



Water Pollution Control Plant

(ECA # 0589-AXZPCW)

2021 - PERFORMANCE REPORT

322 Water Street
Deseronto, Ontario
K0K 1X0

March 2022

Executive Summary

The Deseronto Water Pollution Control Plant performed very well throughout 2021. Effluent quality from the process consistently complied with the prescribed limits in the Ministry of the Environment and Climate Change issued Environmental Compliance Approval #0589-AXZPCW (ECA). Final Effluent also remained essentially free of floating and settleable solids and did not contain oil or any other substances in amounts sufficient to create a visible film or sheen or foam or discolouration on the receiving waters.

In 2021 there was no bypass events.

A total of 1748 m³ of liquid biosolids and 200 tonnes of dewatered biosolid material were beneficially applied to agricultural land during April, August and September of 2021.

The land application program was conducted by Terrapure Organic Solutions in accordance with the requirements of the Nutrient Management Act.

No major upgrades were performed over the past year.

1 Introduction

The Deseronto Water Pollution Control Plant treats wastewater from the Town of Deseronto and from the eastern serviced area of the neighbouring Tyendinaga Mohawk Territory. Originally constructed in the early 1970's, the aging facility underwent extensive upgrading and expansion throughout 2015 with the new process fully operational since January 2016. The data presented in this annual report reflects the sixth year of operation of the upgraded facility.

2 Flow Monitoring Data Summary

The total volume of wastewater treated during 2021 was 14% less when compared to 2020.

Table 1 - Flow Data

Month	Treated Flow			
	Total (m ³)	Average (m ³ /day)	Maximum (m ³ /day)	Minimum (m ³ /day)
January	50817	1694	2609	1263
February	32895	1218	1902	1022
March	56372	1879	3222	1390
April	41064	1467	1804	1220
May	39620	1321	1726	1010
June	28989	1035	1347	906
July	33304	1110	1608	889
August	26432	881	1060	792
September	27831	994	2025	692
October	35068	1169	2847	852
November	35949	1284	1564	1039
December	46652	1555	2324	1188
Year Total				
Average	454992	1301		
Min / Max			3222	692
Design* ADF/Peak		2,400 / 10,050		

* Design ADF/Peak refers to the design average day and peak flow capacities of the upgraded facility.

Average day flow was 1301 m³/d, representing approximately 54 percent of the design rated average day flow capacity of 2400 m³/d. The maximum day treated flow in 2021 was 3222 m³/day approximately 32 percent of the peak capacity.

Calibration of all flow monitoring equipment was completed in August by Tower Electronics Canada.

Bypass / Overflow Events: There was no bypass or overflow events observed in 2021.

To decrease inflow and infiltration:

- Manhole sealing dishes have been installed in low elevation areas.
- The collection system is flushed and inspected every three years to identify problem areas.
- Manhole structures are inspected and repaired as needed.

3 Analytical Monitoring Data Summary

Indicators used to determine treatment process efficiency and regulatory compliance include: the five-day carbonaceous biochemical oxygen demand (CBOD₅), total suspended solids (TSS), total phosphorus (TP), total ammonia nitrogen (TAN), pH, *Escherichia Coliforms* (*E. Coli.*), and Rainbow Trout / *Daphnia Magna* lethality testing. The ECA for the plant prescribes effluent limits and objectives for the above noted parameters. All required monitoring for 2021 was completed. The 2022 monitoring schedule is attached as Appendix A.

Effluent quality that meets the ECA effluent objectives indicates optimal process performance. Operators strive to achieve the effluent objectives by active solids control (i.e., waste activated sludge schedule, step-feed under high flow conditions) and by making appropriate adjustments to chemical dosages based on current analytical test results.

CBOD₅ & TSS: Samples of raw sewage and final effluent are collected weekly and submitted to an accredited laboratory for analysis. A summary of BOD₅, CBOD₅, and

TSS concentrations in raw sewage entering the plant and in effluent discharged to the Bay of Quinte is provided as Table 3.

Raw sewage entering the plant during 2021 was of relatively low strength, having BOD₅ and TSS concentrations averaging 133 mg/L and 224 mg/L respectively. Based on monthly averages, the calculated rates of pollutant removal through the treatment process ranged from 97 to 99 percent for BOD₅ and from 96 to 99 percent for total suspended solids. Removal efficiency is consistent with that observed in previous years.

Non-compliance with respect to CBOD₅ and TSS is deemed to have occurred when the monthly arithmetic mean of all sample results exceeds the ECA concentration or loading limits. Monthly average CBOD₅ and TSS values remained compliant throughout 2021.

Effluent objectives reflect quality that exceeds that required for compliance and indicates optimal performance of the treatment process. Based on 2021 monthly averages, effluent concentration consistently met the ECA objective for both CBOD₅ and TSS.

Table 3 - CBOD₅ and Total Suspended Solids Data

Month	BOD ₅ / CBOD ₅				Total Suspended Solids			
	Raw Sewage (mg/L)	Final Effluent (mg/L)	Removal (kg/d)	Removal %	Raw Sewage (mg/L)	Final Effluent (mg/L)	Removal (kg/d)	Removal %
January	136.8	3.00	5.08	97.8	223.5	2.25	3.81	99.0
February	124.3	3.00	3.66	97.6	296.3	1.59	1.94	99.5
March	121.0	3.00	5.64	97.5	178.1	1.99	3.73	98.9
April	107.8	3.00	4.40	97.2	142.7	1.65	2.41	98.8
May	117.5	3.00	3.96	97.4	187.6	2.10	2.77	98.9
June	130.8	3.00	3.11	97.7	210.7	1.85	1.91	99.1
July	122.3	3.00	3.33	97.5	220.6	1.93	2.14	99.1
August	127.8	3.00	2.64	97.7	232.8	1.77	1.56	99.2
September	136.3	3.00	2.98	97.8	292.8	1.62	1.61	99.4
October	125.5	3.00	3.51	97.6	247.4	1.88	2.20	99.2
November	139.4	3.00	3.85	97.8	163.4	1.74	2.23	98.9
December	208.8	3.00	4.67	98.6	291.6	1.99	3.10	99.3
Yr. Avg.	133.2	3.0	3.9	97.7	224.0	1.9	2.5	99.1
Max. Mo. Avg.		3.0	5.6			2.3	3.8	
ECA Limit		15	60			15	60	
ECA Objective		10				10		

NOTES:

Results represent monthly averages of samples collected at least weekly.

Phosphorus: Phosphorous is removed from raw sewage in the treatment process by chemical precipitation (alum addition), and by enhanced solids removal in the tertiary filter. Total phosphorus concentration and loading as well as alum dosages measured monthly through 2021 are summarized in Table 4.

Non-compliance is deemed to have occurred when the monthly average total phosphorus (TP) concentration or loading exceeds the prescribed limits. During 2021, effluent TP concentration remained compliant with the ECA concentration limit of 0.2 mg/L and below the more stringent objective concentration of 0.15 mg/L. Consistent optimal process performance was demonstrated as removal efficiency ranged from 99 percent throughout 2021. Similarly, effluent TP loading remained below the ECA limit.

Alum Dosage: Average alum dosage to the secondary process was 37 mg/L, representing an approximate 12 percent decrease from 2020 (42 mg/L). The 2021 annual average dosage to the tertiary process was decreased by approximately 25 percent when compared to 2020. Total alum dosage (secondary + tertiary) decreased by 14 percent averaging 44 mg/L versus 51 mg/L in 2020.

Table 4 - Phosphorus Data

Month	Total Phosphorus				Secondary Alum		Tertiary Alum		Total Alum
	Raw Sewage (mg/L)	Final Eff. (mg/L)	Final Eff. (kg/d)	Removal %	Volume (Litres)	Dosage (mg/L)	Volume (Litres)	Dosage (mg/L)	Dosage (mg/L)
January	3.88	0.03	0.05	99.2	3900.84	46.36	661.50	8.01	54.36
February	3.53	0.06	0.07	98.4	2177.87	40.03	418.95	7.80	47.83
March	3.92	0.05	0.10	98.7	3889.06	42.63	588.00	6.43	49.06
April	3.34	0.04	0.06	98.8	2625.71	36.89	465.99	6.66	43.56
May	3.91	0.05	0.06	98.8	2408.89	36.68	448.35	6.99	43.68
June	3.77	0.04	0.05	98.8	1746.52	35.33	341.04	6.96	42.29
July	3.80	0.05	0.05	98.8	1850.26	34.17	360.15	6.54	40.72
August	4.78	0.03	0.03	99.4	1416.56	32.55	301.35	7.00	39.55
September	5.31	0.04	0.04	99.2	1572.10	33.47	308.70	6.80	40.27
October	4.02	0.05	0.05	98.9	1847.87	32.31	333.97	6.37	38.68
November	3.64	0.05	0.06	98.7	2159.02	35.22	370.26	6.03	41.24
December	9.45	0.04	0.06	99.6	2713.95	35.63	460.28	6.01	41.63
Yr. Avg.	4.44	0.04	0.06	98.9	2359	36.77	422	6.80	43.57
Max. Mo. Avg.		0.06	0.10						
ECA Limit		0.2	0.48						
ECA OBJ		0.15							

Nitrogen: Effluent nitrogen is reported in Table 5 as TKN, TAN (total ammonia nitrogen), and as NH₃ (un-ionized ammonia). Ammonia is removed from the wastewater in the activated sludge process by biological nitrification.

The ECA specifies seasonal concentration and loading limits for TAN with the lower limits applying from June through October and the higher from November through May. The process performed well throughout 2021 as both concentration and loading remained below the ECA limits. Further, effluent TAN concentration reflected optimal process performance, consistently remaining below the ECA seasonal objective concentrations. The maximum effluent TAN concentration detected in a single sample during 2021 was 1.48 mg/L in August.

Un-ionized ammonia is the form most toxic to aquatic life. The un-ionized fraction depends on the pH and temperature of the sample and typically represents a very small portion of the total ammonia concentration. The maximum for un-ionized ammonia concentration in the effluent observed in 2021 was 0.014 mg/L, well below the federal limit of 1.25 mg/L.

Table 5 - Nitrogen, pH, and Temperature Data

Month	TKN		TAN		NH ₃	pH	Temp.
	Raw Sewage (mg/L)	Final Eff. (mg/L)	Final Eff. (mg/L)	Final Eff. (kg/d)	Final Eff. (mg/L)	Final Eff.	Final Eff. (C)
January	26.3	1.0	0.15	0.26	0.010	7.02	8.7
February	29.3	1.3	0.12	0.14	0.010	6.93	7.7
March	25.0	1.1	0.28	0.52	0.010	7.02	8.0
April	23.3	0.8	0.05	0.07	0.010	7.02	11.1
May	31.2	0.8	0.05	0.06	0.010	7.14	13.7
June	28.4	1.0	0.06	0.06	0.010	7.01	18.2
July	28.2	0.9	0.06	0.06	0.010	7.05	20.0
August	36.9	2.7	1.48	1.30	0.014	6.96	21.4
September	35.9	0.9	0.05	0.05	0.010	7.14	21.1
October	29.2	1.2	0.09	0.10	0.010	6.88	19.2
November	26.6	1.0	0.05	0.07	0.010	7.25	14.6
December	32.9	0.9	0.06	0.10	0.010	7.27	11.6
Yr. Avg.	29.4	1.1	0.21	0.23	0.01	7.06	14.6
Max. Mo. Avg.			1.48	1.30	0.01		
ECA Limit*			8.0 / 16.0	19.2 / 38.4			
ECA OBJ			5.0 / 12.0			6.5 – 8.5	
EC Limit**					1.25	6.0 - 9.5	

* seasonal limits for TAN - lower applies Jun thru Oct, higher Nov thru May

** Environment Canada - Federal Wastewater Effluent Regulation limit

Reported values are monthly averages calculated from weekly (or more frequent) samples

Temperature and pH: Based on measurements of effluent samples taken through 2021, pH remained within the ECA prescribed range of 6.0 to 9.5 and within the more stringent objective range of 6.5 to 8.5. Discrete pH measurements recorded in 2021 ranged from 6.65 to 7.39. Effluent temperature varied seasonally with a month average low of 7.7 C in February and a maximum month average of 21.4 C in August.

Disinfection: Ultraviolet light (UV) is used to disinfect the treated effluent prior to discharge to the Bay of Quinte. The performance of the UV disinfection system is verified by bacteriological testing (*Escherichia Coliforms*) of weekly effluent grab samples. Testing results are summarized in Table 6.

Of the 52 samples collected through 2021, *E. Coli.* was not detected in over 92 percent. The geometric mean value for all months was well below both the ECA limit of 200 CFU/100 mL and the objective of 100 CFU/100mL.

Table 6 – Effluent *E. Coli.* (CFU/100mL) Monthly Geomean and Maximum Values

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Geometric mean	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Maximum	<1	<1	<1	1.0	<1	<1	<1	<1	1.0	<1	<1	1.0
# of samples	4	4	5	4	4	5	4	5	4	4	5	4
NOTES:												
ECA limit is 200 CFU/100mL based on monthly geometric mean.												
ECA objective is 100 CFU/100mL based on monthly geometric mean.												
Geometric mean calculated using the method detection limit (MDL) for results reported as 0 or <MDL.												

Acute Lethality: The ECA requires that effluent from the facility is non-acutely lethal to Rainbow Trout and *Daphnia Magna*. Monitoring is required annually. During 2021, a sample was collected on August 9th. Non-acute lethality was reported for both test organisms.

Septage: The septage receiving station was utilized all of 2021, lower volumes were received from June to October as this was only utilized by a portable toilet company. The ECA requires collection and testing of weekly samples when the station is in use. Table 7 provides a summary of volume and analytical quality of septage received in 2021.

A total of 3079 m³ was received for 2021. Septage is high in strength, with BOD₅ and TSS averaging 4134 mg/L and 13268 mg/L respectively. Nutrient loading from septage is also significant. Total phosphorus averaged 257 mg/L while TKN averaged 1834 mg/L.

Table 7 – Septage Receiving Station

Septage Receiving Station						
Month	Weeks in Use	Monthly Volume (m ³)	BOD (mg/l)	TSS (mg/l)	TP (mg/l)	TKN (mg/l)
January	4	441	2618	17588	172	635
February	4	471	4642	17300	208	1654
March	5	794	2718	9640	60	326
April	4	281	5850	29425	229	1503
May	5	202	4368	8930	488	2524
June	4	18	5125	6995	302	2470
July	4	20	5378	6250	336	2788
August	5	23	2744	4214	201	2819
September	4	56	2898	10430	273	3225
October	4	77	4073	7025	259	3343
November	5	343	4536	13120	353	2156
December	4	352	3028	10138	208	1577
Total	52	3079				
Average			4134	13268	257.0	1834

4 Biosolids

Excess biological sludge wasted from the extended aeration activated sludge process is directed to an aerobic digester for further stabilization. Following the digestion process the thickened liquid biosolids can either be de-watered in geo-synthetic bags or loaded into a tanker for transport off-site. Ultimately, the de-watered or liquid biosolids are beneficially applied to approved agricultural land during summer and autumn. Land applied biosolids improves the moisture retaining capacity of soil and adds valuable macro and micro nutrients needed for crop growth.

Production: Waste activated sludge (WAS) from the extended aeration process is pumped to the aerobic digester in batches several times each day based on a programmed volume and time sequence. Operators adjust the rate of wasting based on mixed liquor suspended solids and extended aeration solids retention time.

When the digester is full, the blower is turned off and the sludge is given time to settle. After approximately 24 hours of settling, the clear supernatant above the settled sludge is decanted back through the treatment process, creating more room in the digester for additional WAS.

During 2021, a total of 8336 m³ of WAS was transferred to the digester. Supernatant decanted from the digester totaled 3982 m³, and there was 497 m³ additional volume in the digester at the end of the year resulting in a total year volume of digested sludge of:

$$8336 \text{ m}^3 - 3982 \text{ m}^3 + 497 \text{ m}^3 = 4851 \text{ m}^3.$$

Waste sludge and volumes pumped or decanted from the digester are summarized in Table 8.

Table 8 - Aerobic Digester Operation

Month	WAS m ³	Decant m ³	Liquid Hauled m ³	De-watered m ³	De-watered Hauled tonne
January	805.9	574.5	0	0.0	0
February	752.1	415.6	0	632.5	0
March	866.1	338.5	0	368.0	0
April	914.4	294.1	948	0.0	0
May	678.0	179.1	0	0.0	0
June	407.3	468.2	0	0.0	0
July	551.6	381.9	0	0.0	0
August	532.3	165.6	80	0.0	200
September	810.3	122.0	720	0.0	0
October	551.0	547.7	0	0.0	0
November	632.1	147.0	0	0.0	0
December	835.0	348.0	520	0.0	0
Total	8336	3982	2268	1001	200

Biosolids Land Application: During 2021, 2268 m³ of liquid biosolids were hauled from the Deseronto aerobic digester and applied to approved agricultural land by Terratec Environmental. Dates of application were April 20th and 23rd and August 27th and September 1st and 2nd.

The aerobic digester is not large enough to store all the biosolids produced at the Deseronto facility each year, therefore additional storage capacity is provided in geo-synthetic bags. The large porous synthetic bags, with the assistance of polymer addition, are designed to retain solids while allowing water to pass through. An additional 200 tonnes of de-watered biosolids from two geo-synthetic bags was similarly land applied on August 25th. The total volume of digester sludge pumped to the de-watering process in 2021 was 1000 m³.

Analytical Quality of Processed Biosolids: Samples of liquid biosolids collected during March, April, July, August, October, November were analyzed for solids, nutrients, regulated metals, and pathogens to confirm suitability for agricultural use. De-watered biosolids were also sampled and similarly tested in July and August. Summary

tables showing the analytical quality of the biosolids and details of the application sites are provided below.

Table 9 - Deseronto WPCP Digester Biosolids – Analytical Results

Metals	Maximum Permitted Metal Concentrations (mg/kg)	Avg. Metal Concentration in Biosolids (mg/kg)
Arsenic	170	4.76
Cadmium	34	1.43
Cobalt	340	2.01
Chromium	2800	16.51
Copper	1700	619.27
Lead	1100	22.47
Mercury	11	1.04
Molybdenum	94	6.29
Nickel	420	12.71
Selenium	34	5.42
Zinc	4200	666.28
Nutrients		(mg/L)
Total Phosphorus		488.5
Ammonia + Ammonium		3.90
Nitrate+Nitrite		30.0
Total Kjeldahl Nitrogen		994
Potassium		50.72
Bacteria / Total Solids		CFU/g / (mg/L)
<i>E. Coli.</i>	2,000,000	30553
Total Solids (mg/L)		21700

Table 10 - Deseronto WPCP De-watered Biosolids – Analytical Results

Metals	Maximum Permitted Metal Concentrations (mg/kg)	Avg. Metal Concentration in Biosolids (mg/kg)
Arsenic	170	3.5
Cadmium	34	0.98
Cobalt	340	1.75
Chromium	2800	21.75
Copper	1700	516.25
Lead	1100	22.25
Mercury	11	0.33
Molybdenum	94	4.75
Nickel	420	15.0
Selenium	34	4.0
Zinc	4200	606.75
Nutrients		(mg/kg)
Total Phosphorus		18725
Ammonia + Ammonium		6735
Nitrate+Nitrite		<10
Total Kjeldahl Nitrogen		44075
Potassium		1340
Bacteria / Total Solids		CFU/g / (mg/kg)
<i>E. Coli.</i>	2000000	2000
Total Solids (mg/L)		91150

Future Production / Land Application: Biosolids production was increased for 2021 which is consistent with the increase in septage received for 2021. Land application will include both liquid and de-watered material.

Twenty-three sites totaling over 660 hectares are approved to receive Deseronto biosolids through to the end of 2024.

4 Operational Problems / Equipment Maintenance

Operational Problems: The treatment process performed very well throughout 2021 despite periodic high flow rates due to inflow during extreme weather events.

Compliance was maintained through varying flow conditions. There were no major modifications in 2021 that require a Notice of Modifications to Sewage Works (Schedule E).

The performance of the biosolids de-watering process continued to be problematic. Two geo-synthetic bags were opened and transferred to agricultural land in August. The solid content of the de-watered material was transported by dump trailer at approximately 9.15% solids not as good as 2020 of 11.3%.

We are continuing to improve this process by working with our polymer supplier and making process adjustments accordingly.

Maintenance / Upgrading:

Routine maintenance is summarized below.

Equipment	Action – Frequency (D-daily, W-weekly, M-monthly, Q-quarterly, S-semi-annually, A-annually)
Wet Well	Inspect (D), flush (W)
Raw Sewage Pumps	Inspect, check current, flow, VFD temp (D)
Screen	Inspect, check run-time, cycles (D), change auto greaser (A)
De-watering screw	Inspect, check run-time, cycles (D)
Grit tank	Inspect, check blower current (D)
Grit augers	Inspect, check current, cycles (D)
Chain and Flight	Inspect (D), grease (A)
Aeration Tanks and Clarifiers	Drain, clean and inspect equipment in one of two extended air trains (A)
RAS pumps	Check flow, current, VFD temp, speed (D)
Blowers	Inspect, check current, VFD temp, pressures (D), change oil, check belts/filters (A)
Tertiary Filter	Check headloss and backwash cycles (D), change media (as needed)
UV lights	Check intensity, lamp hours, (D), clean quartz sleeves (S), change bulbs (as req'd)
Flow Meters	Calibration (A)
Lift Stations	Check pump operation, station condition, and pump hours (W)X2, check pump currents (Q), clean station wet well as needed.

Non-routine maintenance / upgrades included the following:

- Replaced cooling fans for Raw sewage and Digester blower VFD cabinets.
- Purchased Raw sewage pump parts (impeller, bearings and seals) for Pump #1
- Change out filter cloth on tertiary filter annually. Filter cloths during last change are showing wear and holes. We started a replacement program with 4 filter

cloths purchased and installed in 2021. Currently we have 2 sets of 12, cost of replacement \$1500 each x 24 = \$36,000

- Continued changing out UV bulbs as required and as of the end of 2019 all originals have been replaced and continue into 2021 with the second set.

5 Complaints

There were no reported complaints regarding the operation of the wastewater treatment plant, wastewater collection system, or biosolids program during 2021.

Appendix A – 2022 Deseronto Wastewater Treatment Plant Monitoring Schedule

Sample Description	JAN			FEB			MAR			APR			MAY			JUN			JUL			AUG			SEPT			OCT			NOV			DEC																		
	04-Jan-22	11-Jan-22	18-Jan-22	25-Jan-22	01-Feb-22	08-Feb-22	15-Feb-22	22-Feb-22	01-Mar-22	08-Mar-22	15-Mar-22	22-Mar-22	29-Mar-22	05-Apr-22	12-Apr-22	19-Apr-22	26-Apr-22	03-May-22	10-May-22	17-May-22	24-May-22	31-May-22	07-Jun-22	14-Jun-22	21-Jun-22	28-Jun-22	05-Jul-22	12-Jul-22	19-Jul-22	26-Jul-22	02-Aug-22	09-Aug-22	16-Aug-22	23-Aug-22	30-Aug-22	06-Sep-22	13-Sep-22	20-Sep-22	27-Sep-22	04-Oct-22	11-Oct-22	18-Oct-22	25-Oct-22	01-Nov-22	08-Nov-22	15-Nov-22	22-Nov-22	29-Nov-22	06-Dec-22	13-Dec-22	20-Dec-22	27-Dec-22
WEEKLY																																																				
Raw Sewage																																																				
Secondary Effluent																																																				
Final Effluent																																																				
Final Effluent (Bact)																																																				
Septage Receiving																																																				
MONTHLY																																																				
Waste Clarifier																																																				
Biosolids (if req'd)																																																				
ANNUAL																																																				
Sampling Notes	WEEKLY											MONTHLY											ANNUALLY						OTHER (min. 2 spls, within 2 mths with 1 sple within 30 days of land application)																							
	Raw Sewage: BOD ₅ , TSS, TP, TKN											Waste Clar.: TSS											Final Eff.: Acute Toxicity																													
	Final Eff: CBOD ₅ , TSS, TP, TKN, TAN, NH ₃ , pH																												GeoTube or Digester:																							
	Final Eff.: <i>Escherichia Coliforms</i>																												-11 Heavy Metals																							
	S. Eff.: CBOD ₅ , TSS, TP, TKN																												-Total Solids, Total Volatile Solids																							
	Septage Receiving (if used):																												-NH ₃ , NH ₄ , NO ₃ , NO ₂ , TKN																							
	BOD ₅ , TSS, TP, TKN																												-TP, K																							
																													- <i>Escherichia Coliforms</i>																							