Niagara- on-the-Lake Wastewater Treatment Plant

Annual Performance Report

Treatment and Collection

Reporting Year: 2023

Niagara Region

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NL-T-1 Wastewater Treatment Process Description

The Niagara-on-the-Lake (NOTL) Wastewater Treatment Plant (WWTP) is located at 1550 Lakeshore Road in the Town of NOTL and provides wastewater treatment to areas of NOTL. The NOTL WWTP is a class III extended aeration treatment facility and has been designed to treat an average daily flow (ADF) of 8,000 cubic meters per day (m^3/d). This facility can fully treat all flows up to 34,700 m^3/d.

The NOTL WWTP was constructed to replace the aging NOTL Lagoon wastewater treatment facility. The lagoon is located at 1738 Lakeshore Road in the Town of NOTL. The facility has not received influent, or sewage, for treatment at the site since June 25, 2019. Until January 2021, treated effluent from the new NOTL WWTP was directed back to the lagoon for further treatment. After this date, the plant reached full operation and began to directly discharge treated effluent to Lake Ontario.

This report will cover both the NOTL WWTP and the NOTL Lagoon but the emphasis will be on the new in service NOTL WWTP.

The NOTL WWTP and Lagoon operate under the following MECP approvals:

Environmental Compliance Approval (Sewage): 8314-9MHHJQ, issued September 10, 2014
Environmental Compliance Approval (Air): 5137-9VKHNJ, Issued June 19, 2015

The NOTL WWTP uses the following processes to treat wastewater:

- Imported Sewage Receiving
- Screening
- Grit Removal
- Phosphorus Removal
- Secondary Treatment
- Disinfection (Chlorination/Dechlorination)
- Solids Handling – sludge digestion, storage and transportation

Imported Sewage Receiving Station: To provide service to Niagara Region residents outside the wastewater servicing area, the NOTL WWTP accepts imported sewage from commercial haulers. Receiving stations are situated to ensure all received sewage receives full treatment.

Screening: mechanically cleaned screens remove rags and large debris that could harm pumps and process equipment. Screenings are sent for disposal in landfill.

Grit Removal: A grit tank equipped with coarse bubble diffusers is used to remove grit from wastewater. Heavy suspended material such as sand and small stones (grit) is settled to the bottom of the tanks while lighter organic particles are kept in suspension and pass through the tanks for further treatment. The grit removed is dewatered for landfill disposal.

Phosphorus Removal: A coagulant, aluminum sulphate (alum), is added to the treatment process to aid in phosphorus and suspended solids removal.

Secondary Treatment:

Aeration Tank: Large tanks are equipped with air diffusers to add fine bubbles into the wastewater. This oxygen-enriched environment encourages microorganisms (or “bugs”) to remove dissolved and suspended organics and nutrients. Activated sludge is returned to the aeration process to ensure enough bugs are present to provide adequate wastewater treatment.

Secondary Clarifiers: Secondary clarifiers receive effluent from the aeration tanks which separates the microorganism population and remaining solids. Solids settle as activated sludge on the bottom of the clarifier while a clean effluent flows from the clarifiers to be disinfected and discharged to the environment. A portion of the activated sludge collected on the bottom of the clarifier is pumped back to the front of the aeration tanks to ensure a healthy microbial population. Excess activated sludge is ‘wasted’ or removed from the process and is pumped to the solids handling treatment process.

Disinfection (chlorination/dechlorination):

Chlorine in the form of liquid sodium hypochlorite is added into the effluent stream for pathogen control from April 1 to October 31 each year. Adequate contact time is provided by the chlorine contact chambers. As chlorine can be toxic to aquatic species, disinfected effluent is dechlorinated with a sodium bisulphite solution before being discharged to the Lake Ontario.

Solids Handling

Waste Activated Sludge Thickening: Waste activated sludge from the secondary treatment process is mixed with a polymer solution and sent to a gravity belt thickener where the polymer acts to bring solids together while water is removed and sent back to the liquid treatment process, producing a thickened sludge.

Anaerobic Digestion: Thickened sludge is pumped to an anaerobic digester for thickening. Anaerobic digestion allows a further breakdown of pollutants and pathogens in the collected sludge. The digested sludge is transported from site for further treatment or beneficial reuse such as land application or dewatering at the Garner Road Biosolids Facility.

NL-T-2 Review of Plant Flows, Influent and Imported Sewage Sampling and Monitoring

Review of 2023 Plant Flows

Table NL-T-1 below outlines the volume of sewage treated at the NOTL WWTP during the reporting year. It also outlines how much Imported Sewage was received at site for treatment.

The NOTL Lagoon received no sewage nor had any discharges to the environment in 2023. The NOTL Lagoon is pending decommissioning.

Table NL-T-1: Table of NOTL WWTP 2023 Treated and Imported Sewage Flows

Flow Statistic	Value
Design Average Daily Flow (ML/d)	8.000
Design Peak Flow Rate (ML/d)	34.700
Total Influent Flow (ML)	2,063.106
Annual Average Influent Daily Flow (MLD)	5.652
% Annual Average Daily Flow Utilization	70%
Total Final Effluent Discharged to Environment (ML)	2,490.509
% Increase/Decrease over prior year	7%
Volume Imported Sewage Received (ML)	17.211
% Increase/Decrease Imported Sewage over prior year	16%
Imported Sewage as % of Flow	0.46%

Reviewing the treated flows in 2023, it was observed that, on average, the plant is utilizing 70% of its design Average Daily Flow capacity. This indicates that the facility has the capacity to meet the needs of the collection system with room for additional flows that may be added from development. If the average becomes greater than 80%, plant expansion should be considered.

Daily flows to the plant were reviewed. In 2023, there were 34 instances where the influent flow to the plant was greater than the design Average Daily Flow, amounting to approximately 9% of the year. These instances occurred during and several days following times of wet weather or heavy snow melt suggesting increased flows are occurring due to Inflow and Infiltration.

A review of the monthly average daily flow of the NOTL WWTP since it became operational was completed. This can be observed below in Figure NL-T-1 below. An upward trend was observed. Spikes during typical wet weather seasons further support increased flows are occurring due to Inflow and Infiltration.

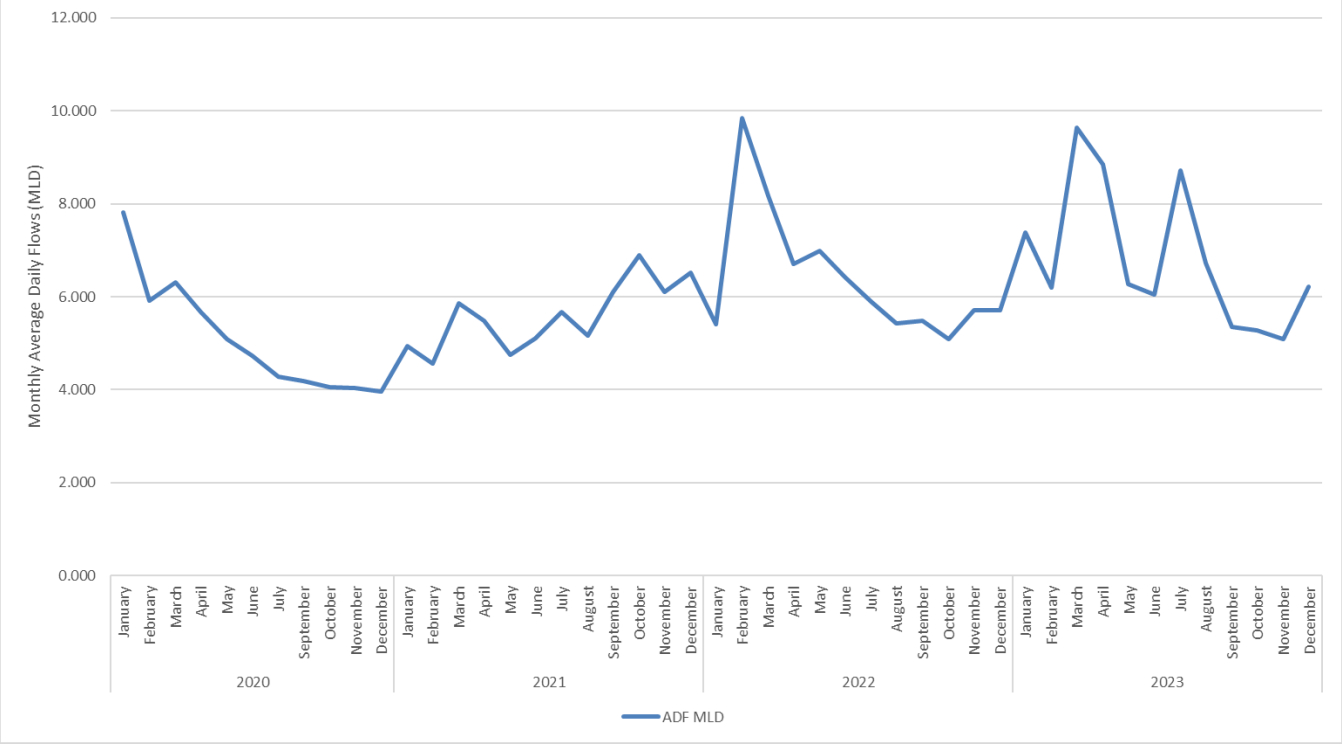

Figure NL-T-1: Graph displaying the Monthly Final Effluent Average Daily Flow Rate in MLD

The volume of imported sewage received at this facility increased 16% compared to the previous reporting period. A decrease was observed in 2022 and volumes in 2023 increased to more typical levels. There were no process issues encountered related to the receiving of imported sewage in 2023.

Review of Influent Sampling and Monitoring Activities

In 2023, 104 samples of influent were collected and tested. An annual summary of influent sampling can be observed in Table NL-T-5.

Although the volume of sewage is an important consideration for the effective operation of a wastewater treatment plant, another important factor to monitor is plant loading. Plant loading displays if the strength of the sewage received at the plant is getting stronger or weaker. Stronger sewage may impact the amount of sewage the plant can treat effectively.

Plant loading is calculated by measuring the average strength of a pollutant per liter of influent sewage and multiplying it by the average volume of sewage received. This is generally displayed as kilograms of pollutant per day or kg/d. Below in Figure NL-T-2, is a graph depicting four commonly monitored pollutant loading to the plant for the period of 2021-2023.

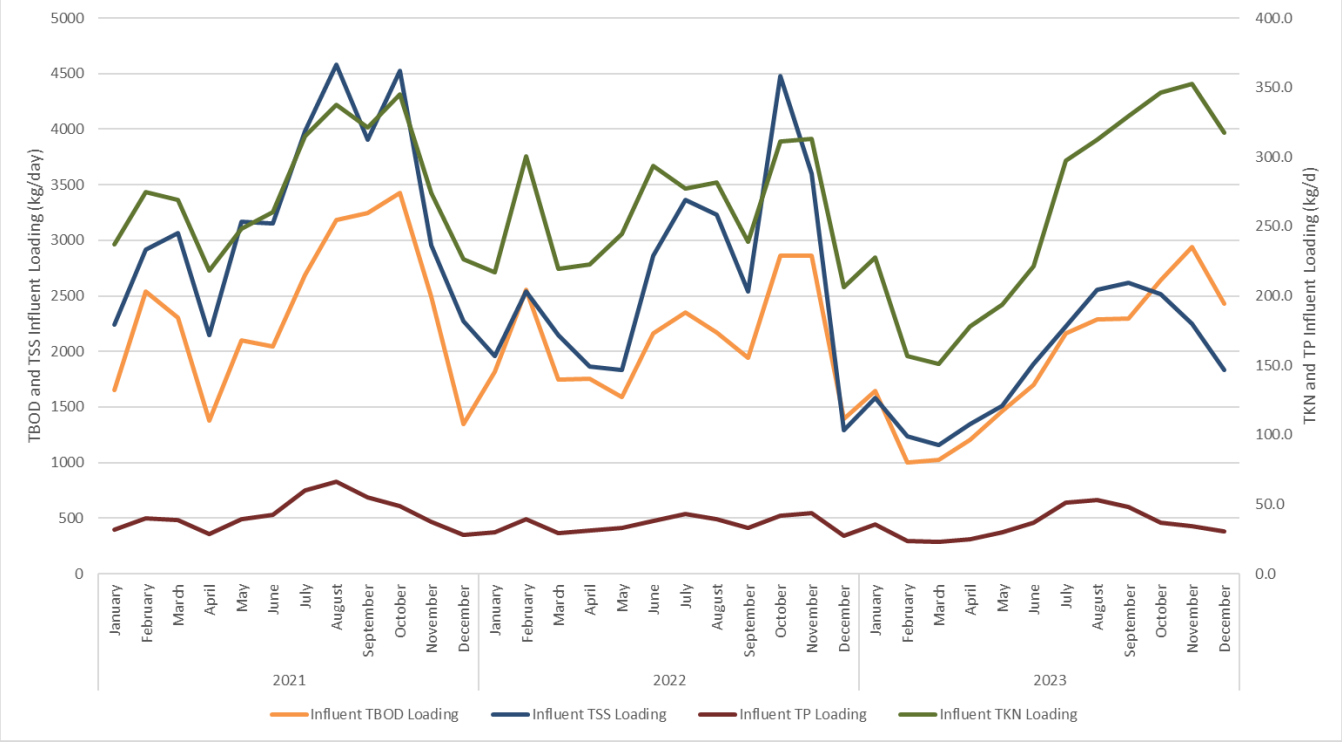

Figure NL-T-2: Figure of monthly plant loadings to the NOTL WWTP for Total Biochemical Oxygen Demand (TBOD), Total Suspended Solids (TSS), Total Kjeldahl Nitrogen (TKN) and Total Phosphorus (TP), in kg/d, for the period 2021 to 2023.

Reviewing the calculated loadings for TBOD, TSS, TKN and TP for the past three years shows no observable change to the sewage strength being received at the site. The influent sampler was relocated in fall 2022 as it was observed to be including return activated sludge (RAS) during periods of low flow in the influent sample. The sampler has been moved further upstream to ensure RAS is not included in the influent sample as to better evaluate pollutant loading to the plant. Loading values in 2023 were lower until centrate from Niagara Falls WWTP began to be accepted at the NOTL WWTP in summer of 2023.

Review of Imported Sewage Sampling and Monitoring

Imported sewage is sampled bi-weekly to ensure sewage being received will not have an adverse impact to the treatment process or the beneficial re-use of biosolids resulting from the wastewater treatment process. Sampling and testing of imported sewage is not regulated by the ECA but is completed as a best practice. In 2023, 23 samples of imported sewage were collected and submitted for testing by an ISO 17025:2017 accredited laboratory. Results were reviewed and compared to the Niagara Region Sewer Use By-law. Where exceedances of the by-law were noted, the source of the imported sewage is investigated. Exceedances of treatable parameters (BOD, TP, TSS, pH) are allowable under the SUBL.

Table NL-T-2: Table of Imported Sewage monthly average analysis results

Analyte	Units	SUBL Limit	January	February	March	April	May	June	July	August	September	October	November	December
Total Solids	mg/L	-	2,710	3,000	3,190	17,300	1,177	1,325	8,335	3,120	56,270	3,790	22,273	9,690
Phosphorus	mg/L	10	13.14	24.00	31.50	49.20	13.92	4.93	104.52	35.75	232.15	29.55	129.03	54.10
Arsenic	mg/L	1	0.02	0.04	0.05	0.12	0.02	0.04	0.02	0.02	0.12	0.04	0.09	0.10
Cadmium	mg/L	0.7	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.04	0.01	0.03	0.03
Chromium	mg/L	3	0.02	0.04	0.05	0.07	0.02	0.04	0.03	0.03	0.14	0.04	0.09	0.10
Cobalt	mg/L	5	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.05	0.01	0.03	0.03
Copper	mg/L	3	0.44	3.98	0.97	26.40	0.34	0.59	0.43	3.55	2.06	0.56	2.75	0.80
Lead	mg/L	1	0.03	0.19	0.05	0.17	0.02	0.05	0.02	0.06	0.30	0.12	0.20	0.10
Mercury	ug/L	10	0.06	0.21	0.05	0.93	0.05	0.38	0.61	0.36	0.54	2.55	0.16	0.09
Molybdenum	mg/L	5	0.01	0.02	0.03	0.83	0.01	0.02	0.02	0.02	0.04	0.01	0.02	0.05
Nickel	mg/L	2	0.01	0.06	0.02	0.08	0.01	0.01	0.03	0.03	0.13	0.03	0.06	0.03
Selenium	mg/L	1	0.03	0.04	0.05	0.03	0.02	0.04	0.02	0.02	0.11	0.04	0.09	0.10
Zinc	mg/L	3	0.40	2.95	1.80	15.10	0.66	0.95	6.17	3.20	7.10	1.35	4.20	0.70
Aluminum	mg/L	-	1.55	8.88	11.10	17.60	3.20	4.45	16.94	7.25	16.50	7.52	4.81	1.40
Antimony	mg/L	5	0.04	0.07	0.10	0.04	0.03	0.07	0.03	0.04	0.27	0.07	0.18	0.20
Barium	mg/L	-	0.08	0.12	0.18	0.68	0.08	0.14	0.35	0.17	0.26	0.16	0.18	0.10
Beryllium	mg/L	-	0.02	0.04	0.05	0.02	0.02	0.04	0.02	0.02	0.11	0.04	0.09	0.10
Boron	mg/L	-	0.40	0.70	1.00	0.60	0.33	0.70	0.30	0.40	2.70	0.70	1.80	2.00
COD	mg/L	-	1,025	4,770	3,600	30,300	1,387	1,180	10,193	3,960	104,395	7,500	70,767	23,700
Conductivity	us/cm	-	4,355	1,855	1,430	2,120	1,199	559	3,675	1,645	3,025	2,135	2,073	2,510
Iron	mg/L	-	1.52	22.85	14.00	19.40	3.54	11.80	16.22	10.31	24.40	13.80	15.01	2.04
Manganese	mg/L	-	0.12	0.91	1.10	0.61	0.18	0.19	1.05	0.58	0.98	0.74	0.93	0.20
pH		6-11	7.70	6.35	7.40	7.40	6.80	7.50	7.15	7.35	5.65	6.85	4.87	3.70

Analyte	Units	SUBL Limit	January	February	March	April	May	June	July	August	September	October	November	December
Silver	mg/L	5	0.02	0.04	0.01	0.02	0.03	0.04	0.02	0.02	0.11	0.04	0.09	0.10
Tin	mg/L	5	0.04	0.11	0.10	0.50	0.03	0.07	0.05	0.13	0.29	0.07	0.65	0.20
Total Volatile Solids	mg/L	-	645	1,840	2,260	13,700	663	885	6,075	2,055	44,020	2,410	16,943	7,810
Vanadium	mg/L	-	0.01	0.02	0.03	0.01	0.01	0.02	0.02	0.02	0.07	0.02	0.04	0.05

Review of Final Effluent Sampling and Monitoring Activities

In 2023, 104 samples of final effluent were collected and tested. Individual as well as monthly average results are reviewed and compared to the objective and compliance limits stated in the facility ECA. Table NL-T-3 below summarizes the number of monthly objective and compliance limit exceedances at the NOTL WWTP in the reporting year.

Table NL-T-3: Evaluation of Final Effluent sample results to ECA objectives and compliance limits

Parameter	**ECA Monthly Concentration Objective**	**ECA Monthly Concentration Limit**	**# of Objective Concentration Exceedances**	**# of Monthly Limit Concentration Exceedances**
pH[1]	6.5-9.0	6.0-9.5	0	0
Carbonaceous Biochemical Oxygen Demand(CBOD)	15 mg/L	25 mg/L	0	0
Total Suspended Solids (TSS)	15 mg/L	25 mg/L	0	0
Total Phosphorus (TP)	0.5 mg/L	0.7 mg/L	0	0
Total Ammonia Nitrogen: April, May, October	5 mg/L	7 mg/L	0	0
Total Ammonia Nitrogen: June - September	2 mg/L	3 mg/L	0	0
Total Ammonia Nitrogen: November - March	10 mg/L	15 mg/L	0	0
Total Residual Chlorine[2] (TRC)	0.01 mg/L	0.02 mg/L	0	0
E-Coli[3] (geomean)	100 MPN/100 mL	200 MPN/100 mL	0	0

NOTL WWTP did not have any instances where the monthly average for a pollutant exceeded the ECA limits or objectives.

[1] pH must meet objectives/limits at all times (inclusive)
[2]TRC monitoring only required April 01 to October 31 inclusive
[3] E.Coli monitoring only required April 01 to October 31 inclusive

A review of individual results against ECA objectives was also complete. Below summarizes the percentage of samples that were over the ECA objective:

- CBOD – 0%
- TSS – 1%
- TP – 0%
- Total Ammonia – 0%
- E.Coli – 6%

Final Effluent sample results did not exceed the ECA objective greater than 50% of the time.

The plant continues to effectively treat all wastewater received for treatment. An annual summary of monthly average final effluent sample results are available in Table NL-T-5 below.

Quarterly sampling and testing of Final Effluent for Acute Lethality to Daphnia Magna[4] and Rainbow Trout[5] is a requirement of the ECA at the NOTL WWTP. This testing includes introducing Daphnia or Rainbow Trout to a sample of Final Effluent. The sample is aerated and observed for multiple days.

- For the Daphnia Magna, the number of test subjects that die during the 48-hour testing period are counted. If more then 50% of the total Daphnia die, the sample fails.
- For Rainbow Trout, 10 trout are tested in the effluent for 96 hours. If more than five trout die during the testing period, the sample fails.
    - Typically during the 96 hour testing period for Rainbow Trout, the action of aerating the effluent will cause the pH of the sample to rise due to the evolution of carbon dioxide. The increase in pH causes ammonium and ammonia concentrations present in the sample to shift resulting in a higher amount of un-ionized ammonia that can be toxic to fish. This is a result of the testing conditions and is not a true representation of the toxicity of the effluent.
    - As the pH shifted sample is not reflective of the actual effluent pH, the Rainbow Trout test can also be conducted using pH stabilization. This means the pH is measured at the beginning and during the test. If it begins to change, the pH is adjusted back to the originally measured value at the beginning of the test.
    - Both the standard Rainbow Trout test as well as the pH stabilized version are run at the same time as a precaution and means to determine if final effluent toxicity is occurring due to the pH shift that can occur during testing

[4] Acute Lethality to Daphnia Magna is carried out as per Environment Canada Publication EPS 1/Rm/14
[5] Acute Lethality to Rainbow Trout is carried out as per Environment and Climate Change Canada publication EPS 1/RM/13 and EPS 1/RM/50 for pH Stabilization

Test results for 2023 can be observed in Table NL-T-4 below.

Table NL-T-4: Summary of Daphnia Magna and Rainbow Trout Acute Lethality Results

Sample Date	Acute Lethality to Daphnia Magna Pass/Fail	Acute Lethality to Rainbow Trout Pass/Fail	Acute Lethality to Rainbow Trout - pH Stabilized Pass/Fail
2023-03-13	Pass	Pass	Pass
2023-05-30	Pass	Pass	Pass
2023-08-08	Pass	Pass	Pass
2023-11-06	Pass	Pass	Pass

NOTL WWTP passed all Acute Lethality to Daphnia Magna and Rainbow Trout tests in 2023. Toxicity test reports are available upon request.

Effluent Quality Assurance Measurements and Control Measures

To ensure NOTL WWTP continues to produce a high-quality effluent the following measures have been implemented:

- Development and implementation of a Wastewater Quality Management System (WWQMS) program
    - This program promotes an environment of continuous improvement for all staff impacting the quality of wastewater
- Compliance samples are analyzed by an ISO 17025:2017 accredited laboratory unless sample results are required to be collected in the field at the time of sampling
- Standard Operating Procedures (SOPs) are in place to support proper sampling and field measurements
- A compliance sampling schedule is created each year to ensure regulatory requirements are being met, as a minimum
- Equipment used in the monitoring and measurement of Final Effluent quality are calibrated annually

Table NL-T-5: Annual Summary of Plant and Imported Sewage Flows, Influent and Effluent Sampling and Monitoring Results

Measured Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Total / Average	Total Samples
Influent - Monthly Average TSS (mg/L)	214	199	120	152	241	312	255	380	489	477	443	295	298	
Number of Influent TSS Samples	9	8	9	8	10	8	9	9	8	9	9	8		104
Influent - Monthly Average TBOD (mg/L)	223	162	106	136	233	281	248	340	430	500	579	391	302	
Number of Influent TBOD Samples	9	8	9	8	10	8	9	9	8	9	9	8		104
Influent - Monthly Average TP (mg/L)	4.8	3.8	2.4	2.8	4.8	6.1	5.9	7.9	9.0	7.0	6.7	4.9	5.5	
Number of Influent TP Samples	9	8	9	8	10	8	9	9	8	9	9	8		104
Influent - Monthly Average TKN (mg/L)	30.81	25.30	15.68	20.11	30.90	36.53	34.09	46.44	61.63	65.59	69.48	51.10	40.64	
Number of Influent TKN Samples	9	8	9	8	10	8	9	9	8	9	9	8		104
Total Plant Flows (ML)	229.100	173.606	298.550	265.248	194.432	181.652	270.405	208.430	160.430	163.570	152.352	192.734	2490.509	
Daily Average (MLD)	7.390	6.200	9.631	8.842	6.272	6.055	8.723	6.724	5.348	5.276	5.078	6.217	6.823	
Maximum Flow (ML)	12.400	8.737	21.619	19.371	8.964	9.750	21.258	9.589	7.285	6.776	7.263	11.612	**MAX**	21.619
Minimum Flow (ML)	6.026	5.071	6.623	5.883	5.388	5.050	5.436	5.675	4.655	4.781	4.676	5.169	**MIN**	4.655
Volume Imported Sewage Received (ML)	1.341	0.995	1.241	1.146	1.240	1.243	1.540	1.823	1.314	2.068	1.936	1.326	17.211	
Final Effluent - Monthly Average TSS (mg/L)	4.7	3.3	4.6	3.8	4.8	9.8	11.9	8.4	7.6	6.6	7.8	7.1	6.7	
Final Effluent - Average Daily TSS Loading (kg/d)	35	20	44	34	30	59	104	56	41	35	40	44	46	
Number of Final Effluent TSS Samples	9	8	9	8	10	8	9	9	8	9	9	8		104
Final Effluent - Monthly Average CBOD (mg/L)	4.0	4.0	4.0	4.0	4.0	4.0	4.1	4.0	4.0	4.0	4.0	5.3	4.1	
Final Effluent - Average Daily CBOD Loading (kg/d)	30	25	39	35	25	24	36	27	21	21	20	33	28	
Number of Final Effluent CBOD Samples	9	8	9	8	10	8	9	9	8	9	9	8		104
Final Effluent - Monthly Average TP (mg/L)	0.14	0.14	0.12	0.12	0.13	0.22	0.29	0.21	0.23	0.19	0.19	0.18	0.18	
Final Effluent - Average Daily TP Loading (kg/d)	1.03	0.87	1.16	1.06	0.82	1.33	2.53	1.41	1.23	1.00	0.96	1.12	1.23	
Number of Final Effluent TP Samples	9	8	9	8	10	8	9	9	8	9	9	8		104
Final Effluent - Monthly Average TKN (mg/L)	1.36	1.24	1.20	1.15	1.34	1.86	1.78	1.66	1.88	2.09	2.19	1.76	1.63	
Number of Final Effluent TKN Samples	9	8	9	8	10	8	9	9	8	9	9	8		104
Final Effluent - Monthly Average NH3 (mg/L)	0.08	0.06	0.13	0.08	0.09	0.08	0.07	0.08	0.12	0.16	0.18	0.10	0.10	
Final Effluent - Average Daily NH3 Loading (kg/d)	0.59	0.37	1.25	0.71	0.56	0.48	0.61	0.54	0.64	0.84	0.91	0.62	0.70	
Number of Final Effluent NH3 Samples	9	8	9	8	10	8	9	9	8	9	9	8		104
Final Effluent - Monthly Average NO3 (mg/L)	5.99	6.10	4.36	4.91	6.27	7.44	7.41	9.23	9.35	8.91	9.82	9.68	7.46	
Number of Final Effluent NO3 Samples	9	8	9	8	10	8	9	9	8	9	9	8		104
Final Effluent - Monthly Average NO2 (mg/L)	0.37	0.36	0.17	0.11	0.35	0.36	0.40	0.40	0.38	0.43	0.56	0.41	0.36	
Number of Final Effluent NO2 Samples	9	8	9	8	10	8	9	9	8	9	9	8		104
Final Effluent - Monthly Geomean E.Coli (mpn/100mL)				2	3	4	6	16	62	23			9	
Number of Final Effluent E.Coli Samples				8	9	9	9	9	8	9				61
Final Effluent - Monthly Average TRC (mg/L)				0.00	0.00	0.00	0.01	0.00	0.00	0.00			0.00	

Measured Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Total / Average	Total Samples
Number of Final Effluent TRC Samples				30	31	30	31	31	30	31				214
Final Effluent - Monthly Average Temperature (°C)	13.08	12.16	12.36	13.99	13.79	20.00	21.47	21.64	21.95	20.34	16.67	16.94	17.03	
Number of Final Effluent Temperature Samples	9	8	9	8	10	8	9	9	8	9	9	8		104
Final Effluent - Monthly Average pH	7.62	7.23	7.49	7.24	7.32	7.05	7.00	7.17	7.00	7.23	7.22	7.45	7.25	
Number of Final Effluent pH Samples	9	8	9	8	10	8	9	9	8	9	9	8		104

Deviations from Scheduled Monitoring Program

Compliance sampling activities at the NOTL WWTP follow a scheduled monitoring program to ensure all provincial and federal requirements are met. A schedule is prepared for the upcoming year and is submitted to the MECP as part of the annual reporting requirement.

In 2023, two (2) deviations from the scheduled sampling days occurred. Table NL-T-6 below provides the instances where a deviation occurred and a reason for the deviation. Sampling and analysis of imported sewage is not required for regulatory purposes.

The 2024 sampling schedule is available upon request.

Table NL-T-6: Table of sampling schedule deviations

Sampling Date Deviation	Sample Type(s)	Reason
2023-02-09	Final Effluent	Autosampler programming issues. Sample submitted the following day.
2023-04-05	Imported Sewage	No sample available for submission prior to courier arrival.

NL-T-3 Description of Operating Problems Encountered and Corrective Actions Taken

No operational issues were encountered in 2023 at the wastewater treatment plant.

NL-T-4 Summary of Major Maintenance Activities and Capital Works

Summary of Maintenance Carried out on Major Equipment

Niagara Region works to keep wastewater infrastructure in a state of good repair. Maintenance activities completed include regular preventative maintenance (PM) activities and normal and emergency equipment repair or replacement. Where a substantial amount of upgrade is required, this work is carried out under the capital works program.

Below is a summary of normal and emergency repairs carried out on major equipment at the NOTL WWTP:

- Refurbishment of digester mixing pump
- Refurbishment of digester recirculation pump
- Re-piping of Imported Sewage station discharge piping
- Rebuild of Imported Sewage pump

- Rebuild of Grit Classifier Drive

This list does not include PM activities. PMs are completed and tracked in a computerized maintenance management system. PMs completed during the reporting year are available upon request.

Planned Capital Upgrades

The following is a list of capital upgrades forecasted for the NOTL WWTP and Lagoon system:

- Decommissioning of NOTL Lagoon – The NOTL Lagoon system is to be decommissioned. The aerated lagoons have been drained to the facultative lagoons. All other work is currently on hold pending discussions with the Department of National Defense and Parks Canada regarding unexploded ordinance issues and responsibilities moving forward.

Summary and Update of Notice of Modifications Completed

Through the facility ECA, MECP has given System Owners the ability to complete low risk changes to a treatment plant without requiring approval from the MECP. These modifications are documented on a Notice of Modification form and are signed off by the Owner or delegate of the system. Any pre-authorized modifications must be reported on annually to the MECP.

During the reporting year 2023, no Notices of Modification were completed.

No Notice of Modification forms were completed in previous reporting years. No status update is required.

Proposed Works – Status Update

There were no Proposed Works to be reported on for the 2023 reporting period.

NL-T-6 Summary Calibration Activities

Flow Meter Calibration – Influent, Effluent and Imported Sewage

Flow meters measuring discharges to the environment are calibrated at minimum, once per calendar year. Below in Table NL-T-7 provides a summary of flow meter calibration

Table NL-T-7: Summary of Flow Meter Calibration

Meter Name	Date Calibrated	Comments
NOTL WWTP Influent Meter	2023-04-24	Passed
NOTL WWTP Final Effluent Meter	2023-06-08	Passed
NOTL WWTP Influent Meter	2023-11-28	Passed

Calibration certificates are available upon request.

The volume of Imported Sewage received at site is reported by the sewage hauler on submitted paper manifests. No calibration required.

Effluent Monitoring Equipment Calibration/Verification

It is a requirement to calibrate, or, where unable to calibrate, verify equipment that is used to measure effluent quality.

Some effluent monitoring equipment calibration or verification is completed daily or as used by operations staff such as pH meter calibration or verification of the Total Residual Chlorine colorimeter.

Once annually, a contractor performs calibration or verification on all effluent monitoring equipment. A summary of calibration/verification activities are available in Table NL-T-8 below.

Table NL-T-8: Summary of Calibration/Verification of Effluent Monitoring Equipment

Equipment Description	Date Calibrated	Comments
DR3900 Spectrophotometer	2023-08-10	Passed
COD Reactor (HACH DRB200)		New reactor purchased in 2023. Factory calibrated.
HQ40D with LDO Meter	2023-08-10	Passed
HQ40D with LDO Meter	2023-08-10	Passed
Hach DR300 - Chlorine Colorimeter	2023-08-10	Passed
Balance – MS204TS/00	2023-09-13	Passed

Calibration certificates are available upon request.

NL-T-7 Solids Handling

Processed Organics Received

No processed organics were received at the NOTL WWTP during the reporting period. NOTL WWTP does not typically receive processed organics.

18.5 ML of centrate was received at this site in 2023 from the Niagara Falls WWTP.

Volumes Sludge Generated and Removed From Site

Solids removed from the treatment process are thickened, digested and transported from site for further processing and beneficial re-use. All sludge removed from the NOTL WWTP is taken to Niagara Region's Garner Road Biosolids Facility where it is stored, further thickened and either sent for land application or for dewatering and conversion to a pelletized fertilizer.

Table NL-T-9 provides a summary of 2022 and 2023 sludge volumes removed from site.

Table NL-T-9: Summary of Sludge Removed from Site

Month	2023 Volume Sludge Hauled (ML)	Prior Year Volume Sludge Hauled (ML)
January	0.780	0.650
February	0.520	0.867
March	0.650	0.780
April	0.607	0.780
May	0.650	0.997
June	0.737	0.694
July	0.824	0.650
August	0.954	0.650
September	0.824	0.694
October	1.474	0.911
November	1.344	0.954
December	1.084	0.824
TOTAL	**10.450**	**9.452**

It was noted there was an 11% increase in sludge removed from site in 2023. In reporting year 2022 volume, sludge had decreased 29% so this is not atypical.

No changes are anticipated for sludge handling in 2024 at the NOTL WWTP.

Sludge Quality Monitoring

Sludge is sampled and analyzed bi-weekly to meet regulatory requirements of the Garner Road Biosolids Facility ECA and maintain our ability to beneficially re-use biosolids. Results are trended and compared to Nutrient Management Act (NMA) limits. Where a trend is detected, investigations are initiated to identify potential sources of the pollutant and correct any issue identified. Average monthly results for 2023 sludge analysis from the NOTL WWTP is included in Table NL-T-10.

Table NL-T-10: Summary of Monthly Average Sludge Results

Analyte	Units	NMA Limits	January	February	March	April	May	June	July	August	September	October	November	December
Total Solids	%	-	2.77	2.65	2.60	2.55	2.60	2.60	2.75	3.00	3.17	3.20	2.95	2.85
Ammonia as N	mg/Kg	-	1,510	1,620	1,470	1,540	1,590	1,540	1,510	1,330	1,307	1,150	1,170	1,415
Nitrate+Nitrite	mg/Kg	-	0.99	0.99	1.00	1.00	1.00	1.00	0.99	0.99	1.03	0.99	1.00	1.00
Phosphorus	mg/Kg	-	16,551	29,450	28,750	32,200	32,400	29,400	29,700	29,633	29,433	25,500	22,100	22,300
Arsenic	mg/Kg	170	2.20	2.39	2.54	2.66	2.05	1.75	1.95	2.15	2.96	2.72	1.73	2.04
Cadmium	mg/Kg	34	0.47	0.70	0.60	0.85	0.85	0.85	0.80	0.73	0.60	0.50	0.50	0.75
Chromium	mg/Kg	2,800	10.36	15.35	16.35	17.25	18.00	16.60	17.20	28.63	28.93	23.30	17.95	17.25
Cobalt	mg/Kg	340	0.87	1.80	1.55	1.95	2.00	1.75	1.90	2.07	1.43	1.70	1.00	1.90
Copper	mg/Kg	1,700	230	400	428	447	479	448	424	378	352	322	336	351
Lead	mg/Kg	1,100	7.03	9.50	9.00	13.00	10.50	8.00	4.50	11.00	5.00	13.50	19.00	21.00
Mercury	mg/Kg	11	0.10	0.10	0.13	0.21	0.29	0.15	0.12	0.15	0.23	0.20	0.16	0.13
Molybdenum	mg/Kg	94	4.36	8.00	6.00	7.00	6.50	7.00	6.00	6.00	4.67	5.50	5.00	6.00
Nickel	mg/Kg	420	7.91	13.95	14.30	14.05	16.70	14.95	12.05	16.60	11.27	9.05	15.10	8.50
Potassium	mg/Kg	-	5,483	9,210	9,005	11,420	9,535	8,715	9,275	6,877	6,920	6,955	8,060	7,885
Selenium	mg/Kg	34	2.86	3.16	3.47	5.37	4.95	2.80	3.50	3.39	2.66	2.52	2.22	2.16
Zinc	mg/Kg	4,200	279	496	495	486	467	418	417	454	501	479	489	465

NL-T-8 Complaints

No complaints were received in 2023 regarding the operation of the NOTL WWTP or the NOTL Lagoon site.

NL-T-9 Bypasses, Overflows, other situations outside Normal Operating, Spills and Abnormal Discharge Events

Bypasses and Overflows

There were no bypasses or overflows from the NOTL WWTP or lagoon in 2023.

Situations Outside of Normal Operating Conditions

The MECP defines “Normal Operating Conditions” as when all unit process(es), excluding Preliminary Treatment System, in a treatment train is operating within its design capacity.

The plant did not operate outside of Normal Operating Conditions during the reporting year.

Spills

Niagara Region strives to maintain and operate wastewater infrastructure so spills to the environment do not occur. However, circumstances may arise and a spill occurs due to equipment malfunction, failure or other reasons. Occasionally, a planned spill may be required to safely complete required maintenance to critical equipment. If this is necessary, approval from the MECP is obtained in advance.

All spills are reported to the MECP Spills Action Centre upon discovery. Spills are investigated and written reports are submitted to the MECP and Environment and Climate Change Canada as required by legislation. Below in Table NL-T-11 summarizes spills that occurred at the NOTL WWTP in 2023.

Table NL-T-11: Summary of spills occurring at the NOTL WWTP during the reporting year

Spill Date	MECP Incident Number	Description of Spill
No spills occurred at the NOTL WWTP or		

Spill Date	MECP Incident Number	Description of Spill
Lagoon in 2023		

Abnormal Discharges

An abnormal discharge is a discharge to the environment that is abnormal in quality or quantity.

On July 31, 2023, an issue with the dechlorinating system resulted in a single effluent Total Residual Chlorine (TRC) value of 0.62 mg/L to be measured in the plant final effluent which is abnormal. The NOTL WWTP ECA has a monthly average compliance limit of 0.02 mg/L. Erring on the side of caution, this incident was reported to the MECP District Office as a non-compliance as it was thought that the monthly average would not be achieved.

Upon further review of all monthly data, it was determined that plant compliance requirements were achieved. The average of all dechlorinated effluent TRC values for July was 0.01 mg/L.

NL-T-10 Summary of Efforts to Achieve Conformance with F-5-1 and/or F-5-5

Summary of Efforts – Procedure F-5-1 – Secondary Treatment Equivalent

Procedure F-5-1 states wastewater treatment facilities are to provide treatment of wastewater to a minimum of secondary treatment equivalence. This means the WWTP should be designed to meet objectives of 15 mg/L for CBOD and TSS and 1 mg/L for TP.

As demonstrated above in section NL-T-2, NOTL WWTP consistently achieved effluent quality that met or exceeded design objectives.

Summary of Efforts – Procedure F-5-1 – Sewage Bypass/Overflow from Nominally Separated System

Procedure F-5-1 states that bypasses and overflows from nominally separated systems are not allowed except in emergency situations. Emergency situations include protection from basement flooding, preventing damage to WWTP equipment or pumping stations or to prevent treatment process washout.

There were no bypasses or overflows from the NOTL WWTP in 2023. The plant is sized to treat peak flows up to 34,700 m^3/d, over four times the design average daily flow.

Excess Primary Treatment Capacity

F-5-1 allows for excess primary treatment where it is impractical or uneconomical to provide secondary treatment to wet weather flow. NOTL WWTP fully treats all flow received and does not experience bypass or overflow conditions.

Industrial Waste

Industrial waste can contain material that can have negative impacts on collection system infrastructure as well as the wastewater treatment process itself. Upsets to the treatment process can cause a plant to become non-compliant with ECA objectives and limits. To protect our infrastructure, the Niagara Region has a Sewer Use By-law in place. Environmental Enforcement Officers conduct industry inspections as well as sampling and monitoring of industrial discharges on a routine basis to ensure that they meet the Sewer Use By-law limits.

Summary of Efforts – Procedure F-5-5

The MECP Procedure F-5-5 applies to combined sewage systems. The NOTL wastewater collection system is considered nominally separated. This procedure does not apply.

NL-C-1 Overview of the Niagara-on-the-Lake WWTP Collection System

The NOTL WWTP collection system is a class III system that collects wastewater from domestic, commercial and some industrial sources from the municipality of NOTL. The collection system consists of the following:

- Local sanitary sewers
- 5.5 kilometres of regional gravity mains
- 9.9 kilometres of regional force mains
- 7 pumping stations:
    - Front Street Sewage Pumping Station
    - Garrison Village Sewage Pumping Station
    - Hunter Farm (Line 2) Sewage Pumping Station
    - Lakeshore Road Sewage Pumping Station
    - Niagara Stone Road Sewage Pumping Station
    - Ricardo Street Sewage Pumping Station
    - William Street Sewage Pumping Station
- A total of three Sanitary Sewage Outfalls (SSO) outfalls, including overflow structures at three of the seven pumping stations

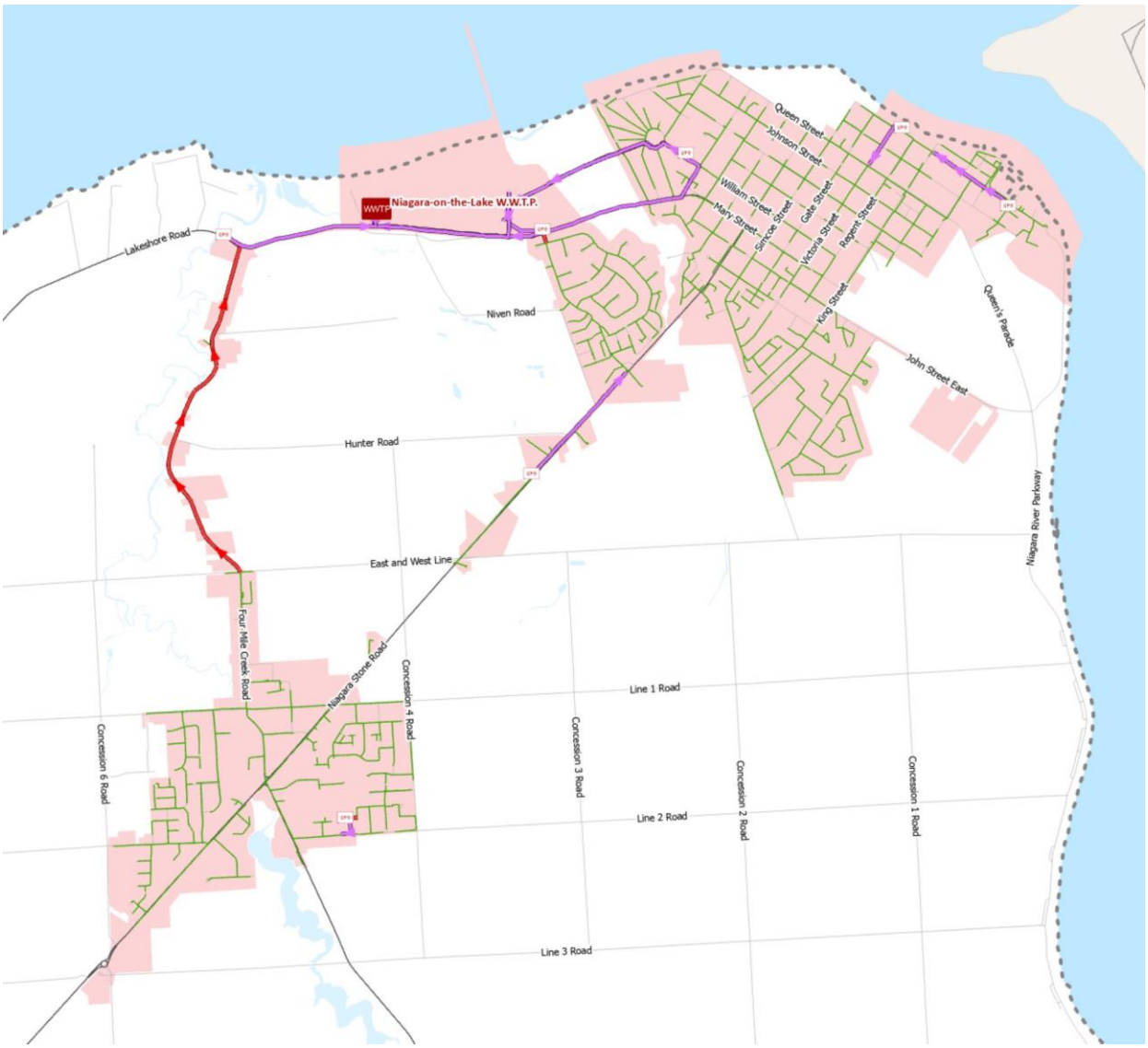

Figure NL-C-1: Map of NOTL WWTP Collection System

The collection system is operated under a two-tier system, where the Town of NOTL owns and operates local gravity sanitary sewers and Niagara Region owns and operates sewage pumping stations, forcemains and larger gravity sanitary sewers or trunk sewers. It is classified as a nominally separated system meaning that storm water is collected separately from sanitary sewage but the system may still be impacted by inflow and infiltration from sources such as roof leaders, foundation drains, leaky pipes and joints and maintenance holes.

The collection system operates under the following Consolidated Linear Infrastructure ECA:

- Niagara-on-the-Lake Wastewater Catchment System, 007-W607, issue number 1

Annual reporting has been prepared to meet the requirements of this approval.

NL-C-2 Summary and Interpretation of Collection System Monitoring Data

Monitoring of Pump Station Operations

Pump stations operate through automatic control and are monitored continuously using Supervisory Control and Data Acquisition (SCADA). Stations alarms are programmed to alert the operations staff at the NOTL WWTP when staffed and operations staff at Port Weller after hours of potential issues including but not limited to high wet well levels, pump faults, communication failures and standby generator status. Operators will respond to station alarms as required to ensure proper station operation.

Station operation is trended in SCADA. SCADA trends are reviewed daily by operations staff to evaluate station performance. Operators will look at pump cycle times, station discharge flow and pump duty rotation to identify potential issues. Where potential issues are identified, work orders are generated for follow up by maintenance staff.

In addition to SCADA monitoring, monthly station inspections are completed by operations staff. This includes inspection of the station and testing of standby generator equipment.

Sanitary Sewer Closed-Circuit Television Inspection Program

Niagara Region owns and maintains 145 kilometers of trunk sanitary gravity sewers, 161 kilometers of sanitary forcemains, and 2,093 sanitary access chambers across 11 municipalities. Approximately 85% of its conventional trunk sanitary gravity system is inspected using closed-circuit television (CCTV) once every three years. The remaining 15% is large diameter trunk sewers, which are inspected once every 10 to 15 years due to the necessity for specialized equipment to access and inspect sewers that have continuous high flow levels.

Table NL-C-1 details the total length of sewers inspected over the past four years.

Table NL-C-1- CCTV Program Summary

Measurement in Kilometers (km)	2020	2021[6]	2022	2023
Inspection Length (km)	37.9	18.5	59.3	33.0

Observations from the inspections are recorded for structural and operational deficiencies of the pipes. Operational deficiencies (blockage from grease, roots, debris) are addressed through the cleaning/flushing program. Structural deficiencies (broken, fractured, surface

[6] 2021 marked the end of one inspection contract and the start of a new contract. Delays in the procurement process due to competing priorities resulted in a gap in inspection contracts. As a result, the length of sewers inspected in 2021 was less than in prior years.

damage, holes) as well as Inflow and Infiltration are forwarded for consideration in the asset management plan and capital upgrade program.

Flow Monitoring

Niagara Region monitors sewer flows at 158 locations. Flow monitoring information is used for municipal Pollution Prevention and Control Plans (PPCPs), Master Servicing Plans (MSPs) including the 2021 Water and Wastewater MSP, Inflow and Infiltration studies, billing, development planning, and capital project design.

NL-C-3 Summary of Operating Issues Encountered and Corrective Actions Taken

Pump Stations and Forcemains

No pump station and forcemain operational issues were encountered in 2023:

Gravity Trunk Sewers

No operational issues were encountered with Niagara Region gravity trunk sewers in 2023.

NL-C-4 Summary of Major Maintenance, Capital Projects and Pre-Authorized Alterations

Summary of Maintenance Carried out on Major Equipment

Niagara Region works to keep wastewater infrastructure in a state of good repair. Maintenance activities completed include regular preventative maintenance (PM) activities and normal and emergency equipment repair or replacement. Where a substantial amount of upgrade is required, this work is carried out under the capital works program.

Below is a summary of normal and emergency repairs carried out on major equipment in the NOTL Collection System:

- Lakeshore Road SPS – repair and rebuild of pump #1

This list does not include PM activities. PMs are completed and tracked in a computerized maintenance management system. PM completed during the reporting year are available upon request.

Planned Capital Upgrades

The following is a list of capital upgrades forecasted for the NOTL Collection System:

- Hunter Farm (Line 2) SPS – sustainability upgrade completed in 2023

Summary of Pre-Authorized Alterations Undertaken

Through collection system ECAs, MECP has given System Owners the ability to complete low risk changes to a sewage pumping station, forcemain or gravity main without requiring further approval from the MECP. These modifications are documented on an applicable MECP form and signed off by the Owner or delegate of the system. Any pre-authorized modifications must be reported on annually to the MECP.

During the reporting year 2023, no pre-authorized modifications were completed.

No pre-authorized works were completed and therefore, there were no alterations that would pose a significant threat to drinking water.

NL-C-5 Summary of Calibration Activities

Collection system overflow meters are calibrated at minimum once per year. Other instrumentation used in process control is calibrated on an as needed basis. Table NL-C-2 below provides a summary of calibrations completed in the collection system in 2023.

Table NL-C-2- Summary of Collection System Calibration Activities

Equipment Description	Date Calibrated	Comments
No equipment calibrations required.		

Calibration certificates are available upon request.

NL-C-6 Summary of Complaints

No complaints were received in 2023 regarding the operation of the NOTL collection system.

NL-C-7 Summary of Collection System Overflows and Spills

Collection System Overflows

Although the NOTL wastewater collection system is nominally separated, collection system overflows occur during wet weather events due to inflow and infiltration into the sewage collection system. Overflows are necessary to prevent basement flooding and to protect downstream infrastructure and wastewater treatment processes.

Table NL-C-3 provides a summary of collection system overflows that occurred during the reporting year. The table includes volume discharge, overflow durations as well as pollutant loading to the environment.

Overflow Location	Overflow Date	Overflow Volume (ML)	Overflow Duration (hhh:mm)	BOD Loading (kg)	TSS Loading (kg)	TP Loading (kg)	TKN Loading (kg)	(N
Front Street SPS	2023-07-23	0.058	002:11	NS	NS	NS	NS	
Front Street SPS	2023-07-29	0.040[8]	004:50	39.7	170.6	0.60	1.49	
Ricardo Street SPS	2023-07-29	0.992[8]	007:05	53.6	18.8	1.19	9.13	

More information on sewage overflows and inflow and infiltration, is available on the Region's website (www.niagararegion.ca/living/sewage/cso).

Table NL-C-3: Collection System Overflow Event Details. Where NS is indicated, no sample information is available

Overflow Location	Overflow Date	Overflow Volume (ML)	Overflow Duration (hhh:mm)	BOD Loading (kg)	TSS Loading (kg)	TP Loading (kg)	TKN Loading (kg)	E.Coli[7] (MPN/100 mL)	Was the Overflow Disinfected (Yes/No)	Were Any Adverse Impacts Observed (Yes/No)	Corrective Actions Taken
Front Street SPS	2023-07-23	0.058[8]	002:11	NS	NS	NS	NS	NS	No	No	Awaited End of Event
Front Street SPS	2023-07-29	0.040[8]	004:50	39.7	170.6	0.60	1.49	10,000	No	No	Awaited End of Event
Ricardo Street SPS	2023-07-29	0.992[8]	007:05	53.6	18.8	1.19	9.13	50,000	No	No	Awaiting End of Event

[7] E.Coli sampling and analysis is required April 01 to October 31 annually.
[8] Volume is estimated.

Collection System Spills

Niagara Region strives to maintain and operate wastewater infrastructure so spills to the environment do not occur. However, circumstances arise where a spill occurs due to equipment malfunction, failure or other reasons. Occasionally, a planned spill may be required to safely complete required maintenance to critical equipment. If this is necessary, approval from the MECP is obtained in advance.

All spills are reported to the MECP Spills Action Centre upon discovery. Spills are investigated and written reports are submitted to the MECP and Environment and Climate Change Canada as required by legislation. Below in Table NL-C-4 summarizes spills that occurred in the NOTL collection system in 2023.

Table NL-C-4: Summary of Spills Occurring in the NOTL Collection System

Spill Date	MECP Incident Number	Description of Spill
No spills occurred in 2023		

NL-C-8 Summary of Efforts to Reduce WWTP Bypasses/Overflows and Collection System Overflows

Projects Undertaken to Reduce Bypasses or Overflows

The NOTL WWTP experiences high flow conditions that require overflows to occur due to inflow and infiltration in the collection system to prevent emergency situations. Being a two-tier system, Niagara Region works closely with the Town of NOTL to reduce overflows in the collection system. Niagara Region participates in a cost sharing strategy with lower tier municipalities to fund overflow reduction projects. In 2023, Niagara Region had an approved budget totaling $4.0M for the overflow reduction cost sharing program. Two projects were approved for cost sharing in the Town of NOTL with Niagara Region contributing $60,000 to support CSO post flow monitoring activities.

Public Reporting of Bypasses and Overflows

Niagara Region reports all bypass and overflow events publicly on the Niagara Region website (https://www.niagararegion.ca/living/sewage/CSO/Reporting/CSOLocations.aspx)

Niagara Region updates the data on recent overflows four times a year and displays any overflows that may have occurred in the past 12 months.

A listing of overflow data back to 2008 is available through the Niagara Open Data website (https://niagaraopendata.ca/dataset/combined-sewage-overflow)

An active project is underway to improve public reporting of bypasses and overflows including making the data available in near real time.