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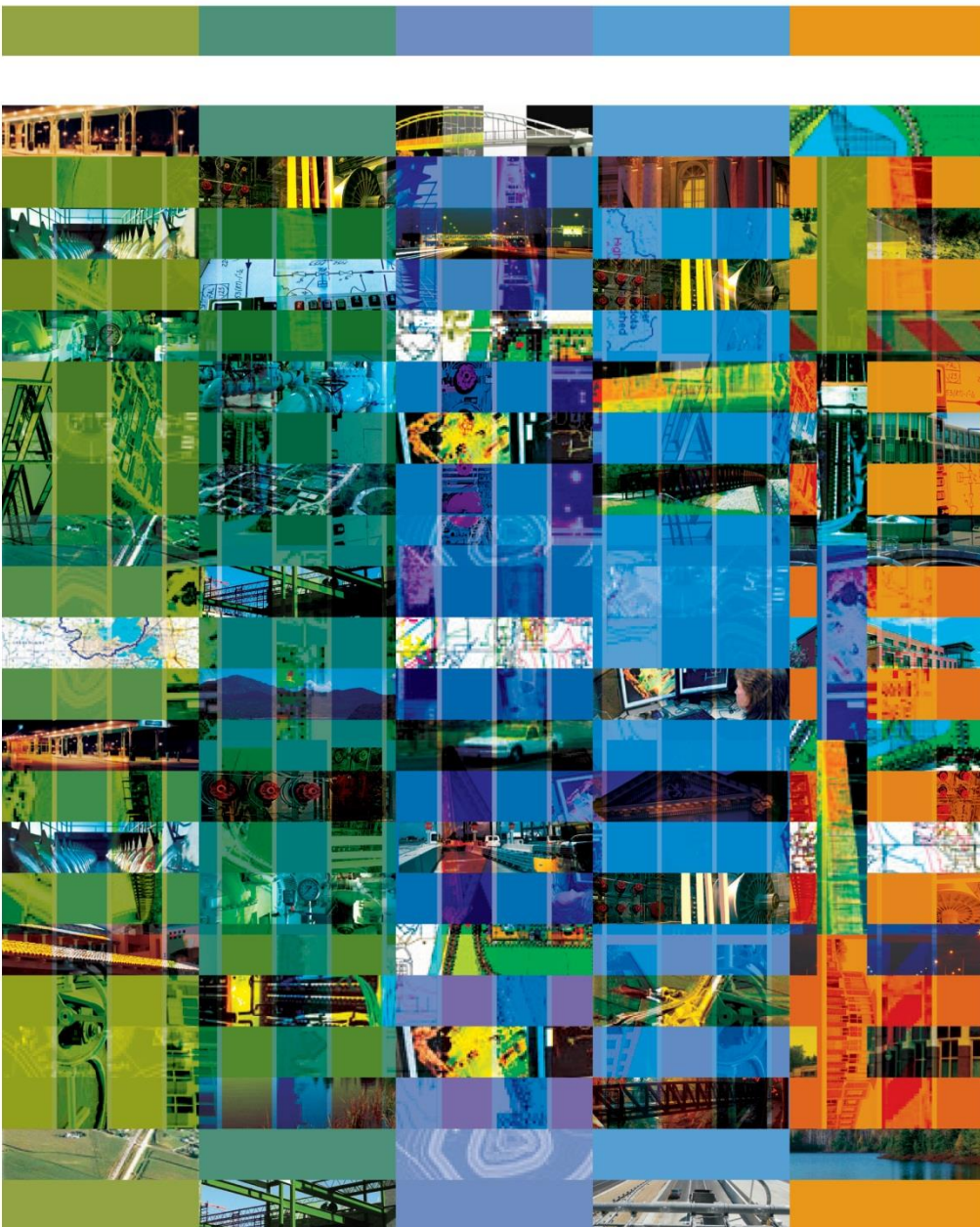
Engineering

Services

East Moline
Regional
Wastewater
Treatment Plant
Phosphorus
Discharge
Optimization
Plan

Report

City of
East Moline, IL
July 2024



Report for City of East Moline, Illinois

East Moline Regional Wastewater Treatment Plant Phosphorus Discharge Optimization Plan



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BACKGROUND INFORMATION

A. Purpose of Report

The City of East Moline, Illinois’ (City) National Pollutant Discharge Elimination System (NPDES) permit for the East Moline Regional Wastewater Treatment Plant (WWTP) was issued by the Illinois Environmental Protection Agency (IEPA) on August 13, 2020, and was effective as of September 1, 2020. The focus and goal of this report is to satisfy Special Condition 19, which requires the City to prepare and submit to the IEPA a Phosphorus Discharge Optimization Plan (PDOP). This PDOP evaluates measures for reducing phosphorus in the WWTP’s effluent, including possible source reduction measures, operational improvements, and minor facility modifications. The optimization evaluation includes influent and effluent reduction measures.

B. Facility Processes and Operations

The City-operated WWTP serves the residents and businesses of the City and surrounding area. The WWTP service area includes the Cities of East Moline, Silvis, Carbon Cliff, Hampton, and Rapids City.

The forward flow at the WWTP undergoes the following process: influent pumping, mechanical bar screens, grit removal, primary clarifiers, intermediate pump station, aeration basins, final clarification, and ultraviolet disinfection. Biosolids processes currently include dissolved air floatation thickening, anaerobic digesters, and sludge dewatering with belt filter presses. When peak flow events occur, an additional clarifier and aeration basin can be put into service.

	Rated Capacity
Flows	
Design Average	11.1 MGD
Design Maximum	27.8 MGD
BOD Load	20,800 lb/day
TSS Load	22,100 lb/day

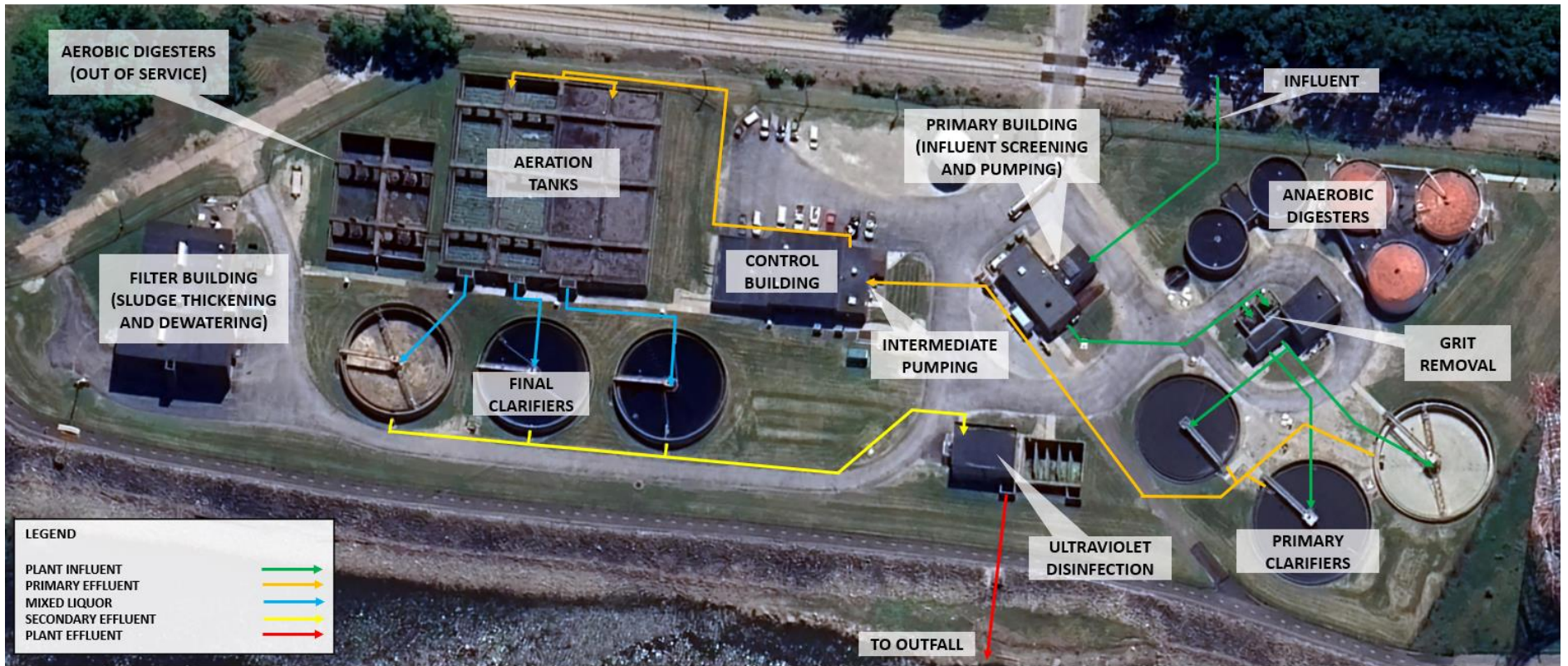
BOD=biochemical oxygen demand
TSS=total suspended solids
MGD=million gallons per day
lb/day=pounds per day

Table 1 WWTP Design Flows and Loadings

The WWTP was initially constructed in 1959 and has undergone several upgrades since then. The WWTP has a design average flow of 11.1 MGD, with a design maximum flow of 27.8 MGD. The design flows and loadings for the East Moline Regional WWTP are presented in Table 1, and an overall process flow schematic is shown in Figure 1.

The WWTP is not currently designed for phosphorus removal, although some phosphorus is inherently removed by the existing conventional treatment.

Figure 1 East Moline Regional WWTP Process Schematic



Aerial Source: Google Earth

C. Baseline Phosphorus Data

The WWTP has been routinely testing for effluent phosphorus one day per month in accordance with its NPDES permit. Influent and effluent phosphorus concentrations and loading for the period between September 2020 to May 2024 are summarized in Table 2. Based on this sampling with influent and effluent TP, the WWTP currently reduces the phosphorus concentration on average by approximately 0.78 milligrams per liter (mg/L), which represents a removal efficiency of approximately 29 percent. The total phosphorus (TP) concentration in a week to medium strength domestically dominated wastewater typically ranges from 4 to 8 mg/L. There are seven influent TP samples in 2020 and 13 samples in 2024. The average influent phosphorus concentration of 2.71 mg/L is below the lower range of typical domestic strength wastewater. There are 42 effluent phosphorus samples from 2020 through January 17, 2024, without influent phosphorus data. The January 2020 through January 2024 average effluent TP is 2.44 mg/L. At 29 percent removal, the influent TP would be approximately 3.4 mg/L.

Table 2 Influent and Effluent Phosphorus

Date	Influent Flow (MGD)	Influent Phosphorus Concentrations (mg/L)	Influent Phosphorus Loading (lb/day)	Effluent Phosphorus Concentration (mg/L)	Effluent Phosphorus Loading (lb/day)
January 6, 2020	4.8			2.8	112
February 3, 2020	7.4			1.7	105
March 2, 2020	4.4			2.5	92
April 6, 2020	5.6			1.2	56
May 4, 2020	5.0			2.2	92
June 15, 2020	5.3			1.1	49
July 6, 2020	4.7			2.1	82
August 24, 2020	3.6			2.9	87
September 7, 2020	4.5	2.8	105	1.7	64
September 16, 2020	5.9	2.5	123	1.6	79
October 5, 2020	4.1	4.0	137	3.3	113
October 27, 2020	4.0	3.4	113	3.5	117
November 2, 2020	3.6	4.0	120	2.5	75
November 16, 2020	3.6	4.4	132	2.6	78
December 7, 2020	3.8	3.6	114	2.3	73
January 4, 2021	4.2			2.3	81
February 2, 2021	4.6			2.5	96
March 8, 2021	7.3			1.2	73
April 5, 2021	5.6			2.1	98
May 3, 2021	5.2			2.4	104
June 28, 2021	6.0			2.1	105
July 5, 2021	4.1			2.3	79
August 9, 2021	3.6			2.6	78
September 27, 2021	3.5			2.6	76
October 4, 2021	3.2			2.7	72
December 13, 2021	3.7			2.3	71
January 17, 2022	3.3			2.3	63
February 7, 2022	3.7			3.3	102
March 7, 2022	4.6			2.3	88
April 4, 2022	6.5			1.6	87
May 2, 2022	5.3			1.7	75
June 6, 2022	4.6			3.0	115
July 11, 2022	5.5			2.1	96
August 1, 2022	3.8			3.4	108
September 5, 2022	3.5			2.9	85
October 17, 2022	3.2			3.2	85
November 7, 2022	3.9			3.3	107
December 5, 2022	3.6			3.4	102
January 16, 2023	4.3			4.8	172
February 14, 2023	5.2			1.3	56
March 20, 2023	5.1			1.6	68
April 3, 2023	7.1			1.3	77
May 1, 2023	5.1			2.1	89
June 12, 2023	3.5			2.2	64
July 10, 2023	3.6			2.4	72
August 7, 2023	4.0			3.3	110
September 4, 2023	2.9			3.5	85

Date	Influent Flow (MGD)	Influent Phosphorus Concentrations (mg/L)	Influent Phosphorus Loading (lb/day)	Effluent Phosphorus Concentration (mg/L)	Effluent Phosphorus Loading (lb/day)
October 2, 2023	3.5			3.2	93
January 17, 2024	4.4			2.3	83
February 7, 2024	6.0	2.4	118	1.2	62
February 22, 2024	4.4	2.6	94	2.0	73
February 28, 2024	4.2	2.9	100	2.1	74
March 6, 2024	4.5	2.0	74	2.1	80
March 13, 2024	4.9	2.1	78	1.7	68
April 1, 2024	7.9	2.0	132	1.9	125
April 30, 2024	7.7	2.0	128	0.9	58
May 2, 2024	5.8	1.6	77	0.7	33
May 6, 2024	5.5	3.1	142	1.8	83
May 7, 2024	7.6	2.5	158	1.9	120
May 8, 2024	6.8	1.7	96	1.1	62
May 16, 2024	5.3	2.0	88	1.6	71
June 3, 2024	4.7	2.8	110	2.2	86
Average	4.8	2.71	112	2.3	85

D. Possible Phosphorus Contributors

Wastewater discharges to the WWTP are from mainly residential and commercial sources.

As part of this study, the City distributed surveys to industries and businesses in the WWTP service area. The surveys requested the products manufactured and services performed, sanitary sewer discharge in gallons per day (gpd), phosphorus-containing chemicals and products used, the process in which the chemical and product is used, and the amount used per month. The City received surveys from four industries and businesses. A summary of industrial survey data is provided in the appendix. Based on the information provided, three surveyed facilities use chemicals or products that contain phosphorus.

Additionally, the June 2021 Phosphorus Removal Feasibility Study included industrial sampling data from 2017 and 2018. Two industries had phosphorus concentrations greater than 20 mg/L, Metokote Corporation and KVF Quad Corporation. The property that was the Metokote Corporation in 2018 is now Ranews Companies, which is a different manufacturing company. From the survey, Ranews Companies uses a zinc phosphate chemical for preparing metal parts in its coating process, and indicated it does not have an alternative chemical for its process. KVF Quad Corporation's survey responded its discharged flows are only 150 gpd and that it does not discharge the phosphorus chemical to the City sewer. John Deere Harvester Works uses several phosphorus chemicals for preparing metal for its coating process. John Deere Harvester Works has pretreatment with ferric chloride addition to remove phosphorus before discharging to the City sewer.

E. Phosphorus Levels in Water Supply

Polyphosphate chemicals are not used in the drinking water supply. The City does not have drinking water supply phosphorus data. The Cities of East Moline and Moline use Mississippi River water for drinking water supply. The City of Moline uses polyphosphates for corrosion control and has a drinking water concentration of approximately 0.1 mg/L TP. Based on the City of Moline's phosphate sampling, East Moline's drinking water supply is expected to be less than 0.1 mg/L TP because it does not add polyphosphate chemicals.

INFLUENT SOURCE REDUCTION MEASURES

Opportunities are limited for cost-effective removal of phosphorus sources from the contributing commercial, residential, and institutional facilities. In addition, based on sampling results, influent TP is already low compared to other municipal wastewater facilities. The NPDES permit suggests the following WWTP influent reduction measures to reduce phosphorous discharges by evaluating the phosphorous reduction potential of users and by determining sources that have the greatest opportunity for reducing phosphorous.

1. Determine whether known sources can adopt phosphorous minimization and water conservation plans.
2. Evaluate the implementation of local limits on influent sources of excessive phosphorous.

Based on the survey results, no significant source reduction measures from minimizing phosphorus discharges have been identified. The City could consider implementing a local limit and potentially add a surcharge rate for TP when the TP limit in the City's NPDES permit is in effect.

OPERATIONAL OPTIMIZATION MEASURES

The following section discusses the potential operational optimization measures for reduction of phosphorus in the effluent. The WWTP's NPDES permit Special Condition 19 lists the following for evaluation of WWTP operational measures for effluent reduction.

1. Adjust the solids retention time (SRT) for nitrification, denitrification, or biological phosphorus removal (BPR).
2. Adjust aeration rates to reduce dissolved oxygen and promote simultaneous nitrification-denitrification.
3. Add baffles to the existing units to improve microorganism conditions by creating divided anaerobic, anoxic, and aerobic zones.
4. Change aeration setting in the plug flow basins by turning off air or mixers at the inlet side of the basin system.
5. Minimize impact on the recycle streams by improving aeration within the holding tanks.
6. Reconfigure the flow through the existing basins to enhance the biological nutrient removal (BNR).
7. Increase the volatile fatty acids for BPR.

A. Evaluation of Adjustments to Existing Operations

Major adjustments to the WWTP are needed to reduce phosphorus loading in the effluent discharge. The above-listed reduction measures are not considered feasible as minor facilities modifications because the existing WWTP was not designed for BPR.

The addition of anaerobic/anoxic selector zones for BNR cannot be easily added without a major capital project. Other operational considerations such as adjusting the SRT, adjusting the aeration rate, and changing aeration settings are not expected to provide additional phosphorus removal.

B. Evaluate Implementation of Chemical Phosphorous Removal (CPR) and BPR

As part of the Phosphorus Removal Feasibility Study required by the City's WWTP NPDES permit, BPR and CPR were evaluated for the ability to meet potential future effluent phosphorus limits. An amendment to the feasibility study will further evaluate BPR with a cost analysis on a 20-year, present-worth basis that incorporates capital costs and operating costs, including power use, chemical use, maintenance, labor, and biosolids disposal.

CONCLUSIONS

The average influent phosphorus concentration to the WWTP is already low compared to other facilities. The WWTP typically discharges final effluent phosphorus concentrations between 0.68 to 4.8 mg/L. Further optimization and reduction of phosphorus are not feasible without a more-significant capital project that would need to include BPR and/or CPR. The June 2021 Phosphorus Removal Feasibility Study was submitted to the IEPA on April 2, 2024. An amendment to the Phosphorous Removal Feasibility Study will be submitted in 2024, further evaluating BPR to meet the 0.5 mg/L TP limit before January 1, 2030.

Industrial Survey Summary

Name of Source	Type of Process	Discharge (gal/day)	Phosphorous Chemicals/Products Used	Process in Which Phosphorous Chemical/Product is Used	Amount Used per Month
Ranews Company– 5th Avenue Coating Service Center	Manufacturing equipment and motor vehicle parts	15,800	Corcoat 85 KR-55SDL	Coating Process Boiler Treatment	200 gal 10 gal
John Deere Harvester Works	Manufacturing facility	14,000	Zinc Phosphate Iron Phosphate Phosphoric Acid 5 to 10 percent Tetrapotassium Pyrophosphate 10 to 15 percent	Metal preparation for electro-coating	1,000 gal
KVF Quad Corporation	Mechanical metal finishing supplier and powder coat painting supplier	150	PPG–51HD PPG–pH Controller	Paintline Pretreatment Paintline Pretreatment	50 to 70 gal 0.1 mL
Vestis Services, LLC	Uniform and workplace supplier	71,000	NA	NA	NA

Note:
 gal=gallons
 gal/day=gallons per day
 NA=not applicable
 mL=milliliters

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