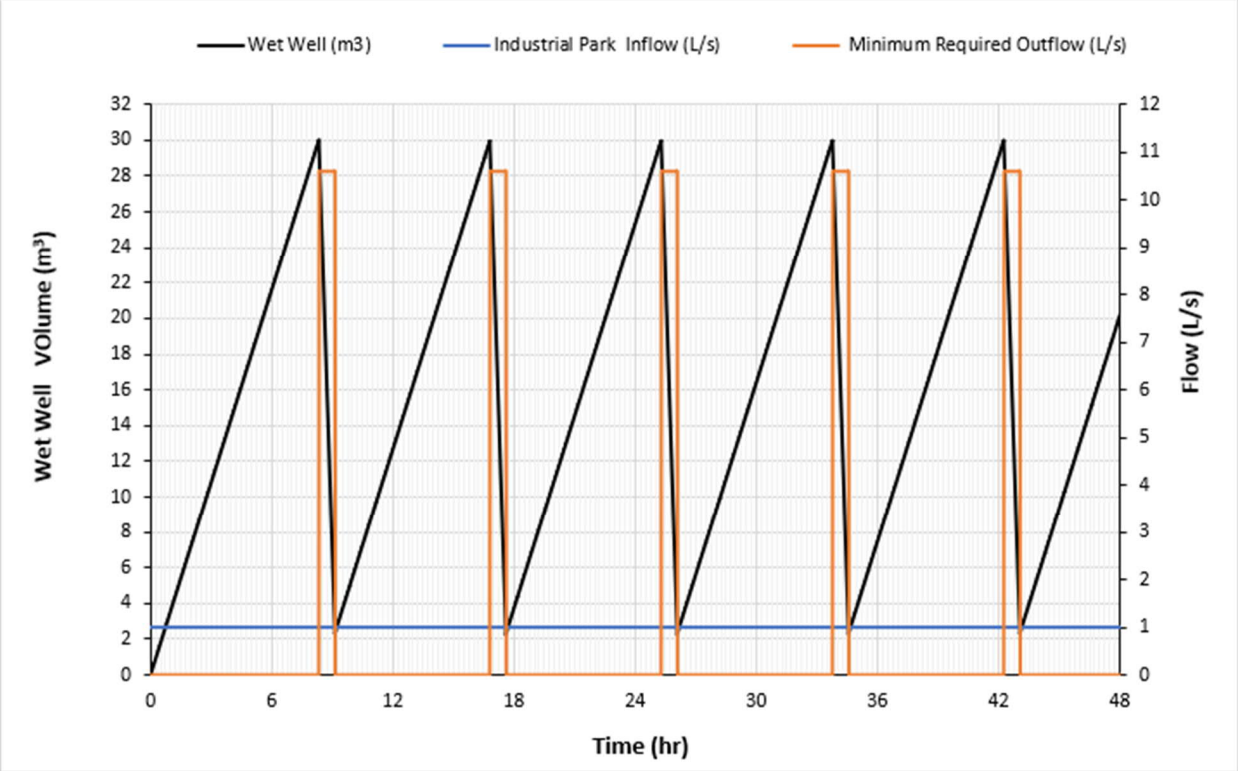

Figure 4 - Pump Cycles and Volume of Water in the Wet Well, Assuming a wet well volume of 30 m3

In order to suggest the proper pump cycling to meet the required flow that results in the minimum required velocity in the forcemain (i.e., scouring velocity), the model needs to be converted to an Extended-Period-Simulation (EPS) model. Flow SCADA data and pump station and forcemain drawings are required for a more accurate pump cycling study. In addition, the location of the 150mm forcemain connection to the Victoria WWPS forcemain should also be validated with detailed drawings since it has an impact on the amount of flow discharged by the Industrial WWPS pumps.

3.2 Future Condition

Figure 5 shows the profile of the gravity sewers along Industrial Road between Main St. and the Industrial Park WWPS under future WW_Peak condition. As shown in the figure, the q/Q ratio was simulated under 50% for all sewers, and no surcharge was simulated on the maintenance holes.

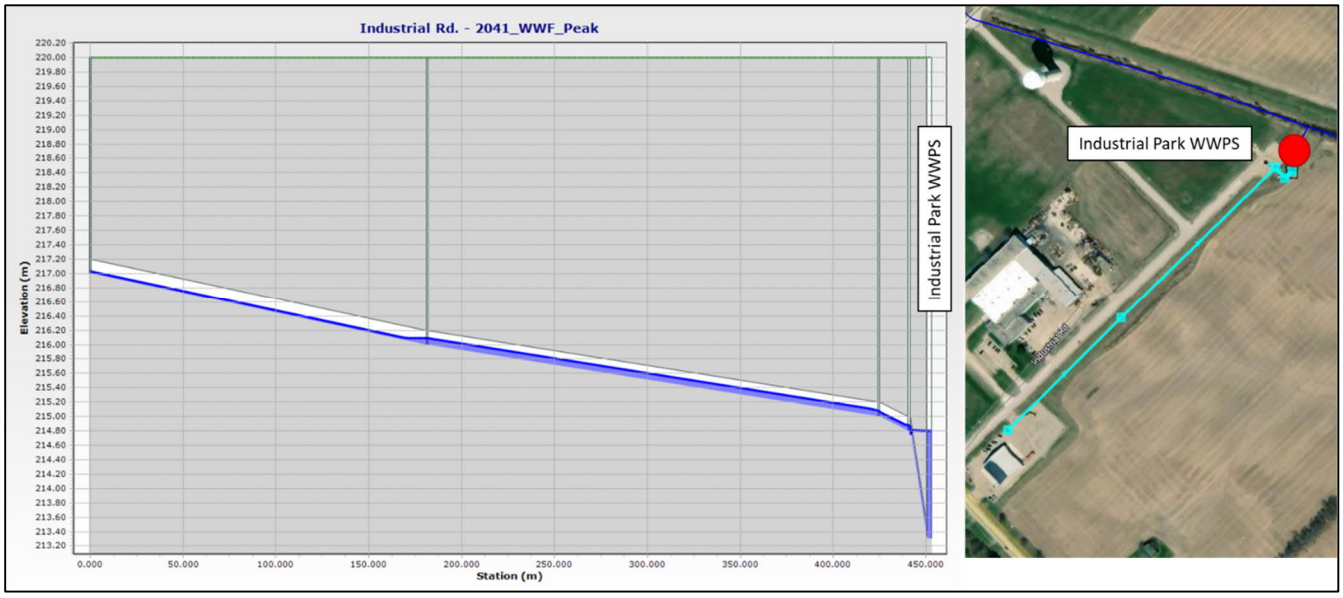

Figure 5 – HGL Profile for the Industrial Road Sewer under 2041 WWF_Peak Condition

The simulated inflow to the wet well was 9 L/s while the discharge from the Lift Station was 7 L/s. **Figure 6** presents the simulated pump curve and operational point of pumps at the Industrial Park WWPS. As shown, the pump was operating close to 100% efficiency during the simulation and provided an outflow of approximately 6.7 L/s with one pump ON. Similarly, the results indicates that the existing pumps are sufficient enough to accommodate the future flow along Industrial Dr., and no upgrade will be needed.

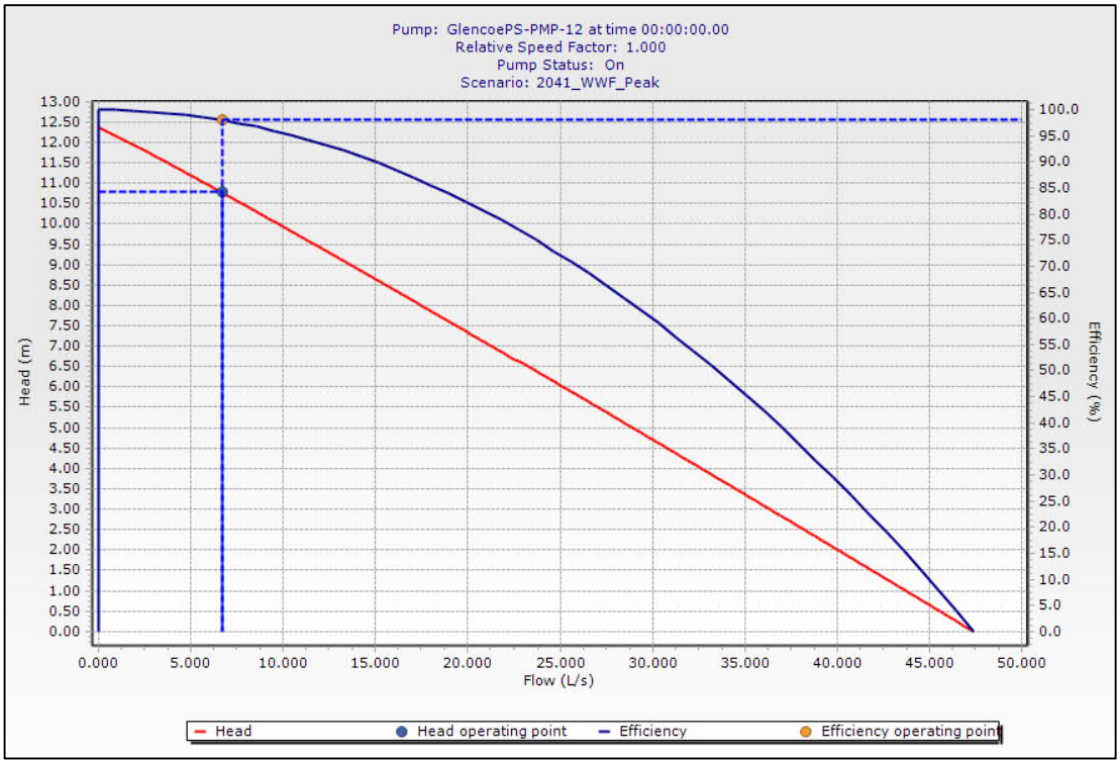

Figure 6 – Simulated Pump Curve at the Industrial Park WWPS under 2041 WWF_Peak Condition

Similar to the existing condition, the velocity in the 150mm forcemain connecting the Industrial Park WWPS to the 250mm forcemain of the Victoria St. PS forcemain was simulated to be 0.38 m/s, which does not satisfy the minimum scouring velocity of 0.6 m/s and causes sedimentation in the pipe. Again, an EPS model will be required to determine the appropriate pump cycles to maintain the required forcemain velocity at the station discharge.

4. Conclusion

Upon completion of the Water and Wastewater Master Servicing Study for the Municipality of Southwest Middlesex in September 2022, WSP was retained to conduct a hydraulic analysis of the Glencoe Industrial Park WWPS tying into the 250mm forcemain to the lagoon, to examine any capacity constraint. Based on the hydraulic simulation results, WSP concludes the following:

1) In the village of Glencoe, the existing gravity sewers along Industrial Road were simulated to have enough capacity to convey the wastewater loads downstream to the Industrial Park WWPS with no surcharge in maintenance holes under both existing and future conditions.

2) The wastewater flows along Industrial Road were collected by the Industrial Park WWPS and conveyed to the existing 250mm forcemain of the Victoria SPS via a 150mm forcemain. The industrial Park WWPS can accommodate the required flow under both existing and future scenarios with the existing infrastructures.

3) The velocity in the 150mm forcemain (tying into the 250mm existing forcemain) is less than the scouring velocity of 0.6m/s and can result in sedimentation in the pipe. This can be resolved by increasing the outflow of the station by increasing the wet well level or reducing the existing pump cycles. In order to suggest the proper pump cycling to meet the required flow that results in the minimum required velocity in the forcemain (i.e., scouring velocity), the model needs to be converted to an Extended-Period-Simulation (EPS) model.

These conclusions remain valid as long as the wastewater distribution system and the Municipality's network configuration remain as described herein. If significant changes are contemplated, this analysis should be updated.