

Wastewater Treatment Plant Operations and Facility Study

City of Northfield, MN.

May 12, 2020



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Agenda

1. Background
2. Operations Study Approach
3. Operations Study Findings
4. Recommendations
5. Next Steps
6. Questions/Comments

1. Background



Incidents that prompted review of the WWTP

- Jan 2018: Flooding of the Biological Aerated Filter (BAF) building basement due to a pipe plug failure.
 - 5 ft of water in basement, 200 gal released to ground
 - Wiring and actuator replacements
 - \$175K insurance claim

Incidents that prompted review of the WWTP

- May 2018: Fire in the biosolids handling facility
 - Significant damage
 - Required emergency biosolids hauling
 - Required emergency temporary treatment system
 - Repair and rebuild of the permanent facility

Incidents that prompted review of the WWTP

- July 2018: Pipe failure in the Sludge Pump Room
 - 6 ft of wastewater in basement
 - 1 MG discharge to river

City Implements Plan for O&M Analysis

Purpose: To prevent future incidents

- April 2019: City issues RFP for Plant Operational Analysis
 - No proposals received
- Initiated scope discussions with Jacobs for completing the Operational Analysis
- Sept 2019: Executed agreement with Jacobs

2. Operations Study Approach



Jacobs Team

- Jim Borton – Director of Operations Consulting
- Steve Waters – Principal Wastewater Engineering and Facilities Maintenance Practitioner
- Bill Haberstroh – Mechanical Asset Inspector
- John Borghesi – Project Manager

Jacobs Approach

- Data review
- Oct 2019: Site visit, onsite interviews, observation of plant operations
- Nov 2019: First draft Operations Study Memo
- Dec 2019: Review of asset conditions and asset management approach
- Feb 2020: First draft of Asset Condition Assessment Report

3. Operations Study Findings



Operations Practices

- Overall the plant is well operated
- Limited process control adjustments are required
 - Biological Aerated Filter (BAF) process is underloaded
 - Plant can handle wastewater flows and loads without excessive operator attention

Operations Practices

- Onsite laboratory is only used for pH and dissolved oxygen analysis
- Opportunity to test process control parameters to optimize the system and reduce costs
 - Jar testing for optimizing polymer and coagulant dosing
 - Nitrogen (ammonia, nitrate, TKN), Alkalinity
 - Establish trends that can help predict potential performance issues



Operations Practices

- One blower per BAF cell set to maximum output because no VFD controls
 - Excessive aeration and energy consumption
 - Unintended nitrification reduces alkalinity than may contribute to corrosion of the BAF cell effluent gates



Maintenance Practices

- The operators perform limited routine maintenance tasks (lubrication, calibration, and minor maintenance on equipment).
- Larger, more complicated maintenance tasks are handled by local contractors (i.e., mechanical and electrical).

Maintenance Practices

- Plant implements the OpWorks CMMS platform.
 - The OpWorks interface is user-friendly.
 - The system is used for both the wastewater and utilities assets.
- Most of the equipment maintenance is corrective and reactive in nature, and very little preventive maintenance is carried out.
 - This is common problem in the industry for facilities of this size

Maintenance Practices

- Limited asset data is captured in the CMMS
- Lack of documented maintenance procedures
 - maintenance procedures based on the equipment manufacturer's recommendations and industry standard practices are essential.
 - excellent asset for training purposes
 - ensure required maintenance is completed properly, increase the efficiency of the staff, and minimize re-work

Maintenance Practices

- Maintenance costs are only tracked at a high level in a limited number of cost accounts,
 - difficult to determine the effectiveness of the maintenance program and identify the amount of effort expended on individual equipment assets.
- The CMMS can track labor hours on a work order but not the cost associated with those labor hours. Tracking of labor hours is not used currently.

Maintenance Practices

- Lack of organized or documented spare parts inventory
- Parts usage and inventory are not tracked, making it difficult to determine critical spares and the appropriate stocking levels
 - CMMS does not have capabilities in cost capture/reporting and inventory control.

Maintenance Practices

- CMMS platform requires additional work to realize its full potential to increase efficiency.
 - Improve asset data capture
 - Add PM procedures
 - Add man-hour tracking, planning
- As compared to industry standards, Northfield is on the entry level, along with many other facilities that are starting to implement CMMS into their daily routines.

Staffing

- Plant is staffed Monday through Friday, 5 AM to 5 PM.
- Plants of Northfield's size are generally not staffed more than 12 hours per day, and most are between 8 to 10 hours per day with operational checks on weekends and holidays.

Staffing

- Currently, one supervisor and four operators are onsite
- O&M duties are divided among the four staff.
- The plant supervisor typically handles process decision-making, data management activities, permit-required reports and coordinating contract laboratory data.

Staffing

- Staff members, by industry standards, are inexperienced.
- Except for one staff member with 30 years of experience, the most experienced staff member at the plant has only 2 years of experience.
- Staffing at the facility is within an expected range for the size and type of facility operated, but on the lower end compared to industry peers.

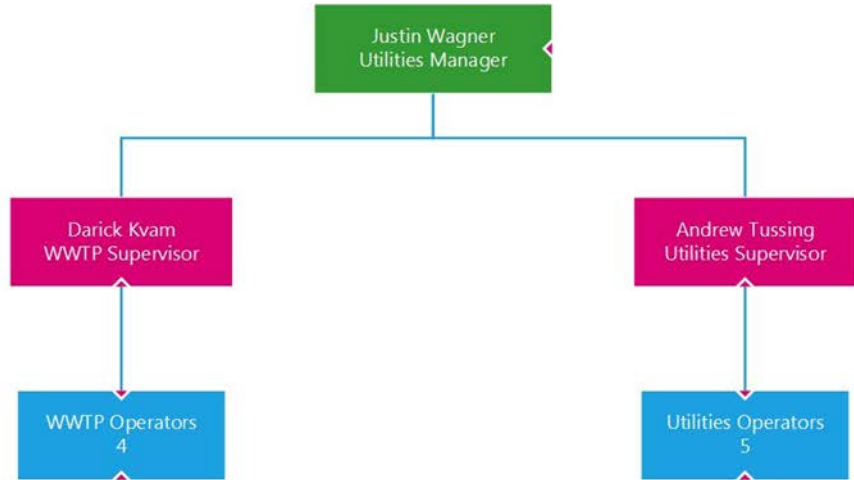
Staffing

Table 1. Staffing Comparisons

Municipality	Design Flow (mgd)	Average Flow (mgd)	Total No. Staff Onsite, Full Time	Manager/ Supervisors on-site Full Time	Comments
Northfield, MN	5.2	2.5	4	1.5	BAF process, solids dewatering and stabilization, UV disinfection, three significant industrial users
Faribault, MN	7	4.5	4	2	Roughing filters/activated sludge process, five significant industrial users
New Prague, MN	1.83	0.75	3	1	BAF process, use part-time help from Street Department for biosolids hauling
Red Wing, MN	4.0	2.5	5	1	City manages two WWTPs with staff listed; Trickling filter municipal plant, physical/chemical and solids dewatering industrial plant pretreatment by another department
Delphos, OH	3.83	1.5	4	1.5	Membrane treatment WWTP with ATAD solids digestion, solids dewatering
Duncan, OK	4.5	N/P	5	1	Trickling Filters/Activated sludge, solids drying beds. Staff includes Lab, IPP and Manager
Pampa, TX	3.0	N/P	3.5	1	Oxidation ditch, solids dewatering.
Stephenville, TX	3.0	N/P	3	1	Oxidation ditch, solids dewatering, chlorination/dechlorination
Mercedes, TX	5.0	N/P	4.5	1	Oxidation ditch, dewatering and drying beds, UV disinfection
Berryville, AR	2.4	N/P	3.5	1	Activated sludge, solids dewatering, UV disinfection
Westerly, RI	3.3	N/P	5	1	IFAS, solids thickening/dewatering, chlorination/dichlorination. Staff include one FTE for Lab/IPP
Carol Stream, IL	6.0	N/P	5	2	Activated sludge, solids thickening/dewatering, chlorination/dichlorination. Staff includes one FTE for Lab/IPP

Staffing

- The City's Utility-wide management structure is an effective arrangement that can be enhanced via staff sharing and cross training.



4. Recommendations



Recommendations

Phase 1

- Hire 1 new staff position focusing on:
 - Maintenance planning and scheduling activities,
 - CMMS input
 - work order execution.
- Cross train new staff position in operations to be able to fill in for staff on sick leave or vacations

Recommendations

Phase 1

- Restructure operator duties:
 - Place Supervisor in position to coordinate work efforts and rely on sufficient staffing levels to complete the tasks under normal circumstances.
 - Rotate operators through all facets of plant operation to gain experience and enhance knowledge for state certification exams.
 - Train operators in laboratory work to perform testing and generate data for process control decision-making.
 - Allow operators to assist the new staff member with maintenance activities

Recommendations

Phase 2

- Develop and implement standardized maintenance procedures to cover preventative and corrective maintenance work.
- Implement an industry-standard work order system to track maintenance costs at a more detailed level.

Recommendations

Phase 2

- Modify or update the existing OpWorks CMMS
 - standardize the asset listings and equipment data
 - add standard maintenance procedures and supporting data.
 - track and record labor hours expended on work orders. Note that OpWorks is only capable of recording labor hours and cannot track the cost of parts used

Recommendations

Phase 2

- For a more accurate accounting of maintenance costs, the City should consider implementing a more robust CMMS that allows the recording and tracking of labor costs, parts, and a spare parts inventory. This is the industry norm as it allows for superior planning and budgeting of maintenance costs.

Recommendations

Phase 2

- Establish a permit system to control the maintenance work performed in the plant by plant personnel and contractors.
 - Establish procedures for obtaining permission to start work and notifying staff management when work has been completed.
 - Apply to any cold or hot work (welding, cutting) carried out in the plant.
 - Document requirements for minimum personal protective equipment and safety orientation for contractors and visitors.

Recommendations

Phase 3

- Evaluate BAF blower VFDs to reduce output and achieve better control of the system for energy conservation.
- Investigate modifications to enable half of the BAF process to be offline to conserve energy and to facilitate future maintenance
- Initiate new and increase the frequency of existing process control testing

5. Next Steps



6. Questions/Comments

