Ontario Clean Water Agency
Agence Ontarienne Des Eaux

Stephan Burt
District Manager
Hamilton District Office
Ministry of the Environment, Conservation and Parks

March 31, 2023

Re: 2022 Annual Performance Report for the Delhi Wastewater Treatment Facility

Attached is the 2022 Annual Performance Report for the Delhi Wastewater Treatment Facility located at 244 Western Avenue in Norfolk County. This report has been completed in accordance with:

- Section 11(4)(a) through (k) cited in Environmental Compliance Approval #5168-AHCJ3G issued on March 17, 2017 to the Corporation of Norfolk County.

This report was prepared by the Ontario Clean Water Agency on behalf of Norfolk County based on the information contained in our records. The report covers the period from January 1, 2022 to December 31, 2022.

Sincerely,

Allison Billingsley
Process and Compliance Technician
Ontario Clean Water Agency-Norfolk Cluster

Cc:
Stephanie Davis – Director, Environmental Services, Norfolk County
Shaun Earls - Manager, Water & Wastewater Compliance, Norfolk County
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Introduction:

Delhi Wastewater Treatment Facility (WWTF) is located at 244 Western Avenue in Delhi, Ontario (Norfolk County). Construction of the facility was completed in the summer of 2015, with commissioning completed in fall 2015. The community of Delhi includes both permanent and seasonal residents along with a food processing industrial plant and a fertilizer plant which also discharges to the sanitary sewer system.

The Delhi WWTF uses a conventional activated sludge process for wastewater treatment. The facility has a rated capacity of 3,182 m^3/d, and has unit processes including screening and grit removal, primary treatment, biological treatment, and UV for disinfection. Waste Activated Sludge (WAS) is co-thickened in the primary clarifiers and the combined sludge and scum are digested in an aerobic digester prior to disposal via land application. The treated effluent is discharged through an outfall pipe to the Big Creek which ultimately discharges into Lake Erie. The facility also has an odour control system which utilizes a bio filter to neutralize odourous gases emitted from the sludge digesters, headwork's and primary treatment.

Raw Wastewater Collection

The wastewater collected in the sanitary sewers in Delhi flows to the WWTF by pump and gravity flow. There are five (5) sewage pumping stations (SPS) in Delhi. St. Michael's Street SPS pumps sewage to the Main Street SPS and from there it is pumped to the WWTF. Hillside and Talbot SPS's pump to the Western Ave SPS and finally the Western Ave SPS delivers raw sewage directly to the plant.

Inlet Works

The preliminary treatment unit includes coarse screening and grit removal equipment which are enclosed inside the main process area of the Headworks Building. Raw sewage flows via a 450 mm gravity sewer from the collection system to MH-1 located north of the Headworks Building. The sewage flows to the Headworks Building where it is screened through two (2) 6mm coarse screens, one (1) automatic screen, and one manual screen. There is a second automatic screen in storage as a spare. The automated screen continuously removes screenings and deposits them into the screenings conveyor. The screened sewage is then dosed with ferrous chloride as it passes through a Detritor Tank which removes grit prior to entering the main treatment process. The grit is pumped back into the Headworks Building to a grit classifier which washes and dewaters the grit slurry. The grit is deposited into a collection bin with the screenings for disposal; the wash-water is returned to the Detritus Tank inlet channel.

Primary Clarification

A double barrel inverted siphon conveys the screened sewage from the Detritor Tank to the Main Treatment Building. The sewage flows into the primary splitter box and is directed to one of the two (2) primary clarifiers by adjustable gates. The primary clarifiers remove a portion of the particulate load of TSS, cBOD5, TKN and TP by settling of suspended solids. Ferrous

chloride can be dosed immediately upstream of the primary clarifiers as a back up to remove a fraction of the soluble phosphorus and promote settling.

Biological Tanks (Aeration and Anoxic Tanks)

The treatment process consists of an activated sludge system with provision of an anoxic swing zone for denitrification. The main purpose of the biological tanks is to remove BOD and TKN from the primary effluent by use of microorganisms. This is to ensure compliance with effluent requirements for cBOD5, unionized and total ammonia.

The biological treatment tanks consist of an anoxic/oxic configuration. The first and smallest of the two (2) cells is the swing zone which can be operated in both anoxic, as well as oxic mode. The second and the larger of the two (2) cells is a dedicated aeration tank with permanent oxic conditions. The swing zone is designed to be operated in anoxic mode for average loading conditions with a provision to switch it to oxic mode if required during peak loading conditions. Operating in anoxic mode, this tank effects denitrification (partial) of the nitrates recycled from the downstream aeration tank through the return activated sludge (RAS) system. Also, in doing so, it provides oxygen and alkalinity credit in the aeration zone which in turn helps maintain a steady state in the aeration zone under frequent loading fluctuations due to extraneous loads at the plant.

Secondary Clarification

The flow from the biological tanks enters the secondary splitter box where it is directed to the two (2) secondary clarifiers. The purpose of the secondary clarifiers is to remove the activated sludge by gravity settling and recycle it to maintain a sufficient quantity of microorganisms in the biological treatment process.

The secondary effluent enters the secondary clarifier outlet chamber, while sludge settles and gets collected into the secondary hoppers. The sludge is then pumped to the aeration tanks (return activated sludge) to recirculate the activated sludge back into the biological treatment system. A portion of the recirculated activated sludge is pumped to the primary clarifier as waste to maintain the concentration of mixed liquors in the secondary treatment process.

Tertiary Treatment

Two (2) 3.25m x 2.65m x 2.68m SWD filtration tanks (one standby) each equipped with a cloth media filter with a Peak Flow Rate of 92L/s.

Disinfection Phase

The effluent is directed by gravity to the disinfection channel ultra-violet (UV) disinfection system equipped with comprising two (2) banks (one standby) of UV lamps before being finally discharged to the effluent outfall manhole flowing to Big Creek.

Sludge Management System

The overall objective of the sludge handling system is to collect, thicken, stabilize, store and dispose of the sludge produced at the plant in a safe and sustainable manner. There are two (2) main sources of sludge production in the treatment system: settling of raw sewage suspended solids, and the waste activated sludge resulting from conversion of a portion of the organic matter and nutrients in the raw sewage to new biomass by microorganisms in the aeration tanks. Both of these sources of sludge are removed from the primary clarifiers and pumped to the aerobic digester where it is biologically stabilized. The stabilized biosolids are periodically loaded in trucks and hauled away for disposal.

Odour Control

An odour control system has been provided to abate emission of foul odours (hydrogen sulphide and other odourous compounds such as mercaptans). Two (2) odour control fans convey foul air from the Primary Clarifiers, Sludge Digesters and Headworks Building to the biofilter located west of the Administration Building. The foul air flows through a perforated pipe embedded within the biofilter and flows upwards through the biofilter media bed. The biofilter media is comprised of a proportioned mixture of limestone, compost and woodchips. The media is irrigated and kept moist by treated plant effluent to develop and sustain a biomass layer that removes odours from the foul air.

Standby Power

The emergency power for the entire plant is supplied from a 600 kW/750 kVA, 600V, 3 phase Diesel Generator Set. The generator is a Generac model SD600 supplied and installed by Total Power Ltd. The gen-set is comprised of an 18.1L diesel engine, 730kW alternator, 225 Amp-hour battery, engine control panel and accessories within a sound-attenuating enclosure. The fuel storage tank is 7578L, allowing for a 48-hour emergency power supply with a full tank of fuel. The generator is sized and connected to provide power for 100% of the facility's connected load.

Plant Facts:

Environmental Compliance Approval:	ECA 5168-AHCJ3G (issued March 17, 2017)
Rated Capacity:	3,182m^3/day
Receiving Water:	Big Creek

For 2022, the Delhi WWTF was operated in accordance with provincial regulations as required in ECA #5168-AHCJ3G (ECA) issued March 17, 2017.The following report is presented such that it corresponds with ECA #5168-AHCJ3G Section 11(4) (a) through (k).

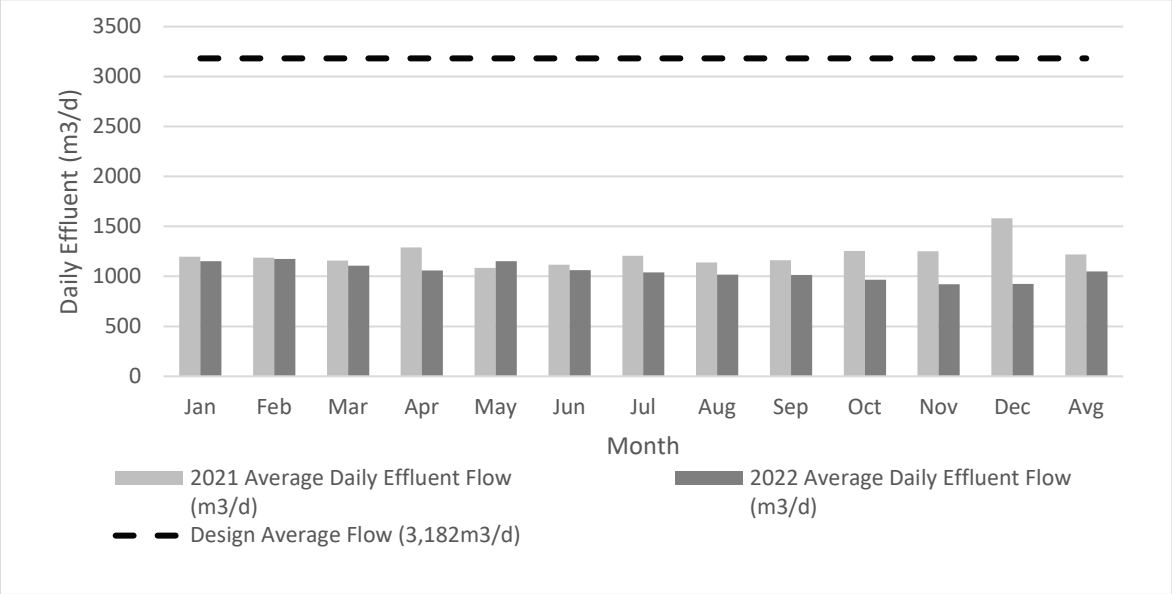
Section A: Summary of Monitoring Data

As outlined in ECA #5168-AHCJ3G, Section 11(4)(a) the following is a summary and interpretation of all monitoring data and a comparison to the Compliance Limits including an overview of the success and adequacy of the works. Detailed monitoring data is supplied in Appendix A.

(I) Effluent Flow Monitoring

The average daily effluent flow for 2022 was 1,049.6m^3/d, which is 33.0% of the Delhi WWTF's rated capacity of 3,182m^3/d. The following Graph 1 shows a comparison of the average daily flows per month for 2022 and 2021 compared to the rated capacity of the facility.

Graph 1. Average daily flows in 2022 compared to 2021.



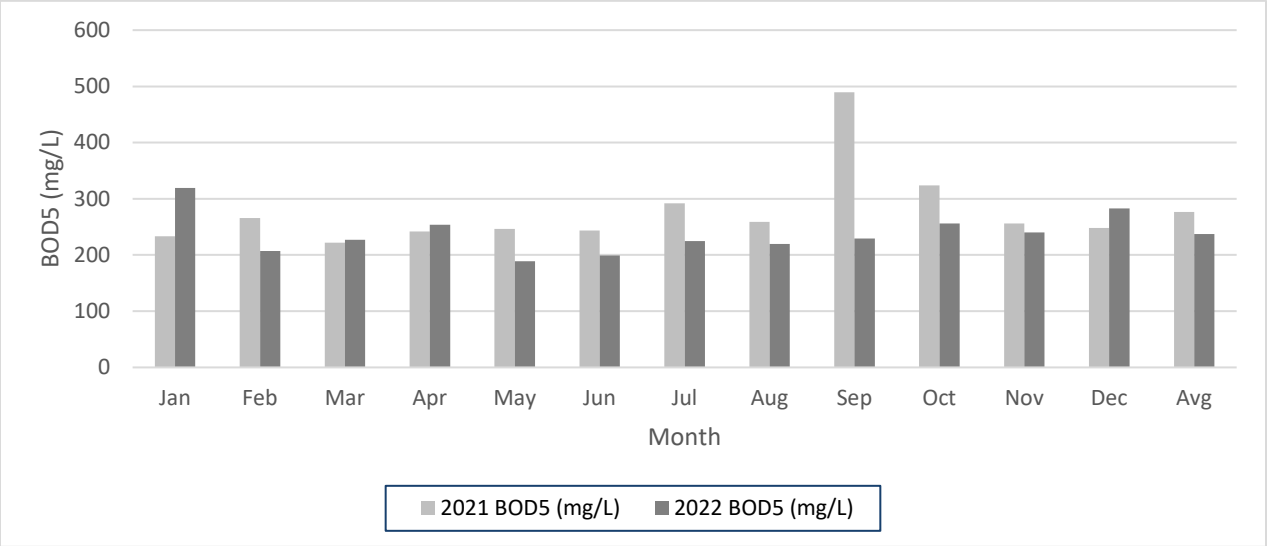
(II) Influent Sewage Monitoring

The influent sewage is monitored for BOD_5, total suspended solids, total phosphorus and total kjeldahl nitrogen on a monthly basis (minimum) by means of a composite sample. The treatment capabilities of the facility were designed based on the raw water characteristics identified in the Operations Manual from the design engineers. Refer to Appendix A for the detailed monthly results.

The influent at the Delhi WWTF is sampled on a weekly basis to be able to monitor the incoming parameters more efficiently and have greater control over the operations of the facility. The following Graphs 2-5 show the monthly average concentrations for the required influent parameters in 2022 compared to 2021.

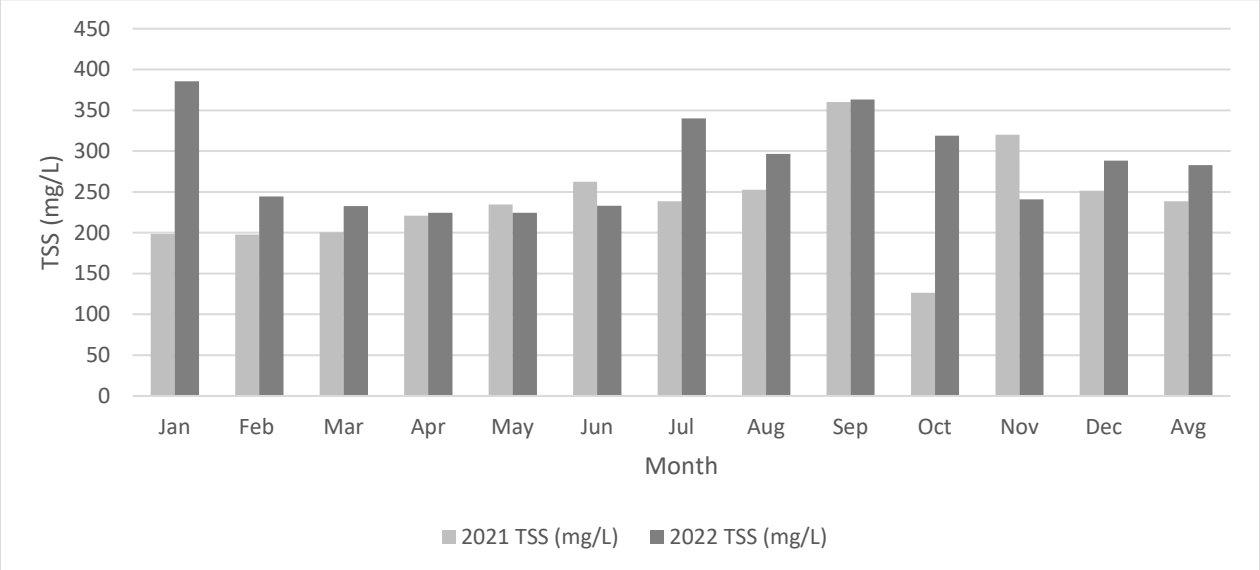
The annual average for the influent sewage BOD_5 concentration to the plant in 2022 was 237.3mg/L with an average loading of 248.4kg/d. This annual average loading is below the design criteria of 570kg/d

Graph 2. Influent sewage average monthly concentration of BOD_5 for 2022 compared to 2021.



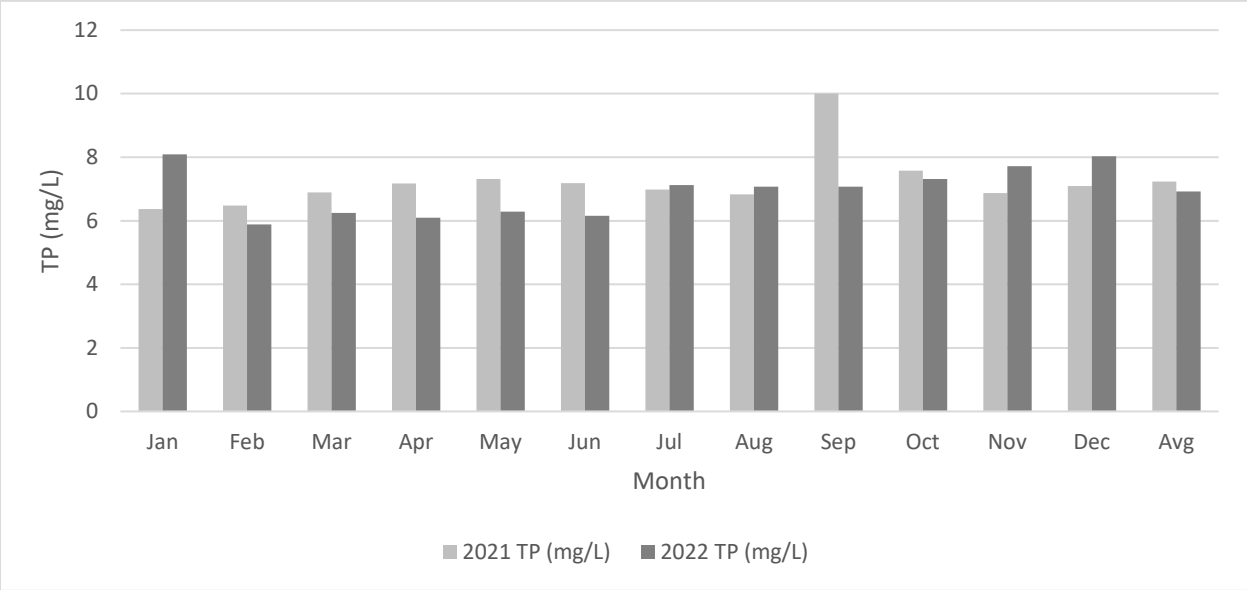
The annual average for the influent sewage total suspended solids (TSS) concentration to the plant in 2022 was 282.7mg/L with an average loading of 296.3kg/d. This annual average loading is below the design criteria of 627kg/d

Graph 3. Influent sewage average monthly concentration of TSS for 2022 compared to 2021.



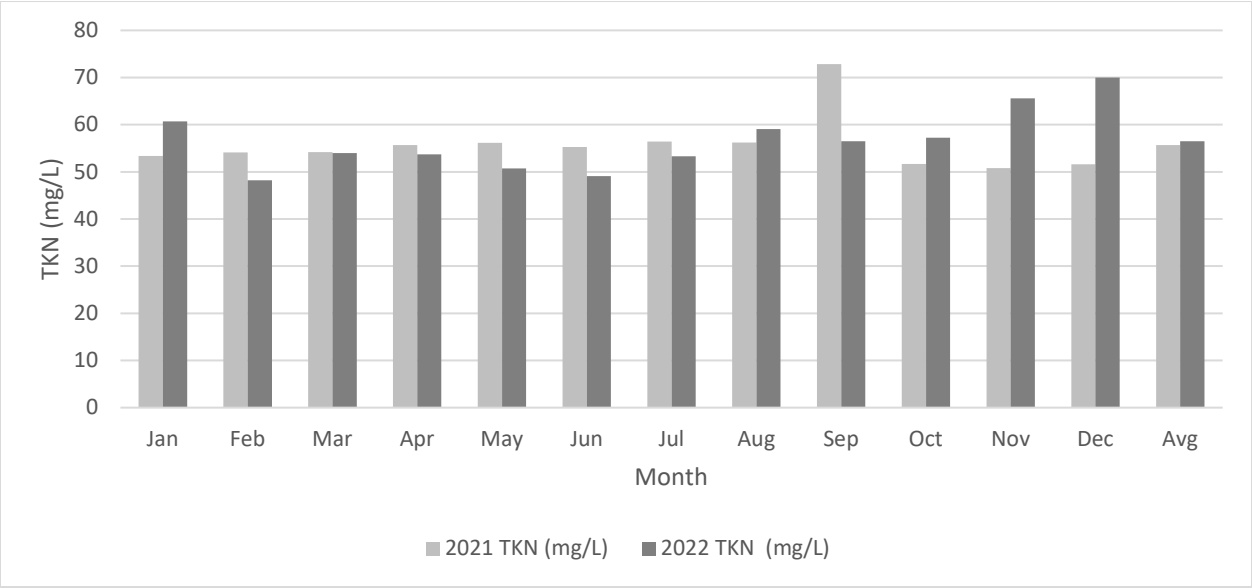
The annual average for the influent sewage total phosphorus (TP) concentration to the plant in 2022 was 6.93mg/L with an average loading of 7.24kg/d. This annual average loading is below the design criteria of 20kg/d.

Graph 4. Influent sewage average monthly concentration of TP for 2022 compared to 2021.



The annual average for the influent sewage total kjeldahl nitrogen (TKN) concentration to the plant in 2022 was 56.5mg/L with an average loading of 58.9kg/d. This annual average loading is below the design criteria of 162kg/d.

Graph 5. Influent sewage average monthly concentration of TKN for 2022 compared to 2021.



The influent characteristics remained consistent throughout 2022.

(III) Final Effluent Monitoring

The Final Effluent is sampled on a weekly basis and tested for $cBOD_5$, total suspended solids, total phosphorus and total ammonia as a composite sample. A grab sample is taken weekly and tested for E. coli, pH and temperature. Total residual chlorine is required weekly when chlorination is in use. During the 2022 reporting period chlorination was not utilized. Detailed results are found in Appendix A. Table 1 below shows the monthly average effluent results and Table 2 shows the monthly average loadings.

Table 1. Monthly average effluent results for 2022.

Month	$cBOD_5$ (mg/L)	TSS (mg/L)	TP (mg/L)	TAN (mg/L)	E. coli (cfu/100mL) Geomean	pH (min-max)	Temp (°C)
January	2.4	2.8	0.17	0.04	1.41	7.49-8.86	12.7
February	4.4	5.4	0.13	4.07	6.85	6.75-8.16	11.7
March	2.2	3.4	0.24	0.73	2.50	6.59-7.21	12.2
April	2.0	3.0	0.12	0.07	1.68	7.06-7.21	13.4
May	2.0	4.3	0.16	0.79	5.40	6.97-7.34	16.0
June	2.0	1.6	0.16	0.05	1.40	6.94-7.39	18.8
July	2.0	1.0	0.15	0.04	1.63	7.01-7.42	20.6
August	2.0	1.2	0.14	0.04	7.07	6.79-7.22	21.3
September	2.0	1.5	0.16	0.04	9.57	6.96-7.64	21.0
October	2.0	1.5	0.15	0.05	1.31	6.57-7.56	18.4
November	2.5	7.0	0.15	0.10	2.67	6.53-7.43	16.6
December	2.4	2.3	0.12	0.48	2.48	6.82-7.26	14.7
Average	**2.3**	**2.9**	**0.15**	**0.54**	**2.86**	**6.53-8.86**	**16.4**
ECA Objective	10.0	10.0	0.25	3.0(6.0)*	200	6.5-8.5	n/a
ECA Limit	15.0	15.0	0.3	4.0(8.0)*	150	6.5-8.5	n/a

- *TAN Objective and Limit is based on Temperature. Values in brackets are from Dec 1 -Mar 1

Table 2. Monthly average loadings for 2022.

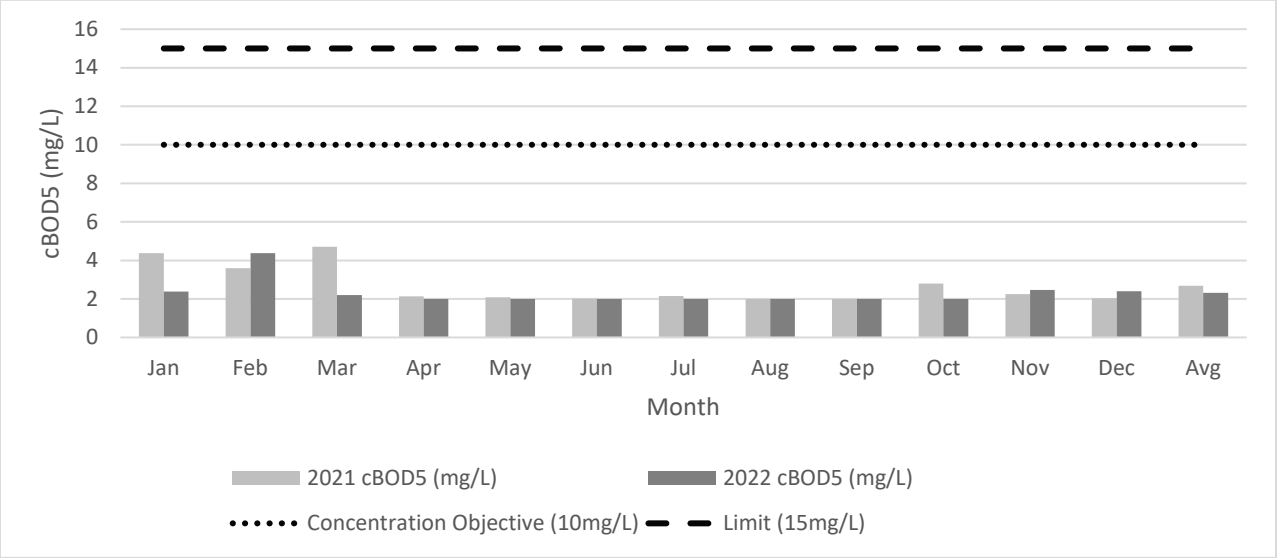
Month	cBOD5 (kg/d)	TSS (kg/d)	TP (kg/d)	TAN (kg/d)
January	2.74	3.17	0.20	0.05
February	5.14	6.17	0.15	4.77
March	2.43	3.76	0.27	0.81
April	2.12	3.18	0.13	0.07
May	2.31	4.90	0.18	0.91
June	2.13	1.70	0.17	0.06
July	2.08	1.04	0.16	0.04
August	2.04	1.22	0.14	0.04
September	2.03	1.52	0.16	0.04
October	1.93	1.45	0.15	0.05
November	2.26	6.44	0.14	0.09
December	2.22	2.08	0.11	0.44
Average	**2.45**	**3.05**	**0.16**	**0.61**
ECA Limit	63.6	63.6	0.95	12.7(25.5)*

- *TAN Objective and Limit is based on Temperature. Values in brackets are from Dec 1 -Mar 1

(IV) Comparison to Compliance Limits and Objectives

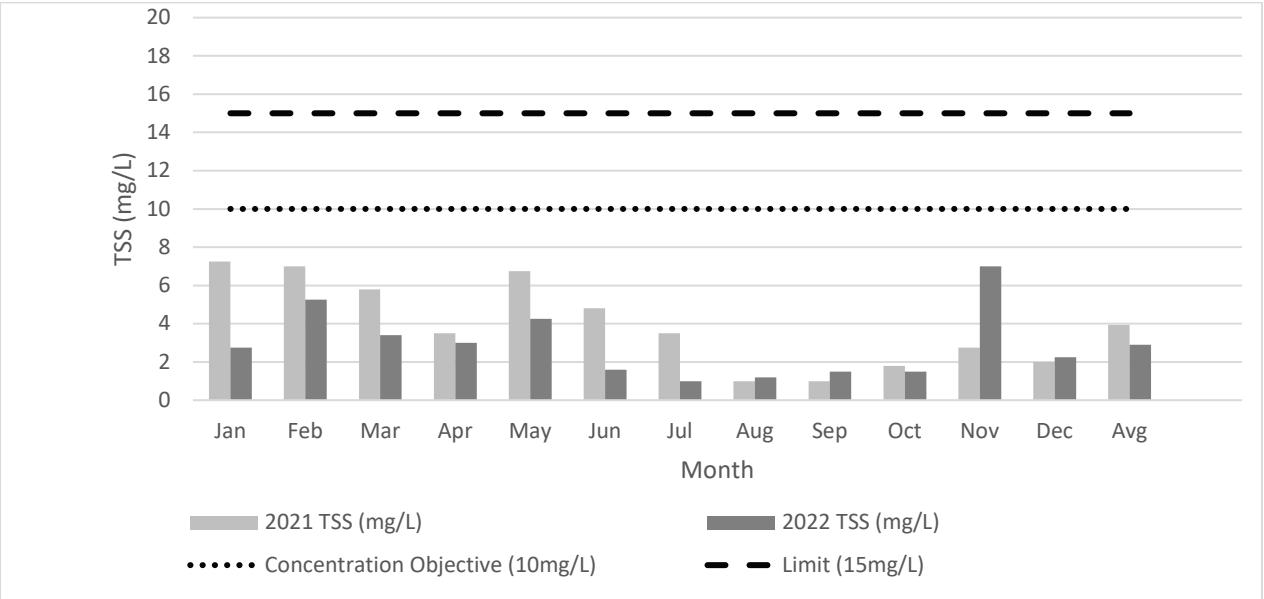
The annual average for the effluent $cBOD_5$ in 2022 was 2.3mg/L. The annual loading of $cBOD_5$ was 2.45kg/d. The monthly compliance limit and objective of 15mg/L and 10mg/l respectively were not exceeded in 2022. Refer to Graph 6 for a comparison of effluent monthly average concentration of $CBOD_5$.

Graph 6. The effluent monthly average concentration of $cBOD_5$ in 2022 compared to 2021.



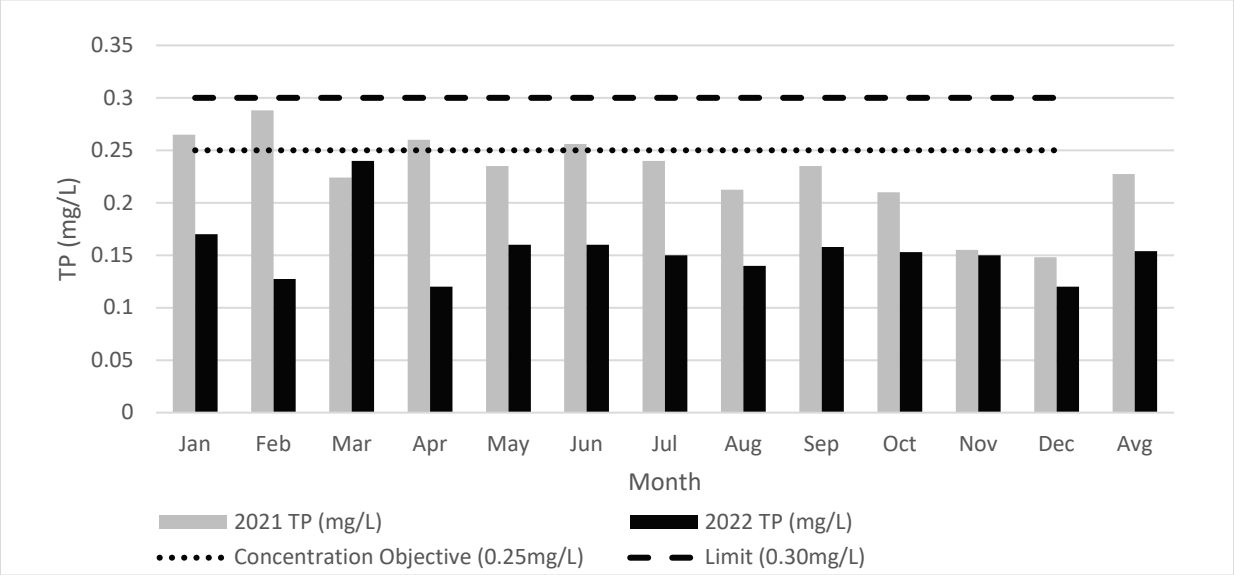
The annual average for effluent TSS in 2022 was 2.9mg/L. The annual loading of TSS was 3.05kg/d. The monthly compliance limit and objective of 15mg/L and 10mg/l respectively were not exceeded in 2022. Refer to Graph 7 for the effluent monthly average concentration of TSS.

Graph 7. The effluent monthly average concentration of TSS in 2022 compared to 2021.



The annual average for effluent TP in 2022 was 0.15mg/L. The annual loading of TP was 0.16kg/d. The monthly compliance limit and objective of 0.3mg/L and 0.25mg/l respectively were not exceeded in 2022. Refer to Graph 8 for the effluent monthly average concentration of TP.

Graph 8. The effluent monthly average concentration of TP in 2022 compared to 2021.

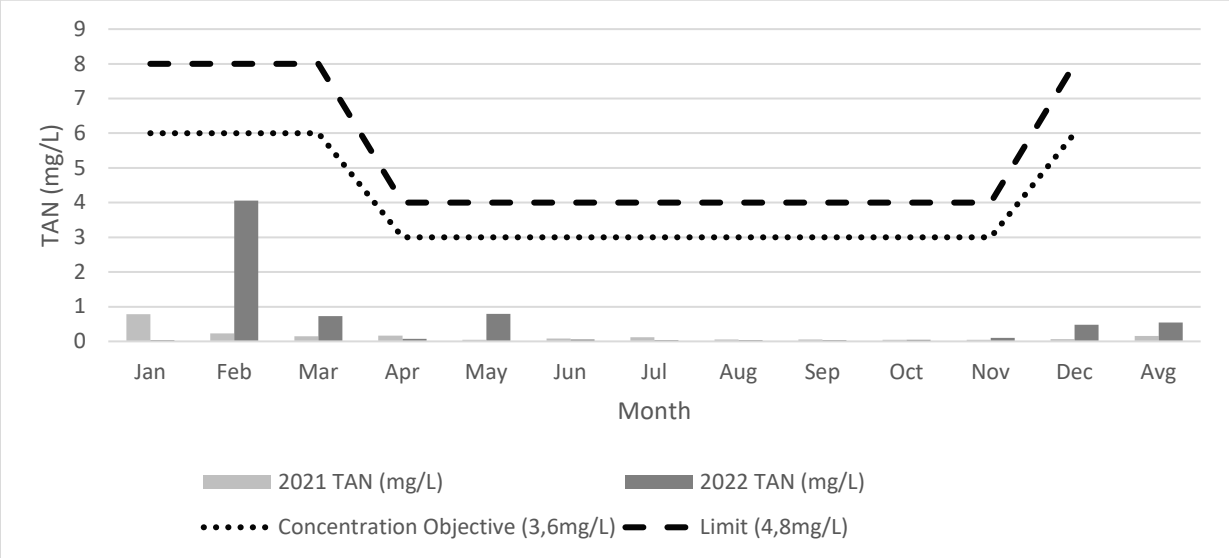


The annual average for effluent Total Ammonia Nitrogen (TAN) in 2022 was 0.54mg/L. The annual loading of TAN was 0.61kg/d. The limits and objectives for TAN are based on temperature (refer to table 2):

- December 1st to March 31st – limit is 8.0mg/L, objective is 6.0mg/L
- April 1st to November 30th - limit is 4.0mg/L, objective is 3.0mg/L.

There were no limit or objective exceedances for TAN in 2022. Refer to Graph 9 for the effluent monthly average concentrations.

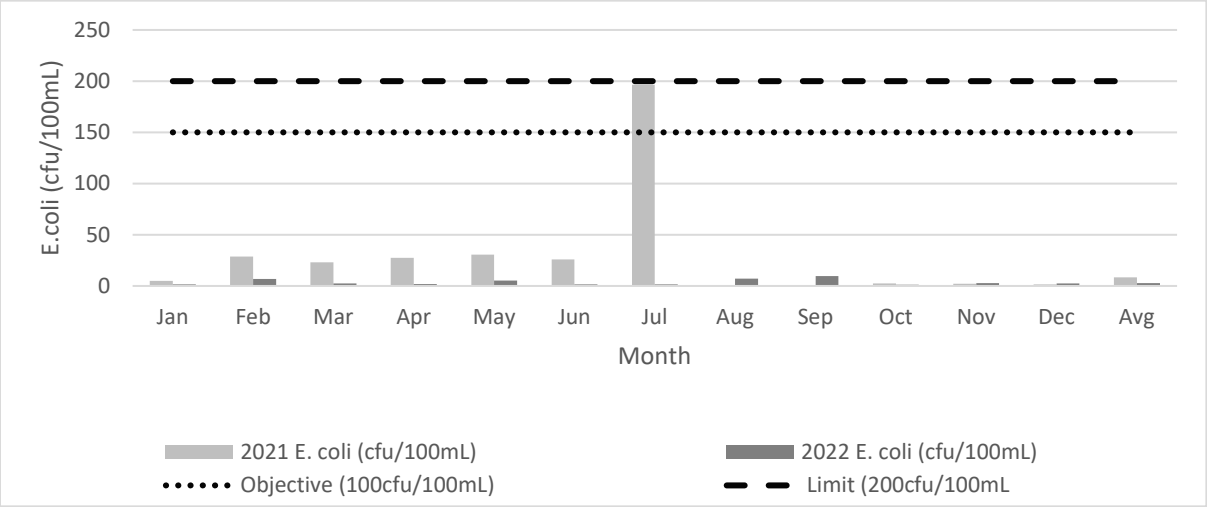
Graph 9. The effluent monthly average concentration of TAN in 2022 compared to 2021.



The annual geometric mean for effluent E.coli in 2022 was 2.86cfu/100mL. The monthly compliance limit and objective of 200cfu/100mL and 150cfu/100mL respectively were not exceeded in 2022. Refer to Graph 10 for the effluent monthly geometric mean concentrations.

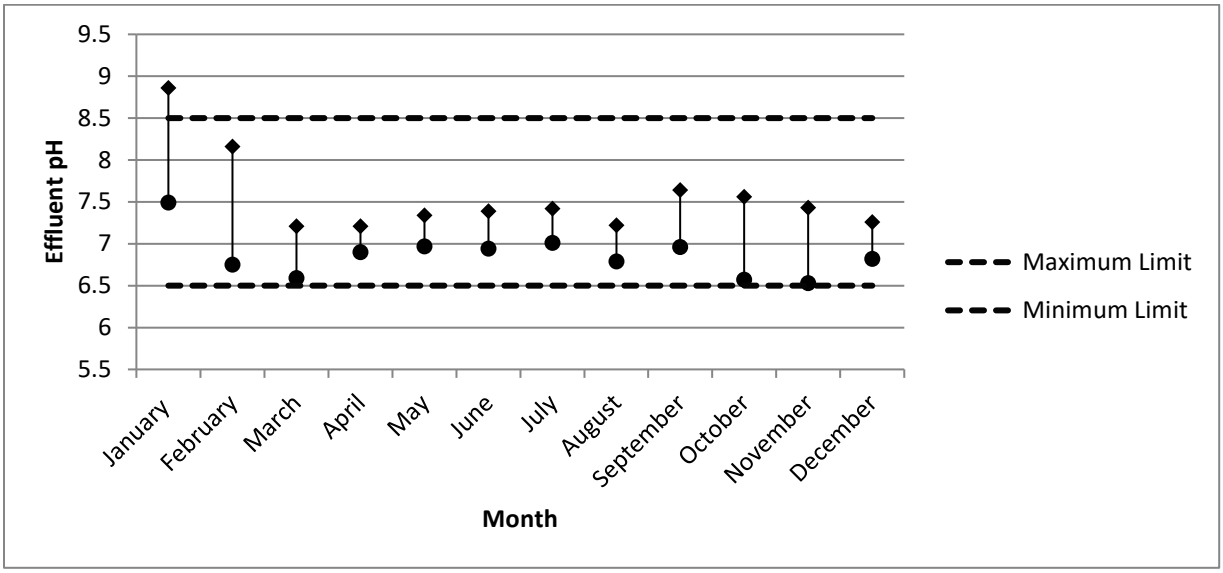
Note: ECA incorrectly identifies objective as 200cfu/100mL and limit as 150cfu/100mL.

Graph 10. The effluent monthly geometric mean concentration of E.coli in 2022 compared to 2021.



The effluent pH is monitored weekly at a minimum at the Delhi WWTP. In January 2022, there were two exceedances of the upper limit for pH and these were reported to the MECP. There were no additional results below or above the compliance limits of 6.5-8.5 in 2022. The pH is required to be maintained between 6.5-8.5 at all times. Refer to Graph 11 for the monthly minimum and maximum pH readings.

Graph 11. Effluent pH readings for 2022.



Section B: Operating Problems and Corrective Actions

There were two (2) non-compliance events at the Delhi WWTF in 2022. These events were communicated as required with the MECP.

1. The final effluent flow meter failed to record accurately in accordance with Condition 9 Section 5 of the ECA. The operator became aware of the issue on Friday July 15th. Upon further investigation, an obstruction was found on the transducer head of the flow meter. The instrument was cleaned and began reading correctly. The review of trending revealed that the readings were inaccurate for July 13th, 14th and 15th. Estimates of the final effluent discharged were made by utilizing the daily average flow readings prior to the malfunction. The average daily flow of 1,032 m^3/day was used for July 13-15 to estimate the final effluent flow. Two corrective actions were initiated to address this non-compliance. The first, was adding a monthly preventative maintenance work order to clean the transducer. The second, was the addition of a visual alarm on SCADA when the flow meter's day to day variance exceeds 20%.

2. During the month of January 2022 the pH limit was exceeded on two occasions. There were no unusual observations noted by the operator. The pH returned to normal ranges, 7.63-8.16, the following week. In order to ensure compliance, the operators will continue to use best practice, by calibrating the pH probes prior to use. The ECA objectives and limits are posted in lab for the operators to confirm that their readings meet the objectives and limits. Training was conducted with the operators on the objectives and limits and the reporting requirements when exceeded.

Section C: Maintenance Activities

Regular scheduled monthly preventative maintenance is assigned and monitored using the Workplace Management System (WMS) program. Refer to Appendix B for preventative maintenance schedule. Items that were repaired or replaced in 2022 were:

Table 3. Major Maintenance Completed in 2022

Date	Maintenance Activities
January 5	Completed annual maintenance on the Detroiter
January 18	Contractor on site to service gas detection system and calibrate O2 and H2S sensors. O2 sensor required replacement (completed February 28).
January 25	Replaced pressure relief valve on hot water tank
February 16	Repaired supernatant line due to damage from freezing.
March 30	Contractor on site to complete lifting device inspections
April 1	Contractor to replace bulb and siren for the gas monitor warning system
April 11	Mechanical Contractor installed the ferrous hose support
April 19&22	Contractor on site for flow meter calibrations
May 19	Repaired RAS pump #2 bleeder valve
June 30	O-rings replaced on hydrants around the plant
September 16	Contractor on site to complete in house lab calibrations
October 5	Reconnected plunger in primary sludge pump

Date	Maintenance Activities
October 6	Trojan installed new bulbs in the UV bank system
October 19	Mechanical contractor completed heat trace on headwork's safety shower and wired the Odour Control Fan through the VFD
November 15	Contractor on site to inspect and test back flow preventers
December 1	Contractor on site to complete generator fuel tank inspection
December 5	ESA inspection completed

Section D: Effluent Quality Assurance

Effluent quality assurance is evaluated by monitoring parameters and changes throughout the facility's processes. The operators monitor the aeration basin by performing weekly tests on the mixed liquor. These tests include dissolved oxygen, pH, temperature, settling tests and mixed liquor suspended solids (MLSS). As well, monitoring of chemical dosages and wasting volumes are completed. Data collected from these tests provide valuable information to the operators to make the appropriate adjustments in the treatment process and take corrective actions before the plant reaches its effluent limits.

Section E: Calibration and Maintenance on Effluent Monitoring Equipment

The Delhi WWTF effluent flow meter was calibrated by SCG Flowmetrix on April 20, 2022. In house meters for pH and dissolved oxygen were calibrated by JBF Controls on September 16, 2022 as per manufacturer's instructions.

Section F: Objective Exceedances & Best Efforts

Table 4. Sample results compared against the effluent objectives and loading limits.

Parameter	Effluent Objective (mg/L)	Monthly Effluent Result Ranges (mg/L)	# of Objective Exceedances	Effluent Loading Limit (kg/d)	Monthly Loadings Result Ranges (kg/d)	# of Limit Loading Exceedances
$cBOD_5$	10.0	2.0-4.4	0	63.6	1.9-5.1	0
TSS	10.0	1.0-7.0	0	63.6	1.0-6.4	0
TP	0.25	0.12-0.24	0	1.9	0.11-0.27	0
TAN	3.0 (6.0)	0.04-4.06	0	12.7 (25.5)	0.04-4.77	0
E. coli (cfu/100mL)*	150	1.3-9.6	0	n/a	n/a	n/a
pH**	6.5 – 8.5	6.53-8.86	2	n/a	n/a	n/a

*expressed as geometric mean, ECA incorrectly identifies objective as 200cfu/100mL
**minimum and maximum result (not monthly averages)

Table 5. Objective exceedances in 2022.

Date	Parameter	Concentration mg/L	Loadings kg/d	Issue and Proactive Actions Taken
27/01/2022	pH	8.9	n/a	Monitored Facility & Staff Training
28/01/2022	pH	8.6	n/a	Monitored Facility & Staff Training

The Delhi WWTF performed well in 2022 producing quality effluent. There were two (2) objective exceedances in 2022 for pH in January. In order to ensure compliance, the operators continue to use best practices, by verifying the pH probes prior to use.

Section G: Sludge Handling and Generated

Sludge sampling results can be found in Appendix C. Sludge is removed from the Delhi WWTF and sent to the Townsend Lagoon for processing or taken to field for land application. The total volume generated in 2022 was 3,524m^3, refer to Table 6 below for a breakdown and Table 7 for the sludge disposal locations.

It is expected that 2023 will be similar to 2022 with approximately 3,500m^3 of sludge being removed from the Delhi WWTF.

Table 6. Sludge Generation 2022.

Month	Delhi WWTF		
	Volume Hauled		
	Townsend Lagoon (m^3)	Field (m^3)	Total (m^3)
January	0	0	**0**
February	510	0	**510**
March	178	0	**178**
April	182	749	**932**
May	181	0	**181**
June	0	136	**136**
July	181	537	**718**
August	0	0	**0**
September	0	0	**0**
October	0	0	**0**
November	179	690	**870**
December	0	0	**0**
Total	**1,412**	**2,112**	**3,524**

Table 7. Sludge Disposal Locations 2022.

Site	NASM#	Expiry	Lot	Conc	Township	Area Spread (ha)	Delhi WWTF (m^3)	Dates Spread
OX1110	24975	2026	6	12	Norwich	20.73	614.00	April 5 & 6
HN1331	23484	2022	13 & 14	12	Townsend	11.14	135.00	April 8, 11, 18, 22
HN1122	23414	2022	14-18	2	Oneida	4.83	135.72	June 20
HN1197	25112	2026	17 & 18	5	Woodhouse	9.56	537.05	July 26 & 27
HN1084	25183	2026	9-12	6 & 7	Townsend	17.10	342.90	Nov 10-18
HN1347	25183	2026	17 & 18	2	Townsend	22.30	347.18	Nov 19, 21, 22
TOTAL						**85.66**	**2111.85**	

Section H: Complaints

There were thirty-three (33) community complaints received for the Delhi WWTP in 2022.

Odour Complaints
Thirty-two (32) of the community complaints were from one (1) homeowner who either notified the Water Inspector, Karl VanHeyst of the MECP, or the Spills Action Centre (SAC) about suspected odours coming from the Delhi WWTF. All complaints were communicated with Norfolk County and were promptly investigated by reviewing the conditions that day at the facility along with weather conditions in the area. There were no unusual conditions identified during any of these investigations and there have been no modifications to the facility that would cause any odours.

The Delhi WWTF was often visited by Operations staff, Management and the MECP following odour complaints with no concerns identified that required addressing. Odour complaints ceased in December 2022 after a letter from the legal department of the Corporation of Norfolk County was issued to the homeowner.

One (1) complaint was received in relation to the Main Street Sewage Pumping Station (SPS). The homeowner noticed odours from the station. Operations staff checked the SPS's wet well for odours and pumped the wet well down to flush it out.

Section I: By-pass, Spill or Abnormal Discharge Events

There were no bypasses, overflows, spills or abnormal discharge events at the Delhi WWTF in 2022.

Section J: Copy of Notice of Modifications Submitted

There were no modifications to the process at the Delhi WWTF that required a Notice of Modification to Sewage Works in 2022.

Section K: Report Summarizing Modifications as a result of Schedule B, Section 3

There were no modifications to the process at the Delhi WWTF as a result of Schedule B, Section 3 in 2022.

Appendix A – Monitoring Data

Appendix B – Maintenance Schedule

Appendix C – Sludge Sampling Results