



KINCARDINE WASTEWATER TREATMENT AND COLLECTION SYSTEM

Annual Performance Report 2023

Municipality of Kincardine, Environmental Services



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1.0 Introduction

The Kincardine Wastewater Treatment System has an Environmental Compliance Approval (ECA) #A-500-1121679176 that was issued on February 11, 2022. Section 11 (4) of the ECA requires that an Annual Performance Report is prepared and outlines the information that must be contained within it.

The Kincardine Wastewater Collection system falls within the Municipal Sewage Collection System ECA 088-W601 issued on November 10, 2022. Schedule E Section 4.6 of the ECA required that an Annual Performance Report is prepared and outlines the information that must be contained within it.

This report covers the requirements of both the treatment system and the collection system ECA's. A copy of both ECA's are available in Appendix A.

The Kincardine Wastewater Treatment Plant is classified as a class II Treatment facility and is located at 520 Bruce Avenue in Kincardine. The plant consists of an aerated lagoon cell with a hybrid coarse/fine bubble submerged air diffuser system, and two conventional stabilization ponds. Alum is added to the aerated cell discharge before the stabilization ponds to aid in phosphorous removal. Treated sewage leaving the lagoon ponds flows by gravity over to the Effluent station located at 169 Mahood Johnston Drive in Kincardine. The effluent is disinfected year-round by ultraviolet radiation before being discharged to Lake Huron. A schematic of the overall treatment system is available in Appendix B.

The Kincardine sewage collection system is a class II Wastewater collection system that services the town of Kincardine including the West Ridge on the Lake Development north of the Huron Ridge subdivision and the Huronville subdivision in Huron Kinloss south of Saratoga Road. The system consists of approximately 61 kilometers of gravity sewermain, 12 kilometers of pressurized sewer mains, 11 pumping stations and services approximately 3939 properties. The collection system leads to the Kincardine Lagoons located at 520 Bruce Ave, Kincardine. A map of the collection system is available in Appendix B

2.0 Monitoring Data

Operations staff collected biweekly grab samples of raw sewage, final effluent sewage, as well as semi-annual samples as required by the ECA. All samples were submitted to SGS Environmental Services for analysis. The analytical results of the biweekly sampling are tracked in monthly spreadsheets and then summarized in an annual spreadsheet. All semi-annual chemical results were within the Provincial Water Quality Objectives with the exception of aluminum which exceeded the limits.

On April 12 and 27 extra TSS samples were taken to lower the monthly average results as the April 4 result was high. On September 19 the E. coli could not be processed as it was over the holding time when received at the lab so a resample was taken and shipped on September 22.

Acute Lethality testing is performed on an annual basis to ensure compliance with the federal regulations for Effluent Regulatory Reporting. These samples are sent to Nautilus Environmental Company Inc. for the analysis of fish mortality.

Monitoring results are included in Appendix C along with the full monitoring schedule for 2023 and 2024.

2.1 Influent Data

The raw flows coming into the plant are recorded with an Influent Flow meter. Influent flows from the Groundwater and Leachate pumping stations at the neighbouring decommissioned Valentine Avenue Landfill site are added manually to the total influent flow for the plant as the flows do not pass through the Influent flow meter. The influent flows are suspected to be under the influence of inflow and infiltration which is discussed further in section 2.3 Design Objectives. Charts comparing Influent flows for the past 5 years as well as the 2023 Influent Flows vs precipitation are available in Appendix D.

Table 1 summarizes the influent flows at the lagoon as well as the contributing collection system flows. There are 11 pumping station in total, but the smaller stations direct the sewage through the larger ones. Only the pump stations with direct forcemains to the lagoons are listed. The Huron Terrace pump station has a new flowmeter installed to

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capture flows. The other pumping stations do not have flow meters. The flows are measured using the liquid pumped with a reference to the material level on the milltronics units. Debris floating around may cause false reading levels. The milltronics units were verified for accuracy in June 2023 but had not been verified in 2022. The Influent flow meter at the Kincardine Wastewater Treatment Plant has been calibrated by a third party on an annual basis however could still have varying accuracy ranging from 0.1% to 5%.

Table 1 KWW Lagoon and Collection System Flows

	Average Flow (m³/d)	Maximum Flow (m³/d)	Total Flow (m³)
Huron Terrace Pump Station	2,496	8,014	854,559
Goderich St Pump Station	365	631	133,845
Park St Pump Station	930	3,516	339,301
Kincardine Ave Pump Station	339	1,560	123,387
Leachate 140 Valentine Ave	15	201	3,151
Groundwater 140 Valentine Ave	4	13	1,473
Total metered sewage from collection system			1,455,716
Influent Flow			1,402,103
Effluent Flow			1,073,681

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2.2 Groundwater, Leachate and Imported Septage

There was no imported septage waste accepted by the municipality in 2023.

The current ECA has a Design Objective (Section 6) which outlines groundwater and leachate flow limits from the decommissioned Valentine Avenue Landfill. A flow of approximately 200 m³/d of Groundwater and 63 m³/d of combined Leachate flow (approximately 30m³/d from the valentine Avenue Landfill and approximately 33 m³/d from the Kincardine Waste Management Center) is permitted. Both the groundwater and leachate are pumped via a 75mm forcemain from the Valentine Ave site directly into the aerated cell. From January 1 to February 8, 2023, the Leachate pump was out of service. Bluewater Sanitation hauled loads of leachate from the Valentine Avenue pump station to the aerated cell on an as needed basis during this time. A new pump was installed in the Leachate PS on February 8, 2023. Since the chamber was backed up with leachate from the pump being out of service, the new pump was run in hand multiple times per week from February to mid June to attempt to pump the chamber down but keep the daily flow below the limit of 30m³/d. There were multiple instances between March and June where the pump was left in hand too long and the flows exceeded the daily limit of 30m³/d for the Valentine Ave site but did not exceed the total limit of 63m³/d. The pump was placed back in auto on June 18. There were 5 daily exceedances from June to December which correlate with heavy precipitation days. Table 2 shows a listing of the days with leachate exceedances and the amounts. Table 3 below gives a monthly summary of the groundwater and leachate flows.

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Table 2 Leachate Exceedances

Date of Exceedance	Leachate Flow m3
March 13	134.1
March 14	69.6
March 22	38.6
March 27	36.2
March 28	40.3
April 6	200.6
May 8	31.2
May 14	33.3
May 28	32.3
September 15	40.9
September 16	40.9
September 17	40.9
December 27	52.5
December 28	52.5

Note: On the days when the 30m³/day was exceeded from the valentine Ave PS, there was no leachate transferred from the KWMC. The total leachate amount of 63m³/day was only exceeded on 3 dates above.

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Table 3 Groundwater, Leachate and Imported Septage

Month	Groundwater Total m3	Leachate Total Valentine Ave m3	Leachate Total KWMC m3	Imported Septage m3
January	167.3	177.3	105	0
February	152.7	156.6	0	0
March	172.7	643.7	0	0
April	108.5	401.5	0	0
May	91.3	332.7	0	0
June	76.8	258.7	0	0
July	114.4	134.4	0	0
August	110.6	120.2	0	0
September	103.3	198.2	0	0
October	113.7	103.7	0	0
November	116.9	224.7	0	0
December	144.7	596.7	0	0
Totals	1472.9	3151.1	105	0

Table 4 below shows the groundwater and leachate flows for the past 5 years.

Table 4 Groundwater and Leachate Flows

		2019	2020	2021	2022	2023
Groundwater (max = 200 m³/d)	Annual average flow (m ³ /d)	2.2	2.1	2.6	3.4	4.0
	Total Annual flow (m ³)	816	783	931	1,241	1,473
Leachate (Valentine Ave max = 30 m³/d) (KWMC max = 33 m³/d)	Annual average flow (m ³ /d)	14.6	14.2	11.9	29.7	9.2
	Total Annual flow (m ³)	5,325	5,178	4,329	1,040	3,348

Note: From January 2022 to February 2023 the Leachate pump was out of service and the chamber was only pumped out as needed.

Municipal staff in conjunction with GHD Engineering, collected leachate and groundwater samples so that leachate testing was completed four times per year and

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groundwater testing twice per year. Appendix E contains the results for the leachate samples that were collected by the Municipality of Kincardine. GHD Engineering has been contracted by the municipality to monitor the Valentine landfill site and prepare a separate annual report on their findings. Please refer to the Ward 1 Valentine Avenue report for detailed information on the landfill's collection system.

2.3 Design Objectives

The design capacity for the plant is 5910 m³/day. Table 5 shows precipitation and flow data monthly for 2023. The months with design exceedances correlate with snow melt and heavy precipitation events.

Table 5 Design Capacity

Month	Influent Flow Total m ³	Precipitation mm	Design Capacity 5910 m ³ /day	Design exceedances (# of days)	Effluent Flow Total m ³
January	132,898	32	73%	4	92,746
February	119,807	32	72%	3	97,056
March	131,268	60	72%	3	109,355
April	149,103	104	84%	5	133,481
May	118,944	57	65%	1	85,894
June	97,571	38	55%	0	64,393
July	109,820	129	60%	0	90,100
August	108,906	110	59%	0	87,608
September	91,168	23	51%	0	57,463
October	104,928	75	57%	0	78,145
November	110,169	48	62%	0	89,836
December	127,519	59	70%	1	87,604
Totals	1,402,103	765	65%	17	1,073,681

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Table 6 compares the precipitation and flow data over the past 5 years. The lagoon system is at approximately 65% capacity and is under the influence of inflow and infiltration.

Table 6 Flow vs Precipitation

	2019	2020	2021	2022	2023
Annual Influent Flow (m³)	1,382,34	1,372,68	1,441,16	1,350,495	1,402,103
Overall Percentage of Influent Design Capacity	64%	63%	67%	63%	65%
Design Capacity Exceedances (days)	15	12	22	13	17
Annual Effluent Flow (m³)	1,135,26	1,108,68	1,136,73	998,846	1,073,681
Precipitation (mm)	709	444	375	582	765
Kincardine Drinking Water Produced (m³) (*Adjusted)	1,072,57	1,130,11	1,410,22	1,205,253*	1,090,896
% Increase- KWTP water produced vs KWWTP Influent Flow	27%	23%	7%	11%	23%

In 2022 the KWTP was shut down for repairs in May and October-November, estimated flows supplied to distribution system by Huron Kinloss were included in total flows. Also removed average volumes for Routes 30, 32 (area north of Huron Ridge) and Inverhuron Park as they are not serviced by the Kincardine Wastewater System.

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2.4 Effluent Data

Tables 7 and 8 compare the Final Effluent average quality to the effluent criteria limits in the ECA. The CBOD exceeded the objective in April but not the monthly average limit.

The Total Suspended Solids exceeded the objective in April and September and November but there was no exceedance of the monthly average limit.

Table 7 Final Effluent Waste Loading

Monthly Averages	CBOD5	Total Suspended Solids	Total Phosphorus
Limits	177.0 kg/D	236.0 kg/D	5.9 kg/D
January	43	52	0.8
February	49	62	0.8
March	72	90	0.9
April	118	166	1.0
May	30	41	0.7
June	12	12	0.6
July	52	45	0.8
August	62	57	0.7
September	39	64	0.6
October	44	70	1.0
November	70	90	1.2
December	65	71	1.7

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Table 8 Final Effluent Quality

	CBOD5 (mg/L)	Total Suspende d Solids (mg/L)	Total Phosphor -ous (mg/L)	E. coli CFU/100 mL	pH (Single Sample Result)
ECA Objectives (mg/L) Monthly Average	25	30	1.0	150	6.5-9.0
ECA Limits (mg/L) Monthly Average	30	40	1.0	200	6.0-9.5
January	14.5	17.5	0.27	2	7.70
February	14.0	18.0	0.23	2	7.60
March	20.5	25.5	0.26	2	7.90
April	26.5	37.3	0.22	4	8.30
May	11.0	14.7	0.24	3	7.50
June	5.5	5.5	0.28	2	7.80
July	18.0	15.5	0.26	3	7.80
August	22.0	20.0	0.24	94	8.10
September	20.5	33.5	0.32	5	8.40
October	17.3	27.7	0.40	3	8.00
November	23.5	30.0	0.42	9	8.70
December	23.0	25.0	0.61	13	8.40

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2.5 Effluent Quality Control Measures

The ability of the Kincardine lagoon system to treat and remove waste in 2023 was comparable to previous years. The UV system provides disinfection of the effluent year-round during normal operations. In 2023 the average UV dosage was 153.18mj/cm² with the range spanning from 42.7 to 411.9mj/cm². The effluent station did not have a backup power source in 2023 therefore any power outages caused the effluent to bypass UV disinfection. Bypass information can be found in Section 6.0.

Alum dosage adjustments were made to maintain final effluent Total Phosphorous levels below 1.0 mg/L. The pH of the effluent was maintained within the range of 6.0 to 9.5, was essentially free of floating and settleable solids and did not contain oil or any other substance in amounts sufficient to create a visible film, sheen, foam or discoloration on the receiving waters.

Table 9 below, summarizes and compares the alum dosages and the percent removals achieved over the last 5 years. There is no BOD percent Removal since we test for BOD on the raw influent and CBOD is tested on the final effluent.

A chart showing the influent flow vs the Alum usage is also available in Appendix D.

Table 9 Comparison of Alum Dosage and Percent Removal

		2019	2020	2021	2022	2023
Alum Dosage (Average)	mg/L	15.6	14.8	14.8	17.42	19.37
	kg/day	55.8	53.4	55.4	61.90	72.28
Percent Removal	TSS	83%	81%	73%	80%	83%
	TP	91%	92%	89%	91%	86%
	TKN	23%	35%	21%	40%	19%

3.0 Operating Issues and Corrective Actions

The new hybrid coarse/fine bubble submerged air diffuser system was commissioned in April 2023. There have been issues with the blowers and trying to keep the dissolved oxygen (D.O.) above the minimum required 2mg/L. Sludge was not removed from the aerated cell prior to the installation of the units and may have been contributing to the

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lower D.O. readings. The sludge in the aerated cell was stirred up after the initial commissioning of the units but the D.O. has slowly risen from a minimum of 0.09mg/L in May to a max reading of 5.29mg/L in November. There was a slight decrease in the D.O. from November to December. The recommended quarterly blowout procedure and diffuser cleaning was not completed on the unit before the end of 2023. This maintenance will be performed in 2024.

The Leachate pump that was placed out of service in November 2021 was replaced in January 2023. The pump had been backordered and experienced shipping delays, so the leachate was trucked from the pump station to the aerated cell when needed. There have been no issues with the pump in 2023.

Problems with pumps plugging occurred at the Harbour Street, Hunter Street and Kincardine Avenue pumping stations. The Harbour Street and Hunter Street pumping stations do not have bar screens so any debris entering the wet wells can get clogged in the pumps. The Kincardine Avenue Pumping station does not have an automatic bar screen, so it requires continual manual removal of solid waste from the wet wells. Staff usually perform this on a bi-weekly basis by making a physical entry in the confined space. Even with this preventative maintenance being performed, debris can still get clogged in the pumps.

There were 16 UV alarms in 2023. Five of the alarms were due to power flickers or interruptions. Bank A and Bank B had Major UV alarms and required maintenance to be performed. During the maintenance one of the banks would be in service while the second bank was being worked on.

4.0 Maintenance and calibration summaries

The Kincardine Wastewater system follows a preventative maintenance schedule set out by the Environmental Services Staff. This schedule includes inspections and maintenance for KWWTP blowers, alum pumps, aeration system cleaning, UV system maintenance, pump station inspections, bar screen cleaning, monthly generator maintenance, as well as sewermain flushing and inspections. All maintenance and

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repairs are recorded in the corresponding site logbook. A copy of the preventative maintenance schedules are available in Appendix F.

Other planned maintenance included:

- replacing the old hatches and frames on the east and west lagoon effluent chambers.
- UV equipment had the motor control card changed, ballasts and bulbs replaced.
- Wet wells were cleaned at the Durham St PS, Goderich St PS, Queen St PS, Park Street, and Kincardine Ave pump stations
- Hunter St PS chains replaced on pumps
- Goderich St and Kincardine Ave pumps greased
- The Connaught PS had the generator battery charger replaced due to an alarm
- The Goderich St. PS generator had the battery replaced
- Annual pump station inspections for all site components were completed
- Annual sewer flushing program
- 1 new sanitary lateral installation

Emergency repairs and maintenance in 2023 included:

- KWWTP splitter box cleaning due to an overflow in November
- Groundwater PS capacitor and relay changed out, and fuse for milltronics replaced
- Pumps pulled and debris removed at Harbour st PS, Hunter St PS, Kincardine Ave PS
- Kincardine Ave Pump #1 impeller, wear rings, bolts and washers replaced
- Huron Terrace bar screen repair and fuse replaced for pump #1
- Leachate PS replacement of pump
- Park Street Pump #2 repair
- Sewermain Flushing on Palmateer and Wieck Blvd for backup issues
- 3 Sanitary Lateral Repairs
- 3 Sanitary Cleanout Repairs
- 1 Manhole repair
- 1 Grinder line repair

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4.1 Sludge Depths

The sludge depths were measured in the Aerated Cell and Lagoon Cells 2 and 3 using a Sludge Judge. The estimated volume of sludge calculated is similar to previous years. No sludge was removed from any of the cells in 2023.

Table 10 Estimated Sludge Volumes

	2019	2020	2021	2022	2023	Cell Capacity used 2023
Aerated Cell (m³)	5,442	4,665	6,047	6,306	6,219	72%
East Cell (#2) (m³)	25,901	20,721	19,426	24,671	29,139	45%
West Cell (#3) (m³)	25,145	21,277	23,211	24,501	31,593	49%

Average sludge depths are calculated by adding up all the depths (ft) in a cell and dividing it by the number of readings then converting ft to metres.

4.2 Calibrations

Routine calibration and maintenance procedures are conducted on all the monitoring equipment used on the Wastewater Treatment System. The Alum metering pumps discharge volumes are measured minimally once/day to ensure proper dosage rates. Monitoring equipment for pH, dissolved oxygen, phosphorous and conductivity measurements are calibrated according to the manufacture's instruction prior to use.

Influent and effluent flow meters equipment is calibrated yearly to check that accuracy is within +/- 5% of full scale. Refer to Appendix G to review the 2023 Calibration Certificates.

5.0 Complaints

There were no complaints related to the Kincardine Wastewater Treatment system in 2023.

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There were 32 complaints for the Kincardine Wastewater Collection System. Most of the complaints received were for wastewater backups that ended up being a homeowner issue on private property. There was one event caused by a heavy rainstorm in April where the Park Street pumping station was bypassing, and the collection system was backed up enough to cause backups in three homes. A full listing of the complaints is available in Appendix H.

6.0 Bypasses, Overflows and Spills

The Kincardine Wastewater Treatment System had two bypasses and one spill reported in 2023. The bypasses occurred at the effluent station and were both due to power outages. The effluent station does not currently have a backup generator on site so during power outages when the UV disinfection system is down all flows going through the station are reported as bypasses. A backup generator has been purchased and will be installed in 2024.

The spill at the Wastewater Treatment Plant occurred in November 2023 and was caused by a plugged outlet at the splitter box between the aerated cell and the lagoon. The debris was removed from the outlet, the spill cleaned up and contaminated soil around the box removed. Cleaning of the splitter box is scheduled twice a year in the spring and fall. The spill occurred before the fall cleaning could be completed. Staff will need to ensure that cleaning is scheduled earlier or more frequently in the 2024 season to prevent spills.

The wastewater collection system had one spill and two overflows. The spill was caused by a leak in a grinder line. The area was excavated, the grinder line repaired, contaminated soil removed, and the area was disinfected.

The two overflows occurred on April 5th at the Durham Street PS and the Park Street Pump stations. The overflows were due to a significant rainfall event. Both pumping stations have engineering started for required upgrades to the sites.

All bypasses, overflows and spill events were reported to the Spills Action Center for the Ministry of the Environment, Conservation and Parks, The Ministry of Health through the Grey Bruce Health Unit and Environment Canada. Downstream users identified such as

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Bruce Power and the Inverhuron Provincial Park were also notified if the bypass or spill went into Lake Huron. A summary of bypasses, overflows and spills are available to the public on the municipal website.

Details including dates, volumes, durations, and sampling results are available in Appendix I.

6.1 Efforts to Reduce Bypasses, overflows and spills **Treatment System**

Engineering was completed in 2022 for a diesel generator to be added at the wastewater effluent station located at 169 Mahood Johnston Drive. The diesel generator will assist with keeping a constant power supply to the UV disinfection system and will eliminate wastewater bypasses during power outages in the area. The generator was tendered 2023 the installation was delayed until 2024 because of backordered electrical components. Engineering costs for 2022 were \$3,115, 2023 costs for engineering are \$7,058.90. Budgeted costs for 2024 installation are \$111,669.10.

Collection System

The existing Huron Terrace pumping station was replaced in 2022. The new pumping station was commissioned in January 2023 and has 2 submersible pumps, and one standby pump with variable frequency drives each rated at 150 L/s. The increased size of the pumps and the upsizing of the forcemain to the lagoons from the pump station should eliminate the possibility of an overflow as it is designed for an initial period peak flow and a 20-year period peak flow of 190 L/s and 300 L/s respectively. Expenditures for the pump station project in 2022 were \$4,473,300.63. A Total cost of \$443,740.44 was required to complete the project in 2023.

Engineering has commenced for upgrades to the Durham Street pumping station. The upgrades will include larger pumps to assist with eliminating the possibility of overflow during wet weather events. Total expenditures on Engineering in 2022 is \$5,947 and 2023 is \$115,550.45. The project is scheduled to commence in 2024 with a budget of \$1,585,489.

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Engineering has commenced for upgrades to the Park Street pumping station. The upgrades will include larger pumps to assist with eliminating the possibility of overflow during wet weather events. A total of \$9,766.98 was spent on engineering in 2023 and another \$164,697 has been budgeted for works in 2024. The upgrades are scheduled to take place in 2025.

The Queen Street reconstruction project included the replacement and upsizing of the sewer main in the downtown core from Durham Market North to Durham Street which was thought to have been installed in the 1930's. The pipe was degrading and could no longer be maintained due to blockages. Replacement of the pipes will have reduced the chance of a spill having to be reported significantly. Preliminary costs of \$59,283.59 were spent on engineering for sewer in 2022. Total cost for the sewer portion of the project in 2023 was \$4,556,500.

6.2 Conformance with Procedure F-5-1

All of the projects listed in section 6.1 above assist in achieving conformance with procedure F-5-1 by reducing the likelihood of a bypass, overflow or spill occurring.

Wastewater Effluent Station UV Disinfection System upgrades are planned for 2024. A total of \$30,000 has been budgeted to rebuild Bank A. This project will assist the system in meeting the effluent objective criteria by ensuring the equipment is functioning at peak performance.

7.0 Modifications to Sewage Works

There were no modifications to the treatment system requiring a Notice of Modifications to Sewage Works. The Aeration upgrades had previously been added to the ECA in version 1.0 issued on February 11, 2022.

There were no alterations to the system in 2023 that posed a significant drinking water threat as noted in the report provided by B. M. Ross and Associates.

8.0 Completion of Construction Works

The Queen Street pumping station was replaced in 2023 for a total cost of \$39,755.52. The upgrade included a Quadplex grinder pumping unit and the replacement of the

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50mm forcemain with a 38mm forcemain. The Director notification and SS2 form were forwarded to the ministry in July 2023.

The Huron Terrace Pumping Station as mentioned in section 6.1 was completed in January 2023. The pumping station components were already included in the new CLI ECA Issue number 1 received in November 2022. The Director notification form for the completion of the project was forwarded to the Ministry in February 2023.

Aeration upgrades have been completed at the Kincardine Wastewater Treatment Plant. Hybrid coarse/fine bubble type submerged air diffusers were installed in the aerated cell with two positive displacement blowers (one duty, one standby), each with design air flow rate of 425 L/s as per the description in the ECA. A total of \$1,011,416.07 was spent on the project in 2022. Due to equipment delivery delays the project was completed in 2023 with a total of \$426,508.69. The aeration system was commissioned in May 2023.