Northern Moraine WRD

By Joe Lapastora, Director of Operations at Northern Moraine WRD

Established in 1969 under the 1917 *Illinois Sanitary District Act*, this regional Sanitary District can be found in Island Lake, IL nestled between southwestern Lake and southeastern McHenry counties. Here the Northern Moraine Wastewater Reclamation District (NMWRD) provides wastewater collection and treatment services to the communities of Island Lake, Lakemoor, Port Barrington, and Holiday Hills along with septage receiving from regional service providers. With a facility planning area comprised of 16,700 acres, NMWRD covers a vast territory. In that territory, 3,700 widely spaced acres are currently within the District's corporate boundaries. The original infrastructure of the District was constructed in 1978 and was established as the Island Lake Sanitary District. The District operated as the Island Lake Sanitary District for 25 years until it was decided that a name that better reflected the regional services that the District provided would be a better fit and give difference from any single community that it serves. And so, in 2003 the Island Lake Sanitary District became the Northern Moraine Wastewater Reclamation District.

The NMWRD collection system initially consisting of two lift stations positioned in Island Lake has seen that count increase over tenfold to 13 in Island Lake, 8 in Lakemoor, 2 in Port Barrington, and 1 in Holiday Hills for a total of 24 lift stations. The two lift stations in Port Barrington receive both conventional gravity flows in addition to those originating from a low-pressure sewer system found in portions of the Port Barrington community located along the waters of the Fox River. Here failing septic systems prone to inundation by floodwaters were replaced by individual grinder pumps installed at over 200 residences to feed into NMWRD's collection system. Each pump is owned and maintained by the District, presenting a significant operations and maintenance burden for staff and requiring a significant stock of spare pumps to be maintained. Most of the collection system is about 45 years old or less, so it is comprised of relatively modern materials such as plastic truss pipe, PVC, and HDPE. The age and construction materials in the collection system aid in preventing significant infiltration and inflow, while a lack of significant industrial users limits operation and maintenance troubles to those of domestic grease and more recently flushable wipes. The District owns a custom televising vehicle which allows staff to televise the collection system following jetting efforts to adhere to our CMOM program without the need for outside contractors. The custom approach with a local upfitter allowed development of a vehicle catered to the District's specific needs such as small narrow streets along with significant cost savings compared to the purchase of prebuilt vehicle. The District is responsible for maintaining approximately 80 miles of sewers and over 1,500 manholes.

The NMWRD wastewater treatment facility is located in the southern portion of its service area in an unincorporated area

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North of the Village of Port Barrington and South of the Village of Island Lake. The current facility site uses 8 acres of a 31-acre parcel abutting protected wetlands to the North and West. There are some residences to the South separated by a quarter-mile buffer consisting of grasslands and farmland. This affords the District plenty of room for future growth along with the communities it serves. A solar array is currently under consideration to make use of the large parcel and to offset energy consumption.

Original construction in 1978 was a comminutor followed by raw pumping feeding to two 78-foot diameter Topco contact stabilization plants with a combined capacity of 1.2 MGD. Downstream of these there was seasonal gaseous chlorination for disinfection. Effluent then exited the facility in a 4,500-foot, 30-inch outfall pipe that discharges into the Fox River through a submerged structure in the center of the riverbed. This effluent pipeline is still in use today. 14 drying beds were used to dewater aerobically digested sludge. In 1991 dechlorination equipment consisting of gaseous feed of sulfur dioxide had been installed as a result of IEPA requirements. A 31-in Rotamat fine screen replaced the comminutor in 1992.

At 20-years in age, the facility was nearing capacity in 1998, and was unable to meet new ammonia nitrogen limits set by IEPA. A plant expansion that overhauled nearly the entire facility would increase capacity, improve treatment for BOD, suspended solids, and meet ammonia nitrogen limits. This expansion was completed in 1999. Plant capacity was increased to 2.0 MGD DAF and 5.0 MGD DMF in this expansion. At the headworks an additional 40-inch Rotamat was installed to provide redundancy and the four raw pumps found replacements with higher capacity, two of which received VFDs to improve efficiency.

Headworks with new MS2 Bar Screen

New Control Building Electrical Room

Class B Sludge Pile

Brandon Scurto Clarifier Blanket Level

These fed into the new 1.2 MG oxidation ditch consisting of two rings with Orbal disc aerators. Downstream two 85-foot diameter clarifiers were constructed with a 4 MGD RAS pump station. Construction continued with a two-channel chlorine contact basin and adjoining chemical feed building that would house the chlorine and sulfur dioxide gas feeds in addition to non-potable water distribution. A portion of the two package plants were repurposed and used as aerobic digesters. Preexisting coarse and fine bubble diffusers were left in place to supply air from three centrifugal blowers. A dewatering building was constructed and housed a 1.5 meter Komline-Sanderson belt filter press to supplement the drying beds. At the time Class B dewatered sludge was conveyed into a dump truck bay within the dewatering building and trucked out to a drying bed dedicated to stockpile use. Following this expansion discharge concentration of ammonia nitrogen went from 20 mg/L to an average of 0.075 mg/L. The design lends itself to easy expansion to 3.0 MGD by addition of a third ring that can include BNR functions. However, with current average flows around 50% of the 2.0 MGD DAF and projections for population growth not meeting that need until the late 2030's that expansion is still a number of years in the future.

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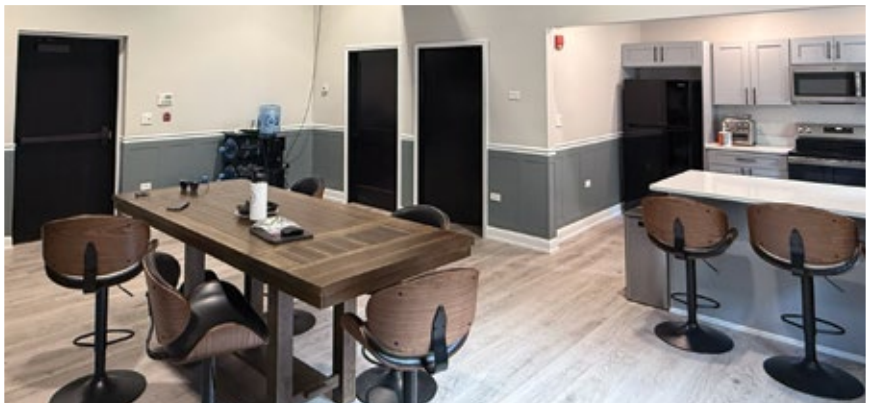

New Operator Breakroom

Chris Molidor Root Removal from Mains

"The Northern Moraine Wastewater Reclamation District is poised to continually improve upon itself as it employs new technologies and explores new ideas to provide a sustainable service to the residents within its service area and to protect downstream users in the Fox River Valley."

The District purchased a small horse farm adjoining the East boundary of the plant site and in 2011 converted the house to an administration building and boardroom. The administrative office was relocated from the control building at the plant site and features a drive-up window for the convenience of many customers who make payments in person. Later in 2018 a horse barn adjacent to the administrative office was upgraded with a concrete slab to better house equipment. It also served as an impromptu open air meeting space for a period during the COVID-19 pandemic, even hosting the CSWEA Operations Challenge team as competition arena in 2020.

In 2011 the gaseous chlorine and sulfur dioxide systems were replaced with liquid sodium hypochlorite and sodium bisulfite feeds to improve workplace safety. This was a project District staff designed and constructed themselves at the time. It consisted of three, 300-gallon bulk storage tanks for sodium hypochlorite and two 300-gallon bulk storage tanks for sodium bisulfite. Four 55-gallon drums were utilized as day tanks where peristaltic pumps drew the chemicals from. These required manual refilling daily. An overhaul of this system was completed in 2019 to make improvements that provided separate secondary containment spaces for the bulk storage tanks, new bulk storage tanks with outdoor fill ports, and ventilation lines off of the storage tanks to the rooftop to eliminate corrosive fumes. District staff custom-built chemical feed skids that draw directly from the bulk storage tanks with new Blue-White M2 peristaltic pumps. This improved efficiency by eliminating the day tanks and the need to refill them daily. Later in 2021 a new non-potable pump skid with VFD-controlled pump motors was installed to replace the aging system from 1999.

Several solids handling improvements have been made over the years. In 2012 improvements were made to the aerobic digesters, dewatering process, and for on-site sludge storage. The full capacity of the old package plants was retrofitted into aerobic digesters by removing the remaining equipment. Sanitaire medium bubble diffusers were installed across the floor of each of the two digesters and aluminum covers were installed over each. This provides nearly 1 million gallons of capacity between the two digesters and allows for significant solids reductions. Around the same time, a Centrisys centrifuge was installed to handle dewatering operations with the belt filter press transitioning to a backup unit. In 2013 a high efficiency centrifugal blower with a 200 HP VFD-controlled motor was installed to provide 100% of the aeration requirements of the aerobic digesters while consuming 33% less power than the three preexisting blowers which were utilized as backups. Seven of the existing drying beds were converted into three covered storage bays for stockpiled sludge with approximately fifteen months of storage capacity readily available. In 2019, the belt filter press was removed and work began to reconfigure the sludge conveyance system to eliminate the need to manually relocate dewatered sludge from the dewatering building to the sludge storage bays. An opening was made in an exterior wall of the dewatering building and the existing shaft-less screw conveyor that had originally moved dewatered sludge into a central bay of the building was repositioned to convey out through the opening. The existing conveyor was not long enough to reach an existing drying bed located about 30-feet away. At the time an additional shaft-less screw conveyor would have cost approximately $2,000 per linear foot. With equipment costs and installation estimated at nearly a quarter million dollars District staff began experimenting with different types of conveyors to see if there was a more economical option. Initial trials of an agricultural belt conveyor were unsuccessful due to sludge falling under the belt and causing slippage on the drive pulley. Success was found with a grain auger that was rented from a local farm supply yard and piloted for a period and the District opted to purchase a 61-foot grain auger for a permeant installation. The auger was installed and fitted with a VFD-driven electric motor to allow speed control, heat trace with insulation to protect against freezing, safety pull cables, and an auger motion sensor to signal back to the centrifuge PLC. These augers have proven to last for 3+ years and due to the cost on these units, the District will continue to utilize this setup for the foreseeable future. While unconventional, it has proven to be an economic alternative to a shaft-less screw conveyor.

Additional improvements at the headworks have also occurred. In 2013 the 31-inch Rotamat fine screen was replaced with a 36-inch Lakeside Raptor Drum Screen that became the District's primary screen. With the District's headworks and adjacent Control Building located within the 100-year flood plain flood-proofing improvements were made in 2018. This included raising the walls of the raw wet well, modifying the Control Building exterior entryways to accept installation of stoplogs to prevent entry of flood waters along with replacement of one of the raw pumps located in a basement dry well with a fully immersible pump, with plans to replace the remaining three with similar immersible pumps to provide continued operation should flooding occur. In 2019 a Channel Monster channel grinder was installed upstream of the Raptor drum screen to reduce rag accumulation on the lower bearing of the screener and to protect against debris as the District began accepting septage from local haulers. In 2023, the 40 inch Rotamat was replace with a Headworks MS2 Bar Screen. After the startup of the MS2 bar screen, the District was back to full redundancy for our headworks screening and this now allows Operations staff to choose which screen is best for the flow coming into the facility.

Improvements at the oxidation ditch began in 2015 with the installation of dissolved oxygen probes and VFDs for the aerator motors to provide DO-controlled pacing of the motors and improve energy efficiency. Later in 2019 with a Phosphorous limit coming into effect for the first time, a chemical feed system was installed to provide CPR. After experimenting with various chemicals and feed points the second ring of the oxidation ditch was selected as a feed point for an aluminum chloride solution provided by Chemtrade known as Hyper+Ion 1997. Two, 1,000 gallon bulk storage tanks were installed in the recessed pit where the old belt filter press used to be located. This provided an adequate secondary spill containment space. Exterior fill ports and venting were installed as well. Chemical

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feed is accomplished with a pump skid equipped with two Blue-White M2 peristaltic pumps. In 2023, the District began to optimize biological phosphorous removal without any major plant upgrades by simply decoupling aerator shafts between the inner ring and outer ring at one of the four quadrants within the ditch. The instantaneous results yielded a promising hope that bio-p removal is truly achievable at our facility and, when fully optimized, our facility was able to remove phosphorous with little to no chemical addition. Of note, NMWRD is now saving upwards of $40,000 on chemical costs based on these changes when compared to previous years.

In 2020 one of the two clarifiers saw replacement of the concrete floor and center drive mechanism following heaving due to hydraulic forces pushing the floor up during routine maintenance. This required removal of the clarifier cover, and removal of most of the existing floor, along with the access bridge and all of the clarifier mechanism. Accompanying the replacement of the floor, 24 pressure relief valves were installed on the new clarifier floor to supplement the existing relief valves in the walls. A new Walker Process stainless steel clarifier mechanism was installed along with a new access bridge.

Other notable improvements, both completed and ongoing, include the deployment of SCADA at the plant and for our collections system. In early 2023, the District started to install the necessary backbone infrastructure that would be the early beginnings of SCADA. New SCADA equipment that has been installed recently includes four new SCADA control panels, fiber loop, and a SCADA command center at the plant. As of today, 9 of our 24 lift stations are fully on SCADA while the remaining 15 are still utilizing auto dialer alarming. Also of note, more than half of the plant is fully tied into SCADA. We expect to have both the plant and the entire collection system on our SCADA by the end of 2026. The District just recently wrapped up its major control building electrical project that moved all critical electrical equipment and control panels into a climate controlled room. The wrap up of this project will allow us to proceed on some upcoming projects which include the installation of three new Kaeser turbo blowers that will replace the three Lamson centrifugal blowers while also replaceing the 30 year+ old 500kw Onan generator with a 600kw Kohler generator, with a belly tank included. Other noteworthy projects completed in the past few years include a full rehab of the Operator breakroom and implementation of a septage receiving station.

The District's staff currently consists of five full-time Operators, Chris Molidor, Emily Lecuyer, Brandon Scurto, Dan Alcock, and Brian Mulee. This talented and dedicated staff are led by Director of Operations, Joe Lapastora. The Operators are cross trained to operate and maintain all aspects of the collection system and wastewater treatment facility with the ability to assist with laboratory work as needed. District Clerk, Elisa Fisher, Assistant District Clerk, Madalina Roscan, and part-time Clerk, Jennifer Duron, handle the administrative work that includes monthly billing of over 5,000 District customers. District Junior Engineer, Jasmin Bait, and District Manager, Mohammed Haque, work to plot a course into the future for the District as they seek and manage grant funding, oversee construction projects, mentor engineering interns, and navigate the legal and administrative aspects of running a sanitary district. The Northern Moraine Wastewater Reclamation District is poised to continually improve upon itself as it employs new technologies and explores new ideas to provide a sustainable service to the residents within its service area and to protect downstream users in the Fox River Valley. CS