

Communities with Combined Sewers Adapting to a Changing Climate: Detroit, Michigan

Background

The Detroit Water and Sewerage Department (DWSD) maintains the city of Detroit's collection system which includes 3,000 miles of storm sewers, sanitary sewers, and combined sewers and serves just under 680,000 people. DWSD sends wastewater and wet weather flows to the Great Lakes Water Authority (GLWA) for treatment.¹

Challenges

Detroit's collection system is facing challenges related to aging infrastructure, failing private lateral service lines, flooding, basement backups, and combined sewer overflows (CSOs). In the last decade, Detroit has experienced several historic flooding events. In 2021, President Biden declared a national disaster when Detroit experienced a major storm that resulted in more than 6 inches of rain in a 12-hour period and led to flooding on streets and freeways, as well as in residential and commercial basements. To plan for and adapt to these challenges, DWSD and GLWA have focused on peak flow control, reducing impervious areas in the sewershed, resilient redevelopment and infrastructure upgrades, and partnerships to improve resiliency to changing climate conditions.

Climate Impacts

[Detroit's Climate Action Plan](#) notes that total annual precipitation in southeast Michigan has already increased by 11 percent when comparing the 1981-2010 average to the 1961-1990 average. Moving forward, Detroit expects these trends to continue, with more frequent and more severe storms as well as more rain than snow due to warming temperatures. These changes are likely to lead to increased flooding, more basement backups, and CSOs.

Solutions

Climate Action Plan

Detroit's Climate Action Plan is organized around major themes with goals, near-term and long-term action steps, indicators for success, and

Key Information

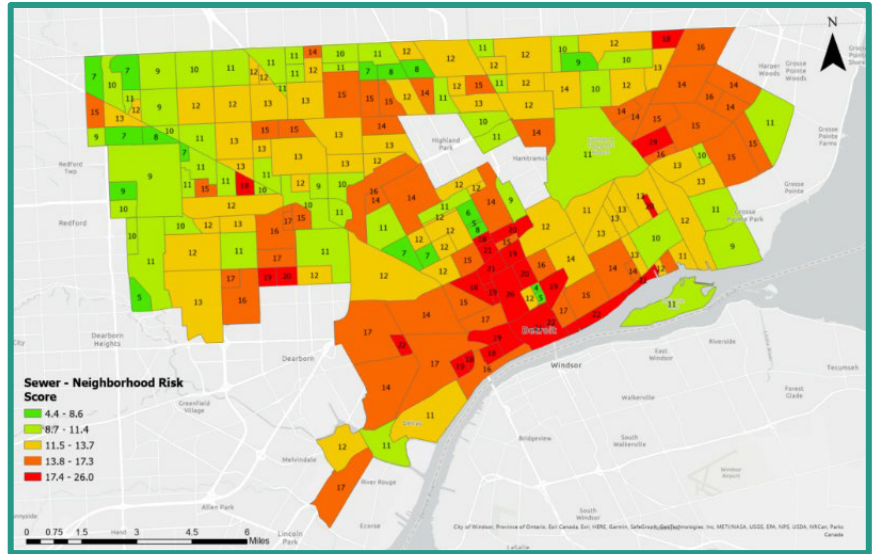
- **Location:** Detroit, MI
- **Population served:** 680,000
- **Permit Number:** MI0022802
- **Key hazards:** increasing storm intensity, increased precipitation, warming temperatures



Historic flooding events in Detroit. Flooded Detroit neighborhood (top) and news report of highway closures and street flooding (bottom)

¹ GLWA operates regional water and wastewater systems for communities in eight southeast Michigan counties, including the city of Detroit, while DWSD operates the city's local water and wastewater systems. See DWSD and GLWA's [roles and responsibilities](#) for more details.

appropriate methods for assessment. One theme is parks, public spaces, and water infrastructure. This theme identifies steps that address stormwater runoff while also providing recreational, habitat, and aesthetic benefits. These steps include increasing tree canopy citywide; developing a green infrastructure plan to manage stormwater, filter pollutants, and improve public health; daylighting streams that have historically been paved over and polluted; and expanding, protecting, and maintaining natural corridors that provide habitat.



Map presenting neighborhood risk scores from DWSD's Capital Improvement Program risk model

Risk-based Asset Management

In order to prioritize projects, DWSD's asset management plan includes a risk model based on the consequence and probability of failure of each asset. This model considers basement backups, environmentally sensitive areas, hard to maintain areas, population density, employment rates, proximity to public transportation, asset condition, and hydraulics. The risk assessment also checks whether each neighborhood can meet a level of service of conveying a 10-year design storm. In collaboration with other city departments, each of these factors is assigned a weight, and weighted scores are used to prioritize projects each year. The model is updated annually as more information is available. DWSD has found that this model is approximately 80% accurate based on field observations.

Stormwater Management

In 2018, in an effort to reduce flooding and CSOs, the city of Detroit established stormwater management requirements through a stormwater ordinance. The stormwater ordinance requires management of 10-year and 100-year peak flow volumes for new developments. As of 2023, 78 projects have been completed with a total of 2.5 million gallons of retention volume, which has reduced peak flows in the collection system by 40 million gallons annually.

Additionally, DWSD has been working to mitigate flooding by restoring capacity in the sewer system through sewer pipe cleaning, catch basin inspection and cleaning, and the construction of two new detention basins.

Green Infrastructure

DWSD has also prioritized implementing green infrastructure. In 2013, the Michigan Department of Environment, Great Lakes, and Energy (EGLE) issued a National Pollutant Discharge Elimination System (NPDES) permit that required DWSD to develop and implement a Green Stormwater Infrastructure Plan for 17 CSO outfalls. To date, DWSD has implemented green infrastructure in municipal parks, replaced impervious surfaces with green space on thousands of acres of vacant lots, planted thousands of trees throughout the city, and overseen a downspout



Completed DWSD green infrastructure project that provides peak flow reduction.

disconnection program. In total, these installations currently provide 2.2 million gallons of peak flow reduction per year and reduce the annual volume of runoff discharged to the collection system by 53 million gallons.

Basement Backups

In 2021, DWSD conducted a study of basement backups to identify the most likely backup locations during storms. Private lateral sewer line repairs can cost homeowners up to twenty thousand dollars, so Detroit provides funding to customers to assist with lateral upgrades or replacements through their [Basement Backup Protection Program](#). Additionally, the program provides inspections, downspout disconnections, and installation of backwater valves for homes in flood-prone neighborhoods to help mitigate backups.

Infrastructure Updates and Rehabilitation

GLWA has made several infrastructure upgrades and is planning more upgrades to improve resiliency against aging infrastructure and flooding, reduce backups, and increase power reliability. GLWA updated several pump stations to improve power reliability and redundancy and plans to update others to reduce the risk of flooding and backups. GLWA is also planning to upgrade the Detroit River Interceptor and rehabilitate other portions of the sewer system to optimize existing capacity, as well as extend the lifespan of existing infrastructure.

Enhancing Resiliency

To implement wet weather improvements including flood mitigation, DWSD and GLWA have obtained funding from a number of grant programs including [FEMA's Building Resilient Infrastructure and Communities](#) and the [Clean Water State Revolving Fund](#). They have also partnered with entities like the Michigan Department of Transportation (MDOT) on several large-scale tunnel, sewer, drainage area disconnection, and freeway removal projects to improve stormwater management and reduce flooding.

Additional Information

For more information on the [Detroit Water and Sewerage Department](#), contact Samuel Smalley, Chief Operating Officer, at Samuel.Smalley@detroitmi.gov. For more information on the [Great Lakes Water Authority](#), contact Todd King, System Resiliency Officer, at todd.king@glwater.org. Additional information about DWSD and GLWA's permit, CSOs, and climate adaptation can be found in the following resources:

- [DWSD's Stormwater Management Plan](#)
- [Great Lakes Water Authority Capital Improvement Plan](#)
- [Detroit's Working for Environmental Justice](#)