



Wisconsin Wastewater
Operators' Association

The Clarifier

WISCONSIN WASTEWATER OPERATORS' ASSOCIATION, INC.



Aerial view of NEW Water's Green Bay Facility, Green Bay, WI

53rd Annual W.W.O.A. Conference

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KI Convention Center, Green Bay

NEW Water, the brand of the Green Bay Metropolitan Sewerage District - "The Perfect Storm": How one utility is adapting to extreme weather

By: Hannah Malmberg, Public affairs & education intern, NEW Water

"Heavy Rains Impact Wastewater Treatment"
"Torrential Rain Leads to Release of Untreated Wastewater"
"Floodwaters Cause Sewage Treatment Plant to Overflow"

These are just a few headlines from around Wisconsin in the recent past, and similar events are occurring to partners in the clean water industry around the U.S. Wet weather events are hitting wastewater treatment plants hard, and with 2018 being the wettest year on record in several parts of Wisconsin, plants around the state know this impact well.

In Green Bay, extreme weather events continued into 2019. On March 14th and 15th 2019, heavy rains combined with several inches of rapid snow melt caused flooding throughout the community. The flooding was so severe it led to Governor Tony Evers declaring a state of emergency. Brown County, the county in which Green Bay

lies, as a whole suffered as a result of this weather causing Brown County Executive Troy Streckenbach to issue a disaster declaration.

Storm Events of March 2019: A Case Study

NEW Water, the brand of the Green Bay Metropolitan District, also felt the impacts of this wet weather event that Treatment Leader Jacob Becken described as "the perfect storm." Rapid thawing of snow in one-to-two days' time, a fair amount of rain, and excessive amounts of Inflow & Infiltration (I&I).

The I&I phenomenon is more significant during extreme weather events, when excess clear water from customer communities gets into the system, takes up capacity, and threatens operations and infrastructure. I&I is impacting the entire clean water industry.

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Green Bay Facility Design Data

Design Flow, million gallons per day		Thickening—Gravity Belt Thickeners	
Average Flow	30	Number	3
Maximum Daily	112	Capacity each unit (GPM)	750
Design Loadings, thousand pounds		Thickening—Centrifuge	
Biochemical Oxygen Demand (BOD5) Design	74	Number	1
Suspended Solids (SS) Design	64	Capacity, GPM	1,250
Phosphorus (mg/l as P) Design	15	Dewatering—Centrifuge	
Influent Pumps		Number	3
Number	4	Capacity each unit, GPM	150
Total Installed Capacity, MGD	160	Dryer	
Horsepower each pump	900	Number	1
Primary Clarifiers		Capacity, dry tons/day	51
Number	4	Incinerator (Fluid Bed)	
Diameter, Feet	120	Number	1
Volume, MG	1.25	Capacity each unit, dry tons/day	51
Activated Sludge System		Anaerobic Digesters	
Anoxic Basins		Number	2
Number	6	Volume, MG	2.2
Volume, MG (North Plant)	1.32	Height	110 ft.
Volume, MG (South Plant)	0.91	Bio-Gas Generators	
Contact Basins		Number	2
Number	6	Capacity each unit, MW	2.0
Volume, MG (North Plant)	2.69	Emergency Generators	
Volume, MG (South Plant)	1.84	Number	2
Final Clarifiers – North Plant		Capacity each unit, MW	2.0
Number	8	Plant Effluent Quality Requirements	
Diameter, Feet	125	C-BOD, mg/l	25
Volume, MG	1.7	Suspended Solids, mg/l	30
Final Clarifiers – South Plant		Phosphorus, mg/l	1.0
Number	2	Fecal Counts /100 ml	400
Diameter, Feet	135	Process Air Compressors	
Volume, MG	1.93	Number	4
Return Activated Sludge Pumps		Capacity Each unit (SCFM)	21K—55K
Number	16		
Capacity Each Pump, GPM	4,500		

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Over the course of the March 2019 weather event, flows at NEW Water's De Pere Facility (average of eight million gallons per day (MGD) rose from 11.9 MGD to around 50 MGD with all six influent pumps running at max capacity for 18 hours straight. The Green Bay Facility (average 30 MGD) rose from 78 MGD to over 100 MGD with 5 million gallons being transferred from De Pere. NEW Water staff worked day and night to facilitate continuous service at both treatment plants and throughout the interceptor system.

While both facilities were pushed to the limit, the De Pere Facility in particular posed a challenge to Treatment and Operations staff. "We had to do things we had never really done before," Becken said. Hydraulically, the plant could not handle pumping that much for that long of a period time and they risked washing microorganisms out of the system, which would take weeks to recover from. The team had to stop the aeration basin blowers allowing for the microorganisms to settle into the basins until the flows came down. "We had to think long term. Sure, it's going to be bad for a little bit -- but we have to protect the plant," Becken said.

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Collection System Mysteries Solved

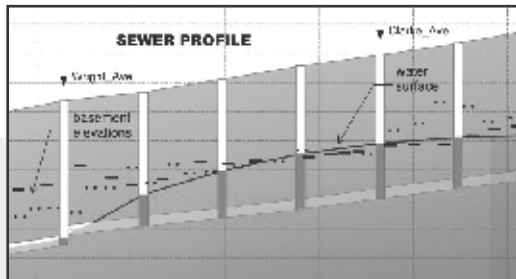
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De Pere Facility Design Data

Design Flow, million gallons per day (MGD)		Return Activated Sludge Pumps	
Average Dry Weather Flow	8.0	Number	5
Design Flow	14.2	Capacity Each Pump, gpm	3125
Maximum Hourly - Dry Day Flow	23.8		
Maximum Hourly - Wet Day Flow	30		
Design Loadings, thousand pounds per day		Waste Activated Sludge Pumps	
Biochemical Oxygen Demand (BOD5) Design	41	Number	2
Suspended Solids (SS) Design	28.9	Capacity Each Pump, gpm	650
Phosphorus (mg/l as P) Design	15		
Total Available Ammonium (mg/l as N) Maximum	22.2		
Influent Pumps		Mill Waste Conveyance Pumps	
Number	6	Number	2
Total Installed Capacity, MGD	55	Capacity Each Pump, gpm	750
Horsepower each pump	150		
Two pumps conveying metro waste to GB	100,150 hp		
Preliminary Treatment Units		Final Clarifiers	
Number	2	Number	3
Size, Feet	50x50	Diameter, Feet	125
		Side Water Depth, Feet	10.9
		Overflow Rate at Design Flow, gpd/ft ²	420
Activated Sludge System		Return Activated Sludge Pumps	
Anoxic Basins		Number	5
Number	2	Capacity Each Pump, gpm	2500
Volume, MG (Both Basins)	2.2		
Contact Basins		Tertiary Filtration Sand Filters	
Number	2	Number	5
Volume, MG (Both Basins)	4.4	Hydraulic Loading at Design Flow, gpm/ft ²	5
HST Turbo Compressors		UltraViolet Disinfection	
Number	6	Number of Channels	2
Capacity each unit (SCFM)	5300	Design Flow per Channel, MGD	15.0
Horsepower each unit	322	Average Dose mWs/cm ²	30
Intermediate Clarifiers		Plant Effluent Quality Requirements	
Number	2	C-BOD mg/l	9.0
Diameter, Feet	100	Suspended Solids SS, mg/l	10
Side Water Depth, Feet	13.7	Phosphorus P, mg/l	1.0
Overflow Rate at Design Flow, gpd/ft ²	1000	Fecal Counts/100 ml	400

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Of course, what impacts the treatment plant is also impacting the interceptor system. And they had their own share of woes during this event.



Field Services opening up a siphon barrel to allow more flow capacity to NEW Water's DePere facility

Becken and the Operations staff were in constant contact with the Field Services team throughout the night as the plant is always interested in whether they have crested in the collection system. The plant can then judge what needs to be done based off of what Field Services is seeing out in the field.

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While Operators were handling the situation at the plant, Field Services Technicians were handling critical situations at two locations. The East River Lift Station (ERLS) not only had high flow alarms, but the flooding of the East River was encroaching on the lift station. While there were flood gates in the doorways, there was nothing to protect the transformers and power was at risk of being lost. With



Fish entering a confined space to evaluate the equipment in one of our service area lift stations.

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the help of Maintenance staff, along with workers from Brown County Emergency Management, Brown County Public Works, Ledgeview Public Works, Brown County Sheriff's Office, and Wisconsin Public Service, emergency sand berms were built around the transformers. This situation was a first not only for Field Services Team Leader Duane Fish, but the entire Field Services team. "In my time here, this is the first time I've ever heard of water getting up close to the transformers, which are about 10 yards from the building," he said.



Grasland waterways after

The East Bay Shore (EBS) system was also seeing high flow rates. The EBS system includes a series of interconnected lift stations that requires significant intervention by the Field Services team and Maintenance team at high flow rates in order to operate without overflows and backups. Four people were needed at all times at the EBS lift stations and septic haulers were called in to pump out wet wells in order to prevent sanitary sewage overflows and basement backups as the pumps couldn't keep up with flows. The loads were then brought to the Green Bay Facility. For the future, Field Services Manager Sharon Thiesen said NEW Water is evaluating improvements to the ERLS including constructing a berm.

Furthermore, a reduction in I&I would help mitigate storm event impact. During these events, water volume flowing to NEW Water can increase upwards of five times the average – and that's not because people are flushing their toilets five times as often. Leaky pipes in the interceptor system are coming from customer communities, with up to 80% of that coming from the homeowner pipes, according to industry statistics. Truly a wicked problem, tackling I&I will require community

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buy-in, and community partnership. NEW Water has already begun to engage customer communities in the I&I problem.

Meanwhile, Becken noted that “it appears as though the intensity of some of these storms has changed. Rainfall amounts have been happening in a shorter period of time, which almost forces a change in the way we manage certain things.”

As NEW Water looks at the long-term, understanding the different flow impacts to the facilities during rain events is critical. Becken went on to note that as NEW Water goes through a Liquids Facility planning process, peak flows will be analyzed, including how those flows trend, and how they have looked historically over the past ten years or more. “Based off of that, we’ll look at what we need to do as an organization to make sure that we can handle what’s going to come our way in the future,” Becken said. Meanwhile, Becken said he is proud of the way the NEW Water team has handled events like March’s flooding.

“Overall, I am very proud of the way we’ve all handled a lot of these big rain events recently, especially the power



NEW Water's Green Bay facility with the Bay of Green Bay in the background

outages,” Becken said. “Some situations could have been terrible, and we could have been in the news big time, but we didn’t let it get to that point.”

Added Operator Mike Gardner: “I think it’s impressive that everybody is in here working extra hard, doesn’t matter what time of day it is.”

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He added that no two challenges are alike: “It’s always a learning opportunity. It seems we learn something new each time we go through these events.”



“Unflushable”—wipes, fat, oil, grease, dental floss, etc.,—are posing an increasing challenge for equipment. These photos depict “unflushables” in NEW Water’s influent pump station wet well.

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Being Prepared: NEW Water’s Proactive Approach

For Field Services, there is little that can be done to prepare for extreme weather events as they, Fish notes, are at the mercy of gravity systems and I&I. However, Field Services Technicians conduct weekly station checks to make sure pumps are in good condition. If not, the pumps are deconstructed and more often than not, “rags,” which include wipes, fats, oil, grease, dental floss and other “unflushable” material, are removed. The one-to-two week aftermath of an extreme weather event is an important time to check for “unflushables” in pumps as everything is being washed out through the system.

Additionally, cleaning and televising are used in the interceptor system to identify possible problem areas. Thieszen believes weekly station checks and maintenance are very important preventative steps to take. “If you already have a plugged pump going into a wet weather event, you are really behind,” Thieszen said.



Jacob Becken and Craig Lawniczak examining the inside of the digester.

The Treatment and Maintenance teams take several steps to prepare for extreme weather events as well. Going in to a rain event, the team likes to have full redundancy at both facilities. Additional aeration basins are examined to make sure that they are ready go and staff makes sure that two aeration basins are never down for maintenance at the same time.

Weather radar is monitored in the control room and if the storm looks as though it will be bad, the process of looking at who is on staff to help begins. With events that can happen any time of the day, knowing the crews well is an important step of this process. Knowing who is working, who is available, and who worked last is critical in managing people’s wellbeing and time to sleep during a long-lasting event.

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Knowing the structure of the plant well is also vital in an extreme weather situation. "When I first got there [in March], we were physically sprinting from one place to the next because you have to do things pretty timely, because it happened quick and you have to make sure that certain parts of the plant can take the flow," Becken said.

When the Storms Hit: Adaptation is Key

When an extreme weather situation occurs, alarms installed at pump stations will alert NEW Water's control room when flow levels begin to rise and the pumps are unable to keep up. The control room will contact Field Services and a minimum of two technicians, due to confined space requirements, will be sent to monitor the situation. The technicians will remain in contact with the plant and if the pumps are unable to keep up, the back-up plan is to call septic haulers to suck out of the wet wells. Both Thieszen and Fish agree that communication is vital in an extreme weather situation, not only among the Field Services team but also with the plant, back up resources in the community like septic haulers, and the NEW Water team as a whole.



NEW Water staff collaborating in the control room.

"We pretty much don't let ourselves get in that position," Becken said. "You always have to think worst case. If we get this much rain, what are we going to do?" However, given the trend of weather events coming on with little advance notice, there is often little time to prepare. Teamwork, therefore, is key, as are experience, knowledge, and skill.

Gardner said this means all hands on deck. "Whoever is here will get together and come up with a game plan," he said. However, even with preparation, storm events like the one in March call for everyone to have to adapt quickly on their feet.

Looking to the future, NEW Water is planning to collaborate with the community to reduce I&I, to attack

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A black and white photograph showing two workers in safety gear. One worker is kneeling and working on a piece of equipment, while the other is standing and holding a tool. They appear to be in a confined space or a trench.

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the “unflushables” problem through enhanced public education and community engagement, and continue to address and mitigate risk caused by these extreme weather events.

NEW Water Executive Director Thomas W. Sigmund, P.E., praised the efforts of the staff to rally to the call whenever needed, in order to serve the community. “Our staff demonstrate dedication and commitment at every turn – and these extreme weather events are posing challenges we’ve never seen before,” Sigmund said. “I am so proud of their tireless efforts to protect our most valuable resource, water.” ☪



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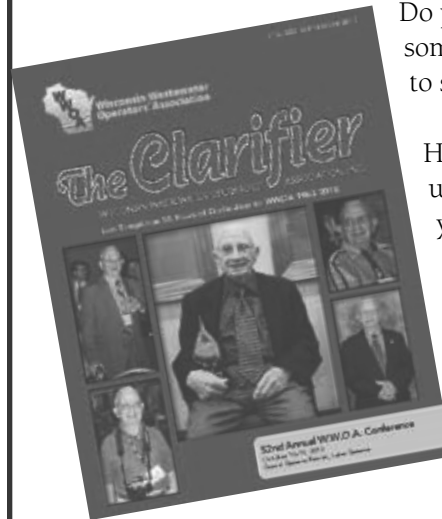
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