



Water Pollution Control Plant

(ECA # 0589-AXZPCW)

2020 - PERFORMANCE REPORT

322 Water Street
Deseronto, Ontario
K0K 1X0

March 2020

Executive Summary

The Deseronto Water Pollution Control Plant performed very well throughout 2020. 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).

In 2020 there was no bypass events.

A total of 1520 m³ of liquid biosolids and 222 tonnes of dewatered biosolid material were beneficially applied to agricultural land during July, August and November of 2020. 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 fifth year of operation of the upgraded facility.

2 Flow Monitoring Data Summary

The total volume of wastewater treated during 2020 was similar when compared to 2019.

Table 1 - Flow Data

Month	Treated Flow			
	Total (m ³)	Average (m ³ /day)	Maximum (m ³ /day)	Minimum (m ³ /day)
January	70268	2267	7636	1346
February	44493	1534	3362	1243
March	70083	2261	4473	1524
April	52428	1748	2951	1209
May	47021	1517	4033	1098
June	28817	961	1311	761
July	25138	811	1136	708
August	26075	841	1365	705
September	25460	849	1145	743
October	33446	1079	1409	909
November	35263	1175	1856	940
December	62332	2011	5731	1222
Year Total	520824			
Average		1421		
Min / Max			7636	705
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 1421 m³/d, representing approximately 59 percent of the design rated average day flow capacity of 2400 m³/d. The maximum day treated flow in 2020 was 7636 m³/day approximately 76 percent of the peak capacity.

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

Bypass / Overflow Events: There was no bypass or overflow events observed in 2020.

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 2020 was completed. The 2021 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 2020 was of relatively low strength, having BOD₅ and TSS concentrations averaging 124 mg/L and 241 mg/L respectively. Based on

monthly averages, the calculated rates of pollutant removal through the treatment process ranged from 96 to 98 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 2020.

Effluent objectives reflect quality that exceeds that required for compliance and indicates optimal performance of the treatment process. Based on 2020 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)	(kg/d)	Removal %	Raw Sewage (mg/L)	Final Effluent (mg/L)	(kg/d)	Removal %
January	112.8	3.25	7.37	97.1	217.5	3.75	8.50	98.3
February	125.3	3.00	4.60	97.6	262.5	3.25	4.99	98.8
March	70.8	3.20	7.23	95.5	315.0	3.60	8.14	98.9
April	88.8	3.00	5.24	96.6	177.5	4.00	6.99	97.7
May	88.8	3.00	4.55	96.6	161.3	6.00	9.10	96.3
June	136.2	3.00	2.88	97.8	267.0	3.40	3.27	98.7
July	155.0	3.00	2.43	98.1	273.8	3.50	2.84	98.7
August	187.5	3.00	2.52	98.4	275.0	3.00	2.52	98.9
September	161.0	3.00	2.55	98.1	270.0	3.00	2.55	98.9
October	134.3	3.00	3.24	97.8	230.0	3.00	3.24	98.7
November	112.0	3.00	3.53	97.3	212.8	4.75	5.58	97.8
December	110.4	3.00	6.03	97.3	231.4	3.20	6.43	98.6
Yr. Avg.	123.6	3.0	4.3		241.1	3.7	5.3	
Max. Mo. Avg.		3.3	7.4			6.0	9.1	
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 2020 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 2020, 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 98 to 99 percent throughout 2020. Similarly, effluent TP loading remained below the ECA limit.

Alum Dosage: Average alum dosage to the secondary process was 42 mg/L, representing an approximate 11 percent decrease from 2019 (47 mg/L). The 2020 annual average dosage to the tertiary process was decreased by approximately 4 percent when compared to 2019. Total alum dosage (secondary + tertiary) decreased by 9 percent averaging 51 mg/L versus 56 mg/L in 2019.

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	2.41	0.03	0.074	98.7	4498	42.3	870	7.9	50.3
February	3.39	0.04	0.058	98.9	3013	42.3	552	7.8	50.2
March	2.35	0.04	0.099	98.1	4932	43.9	948	8.5	52.4
April	2.65	0.05	0.087	98.1	3771	44.8	801	9.2	54.0
May	3.31	0.07	0.102	98.0	3323	45.7	735	10.2	55.9
June	4.39	0.06	0.056	98.7	2048	44.5	331	6.8	51.3
July	5.08	0.04	0.028	99.3	1650	41.1	616	15.4	56.4
August	5.16	0.03	0.027	99.4	1758	42.6	419	10.3	52.9
September	4.86	0.03	0.022	99.5	1570	38.3	345	9.5	47.8
October	4.04	0.04	0.040	99.1	2044	38.4	434	8.2	46.5
November	3.47	0.03	0.038	99.1	2279	39.7	453	7.9	47.7
December	3.15	0.03	0.052	99.2	4455	45.1	684	6.8	51.9
Yr. Avg.	3.69	0.04	0.06	98.8	2945	42.4	599	9.1	51.4
Max. Mo. Avg.		0.07	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 2020 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 2020 was 4.5 mg/L in October.

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 2020 were 0.37 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	17.1	1.1	0.3	0.70	0.37	7.12	8.43
February	23.3	1.0	0.1	0.09	0.01	7.00	7.66
March	16.0	0.8	0.1	0.14	0.01	7.35	8.00
April	19.5	1.0	0.1	0.12	0.01	7.34	9.66
May	23.5	1.3	0.2	0.28	0.01	7.12	12.00
June	34.6	2.1	0.9	0.90	0.01	6.91	17.41
July	39.3	1.1	0.1	0.05	0.01	6.97	21.13
August	40.3	1.1	0.1	0.05	0.01	6.83	21.65
September	36.3	1.1	0.2	0.16	0.01	6.89	20.60
October	31.3	5.5	4.5	4.86	0.03	7.00	17.08
November	20.8	1.0	0.0	0.05	0.01	6.88	13.76
December	22.4	0.8	0.0	0.07	0.01	7.13	10.66
Yr. Avg.	27.0	1.5	0.54	0.62	0.04	7.05	14.0
Max. Mo. Avg.			4.5	4.86	0.37		
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 2020, 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 2020 ranged from 6.83 to 7.35. Effluent temperature varied seasonally with a month average low of 7.7 C in February and a maximum month average of 21.7 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 2020, *E. Coli.* was not detected in over 85 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	1.15	1.0	1.0	1.0	1.0	1.0	1.15	1.0	1.0	1.15
Maximum	<1	1.0	2.0	1.0	<1	<1	<1	<1	2.0	<1	1.0	2.0
# of samples	4	4	5	4	4	5	4	4	5	4	4	5
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 2020, a sample was collected on August 4th. Non-acute lethality was reported for both test organisms.

Septage: The septage receiving station was utilized during the months of January through May and in July, October, November and December. 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 2020.

A total of 200 loads were received in 2020, each averaging 7.87 m³. Septage is high in strength, with BOD₅ and TSS averaging 2901 mg/L and 15995 mg/L respectively.

Nutrient loading from septage is also significant. Total phosphorus averaged 138.5 mg/L while TKN averaged 755 mg/L.

Table 7 – Septage Receiving Station

Septage Receiving Station							
Month	Weeks in Use	Loads	Monthly Volume	BOD	TSS	TP	TKN
January	4	52	377	802	2900	23.3	143
February	4	29	233	1381	12300	110.5	410
March	5	49	387	2578	13760	110.6	545
April	2	5	29	1874	8575	60.5	383
May	2	2	14	5385	22750	267.5	1400
June	0	0	0	0	0	0	0
July	1	1	6	4310	22000	189	1400
August	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0
October	1	1	11	3680	13000	119	958
November	2	4	33	4155	27500	174.5	919
December	3	57	484	1947	21170	192	639
Total	24	200	1574				
Average			7.87	2901	15995	138.5	755

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 2020, a total of 6557 m³ of WAS was transferred to the digester. Supernatant decanted from the digester totaled 3339 m³, and there was 583 m³ additional volume in the digester at the end of the year resulting in a total year volume of digested sludge of:

$$6557 \text{ m}^3 - 3339 \text{ m}^3 + 583 \text{ m}^3 = 3801 \text{ m}^3.$$

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	699	492	0	0	0
February	578	465	0	55	0
March	687	210	0	885	0
April	712	230	0	0	0
May	489	196	0	133	0
June	510	367	0	0	0
July	552	218	840	0	0
August	465	0	0	0	222
September	378	411	0	0	0
October	433	365	0	0	0
November	462	199	680	0	0
December	592	196	0	0	0
Total	6557	3339	1520	1073	222

Biosolids Land Application: During 2020, 1520 m³ of liquid biosolids were hauled from the Deseronto aerobic digester and applied to approved agricultural land by Terratec Environmental. Dates of application were July 21st and 22nd and November 19th, 20th and 21st.

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 222 tonnes of de-watered biosolids from two geo-synthetic bags was similarly land applied on August 14th. The total volume of digester sludge pumped to the de-watering process in 2020 was 1073 m³.

Analytical Quality of Processed Biosolids: Samples of liquid biosolids collected during February, May, June, July and October 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	3.65
Cadmium	34	1.21
Cobalt	340	1.90
Chromium	2800	12.48
Copper	1700	414.09
Lead	1100	13.39
Mercury	11	0.32
Molybdenum	94	4.58
Nickel	420	11.17
Selenium	34	3.65
Zinc	4200	426.89
Nutrients		(mg/L)
Total Phosphorus		621.1
Ammonia + Ammonium		4.41
Nitrate+Nitrite		104.1


Total Kjeldahl Nitrogen		1272.9
Potassium		51.1
Bacteria / Total Solids		CFU/g / (mg/L)
<i>E. Coli.</i>	2,000,000	32,715
Total Solids (mg/L)		29,429

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	3.00
Cadmium	34	0.85
Cobalt	340	2.33
Chromium	2800	17.83
Copper	1700	443.0
Lead	1100	14.67
Mercury	11	0.34
Molybdenum	94	3.67
Nickel	420	13.17
Selenium	34	2.67
Zinc	4200	458.83
Nutrients		(mg/kg)
Total Phosphorus		36,233
Ammonia + Ammonium		6,051
Nitrate+Nitrite		<10
Total Kjeldahl Nitrogen		45,100
Potassium		1,095
Bacteria / Total Solids		CFU/g / (mg/kg)
<i>E. Coli.</i>	2000000	4,268
Total Solids (mg/L)		112,500

Future Production / Land Application: A similar volume of biosolids production is anticipated 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.

 Town of Deseronto - Sites Applied with Biosolids 2020												
Date 2020	Source	Farmer/ Farm Name	NASM #	Lot	Con	Municipality	Ward	Field #	Application Method	Total Volume (m3)	Total Tonnes (t)	Area Spread (ha)
July 21	Liquid Tank	Snyder - Home	23876	7	5	Township of Tyendinaga	Tyendinaga	3	Surface, Standing Crop	240		3
July 21								4		200		2.21
July 21								5		200		2.43
July 22								2		200		2.33
Aug 14	Geotube	Vermilyea - McIntyre Rd.	24405	14-15	2	Loyalist Township	Ernestown	4	Surface, Incorporated		222	18.79
Nov 19-21	Liquid Tank	McFaul - Atkins Rd.	23510	18-19	2	City of Belleville	Thurlow	1	Surface	680		5.23
TOTAL										1520	222	33.99
												84.0

4 Operational Problems / Equipment Maintenance

Operational Problems: The treatment process performed very well throughout 2020 despite periodic high flow rates due to inflow during extreme weather events.

Compliance was maintained through varying flow conditions.

The performance of the biosolids de-watering process continued to be problematic. An alternate polymer has been jar tested with promising results. The new polymer was used on the full-scale system 2020 with the goal of improved dewatering to optimize storage space and decrease transportation costs. 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 11.25% solids not as good as 2019 of 15.2%.

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)X2, clean station wet well as needed.

Non-routine maintenance / upgrades included the following:

- Replaced cooling fans for Raw sewage and Digester blower VFD cabinets.
- Replaced VFD Drive on Blower #1

- Change out filter cloth on tertiary filter annually. Filter cloths during last change are showing wear and holes. Will need to start a replacement program. 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 2020 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 2020.

