Opportunities for Advancing Stormwater Control: Municipal Examples and Ideas for Policy Implementation

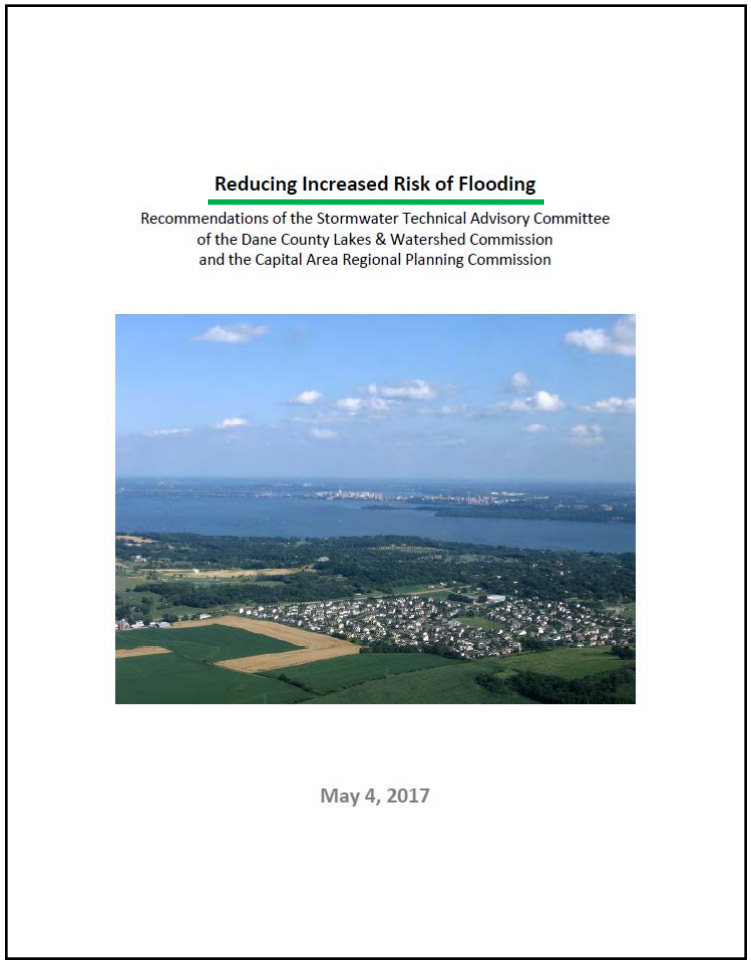
- or -

Mike Rupiper, PE, ENV SP
Director of Environmental Resources Planning
Capital Area Regional Planning Commission

Opportunity for a Watershed Approach to Increase Community Resilience with Distributed Green Infrastructure

Mike Rupiper, PE, ENV SP
Director of Environmental Resources Planning
Capital Area Regional Planning Commission

2017 Joint Stormwater TAC



1. Develop and Implement a Stormwater Volume Trading Program
2. Improve standards for volume control for closed basins, new development, and redevelopment

Joint Stormwater Work Group

DC Retention Credit Program

Greenseams® Program

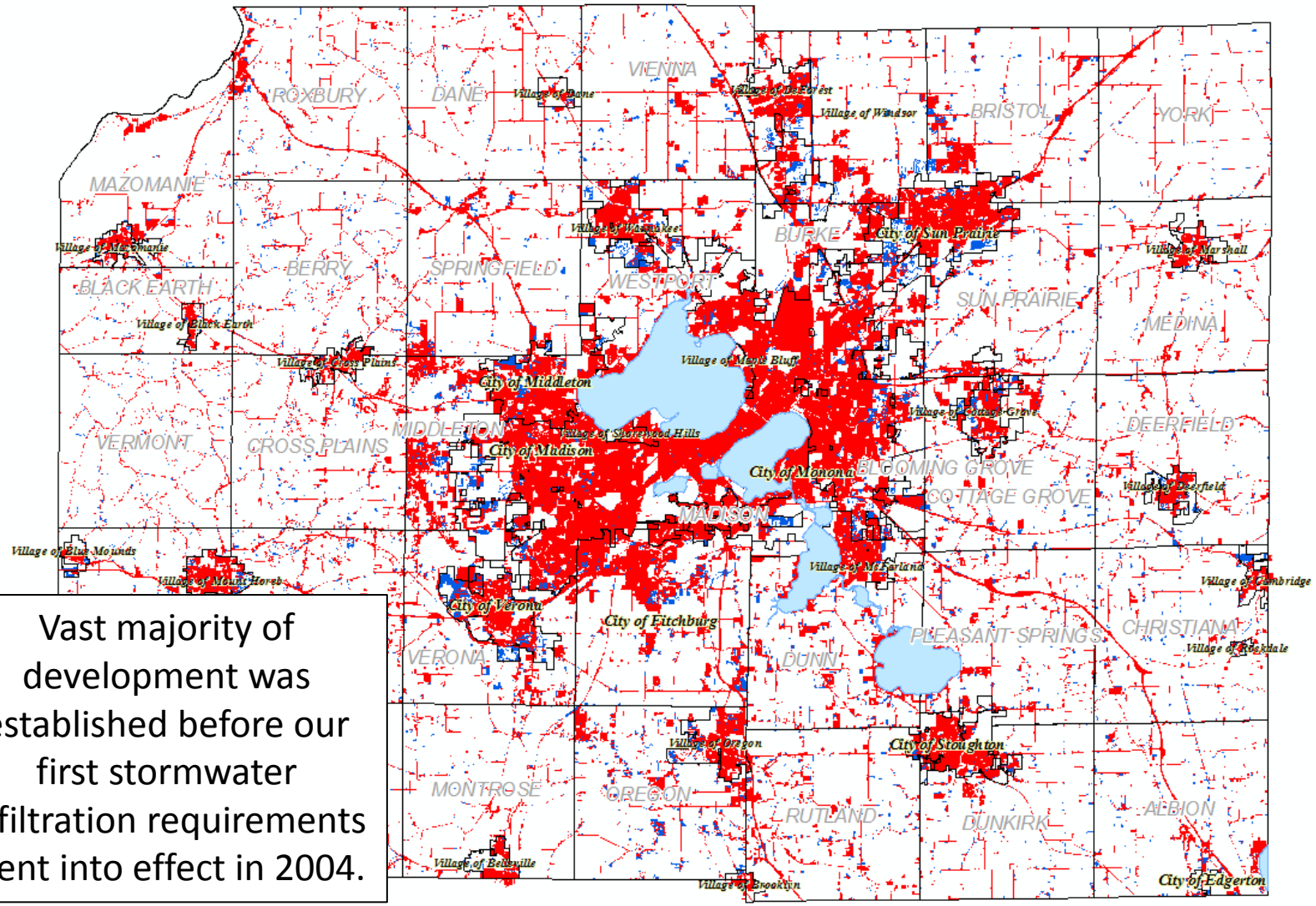
Wetland Mitigation Programs

Current Dane County Efforts

- Volume control practices are now eligible under the Urban Water Quality Grant program

- Pilot projects for conversion of County owned land from agricultural to prairie

Legacy of Historical Development



Vast majority of development was established before our first stormwater infiltration requirements went into effect in 2004.

Green Infrastructure

A source reduction approach to capturing, absorbing, infiltrating, evaporating, or storing rain and melting snow

Green Infrastructure Strategies

Rain Barrels & Cisterns

collect rain for later

→

Rain Gardens

beauty & rain collection

→

Native Landscaping

create a healthy habitat

→

Stormwater Trees

hold more water

→

Soil Amendments

create deeper roots

→

Green Roofs

lower your utility bills

→

Porous Pavement

rain soaks into the ground

→

Bioswales

catch dirty road runoff

→

Wetlands

support wildlife

→

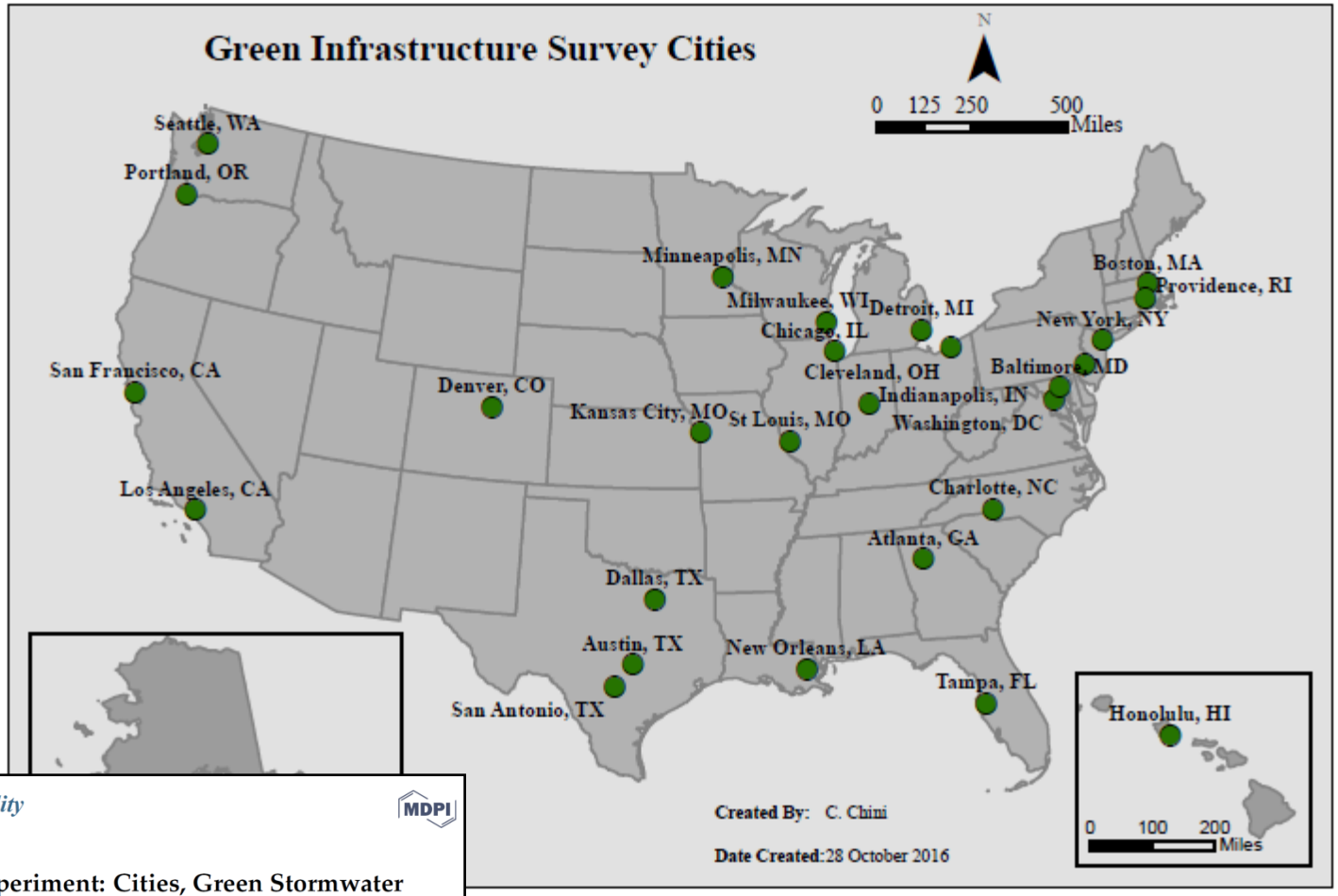
Greenseams®

manage flooding upstream

→

FRESH COAST GUARDIANS

Green Infrastructure Programs



sustainability
MDPI
Article

The Green Experiment: Cities, Green Stormwater Infrastructure, and Sustainability

Christopher M. Chini [1], James F. Canning [1], Kelsey L. Schreiber [1], Joshua M. Peschel [2,*] and Ashlynn S. Stillwell [1]

Motivations for Green Infrastructure

Green Infrastructure Motivations

	Water Quality				Economic					Environmental				Social		
Cities	EPA Consent Decree	Reduce CSOs No Consent Decree	Clean up Local Waterways	Improve Drinking Water Quality	Increase Property Values	Promote Green Jobs	Decrease Floods and Basement Backups	Reduced Wastewater Treatment Costs	Conserve Energy	Mitigate Urban Heat Island Effect	Improve Ambient Air Quality	Adapt to Climate Change	Provide Habitat for Local Wildlife	Reduce Violent Crime	Improve Public Mental and Physical Health and Safety	Create Aesthetically Pleasing Green Spaces
Atlanta, GA			✓	✓	✓								✓		✓	✓
Austin, TX			✓				✓									✓
Baltimore, MD			✓				✓			✓	✓		✓			✓
Boston, MA							✓			✓		✓			✓	✓
Charlotte, NC			✓		✓								✓		✓	
Chicago, IL	✓		✓				✓					✓				
Cleveland, OH	✓		✓										✓			
Dallas, TX			✓													
Denver, CO			✓				✓		✓	✓	✓	✓				✓
Detroit, MI	✓		✓		✓			✓						✓	✓	✓
Honolulu, HI								✓	✓							
Indianapolis, IN	✓		✓													
Kansas City, MO	✓		✓	✓			✓								✓	
Los Angeles, CA			✓	✓												
Milwaukee, WI		✓	✓				✓									
Minneapolis, MN		✓	✓				✓									
New Orleans, LA	✓									✓						
New York, NY	✓		✓								✓					✓
Philadelphia, PA	✓		✓													✓
Portland, OR		✓	✓		✓		✓	✓	✓	✓	✓	✓	✓		✓	✓
Providence, RI				✓			✓									
San Antonio, TX			✓					✓								
San Francisco, CA						✓		✓	✓	✓	✓		✓		✓	✓
Seattle, WA		✓	✓		✓							✓				
St. Louis, MO		✓	✓		✓											
Tampa, FL			✓													
Washington, DC	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓					✓

sustainability

Article

The Green Experiment: Cities, Green Stormwater Infrastructure, and Sustainability

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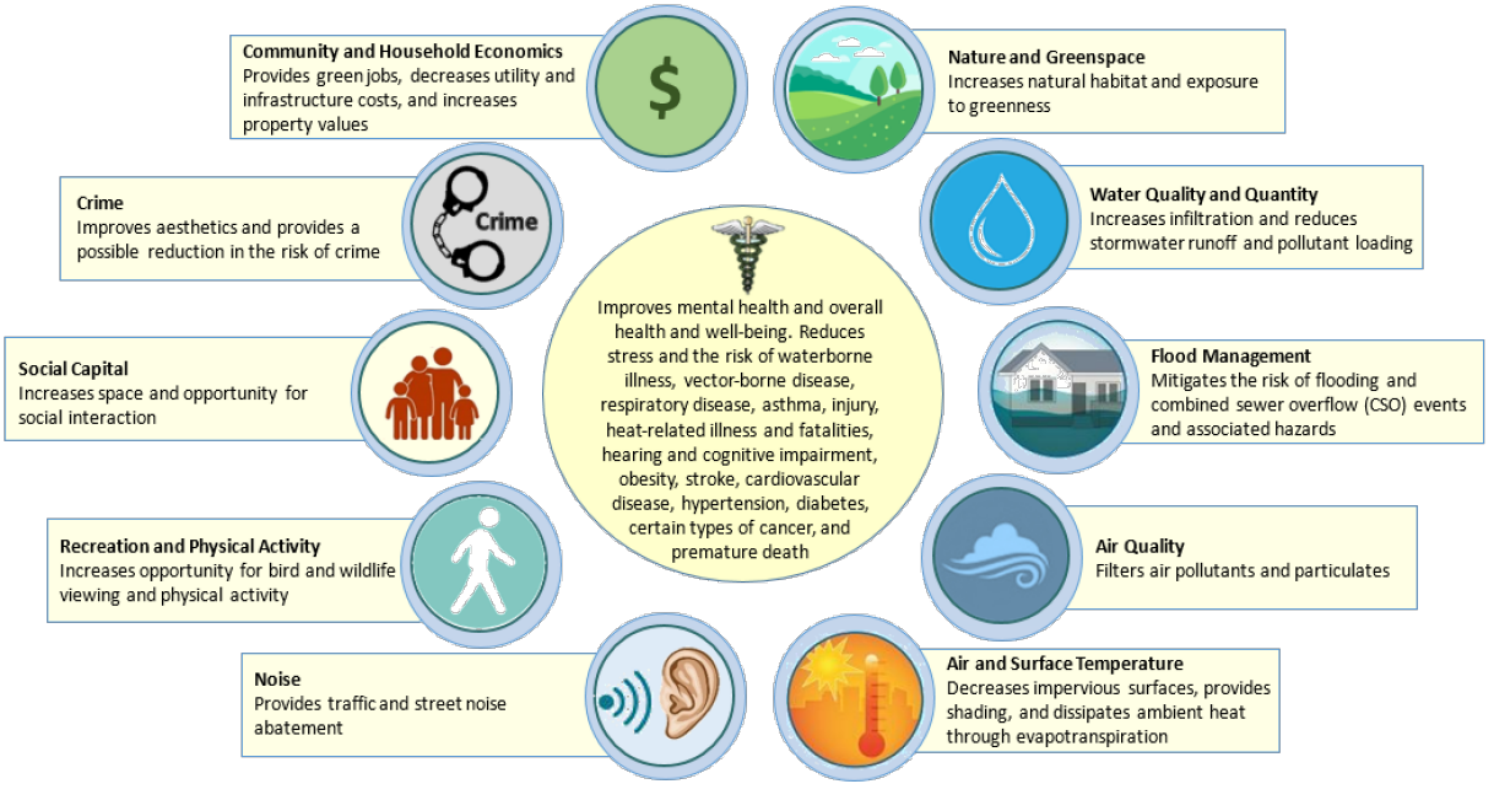
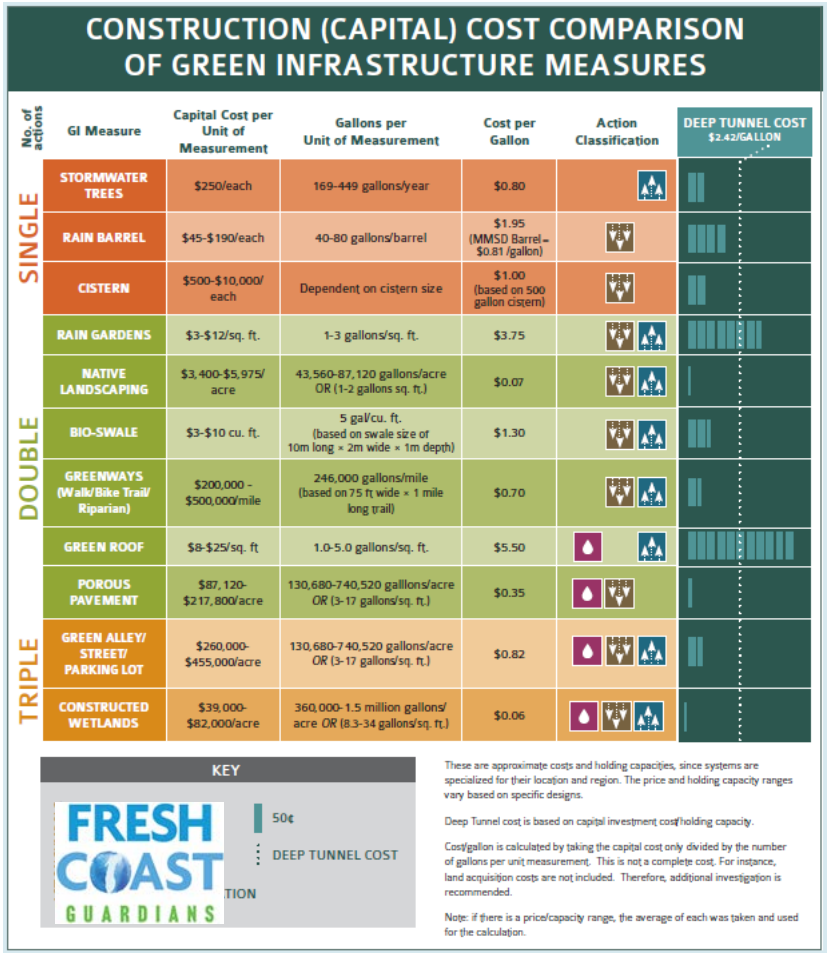
Multiple Benefits of Green Infrastructure



Environmental, social, economic, and public health benefits of green infrastructure

U.S. Environmental Protection Agency
Office of Research and Development

Investing in Green Infrastructure



CONSTRUCTION (CAPITAL) COST COMPARISON OF GREEN INFRASTRUCTURE MEASURES

No. of actions	GI Measure	Capital Cost per Unit of Measurement	Gallons per Unit of Measurement	Cost per Gallon	Action Classification
SINGLE	STORMWATER TREES	$250/each	169-449 gallons/year	$0.80	
SINGLE	RAIN BARREL	$45-$190/each	40-80 gallons/barrel	$1.95 (MMSD Barrel – $0.81 /gallon)	
SINGLE	CISTERN	$500-$10,000/ each	Dependent on cistern size	$1.00 (based on 500 gallon cistern)	
DOUBLE	RAIN GARDENS	$3-$12/sq. ft.	1-3 gallons/sq. ft.	$3.75	
DOUBLE	NATIVE LANDSCAPING	$3,400-$5,975/ acre	43,560-87,120 gallons/acre OR (1-2 gallons sq. ft.)	$0.07	
DOUBLE	BIO-SWALE	$3-$10 cu. ft.	5 gal/cu. ft. (based on swale size of 10m long × 2m wide × 1m depth)	$1.30	
DOUBLE	GREENWAYS (Walk/Bike Trail/ Riparian)	$200,000 - $500,000/mile	246,000 gallons/mile (based on 75 ft wide × 1 mile long trail)	$0.70	
DOUBLE	GREEN ROOF	$8-$25/sq. ft	1.0-5.0 gallons/sq. ft.	$5.50	
DOUBLE	POROUS PAVEMENT	$87,120-$217,800/acre	130,680-740,520 galllons/acre *OR* (3-17 gallons/sq. ft.)	$0.35	
TRIPLE	GREEN ALLEY/ STREET/ PARKING LOT	$260,000-$455,000/acre	130,680-740,520 gallons/acre *OR* (3-17 gallons/sq. ft.)	$0.82	
TRIPLE	CONSTRUCTED WETLANDS	$39,000-$82,000/acre	360,000-1.5 million gallons/ acre *OR* (8.3-34 gallons/sq. ft.)	$0.06	

DEEP TUNNEL COST $2.42/GALLON

KEY

50¢

DEEP TUNNEL COST

TION

These are approximate costs and holding capacities, since systems are specialized for their location and region. The price and holding capacity ranges vary based on specific designs.

Deep Tunnel cost is based on capital investment cost/holding capacity.

Cost/gallon is calculated by taking the capital cost only divided by the number of gallons per unit measurement. This is not a complete cost. For instance, land acquisition costs are not included. Therefore, additional investigation is recommended.

Note: if there is a price/capacity range, the average of each was taken and used for the calculation.

- Different strategies have different costs and provide different benefits
- Select strategies that are most appropriate for a specific area and conditions

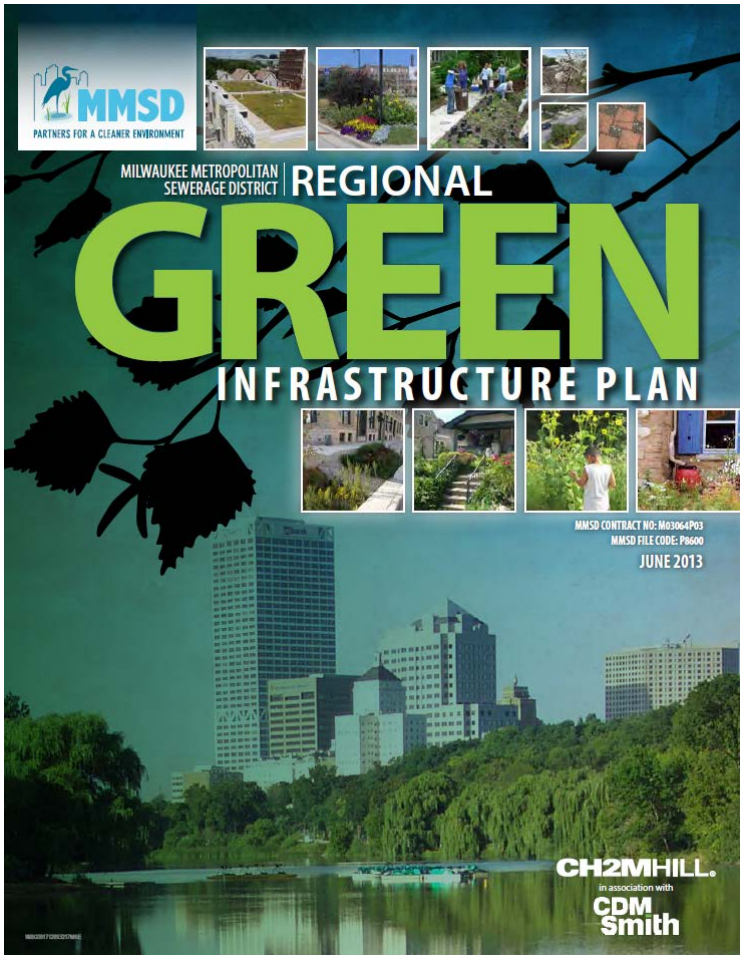
Support for Green Infrastructure

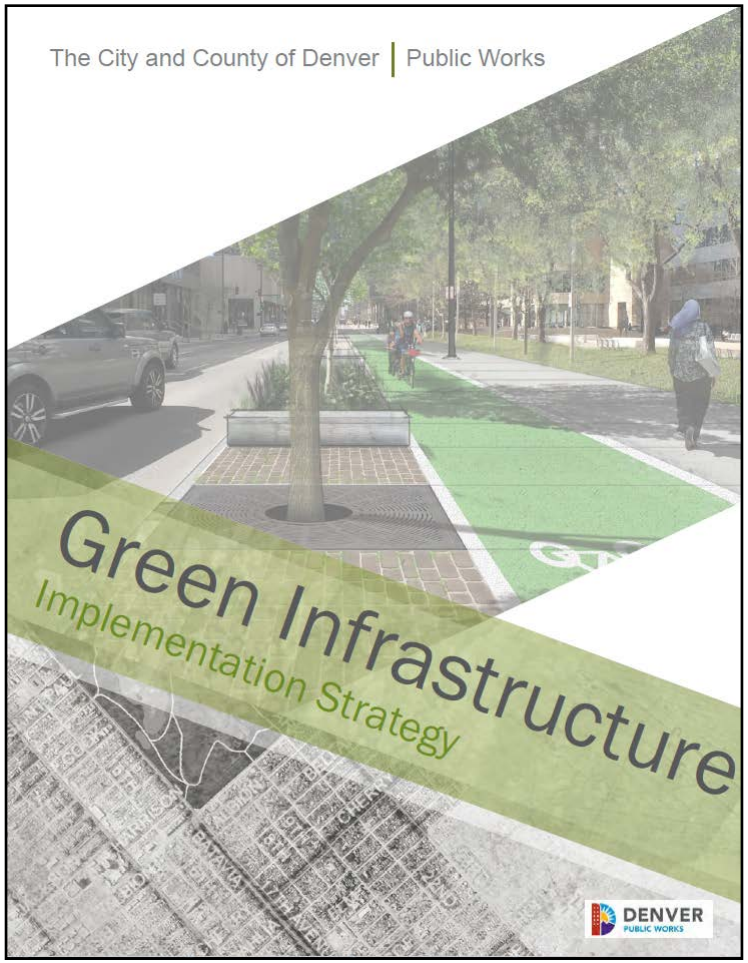
Strategy	Quartile 1	Quartile 2	Quartile 3	Quartile 4
01 More Renewable Energy	3,437	2,330	1,681	1,186
02 Green Infrastructure	3,249	2,838	1,672	875
03 More Community-Based Resources	3,022	2,390	2,001	1,221
04 Better Connect Education and Work	2,764	2,401	2,023	1,447
05 Expand Transit	2,739	2,028	1,920	1,946
06 Expanded Housing Options	2,602	2,102	1,594	2,336
07 More Local Energy Production	2,518	2,794	2,269	1,053
08 More Locally Grown Food	2,114	3,170	2,212	1,138
09 Walkable Communities	2,084	2,451	2,718	1,381
10 More Close-Knit Communities	1,960	1,875	2,670	2,129
11 Preserve More Farming Areas	1,569	1,612	2,312	3,141
12 Promote Tech Job Growth	1,543	1,727	2,149	3,215
13 More Vibrant Centers	1,431	2,225	2,444	2,534
14 Bigger and More Connected Natural Areas	1,401	1,805	2,798	2,630
15 More Access to Outdoors	1,356	1,726	2,475	3,077
16 More Online Communication and Remote Living	747	1,062	1,598	5,227

A Greater Madison Vision

how we grow matters

Green Infrastructure Plan





Example Green Infrastructure Goal

Milwaukee's Goal:

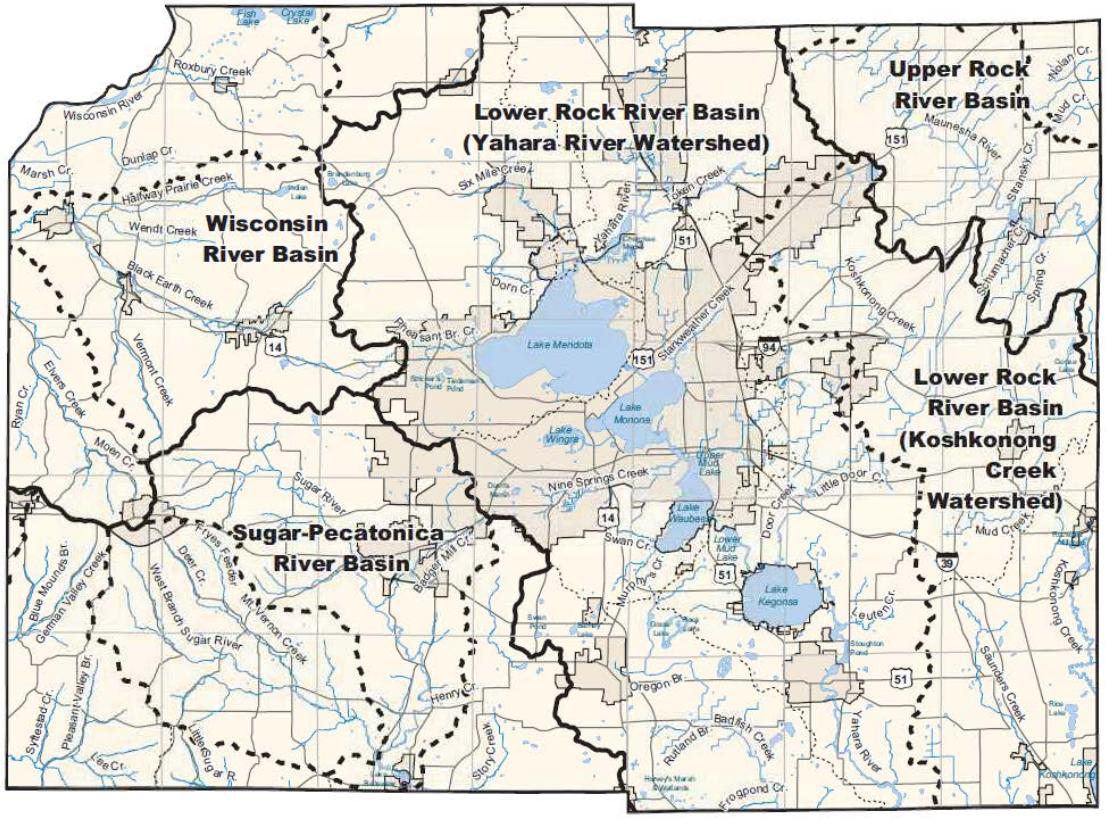
By the year 2035, create enough green infrastructure to capture 740 million gallons of water every time it rains.

Example Green Infrastructure Assessment

DENVER
PUBLIC WORKS

In 2013, an Urban Forest Assessment attributed $122 million in environmental services annually from Denver's urban forest with the ability to intercept 1.4 billion gallons of rainfall each year.

Regional Watershed Approach



Implementation higher up in the watershed will benefit more people in the watershed overall

Yahara WINs Model

Madison Metropolitan Sewerage District
Adaptive Management Plan

January, 2017

1

INTERGOVERNMENTAL AGREEMENT FOR
AN ADAPTIVE MANAGEMENT PLAN
FOR THE YAHARA WATERSHED

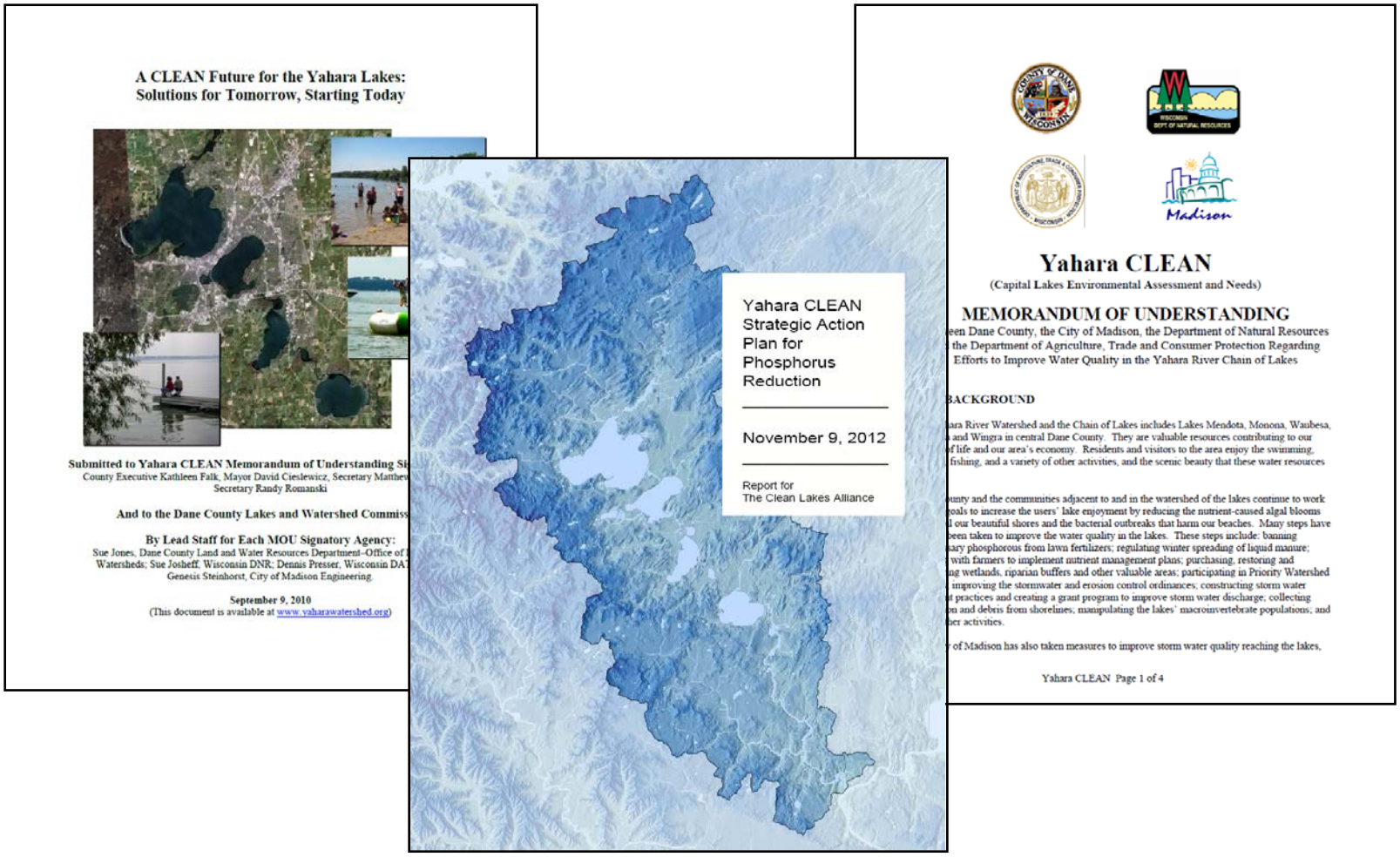
WHEREAS, Wis. Stat. § 66. 0301, entitled "Intergovernmental cooperation," provides that any municipality (defined as including but not limited to any state agency, city, village, town, county, sanitary district, metropolitan sewerage district or sewer utility district) may contract with other municipalities for the furnishing of services, and the joint exercise of any power or duty required or authorized by law;

WHEREAS, the U.S. Environmental Protection Agency (EPA) has approved Total Maximum Daily Loads for Total Phosphorus and Total Suspended Solids (TSS) in the Rock River Basin (the "Rock River TMDL" or "TMDL"), which includes the Yahara Watershed as shown on Exhibit A;

WHEREAS, municipalities who own Publicly Owned Treatment Works (POTWs) and/or Municipal Separate Storm Sewer Systems (MS4s) in the Yahara Watershed are required to meet surface water quality standards and/or not exceed wasteload allocations for phosphorus and TSS pursuant to the provisions of Wis. Admin Code § NR 217 and/or the Rock River TMDL;

WHEREAS, Wis. Admin Code § NR 217. 18 allows sources holding a Wisconsin Pollutant Discharge Elimination System (WPDES) permit the option known as adaptive

Yahara CLEAN Model



A CLEAN Future for the Yahara Lakes:
Solutions for Tomorrow, Starting Today

Submitted to Yahara CLEAN Memorandum of Understanding Si
County Executive Kathleen Falk, Mayor David Cieslewicz, Secretary Matthew
Secretary Randy Romanski

And to the Dane County Lakes and Watershed Commiss

By Lead Staff for Each MOU Signatory Agency:
Sue Jones, Dane County Land and Water Resources Department–Office of
Watersheds; Sue Josheff, Wisconsin DNR; Dennis Presser, Wisconsin DA
Genesis Steinhorst, City of Madison Engineering.

September 9, 2010
(This document is available at www.yaharawatershed.org)

Yahara CLEAN
Strategic Action
Plan for
Phosphorus
Reduction

November 9, 2012

Report for
The Clean Lakes Alliance

Yahara CLEAN
(Capital Lakes Environmental Assessment and Needs)

MEMORANDUM OF UNDERSTANDING
een Dane County, the City of Madison, the Department of Natural Resources
the Department of Agriculture, Trade and Consumer Protection Regarding
Efforts to Improve Water Quality in the Yahara River Chain of Lakes

BACKGROUND

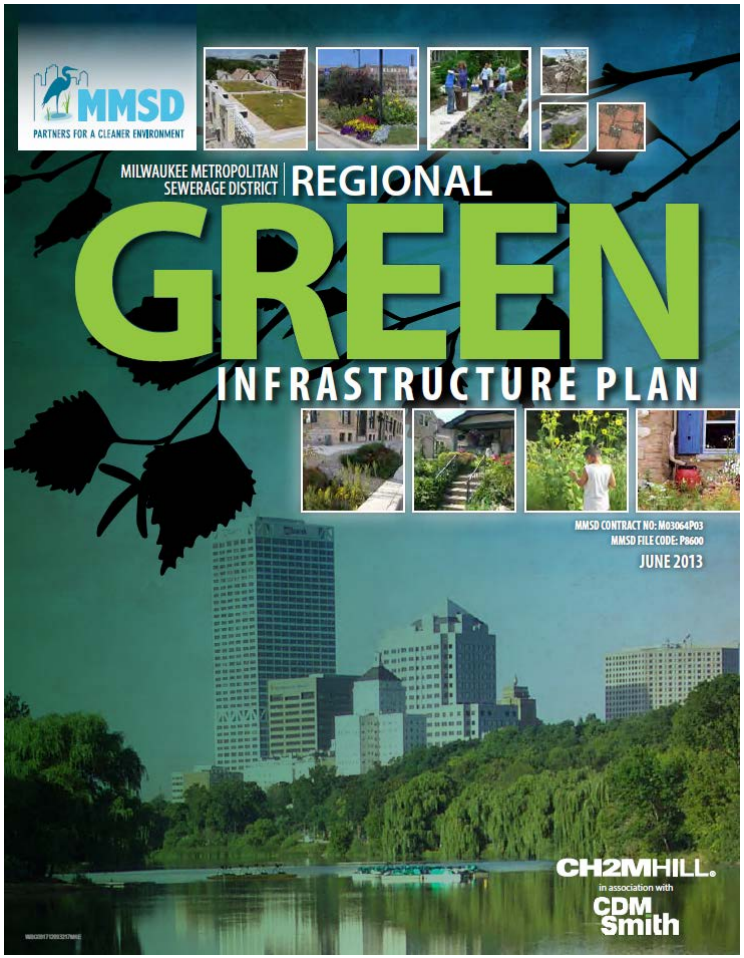
ara River Watershed and the Chain of Lakes includes Lakes Mendota, Monona, Waubesa,
and Wingra in central Dane County. They are valuable resources contributing to our
of life and our area's economy. Residents and visitors to the area enjoy the swimming,
fishing, and a variety of other activities, and the scenic beauty that these water resources

unty and the communities adjacent to and in the watershed of the lakes continue to work
oals to increase the users' lake enjoyment by reducing the nutrient-caused algal blooms
l our beautiful shores and the bacterial outbreaks that harm our beaches. Many steps have
been taken to improve the water quality in the lakes. These steps include: banning
ary phosphorous from lawn fertilizers; regulating winter spreading of liquid manure;
with farmers to implement nutrient management plans; purchasing, restoring and
ng wetlands, riparian buffers and other valuable areas; participating in Priority Watershed
improving the stormwater and erosion control ordinances; constructing storm water
l practices and creating a grant program to improve storm water discharge; collecting
on and debris from shorelines; manipulating the lakes' macroinvertebrate populations; and
her activities.

of Madison has also taken measures to improve storm water quality reaching the lakes,

Yahara CLEAN Page 1 of 4

Start with a Plan



- What is our green infrastructure goal for each watershed?
- What is the most cost effective mix strategies & locations for implementation?
- How will we fund it?

Regional Collaboration

Recommendations

- Continue to develop support for a broad based regional collaboration to address stormwater runoff and flooding
- Develop a detailed green infrastructure plan (consultant / steering committee)
- Develop the detailed framework for a stormwater retention credit (volume trading) program (consultant / steering committee)

Lakes & Watersheds Commission Discussion and Input

How Much is 740 Million Gallons?

- 2.8” over Lake Mendota
- 8.3” over Lake Monona
- 13.1” over Lake Waubesa
- 8.5” over Lake Kegonsa