

Communities with Combined Sewers Adapting to a Changing Climate: Milwaukee, Wisconsin

Background

The Milwaukee Metropolitan Sewerage District (MMSD) is a regional government agency that provides wastewater treatment and flood management services for the Greater Milwaukee area in Wisconsin, serving over 1 million people across 29 communities. As an agency that provides both conveyance and treatment services, MMSD takes a holistic approach to sanitary sewer overflow (SSO) and combined sewer overflow (CSO) management, weaving in aspects of long-term sustainability and resiliency to the actions it takes to meet its permit requirements.

Challenges

The Milwaukee area experiences extreme storms in part due to its location on Lake Michigan which, due to local factors, such as the urban heat island effect,¹ causes storms to stall over the city. In 2012, MMSD published a [Sustainability Plan](#), which outlined the challenges they face and their ongoing approach to protecting the area's water resources. To anticipate and plan for changing climate conditions, they used climate projections developed by the [Wisconsin Initiative on Climate Change Impacts](#). Based on these projections, the Milwaukee area is expected to see an increase in air temperatures, especially during winter months. This is expected to exacerbate urban heat island effects and will likely lead to a greater proportion of winter precipitation falling as rain instead of snow. Annual precipitation averages are also expected to increase, but unevenly across seasons. Average precipitation is expected to increase during the fall, winter, and spring; conversely, precipitation is expected to decrease in the summer. Additionally, the frequency and magnitude of large storm events is expected to increase.

These precipitation and storm intensity changes are expected to put greater stress on existing collection systems and treatment facilities which may lead to more localized flooding and overflows. MMSD is also concerned with secondary effects. For example, higher temperatures and drier conditions during summer months may have detrimental effects on water quality, fish habitat, and vegetation. Higher precipitation during winter months may lead to greater

Key Information

- Location:** Milwaukee, WI
- Population served:** over 1 million
- Permit Number:** WI0036820
- Key hazards:** extreme storms, increased temperatures, increased precipitation, more winter rain than snow



Sinkhole at an intersection after a storm.

¹ Buildings and roads absorb and re-emit the sun's heat causing cities to become "islands" of higher temperatures known as heat islands. The impact of these heat islands are known as heat island effects.

sediment and nutrient loading, changes in ice cover, and changes in lake levels.

Solutions

MMSD's [2035 Vision](#) takes a holistic approach to addressing its water resource challenges, including CSOs.

Integrated Water Management

MMSD's 2035 Vision is based on two strategic objectives—Integrated Water Management and Climate Change Mitigation and Adaptation. Integrated Water Management focuses on seeking a balance between grey infrastructure and green infrastructure. MMSD acknowledges the necessary and critical services that grey infrastructure—roads, pipes, treatment plants—provides, and seeks to enhance those services through incorporation of more green infrastructure. In keeping with a watershed-based approach, MMSD's portfolio includes both smaller scale 'built' practices such as rain gardens, porous pavements, and bioswales, and the preservation and restoration of natural landscape features such as forests, floodplains, and wetlands that perform the same hydrologic functions but at much larger scales.



Milwaukee Public Library green roof which helps manage stormwater on site.

A sample of integrated water management goals with direct applicability to CSOs includes:

- Strive toward zero basement backups
- Achieve, to the extent feasible, zero SSOs and CSOs
- Achieve zero homes in the 100-year floodplain
- Use green infrastructure to capture the first 0.5 inches of rainfall
- Acquire an additional 10,000 acres of river buffers through Greenseams® and other regional programs



MMSD's Greenseams program allows recreational access to undeveloped areas.

In 2001, MMSD launched its [Greenseams®](#) program to purchase easements in undeveloped, privately owned properties in areas expected to have major growth in the next 20 years, thus ensuring protection of critical forests, floodplains, and wetlands and the ecosystem services they provide. Initially, the program was met with resistance from the public, but MMSD gained greater support by allowing recreational access to these areas.

Climate Change Mitigation and Adaptation

As part of the Climate Change Mitigation and Adaptation objective, MMSD has set energy efficiency and carbon footprint goals and is developing its modeling and predictive capabilities to be better able to respond to changing climate and wet weather conditions. They are working with the University of Wisconsin to look at more recent storm data to study the heat island effect, how it impacts storm stalling, and how strategic greening can be used to alleviate these impacts while treating stormwater. They even leverage aspects of their green infrastructure initiatives to meet their carbon footprint goals. For example, they intend to use the carbon sequestration benefits of their

Greenseams® Program to offset 30% of their carbon footprint. By taking an integrated watershed perspective, MMSD is able to reduce wet weather flows while also realizing multifaceted benefits including habitat protection, coastline resiliency, urban cooling, and carbon sequestration.



Menomonee River Concrete Removal. Restoring channelized rivers is one tool MMSD is using to provide greater peak flow attenuation, floodplain connection, habitat restoration, and aesthetic benefits.

Regulatory Drivers

In 2019, the Wisconsin Department of Natural Resources added wet weather management plan requirements to [MMSD's National Pollutant Discharge Elimination System \(NPDES\) permit](#). Specifically, the permit added green infrastructure capacity requirements to capture the first 0.5 inch of rainfall on impervious areas, which is equivalent to 740 million gallons of storage. MMSD is working towards this goal by providing financial incentives to municipalities to implement green infrastructure, requiring green infrastructure for large developments, and tracking progress towards this goal using a web-based dashboard. Having green infrastructure requirements in the MMSD permit has further supported the district in implementing green infrastructure in the municipalities it serves.

Additional Information

For more information on [Milwaukee Metropolitan Sewerage District](#), contact Kevin Shafer, Executive Director, at kshafer@mmsd.com. Additional information on MMSD's permit, CSOs, and climate adaptation can be found here:

- [MMSD's 2019 NPDES Permit \(WI0036820\)](#)
- [MMSD Regional Green Infrastructure Plan](#)
- [Updates and Recommendations to the Milwaukee Metropolitan Sewerage District's Climate Change Mitigation and Adaptation Programs](#)