2018 Dunnville WWTP Annual Report

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1. Background

The Dunnville WWTP is owned by Haldimand County and operated by Veolia Water. The WWTP was initially operated under the amended ECA # 7329-9YUJJV until March 10, 2017 when the newly Amended ECA # 9333-AHNP7D was issued. The WWTP has a nominal design flow of 7,728 m^3/d. The plant is a parallel train extended aeration facility with effluent chlorination for disinfection and de-chlorination prior to discharge to receiving water. The plant receives hauled sewage (holding tank, septic tank and portable toilet wastes) and landfill leachate. Treated effluent is discharged to the Grand River. Sludge produced is aerobically treated and stored in on-site lagoons. From the storage lagoons, the biosolids are typically land applied and if required, transferred to the Townsend biosolids storage facility for winter storage.

2. Per Capita Flows and Loadings

Table 1 – Dunnville Per Capita Flows and Loadings			
Parameter	**2017**	**2018**	
Population	5,759	5,759	
Average Daily Influent Flow (m^3/d)	4,288	4,439	
Peak Daily Influent Flow (m^3/d)	16,803	20,536	
Average Influent BOD_5 (mg/L)	246	231	
Average Influent TSS (mg/L)	190	190	
Average Influent TKN (mg/L)	32	33	
Average Influent TP (mg/L)	4.4	4.4	
Per Capita Flows and Loadings			
Parameter	**2017**	**2018**	**Typical**
Per Capita Wastewater Flow (L/person/day)	745	771	350 – 500* 332**
Per Capita BOD_5 Loading (g/person/day)	183	180	80*
Per Capita TSS Loading (g/person/day)	142	148	90*
Per Capita TKN Loading (g/person/day)	24	25	13*
Ratios			
Peak Day / Annual Average Flow	3.9	4.6	2.0 – 3.0
Influent TSS/BOD_5	0.8	0.8	0.8 – 1.2
Influent TKN/BOD_5	0.1	0.1	0.1 – 0.2

Notes:
* Results are for typical residential wastewater and are identified in Metcalf and Eddy, Wastewater Treatment and Reuse (4th Edition).
**Grand River Conservation Authority, "2017 Watershed Overview of Wastewater Treatment Plant Performance", July, 2018

Comments:

- The 2018 annual average daily flow of 4,439m^3/d represents a modest increase of 3.5% compared to 2017 (4,288 m3/d) and is 57% of the nominal design flow;
- Peak day flow is very high as a result of severe rain events in 2018;
- The plant experiences high per capita BOD_5, TSS and TKN loading. This is probably caused by hauled waste, leachate and industrial contributions;
- High per capita wastewater flows indicates high inflow and infiltration. 771 L/p/d is significantly greater than the typical range of 350-500 L/p/d and GRCA average of 332 L/p/d;
- Influent TSS/BOD_5 and TKN/BOD_5 ratios are within typical values.

3. Performance

- **Effluent Concentration Compliance**

Table 2 is a summary of the effluent quality objectives and limits identified in the ECA # 9333-AHNP7D.

Table 2 – Summary of ECA Objectives and Limits for Effluent Quality			
Parameter	**Objectives (mg/L)**	**Monthly Limits (mg/L)**	**Annual Average Loading Limits (kg/d)**
$cBOD_5$	15	25	193
Total Suspended Solids (TSS)	15	25	193
Total Phosphorous (TP)	0.5	1.0	7.7
Total Ammonia Nitrogen (Dec. – Apr.)	10	-	-
Total Ammonia Nitrogen (May – Nov.)	5	-	-
Total Chlorine Residual	Non-Detect	0.02	-
E. Coli.	150 CFU/100ml	200 CFU / 100 mL	-
pH	6.5 – 8.5	6.0 - 9.5	-
Note: There were no Ammonia Objectives Prior to March 10, 2017.			

Concentration compliance for all parameters identified in Table 2 (except E. Coli. and pH) are based on monthly averages of samples taken weekly. Compliance for E. Coli is based on a monthly Geometric Mean Density of all samples, while pH must be maintained within the range at all times. The loading compliance for all parameters identified in Table 2 is based on annual averages. A summary of all monthly data is included in this report in Table 8.

Haldimand County is also committed to achieving the Grand River Conservation Authority (GRCA) final effluent targets for total phosphorous (TP) and total ammonia nitrogen (TAN). The targets are shown for secondary treatment plants in Table 3 below.

Table 3: GRCA Secondary Treatment Targets for Effluent discharging into the Grand River	
Parameter	**Final Target (mg/L)**
Total Effluent Phosphorous	0.30
Total Ammonia Nitrogen	
Summer	1.0
Winter	2.0

The average concentrations for $cBOD_5$ compared against the objective and limit are shown in Figure 1.

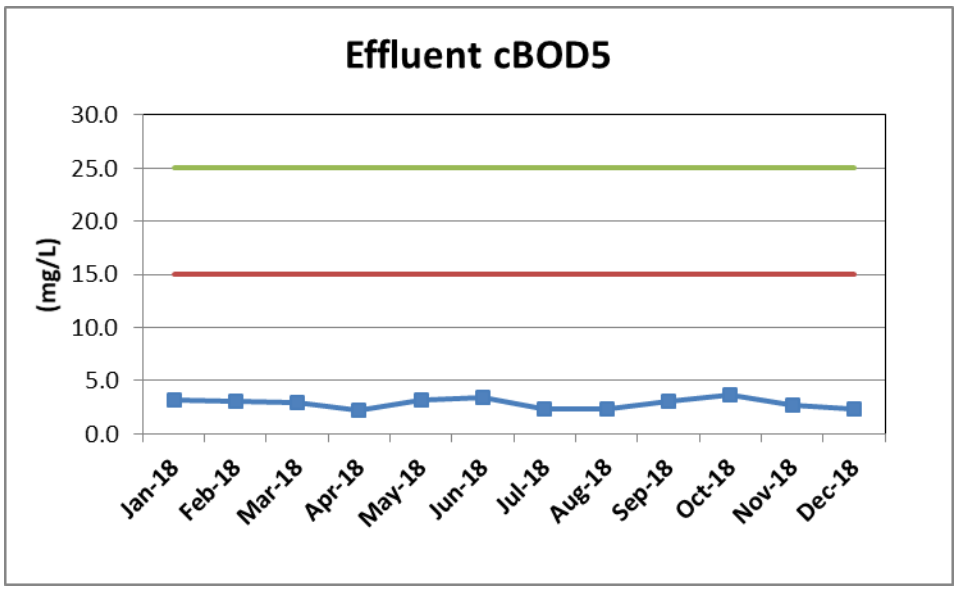

Figure 1 – Monthly Average Effluent $cBOD_5$ Compliance Graph

Comments:

- The monthly average effluent $cBOD_5$ met the compliance limit of 25 mg/L and objective of 15 mg/L in all 12 months.

The average concentrations for TSS compared against the objective and limit are shown in Figure 2.

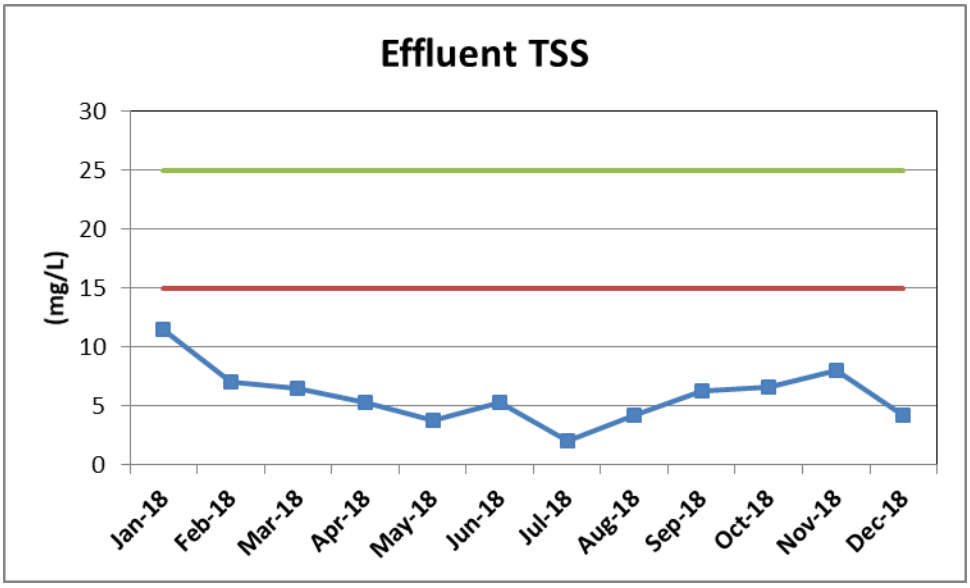

Figure 2 – Monthly Average Effluent TSS Compliance Graph

Comments:

- The monthly average effluent TSS met the compliance limit of 25 mg/L and objective of 15 mg/L in all 12 months;
- The effluent is essentially free of solids and visual observations indicate that the effluent is free of oils.

The average concentrations for TP compared against the objective, limit and GRCA final target are shown in Figure 3.

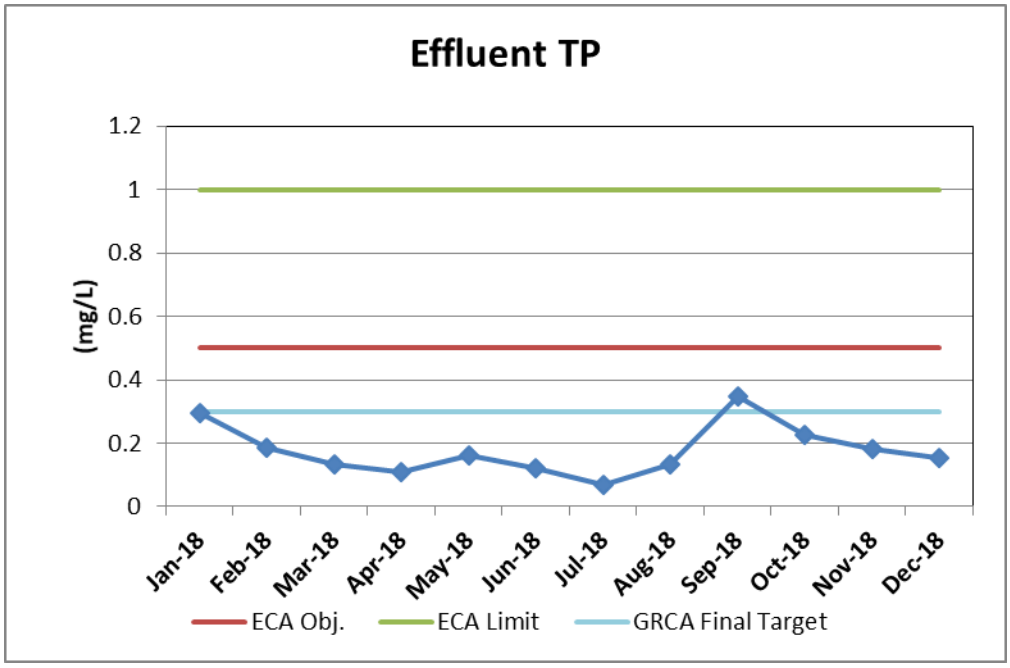

Figure 3 – Monthly Average Effluent TP Compliance Graph

Comments:

- The monthly average effluent TP met the compliance limit of 1.0 mg/L and objective of 0.5 mg/L in all 12 months;
- The GRCA final TP target of 0.30 mg/L was achieved in 11 of 12 months.

The monthly geometric mean density for E. Coli compared against the limit are shown in Figure 4.

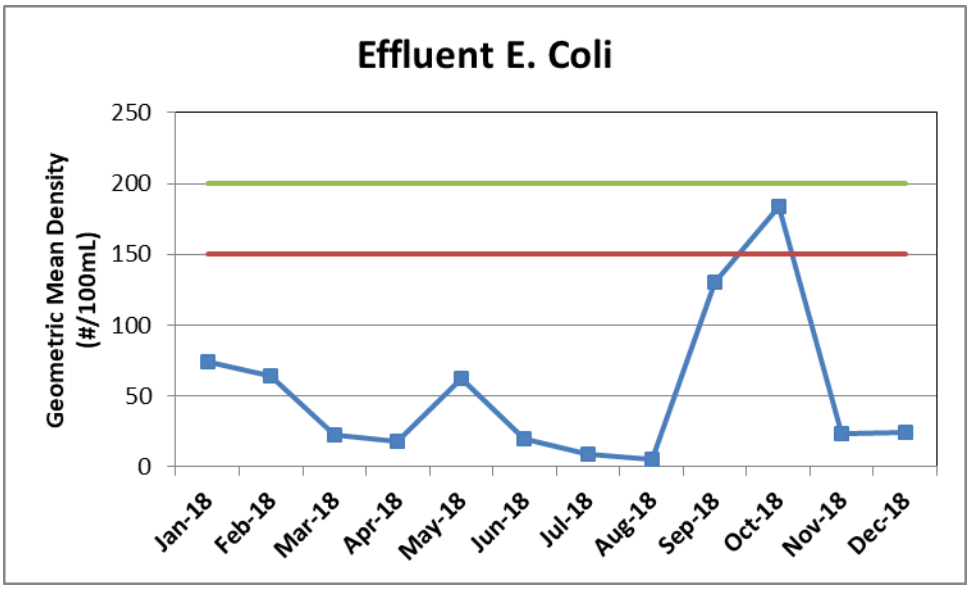

Figure 4 – Monthly Geometric Mean for E. Coli Compliance Graph

Comments:

- Monthly E. Coli Geometric Mean Density exceeded the objective in October and achieved the compliance limit in all 12 months;
- The increase over September and October was due to build up of solids in clarifier changing the demand for chlorine addition. This is due to the temporary return activated sludge (RAS) system being put in place during the on-going construction activity at the facility.

Effluent pH results compared against the objectives and limits are shown in Figure 5.

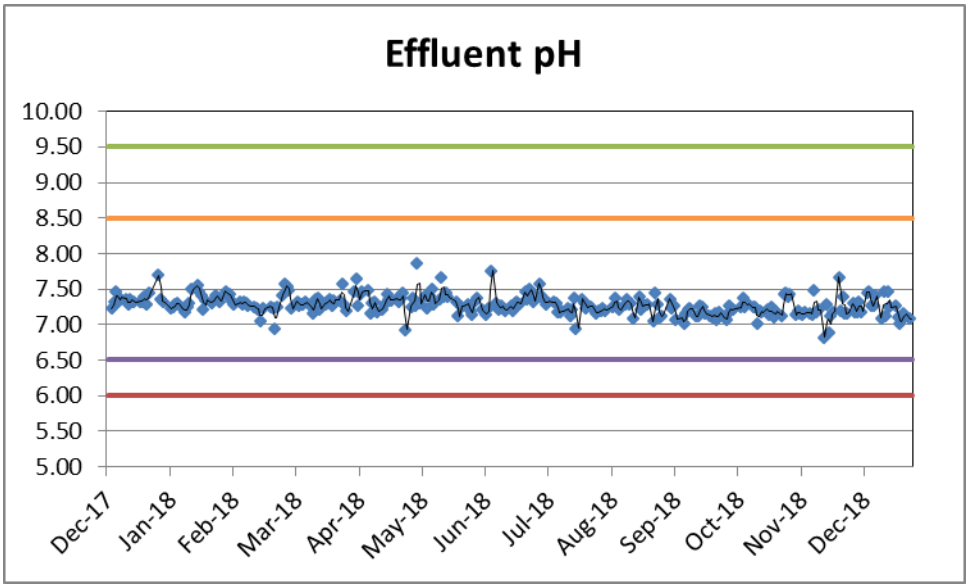

Figure 5 – Effluent pH Compliance Graph

Comments:

- pH Objectives were added in March of 2017 upon revisions to the ECA;
- The daily pH levels met the objectives and limits in 2018.

The monthly average concentration for total ammonia nitrogen compared against the objective and GRCA interim and final targets is shown in Figure 6.

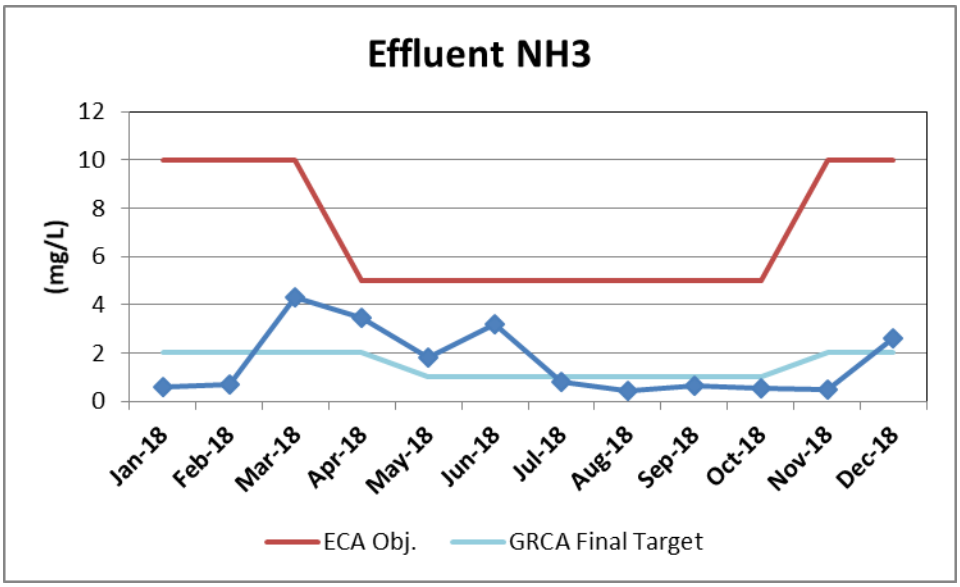

Figure 6 –Monthly Average Effluent Total Ammonia Nitrogen Compliance Objective Graph

Comments:

- The monthly average ammonia met the ECA objective in all 12 months;
- The GRCA final target of 2.0 mg/L (November to April) and 1.0 mg/L (May to October) was achieved in 7 of 12 months.

Effluent total chlorine residuals are compared against the compliance limit in Figure 7.

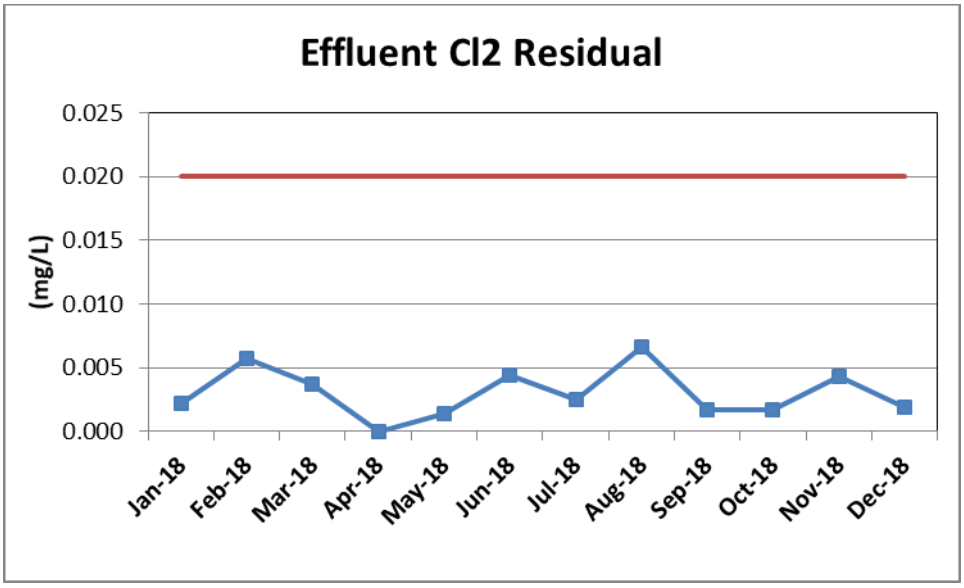

Figure 7 – Effluent Total Chlorine Residual Compliance Graph

Comments:

- The monthly average total chlorine residual results were below the limit in all 12 months;
- Accurately measuring low level concentrations is difficult due to sampling location and limitations with the existing analytical equipment.

The monthly average flows compared against design is shown in Figure 8.

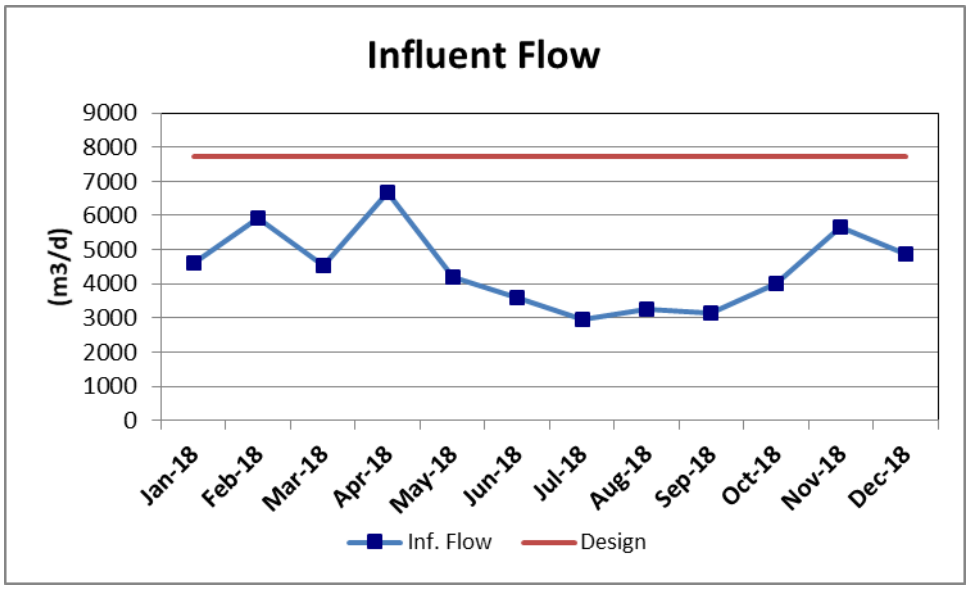

Figure 8 – Monthly Average Flow Compliance Graph

Comments:

- The monthly average flows were below design flow of 7,728 m^3/d in all 12 months.

Effluent Loading Compliance

A summary of the annual average effluent loading compliance is displayed in Table 4.

Table 4 – Summary of Annual Average Effluent Loading Compliance		
Parameter	**Annual Average Loading**	**Annual Average Loading Limit**
$cBOD_5$ Loading	14.6 kg/d	193 kg/d
TSS Loading	31.6 kg/d	193 kg/d
TP Loading	0.90 kg/d	8.0 kg/d

Comments:

- The annual average loading for $cBOD_5$, TSS and TP met ECA loading limits in 2018.

4. Non-Regulated Effluent Sampling

The Dunnville WWTP is also required to analyze the effluent for temperature and un-ionized ammonia. The following are the results collected.

The daily effluent temperature results are displayed in Figure 9.

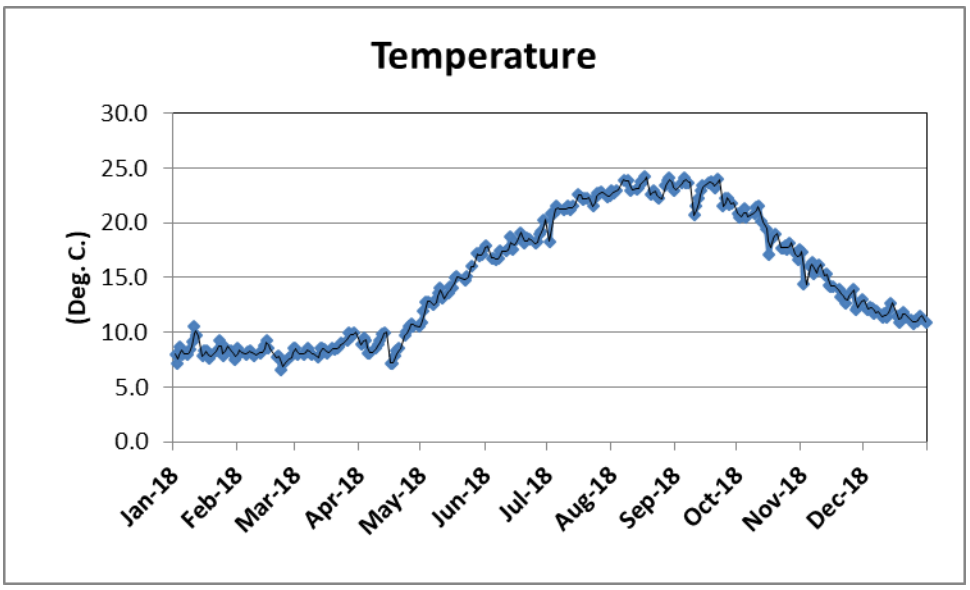

Figure 9 - Daily effluent temperature results

Comments:

- Water temperature ranged from approximately 6.6°C in March to 24.2°C in September.

The weekly un-ionized Ammonia results are displayed in Figure 10.

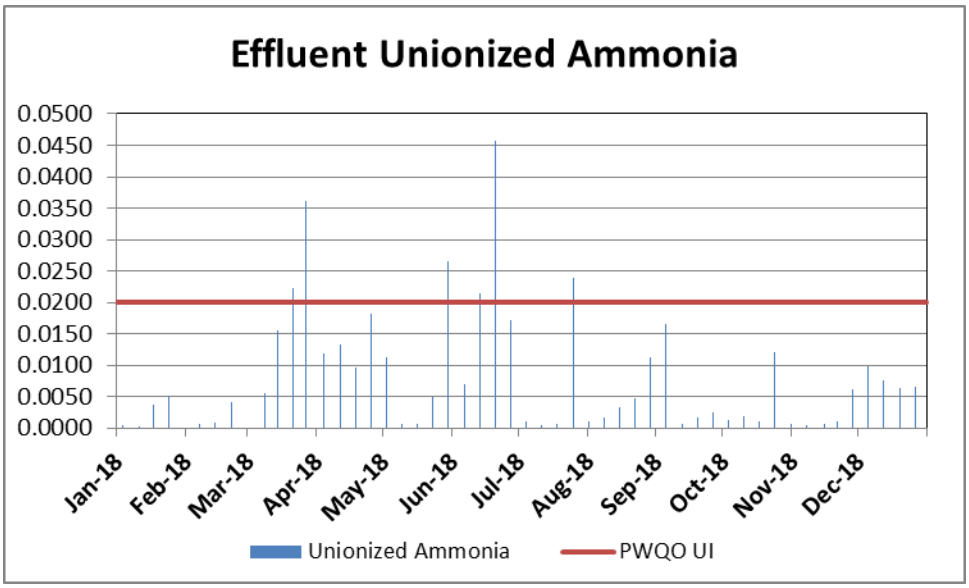

Figure 10 – Weekly effluent un-ionized ammonia results

Comments:

- There were 6 instances where the effluent un-ionized ammonia was above the provincial water quality objective in 2018.
- This was a result of process upsets through construction activities going at the facility.

5. Operational Issues

- Operators continue to experience frequent fouling problems with RAS pumps and the digester jet mixing pump due to lack of preliminary treatment (screening and grit removal) – on-going capital upgrades will improve this situation.

6. Sludge Generation

- **Sludge Production**

Reported sludge being removed from the treatment plant is compared to projected sludge that the plant would be expected to produce. If the difference between the two sludge masses (kg/d) is within ± 15%, then the sludge data is probably accurate. The sludge accountability is reported in Table 5.

Table 5 – Summary of Sludge Accountability				
Reported Sludge (kg/d)		**Projected Sludge (kg/d)**		**Accountability**
Intentional Wasting	756	Biological Sludge	872	11%
Unintentional Wasting	26	Chemical Sludge	6	
Total Reported Sludge	782	Total Projected Sludge	878	

Comments:

- The sludge accountability calculation closed within ± 15% (11%). Therefore, the reported data probably represents the true performance of the facility.

Biosolids Storage and Removal

Table 6 identifies a monthly summary of the volume of biosolids transferred from the digesters to the on-site storage lagoons at the Dunnville WWTP and then offsite.

Table 6 – Monthly Summary of Biosolids Removed												
Month	**Volume of Biosolids to On-Site Lagoons (m^3)**		**Total Solids Concentration (mg/L)**		**Biosolids Volume Hauled to Townsend Lagoons (m^3)**		**Biosolids Volume Removed for Land Application (m^3)**		**Hauled Average Total Solids Concentration (mg/L)**		**Hauled Biosolids Generated (kg)**	
	2017	**2018**	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**
January	686	1,568	10,091	15,125								
February	1,096	973	17,136	13,100								
March	1,262	1,902	15,705	14,112								
April	1,643	1,915	16,194	24,000		1,165				23,170		26,993
May	1,398	2,078	14,000	16,500		675		3,498		17,700/ 41,979		11,948/ 146,843
June	2,121	2,185	16,110	11,057			1,923		40,135		77,180	
July	1,748	1,196	13,048	20,214								
August	1,611	1,339	18,095	15,110								
September	1,739	1,080	12,005	15,132			3,013	1,860	28,000	30,542	84,364	56,796
October	1,302	1,193	14,983	19,169								

November	1,340	1,052	17,065	17,224								
December	1,046	1,050	13,065	20,188		2,340				27,216		63,685
Total	**16,992**	**17,531**			**N/A**	**4,180**	**4,462**	**5,358**			**161,544**	**306,265**
Average			**14,791**	**16,774**					**34,068**	**29,167**		

Comments:

- Biosolids mass to on-site lagoons was 327,613 kg in 2018 based on the total volume to on-site lagoons and the average total solids concentration. The mass hauled from the lagoons was 21,348 kg less than the mass to the on-site lagoons;
- The mass of solids removed in 2018 is 144,721 kg more than in 2017. This is due to not cleaning out the lagoons in the Fall of 2017 and completely cleaning them out in the Fall of 2018;
- For 2019 it is estimated that the mass of biosolids generated will be comparable to 2018.

7. Hauled Waste

- Volumetric requirements for daily hauled leachate met compliance in 2018. Table 8 displays the quarterly leachate sampling results for 2018.

8. Biosolids Removal

- Biosolids were applied to land in May and September to DL3, HN1315 and HN1316.

9. Facility Activities in 2018

- On-going construction activities
  - New pre-treatment system for raw sewage screening and grit removal;
  - Return and waste sludge system upgrades;
  - New waste sludge thickening tanks;
- New administration building with lab, office, meeting room, ladies and men washrooms and new motor control centre.
- Improved pump control systems at Broad Street Pumping Station to increase reliability

10. Planned Activities for 2019

- Complete the construction activities initiated in 2017;
- SCADA replacements;
- Continue working with industry to meet Sewer Use By-Law compliance.

11. Bypasses, Spills and Overflows

- There were no reported bypass events in 2018.

12. Public Complaints

- There were no reported complaints in 2018.

13. Monthly Average Effluent Data Summary

- Table 7 displays a summary of all monthly average effluent data

14. Calibration Reports

- See attached

15. Maintenance Activities

Routine preventative maintenance was performed on various plant and pumping station equipment during the reporting period. This includes tasks such as:

- the lubrication of applicable bearings and/or gearboxes on various equipment;
- the removal, inspection and servicing of numerous submersible pumps;
- the inspection and servicing of chemical feed systems;
- the inspection and servicing of various HVAC systems;
- the inspection, testing and servicing of back-up generator systems;
- See attached for complete annual maintenance report.

Table 7 – Summary of Monthly Average Effluent Data																
	Plant Flow	CBOD	C of A CBOD Limit	CBOD Loading	C of A CBOD Load Limit	TSS	C of A TSS Limit	TSS Loading	C of A TSS Load Limit	Phosphorous	C of A TP Limit	Phosphorous Loading	C of A TP Load Limit	Ammonia	E. Coli	C of A E. Coli Limit
Month	(m^3/d)	(mg/L)	(mg/L)	(kg)	(kg)	(mg/L)	(mg/L)	(kg)	(kg)	(mg/L)	(mg/L)	(kg)	(kg)	(mg/L)	(#/100mL)	(#/100mL)
Jan-18	4597	3.2	25.0	14.7	193.0	11.5	25.0	43.4	193.0	0.30	1.00	0.89	8.0	0.58	75	200
Feb-18	5929	3.1	25.0	18.4	193.0	7	25.0	58.7	193.0	0.19	1.00	0.93	8.0	0.67	64	200
Mar-18	4534	2.9	25.0	13.1	193.0	6.5	25.0	43.5	193.0	0.13	1.00	0.69	8.0	4.31	23	200
Apr-18	6666	2.3	25.0	15.2	193.0	5.25	25.0	55.1	193.0	0.11	1.00	1.03	8.0	3.44	18	200
May-18	4213	3.1	25.0	13.2	193.0	3.8	25.0	30.1	193.0	0.16	1.00	0.99	8.0	1.83	63	200
Jun-18	3601	3.4	25.0	12.2	193.0	5.25	25.0	42.8	193.0	0.12	1.00	0.94	8.0	3.21	20	200
Jul-18	2968	2.4	25.0	7.1	193.0	2	25.0	16.8	193.0	0.07	1.00	0.44	8.0	0.80	9	200
Aug-18	3256	2.3	25.0	7.4	193.0	4.2	25.0	23.3	193.0	0.13	1.00	0.48	8.0	0.45	6	200
Sep-18	3146	3.0	25.0	9.5	193.0	6.25	25.0	35.6	193.0	0.35	1.00	0.92	8.0	0.62	130	200
Oct-18	3999	3.7	25.0	14.6	193.0	6.6	25.0	44.4	193.0	0.23	1.00	1.01	8.0	0.54	184	200
Nov-18	5658	2.7	25.0	15.3	193.0	8	25.0	53.0	193.0	0.18	1.00	0.93	8.0	0.47	23	200
Dec-18	4890	2.4	25.0	11.7	193.0	4.25	25.0	33.0	193.0	0.15	1.00	0.59	8.0	2.58	24	200
Average	4455	2.9		12.7		5.9		40		0.20		0.8		1.6	53	

Table 8 – Summary of Quarterly Leachate Sampling Results											
	CBOD	TSS	Phosphorous	TKN	Boron	Cobalt	Magnesium	Manganese	Potassium	Strontium	Bis (2-ethylhexyl) Phthalate
Month	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Jan-09-18	20.8	28.00	0.82	97.4	2.68	0.007	75.8	0.1	134	10.8	0.006
Mar-26-18	22.7	34.00	0.31	122	3.72	0.007	98.8	0.24	128	14.3	0.005
Jul-05-18	21.3	30.00	0.77	134	3.29	0.007	101.0	0.18	142	16.8	0.005
Oct-01-18	25.5	35.00	0.87	160	4.12	0.007	110	0.21	180	17.9	0.005
Average	22.58	31.75	0.69	128.4	3.45	0.007	96.4	0.18	146	15	0.005