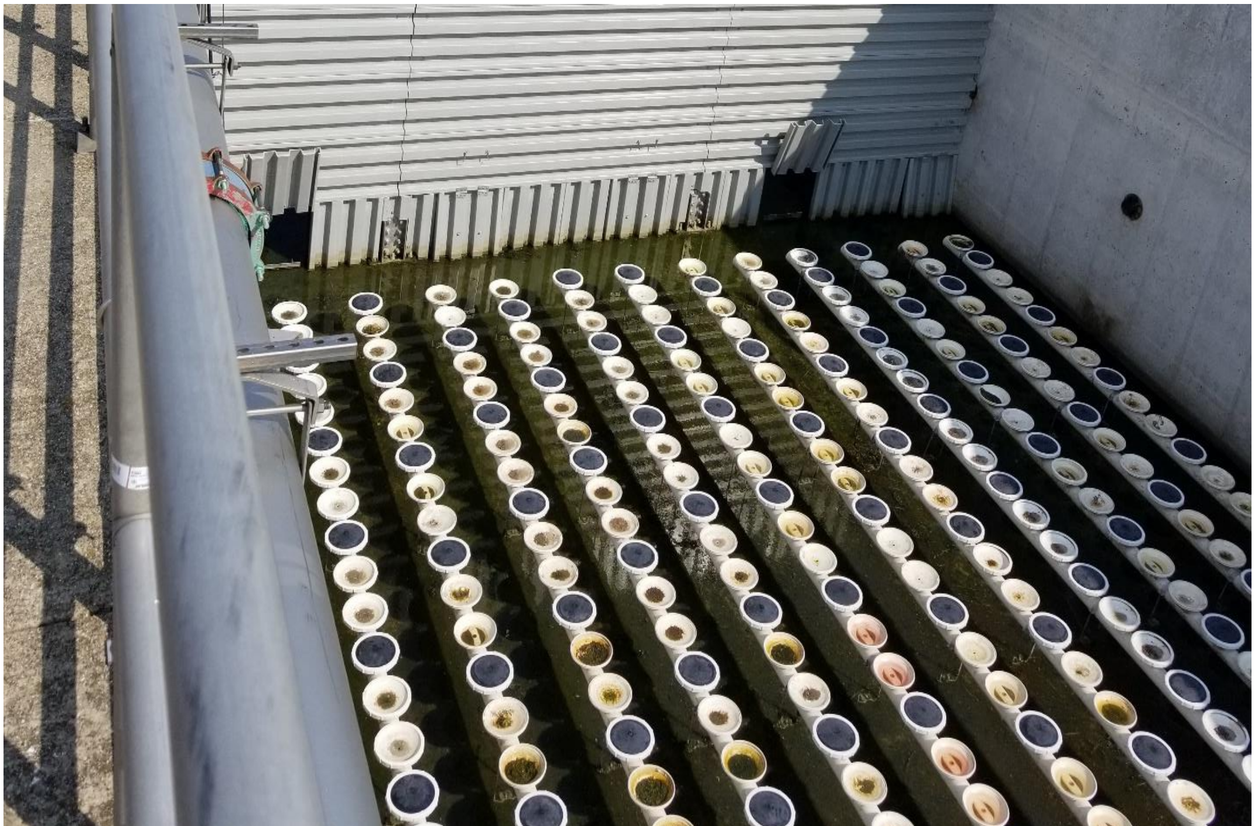

Water Reclamation Facility Phosphorus Feasibility Study

City of Rochelle, Illinois

July 2022

BAXTER & WOODMAN Consulting Engineers

City of Rochelle, Illinois
Water Reclamation Facility
Phosphorus Feasibility Study

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C WRF Operating & DMR Data

D Process Flow Diagram – Chemical Phosphorus Removal

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LIST OF ABBREVIATIONS

avg - average
BNR - biological nutrient removal
BOD - biochemical oxygen demand
BPR - biological phosphorus removal
CBOD - carbonaceous biochemical oxygen demand
COD - Chemical Oxygen Demand
CPR - Chemical Phosphorus Removal
CWA - Clean Water Act
DO - dissolved oxygen (O_2)
DMR - Discharge Monitoring Report
DRSCW - DuPage River Salt Creek Workgroup
EBPR - Enhanced Biological Phosphorus Removal
EOPC - engineer's opinion of probable cost
ffCOD - flocculated and filtered chemical oxygen demand
ft - feet
gcd - gallons per capita per day

gpd	-	gallons per day
gpm	-	gallons per minute
HRT	-	hydraulic retention time
IEPA	-	Illinois Environmental Protection Agency
IRSSW	-	Illinois Recommended Standards for Sewage Works
lbs.	-	pounds
max	-	maximum
MDF	-	maximum daily flow
MG	-	million gallons (or mil gal)
MGD	-	million gallons per day
mg/L	-	milligrams per liter (parts per million in dilute solutions)
min	-	minimum
MLSS	-	mixed liquor suspended solids
MLVSS	-	mixed liquor volatile suspended solids
NH_3-N	-	ammonia nitrogen
NO_2-N	-	nitrite (as nitrogen)
NO_3-N	-	nitrate (as nitrogen)
NPDES	-	National Pollutant Discharge Elimination System
O&M	-	operation and maintenance
ORP	-	oxidation reduction potential
P	-	phosphorus
PAO	-	Phosphorous Accumulating Organisms
PHB	-	polyhydroxybutyrate
$P0_4$	-	ortho-phosphate (soluble)
ppd	-	pounds per day
RAS	-	return activated sludge
rbCOD	-	readily biodegradable Chemical Oxygen Demand
SCADA	-	supervisory control and data acquisition
SNRP	-	soluble non-reactive phosphorus
SRT	-	solids retention time
STP	-	sewage treatment plant
SVI	-	sludge volume index
TKN	-	total Kjeldahl nitrogen
TMDL	-	Total Maximum Daily Load
TN	-	total nitrogen
TP	-	total phosphorous (particulate and soluble)
TSS	-	total suspended solids (or SS)
VFA	-	volatile fatty acid
VS	-	volatile solids
VSS	-	volatile suspended solids
WAS	-	waste activated sludge

LIST OF DEFINITIONS

Aerobic

A condition in which sufficient dissolved oxygen (and other forms of oxygen, such as NO_3-Oxygen (nitrate) or SO_4-Oxygen) is available for use by microorganisms.

Anaerobic

A condition in which dissolved oxygen or NO_3-Oxygen (nitrate) is not available for use by microorganisms.

Anoxic

A condition in which dissolved oxygen is not available and other forms of oxygen, such as NO_3-Oxygen or SO_4-Oxygen, are used by microorganisms.

Aerobic digestion

Microbial decomposition of wastewater sludge in the presence of oxygen.

Anaerobic digestion

Microbial decomposition of wastewater sludge in the absence of oxygen

Biochemical oxygen demand

Measurement of the oxygen utilized by microorganisms in the stabilization of the organic matter present in wastewater.

Denitrification

Anoxic conversion of nitrate to nitrate gas, which is removed from the wastewater.

Infiltration

Water other than wastewater that enters a sewage collection system (including sewer service connections) from the ground through such sources as defective pipes, pipe joints, connections, or manholes. Infiltration does not include, and is distinguished from, inflow.

Inflow

Water other than wastewater that enters a sewage collection system (including sewer service connections) from sources such as roof leaders, cellar drains, yard drains, area drains, foundation drains, drains from springs and swampy areas, manhole covers, cross connections between storm sewers and sanitary sewers, catch basins, cooling towers, storm water, surface runoff, street wash waters, or drainage. Inflow does not include, and is distinguished from, infiltration.

Nitrification

Aerobic conversion of ammonia to nitrate by microorganisms.

Phosphorous Accumulating Organisms (PAOs)

Specific microorganisms that utilize VFA's to release soluble phosphorus under anaerobic conditions and uptake soluble phosphorus under aerobic conditions.

Readily biodegradable chemical oxygen demand (rbCOD)

Portion of chemical oxygen demand that can be easily broken down in volatile fatty acids (VFA's) which support biological phosphorus removal.

Readily biodegradable chemical oxygen demand (ffCOD or ccCOD)

Soluble portion of chemical oxygen demand determined after filter sampling. The particulate portion remains on the filter. This soluble portion is quickly and easily assimilated by biomass for phosphorus removal.

Soluble Non-Reactive Phosphorus

Soluble portion of chemical oxygen demand determined after filter sampling. The particulate portion remains on the filter. This soluble portion is does not assimilate by biomass for phosphorus removal and essentially passes through the STP. This is portion is important when considering very low total phosphorus limits such as 0.1 mg/L.

Sludge

Concentrated organic solids produced during wastewater treatment (also termed "biosolids").

Suspended solids

Particulate matter suspended in wastewater.

Volatile fatty acids

Organic substances that select microorganisms (PAO's specifically) use to release phosphorus under anaerobic conditions. Also utilized in denitrification, thus can create competing demands.

Volatile suspended solids

That portion of the suspended solids that is destroyed at temperatures above 550°C and is an indicator of the organic fraction of the suspended solids.

1. PROJECT BACKGROUND & SCOPE

1.1 Study Purpose and Scope

The City of Rochelle operates the wastewater conveyance and Water Reclamation Facility (WRF) that provides service to the residents, industries, and businesses of the City of Rochelle, Village of Creston, and Village of Hillcrest.

The City of Rochelle WRF received a new Special Condition (Special Condition 19) on their renewed NPDES Permit No. IL0030741 with Effective Date September 1, 2019 and Expiration Date August 31, 2024.

Specifically, the NPDES Special Condition 19 reads as follows:

"SPECIAL CONDITION 19: The Permittee shall, within thirty-six (36) months of the effective date of this permit, prepare and submit to the Agency a feasibility study that identifies the method, timeframe, and costs of reducing phosphorus levels in its discharge to a level consistently meeting a future potential effluent limit of 1.0 mg/L, 0.5 mg/L and 0.1 mg/L. The study shall evaluate the construction and O&M costs of the application of these limits on a monthly, seasonal, and annual average basis."

A copy of the NPDES Permit is included in Appendix A.

The purpose of this study is to meet the NPDES requirements for the phosphorus feasibility study, specifically evaluating the following at the WRF:

1. Existing secondary treatment process performance and modifications to remove phosphorus levels in its discharge down to meet limits of 1.0 mg/L, 0.5 mg/L, and 0.1 mg/L.

2. Total capital and O&M cost of improvements to meet the limits on a monthly, seasonal, and annual basis.

3. The associated timeframe and increase in typical household sewer rates per modification and limit.

1.2 Study Methodology

The approach taken by this study is part of an overall methodology used to evaluate nutrient removal at wastewater reclamation facilities.

The first part of the approach is examining the performance of the City's existing biological nutrient removal (BNR) process for removing phosphorus, and establishing a biological model for predicting future performance of the system.

The second part is reviewing the cost and applicability of chemical phosphorus removal in conjunction with the City's BNR system. Chemical phosphorus removal involves using alum, ferric chloride, or other metal salt to react with soluble phosphorus, creating a precipitate that settles with the sludge and is removed with sludge wasting and disposal.

As a general study philosophy, utilizing the existing BNR is the preferred method for reducing phosphorus at the WRF. Whereas the capital cost and effectiveness associated with traditional chemical removal processes are more predictable, the benefits of the biological process over chemical are the lower O&M costs over time through reduced chemical consumption and a more sustainable process.

1.3 General Facility Information

The Water Reclamation Facility was constructed in the 1960s with numerous improvements since then. The most significant improvements were made in 1992 with the addition of an Anaerobic Lagoon for pretreatment of industrial waste and the addition of a single stage nitrification activated sludge process.

The WRF recently completed the construction of an improvements project, which was designed in 2017. It converted the activated sludge process to BNR and rehabilitated the anaerobic lagoon for industrial waste stabilization and pretreatment. A process flow diagram of the Rochelle WRF is shown as Appendix B.

The plant receives essentially two separate influent flow streams. Rochelle calls them "Domestic" and "System 1". The Domestic influent is primarily residential, commercial, and institutional wastewater. The System 1 influent is primarily industrial wastewater.

Upstream of the BNR System, the Domestic influent is treated separately from the System 1 influent. They both feed the BNR System.

The treatment process for the Domestic influent includes the following components: mechanically cleaned screens, grit removal, flow metering, flow equalization, and pumping (Domestic Pump Station). The Domestic Pump Station discharges to the BNR System (aeration tanks).

The treatment process for the System 1 influent includes a manually cleaned bar screen, raw sewage pumping, stabilization/pretreatment in a covered anaerobic lagoon, and pumping (Anaerobic Lagoon Effluent Pump Station). The majority of solids, fats, oils, and greases from System 1 remain in the anaerobic lagoon, while the effluent from the lagoon is rich in VFAs. The Anaerobic Lagoon Effluent Pump Station discharges to the BNR System (aeration tanks).

The BNR system includes aeration, final clarification, tertiary filtration, and disinfection prior to discharge into the Kyte River. The recent improvements to the aeration tanks included two new high speed single stage centrifugal blowers with air bearings ("Turbo" blowers), re-configuration of the fine bubble diffusers, submersible mixers, baffle walls to create separate Anaerobic, Anoxic, and Aerobic zones, internal Mixed Liquor Recycle Pumps, and DO and ORP probes for control.

The sludge handling process includes thickening of waste activated sludge (WAS) by gravity belt thickener and dewatering of thickened sludge by centrifuge. The dewatered sludge is hauled to a landfill. There is no sludge digestion process.

1.4 Current Regulations

The City of Rochelle WRF has a permitted Design Average Flow (DAF) of 4.87 million gallons per day (MGD) for the existing facility and a Design Maximum Flow (DMF) of 8.76 million gallons per day (MGD).

Table 1 shows the effluent limits for the existing treatment plant from the National Pollution Discharge Elimination System (NPDES) Permit for the City of Rochelle.

TABLE 1

NPDES Permit No. IL0030741 WRF Monitoring Frequency and Effluent Limits
Effective Date: September 1, 2019
Expiration Date: August 31, 2024

Parameter	Concentration Limits (mg/L)		
	Monthly Average	Weekly Average	Daily Maximum
$CBOD_5$	10		20
TSS	12		24
pH	Shall be in the range of 6 to 9 Standard Units		
Fecal Coliform	Daily Maximum < 400 units per 100 mL (May through October)		
Chlorine Residual			0.05
Ammonia Nitrogen			
April-May/Sept.-Oct	1.4	-	2.6
June – August	1.5	-	3.0
Nov. – Feb.	4.0	-	7.1
Total Phosphorus (as P)	Monitor Only		
Total Nitrogen	Monitor Only		
Dissolved Oxygen			
March - July	N/A	≥6.25	5.0
August - Feb.	≥6.0	≥4.5	4.0

2. EXISTING FLOWS, LOADINGS, AND PERFORMANCE

2.1 BNR System Influent Flows and Loadings

Wastewater flow data from Discharge Monitoring Reports (DMRs) and operational plant data were compiled for the period of January 2021 through May 2022 for BNR influent from the System 1 and Domestic treatment processes.

Table 2 shows the flows and pollutant concentrations of the domestic influent. The samples were collected at the Domestic Pump Station wet well.

Table 3 shows the flows and pollutant concentrations of the System 1 anaerobic lagoon effluent. The samples were collected at the Anaerobic Lagoon Effluent Pump Station.

The data is also tabulated in Appendix C.

TABLE 2

WRF Domestic Influent Monthly Average Flow and Pollutant Concentrations

Time	Flow MGD	TSS mg/L	BOD mg/L	Total Phosphorus, as P mg/L	Ammonia, as N mg/L
Jan -2021	1.59	74	99	6.7	15.72
Feb-2021	1.81	52	95	7.3	14.58
Mar-2021	2.87	46	93	24.0	8.39
Apr-2021	2.63	35	108	15.0	12.76
May-2021	2.17	42	111	18.0	17.24
June-2021	2.15	47	105	10.0	17.67
July-2021	2.05	43	87	11.0	13.13
Aug-2021	1.79	47	94	12.0	22.05
Sept-2021	1.36	33	117	18.0	25.11
Oct-2021	1.74	48	120	19.0	22.71
Nov-2021	1.90	64	102	20.0	18.50
Dec-2021	1.92	74	110	13.0	15.58
Jan-2022	1.79	70	163	14.6	17.35
Feb-2022	1.71	63	184	19.4	19.32
Mar-2022	2.14	68	192	15.4	14.48
Apr-2022	2.68	46	104	8.7	13.32
May-2022	2.44	44	107	6.2	13.10
Average	**2.04**	**53**	**117**	**14.0**	**16.5**
Max	2.87	74	192	24.0	25.1
Min	1.36	33	87	6.2	8.40

TABLE 3

WRF Anaerobic Lagoon Effluent Monthly Average Flow and Concentrations

Time	Flow	TSS	BOD	Total Phosphorus, as P	Ammonia, as N
	MGD	mg/L	mg/L	mg/L	mg/L
Jan -2021	0.68	92	605	15	27.60
Feb-2021	0.75	147	717	20	35.52
Mar-2021	0.81	96	594	24	30.21
Apr-2021	0.82	99	518	15	31.58
May-2021	0.76	91	561	18	40.41
June-2021	0.76	104	640	15	41.90
July-2021	0.82	102	552	14	35.54
Aug-2021	0.79	113	553	16	53.19
Sept-2021	0.60	124	492	14	47.73
Oct-2021	0.81	112	468	19	44.10
Nov-2021	0.74	92	425	13	33.19
Dec-2021	0.70	105	479	17	26.54
Jan-2022	0.66	121	538	19	16.92
Feb-2022	0.67	217	574	20	22.68
Mar-2022	0.85	218	486	19	18.26
Apr-2022	0.83	81	334	17	13.66
May-2022	0.99	87	312	21	16.81
Average	**0.77**	**118**	**550**	**17.4**	**31.52**
Max	0.99	218	717	24.0	53.19
Min	0.60	81	425	13.0	13.66

2.2 Existing Process Performance

2.2.1 A_2O Process Loadings

The influent wastewater at the City consists of both domestic and industrial sources. A majority of the industrial wastewater flows to the System 1 lift station and is pumped to the anaerobic lagoon, but there is some industrial wastewater in the domestic influent that flows to the City's headworks.

There are four Aeration "Bays". Each Bay consists of two aeration tanks.

Currently, two Bays are offline. The biological process occurs in the other two Bays, which are configured for BNR. A recent improvements project added baffle walls, mixers, a turbo blower, DO/ORP probes, mixed liquor recycle pumps, and modified air diffuser layouts, to form an A_2O process. The baffle walls create dedicated anaerobic, anoxic, and aerobic zones in the tanks, the DO/ORP probes and turbo blower provide control of aeration to each zone, mixers prevent mixed liquor from settling out in the anaerobic zone, and mixed liquor recycle pumps return nitrate/nitrite rich mixed liquor from the aerobic zone to the anoxic zone for denitrification.

Using only two Aeration Bays, the activated sludge system has a design loading of 23 ppd BOD per thousand cubic feet of tank volume (ppd/kcf) when considering the organic load from both domestic influent and anaerobic lagoon effluent, as delineated in the calculation below. This value is above the design loading of 15 ppd/kcf based on the Illinois Recommended Standards for Sewage Works (IRSSW) for single stage nitrification.

$$Design\ Aeration\ Tank\ Loading = \frac{10{,}283\ ppd\ BOD}{446.88\ kcf\ in\ Aeration\ Bays\ 1\ \&\ 2} = 23.0\frac{ppd}{kcf}$$

The actual average loading, from 2021 influent flows and pollutant concentrations, is lower than 23.0 ppd/kcf design loading, shown by the calculations below.

$$\left(2.0\ MGD * 550\frac{mgBOD}{L} * 8.34\right) + \left(0.75\ MGD * 103\frac{mgBOD}{L} * 8.34\right) = 5{,}158\ ppd\ BOD$$

$$Actual\ Aeration\ Tank\ Loading = \frac{5{,}158\ ppd\ BOD}{446.88\ kcf\ in\ Aeration\ Bays\ 1\ \&\ 2} = 11.5\frac{ppd}{kcf}$$

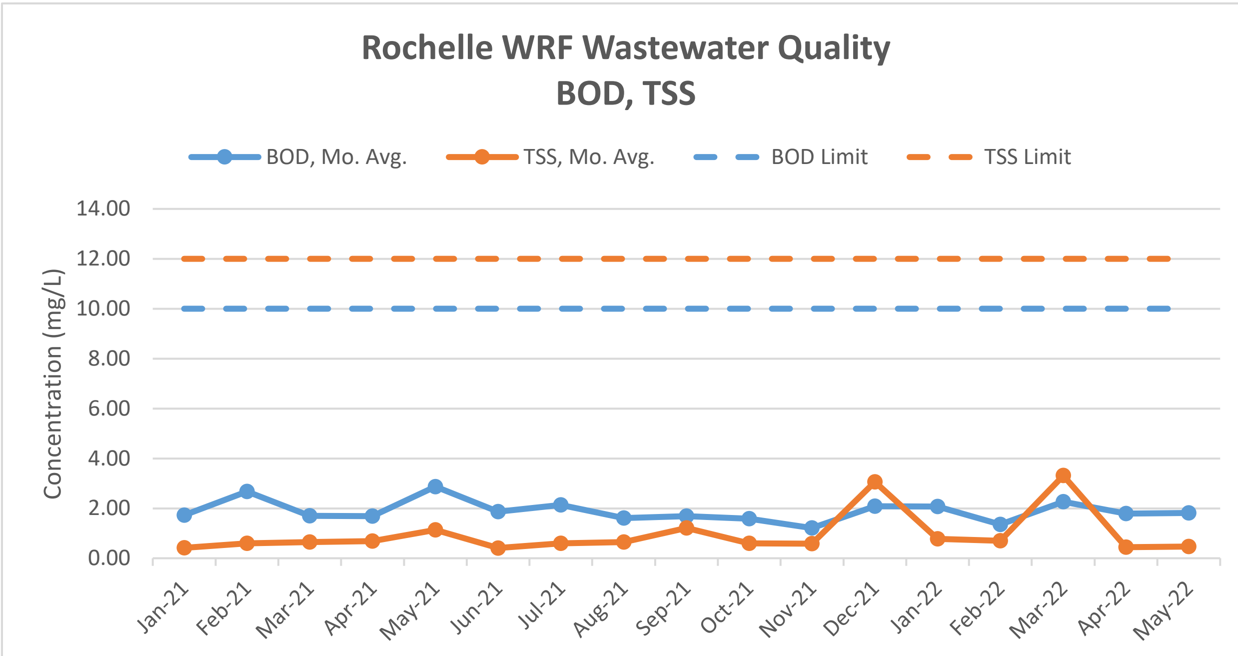
2.2.2 A_2O Process Performance

The WRF consistently meets the permitted effluent limits on TSS, BOD, and Ammonia. Figure 1, 0, and Figure 3 show the effluent quality for the period of January 2021 – May 2022. The reported WRF effluent quality is also tabulated in Appendix C.

Mixed liquor suspended solids (MLSS) concentrations for 2021 were between 3,000 mg/L and 4,000 mg/L, which is in the range of typical concentrations for activated sludge systems. The design sludge age is 14 days, which is also in the typical range for activated sludge systems operating BNR.

FIGURE 1

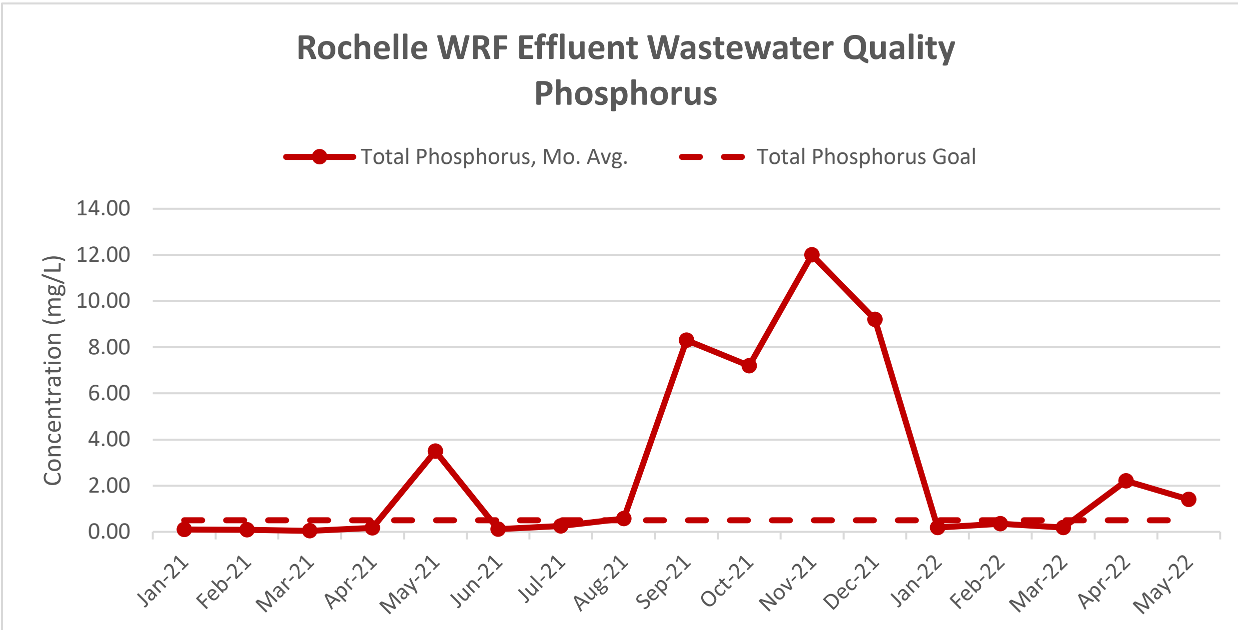
WRF Effluent Wastewater Quality (January 2021 – May 2022)



During normal BNR operation from January 2021 through April 2021, the average effluent Total Phosphorus concentration was 0.10 mg/L, with a minimum concentration of 0.04 mg/L reported in March 2021. At this time, the City's NPDES permit requires the monthly total phosphorus load to be monitored, but does not set a limit on the phosphorus load in the plant effluent. Special Condition 21 of the City's NPDES permit specifies that a maximum total phosphorus limit of 0.5 mg/L with biological phosphorus removal will apply in the future, and is shown as a goal for effluent concentrations in the figure below.

FIGURE 2

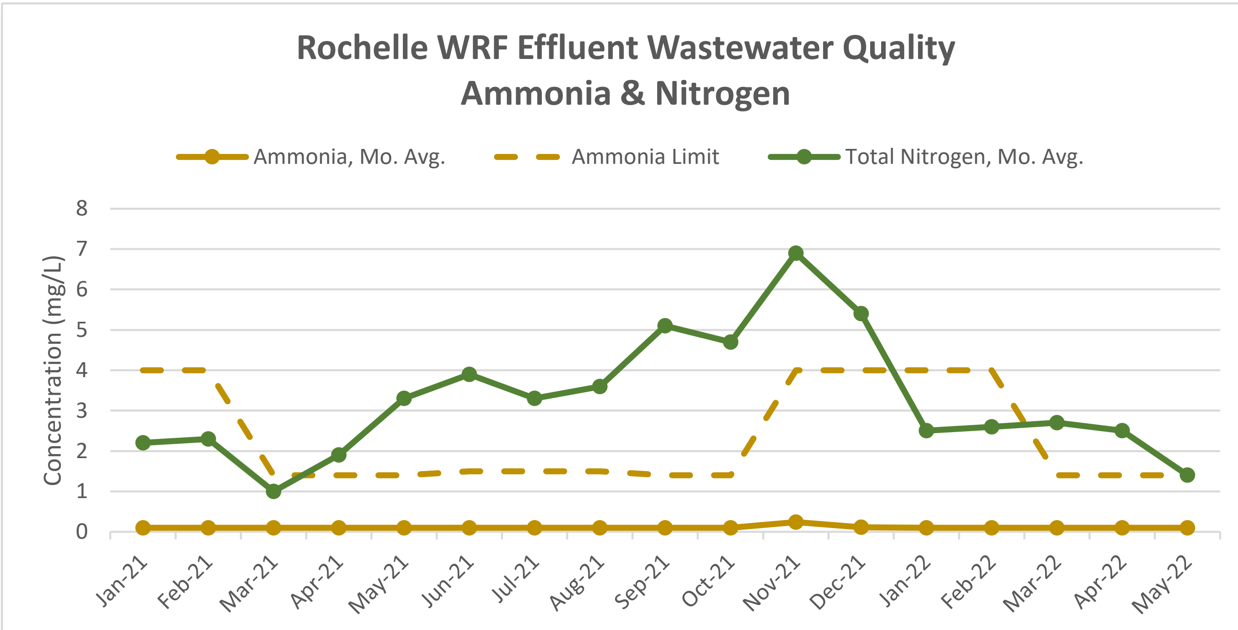
WRF Effluent Phosphorus Concentration (January 2021 – May 2022)



The WRF has demonstrated consistent compliance with seasonal ammonia limits. At this time, the City's NPDES permit requires the monthly total nitrogen load to be monitored, but does not set a limit on the nitrogen load in the plant effluent. For January 2021 through May 2022, the total nitrogen concentration in the effluent varies from 1 mg/L to 6.9 mg/L.

FIGURE 3

WRF Effluent Ammonia and Nitrogen Concentrations (January 2021 – May 2022)



2.2.3 A$_2$O Startup Challenges

The BNR system was started up on November 9, 2020. In short order, it demonstrated good phosphorus removal. Effluent phosphorus concentration was usually in the range of 0.1-0.2 mg/L (See Figure 2). However, performance started to deteriorate in May 2021.

In May 2021, the effluent TP jumped to 4.0+ mg/L. Some process changes were made to better protect the Anaerobic Zone to try to keep it anaerobic. Effluent TP then dropped again and stayed below 0.5 mg/L in June – August 2021.

However, the process deteriorated again near the end of August. There was an extended upset of the phosphorus removal process from September 2021 through May 2022. The prolonged upset began to significantly increase the effluent phosphorus concentrations. The effluent total phosphorus concentration was 8.3 mg/L in September 2021, which is nearly 14-times greater than the August 2021 effluent phosphorus concentration.

<u>Filaments (Thiothrix)</u>

Ultimately, it was determined that there was a proliferation of filamentous organisms, primarily Thiothrix II and, to a lesser degree, Thiothrix I. This was due to the conditions in the Anaerobic Zone - it was not truly anaerobic.

In May 2021, Phosphorus removal essentially stopped and settling in the secondary clarifiers became very poor. Key parameters were:

Effluent P	4± mg/L
SVI	400
Anaerobic Zone ORP	-100 to 0
Anoxic Zone ORP	>0
Aeration Tank Water Level	Too High

Thiothrix does not survive well in anaerobic conditions. An anaerobic selector has often been used to control the Thiotrix population. Therefore, the Anaerobic Zone of Rochelle's BNR process should have kept Thiothrix from proliferating. However, it did not. This was an indication that the conditions in the Anaerobic Zone were not truly anaerobic. The Anaerobic Zone ORP needed to be much lower than its -100 to 0 range.

An investigation was started. The investigation went from May to November, 2021. The following are the results of that investigation.

<u>Corrected Hydraulics</u>
The Mixed Liquor Recycle Pumps raised the water level in the Anoxic Zone too high. This in turn raised the water level in the Anaerobic Zone and Influent Channel. This caused two major problems.

First, a portion of the raw sewage and RAS was flowing from the aeration tank influent channel to the effluent channel. The two channels are side-by-side on the south side of the aeration tanks. They are separated by a common wall. Each contain a channel aeration system. The air supply pipe passes through the common wall at several locations. A combination of raw sewage and RAS was flowing through the annular space between the pipe and the edge of the hole in the concrete wall.

Normally, the air pipe holes are safely above the water line. However, when the Mixed Liquor Recycle Pumps ran, it caused the water level to rise above the invert of those holes. A portion of the raw sewage and RAS then started to flow directly into the effluent channel. Since a portion of the raw sewage bypassed the aeration tanks, plant effluent quality suffered.

Second, a portion of the Mixed Liquor Recycle was flowing backward from the Anoxic Zone into the Anaerobic Zone. That Mixed Liquor Recycle was rich in nitrates, nitrites, and D.O., which provided oxygen to the anaerobic zone, preventing the creation of truly anaerobic conditions. Without anaerobic conditions, phosphorus was not released in the anaerobic zone and there was no luxury uptake of phosphorus in the aerobic zone.

Each Mixed Liquor Recycle Pump is in the Aerobic Zone and pumps into the upstream end of the Anoxic Zone. There is a 90° elbow on the Mixed Liquor Recycle Pump discharge. The elbow was pointing up (vertical). This caused the water level to rise in the corner of the Anoxic Zone, immediately above the discharge elbow.

In that corner, the water level was higher than the water level in the Anaerobic Zone. Consequently, the flow went backward from there, over the adjacent weirs, and into the Anaerobic Zone. This supplied the Anaerobic Zone with nitrate (NO_3) and D.O., which prevented the zone from going truly anaerobic.

There are 8 weir openings in the baffle wall between the Anaerobic Zone and Anoxic Zone. Flow was going backward through the 2 weirs that were closest to the Mixed Liquor Recycle Pump Discharge (due to the localized upwelling of the recycled mixed liquor). Over the other 6 weirs, the mixed liquor continued to flow correctly from the Anaerobic Zone to the Anoxic Zone.

Three actions were taken to correct these hydraulic problems. First, the weirs were widened on the baffle wall between the Anoxic Zone and Aerobic Zone. The original weirs were sized for only the forward flow. The Mixed Liquor Recycle flow of 7,900 gpm (11 mgd) had not been taken into account. As a result, the weirs were too narrow, which caused the Anoxic Zone water level to rise too high when the Mixed Liquor Recycle Pumps ran. Widening the weirs brought the water level down to where it should have been.

The second action was to re-aim the 90° elbow on the Mixed Liquor Recycle Pump discharge. The elbow was rotated 22.5° (one flange bolt hole). This reduced the impact of the upwelling. However, it did not reduce it enough. The upwelling is still causing some backward flow from the Anoxic Zone into the Anaerobic Zone. Rochelle plans on further rotating the 90° elbow or making other modifications to the Mixed Liquor Recycle Pump discharge to eliminate this problem.

The third action was to install Variable Frequency Drives (VFDs) on the Mixed Liquor Recycle Pumps. The VFDs allowed Rochelle to reduce the Mixed Liquor Recycle Pumping rate. At full speed, the recycle rate was 600%:

Current Forward Flow	3.8 mgd
Two Aeration Bays in Service	÷ 2 Bays
Fwd Flow (per Bay)	1.9 mgd/bay
MLRP = 7,900 gpm =	11.4 mgd
Fwd Flow (per Bay)	1.9 mgd/bay
Recycle Rate	600%

A lower pumping rate reduced the upwelling effect and lowered the water level in the Anoxic Zone.

Too much Oxygen in Mixed Liquor Recycle

The Mixed Liquor Recycle contained too much dissolved oxygen (D.O.), which was negatively affecting the Anoxic Zone, and because of the backward flow, also the Anaerobic Zone.

To reduce the D.O. in the Mixed Liquor Recycle, the diffusers were blanked-off within a 10 ft radius of the Mixed Liquor Recycle Pumps.

Other Sources of Oxygen

By November 2021, the hydraulic problems and Mixed Liquor Recycle D.O. had been addressed. However, the Anaerobic Zone was still not going truly anaerobic. Rochelle started looking for other sources of oxygen.

Channel Aeration: It was unlikely that the channel aeration was adding a significant amount of oxygen. It uses coarse bubble diffusers, and there is only a few feet of water depth above the diffusers. Both of which make the oxygen transfer efficiency extremely low. Therefore, not much oxygen was added by the channel aeration system. Nonetheless, the channel aeration was stopped.

RAS: RAS was tested to determine if it had a significant D.O. or nitrate concentrations. It did not. It was not necessary to increase the sludge blanket depth in the secondary clarifiers to force denitrification.

Flow Equalization: There is a flow equalization tank (FEQ Tank) on the "Domestic" system upstream of the aeration tanks. The FEQ Tank is aerated. It was found to significantly increase the D.O.

Rochelle bypassed the FEQ Tank. The D.O. in the Domestic influent dropped from 5.0 to 1.0 mg/L.

Industrial Interference

On November 15, 2021, the last of the remedial measures were completed. Performance gradually improved, SVIs trended downward. Effluent Phosphorus was also coming down. However, performance was not improving as much and as fast as it should have. Rochelle dug deeper into the data.

The data revealed that the ORP in the Anaerobic Zone spiked every day, seven days per week. At noon each day, the ORP jumped precipitously from around -400 to about -150.

At first, Rochelle suspected that the ORP spike was caused by some process in the WRF that was on a timer. Because the ORP spike was occurring 7 days per week, it seemed unlikely that it was an external source. However, all of the internal processes were systematically eliminated.

It was theorized that industrial wastewater from the anaerobic lagoon might contain a large load of nutrients or substances toxic to the biology in the anaerobic zone, interfering with the biological phosphorus removal. To test this theory, the anaerobic lagoon effluent pumps were shutdown for a 24-hour period. The intensity and frequency of ORP spikes were not affected during the 24 hour period when no anaerobic lagoon effluent was pumped to the aeration tanks.

Rochelle then installed a portable ORP probe upstream of the Anaerobic Zone. They found the daily ORP spikes were in the domestic influent flow upstream of the point where it combined with the RAS.

Another theory was that the Anaerobic Zone Mixer might be causing the contents of the Anaerobic Zone to mix with the Anoxic Zone. The nitrates/nitrites in the Anoxic Zone could be spiking the ORP. However, Rochelle compared the trend of mixer on/off cycles with the ORP spikes over time. No correlation was found between anaerobic zone mixing and ORP spikes.

Another theory was that the Waste Sludge and Recycle Streams might be impacting Anaerobic Zone and causing the ORP Spikes. Wasting could reduce the amount of RAS being returned to the aeration tanks. Additionally, filtrate and centrate from thickening and dewatering could provide a slug load of nutrients. Rochelle compared the trend of sludge wasting, thickening, and dewatering with the ORP spikes over time. The ORP spikes occurred consistently every day of the week, while wasting, thickening, and dewatering did not. Therefore, the City concluded that sludge wasting was not related to ORP spikes.

At the end of January 2022, Rochelle noticed that the flows from the Pump Station 38 West tracked closely with the ORP spikes. Rochelle started searching the collection system tributary to Pump Station 38 West and found the source of wastewater that was causing the daily ORP spikes. It was a large greenhouse that grows tomatoes.

The greenhouse has an internal wastewater recycle system and thus, it was not supposed to have any significant wastewater discharge. However, in July 2021, a viral infection hit the greenhouse. The internal recycle system had to be shutdown so that it would not constantly re-feed the virus. Instead, the greenhouse had to discharge all of its wastewater to the sewer system: about 60,000 gpd with 330 mg/l nitrates. The first shift operator dumped the 60,000 gals at almost the exact same time every day. As a result, that load hit the Anaerobic Zone at the WRF about noon every day. Of course, the greenhouse did not notify RMU.

The high nitrate load spiked the Anaerobic Zone ORP. The nitrate was partly used in the anaerobic zone and partly in the anoxic zone, and because there likely was not enough carbon to go with all that nitrate nor time to make all that denitrification happen, the remaining nitrate passed through the aerobic zone and out in the effluent.

With all that nitrate, the Anaerobic Zone was no longer truly anaerobic. There was no phosphorus release and no subsequent luxury phosphorus uptake. Phosphorus removal was overwhelmed, at least for a good portion of the day.

The Pump Station 38 West force main discharges directly into the "Domestic" system in the WRF. On February 7, 2021, Rochelle began diverting that force main to a holding pond. The daily spike in the Anaerobic Zone ORP stopped immediately, confirming that the greenhouse's wastewater contribution interfered with phosphorus removal.

Since then, the 38 West force main has been permanently diverted to the Anaerobic Lagoon influent manhole. Rochelle has been testing the Anaerobic Lagoon Effluent. It contains no nitrates. None of the greenhouse's nitrate is making it through the Anaerobic Lagoon. Ammonia remains at about 18 mg/L and Total Phosphorus remains at about 20 mg/L. VFAs continue to average about 200 mg/L.

Performance began to improve as the BNR system re-adjusted. Phosphorus is still not down to the initial levels of 0.1-0.2 mg/L. However, it is expected to eventually return to that level of performance without any more industrial interferences.

Redirecting the greenhouse wastewater improved the City's BNR process in two ways:

- A slug load of phosphorus was not being pumped to the process. Although the City's BNR had previously demonstrated good phosphorus removal to levels below 0.1 mg/L, the BNR system performance was hurt by the slug loads of nutrients.
- A source of oxygen in the form of nitrates/nitrites from the industry wastewater was no longer causing the ORP measured in the anaerobic zone to spike from -400 to -100 mV, which is insufficiently anaerobic to get a phosphorus release.

After redirecting the greenhouse's wastewater flow, the BNR process began demonstrating good phosphorus removal, and the effluent total phosphorus concentrations decreased to below 0.5 mg/L for January through March 2022. The ORP levels in the anaerobic zone stayed consistently low enough to release phosphorus in the anaerobic zone and have luxury phosphorus uptake occur in the aerobic zone to reduce the total phosphorus in the plant effluent.

Beginning in April 2022, effluent phosphorus concentrations began to rise again and the anaerobic zone ORP rose from -400 mV to -300 mV. The City began investigating industrial sources and discovered that a local distillery was sending fermented corn mash into the sewer. The City instructed the distillery to haul the fermented corn mash to a landfill instead of sending to the sewer, and the City is currently waiting to see if the BNR system recovers from this adjustment.

2.2.4 Biosolids Sidestreams

Filtrate from the sludge thickening process and centrate from the sludge dewatering process are common pathways for nutrient recycles to the head of the treatment process. Although biosolid sidestream loads can have an impact on BNR, it is not likely that biosolid sidestreams contribute a significant source of phosphorus to the head of the WRF. There is no digestion of the sludge at the WRF where the destruction of organisms would typically release phosphorus into solution.

Furthermore, biosolids sidestream nutrient contributions are included in the collected domestic influent samples and represented in stream entering the BNR process. Even with the contribution of the biosolids sidestream, the WRF is still able to demonstrate sufficient removal of phosphorus.

2.3 Current Loadings and Operation Summary

In summary, the current operation of the WRF:

- Has lower flows and loadings than design;
- Meets the required permit limits consistently;

- Operates with high MLSS concentration to buffer toxic industrial wastewater and high flow events.
- Appears to have very little impact from recycle streams on phosphorus removal.
- Has demonstrated phosphorus removal to levels below 0.1 mg/L in the WRF effluent.
- Experienced a period of process upset that disrupted phosphorus removal. The following adjustments and improvements were implemented/tested:
    - Widened weirs on Baffle Wall between Anoxic and Aerobic Zones
    - Rotated Mixed Liquor Recycle Pumps discharge elbow by 22.5°
    - Installed VFDs on the Mixed Liquor Recycle Pumps
    - Blanked-off diffusers within a 10-ft radius of the Mixed Liquor Recycle Pumps
    - Temporarily bypassed the Domestic System FEQ Tank
    - Momentarily turned off anaerobic lagoon effluent pumping
    - Temporarily turned down Influent Channel aeration
    - Did not find correlation of ORP spikes with anaerobic zone mixing or sludge wasting
- Confirmed process upset and ORP spikes in the anaerobic zone were caused by wastewater flow from a greenhouse.
    - Permanently redirected Pump Station 38 West to the Anaerobic Lagoon, thereby providing pretreatment of the greenhouse wastewater flow. This resolved the process upset, and the BNR system immediately began to recover.

3. EBPR REMOVAL

3.1 EBPR Description

EBPR is a three-step process of phosphorus release and uptake:

1. The first step occurs under anaerobic conditions in the presence of soluble phosphorus and readily biodegradable substrates, or specifically readily biodegradable COD (rbCOD). Under zero oxygen conditions (including no nitrates), phosphorus accumulating organisms (PAOs) utilize volatile fatty acids (VFAs) as a carbon source (rbCOD). The PAOs are in "famine or stressed" conditions, where they hydrolyze rbCOD and store carbon as poly-β-hydroxybutyrate (PHB). This action results in the release of phosphorus and energy.

   In a properly operating anaerobic zone with sufficient VFAs (rbCOD), soluble phosphorus release is significant, yielding soluble phosphorus concentrations as high as 10-30 mg/L.

   Without the VFAs, these organisms are unable to release phosphorus. Other activated sludge organisms are not as sensitive to this effect as PAOs because of longer solids residence times and more robust capacity to solubilize slowly biodegradable substrates. However, solubilizing the slowly biodegradable substrates takes more time than the typical aeration system hydraulic retention time (HRT) allows.

   Additionally, denitrification microorganisms can out-compete PAOs for VFAs if conditions are not anaerobic enough.

2. The second step occurs in the presence of oxygen and the released soluble phosphorus. Once subjected to aerobic conditions, the phosphorus-removing bacteria effectively undergo "feast" conditions, which causes them to oxidize their stored PHB and consume the soluble phosphorus. The VFAs produced during the anaerobic phase are now depleted and those same PAOs more or less reverse function and start "uptaking" soluble phosphorus for cellular function and cell growth. Both due to new PAO cell growth and because the PAO's biomass has been in low food "stressed state" in the anaerobic zones, they absorb higher concentrations of soluble phosphorus than normal (luxury uptake). This can reduce soluble biodegradable phosphorus to low levels.

3. The third step is removal of the accumulated phosphorus within the PAO biomass via waste activated sludge (WAS). The wasting, stabilization, and disposal of sludge is ultimately what removes phosphorus from a WRF. However, care is required to avoid releasing phosphorus back into the WRF (called secondary release) via biosolids stabilization and/or recycle streams.

In short, the successful EBPR is about managing the carbon resources (COD and VFAs) in the WRF. Summarizing, the major factors driving EBPR at a WRF are:

- Amount of VFAs.
- Proper anaerobic conditions without oxygen and nitrates.
- Avoiding secondary phosphorus release from the biosolids removal recycle streams.

3.2 Wastewater Constituents

The City of Rochelle's wastewater, particularly the anaerobic lagoon effluent, is rich with VFAs needed to promote phosphorus release in the anaerobic zone and subsequent luxury uptake in the aerobic zone. In 2021, the average Anaerobic Lagoon Effluent VFA concentration, detected as acetic acid, was 212 mg/L. This provides a good source of carbon that is consistently available to the process. Table 4 below shows the measured VFA content of the Anaerobic Lagoon Effluent that is pumped to the anaerobic zone for 2021.

TABLE 4

Anaerobic Lagoon Effluent Monthly Volatile Fatty Acid (VFA) Concentrations

Month	VFA (acetic acid) mg/L
Jan -2021	167
Feb-2021	181
Mar-2021	283
Apr-2021	230
May-2021	164
June-2021	254
July-2021	214
Aug-2021	225
Sept-2021	185
Oct-2021	248
Nov-2021	199
Dec-2021	199
Average	**212**
Max	283
Min	164

Having a consistent source of VFAs for PAOs in the anaerobic zone is one reason the City has been able to demonstrate good phosphorus removal from the treatment process. Typically, municipalities struggle with starting-up and operating BPR because of deficient rbCOD and VFAs in the influent wastewater.

The next section discusses the biological models that were set up to simulate the City's good BPR performance and to predict performance for future process improvements.

4. FACILITY BIOLOGICAL MODEL

Utilizing wastewater sampling results, a baseline biological model was developed and calibrated against known operating conditions and effluent performance. Once the baseline model was calibrated to a reasonable level, a model was developed to simulate system phosphorus removal performance with planned improvements currently in the design phase. These planned improvements include the conversion of Aeration Bays 3 & 4 into BNR. Aeration Bays 1 & 2 were converted to BNR in the WRF Improvements project that was designed in 2017 and constructed 2019-2020.

A reasonable level of model calibration is that a majority of the predicted process variables are close to the actual measured process variables. Exact approximations are very difficult to achieve, requiring considerably longer periods of variable sampling. Such an effort is not provided for nor required for this level of study.

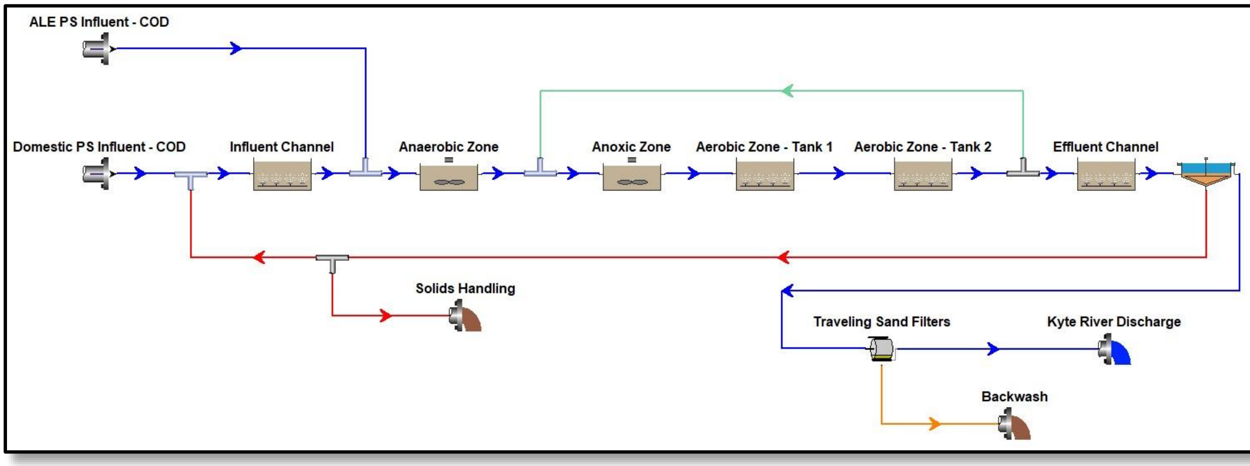
4.1 Summary of Model Development

The WRF processes modeled for the City included the following main components:

- Domestic Pump Station (PS) Influent
- Anaerobic Lagoon (ALE) PS Effluent
- Activated Sludge Aeration System (A_2O Process)
- Mixed Liquor Recycle
- Secondary Clarifiers
- Sand Filters
- Return Activated Sludge (RAS)
- Waste Activated Sludge (WAS)

FIGURE 4

BioWin™ Baseline Model



The headworks (perforated plate fine screen and grit removal), and effluent disinfection (peracetic acid dosing and contact tank) are not included in the model as they typically have little impact on phosphorus removal.

As how in Figure 4, the "Domestic PS Influent" and the "ALE PS Influent" specify the influent parameters from the City's domestic influent sewer and pretreated industrial flows, respectively, based on average values from Discharge Monitoring Reports, WRF operational plant data, and analyses performed by third-party laboratories.

The activated sludge system is divided into four reactor tanks consistent with volumes designed in the 2017 WRF Improvements project to run an A_2O process. This allows for a more accurate representation of the process control of each zone instead of a completely mixed tank.

Performance of the Secondary Clarifiers is represented with input of physical tank dimensions and sludge blanket height as provided by testing and by adjustments to the solids capture efficiency and sludge removal flow rate.

Solids Handling and Filter Backwash are shown as waste streams that do not return to the head of the process for simplicity. The samples collected for testing the Domestic PS Influent were taken at a point in the treatment process where return flows from thickening filtrate, dewatering centrate, filter backwash, and other building drains are already incorporated with the raw influent flow.

4.1.1 Influent Data

The City provided operational data for the WRF from January 2021 through December 2021 and sent out monthly composite samples to a third-party laboratory for testing. This additional data included:

- Domestic Influent, Anaerobic Lagoon Effluent, and WRF Effluent composite samples for: Total Nitrogen, Nitrate/Nitrite-N, Total Phosphorus, Total Kjeldahl Nitrogen.
- Anaerobic Lagoon Effluent VFA concentration.

4.2 Calibration

The baseline model results were compared to operating plant data provided such as MLSS, DO, and effluent quality parameters. Based on the plant's reported solids inventory for the study period, the Solids Retention Time (SRT) was calculated to be about 20 days, which is reasonable for WRFs operating BNR. Table 5 shows the model results as compared to the WRF actual data.

TABLE 5

Baseline Model Calibration Results

Parameter	Units	WRF Actual Data			Baseline Model	
		Influent	Mixed Liquor	Plant Effluent	Mixed Liquor	Plant Effluent
Flow	MGD	2.5	-	2.5	-	2.5
Total COD	mg/L	366	-	56.8	-	33.63
Total CBOD	mg/L	103.3	-	2.03	-	1.18
TSS	mg/L TSS	50.40	3,344	0.9	2,330	0.9
Ammonia	mg/L NH_3-N	16.95	-	0.1	-	0.13
Filtered TKN	mg/L TN	20.4	-	-	-	1.43
Total Phosphorus	mg/L TP	14.5	-	0.1	-	0.29

4.3 Baseline Modeling Results

Although the baseline model reasonably matched the effluent quality concentrations, there are a few concerns with the reliability of the model:

1. **Industrial Wastewater:** The City of Rochelle has a large industrial presence that contributes wastewater flow, primarily to the City's System 1 anaerobic lagoon, and to a much lesser extent, the domestic influent. Where data for influent parameters required by the biological model was unavailable, typical values were used that are consistent with domestic wastewater. The influent parameters were then adjusted to match actual WRF performance. To achieve reasonable calibration, none of the parameters needed to be adjusted significantly enough outside the range of typical wastewater characteristics to require further investigation into the wastewater sources.

   While the model was able to achieve reasonable calibration, there is some uncertainty in the characteristics and frequency of the industrial wastewater the City receives. Additionally, as more industries contribute wastewater to the WRF or change their manufacturing practices, influent parameters are likely to change or become unpredictable.

2. **Microbiology Speciation:** BioWin constructs models assuming the presence of common but specific species of microbiology. Properly modeling the reactions due to unique species and conditions could be complex and would require additional sampling to determine the speciation of biology present in the wastewater. Analyzing samples to identify the wastewater speciation is not likely to have a significant impact on the analysis done for this study and would require additional time and effort. Furthermore, BioWin is not as reliable at modeling biology for biological phosphorus removal is it is for modeling biological nitrogen removal.

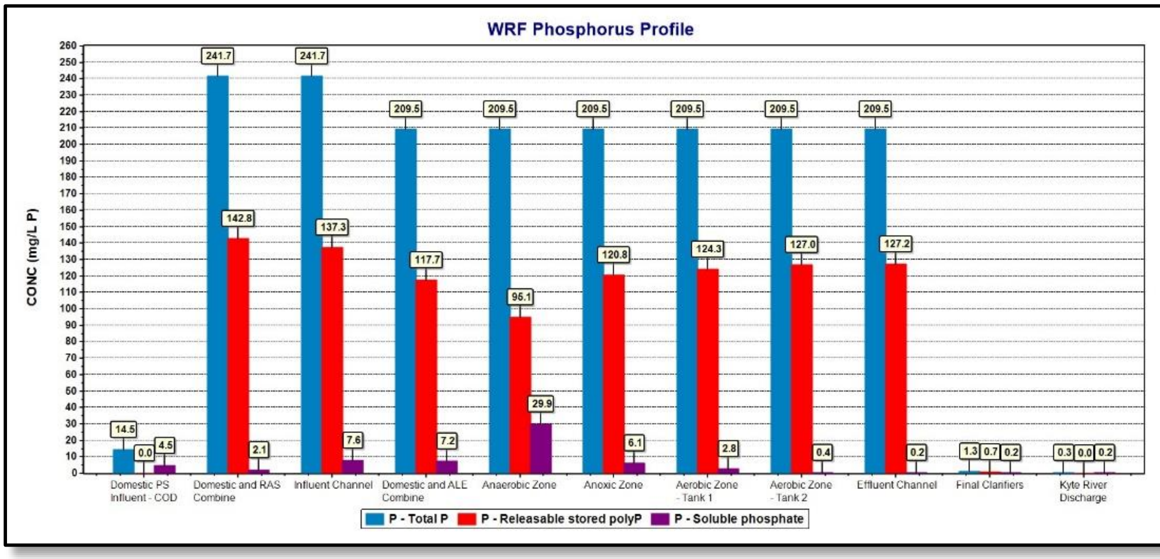
3. **Steady State Conditions:** The biological model, while a useful tool for understanding the City's treatment process and operating conditions, assumes steady state conditions. The City sees varying flows and adjusts many parameters to optimize the treatment process. Consequently, the results of the model are not always indicative of actual treatment process performance, especially during high flow events and process upsets.

4.3.1 Baseline Phosphorus Removal

The baseline model predicted phosphorus removal to an effluent TP concentration of 0.29 mg/L. The model also supported the activity of the WRF's BPR process in each zone of the aeration tank, as shown in Figure 5. The modeled PAOs successfully release phosphorus, as seen by the increase in "P-Soluble phosphate" from 7.2 mg/L at the Domestic and ALE Combine point to 29.9 mg/L in the Anaerobic Zone. Downstream, luxury uptake of phosphorus by the PAOs is apparent because of the decrease in soluble phosphate from 29.9 mg/L in the anaerobic zone to 0.4 mg/l in the Aerobic Zone – Tank 2. The total phosphorus significantly decreases at the Final Clarifiers as PAOs storing phosphorus settle with the sludge and are wasted or returned to the head of the BNR process.

FIGURE 5

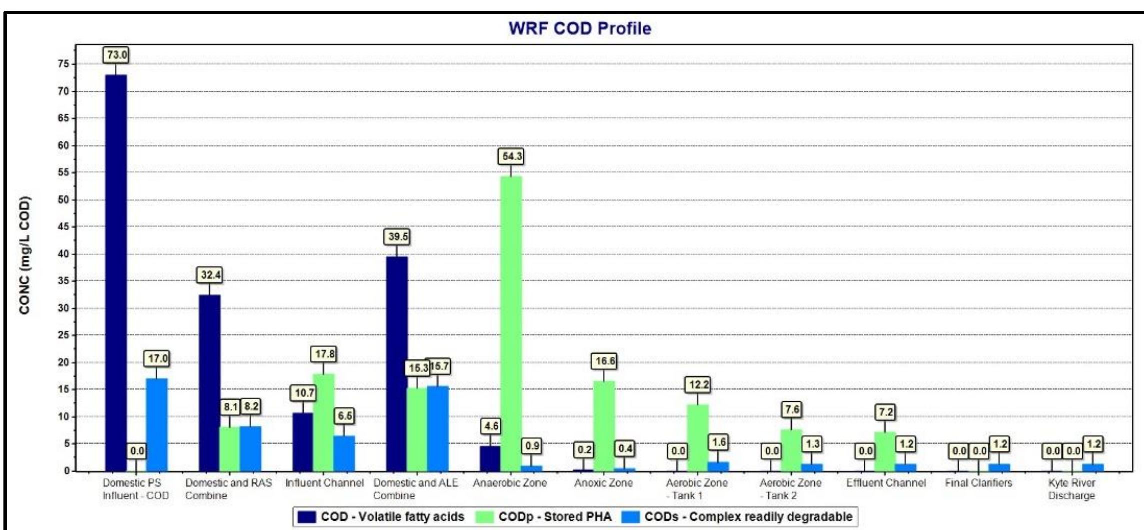
Baseline BioWin Model WRF Phosphorus Profile



The model also shows a COD profile across each zone consistent with successful BPR, as shown in Figure 6. There is a spike of stored PHA in the anaerobic zone as PAOs uptake the available VFAs in anaerobic conditions. In the following zones, the stored PHA levels decrease as PAOs oxidize the PHA to uptake phosphorus in the presence of oxygen.

FIGURE 6

Baseline BioWin Model COD Profile



Although BioWin™ has modeled successful biological phosphorus removal, the City has demonstrated the ability to remove more phosphorus than predicted by the baseline model. From the period of January 2021 through April 2021, the average effluent TP concentration was 0.10 mg/L, with the minimum monthly average reported concentration being 0.04 mg/L.

For the period of January 2021 through August 2021, before the greenhouse wastewater really started to interfere with the BNR process, the average effluent TP concentration was 0.60 mg/L. This 0.60 mg/L average includes a process upset in May 2021. Excluding the outlier data from the May process upset, the average effluent TP concentration of the normally operating system is 0.19 mg/L. Total phosphorus effluent concentrations are expected to return or even decrease further below 0.19 mg/L as the City fine-tunes the treatment process and recovers from the process upset.

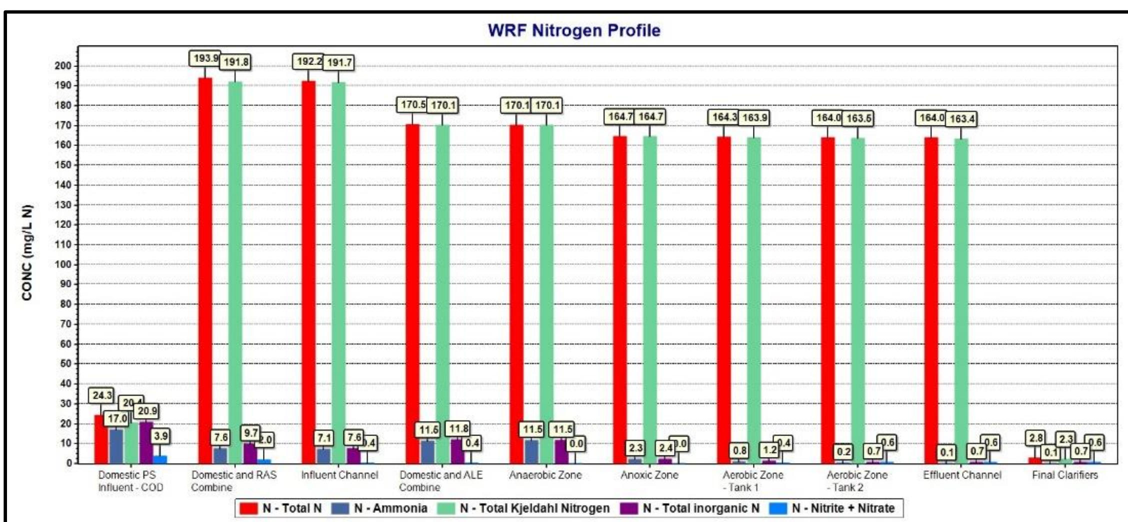
BioWin™ is not as accurate at modeling phosphorus removal as it is at modeling nitrogen removal. Therefore, it is reasonable to assume that the City is capable of removing phosphorus to concentrations of 0.50 mg/L or lower, excluding periods of process upsets or drastic changes to influent wastewater strength or characteristics.

4.3.2 Baseline Nitrogen Removal

The baseline biological model predicted removal of Total Nitrogen to an effluent concentration of 2.8 mg/L as shown in Figure 7.

FIGURE 7

Baseline BioWin Model WRF Nitrogen Profile



The average effluent TN concentration recorded from January 2021 through May 2022 was 3.3 mg/L, slightly higher than the modeled performance. Non-steady state conditions and receiving slug loads of nitrogen from industries could be cause for the slightly higher effluent TN concentration.

Regardless, the WRF has demonstrated good nitrogen removal while also removing phosphorus, confirming there is a sufficient amount of carbon for both phosphorus removal and denitrification.

4.4 Baseline Modeling Summary

The baseline biological model constructed for the City of Rochelle is considered a useful tool in studying phosphorus removal and confirms the City's existing total phosphorus and total nitrogen removal performance.

- BioWin model was developed and calibrated to match existing performance
    - Industrial contribution increases uncertainty of influent wastewater characteristics
    - The model works with steady state conditions based on averaged data
- Phosphorus and COD-PHAs profiles the model generated for the treatment process are consistent with biological phosphorus removal
    - Soluble phosphorus increases to 29.9 mg/L in the anaerobic zone and decreases to 0.4 mg/L in the aerobic zone
    - Stored PHA increases in the anaerobic zone microorganisms as they release phosphorus, and decreases in the aerobic zone as the PHA is oxidized for the luxury uptake of soluble phosphorus.
- Baseline model effluent total phosphorus concentration: 0.29 mg/L
- Baseline model effluent total nitrogen concentration: 2.8 mg/L

The modeling results and operating data are used in the next section to evaluate methods, timeframe, and costs of reducing total phosphorus concentrations to meet potential future effluent limits of 1.0 mg/L, 0.5 mg/L, and 0.1 mg/L.

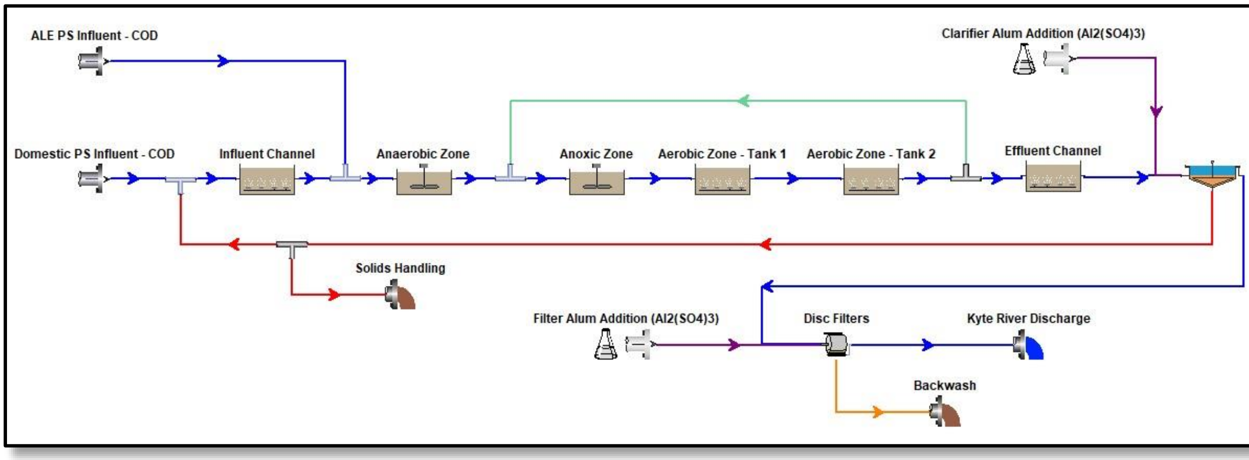
4.5 Future Conditions Model

The biological model for future conditions modeled the City's BNR process with several changes to the baseline model as shown in Figure 8:

- Increased volumes of anaerobic, anoxic, and aerobic zones to model three aeration bays in operation. Currently, only two of the four existing aeration bays have been converted to BNR. Conversion of Aeration Bays 3 & 4 to BNR is being designed.
- Disc Filters replaced Sand Filters to model the cloth media filters in design.
- Chemical addition upstream of clarifiers to reduce secondary effluent TP concentrations to 1.0 mg/L, as required.
- Chemical addition upstream of filters to reduce final effluent TP concentrations to 0.1 mg/L.

FIGURE 8

BioWin Future Condition Model



4.5.1 Future Conditions Phosphorus Removal

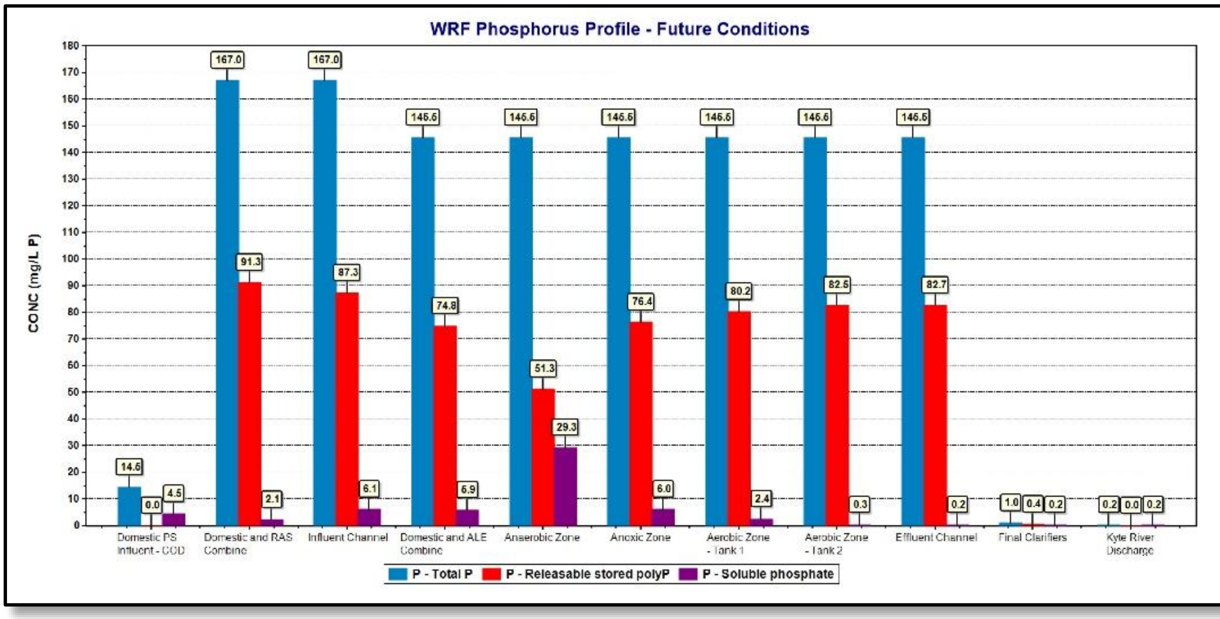
Increasing the volume of the BNR process with no increase in influent flowrate or strength decreased phosphorus removal performance because of a decrease in the food to mass (F:M) ratio. A low F:M ratio causes microorganisms to die from starvation and release stored phosphorus back into solution. The soluble phosphorus does not settle in the secondary clarifiers unless a metal salt, such as aluminum sulfate or ferric chloride, is added to form flocs. Without chemical addition, the secondary effluent will contain higher TP concentrations in the form of soluble phosphorus released by dead microorganisms.

With the increase in aeration capacity and biomass inventory, sludge wasting rates were proportionally increased to remove more sludge from the system and chemical addition was added to the model to remove soluble phosphorus so the total phosphorus concentration prior to the cloth media filters is 1.0 mg/L. A solids concentration that is too high in the secondary effluent will plug the filters, and a large phosphorus concentration will require more chemical to coagulate. As seen in the baseline modeling results however, chemical addition is not required when operating two aeration bays instead of three aeration bays for the existing wastewater loading.

Figure 9 shows the phosphorus profile of the future conditions with chemical addition prior to the secondary clarifiers and filters. Because of the low F:M ratio and reduced setting, chemical addition is required to remove phosphorus to about the same conditions as the baseline model without chemical addition.

FIGURE 9

BioWin™ Future Condition Model



The additional aeration bays being modified for BNR could be utilized to handle large wet weather events and allow better flexibility for taking the existing aeration bays out of commission for cleaning and maintenance.

When future flows increase to provide sufficient food to sustain more biomass in the system, additional bays can be incorporated into the dry weather BNR process. Adding an additional bay to accommodate future loadings is not expected to change performance, but capacities of sludge return pumping and sludge wasting may need to increase.

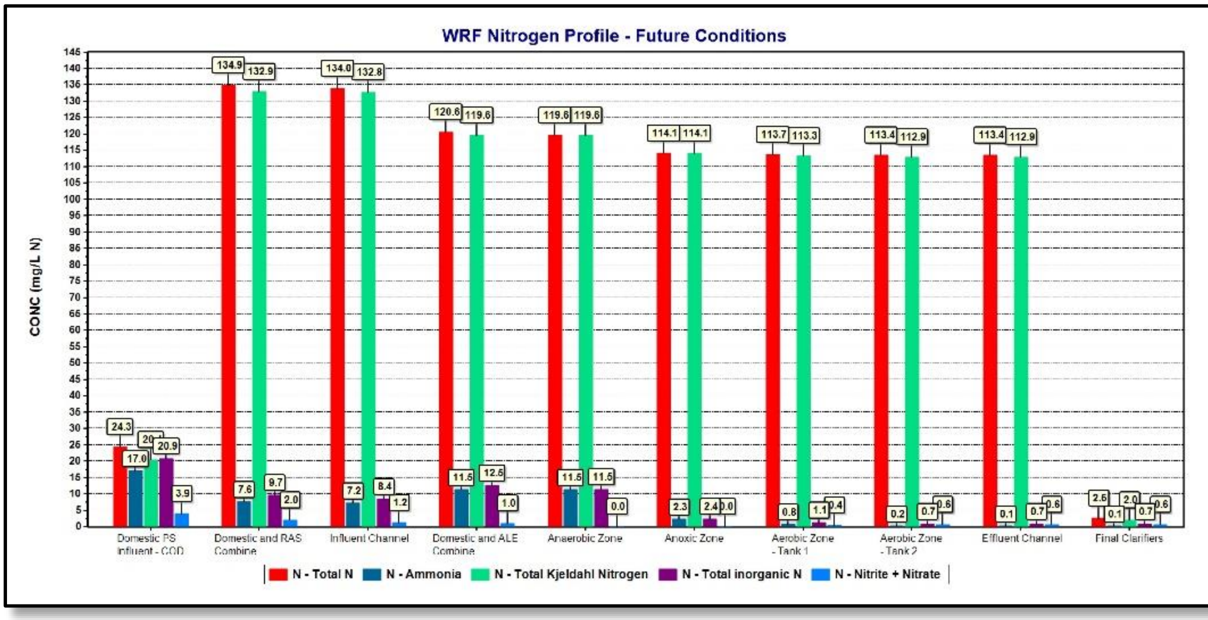
For the remainder of this feasibility study, costs and process modifications assume two aeration bays are running without chemical dosed upstream of the secondary clarifiers.

4.5.2 Future Conditions Nitrogen Removal

The future conditions model, like the baseline model, showed sufficient removal of total nitrogen while removing phosphorus. The future conditions total nitrogen profile is shown as Figure 10, which predicts an effluent total nitrogen concentration of 2.6 mg/L.

FIGURE 10

BioWin™ Future Condition Model



Adding a third aeration bay operating BNR did not significantly improve total nitrogen removal compared to the baseline model. No further evaluation or modeling effort is necessary to demonstrate adequate nitrogen removal for future conditions with phosphorus removal.

4.6 Future Conditions Modeling Summary

The future conditions biological model constructed for the City of Rochelle is considered a useful tool in studying phosphorus removal and confirms the City's existing total phosphorus and total nitrogen removal performance.

- Baseline BioWin model was updated to implement process improvements currently in design:
  - Additional BNR capacity by the conversion of existing Aeration Bays 3&4 to BNR
  - Cloth media disc filters replacing traveling bridge sand filters
- A low F:M ratio with no change to influent loading decreased the process performance for removing phosphorus. Chemical phosphorus removal was required at the secondary clarifiers to perform similar to the baseline model:
  - Baseline model effluent total phosphorus concentration: 0.2 mg/L
  - Baseline model effluent total nitrogen concentration: 2.6 mg/L
- Extra aeration capacity is not required to treat current loads. Additional aeration bays should be utilized for high flow events, flexibility with tank maintenance and cleaning, and future operation with increased flow and loading.

5. CONTINUED FEASIBILITY STUDY ANALYSES

The City of Rochelle is seeing successful phosphorus removal from its BNR process, supported by biological modeling results, while also removing other pollutants to meet permitted effluent limits.

The next part of this feasibility study is to analyze and determine the most cost-efficient options to lower the WRF total phosphorus effluent concentration to 1.0 mg/L, 0.5 mg/L, and 0.1 mg/L. Alternatives will consider the modelling results and existing data for enhanced biological treatment, adding chemical treatment, filters, and other processes and equipment.

5.1 Phosphorus Effluent Limit of 1.0 mg/L and 0.5 mg/L

According to baseline biological modeling results and operational data when the WRF was not experiencing a process upset or interference from industrial wastewater, the WRF is capable of achieving effluent phosphorus concentrations at or below 0.5 mg/L on a consistent basis. The average effluent TP concentration for the period of January 2021 through April 2021 when the WRF was experiencing good BNR operation was 0.10 mg/L.

As discussed in Section 2, the process upset that began in September 2021 was identified as a single industrial wastewater source, the greenhouse. Diverting the greenhouse wastewater to a holding pond in January 2022 immediately resolved symptoms of the process upset and the biological phosphorus removal began to improve.

The reported effluent TP concentrations in January, February, and March 2022 indicate that the BNR process recovered once the greenhouse interference was remediated.

When there were no industrial interferences, the A2O BNR process was able remove phosphorus to levels below 0.5 mg/L, just as it was designed to do. However, industrial interferences continue to plague the WRF and upset the BNR process. These industrial interferences are hampering efforts to make the BNR process adjustments and optimize performance.

The A2O BNR process, that the City installed and operates, has been proven at other water reclamation facilities in the region. It successfully removes nutrients from wastewater. It is expected to perform equally well at Rochelle. However, due to industrial interferences, there has not been enough operating data to conclusively demonstrate that its A2O BNR process is able to consistently and reliably meet the 0.5 mg/L effluent limit.

Rochelle has 13+ years to bring its industries under control and end the industrial interferences. NPDES Permit Special Condition 21 requires Rochelle to meet a Total Phosphorus effluent limit of 0.5 mg/L 12 month rolling geometric mean by January 1, 2030. However, per the terms of Special Condition 21 B. 2., that deadline is extended to December 31, 2035 because Rochelle chose to “construct/operate biological nutrient removal (BNR) process(es), incorporating nitrogen reduction...”

The installation of Chemical Phosphorus Removal (Chem-P) is not recommended at this time. Rochelle’s BNR process has shown signs that it can, by itself, meet the 0.5 mg/L effluent during times when there is no industrial interference. In an attempt to conclusively prove that the BNR system can meet the effluent limit without a backup Chem-P system, Rochelle intends to:

1. Gather more operating data.
2. Identify specific industrial interferences and work with those industries to resolve them.
3. Implement the Influent Reduction Measures identified in the Phosphorus Discharge Optimization Plan.

If, by 2030, the BNR Process is still unable to meet a 0.5 mg/L TP limit, Rochelle will reassess influent conditions and determine if it is necessary to install Chem-P as a backup to the BNR system.

5.1.1 Monitoring Frequency and Other Considerations

The target concentration that the WRF should attempt to achieve may be affected by the time length selected to average the effluent concentration. The longer the length of time for monitoring effluent, the easier it is to compensate a high effluent concentration.

1. Monthly Monitoring Frequency: The City’s existing BNR system has the potential to meet a monthly monitoring frequency without modification to the process for a 1.0 mg/L or 0.5 mg/L limit. The monitoring frequency period should not be more than monthly. Daily or weekly limits should be avoided. If monitoring frequency more than monthly must be considered, those effluent limits should be significantly higher than the monthly limit to compensate for plant upsets, variations in short term process conditions, and wet weather events.

2. Seasonal Monitoring Frequency: The City’s existing BNR system has the potential to meet a seasonal monitoring frequency without modification to the process for a 1.0 mg/L or 0.5 mg/L limit.

   However, seasonal limitations do affect ammonia removal performance. Significantly reducing ammonia limits may have some repercussions to the City’s biological process configuration if more aeration space is required for nitrification. Allowing higher levels of phosphorus discharge during certain periods of the year with low ammonia limits could avoid the need for chemical phosphorus removal to meet permit limits.

3. Annual Monitoring Frequency: Annual monitoring should be considered for the 1.0 and 0.5 mg/L effluent limits, as the WRF has demonstrated that meeting those limits is attainable with BNR.

The performance of the City's BNR has demonstrated the ability to achieve 1.0 and 0.5 mg/L TP effluent limits, without unexpected industrial interference, on an annual, seasonal, and monthly limit.

5.2 Phosphorus Effluent Limit of 0.1 mg/L

This section of the report presents a summary of the treatment processes required to achieve the effluent TP limit of 0.1 mg/L.

Chemical phosphorus removal (CPR) in conjunction with the City's existing EBPR is presented as the main solution to achieve consistent effluent limits below 0.1 mg/L TP.

5.2.1 Removal Processes

As previously discussed, the biological model confirms good EBPR operation at the WRF, and reported TP effluent concentrations during the period without industrial wastewater causing a process upset show good TP removal below 0.5 mg/L. At times, the reported effluent TP concentrations are below 0.1 mg/L, but not enough data has been collected during good BPR operation to confidently say the system can remove enough phosphorus to consistently meet a 0.1 mg/L effluent limit.

The City is currently in the design stage of a project to modify the remaining aeration bays for BNR and install cloth media filters to replace the traveling bridge sand filters. The cloth media filters are expected to improve phosphorus removal by capturing more solids than the existing traveling bridge sand filters. If the cloth media filters are unable to reduce phosphorus consistently below 0.1 mg/L, then chemical addition upstream of the filters is recommended to maximize solids capture and reduce effluent TP concentrations.

Chemical Phosphorus Removal (CPR) is a process that consists of adding metal salt solutions to the wastewater that react with soluble phosphorus (and other compounds), producing low-solubility phosphate particulates which could be removed via the cloth media filters. The most common salts are aluminum sulfate (alum) and ferric chloride (ferric). Other metals such poly-aluminum chloride, ferric sulfate, or rare earth-based products are also utilized but less common.

Alum is recommended for the WRF as ferric is a more corrosive and hazardous chemical. Additionally, alum is typically lower in cost and easier to handle when compared to ferric. However, jar testing of the different chemicals should be performed before selecting the most suitable option.

Chemical addition is an effective and operationally simple process. The downsides are that chemical delivery is a recurring cost the City will always incur, and a new building must be constructed to house the equipment and provide proper containment of the chemical. Appendix D shows the WRF process flow diagram with cloth media filters and chemical addition.

On another note, success of meeting a low effluent TP limit of 0.1 mg/L depends heavily on the phosphorus speciation in the process flow. Chemical addition can remove reactive phosphorus through precipitation, but it does not remove phosphorus in a soluble, non-reactive state. Soluble, non-reactive phosphorus (SNRP) is a component of total phosphorus which cannot presently be removed, hence concentrations at or above 0.1 mg/L make achieving a 0.1 mg/L effluent TP limit practically impossible. Tests for soluble, non-reactive phosphorus are recommended to determine the level present in the WRF domestic influent and anaerobic lagoon effluent.

5.2.2 Capital and O&M Costs

To implement chemical phosphorus removal at the Rochelle WRF, a new building dedicated for chemical storage and pumping must be constructed. Appendix E provides a typical layout for the Chemical Feed Building and potential location for the building on the WRF site. This building layout was used to determine the planning level cost below. A phosphorus analyzer is also recommended for metering the chemical addition based on measured total phosphorus in the effluent. This will help to both reduce the amount of chemical used during low influent concentrations and prevent under dosing chemical during influent TP spikes.

The total capital cost for CPR is shown in Table 6 below. The material, labor, and equipment costs were scaled to April 2022 USD from a 2019 cost estimate for a chemical phosphorus building of the same size. At the time of this report, inflation and market prices for materials are volatile and unpredictable and costs may need to be adjusted to more accurately predict costs for future planning.

TABLE 6

OPC for Chemical Phosphorus Removal Improvements

Item	Cost
General Conditions	$170,000
Sitework	$67,000
Chemical Building	$220,000
Equipment	
Storage Tank	$14,000
Chemical Feed Pumps (2) with Skid	$27,000
Phosphorus Analyzer	$57,000
Misc.	$23,000
Subtotal	**$578,000**
Electrical (15%)	$87,000
Instrumentation (10%)	$58,000
HVAC (5%)	$29,000
Subtotal	**$752,000**
OH&P, Bond, & Insurance (13%)	$98,000
Contingencies (20%)	$151,000
Total Construction Cost with Contingency	**$1,001,000**
Design (8%)	$81,000
Construction Services (8%)	$81,000
Legal and Administrative (1%)	$11,000
Total Capital Cost (April 2022 USD)	**$1,174,000**

The annual chemical cost depends largely on the amount of soluble phosphorus in the secondary effluent that is able to react with the dosed chemical. A conservative cost estimate assumes 0.5 mg/L of soluble phosphorus in the secondary effluent leaving the clarifiers upstream of filtration to be removed by CPR. The baseline biological model estimates that 0.2 mg/L of soluble phosphorus remains in the secondary effluent. These estimates are used to provide a range of annual chemical costs in Table 7 below.

TABLE 7

Annual Costs for Chemical Phosphorus Removal – 0.1 mg/L

Item	0.1 mg/l Annual Costs at DAF
Chemicals	\$19,000 - \$39,000[1]
Operation and Electrical	\$11,000
Total O&M Cost (April 2022 USD)	**\$30,000 - \$50,000**

Additional sludge production from precipitation was not significant for concentration of soluble phosphorus treated with CPR. The WRF 2017 basis of design calculated a daily WAS production of 11,600 lbs/day. Removing 0.5 mg/L of soluble phosphorus increased sludge production by 107 lbs/day (about a 1% increase) and removing 0.2 mg/L of soluble phosphorus increased sludge production by 54 lbs/day (about a 0.5% increase). The O&M cost for processing these amounts of additional sludge is negligible.

5.2.3 Timeframe

A tentative schedule for the design and construction of the chemical phosphorus removal facility is shown below.

Design	6 months
Permitting	3 months
Bidding	2 months
Construction	9 months
Total	20 months

5.2.4 Monitoring Frequency and Other Considerations

The target concentration that the WRF should attempt to achieve may be affected by the time length selected to average the effluent concentration. The longer the length of time for monitoring effluent, the easier it is to compensate a high effluent concentration.

As mentioned previously, the unpredictability of the soluble non-reactive phosphorus (SNRP) fraction in the wastewater should be tested and monitored further before concluding whether the WRF might be able to achieve less than 0.1 mg/L TP effluent on an annual, seasonal, and monthly limit. Depending on the monitoring frequency period, the objective effluent limit will vary as well as the operational cost.

1. Monthly Monitoring Frequency: Provided that the SNRP fraction is well below 0.1 mg/L, the City has the potential to consistently meet a monthly 0.1 mg/L limit. Monitoring frequency periods less than monthly are not recommended. If monitoring frequency more than monthly must be considered, those effluent limits should be significantly higher than the monthly limit

[1] Based on \$0.17 per lb. of Al_2O_3, DAF of 4.76 MGD, 0.2 – 0.5 mg/L of soluble P in the secondary effluent after biological phosphorus removal and settling.

to compensate for plant upsets, variations in short term process conditions, and wet weather events.

2. Seasonal Monitoring Frequency: Seasonal monitoring for the 0.1 mg/L limit may be appropriate if the frequency period is less than monthly (otherwise the monthly frequency opinion applies.)

   Seasonal limits may result in a decrease in operating costs commensurate with the reduction in the treatment requirements. If seasonal requirements were identified, allowing higher levels of discharge during certain periods of the year, there could be potential reductions in operational cost from chemical addition, power, and labor.

3. Annual Monitoring Frequency: Annual monitoring should be considered for the 0.1 mg/L effluent limit to reduce the overall operating costs and accommodate process upsets, short term process variations, and wet weather events.

6. IMPACT ON SEWER RATES

The City would need to increase sewer rates in order to provide the revenue necessary to cover the capital and operating costs for chemical phosphorus removal. A rate study analysis by Willet Hoffman & Associates Inc. proposed modifications to sewer rates through 2025 to balance expenses of recent improvement projects. The proposed 2025 sewer revenues established in the rate study analysis are used as a baseline for determining sewer revenues to accommodate capital and operating costs of chemical phosphorus removal, assuming payments for the chemical phosphorus removal project and operation begin in 2025.

Presented below is the change in revenue generated from sewer rates for two levels of chemical phosphorus removal:

1. Reducing effluent TP from 0.2 mg/L to 0.1 mg/L.
2. Reducing effluent TP from 0.5 mg/L to 0.1 mg/L.

The first level is based on the BNR system reliably achieving the performance it had in early 2021, when it consistently produced effluent of 0.2 mg/L TP or less.

The second level is based on the BNR system having less consistent performance, in which case it would be predicted to produce effluent of 0.5 mg/L TP or less.

The two levels differ only in operating cost. The capital cost is the same for both levels: approximately $1.2 Million. The annual operating cost is $30,000 vs $50,000 for the two levels.

Only the revenue generated from user rates was adjusted to offset the capital and operating cost of these two levels of chemical phosphorus removal. Other revenue streams and expenses were not changed to calculate the needed increase in sewer revenue.

Table 8 shows the calculated 2025 revenue from user rates required to offset the capital and operating cost of chemical phosphorus removal to reduce phosphorus level from 0.2 mg/L to 0.1 mg/L, removing 0.1 mg/L TP. This scenario assumes that the City's BNR operates well, as predicted by the biological model of the existing BNR process and demonstrated by operating data in early 2021.

TABLE 8

Estimated Impact on Sewer Rates to Remove 0.1 mg/L TP

Item	2025 Revenue from User Rates per Rate Study without CPR	Proposed 2025 Revenue from User Rates to remove 0.1 mg/L TP with CPR
Total Project Cost [2]	-	$1,174,000
Annual Debt Service [3]	-	$66,707
Annual Operating Cost	-	$30,000
Annual Additional Cost	**-**	**$97,000**
2025 Required Revenue from Users	$3,801,648	$3,898,648
Increase in rates	-	2.5%
2025 Residential Revenue	$1,413,200	$1,449,258
2025 Commercial Revenue	$1,167,800	$1,197,597
2025 Industrial Revenue	$1,118,248	$1,146,780
2025 Creston Revenue	$84,000	$86,143
2025 Hillcrest Revenue	$18,400	$18,869
2025 Surcharge Fee Revenue (no change)	$308,000	$308,000
2025 Total Water Reclamation Sales	**$4,109,648**	**$4,206,648**

TABLE 9 shows the calculated 2025 revenue from user rates required to offset the capital and operating cost of chemical phosphorus removal to reduce phosphorus level from 0.5 mg/L to 0.1 mg/L, removing 0.4 mg/L. This scenario assumes that the City's BNR operates well, but does not remove as much phosphorus as predicted by the biological model or as demonstrated by previous data. This assumption provides a more conservative cost estimate for operating costs.

TABLE 9

Estimated Impact on Sewer Rates to Remove 0.4 mg/L TP

Item	2025 Revenue from User Rates per Rate Study without CPR	Proposed 2025 Revenue from User Rates to remove 0.4 mg/L TP with CPR
Total Project Cost [4]	-	$1,174,000
Annual Debt Service	-	$66,707
Annual Operating Cost [5]	-	$50,000
Annual Additional Cost	**-**	**$117,000**
2025 Required Revenue from Users	$3,801,648	$3,918,648
Increase in rates	-	3.0%
2025 Residential Revenue	$1,413,200	$1,449,258

[2] Estimated Total Capital Cost with Contingency in April 2022 USD.
[3] Estimated assuming 1.25% interest with IEPA SRF loan and a 20-year loan term.
[4] Estimated Total Capital Cost with Contingency in April 2022 USD.
[5] Estimated assuming 1.25% interest with IEPA SRF loan and a 20-year loan term.

Item	2025 Revenue from User Rates per Rate Study without CPR	Proposed 2025 Revenue from User Rates to remove 0.4 mg/L TP with CPR
2025 Commercial Revenue	$1,167,800	$1,197,597
2025 Industrial Revenue	$1,118,248	$1,146,780
2025 Creston Revenue	$84,000	$86,143
2025 Hillcrest Revenue	$18,400	$18,869
2025 Surcharge Fee Revenue (no change)	$308,000	$308,000
2025 Total Water Reclamation Sales	**$4,109,648**	**$4,226,648**

The rate increases are calculated in the case where the proposed user fee takes effect at the same time as the additional annual costs. These rates could be reduced if sewer rates are raised prior to the first payment for these additional costs.

7. RECOMMENDATIONS

The following are the improvements recommended to meet the NPDES Feasibility Study total phosphorus effluent limits:

A. For the 1.0 mg/L effluent limit:

1. No improvements to the existing treatment process are recommended at this time to meet a 1.0 mg/L effluent limit.
2. Monthly, seasonal, and annual monitoring frequency is achievable for the 1.0 mg/L limit.
3. If, by 2030, the BNR Process is unable to meet a 1.0 mg/L limit, the City will reassess influent conditions to determine the feasibility of chemical phoshorus removal. Per Special Condition 21 of the NPDES permit, a future phosphorus limit would be implemented in 2035.

B. For the 0.5 mg/L effluent limit:

1. No improvements to the existing treatment process are recommended at this time to meet a 0.5 mg/L effluent limit.
2. Monthly, seasonal, and annual monitoring frequency is achievable for the 0.5 mg/L limit.
3. If, by 2030, the BNR Process is unable to meet a 0.50 mg/L limit, the City will reassess influent conditions to determine the feasibility of chemical phoshorus removal. Per Special Condition 21 of the NPDES permit, a future phosphorus limit would be implemented in 2035.

   NPDES Permit Special Condition 21 requires Rochelle to meet a Total Phosphorus effluent limit of 0.5 mg/L 12 month rolling geometric mean by January 1, 2030. However, per the terms of Special Condition 21 B. 2., that deadline is extended to December 31, 2035 because Rochelle chose to "construct/operate biological nutrient removal (BNR) process(es), incorporating nitrogen reduction..."

C. For the 0.1 mg/L Effluent Limit:

1. Test for soluble non-reactive phosphorus in order to define whether the 0.1 mg/L limit is even feasible to reach with current technology.
2. If the phosphorus speciation results indicate a 0.1 mg/L limit is achievable, install a chemical phosphorus removal facility sized accordingly for the amount of soluble phosphorus remaining in the secondary effluent after biological phosphorus removal and settling. Chemical removal jar testing should be performed prior to design of the chemical removal facilities in order to determine the correct type and amount of chemical to be utilized.
   a. Capital Cost: $1.2 million (April 2022 USD)
   b. Estimated Annual Cost: $30,000 – $50,000 (April 2022 USD)

3. Seasonal and annual monitoring frequencies could be achievable, depending on duration. Compliance with monthly monitoring frequency could be difficult to achieve. The longer compliance timeframe is required to endure plant upsets, short-term process changes, and wet weather events.

8. NEXT STEPS

The following is the recommended plan of action for compliance with the NPDES Feasibility Permit requirements at this time:

1. Submit report to IEPA for review and approval.

2. Complete design, construction, and startup of cloth media filters. Determine if cloth media filters, in conjunction with the BNR process, consistently remove TP below 0.1 mg/L.

3. If a 0.1 mg/L limit is imposed and the BNR process with cloth media filters does not sufficiently remove phosphorus to meet the limit consistently:
   a. Perform a bench test to confirm influent phosphorus speciation.
   b. Perform a chemical removal jar test to determine the most appropriate chemical for CPR.
   c. Proceed with design of chemical phosphorus removal facilities.

Appendix A

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-3397
JB PRITZKER, GOVERNOR JOHN J. KIM, DIRECTOR
217/782-0610

August 13, 2019

City of Rochelle
333 Lincoln Highway
P.O. Box 456
Rochelle, Illinois 61068

Re: City of Rochelle
City of Rochelle Water Reclamation
NPDES Permit No. IL0030741
Final Permit

Gentlemen:

Attached is the final NPDES Permit for your discharge. The Permit as issued covers discharge limitations, monitoring, and reporting requirements. Failure to meet any portion of the Permit could result in civil and/or criminal penalties. The Illinois Environmental Protection Agency is ready and willing to assist you in interpreting any of the conditions of the Permit as they relate specifically to your discharge.

Pursuant to the Final NPDES Electronic Reporting Rule, all permittees must report DMRs electronically unless a waiver has been granted by the Agency. The Agency utilizes NetDMR, a web based application, which allows the submittal of electronic Discharge Monitoring Reports instead of paper Discharge Monitoring Reports (DMRs). More information regarding NetDMR can be found on the Agency website, https:www2.illinois.gov/epa/topics/water-quality/surface-water/netdmr/pages/quick-answer-guide.aspx. If your facility has received a waiver from the NetDMR program, a supply of preprinted paper DMR Forms will be sent to your facility. Additional information and instructions will accompany the preprinted DMRs. Please see the attachment regarding the electronic reporting rule.

The attached Permit is effective as of the date indicated on the first page of the Permit. Until the effective date of any re-issued Permit, the limitations and conditions of the previously-issued Permit remain in full effect. You have the right to appeal any condition of the Permit to the Illinois Pollution Control Board within a 35 day period following the issuance date.

Should you have questions concerning the Permit, please contact Kaushal Desai at 217/782-0610.

Sincerely,

Amy L. Dragovich, P.E.
Manager, Permit Section
Division of Water Pollution Control

ALD: KKD:16052401 IL0030741 Rochelle.docx

Attachment: Final Permit

cc: Records
Compliance Assurance Section
Des Plaines Region
Billing
USEPA (via e-mail)

NPDES Permit No. IL0030741

Illinois Environmental Protection Agency

Division of Water Pollution Control

1021 North Grand Avenue East

Post Office Box 19276

Springfield, Illinois 62794-9276

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

Reissued (NPDES) Permit

Expiration Date: August 31, 2024

Issue Date: August 13, 2019
Effective Date: September 1, 2019

Name and Address of Permittee:

City of Rochelle
333 Lincoln Highway
P.O. Box 456
Rochelle, Illinois 61068

Facility Name and Address:

City of Rochelle Water Reclamation
888 Elliots Way
Rochelle, Illinois 61068
(Ogle County)

Receiving Waters: Kyte River

In compliance with the provisions of the Illinois Environmental Protection Act, Title 35 of the Ill. Adm. Code, Subtitle C, Chapter I, and the Clean Water Act (CWA), the above-named Permittee is hereby authorized to discharge at the above location to the above-named receiving stream in accordance with the Effluent Limitations, Monitoring, and Reporting requirements; Special Conditions and Attachment H Standard Conditions attached herein.

Permittee is not authorized to discharge after the above expiration date. In order to receive authorization to discharge beyond the expiration date, the Permittee shall submit the proper application as required by the Illinois Environmental Protection Agency (IEPA) not later than 180 days prior to the expiration date.

Amy L. Dragovich, P.E.
Manager, Permit Section
Division of Water Pollution Control

ALD:KKD:16052401 IL0030741 Rochelle.docx

NPDES Permit No. IL0030741

Effluent Limitations, Monitoring, and Reporting

FINAL

Discharge Number(s) and Name(s): 001 STP Outfall

Load limits computed based on a design average flow (DAF) of 4.87 MGD (design maximum flow (DMF) of 8.76 MGD).

From the effective date of this Permit until the expiration date, the effluent of the above discharge(s) shall be monitored and limited at all times as follows:

	LOAD LIMITS lbs/day DAF (DMF)*			CONCENTRATION LIMITS mg/L				
Parameter	Monthly Average	Weekly Average	Daily Maximum	Monthly Average	Weekly Average	Daily Maximum	Sample Frequency	Sample Type
Flow (MGD)							Continuous	
$CBOD_5$**[1]	406 (731)		812 (1461)	10		20	1 Day/Week	Composite
Suspended Solids[1]	487 (877)		975 (1753)	12		24	1 Day/Week	Composite
pH	Shall be in the range of 6 to 9 Standard Units						1 Day/Week	Grab
Fecal Coliform***	Daily Maximum shall not exceed 400 per 100 mL (May through October)						2 Days/Week	Grab
Chlorine Residual***						0.05	2 Days/Week	Grab
Ammonia Nitrogen: as (N)								
March-May, Sept.-Oct.	57 (102)		106 (190)	1.4		2.6	2 Days/Week	Composite
June-August	61 (110)		122 (219)	1.5		3.0	2 Days/Week	Composite
Nov.-Feb.	162 (292)		288 (519)	4.0		7.1	2 Days/Week	Composite
Total Phosphorus (as P)	Monitor Only						1 Day/Month	Composite
Total Nitrogen (as N)	Monitor Only						1 Day/Month	Composite
				Monthly Average not less than	Weekly Average not less than	Daily Minimum		
Dissolved Oxygen								
March-July				—	6.25	5.0	2 Days/Week	Grab
August-February				6.0	4.5	4.0	2 Days/Week	Grab

*Load limits based on design maximum flow shall apply only when flow exceeds design average flow.
**Carbonaceous BOD_5 ($CBOD_5$) testing shall be in accordance with 40 CFR 136.
***See Special Condition 10.

Flow shall be reported on the Discharge Monitoring Report (DMR) as monthly average and daily maximum.
Fecal Coliform shall be reported on the DMR as a daily maximum value.
pH shall be reported on the DMR as minimum and maximum value.
Chlorine Residual shall be reported on DMR as daily maximum value.
Dissolved oxygen shall be reported on the DMR as a minimum value.
Total Phosphorus shall be reported on the DMR as a daily maximum value.
Total Nitrogen shall be reported on the DMR as a daily maximum value. Total Nitrogen is the sum total of Total Kjeldahl Nitrogen, Nitrate, and Nitrite.

[1]BOD_5 and Suspended Solids (85% removal required): In accordance with 40 CFR 133, the 30-day average percent removal shall not be less than 85 percent. The percent removal need not be reported to the IEPA on DMRs but influent and effluent data must be available, as required elsewhere in this Permit, for IEPA inspection and review. For measuring compliance with this requirement, 5 mg/L shall be added to the effluent $CBOD_5$ concentration to determine the effluent BOD_5 concentration or laboratory analysis for the determination of BOD_5 may be used. Percent removal is a percentage expression of the removal efficiency across a treatment plant for a given pollutant parameter, as determined from the 30-day average values of the raw wastewater influent concentrations to the facility and the 30-day average values of the effluent pollutant concentrations for a given time period.

NPDES Permit No. IL0030741

Influent Monitoring, and Reporting

The influent to the plant shall be monitored as follows:

Parameter	Sample Frequency	Sample Type
Flow (MGD)	Continuous	
BOD_5	1 Day/Week	Composite
Suspended Solids	1 Day/Week	Composite

Influent samples shall be taken at a point representative of the influent.

Flow (MGD) shall be reported on the Discharge Monitoring Report (DMR) as monthly average and daily maximum.

BOD_5 and Suspended Solids shall be reported on the DMR as a monthly average concentration.

Special Conditions

SPECIAL CONDITION 1. This Permit may be modified to include different final effluent limitations or requirements which are consistent with applicable laws and regulations. The IEPA will public notice the permit modification.

SPECIAL CONDITION 2. The use or operation of this facility shall be by or under the supervision of a Certified Class 1 operator.

SPECIAL CONDITION 3. The IEPA may request in writing submittal of operational information in a specified form and at a required frequency at any time during the effective period of this Permit.

SPECIAL CONDITION 4. The IEPA may request more frequent monitoring by permit modification pursuant to 40 CFR § 122.63 and Without Public Notice.

SPECIAL CONDITION 5. The effluent, alone or in combination with other sources, shall not cause a violation of any applicable water quality standard outlined in 35 Ill. Adm. Code 302 and 303.

SPECIAL CONDITION 6. The Permittee shall record monitoring results on Discharge Monitoring Report (DMR) electronic forms using one such form for each outfall each month.

In the event that an outfall does not discharge during a monthly reporting period, the DMR Form shall be submitted with no discharge indicated.

The Permittee is required to submit electronic DMRs (NetDMRs) instead of mailing paper DMRs to the IEPA unless a waiver has been granted by the Agency. More information, including registration information for the NetDMR program, can be obtained on the IEPA website, https:www2.illinois.gov/epa/topics/water-quality/surface-water/netdmr/pages/quick-answer-guide.aspx.

The completed Discharge Monitoring Report forms shall be submitted to IEPA no later than the 25th day of the following month, unless otherwise specified by the permitting authority.

Permittees that have been granted a waiver shall mail Discharge Monitoring Reports with an original signature to the IEPA at the following address:

Illinois Environmental Protection Agency
Division of Water Pollution Control
Attention: Compliance Assurance Section, Mail Code # 19
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

SPECIAL CONDITION 7. The provisions of 40 CFR Section 122.41(m) & (n) are incorporated herein by reference.

SPECIAL CONDITION 8. Samples taken in compliance with the effluent monitoring requirements shall be taken at a point representative of the discharge, but prior to entry into the receiving stream.

SPECIAL CONDITION 9. This Permit may be modified to include alternative or additional final effluent limitations pursuant to an approved Total Maximum Daily Load (TMDL) Study or upon completion of an alternate Water Quality Study.

SPECIAL CONDITION 10. Fecal Coliform limits for Discharge Number 001 are effective May thru October. Sampling of Fecal Coliform is only required during this time period.

Any use of chlorine to control slime growths, odors or as an operational control, etc. shall not exceed the limit of 0.05 mg/L (daily maximum) total residual chlorine in the effluent

If the Permittee is chlorinating for any purpose during the months of November through April on a daily basis, sampling is required two days per week. If the Permittee is chlorinating for any purpose during the months of November through April on a sporadic basis, sampling is required on a daily grab basis until residual chlorine levels stabilize. Sampling frequency for the months of May through October shall be as indicated on effluent limitations, monitoring and reporting page of this Permit.

SPECIAL CONDITION 11. The Permittee shall conduct semi-annual monitoring of the effluent and report concentrations (in mg/L) of the following listed parameters. Monitoring shall begin three (3) months from the effective date of this permit. The sample shall be a 24-hour effluent composite except as otherwise specifically provided below and the results shall be submitted on Discharge Monitoring Report Forms to IEPA unless otherwise specified by the IEPA. The parameters to be sampled and the minimum reporting limits to be attained are as follows:

STORET CODE	PARAMETER	Minimum reporting limit

Special Conditions

01002	Arsenic	0.05 mg/L
01007	Barium	0.5 mg/L
01027	Cadmium	0.001 mg/L
01032	Chromium (hexavalent) (grab)	0.01 mg/L
01034	Chromium (total)	0.05 mg/L
01042	Copper	0.005 mg/L
00720	Cyanide (total) (grab)***	5.0 µg/L
00722	Cyanide (grab) (available**** or amenable to chlorination)***	5.0 µg/L
00951	Fluoride	0.1 mg/L
01045	Iron (total)	0.5 mg/L
01046	Iron (Dissolved)	0.5 mg/L
01051	Lead	0.05 mg/L
01055	Manganese	0.5 mg/L
71900	Mercury (grab)**	1.0 ng/L*
01067	Nickel	0.005 mg/L
00556	Oil (hexane soluble or equivalent) (Grab Sample only)	5.0 mg/L
32730	Phenols (grab)	0.005 mg/L
01147	Selenium	0.005 mg/L
01077	Silver (total)	0.003 mg/L
01092	Zinc	0.025 mg/L

Minimum Reporting Limits are defined as – (1) The minimum value below which data are documented as non-detects. (2) Three to ten times the method detection limit. (3) The minimum value of the calibration range.

All sample containers, preservative, holding times, analyses, method detection limit determinations and quality assurance/quality control requirements shall be in accordance with 40 CFR 136.

Unless otherwise indicated, concentrations refer to the total amount of the constituent present in all phases, whether solid, suspended or dissolved, elemental or combined, including all oxidation states.

*1.0 ng/L = 1 part per trillion.
**Utilize USEPA Method 1631E and the digestion procedure described in Section 11.1.1.2 of 1631E.
***Analysis for cyanide (available or amenable to chlorination) is only required if cyanide (total) is detected at or above the minimum reporting limit.
****USEPA Method OIA-1677.

The Permittee shall provide a report briefly describing the permittee's pretreatment activities and an updated listing of the Permittee's significant industrial users. The list should specify which categorical pretreatment standards, if any, are applicable to each Industrial User. Permittees who operate multiple plants may provide a single report. Such report shall be submitted within twelve (12) months of the effective date of this Permit to the following addresses:

U.S. Environmental Protection Agency
Region 5
77 West Jackson Blvd.
Chicago, Illinois 60604
Attention: Water Enforcement and Compliance
Assurance Branch

Illinois Environmental Protection Agency
Division of Water Pollution Control
Attention: Compliance Assurance Section, Mail Code #19
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

SPECIAL CONDITION 12. During January of each year the Permittee shall submit annual fiscal data regarding sewerage system operations to the Illinois Environmental Protection Agency/Division of Water Pollution Control/Compliance Assurance Section. The Permittee may use any fiscal year period provided the period ends within twelve (12) months of the submission date.

Submission shall be on forms provided by IEPA titled "Fiscal Report Form For NPDES Permittees".

SPECIAL CONDITION 13. The Permittee shall conduct biomonitoring of the effluent from Discharge Number(s) 001.

Biomonitoring

A. Acute Toxicity - Standard definitive acute toxicity tests shall be run on at least two trophic levels of aquatic species (fish, invertebrate) representative of the aquatic community of the receiving stream. Testing must be consistent with Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms (Fifth Ed.) EPA/821-R-02-012. Unless substitute tests are pre-approved; the following tests are required:

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1. Fish 96-hour static LC_{50} Bioassay using fathead minnows (*Pimephales promelas*).

2. Invertebrate 48-hour static LC_{50} Bioassay using *Ceriodaphnia*.

B. Testing Frequency - The above tests shall be conducted using 24-hour composite samples unless otherwise authorized by the IEPA. Sample collection and testing must be conducted in the 18th, 15th, 12th, and 9th month prior to the expiration date of this Permit. When possible, bioassay sample collection should coincide with sample collection for metals analysis or other parameters that may contribute to effluent toxicity.

C. Reporting - Results shall be reported according to EPA/821-R-02-012, Section 12, Report Preparation, and shall be mailed to IEPA, Bureau of Water, Compliance Assurance Section or emailed to EPA.PrmtSpecCondtns@Illinois.gov within one week of receipt from the laboratory. Reports are due to the IEPA no later than the 16th, 13th, 10th, and 7th month prior to the expiration date of this Permit.

D. Toxicity – Should a bioassay result in toxicity to >20% of organisms tested in the 100% effluent treatment, the IEPA may require, upon notification, six (6) additional rounds of monthly testing on the affected organism(s) to be initiated within 30 days of the toxic bioassay. Results shall be submitted to IEPA within one (1) week of becoming available to the Permittee. Should any of the additional bioassays result in toxicity to ≥50% of organisms tested in the 100% effluent treatments, the Permittee must contact the IEPA within one (1) day of the results becoming available to the Permittee and begin the toxicity identification and reduction evaluation process as outlined below.

E. Toxicity Identification and Reduction Evaluation - Should any of the additional bioassays result in toxicity to ≥50% of organisms tested in the 100% effluent treatment, the Permittee must contact the IEPA within one (1) day of the results becoming available to the Permittee and begin the toxicity identification evaluation process in accordance with Methods for Aquatic Toxicity Identification Evaluations, EPA/600/6-91/003. The IEPA may also require, upon notification, that the Permittee prepare a plan for toxicity reduction evaluation to be developed in accordance with Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants, EPA/833B-99/002, which shall include an evaluation to determine which chemicals have a potential for being discharged in the plant wastewater, a monitoring program to determine their presence or absence and to identify other compounds which are not being removed by treatment, and other measures as appropriate. The Permittee shall submit to the IEPA its plan for toxicity reduction evaluation within ninety (90) days following notification by the IEPA. The Permittee shall implement the plan within ninety (90) days or other such date as contained in a notification letter received from the IEPA.

The IEPA may modify this Permit during its term to incorporate additional requirements or limitations based on the results of the biomonitoring. In addition, after review of the monitoring results, the IEPA may modify this Permit to include numerical limitations for specific toxic pollutants. Modifications under this condition shall follow public notice and opportunity for hearing.

SPECIAL CONDITION 14. For the duration of this Permit, the Permittee shall determine the quantity of sludge produced by the treatment facility in dry tons or gallons with average percent total solids analysis. The Permittee shall maintain adequate records of the quantities of sludge produced and have said records available for U.S. EPA and IEPA inspection. The Permittee shall submit to the IEPA, at a minimum, a semi-annual summary report of the quantities of sludge generated and disposed of, in units of dry tons or gallons (average total percent solids) by different disposal methods including but not limited to application on farmland, application on reclamation land, landfilling, public distribution, dedicated land disposal, sod farms, storage lagoons or any other specified disposal method. Said reports shall be submitted to the IEPA by January 31 and July 31 of each year reporting the preceding January thru June and July thru December interval of sludge disposal operations.

Duty to Mitigate. The Permittee shall take all reasonable steps to minimize any sludge use or disposal in violation of this Permit.

Sludge monitoring must be conducted according to test procedures approved under 40 CFR 136 unless otherwise specified in 40 CFR 503, unless other test procedures have been specified in this Permit.

Planned Changes. The Permittee shall give notice to the IEPA on the semi-annual report of any changes in sludge use and disposal.

The Permittee shall retain records of all sludge monitoring, and reports required by the Sludge Permit as referenced in Standard Condition 25 for a period of at least five (5) years from the date of this Permit.

If the Permittee monitors any pollutant more frequently than required by this permit or the Sludge Permit, the results of this monitoring shall be included in the reporting of data submitted to the IEPA.

The Permittee shall comply with existing federal regulations governing sewage sludge use or disposal and shall comply with all existing applicable regulations in any jurisdiction in which the sewage sludge is actually used or disposed.

The Permittee shall comply with standards for sewage sludge use or disposal established under section 405(d) of the CWA within the time provided in the regulations that establish the standards for sewage sludge use or disposal even if the permit has not been modified to incorporate the requirement.

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The Permittee shall ensure that the applicable requirements in 40 CFR Part 503 are met when the sewage sludge is applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator.

Monitoring reports for sludge shall be reported on the form titled "Sludge Management Reports" to the following address:

Illinois Environmental Protection Agency
Bureau of Water
Compliance Assurance Section
Mail Code #19
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

SPECIAL CONDITION 15. The Permittee has undergone a Monitoring Reduction review and the influent and effluent sample frequency has been reduced for parameters due to sustained compliance. The IEPA may require that the influent and effluent sampling frequency for these parameters be increased without Public Notice. This provision does not limit EPA's authority to require additional monitoring, information or studies pursuant to Section 308 of the CWA.

SPECIAL CONDITION 16. Consistent with permit modification procedures in 40 CFR 122.62 and 63, this Permit may be modified to include requirements for the Permittee on a continuing basis to evaluate and detail its efforts to effectively control sources of infiltration and inflow into the sewer system and to submit reports to the IEPA if necessary.

SPECIAL CONDITION 17. The Permittee shall work towards the goals of achieving no discharges from sanitary sewer overflows or basement back-ups and ensuring that overflows or back-ups, when they do occur do not cause or contribute to violations of applicable standards or cause impairment in any adjacent receiving water. Overflows from sanitary sewers are expressly prohibited by this permit and by Ill. Adm. Code 306.304. As part of the process to ultimately achieve compliance through the elimination of and mitigating the adverse impacts of any such overflows if they do occur, the Permittee shall (A) identify and report to IEPA all SSOs that do occur, and (B) develop, implement and submit to the IEPA a Capacity, Management, Operations, and Maintenance (CMOM) plan which includes an Asset Management strategy within thirty-six (36) months of the effective date of this Permit or review and revise any existing plan accordingly. The Permittee shall modify the Plan to incorporate any comments that it receives from IEPA and shall implement the modified plan as soon as possible. The Permittee should work as appropriate, in consultation with affected authorities at the local, county, and/or state level to develop the plan components involving third party notification of overflow events. The Permittee may be required to construct additional sewage transport and/or treatment facilities in future permits or other enforceable documents should the implemented CMOM plan indicate that the Permittee's facilities are not capable of conveying and treating the flow for which they are designed.

The CMOM plan shall include the following elements:

A. Measures and Activities:

1. A complete map and system inventory for the collection system owned and operated by the Permittee;
2. Organizational structure; budgeting; training of personnel; legal authorities; schedules for maintenance, sewer system cleaning, and preventative rehabilitation; checklists, and mechanisms to ensure that preventative maintenance is performed on equipment owned and operated by the Permittee;
3. Documentation of unplanned maintenance;
4. An assessment of the capacity of the collection and treatment system owned and operated by the Permittee at critical junctions and immediately upstream of locations where overflows and backups occur or are likely to occur; use flow monitoring and/or sewer hydraulic modeling, as necessary;
5. Identification and prioritization of structural deficiencies in the system owned and operated by the Permittee. Include preventative maintenance programs to prevent and/or eliminate collection system blockages from roots or grease, and prevent corrosion or negative effects of hydrogen sulfide which may be generated within collection system;
6. Operational control, including documented system control procedures, scheduled inspections and testing, list of scheduled frequency of cleaning (and televising as necessary) of sewers;
7. The Permittee shall develop and implement an Asset Management strategy to ensure the long-term sustainability of the collection system. Asset Management shall be used to assist the Permittee in making decisions on when it is most appropriate to repair, replace or rehabilitate particular assets and develop long-term funding strategies; and
8. Asset Management shall include but is not limited to the following elements:
   a. Asset Inventory and State of the Asset;
   b. Level of Service;
   c. Critical Asset Identification;
   d. Life Cycle Cost; and
   e. Long-Term Funding Strategy.

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B. Design and Performance Provisions:

1. Monitor the effectiveness of CMOM;
2. Upgrade the elements of the CMOM plan as necessary; and
3. Maintain a summary of CMOM activities.

C. Overflow Response Plan:

1. Know where overflows and back-ups within the facilities owned and operated by the Permittee occur;
2. Respond to each overflow or back-up to determine additional actions such as clean up; and
3. Locations where basement back-ups and/or sanitary sewer overflows occur shall be evaluated as soon as practicable for excessive inflow/infiltration, obstructions or other causes of overflows or back-ups as set forth in the System Evaluation Plan.
4. Identify the root cause of the overflow or basement backup, and document to files;
5. Identify actions or remediation efforts to reduce risk of reoccurrence of these overflows or basement backups in the future, and document to files.

D. System Evaluation Plan:

1. Summary of existing SSO and Excessive I/I areas in the system and sources of contribution;
2. Evaluate plans to reduce I/I and eliminate SSOs;
3. Evaluate the effectiveness and performance in efforts to reduce excessive I/I in the collection system;
4. Special provisions for Pump Stations and force mains and other unique system components; and
5. Construction plans and schedules for correction.

E. Reporting and Monitoring Requirements:

1. Program for SSO detection and reporting; and
2. Program for tracking and reporting basement back-ups, including general public complaints.

F. Third Party Notice Plan:

1. Describes how, under various overflow scenarios, the public, as well as other entities, would be notified of overflows within the Permittee's system that may endanger public health, safety or welfare;
2. Identifies overflows within the Permittee's system that would be reported, giving consideration to various types of events including events with potential widespread impacts;
3. Identifies who shall receive the notification;
4. Identifies the specific information that would be reported including actions that will be taken to respond to the overflow;
5. Includes a description of the lines of communication; and
6. Includes the identities and contact information of responsible POTW officials and local, county, and/or state level officials.

For additional information concerning USEPA CMOM guidance and Asset Management please refer to the following web site addresses.
http://www.epa.gov/npdes/pubs/cmom_guide_for_collection_systems.pdf and
http://water.epa.gov/type/watersheds/wastewater/upload/guide_smallsystems_assetmanagement_bestpratices.pdf

SPECIAL CONDITION 18. The Permittee shall develop and submit to the Agency a Phosphorus Discharge Optimization Plan within thirty-six (36) months of the effective date of this permit. The plan shall include a schedule for the implementation of these optimization measures. Annual progress reports on the optimization of the existing treatment facilities shall be submitted to the Agency by March 31 of each year beginning 12 months from effective date of the permit. In developing the plan, the Permittee shall evaluate a range of measures for reducing phosphorus discharges from the treatment plant, including possible source reduction measures, operational improvements, and minor facility modifications that will optimize reductions in phosphorus discharges from the wastewater treatment facility. The Permittee's evaluation shall include, but not be limited to, an evaluation of the following optimization measures:

A. WWTF influent reduction measures.
   1. Evaluate the phosphorus reduction potential of users.
   2. Determine which sources have the greatest opportunity for reducing phosphorus (i.e., industrial, commercial, institutional, municipal and others).
      a. Determine whether known sources (i.e., restaurant and food preparation) can adopt phosphorus minimization and water conservation plans.
      b. Evaluate implementation of local limits on influent sources of excessive phosphorus.

B. WWTF effluent reduction measures.
   1. Reduce phosphorus discharges by optimizing existing treatment processes.
      a. Adjust the solids retention time for either nitrification, denitrification, or biological phosphorus removal.
      b. Adjust aeration rates to reduce dissolved oxygen and promote simultaneous nitrification-denitrification.

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c. Add baffles to existing units to improve microorganism conditions by creating divided anaerobic, anoxic, and aerobic zones.
d. Change aeration settings in plug flow basins by turning off air or mixers at the inlet side of the basin system.
e. Minimize impact on recycle streams by improving aeration within holding tanks.
f. Reconfigure flow through existing basins to enhance biological nutrient removal.
g. Increase volatile fatty acids for biological phosphorus removal.

SPECIAL CONDITION 19. The Permittee shall, within thirty-six (36) months of the effective date of this permit, prepare and submit to the Agency a feasibility study that identifies the method, timeframe, and costs of reducing phosphorus levels in its discharge to a level consistently meeting a potential future effluent limit of 1.0 mg/L, 0.5 mg/L, and 0.1 mg/L on a monthly, seasonal and annual average basis. The study shall evaluate the construction and O & M costs of the application of these limits on an annual average basis.

SPECIAL CONDITION 20. The Agency has determined that the Permittee's treatment plant effluent is located upstream of a waterbody or stream segment that has been determined to be at risk of eutrophication due to phosphorus levels in the waterbody. This determination was made upon reviewing available information concerning the characteristics of the relevant waterbody/segment and the relevant facility (such as quantity of discharge flow and nutrient load relative to the stream flow).

A waterbody or segment is at risk of eutrophication if there is available information that plant, algal or cyanobacterial growth is causing or will cause violation of a water quality standard.

The Permittee shall develop, or be a part of a watershed group that develops, a Nutrient Assessment Reduction Plan (NARP) that will meet the following requirements:

A. The NARP shall be developed and submitted to the Agency by December 31, 2023. This requirement can be accomplished by the Permittee, by participation in an existing watershed group or by creating a new group. The NARP shall be supported by data and sound scientific rationale.
B. The Permittee shall cooperate with and work with other stakeholders in the watershed to determine the most cost-effective means to address the risk of eutrophication. If other stakeholders in the watershed will not cooperate in developing the NARP, the Permittee shall develop its own NARP for submittal to the Agency to comply with this condition.
C. In determining the target levels of various parameters necessary to address the risk of eutrophication, the NARP shall either utilize the recommendations by the Nutrient Science Advisory Committee or develop its own watershed-specific target levels.
D. The NARP shall identify phosphorus input reductions from point sources and non-point sources in addition to other measures necessary to remove the risk of eutrophication characteristics that will cause or may cause violation of a water quality standard. The NARP may determine, based on an assessment of relevant data, that the watershed does not have a risk of eutrophication related to phosphorus, in which case phosphorus input reductions or other measures would not be necessary. Alternatively, the NARP could determine that phosphorus input reductions from point sources are not necessary, or that phosphorus input reductions from both point and nonpoint sources are necessary, or that phosphorus input reductions are not necessary and that other measures, besides phosphorus input reductions, are necessary.
E. The NARP shall include a schedule for the implementation of the phosphorus input reductions and other measures. The NARP schedule shall be implemented as soon as possible and shall identify specific timelines applicable to the permittee.
F. The NARP can include provisions for water quality trading to address the phosphorus related risk of eutrophication characteristics in the watershed. Phosphorus/Nutrient trading cannot result in violations of water quality standards or applicable antidegradation requirements.
G. The Permittee shall request modification of the permit within 90 days after the NARP has been completed to include necessary phosphorus input reductions identified within the NARP. The Agency will modify the permit if necessary.
H. If the Permittee does not develop or assist in developing the NARP and such a NARP is developed for the watershed, the Permittee will become subject to effluent limitations necessary to address the risk of eutrophication. The Agency shall calculate these effluent limits by using the NARP and any applicable data. If no NARP has been developed, the effluent limits shall be determined for the Permittee on a case-by-case basis, so as to ensure that the Permittee's discharge will not cause or contribute to violations of the dissolved oxygen or narrative offensive condition water quality standards.

SPECIAL CONDITION 21.

A. Subject to paragraph B below, an effluent limit of 0.5 mg/L Total Phosphorus 12 month rolling geometric mean (calculated monthly) basis (hereinafter "Limit"), shall be met by the Permittee by January 1, 2030, unless the Permittee demonstrates that meeting such Limit is not technologically or economically feasible in one of the following manners:
   1. the Limit is not technologically feasible through the use of biological phosphorus removal (BPR) process(es) at the treatment facility; or
   2. the Limit would result in substantial and widespread economic or social impact. Substantial and widespread economic impacts must be demonstrated using applicable USEPA guidance, including but not limited to any of the following documents:
      a. Interim Economic Guidance for Water Quality Standards, March 1995, EPA-823-95-002;
      b. Combined Sewer Overflows – Guidance for Financial Capability Assessment and Schedule Development, February 1997, EPA-832—97-004;
      c. Financial Capability Assessment Framework for Municipal Clean Water Act Requirements, November 24, 2014; and

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d. any additional USEPA guidance on affordability issues that revises, supplements or replaces those USEPA guidance documents; or

3. the Limit can only be met by chemical addition for phosphorus removal at the treatment facility in addition to those processes currently contemplated; or
4. the Limit is demonstrated not to be feasible by January 1, 2030, but is feasible within a longer timeline, then the Limit shall be met as soon feasible and approved by the Agency; or
5. the Limit is demonstrated not to be achievable, then an effluent limit that is achievable by the Permittee (along with associated timeline) will apply instead, except that the effluent limit shall not exceed 0.6 mg/L Total Phosphorus 12 month rolling geometric mean (calculated monthly).

B. The Limit shall be met by the Permittee by January 1, 2030, except in the following circumstances:
1. If the Permittee develops a written plan, preliminary engineering report or facility plan no later than January 1, 2025, to rebuild or replace the secondary treatment process(es) of the treatment facility, the Limit shall be met by December 31, 2035; or
2. If the Permittee decides to construct/operate biological nutrient removal (BNR) process(es), incorporating nitrogen reduction, the Limit shall be met by December 31, 2035; or
3. If the Permittee decides to use chemical addition for phosphorus removal instead of BPR, the Limit and the effluent limit of 1.0 mg/L Total Phosphorus monthly average shall be met by December 31, 2025; or
4. If the Permittee has already installed chemical addition for phosphorus removal instead of BPR, and has a 1.0 mg/L Total Phosphorus monthly average effluent limit in its permit, or the Permittee is planning to install chemical addition with an IEPA construction permit that is issued on or before July 31, 2018, the 1.0 mg/L Total Phosphorus monthly average effluent limit (and associated compliance schedule) shall apply, and the Limit shall not be applicable.
5. The NARP determines that a limit lower than the Limit is necessary and attainable. The lower limit and timeline identified in the NARP shall apply to the Permittee.
6. If the Permittee participates in a watershed group that is developing a NARP for an impairment related to phosphorus or a risk eutrophication, and IEPA determines that the group has the financial and structural capability to develop the NARP by the deadline specified in the NARP provisions below.

C. The Permittee shall identify and provide adequate justification of any exception identified in paragraph (A) or circumstance identified in paragraph (B), regarding meeting the Limit. The justification shall be submitted to the Agency at the time of renewal of this permit or by December 31, 2023, whichever date is first. Any justification or demonstration performed by the Permittee pursuant to paragraph (A) or circumstance pursuant to paragraph (B) must be reviewed and approved by the Agency. The Agency will renew or modify the NPDES permit as necessary. No date deadline modification or effluent limitation modification for any of the exceptions or circumstances specified in paragraphs (A) or (B) will be effective until it is included in a modified or reissued NPDES Permit.

D. For purposes of this permit, the following definitions are used:
1. BPR (Biological Phosphorus Removal) is defined herein as treatment processes which do not require use of supplemental treatment processes at the treatment facilities before or after the biological system, such as but not limited to, chemical addition, carbon supplementation, fermentation, or filtration. The use of filtration or additional equipment to meet other effluent limits is not prohibited, but those processes will not be considered part of the BPR process for purposes of this permit; and
2. BNR (Biological Nutrient Removal) is defined herein as treatment processes used for nitrogen and phosphorus removal from wastewater before it is discharged. BNR treatment processes, as defined herein, do not require use of supplemental treatment processes at the treatment facilities before or after the biological system, such as but not limited to, chemical addition, carbon supplementation, fermentation or filtration. The use of filtration or additional equipment to meet other effluent limits is not prohibited, but those processes will not be considered part of the BNR process for purposes of this permit.

E. The 0.5 mg/L Total Phosphorus 12 month rolling geometric mean (calculated monthly) effluent limit applies to the effluent from the treatment plant.

Attachment H
Standard Conditions

Definitions

Act means the Illinois Environmental Protection Act, 415 ILCS 5 as Amended.

Agency means the Illinois Environmental Protection Agency.

Board means the Illinois Pollution Control Board.

Clean Water Act (formerly referred to as the Federal Water Pollution Control Act) means Pub. L 92-500, as amended. 33 U.S.C. 1251 et seq.

NPDES (National Pollutant Discharge Elimination System) means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 402, 318 and 405 of the Clean Water Act.

USEPA means the United States Environmental Protection Agency.

Daily Discharge means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurements, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

Maximum Daily Discharge Limitation (daily maximum) means the highest allowable daily discharge.

Average Monthly Discharge Limitation (30 day average) means the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

Average Weekly Discharge Limitation (7 day average) means the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week.

Best Management Practices (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the State. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Aliquot means a sample of specified volume used to make up a total composite sample.

Grab Sample means an individual sample of at least 100 milliliters collected at a randomly-selected time over a period not exceeding 15 minutes.

24-Hour Composite Sample means a combination of at least 8 sample aliquots of at least 100 milliliters, collected at periodic intervals during the operating hours of a facility over a 24-hour period.

8-Hour Composite Sample means a combination of at least 3 sample aliquots of at least 100 milliliters, collected at periodic intervals during the operating hours of a facility over an 8-hour period.

Flow Proportional Composite Sample means a combination of sample aliquots of at least 100 milliliters collected at periodic intervals such that either the time interval between each aliquot or the volume of each aliquot is proportional to either the stream flow at the time of sampling or the total stream flow since the collection of the previous aliquot.

(1) **Duty to comply.** The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action, permit termination, revocation and reissuance, modification, or for denial of a permit renewal application. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirements.

(2) **Duty to reapply.** If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. If the permittee submits a proper application as required by the Agency no later than 180 days prior to the expiration date, this permit shall continue in full force and effect until the final Agency decision on the application has been made.

(3) **Need to halt or reduce activity not a defense.** It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

(4) **Duty to mitigate.** The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

(5) **Proper operation and maintenance.** The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up, or auxiliary facilities, or similar systems only when necessary to achieve compliance with the conditions of the permit.

(6) **Permit actions.** This permit may be modified, revoked and reissued, or terminated for cause by the Agency pursuant to 40 CFR 122.62 and 40 CFR 122.63. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

(7) **Property rights.** This permit does not convey any property rights of any sort, or any exclusive privilege.

(8) **Duty to provide information.** The permittee shall furnish to the Agency within a reasonable time, any information which the Agency may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with the permit. The permittee shall also furnish to the Agency upon request, copies of records required to be kept by this permit.

(9) **Inspection and entry.** The permittee shall allow an authorized representative of the Agency or USEPA (including an authorized contractor acting as a representative of the Agency or USEPA), upon the presentation of credentials and other documents as may be required by law, to:

(a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

(b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

(c) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

(d) Sample or monitor at reasonable times, for the purpose of assuring permit compliance, or as otherwise authorized by the Act, any substances or parameters at any location.

(10) **Monitoring and records.**

(a) Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

(b) The permittee shall retain records of all monitoring information, including all calibration and maintenance records, and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of this permit, measurement, report or application. Records related to the permittee's sewage sludge use and disposal activities shall be retained for a period of at least five years (or longer as required by 40 CFR Part 503). This period may be extended by request of the Agency or USEPA at any time.

(c) Records of monitoring information shall include:

(1) The date, exact place, and time of sampling or measurements;
(2) The individual(s) who performed the sampling or measurements;
(3) The date(s) analyses were performed;
(4) The individual(s) who performed the analyses;
(5) The analytical techniques or methods used; and
(6) The results of such analyses.

(d) Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit. Where no test procedure under 40 CFR Part 136 has been approved, the permittee must submit to the Agency a test method for approval. The permittee shall calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals to ensure accuracy of measurements.

(11) **Signatory requirement.** All applications, reports or information submitted to the Agency shall be signed and certified.

(a) **Application.** All permit applications shall be signed as follows:

(1) For a corporation: by a principal executive officer of at least the level of vice president or a person or position having overall responsibility for environmental matters for the corporation:
(2) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or
(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.

(b) **Reports.** All reports required by permits, or other information requested by the Agency shall be signed by a person described in paragraph (a) or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described in paragraph (a); and
(2) The authorization specifies either an individual or a position responsible for the overall operation of the facility, from which the discharge originates, such as a plant manager, superintendent or person of equivalent responsibility; and
(3) The written authorization is submitted to the Agency.

(c) **Changes of Authorization.** If an authorization under (b) is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of (b) must be submitted to the Agency prior to or together with any reports, information, or applications to be signed by an authorized representative.

(d) **Certification.** Any person signing a document under paragraph (a) or (b) of this section shall make the following certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

(12) **Reporting requirements.**

(a) **Planned changes.** The permittee shall give notice to the Agency as soon as possible of any planned physical alterations or additions to the permitted facility.
Notice is required when:

(1) The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source pursuant to 40 CFR 122.29 (b); or
(2) The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements pursuant to 40 CFR 122.42 (a)(1).
(3) The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan.

(b) **Anticipated noncompliance.** The permittee shall give advance notice to the Agency of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

(c) **Transfers.** This permit is not transferable to any person except after notice to the Agency.

(d) **Compliance schedules.** Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

(e) **Monitoring reports.** Monitoring results shall be reported at the intervals specified elsewhere in this permit.

(1) Monitoring results must be reported on a Discharge Monitoring Report (DMR).

(2) If the permittee monitors any pollutant more frequently than required by the permit, using test procedures approved under 40 CFR 136 or as specified in the permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.

(3) Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified by the Agency in the permit.

(f) **Twenty-four hour reporting.** The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24-hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and time; and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. The following shall be included as information which must be reported within 24-hours:

(1) Any unanticipated bypass which exceeds any effluent limitation in the permit.

(2) Any upset which exceeds any effluent limitation in the permit.

(3) Violation of a maximum daily discharge limitation for any of the pollutants listed by the Agency in the permit or any pollutant which may endanger health or the environment.

The Agency may waive the written report on a case-by-case basis if the oral report has been received within 24-hours.

(g) **Other noncompliance.** The permittee shall report all instances of noncompliance not reported under paragraphs (12) (d), (e), or (f), at the time monitoring reports are submitted. The reports shall contain the information listed in paragraph (12) (f).

(h) **Other information.** Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to the Agency, it shall promptly submit such facts or information.

(13) **Bypass.**

(a) Definitions.

(1) Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

(2) Severe property damage means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

(b) Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs (13)(c) and (13)(d).

(c) Notice.

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass.

(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in paragraph (12)(f) (24-hour notice).

(d) Prohibition of bypass.

(1) Bypass is prohibited, and the Agency may take enforcement action against a permittee for bypass, unless:

(i) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(ii) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(iii) The permittee submitted notices as required under paragraph (13)(c).

(2) The Agency may approve an anticipated bypass, after considering its adverse effects, if the Agency determines that it will meet the three conditions listed above in paragraph (13)(d)(1).

(14) **Upset.**

(a) Definition. Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

(b) Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of paragraph (14)(c) are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

(c) Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(1) An upset occurred and that the permittee can identify the cause(s) of the upset;

(2) The permitted facility was at the time being properly operated; and

(3) The permittee submitted notice of the upset as required in paragraph (12)(f)(2) (24-hour notice).

(4) The permittee complied with any remedial measures required under paragraph (4).

(d) Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

(15) **Transfer of permits.** Permits may be transferred by modification or automatic transfer as described below:

(a) Transfers by modification. Except as provided in paragraph (b), a permit may be transferred by the permittee to a new owner or operator only if the permit has been modified or revoked and reissued pursuant to 40 CFR 122.62 (b) (2), or a minor modification made pursuant to 40 CFR 122.63 (d), to identify the new permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

(b) Automatic transfers. As an alternative to transfers under paragraph (a), any NPDES permit may be automatically transferred to a new permittee if:

(1) The current permittee notifies the Agency at least 30 days in advance of the proposed transfer date;

(2) The notice includes a written agreement between the existing and new permittees containing a specified date for transfer of permit responsibility, coverage and liability between the existing and new permittees; and

(3) The Agency does not notify the existing permittee and the proposed new permittee of its intent to modify or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement.

(16) All manufacturing, commercial, mining, and silvicultural dischargers must notify the Agency as soon as they know or have reason to believe:

(a) That any activity has occurred or will occur which would result in the discharge of any toxic pollutant identified under Section 307 of the Clean Water Act which is not limited in the permit, if that discharge will exceed the highest of the following notification levels:

(1) One hundred micrograms per liter (100 ug/l);

(2) Two hundred micrograms per liter (200 ug/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/l) for 2,4-dinitrophenol and for 2-methyl-4,6 dinitrophenol; and one milligram per liter (1 mg/l) for antimony.

(3) Five (5) times the maximum concentration value reported for that pollutant in the NPDES permit application; or

(4) The level established by the Agency in this permit.

(b) That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the NPDES permit application.

(17) All Publicly Owned Treatment Works (POTWs) must provide adequate notice to the Agency of the following:

(a) Any new introduction of pollutants into that POTW from an indirect discharge which would be subject to Sections 301 or 306 of the Clean Water Act if it were directly discharging those pollutants; and

(b) Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

(c) For purposes of this paragraph, adequate notice shall include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

(18) If the permit is issued to a publicly owned or publicly regulated treatment works, the permittee shall require any industrial user of such treatment works to comply with federal requirements concerning:

(a) User charges pursuant to Section 204 (b) of the Clean Water Act, and applicable regulations appearing in 40 CFR 35;

(b) Toxic pollutant effluent standards and pretreatment standards pursuant to Section 307 of the Clean Water Act; and

(c) Inspection, monitoring and entry pursuant to Section 308 of the Clean Water Act.

(19) If an applicable standard or limitation is promulgated under Section 301(b)(2)(C) and (D), 304(b)(2), or 307(a)(2) and that effluent standard or limitation is more stringent than any effluent limitation in the permit, or controls a pollutant not limited in the permit, the permit shall be promptly modified or revoked, and reissued to conform to that effluent standard or limitation.

(20) Any authorization to construct issued to the permittee pursuant to 35 Ill. Adm. Code 309.154 is hereby incorporated by reference as a condition of this permit.

(21) The permittee shall not make any false statement, representation or certification in any application, record, report, plan or other document submitted to the Agency or the USEPA, or required to be maintained under this permit.

(22) The Clean Water Act provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Clean Water Act is subject to a civil penalty not to exceed $25,000 per day of such violation. Any person who willfully or negligently violates permit conditions implementing Sections 301, 302, 306, 307, 308, 318 or 405 of the Clean Water Act is subject to a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than one year, or both.
Additional penalties for violating these sections of the Clean Water Act are identified in 40 CFR 122.41 (a)(2) and (3).

(23) The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than 2 years, or both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment is a fine of not more than $20,000 per day of violation, or by imprisonment of not more than 4 years, or both.

(24) The Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

(25) Collected screening, slurries, sludges, and other solids shall be disposed of in such a manner as to prevent entry of those wastes (or runoff from the wastes) into waters of the State. The proper authorization for such disposal shall be obtained from the Agency and is incorporated as part hereof by reference.

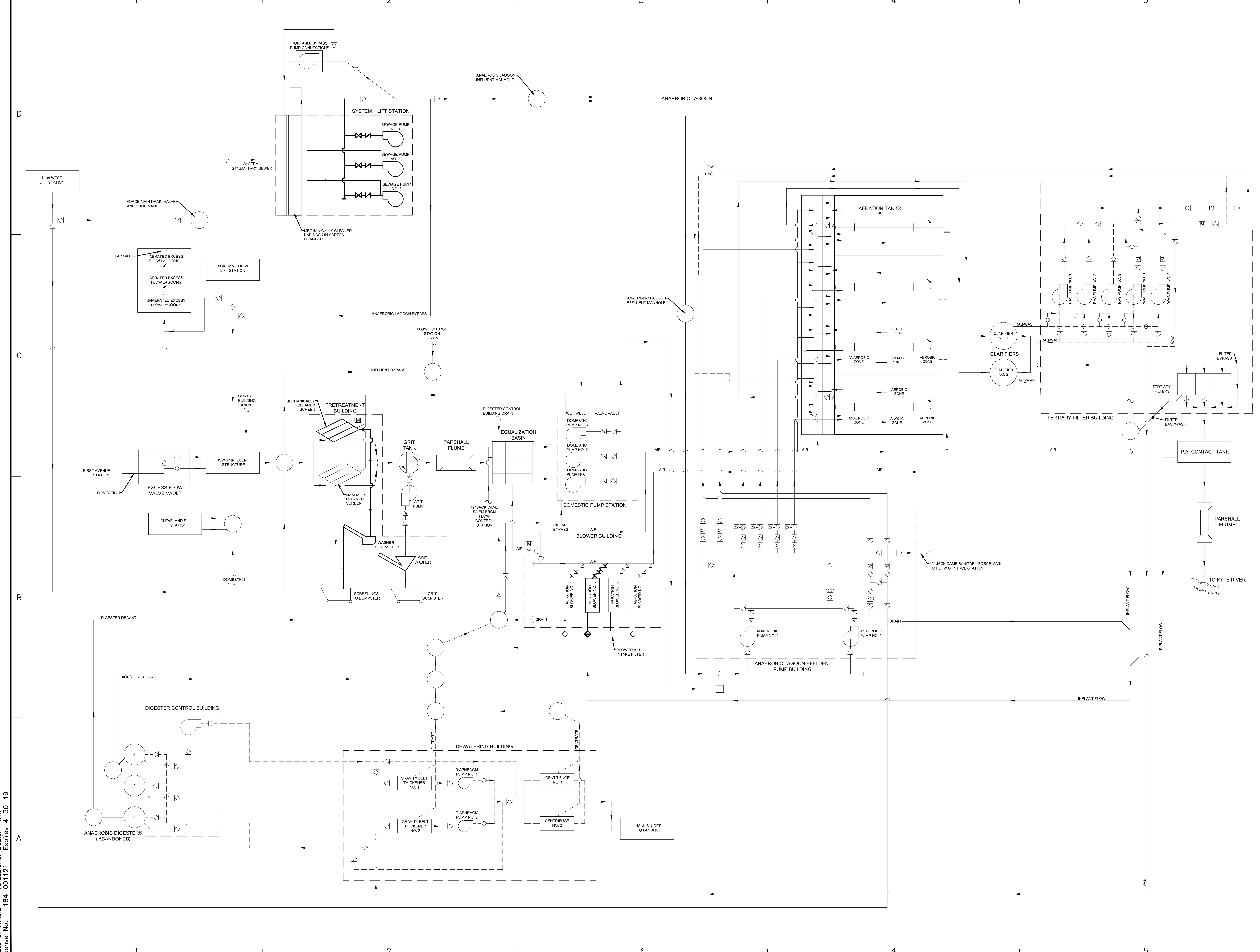
(26) In case of conflict between these standard conditions and any other condition(s) included in this permit, the other condition(s) shall govern.

(27) The permittee shall comply with, in addition to the requirements of the permit, all applicable provisions of 35 Ill. Adm. Code, Subtitle C, Subtitle D, Subtitle E, and all applicable orders of the Board or any court with jurisdiction.

(28) The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit is held invalid, the remaining provisions of this permit shall continue in full force and effect.

Appendix B

BAXTER & WOODMAN
Consulting Engineers



BAXTER & WOODMAN
Consulting Engineers

CONSULTANTS

MILESTONE

FOR CONSTRUCTION

NO.	DATE	REVISIONS DESCRIPTION

* - REFER TO EQUIPMENT MANUFACTURER'S SHOP DRAWING
** -

PLAN SHEET DESIGNATION
COVER
G - GENERAL
H - HAZARDOUS MATERIALS
C - CIVIL
L - LANDSCAPE
S - STRUCTURAL
A - ARCHITECTURAL
Q - EQUIPMENT
I - INSTRUMENTATION
F - FIRE PROTECTION
P - PLUMBING
M - MECHANICAL
E - ELECTRICAL
T - TELECOMMUNICATIONS
R - RESOURCE

PROJECT NO: 171097.40

SCALE: AS NOTED
DATE: 4-6-19
DESIGNED BY: ARH
DRAWN BY: MAB
CHECKED BY: CFF

CLIENT

CITY OF ROCHELLE, ILLINOIS

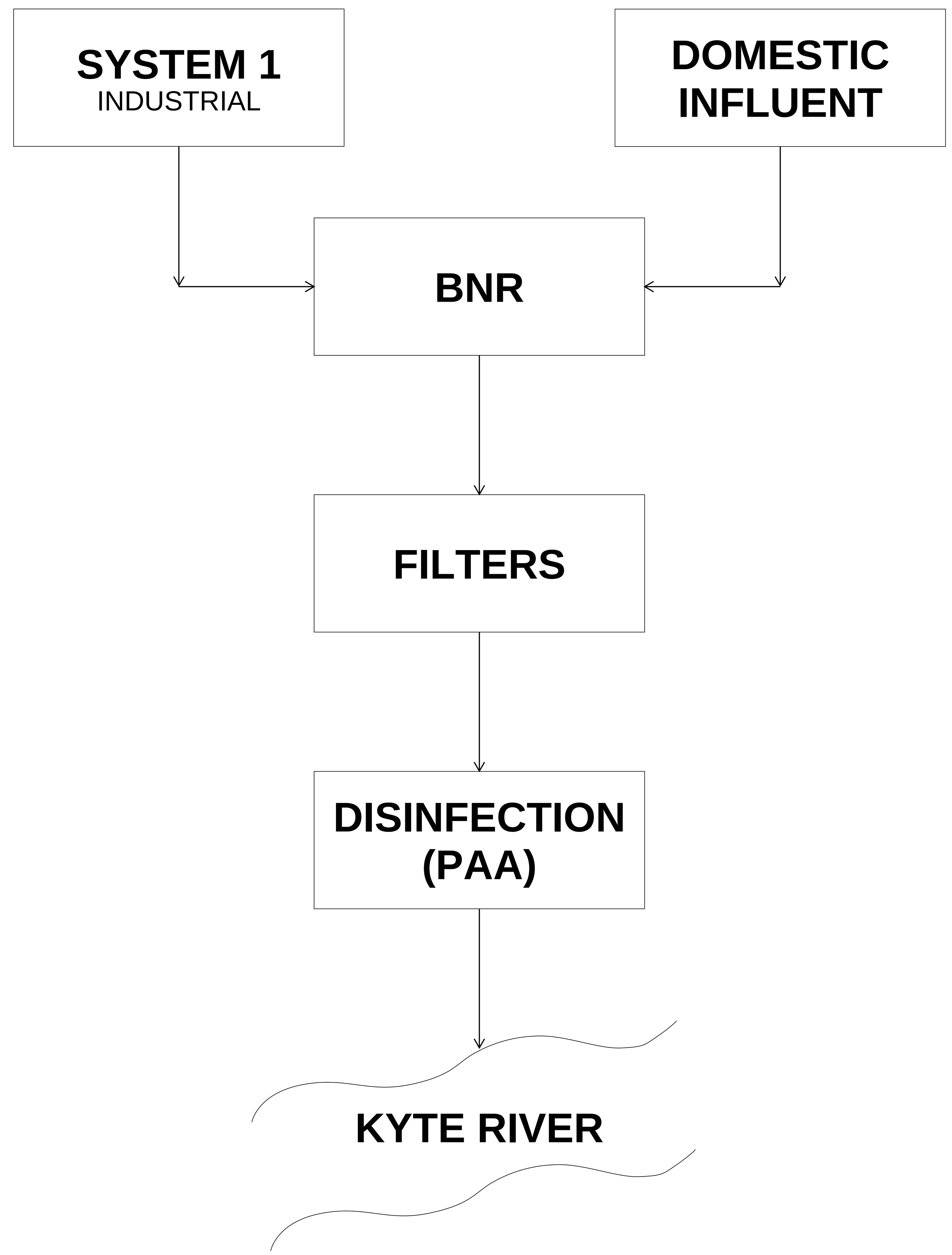
WATER RECLAMATION FACILITY IMPROVEMENTS

SHEET TITLE

PROCESS FLOW DIAGRAM

G-6

I:\CRYSTAL LAKE\ROCHC\171097-WATER REC IMPROVEMENTS\CADD\DRAWINGS\CURRENT\ROCHC-2D DRAWINGS\SHEETS\GENERAL\PROCESS FLOW DIAGRAM.DWG G-6 Process Flow Diagram
Plotted: 06/24/19 By: 078MSB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INDUSTRIAL
DOMESTIC INFLUENT
BNR
FILTERS
DISINFECTION (PAA)
KYTE RIVER


BNR
MANUALLY-CLEANED BAR RACK
RAW SEWAGE PUMPS
ANAEROBIC LAGOON
ANAEROBIC LAGOON EFFLUENT PUMPS

SYSTEM 1


BNR
MECHANICALLY-
CLEANED
FINE SCREEN
GRIT TANK
PARSHALL FLUME
FLOW METER
AERATED FLOW
EQUALIZATION TANKS
DOMESTIC PUMPS

DOMESTIC

BIOLOGICAL NUTRIENT REMOVAL

Appendix C

BAXTER & WOODMAN
Consulting Engineers

Appendix C - Rochelle WRF 2021 DMR Data

	Domestic (Combined) Influent							Anaerobic Lagoon Effluent						
Date	Average Flow (MGD)	Daily Max Flow (MGD)	Average BOD5 (mg/L)	Average TSS (mg/L)	Average TP (mg/L)	Average Ammonia (mg/L)	Average Total Nitrogen (mg/L)	Average Flow (MGD)	Daily Max Flow (MGD)	Average BOD5 (mg/L)	Average TSS (mg/L)	Average TP (mg/L)	Average Ammonia (mg/L)	Average Total Nitrogen (mg/L)
Jan-21	1.59	2.00	99.2	73.7	6.7	15.7	20.0	0.68	0.77	605.0	91.5	15.0	27.6	35.0
Feb-21	1.81	2.81	94.8	52.0	7.3	14.6	23.0	0.75	0.87	716.9	147.1	20.0	35.5	36.0
Mar-21	2.87	5.57	92.8	46.3	24.0	8.4	9.0	0.81	0.90	593.6	96.4	24.0	30.2	31.0
Apr-21	2.63	3.45	108.4	35.0	15.0	12.8	21.0	0.82	1.08	518.1	99.0	15.0	31.6	26.0
May-21	2.17	2.49	110.5	42.4	18.0	17.2	28.0	0.76	0.84	560.8	91.1	18.0	40.4	37.0
Jun-21	2.15	2.75	105.1	46.9	10.0	17.7	35.0	0.76	0.89	639.8	104.2	15.0	41.9	43.0
Jul-21	2.05	2.43	87.1	43.0	11.0	13.1	21.0	0.82	0.92	552.1	101.5	14.0	35.5	36.0
Aug-21	1.79	2.28	93.5	46.5	12.0	22.1	18.0	0.79	0.85	553.1	112.7	16.0	53.2	31.0
Sep-21	1.36	1.60	116.5	33.4	18.0	25.1	32.0	0.60	0.72	491.7	123.5	14.0	47.7	41.0
Oct-21	1.74	2.57	120.4	48.4	19.0	22.7	40.0	0.81	1.14	468.0	111.5	19.0	44.1	48.0
Nov-21	1.90	2.15	101.7	63.5	20.0	18.5	27.0	0.74	1.78	425.0	92.4	13.0	33.2	36.0
Dec-21	1.92	2.18	109.6	73.8	13.0	15.6	20.0	0.70	0.85	479.2	104.9	17.0	26.5	36.0
Jan-22	1.79	2.10	162.6	69.6	14.6	17.4	not sampled	0.66	0.85	538.0	120.7	19.2	16.9	not sampled
Feb-22	1.71	2.36	184.0	63.0	19.4	19.3	not sampled	0.67	0.79	574.0	217.0	20.5	22.7	not sampled
Mar-22	2.14	2.60	192.0	68.0	15.4	14.5	not sampled	0.85	1.16	486.0	218.0	18.7	18.3	not sampled
Apr-22	2.68	3.48	104.4	45.8	8.7	13.3	not sampled	0.83	1.03	333.9	81.3	16.7	13.7	not sampled
May-22	2.44	3.11	106.7	44.2	6.2	13.1	not sampled	0.99	1.30	312.0	86.7	21.1	16.8	not sampled
Maximum	2.87	5.57	192	73.78	24	25.11	40	0.99	1.78	716.93	218	24	53.19	48
Average	2.04	2.70	117.02	52.67	14.02	16.53	24.50	0.77	0.98	520.41	117.62	17.42	31.52	36.33
Minimum	1.36	1.6	87.06	33.41	6.23	8.39	9	0.6	0.72	312	81.3	13	13.66	26

Appendix C - Rochelle WRF 2021 DMR Data

	WRF Effluent (Outfall 001)					
Date	Average Flow (MGD)	Average BOD5 (mg/L)	Average TSS (mg/L)	Maximum TP (mg/L)	Average Ammonia (mg/L)	Maximum TN (mg/L)
Jan-21	2.17	1.7	0.4	0.1	0.1	2.2
Feb-21	2.35	2.7	0.6	0.1	0.1	2.3
Mar-21	3.21	1.7	0.7	0.0	0.1	1.0
Apr-21	2.88	1.7	0.7	0.2	0.1	1.9
May-21	2.46	2.9	1.1	3.5	0.1	3.3
Jun-21	2.65	1.9	0.4	0.1	0.1	3.9
Jul-21	2.98	2.1	0.6	0.3	0.1	3.3
Aug-21	2.96	1.6	0.7	0.6	0.1	3.6
Sep-21	2.38	1.7	1.2	8.3	0.1	5.1
Oct-21	2.11	1.6	0.6	7.2	0.1	4.7
Nov-21	2.03	1.2	0.6	12.0	0.2	6.9
Dec-21	2.14	2.1	3.1	9.2	0.1	5.4
Jan-22	2.19	2.1	0.8	0.2	0.1	2.5
Feb-22	2.35	1.4	0.7	0.4	0.1	2.6
Mar-22	2.56	2.3	3.3	0.2	0.1	2.7
Apr-22	3.05	1.8	0.4	2.2	0.1	2.5
May-22	2.92	1.8	0.5	1.4	0.1	1.4
Maximum	3.211	2.87	3.31	12	0.24	6.9
Average	2.55	1.89	0.96	2.70	0.11	3.25
Minimum	2.03	1.21	0.41	0.04	0.1	1

Appendix D

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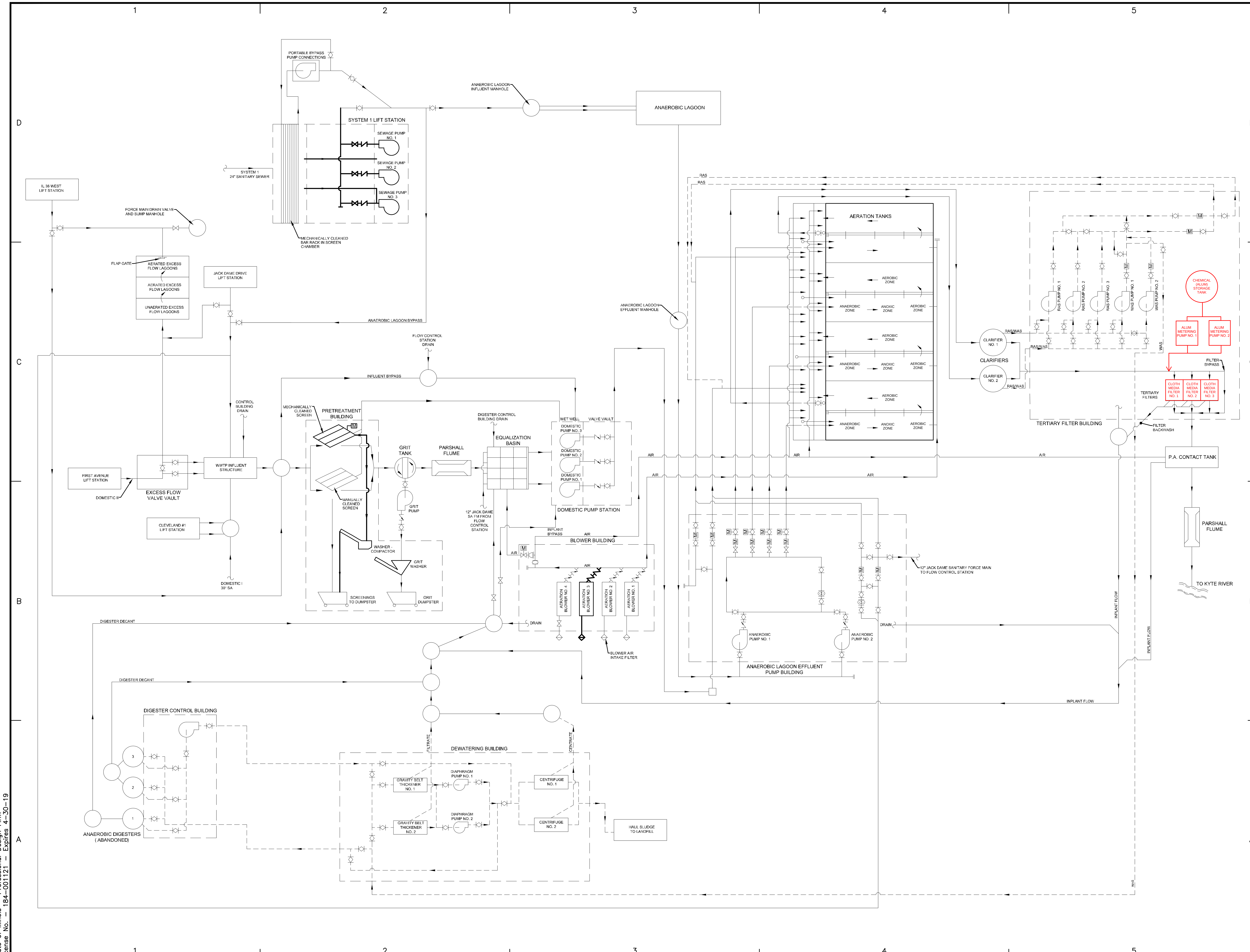

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Consulting Engineers

CONSULTANTS

MILESTONE

FOR CONSTRUCTION

NO.	DATE	DESCRIPTION

REVISIONS

* - REFER TO EQUIPMENT MANUFACTURER'S SHOP DRAWING
** -

PLAN SHEET DESIGNATION

COVER
G - GENERAL
H - HAZARDOUS MATERIALS
C - CIVIL
L - LANDSCAPE
S - STRUCTURAL
A - ARCHITECTURAL
I - INSTRUMENTATION
Q - EQUIPMENT
F - FIRE PROTECTION
P - PLUMBING
M - MECHANICAL
E - ELECTRICAL
T - TELECOMMUNICATIONS
R - RESOURCE

PROJECT NO: 171097.40

SCALE: AS NOTED
DATE: 4-6-19
DESIGNED BY: ARH
DRAWN BY: MAB
CHECKED BY: CFF

CLIENT

CITY OF ROCHELLE, ILLINOIS

WATER RECLAMATION FACILITY IMPROVEMENTS

SHEET TITLE

PROCESS FLOW DIAGRAM

G-6

I:\CRYSTAL LAKE\ROCHC\171097-WATER REC IMPROVEMENTS\CADD\DRAWINGS\CURRENT\ROCHC-2D DRAWINGS\SHEETS\GENERAL\PROCESS FLOW DIAGRAM.DWG G-6 Process Flow Diagram
Plotted: 06/24/19 By: 078MSB

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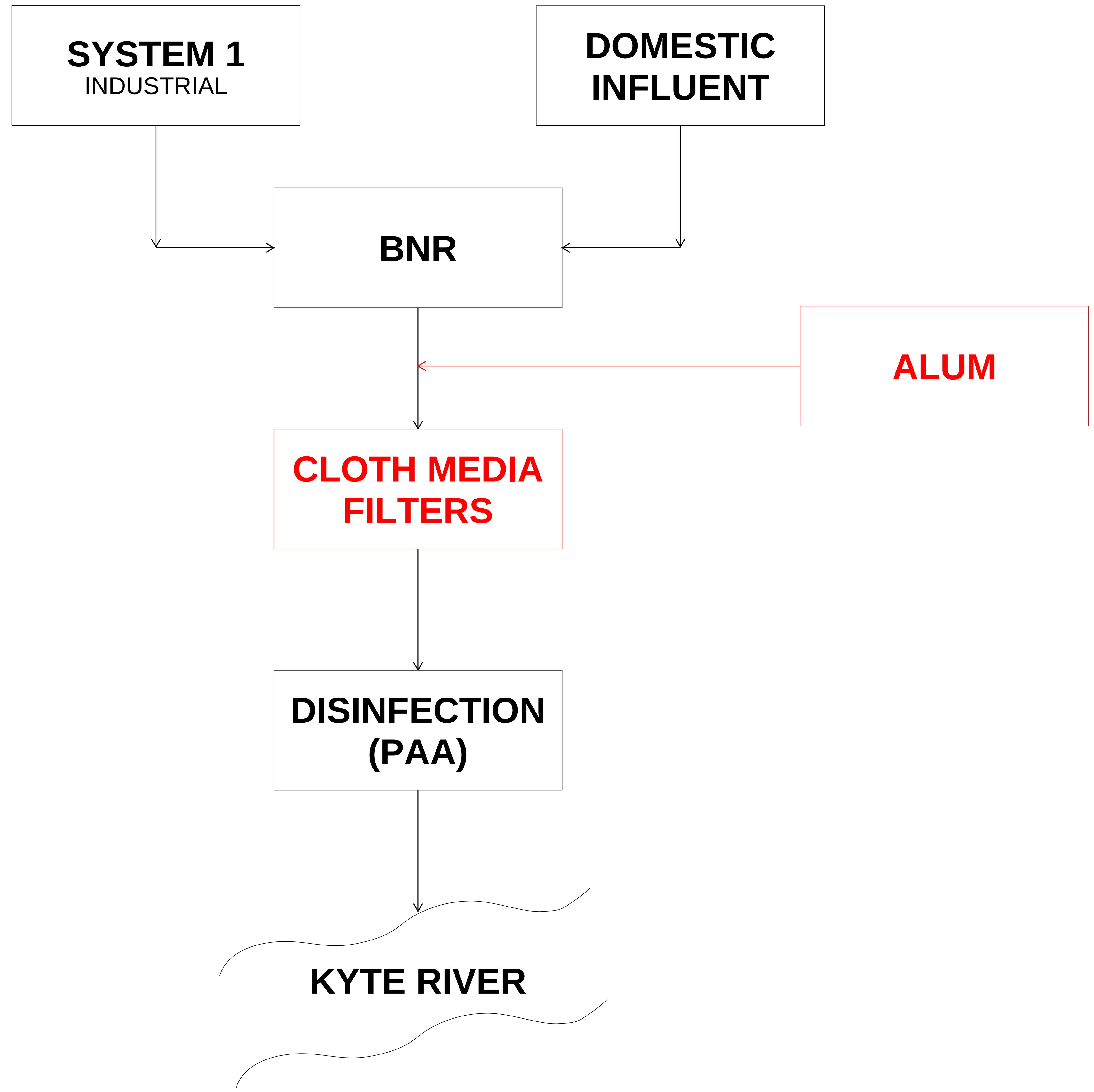
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DOMESTIC INFLUENT
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ALUM
CLOTH MEDIA FILTERS
DISINFECTION (PAA)
KYTE RIVER


BNR
MANUALLY-CLEANED BAR RACK
RAW SEWAGE PUMPS
ANAEROBIC LAGOON
ANAEROBIC LAGOON EFFLUENT PUMPS

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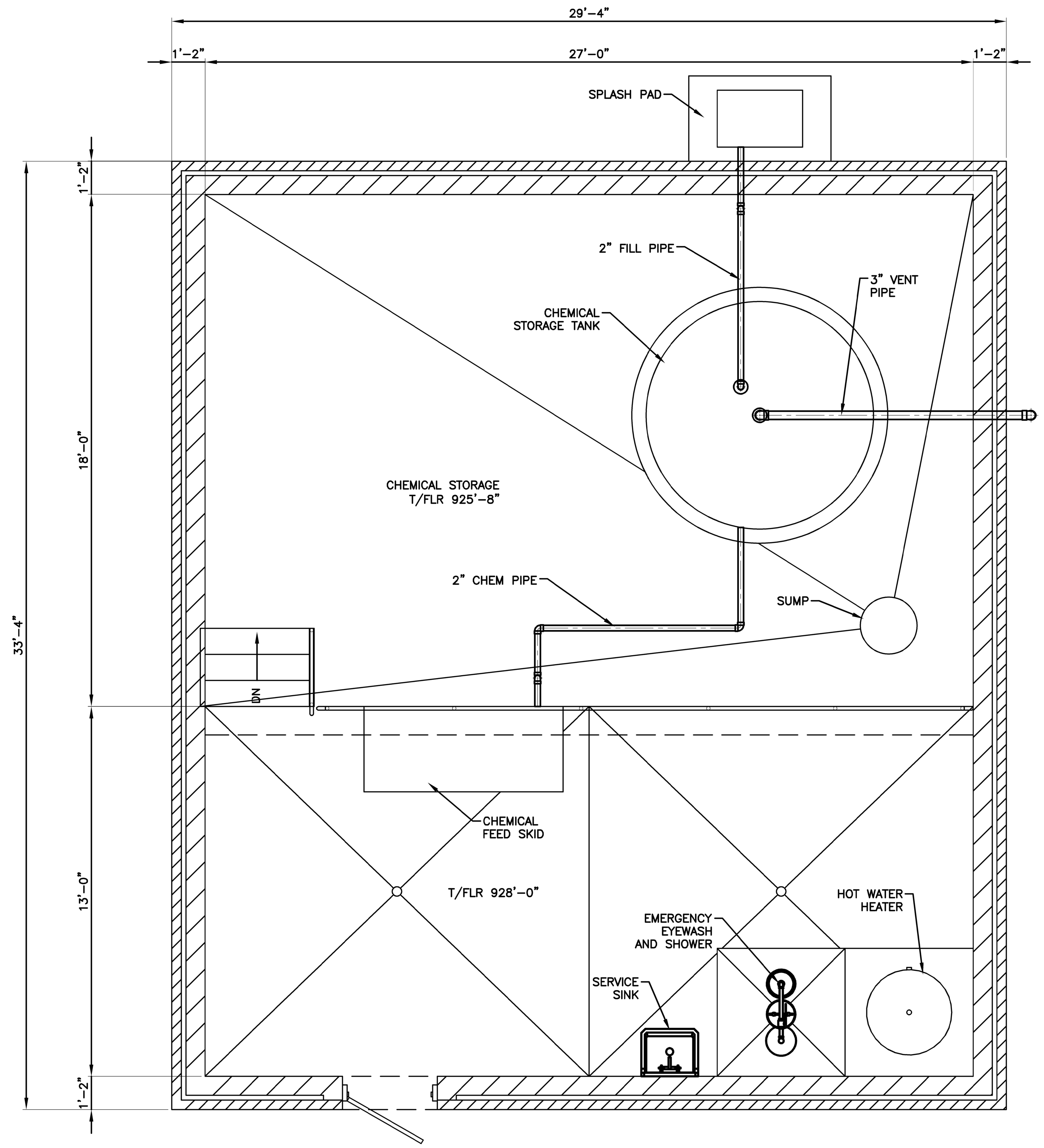
MECHANICALLY-
CLEANED
FINE SCREEN
GRIT TANK
PARSHALL FLUME
FLOW METER
AERATED FLOW
EQUALIZATION TANKS
DOMESTIC PUMPS

DOMESTIC

BIOLOGICAL NUTRIENT REMOVAL

Appendix E



FLOOR PLAN
SCALE: 3/8" = 1'-0"

BAXTER & WOODMAN
Consulting Engineers

CONSULTANTS

MILESTONE

PLANNING

REVISIONS

NO.	DATE	DESCRIPTION

* - REFER TO EQUIPMENT MANUFACTURER'S SHOP DRAWING
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- COVER
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- M - MECHANICAL
- E - ELECTRICAL
- T - TELECOMMUNICATIONS
- R - RESOURCE

PROJECT NO: 200144.30

SCALE: AS NOTED
DATE:
DESIGNED BY: NJD
DRAWN BY: MAB
CHECKED BY: ARS

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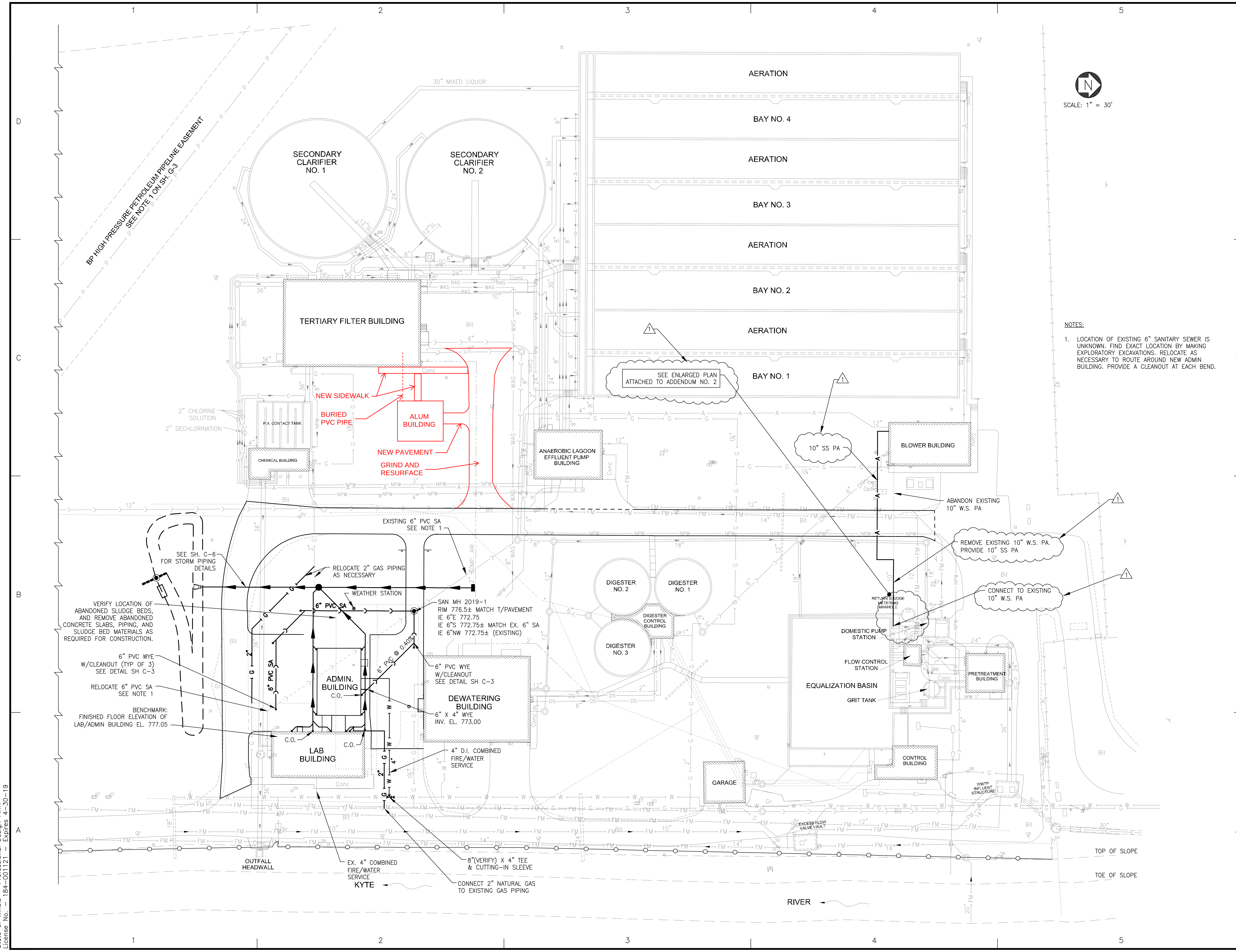
CITY OF ROCHELLE, IL WATER RECLAMATION FACILITY

PHOSPHOROUS FEASIBILITY STUDY

SHEET TITLE

CHEMICAL BUILDING FLOOR PLAN

APPENDIX E



I:\CRYSTAL LAKE\ROCHC\171097-WATER REC IMPROVEMENTS\CADD\DRAWINGS\CURRENT\171097-APLN C3D14.DWG C-7 PIPING PLAN - NORTH
Plotted: 06/24/19 By: 078MSB
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BAXTER & WOODMAN Consulting Engineers

CONSULTANTS

MILESTONE

FOR CONSTRUCTION

REVISIONS

NO.	DATE	DESCRIPTION
1	5/16/19	PER ADDENDUM NO. 2

* - REFER TO EQUIPMENT MANUFACTURER'S SHOP DRAWING
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PLAN SHEET DESIGNATION
COVER
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H - HAZARDOUS MATERIALS
C - CIVIL
L - LANDSCAPE
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E - ELECTRICAL
T - TELECOMMUNICATIONS
R - RESOURCE

PROJECT NO:	171097.40
SCALE:	AS NOTED
DATE:	4-6-19
DESIGNED BY:	ARH
DRAWN BY:	SLE
CHECKED BY:	CFF

CLIENT

CITY OF ROCHELLE, IL WATER RECLAMATION FACILITY

PHOSPHOROUS FEASIBILITY STUDY

SHEET TITLE

CHEMICAL BUILDING PIPING PLAN - NORTH

APPENDIX E