NUTRIENT ASSESSMENT REDUCTION PLAN

December 2023

VILLAGE OF RANTOUL, ILLINOIS

PREPARED BY: NORTHWATER CONSULTING AND DONOHUE & ASSOCIATES

PREPARED FOR: VILLAGE OF RANTOUL, ILLINOIS

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LIST OF ACROYNMS

BNR	Biological Nutrient Removal
CFS	Cubic Feet Per Second
CWA	Clean Water Act
DAF	Design Average Flow
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
EPA	Environmental Protection Agency
HUC	Hydrologic Unit Code
INLRS	Illinois Nutrient Loss Reduction Strategy
MGD	Million Gallons per Day
NARP	Nutrient Assessment Reduction Plan
NHD	National Hydrography Dataset
NRCS	Natural Resource Conservation Service
NLCD	National Land Cover Database
NPS	Nonpoint Source
NH_3	Ammonia
NO_3^-	Nitrate
NPDES	National Pollution Discharge Elimination System
POTW	Publicly Owned Treatment Works
SWCD	Soil and Water Conservation District
STEPL	Spreadsheet Tool for Estimating Pollutant Loads
SFSC	Salt Fork Steering Committee
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
UCSD	Urbana-Champaign Sanitary District
USGS	United States Geological Survey
USDA	United States Department of Agriculture
WIP	Watershed Implementation Plan
WWTP	Wastewater Treatment Plant

Village of Rantoul WWTP

1. INTRODUCTION & BACKGROUND

In 2018, the Illinois EPA instituted nutrient reduction permit requirements applicable to Publicly Owned Treatment Works (POTW) with effluent discharges greater than 1-million gallons per day (MGD). The nutrient reduction approach for POTWs supports a pathway to establish site-specific permit limits for phosphorus in the receiving streams at each facility in lieu of instituting a statewide limit. The Nutrient Assessment Reduction Plan (NARP) requirement resulted from negotiations with environmental organizations, Illinois EPA, and the Illinois Association of Wastewater Agencies.

A NARP Special Permit Condition is now included in a National Pollution Discharge Elimination System (NPDES) permit if a receiving stream segment or downstream segment is on the Illinois Clean Water Act (CWA) 303(d) list as impaired with phosphorus-related causes. A NARP is also required if there is a "risk of eutrophication" as defined by meeting any of the three conditions outlined in Table 1.

Table 1 - Illinois EPA Risk of Eutrophication Criteria

Risk of Eutrophication if any of these Conditions Met:		
pH	**Median Sestonic Chlorophyll α**	**On any Two Days During Illinois EPA Monitoring Week, Daily Max**
> 9	> 26 µg/L	pH > 8.35 and DO saturation > 110%

Whether the NARP special permit condition is triggered by a CWA 303(d) impairment listing, or eutrophication risk criteria, the designation is often based on limited data. For example, the risk of eutrophication justification for some sites is based on only two non-consecutive weeks of continuous Dissolved Oxygen (DO) and pH data collection performed by the Illinois EPA. In some cases, the data is over 10 years old.

The Illinois EPA allows the NPDES permittee to undertake additional data collection and assessment, which can confirm NARP triggering conditions, or determine that the watershed does not have a phosphorus-related impairment or risk of eutrophication. If sufficient evidence indicates no impairment or risk of eutrophication, it is possible that phosphorus regulation and mitigation measures may not be necessary. The following actions have been proposed to comply with the NARP permit condition:

- Examine if sufficient data exists to fully characterize impairment or risk of eutrophication in the receiving watershed.
    - If data is insufficient, create a water quality monitoring plan and collect data.
- If existing or new data indicates a full NARP is required:
    - Undertake watershed characterization.
    - Model watershed and instream processes.
    - Establish defensible site-specific water quality criteria.
    - Define scenarios and strategies to achieve water quality targets.
    - Implement NARP recommended actions and engage stakeholders.

This report details the monitoring program implemented to support a NARP Strategy and Work Plan. Section 2 provides an overview of water quality triggers. Section 3 describes the monitoring program, methods, and results with interpretation at the end of the section. Section 4 presents a Strategy and Work Plan following a watershed characterization.

1.1 TREATMENT PLANT BACKGROUND

The Village of Rantoul, located in Champaign County, Illinois, operates one POTW (NPDES Permit No. IL0022128) with a design average flow (DAF) of 4.33 MGD. The facility is subject to a NARP special permit condition with a deadline of December 31, 2023. The plant serves a population of approximately 12,100 with 4,660 residential, commercial, and industrial connections. A large slaughterhouse and meatpacking plant is a notable connection to the sewer system.

Treatment consists of screening, grit removal, holding or detention pond, primary clarification, trickling filtration, secondary clarification, nitrification towers, rapid sand filtration, anaerobic digestion, sludge belt filtration, drying beds, sludge lagoons, and landfill disposal of sludge. The plant also utilizes chemical phosphorus removal. The Wastewater Treatment Plant (WWTP) discharges to Upper Salt Fork Drainage Ditch, a small drainage channel at the point of discharge characterized with seven-day one in ten-year low flow (7Q10) of 0 cubic feet per second (CFS). Approximately 14.75 miles downstream from the outfall, the Salt Fork Drainage Ditch joins the Spoon River to form the Salt Fork Vermilion River. A further 3 miles downstream the Saline Branch Drainage Ditch joins the Salt Fork Vermilion River. The Urbana-Champaign Sanitary District (UCSD) Northeast WWTP (DAF 17.3 MGD) discharges into the Saline Branch Drainage Ditch and has a NARP requirement in its NPDES permit.

2. NARP TRIGGERS & ACTIONS

The Rantoul NARP special condition was triggered by the inclusion of the effluent-receiving stream segment (Upper Salt Fork Drainage Ditch, IL_BPJG) on Illinois' 2016 303(d) list of impaired waters. The segment was impaired for aquatic life use with causes of DO, pH and phosphorus and for aesthetic quality use with a potential cause of phosphorus. On the 2020/2022 list, the only impairment is for aquatic life use with a cause of phosphorus.

Supporting data was limited and not considered adequate to fully understand the nature of the stream impairment, nor the risk of eutrophication. It was not considered conclusive that nutrient concentrations in Rantoul effluent contributed to the impairment or the risk of eutrophication threshold exceedances. The drainage area upstream of the plant outfall is 10.9 mi^2, and the entire size of the watershed at the end of the impaired stream section is 89.2 mi^2. The watershed is primarily row crop agriculture with extensive tile drainage.

Data mining was undertaken using publicly available sources to locate any informative and relevant nutrient, DO, pH or chlorophyll data. Several sites were identified in the study area (Figure 1), however, there were no more than 4 days of measurements per parameter since 2012. A water quality monitoring plan (Appendix A) was created in cooperation with UCSD to further evaluate the status of the impairment, the risk of eutrophication and guide additional components of the NARP process. The plan was presented to Illinois EPA staff during a meeting on 4 March 2022, and thereafter modified to be responsive to the feedback received.

3. WATER QUALITY MONITORING PROGRAM & RESULTS

Based on Illinois EPA recommendations, a monitoring effort was carried out with three main objectives:

1. Confirm or contest the appropriateness of the NARP requirement for each plant's NPDES permit.
2. Improve understanding of nutrient dynamics to inform next steps if a NARP needs to be advanced to establish site-specific phosphorus limits.
3. Provide data to guide equitable implementation of nutrient reduction measures among contributors if such reductions are necessary.

Rantoul retained Northwater Consulting to develop the monitoring plan and support the Village in implementing the monitoring program. The Work Plan and Strategy presented in Sections 4.2 and 4.3 are guided by the monitoring results and the foundation of next steps in the NARP process.

3.1 MONITORING STATIONS & INFRASTRUCTURE

Figure 1 and Table 2 illustrate the two stations and pertinent details about the monitoring commissioned by the Village of Rantoul in 2022 and 2023. Section 3.2 details methods and parameters.

The WWTP discharges to Upper Salt Fork Drainage Ditch. The monitoring program was designed as an upstream/downstream configuration (Figure 1) to capture stream conditions (1) before the WWTP outfall, and (2) immediately after the outfall before the influence additional watershed area.

Data collection began May 2022 and continued through the end of October 2022. (Table 2). Due to abnormally low flows and several short data gaps due to instrument malfunction and fouling, three additional months of monitoring were undertaken in July-September 2023.

Table 2 - Monitoring Stations - 2022-2023 Period

Station ID	Name	Lat/Long (decimal degrees)	Approximate Distance from Outfall (mi)	Watershed area (mi^2)	Type of Sampling	Monitoring Periods
RNT-U	Upper Salt Fork Drainage Ditch Rantoul Upstream	40.31571, -88.12234	0.15 (upstream)	10.6	Continuous, Biweekly Grab	May - October 2022 & July - September 2023
RNT-D	Upper Salt Fork Drainage Ditch Rantoul Downstream	40.31240, -88.11739	0.3 (downstream)	13.3	Continuous, Biweekly Grab	May - October 2022 & July - September 2023

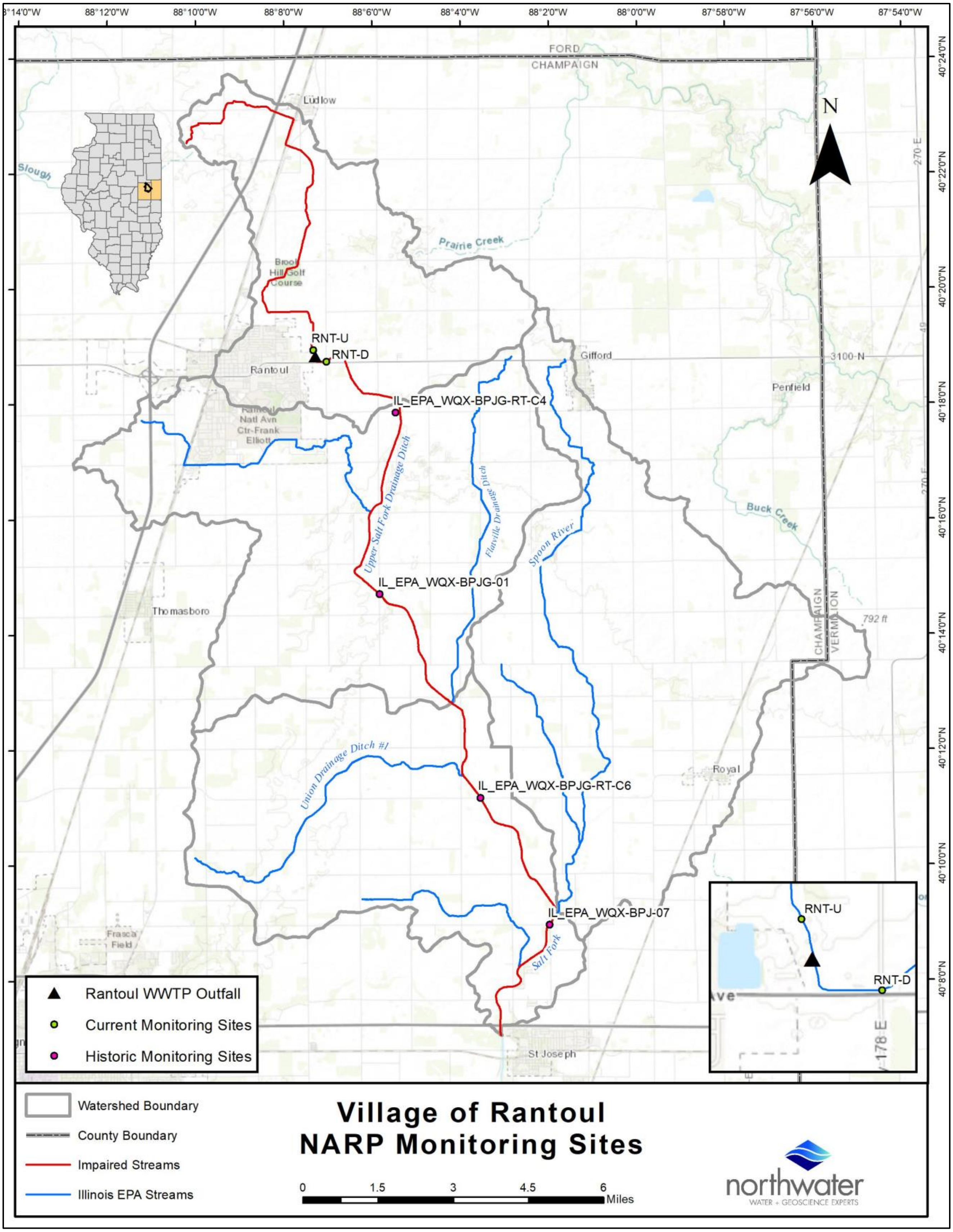

Figure 1 - Watershed Map and Monitoring Sites

3.2 METHODS

Sampling parameters were selected to be directly responsive to the NARP triggering criteria, with a combination of continuous monitoring, spot checks with handheld meters and grab samples submitted for lab analysis. Table 3 summarizes all parameters and other details including methods and sampling frequency. Continuous data collection stations included temporarily deployed infrastructure to facilitate use of water quality sondes. Sondes were placed in 3" perforated PVC pipes that extended from the bank as close as practical to the channel thalweg. The sondes were positioned so that they were in flowing water and not influenced by stagnant or non-flowing backwater conditions.

Continuous Monitoring

- In-Situ Inc. AquaTroll 500 multiparameter continuous monitoring sondes with anti-fouling wiper, internal logging, and battery deployed at both stations.
    - Bi-weekly site visits to download data, calibrate and maintain the sensors and infrastructure. All instrument calibrations and maintenance followed manufacturer's recommended practices and calibration logs were saved.
- The sondes were equipped with pH, DO, temperature, conductivity, and chlorophyll α optical fluorescence sensors. The sondes also included pressure transducers to record water height/stage.
- Data collection frequency was 15-minutes to enable the capture of daily maxima and minima of parameters such as pH and DO, which is relevant to Illinois EPA eutrophication risk criteria.
- Chlorophyll α optical fluorescence data was collected to better understand its occurrence and variability through the monitoring period as it is a eutrophication risk criterion (26 µg/L is the NARP threshold). The sensor data is considered a qualitative measurement and not reliable to make conclusive determinations of NARP triggers.

Spot Checks and Field Water Quality Data

- Water quality spot checks were performed bi-weekly for DO, pH, temperature, conductivity, and turbidity using calibrated handheld water meters (YSI ProQuatro and YSI ProDSS).
- Flow was measured bi-weekly at all sites using a measuring tape, top set wading rod and electromagnetic flowmeter. The United States Geological Survey (USGS) midsection method was applied to measure flows using a Hach FH-950 electromagnetic velocity meter, tape measure, and a top-set wading rod.
- Spot checks, flow measurement and instrument calibration were performed by Northwater Consulting.

Laboratory Analysis

- Nutrient grab samples were collected by WWTP staff on the bi-weekly schedule at all stations.
- Parameters included total phosphorus (TP), orthophosphate, total nitrogen (TN), ammonia (NH_3) and nitrate (NO_3^-), as well as chlorophyll α (Table 3).
- Nitrogen analysis was added for the 2023 monitoring season to support an improved understanding of in-steam chemistry processes.

- Laboratory analysis for nutrients was performed by WWTP staff in-house. Chlorophyll α was sent to an accredited contract laboratory (Pace Analytics, Peoria, IL) for analysis.

WWTP Effluent

Effluent data is collected as part of the Illinois EPA-required Discharge Monitoring Report (DMR). Parameters relevant to the NARP study include daily discharge and TP which is monitored and reported weekly.

- The average effluent flow for the Rantoul WWTP during the monitoring period was 5.16 MGD, or 7.98 ft^3/s.
- The average TP concentration in weekly effluent samples during the monitoring period was 0.32 mg/L.

Table 3 - Water Quality Monitoring Parameters and Methods

Parameter	Collection Type	Frequency	Method	Method Identifier	Sonde Calibration Method
Dissolved Oxygen	Continuous Probe	Continuous	Optical	InSitu: EPA Approved Method YSI: ASTM D888-09	100% Air Saturation
	Handheld Meter	Bi-weekly	Optical	ASTM D888-09	-
pH	Continuous Probe	Continuous	Potentiometric	EPA 150.2	2 Point 7 & 10 pH
	Handheld Meter	Bi-weekly	Potentiometric	EPA 150.2	-
Water Temperature	Continuous Probe	Continuous	Thermistor	EPA 170.1	Factory Calibration
	Handheld Meter	Bi-weekly	Thermistor	EPA 170.1	-
Chlorophyll-α	Continuous Probe	Continuous	In-situ Optical Fluorescence	Instrument Manufacturer Optical Method	2 Point Rhodamine 0 & 2.9 RFU
	Grab	Bi-weekly	Lab Spectrophotometric	EPA 445.0	-
Total Phosphorus	Grab	Bi-weekly	Colorimetry	EPA 365.1 / EPA 365.3	-
Orthophosphate	Grab	Bi-weekly	Colorimetry	EPA 365.1 / EPA 365.3	-
Ammonia	Grab	Bi-weekly	Colorimetry	Hach 10205	-
Nitrate	Grab	Bi-weekly	Colorimetry	Hach 10206	-
Total Kjeldahl Nitrogen	Calculated	-	Calculated	-	-
Total Nitrogen	Grab	Bi-weekly	Colorimetry	Hach 10208	-
Conductivity	Continuous Probe	Continuous	Resistor Network	EPA 120.1	1 Point 1,413 µS/cm

Parameter	Collection Type	Frequency	Method	Method Identifier	Sonde Calibration Method
	Handheld Probe	Bi-weekly	Resistor Network	EPA 120.1	-

3.3 MONITORING RESULTS

This section presents results of the monitoring program and is organized into relevant sections based on the measured parameters relevant to the NARP. All grab sampling data can be found in Appendix B.

STREAMFLOW

Table 4 and Figure 3 present a summary of the flow data collected during the monitoring period. Some data were influenced by precipitation and runoff events however, flows were generally low at all the sites through the monitoring period. Drought conditions were experienced as illustrated by nearby United States Geological Survey (USGSr) station 03337570 on the Saline Branch Drainage Ditch near Urbana. In 2022 this station recorded its lowest mean flows from May - October (Figure 2) since 2012. Data from 2023 is incomplete at the time of this report but is on track to be in the lowest quartile. The monitoring period is not considered representative of average conditions, and the hydrology and flows of the river systems were more significantly driven by POTWs during this period than is typical.

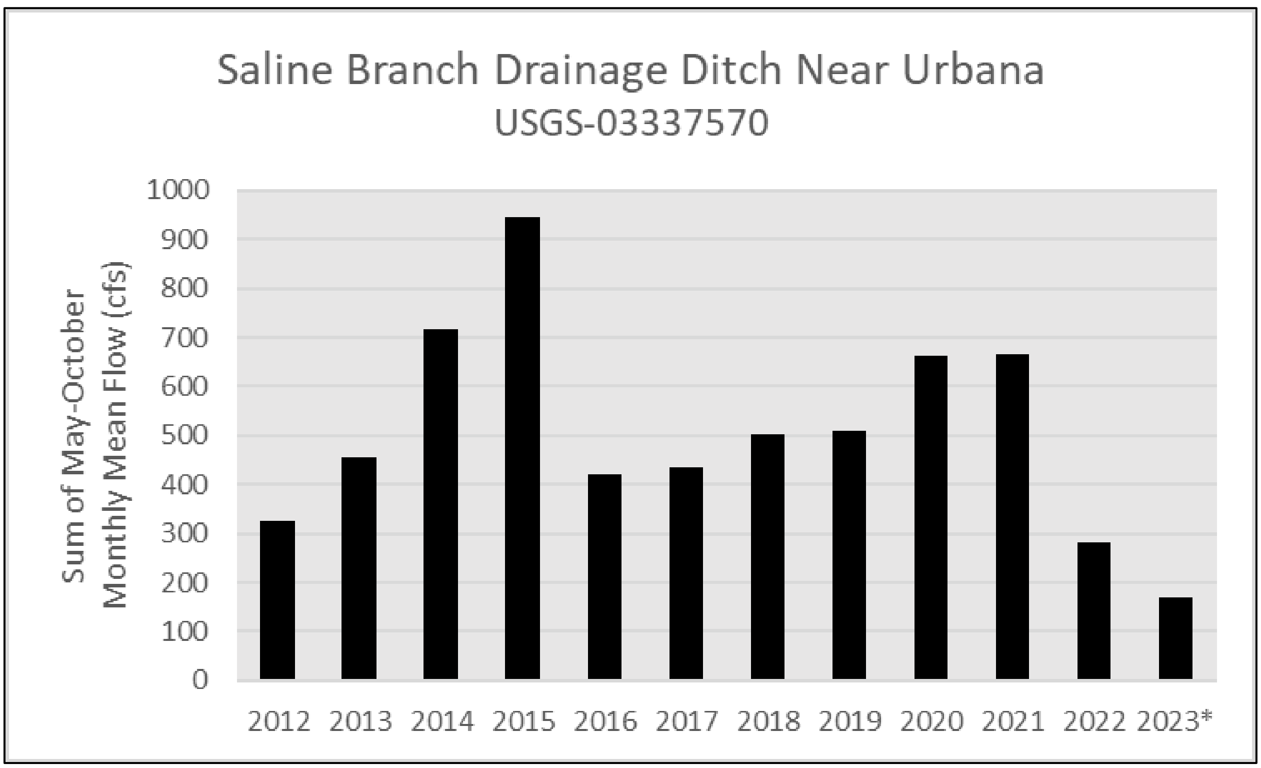

Figure 2 - Sum of Monthly Mean Flows at USGS-03337570, Saline Branch Drainage Ditch Near Urbana - May-October (*NOTE: 2023 data is incomplete and represents May-July only)

Salt Fork Drainage Ditch Upstream (RNT-U)

- The Upper Salt Fork Drainage Ditch upstream of the WWTP typically had low flows, with a median of 1.7 cfs. There were no instances of zero discharge during the monitoring period. The highest flow recorded was 9.1 cfs on 13 May 2022.

Salt Fork Drainage Ditch Upstream (RNT-D)

- The monitoring site downstream of the Rantoul WWTP is approximately 0.3 mi from the outfall. The median measured flow at this site was 4.9 cfs. There were no instances of zero discharge. The maximum flow of 22.7 cfs occurred on 9 August 2023 and was measured immediately after a heavy rainstorm in the area. A large culvert that normally is dry was discharging a significant flow explaining the large difference between the upstream and downstream measurements on this date. The culvert appears to drain a highly developed portion of the Village of Rantoul, and runoff appears to be flashy and brief.

Table 4 - Summary of Flow Data

Station	# Measurements	Flow Range (cfs)	Median	Approximate WWTP % of Flow at Median
Salt Fork Drainage Ditch Upstream	16	0.3-9.1	1.7	Upstream
Salt Fork Drainage Ditch Downstream	16	1.3-22.7	4.9	65%

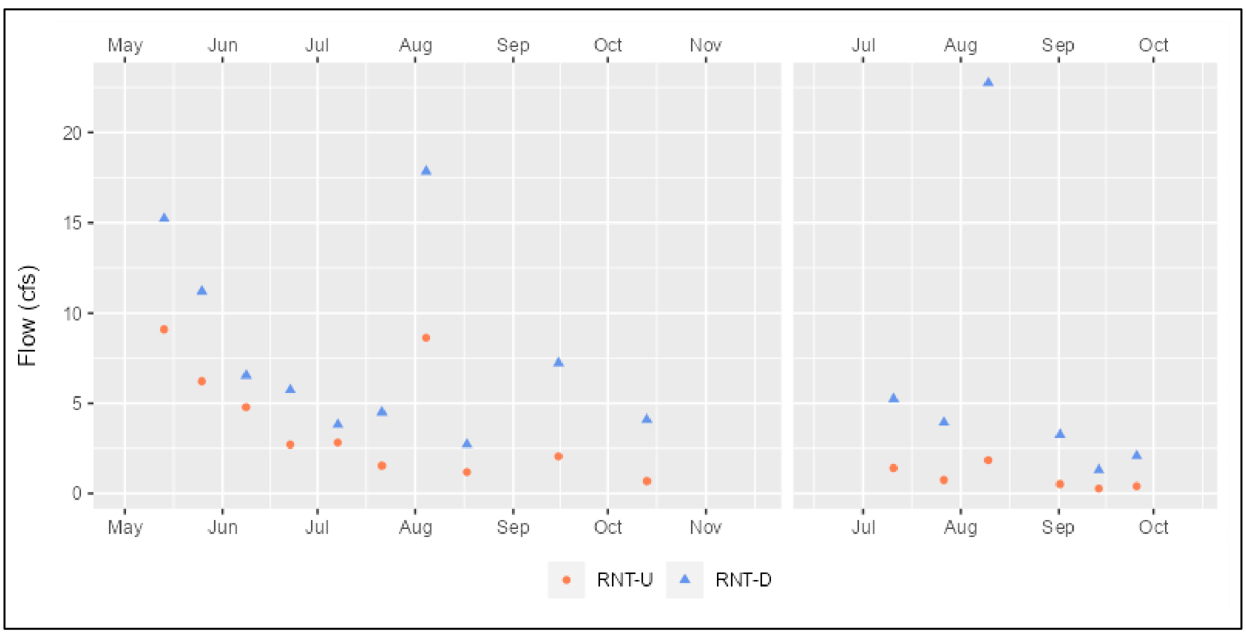

Figure 3 - Flow Measurements During Monitoring Period

SESTONIC CHLOROPHYLL A

Chlorophyll α results (n=22 for each site) are shown in Figure 4 and were low throughout the monitoring period, typically far below the 26 µg/L risk of eutrophication threshold.

- This is expected in a stream with perennial baseflow conditions.
- Sensor data, though not a quantitative measure of chlorophyll concentration, corroborates what is observed in grab samples.
- Sestonic chlorophyll is not a risk of eutrophication criterion of concern.

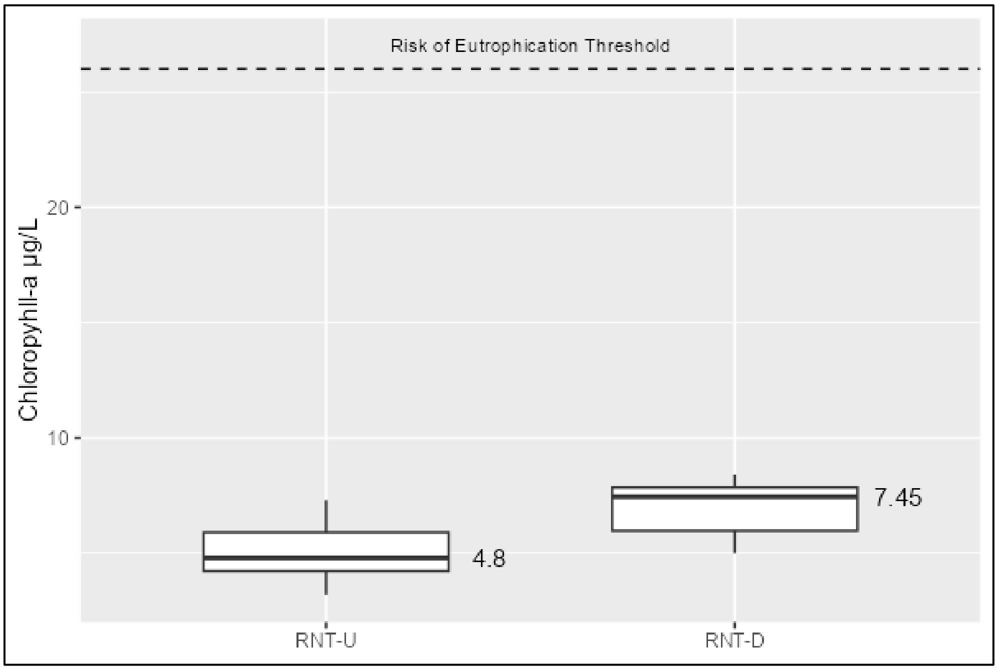

Figure 4 - Chlorophyll α Results (presented as box plots with sample medians annotated)

SALT FORK DRAINAGE DITCH UPSTREAM (RNT-U) – DO, pH, PHOSPHORUS

RNT-U Key Takeaways:

- This station is upstream and outside the influence from the WWTP outfall.
- There were 265 days of continuous monitoring across the 2022 and 2023 seasons.
- pH did not exceed the water quality standard of 9.0.
- DO exceeded the minimum concentration water quality standard.
  - 79 of 112 days monitored during the March-July period had results below 5.0 mg/L.
  - 47 of 87 days monitored during the Aug-Feb period had results below 3.5 mg/L.
- Eutrophication risk criteria was met based on the 110% DO + 8.35 pH criteria.
  - 18 days, representing 7% in the monitoring period.
- Eutrophication risk conditions were not met based on the median sestonic chlorophyll α criteria.
- Data indicates that the Salt Fork Drainage Ditch is impaired for DO upstream of the WWTP outfall, and that nonpoint sources (NPS) are a contributor of nutrient loads during baseflow conditions.

The Salt Fork Drainage Ditch upstream of the WWTP was monitored with sensors. This allowed for characterization of the diel range of DO and pH (Figure 5). Additionally, grab samples were collected, and spot checks were performed during instrument calibration visits, approximately every two weeks. Data was compared to the risk of eutrophication criteria, and the DO and pH water quality standards (Illinois Admin Code Title 35, Part 302, Subpart B, Sections 302.204 & 302.206), as an impairment on the Upper Salt Fork Drainage Ditch triggered the NARP special permit condition. There were 265 monitoring days with both DO and pH measurements (Table 5). None of these measurements exceeded the maximum 9.0 pH water quality standard. Seventy-nine of 112 days (71%) exceeded the minimum DO concentration limit of 5.0 mg/L at any time during March - July, and 91 of 153 days (59%) exceeded the minimum DO concentration limit of 3.5 mg/L at any time during the August - February period (Figure 6).

Table 5 - Summary of RNT-U Continuous Monitoring Data

Days with Continuous Monitoring	Days (%) Not Meeting Minimum DO Water Quality Standard	# of Days Exceeding the 9.0 Maximum pH Standard	# of Days (%) Exceeding the Risk of Eutrophication Criteria (8.35 pH + 110% DO)
265	79 of 112 (71%) below 5.0 mg/L March-July 91 of 153 (59%) below 3.5 mg/L August-February	0 (0%)	18 (7%)

The daily maximum 110% DO saturation + 8.35 pH risk of eutrophication criteria was exceeded 18 days, or 7% of the total. Chlorophyll was generally low, well below the 26 µg/L criteria. The median concentration was 4.8 µg/L with a maximum of 7.3 µg/L, indicating chlorophyll is not a risk of eutrophication criterion of concern.

There is phosphorus available in the stream from NPS. The mean TP concentration was 0.09 mg/L (n=22) and the maximum was 0.17 mg/L. Phosphorus results were elevated during May and June 2022, when base flows were at their highest, however for the remainder of the monitoring period, a clear pattern in TP concentrations related to DO is not evident. A pattern in DO and pH data was observed where precipitation events result in a short-term buffering or attenuation effect on DO and pH diel ranges and the daily low pH drops well below the normal range, then over a few days the diel ranges of DO and pH recover. The lack of canopy and the availability of nutrients from NPS allows for a very high diel range of DO at this site, indicating it is impacted by nutrients even before the addition of treated effluent from the plant.

Salt Fork Drainage Ditch Upstream of Rantoul WWTP (RNT-U)

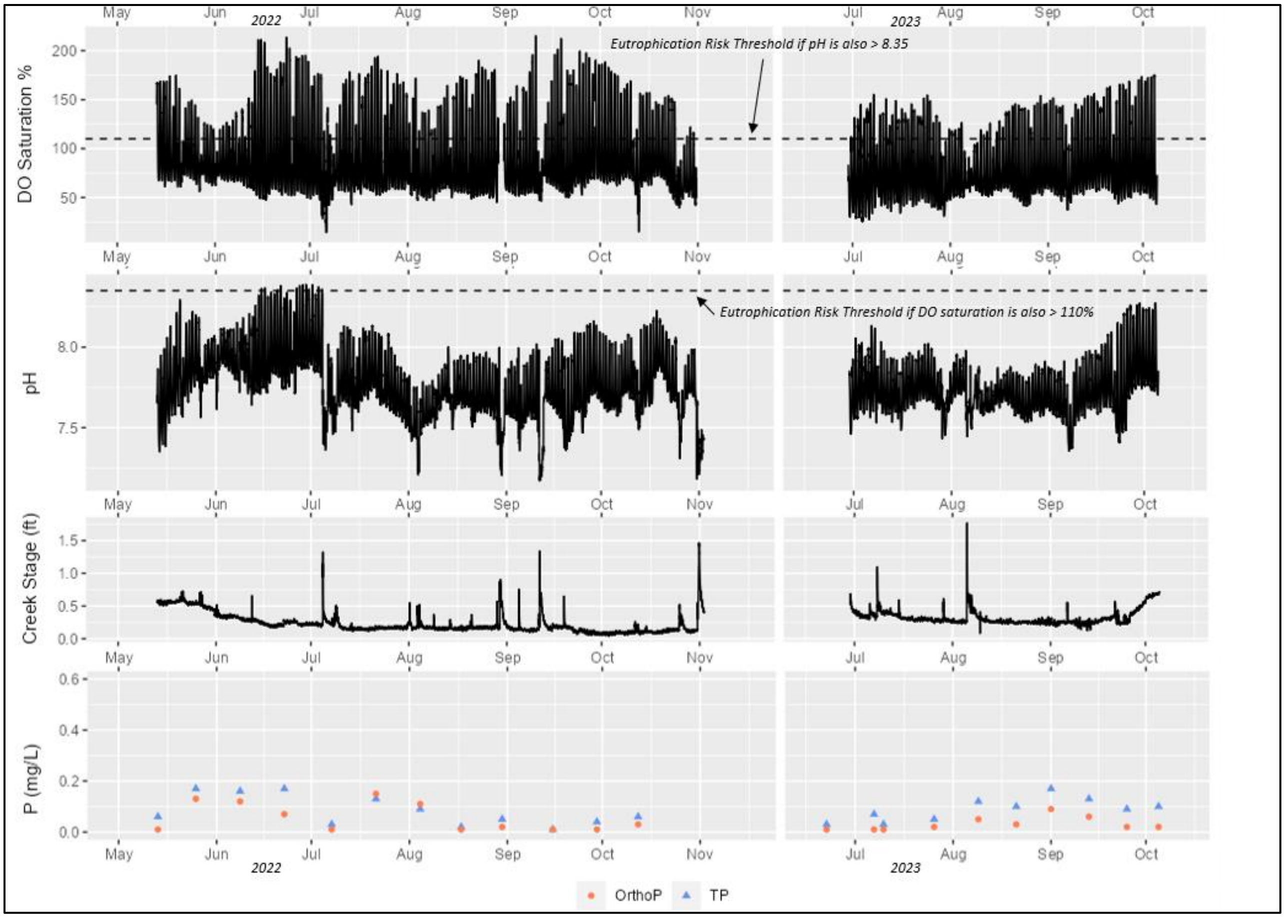

Figure 5 – Salt Fork Drainage Ditch Upstream (RNT-U) 0.1 Miles from the Rantoul Outfall - DO Saturation, pH, Stage and TP – 2022 - 2023

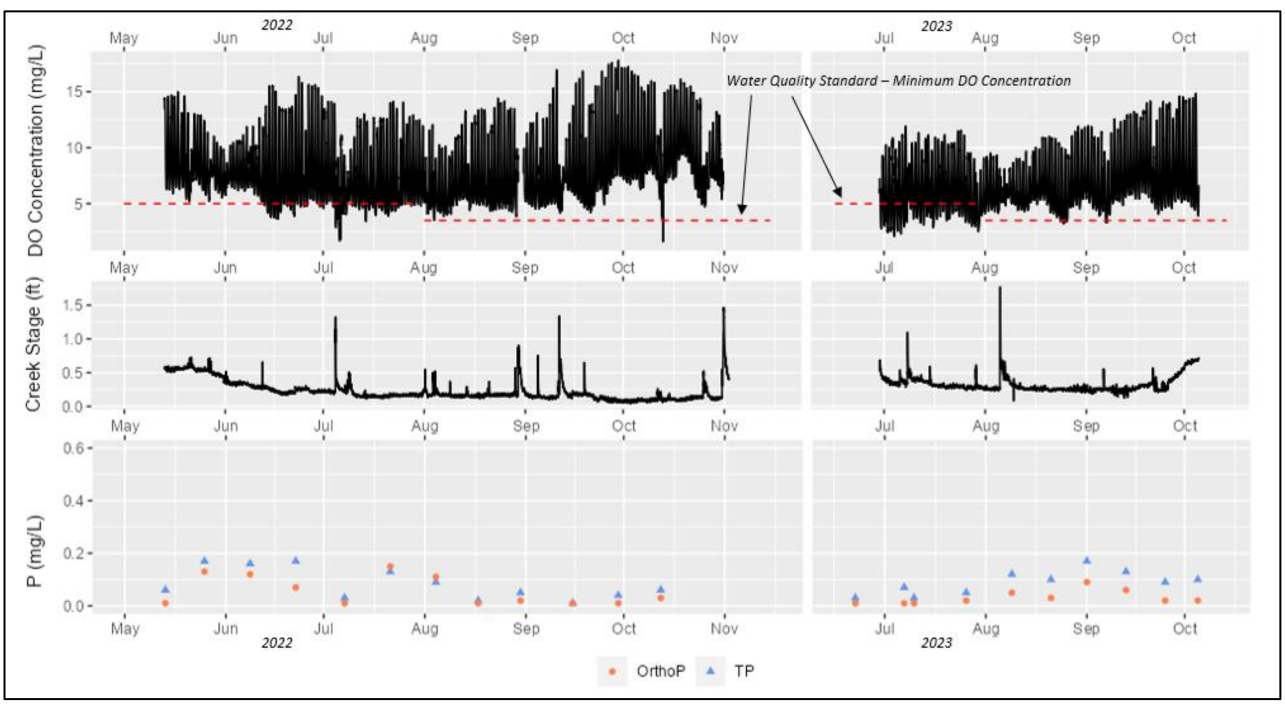

Figure 6 - Salt Fork Drainage Ditch Upstream (RNT-U) 0.1 Miles from the Rantoul Outfall - DO Concentration, TP, and Stage – 2022-2023 (minimum DO concentration water quality standard annotated)

SALT FORK DRAINAGE DITCH DOWNSTREAM (RNT-D) – DO, pH, PHOSPHORUS

RNT-D Key Takeaways:

- This station captures the watershed that includes the WWTP. The site is approximately 0.3 miles downstream of the outfall.
- There were 210 days of continuous monitoring across the 2022 and 2023 seasons.
- pH did not exceed the water quality standard of 9.0.
- DO exceeded the minimum concentration water quality standard.
  - 58 of 63 days monitored during the March-July period had results below 5.0 mg/L.
  - 124 of 147 days monitored during the Aug-Feb period had results below 3.5 mg/L.
- Eutrophication risk criteria was met based on the 110% DO + 8.35 pH criteria.
  - 9 days, representing 4% of days in the monitoring period.
- Eutrophication risk conditions were not met based on the median sestonic chlorophyll α criteria.
- Data indicates that point and NPS are a contributor of Salt Fork Drainage Ditch nutrient loads during normal flow conditions.

The Salt Fork Drainage Ditch Downstream is 0.3 miles downstream of the plant and was monitored with sensors. This allowed for characterization of the diel range of DO and pH (Figure 7). Additionally, grab samples were collected, and spot checks were performed during instrument calibration visits, approximately every two weeks. There were 210 monitoring days with both DO and pH measurements. During the 2022 monitoring season, equipment malfunctions associated with sediment buildup and fouling after high flow events caused several data gaps. This issue was resolved for the 2023 monitoring season.

Data was compared to the risk of eutrophication criteria, and the DO and pH water quality standards (Illinois Admin Code Title 35, Part 302, Subpart B, Sections 302.204 & 302.206), as a 303(d) listing triggered the NARP special permit condition. None of these measurements exceeded the maximum 9.0 pH water quality standard. Nine of 210 days exceeded the 110% DO + 8.35 pH risk of eutrophication threshold (Table 6). Fifty-eight of 63 days (92%) exceeded the low DO concentration limit of 5.0 mg/L at any time during March - July, and 124 of 147 days (84%) exceeded the low DO concentration limit of 3.5 mg/L at any time during August - February.

Table 6 - Summary of RNT-D Continuous Monitoring Data

Days with Continuous Monitoring	Days (%) Not Meeting Minimum DO Water Quality Standard	# of Days Exceeding the 9.0 Maximum pH Standard	# of Days (%) Exceeding the Risk of Eutrophication Criteria (8.35 pH + 110% DO)
210	58 of 63 (92%) below 5.0 mg/L March-July 124 of 127 (84%) below 3.5 mg/L August-February	0 (0%)	9 (4%)

Chlorophyll was generally low, well below the 26 µg/L criteria. The median concentration was 7.5 µg/L with a maximum of 8.4 µg/L, indicating chlorophyll is not a risk of eutrophication criterion of concern.

The mean TP concentration was 0.29 mg/L (n=22), and the maximum was 0.53 mg/L. Interestingly, some of the highest TP concentrations occur when flows are low and the daily DO range is high, but high TP also occurs during runoff events, indicating NPS phosphorus in the stream. A pattern in DO and pH data was observed where precipitation events result in a short-term buffering or attenuation effect on DO and pH diel ranges and the daily low pH and DO drop well below the normal range. Then typically over a series of days the diel range of DO and pH recover. The lack of canopy cover allows for algal growth and a high diel range of DO at this site.

Salt Fork Drainage Ditch Downstream of Rantoul WWTP, Township Hwy 178E bridge. (RNT-D), 9 May 2022.

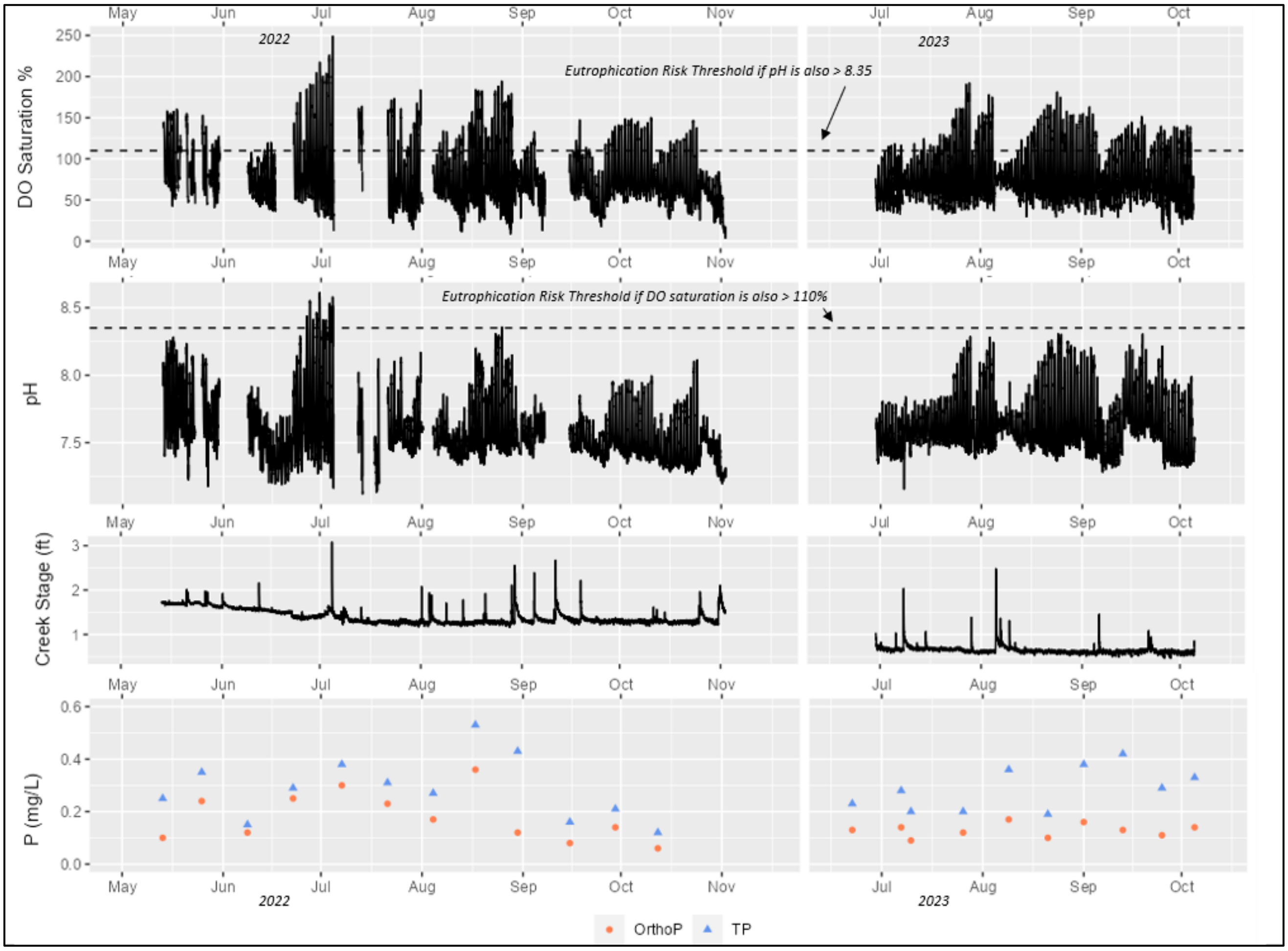

Figure 7 - Salt Fork Drainage Ditch Downstream (RNT-D) – DO Saturation, pH, TP, and Stage

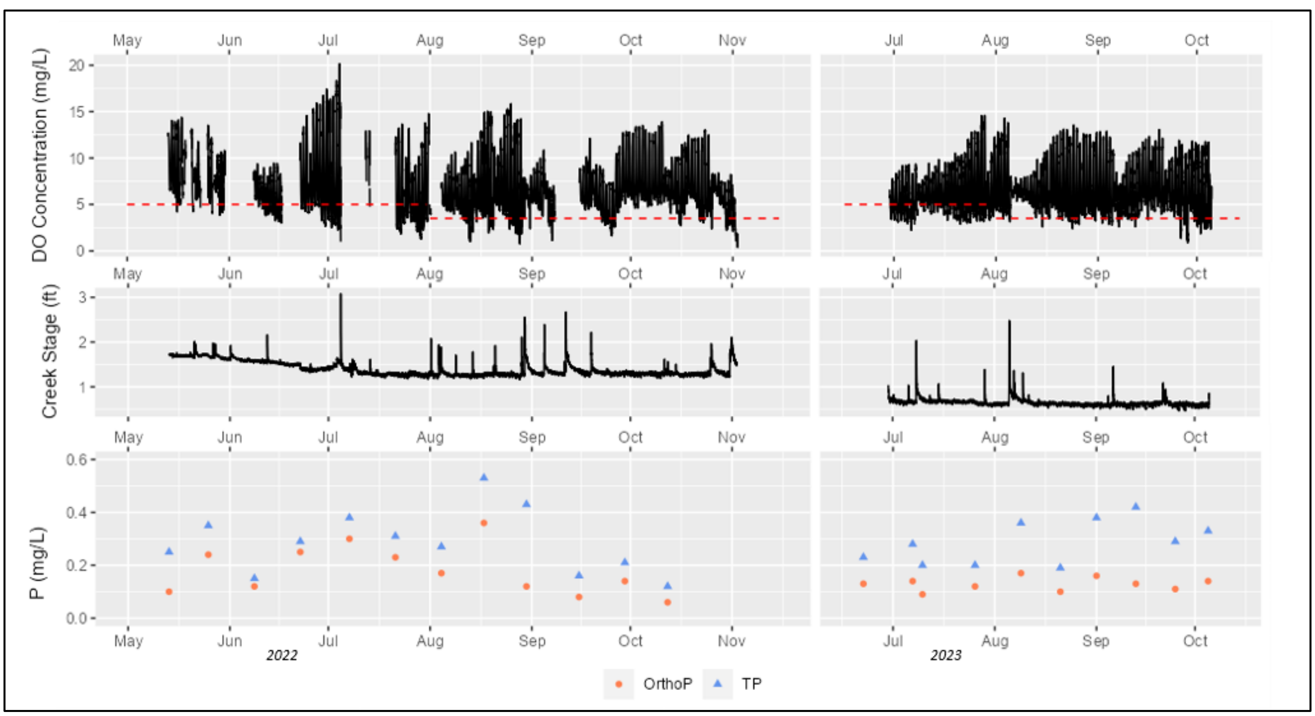

Figure 8 - Salt Fork Drainage Ditch Downstream (RNT-D) - DO Concentration, TP, and Stage

3.4 INTREPRETATION & ANALYSIS

The monitoring results confirmed low DO and eutrophication risk based on the pH > 8.35 and DO saturation > 110% threshold at both the upstream and downstream stations on Upper Salt Fork Drainage Ditch. There were no exceedances of the median chlorophyll α or pH > 9 criteria. The water quality standard exceedances documented do not appear to correlate with patterns in phosphorus concentrations. The results illustrate the complex watershed and stream system processes affecting water quality and contributing to eutrophication risk. Therefore, the treated effluent from Rantoul may be only one of several drivers, especially given the magnitude of the upstream exceedances and the relatively low phosphorus concentrations in effluent. The data demonstrates that NPS and treated wastewater are both contributors of phosphorus, and that factors such as minimal canopy cover and hydrologic modifications, such as stream channelization have an influence on DO dynamics. Additionally, the dry conditions and lower baseflows during 2022 and 2023 likely elevated the frequency and duration of risk of eutrophication exceedances.

Rantoul intends to focus further efforts and next steps on the NARP Strategy and Work Plan relative to the NARP triggering stream segment - Upper Salt Fork Drainage Ditch, IL_BPJG-01. A Strategy and Work Plan is presented in subsequent sections.

4. NARP STRATEGY & WORK PLAN

Based on an understanding of the watershed dynamics and the results of the monitoring program, the NARP strategy and workplan is presented focusing on the Upper Salt Fork Drainage Ditch stream segment IL_BPJG and the associated 90,563-acre drainage, made up of four Hydrologic Unit Code (HUC) 12 subwatersheds within the Upper Salt Fork Drainage Ditch-Salt Fork HUC10 watershed. These subwatersheds are characterized below. The subwatersheds are captured in the 2007 Watershed Implementation Plan (WIP) for the Salt Fork Vermillion River, an Illinois EPA approved nine-element plan.

The watershed is comprised of 89% agriculture and 6.1% urban/developed lands and includes the Village of Rantoul WWTP.

4.1 WATERSHED CHARACTERIZATION

A concise watershed characterization is presented and includes relevant information related to hydrology, land cover, climate, and demographics. Current and historical water quality impairments are summarized and estimates of phosphorus loading from NPS are presented from a map-based, planning-scale pollutant load model created for this NARP, using formulas and methods derived from the United States EPA Spreadsheet Tool for Estimating Pollutant Loads (STEPL). Point source loads are detailed and this section also details applicable linkages with the 2007 WMP and other relevant plans, efforts, and initiatives.

HYDROLOGIC UNIT CODES

Upper Salt Fork Drainage Ditch-Salt Fork is in east-central Illinois, located in Champaign and Vermilion Counties and within the larger Salt Fork Vermilion River watershed. The 10-digit HUC (0512010903) watershed is 133,604 acres and contains six smaller HUC12 subwatersheds, though only four are relevant to the Village of Rantoul NARP, totaling 90,563 acres. (Table 7). The subwatershed area is mapped in Figure 1.

Table 7 – Upper Salt Fork Drainage Ditch Selected HUC12 Subwatersheds

HUC Name	HUC 12 ID	Area (acres)
East Fork-Upper Salt Fork Drainage Ditch	051201090301	15,474
Flatville Drainage Ditch-Upper Salt Fork Drainage Ditch	051201090302	26,506
Spoon River	051201090303	27,495
Upper Salt Fork Drainage Ditch	051201090304	21,088
	Total:	**90,563**

STREAMS & LAKES

According to the National Hydrography Dataset (NHD) there are 216 miles of streams and rivers, including artificial drainageways (Table 8). Upper Salt Fork Drainage Ditch is the longest named stream at 24 miles followed by Spoon River (13.9) and Flatville Drainage Ditch (4.1 miles). Unnamed tributaries and artificial drainage ways cover 164 miles. Water quality impairments are included in a proceeding section of this watershed characterization.

Table 8 - Watershed Stream Segments and Illinois EPA Assessment ID

Stream Name	Illinois EPA Assessment ID	Length (Miles)
Unnamed Tributary/Drainage Way	N/A	164
Upper Salt Fork Drainage Ditch	IL_BPJG-01	24
Spoon River	IL_BPJD-02	13.9
Flatville Drainage Ditch	IL_BPJI-02	4.1
Union Drainage Ditch Number 1	IL_BPJM-01	3.6
Stanton Special Drainage Ditch	IL_BPJH	3.1
Salt Fork	IL_BPJ-07	3.1
Total:	**-**	**216**

The NHD also identifies 166 acres of lakes, ponds and reservoirs, the largest waterbody is 34 acres in size. There are no named lakes or ponds within the subwatersheds.

CLIMATE NORMALS

Based on climate normals published by the Illinois State Climatologist, for Rantoul for the period of 1991 – 2020 (UofI, 2023), Rantoul experiences an average of 40.35 inches of precipitation per year (3.36 inches/month). April is typically the wettest month, with an average of 4.61 inches. Average temperature is 52 degrees Fahrenheit and July is the warmest month.

The watershed experienced 5% less precipitation than average in 2022 and 24% less than average in 2023. The monitoring data supporting this NARP is from a climatic and hydrological period that is not representative of average conditions.

LAND COVER

Table 9 presents the land cover of the watershed. The two predominant land cover categories are (i) 89% agriculture comprising 80,928 acres of cultivated crops, and (ii) 6.1% developed/urban areas of 5,534 acres according to the National Land Cover Database (NLCD) (Dewitz, J., 2021). The Spoon River (HUC12 051201090303) and Upper Salt Fork Drainage Ditch (HUC12 051201090304) have the greatest proportion of agriculture/cultivated crops, with both at 93%.

Table 9 – Subwatersheds Land Cover

Land Cover	Area (acres)	% of Watershed Area
Cultivated Crops	80,928	89%
Developed	5,534	6.1%
Developed Open Space	3,194	3.5%
Grasslands/Hay/Pasture	385	0.4%
Forest	225	0.2%
Open Water	145	0.2%
Wetlands	117	0.1%
Barren Land	34	0.0%
Total:	**90,562**	**100%**

DEMOGRAPHICS & ECONOMY

The only significant urban area located within the subwatersheds is Rantoul, with a 2022 population of 12,122, a decline of 6.3% from 2010 according to the US Census Bureau.

Rantoul falls within an Environmental Justice area designated by a low-income population and has a poverty rate of 20.5%. Median household income (2018 – 2022) is $46,078 compared to $78,433 for Illinois and the national average of $75,149.

WATER QUALITY IMPAIRMENTS

The Upper Salt Fork Drainage Ditch segment IL_BPJG-01 is listed on the 2020/2022 303(d) list as impaired for aquatic life with cause of TP (Table 10). The segment was previously listed with causes of DO and pH, but there was no standard violation for those parameters in the 2020/2022 cycle. Several potential sources of the impairments are noted such as loss of stream-side vegetation and loss of instream cover.

Table 10 – Upper Salt Fork Drainage Ditch Watershed Historical Impairments

Stream	HUC12 Watershed	Illinois Assessment Unit	303(d) Impairments	Causes & Years on List
Upper Salt Fork Drainage Ditch	051201090301	IL_BPJG-01	Aesthetic Quality; Aquatic Life	DO: ’18, ’16, ’14 pH: ’18, ’16, ’14, TP: ’20/22, ’18, ’16, ’14, ’12

RELATIONSHIP TO OTHER PLANS & WATERSHED EFFORTS

Three plans and studies are relevant to the Rantoul NARP, (i) the 2007 WIP for the Salt Fork Vermillion River completed by the Salt Fork Steering Committee (SFSC), (ii) the 2007 Salt Fork Vermilion River Total Maximum Daily Load (TMDL), and (iii) the Illinois Nutrient Loss Reduction Strategy (INLRS). The TMDL addressed DO, pH, nitrate, and fecal coliform for several stream segments in the Salt Fork Vermilion River watershed. The receiving stream for the Village of Rantoul WWTP, the Upper Salt Fork Drainage Ditch, was not one of the TMDL segments however, the report does provide insight into characteristics of the broader watershed and implementation strategies that can be adopted by the agricultural community and agencies to reduce NPS. As described in Section 4, Rantoul plant upgrades will also have a direct, positive impact on nutrient reduction targets listed in the INLRS.

WATERSHED IMPLEMENTATION PLAN FOR THE SALT FORK VERMILION RIVER

The WIP was developed using a collaborative planning process of the United States Department of Agriculture Natural Resources Conservation Service (USDA - NRCS). People who live, work, recreate or otherwise have an interest in the Salt Fork watershed were brought together under the leadership of the Champaign County Soil and Water Conservation District (SWCD). These stakeholders comprised the SFSC whose charge was to develop a watershed management plan that reflects the interests, intentions and aspirations of local people for addressing natural resource needs in the Salt Fork watershed (SFSC, 2007). The Committee is still active today and meets regularly to discuss and tackle local water quality issues. The Champaign County SWCD is also active in this and other watersheds, working with farmers to adopt voluntary conservation practices.

The plan characterizes the larger Salt Fork watershed, identifies issues and concerns, goals, and potential solutions. Solutions or recommended practices focus primarily on addressing NPS pollution, the key driver of nutrient and sediment loading. Issues highlighted in the plan include stream channelization and a lack of adequate stream buffers and existing conservation practices on agricultural lands, streambank erosion, flooding (primarily downstream of Rantoul) and urban NPS runoff from Urbana and Champaign.

POINT & NONPOINT SOURCE LOADING

Point source pollution is defined by the United States Environmental Protection Agency (USEPA) as "any single identifiable source of pollution from which pollutants are discharged, such as a pipe, ditch, ship or factory smokestack" (Hill, 1997). The NPDES, a provision of the Clean Water Act, prohibits point source discharge of pollutants into waters of the U.S. unless a permit is issued by the USEPA or a state or tribal government. Individual permits are specific to individual facilities (e.g., water or wastewater treatment facilities), and general permits are for a group of facilities in a geographical area. Permits describe the allowed discharge of pollutant concentrations (mg/L) and loads (lbs/day). The Rantoul WWTP currently has a 1.0 mg/L monthly average TP discharge limit.

Nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. The term "nonpoint source" is defined to mean any source of water pollution that does not meet the legal definition of "point source." Unlike pollution from point sources like industrial and sewage treatment plants, NPS pollution comes from many diffuse sources and is caused by rainfall or snowmelt moving over and through the ground. The runoff picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters (USEPA, 2018).

Point source loading of phosphorus from the Rantoul WWTP is provided in Table 11. Based on US EPA-required discharge monitoring report data, average annual loading from 2017 through 2022 is 7,641 lbs, and average effluent TP concentration is 0.69 mg/L.

Table 11 - Annual Phosphorus Load from Rantoul WWTP - Data Source: USEPA ECHO

Year	2017	2018	2019	2020	2021	2022	Average Annual
Total Phosphorus (lbs/yr)	5,472	7,413	6,702	12,276	9,335	4,650	**7,641**

A planning-level pollution load model based on STEPL was developed for the four relevant HUC12 subwatersheds in the Upper Salt Fork HUC10. The model results were compared to a nearby watershed with similar land cover, soils and precipitation characteristics to ensure loading estimates were in the correct range. The model indicates the average annual NPS phosphorus load for the watershed is 71,464 lb/yr. The total average annual phosphorus loading from all sources is estimated at 79,105 lbs/yr with the Rantoul WWTP accounting for 9.7%. Nonpoint sources are responsible for 90.3% of average annual phosphorus loads in the watershed and are a significantly larger contributor than the point source (Figure 9).

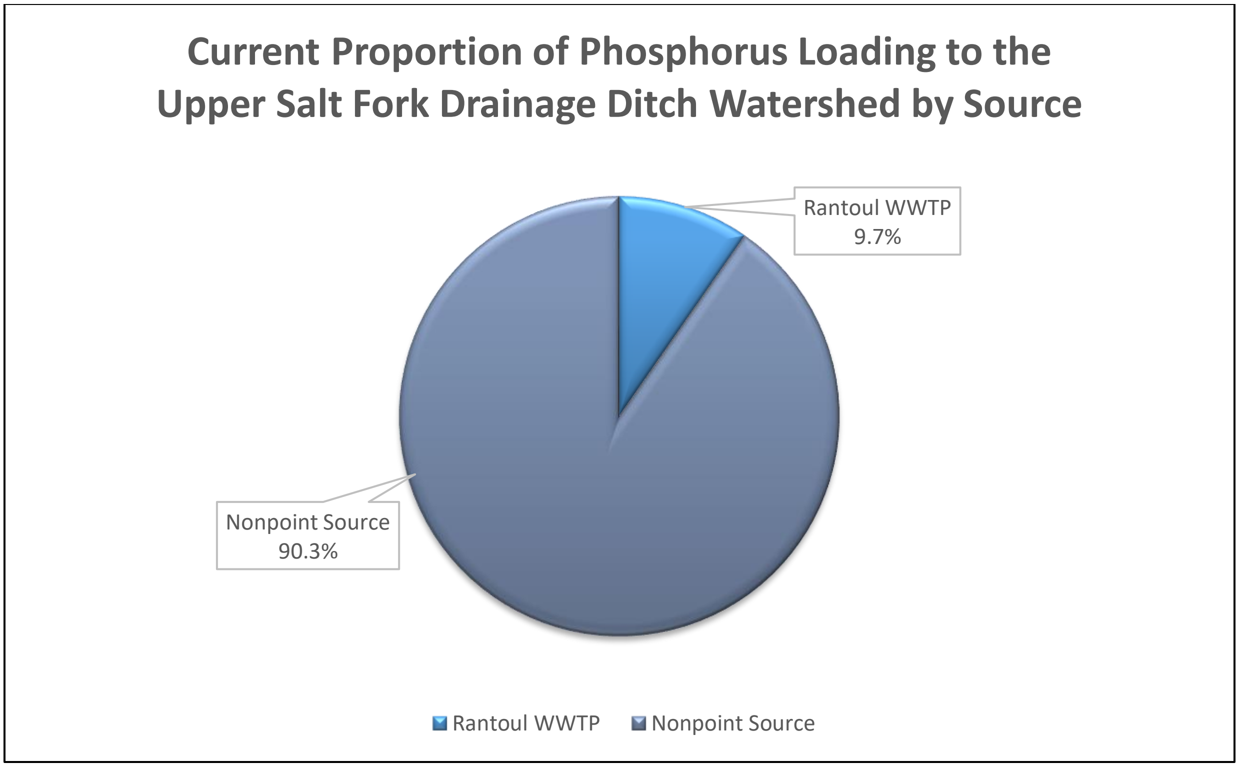

Figure 9 - Proportion of Annual Total Phosphorus Load to Upper Salt Fork Drainage Ditch Watershed by Source

4.2 NARP STRATEGY

Rantoul's NARP strategy focuses on the BPJG-01 segment of the Upper Salt Fork Drainage Ditch and its watershed described in Section 4.1. The Rantoul NARP was triggered by a 2016 impairment on this 24-mile segment, which received non-attainment for both Aquatic Life and Aesthetic Quality designated uses with causes of DO, pH, TP, loss of instream cover, lack of littoral vegetation, and algae. Illinois EPA listed several potential sources of the issues including channelization, municipal point source discharges and agriculture. More recently, the segment was on the 2020/2022 list for TP, but the DO and pH causes of impairment were removed. Extensive monitoring undertaken upstream and downstream of the WWTP in 2022 and 2023 demonstrated that a low DO condition and risk of eutrophication exists both upstream and downstream of the outfall. Based on an analysis of land cover, planning level loading estimates, and monitoring, NPS pollution is a major contributor of water quality impairments, with the Rantoul WWTP only contributing approximately 9.7% of the average annual phosphorus load to watershed. Nonpoint sources are estimated to contribute 10X more than the Rantoul WWTP and are a larger contributor to the water quality issues and eutrophication risk conditions (Figure 9). The availability of phosphorus in the stream systems is systemic due to the agricultural and to a much lesser extent, urban (wastewater) land uses that dominate the watershed. Based on conditions observed during the monitoring period, riparian conditions and canopy cover are poor, and the areas adjacent to the stream are highly agricultural.

The Village of Rantoul recognizes their contribution of phosphorus to the watershed, and how this input is a part of complex and dynamic processes that may affect DO in the stream and risk of eutrophication. The Village does not have jurisdiction over land management decisions made outside of boundaries where a majority of the nutrients originate. In this context, Rantoul's NARP is focused on improving water quality in the watershed in three ways:

1. **WWTP Plant Operation and Upgrades** – Rantoul will continue the practice of chemical addition for phosphorus removal to meet the 1.0 mg/L average monthly effluent limit and will complete treatment plant upgrades including Biological Nutrient Removal (BNR) to reduce phosphorus effluent to meet a 0.5 mg/L (avg. annual geometric mean) concentration limit.
    a. Rantoul's contribution of phosphorus will be reduced by at least 27% with these upgrades to meet the 0.5 mg/L limit. The annual loading will be reduced to approximately 5,547 lbs/year from 7,641 lbs/year.
    b. This will result in Rantoul's portion of annual watershed phosphorus loading being reduced from **9.7% to 7.2%**. Figure 10 illustrates the proportion of phosphorus loading after plant upgrades.
    c. The plant upgrades and phosphorus load reductions will have a positive effect on water quality and eutrophication risk conditions.
2. **Collaborate** - on and continue to support any future watershed planning and implementation efforts that address NPS pollution loading. Rantoul has been a consistent and active supporter of watershed NPS reduction efforts for well over a decade.
    a. Evaluate developing an internal means to track involvement and investments in a measurable way to report on progress and improvements.
3. **Local Watershed Group** – The Village of Rantoul will continue to participate in the local watershed stakeholder group, the SFSC, and will encourage and support watershed management activities such as future grant funding through the Illinois EPA Section 319 program as well as other local collaborative efforts to reduce NPS pollution.

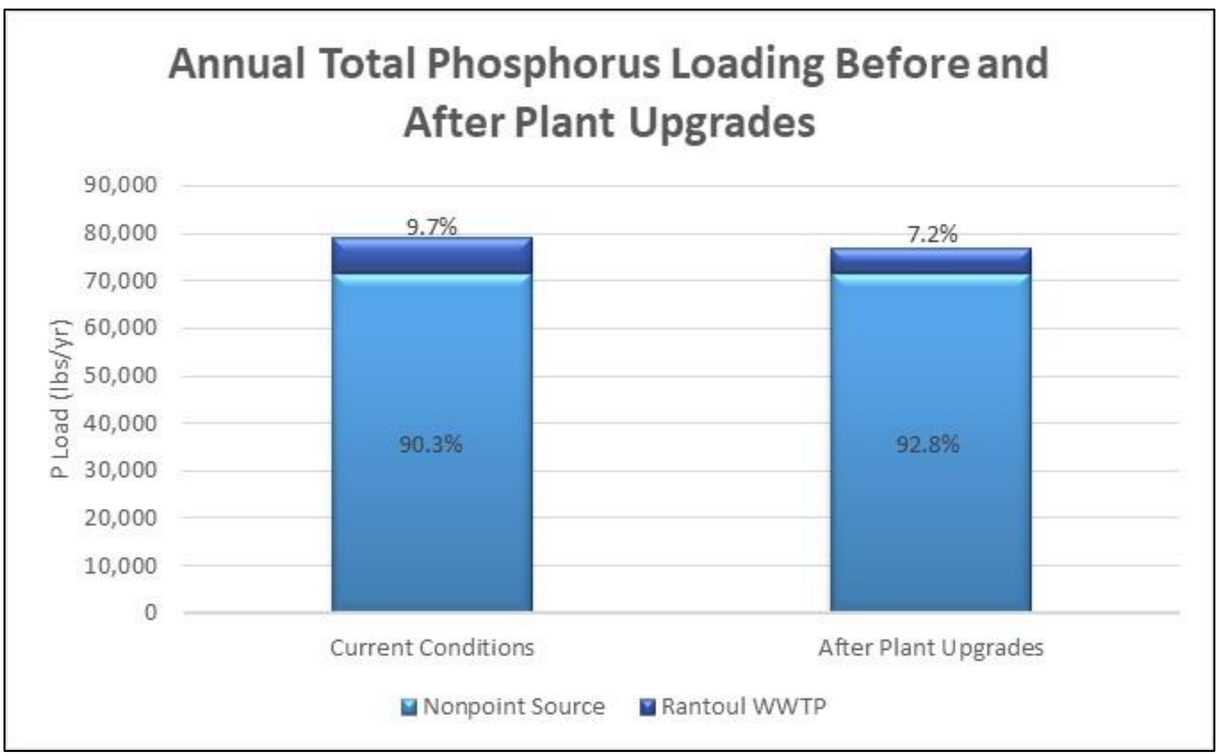

Figure 10 - Phosphorus Loads from Point and NPS and Percent of Total Load Before and After Plant Upgrades

Appendix C provides the treatment plant upgrade plans. The plans include conversion of the treatment process to an activated sludge system to achieve BNR and meet a new phosphorus limit of 0.5 mg/L. It is estimated that by 2025 the new system will achieve a 27% reduction in phosphorus loading. The village is committed to removing nutrients from the discharge to the watershed. Plant upgrades will also include improvements to solids handling, replacing traveling bridge filters with diamond filters, installation of new final clarifiers and sludge dewatering improvements. These upgrades and corresponding point source reductions will have a positive effect on water quality and reduce risk of eutrophication conditions.

4.3 NARP WORK PLAN

The Work Plan includes a schedule and cost estimate for NARP activities moving forward. Rantoul is committed to a series of key activities that will significantly reduce phosphorus loading to the Upper Salt Fork Drainage Ditch, the subject of the impairment designation that triggered the NARP, as well as contributing to source reductions needed to meet targets in the INLRS. Furthermore, Rantoul will work with area stakeholders to further limit NPS loading through collaborative efforts outside of their jurisdiction. Actions include plant upgrades, continued involvement in a watershed group and partnerships to help secure outside funding for NPS reductions.

ACTIONS & SCHEDULE

A schedule of activities is presented in Table 12. Significant plant upgrades are planned to be completed by 2026, before the permit deadline. The Village of Rantoul will continue to participate in the SFSC watershed group. Rantoul will also continue seeking partnerships with others to secure outside grant funding for NPS reduction projects recommended in the 2007 WIP and will support production of an updated plan if the watershed group pursues it.

Table 12 - NARP Actions and Schedule

NARP Action	Anticipated Start Date	Anticipated End Date	Notes
Plant upgrades	2024	2025-2026	Upgrades will implement biological nutrient removal and achieve compliance with 0.5 mg/L effluent concentration limit and will achieve a 26% reduction in TP loading, approximately 10 years before the 2035 permit deadline.
Watershed Group	Ongoing	Ongoing	Rantoul will continue participation in the SFSC stakeholder group.
NPS Reduction Grants	TBD	TBD	Rantoul will look for opportunities to partner with other entities to implement NPS reductions in the Upper Salt Fork Drainage Ditch watershed.

COST ESTIMATES

The WWTP capital improvements and plant upgrades are estimated to cost **$36,815,000**, with Phase I estimated at $11,128,000. Phase I will require sewer rates for the average current resident to rise from $22.00/month to $32.94/month.

Participation in a watershed group is estimated at **$2,000** per year including some limited financial support to the Champaign County SWCD. The cost of NPS measures is currently unknown.

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Salt Fork Steering Committee of the Champaign County Soil and Water Conservation District, 2007. Watershed Implementation Plan for the Upper Salt Fork of the Vermilion River

APPENDIX A: MONITORING PLAN

Village of Rantoul & Urbana-Champaign Sanitary District

Nutrient Assessment Reduction Plan Data Mining and Proposed Monitoring Plan

April 2022

Prepared for: Urbana-Champaign Sanitary District
Village of Rantoul
Prepared by: Northwater Consulting & Donohue and Associates

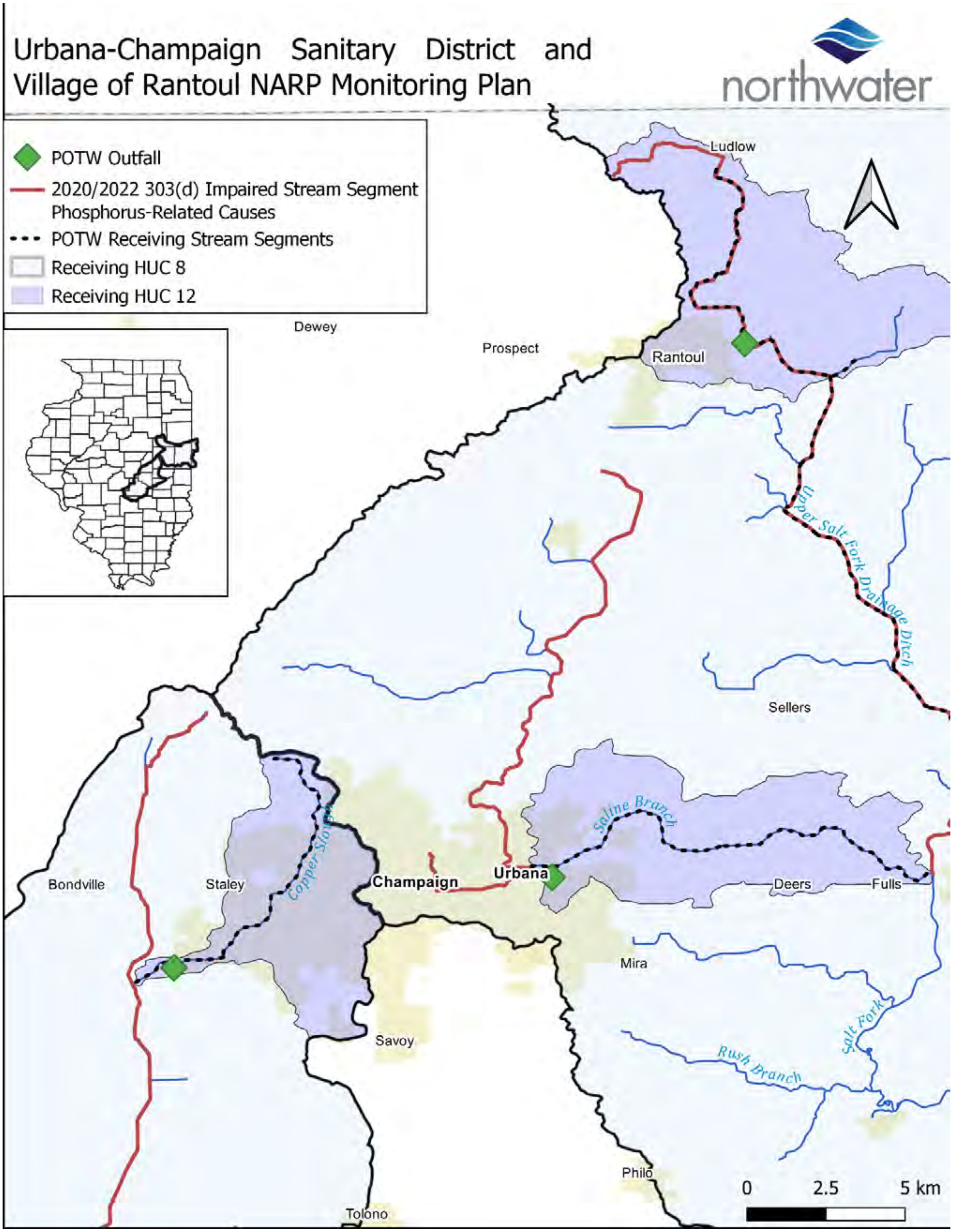

Figure 1. Project Area

Contents

1 Introduction
1.1 NARP Process & Requirements

In 2018, the Illinois EPA (IEPA) instituted a new process for NPDES permitting of POTW discharges that would allow for consideration of site-specific conditions for phosphorus limits. The Nutrient Assessment Reduction Plan (NARP) process resulted from negotiations with environmental organizations, IEPA, and the Illinois Association of Wastewater Agencies. A NARP is required if a receiving stream segment or downstream segment is on the Illinois Clean Water Act 303(d) list as impaired with phosphorus-related causes. A NARP is also required if there is a "risk of eutrophication" as defined by meeting any of the conditions outlined in Table 1.

Table 1. IEPA Risk of Eutrophication Criteria

Risk of eutrophication if any of these conditions met		
pH	Median sestonic chlorophyll *a*	On any two days during IEPA monitoring week, daily max
>9	>26 u/l	pH>8.35 and DO sat >110%

The Village of Rantoul operates one treatment plant and the Urbana-Champaign Sanitary District (UCSD) operates two that are required to undertake the NARP process as part of their National Pollution Discharge Elimination System (NPDES) permits. However, in this process, it may be determined through assessment of relevant data that the watershed does not have a phosphorus-related impairment. In this case, phosphorus input reductions and other measures may not be necessary. Donohue & Associates and Northwater Consulting were retained by the Village of Rantoul and UCSD to assess if a NARP is required for these facilities, and if so, develop a strategy for development of a full NARP. This process has several components which include:

- Examining if there is sufficient water quality data to determine if NARP requirements apply.
    - If data insufficient, a create a water quality monitoring plan and collect data.
- Undertake watershed characterization and determine if a full NARP is required.
- If a NARP is required:
    - Engage stakeholders throughout the process.
    - Model watershed and instream processes.
    - Establish defensible site-specific water quality criteria.
    - Define scenarios and strategies to achieve water quality targets.
    - Implement the recommendations of the NARP.

1.2 Data for NARP Determination

To make a NARP determination, sufficient dissolved oxygen (DO), pH and sestonic chlorophyll *a* data must be available between May 1 and October 31 to assess if any of the eutrophication risk criteria are met. Based on mining and analysis of existing datasets for the three outfalls and associated stream segments, it was determined that additional water quality data collection is necessary to evaluate impairments and eutrophication risks according to NARP criteria.

This plan outlines the recommended monitoring and data collection actions necessary to assess NARP requirements for each treatment plant. The data will also support focused recommendations and a strategy to develop additional NARP components for each, if required. The plan is intended to guide the Urbana-Champaign Sanitary District (UCSD) and Village of Rantoul through the data collection and assessment phase. More detailed results of the process and plan are presented herein.

2 Data Mining Results

The three receiving streams were cross referenced with the 2020/2022 Illinois EPA (IEPA) Clean Water Act Section 303(d) list[1] of impaired waters. Details of phosphorus-related impairments are summarized for each treatment plant. The only stream segment currently impaired for phosphorus is associated with the Village of Rantoul, which has been on the 303(d) list since 2010. The two UCSD treatment plants receiving stream segments have not been listed as impaired with P-related causes since 2010.

A search was completed for existing water quality data over the past 10 years from the USEPA Water Quality Portal.[2] Each facility also provided data available from effluent and receiving stream water quality monitoring. Existing datasets were examined to determine if eutrophication risk determinations could be made using DO, pH, chlorophyll-*a* and water temperature data. Data collected during the last 5 years was prioritized over older data. A summary of the data mining and analysis results for each treatment plant is presented below.

2.1 Village of Rantoul Wastewater Treatment Plant

The effluent-receiving stream Upper Salt Fork Drainage Ditch (IL_BPJG-01) is impaired with P-related causes (Table 2). The next downstream segment (IL_BPJG-07) is also impaired for DO.

Table 2. Village of Rantoul Wastewater Plant

Village of Rantoul Receiving Stream Segment				
Receiving Stream	HUC12 Watershed	Illinois Assessment Unit	303(d) Impairments	Causes Related to P & Years on List
Upper Salt Fork Drainage Ditch	051201090301	IL_BPJG-01	Aesthetic Value; Aquatic Life	DO: '20/22, '18, '16, '14 pH: '20/22, '18, '16, '14 TP: '20/22, '18, '16, '14, '12

Receiving Major Watershed	POTW Design Average Flow	POTW Design Maximum Flow
Vermilion River-Wabash River	4.33 MGD	8.65 MGD

[1] https://www2.illinois.gov/epa/topics/water-quality/watershed-management/tmdls/Pages/303d-list.aspx
[2] www.waterqualitydata.us

Few usable monitoring sites sourced from publicly available data were found for the Upper Salt Fork Drainage Ditch. Of the three potential sites identified, one is upstream, and two downstream of the outfall. At all three, data was only available for a single collection event in 2016. There are additional IEPA monitoring stations with 2016 data much further downstream in the assessment unit, with pH increasing with distance from the outfall. However, these sites are significantly influenced by tributaries and their associated point and nonpoint sources and thus are less appropriate for determining if NARP thresholds are met. Additional data was provided by the Village and included upstream and downstream sampling approximately two days per month during portions of 2020 and 2021. Parameters include temperature, DO and pH. Chlorophyll *a* data was not collected during this monitoring period.

From this limited data set it appears that pH and DO do not meet the threshold criteria that trigger a NARP (8.35 with 110% saturation). However, because the facility discharges into a stream that is impaired with likely causes related to phosphorus, the facility would be required to complete a full NARP. Additional data collection and analysis will help to better assess the contributions of the treatment plant to the receiving stream water quality and allow for an informed decision on the necessity of undertaking a full NARP that includes watershed characterization, development of site-specific water quality targets, and implementing management actions.

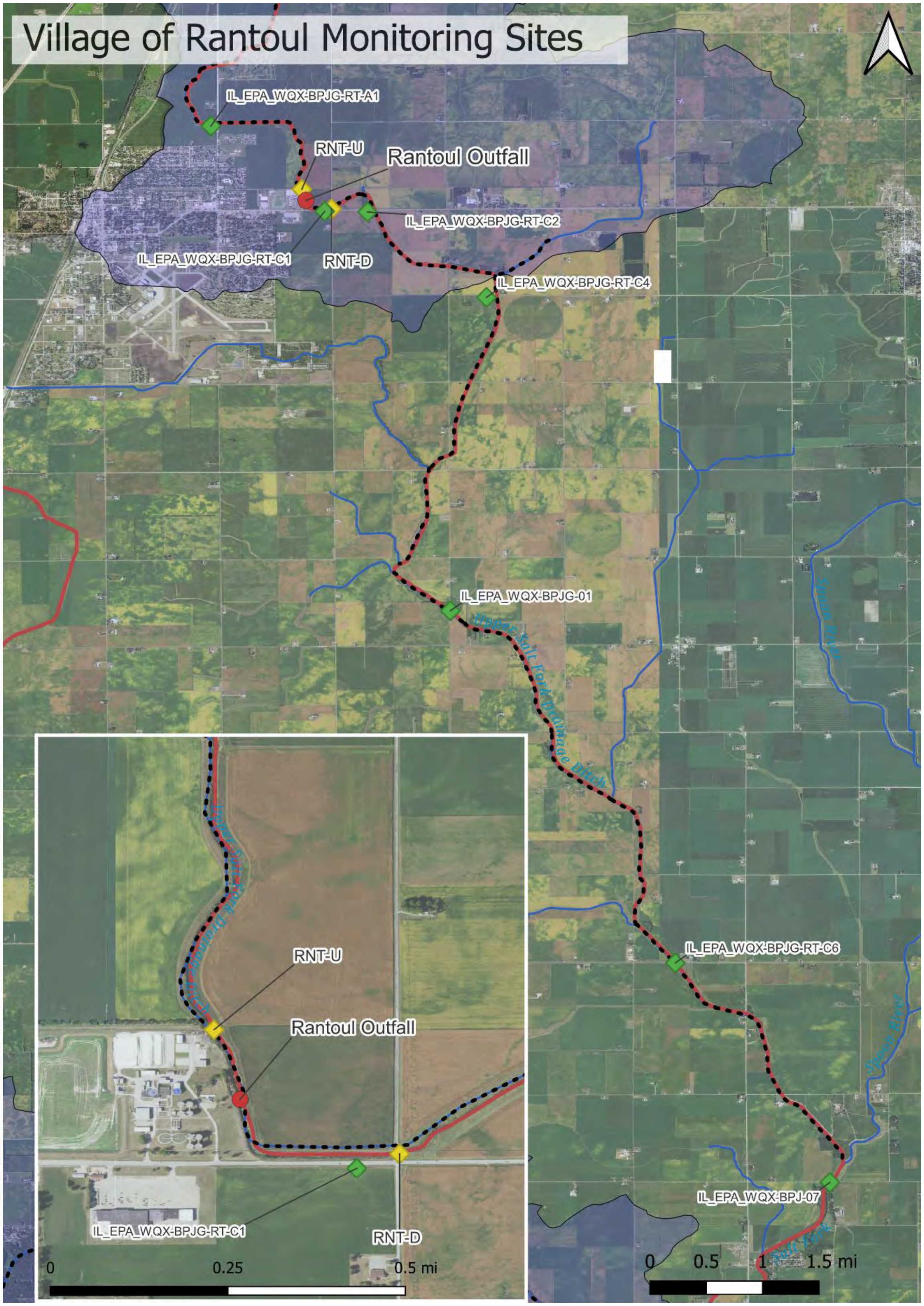

Figure 2. Village of Rantoul Detail

2.2 UCSD Northeast Wastewater Treatment Plant

The effluent-receiving stream segment, Saline Branch (IL_BPJC-06), fully supports its designated uses. Two stream segments above the receiving segment are impaired with P-related causes. Boneyard Creek (IL_BPJA) for DO and total phosphorus (TP), and Saline Branch Drainage Ditch (IL_BPJC-08) for pH and DO. The next several segments downstream have no P-related impairments. Upstream of the confluence, the Upper Salt Fork Drainage Ditch is impaired for DO.

Table 3. UCSD Northeast Wastewater Treatment Plant Receiving Stream Information

UCSD Northeast Plant Receiving Stream Segment				
Receiving Stream	HUC12 Watershed	Illinois Assessment Unit	303(d) Impairments	Causes Related to P & Years on List
Saline Branch	051201090203	IL_BPJC-06	None – Fully Supports Designated Uses	N/A
Receiving Major Watershed	POTW Design Average Flow		POTW Design Maximum Flow	
Vermilion River - Wabash River	17.3 MGD		34.6 MGD	

There are three monitoring sites with publicly available data in the receiving watershed, all of which are downstream of the outfall. The IEPA Ambient Network monitoring site (IL_BPJC-06) includes approximately 8 samples per year in years data was collected for relevant parameters. USGS monitoring station 03337700 is co-located here and has data collected during 2019 and 2020. These sampling locations, though in the same assessment unit, are greater than 5 miles downstream of the plant outfall, which allows instream processes to alter the effects of the effluent on stream water quality and introduces potential for pollutant additions from nonpoint sources and tributaries. The IEPA ambient site has one sample out of 25 in the last 5 years with values for pH and DO saturation meeting the upper threshold of NARP criteria of 8.35 pH with 110% DO saturation. (02/20/2017 sample was 8.54 pH and 153.5% DO). Five samples of 53 older than five years meet the threshold, however emphasis is placed on the most recent sampling efforts. Chlorophyll *a* data is not available. The USGS site has 15 pH and DO samples, none of which meet the NARP threshold.

The UCSD provided additional data from the receiving stream above and below the plant outfall, though the majority of that data is greater than 5 years old and is not current enough to determine if the NARP thresholds are being met. Because of limited current water quality monitoring data and past indicators of eutrophication risk, additional monitoring is recommended up and downstream of the treatment plant.

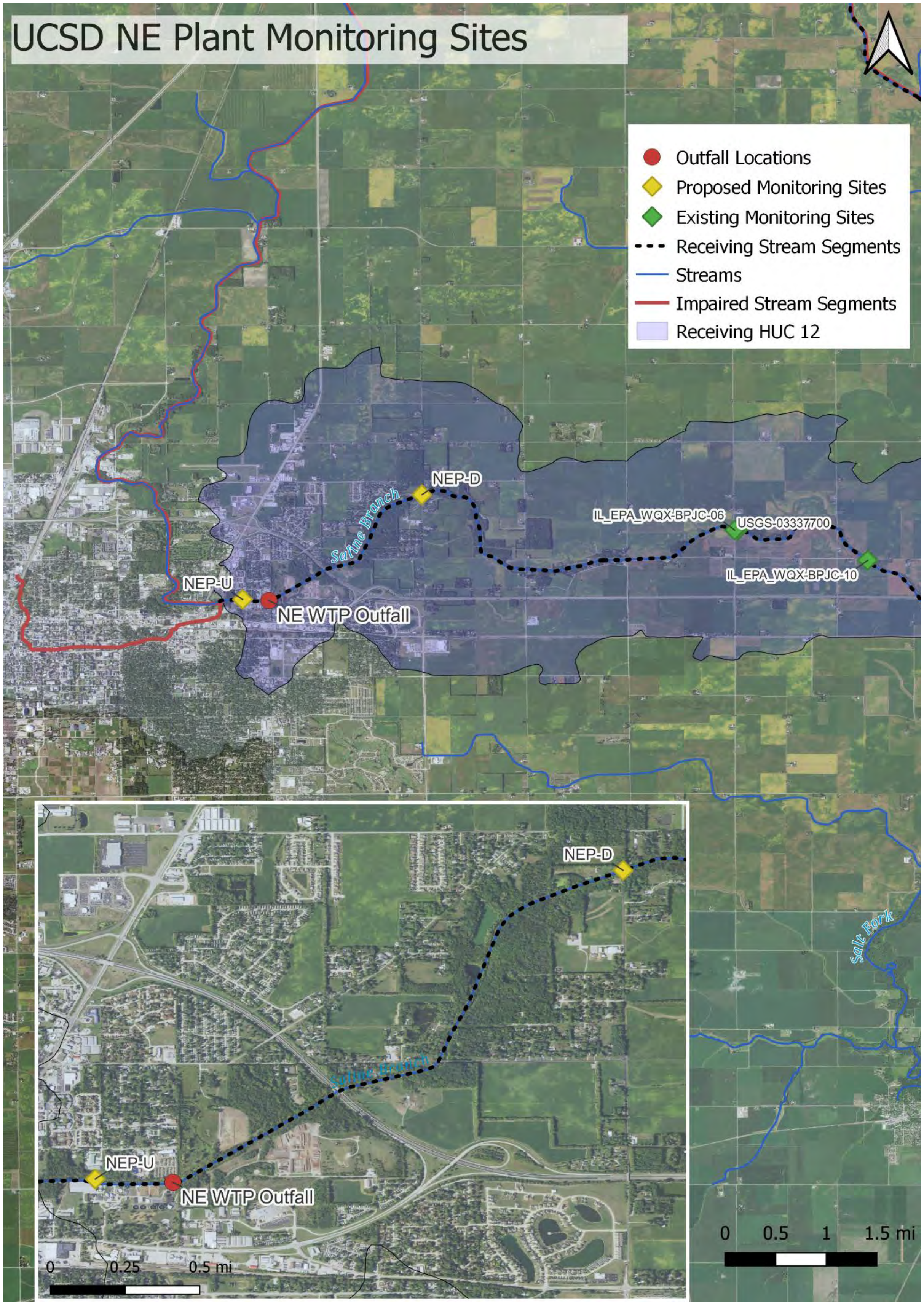
UCSD NE Plant Monitoring Sites
Outfall Locations
Proposed Monitoring Sites
Existing Monitoring Sites
Receiving Stream Segments
Streams
Impaired Stream Segments
Receiving HUC 12
NEP-D
NEP-U
NE WTP Outfall
Saline Branch
IL_EPA_WQX-BPJC-06
USGS-03337700
IL_EPA_WQX-BPJC-10
Salt Fork
0 0.5 1 1.5 mi
0 0.25 0.5 mi

Figure 3. UCSD Northeast Plant Detail

2.3 UCSD Southwest Wastewater Treatment Plant

The effluent-receiving stream, Copper Slough, fully supports its designated uses. However, it empties into the Kaskaskia River (segment IL_O-35) which is impaired for DO and pH, and the segment upstream from the confluence (IL_O-37) is impaired for DO.

Table 4. UCSD Southwest Wastewater Treatment Plant Receiving Stream Information

<table>
<tr><th colspan="6">UCSD Southwest Plant Design Flow & Receiving Stream</th></tr>
<tr><th>Receiving Stream</th><th>HUC12 Watershed</th><th>Illinois Assessment Unit</th><th colspan="2">303(d) Impairments</th><th>Causes Related to P & Years on List</th></tr>
<tr><td>Copper Slough</td><td>071402010201</td><td>IL_OZYA</td><td colspan="2">None – Fully Supports Designated Uses</td><td>N/A</td></tr>
<tr><th colspan="2">Receiving Major Watershed</th><th colspan="2">POTW Design Average Flow</th><th colspan="2">POTW Design Maximum Flow</th></tr>
<tr><td colspan="2">Kaskaskia River</td><td colspan="2">7.98</td><td colspan="2">17.25</td></tr>
</table>

Based on data mining, IEPA data was only available at one location in the assessment unit, approximately 0.25 miles downstream of the Southwest Wastewater Treatment Plant outfall. The data included three measurements of DO, pH and chlorophyll *a* from 2017, thus these data are of limited utility.

UCSD performed a study in the summer and early fall of 2020 at locations above and below the outfall on Copper Slough. Continuous monitoring equipment was used to measure DO and pH, as well as other ancillary parameters. Chlorophyll *a* was not monitored. However, issues with sensors and data quality were reported by staff. As a result of inconclusive water quality data results, additional monitoring is recommended.

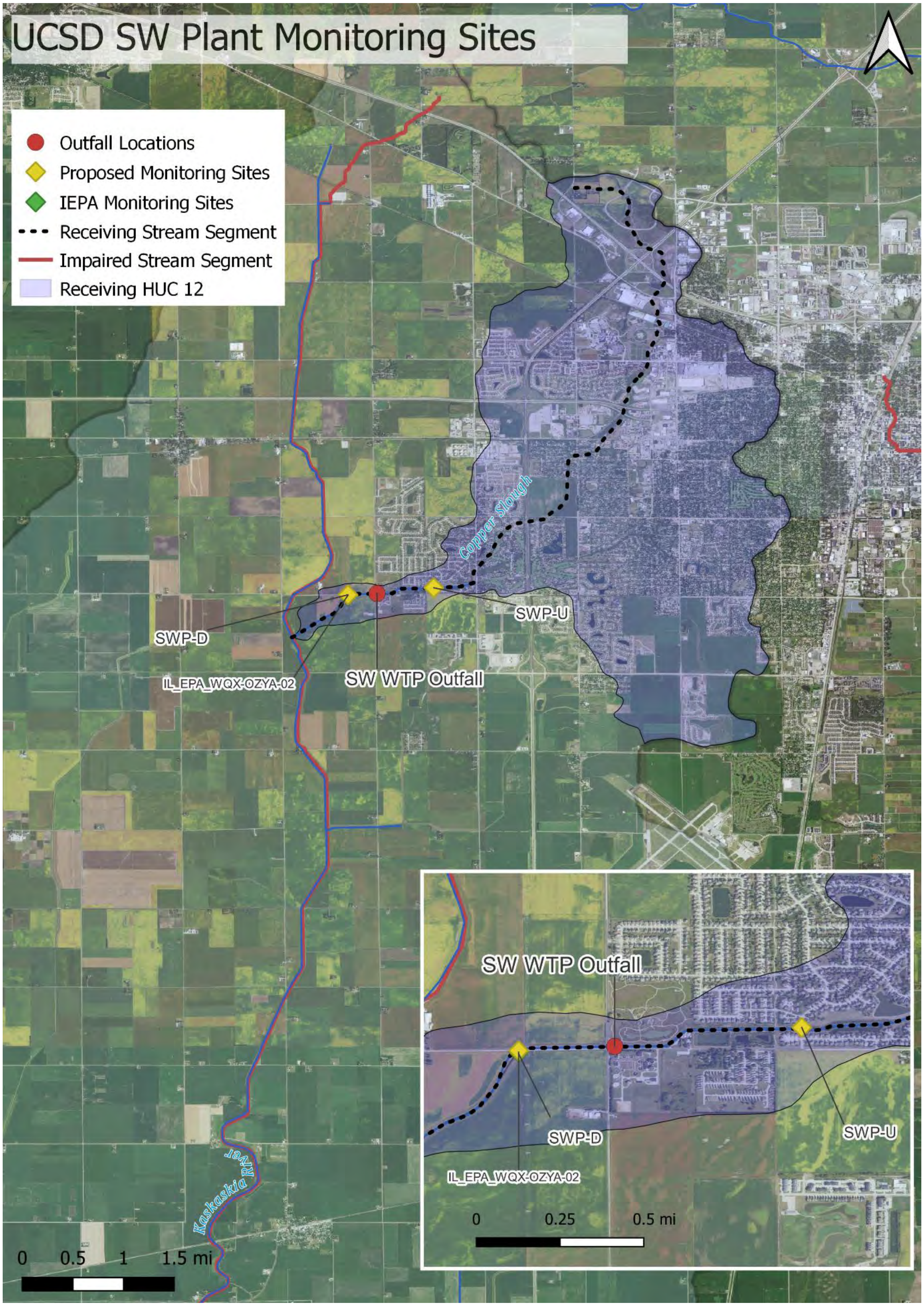

Figure 4. UCSD Southwest Plant Detail

3 Monitoring Plan Overview

Considering the effort and investment necessary for NARP development, and the lack of data available to make "at risk" determinations, stream monitoring is recommended at all three treatment plants. The water quality data will facilitate the assessment of the risk of eutrophication and guide further NARP development if required.

The proposed in-stream water quality monitoring expands upon past data collection efforts at each treatment plant. The monitoring program will be organized by Northwater Consulting and Donohue & Associates, in partnership with UCSD and the Village of Rantoul. To augment existing records, data collection is prioritized to locations with previous monitoring. The goal of this plan is to collect adequate data during the critical period between May and October when NARP triggering conditions are most likely to occur. Monitoring will determine if each receiving stream is at risk of eutrophication and will guide future stages of the NARP such as watershed characterization, assessing impairment causes/sources, and water quality model development. Further, the contribution of each treatment plant to the stream impairment or risk of eutrophication can be evaluated.

Recommended monitoring elements include:

1. Retrofit existing stations to monitor upstream and downstream of each outfall (6 total stations)
2. Installation of water quality sonde and sensors from Mid-May through October
    a. Hydrological Parameters: Stream stage
    b. Water Quality Parameters: pH, sestonic chlorophyll *a*, water temp, DO, conductivity
3. Bi-weekly storm monitoring
    a. Stream discharge/flow
    b. In-situ analysis of pH, conductivity, oxidation reduction potential, temperature, dissolved oxygen and turbidity
    c. Grab samples for laboratory analysis of orthophosphate, total phosphorus, chlorophyll *a*

These recommended parameters capture data critical for making the NARP determination. While there are myriad sampling methods that could be employed and characteristics available to measure, such as periphyton (attached algae chlorophyll) and nitrogen, this limited sampling scheme is designed to adhere closely to Illinois EPA NARP guidance.

4 Stream Monitoring

4.1 General Schedule

Data collection will commence for the UCSD Northeast Plant and Village of Rantoul Plant as soon as possible, on or around May 1, 2022 and will continue through October 31. This period captures the time of year when water quality issues are most likely to occur in these streams. The UCSD Southwest Plant is scheduled to have upgrades and operating changes designed to improve its effluent pH throughout 2022. Additionally, a stream restoration project in its receiving stream, Copper Slough, is scheduled to be installed. To capture the impacts of these changes relevant to NARP determination, data collection for the Southwest Plant will take place in summer 2023.

4.2 Stations

Three pairs of stations are recommended to be monitored one in each receiving stream. Stations will be located up and downstream of each outfall (Figures 5-7 and Table 5). This approach will characterize conditions and the effluent's effect on water quality. The additional water quality monitoring will provide sufficient data for NARP determination and next stages of NARP development, if necessary. The six stations are located at bridge crossings or preestablished access points. All have been monitored to some degree. Upstream sites are close enough to the outfall to capture as much upstream watershed as possible without the influence of effluent. Downstream sites are located at an ideal distance to allow for sufficient mixing of effluent and streamflow and to determine the immediate impacts of nutrients from the treatment plant. Station selections also eliminate the influence of other point and nonpoint sources that contribute to algal growth and are technically infeasible to isolate from plant effluent. Data collected using this approach can then be used to develop a predictive model estimating the potential impacts to downstream water quality.

Table 5 – Proposed Water Quality Monitoring Stations

Station ID	Name	Lat/Long	Station ID and organization which previously collected data at this site	Approximate distance from outfall	Year Monitoring Begins
SWP-U*	Copper Slough Southwest Plant Upstream – Mullikin Dr	40.085482, -88.332208	UCSD SW Upstream	0.5 mi	2023
SWP-D*	Copper Slough Southwest Plant Downstream – Windsor Road	40.084077, -88.33800	UCSD SW Downstream	0.4 mi	2023
NEP-U	Saline Branch Northeast Plant Upstream Plant Grounds	40.139727, -88.162975	UCSD NE Stream Point 1	0.25 mi	2022
NEP-D	Saline Branch Northeast Plant Downstream High Cross Road	40.139694, -88.162941	UCSD NE Stream Point 2	2.2 mi	2022
RNT-U	Salt Creek Ditch Rantoul Upstream Plant Grounds	40.31571, -88.12234	Rantoul WWTP Upstream	0.15 mi	2022
RNT-D	Salt Creek Ditch Rantoul Downstream Township 178E	40.31240, -88.11739	Rantoul WWTP Downstream	0.30 mi	2022
*Proposed Copper Slough monitoring site locations may change after stream restoration project completed.					

Figure 5. UCSD Southwest Plant Monitoring Locations

4.2.1 UCSD Southwest Plant Monitoring Location Information

Monitoring will begin in summer 2023 after changes in plant operations and a stream restoration project are in place. The proposed sites may be modified based on outcomes of construction. The upstream site is about 0.5 miles from the outfall with no significant point or nonpoint sources between. The downstream monitoring site on Copper Slough is approximately 0.4 miles from the outfall, which enters the stream from the bank and travels over a series of rocks to agitate the water to increase mixing. There is a bend in the river that also enhances mixing. Between the proposed site and where Copper Slough joins the Kaskaskia River stream access is not possible. This site represents the best chance of capturing the initial impact of the effluent on Copper Slough, as water quality at potential sites further downstream will have significant influence from another watershed and its point and nonpoint sources, therefore it will not be feasible to determine where the population of algae got its nutrients. However, the data collected at this site can be used in a predictive model to estimate the potential impact to downstream water quality.

Figure 6. UCSD Northeast Plant Monitoring Locations

4.2.2 UCSD Northeast Plant Monitoring Location Information

Monitoring in the Saline Branch will begin in May 2022. The upstream site is located on plant property, approximately 0.25 miles from the outfall, which enters the stream from the side and passes over rocks and concrete to agitate the water and enhance mixing. The stream channel has some sinuosity and traverses multiple bends before reaching the downstream sample site approximately 2.2 miles downstream. UCSD has historically monitored at this site. The proposed site represents an ideal location for capturing the impact of the effluent on water quality in the Saline Branch. Data from this site can be used in a predictive model to estimate the impact on downstream water quality.

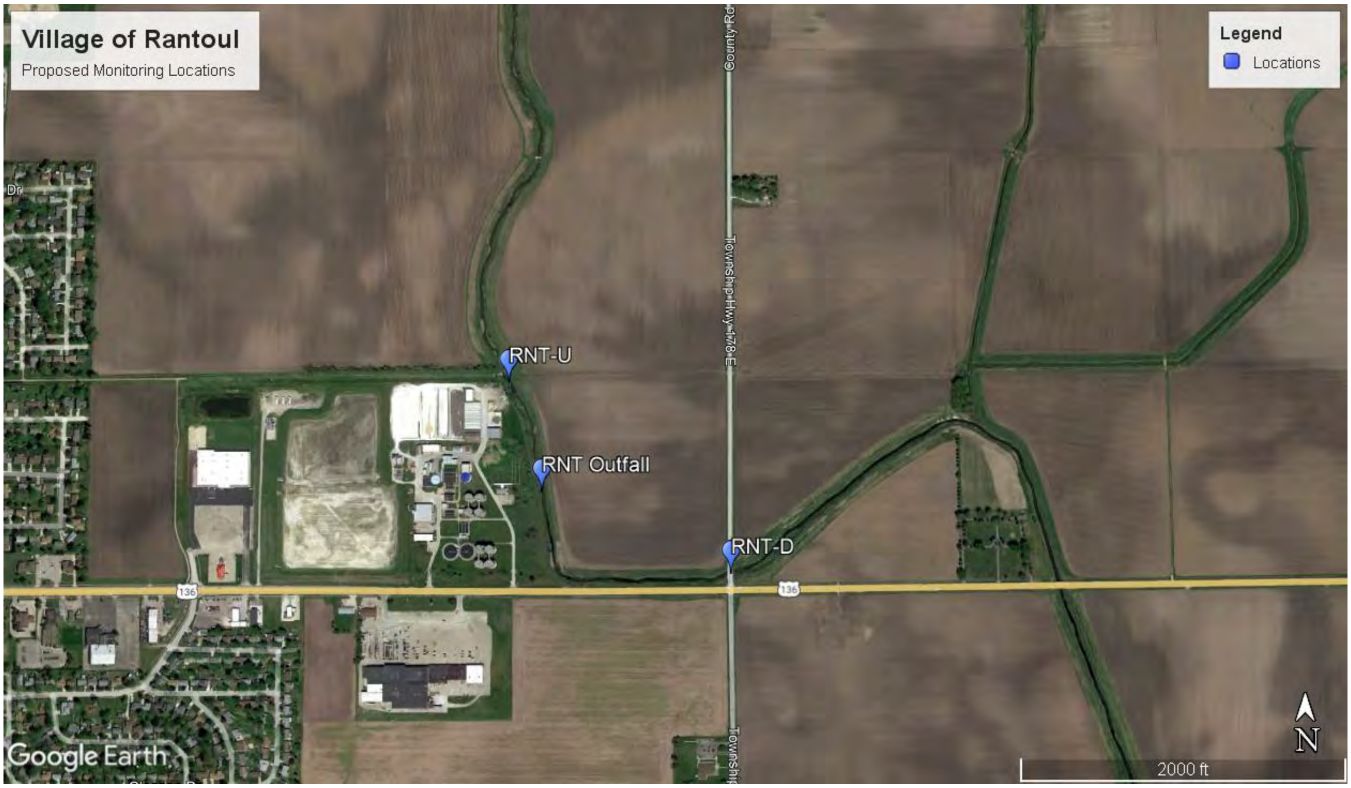

Figure 7. Village of Rantoul Monitoring Locations

4.2.3 Village of Rantoul Plant Monitoring Location Information

Monitoring on the Salt Fork Drainage Ditch will begin in May 2022 and continue through October. The upstream site is located approximately 0.15 miles from the outfall, which enters the stream from the side and is agitated by passing over rock. The downstream site is approximately 0.3 miles away from the outfall and traverses a significant bend in the stream and follows a somewhat sinuous channel. Streamflow and effluent at the sampling location will be fairly well mixed. This location represents the best chance of capturing the initial impact on water quality, as it avoids impacts from downstream tributaries and point and nonpoint sources, yet it is far enough away from the outfall to observe impacts on the aquatic community in the stream. Because there is no technically feasible method of determining from what source a far downstream algal population's nutrients came, a predictive model incorporating data from this site can be developed to estimate impacts on the aquatic community.

4.3 Sampling and Analyses

Sampling will be identical at each site unless circumstances arise that require a modification in protocol. Industry standard and manufacturer protocols for calibration, maintenance, data collection, and analysis will be followed and documented.

4.3.1 Hydrology Data

Stream stage and discharge data will be collected at each site (Table 6). If a sufficient range of flows is captured with monitoring, a rating curve can support estimates of watershed loading which could support watershed characterization and NARP development.

Table 6. Hydrology Parameters

Parameter	Collection Type	Frequency	Instrument/Method
Stream Stage	Continuous Probe	Continuous	Vented Pressure Transducer
Discharge	Manual	Bi-weekly, with additional storm samples	Digital Electromagnetic Flow Meter + wading staff or ADCP

4.3.2 Water Quality Data

Multiparameter sondes with integrated sensor wipers to reduce biofouling will be installed at each site and will collect data (Table 7) at a continuous 15-minute interval. Sondes will be left in place for multi-week deployments and will be serviced and/or calibrated no less frequently than every 30 days using manufacturer protocols. Multiparameter sondes manufactured by In-Situ instruments and YSI will be deployed for the water quality sampling. Grab samples and in-situ water quality measurements will be collected to augment the sonde monitoring data and will support quality assurance of sensor data and provide additional parameters useful for the NARP assessment. Grab samples will be collected on a bi-weekly frequency (Table 7) and 40 CFR Part 136 procedures will be followed and will include using laboratory-provided bottles with appropriate preservative, adherence to recommended holding times and conditions for samples, and daily duplicates for quality control. Where appropriate, a depth integrated, isokinetic sampler will be used for collection. Grab samples will be analyzed in-house at USCD and Rantoul laboratories, with chlorophyll *a* samples being sent to an accredited environmental laboratory.

Table 7. Water Quality Parameters

Parameter	Collection Type	Frequency	Method	Method Identifier
Dissolved Oxygen	Continuous Probe	Continuous	Optical	InSitu: EPA approved method YSI: ASTM D888-09
	Handheld Meter	Bi-weekly, Storm	Optical	ASTM D888-09
pH	Continuous Probe	Continuous	Potentiometric	EPA 150.2
	Handheld Meter	Bi-weekly, Storm	Potentiometric	EPA 150.2
Water Temperature	Continuous Probe	Continuous	Thermistor	EPA 170.1
	Handheld Meter	Bi-weekly, Storm	Thermistor	EPA 170.1
Chlorophyll-a	Continuous Probe	Continuous	In-situ Optical Fluorescence	Instrument Manufacturer Optical Method
	Grab	Bi-weekly, Storm	Lab Spectrophotometric	EPA 445.0
Total Phosphorus	Grab	Bi-weekly, Storm	Colorimetry	EPA 365.1 / EPA 365.3
Orthophosphate	Grab	Bi-weekly, Storm	Colorimetry	EPA 365.1 / EPA 365.3
Conductivity	Continuous Probe	Continuous	Resistor Network	EPA 120.1
	Handheld Probe	Bi-weekly, Storm	Resistor Network	EPA 120.1

5 Data Management & Quality Control

Data will be downloaded from each logger at each site visit and will be maintained in a relational Microsoft Access database or Microsoft Excel spreadsheet. Continuous data will be corrected for drift using the statistical software R, package driftR[3] using a standard procedure based on instrument calibration.

[3] https://rdocumentation.org/packages/driftR/versions/1.1.0

APPENDIX B: WATER QUALITY DATA

Appendix B Data Table 1 - Upper Salt Fork Drainage Ditch Upstream from Rantoul WWTP (RNT-U) Grab Sample Data

Date Time	Site	TP	OrthoP	ChlA	Temp	DO conc.	Sp. Cond.	pH	ORP	Turbidity	DO Sat.	Flow	NO3-N	NO2-N	TN	NH3-N
		mg/L	mg/L as P	µg/L	C	mg/L	µS/cm	SU	mV	RFU	%	cfs	mg/L	mg/L	mg/L	mg/L
5/13/22 10:34	RNT-U				17.2	13.82	528	7.7	163	5.38	147.5	9.09				
5/25/22 10:04	RNT-U				16.4	10.11	517	7.5	178	2.87	106.1	6.22				
6/8/22 10:03	RNT-U				15.9	9.02	547	7.51	221	2.76	93.7	4.78				
6/22/22 10:06	RNT-U				24.1	12.1	555	7.4	147	5.12	148.1	2.71				
7/7/22 9:53	RNT-U				23.4	9.12	613	7.73	189	2.82		2.82				
7/21/22 10:05	RNT-U				23.4	10.13	634	7.69	126	1.88	120.9	1.54				
8/4/22 9:35	RNT-U				22	5.85	402.9	7.08	152	11.16	67.3	8.63				
8/17/22 9:01	RNT-U				18.4	7.32	600	7.46	265	3.14	78.2	1.19				
8/31/22 10:15	RNT-U				20.3	7.57	424.9	7.5	237	8.4	84.2					
9/15/22 8:43	RNT-U				17.2	7.96	599	8.12	178	3.02	82.7	2.06				
5/13/22 10:35	RNT-U	0.06	0.01	7.3												
5/25/22 10:29	RNT-U	0.17	0.13	5.9												
9/29/22 8:45	RNT-U				10.1	10.16	444	8.61	165	1.71	89.5					
6/8/22 10:04	RNT-U	0.16	0.12	4.3												
6/22/22 10:08	RNT-U	0.17	0.07	3.2												
7/7/22 9:30	RNT-U	0.03	0.01	4.8												
7/21/22 10:00	RNT-U	0.13	0.15	5.7												
10/13/22 9:09	RNT-U				10.1	6.31	388.3	7.19	242	1.46	56.9	0.69				
8/4/22 9:30	RNT-U	0.09	0.11	4.2												
11/2/22 11:18	RNT-U				12.4	7.88	365.1	7.45	138	7.58	73.7					
8/17/22 8:44	RNT-U	0.02	0.01	3.3												
8/30/22 8:15	RNT-U	0.05	0.02	4.1												
7/10/23 16:23	RNT-U				28	8.76	579	7.89	114	0.29	112.0	1.41				
9/15/22 8:15	RNT-U	0.01	0.01	4.8												
9/29/22 7:30	RNT-U	0.04	0.01	5.1												
7/26/23 15:26	RNT-U				27.7	10.22	606	7.83	115	4.03	127.8	0.75				
10/12/22 8:01	RNT-U	0.06	0.03	3.2												
8/9/23 15:38	RNT-U				23	7.26	584	7.82	102	2.19	87.2	1.84				
6/22/23 0:00	RNT-U	0.03	0.01	5.9									3.29	0.02	14.05	0.017
7/7/23 0:00	RNT-U	0.07	0.01	4.5									4.58	0.271	11.7	0.015
7/10/23 0:00	RNT-U	0.03	0.01	6.6									6.07	0.102	12.6	0.01
7/26/23 0:00	RNT-U	0.05	0.02	4.3									3.53	0.065	12.3	0.01
9/1/23 8:59	RNT-U				15.8	7.5	430.2	7.9	110	1.27	76.8	0.52				
8/9/23 0:00	RNT-U	0.12	0.05	3.6									4.49	0.196	13.07	0.012
8/21/23 0:00	RNT-U	0.1	0.03	4.7									4.56	0.128	11.7	0.15
9/1/23 0:00	RNT-U	0.17	0.09	5.2									6.69	0.332	10.02	0.054
9/13/23 0:00	RNT-U	0.13	0.06	6.1									5.6	0.766	13.23	0.033
9/13/23 16:05	RNT-U				22.7	12.22	515	7.97	124	0.35	144.9	0.28				
9/25/23 0:00	RNT-U	0.09	0.02	6.2									7.37	0.327	10.64	0.015
9/25/23 16:19	RNT-U				21.6	13.33	433.8	8.11	93	0.51	154.8	0.41				
10/5/23 0:00	RNT-U	0.1	0.02	6.5									6.07	0.356	9.33	0.033

Appendix B Data Table 2 - Upper Salt Fork Drainage Ditch Downstream from Rantoul WWTP (RNT-D) Grab Sample Data

Date Time	Site	TP mg/L	OrthoP mg/L as P	ChlA µg/L	Temp C	DO conc. mg/L	Sp. Cond. µS/cm	pH SU	ORP mV	Turbidity RFU	DO Sat. %	Stage ft	Flow cfs	NO3-N mg/L	NO2-N mg/L	TN mg/L	NH3-N mg/L
5/13/22 11:20	RNT-D	0.25	0.1	7.6													
5/13/22 11:35	RNT-D				18.5	10.79	614	7.52	182.8	6.39	118.3	1.62	15.23				
5/25/22 10:39	RNT-D	0.35	0.24	6.2													
5/25/22 10:40	RNT-D				17.6	9.08	599	7.57	192.9	4.79	97.7	1.58	11.2				
6/8/22 11:04	RNT-D	0.15	0.12	5.1													
6/8/22 11:13	RNT-D				17.1	8.63	698	7.43	193.7	3.33	91.9	1.48	6.54				
6/22/22 10:58	RNT-D	0.29	0.25	6.4													
6/22/22 11:03	RNT-D				23.9	10.06	762	7.53	148.7	4.77	122.6	1.4	5.74				
7/7/22 9:48	RNT-D	0.38	0.3	8.1													
7/7/22 11:16	RNT-D				23.9	8.99	808	7.67	189.9	5.99	109.6		3.82				
7/21/22 10:10	RNT-D	0.31	0.23	7.9													
7/21/22 10:45	RNT-D				24.2	8.41	886	7.57	135	6.42	95.2	1.39	4.5				
8/4/22 10:13	RNT-D				23.2	6.01	597	7.07	161	8.65	69.5	1.6	17.85				
8/4/22 10:15	RNT-D	0.27	0.17	7.4													
8/17/22 8:59	RNT-D	0.53	0.36	5.7													
8/17/22 9:22	RNT-D				21.1	9.03	897	7.53	253	1.62	104.0	1.32	2.72				
8/30/22 8:28	RNT-D	0.43	0.12	7.5													
8/31/22 10:49	RNT-D				22.1	7.03	519	7.45	224.6	6.86	81.6	1.43					
9/15/22 8:26	RNT-D	0.16	0.08	8.1													
9/15/22 9:12	RNT-D				20.6	6.21	770	7.58	190.5	1.69	69.6	1.38	7.23				
9/29/22 7:42	RNT-D	0.21	0.14	7.6													
9/29/22 9:13	RNT-D				15.7	8.9	670	8.11	148.7	4.47	88.8	1.3					
10/12/22 8:11	RNT-D	0.12	0.06	5.6													
10/13/22 8:05	RNT-D				15.4	4.64	605	7.63	238.4	3.35	47.7	1.3	4.09				
11/2/22 12:37	RNT-D				15.2	7.2	463.8	7.1	132.5	7.12	71.8						
6/22/23 0:00	RNT-D	0.23	0.13	6.8										8.52	0.17	18.37	0.056
7/7/23 0:00	RNT-D	0.28	0.14	5.2										7.31	0.559	19.13	0.073
7/10/23 0:00	RNT-D	0.2	0.09	8.4										10.5	0.258	18.22	0.071
7/10/23 17:06	RNT-D				24.6	6.94	628	7.74	112.6	1.11	83.4		5.24				
7/26/23 0:00	RNT-D	0.2	0.12	5.9										6.88	0.117	20.1	0.088
7/26/23 16:08	RNT-D				25.7	11.88	805	8.07	103	2.82	146.9		3.94				
8/9/23 0:00	RNT-D	0.36	0.17	5										7.2	0.533	20.92	0.042
8/9/23 16:21	RNT-D				23.3	7.25	459.9	7.74	106.6	11.65	87.7		22.74				
8/21/23 0:00	RNT-D	0.19	0.1	6.8										7.18	0.424	18.47	0.139
9/1/23 0:00	RNT-D	0.38	0.16	7.6										7.45	0.684	21.37	0.12
9/1/23 9:54	RNT-D				20.5	9.5	616	7.89	132.6	0.66	107.3		3.26				
9/13/23 0:00	RNT-D	0.42	0.13	8.4										6	1.12	24.58	0.293
9/13/23 16:37	RNT-D				21.6	10.02	712	7.77	128.6	0.64	116.3		1.31				
9/25/23 0:00	RNT-D	0.29	0.11	7.7										9.9	0.759	20.06	0.164
9/25/23 16:51	RNT-D				21.4	9.91	635	7.65	110.4	0.23	114.7		2.09				
10/5/23 0:00	RNT-D	0.33	0.14	8.2										11.4	0.786	18.41	0.225

APPENDIX C: FACITLITY IMPROVEMENT PLAN

Village of Rantoul
333 South Tanner Street, Rantoul, IL 61866

Rantoul WWTP
Capital Improvement Plan Amendment

November 2022

Prepared by:

Donohue & Associates, Inc.
1605 South Street, Suite 1C | Champaign, IL, 61820
donohue-associates.com

Donohue Project No.: 13910

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ABBREVIATIONS

BOD	Biological Oxygen Demand
DAF	Design Average Flow
DMF	Design Maximum Flow
MGD	Million Gallons per Day
MHI	Median Household Income
NPDES	National Pollutant Discharge Elimination System
PPD	Pounds per Day
SWD	Side Water Depth
TSS	Total Suspended Solids
WWTP	Wastewater Treatment Plant

1. EXECUTIVE SUMMARY

The Village of Rantoul, in conjunction with Donohue & Associates, Inc., has completed a Capital Improvement Plan for the Rantoul wastewater treatment plant (WWTP) that has focused on upgrading or replacing key treatment processes, solids handling upgrades, meeting biological nutrient removal requirements, and at the same time, upgrading the northwest lift station and installing a new force main.

The Village's WWTP currently is permitted to treat a design average of 4.33 MGD with the permitted design maximum flow being 8.65 MGD. The plant has crucial equipment that is approaching the end of its reliable service life that needs upgrading. Considering current nitrification requirements and treatment recommendation, as well as future nutrient removal requirements, the solids handling processes are improperly designed for current volumetric loading rates and industrial contributions. A new force main is also needed to handle increasing industrial flows. The recommended improvements will address these concerns and update existing aging equipment. The implementation of these improvements is divided into phases. The recommended design improvements for the plant upgrades planning, by phase, include:

Table 1-1 Improvements Divided by Phase

Phase	Description	Capital Cost	Year
1	Northwest Pump Station Improvements	$1,140,000	2023
	Rantoul Foods Pump Station, Evans Road Pump Station Improvements	$3,550,000	2023
	Chemical System Improvements	$74,000	2023
	Sludge Dewatering Upgrade	$6,241,000	2023
	Solids Piping Improvements	$123,000	2023
	Subtotal	$11,128,000	
2	Replace South Traveling Bridge Filter with Diamond Filter	$4,351,000	2024
	North Primary Clarifier Structural Repair	$212,000	2024
	Screw Pump Replacement	$183,000	2024
	Subtotal	$4,746,000	
3	New BNR Activated Sludge Tanks and Blower, RAS and WAS Pumping Building	$15,210,000	2025
	New Final Clarifiers	$3,665,000	2025
	WAS Thickening	$2,067,000	2025
	Subtotal	$20,942,000	
	Total	$36,815,000	

The proposed plant upgrades for phase 1 are forecasted to have a total initial capital cost of $11.128 million. The Village has the option to finance the project with an IEPA low interest loan, with the 2022-23 "small community" interest rate of 0.93%. If the Village pursued this the project is expected to result in an annual debt retirement cost to the Village of $612,300 per year over 20 years assuming no loan forgiveness. This will result in an increase in sewer rates from the average current residential rate of $22.00 per month to $32.94 per month.

2. INTRODUCTION

2.1 AUTHORITY AND PURPOSE

This report has been prepared at the direction of the Village of Rantoul, as authorized by Task Order No. 5 to a Continuing Engineering Services Agreement executed in May 2021 between the Village of Rantoul and Donohue & Associates, Inc. The purpose of this report is to determine the best means of updating or replacing the wastewater treatment systems at the Village's wastewater treatment plant and to determine the best means of achieving nutrient removal at the facility. In addition, this report is to evaluate the best means to upgrade the Village's northwest wastewater pump station.

2.2 SCOPE

This report considered the following characteristics of the treatment processes and collection system components, to determine which treatment processes and collection system upgrades are best suited to meet the Village's needs.

From this assessment, the following considerations were given to determine the most cost-effective means of meeting the established effluent and water quality standards.

- Development and evaluation of alternative treatment systems.
- Selection of a recommended alternative for the upgrading or replacing the treatment systems and conveyance systems.
- Preparation of the Project Plan report for the recommended alternative of each plan component.
- Identification and discussion of implementation and financial arrangement

Multiple workshop meetings were conducted to discuss the evaluation of alternative treatment systems and the construction of this report.

3. PROJECT PLANNING AREA

3.1 FACILITY PLANNING INFORMATION

The Rantoul Wastewater Treatment Plant (WWTP) is located at 1625 E Grove Avenue just inside the corporate limits of the Village of Rantoul and serves approximately 4,663 customers of which 4,663 are residential. It is situated just west of the Upper Salt Fork Drainage Ditch.

The Rantoul WWTP is located in Section 36 of Township 22 North, Range 9 East in the Third Principal Meridian. The facility is in Rantoul Township of Champaign County. See Figure 3-1 for an excerpt of the USGS Rantoul Quad Map, showing the location of the plant.

The Rantoul WWTP discharges treated effluent to the Upper Salt Fork Drainage Ditch under the authority of NPDES Permit IL0022128, which was issued on June 13, 2019. Appendix A provides a copy of this permit. This permit expires on May 31, 2024. The plant is permitted to discharge a design flow of 4.33 MGD and a design maximum flow of 8.65 MGD. Current effluent permit limits are summarized in Table 3-1.

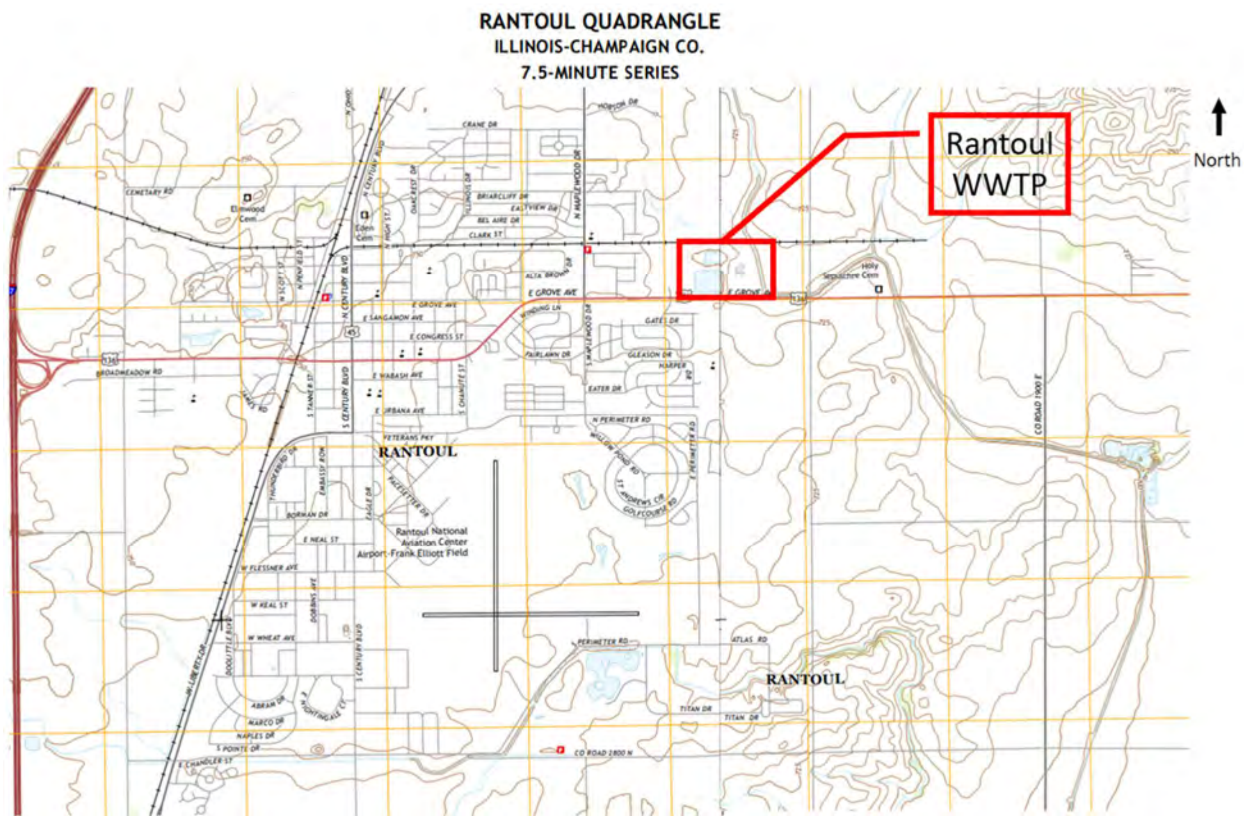

Figure 3-1 Project Location Map

Table 3-1 NPDES Permit Effluent Limitations

Parameter		Load Limits (ppd)				Concentration Limits (mg/L)		
		Monthly Average		Daily Maximum		Monthly Average	Weekly Average	Daily Maximum
		DAF	DMF	DAF	DMF			
BOD		361	721	722	1443	10		20
TSS		433	866	867	1731	12		24
Ammonia Nitrogen as (N)	April-Oct.	54	108	108	216	1.5		3.0
	Nov. – Feb.	94	188	188	375	2.6		5.2
	March	54	108	184	368	1.5		5.1
Phosphorus		36	72			1.0		
Dissolved Oxygen	March-July						>6.0	>5.0
	Aug.-Feb.					>5.5	>4.0	>3.5

3.2 ENVIRONMENTAL RESOURCES

As part of this study effort, Donohue & Associates, Inc. will solicit input from agencies associated with environmental issues such as wetlands; flood plains; unique plant or animal communities or other important fish and wildlife habitats; historic, archeological, and cultural features; and any other factors that would be significantly affected by the proposed improvements.

For this project, the Village of Rantoul will comply with the various State of Illinois and federal enactments for protecting the area's environmental resources. The agencies listed below will be notified of this project for their appropriate sign-off. Appendix B in the back of the report will provide the latest correspondence and Environmental Signoffs and approvals from the following agencies about the project:

- Historic Preservation & Archeological Issues: Illinois State Historic Preservation Office (SHPO) of the Illinois Department of Natural Resources

- Endangered Species Protection & Natural Areas Preservation: Illinois Department of Natural Resources – Division of Natural Resources Review & Coordination

- Wetlands issues: Illinois Department of Natural Resources – Division of Natural Resources Review & Coordination

Figure 3-2 below provides an aerial map of the current wastewater treatment facility. As Figure 3-2 shows, except for the southeast end of the site, the WWTP is nearly fully developed, with lagoons, buildings and structures taking up most of the site. The work proposed in this project will take place on the southeast end of the site. For the most part, only a limited amount of land will disturbed by the recommended project.

Figure 3-2 Wastewater Treatment Plant Aerial Photo

Under this study effort, Donohue reviewed FEMA's website to determine whether the Project's Study Area is flood prone. Figure 3-3 below provides an excerpt from the FEMA flood map for the Rantoul WWTP site and its surrounding areas. As one can see, the plant site is not located in the regulatory floodway. The plant is located within a minimal flood hazard area.

Figure 3-3 Rantoul WWTP FEMA Flood Map

Figure 3-4 below provides an excerpt from the FEMA flood map for the Rantoul Northwest Pump Station and its surrounding areas. The site is not located in the regulatory floodway and is located within a minimal flood hazard area.

Figure 3-4 Northwest Pump Station FEMA Flood Map

3.3 PLANNING PERIOD

The project planning period is a 20-year period, extending from 2022 to 2052. It is intended that all equipment proposed in this report have a design life of as much as 20 years. All user charge calculations have been compiled assuming a 20-year payback of the instruments of finance, such as Illinois EPA Water Pollution Control Loan Program loans.

3.4 POPULATION PROJECTION

The U.S. Census Bureau reports that, as of the 2010 census, the Village of Rantoul had a population of 12,969 persons. Population estimates were also made for the period from 2011 to 2020. Table 3-2 provides those estimates. As this data shows, the Village has had varying population changes over time but over the last ten-year period the change has been relatively flat with a slight decline in population.

Table 3-2 Rantoul Population Estimates, 2011-2020

Year	Population
2010	12,969
2011	13,014
2012	13,045
2013	13,159
2014	13,170
2015	13,047
2016	12,928
2017	12,805
2018	12,691
2019	12,493
2020	12,400

After reviewing this information and overall recent population trends for Champaign County, Donohue believes that long-term population change beyond the existing population will be very limited at a max growth of 0.25% per year. Figure 3-5 below provides Rantoul's 30-year population projects to 2050. The Rantoul WWTP was originally designed for a population equivalent of 30,812 and Donohue believes there is no reason for expansion considering residential contributors.

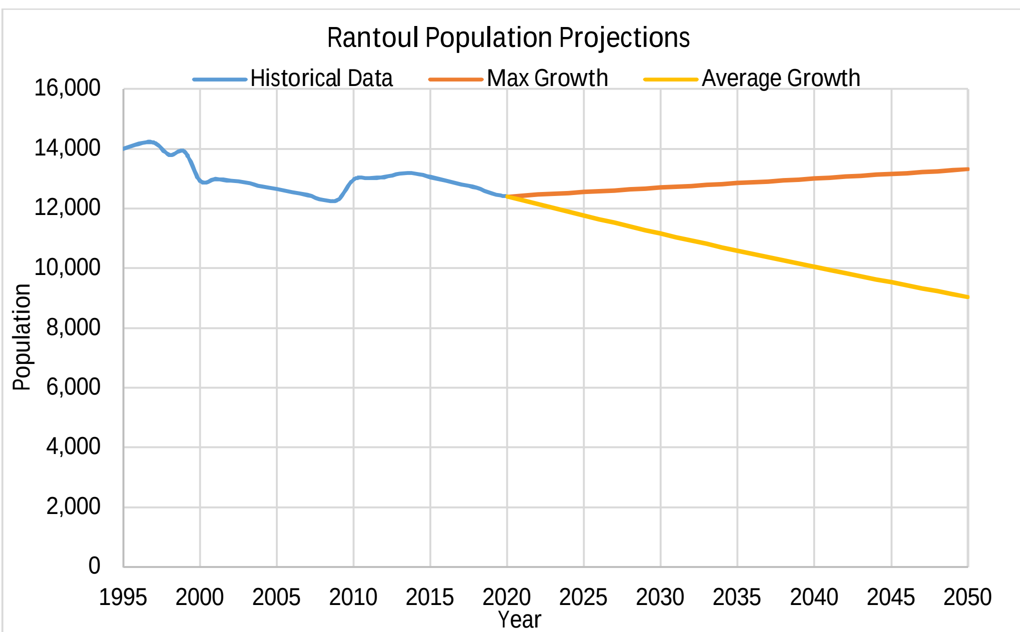

Figure 3-5 Rantoul Population Projections

3.5 INCOME DATA

The U.S. Census Bureau reports that Rantoul's average Median Household Income (MHI) for 2016-2020 was $41,837. The statewide average MHI for all of Illinois for 2016-2020 was reported to be $68,428.

3.6 CURRENT LAND USE

All the Rantoul WWTP site is zoned for AG which is the "Agricultural" District. Within the corporate limits the site is mostly surrounded by agricultural and commercial zones with residential areas to the west and south. No projected changes in land use are expected under this project. Figure 3-6 below depicts an expert from the Village of Rantoul's Zoning Map accessible on their website.

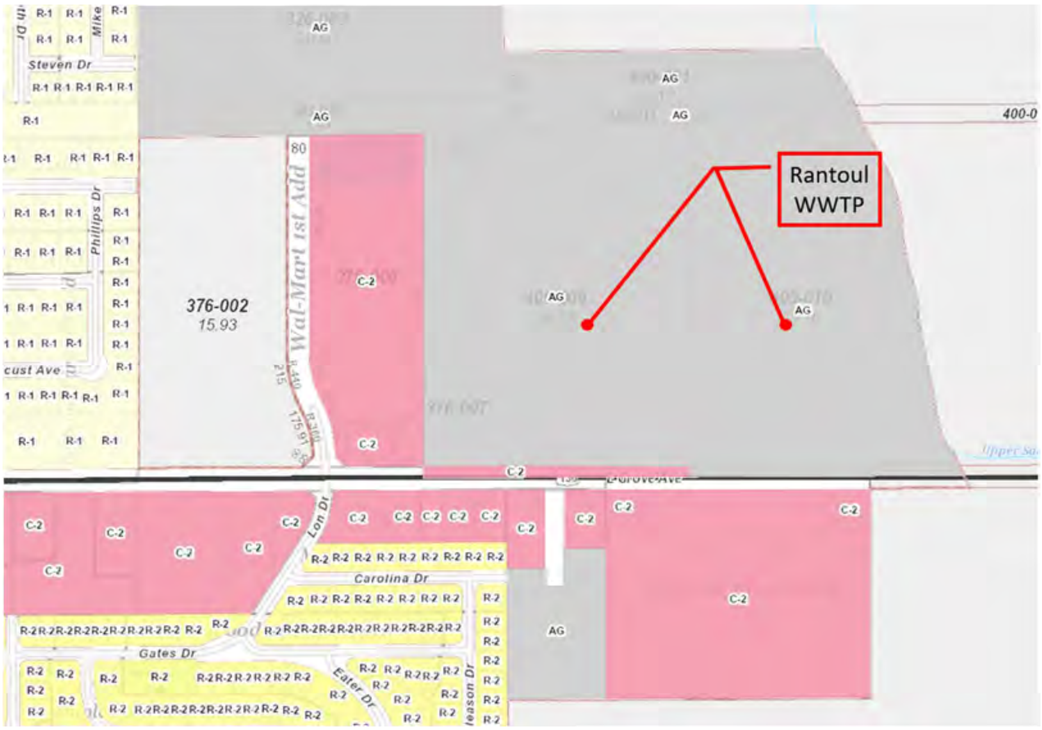

Figure 3-6 Excerpt from Rantoul Zoning Map

4. EXISTING CONDITIONS

4.1 CURRENT FLOWS

The original design treatment capacities, the current flows, and the future design flows are summarized in Table 4-1. The current average flow is estimated to be 3.55 MGD. Rantoul Foods, located at the west end of Rantoul, is a major contributor to WWTP. The Rantoul Foods plant plans to increase flow from 300,000 gpd to 600,000 gpd resulting in a projected future DAF of 3.85 MGD. Population projections discussed in Section 3.4 do not show major growth thus no significant increases to influent flow are expected. There is no indication that the Rantoul WWTP is in need of expansion.

Table 4-1 Design and Current Flows

Flows (MGD)	DAF	DMF
Original Design Flows	4.33	8.65
Current Flows	3.55	7.69
Future Design Flows	4.33	8.65

Historical influent flow data from 2014 to 2021 for the Rantoul WWTP is shown in Figure 4-1. The current average flow of 3.55 MGD is below the design average flow of 4.33 MGD.

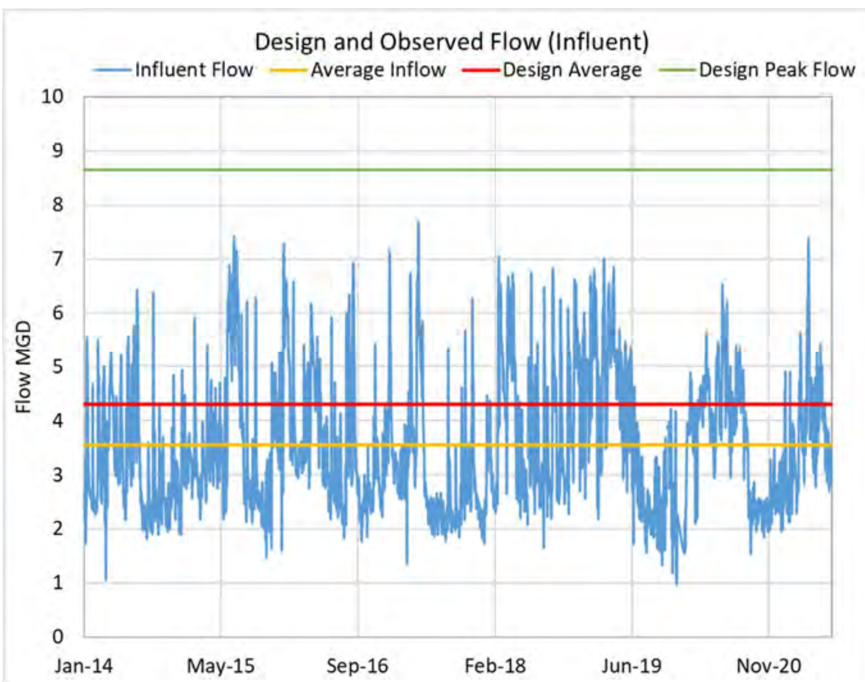

Figure 4-1 Observed Flow, 2014-2021

4.2 CURRENT LOADINGS

The plants' current concentrations and loadings are shown below in Table 4-2. The current influent average flow is based on the plant's 2014-2021 raw influent flow data reported via Discharge Monitoring Reports (DMR) mandated under the NPDES Permit.

Table 4-2 Current Influent Average Concentrations and Loadings

Monthly Average		Influent
Flow	MGD	3.55
BOD	mg/L	140
	ppd	3,840
TSS	mg/L	167
	ppd	4,710
Ammonia	mg/L	15.5
	ppd	416
Phosphorus	mg/L	4.69
	ppd	129

4.2.1 BOD

The raw influent BOD concentrations and loadings are shown in Figure 4-2 and Figure 4-3. The data shows a slight increase in loading.

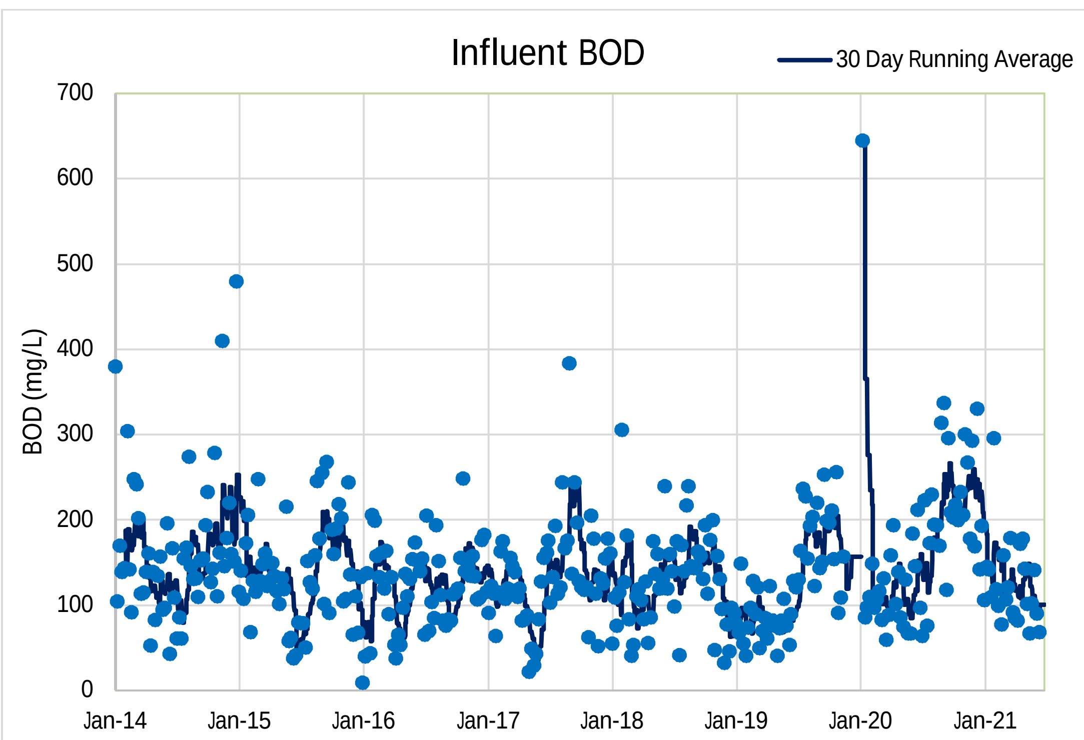

Figure 4-2 Raw Influent BOD Concentration

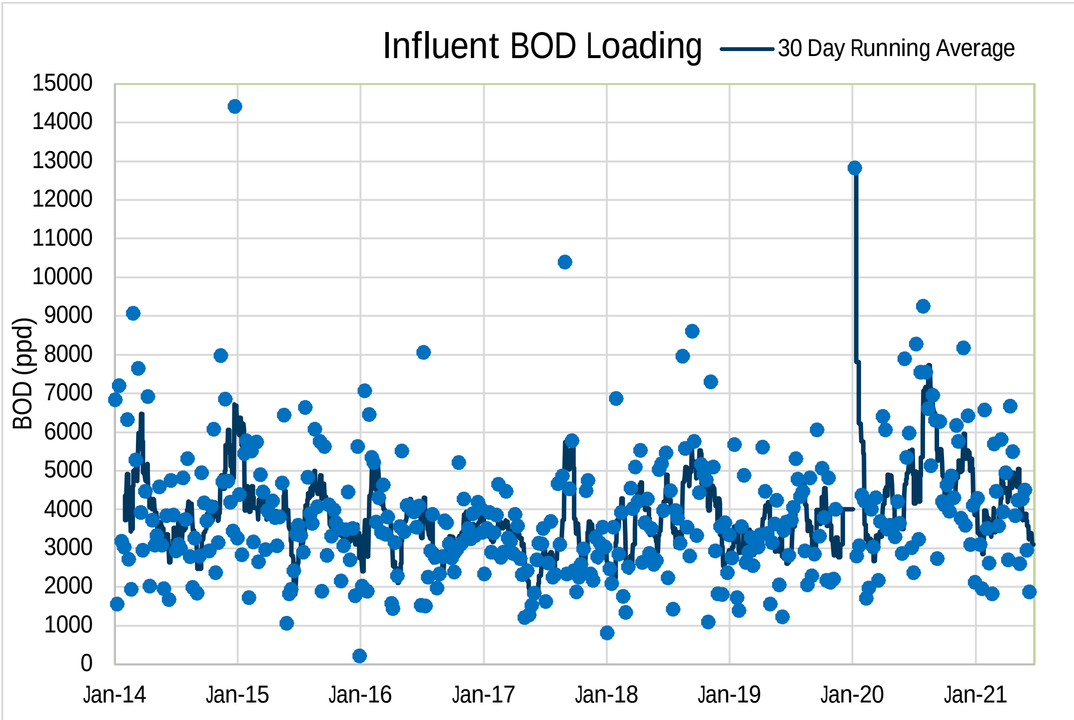

Figure 4-3 Raw Influent BOD Loading

4.2.2 TSS

Raw influent TSS concentrations and loadings are shown in Figure 4-4 and Figure 4-5. The data shows a downward trend in concentration and loading.

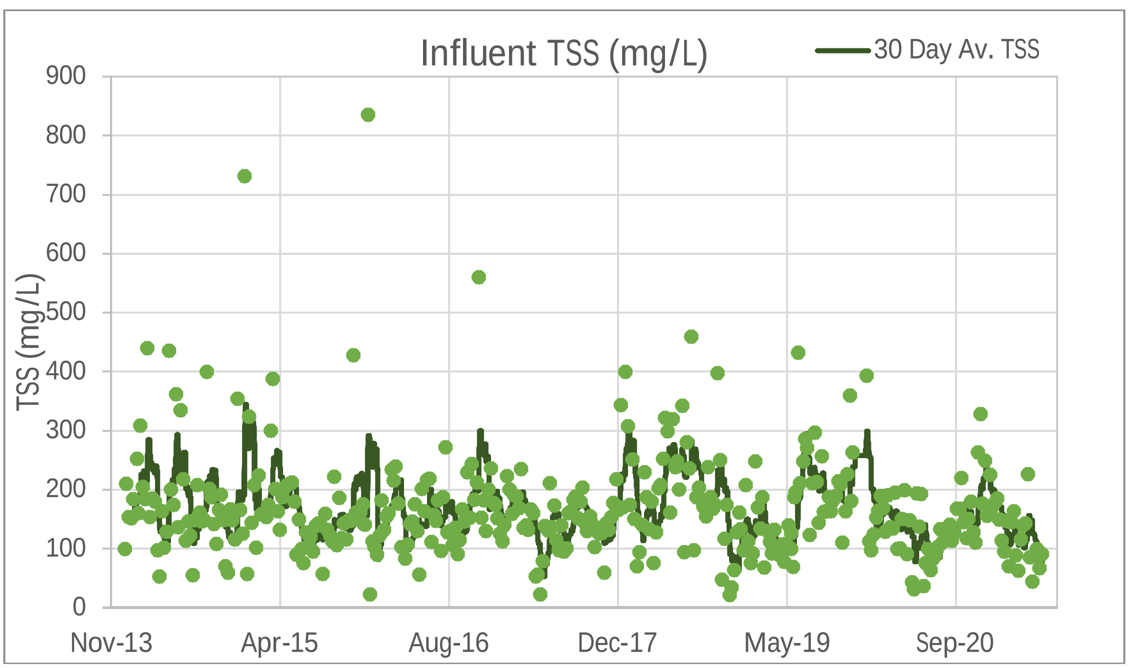

Figure 4-4 Raw Influent TSS Concentration

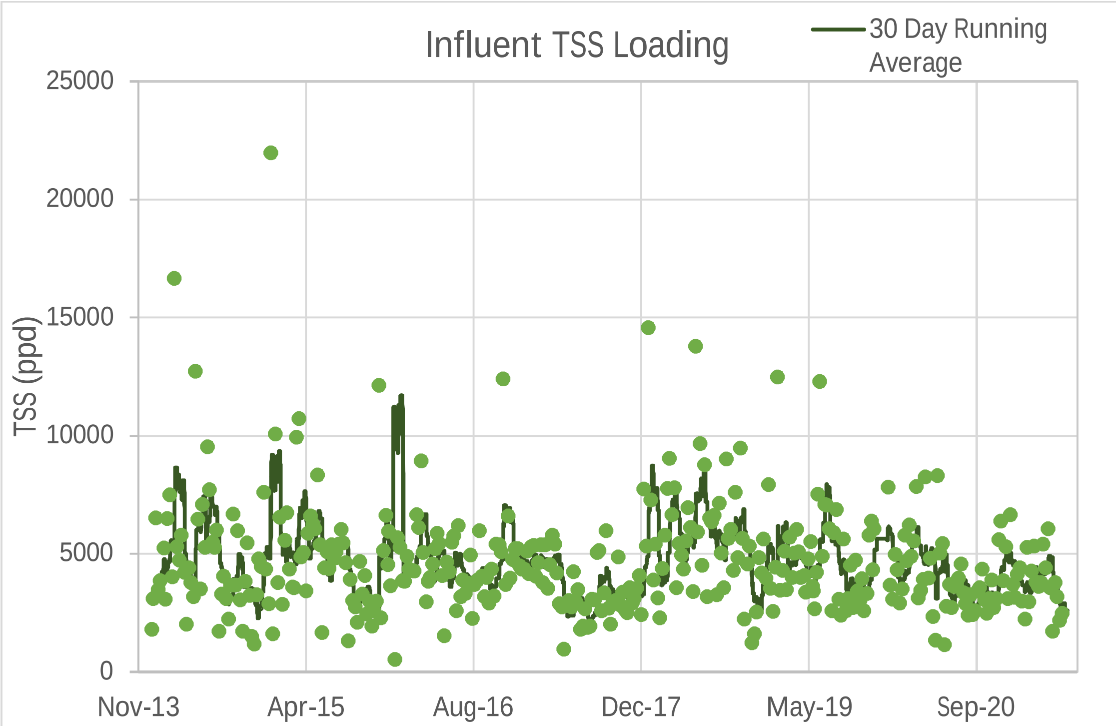

Figure 4-5 Raw Influent TSS Loading

4.2.3 PHOSPHORUS

Influent phosphorus concentrations are displayed in Figure 4-6 and Figure 4-7. The concentrations and loadings do not show any upward or downward trends through the six years of data.

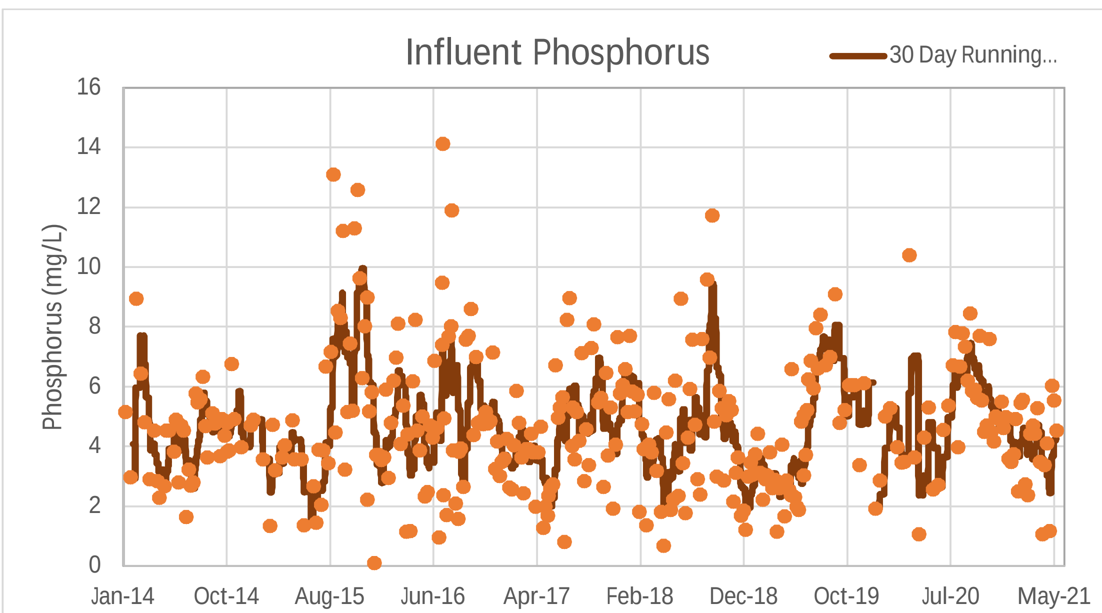

Figure 4-6 Raw Influent Phosphorus Concentration

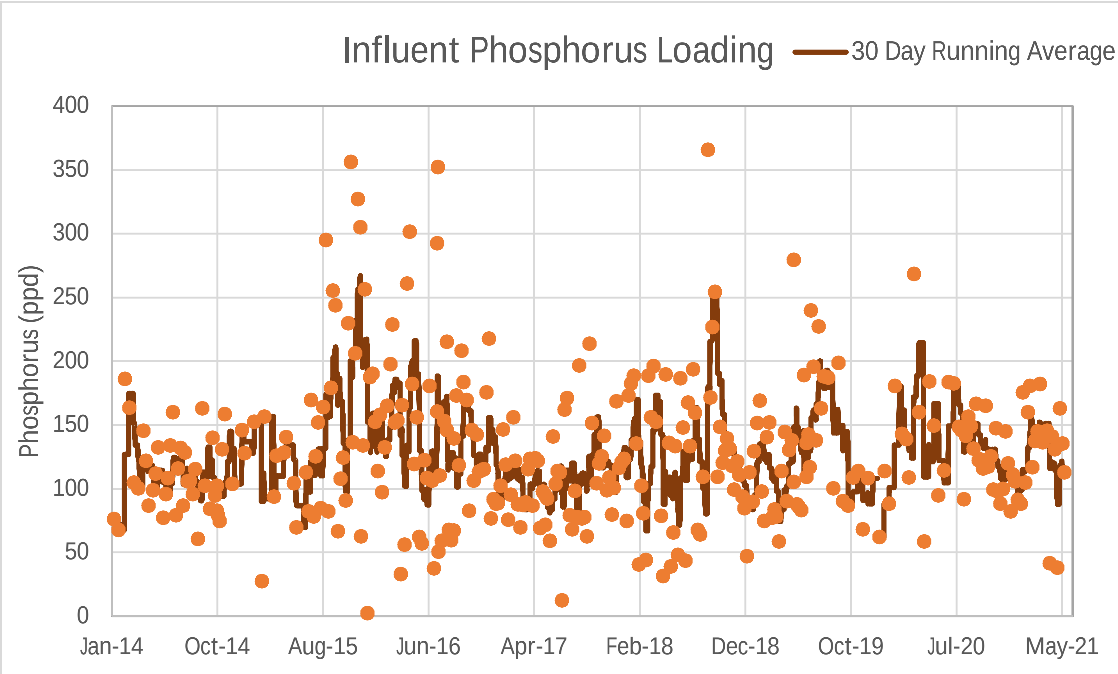

Figure 4-7 Raw Influent Phosphorus Loading

4.2.4 AMMONIA AS N

Influent ammonia concentrations are displayed in Figure 4-8 and Figure 4-9. The data shows an upward trend in concentrations and loadings.

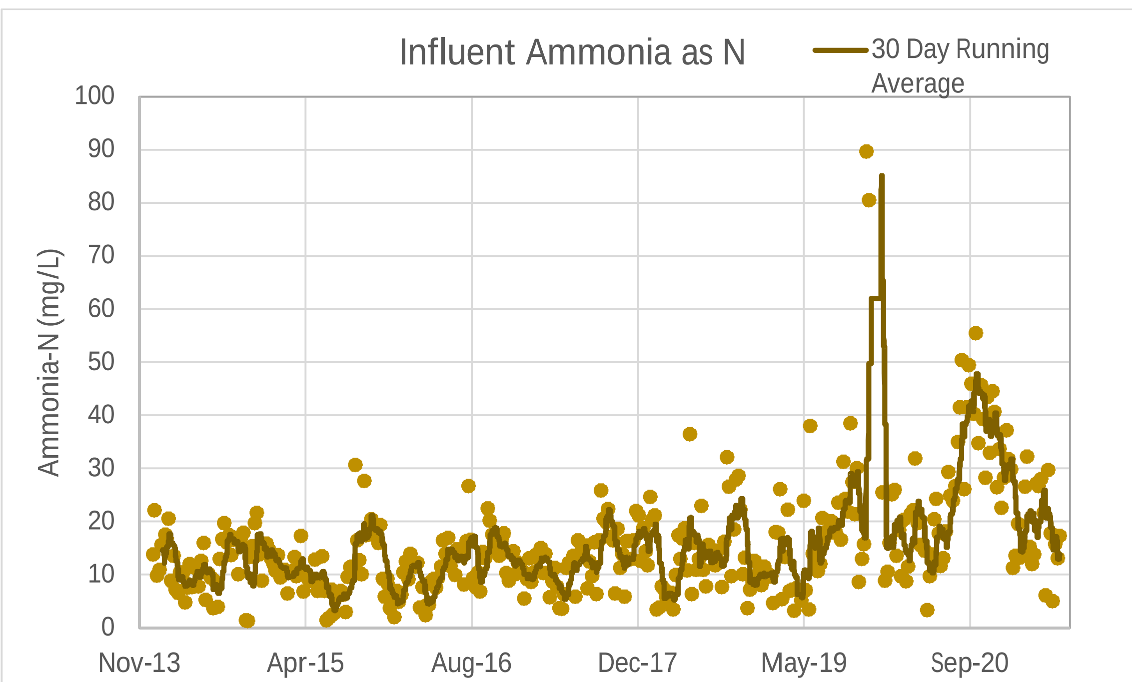

Figure 4-8 Raw Influent Ammonia Concentration

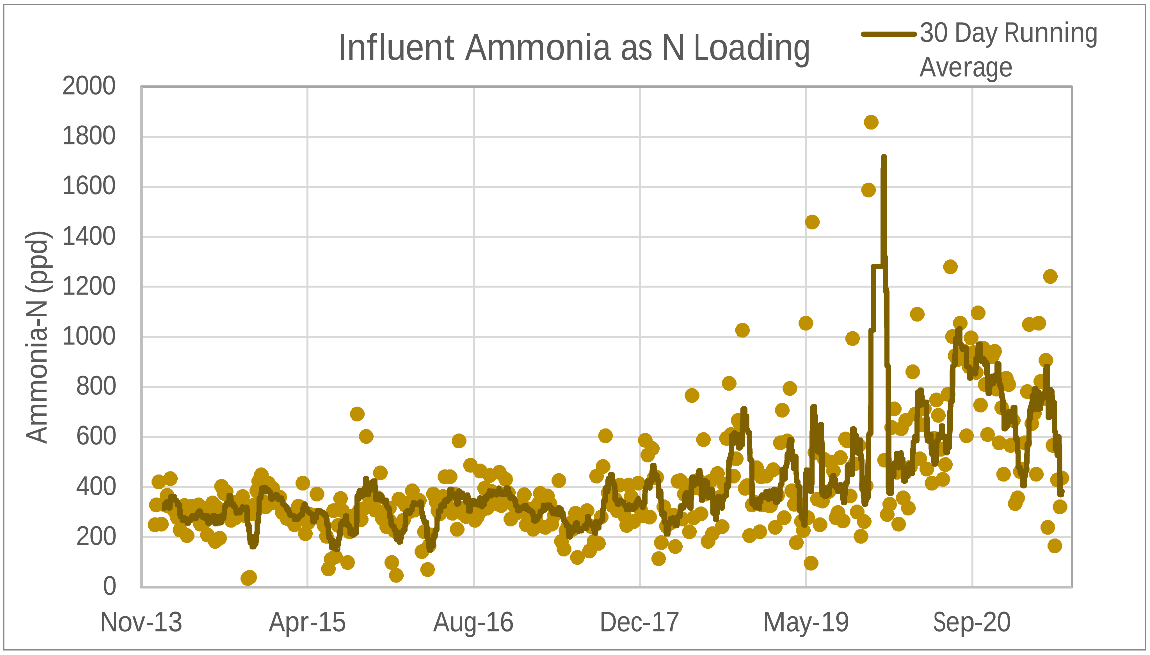

Figure 4-9 Raw Influent Ammonia Loading

4.3 EFFLUENT

Effluent concentrations for BOD, TSS, Phosphorus and Ammonia all showed an increase in concentration from late 2019 to early 2020. This was due to a change in solids handling practices that resulted in exceeding permitted limits. This incident was reported and resolved with the appropriate agencies. The final effluent BOD concentration is shown in Figure 4-10.

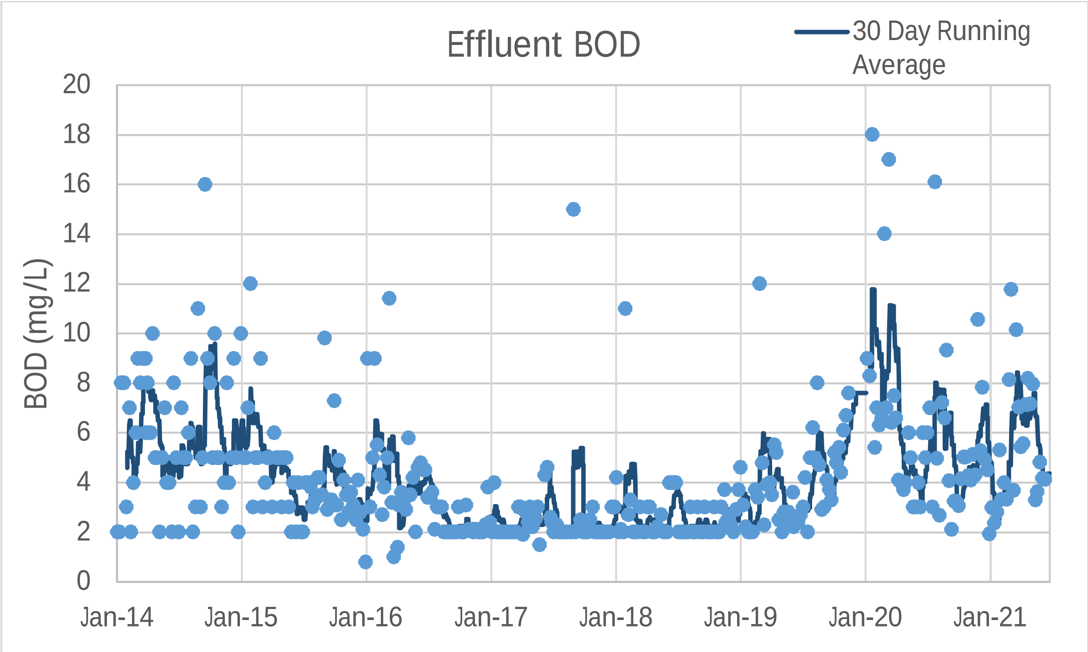

Figure 4-10 Effluent BOD Concentration

The final effluent TSS concentration is shown in Figure 4-11. There was a large increase in effluent TSS concentration in early 2020 and has decreased but is still above levels from 2013 – 2018.

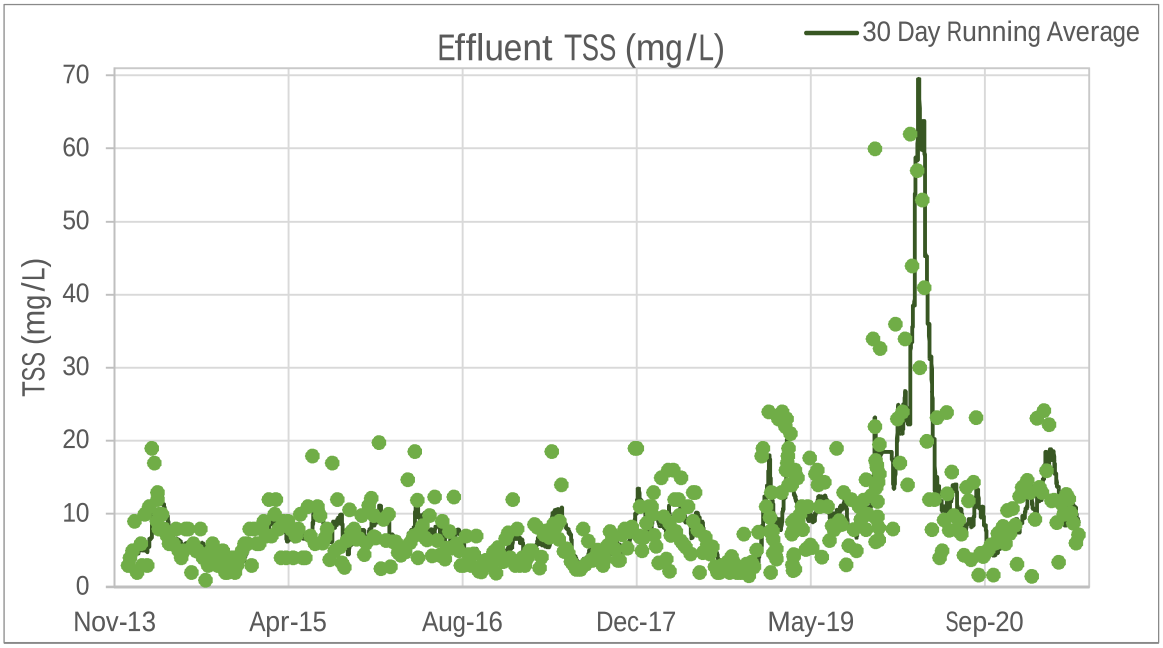

Figure 4-11 Effluent TSS Concentration

The effluent phosphorus concentrations are shown in Figure 4-12. There was an increase in effluent phosphorus concentration in the summer of 2020 and has decreased since.

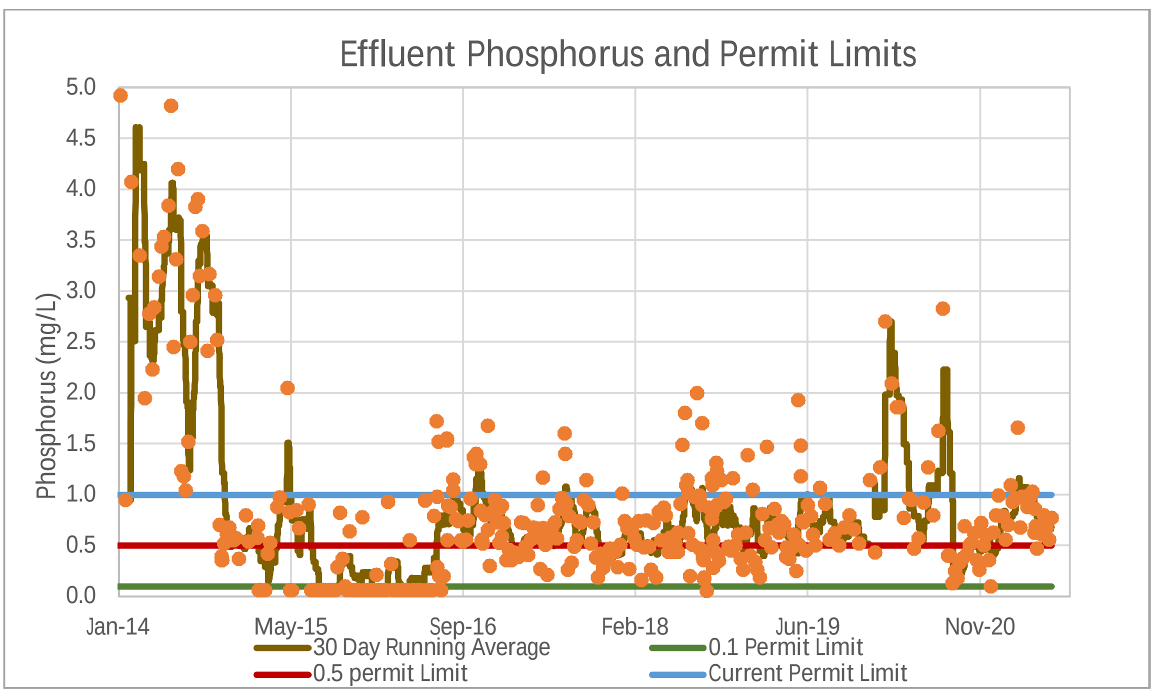

Figure 4-12 Effluent Phosphorus Concentration

The effluent ammonia concentration is shown in Figure 4-13. The data has been relatively consistent until a large increase in 2020 and has come down back since but is still above 2013-2019 levels.

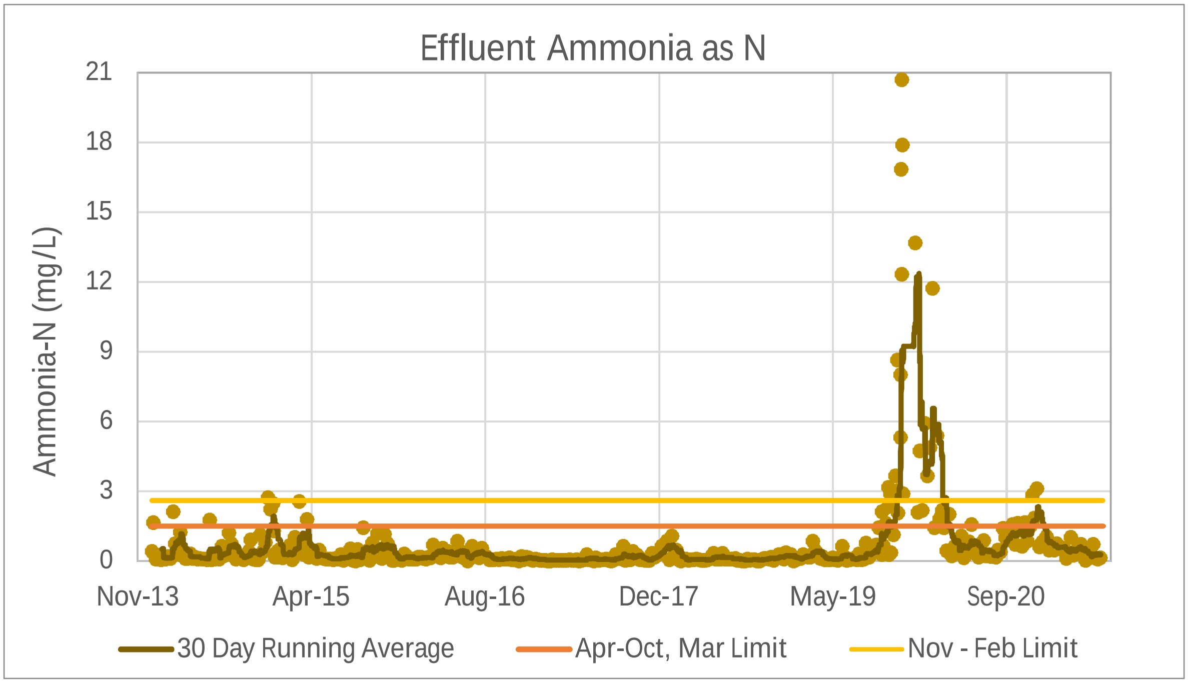

Figure 4-13 Effluent Ammonia Concentration

5. TREATMENT PROCESS OVERVIEW

The Rantoul WWTP was designed and built in the 1970's with improvements made in 1983, 2006, 2008, and 2013. In 1983 the plant underwent a major expansion adding much of the processes and infrastructure used today. In 2006 various electrical and process updates were made to the chemical feed system for disinfection. The 2008 update involved a redesign of the plant's screening method and various SCADA improvements. In 2013 the east digester was added in an effort to handle higher sludge loads. The facility was designed for a design average flow of 4.3 MGD and a design maximum of 8.65 MGD. The location of each treatment process within the plant is shown below in Figure 5-1.

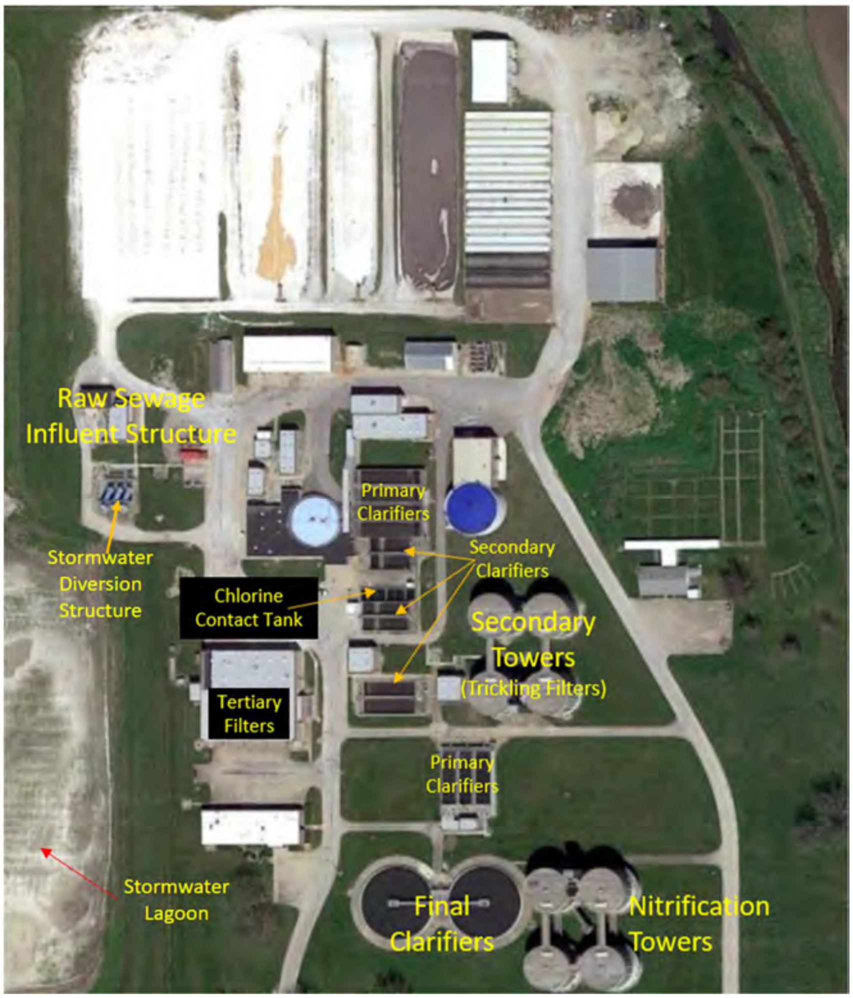

Figure 5-1 Rantoul Liquids Handling Processes Locations

Flow enters the plant through the Storm Water Diversion Structure via a 30-inch influent sewer from the influent collection box. All flow more than 8.65 MGD is diverted to the storm water lagoon. Bypass flow continues to go to the lagoon until the plant influent rates drops to the set point and no flow is being bypassed. When the plant is set to return mode the control system automatically bleeds back flow from the lagoon at a rate which when combined with the influent rate is equal to the set point.

Flow enters the plant headworks through a parshall flume and continues to a fine screening. After screening the wastewater flows by gravity into a grit tank, located in the raw sewage influent structure.

The raw sewage pumps located in the raw influent structure discharge to seven rectangular primary clarifiers. The flow is split as there are four clarifiers at the the northern end of the plant and three to the south.

After primary treatment flow is divided between four secondary treatment trickling filters. The system monitors the flow rate through the influent flume and modulates the recirculation slide gate such that the influent rate plus the recirculation flow rate, as measured by the recirculation flume, is equal to the adjusted setpoint. Flow exits the secondary towers and receives secondary clarification via six rectangular clarifiers.

Effluent from the secondary clarifiers is then pumped through the nitrification pump building to the four nitrification tricking filter towers. Flow exits the nitrification towers and receives final clarification via two 85' diameter circular clarifiers. After final clarification the effluent is filtered and disinfected with chlorine before being discharged into the Upper Salt Fork Drainage Ditch.

Primary sludge from the seven primary clarifiers under normal conditions is digested in two anaerobic digesters. The east anaerobic digester is currently not in use due to damage to the digester lid therefore sludge is only being sent to one digester. Only one of the two belt filter presses located at the plant is being used for sludge dewatering. Digested sludge is pumped to the two sludge storage lagoons. There are also 12 sludge drying beds located at the plant.

A summary of unit process capacities and sizing can be seen in Table 5-1. A general process flow diagram is shown in Figure 5-2.

Table 5-1 Summary of Unit Process Capacity and Sizing

Treatment Process		Quantity	Capacity (per unit)	Sizing
Headworks	Fine Screens	2	11 MGD	Width 3', Max SWD 5'
	Aerated Grit Tank	1	11 MGD	46'x5'x7.25' SWD
Primary Treatment	Primary Clarifiers	7		74'x18'x7' SWD (4) 77'x18'x7' SWD (3)
Secondary Treatment	Secondary Tower Trickling Filter	4		45' diameter, 21' media depth
	Secondary Clarifiers	6		54'5.5"x18'x7' SWD (2) 62'6.5"x16'x7' SWD (2) 77'x18'x7' SWD (2)
Tertiary Treatment	Nitrification Tower Trickling Filter	4		45' diameter 21' media depth
	Final Clarifiers	2		85' diameter, 7.2' SWD
	Tertiary Filters (Traveling Bridge)	2		98'x16'
Disinfection	Chlorine Contact Tank	1		61.4' x 15' x 13.08' SWD
Solids Handling	West Anaerobic Digester	1		60' diameter, 23.5' SWD
	East Anaerobic Digester	1		60' diameter, 28'2" SWD
	Belt Filter Press	2	2023 dry lb./hr.	
	Sludge Drying Beds	12		20'x100'
Stormwater	Stormwater Pumps	3	9,521 gpm	
	Stormwater Lagoon	1	43.5 MG	Max Depth 8.5'

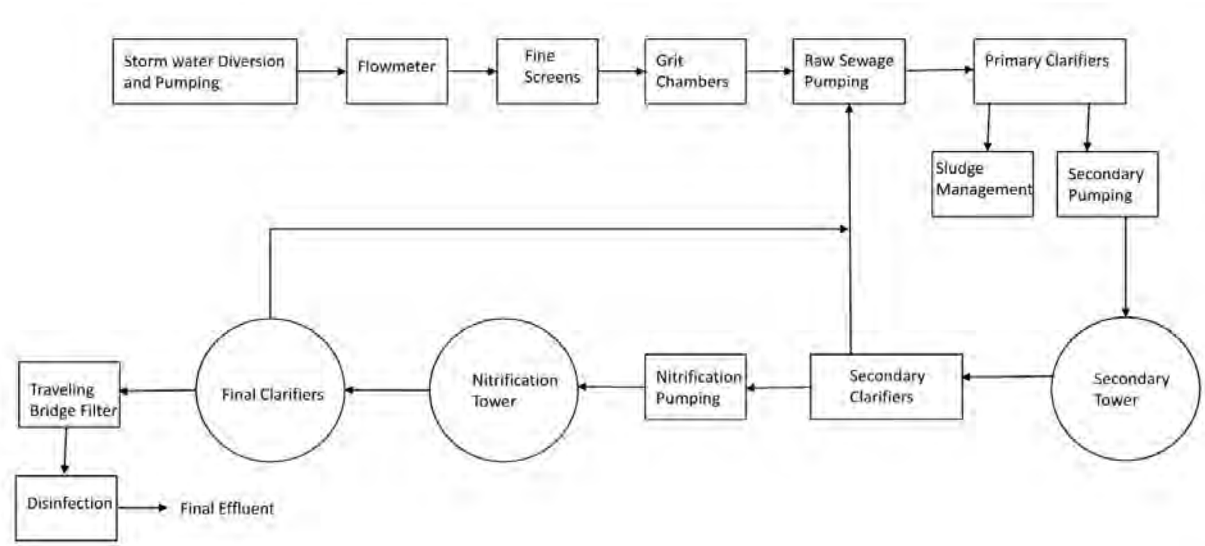

Figure 5-2 Flow Diagram of Existing Liquid Treatment Process

5.1 HEADWORKS AND STORMWATER

5.1.1 HEADWORKS

Influent screening and grit removal occur in the Raw Sewage Influent Structure. This structure needs electrical upgrades in the grit and screen collection room. The two fine filter screens used have a total capacity of 11 MGD. The screens are working well but the unit's programming could use updating.

The plant utilizes one aerated grit chamber and grit collector shown in Figure 5-3. The grit tank is 46 feet long by 5' wide with a side water depth of 7.25 feet. The detention time at the DAF, DMF, and current average flow are 6.4 minutes, 3.2 minutes, and 7.8 minutes, respectively. The grit collector is run for about a half an hour every hour and the grit collected is removed about once a week.

Figure 5-3 Grit Collector

After screening and grit removal flow is pumped to the primary clarifiers via four raw sewage pumps located in the pump room shown in Figure 5-4. This room can be classified as a Class I DIV I space.

Figure 5-4 Pump Room holding Raw Sewage Pumps

5.1.2 STORMWATER

Figure 5-5 Stormwater Diversion Structure

Figure 5-6 Stormwater Screw Pumps

Flow enters the plant through the Storm Water Diversion Structure show in Figure 5-5. All flows up to 8.65 MGD enter the Raw Sewage Influent Structure. All flows above 8.65 MGD are pumped to the stormwater lagoon via three 9,521 gpm screw pumps shown in Figure 5-6. Only two screw pumps are run at a time. The pumps have recently been painted but chipping often occurs during and after cold weather. The concrete structures under the motor and drive units of the screw pumps seem to be worn down and chipping away.

The lagoon has a capacity of 43.5 MG. Once influent flow drops under 8.65 MGD flow bleeds back from the lagoon to the influent collection box at a rate which when combined with the influent rate is equal to 8.65 MGD.

5.2 PRIMARY TREATMENT

Primary treatment consists of seven rectangular primary clarifiers shown in Figure 5-7. There are four north primary clarifiers adjacent to the control building. These four clarifiers have dimensions of 74' in length, an 18' width, and a 7' SWD each. A maximum of 5.5 MGD is sent to the north primary clarifiers. There are three additional southern primary clarifiers that have the dimensions of 77' in length, an 18' width and a 7' SWD each. These seven clarifiers make a total primary clarifier volume of 0.5 MG and a surface area of 9,486 SF.

Figure 5-7 Primary Clarifiers

The surface overflow rate for all seven primary clarifiers at DAF, DMF, and current average flow are 456 gpd/sf, 912 gpd/sf, and 374 gpd/sf, respectively. The weir overflow rate for all seven clarifiers at DAF, DMF, and current average flow are 8,375 gpd/ft, 16,731 gpd/ft, and 6,867 gpd/ft, respectively. Both the surface overflow rates and weir overflow rates are below IEPA recommendations thus the clarifiers are adequately sized for the design flows and current average flow.

The seven primary clarifiers have a side water depth (SWD) of 7 feet. To provide an adequate separation zone between the sludge blanket and overflow weirs the Ten State Standards recommends a minimum primary clarification SWD of 10 feet, IEPE Standards recommend a minimum depth of 7ft. It should be noted that shallower clarifiers can have more difficulty achieving the expected removal rates.

Primary sludge is released to the solids handling process about two to three times a day, depending on the amount of sludge storage available. Primary sludge is currently only sent to the west digester.

5.3 SECONDARY TREATMENT

Secondary treatment consists of four secondary trickling filter towers and six secondary clarifiers. Primary effluent is pumped to the secondary towers via four secondary pumps, located in the secondary pump building.

The four secondary trickling filter towers are shown in Figure 5-8. The four towers are each 45' in diameter and have a 21' media depth. Flow is recirculated in the towers through the secondary pump building. The towers were built in the mid 1980's are in need of rehabilitation. The media within the towers is falling in on itself and would require a complete media replacement. It also seems that there is little liquid disbursement within the towers and that recirculation of the tower flow is no longer effective.

Figure 5-8 Secondary Towers

There are three sets of two secondary clarifiers, shown in Figure 5-9. The most northern clarifiers are each 54'5.5" long, 18' wide with a 7' SWD. The middle two clarifiers are each 62'6.5" long, 16' wide with a 7' SWD. The most southern clarifiers are each 77' long, 18' wide, with a 7' SWD.

The surface overflow rate for all six secondary clarifiers at DAF, DMF, and current average flow are 643 gpd/sf, 1,285 gpd/sf, and 527 gpd/sf, respectively. The weir overflow rate for all seven clarifiers at DAF, DMF, and current average flow are 6,830 gpd/ft, 13,644 gpd/ft, and 5,599 gpd/ft, respectively. Both the surface overflow rates and weir overflow rates of the secondary clarifiers are below IEPA recommendations and are adequately sized for the design flows and current average flow.

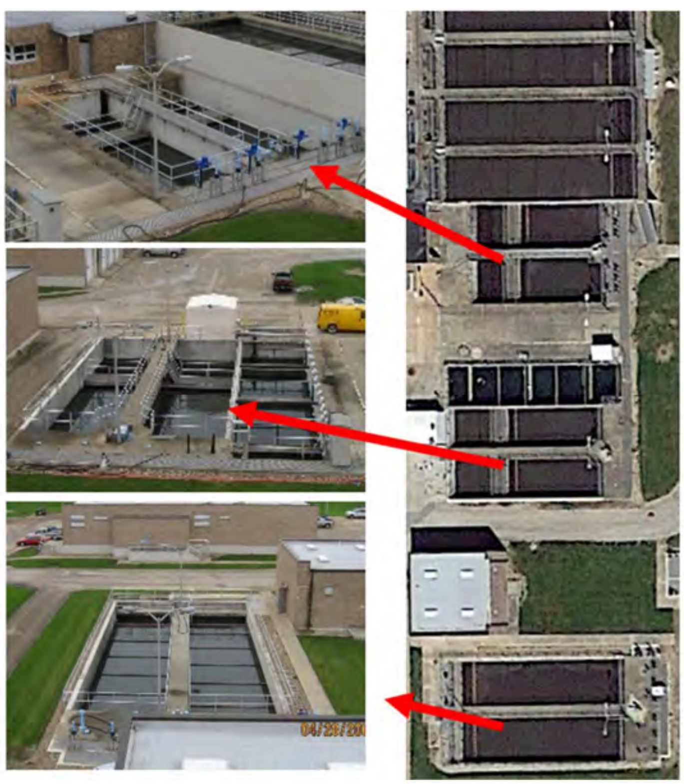

Figure 5-9 Secondary Clarifiers

5.4 TERTIARY TREATMENT

Tertiary treatment consists of four nitrification towers, two final clarifiers, and two traveling bridge filters. Effluent from the secondary clarifiers is pumped to the four nitrification towers via four nitrification pumps located in the nitrification pump building.

The four nitrification towers, shown in Figure 5-10, are 45' in diameter and have a 21' media depth. The nitrification towers seem to have the same problems with media collapsing and the lack of liquid dispersion as the secondary towers. Complete media replacement would be required.

Figure 5-10 Nitrification Towers

The nitrification towers are followed by two circular final clarifiers shown in Figure 5-11. The two clarifiers each have an 85' diameter and a 7.2' SWD. The surface overflow rate for both clarifiers at DAF, DMF, and current average flow are 382 gpd/sf, 762 gpd/sf, and 313 gpd/sf, respectively. The weir overflow rate at DAF, DMF, and current average flow are 8,608 gpd/ft, 17,197 gpd/ft, and 7,058 gpd/ft, respectively. Both the surface overflow rates and weir overflow rates of the final clarifiers are below IEPA recommendations and are adequately sized for the design flows and current average flow.

Figure 5-11 Final Clarifiers

The final clarifiers are followed by two traveling bridge sand filters. Each unit is 96' long and 16' wide. The filtration rate with one filter out of service for DAF, DMF, and current average flow are 1.92 gpm/sf, 3.83 gpm/sf and 1.57 gpm/sf, respectively. These are below IEPA recommendation of 5 gpm/sf at peak hourly flow rate thus the filters are adequately sized for the design flows and current average flow.

In January 2021 an assessment was conducted to evaluate the condition of the sand filters. It was found that the porous plate and slotted pipe underdrains are severely fouled, causing reduced hydraulic capacity, inefficient backwash, and reduced solids loading. The plant received a quote in March 2021 from Aqua-Aerobic Systems to rebuild the south filter.

5.5 DISINFECTION

Disinfection is completed with one chlorine contact tank shown in Figure 5-12. The tank is 61.4' in length, 15' wide, and a 13' SWD. The detention time for the chlorine tank at DAF, DMF, and current average flow is 30 minutes, 15 minutes, and 36.6 minutes, respectively. Flow is treated with about 40-50 gal/day of hypochlorite, 4-7 gal/day of bisulfite is also used. The chlorine contact tank seems to be performing well but could use cleaning.

Figure 5-12 Chlorine Contact Tank

5.6 SOLIDS HANDLING

Figure 5-13 Locations of Solids Handling Units

The stabilization of sludge solids produced by the treatment plant is completed through anaerobic digestion. Primary Sludge is sent directly to the anaerobic digesters. After digestion sludge is sent to the belt filter press, the sludge lagoons or the sludge drying beds. The location of each unit of the solids handling process is shown in Figure 5-13.

There are two anaerobic digesters, each sized at 60' diameter and a SWD of 23.5' shown in Figure 5-14. The east digester was added in 2013 but is currently not in use because the lid is damaged. The lid has since been removed from the east digester and the west digester is the only digester in use.

Figure 5-14 West Anaerobic Digester (left) and East Anaerobic Digester (right)

The plant has two belt filter presses located in the Sludge Dewatering Building. Only one belt filter press is currently in use. The two units have not been used by the plant recently and the unit not in use is being used for spare parts to continuously repair the other unit. There are also 12 sludge drying beds on site. Each bed is 100' long and 20' wide.

5.7 NORTHWEST PUMP STATION

The Northwest Pump and Lift Stations are located at the old west wastewater treatment plant on Township Highway 151 on the northwest side of Rantoul. The site holds a pump building, lift station, an abandoned treatment basin, and a storage lagoon. The Northwest Pump Station transfers flow from the west side of the Village to the main WWTP via 14-inch and 30-inch force mains. Many of the components of the Northwest Lift and Pump Stations were installed in 1983 and need replacement or upgrades. The station's needs include:

- Replacement of the three main pumps (30 HP each) and valves with a larger size
- Replacement of the diesel generator
- New ATS switch
- New Electrical Room
- A Portacon bypass system to the lagoon

A section view of the Northwest Pump Station showing the three pumps used is presented in Figure 5-15. An aerial view of the west wastewater treatment is shown in Figure 5-16.

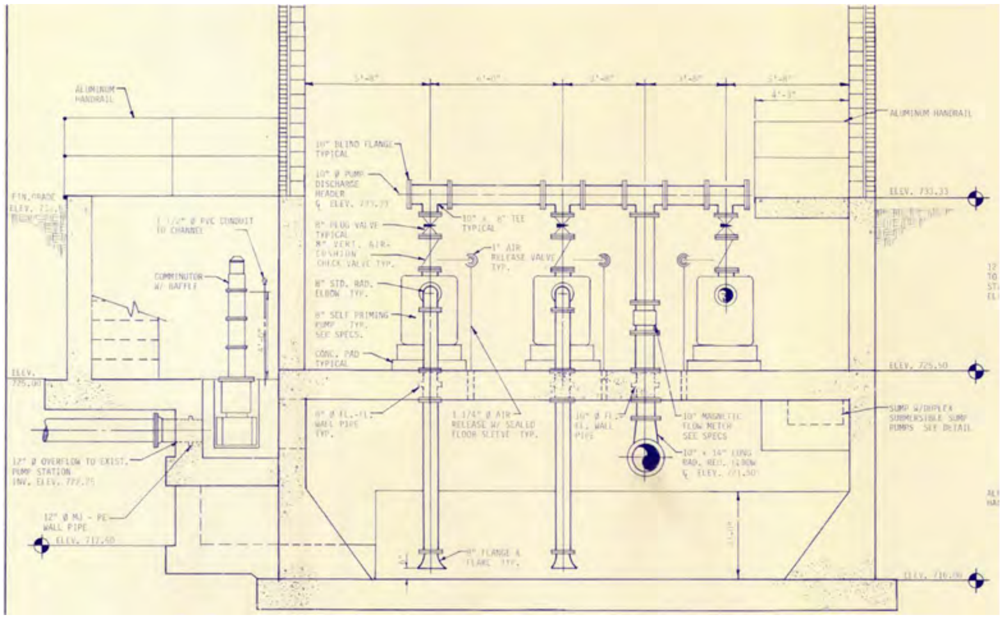

Figure 5-15 Section view of the Northwest Pump Station

Figure 5-16 Aerial View of West WWTP

6. TREATMENT PLANT UPGRADES

6.1 ALTERNATIVES

Improvements to the Rantoul WWTP are necessary to achieve compliance with current and future design standards and to update processes at the end of their design life. The current processes are adequately sized for current and future loadings, however many of the existing process equipment and infrastructure are at the end of their useful life. Specifically, the trickling filter towers and the solids handling process are in need of rehabilitation or a complete process replacement. The eight trickling filter towers at the plant were installed about 30 years ago and are no longer working efficiently. Problems within solids handling process have stalled the plant's sludge production and are not allowing the plant to waste as much solids as needed. Alternatives have been developed for liquid treatment, tertiary filtration, and solids treatment.

6.2 ALTERNATIVES EVALUATION

6.2.1 LIQUID TREATMENT ALTERNATIVES

A baseline alternative was created to keep all existing liquid treatment processes at the plant but includes upgrades that are necessary to rehabilitate equipment at the end of their life. This alternative includes restoring all eight trickling filter towers by replacing the media and distributor arms as well as accounting for possible structural improvements. Under this scenario the seven primary clarifier and six secondary clarifier mechanisms are replaced.

The first alternative evaluated was a complete process change to activated sludge. This conversion would include constructing multiple aeration basins and a building to hold the blowers. New basins would need to be constructed because the existing clarifier basins are too shallow to be converted to aeration basins. Under this scenario the secondary clarifiers and trickling filter towers would no longer be used.

An alternative to utilize an oxidation ditch was evaluated. An oxidation ditch and selector would be constructed under this alternative. The trickling filter towers would no longer be used. An oxidation ditch can be used with or without primary treatment and is reflected in the oxidation ditch basin size requirements and costs.

An alternative was evaluated to use membrane bioreactor (MBR) technology. To use this technology aeration basins, a blower building, and membrane holding basins would be constructed. Under this scenario the secondary clarifiers and trickling filter towers would no longer be used.

An alternative to utilize AquaNereda aerobic granular sludge technology was evaluated. This alternative would require the construction of sludge reactor tanks, buffer tanks, a level correction tank, and a blower building. Under this alternative the secondary clarifiers and trickling filter towers would no longer be used.

Advantages and disadvantages for each liquid treatment alternative are presented in Table 6-1. The capital costs, annual costs, and 20-year present worth costs of each of these alternatives are presented in

Table 6-2. Graphical representations of the capital costs and present worth costs are shown in Figure 6-1 and Figure 6-2 respectively.

Table 6-1 Advantages and Disadvantages of Liquid Treatment Alternatives

Alternative	Advantages	Disadvantages
Baseline	• Known Operation • Less aeration costs	• Towers could be costly to maintain
Activated Sludge	• Eliminates towers • Known process • Low maintenance	• Add return sludge pumps • Complete process change • New tanks required
Oxidation Ditch	• Eliminates towers • Low maintenance • Typically lower sludge production • Possible to eliminate primary treatment	• New tanks required • Larger tank volume than traditional activated sludge
MBR	• Eliminates filtration • Reduce UV requirements • Possibly eliminate primary treatment • Reduce power for transfer pumps	• Requires 2 mm screening • Few installations • High O&M costs • Current Tanks undersized (shallow)
AquaNereda	• Eliminates towers • Possibly eliminates filtration • Reduces treatment volume • Biological phosphorus and nitrogen removal • No RAS pumping	• Significant new construction required • No current installations in Illinois • Higher pumping costs

Table 6-2 Liquid Treatment Alternative Costs

Liquid Treatment Alternative	Capital Cost	Annual Cost	Total Present Worth
Baseline	$10,616,000	$313,756	$18,031,000
Activated Sludge	$15,210,000	$108,898	$17,280,000
Oxidation Ditch with Primary Treatment	$16,014,000	$148,670	$18,841,000
Oxidation Ditch without Primary Treatment	$20,129,000	$208,000	$24,086,000
MBR	$22,011,000	$131,000	$25,321,000
AquaNereda	$21,463,000	$35,000	$22,119,000

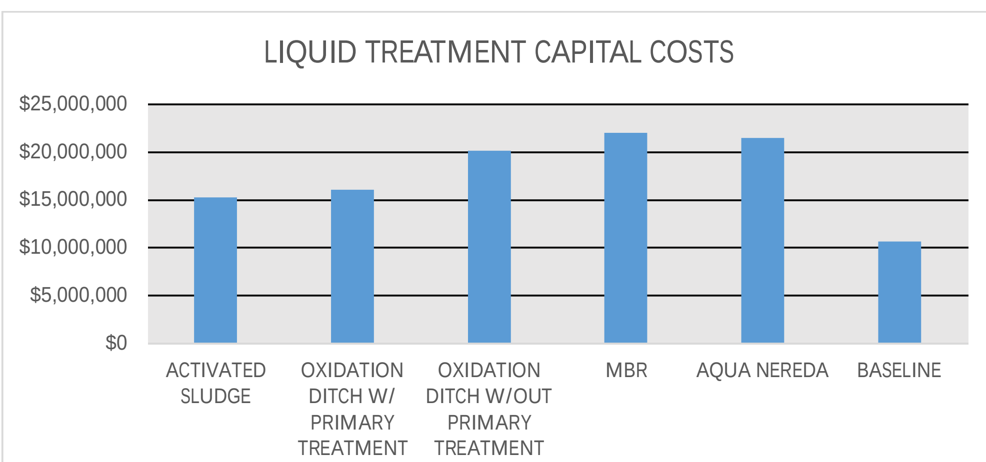

Figure 6-1 Liquid Treatment Alternatives Capital Costs

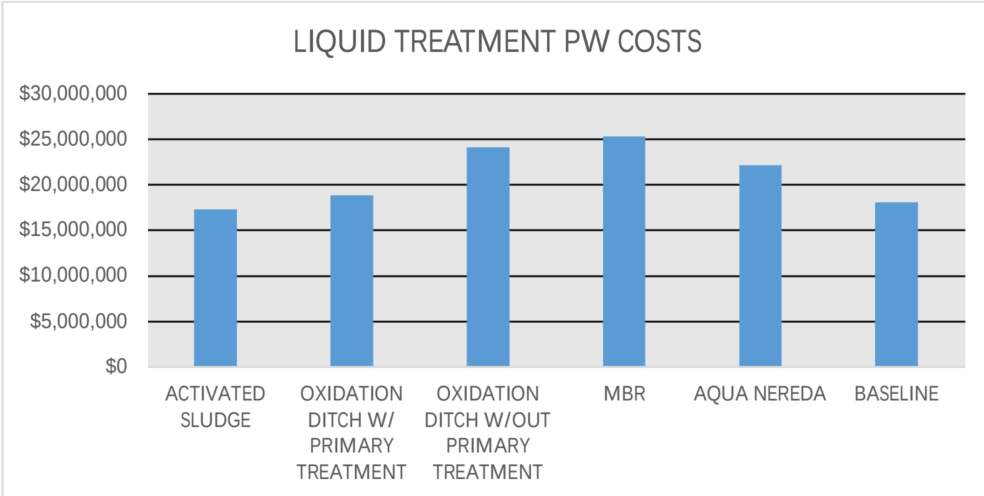

Figure 6-2 Liquid Treatment Alternatives Present Worth Costs

The MBR, AquaNereda, and oxidation ditch without primary treatment have the highest capital costs and present worth costs of the alternatives presented. These are followed by an oxidation ditch with primary treatment. The baseline alternative has the lowest capital cost followed by the activated sludge alternative. However, the 20-year present worth cost of the baseline alternative is higher than that of the activated sludge. The full detailed cost opinion of the liquid treatment alternatives is attached in Appendix C.

6.2.2 TERTIARY FILTRATION ALTERNATIVES

The option of rehabilitating the two existing traveling bridge filters was evaluated. The north filter is currently being rebuilt but cost estimates below include the price of both filters. Other alternatives evaluated include removing and replacing the traveling bridge filters with disc filters or replacing the bridge filters with diamond filters. The advantages and disadvantages for each filtration alternative is presented in Table 6-3. Table 6-4 presents the capital costs, annual costs, and 20-year present worth costs of each filtration alternative.

Table 6-3 Advantages and Disadvantages of Tertiary Filtration Alternatives

Alternative	Advantages	Disadvantages
Rehab Existing Traveling Bridge Filters	• Work in existing tanks • No new piping or channels	• Costly upgrades • Same backwash requirements • Difficult to achieve low effluent phosphorus
Disc Filters	• Smaller footprint • Less backwash water • Can be self-contained • Automated • May be able to reduce transfer pumping	• Disk Replacement O&M • Energy use for disk rotation • Require new tanks • Possible hydraulic limitations
Diamond Filters	• Traveling Bridge Tanks can be used	• Costly Equipment

Table 6-4 Tertiary Filtration Alternative Costs

Tertiary Filtration Alternative	Capital Cost	Annual Cost	Total Present Worth
Rehab Traveling Bridge Filters	$820,000	$3,000	$1,888,000
Disc Filters	$3,078,000	$3,000	$3,439,000
Diamond Filters	$4,351,000	$8,500	$5,093,000

The diamond filters have the highest capital, annual cost, and the highest present worth cost due to the high cost of this filter equipment. Replacing filtration with disc filters has the second highest capital and present worth costs behind the diamond filters. Rehabilitating the traveling bridge filters has the lowest capital and present worth cost thus it is the most cost effective for tertiary filtration. The full detailed cost opinion of the filtration alternatives is attached in Appendix C.

6.2.3 SOLIDS TREATMENT ALTERNATIVES

As mentioned previously the east digester is currently being used only for sludge storage because the digester lid is broken. An option was developed to rehabilitate this digester for continued use as an aerobic digester. This includes the price and installation of a new lid. Another alternative developed was to convert the east digester into aerobic digestion. This alternative includes the installation of an aeration system for the digester. The last alternative was converting both digesters to aerobic digestion. The advantages and disadvantages for each digestion alternative is presented in Table 6-5. Table 6-6 presents the capital costs, annual costs, and 20-year present worth costs of each digestion alternative.

Table 6-5 Advantages and Disadvantages of Digestion Alternatives

<table>
<tr><th>Alternative</th><th>Advantages</th><th>Disadvantages</th></tr>
<tr><td>Keep Anaerobic Digestion</td><td>• No change in process
• Low energy process</td><td>• High Costs to rehabilitate East Digester</td></tr>
<tr><td>Convert East Digester to Aerobic Digestion</td><td rowspan="2">• Increased solids destruction
• Eliminates digester gas
• Decrease solids handling costs
• Better nitrogen removal</td><td rowspan="2">• Complete update of current digestion system
• Aerating O&M</td></tr>
<tr><td>Convert Both Digesters to Aerobic Digestion</td></tr>
<tr><td>East Digester to Sludge Storage</td><td>• Significantly lower costs
• Keeps this newer digester useful</td><td>• Could increase solids handling costs</td></tr>
</table>

Table 6-6 Digestion Alternatives Cost

Digester Alternatives	Capital Cost	Annual Cost	Total Present Worth
Anaerobic Digestion	$1,315,000	$51,000	$2,284,000
East Digester to Aerobic Digestion	$2,157,000	$61,000	$3,317,000
Both Digesters to Aerobic Digestion	$4,051,000	$112,000	$6,177,000
Keep East Digester as Sludge Storage	$55,000	$18,000	$320,000

Converting both digesters to aerobic digestion has the highest capital cost, annual cost, and the highest present worth cost. Converting the east digester to aerobic digestion has the second highest capital and present worth costs behind converting both digesters to aerobic digestion. Rehabilitating the east digester for continued use as an aerobic digester has the second lowest capital cost, annual cost, and present worth cost. Keeping the east digester functioning as sludge storage has a significantly lower capital cost than the other alternatives. The only cost accounted for in this scenario is removing the lid from the plant. The full detailed cost opinion of the digester alternatives is attached in Appendix C.

As mentioned, the current dewatering process is conducted by one belt filter press. The other belt filter press is damaged and being used for spare parts. An alternative to replace both belt filter presses was evaluated. Disposal fees were included in this evaluation assuming $40/ton at 18% dryness. The belt filter presses require a polymer system and a 20 lbs/dry tons polymer consumption was assumed.

An alternative to replace both belt filter presses with two screw presses was evaluated. Disposal fees were included in this evaluation at $40/ton at 23% dryness. The screw presses require a corresponding polymer system at which a 20 lbs/dry tons polymer consumption was assumed. The current dewatering building ceiling is too low to fit the two screw presses so the cost of constructing a new dewatering building on the northwest side of the plant is included in this alternative.

An alternative to replace both belt filter presses with two centrifuges was evaluated. Disposal fees were included in this evaluation at $40/ton at 25% dryness. The belt filter presses require a polymer system. A 25 lbs/dry tons polymer consumption was assumed. The current dewatering building ceiling is too low to fit the two centrifuges so the cost of constructing a new dewatering building on the northwest side of the plant is included in this alternative.

An alternative to perform dewatering via a belt dryer was evaluated. A belt dryer system performs after the dewatering process, thus this alternative included the equipment and installation for two centrifuges. Disposal fees were included in this evaluation at $40/ton at 90% dryness. This alternative requires a polymer system. A 25 lbs/dry tons polymer consumption was assumed. The current dewatering building ceiling is too low to fit the two centrifuges so the cost of constructing a new dewatering building on the northwest side of the plant is included in this alternative.

Utilizing high temperature pyrolysis was an alternative evaluated to target PFAS removal. By removing PFAS this process allows for the sludge to be land applied so no disposal fees are included in this alternative. The process of pyrolysis needs a relatively high dry input so two centrifuges and one dryer is included in this alternative. This alternative requires a polymer system. A 25 lbs/dry tons polymer consumption was assumed. The current dewatering building ceiling is too low to fit the two centrifuges so the cost of constructing a new dewatering building on the northwest side of the plant is included in this alternative.

The advantages and disadvantages for each dewatering alternative is presented in Table 6-7. The capital costs, annual costs, and 20-year present worth costs of each dewatering alternative is presented in Table 6-8. The full detailed cost opinion of the solids treatment alternatives is attached in Appendix C.

Table 6-7 Advantages and Disadvantages of Dewatering Alternatives

Alternative	Advantages	Disadvantages
Belt Filter Press	• Familiar process	• No automation • Significant Operator Attention
Screw Press	• Reduce sludge handling costs • Dry cake vs liquid sludge • Automated system	• Higher polymer use
Centrifuge	• Increased solids destruction • Decrease solids handling costs • Better nitrogen removal	• High energy use • Difficult Maintenance
Belt Dryer	• Reduce sludge handling costs • May be able to achieve Class A sludge • Automated/self-contained	• Limited space for dryer addition • Adds complexity • Safety over dust and fire
Pyrolysis	• May be able to reduce PFAS • Able to significantly reduce hauling/landfilling costs	• Expensive • Newer process • Limited space

Table 6-8 Dewatering Alternatives Costs

Dewatering Alternatives	Capital Cost	Average Annual Cost	Total Present Worth
Belt Filter Press	$2,965,000	$226,000	$6,544,000
Screw Press	$6,241,000	$76,000	$7,476,000
Centrifuge	$5,204,000	$93,000	$6,764,000
Dryer	$17,169,000	$145,000	$19,877,000
Pyrolysis	$23,642,000	$228,000	$27,467,000

The options of pyrolysis and belt dryer have the highest capital and present worth costs. This is due to the equipment having high capital costs and needing a dewatering process beforehand. Utilizing a belt filter press has the lowest capital and present worth costs followed by the centrifuge and screw press.

6.3 RECOMMENDED UPGRADES

6.3.1 LIQUID TREATMENT

The Village has elected to pursue the activated sludge alternative. This decision was based on the activated sludge's relatively low capital costs, low present worth costs, relative ease of operation, and that the trickling filter towers would no longer need to be operated and maintained.

The conventional activated sludge system will enact a complete process change at the plant. Using an activated sludge system will no longer require the use of the six secondary clarifiers and eight trickling filter towers. To convert the plant to activated sludge six 87.5 feet long, 20 feet wide and 17 feet deep aeration basins will be built. Two 87.5 foot long, 20 foot wide selector basins will also be constructed to create an anoxic zone targeting denitrification prior to the aerated tanks. The proposed location for these basins is the approximately 215 feet by 125 feet open field east of the southern primary clarifiers. The primary effluent piping that converges at the secondary pump building will have to be reconfigured to enter the new aeration basins.

To support the aerated tanks 3 blowers will be installed at the plant. As shown in Section 6.4 the air required for the aeration basin based on BOD and Ammonia-N Loading is 4,052 scfm for design average flows and loading and 8,094 for design maximum flows and loading. The 3 blowers will be turbo blowers with a capacity of just over 4,000 scfm each to supply the design maximum air requirements with one blower out of service. The evaluation has accounted for construction of a new building to house these blowers east of the existing nitrification towers. The new RAS and WAS pumps from final clarification will also be located in this building. Three RAS pumps will be sized to send 100% of the DAF, 4.33 MGD, with one pump out of service. Two WAS pumps will be installed and will each be sized to send approximately 90 gpm of wasted sludge from the final clarifiers to the digester.

The existing final clarifiers have a side water depth (SWD) of 7.2 feet. Ten State Standards recommends a minimum final clarification SWD of 12 feet after activated sludge. Two new 80-foot diameter circular clarifiers with a 12 foot SWD will be constructed on the east side of the plant. Aeration effluent piping will be installed to transfer flow to two new clarifiers. Return sludge piping and waste sludge piping will be constructed from the final clarifiers. The cost estimate for the final clarifiers is $3,665,000 as shown in Appendix C.

Figure 6-3 presents the general process flow diagram under the activated sludge process, the additions to the plant are shown in red. The changes are shown in red and are subject to change pending further design.

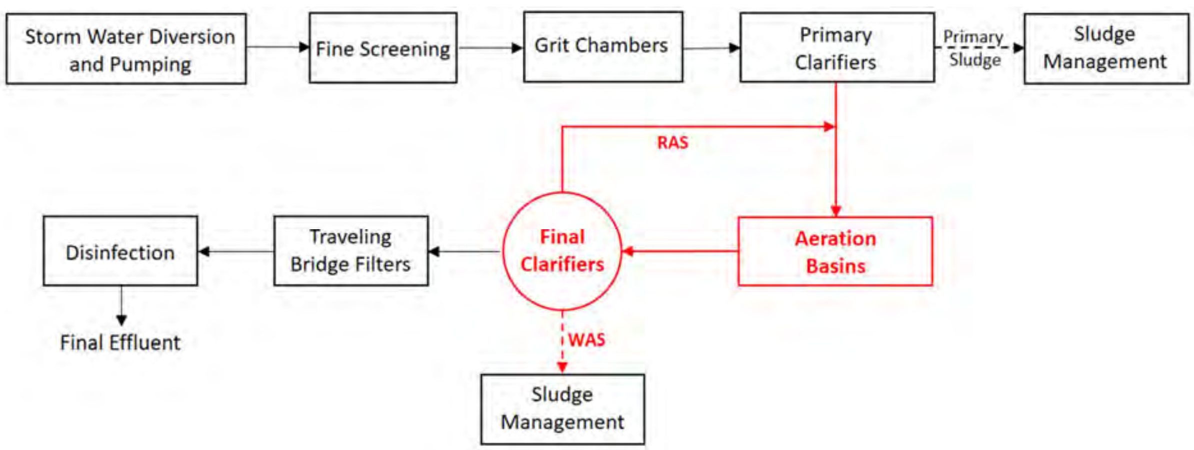

Figure 6-3 Activated Sludge Process Flow

6.3.2 TERTIARY FILTRATION

The Village has elected to pursue retrofitting the south traveling bridge filter with a diamond filter. The north filter will stay as a traveling bridge sand filter as it is already being rebuilt. In March of 2021 Aqua Aerobics provided the village with a proposal to rebuild the south filter but the Village has decided to rebuild the north filter first. The diamond filter is the more expensive option but only building one brings the cost down to $2,231,000 which is less expensive than converting to disc filtration by about $500,000. The diamond filter will also be able to handle a capacity up to 12 MGD making the system fit for expansion and reliable. The diamond filter will be designed to fit into the existing south traveling bridge filter. This technology combines the concept of cloth media filters with a traveling bridge configuration. The total filter surface area is 2,560 sq. ft. giving an average hydraulic loading of 1.17 gpm/sf at the DAF. Figure 6-4 shows the cloth “diamond” laterals of the Aqua-Aerobics system.

Figure 6-4 Diamond Filter Cloth Laterals

6.3.3 SOLIDS TREATMENT

The Village has elected to keep the west digester as anaerobic digestion. This decision was based on the low capital and present worth costs of keeping the current system. The east digester lid was damaged and has since been removed from the basin. Meanwhile the plant has been using this tank as a sludge storage space. The Village has noted that it is not crucial to have the east digester immediately functional again if the dewatering and hydraulic issues in the solids train are given priority, therefore it is recommended to keep the east digester in its current condition and act as a sludge storage tank. This solution will allow the east digester to be useful to the treatment process without adding the high costs needed to restore it. Keeping the east digester acting like a storage tank will not impact sludge disposal methods as the sludge currently being land applied. The mixers and heat exchanger will be utilized as needed to keep the sludge from freezing in the winter.

The Village has elected to replace the two belt filter presses with two screw presses. This decision was based on the relatively low capital costs and ease of automation of the screw press. The screw presses will be sized for 1,500 lb/hr of sludge for each unit. This is based on current sludge data out of the primary clarifiers and future sludge wasted from new final clarifiers. One unit will be capable of dewatering all of the plant's wasted sludge on an average day.

The existing dewatering building does not have enough height for installation of a screw press system. A new dewatering building will be constructed northwest of the existing building south of the sludge storage shed as shown in section 6.4. The new building will consist of a sludge dewatering room and new polymer room with a new polymer feed system. The screw press cake solids be conveyed to the covered sludge storage pad.

After the new dewatering system is installed the old dewatering building will be used for WAS thickening by two disc thickeners sized for a 185 lb/hr solids loading rate each. Each disc thickener will be capable of handling the design maximum sludge waste from the final clarifiers. The existing polymer system equipment will be replaced in kind to supply the disc thickeners.

6.4 BASIS OF DESIGN

Figure 6-5 provides a generic layout of the proposed modifications to the plant, including common upgrades discussed in Section 7.

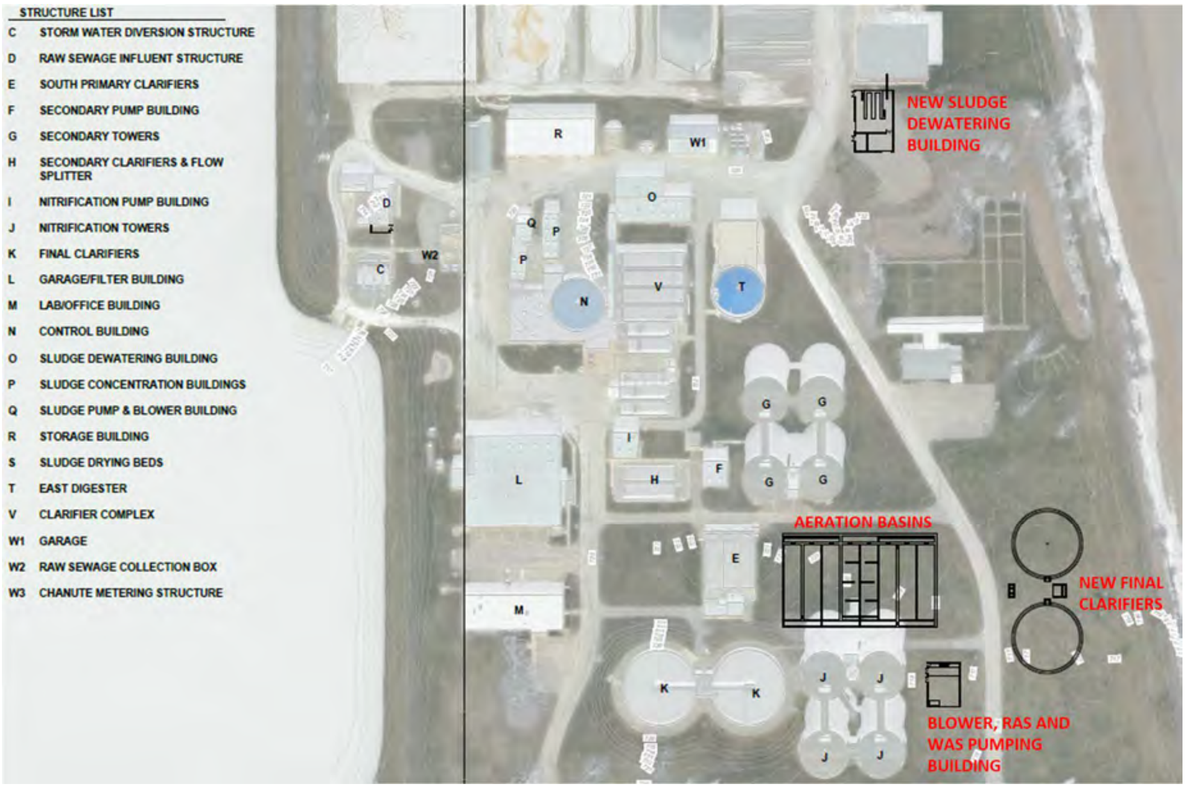

Figure 6-5 Proposed Site Plan for All Projects

The full basis of design calculations for the recommended treatment plant upgrades are provided in Appendix D in the back of the report. The major design parameters for the aeration basins and final clarifiers are shown in Table 6-9 and Table 6-10 respectively.

Table 6-9 Aeration Basin Design Parameters

Parameter	Units	DAF 4.33 MGD	DMF 8.65 MGD	Illinois Part 370.920 Limits
HRT	Hours	9.87	4.94	--
Organic Loading Rate	lb/d/kcf	19.9	39.1	50 @ DAF
Air Required	scfm	5,539	8,088	--

Table 6-10 Final Clarification Design Parameters

Parameter	Units	DAF 4.33 MGD	DMF 8.65 MGD	Illinois Part 370.920 Limits
Solids Loading Rate	lb/d/sf	12.9	25.8	50 @ Peak Hourly
Surface Overflow Rate	gpd/sf	431	860	1,000 @ Peak Hourly
Weir Overflow Rate	gpd/ft	9,068	18,114	30,000 @Peak Hourly

7. COMMON UPGRADES

In addition to the scenarios presented, the Village has also recognized necessary minor improvements for various process equipment at the plant. These improvements will be referred to as common upgrades that are mostly replacements. Annual costs for these upgrades are assumed to be similar to the existing O&M costs for the replaced equipment and processes and therefore have not been detailed in this report. Common upgrades identified are as follows:

Screw Pump Replacement

- Screw Pump Replacement
- No change in pump capacity

Primary Clarifier Repairs

- Structural repairs to the south wall of the north primary clarifiers

Chemical Feed System Improvements

- Replace bisulfite tank in kind
- Installation of a second bisulfite pump. The new pump will be the same capacity as the existing pump and act as a standby pump.
- Installation of a third liquid sodium hypochlorite pump. The pump will have the same capacity as the two existing pumps and act as a swing that can pump to the chlorine contact tank or the filter building when another pump is down for maintenance.

Solids Piping Installation

- Installation of approximately 50 feet of piping and new valves to allow digested sludge to travel to dewatering or the sludge drying beds

Northwest Pump Station Upgrades

- New Generator
- New Automatic Transfer Switch
- New Pump Controls
- Replace 3 dual speed suction lift pumps with three larger pumps sized for 1,300 gpm each
- Installation of variable frequency drives for all three pumps

Evans Road and Rantoul Foods Pump Station Upgrades

- Replacement of the approximate 5,400 ft 10-inch Rantoul Foods Pump Station force main with a 14-inch force main
- Replacement of the approximate 5,400 ft 10-inch Rantoul Foods/Evans Road joint force main with 14-inch joint force main
- Approximately a 4,300 ft. extension of the joint force main (14-inch) from Murray Road to the 21-inch Indian Hills sanitary sewer
- Replacement of the two pumps at the Evans Road Pump Station with two pumps of the same capacity of 500 gpm but adjusted total dynamic head for the new force main size.
- Replacement of the three pumps at the Rantoul Foods Pump Station with three pumps of the same capacity of 950 gpm but adjusted total dynamic head for the new force main size.

The recommended Rantoul Foods and Evans Road force main and pump improvements are based on a 2018 study evaluating pump station capacity for anticipated increased flows from the Rantoul Foods pork processing plant on the west side of the village. The factory is expected to increase flows from 300,000 gallons per day (gpd) to 600,000 gpd. This report is attached in Appendix E. Figure 7-1 shows the location of the recommended improvements.

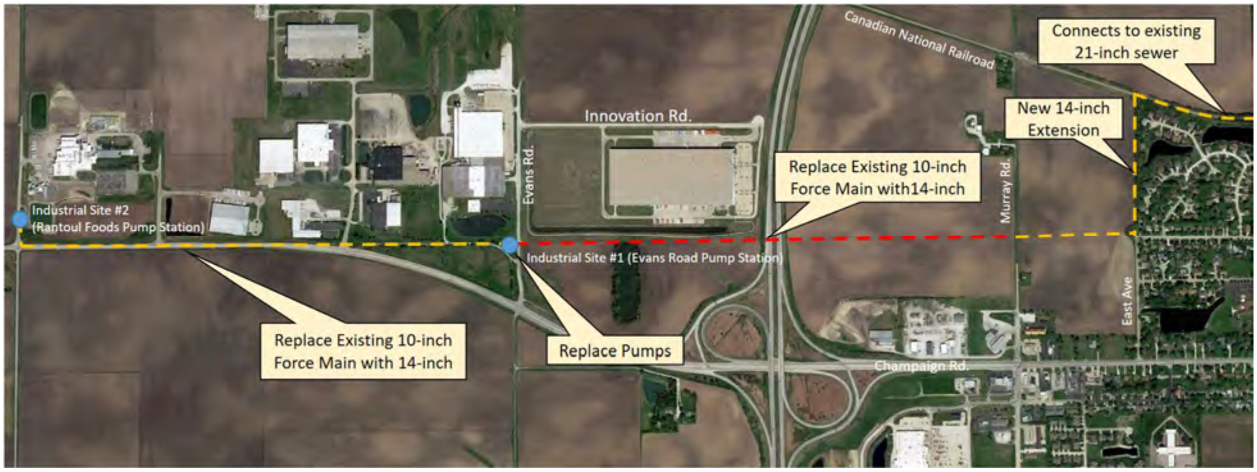

Figure 7-1 New Force Main Recommended Route

The original cost estimate for the force main upgrades in the 2018 evaluation was $3,000,000. An additional $550,000 was added to this cost to account for replacing the existing 10-inch force main.

The capital costs of each common upgrade mentioned is presented in Table 7-1. The full detailed cost opinion of the common upgrades is attached in Appendix C.

Table 7-1 Common Upgrades Costs

Common Upgrades	Capital Cost
Northwest Pump Station Upgrades	$1,048,000
Rantoul Foods and Evans Road Pump Station Improvements	$3,550,000
Screw Pump Replacement	$183,000
North Primary Clarifiers	$212,000
Chemical Feed System	$74,000
Solids Piping	$123,000
Total	$5,601,000

8. RECOMMENDED IMPROVEMENTS

8.1 ANTI-DEGRADATION ASSESSMENT

This section of the Project Plan addresses the anti-degradation aspects and requirements of the project, which are regulated by 35 Ill. Adm. Code 302.105 under Title 35 Part 302 – Water Quality Standards. This section of the code was added to Title 35 in December 2002 in order to " ... protect the existing uses of all waters of the State of Illinois and to maintain the quality of waters with quality that is better than water quality standards, and to prevent unnecessary deterioration of waters of the State."

It should be noted that the project, as proposed, does not propose any increases flows or pollutant loadings into the receiving stream. Effluent BOD, TSS, and phosphorus loadings are not expected to change and effluent nitrogen levels are expected to decrease as much as 50% by switching the treatment process to biological nutrient removal via activated sludge. For these reasons, the Anti-Degradation requirements of 35 Ill. Adm. Code 302.105 do not apply to this project.

8.2 RECOMMENDED IMPROVEMENTS BY PHASE

The plant has equipment that is approaching the end of its reliable service life that needs upgrading. Considering current nitrification requirements and treatment recommendation, as well as future nutrient removal requirements, the solids handling processes are improperly designed for current volumetric loading rates and industrial contributions. A new force main is also needed to handle increasing industrial flows. The recommended improvements will address these concerns and update existing aging equipment. The implementation of these improvements is divided into three phases. The upgrades will be funded separately by phase. Table 8-1 lists the planned improvements by phase.

Table 8-1 Improvements Divided by Phase

Phase	Description	Capital Cost	Year
1	Northwest Pump Station Improvements	$1,140,000	2023
	Rantoul Foods Pump Station, Evans Road Pump Station Improvements	$3,550,000	2023
	Chemical System Improvements	$74,000	2023
	Sludge Dewatering Upgrade	$6,241,000	2023
	Solids Piping Improvements	$123,000	2023
	Subtotal	$11,128,000	
2	Replace South Traveling Bridge Filter with Diamond Filter	$4,351,000	2024
	North Primary Clarifier Structural Repair	$212,000	2024
	Screw Pump Replacement	$183,000	2024
	Subtotal	$4,746,000	
3	New BNR Activated Sludge Tanks and Blower, RAS and WAS Pumping Building	$15,210,000	2025
	New Final Clarifiers	$3,665,000	2025
	WAS Thickening	$2,067,000	2025
	Subtotal	$20,942,000	
	Total	$36,815,000	

8.3 PROJECT FINANCING

The project cost for the phase 1 upgrades is $11,128,000. This cost includes construction costs, design engineering, construction engineering, contractor overhead and profit and 10% construction contingency. The Village has the option to finance the project with an IEPA low interest loan, with the 2022-23 “small community” interest rate of 0.93%. Table 8-2 provides the simple-interest loan financing calculations for the project and assumes that the Village will be able to fund the project for 20 years. Financing calculations considering IEPA Loan forgiveness is shown in Appendix F.

The Village of Rantoul would intend to repay the loan using monies derived from its sanitary sewer fees charged to existing customers served by the Village. Currently, the Village has 4,663 total sewer customers within its service area. The computed principal and interest for the loan, as computed in Table 8-2 totals $612,300 per year. That cost, when spread out uniformly amongst those customers, results in an average debt retirement cost per customer of about $131.31 per year or $10.94 per month.

Table 8-2 Project Financing Details

Village of Rantoul, Illinois
Rantoul Wastewater Improvements
Revised: November 11, 2022
PHASE 1 FINANCING

A. Summary Total Initial Project Costs		
Total Project Cost =	$11,128,000	
B. Funding Sources		
City Funds On Hand =	$0	non-eligible items
Loan proceeds needed for City share =	$11,128,000	
Total Project Cost	$11,128,000	
C. Debt Repayment Calculations		
	IEPA Loan	
Total Amount to be borrowed =	$11,128,000	
Estimated IEPA loan interest rate =	0.93%	
Number of payments in years =	20	
Computed Principal & Interest for Repayment of IEPA loan =	$612,300	
New Annual Debt payment =	$612,300	
D.-1 Impact of Debt Repayment on Customers		
New Annual Debt payment =	$612,300	
Approximate Number of Sewer Customers =	4,663	
Average Debt Retirement Cost Per Customer =	$131.31	per year
=	$10.94	per month
D-2. Current Average Residential Sewer Bill		
Current Residential Sewer Bill (assumes 1,972 gallon/month usage) =	$22.00	per month
D-3. New Average Residential Sewer Bill after Project Financing		
The City intends to use surplus funds in the existing sewer system budget to pay for the proposed annual loan cost.		
New Residential Sewer Bill (assumes 1,972 gallon/month water usage) =	$32.94	per month
Percent Increase in Sewer Bill =	49.7%	

8.4 AFFORDABILITY ANALYSIS

In order to determine the financial impact of the proposed project on the Village's sewer customers, the annual cost for sewer service is often evaluated in the form of a percentage of the Median Household Income (MHI) in the service area. According to the current U.S. Census Bureau information, the MHI for the Village of Rantoul, Illinois is $41,837, which is the Bureau's estimate for 2019. It is important to note that using that data source is consistent with the requirements of 35 Ill. Adm. Code 365.110. The statewide MHI for all of Illinois is currently $68,428. Rantoul's MHI is currently 61% of the statewide MHI.

Rantoul's current sewer rate charges each customer $5.03 per month for 1,000 gallons of water passing through the customer's water meter. Sewer rates also include a monthly rate determined by service line size as noted in Ordinance No. 2634 of the Rantoul village code attached in Appendix G. These monthly rates are shown in Table 8-3 and increase annually. The 2021-2022 rates are used in the financial estimates presented in this report.

Table 8-3 Schedule of Wastewater Rates

		For the Period Beginning				
	Current	4/1/2020	5/1/2021	5/1/2022	5/1/2023	5/1/2024
Monthly Facilities Charge:						
Residential Customer Charge - .75"	$ 6.10	$ 7.20	$ 8.30	$ 9.40	$ 10.50	$ 11.60
Residential Customer Charge - 1"	$ 6.10	$ 9.10	$ 12.10	$ 15.10	$ 18.10	$ 19.34
Residential Customer Charge - 1.5"	$ 6.10	$ 13.10	$ 20.10	$ 27.10	$ 34.10	$ 38.68
Commercial Customer Charge - .75"	$ 17.74	$ 16.54	$ 15.34	$ 14.14	$ 12.94	$ 11.60
Commercial Customer Charge - 1"	$ 17.74	$ 18.06	$ 18.38	$ 18.70	$ 19.02	$ 19.34
Commercial Customer Charge - 1.5"	$ 38.17	$ 38.27	$ 38.37	$ 38.48	$ 38.58	$ 38.68
Commercial Customer Charge - 2"	$ 66.30	$ 65.30	$ 64.30	$ 63.30	$ 62.30	$ 61.30
Industrial Customer Charge - 3"	$ 120.00	$ 119.00	$ 118.00	$ 117.00	$ 116.00	$ 115.00
Industrial Customer Charge - 4"	$ 225.00	$ 219.00	$ 213.00	$ 207.00	$ 201.00	$ 195.00
Industrial Customer Charge - 6"	$ 350.00	$ 357.36	$ 364.72	$ 372.07	$ 379.43	$ 386.79
Village Customer Charge - Placed into appropriate meter size						
Volume Charge	$ 4.80000	$ 4.91000	$ 5.03000	$ 5.16000	$ 5.30000	$ 5.46000

Using the aforementioned rate system, the average Rantoul residential customer's sanitary sewer only bill is computed as follows:

- Monthly Charge (average for residential users):$12.08/month = $12.08 per month
- Sewer Rate Volume Charge: $0.00503/gallon x 1,972 gallons = $9.92 per month

TOTAL CURRENT AVG. RESIDENTIAL MONTHY SEWER BILL = $22.00 per month

The following calculation computes what percentage the current average sewer bill is when compared to the Median Household Income (MHI) in Rantoul:

$22.00 per month x 12 months/year ÷ MHI of $41,837 x 100 = 0.63%

This calculation demonstrates that Rantoul's current average sewer bill constitutes 0.63% of the MHI. USEPA's stated view on the cost of sanitary sewage service is that it is affordable if it costs less than 2% of the MHI. Based on this criteria, the current Rantoul average sewer bill is considered affordable.

The Village will likely increase sanitary sewer rates to repay the loan's principal and interest using revenues derived from future increases in sewer bills. As Table 8-2 computed, the average future residential sanitary sewer bill needed to fund the project is projected to be $32.94 per month. The following computes the affordability of this new average bill:

$32.94 per month x 12 months/year ÷ MHI of $41,837 x 100 = 0.95%

This calculation demonstrates that Rantoul's future average sewer bill will constitute 0.95% of the MHI. As stated above, USEPA's view on the cost of sanitary sewage service is that it is affordable if it costs less than 2% of the MHI. Based on this criteria and assuming no other drastic changes to the system, the future Rantoul average sewer bill will be considered affordable.

8.5 PROJECT BENEFITS

Currently a large amount of the processes at the Rantoul WWTP are reaching the end of their design life. The solids treatment process is need of major improvements as the plant cannot keep up with current sludge production. The proposed dewatering treatment upgrades will replace the poor-performing belt filter press with a new screw press system that will dewater the sludge to a 20% total solids concentration.

8.6 PROJECT SCHEDULE

The following table outlines the projected schedule of the phase 1 projects at the WWTP. It is assumed that Illinois EPA loan funds would be available for the project in the 2023 calendar year.

Table 8-4 Phase 1 Schedule

Task	Start Date	Completion Date
Complete Facility Plan and send to IEPA	1/01/2022	2/28/2022
Complete Facility Plan Amendment	12/15/2022	12/15/2022
IEPA Facility Plan Approval	3/31/2023	3/31/2023
Complete Final Design and send plans/specs to IEPA	1/01/2023	4/01/2023
IEPA Permit Application	4/01/2023	7/01/2023
Advertise for and open bids	7/01/2023	9/01/2023
Construction to Substantial Completion	10/01/2023	10/01/2025
Initial Loan Payment	5/01/2026	5/01/2026