GREEN INFRASTRUCTURE TYPES

BIOSWALEs
Landscape features that capture and infiltrate runoff and can also remove pollutants.

GREEN ROOFS
Partially or completely planted roofs with vegetation growing in soil or other growing media to hold rainwater.

GREENWAYS
Riparian buffer zones that store stormwater runoff into the ground naturally.

NATIVE LANDSCAPING
The use of native plants that can tolerate drought and flooding cycles because of deep roots and climate-specific adaptations.

POROUS PAVEMENT
Pavement that can reduce and infiltrate surface runoff through its permeable surface into a stone or filter media below.

RAIN GARDENS
Gardens collect stormwater runoff, slowly infiltrating it into the ground.

CISTERNs WITH PUMPS FOR RE-USE
The capture and storage of water, potentially for reuse later.

DEPAVING
Removal of structures or paving in order to allow infiltration.

SOIL AMENDMENTS
Materials worked into the soil to enhance its ability to infiltrate or absorb water.

TREES
Trees that can hold rainwater on their leaves and branches.

WETLANDS
Areas that have soils that are inundated or saturated for part of the year or the entire year.
Green Infrastructure Benefits

- Supports biodiversity
- Improves stormwater quality in separated sewer area (TMDLs)
- Reduces risk of Combined Sewer Overflows
- Provides a better learning environment for children
- Climate change adaptation and resiliency
- Reduce flood risk
- Increase property values
- Reduce urban heat island
- Improves human health through air/water quality
- Improves stormwater quality in separated sewer area (TMDLs)

**CO-BENEFITS OF GREEN INFRASTRUCTURE**
Collaboration is Key

<table>
<thead>
<tr>
<th>Metro Wastewater/Stormwater Utility</th>
<th>City Government</th>
<th>Funders and Community Partners</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="MMSD Logo" /></td>
<td><img src="image2.png" alt="City of Milwaukee Logo" /></td>
<td><img src="image3.png" alt="Fund for Lake Michigan Logo" /></td>
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<td><img src="image4.png" alt="MMSD Logo" /></td>
<td><img src="image5.png" alt="City of Milwaukee Logo" /></td>
<td><img src="image6.png" alt="WALNUT WAY CONSERVATION CORP Logo" /></td>
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<td><img src="image7.png" alt="MMSD Logo" /></td>
<td><img src="image8.png" alt="City of Milwaukee Logo" /></td>
<td><img src="image9.png" alt="Green Schools Consortium of Milwaukee Logo" /></td>
</tr>
</tbody>
</table>
Green Infrastructure History in Milwaukee

- **2003**: MMSD starts promoting green infrastructure demonstration projects.
- **2008-2011**: Green Street Pilot Projects; City ordinances updated to allow for green infrastructure.
- **2010-2011**: Flooding Task Force.
- **2012**: MMSD Permit Requires Green Infrastructure.
- **2013**: Green Streets Stormwater Management Plan.
- **2013**: Refresh Milwaukee Sustainability Plan.
- **2013**: MMSD Regional Green Infrastructure Plan.
- **2015**: Green Infrastructure Baseline Inventory.
- **2018-2020**: Green Schoolyard Projects.
- **2019**: City of Milwaukee GI Plan & ordinance update.
Too Much Pavement + Increasing Risk of Extreme Storms = Flood Risk

• Flooding in 2010 cost the Milwaukee County and developers at least $37 million dollars in damage

• Climate change increases the risk of extreme storms.
GREY TO GREEN:
CITY IS LEADING BY EXAMPLE ON GREEN INFRASTRUCTURE IN OUR REDEVELOPMENT PROJECTS
GREEN LUMINARIES IN PRIVATE DEVELOPMENT

December 2017 - Freshwater Plaza

June 2017 - Urban Ecology Luminary

November 2017 - Ascension Columbia St. Mary's
GREY TO GREEN:

BUT OPPORTUNITY REMAINS IN OUR PARKING LOTS, ROOFS AND SCHOOL YARDS
Setting Goals

• City’s 2013 ReFresh Milwaukee Plan set goal of increasing Green Infrastructure 10% per year

• MMSD Goal of 740 million gallons

• What’s the baseline?

• How much is needed?

• How much is affordable?
Green Infrastructure Baseline Inventory

• Need to quantify existing green infrastructure for setting future goals

• Review and quantify existing MMSD and City funded projects

• Estimate gallons captured of known projects
Green Infrastructure Baseline Inventory-Key Findings

• 45.5% of Milwaukee’s land area is impervious

• Green Infrastructure as of 2015 was enough to capture 14m gallons

• Following the 10% annual increase goal would yield 36 million gallons by 2023
## Standard Green Infrastructure Specs

[www.freshcoastguardians.com](http://www.freshcoastguardians.com)

### TABLE 3
**Assumed Stormwater Performance Capacities by Green Infrastructure Strategy**

<table>
<thead>
<tr>
<th>Green Infrastructure Strategy</th>
<th>Unit of Measure</th>
<th>Potential Storage Capacity (gallon)</th>
<th>Expected Impervious Area Managed Per Unit (SF)</th>
<th>Equivalent Capacity (inches from contributing area)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green roofs</td>
<td>SF</td>
<td>1.1</td>
<td>1</td>
<td>1.70</td>
</tr>
<tr>
<td>Rain gardens</td>
<td>SF</td>
<td>4.4</td>
<td>12</td>
<td>0.58</td>
</tr>
<tr>
<td>Stormwater trees</td>
<td>Each</td>
<td>25</td>
<td>157</td>
<td>0.26</td>
</tr>
<tr>
<td>Bioretention/Bioswales/</td>
<td>SF</td>
<td>7.5</td>
<td>12</td>
<td>1.00</td>
</tr>
<tr>
<td>Native landscaping</td>
<td>SF</td>
<td>0.4</td>
<td>N/A</td>
<td>0.58</td>
</tr>
<tr>
<td>Porous pavement</td>
<td>SF</td>
<td>3.0</td>
<td>4</td>
<td>1.20</td>
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<tr>
<td>Rain barrels</td>
<td>Each</td>
<td>55</td>
<td>350</td>
<td>0.25</td>
</tr>
<tr>
<td>CiSterms</td>
<td>Each</td>
<td>1,000</td>
<td>6,500</td>
<td>0.25</td>
</tr>
<tr>
<td>Soil amendments</td>
<td>SF</td>
<td>0.2</td>
<td>N/A</td>
<td>0.39</td>
</tr>
</tbody>
</table>

1. The green infrastructure strategies-gutters, streets, and parking lots are made up of other strategies. The wetlands/green infrastructure strategy is encouraged but not quantified in the Plan.
2. This is the physical storage capacity per square foot.
3. Annual capture is determined using equivalent capacity with Figure 12.
4. Capacities for native landscaping and soil amendments are estimated based on Natural Resources Conservation Service runoff volume changes during a 2-inch rainfall.
Baseline Inventory- Behind the Scenes Footage

**Exact number unknown; data from MMSD and H2O Capture; see GIBI Goals.xls**

**ADDED 10/6/2014 FROM:**

"COPY OF CITY OF MILWAUKEE GL_MMSD FUNDED" EXCEL SPREADSHEET

<table>
<thead>
<tr>
<th>NUMBER (TOTAL SF)</th>
<th>GAL/SF</th>
<th>TOTAL GAL ADDED</th>
<th>ACRES</th>
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<tbody>
<tr>
<td>BIOSWALE</td>
<td>9</td>
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<tr>
<td>GREEN ROOFS</td>
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<tr>
<td>NATIVE LANDSCAPING</td>
<td>6</td>
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<tr>
<td>POROUS PAVEMENT</td>
<td>6*</td>
<td>65165</td>
<td>3</td>
</tr>
<tr>
<td>RAIN GARDEN</td>
<td>1*</td>
<td>4974</td>
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<tr>
<td>RAINWATER CATCHMENT**</td>
<td>10</td>
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<td>129485</td>
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<tr>
<td>STORMWATER TREES***</td>
<td>234</td>
<td>25</td>
<td>5850</td>
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</table>

**TOTALS**

<p>| | |</p>
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<tbody>
<tr>
<td>TOTALSF</td>
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<td>TOTALACRES</td>
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</tbody>
</table>

DOES NOT INCLUDE GREENWAYS/GREENSEAMS!!

**TOTAL FOR ALL GI:**

<p>| | |</p>
<table>
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<tr>
<td>TOTALSF</td>
<td>2364761</td>
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<tr>
<td>TOTALGAL</td>
<td>14005782</td>
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<tr>
<td>TOTALACRES</td>
<td>55.07869606</td>
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</table>
Green Infrastructure Plan 2019

MILWAUKEE'S STORMWATER CAPTURE GOAL

1/2 inch rain captured by green infrastructure per rain event

36 million gallons of water per rain event

= Approximately 143 acres of new open space
CONSIDERATIONS FOR GREEN INFRASTRUCTURE PLAN

• Develop policies that substantially add to the amount of visible installed green infrastructure

• Encourage development and investment in the City

• Maneuver within City’s tight financial constraints
**Recommendations Overview**

**Regulatory**
- Require developments to capture the first half inch of runoff when a stormwater management plan is required
- Add climate adaptation and co-benefits of green infrastructure to “Purpose” section of our stormwater management code
- Publicly support MMSD’s regional new thresholds for green infrastructure

**Economic**
- One-time grants to property owners to implement their green infrastructure
- Partnership with Milwaukee Public Schools to green schoolyards and create new sustainability manager position

**Education and Outreach**
- Outreach to Business Improvement Districts and Real Estate Groups
- Provide developer education through the Fresh Coast Guardians’ Resource Center
- Review and possibly revise parking lot landscape standards
We revised City Ordinance Chapter 120 governs actions that obligate developers to create a stormwater management plans

1. Add “Climate Adaption” and “Co-benefits of Green Infrastructure” to “Purpose Section.”

2. Define Green Infrastructure practices; prioritize those with co-benefits

3. Require that the Stormwater Management Plans use Green Infrastructure to capture at least 1/2” of stormwater using GI

4. If GI is not feasible on site, City Engineer may consider negotiated solution.
ECONOMIC INCENTIVE:
FUNDING PRIORITIES FOR GREEN INFRASTRUCTURE

• Green Streets & Alleys

• Schoolyards

• Libraries

• Parking Lots
Green Streets

- 2013 Green Streets Plan
- Bioswales in medians
- Permeable pavement in alleys or parking lanes
Green School Yard

H.W. Longfellow School 1021 S. 21st St., Milwaukee

Green Schools Consortium of Milwaukee
A Green & Healthy Schools Wisconsin Regional Network
Green Schools 2
Green Solutions could provide grants up to $25,000 to commercial and non-profit parking lot owners.

Could be used for any implementation of Green Infrastructure including static projects that do not require a stormwater management plan.

Requires conservation easement

Milwaukee.gov/GreenLots
GEOGRAPHIC PRIORITIZATION

GRAEF Engineering developed weighted scale for siting GI for the greatest impact and is generating maps for priority areas.
Thanks to our Partners!

Erick Shambarger, Environmental Sustainability Director
Environmental Collaboration Office (ECO)
City of Milwaukee
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414-286-8556
eshamb@milwaukee.gov