As part of Project Groundwork, the Metropolitan Sewer District of Greater Cincinnati (MSD) is exploring, designing and implementing a variety of green solutions to manage rain water runoff. Keeping runoff out of the sewers helps reduce combined sewer overflows (CSOs) into waterways.

**Background**

The major culprit in a combined sewer overflow (CSO) is rain water, not sewage. CSOs occur when too much rain water (also known as stormwater) fills up sewers beyond what they can hold and the mixture overflows into a local stream or river.

As part of Project Groundwork, the Metropolitan Sewer District of Greater Cincinnati (MSD) is exploring, designing and implementing green solutions to keep rain water runoff out of the sewer system. This effort, combined with more traditional solutions such as larger sewers or separate storm sewers, will help reduce CSOs in our area.

These green solutions, commonly referred to as natural solutions, green infrastructure or sustainable stormwater solutions, can range from rain gardens and pervious pavement to bioswales, stormwater detention basins, stream restoration and bioengineered streams.

Green solutions allows rainwater to be filtered through soil, rocks and plants to remove impurities before it enters a stream or river. The rain water can also soak into the ground where it is filtered and absorbed by plants or recharges groundwater systems.

**Green Solutions**

MSD has been exploring green solutions to manage rain water since 2009. To date, we are capturing more than 1 billion gallons of stormwater annually. See our project map on the inside spread.

**Low Impact Development (LID)**

Early on, MSD partnered with about 20 different public and private organizations across Hamilton County to evaluate the effectiveness of Low Impact Development (LID) stormwater controls. LID controls typically capture less than 10 million gallons of stormwater annually.

As part of the program, MSD helped fund the design and/or installation of numerous stormwater controls (green infrastructure) at partner sites.

Examples of the stormwater controls evaluated include:

- **Rain gardens** — depressed, vegetated areas that capture and absorb stormwater from nearby impervious surfaces.

- **Green or vegetative roofs** — roofs that use vegetative materials to uptake and filter stormwater before flowing via gravity to a roof drain system.

- **Bioinfiltration areas/cells** — depressions in the land that are designed to capture stormwater from impervious surfaces through vegetation and subsurface storage.
Sustainable Stormwater Projects

1. San Antonio Church
   South Fairmount
   Permeable pavers and rain gardens (2012).

2. St. Francis Court Apts.
   South Fairmount
   Two bioinfiltration basins (2010). Removes ~360,000 gallons a year.

3. Roberts Academy Stormwater Control
   East Price Hill
   Retrofit of an existing stormwater detention basin and five new bioinfiltration basins (2014).

4. Lick Run Project
   South Fairmount
   The Lick Run project includes numerous green solutions, including:
   - Bumpout planter at Harrison Ave & Tremont (2013)
   - Bioswale at Rapid Run Park (2015)
   - Stream restoration off Quebec Road and behind the Judson Care Center (2019)
   - Lick Run Greenway (2020)
   More info at: projectgroundwork.org/lickrun

5. Former Habig's Parking Lot
   North Fairmount
   Porous pavers and bioinfiltration area.

6. Denham Street Rain Garden
   North Fairmount
   Bioswale installed in 2015. Funded in part by Ohio EPA SWIF grant.

7. West Fork Project
   Northside
   Two stormwater detention basins (2019) and new storm sewers (2015) to convey rain water directly to the West Fork Creek.
   More info at: projectgroundwork.org/kingsrun

8. Kings Run Project
   West End
   Stormwater detention basins, new storm sewers, and stream restoration to convey rain water directly to the Mill Creek.
   More info at: projectgroundwork.org/kingsrun

9. City of Wyoming
   Wyoming
   Rain garden and 250 rain barrels at residential properties.

10. Clark Montessori High School
    Hyde Park
    Two vegetative roofs, two bioswales, three stormwater planters, pervious pavers, and a rain garden. Removes ~1,875 million gallons a year.

11. Evanston Aquatic Center
    Evanston
    Three bioinfiltration basins.

12. Wyoming High School
    Wyoming
    Retrofit of 1,500 square feet of an existing detention basin on the school's property.

13. Hartwell Elementary School
    Hyde Park
    Porous concrete in parking lot.

14. Cincinnati State Technical and Community College
    Clifton
    Bioretention pond, infiltration chamber, level spreader, pervious pavement, 10 rain gardens, and two cisterns. Removes about 10 million gallons a year.

15. Cincinnati Museum Center
    Queensgate
    Green roof.

16. Civic Garden Center’s Green Learning Station
    Avondale
    Permeable pavers, porous asphalt and concrete, green roofs, bioswales, and cistern.

17. Cincinnati Zoo & Botanical Garden
    Avondale
    African Savannah: Enhanced turf, porous paving, and storm sewer separation. Removes ~15.6 million gallons a year.
    Main Entrance: Pervious pavers and rainwater storage tank.

18. Ault Park Stream Restoration
    Over-the-Rhine
    Mount Lookout Stream restoration and new storm sewers.

19. American Red Cross
    North Avondale
    Green roof.

20. Oakley Square
    Oakley
    Bioretention planters, pervious concrete sidewalks, and a bioretention basin.

21. San Antonio Church
    South Fairmount
    Permeable pavers and rain gardens.

22. Lick Run Project
    South Fairmount
    The Lick Run project includes numerous green solutions, including:
    - Bumpout planter at Harrison Ave & Tremont (2013)
    - Bioswale at Rapid Run Park (2015)
    - Stream restoration off Quebec Road and behind the Judson Care Center (2019)
    - Lick Run Greenway (2020)
    More info at: projectgroundwork.org/lickrun

23. Comer and Osborn Alleys
    Over-the-Rhine
    Permeable pavers.

24. Taft IT High School
    West End
    Green roof and bioinfiltration basin.

25. Cincinnati Museum Center
    Queensgate
    Green roof.

26. Civic Garden Center’s Green Learning Station
    Avondale
    Permeable pavers, porous asphalt and concrete, green roofs, bioswales, and cistern.

27. Cincinnati State Technical and Community College
    Clifton
    Bioretention pond, infiltration chamber, level spreader, pervious pavement, 10 rain gardens, and two cisterns. Removes about 10 million gallons a year.

28. Cincinnati Zoo & Botanical Garden
    Avondale
    African Savannah: Enhanced turf, porous paving, and storm sewer separation. Removes ~15.6 million gallons a year.
    Main Entrance: Pervious pavers and rainwater storage tank.

29. Ault Park Stream Restoration
    Over-the-Rhine
    Mount Lookout Stream restoration and new storm sewers.

30. American Red Cross
    North Avondale
    Green roof.

31. Cincinnati State Technical and Community College
    Clifton
    Bioretention pond, infiltration chamber, level spreader, pervious pavement, 10 rain gardens, and two cisterns. Removes about 10 million gallons a year.

32. Cincinnati Zoo & Botanical Garden
    Avondale
    African Savannah: Enhanced turf, porous paving, and storm sewer separation. Removes ~15.6 million gallons a year.
    Main Entrance: Pervious pavers and rainwater storage tank.
• **Pervious paving and pavers** — alternatives to concrete or asphalt that allow water to pass to the ground or to subsurface storage below.

• **Rainwater harvesting** — allows rainwater to be collected before reaching the ground and reused.

• **Bioswales** — long, trough-like areas that capture and detain rainwater on vegetated ground and in subsurface storage for as long as possible before re-entering sewage systems.

MSD partners included local non-profits, hospitals, museums, churches, colleges and municipalities, among others. The projects are located throughout the MSD service area in areas served by combined sewers.

Monitoring has been performed at some sites to measure water quality benefits and reduction in runoff volume to CSOs.


**Larger-Scale Stormwater Management Projects**

MSD needs to remove large volumes of stormwater from its combined sewer system to make a measurable difference in reduction of CSOs. As a result, we have begun installing larger-scale green infrastructure such as bioswales, stream restoration and stormwater detention basins.

These types of projects capture multiple millions of gallons of stormwater annually.

Much of this effort has focused on the Lower Mill Creek watershed area, where MSD was required under its Consent Decree to eliminate 1.78 billion gallons of combined sewer overflows by 2018.

As part of this program, MSD negotiated with the U.S. EPA to approve a green solution instead of a deep underground CSO storage tunnel, at a savings of more than $200 million.

The nationally recognized Lick Run Project removes about 500 million gallons of stormwater from the combined sewer system. The primary feature is a mile-long engineered stream that conveys rain water to the Mill Creek.

MSD also completed a stream restoration project in Ault Park which reduces CSOs into the Little Miami River.