

## Weaving Milwaukee's Green & Grey Infrastructure Into a Sustainable Future

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## Today's Presentation

- Background
- Green Pilot Projects/Programs
- Fresh Coast Green Solutions
- Green + Grey Symphony Modeling
- The Future...



## What is MMSD?



- 1.1 Million Customers
- 28 Municipalities
- 411 Square Miles

## You have to start with a grey backbone...



- Reclamation Facilities
- Sewer Pipes
- Storage Vessels....

## Water Reclamation Facilities



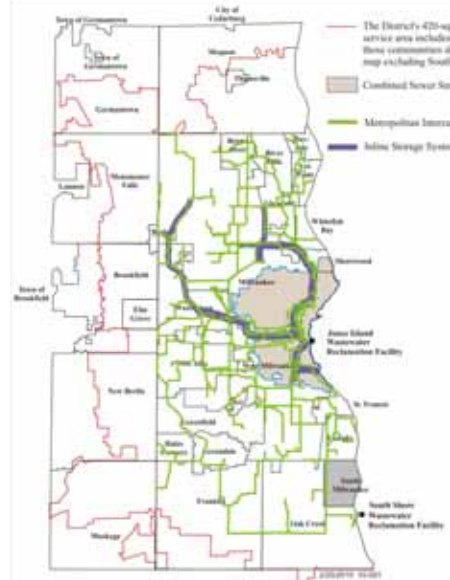
Jones Island



South Shore



## Sewer Pipes



The vicinity 420-sq service area includes those communities a map excluding South Shore.

- Combined Sewer Svc
- Metropolitan Interiors
- In-line Storage System

**300 Miles**  
MMSD Sewers

**3,000 Miles**  
Municipally Owned Sewers

**3,000 Miles**  
Private Laterals

## Deep Tunnels

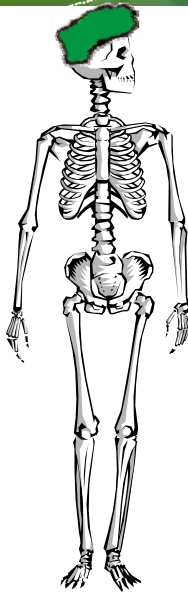


**300 Feet**  
Below ground

**521 Million**  
Gallons of storage

**28.5 Miles**  
Long

**17- to 32-feet**  
In Diameter



**You have to start with a grey  
backbone...**

- Treatment Plants
- Sewers
- Storage Vessels...

**To go Green...**

- Rain Barrels
- Rain Gardens
- Bioretention...

## The Wider Case for Going Green

**The Future's Relationship to the Past Has Δ'd...**

**There's a Growing....**

- Awareness of Resource Depletion
- Need to Seek Energy Independence
- Idea that Reducing GHG Emissions is a Survival Instinct
- Understanding of the Need to Adapt to Climate Δ
- Need to Create **Jobs**, Particularly **Green Jobs**

## Green Infrastructure at MMSD

- “Every Drop Counts” Campaign
- Greenseams Property Acquisitions
- Lake MI Raingardens Initiative
- Flood Management Projects
- Increasingly Widespread Green
  - Rain Barrels
  - Downspout Disconnections
  - Green/Sustainable Infrastructure Partnerships




## Many Strategies, Many Projects



A collage of four images illustrating different water sustainability strategies. Top left: A grey rainwater harvesting barrel with a blue hose. Top right: A rain garden with a butterfly and the text "RAIN garden". Bottom left: A person in a red jacket and blue jeans kneeling next to a white downspout disconnect pipe with the text "downspout DISCONNECT". Bottom right: A green roof with plants and the text "green ROOF".

## Greenseams<sup>SM</sup>



Since 2002....  
2,254 Acres  
75 Properties

## Lake Michigan Rain Garden Initiative

*Over 15,000 plants  
sold since 2006*



## Rain Barrels



- 15,257 Sold
- Triple-bottom Line Story
- About 800,000 Gallons/Event
- Benefits in Milwaukee
  - Widespread Implementation
  - Far-Ranging Outreach has Spill-over Value
  - Unique Approaches
  - Culture Change
  - Volume of Interest
  - Technical Successes

## Green Roofs



**MMSD**


**Mequon**

**Milwaukee County Zoo**

**MillerCoors**

**709,090 Gallons** (assuming 2.5 gal/sq. ft.)  
**6.5 acres**

## Bioswales

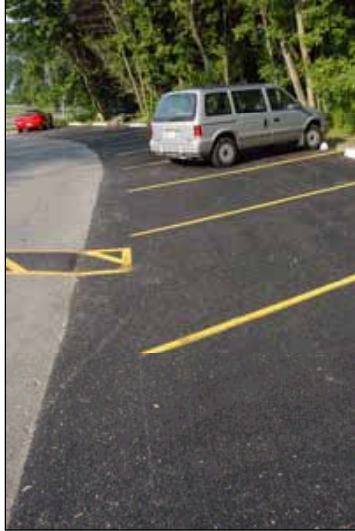


**Grange Avenue, Greendale, WI**

**2.93 acres**



## Porous Pavement



- 60,121 Square Feet
- 1.38 acres
- 601,128 gallons (assuming 435,600 gal/acre)

## 2003-2009 Stormwater BMP Partnerships

<u>G.I. Measure</u>	<u>Result</u>
Stormwater Trees	1 project
Rain barrels/Cisterns	12,500+ sold
Rain Gardens	24,269 SF
Native Landscaping	1 project
Bio-swales/Bioretention	127,684 SF
Greenways/Greenseams <sup>SM</sup>	2,000 acres
Green/Blue Roofs	75,614 SF
Porous Pavement	61,381 SF
Green Alley/Street/Parking Lot	1 project
Constructed Wetlands	3 projects

# Fresh Coast Green Solutions:



**FRESH COAST GREEN SOLUTIONS**  
DRAWING MILWAUKEE'S GREEN & GREY INFRASTRUCTURE INTO A SUSTAINABLE FUTURE

TYPE	MEASURE	Capital Cost per Class Measurement	Suburban Class Measurement	Urban Class Measurement	Water Classification	APPLICABLE COSTS to manage
SINGLE	CONCRETE CURB	Low	Low	Low	U	
	ASPHALT CURB	Low	Low	Low	U	
	GRASS CURB	Low	Low	Low	U	
DOUBLE	CONCRETE CURB	Low	Low	Low	U	
	ASPHALT CURB	Low	Low	Low	U	
	GRASS CURB	Low	Low	Low	U	
TRIPLE	CONCRETE CURB	Low	Low	Low	U	
	ASPHALT CURB	Low	Low	Low	U	
	GRASS CURB	Low	Low	Low	U	

**KEY**

## Green Infrastructure Definitions

### 10 GREEN INFRASTRUCTURE DEFINITIONS

Green Infrastructure is an approach to water resource management that is site-specific, multi-scale, and multi-functional. It is an approach to water resource management that is site-specific, multi-scale, and multi-functional. It is an approach to water resource management that is site-specific, multi-scale, and multi-functional.



**RAIN GARDEN**  
Rain gardens are garden beds designed to catch and absorb excess runoff from roofs, driveways, and parking lots. They are typically installed in areas where water runoff is common, such as near downspouts or in low-lying areas. Rain gardens help to reduce the volume of water that enters the stormwater system, thereby reducing the risk of flooding and erosion.



**PERMEABLE PAVEMENT**  
Permeable pavement is a type of pavement that allows water to pass through it. It is typically made of porous materials such as gravel, crushed stone, or permeable bricks. Permeable pavement helps to reduce the volume of water that enters the stormwater system, thereby reducing the risk of flooding and erosion.



**BIO-SWALE**  
Bio-swales are shallow, vegetated channels that are designed to capture and filter stormwater runoff. They are typically installed in areas where water runoff is common, such as near downspouts or in low-lying areas. Bio-swales help to reduce the volume of water that enters the stormwater system, thereby reducing the risk of flooding and erosion.




**GREEN ROOF**  
Green roofs are roofs that are covered with vegetation. They are typically installed on flat roofs and help to reduce the volume of water that enters the stormwater system, thereby reducing the risk of flooding and erosion. Green roofs also provide additional benefits, such as improved air quality and reduced energy costs.



**NATIVE LANDSCAPING**  
Native landscaping is the use of native plants and trees in landscaping. Native plants are plants that are native to a particular region and are adapted to the local climate and soil conditions. Native landscaping helps to reduce the volume of water that enters the stormwater system, thereby reducing the risk of flooding and erosion. It also provides additional benefits, such as improved air quality and reduced energy costs.



**STORMWATER TREES**  
Stormwater trees are trees that are planted in areas where stormwater runoff is common. They are typically planted in areas where water runoff is common, such as near downspouts or in low-lying areas. Stormwater trees help to reduce the volume of water that enters the stormwater system, thereby reducing the risk of flooding and erosion. They also provide additional benefits, such as improved air quality and reduced energy costs.



**GREEN WALLS**  
Green walls are walls that are covered with vegetation. They are typically installed on vertical surfaces and help to reduce the volume of water that enters the stormwater system, thereby reducing the risk of flooding and erosion. Green walls also provide additional benefits, such as improved air quality and reduced energy costs.



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## MMSD Water Reclamation Facilities

- MMSD System Background
- How the System Works
- New Ways of Thinking
  - Green + Grey → 0 Overflows
  - MMSD System is Unique
  - Green Infrastructure Benefits Beyond Stormwater

**What is MMSD?**

During the public health and pollution control...  
 The...  
 MMSD...  
 Green infrastructure...

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## The Path to Zero is Paved with Green Infrastructure Intentions

- Effective Combinations
  - Residential
  - Commercial
  - Industrial
- Green Infrastructure Enhancements
  - Disconnecting Downspouts
  - Improving Soil Porosity
  - Planting Conifers
  - Inlet Restrictors




**Green Infrastructure Enhancements**

Disconnecting Downspouts  
 Improving Soil Porosity  
 Planting Conifers  
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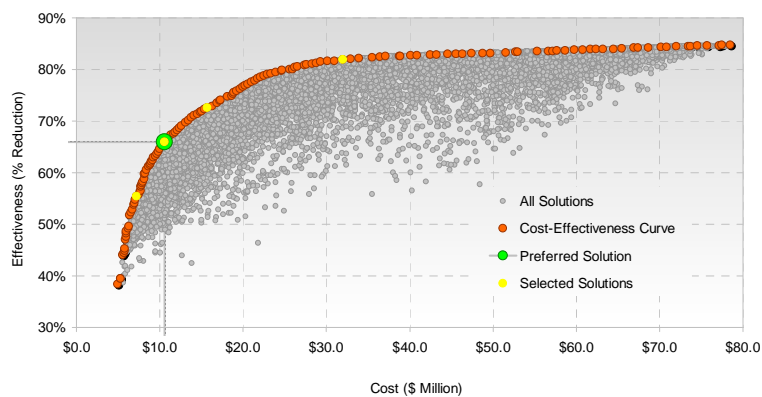
## Green + Grey = A Symphony

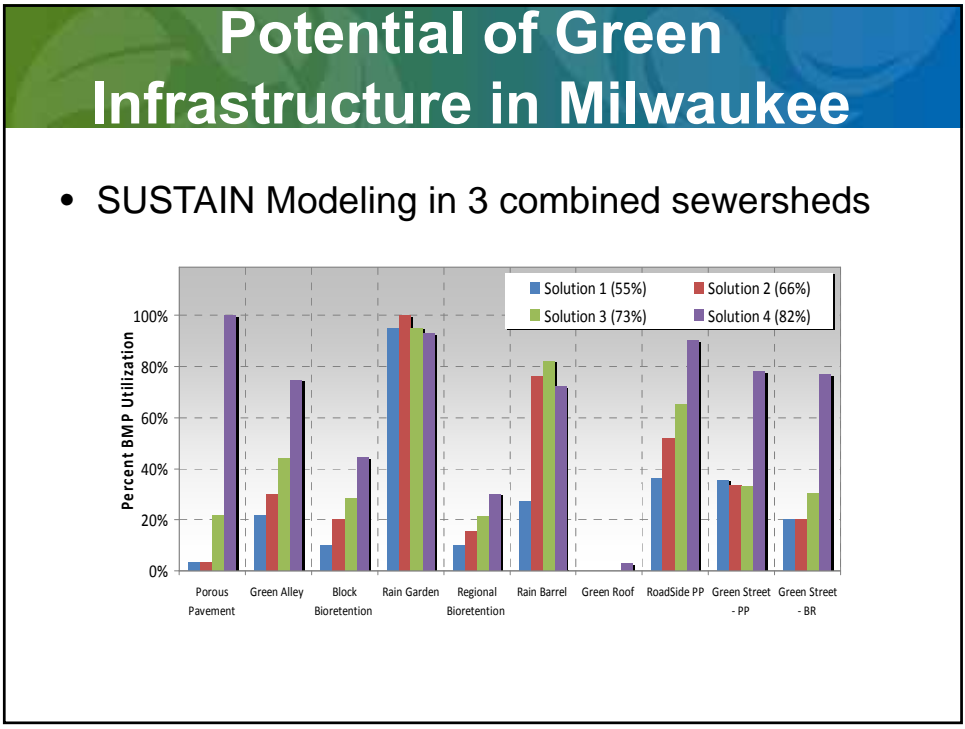
- Combined Sewer Area
  - 14,338 acres, approximately 4,000 acres pervious
  - 3.1 CSOs per year, 771 MG per year
- Planning-level Impacts of Green Conversion
  - Additional 400 pervious acres = CSO -7% (2.9 CSOs/yr)
  - Additional 1,000 pervious acres = CSO -11% (2.7 CSOs/yr)
  - Additional 2,000 pervious acres = CSO -9% (2.2/yr)

Note: based on MACRO Modeling

## Potential of Green Infrastructure in Milwaukee

- SUSTAIN Modeling in 3 combined sewersheds





## Potential of Green Infrastructure in Milwaukee

Solution ID	Flow Volume	Peak Flow	TSS	TN	TP	Cost (\$ millions)
Solution 1	55.4%	13.4%	33.5%	25.1%	29.1%	7.2
Solution 2	66.0%	19.2%	39.5%	27.6%	31.3%	10.6
Solution 3	72.6%	32.9%	41.4%	28.9%	32.3%	15.7
Solution 4	81.9%	47.5%	44.6%	30.7%	34.1%	32.0

Note: Source is SUSTAIN model

## Green Infrastructure as Climate Change Adaptation

- Top 5 River Crests in the KK River (11<sup>th</sup> St) Over the Past ~35 Years:
  - (1) 16.01 ft on 08/06/1986
  - (2) 13.29 ft on 06/08/2008
  - (3) 13.22 ft on 07/10/2006
  - (4) 13.20 ft on 07/15/2010
  - (5) 13.17 ft on 07/23/2010
- WICCI says Projections Show a 50% Increase in Heavy Rainfalls in Milwaukee

Source: National Weather Service

## Moving Forward: 2011+

- Green Infrastructure **Projects**:
  - Ongoing Greenseams<sup>SM</sup> Acquisitions
  - Ongoing Stormwater BMP Program
  - Green Roof Program
  - Gravel Wetland Demonstration Project
  - Select parts of PP/II (like infiltrating sump pump discharge into lawns)
- Green Infrastructure **Programs**:
  - Continued Rain Barrel Sales
  - Continued Rain Garden Plant Sales



## Moving Forward: 2011+

- System or “Symphony” Modeling Promotion
- Triple Bottom Line Analysis Promotion
- H2O Capture (to track & build participation)
- Collaborative Opportunities:
  - SWWT, plus regulators: Watershed-based permitting
  - American Rivers/CNT: Green infrastructure portfolio standards
  - American Rivers & SWWT: KK watershed implementation
  - Clean Water America Alliance: Creating a Sustainable Water Utility
  - Great Lakes and St. Lawrence Cities Initiative: Green CiTTS Stormwater Advisory
  - Center for Neighborhood Technologies: Great Lakes Sustainable Water Planning
  - Many Others!

## Obstacles/Hurdles? Working To Change...

- Our Thinking
  - Milwaukee’s Cultural Aesthetic about what’s Pretty
  - Educational Focus Traditionally on Grey Infrastructure
  - High Cost and Climate Suitability *Perceptions*
- Our Doing
  - Traditional Codes/Ordinances
  - Traditional Technical Guidance
  - Periodic Maintenance Requirements
  - Infiltration Capability of Clay Soils

**Thank You**

