



BRUCE ENERGY CENTER WASTEWATER TREATMENT AND COLLECTION SYSTEM

Annual Performance Report 2023

Municipality of Kincardine, Environmental Services



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1.0 Introduction

The Bruce Energy Center (BEC) Wastewater Treatment System has an Environmental Compliance Approval (ECA) #2362-BXVTJS that was issued on February 26, 2021. 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 BEC 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 BEC Wastewater Treatment Plant is classified as a Wastewater Treatment II facility and is located at 1842 Concession 2 outside of Tiverton. The plant consists of an aerated four-cell lagoon system using a multi-stage centrifugal type blower system. Alum is added at Cell 3 to aid in phosphorus removal. 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 Bruce Energy Center (BEC) sewage collection system is a class II Wastewater Collection system that services the villages of Tiverton, Inverhuron and also the Bruce Energy Center Industrial Park located on Concession 4. It consists of approximately 14 kilometers of gravity sewer mains, 9 kilometers of pressurized sewer mains, 4 sewage pumping stations and services approximately 488 properties. The collection system leads to the Bruce Energy Center Lagoons located at 1842 Concession 2, Tiverton. A map of the collection system is available in Appendix B.

2.0 Monitoring Data

Operations staff collected biweekly composite samples of raw sewage and grab samples of final effluent sewage 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.

On November 30 an extra set of samples were taken to try and lower the Total phosphorous. The daily sample limit of 1.5 was not exceeded but the monthly average limit of 1.00mg/L for phosphorous was exceeded. The monthly average for November was 1.23mg/L and the exceedance was reported to the ministry.

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.

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. The 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.

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Table 1 BEC Lagoon and Collection System Flows

	Average Flow (m³/d)	Maximum Flow (m³/d)	Total Flow (m³)
Tiverton Collection System	377.2	1,113	137,534
Inverhuron Collection System (No meter)	--	--	--
Inverhuron Provincial Park	--	--	6,523
BEC Industrial Park	--	--	126,851
Hauled septage	--	--	203
Total metered sewage from collection system			271,111
BEC Influent Flow	844	1,982	307,929
BEC Effluent Flow	759	2,245	227,051

BEC Industrial Park flow data is a sum of the wastewater flows from two businesses within the park that are metered. Not all businesses are equipped with flow meters as they have low flows. The Inverhuron Collection system now only records pump hours and does not totalize flows.

2.2 Imported Sewage

A total of 203m³ of septage was received from Bruce Power in 2023 as part of the MCR Project. The MCR event started in July 2020 and ended in October 2023. Sample results are included in Appendix E.

There was no Leachate hauled form the Kincardine Waste Management Center to the BEC in 2023.

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2.3 Design Objectives

The design capacity for the plant is 2200 m³/day. Table 2 shows precipitation and flow data monthly for 2023.

Table 2 Design Capacity

Month	Influent Flow Total m ³	Precipitation mm	Design Capacity 2200 m ³ /day	Design exceedances (# of days)	Effluent Flow Total m ³
January	16,899	32	25%	0	30,474
February	15,448	32	25%	0	24,950
March	17,488	60	26%	0	26,716
April	14,529	104	22%	0	29,380
May	22,844	57	33%	0	20,216
June	22,417	38	34%	0	12,184
July	30,365	129	45%	0	15,908
August	32,542	110	48%	0	18,217
September	35,904	23	54%	0	17,206
October	33,383	75	49%	0	24,010
November	32,051	48	49%	0	26,380
December	34,059	59	50%	0	31,410
Totals	307,929	765	38%	0	277,051

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Table 3 compares the precipitation and flow data over the past 5 years. The lagoon system is at approximately 38% capacity and is under the influence of some inflow and infiltration.

Table 3 Flow vs Precipitation

	2019	2020	2021	2022	2023
Annual Influent Flow (m³)	284,900	252,809	261,202	206,073	307,929
Overall Percentage of Influent Design Capacity	36%	31%	33%	26%	38%
Design Capacity Exceedances (days)	1	0	0	0	0
Annual Effluent Flow (m³)	300,122	254,770	262,283	255,056	277,051
Precipitation (mm)	709	444	375	582	765

Some Business Park residents as well as some Inverhuron residents are on private drinking water wells so we would not be able to estimate the extra water going into the sanitary sewer system.

Inflow and infiltration continue as evidenced through the increased flows at the Tiverton pump stations and, in the wastewater pumped to the BEC lagoon during times of heavy precipitation. Maple Street in Tiverton was reconstructed in 2021 and footing drain tie in connections to sanitary were removed. This has relieved some of the infiltration issues on the system, but it is suspected other areas of Tiverton also have footing drain connections to the sewers. Table 4 compares the volume of water produced by the Tiverton Drinking Water System, the annual precipitation and the volume pumped from the Maple Street SPS.

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Table 4 Tiverton Volume Comparisons

	2019	2020	2021	2022	2023
Tiverton Drinking Water Produced (m³)	84,573	80,719	77,311	79,340	78,903
Tiverton Collection System Flow (m³)	126,022	119,349	128,745	121,550	137,534
% Increase	33%	32%	40%	35%	43%
Annual Precipitation (mm)	709	444	375	582	765

2.4 Effluent Data

Tables 5 and 6 compare the 2023 Final Effluent average quality to the effluent criteria limits in the ECA. Total Phosphorus exceeded the monthly average objective of 0.8mg/L in October and November but only exceeded the monthly average limit of 1.0mg/L in November. The Single sample result limit of 1.5mg/L was not exceeded. An exceedance of Total Phosphorus in the month of November was reported to the Ministry with a value of 1.23mg/L.

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Table 5 Sample Results compared to Non-compliance Limits

	CBOD5 (mg/L)		Total Suspended Solids (mg/L)		Total Phosphorous (mg/L)		Total Ammonia (mg/L)			
	Monthly Average	Max Daily	Monthly Average	Max Daily	Monthly Average	Max Daily	Freezing		Non-freezing	
Non-compliance Limits	30	45	30	45	1.0	1.5	15	20	7.5	10
January	7.00	11.00	9.00	10.00	0.27	0.27	6.80	6.80	--	--
February	4.50	7.00	6.00	7.00	0.17	0.20	6.55	6.70	--	--
March	4.50	5.00	9.00	12.00	0.24	0.30	5.95	6.50	--	--
April	15.00	22.00	15.50	20.00	0.34	0.40	--	--	2.55	4.50
May	12.67	20.00	14.33	18.00	0.32	0.39	--	--	0.70	1.40
June	7.50	9.00	11.50	17.00	0.18	0.23	--	--	0.55	0.60
July	5.50	6.00	8.50	13.00	0.12	0.16	--	--	2.55	3.60
August	6.50	8.00	19.00	24.00	0.14	0.14	--	--	0.55	0.90
September	7.00	8.00	23.00	27.00	0.21	0.24	--	--	0.30	0.40
October	4.00	4.00	15.00	17.00	0.87	1.27	--	--	0.93	1.60
November	4.00	6.00	8.00	10.00	1.23	1.29	--	--	3.07	3.50
December	4.00	4.00	3.00	4.00	0.74	0.95	6.30	7.10	--	--

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Table 6 Final Effluent Monthly Average Loading

Monthly Average Loading kg/day					
	CBOD5	TSS	TP	Ammonia freezing	Ammonia non-freezing
Effluent Objective	55	55	1.8	26.4	11
January	7	9	0.3	6.68	--
February	4	5	0.2	5.84	--
March	4	8	0.2	5.13	--
April	15	15	0.3	--	2.5
May	8	9	0.2	--	0.46
June	3	5	0.1	--	0.22
July	3	4	0.1	--	1.31
August	4	11	0.1	--	0.32
September	4	13	0.1	--	0.17
October	3	12	0.7	--	0.72
November	4	7	1.1	--	2.7
December	4	3	0.8	6.38	--
Averages	5	8	0.3		

2.5 Effluent Quality Control Measures

The coarse bubble diffuser system and the addition of the coagulant aluminum sulphate, work together to meet the effluent objectives outlined in the ECA. Aluminum sulphate is added to the transfer pipe between Cell 2 and 3 to aid in coagulation and for phosphorous removal. A total of 9313 Kg of alum was added in 2023 and the average dosage was 32.16mg/L per day. When comparing the influent and effluent sample results, we determined that there was an 88% removal of Total Suspended Solids and 89% removal of Total Phosphorous.

The ability of the BEC Lagoon system to treat and remove waste in 2023 was comparable to previous years. The effluent 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 discolouration on the receiving waters.

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Table 7 below, summarizes and compares the alum dosages and the percent removals achieved over the last 5 years.

Table 7 Comparison of Alum Dosage and Percent Removal

		2019	2020	2021	2022	2023
Alum Dosage (Average)	mg/L	26.12	24.74	36.64	45.35	32.16
	kg/day	15.06	14.12	15.60	16.96	25.52
Percent Removal	TSS	90%	86%	94%	91%	88%
	TP	91%	93%	93%	93%	89%

The effluent was continuously disinfected by UV resulting in an E. coli annual geometric mean density of 2 organisms per 100ml with most samples being below the method detection limit of the lab. The effluent objective is 150 organisms per 100ml.

The UV system provides disinfection of the effluent year-round during normal operations in 2023 the average UV dosage was 147.40mj/cm² with the range spanning from 77.77 to 360.65mj/cm².

The effluent pH ranged from 4.40 to 9.30. The pH of 4.40 that was recorded on December 6 is thought to be an issue with the calibration of the equipment by new staff and not a true representative sample of the effluent.

3.0 Operating Issues and Corrective Actions

An exceedance of Total Phosphorus in the month of November was reported to the ministry on December 5, 2023. The monthly average limit for Total Phosphorus is 1.0mg/L and our monthly average result came to 1.23mg/L. Staff were aware the phosphorus levels were slowly increasing since the October 31 sample. Adjustments to alum dosages were being made onsite to try and bring the phosphorus levels down. An issue with the alum pumping system plugging on October 20 may have contributed to the exceedance. Staff have started sampling and monitoring the sewage output from the individual businesses at the Bruce Energy Center Industrial Park to confirm the strength of the sewage being sent to our site for treatment. Staff will be following up with

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individual businesses that exceed the sewage strength limits in the Municipal Sewer Use Bylaw to ensure our monthly compliance limits can be met going forward.

There were 8 UV alarms in 2023. Two of the alarms resulted in repairs due to a lamp failure and a sensor needing to be replaced. The other UV alarms were due to power flickers.

The generator at the WWTP faulted on October 10, 17 and 22. No issues could be found onsite, and the UV equipment was in operation each time. The Generator was tested afterwards and showed no issues.

Staff attempted to clean grit out of the influent chamber on May 17 but were unable to get all the debris out due to the volume of influent flow. The influent valve was seized but staff were able to get it working. A planned bypass was arranged to complete the influent chamber cleaning on June 28, 2023. The line from the BEC Energy Park was plugged, and staff were controlling the influent flows at the Maple and King Street pumping stations, but the influent flows were still too much for the vector to keep up with. The job was not completed but a total of 183.57m³ of sewage was estimated to have been sucked out of the influent chamber and dumped into lagoon cell #1. A spill occurred during the work that had 70L released from the truck onto the ground. This sewage was cleaned up and put into lagoon cell #1. Future work will need to be done to the influent chamber to allow staff to isolate the chamber for cleaning.

The Maple Street pump station had 6 High level alarms with only one event ending up with an overflow to the environment. All high level alarms were due to heavy rainfall events.

The Inverhuron Park sewage pumping station had 2 high level alarms that were determined to be a result of campers using the dumping station at the Provincial Park. No follow up was required.

4.0 Maintenance and calibration summaries

The BEC Wastewater system follows a preventative maintenance schedule set out by the Environmental Services Staff. This schedule includes inspections and maintenance for BEC blowers, alum pumps, aeration system cleaning, UV system maintenance,

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pump station inspections, bar screen cleaning, monthly generator maintenance, as well as sewermain flushing and inspections. All maintenance and repairs are recorded in the corresponding site logbook. A copy of the preventative maintenance schedules are available in Appendix F.

Other planned maintenance included:

- Alum line flushing
- Alum pump #1 rebuilt with new diaphragm, gaskets, and check valves on suction and discharge
- Replaced back pressure relief valve on alum system
- Wet well cleaning was performed at the Maple Street, King Street and Lake Street pump stations
- Annual pump station inspections for all site components were completed at the Maple Street, King Street and Lake Street pumping stations
- Annual sewer flushing program
- BEC raw composite sampler replacement
- BEC Effluent Flow meter replacement
- BEC Influent grit chamber cleaning
- Lake Street sanitary collection system from Pine Street to Bruce Road 15, 23 manholes raised to grade and sewer mains flushed

Emergency repairs and maintenance in 2023 included:

- UV equipment had sensor and bulbs replaced and sleeves cleaned after alarms
- Telephone line at the Maple Street Pump station repaired by BMTS
- 3 Sanitary Lateral repairs
- 2 Sanitary Cleanout repairs

4.1 Sludge Depths

Sludge depths were taken in each cell in 2023 using a sludge judge. The average volume of sludge in each cell was estimated and is shown in table 8 below. From the estimated volumes there is a significant increase in sludge for Cell #1 from 2022 to

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2023 figures. It was noted that the 2022 decrease in sludge could have been caused by samples being taken in different locations in each cell from the previous year. In 2023 grit was removed from the Inlet chamber and added to Cell #1 which could have influenced the sludge volume. No sludge was removed from any of the cells in 2023.

Table 8 Estimated Sludge Volumes

	2019	2020	2021	2022	2023	Cell Capacity Used
Cell #1	4,501	4,501	4,620	3,435	6,396	54%
Cell #2	3,435	2,822	4,294	2,822	4,907	40%
Cell #3	6,046	3,481	4,580	4,214	5,130	56%
Cell #4	1,783	3,121	3,478	2,675	2,853	32%

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 milltronics 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 Bruce Energy Center Wastewater Treatment System in 2023.

There were 4 complaints related to the wastewater collection system in 2023. One wastewater odour complaint in Inverhuron was found not to be related to the wastewater system. One wastewater backup resulted in a homeowner issue. Two wastewater complaints ended up resulting in a contractor digging up the sewer laterals for repairs. A full listing of the complaints is available in Appendix H.

6.0 Bypasses, Overflows and Spills

The BEC Wastewater Treatment system had one planned bypass and two spill events. All 3 events were related to the cleaning of the Influent grit chamber. A planned bypass was arranged for June 28th and resulted in a total of 183.57m³ of sewage bypassing the influent chamber and being pumped directly into lagoon cell #1. A spill occurred during the work that had 70L released from the truck onto the ground. This sewage was cleaned up and put into lagoon cell #1.

On December 12 staff attempted to clean out the influent chamber again and had a spill of 10m³ from the vactor truck onto the ground. The spilled sewage was washed into lagoon cell #1 with a high-pressure water hose.

The BEC Wastewater Collection system had one overflow event at the Maple Street pumping station on April 5, 2023. The overflow was due to a significant rainfall event and it is estimated that a total of 83.2m³ was released to the environment.

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 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.

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6.1 Efforts to Reduce Bypasses, Overflows and Spills

Treatment System

There was no work completed to reduce bypasses, overflows or spills on the treatment system in 2023.

Collection System

Upgrades have been budgeted for the Maple Street Pumping Station with engineering scheduled to proceed in 2024 and construction scheduled for 2025. The upgrades will include larger pumps to assist with eliminating the possibility of overflow during wet weather events. A total of \$100,000 has been allocated for Engineering and \$750,000 has been allocated for construction.

6.2 Conformance with Procedure F-5-1

The maple street pumping station project listed in 6.1 above will assist in achieving conformance with procedure F-5-1 by reducing the likelihood of a bypass, overflow or spill occurring.

A Sludge inspection and removal project at the lagoons is being undertaken in 2024. Removing sludge from the cells will assist in conforming to procedure F-5-1 by providing optimal treatment at the site and ensuring that the effluent design objectives are met.

7.0 Modifications to Sewage Works

There were no modifications to the treatment system requiring a Notice of Modifications to Sewage Works.

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

There were no major projects in 2023 requiring a notice of completion.