

# Strategic Progress

## 2022 Annual Report

Madison Metropolitan Sewerage District



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# Introduction: Strategic progress

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In 2022, District staff made strategic progress on several fronts, both internal and external. This progress allows us to set a foundation for success for years. It will positively impact the communities we serve, the local economy and our mission to protect public health and the environment.

***New strategic plan:*** A key highlight of 2022 was completing and approving the District’s new strategic plan in August 2022. This critical work began through discussions with our Commission in 2021. At that time, we determined we needed a plan that provided clear direction and guardrails to guide decision-making, was consistent with the District’s statutory powers and obligations, and positioned the District for success.

Built through collaborative effort, our new strategic plan better plans and prioritizes our work and is codified by including focus items in our annual budget. At the same time, it is forward-looking yet realistic, providing the framework we need for continued success.

***Service charge work:*** Another highlight in 2022 was our work to engage owner communities on our rate structure to inform the next steps. Through the Service Charges Fiscal Workgroup, comprised of community representatives with expertise in rates and billing, we received feedback on the strengths and challenges with the District’s current service charges methodology. While this work continues into 2023, this input forms the basis of recommended changes and improvements to better meet the needs of our owner communities.

***Climate mitigation:*** One of the most significant challenges of our time is climate change, and all organizations have a role to play. The District itself is vulnerable to extreme weather, and we are a significant producer of greenhouse gases.

To identify opportunities to reduce our contributions to climate change, we began work in 2022 to write the District’s first Climate Mitigation plan. This project explicitly addresses areas where the District has resources and leverage to reduce the greenhouse gas emissions for which we are responsible. This plan will include a set of feasible yet appropriately challenging options. Specific emission-reduction projects will go through the capital improvements planning process to thoroughly vet spending, timing and resource requirements.

This annual report highlights the value we provide to our owner communities and the public we serve. This value is in the infrastructure projects we engineer and build, the service we provide, the resources we recover and, as evidenced in this review of 2022, the strategic, forward-looking planning we do. We appreciate the opportunity to do our part to protect public health and the environment.

Thank you for your support. I welcome your comments and feedback on this annual report.

Sincerely,



**Michael Mucha, P.E., ENV-SP**

Chief Engineer and Director | Madison Metropolitan Sewerage District

# About the District

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## WHO WE ARE

### The District Defined

Madison Metropolitan Sewerage District (District) is a body corporate with the powers of a municipal corporation for the purpose of carrying out the provisions of Sections 200.01 to 200.15 of the State of Wisconsin Statutes. These provisions allow for the creation of "metropolitan sewerage districts" governed by a Commission to manage wastewater collection and treatment in metropolitan areas in Wisconsin.

### Our Mission

#### **PROTECT PUBLIC HEALTH AND THE ENVIRONMENT**

We are a passionate and experienced resource recovery team focused on protecting public health and the environment. Whenever we clean and return wastewater safely to nature or apply Metrogro to help farmers grow more food, we are taking steps to create a cleaner and better world. We are known for our innovative engineering, conservation leadership and expertise in resource recovery. We are also cost-conscious ratepayers, just like you.

### Our Vision

#### **ENRICH LIFE THROUGH CLEAN WATER AND RESOURCE RECOVERY**

Our vision is to enrich the community by improving living conditions for people, plants and animals while seeking partnerships with others to better conserve our shared resources. Water is finite; we can't create more of it. By changing how we think about and use water, we can enhance the quality of life on our planet. By making small changes and respecting every drop of water we have today, we can set the tone for a resource-conscious and sustainable community tomorrow.

### Our Purpose

Protect public health, welfare and the environment by providing efficient and strategic wastewater management on behalf of our owner communities.

## Commission

The District is governed by a nine-member Commission appointed for staggered three-year terms. The Mayor of Madison appoints five individuals as members of the Commission. An executive council composed of the elected executive officers of each city and village that is wholly or partly within the boundaries of the District, except Madison, appoints three members of the Commission by a majority vote of the members of the executive council. An executive council composed of the elected executive officers of each town that is wholly or partly within the boundaries of the District appoints one member of the Commission by a majority vote of the executive council members.

- Thomas D. Hovel, President; term ending Fall 2023
- Ezra Meyer, Vice President; term ending Fall 2025
- Bradley Murphy, Secretary; term ending Fall 2024
- Beth Bookland; term ending Fall 2023
- Ken Clark; term ending Fall 2025
- Sara Eskrich; term ending Fall 2023
- Grant Foster; term ending Fall 2023
- Tom Wilson; term ending Fall 2024

*Note that the Commission had one vacancy through 2022.*

*Note:* D. Michael Mucha serves as the Chief Engineer and Director of the District. Craig Franklin, the Treasurer of the City of Madison, serves as Treasurer of the District. Paul Kent, Stafford Rosenbaum, LLP is legal counsel for the District.

### **TIME AND PLACE OF MEETINGS**

The Commissioners of the District meet one to two times each month. In-person meetings are held at the District's Maintenance Facility Training Center at 1610 Moorland Road, Madison, WI 53713; however, in early 2020, Commission meetings were moved to the Zoom platform and most meetings are conducted virtually; in-person meetings with a hybrid option are held quarterly or as needed. Virtual meetings are livestreamed via the District's YouTube channel. Special meetings are held upon the call of any member of the Commission.

## Executive Team

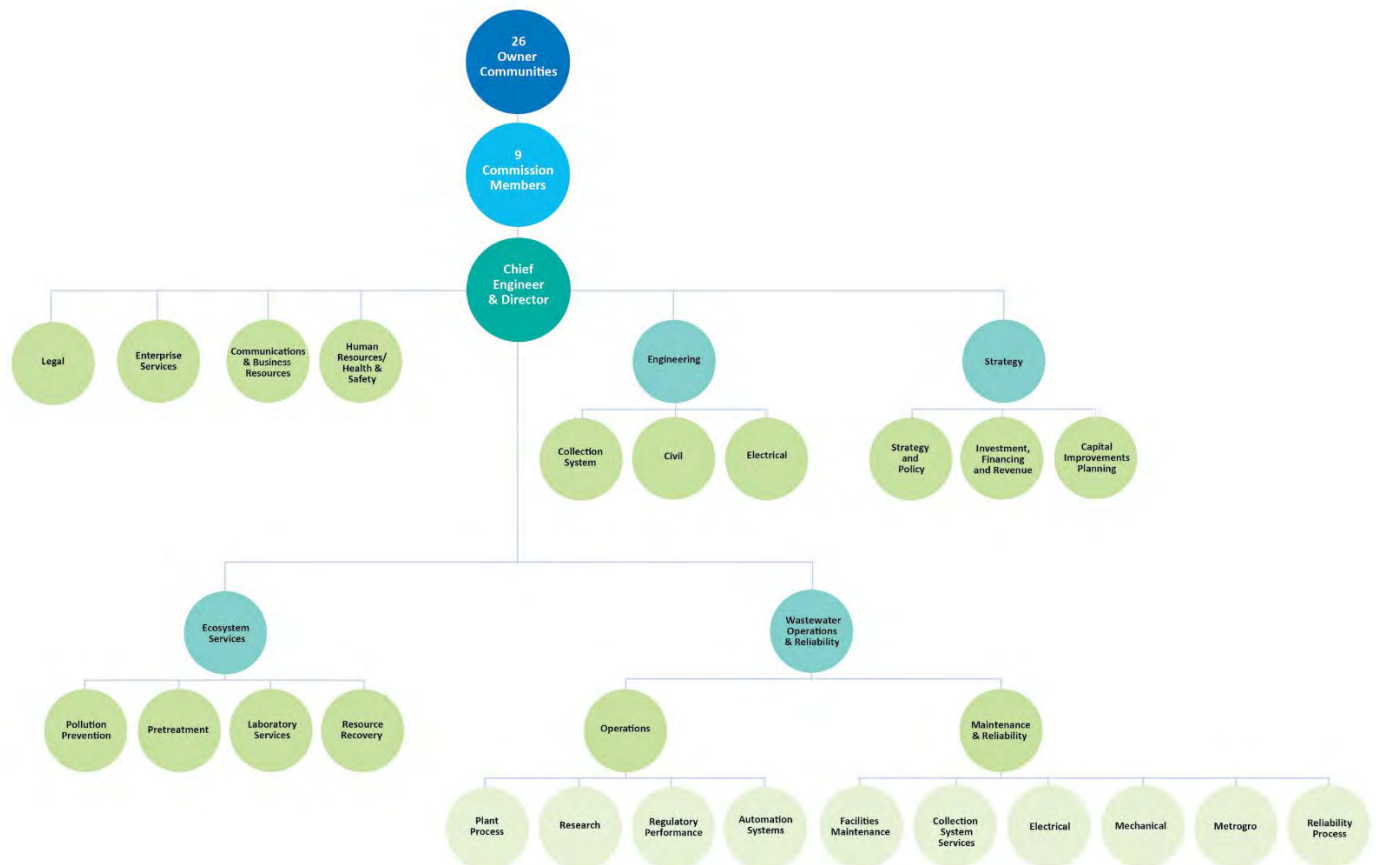
In 2022, the Executive Team consisted of four directors, a human resources manager, a communications and public affairs manager, a budget manager and the Chief Engineer and Director. The team meets Wednesdays.

The directors oversee the following departments:

- District Leadership and Support (Chief Engineer and Director)
- Ecosystem Services
- Engineering
- Operations and Maintenance
- Strategy

Figure 1 is an organizational chart representing the District's hierarchy at the end of 2022.

Figure 1 Organizational Chart



## Personnel

In 2022, the District employed 122.5 full-time employees (FTE). Table 1 represents the District's overall staffing from the end of 2021 to the end of 2022.

**Table 1 – FTE Employees**

DEPARTMENT	2021 FTE COUNT	2022 FTE COUNT
District Leadership and Support	15.5	16.5
Ecosystem Services	18	14
Engineering	8.5	12
Operations and Maintenance	57	65
Strategy	15	15
<b>TOTALS</b>	<b>114</b>	<b>122.5</b>

### 2022 NEW POSITIONS, RETIREMENTS AND PROMOTIONS OF DISTRICT EMPLOYEES





## WHAT WE DO

For more than 90 years, the Madison Metropolitan Sewerage District has protected public health and the environment by monitoring, maintaining and operating the complex system of pipes and equipment that convey, treat and return wastewater to the environment.

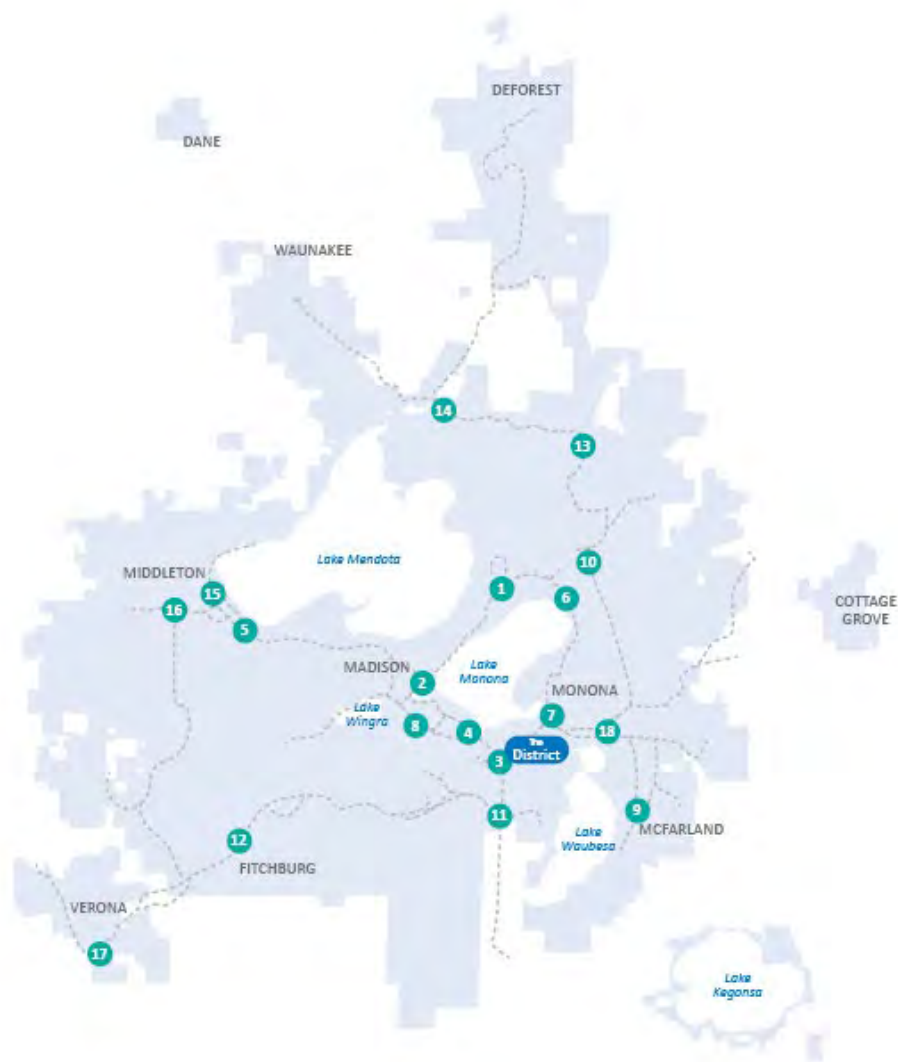
To convey the wastewater generated from homes, businesses and industries throughout our service area, we operate and maintain just under 98 miles of gravity sewers known as interceptors. These interceptors collect and transport wastewater from smaller sewers owned by local municipalities to 18 regional pumping stations operated by the District. The 18 District-owned pumping stations and the 32 miles of pressurized force mains associated with the pumping stations are required due to the relatively flat topography in the region. All wastewater flow generated in the service area, approximately 36 million gallons per day, is pumped to the Nine Springs Wastewater Treatment Plant.

Once at the plant, the wastewater proceeds through an advanced treatment process that recovers three valuable resources: treated effluent, energy and biosolids. An additional 15 miles of effluent force mains convey cleaned, treated wastewater to the Badfish and Badger Mill creeks. Energy is produced via methane, a combustible gas, which is recovered during treatment and used to power engines that drive generators and a blower. Biosolids, also known as Metrogro, are an organic fertilizer and soil conditioner recycled to area farm fields in the spring and fall.

## WHO WE SERVE

In 2022, the District served over 400,000 people in the greater Madison area. At the start of the year, our 187.5- square-mile service area included five cities, eight villages and 13 sanitary/utility districts. On Oct. 31, 2022, the Town of Madison was fully incorporated into the cities of Madison and Fitchburg, reducing the number of sanitary/utility districts served to 12. The District's service area stretches from the Village of Dane southwest to the City of Verona and southeast to Lake Kegonsa Sanitary District. Figure 2 shows the District collection system, including its 18 pumping stations.

Figure 2 District Collection System



## ANNEXATIONS TO THE DISTRICT

In 2022, the District added 94.5 acres in annexations to the District. Table 2 shows information related to these annexations.

**Table 2 – Annexations to the District**

<b>Annexation Name</b>	<b>Number</b>	<b>Municipality</b>	<b>Acres Added</b>
Kellerman Property	2022-01	Pleasant Springs Sanitary District	2.19
Highland Reserve	2022-02	City of Fitchburg	89.20
Wilmer A. and Sandra S. Dahl Properties	2022-03	City of Madison	3.13
		<b>TOTAL</b>	94.52

# Department Summaries

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## DISTRICT LEADERSHIP AND SUPPORT

The purpose of the District Leadership and Support team is to provide human resources, Commission support, and business and communication services to the organization so that the District develops and invests in its workforce, advances a policy-driven strategic approach to governance, and deepens relationships with owner communities and the public. This department also provides financial services – procurement, accounting and financial process improvement – to internal and external customers so the District can achieve its mission of protecting public health and the environment.

### Staffing

The District Leadership and Support workgroup has 14 full-time employees and 2 part-time employees:

- Chief Engineer and Director
- Budget Manager/Comptroller
- Accounting Supervisor
- Accountant (2)
- Accounting Assistant
- Procurement Agent
- Communications and Public Affairs Manager
- Communications & Marketing Specialist (part-time)
- Business Services Supervisor
- Program Resource Associate (2)
- Program Resource Assistant (part-time)
- Human Resources Manager
- Health, Safety and Security Leader
- HR Generalist

In late 2022, two purchasing and inventory assistants moved from the Purchasing workgroup to the newly formed Reliability Process workgroup.

## Responsibilities of Workgroup

The workgroup's main responsibilities are as follows:

- Business services
- Communications/marketing and public affairs
- Commission management
- Executive management
- Health, safety, and security
- Human resources
- Insurance management
- Budget, accounting, payroll, purchasing and procurement support for all District departments
- Clean Water Fund loans administration, including loan applications and disbursements
- Accounting services for the Yahara Watershed Improvement Networks (Yahara WINS)

## Programs, Initiatives and Work Reporting

### **RESOURCE TEAM/COMMUNICATIONS**

The District's success in fulfilling its mission is supported by our owner communities and the residents who live in them, which requires public outreach and engagement. In 2022, the District engaged a public relations and community outreach professional on a contract basis to assist in engaging the public and stakeholders in Badger Mill Creek Project PLUS, the District's work to determine a phosphorus compliance solution for its discharge site on Badger Mill Creek. That work continues into 2023 to meet the District's May 31, 2023, deadline with the Wisconsin Department of Natural Resources.

The Resource Team also supported work to rewrite and get approval for the District's new strategic plan. The new strategic plan provides clear direction and guardrails to guide decision-making, is consistent with the District's statutory powers and obligations, and positions the District for success. Built through a collaborative effort with our Commission, the District's new strategic plan better plans and prioritizes our work and is codified by including focus items in our annual budget. At the same time, it is forward-looking yet realistic, providing the framework we need for continued success.

### **HUMAN RESOURCES**

COVID continued to affect operations at the District in 2022, with HR leading efforts to mitigate its impacts. HR staff led the internal Emergency Management Team through the summer; this team regularly reviewed COVID numbers internally and in the area to best evaluate how District operations should be adjusted. By fall, COVID emergencies at the local level expired

and the District returned to "normal" operations. Employees continued to report positive tests and isolate consistent with CDC guidelines, but other operational restrictions, such as limits on public tours or outside meetings, were lifted.

On the hiring front, HR worked closely with Operations and Maintenance to implement the District's new trainee and succession planning programs. The District's first trainee was hired in the Facilities Maintenance workgroup in February 2022 and moved into a regular position in August 2022. Following the first trainee's promotion, a new trainee was hired in the Facilities Maintenance workgroup in October. To support District succession planning, the District hired a journeyman electrician in anticipation of near-future retirements in that group. In addition, an operator was hired in June, so this individual could be trained before a longtime operator retired in November. This program was so successful that it was recognized by the National Association of Clean Water Agencies (NACWA) with an Excellence Award and featured in the APWA Reporter magazine.

The District's internship program was a rousing success in 2022, featuring nine interns in six workgroups. The interns all received tours of the plant and various pumping stations as part of their experience. Interns also developed presentations outlining their work and what they learned. This program was so successful that several interns continued work into the fall, and one intern was hired as a regular Project Engineer following their graduation in December.

The HR Department engaged effectively with the Employee Leadership Council (ELC). The HR Manager led an extensive process to engage the ELC in updating the District's Employee Handbook. This Handbook had not been thoroughly reviewed since it was created in 2016, and several provisions needed review. Although the work started in 2021, the Handbook was not completed until September, and the Commission approved the final Handbook in November. Implementation occurred on Jan. 1, 2023.

As part of the 2023 budget process, a new Organizational Development Specialist position was created for the HR Department to be filled in 2023.

## **SAFETY**

The District continues to prioritize safety, and our accident rates remain low. The 2022 OSHA recordable incident rate and DART (Days Away/Restricted Time) rate increased, as shown below in Table 3. However, regarding worker's compensation, the District's Experience Modification Rate (MOD Rate) was 0.72, compared to 0.69 in 2021. The MOD Rate compares the District's worker's compensation claims to other employers of a similar size and in the same industry. Viewing a MOD Rate of 1.0 as average, the District's rate of 0.72 is excellent and contributes to lower costs for our worker's compensation premium.

**Table 3 – OSHA Recordable Incident and DART Rate Comparison**

<b>Year</b>	<b>OSHA Recordable Incident Rate</b>	<b>DART Rate</b>
2016	3.4	1.1
2017	3.7	3.7
2018	6.5	4.3
2019	0.88	0
2020	2.43	0
2021	2.41	.85
2022	3.1	3.1

## **BUDGET AND ACCOUNTING**

This team provides budget, accounting, payroll, and insurance management services for the District.

Significant achievements and work advanced in 2022 include:

- Obtained an audit for the District and Yahara Watershed Improvement Networks (Yahara WINS) for fiscal year 2022 that found no material weaknesses or significant deficiencies (a “clean” audit).
- Procured consultants to work with Accounting, HR, IT and Procurement to prepare the team to implement a new enterprise resource planning (ERP) system. This included mapping current and future state workflows and reviewing existing policies and procedures. Recommendations will be finalized in 2023.
- Developed the 2022 annual budget of \$52 million. The team continues to make process improvements, saving Accounting and other departments’ staff time by removing non-value-added steps. Because of this, we were able to move the development timeline up by one month, giving us more time to prepare the budget document and presentation of the budget. The new streamlined process helps us meet tight budget timelines. The Commission adopted the budget with no changes in October 2022.

## **PURCHASING**

This team focuses on the purchasing, receiving, kitting and replenishing parts and materials for the Operations and Maintenance department. Utilizing our systems, this team maintains a spare part inventory of 3,100 items valued at \$1.7 million. The team also maintains an open storeroom of expense consumable and safety-related materials.

Significant achievements and work advanced in 2022:

- Supported Reliability Centered Maintenance (RCM) initiatives, including asset retirement workflow; reorder point (ROP) analysis; weekly part demand follow-up review process; and continued catalog stock code creation.
- Identified inactive, obsolete materials for accounting write-off.
- Collaborated with accounting to update catalog stock code records.
- Realigned receiving workflows to accommodate new security policy.
- Cross-trained assistants to smooth work responsibilities and better align daily tasks. Re-aligned ownership of certain tasks outside of purchasing. Transitioned both assistants to a new workgroup.

## **CLEAN WATER FUND LOANS**

In 1989, the State of Wisconsin replaced the Wisconsin Fund Grant Program with the Clean Water Fund Loan Program. The Clean Water Fund is a state revolving loan fund capitalized initially with grants from the U.S. Environmental Protection Agency and by bonds issued by the State of Wisconsin. The District has issued general obligation bonds and notes to the State of Wisconsin for 30 loans under this program. A total amount of \$288.4 million has been financed through these Clean Water Fund loans through the end of 2022. One new Clean Water Fund loan was obtained in 2022. The District had three Clean Water Fund loans for which disbursements were received in 2022. The status of each loan is as follows:

### **Liquid Processing Improvements Phase 1, Headworks Flow Metering Improvements and Pumping Station Number 7 Improvements**

The District issued General Obligation Sewerage System Promissory Notes, Series 2020B, on Aug. 12, 2020, to the State of Wisconsin Clean Water Fund (CWF Project 4010-57). These bonds are for an aggregate amount not to exceed \$23,540,644 and are to be repaid at an annualized interest rate of 1.76%. The first interest payment on the loan was made on Nov. 1, 2020. The first principal payment was made on April 28, 2022. The final payment will be made on May 1, 2040. The District received the final disbursement for this loan in May 2022, bringing the total amount received for this project to \$22,786,870.04.



**Pumping Stations 13 & 14 Rehabilitation, West Interceptor Spring Street Relief Lining, Nine Springs Hot Water and W1 Piping Improvements, and Operations Building 1<sup>st</sup> Floor Remodel**

The District issued General Obligation Sewerage System Promissory Notes, Series 2021 A, on June 23, 2021, to the State of Wisconsin Clean Water Fund (CWF Project 4010-61). These bonds are for an aggregate amount not to exceed \$14,610,172 and are to be repaid at an annualized interest rate of 1.529%. The first interest payment on the loan was made on Nov. 1, 2021. The first principal payment was made on April 28, 2022. The final payment will be made on May 1, 2041. The District has received \$12,876,487.86 for this project as of Dec. 31, 2022.

**Nine Springs Valley Interceptor (McKee Road to Dunn's Marsh) and West Interceptor – Shorewood Relief Sewer (Phase 1)**

The District issued General Obligation Sewerage System Promissory Notes, Series 2022 A, on Jan. 26, 2022, to the State of Wisconsin Clean Water Fund (CWF Project 4010-70). These bonds are for an aggregate amount not to exceed \$8,686,674 and are to be repaid at an annualized interest rate of 1.611%. The loan's first principal and interest payment was made on April 28, 2022. The final payment will be made on May 1, 2041. The District has received \$7,926,889.87 for this project as of Dec. 31, 2022.

## ECOSYSTEM SERVICES

The Ecosystem Services department aims to advance initiatives and provide support services so that treatment plant operating systems can be optimized, demand for traditional wastewater treatment infrastructure and collection services can be reduced, resources can be recovered and environmental quality can be enhanced.

### Staffing

The Ecosystem Services department has 14 full-time employees:

- Director of Ecosystem Services
- Pretreatment Coordinator
- Watershed Programs Coordinator
- Biosolids Specialist
- Lab Manager
- Chemist (6)
- Pollution Prevention Manager
- Pollution Prevention Specialist (2)
- Wisconsin Salt Wise Coordinator (Grant funded limited-term position ended at the end of 2022)

### Responsibilities of Workgroup

The purpose of the Ecosystem Services department is to envision and execute next-generation water quality and resource recovery solutions. It is responsible for resource recovery, laboratory, pollution prevention, pretreatment and waste acceptance programs. The team advances initiatives and provides support services so that treatment plant operating systems can be optimized, demand for traditional wastewater treatment infrastructure and collection services can be reduced, resources can be recovered and environmental quality can be protected and enhanced. This includes advancing regulatory and strategic initiatives that provide flexibility and encourage innovation. Ecosystem Services staff work across other District departments on various initiatives, in some cases leading the initiative, while in other cases providing supporting services.

### Programs, Initiatives and Work Reporting

#### **POLLUTION PREVENTION**

The pollution prevention team typically works outside the plant, in and with the community to reduce operational nuisances in the collection system and at the plant, and to minimize threats

to public and environmental health. Using behavior change, policy, partnerships and education, pollution prevention can be an effective approach where infrastructure and technological solutions do not yet exist or are not cost-effective. In 2022, major pollution prevention activities centered on Wisconsin Pollutant Discharge Elimination System (WPDES) permit compliance for both chloride and mercury variances.

### **Chloride Reduction**

The estimated total mass of chloride that passed through the plant in 2022 was comparable to the estimated total annual mass in 2021. This aligns with the general downward trend observed since the source reduction program began in 2010.

Plant effluent met permit (variance) weekly concentration limits for the whole year in 2022 (465 mg/L winter and 430 mg/L summer). Staff were never required to report an exceedance, despite weekly average concentration being higher most weeks in 2022 than the previous five years' average for similar weeks. This is likely because it was a comparatively lower-flow year than the previous five years' average – a reminder that weather and flow highly influence effluent chloride levels.

Overall, tremendous progress has been made with source reduction. However, there is still more to do, as the weekly average concentration for 16 of the permit weeks in 2022 averaged above the water quality standard of 395 mg/L.

### **Salt Savers Pilot Program**

The Salt Savers pilot program wrapped up in 2022 after running for about two and a half years in the Pumping Station 9 service area. The pilot was designed to study the feasibility of costs associated with administering a household softener rebate program. Highlights of positive outcomes from the pilot include:

- Training around 200 service providers on water softener efficiency best practices.
- Developing a home-diagnostic (“Self-Screen”) tool used by over 300 individuals throughout the pilot.
- Issuing rebates to about 200 addresses, reducing an estimated 45 pounds of chloride per day to the sewer system.
- Renewed partnership with owner communities leading chloride reduction activities.
- Building capacity for outreach and marketing among District staff.

Ultimately, the cost and level of effort to run the household incentive program related to the per-pound reduction outcome were high compared to other chloride reduction incentive programs previously tested, with the overall level of participation in the pilot rebate program fairly low. The full results of the pilot are summarized in a report.

### **Softener Service Professionals Training**

The District and Plumbers Union Local 75 agreed on a mutual interest in training plumbers on best management practices related to reducing chloride discharge from water softeners. The two parties will collaborate to integrate the District-developed “Salt Wise Soft Water” training materials and best practices into existing apprentice and continuing education curricula over the next few years. As well as providing resources for transitioning softener best management practices content into the standard plumbing curriculum, the District will consult with Local 75 as they build out the water quality lab at their new Madison training facility to include soft-water reduction equipment and test set-ups. This partnership will be promoted during a co-funded and co-produced episode of Building WI TV to air in early 2023. The episode will focus on communicating the urgent need for softener efficiency across Southern Wisconsin and give practical advice from plumbers on softener set-ups. It will also highlight plumbing as a career and careers in the building trades generally.

### **Chloride Reduction Innovation Grants**

No new innovation grants were awarded in 2022.

### **Wisconsin Salt Wise**

Wisconsin Salt Wise hosted a second annual Wisconsin Salt Awareness Week in early 2022. This event and many subsequent events and presentations throughout the year garnered significant positive media coverage, effectively spreading the WI Salt Wise messages. WI Salt Wise continued to focus on training and winter best management practices education this year; 237 individuals from 63 organizations around the state attended a training this year. Additionally, the partnership worked with many municipalities to host regional equipment open houses and monthly webinars on various topics to stimulate conversation about winter best management practices. The monthly webinars had over 1,00 views cumulatively.

The Wisconsin Salt Wise Coordinator position continued to be supported by a Fund for Lake Michigan Grant and partner contributions and was housed as an FTE Pollution Prevention Specialist staff position at the District.

### **Mercury Minimization**

Mercury levels remained low in influent, effluent and biosolids throughout 2022, averaging 0.92 ng/L in effluent (average of monthly grab sample n=12) and 0.3 mg/kg dry weight in GBT biosolids (average of 12 monthly composites samples). 2022 was consistent with values recorded in recent years. There were no unexpectedly high mercury values in influent, effluent or biosolids. All effluent mercury concentration values were below the District’s variance permit limit of 3.3 ng/L.

Source identification efforts for the year included special collection system sampling and a continued partnership with the U.S. Geological Survey (USGS) Mercury Research Laboratory

(MRL). Sludge samples are collected and analyzed during sewer cleaning and lining projects when feasible. By taking samples from various points in the collection system using this convenience sample method, we are starting to build an understanding of what are normal and high values. The work with MRL also helps better understand the remaining sources of mercury entering the treatment plant. This work uses isotope analysis to give an idea of whether any given sample has watershed mercury (usually not traceable, household signature, non-point) or industrial mercury (less degraded, indicates it is coming from a point source). Knowing the relative proportions gives clues as to where and how to focus source reduction efforts in the future.

Source reduction efforts in 2022 included continued annual dental amalgam certification, encouraging service area residents to take mercury-containing materials to Dane County Clean Sweep, waste handling standard operating procedure (SOP) development at the plant, and collaboration with the Wisconsin Department of Natural Resources (WDNR) small business assistance and hazardous waste staff to standardize and make more accessible mercury reduction resources for dental clinics and their regulators.

The District took action to improve its internal mercury waste handling through staff outreach and process standardization. Although much mercury-containing equipment (MCE) has been removed from the plant, maintenance staff occasionally encounter MCE (e.g., float balls) throughout the collection system, and newer maintenance staff may not be familiar with identifying such waste and what to do when it's found. Staff developed an internal mercury disposal SOP, which was delivered at a plant meeting in 2022. To formalize this work, the District solicited proposals from consulting firms for a comprehensive waste audit of the treatment plant. By contracting with a consultant with waste expertise, the District aims to improve its general identification and management of hazardous wastes at the plant, including MCE.

### **Non-Permit Compliance Pollution Prevention**

Pollution prevention initiatives not driven by permit compliance include work to identify sources of fats, oils and grease (FOG), per-and polyfluoroalkyl substances (PFAS) and clogs/wastewater garbage as part of the District's Toilets Are Not Trashcans campaign. These topics were included in public outreach ad hoc throughout 2022, with some attention to source identification.

## **PUBLIC EDUCATION**

The District's new strategic plan, approved by the Commission in August 2022, includes public trust as a performance area, citing the importance of transparency and having adequate social capital to effectively operate. Investing in public education is one way to work towards these goals. As pandemic precautions waned in 2022, public education activities transitioned back to the plant and outreach at community events.

### **Tours**

The District tour program was paused with the onset of the COVID-19 pandemic in 2020, and it remained on hiatus into 2022 to protect the health of visitors and staff. The District reopened for tours on a limited basis in the spring of 2022, opening up at first only to small groups and groups with essential business purposes. In July 2022, the District restarted First Friday tours, which are open to all members of the public and take place on the first Friday of every month at noon. In all, the District hosted 31 tours consisting of approximately 400 people in 2022. Groups included agency staff, trade apprentices, professional groups and youth enrichment organizations. Tours increased in frequency later in 2022, indicating the beginning of a return to normal for District tours.

### **Outreach**

With a slow start to tours and asks for District participation in community events early in 2022, the District took the opportunity to sponsor and send a group of staff to participate in the National Science Foundation Portal to the Public program, implemented through the Wisconsin Idea STEM Fellows program. Through workshops and coaching from science communication experts, staff worked on interactive exploration projects such as hands-on activities, exhibits and displays based on educational best practices for engaging with science topics.

Following the success of a very popular Master Recycler course in the community, the District partnered with the local non-profit organization Sustain Dane to develop and pilot the Water Stewards course. The program was designed to be an entry point for people to become more informed and aware of water issues in their community. This course covered the proper disposal of mercury and other hazardous wastes as a stewardship action. In total, 112 people participated in three instances of the course, including youth in UW Health's Health Occupations and Professions Exploration (HOPE) program.

It should be noted that although the primary emphasis on outreach is for pollution prevention, District outreach is not limited to these topics. Staff participated in a variety of engagements throughout 2022, including the Future Quest job fair, which focuses on building relationships with community organizations for the purposes of workforce development.

## **Shop One Development**

The first Shop One Artist/Educator in Residence, nipinet landsem, began work in February 2022. Bringing extensive experience as a community organizer and water protector into the role, nipinet helped define the residency and see it through a very successful first year. They initiated connections and conversations with many new audiences through a series of focus group dialogues and public events organized around different themes and affinity groups. Additionally, a supporting social media brand, @onewatermadison, was created to open up direct conversations around topics that residents care about. nipinet synthesized the water connections uncovered throughout the dialogues through a series of zines and illustrations. With the goal of engaging and empowering water stewards, this residency helped connect District staff to the community in a different way than they have previously – to both listen and share.

Halfway through the year, as part of preparing to hire the next resident artist/educator, the District developed a standing request for proposal (RFP) process for equitably and transparently engaging with community members as experts to help select artists for community-oriented projects. Given the goals of Shop One, bringing the community into the selection processes fairly was an important step in the evolution of this program and will set future residencies up for continued success. By the end of 2022, the community panel approach got its first run and successfully selected a resident artist/educator for 2023.

This work was recognized by the US Water Alliance when multiple District staff and the 2022 Artist/Educator in Residence were asked to be part of a special arts and culture delegation at the US Water Alliance's OneWater Summit in the fall of 2022.

## **INDUSTRIAL PRETREATMENT PROGRAM**

When added to sewage, certain substances can impact worker health and safety, the biology of the treatment plant, the quality of Metrogro biosolids, the operation of sewers and pumping stations and water quality in the receiving streams. The District's industrial pretreatment program helps to ensure that toxic substances are kept out of the sanitary sewer system. The program enforces the sewer use ordinance, operates a permitting program and implements pollution prevention and source reduction initiatives.

The core of the permitting program is maintaining relationships with the current 18 significant industrial users with categorical wastewater processes or with discharges affecting pollution prevention initiatives. All industrial permittees submitted self-monitoring reports, and compliance monitoring of regulated wastewater discharges occurred in both semiannual periods. There were no instances of significant noncompliance by permittees or other users in 2022.

The industrial pretreatment program also maintains an additional 21 permits for non-typical organic industrial users and permits with 38 waste haulers. All waste haulers that use District

facilities must have a District-issued permit to discharge hauled waste. All permits are renewed annually on September 1. Staff members continued to perform waste acceptance reviews and respond to non-permitted industrial, hauled waste and other waste acceptance requests.

**ACCEPTANCE OF SEPTAGE AND OTHER WASTEWATERS**

Hauled wastes have been accepted at Nine Springs Wastewater Treatment Plant since 1986. In 2022, the District accepted waste from 38 permitted septage haulers. The haulers are charged a specific rate for each category of septage or type of hauled wastewater that reflects the District’s cost of treating the material. In 2022, hauled wastewater treatment revenue exceeded \$1,077,000. Approximately 39 million gallons of wastewater were received via truck in 2022.

Table 4 lists the five domestic septage categories, the number of gallons of septage received during 2022, and the percent increase or decrease in volume from 2021 to 2022.

**Table 4 – Domestic Septage Received (Gallon)**

<b>Septic Tank</b>	<b>Holding Tank</b>	<b>Grease Trap</b>	<b>Settling Basin</b>	<b>Portable Toilet</b>
11,240,000	18,313,000	2,111,000	283,000	558,000
7% decrease	1% decrease	42% increase	4% decrease	12% increase

The hauled waste receiving facility, and, infrequently, the whey well are the discharge points for other wastewater not characterized by the five domestic septage categories. In 2022, other wastewater types and volumes received are listed in Table 5.



**Table 5 – Other Wastewater Types Received**

<b>Wastewater Received</b>	<b>Volume (gal)</b>
Village of Belleville Biosolids	714,000
Refuse Hideaway Landfill Leachate	24,000
Middleton Landfill Leachate	10,000
Verona Landfill Leachate	549,000
Meat Processing Industries	806,000
Other Gray Water	486,000
Grocery Store Food Waste	51,000
WVDL Tissue Digester Residue	9,000
Dane County Landfill RNG Tower Flush	1,478,000
Dewatering from City of Madison Dredging	563,000
Whey Processing Wastewater	1,827,000
Other Industrial Wastewater	80,000

### **LAGOON SITE PROJECT**

Routine inspections, operations and maintenance activities continued on the lagoon site project in 2022. These activities included monthly visual inspections of capped areas and containment dikes, water management and vegetation control. Vegetation control in 2022 consisted of removing downed trees and mowing the dike roads and capped cells, as ground conditions permitted. In the spring and fall of 2022, the District continued its nuisance-wildlife management program to remove muskrats and woodchucks and protect dike integrity from rodent burrows. The U.S. Environmental Protection Agency (EPA) Region V conducted a five-year review of the lagoon site in 2022. The five-year review fulfills a statutory requirement on the part of the EPA and includes both a site visit and an inspection.

## **WATERSHED PROJECTS**

### **Yahara Watershed Improvement Network**

In 2022, the District-led Yahara Watershed Improvement Network (Yahara WINS) adaptive management project completed its sixth year of the full-scale project aimed at reducing sources of phosphorus in the Yahara River watershed over the next 20 years. The Yahara WINS partnership has successfully funded projects directly or indirectly that have resulted in hundreds of urban and agricultural practices like cover crop planting, strip tillage and leaf management. It is anticipated that when all the phosphorus reductions are calculated for 2022, there will be even greater success than in 2021.

Yahara WINS launched a new podcast in 2022, Soil+Water: Conservation Conversations, that can be found on the website. [www.yaharawins.org](http://www.yaharawins.org). The most up-to-date information on phosphorus reductions can also be found on the website in the annual report, published on or before June 30 each year.

### **Watershed Monitoring Program**

The District conducts monitoring activities in both the Yahara and Sugar River watersheds to help assess the overall condition of our receiving streams. Monitoring initiatives include the collection of water chemistry samples and evaluating the fish and macroinvertebrate communities to determine the biological health of select streams. In 2022, District staff collected water chemistry samples and conducted fish and macroinvertebrate surveys. All water chemistry samples were analyzed at the District's laboratory. Fish identification and analysis were done with the help of a consultant. Macroinvertebrate samples were sent to the University of Wisconsin–Stevens Point for sorting and classification.

In general, stream water quality, as measured by water chemistry, was like the previous year. The 2022 data showed a modest increase in fish species compared to 2021 due to the unusual 2021 climatic conditions, including drought, heat and significantly lower stream flows.

The District also has joint funding agreements with USGS for two gauging stations in the Yahara River watershed and two in the Sugar River watershed. The stations in the Yahara River watershed are used for traditional flow measurements. The stations in the Sugar River watershed are used for flow, temperature, dissolved oxygen and conductivity measurements.

## LABORATORY SERVICES

In 2022, the District laboratory performed 69,257 analyses on 16,401 samples.

**Table 6 – Analyses Performed in 2022**

<b>PARAMETERS</b>	<b>QUANTITY</b>
Nutrients (TKN, TP, NH3-N, PO4-P, WEP)	21,963
Solids (Suspended, Total, Dissolved)	23,760
Biochemical Oxygen Demand	4,713
Anions (Cl, NO3-N, NO3+NO2, NO2-N, SO4)	5,082
Field Measurements (pH, TEMP, COND, DO)	3,960
Metals	6,056
Bacteria (FCOLI, TCOLI, ECOLI, Salmonella)	1,297
Volatile Fatty Acids (VFA)	1,022
Misc. Testing (Alkalinity, Density, Chlorophyll, CH4, WET)	1,404

The District laboratory continued to support the following activities in 2022:

- The laboratory analyzed 916 samples in support of the Yahara WINS adaptive management project. Of these samples, 341 were collected by citizen volunteers.
- The laboratory provided analytical support for several District-sponsored research pilot projects conducted with the University of Wisconsin-Madison. These projects are investigating potential opportunities for the District to reduce energy demands while maintaining or increasing the level of treatment. The laboratory analyzed 2,925 samples and performed 8,255 analyses for these projects. The lab values the importance of this partnership and strives to support these pilots.
- Chloride testing was completed daily on all five main pumping stations for the months of January, February, March, and December. This testing was in support of pollution prevention efforts.

Other noteworthy activities in the laboratory during 2022 were the following:

- Throughout 2022, the lab continued to provide influent and pumping station samples to

test for SARS-CoV-2 in wastewater to assist in local and national surveillance initiatives. Data from these provided samples can be viewed on the Wisconsin Department of Health Services (DHS) and National Wastewater Surveillance System dashboards.

- In 2022, the District progressed to Phase 2 of the PFAS Action Plan. This phase involved further sampling and analysis of PFAS compounds in influent, effluent and biosolids, building upon the initial data from 2021. The collected data provides additional insight into the PFAS compounds entering the District and their ultimate disposition.
- The lab acquired a new CETAC M-8000 mercury analyzer to comply with District initiatives for platform upgrades in March 2022. The analyzer features an upgraded detector and software. This transition to a familiar instrument allowed the lab to minimize downtime effectively.
- In March 2022, the lab upgraded the technology used in hexavalent chromium analysis from a spectrophotometer to an autoanalyzer. With this change, the lab could perform the test more time-efficiently and cross-train more readily, allowing for more redundancy in testing capabilities.
- In May 2022, the replacement for the BOD AutoEZ, the Skalar SP2000, was installed. Soon after, process and method development steps began so the lab could transition to this new instrument and technology.

# ENGINEERING

The Engineering team provides design and construction administration services to other departments and advisory services to District teams to build safe, reliable, cost-effective infrastructure.

## Staffing

The Engineering department began 2022 with nine full-time employees:

- Director of Engineering
- Project Engineer (4)
- Electrical Engineer (2)
- Collection System Engineer
- Project Coordinator

The Commission approved the addition of three project engineer positions to the department on March 17, 2022. Recruiting for the three positions began shortly thereafter; one of the new positions was filled in September 2022, and one in December 2022.

In September 2022, the director of engineering resigned, and the position was filled by promoting one of the department's incumbent project engineers. At the end of 2022, the department had 10 full-time employees and two vacant positions:

- Director of Engineering
- Project Engineer (5)
- Project Engineer (2 vacant positions)
- Electrical Engineer (2)
- Collection System Engineer
- Project Coordinator

Most engineering positions are filled with registered professional engineers (PE). The exceptions are one newly hired project engineer who is not yet eligible to become a PE and the project coordinator. All professional engineers are ISI-Envision credentialed sustainability professionals.

## Responsibilities of Workgroup

The Engineering department oversees the planning, design, construction and commissioning of all major capital improvement projects at the District. This includes engineering functions encompassing civil, structural, mechanical, plumbing, electrical, controls and HVAC disciplines. These projects range in value from less than \$50,000 to \$50 million or more. Depending on the

scope of the work, smaller capital projects are typically planned and designed in-house, whereas consulting services are utilized for larger projects. These consulting services are retained and managed by department staff. Similarly, the Engineering department typically assumes the lead role during project construction, performing all construction management duties and utilizing consulting services for field support as needed.

The department also manages condition assessments and rehabilitation of the gravity and force main portions of the collection system. This includes developing an inflow and infiltration (I/I) reduction program; annual televising and cleaning projects within the collection system; collection system maintenance projects; manhole rehabilitation projects; and condition assessment of the force mains. Other duties performed by the Engineering department include:

- Assistance with long-range asset management, capital planning and budgeting.
- Assistance with large maintenance projects.
- General assistance to the Operations and Maintenance (O&M) department.
- Response to emergency and high-flow events.
- Utility coordination and administration.
- Coordination with other municipalities (e.g., City of Madison) and agencies (e.g., Wisconsin Department of Transportation (WisDOT)).
- Process control programming and HMI (i.e., computer control screen) design.
- Real estate and property issues
- Facility transfers

## Programs, Initiatives and Work Reporting

### **INFLOW & INFILTRATION (I/I) PROGRAM UPDATE**

In 2020, the District began developing a regional I/I reduction program plan. I/I reduction provides value to the District and owner communities over time by increasing resilience to changing weather patterns, deferring needs for capacity increases, improving system performance and meeting regulatory requirements. The Commission supported a timeline of program work and costs planned through 2026. Program activities are proceeding as planned. An advisory committee comprised of six owner communities was formed in 2020 to provide feedback to the District during the development of the program framework. Work with the advisory committee continued in 2021 and 2022.

Additional program work was completed in 2021 and 2022. The District's hydraulic model was converted from the urban water modeling software MIKE Urban to PCSWMM, and calibration was completed in 2021. In 2022, the updated model was used to identify capacity limitations in the District's collection system under several scenarios ranging from current conditions to

future flow with increasing rates of I/I. High-level cost estimates were prepared for capacity improvement needs and I/I reduction under each scenario.

The next phase of the work for 2023 will focus on developing a flow monitoring program plan, creating technical and educational resource materials, and continuing work with the advisory committee. Expanding flow monitoring is essential for identifying areas to focus I/I reduction efforts; I/I reduction is most cost-effective in areas with high I/I.

Initial work on the I/I program was done with the assistance of Brown and Caldwell. As 2023 was approaching and Brown and Caldwell's scope of work was drawing to a close, an RFP was developed for the subsequent phases of work for 2023 through 2025. On Nov. 8, 2022, the District posted an RFP for engineering consulting services associated with the I/I reduction program for 2023 through 2025. Three proposals were received on Dec. 15, 2022. Selection of a consultant will be completed in January 2023, with continuing work on the flow monitoring program and technical and educational resource materials anticipated to continue for 2023.

## **ENGINEERING AND CONSTRUCTION**

### **Grass Lake Dike Restoration**

In 1958, the District constructed various improvements to discharge effluent to the Badfish Creek waterway, the most significant being an earthen dike approximately 5,000 feet in length along the western edge of Grass Lake. The dike was constructed to divide Grass Lake and the effluent discharge waterway.

In 1988, a permit to maintain the dike and effluent ditch was granted to the District. Conditions of the permit required perpetual maintenance of the bank slopes. Over the decades, portions of the dike banks have eroded. Bank subsidence occurred in many locations, along with minor damage from animal burrows.

An RFP for bank evaluation and design services was developed, and the work was awarded to Cardno in August 2018. Due to issues associated with floodplain management, COVID-19 and permitting, the design phase of the work took longer than anticipated, going into mid-2022. The project was bid in July 2022, with the Commission awarding the contract to Resource Environmental Solutions for a bid price of \$489,616. Construction activities began in September 2022 and were substantially complete by the end of 2022. Throughout construction, there were six change orders totaling \$4,016.43 (+0.82%), resulting in a final construction cost of approximately \$493,632.43.

### **Lagoon Dike Improvements**

Until the early 1980s, the area of ponds (known as the lagoon area) immediately east of the Nine Springs Treatment Plant served as storage for biosolids produced at the plant through the treatment process. Following updates to the treatment plant process and biosolids storage, biosolids began to be cleaned out of the lagoons in the early 1990s. The western portion was

reconstructed to provide habitat and recreational opportunities, while also serving as an overflow for treated effluent during high flow events. The eastern portion remained as a storage area for previously placed biosolids that contained PCB levels above the allowable reuse limit.

To date, current maintenance has included mowing and controlled burns to control invasive plants, tree and brush growth; nuisance animal control of geese and woodchucks; and building up of the low areas of the dike roads with a mixture of woodchips and soil, topped with a thin layer of road gravel.

During an extreme high-flow event in August 2018, the Nine Springs Creek reached record levels near the southern dike roads of the eastern lagoon area, and leaks formed on the southern dike road, causing water from Nine Springs Creek to enter the lagoon area. This event, which required emergency repairs, highlighted the need to consider the resilience of the dikes during future high-water events. An RFP to conduct an engineering study was developed to evaluate the dikes surrounding the lagoon and provide recommendations to ensure the dikes have adequate freeboard and resilience from weather events in the future.

The work was awarded to Golder Associates, Inc. in March 2021, and field data gathering and an engineering study began. An alternatives analysis was completed in 2022. Further study, coordination with regulatory entities, and a final design are anticipated to be ongoing in 2023-2024. The project is expected to move into the construction phase in 2025.

### **Liquid Processing Improvements – Phase 2**

The 2016 Liquid Processing Facility Plan recommended improvements to the liquid processing facilities to be implemented in phases over a 10-plus-year period. The first construction phase, Nine Springs Liquid Processing Improvements – Phase 1, was completed in 2021. Phase 2 is focused on the existing activated sludge process equipment that is at the end of its useful life and needs to be replaced. This presents an opportunity to potentially reduce energy demands and effluent total nitrogen by potentially implementing a biological nutrient removal (BNR) process configuration that reduces aeration and pumping requirements. The overall project includes five sub-projects:

- East Primary Influent Channel Air Piping Replacement: Replacement of the piping supplying pressurized air to the wastewater so that the solids remain suspended until they reach the primary settling basins.
- Low Dissolved Oxygen (Partial Plant): Testing low dissolved oxygen (DO) use at full scale on a portion of the biological nutrient removal process. Test results will be used to determine if the low DO process changes can be implemented in the entire secondary treatment process.
- Low Dissolved Oxygen (Full Plant): Implement a low DO biological nutrient removal process on a plant-wide basis, assuming successful pilot scale testing of the process.



- West Blowers and Switchgear Replacement: Replacement of all three west blowers and associated switchgear, which have been in operation for more than 35 years.
- East Blowers and Switchgear Replacement: Replacement of the east blowers and associated medium-voltage switchgear. Some of this equipment has been in service for more than 50 years.

An RFP for engineering consulting services was issued in September 2022. Three proposals were received in November 2022, with the selection process ongoing at the end of 2022. Following the approval of the selected consultant in January 2023, the alternatives analysis and preliminary design will begin. The preliminary design is anticipated to be completed near the end of 2023, followed by a detailed design. The project is anticipated to be designed and constructed in two phases, with the first phase beginning construction in late 2024 and the second beginning construction in 2027. The project is anticipated to be completed in 2027.

### **West Interceptor Shorewood Relief**

The District's West Interceptor system is a complex network of sewers that provide service to the near west side of the City of Madison, the City of Middleton, the Village of Shorewood, and the Town of Westport. The system generally comprises two or three parallel sewers extending westward from Pumping Stations 2 and 8.

The majority of the West Interceptor system has adequate long-term capacity. However, several areas of the system need additional capacity. These sections comprise approximately 11,500 feet of sewer near the Village of Shorewood Hills, along University Avenue between Walnut Street and Whitney Way.

The West Interceptor Shorewood Relief project will provide additional capacity to convey projected future flows from the District's west side service area, including expected growth in the City of Middleton and the Town of Westport. Due to the size and complexity of the project, the design and construction of the relief sewer is occurring in three phases over several years.

Planning of the overall project, detailed design and bidding for the construction of Phase 1 was completed in late 2020. The Commission awarded the contract to Advance Construction, Inc. in January 2021 at a bid price of approximately \$3,410,500. Phase 1 construction activities began in the spring of 2021 and continued throughout the summer and into the fall. There were construction delays due to Hobas pipe shortages, extending the substantial completion date to March 2022. At the end of 2022, most punch list items were complete, with only one outstanding item (fencing) to be completed in spring 2023. The final construction cost is anticipated to be approximately \$3,472,000 (+1.8%).

Phase 2 of this project was designed throughout 2021, and construction began as a part of a WisDOT project on University Avenue in May 2022. Ongoing construction was delayed by factors in work related to WisDOT items, including delays in the delivery of retaining wall

panels and a pedestrian steel truss bridge. At the end of 2022, outstanding District work included relocation of the relief sewer in University Bay Drive to make way for the pedestrian bridge; extending the West Interceptor Shorewood Relief Phase 2 pipe across University Bay Drive; and manhole rehabilitation at Shorewood Drive and University Avenue. Phase 2 construction is expected to be completed by October 2023.

Detailed design of Phase 3 of the project began in October 2022. It was originally intended to be constructed in 2023; however, with WisDOT's work incomplete on University Avenue and some of the District's work being challenging to coordinate with WisDOT's work, the construction schedule for Phase 3 was moved to 2024. Design of Phase 3 will be completed in 2023.

### **Lower Badger Mill Creek Interceptor – Phases 5 and 6**

The Lower Badger Mill Creek watershed is located along the District's westerly boundary. It includes lands in the Town of Middleton, Town of Verona, City of Madison, and City of Verona. This area has and will continue to have a great deal of growth. In the early 2000s, the District began planning to serve this area in conjunction with the affected municipalities. A design was completed for the entire corridor from Pumping Station (PS) 17 to Midtown Road in 2006. Portions of the collection system north of Midtown Road were constructed by the City of Madison and included various temporary lift stations that would be necessary until the ultimate design was built out. Currently, the Midtown Road station, owned by the City of Madison, remains and is reaching capacity. This project is also related to other projects, including improvements at PS 17 and the PS 17 Force Main Relief, which will handle the increased flows to PS 17 due to the flow from this watershed.

Various portions of the Lower Badger Mill Creek Interceptor have already been completed in three phases, extending from PS 17 to County Highway (CTH) PD. The last legs of the interceptor that need to be completed are Phase 5 (from CTH PD to Shady Oak Lane) and Phase 6 (from Shady Oak Lane to Midtown Road). Phase 5 will be closely coordinated with a Veridian Homes development that the interceptor will traverse. Phase 6 will involve some challenges, including a route through private property backyards, proximity to an intermittent stream, karst geology, and proximity to a cave feature.

In June 2022, an RFP was prepared to solicit design services for Phases 5 and 6. The District received five proposals, and raSmith was awarded the work by the Commission on Sept. 15, 2022. Initial work by raSmith started in late 2022. It included preliminary design to develop a final alignment; determining additional efforts to mitigate environmental and corridor concerns such as wetlands, waterways, archaeological, geological/speleological (bedrock and caves); and understanding real estate acquisition needs.

An in-person open house was held for the project in December 2022. Work planned in 2023 includes final design and construction of Phase 5, and final design, permitting and real estate

acquisition for Phase 6. Construction of Phase 6 is anticipated in 2024.

### **Pumping Station 17 and Relief Force Main**

The original Pumping Station 17 (PS 17) and associated force main were commissioned in 1995 as a cost-effective and regional solution to meet Verona's wastewater needs. As the City of Verona, the Town of Verona and the City of Madison continue to develop areas surrounding the current PS 17 service area, increased capacity needs of PS 17 are being realized.

Completing the Lower Badger Mill Creek Interceptor will reroute a significant amount of current (and future) flow from Pumping Stations 12 and 16 to PS 17. By 2040, the required capacity for PS 17 is estimated to be 11.82 million gallons per day (MGD), far exceeding the current firm capacity of 4.6 MGD. Therefore, a major capacity upgrade of PS 17 is necessary, as well as an upgrade of the existing 16-inch diameter force main, which has a maximum capacity of approximately 8 MGD.

The Pumping Station 17 and Relief Force Main project includes rehabilitating PS 17 and constructing a new PS 17 relief force main (PS 17 RFM), which is designed to work with the existing force main to handle the estimated future flows from this area. The PS 17 RFM is being designed and constructed in two phases, with Phase 1 completed in conjunction with the City of Verona's Eastside Interceptor. With both utilities located in the same corridor, coordinating the design and construction of PS 17 RFM Phase 1 with the City of Verona allowed for economies of scale and cost savings by sharing a common topographic survey, design, mobilization and administration with the City.

Design of PS 17 RFM Phase 1 was completed in 2020 by Short Elliott Hendrickson Inc., and the construction was completed in the fall of 2021 by Minger Construction Co., Inc. PS 17 RFM Phase 1 included nearly 7,000 lineal feet of 24-inch diameter force main, with an original bid price of approximately \$2,952,000 and a final construction cost of approximately \$3,001,000 (+1.6%).

The design of PS 17 rehabilitation and the PS17 RFM Phase 2 began in October 2021 by MSA Professional Services, Inc. The second phase of the PS17 RFM is anticipated to consist of approximately 8,000 lineal feet of 24-inch force main and 3,400 lineal feet of 36-inch gravity interceptor to connect to the East Nine Springs Interceptor along US Highway 18/151 near Goose Lake. This corridor has a variety of environmental and archeological permitting challenges.

During 2022, final design continued, and the real estate acquisition process began for the needed utility and temporary construction easements. Bidding of the project is anticipated in May 2023, with construction expected to continue through the winter of 2024-2025. Winter construction is desirable for this project due to permitting and construction constraints related to the presence of wetlands along the alignment. Bidding of the PS 17 rehabilitation is expected in late summer 2023, with anticipated completion in 2025.

### **Operations Building 1<sup>st</sup> Floor Remodel**

A portion of the Operations Building's first floor (approximately 5,000 sq. ft.) was identified as underutilized and inefficient during a 2013 space needs study conducted by Bray Architects. Other issues, such as public/disabled access and building security, were also identified as concerns. A remodel of the area was added to the 2021 Capital Improvements Plan to solve these issues. Major goals of the project included:

- Better security for the lab and operator area.
- Better functionality of the operator area.
- Increased lab safety, including limiting entrance to only those who need to be in the lab.
- More efficient use of space: Before the project, some lab space was underutilized, while more cohesive areas for the Ecosystem Services and Operations departments were needed.
- A more inclusive workplace: Before the project, the building entrance for people with mobility issues was separate from the main entrance. This created two public entrances to the building and required those with accessibility issues to traverse through hallways and staff areas to reach the front desk. A single, revitalized and welcoming public entrance for everyone was desired.
- Improved working conditions and a healthy workplace that promotes employee engagement and satisfaction, including a common cafeteria area separate from work areas and conference rooms. A cafeteria was desired as a healthier place to eat and a place for informal meetings and collaboration.

In September 2019, Engberg Anderson Architects were retained to assist with planning and design of the Operations Building 1<sup>st</sup> Floor Remodel project. This included a space-needs study, adjacency investigation, evaluation of alternatives, conceptual design and detailed design. This planning and design work was completed in the summer of 2020, and the construction project was bid out and awarded to Kenneth F. Sullivan Co. in August 2020 for a bid price of \$1,566,525. Construction activities began in the fall of 2020, continued through 2021, and were completed in July 2022, with a final construction cost of approximately \$1,628,300.96 (+3.9%).

### **Pumping Station Rehabilitations**

In 2011, the District updated its Collection System Facilities Plan, which included a condition assessment of all District pumping stations across six major categories: peak flow capacity; firm flow capacity; power system redundancy; mechanical condition; structural integrity; and electrical condition. Across the six categories, Pumping Stations 4, 13, and 14 received the highest priority for improvements among the District's pumping stations, indicating the need to prioritize the rehabilitation of these stations in the near term.

Pumping Station 4 (PS 4) is part of the South Interceptor system and provides service to the City of Madison and the Town of Madison. The station was placed into service in 1967, and pumps flow directly to the NSWTP through a parallel system with Pumping Stations 2 and 3. The current firm capacity of PS 4 is 4.2 MGD; following rehabilitation, the firm capacity will be 5.5 MGD.

Pumping Station 13 (PS 13) and Pumping Station 14 (PS 14) are located along the Northeast Interceptor (Waunakee/DeForest Extension), which serves the northerly portions of the collection system, including the north side of the City of Madison and the villages of Waunakee and DeForest. PS 13 and PS 14 were placed into service in 1970 and 1971, respectively, and PS 14 pumps its flows to PS 13. The current firm capacity of PS 13 and PS 14 is 20.0 MGD and 15.0 MGD, respectively, and following rehabilitation, the firm capacity will be 29.4 MGD and 20.2 MGD, respectively.

Typical of District pumping station rehabilitation projects, the PS 4, PS 13 and PS 14 projects include the installation of new pumps; enhancement of power system redundancy; replacement of major electrical and control equipment; installation of new HVAC systems; replacement of manual valves and gates; installation of new flow metering equipment; installation of generators; and wet well repairs. Due to their proximity and interconnectedness, PS 13 and PS 14 were selected to be designed and rehabilitated together.

Planning and design for PS 13 and PS 14 were completed in the summer of 2020 by Strand Associates, Inc., and the construction project was awarded to C.D. Smith Construction Inc. in August 2020 for a bid price of approximately \$9,277,000. Construction activities began in late 2020 and continued through 2021 and 2022, with delays partly due to supply chain disruption for procuring pumps and motors. Substantial completion is expected in January 2023, with final completion expected in August 2023. The final construction cost is anticipated to be approximately \$9,340,000 (-0.7%).

Planning and design for PS 4 began in April 2021 by Applied Technologies, Inc. The construction project was bid in November 2022 and awarded to J.F. Ahern for \$3,883,000 on Dec. 15, 2022. Construction is anticipated to begin in 2023, with final completion in August 2024.

### **2021 Treatment Plant HVAC Improvement Project**

This project aims to upgrade and replace aging HVAC systems in various buildings at the treatment plant. Many systems are aging, not working as designed or not functioning at all, not meeting applicable codes, and may pose risks to workers. A consultant performed a comprehensive study of the systems in 2020 and compiled a prioritized list of the most deficient systems. The first project will include improvements in the Gravity Belt Thickener Building, Dissolved Air Flotation Thickener Building, Metrogro Pumping Station and Headworks Building control room. Other plant areas will be addressed in future projects.

Strand Associates was retained in October 2021 to design the project. Work continued in 2022, and the project was put out to bid in November 2022. The work will be awarded in January

2023 to Illingworth-Kilgust Mechanical for \$1,994,000. Construction is expected to be complete in 2024.

### **Electrical Service Equipment Replacement**

This project aims to replace the incoming H1 switchgear, transformers and busway system, and S1 switchgear for the incoming electrical service to the treatment plant. This equipment steps down incoming voltage from Madison Gas and Electric (MG&E) from 13.8 kV to 4.16kV for use in the plant, distributes power, and isolates and protects equipment. All of this equipment was installed in the mid-1980s and is approaching the end of its useful life.

An RFP for consulting engineering services was prepared and posted in July 2022. Proposals were received from four firms; Donahue & Associates was selected and awarded the work by the Commission on Sept. 29, 2022. Work began on the project in the fall of 2022. In December 2022, a workshop was held to determine the selected alternative. The selected alternative consists of eliminating Switchgear H1; replacing the two transformers with new transformers with close-coupled breakers; replacing the bus duct with cables in an underground duct bank; and replacing switchgear S1 in a new electrical building located north of the Effluent Building.

Design will be ongoing in 2023. The anticipated total project cost will be approximately \$12,100,000, which is higher than anticipated due to continued inflation and demand for electrical equipment following the pandemic supply chain disruption. It is expected that the project will be bid in early 2024. Lengthy equipment lead times are predicted, so construction on site is anticipated to begin in mid-2025 and extend to mid-2026.

### **Flow Splitter Improvements**

The flow splitter structure within the plant is located immediately downstream of the grit removal tanks at the Headworks facility and was built in 2005 as part of the Tenth Addition. It allows for the controlled splitting of flow between the east and west plants. Flow rises within the structure and spills over weirs that empty into channels that connect pipes leading to the east and west plants. Flow is controlled to each plant via the placement of stop logs in the channels. A video inspection of the structure in February 2021 revealed that portions of the metal components and portions of the concrete walls of the splitter are in poor condition, likely due to a hydrogen sulfide attack. This is a critical hydraulic control structure in the plant, and failure would severely limit the plant's ability to properly treat and manage flows. For this reason, this project was initiated to rehabilitate or replace the flow splitter.

An RFP for engineering services was prepared and posted in December 2022. In 2023, it is anticipated that a consultant will be selected, and the design will progress such that bidding can occur in early 2024.

### **Pumping Station 6 to Pumping Station 10 Connector**

This project involves the potential diversion of wastewater between Pumping Station 6 (PS 6) and Pumping Station 10 (PS 10). A connection may be feasible because these pumping stations are relatively close geographically, and the operating elevations in the wet wells are similar. This interconnection has long been desired to increase the redundancy of facilities during emergency situations, most notably if there were a problem with the PS 6 or PS 10 force mains. Preliminary planning efforts identified several options for the interconnection, including a gravity option, force main option, or a combination of these. However, further work is needed to confirm the hydraulic feasibility of this and look at constructability issues and costs. Once an alternatives analysis is complete, the District will decide whether to proceed with the project and begin the more detailed design process.

In May 2022, an RFP was prepared to solicit engineering services for the project. Three proposals were received, and Brown and Caldwell was awarded the work at the July 28, 2022, Commission meeting. The alternatives analysis is intended to be completed in the first quarter of 2023. If the decision is made to proceed with the project, construction is anticipated in 2024.

### **Northeast Interceptor – Waunakee Extension Capacity Improvements (Phase 1)**

The existing Northeast Interceptor – Waunakee Extension is located between the Yahara River and Village Center Pond in the Village of Waunakee. It traverses lands in the City of Madison, Town of Westport and Village of Waunakee. It is a 10- to 30-inch diameter concrete sewer constructed in 1971 and is approximately 26,000 feet long. Previous studies by the Capital Area Regional Planning Commission (CARPC) in 2009, 2012 and 2018 indicated that portions of the sewer will reach capacity before 2030. Other portions are anticipated to reach capacity by 2030, and still others beyond 2040.

It is anticipated that additional needed capacity may be achieved with either a relief sewer constructed parallel to the existing sewer, a replacement sewer sized for future flows, or a combination of these. The project is expected to be constructed in three phases, with the portion having the most urgent capacity needs to occur first. The first phase extends approximately from manhole (MH) MH315 near the intersection of Highway 113 and County Road M, to the railroad crossing of the interceptor at MH14-333, a pipe length of approximately 8,940 feet.

An RFP for design services was prepared and posted in May 2022. Intended design work includes an alternatives analysis and preliminary design for the entire corridor, from the Yahara River to the north end. Following these steps, a detailed design of Phase 1 would occur. It is anticipated that construction of Phase 1 will begin in late 2023 or in 2024. Five proposals were received, and the Commission awarded Strand Associates the work on June 30, 2022. As of the end of 2022, work was progressing on the alternatives analysis, and an initial public meeting is planned for January 2023.

### **West Interceptor Extension Repairs – Allen Boulevard**

The District's West Interceptor Extension was constructed in 1957 and extends from Marshall Park in the City of Madison to Baskerville Harbor in the City of Middleton. The interceptor is reinforced concrete pipe, with pipe sizes ranging from 14 to 30 inches in diameter. A routine inspection of this sewer by closed-circuit TV in December 2021 revealed that several 30-inch diameter pipe segments had settled along Allen Boulevard, just west of the District's Pumping Station 15. The settlement caused the joints to separate and partial obstructions from grease and rags to form in the pipe.

MSA Professional Services, Inc. was retained in April 2022 to prepare plans and specifications to repair the damaged infrastructure. Initially, it was assumed that the design and repair cost would be low enough to be funded out of the operating budget. However, as the design progressed, it became apparent that the project would be more costly, partly due to the anticipated need for detailed traffic control of Allen Boulevard, a county highway, and the bypass pumping of wastewater. On Aug. 25, 2022, the Commission approved a resolution to amend the 2022 Capital Projects Budget to include this project with a total project cost of \$500,000.

The project was advertised for bid in November 2022; five companies were prequalified to bid, and bids were opened on Dec. 1, 2022. The low bidder was Terra Engineering and Construction Corporation, with a bid of \$530,850. The Commission was also requested to increase the total project cost from \$500,000 to \$725,000 to account for the higher-than-anticipated bid. The project is expected to begin construction in the spring of 2023 with a mid-summer 2023 completion.



# MAINTENANCE OF DISTRICT FACILITIES

This department protects human health and the environment by ensuring that all wastewater generated in the District's service area is safely conveyed to the Nine Springs Wastewater Treatment Plant. They then recover the resources of clean water, biosolids, biogas and phosphorus fertilizer.

## Staffing

The Maintenance workgroup has 45 full-time employees:

- Maintenance and Reliability Manager
- Collection System Supervisor
- Collection System Services Worker (6)
- Electrical Maintenance Supervisor
- Electrician (7)
- HVAC Technician (2)
- Facilities Maintenance Supervisor
- Facilities Maintenance Worker (9)
- Facilities Maintenance Trainee (1)
- Mechanical Maintenance Supervisor
- Mechanic/Lubrication Technician (9)
- Metrogro Operations Supervisor
- Metrogro Mechanic (2)
- Biosolids Program Assistant
- O&M Succession Planning Position (2)

## Responsibilities of Workgroup

The workgroup's primary responsibilities are as follows:

- Conducting preventative, predictive and reactive maintenance activities at the treatment plant, pumping stations, and the collection system.
- Monitoring and sampling collection system wastewater for customer billing.
- Locating District utilities as part of Digger's Hotline program.
- Facilities management of District properties and buildings.
- Biosolids processing, handling and disposal.

## Programs, Initiatives and Work Reporting

### **WORKFORCE DEVELOPMENT PROGRAM**

In 2022, the department implemented two programs to promote workforce development: the Trainee and Succession Planning programs.

The Trainee Program provides on-the-job training to people who may not have experience in the trades but show good potential. Though open to everyone, the program includes strategies to recruit candidates from nontraditional backgrounds, such as people of color and women. The program has developed two successful facilities maintenance team members in just one short year.

The Succession Planning Program is designed to identify and anticipate near-term staffing needs due to retirements. Two positions were a part of the program in 2022 – an operator position and an electrical maintenance position.

Multiple associations recognized the success of these programs, including a National Association of Clean Water Agencies (NACWA) award for Workforce Development.

### **MAINTENANCE WORKGROUPS**

The Maintenance workgroups of the Operations and Maintenance department are responsible for the maintenance of the Nine Springs Wastewater Treatment Plant (NSWWTP), District and non-District pumping stations, the District's interceptor system, and the District's rental properties. This work is performed by the Facilities Maintenance, Electrical Maintenance, Mechanical Maintenance, and Collection System Services sections. Additionally, the workgroup includes the Metrogro Operations section responsible for biosolids' resource recovery disposal.

### **FACILITIES MAINTENANCE**

The Facilities Maintenance section spends most of the year maintaining the District and non-District pumping stations, NSWWTP facilities and grounds, odor control equipment, roads and small equipment. Routine work includes landscaping projects; treatment tank maintenance; cleaning plant buildings and galleries; maintaining lagoon and dike roads; painting, plumbing and carpentry projects; lawn mowing and maintenance; and snow plowing. This section also performs preventive maintenance work on the District's electrical manholes, process tanks, roofs and floors.

This section completed several projects in 2022:

- Removal and replacement of H<sub>2</sub>S media in the plant's biogas treatment system.
- Removal and replacement of siloxane media in the plant's biogas treatment system.
- Operations Building Elevator Modernization

The Facilities Maintenance section continued improving snow removal operations and reducing

salt use by applying knowledge acquired from attendance at winter roadway maintenance trainings and utilizing innovations in equipment and techniques.

In 2022, the Facilities Maintenance crew assisted operations and engineering staff with projects, including preventative maintenance on plant primary settling tanks, aeration tanks, final clarifiers, sump pumps and pits, as well as inspection of plant and pumping station roofs and cleaning wet wells of District-owned pumping stations (in conjunction with the City of Madison).

Facilities Maintenance also contracted services for repairing the plant perimeter fence following damage from multiple downed trees and vehicle accidents.

In 2022, the Facilities Maintenance crew continued working on Reliability Centered Maintenance (RCM) objectives through:

- Implementing the scheduling module in the current computerized maintenance management system (CMMS) to facilitate increased scheduling efficiency and provide data for key performance indicators.
- Continued development of SOPs for routine tasks to promote consistency and efficiency in work.
- Continued work with the Strategy department on the District's asset management plan and redefining workflow processes to aid the selection of a new CMMS.

Facilities Maintenance hired new staff to fill two vacancies created through advancement and separation. This section also implemented the new Trainee Program in 2022 with great success.

## **ELECTRICAL MAINTENANCE**

The Electrical Maintenance section devoted much of the year to providing the knowledge and skills necessary to assure high electrical reliability to District facilities and the facilities owned by communities or sanitary districts yet maintained by the District. This was accomplished through a mix of preventive and reactive maintenance, standard operating procedures, electrical staff training, planned improvements, construction projects and daily maintenance. Examples of preventive maintenance tasks performed by the section include calibration, inspection, testing/cleaning of electrical and instrumentation equipment, and thermographic imaging of electrical devices.

The continued use of the District's CMMS has allowed the Electrical Maintenance section to identify problems by tracking equipment data, scheduling maintenance, and creating daily and preventive maintenance work orders. This section continued to lend its expertise to other departments to facilitate District projects and improve the treatment process, including providing electrical cross-training to District mechanics, operators and HVAC personnel; assisting the Engineering department with submittal reviews and the evaluation of the Liquid

Process Facility Plan; collecting data on electrical assets for the CMMS; and operating District portable generators during planned and unplanned power outages.

The following additional improvements and projects were completed or continued in 2022:

- Continued to upgrade and modify existing electrical equipment at the District and non-District facilities to accommodate the requirements of NFPA 70E (Arc Flash).
- Completed design, fabrication and installation of new controls and telemetry for the City of Madison Arbor Hills and Westport Pumping Stations.
- Completed the communications/PLC upgrade at Pumping Station 5.
- Completed the Metrogro Pumping Station Lighting Replacement Project.
- Completed installation of VFDs for Final Clarifier 12 flocculator.
- Completed the PLC upgrades for the Headworks and Sludge Dewatering Buildings' temperature control panels.
- Completed the PLC upgrades for the Gas Control Building control panel.
- Planned the PLC upgrades for the DAF and Boiler Buildings.
- Designed and planned the replacement of the Effluent Building's DO and sump pump control replacements.
- Installed a new electrical service at the Badfish Creek outfall.
- Planned the Pumping Station 9 antenna tower replacement.
- Assisted the Engineering department with the following:
  - City of Madison's Truax Lift pumping station design review
  - Review of Pumping Station 4 and Pumping Station 17 designs
  - Facilitation of the Engine Generator Control Panel Replacement Project
  - Assisted with necessary shutdowns and tie-ins for the Pumping Station 13 & 14 Rehabilitation Project.
- RCM implementation:
  - Implemented the scheduling module in the current CMMS to facilitate increased scheduling efficiency and provide data for key performance indicators.
  - Continued developing SOPs for routine electrical tasks to promote consistency and efficiency in work.
  - Continued working with the Strategy department on the District's asset management plan and redefining workflow processes to aid in selecting a new CMMS. Classified stock codes and worked with the purchasing department to set critical inventory levels for the needed parts.

## **HVAC MAINTENANCE**

In 2022, the HVAC Maintenance section provided the knowledge and skills necessary to increase the HVAC reliability of District facilities and the facilities owned by communities or sanitary districts yet maintained by the District. This was accomplished through a mix of preventive and reactive maintenance, standard operating procedures, HVAC staff training, planned improvements and daily maintenance. Examples of preventive maintenance tasks performed by the section include inspection, testing and cleaning of HVAC equipment and daily steam boiler checks. The continued use of the District's CMMS has allowed the section to identify problems by tracking equipment data, scheduling maintenance and creating daily and preventive maintenance work orders. The section continued to lend its expertise to other departments to facilitate District projects and environmentally protect process equipment, including assisting the Engineering department with submittal reviews, evaluating the Liquid Process Facility Plan, and collecting data on HVAC assets for the CMMS.

The following improvements and projects were started or completed in 2022:

- Supported the design of the Treatment Plant HVAC Improvement Project by assisting with the selection of HVAC assets that will be included in the first phase of the project and the review of design documents.
- Additional analysis of the deaerator system in the WAS Thickening Building was done. Improvements to the system were made through programming changes and the addition of beneficial alarms.
- Completed replacement of both refrigerant compressors for the Headworks Building control room air handling unit.
- Made a major repair to the heating coil for the air handler unit that feeds the lab in the Operations Building.
- Repaired the heating coil of WAS Thickening Building air handling unit 75.
- Supported the East Boiler Controls and Burner Replacement Project.
- RCM implementation:
  - Implemented the scheduling module in the current CMMS to facilitate increased scheduling efficiency and provide data for key performance indicators.
  - Continued developing SOPs for routine HVAC tasks to promote consistency and efficiency in work.
  - Continued working with the Strategy department on the District's asset management plan and redefining workflow processes to aid in the selection of a new CMMS. Classified stock codes and worked with the purchasing department to set critical inventory levels for the needed parts.

## MECHANICAL MAINTENANCE

The Mechanical Maintenance section maintains mechanical equipment through preventative and reactive maintenance of NSWWTP equipment and District and non-District pumping stations. The section verifies the proper operation of equipment and, with the support of operations and other maintenance sections, ensures that all collected wastewater is conveyed to the plant. The section also maintains the District's vehicle fleet and develops the skills of section staff members through the District's apprenticeship program and other training.

In addition to many scheduled and unscheduled maintenance activities, major accomplishments completed in 2022 included:

- RCM implementation:
  - Implementing the scheduling module in the current CMMS to facilitate increased scheduling efficiency and provide data for key performance indicators.
  - Continued developing SOPs for routine mechanical tasks to promote consistency and efficiency in work.
  - Continued working with the Strategy department on the District's asset management plan and redefining workflow processes to aid in the selection of a new CMMS. Classified stock codes and worked with the purchasing department to set critical inventory levels for the needed parts.
  - Continued improving lubrication department equipment and work practices.
- Every week, rags and other debris were removed from plugged collection system pumps to keep them functioning at the required capacities. Responded to 386 emergency work orders in 2022.
- Replaced a total of six pumps at the treatment plant and non-District pumping stations where the cost-benefit analysis dictated the purchase of a new pump was most beneficial.
- Rebuilt five pumps at District pumping stations and three at non-District stations.
- Rebuilt 24 pumps at the treatment plant that serve various treatment plant functions.
- Continued replacement of unreliable rotary lobe pumps with a more reliable brand.
- Replaced obsolete flocculator drives on final clarifier 12 with a newer, more reliable and energy-efficient style, setting a new standard for the future.
- Responded to Waukesha engine failures and performed repairs in a timely manner, maintaining a key gas biogas utilization and energy resource to the treatment plant.
- Finalized the Blower Engine Overhaul Project, completely overhauling the Waukesha engine to ensure reliability in the future.

- Replaced the Operations Building vacuum compressor for the lab.
- Replaced three critical oil coolers on the west aeration blowers and repaired the inlet guide vane on the west aeration blower 1.
- Installed two new pressure vessels on the scum ejector systems based on the result of a root cause analysis.
- Assisted the Engineering department with the following:
  - Review of PS 4 and PS 17 designs.
  - Facilitation of the Engine Generator Control Panel Replacement Project.
  - Assisted with necessary shutdowns and tie-ins for the Pumping Station 13 & 14 Rehabilitation Project.

### **COLLECTION SYSTEM SERVICES**

This section devotes its time to three major functions for the District. The first is the collection of wastewater samples and flow information from the communities and sanitary districts the District serves. The analysis results measured by the District's laboratory on these samples and the flow data recorded by the crew are used for billing the District's municipal customers for treatment services. The Collection System Services crew also collects samples at companies with discharge permits issued by the District's industrial pretreatment program.

The second major function is the annual inspection and maintenance of the District's collection system. This work includes identifying and repairing assets by the collection system services staff or contractors and working with contractors for the District's annual cleaning and televising portions of the interceptor system.

The third major function is locating. This work includes the protection of District collection system assets by locating utilities, mapping, monitoring projects, attending construction meetings and repairing locating posts.

- RCM implementation:
  - Implementing the scheduling module in the current CMMS to facilitate increased scheduling efficiency and provide data for key performance indicators.
  - Continued developing SOPs for routine mechanical tasks to promote consistency and efficiency in work.
  - Continued working with the Strategy department on the District's asset management plan and redefining workflow processes to aid in the selection of a new CMMS. Classified stock codes and worked with the purchasing department to set critical inventory levels for the needed parts.
  - Continued improving lubrication department equipment and work practices.

During 2022, the following activities were performed by the crew:

- Conducted preventive maintenance work, including all work on air release valves; exercising valves; replacing air release valves with new prototype stainless valves; inspecting stop logs and flap gate structures; and inspecting where force mains meet gravity manholes.
- Monitored and recorded all lateral connections.
- Utilized the geographic information system (GIS) editing program through manhole repairs.
- Viewed and verified interceptor-televised videos.
- Monitored numerous construction projects involving utility crossings of District interceptors and force mains through on-call duties.
- Investigated odor complaints.
- User-charge program repair and construction of manhole weirs.
- Collected flow meter readings from pumping stations and other municipality lift station pumps for billing.

### **User-Charge Monitoring and Billing**

User-charge billing of the District's municipal customers is performed quarterly using data collected at the NSWWTP and within the collection system. The Collection System Services crew supports quarterly billing by providing sampling and flow measurements at key points in the collection system. The crew and plant staff collected data and samples at 70 sampling points in 2022. The sampling points generated 4,151 samples throughout the year.

### **2022 Manhole Inspections**

Collection System Service staff inspected the manholes and surrounding areas for the following interceptors:

- West Interceptor System (16 manholes)
- Northeast Interceptor Systems (49 manholes)
- Nine Springs Valley Mineral Point Extension (207 manholes)
- Southeast Interceptor System (19 manholes)

### **Other Projects**

- Siphon cleaning
- Sampled and took H<sub>2</sub>S readings from Dane County Landfill on HWY 12 to Marsh Road in McFarland
- Repaired 112 manholes
- Assisted with chloride sampling



- Located all buried treatment plant valves
- Installed three new air valves on the Badger Mill Creek force main
- Installed stainless steel screens to prevent grease on the Crosstown air valves
- Performed flow monitoring at the Midtown pumping station basin for the City of Madison
- Special COVID sampling for the University of Wisconsin
- Televised the West Interceptor, Far East Interceptor Waubesa Extension, Nine Springs Valley Interceptor and Nine Springs Valley Interceptor Waubesa Extension
- Continued education for Collection System Services technicians through the District’s progression program

**METROGRO OPERATIONS**

The District recycles biosolids to agricultural land through its Metrogro program. This program provides valuable crop nutrient resources to local agricultural production systems, allowing the District to meet biosolids storage and disposal goals.

The spring of 2022 started with more moisture than is ideal, delaying the hauling season's start until April 20. The Metrogro crew was able to hit spring hauling goals by May 16. Good weather and an increase in winter wheat acres helped to secure more applications for the summer season and alleviate some pressure heading into fall. The 2022 hauling season ended abruptly on Nov. 30 due to frost, leaving storage tank levels at 17%. The 2022 season was a success all around, and with the continuous equipment upgrades, the crew hauled over 1 million gallons a day for four consecutive days in the spring.

Summary hauling and cost information for the last three years is provided in Table 7.

**Table 7 – Metrogro Program Details for the Past Three Years**

<b>Year</b>	<b>2020<sup>1</sup></b>	<b>2021</b>	<b>2022</b>
Gallons Recycled (MG)	37.6	40.2	35
Dry Tons Recycled	7,182	7,894	6,694
Acres Applied	5,030	5,508	4,915

<sup>1</sup> Numbers shown for 2020 do not include the 1.3MG of additional Class B liquid biosolids stored at an off-site manure pit and land applied by a contractor. Numbers shown for 2020 do not include the 2,600 dry tons of additional dewatered material recycled at the landfill. Combined costs of these additional activities were around \$290,000.

The District continues to produce a high-quality biosolids product. Metal concentrations in 2022 were below the concentrations used by EPA to define an exceptional quality biosolid, as shown in Table 8 (Note: Wisconsin Department of Natural Resources uses the term “high quality” in NR 204).

**Table 8 - Metrogro Biosolids Quality 2022 Average Values**

<b>Parameter</b>	<b>Concentration</b>	<b>EPA EQ Limit*</b>	<b>EPA Ceiling Limit</b>	<b>Units (Dry Weight)</b>
<b>Total Solids</b>	5.03	NA	NA	%
<b>TKN</b>	8.88	NA	NA	%
<b>NH3-N</b>	4.3	NA	NA	%
<b>Total-K</b>	.59	NA	NA	%
<b>Total-P</b>	3.35	NA	NA	%
<b>Arsenic</b>	4.2	41	75	mg/kg
<b>Cadmium</b>	.9	39	85	mg/kg
<b>Chromium</b>	42.5	NA	NA	mg/kg
<b>Copper</b>	504	1,500	4,300	mg/kg
<b>Lead</b>	16.1	300	840	mg/kg
<b>Mercury</b>	0.4	17	57	mg/kg
<b>Molybdenum</b>	22.9	NA	75	mg/kg
<b>Nickel</b>	26.4	420	420	mg/kg
<b>Selenium*</b>	5.8	100	100	mg/kg
<b>Zinc</b>	718	2,800	7,500	mg/kg
<b>PCB</b>	<0.017	NA	NA	mg/kg

\* EQ means “exceptional quality”

NA means not applicable

< data qualifier is used if one or more of the monthly values used to calculate the yearly average is reported as below the analytical limit of detection.

Environmental monitoring to support the Metrogro program continued in 2022. Approximately 522 water samples were collected from private wells, with samples analyzed for nitrate nitrogen and coliform bacteria. Soil samples were collected through the District, as well as through the farmer's crop consultants.

### **Equipment Upgrades**

The District continually seeks to increase efficiencies and improve biosolid applications and nutrient management. In 2022, a third Oxbo applicator and a third Zimmerman low disturbance toolbar were added. The Oxbo applicator's advanced technology and increased capacity allowed for more acres to get covered in a timely manner. With the addition of the third Zimmerman toolbar, the Metrogro crew was able to cover 65% of the acres with low disturbance tillage, which helped reduce phosphorous runoff.

## **MISCELLANEOUS WORK REPORTING**

### **Reliability Centered Maintenance (RCM)**

In 2022, District staff continued to develop RCM best practices in a continual effort to shift the maintenance culture. Weekly schedule development was one focus for the maintenance department. Staff navigated using an in-house scheduling tool to the scheduling module in the District's CMMS. This allows for more effective scheduling based on work order status and priority, which are linked in the system.

Maintenance supervisors only place ready-to-schedule work orders on their schedules; these are work orders that have been pre-planned and are ready for execution. Best practices show this method of scheduling results in the highest schedule compliance while getting the highest priority work completed. Using the CMMS scheduling module also allows for tracking of necessary data to develop key performance indicators.

A second RCM priority for the maintenance groups was developing a root cause analysis (RCA) program. The goal of implementing an RCA program first started with a large staff training given by our RCM consultant. This staff group consisted of maintenance supervisors, leads and selected staff from each maintenance section or team. During the training, groups were introduced to the RCA process, brainstormed issues, and reviewed example root cause analyses. Following the training, formal RCAs for each group's issue were developed. Some RCAs have been closed with remediating actions, and some are still in process. Over the year, as other issues arose that justified an RCA, formal analyses were developed. The results thus far have been positive for many RCAs, resulting in saved labor, reduced maintenance and reduced costs.

A final RCM priority was the upgrade and enhancement of the District's equipment lubrication program. This included several activities that involved both maintenance and reliability process staff. In the first quarter of 2022, staff purchased and implemented two oil filtration carts

recommended as a best practice during a machinery lubrication technician training the previous November. The purpose of filtering new oil is to remove any particulates that can damage internal machine components, extending their useful life.

Also, in July 2022, the District participated in its first lubrication audit. The audit looked at all lubricated assets and lubricants in the District, with the goal to consolidate lubricants and ensure equipment was lubricated with the correct lubricant. Thus far, the program has been successful, and the audit recommendations are still being implemented.

# RELIABILITY PROCESS

This workgroup is new to the District and was formed in the fourth quarter of 2022. This group works collaboratively with the other Operations and Maintenance (O&M) workgroups and stakeholders to develop and implement best practices that ensure safe, compliant, and reliable assets to support the District and our owner communities. The workgroup's vision is to be the center of excellence in continuous improvement for the organization.

## Staffing

At the end of 2022, the Reliability Process department had four full-time employees and one part-time employee:

- Reliability Process Manager
- Asset Management Specialist (2)
- Purchasing and Inventory Assistant (2, 1 part-time)

The staff who make up this new workgroup previously served in other departments or workgroups; the manager and one asset management specialist moved from the Strategy department; one asset management specialist moved from the Electrical workgroup; and the two purchasing and inventory assistants moved from the Purchasing workgroup in the District Leadership and Support department.

Two new Maintenance Planner positions will be added to the department in 2023.

## Responsibilities of Workgroup

This workgroup is broken down into three core areas: asset management, inventory management and maintenance planning. This workgroup's main responsibilities are:

- Creation, revision, and upkeep of the processes and standards that support the effective use of the District's CMMS.
- Ownership and maintenance of the electronic asset register for maintainable assets housed in the CMMS (e.g., commissioning, modification, decommissioning).
- Management of asset maintenance documentation (e.g., manuals, SOPs, preventative maintenance (PMs)).
- Purchasing O&M materials less than \$25,000.
- Managing the on-site storerooms for spare parts totaling over \$1,700,000, including receiving, stocking, counting and maintaining.
- Planning all non-emergency work orders for the Electrical and Mechanical Maintenance workgroups. Managing corresponding records for data tracking.
- Managing the RCM rollout plan for the District.

The Reliability Process workgroup is primarily responsible for managing the processes, planning, and materials needed to execute the maintenance work of the District. Within the timeframe of the last quarter of 2022, the workgroup was able to execute the following projects:

- The development, training and management of the plan and necessary software changes required to roll out the weekly scheduling routines using the scheduling module in the CMMS.
- With the support of IT, created multiple reports and a new meeting structure that allows for more accurate maintenance efficiency tracking with less administrative labor from the maintenance teams.
- Executed a year-end count that resulted in a total of just \$4,100 in adjustments, an 85% improvement over 2021.
- Executed the reorder point analysis project that utilizes actual usage and lead time data to optimize inventory stocking levels. This has reduced the number of stockouts for parts while decreasing total labor to manage reordering.
- Kicked off and coached four RCAs, two of which significantly reduced labor to maintain assets in the plant and collection system.
- Initiated an asset record cleanup project that prepares the existing CMMS asset hierarchy for transition to a new system and enables more accurate cost and labor reporting today.
- Improved and retrained multiple CMMS workflows to increase the system's data quality.
- Developed job descriptions for two new full-time maintenance planner positions to be implemented in 2023, supporting the electrical and mechanical maintenance teams.

## **ASSET MANAGEMENT**

The Asset Management section of the workgroup is primarily responsible for the ownership and maintenance of the electronic asset register for maintainable assets housed in the CMMS. In addition, the team manages the paper and electronic records associated with those assets to enable maintenance. To keep the source of records accurate, the team also manages the commissioning, modification and decommissioning processes. Finally, the team supports improvement initiatives by generating reports and datasets that document where savings in cost and labor can be achieved.

## **INVENTORY MANAGEMENT**

The Inventory Management section of this workgroup is primarily responsible for quoting and purchasing all parts and services less than \$25,000 for the O&M department. In addition, this team manages the on-site storerooms that house critical replacement parts

for our assets. This activity includes receiving, stocking, counting and maintaining those parts to ensure they are available and in working order when needed. This team pulls and kits all required parts for scheduled jobs so technicians can “grab and go” to the job site. Finally, the Inventory Management section manages the CMMS’s catalog record to ensure parts are ordered efficiently and correctly.

### **MAINTENANCE PLANNING**

The Maintenance Planning section primarily prepares all non-emergency work orders for the Electrical and Mechanical Maintenance workgroups. This task includes walking down issues in the field, identifying correct parts, identifying special tools and services, anticipating outages and issues, and estimating crew labor to complete work. Additionally, this section captures all this information in the CMMS system and continually updates it over time to improve planning accuracy. They ensure the right work is ready so the technicians can focus on getting the work done.

## OPERATIONS

This department protects human health and the environment by ensuring that all wastewater generated in the District's service area is safely conveyed to the Nine Springs Wastewater Treatment Plant. They then recover the resources of clean water, biosolids, biogas and phosphorus fertilizer.

### Staffing

The Operations workgroup has 19 full-time employees:

- Director of Wastewater Operations & Reliability
- Operations Manager
- Senior Automation Systems Integrator
- Automation Systems Integrator
- Process and Research Engineer
- Regulatory Performance and Process Engineer
- Process and Project Specialist
- Operations Supervisor
- Lead Operator
- Operators (10)

### Responsibilities of Workgroup

The workgroup's main responsibilities are as follows:

- Operation of the Nine Springs Wastewater Treatment Plant (NSWWTP)
- Resource recovery of clean water, biosolids, biogas and phosphorous fertilizer
- Regulatory compliance reporting
- Maintaining the District supervisory control and data acquisition (SCADA) system for collection system and treatment plant monitoring
- Researching, monitoring and testing process efficiencies for greater plant performance

### Programs, Initiatives and Work Reporting

#### **OPERATIONS WORKGROUP**

The Operations workgroup is primarily responsible for operating the Nine Springs Wastewater Treatment Plant and the Process Control System (PCS). Significant projects the group worked on in 2022 included:

- Assisting the Engineering department with scoping, bidding and selecting design



consultant services for Liquids Processing Improvements Phase 2.

- Cleaning acid phase digester 1 and gas phase digesters 6 and 7.
- The EPA Five-Year Review (FYR) of the lagoon superfund site.
- Bidding, trialing and selecting polymers for use in routine plant operations.
- Coordinating variable frequency drive (VFD) improvements at Pumping Stations 6 and 10.

## **OPERATION OF WASTEWATER FACILITIES**

### **Sources of Wastewater**

The District receives and treats wastewater from the cities of Fitchburg, Madison, Middleton, Monona and Verona; the villages of Cottage Grove, Dane, DeForest, Maple Bluff, McFarland, Shorewood Hills, Waunakee and Windsor; and from sanitary and utility districts and other areas in the towns of Dunn, Madison, Pleasant Springs, Verona, Vienna and Westport. The District served 26 municipal customers from Jan. 1, 2022, to Oct. 30, 2022. The Town of Madison was dissolved on Oct. 30, 2022, and its lands were attached to the City of Fitchburg and the City of Madison, thereby reducing the District's total number of municipal customers to 25.

The District also accepts septic tank wastes and similar wastes from unsewered areas located primarily in rural Dane County. In 2022, 94.5 acres of land were annexed by the District. The District's total area at the end of 2022 was 187.47 square miles.

### **Interceptor Service**

Interceptor sewer service is provided within the District through the District's main and intercepting sewers. The District operated and maintained 97.70 miles of gravity sewers and siphons and 31.79 miles of raw wastewater force mains at the end of 2022. Wastewater collecting systems are owned and operated by city, village and town sanitary and utility districts and are connected to the metropolitan interceptor system.

All wastewater generated in the District is treated at the Nine Springs Wastewater Treatment Plant located at 1610 Moorland Road, Madison, Wisconsin, approximately one mile south of Lake Monona. The easterly part of the District is served by the East Interceptor, the Southeast Interceptor, the Northeast Interceptor and the Far East Interceptor. The westerly part of the District is served by the Lower Badger Mill Creek Interceptor, the West Interceptor, the Southwest Interceptor, the South Interceptor and the Nine Springs Valley Interceptor.

The transmission of wastewater from the metropolitan area to the treatment plant requires the operation of 135 pumping stations, not including 448 small grinder pump installations. Table 9 and Table 10 list the number of pumping stations operated and maintained by individual communities and the District.

**Table 9 – Pumping Stations Operated and Maintained by Communities**

<b>Owner</b>	<b>Number of Pumping Stations</b>	<b>Number of Grinder Stations</b>
City of Fitchburg	1	
City of Middleton	8	
City of Monona	7	
Village of Cottage Grove	5	
Village of Dane	1	
Village of DeForest	1	1
Village of McFarland	5	1
Village of Shorewood Hills	1	
Village of Waunakee	3	1
Village of Windsor	4	11
Town of Dunn Kegonsa Sanitary District	5	355
Town of Pleasant Springs Sanitary District No. 1	9	55
Town of Vienna Utility District No. 1	1	
Town of Vienna Utility District No. 2	1	5
Town of Westport Utility Districts	10	15
State of Wisconsin:		
University of Wisconsin Campus	6	4
University of Wisconsin Arboretum	1	
Dane County - Rodefild Landfill	1	
<b>Total</b>	<b>70</b>	<b>448</b>

**Table 10 – Pumping Stations Operated and Maintained by the District**

<b>Owner</b>	<b>Number of Pumping Stations</b>
Madison Metropolitan Sewerage District	18
City of Madison*	31
City of Verona	2
Village of Maple Bluff	3
Town of Dunn Sanitary District No. 1	4
Town of Dunn Sanitary District No. 3	3
Town of Madison*	3
Dane County Lake Farm Park	1
<b>Total</b>	<b>65</b>

\*Note: Ownership of Town of Madison pumping stations was transferred to the City of Madison on Oct. 30, 2022.

**Quantity of Wastewater**

The District received 13,258,008,000 gallons of wastewater at the NSWTP in 2022. This was a 0.32% decrease from 2021. The average daily quantities of wastewater received from each municipality and through infiltration into the District’s intercepting sewers in 2022 are shown in Table 11.

**Table 11 – Average Daily Quantities of Wastewater**

<b>Municipality</b>	<b>2022 (GPD)</b>	<b>% of Total</b>
City of Fitchburg	1,915,000	5.27
City of Madison	22,801,000	62.77
City of Middleton	1,989,000	5.48
City of Monona	631,000	1.74
City of Verona	963,000	2.65
Village of Cottage Grove	695,000	1.91
Village of Dane	53,000	0.15
Village of DeForest	984,000	2.71
Village of Maple Bluff	130,000	0.36
Village of McFarland	583,000	1.61
Village of Shorewood Hills	135,000	0.37
Village of Waunakee	1,541,000	4.24
Village of Windsor	484,000	1.33
Town of Dunn San. Dist. No. 1	137,000	0.38
Town of Dunn San. Dist. No. 3	68,000	0.19
Town of Dunn San. Dist. No. 4	11,000	0.03
Town of Dunn Kegonsa San. Dist.	123,000	0.34
Town of Madison	473,000	1.30
Town of Pleasant Springs San. Dist. No. 1	70,000	0.19
Town of Verona	600	<0.01
Town of Verona Util. Dist. No. 1	26,000	0.07
Town of Vienna - Wyst59 LLC	100	<0.01
Town of Vienna Util. Dist. No. 1	64,000	0.17
Town of Vienna Util. Dist. No. 2	31,000	0.09
Town of Westport Sewer Utility District	461,000	1.27
Town of Westport - Cherokee Golf & Tennis	3,100	0.01
<b>Total Wastewater</b>	<b>34,370,000</b>	<b>94.62</b>
Infiltration into District Interceptors	1,953,000	5.38
<b>Total Received at the Treatment Plant</b>	<b>36,323,000</b>	<b>100.00</b>

### **Wastewater Treatment**

The District has a single treatment plant, the Nine Springs Wastewater Treatment Plant. In 2022, the treatment plant met all Wisconsin Department of Natural Resources (DNR) discharge limitations. This level of compliance qualifies the District for a second consecutive gold-level Peak Performance Award from the National Association of Clean Water Agencies (NACWA).

Preliminary treatment includes influent wastewater fine screening and grit removal. Fine screening is accomplished by three rotating band screens with six-millimeter openings and a vortex grit system for grit removal. Variable speed drives for the band screens are used to

control the influent well level. Grit is removed continuously from three vortex grit chambers. The dewatered grit and screenings are conveyed to dumpsters and hauled by a contractor to the landfill three to five times weekly.

All material the fine screens remove is conveyed to a screening processing well. Pumps macerate the screenings and pump them to compactors that squeeze water out before placing them in a dumpster. The grit is removed from this well two to four times a day. The grit and accompanying rags are pumped to a separate settling basin, termed a “snail.” The material settled in the snail is conveyed to the grit and screenings dumpster.

Following preliminary treatment, 19 primary settling tanks remove floatable and settleable material from the wastewater. After primary settling, the wastewater is biologically treated in the activated sludge system. The activated sludge system consists of tanks with anaerobic, anoxic and aerobic selector zones configured for biological phosphorus and ammonia removal and decomposition of organic material.

The material flowing from the aeration tanks is a mixture of cleaned water and microorganisms. It flows to secondary clarifiers for separation. The secondary clarifiers are a combination of center feed/peripheral draw-off and peripheral feed/peripheral draw-off configurations that efficiently remove the suspended bacterial solids to meet advanced secondary standards. Most of the solids, which contain the microbial culture, are pumped back into the aeration tanks. A certain percentage of solids are removed from the activated sludge process and pumped to the solids handling processes daily to maintain a desired bacterial population; these removed solids are termed waste-activated sludge (WAS). An eight-to-ten-day solids retention time is normally maintained in the process.

During 2022, the secondary portion of the NSWWTP was operated as four separate treatment units (or “plants”). Effluent from the individual plants was monitored to ensure adequate process control and to provide information on differing operating modes.

The treated water is disinfected by ultraviolet irradiation from April 15 through Oct. 15 and pumped to surface outfalls on Badfish Creek and Badger Mill Creek. In 2022, on average, approximately 34.43 million gallons per day (MGD) were pumped to Badfish Creek and 3.34 MGD to Badger Mill Creek.

Primary sludge is pumped sequentially from the 19 primary settling tanks to three gravity thickener tanks. The solids concentration from the gravity thickeners averaged 5.3% in 2022.

The waste-activated sludge is thickened on three gravity belt thickeners. Generally, two of the three units are in service, with one unit on standby. The thickened solids concentration from the gravity belt thickeners averaged 6.6% in 2022.

The anaerobic digestion process was operated as a phased system throughout 2022. The sludge treatment flow train is normally run as follows:

- Gravity-thickened primary sludge is directly fed unheated to acid phase digestion.
- Thickened waste-activated sludge is heated with steam injection and fed to acid phase digestion.
- One acid phase digester is heated to approximately 94 degrees Fahrenheit with an approximately 1.06-day (25.4-hour) detention time.
- Acid phase sludge is fed to east digesters 4-9, and the temperature is maintained at 95 to 98 degrees Fahrenheit. The detention time in the east digesters averaged approximately 32 days.
- Digested sludge from east digester 7 is normally pre-heated to approximately 120 degrees Fahrenheit through a Lackeby tube and shell heat exchanger and transferred to west digesters 1-3 for time/temperature Class A biosolids batching at 134 degrees Fahrenheit.
- The required batching time at that temperature is approximately 14 hours minimum. In 2022, approximately 8% of the total biosolids mesophilically digested underwent additional time-temperature batch treatment to meet Class A liquid criteria.

Digested sludge from the east digesters is normally thickened on gravity belt thickeners. The thickened sludge is land applied as part of the Metrogro liquid land application program. Class A digested biosolids production started in November 2014. Most of the production has remained in the liquid form and is thickened on gravity belt thickeners in combination with the Class B biosolids. The resulting combination is handled as Class B liquid biosolids. After receiving approval by the DNR on Oct. 18, 2016 for the plan to produce and distribute Class A equivalent biosolids, the limiting factor in production has been demand for the product. In 2022, the centrifuge was operated weekly for a period in February through April to make Class A cake biosolids for testing; the centrifuge was also run a couple of times in July primarily to facilitate testing of dewatering system polymers for bidding.

The digested biosolids concentration averaged 2.9% for 2022 from the east digesters and 1.7% from the west digesters after the time and temperature batching operation. The digested biosolids were thickened to an average concentration of 5.53% in 2022 by adding polymer on a gravity belt thickener. An average of 25.1 tons per day of digested biosolids was thickened in 2022. Anaerobic digester foaming was controlled through operational measures (such as feed time, liquid levels and temperature adjustments) and limited use of chemical defoamant.

Filtrates from the digested sludge gravity belt thickening, centrifuge dewatering, and the WAS thickening processes are combined and sent to the Ostara struvite harvesting process for nutrient recovery (as magnesium ammonium phosphate). The struvite harvesting process aims to remove phosphorus before anaerobic digestion, where nuisance struvite is formed and to reduce phosphorus in the biosolids that will be land applied.

The District utilizes biological phosphorus removal in its secondary process. In this process,

anaerobic/aerobic cycling is used to alternately release and take up phosphorus in excess of metabolic requirements. In the anaerobic section, with the availability of organic material in the form of volatile fatty acids, the bacteria release phosphorus. This aspect of biological phosphorus removal is also used in the anaerobic WAS treatment tanks before the WAS gravity belt thickeners. A low-flow stream of acid phase sludge is recycled to the treatment tanks and contains significant concentrations of volatile fatty acids, more than 5,000 milligrams per liter. The volatile fatty acids in the acid phase sludge trigger phosphorus release from the waste-activated sludge.

A significant amount of soluble phosphorus is also released in the acid phase digestion process. The filtrate from the WAS thickeners is thus rich in soluble phosphorus and is combined with the filtrate from the digested sludge thickener, which has a high ammonia concentration. These streams are fed to the struvite harvesting reactors purchased from Ostara. Magnesium chloride and sodium hydroxide are added to enhance struvite formation. The process forms spheroidal struvite pellets.

By contract, the product is sold to Ostara in 1-ton bags. Ostara picks up the product and markets it as a slow-release fertilizer for applications where high phosphorus content is required. For 2022, 556.2 tons of struvite product was produced and shipped off-site.

The digested liquid biosolids produced by the District are marketed under the name "Metrogro." The thickened biosolids from the gravity belt thickeners are pumped directly to truck loading facilities or the Metrogro storage tanks. All liquid biosolids are stored in the Metrogro storage tanks during the winter. The tanks have a storage capacity of 19.5 million gallons. The biosolids are hauled and applied to cropland as a soil conditioner and fertilizer.

As a byproduct of the anaerobic digestion process, gas is produced that is approximately 60% methane. Digester gas production averaged around 867,000 cubic feet per day in 2022. Part of the digester gas was used to fuel boilers for plant heating and a 650-horsepower blower engine, which provides air to aeration tanks. The remainder of the gas was used to fuel two generator engines in Sludge Control Building 2. Before use in the engines and boilers, the gas is treated by a gas treatment system which removes moisture, hydrogen sulfide and siloxanes. An average of 16,387 kilowatt-hours of electricity was generated each day in 2022. In addition, the blower engine saved the purchase of approximately 8,076 kilowatt-hours per day of electrical energy. The District supplements digester gas production with natural gas purchased from Madison Gas and Electric.

The District takes advantage of the heat recovered from the engines to heat anaerobic digesters and most buildings at the treatment plant and heating air in the struvite dryers. Jacket water heat and engine exhaust heat are recovered from all three engines when available. Lube oil heat is recovered from the generator engines but not from the blower engine. If plant heating demands cannot be satisfied with recovered heat, three sets of three

boilers are available to satisfy the heating load.

The “Nine Springs Energy Use Profile” section in this report describes the electrical and thermal demands at the treatment plant in detail. Table 14, “Annual Energy Use Summary,” shows a complete breakdown of the thermal and electrical savings from using digester gas.

The 2022 wastewater treatment data are reported in accordance with the District’s Wisconsin Pollutant Discharge Elimination System Permit (WPDES), and a summary of this information is shown in Table 12. Monitoring data for effluent metals are reported in Table 13.

**Table 12 – Yearly Log of Plant Operations 2022**

Madison Metropolitan Sewerage District  
 Nine Springs Wastewater Treatment Plant  
 YEARLY LOG - PLANT OPERATIONS  
 2022

Month	Influent Flow (MGD)	BFC Effluent Flow (MGD)	BMC Effluent Flow (MGD)	BOD		TSS		Nitrogen		Phosphorus		Effluent FCOLI MPN/100 Mean(1)	Min Hr Effluent D.O. (MG/L)
				RAW CBOD (MG/L)	Effluent CBOD (MG/L)	RAW TSS (MG/L)	Effluent TSS (MG/L)	RAW TKN (MG/L)	Effluent Ammonia (MG/L)	RAW TP (MG/L)	Effluent TP (MG/L)		
Jan-22	34.22	30.97	3.08	345.33	3.62	281.53	4.32	56.72	0.16	7.02	0.24		8.34
Feb-22	34.66	31.55	3.09	369.18	3.55	281.25	4.34	58.36	0.34	7.11	0.23		6.15
Mar-22	36.36	33.85	3.09	358.61	3.64	275.68	4.82	55.69	0.45	6.62	0.25		4.97
Apr-22	38.29	35.99	3.08	343.53	3.90	263.77	5.41	54.27	0.28	6.49	0.30	34.25	5.49
May-22	36.33	34.08	3.43	325.57	3.47	276.68	5.79	54.56	0.21	6.63	0.35	46.67	5.30
Jun-22	36.16	33.35	3.51	325.03	2.75	264.87	5.50	51.90	0.10	6.34	0.38	72.00	5.25
Jul-22	35.3	32.89	3.54	320.23	2.09	261.81	5.40	51.70	0.22	6.66	0.38	47.38	5.53
Aug-22	36.95	34.60	3.54	319.58	2.45	261.68	5.33	54.47	0.20	6.67	0.40	76.89	5.33
Sep-22	39.07	37.31	3.49	319.23	2.43	252.13	6.54	54.27	0.16	6.09	0.43	83.78	5.14
Oct-22	35.42	33.35	3.54	343.13	2.47	267.13	5.17	56.34	0.13	6.69	0.30	83.25	7.03
Nov-22	36.53	33.30	3.54	333.70	3.14	260.83	6.83	54.48	0.19	6.61	0.33		6.78
Dec-22	36.71	33.85	3.11	308.68	3.17	262.03	4.72	50.65	0.13	6.05	0.26		6.87
Average	36.33	33.76	3.34	334.32	3.06	267.45	5.35	54.45	0.21	6.58	0.32	63.46	6.02

BFC is to Badfish Creek Outfall  
 BMC is to Badger Mill Creek Outfall  
 (1) Geometric mean

**Table 13 – Influent and Effluent Metal Concentrations 2022**

Month	Effluent MGD	Cadmium (T) (ppb)		Chromium (T) (ppb)		Copper (T) (ppb)		Lead (T) (ppb)		Mercury (T) (ppt)		Nickel (T) (ppb)		Zinc (T) (ppb)	
		Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff
Jan-22	34.05	0.26 b	0.26 b	4.00	0.8 q	114.0	13.60	5.21 q	3.15 b	34.6	0.70	4.36	1.88 q	160	49.1
Feb-22	34.64	0.26 b	0.26 b	5.27	0.8 q	77.1	6.72	3.70 q	3.15 b	35.8	0.69	4.20	1.69 q	156	53.3
Mar-22	36.94	0.26 b	0.26 b	6.10	1.0 q	99.5	13.00	4.20 q	3.15 b	36.0	0.73	4.65	2.08 q	153	47.9
Apr-22	39.07	0.26 b	0.26 b	2.87	0.6 b	70.9	6.22	4.28 q	3.15 b	44.2	1.52	4.01	1.67 q	160	65.7
May-22	37.51	0.26 b	0.26 b	3.18	0.7 q	66.1	6.62	3.16 q	3.15 b	35.7	0.95	4.14	2.04 q	140	51.9
Jun-22	36.86	0.26 b	0.26 b	3.54	0.9 q	78.6	13.40	3.15 b	3.15 b	48.1	0.82	4.51	2.08 q	153	37.8
Jul-22	36.43	0.26 b	0.26 b	2.63	0.6 b	70.0	12.30	3.16 q	3.15 b	36.5	0.71	3.39	1.76 q	114	35.0
Aug-22	38.14	0.29 q	0.28 q	3.79	0.8 q	84.2	9.71	3.61 q	3.15 b	83.0	1.35	4.17	1.75 q	157	30.9
Sep-22	40.8	0.26 b	0.26 b	2.92	0.6 b	78.4	7.56	3.15 b	3.15 b	49.5	1.30	3.79	1.70 q	144	59.0
Oct-22	36.89	0.26 b	0.26 b	3.45	0.6 b	74.7	4.95 q	3.15 b	3.15 b	60.4	0.98	3.34	1.51 q	153	33.9
Nov-22	36.84	0.26 b	0.26 b	2.87	0.6 b	80.1	11.50	3.15 b	3.15 b	64.2	0.75	4.01	1.92 q	136	53.7
Dec-22	36.96	0.26 b	0.26 b	3.13	0.6 b	85.4	6.40	3.15 b	3.15 b	79.3	0.59	3.69	1.43 q	119	35.0

"b" validation code indicates that sample concentration is less than the method detection limit

"q" validation code indicates that sample concentration is less than the limit of quantitation and above the method detection limit

Effluent MGD is monthly average of BFC outfall plus BMC outfall.

## RESEARCH

### **Pilot-scale study to evaluate total nutrient removal with low dissolved oxygen**

To address energy demands and constantly strive to provide better treatment, the District continued a research project that was initiated in 2013 with Dr. Daniel Noguera (Civil and Environmental Engineering department, University of Wisconsin–Madison) to explore the possibility of removing both nitrogen and phosphorus at low dissolved oxygen concentrations. This work has continued for several years due to the relatively slow growth rate of the microorganisms involved and the novel nature of the research. The initial phases of work were aimed at reducing input oxygen levels to establish the practical boundaries of treatment. Early results suggested a potential to save approximately 30% on aeration energy costs for treatment while achieving the same or slightly better overall effluent quality. These initial results indicated that full-scale implementation in some form may be possible.

While early results demonstrated an ability to achieve desired nutrient removal with reduced energy demand, negative impacts on sludge settleability were observed. In 2022, work focused on understanding factors that may impact sludge settling characteristics, including the relationship between dissolved oxygen concentration and sludge settleability and utilizing novel sludge wasting techniques to help enrich desired microorganisms. The work also introduced sampling for nitrous oxide to better understand biological nitrogen removal mechanisms. Results from work in 2022 have helped better define the tradeoff in energy



savings potential from operating at low dissolved oxygen versus maintaining desired sludge settling characteristics.

This research project is now completed. Key information and results from this project are being utilized to inform design decisions in the District's Liquids Processing Improvements Phase 2 Project, which is focused on activated sludge infrastructure replacements.

### **Evaluating the effect of microaeration on anaerobic digestion**

To seek improvements in anaerobic digestion efficiency, the District initiated a research project with Dr. Daniel Noguera (Civil and Environmental Engineering department, University of Wisconsin–Madison) to explore the possibility of microaerating anaerobic digesters.

Microaeration is a novel concept that involves introducing small amounts of oxygen into an otherwise anaerobic biological system. Previous academic studies suggest that microaeration in anaerobic digesters may support enhanced sludge hydrolysis, increased biogas yield and reduced hydrogen sulfide production. If effective, microaeration would be a cost-effective strategy to reduce the amount of biosolids the District needs to manage, increase renewable fuel production (biogas) and reduce chemical demands for hydrogen sulfide management. This project will involve a more detailed literature review of existing examples of microaeration and will also involve running bench-scale anaerobic digesters with NSWTP sludge at different microaeration rates. This work is scheduled to be completed in 2024.

### **NINE SPRINGS ENERGY USE PROFILE**

Table 14 estimates the total amount of electric and thermal energy used at the NSWTP and the division between purchased and renewable (primarily self-produced) power. From 2018 to 2022, renewable energy used at NSWTP provided roughly 36.6% of the plant's total energy needs and had an estimated total value of just under \$6.3 million.

#### *Notes:*

- The District fuels three large gas-driven engines from biogas produced in its anaerobic digestion process. Two of these engines drive electric generators, while one powers an aeration system blower.
- In early 2018, a generator engine experienced mechanical failure (thought to be attributable to excess temperature operations stemming from catalyst use), requiring an off-site rebuild to correct, removing it from service for three months. The other engine generator was scheduled for rework in 2018 and started that process in December. Both events reduced the amounts of power generated and thermal energy to recover in 2018.
- A sustained high flow event in Summer 2018 resulted in high power demands from the plant to maintain operations, specifically related to pumping. This also increased overall electric demand, which, combined with less generation, reduced the percentages of

renewable energy used.

- In late 2021, the engine blower was removed from service for overhaul and repair. These events contributed to greater thermal energy generation from digester gas and decreased energy generation/avoided purchase. This work was completed in late January 2022 when the engine blower resumed regular service.
- Generator controls were upgraded in the late third and fourth quarters of 2022, resulting in one generator being offline at a time during the upgrades. This upgrade window resulted in slightly reduced power generation and thermal energy recovery in 2022.

**Table 14 – Annual Energy Use Summary**

<b>Electric Energy</b>	<b>2018</b>		<b>2019</b>		<b>2020</b>		<b>2021</b>		<b>2022</b>	
	kWh/ Day	% of Total	kWh/ day	% of Total	kWh/ day	% of Total	kWh/ day	% of Total	kWh/ Day	% of Total
Commercial Service Purchased from MG&E	67,335	72.6%	65,918	70.9%	62,809	69.1%	64,571	73.7%	64,635	72.5%
Wind Power Purchased from MG&E	41	0.0%	40	0.0%	40	0.0%	40	0.0%	41	0.0%
Generated from Digester Gas	16,057	17.3%	17,627	19.0%	18,838	20.7%	15,903	18.2%	16,387	18.4%
Avoided Purchase Due to Blower Gas Engine	9,335	10.1%	9,378	10.1%	9,185	10.1%	7,060	8.1%	8,076	9.1%
<b>Total Used &amp; Avoided</b>	<b>92,768</b>		<b>92,963</b>		<b>90,873</b>		<b>87,574</b>		<b>89,139</b>	
Average cost of purchased power (\$/kWh)	\$0.0869		\$0.0844		\$0.0881		\$0.0873		\$0.0981	
Estimated total monthly value of energy used	\$245,140		\$238,677		\$244,135		\$232,468		\$266,084	
Estimated monthly value of renewable energy	\$67,206	27.4%	\$69,436	29.1%	\$75,396	30.9%	\$61,062	26.3%	\$73,145	27.5%
<b>Thermal Energy</b>	<b>2018</b>		<b>2019</b>		<b>2020</b>		<b>2021</b>		<b>2022</b>	
	therms/ Day	% of Total	therms/ day	% of Total	therms/ day	% of Total	therms/ day	% of Total	therms/ Day	% of Total
Generated from Natural Gas	523	24.2%	533	22.7%	757	30.2%	584	25.4%	587	24.1%
Generated from Digester Gas	280	13.0%	356	15.2%	201	8.0%	387	16.8%	440	18.1%
Recovered from Gas Engines	1,359	62.9%	1,457	62.1%	1,545	61.7%	1,332	57.9%	1,407	57.8%
<b>Total hot water energy used</b>	<b>2,163</b>		<b>2,346</b>		<b>2,503</b>		<b>2,303</b>		<b>2,434</b>	
Average cost of purchased gas (\$/therm)	\$0.5057		\$0.4876		\$0.3591		\$0.5451		\$0.8372	
Estimated total monthly value of gas used*	\$44,348		\$46,391		\$36,552		\$50,914		\$82,642	
Estimated monthly value of renewable energy	\$33,621	75.8%	\$35,847	77.3%	\$25,498	69.8%	\$37,999	74.6%	\$62,714	75.9%
<b>Total Energy Use</b>	<b>2018</b>		<b>2019</b>		<b>2020</b>		<b>2021</b>		<b>2022</b>	
	\$ per Month	% of Total	\$ per month	% of Total	\$ per month	% of Total	\$ per month	% of Total	\$ per month	% of Total
Total Estimated Value of Energy Used	\$289,488		\$285,068		\$280,687		\$283,382		\$348,726	
Estimated Value of Renewable Energy Used	\$100,827	34.8%	\$105,283	36.9%	\$100,893	35.9%	\$99,060	35.0%	\$135,859	39.0%

\* Conversion of natural gas to heat is assumed to be 75% efficient, and heat recovered from the gas engines is assumed to be 40%.

Note – due to rounding, numbers may not add exactly.

# STRATEGY

The Strategy department monitors, evaluates, and reports on the overall health of District infrastructure in support of long-term planning and financial sustainability. The department uses analytical tools and data, which it develops in cooperation with other departments, including asset management, information technology, the computerized maintenance management system (CMMS) and the geographic information system (GIS), among others.

## Staffing

The Strategy department was formed in 2016 by combining some staff from Engineering and Operations. In the fall of 2018, the information technology (IT) workgroup was transferred from the Administration department. Effective the end of 2020, the vacant Assistant Chief Engineer and Director position was reclassified to Capital Investment Policy Advisor and moved to the department.

The Strategy department had 13 full-time employees at the end of 2022:

- Senior Director of Strategy
- Capital Investment Policy Advisor
- Capital Planning Engineer
- Engineering Technician
- Strategic Performance and Policy Advisor
- GIS Analyst
- District Technology Manager
- Records Program Administrator
- Programmer/Analyst (2)
- Network Administrator (2)
- Database Administrator

With the formation of the Reliability Process workgroup at the end of 2022, two positions within the Strategy department moved to the new workgroup: the Asset and Maintenance Management System Administrator and the Asset Management Specialist.

## Responsibilities of Department

The department's primary responsibilities are as follows:

- Asset management
- Business needs and technology systems analysis
- Capital finance

- Capital improvements planning
- Customer community requests for sewer extensions and annexations
- Data management
- Geographic information systems
- IT infrastructure administration and design
- Maintenance and replacement of the Oracle Work And Management (WAM) system
- Quarterly service charges
- Software and systems support
- Software needs assessment and design
- Strategic financial planning
- Technology advising for workgroups and staff
- Technology planning and strategy

## Programs, Initiatives and Work Reporting

### **ASSET MANAGEMENT**

The department is responsible for the overall direction of the District's asset management efforts. The goals of asset management are to maximize the productive life of assets, minimize asset lifecycle cost, maintain needed service levels and manage risk. The department sets standards, monitors performance and helps other work groups succeed in their asset management duties.

In 2021, with the support of the firm Reliability X, the department established the foundations of a reliability-centered maintenance program (RCM). In October 2022, that program and its two primary employees were transferred from Strategy to Operations and Maintenance to embed RCM in the plant's day-to-day operations.

In 2022, the department also led the creation of the District's strategic plan, which provides the basis to create defined levels of service for the District. Next, the department will be looking to define indicators that will allow the District to monitor performance on the strategic plan, one element of which is asset management.

### **CAPITAL IMPROVEMENTS PLANNING**

Each year the department prepares the District's Capital Improvements Plan. This plan includes the major capital projects that will be undertaken by the District in the next six years and the intended funding sources. Also included in the plan is a listing of revenue sources and expenditures for the capital fund and the status of the debt service fund. A draft of the Capital Improvements Plan is introduced to the Commission in July of each year and is accepted by them for planning purposes. Any changes to the plan are incorporated into the document and

the plan is then used to prepare the annual capital budget. These documents are available on the District's website at [madsewer.org/news-resources/plans-reports](http://madsewer.org/news-resources/plans-reports).

### **MAINTENANCE MANAGEMENT AND FINANCE SYSTEMS**

The department is responsible for the District's Oracle Work And Management (WAM) system. It supports several vital functions at the District, including maintenance management and some financial and human resources functions. The system is one of the District's most important assets, along with the plant process control system. However, WAM needs to be replaced because Oracle support for the District's version of the product is ending and other systems will better suit the District's future needs.

The District is replacing WAM with separate maintenance management and financial systems. Depending on the market, systems or additional modules to support human resources functions and IT asset management will also likely be added. The effort is supported by a project in the Capital Improvements Plan. Work in 2022 focused on evaluating the District's financial systems and processes with assistance from Baker Tilly. A final report and recommendation will be received in 2023.

### **COLLECTION SYSTEM**

The department is responsible for reviewing and approving any proposed connections to, or alterations of, the public sewerage system within the District's service area. District staff ensure that plans for new public sewers conform with the District's sewer use ordinance and determine the amount of connection charges due before connection to the system.

The department is also charged with adding new lands to the District's service area through the annexation process. Requests for annexation to the District are submitted by the District's owner communities. They are reviewed by staff for conformance to District policies and to regional planning standards of the Capital Area Regional Planning Commission. In 2022, the District processed 59 sewer extensions and three annexations, adding 95 acres to the District's territory.

### **GEOGRAPHIC INFORMATION PROGRAM**

The geographic information program supports the District's need to manage, analyze and map spatial information. Treatment plant maintenance, engineering projects and sewer maintenance are supported by having District asset information accessible on an interactive map both in the office and the field.

The geographic information program also maintains applications that improve workflows and distribute information more efficiently. Examples of this include the publicly available Paid Areas Viewer to track District connection charge payment status; the MMSD Collection System Viewer used to provide collection system asset information both internally and externally; the Nine Springs Asset Viewer to inform users about plant assets and utilities; and the new GPS

data collection workflow to improve locational accuracy of the District collection system GIS. The GIS is also becoming more integrated with other District information systems. Map users can now access documents stored in OnBase, data from WAM work orders and links to pipe inspections stored in SewerAI, all through the GIS portal.

## **INFORMATION TECHNOLOGY**

The District's information systems (IT) workgroup provides infrastructure support, software support, system administration, cybersecurity services, design services, data management, database administration, records administration and technological consulting services for all departments at the District. Services and systems of note are listed by department in the following summary.

### **Finance**

Supported services and applications for the function and productivity of the Finance workgroup include the Sage accounting system; budgeting database system; pumping station billing database and applications; custom maintenance management system reports; Optimas reporting system; and the rate-setting database and applications.

### **Ecosystem Services**

The Ecosystem Services team is supported by IT staff in the management of the Metrogro hauling and land application database; septage receiving database and applications; the laboratory's Ethosoft X-LIMS laboratory information system; laboratory software integration applications; the home well-sampling application; the application to create eDMR submissions; and the pretreatment database and applications.

### **Engineering**

Systems supported for the work of the Engineering department include the construction administration database, construction plan holders application, the easements database and administration of records related to the Engineering department.

### **Operations and Maintenance**

The following applications and programs are supported for the work of the Operations and Maintenance department: Data Access and Reporting Center (DARC) process reporting system; process control data transfer and analysis; process control system reporting; lock-out/tag-out database and applications; work scheduler application; Optimus reports; Citrix virtual desktop and applications; and the manhole inspection database and applications.

### **Strategy**

Supported technology for the Strategy department includes the GIS geodatabase and applications; connection charges database and applications; collection system applications; the

WAM system (especially CRM and asset-related functions); and the user charge billing system.

### **Leadership and Support**

Services provided to the District's Leadership and Support department include the administration of technology for the internal websites; security camera technology support and administration; support for meeting and event-related software; administration services for Agenda Management; and general Commission-related technology support.

### **District-Wide**

The IT group supports and administers these District-wide programs and systems: network infrastructure; digital information storage; cloud storage; server virtualization; desktop virtualization; virtual private network; plant-wide wireless systems; network security; Cybersecurity Awareness Training (CAT) program; records management and administration; records related workflow systems; cybersecurity tools and systems; email systems; printers, scanners and plotters; enterprise and workgroup databases; business analysis; computer and device programming; smartphones and cellular devices; technology project management; technology planning and strategy; desk phone system; software upgrades and testing; software customization and configuration; license management; technology asset management; and network disaster recovery planning.

Notable work and changes in 2022 include the implementation of multifactor authentication across all District user accounts; implementation of new audio-visual equipment in District conference rooms; enhancements to the Metrogro database application to improve workflow and data quality; and upgrades to the plant-wide wireless equipment to increase performance and expand coverage. The team also hired and onboarded a new Senior Programmer/Analyst; developed several custom enhancements to the WAM system to support the maintenance and reliability program; upgraded the Laboratory Information System (XLIMS); completed a technology assessment of the Process Control System (PCS) Network; developed a new version of the Homewell Letters application; and moved the Sewer Use Ordinance chloride workflow and form into OnBase automation.

### **SERVICE CHARGES**

Service charges are the District's primary source of revenue and are paid by the District's owner communities. Each year, the District calculates service charge rates that are expected to provide the revenue requirement approved by the Commission in the annual budgeting process. These rates are then multiplied by sampled flows and loadings to calculate quarterly service charge bill amounts for each of the District's owner communities.

In 2022, the District collected \$46 million in service charge revenues, \$400,000 under the budgeted amount. This shortfall was primarily driven by lower-than-expected wastewater volume from the District's owner communities.



The District’s 2022 service charge rates, shown in Table 15, were adopted by the Commission on Oct. 28, 2021.

**Table 15 – 2022 Service Charge Rates**

Parameter	Rate	Units
Volume	\$1,013.85	per million gallons
CBOD	\$0.17582	per pound
Suspended Solids	\$0.30662	per pound
TKN-Nitrogen	\$0.47471	per pound
Total Phosphorus	\$5.53343	per pound
Actual Customers	\$41.88	per year
Equivalent Meters	\$40.11	per year

While service charges are billed to municipalities and not directly to residents, average residential charges can be estimated based on typical wastewater volume and strength. In 2022, the District’s service charge for an average home was \$236 per year or \$19.70 monthly.

These charges are in addition to what the District’s owner communities charge for their own sewer infrastructure and services. For example, in 2022, the average annual charge for a home in the City of Madison, the District’s largest owner community, was \$412, including both the District’s service charges and the City’s own charges. The national average for annual sewer service charges in 2022 was \$535 per year, according to the National Association of Clean Water Agencies (NACWA).

**Table 16 - Costs per Million Gallons of Wastewater Treated**

District Function	2018	2019	2020	2021	2022
Administration	\$368	\$403	\$375	\$435	\$545
Collection	\$154	\$171	\$184	\$271	\$254
Treatment	\$777	\$782	\$911	\$1,101	\$1,319
Debt Service	\$887	\$903	\$1,034	\$1,244	\$1,229
<b>TOTAL</b>	<b>\$2,185</b>	<b>\$2,259</b>	<b>\$2,504</b>	<b>\$3,051</b>	<b>\$3,348</b>

The District’s costs are largely fixed in nature. In 2022, the District experienced below-average wastewater flow to the treatment plant while the District’s largely fixed costs increased. As a result, the cost per million gallons of wastewater treated increased from \$3,051 per million gallons in 2021 to \$3,348 per million gallons in 2022, as shown in Table 16.

# Financials

## FINANCIAL SUMMARY FOR THE YEAR ENDED DECEMBER 31, 2022

This statement is for informational purposes only and is not intended to represent full financial disclosure. Complete financial statements and related footnotes are available on our website at [www.madsewer.org](http://www.madsewer.org) or available upon request.

	<u>2022</u>	<u>2021</u>
<b>OPERATING REVENUES</b>		
Charges for services:		
Transmission and treatment of sewage	45,960,857	45,152,382
Servicing pumping stations	471,917	514,389
Septage disposal	1,077,888	967,427
Pretreatment monitoring	34,546	29,922
Struvite Harvesting	217,250	212,279
Total operating revenues	<u>47,762,458</u>	<u>46,876,399</u>
<b>OPERATING EXPENSES</b>		
Administration	6,368,115	5,783,541
Treatment	17,537,413	14,651,050
Collection	3,370,105	3,597,821
Depreciation	9,982,667	9,302,596
Total operating expenses	<u>37,258,300</u>	<u>33,335,008</u>
Operating income	<u>10,504,158</u>	<u>13,541,391</u>
<b>NONOPERATING REVENUES (EXPENSES)</b>		
Investment income (losses)	523,272	19,244
Rent	85,700	83,534
Other	224,463	247,642
Capital assets contributed to other governments		
Construction expenses	(411,624)	(2,120,504)
Disposal of property and equipment	0	(483,043)
Interest expense	(3,030,156)	(3,104,684)
Total nonoperating revenues (expenses)	<u>(2,608,345)</u>	<u>(5,357,811)</u>
Income (loss) before capital contributions	7,895,813	8,183,580
<b>CAPITAL CONTRIBUTIONS</b>		
Contributed assets	-	-
Conveyance Facilities Connection/Treatment charges	3,172,397	3,814,145
Total capital contributions	<u>3,172,397</u>	<u>3,814,145</u>
<b>CHANGE IN NET POSITION</b>	11,068,210	11,997,725
<b>NET POSITION</b>		
<b>BEGINNING OF YEAR, AS PREVIOUSLY REPORTED</b>		-
<b>RESTATEMENT</b>		
<b>BEGINNING OF YEAR, RESTATED</b>	-	-
<b>END OF YEAR</b>	<u>\$ 11,068,210</u>	<u>\$ 11,997,725</u>

Protecting public health and the environment

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