Green Infrastructure Pilot Study

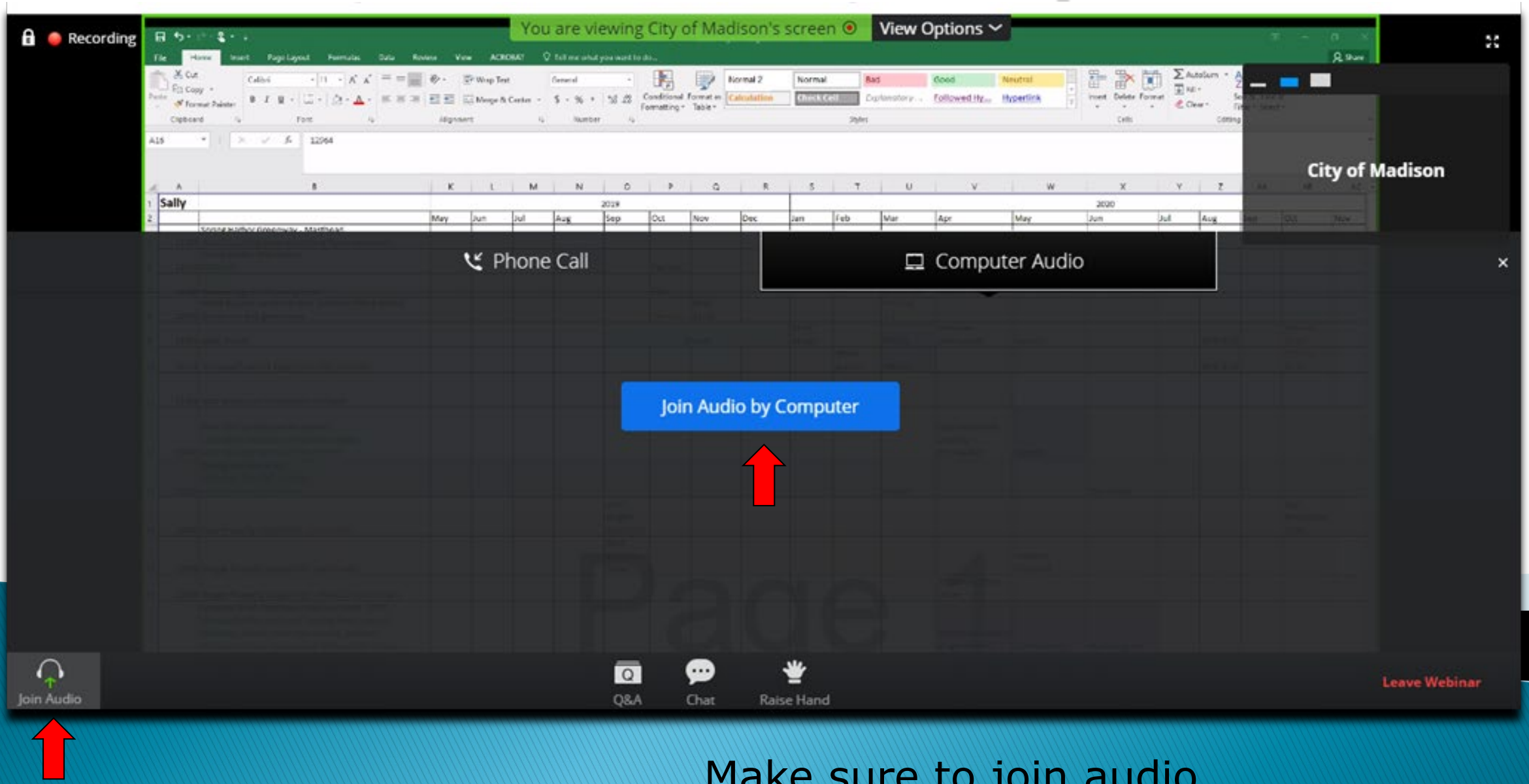
Public Information Meeting
by City of Madison Engineering Division
6/10/2020

Presentation Outline

- Presentation Guidelines
- Study and green infrastructure overview
- Overview and history of landscape change and stormwater management
- Pilot study description
- Green infrastructure descriptions
- Incentives
- Looking forward and partnerships
- Questions and answers

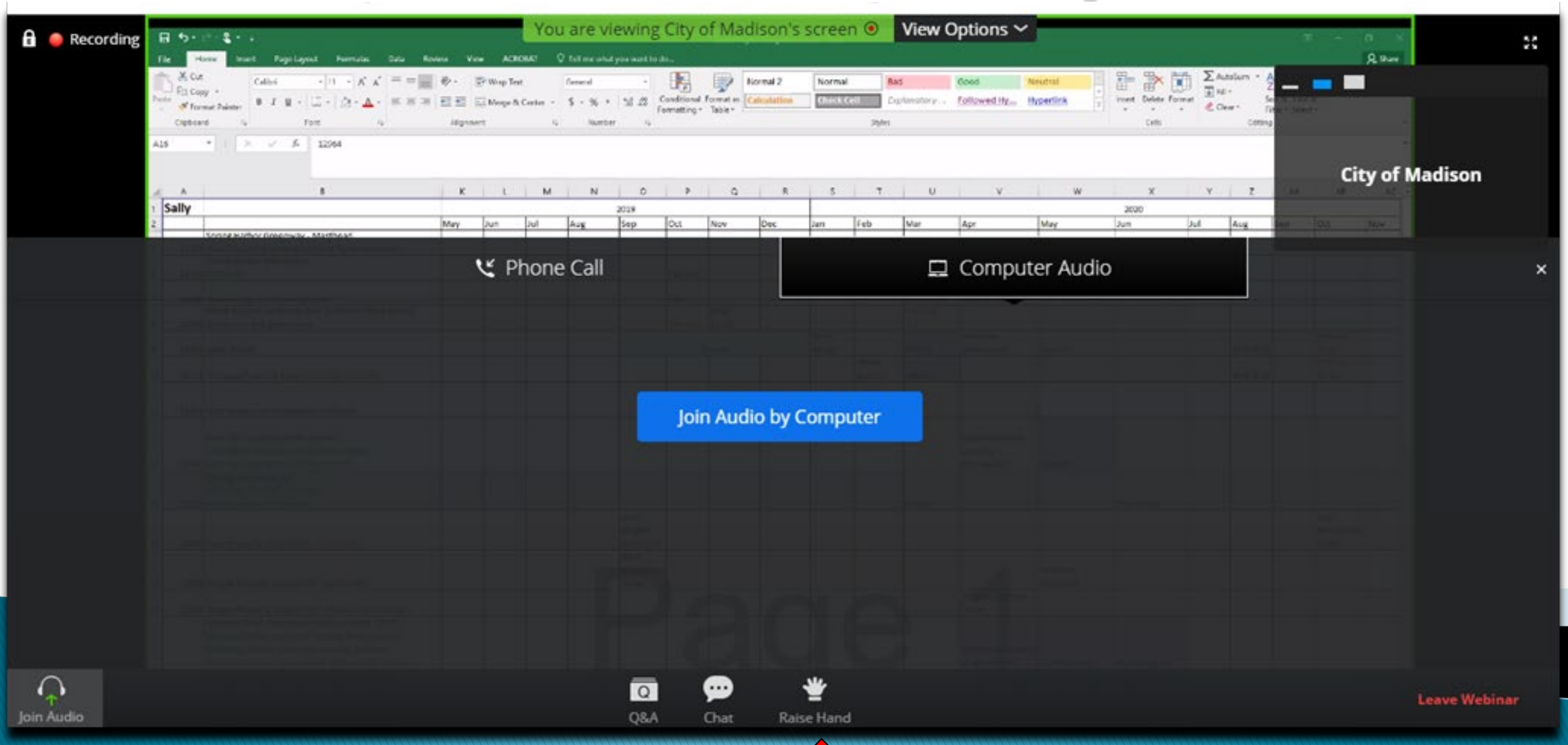
- ✓ This meeting will be **recorded** and posted to the City's project page.
- ✓ All attendees should stay be **muted** to keep background noise to a minimum.
- ✓ You may use the **"raise hand"** option at the bottom if you have something that required immediate clarification.
- ✓ Use **"chat"** option if you are having technical issues and a staff person can try to assist.
- ✓ Please use the **"Q&A"** option at the bottom of the screen to type your question. Questions will be answered at the end of the presentation. Inappropriate questions may be dismissed.

How to Participate



Make sure to join audio

How to Participate



Raise your hand to be unmuted
For comments or ask additional questions.

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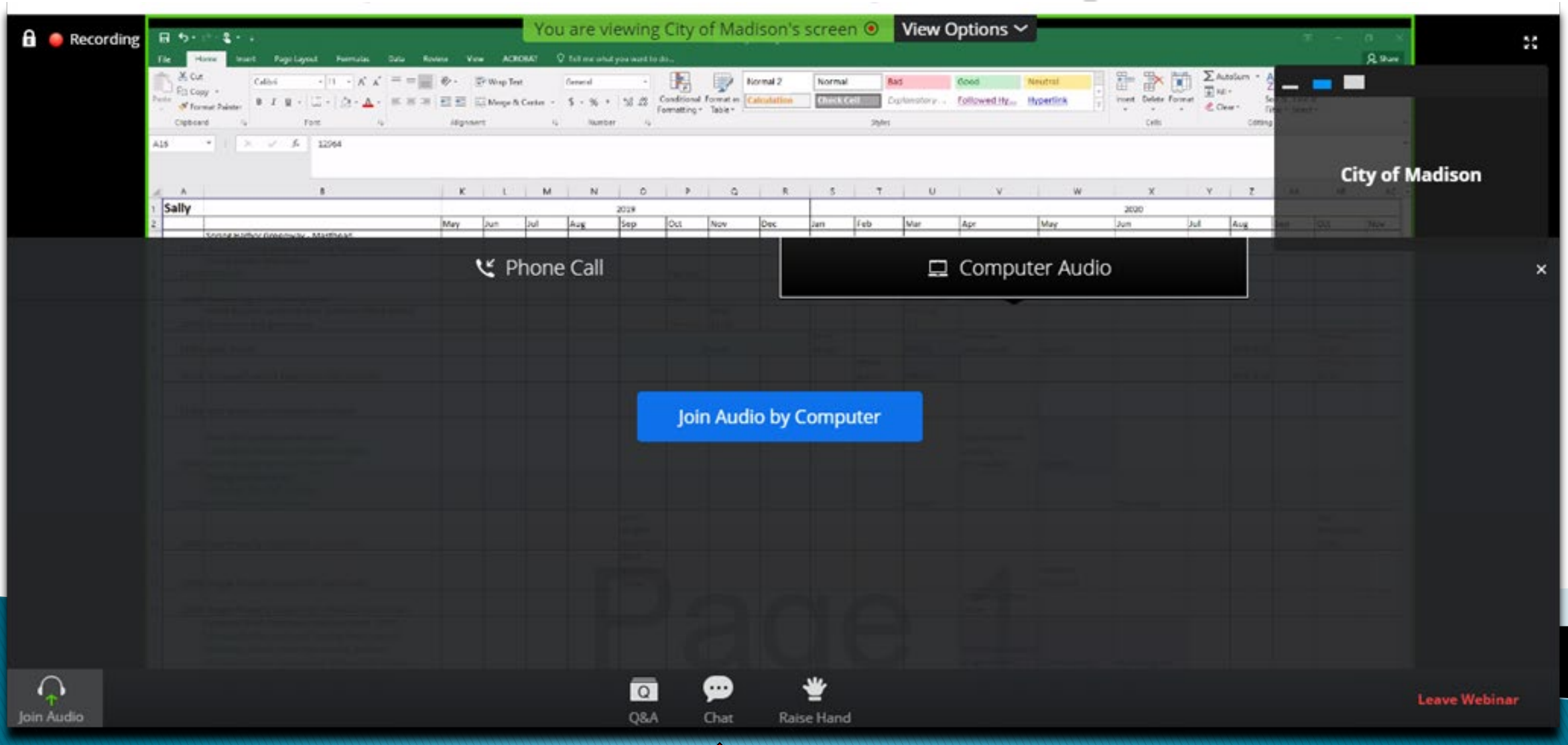

Use chat if you have technical issues or a question for the panelists

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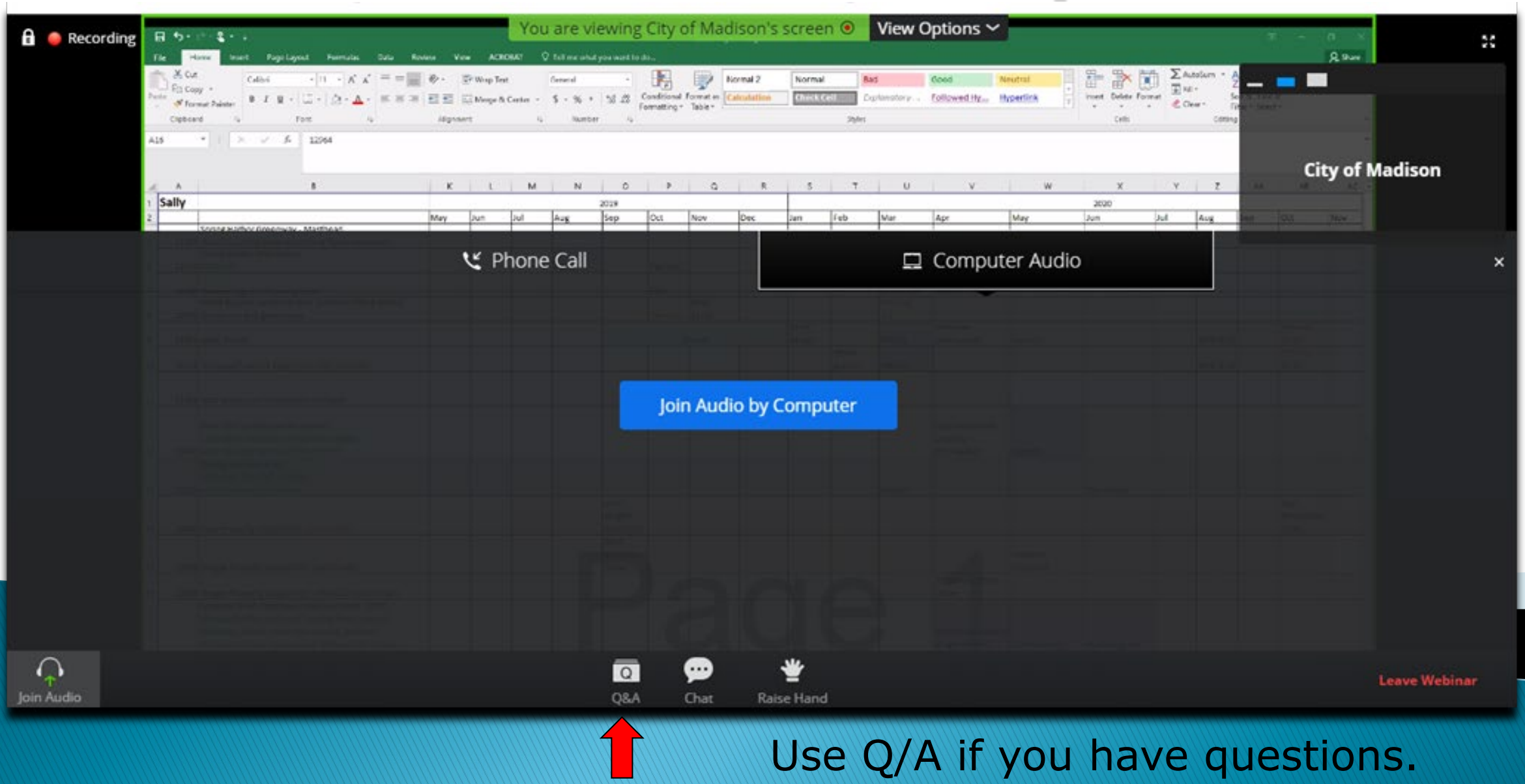

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We will answer after the presentation

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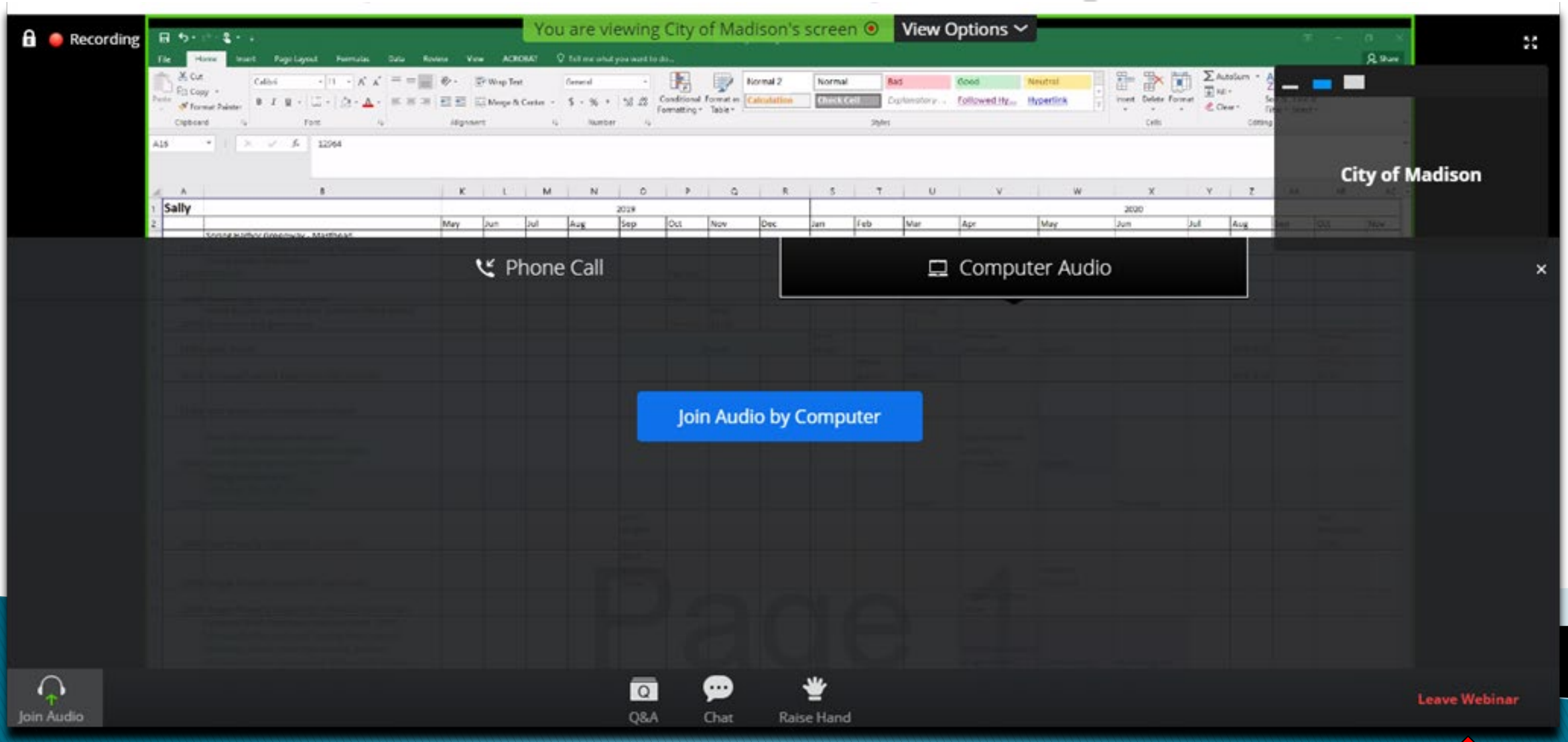

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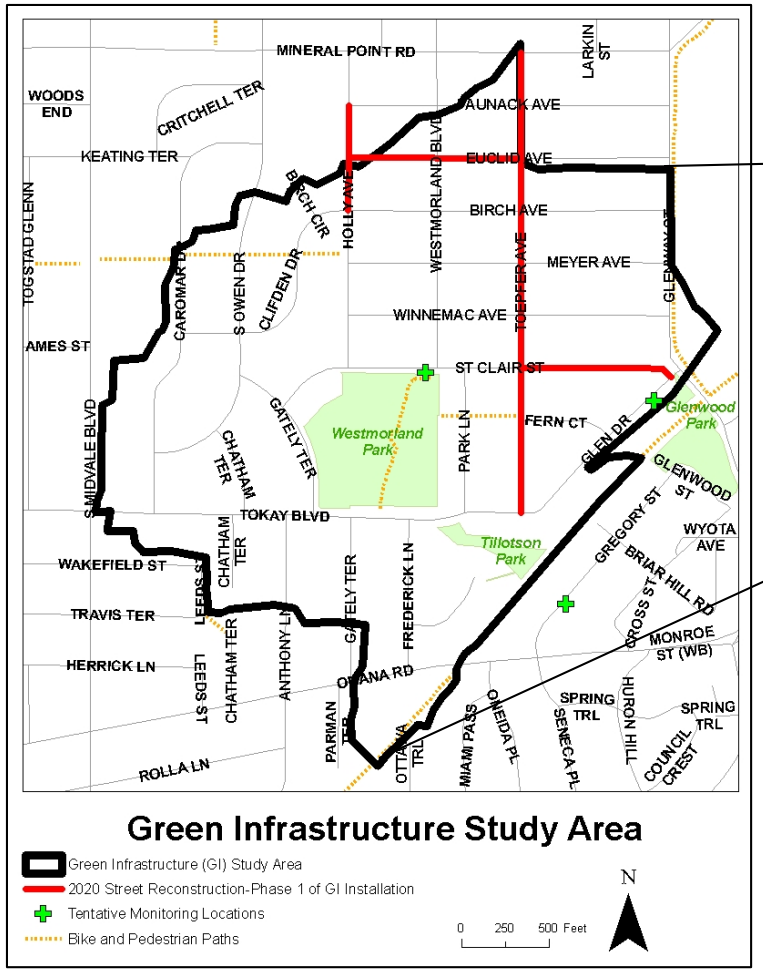
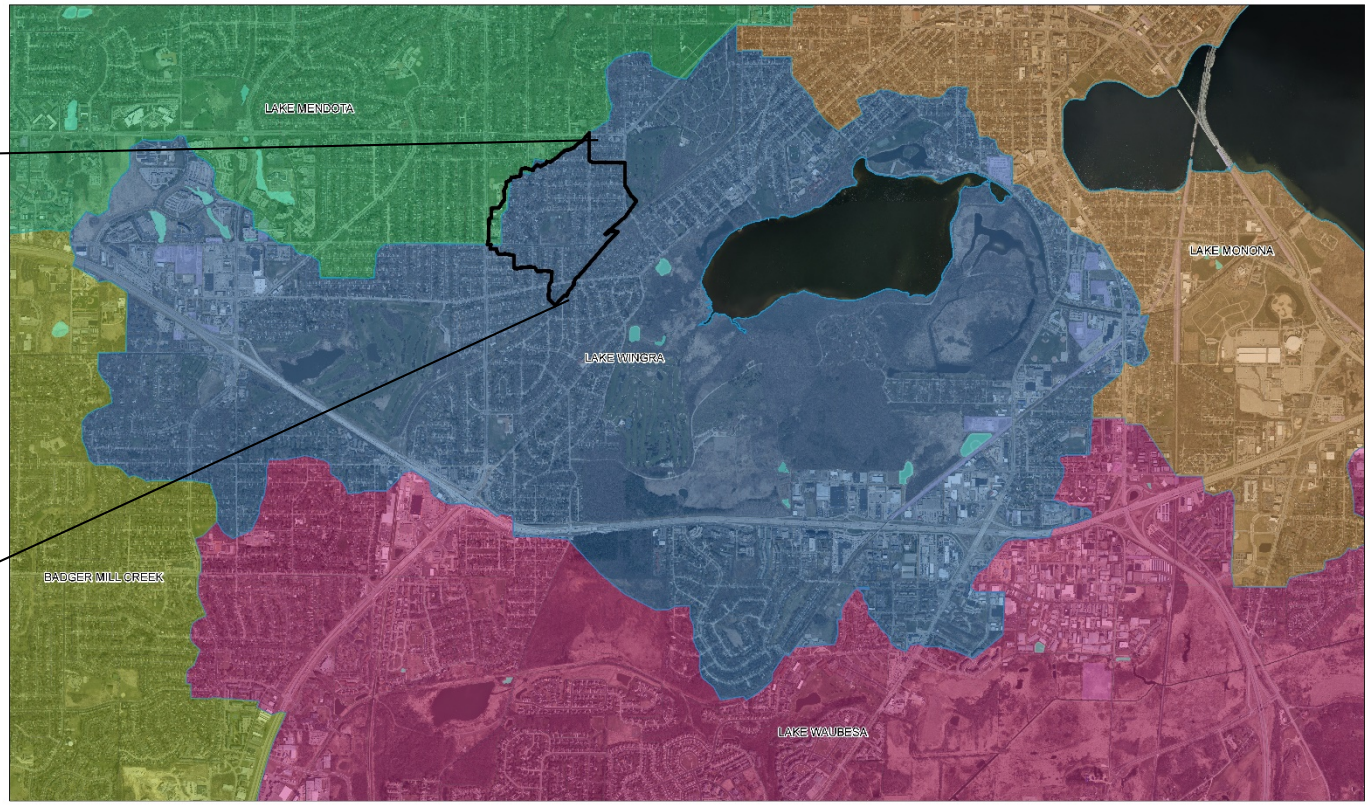
Project Location





City of Madison
Wingra Watershed and GI Project Area

0 0.5 1 2 Miles

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Overview: Purpose of Study

- **Green infrastructure (GI)** reduces and treats stormwater at its source
  - This is contrast with Madison's current system of gray stormwater infrastructure that is designed to move stormwater quickly to the rivers and lakes

- In the study, the USGS will measure the impact of increasing quantities of GI within the neighborhood for 5 years
  - City is adding GI to the right of way
  - The City is encouraging residents to install GI on private property by reimbursing residents in the study area

Overview: Types of GI in study area

On Private Property, reimbursable

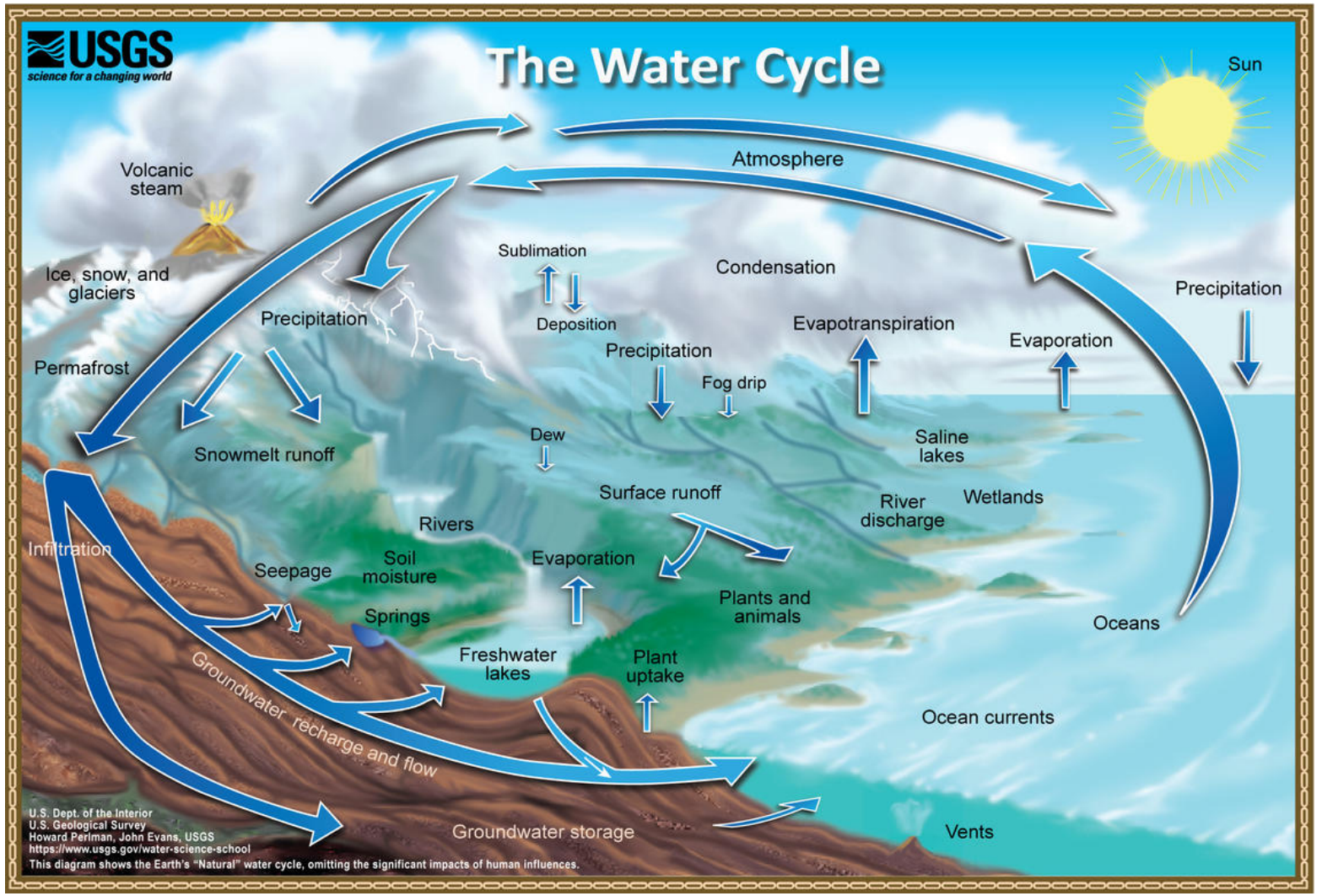
- Rain Gardens
- Directing water to grass or a garden
- Soil amendments
- Permeable surfaces
- Green Roofs

In Right of Way

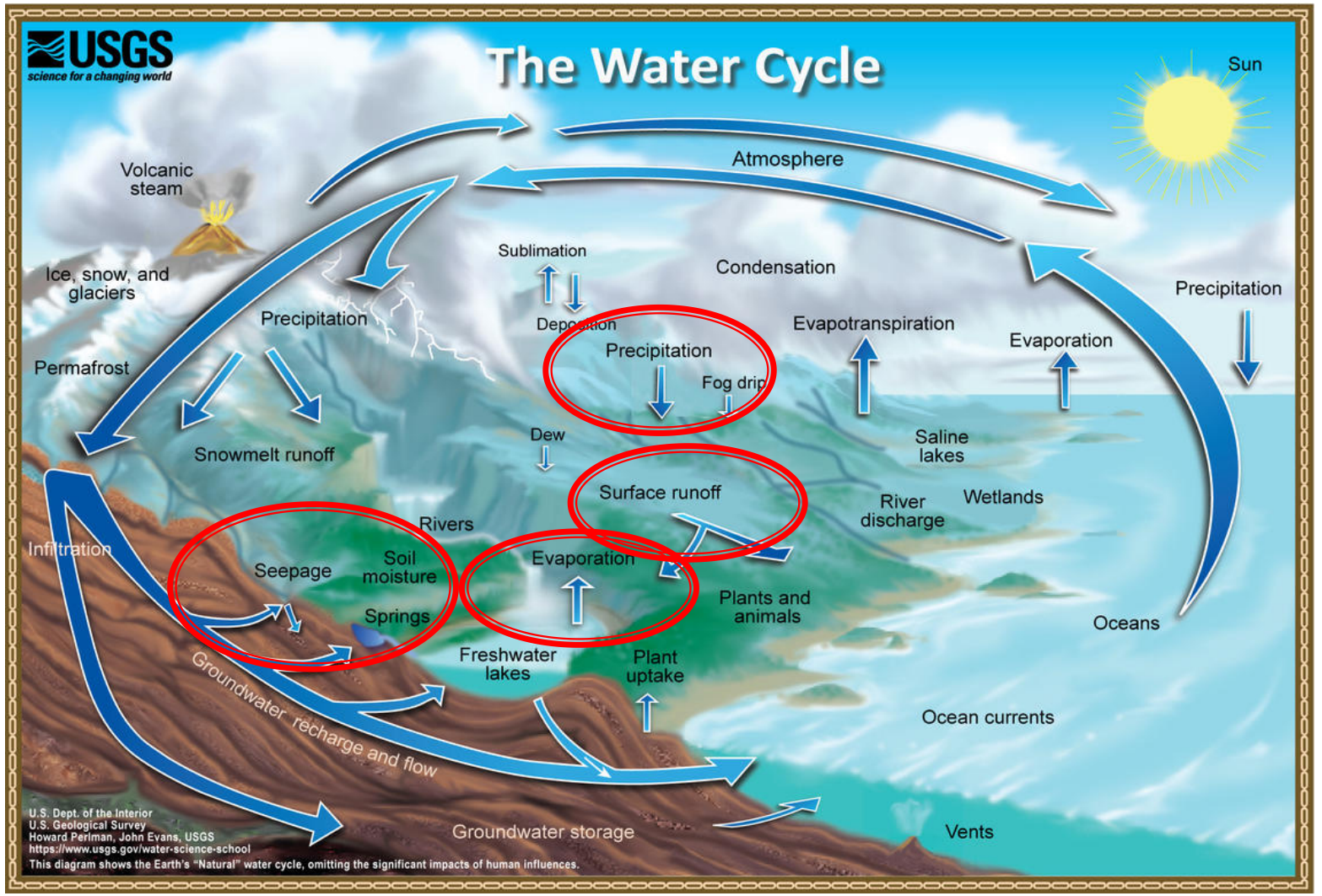
- Stormwater Terraces
  - Rain Gardens
  - Rain Basins
- Permeable Streets
- Rock Cribs

Spaight Street

Stormwater Overview



Stormwater Overview



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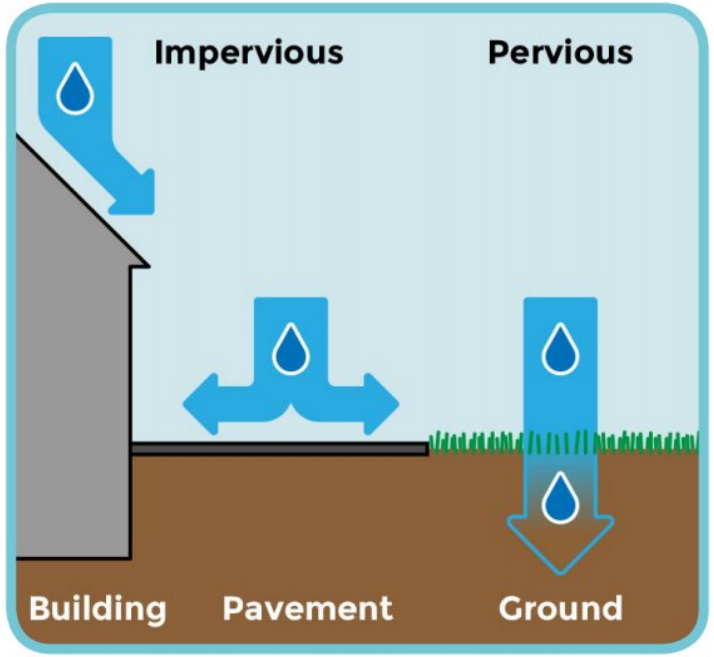
Surface Runoff

- How much stormwater "runs off" a surface (runoff) is impacted by how much water can soak into the ground.
  - This impacts both flooding and water quality
  - Changes over time have changed the quantity of runoff in our city
    - More concrete and development
    - Vegetation with shallower roots



- **Impervious**: water can't soak in
  - concrete, asphalt, roofs
- **Pervious**: water can soak in
  - Woods, grass, fields
- **Infiltration**: the process of water soaking into the ground

https://detroitfuturecity.com/wp-content/uploads/2018/03/Stormwater-101_PD_021918-1.pdf

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Factors controlling runoff

Pre-European Settlement

- Oak Savannah
- Fires every 5-10 years
- Deep roots =Very little runoff

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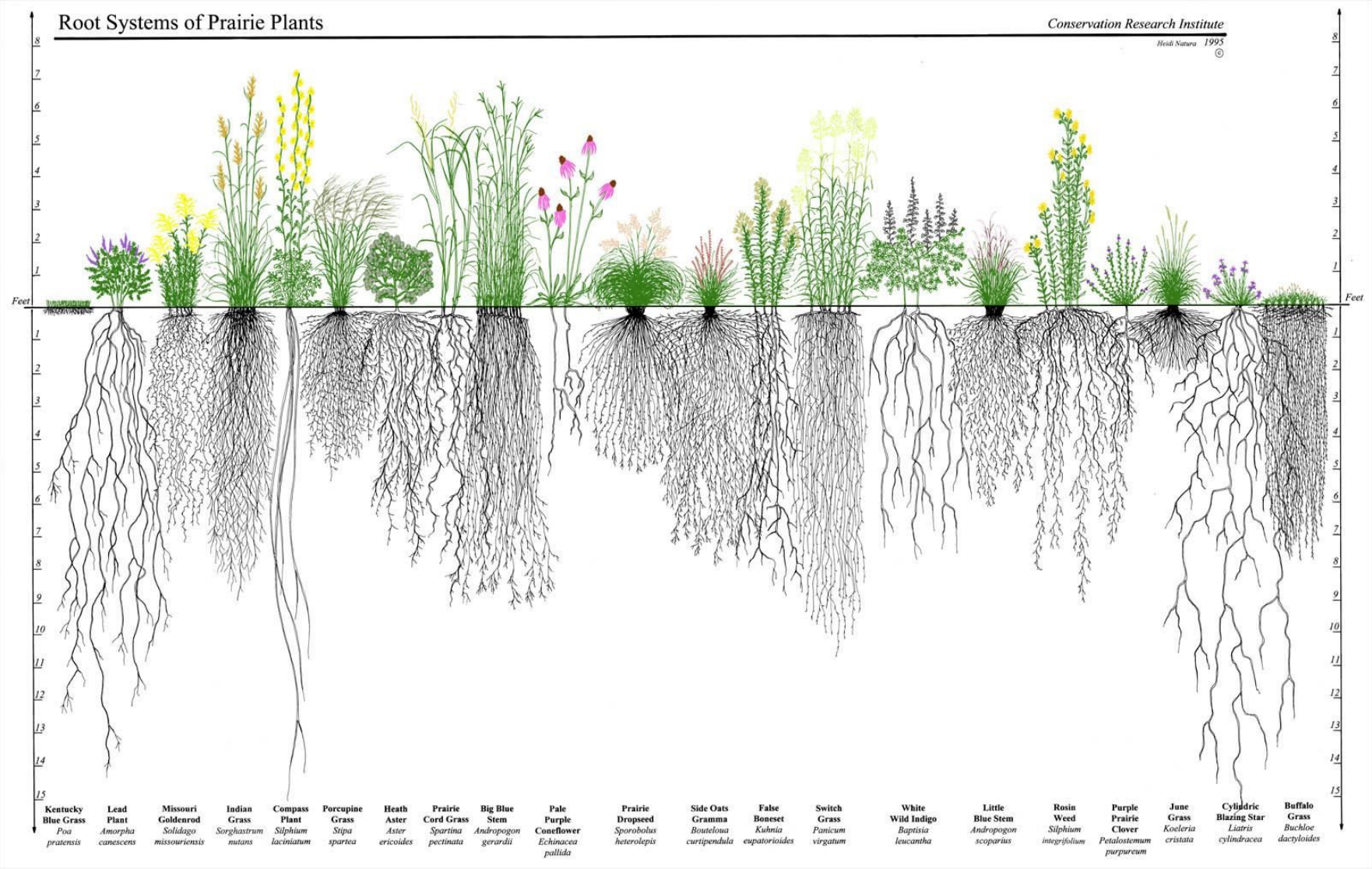

Deep Roots: Open Soil, Scavenge Water, Make Plants Hardy

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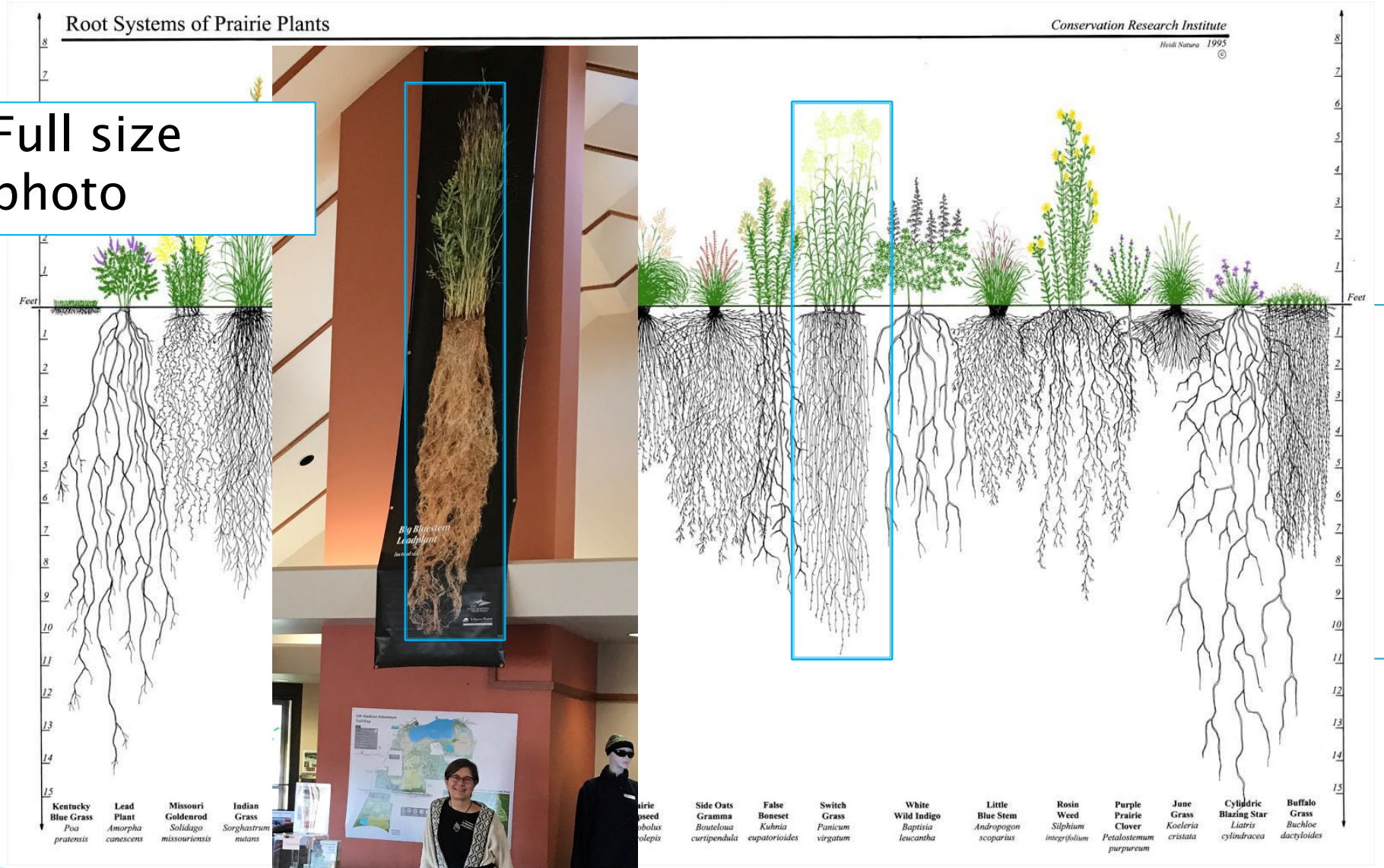
Full size photo



11 feet

Landscapes Change

Pre-European Settlement
- Oak Savannah
- Fires every 5-10 years
- Deep roots =Very little runoff

Urbanization

Farming

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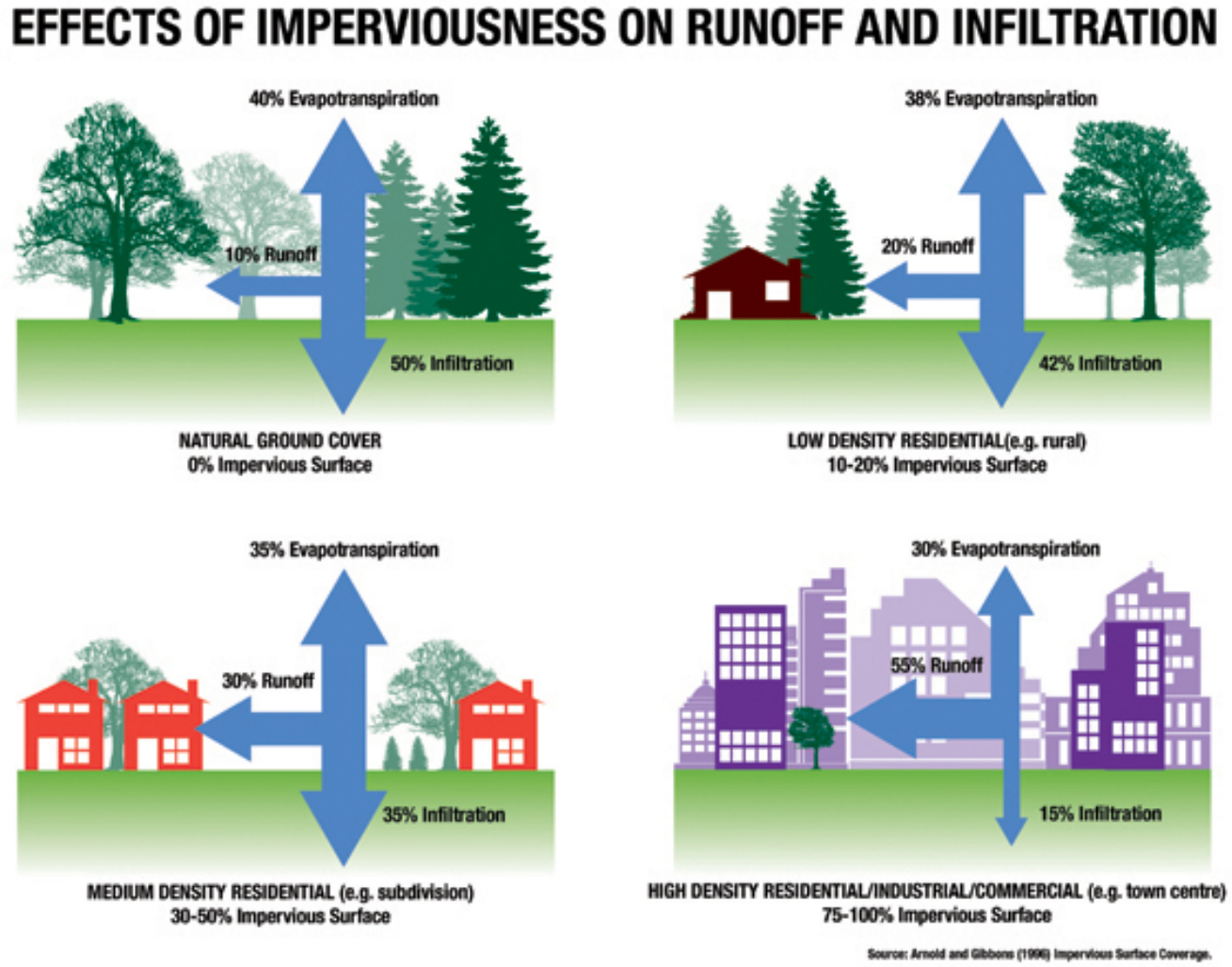
Impervious Area Increases, Infiltration Decreases



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East Washington Development—lots of impervious area

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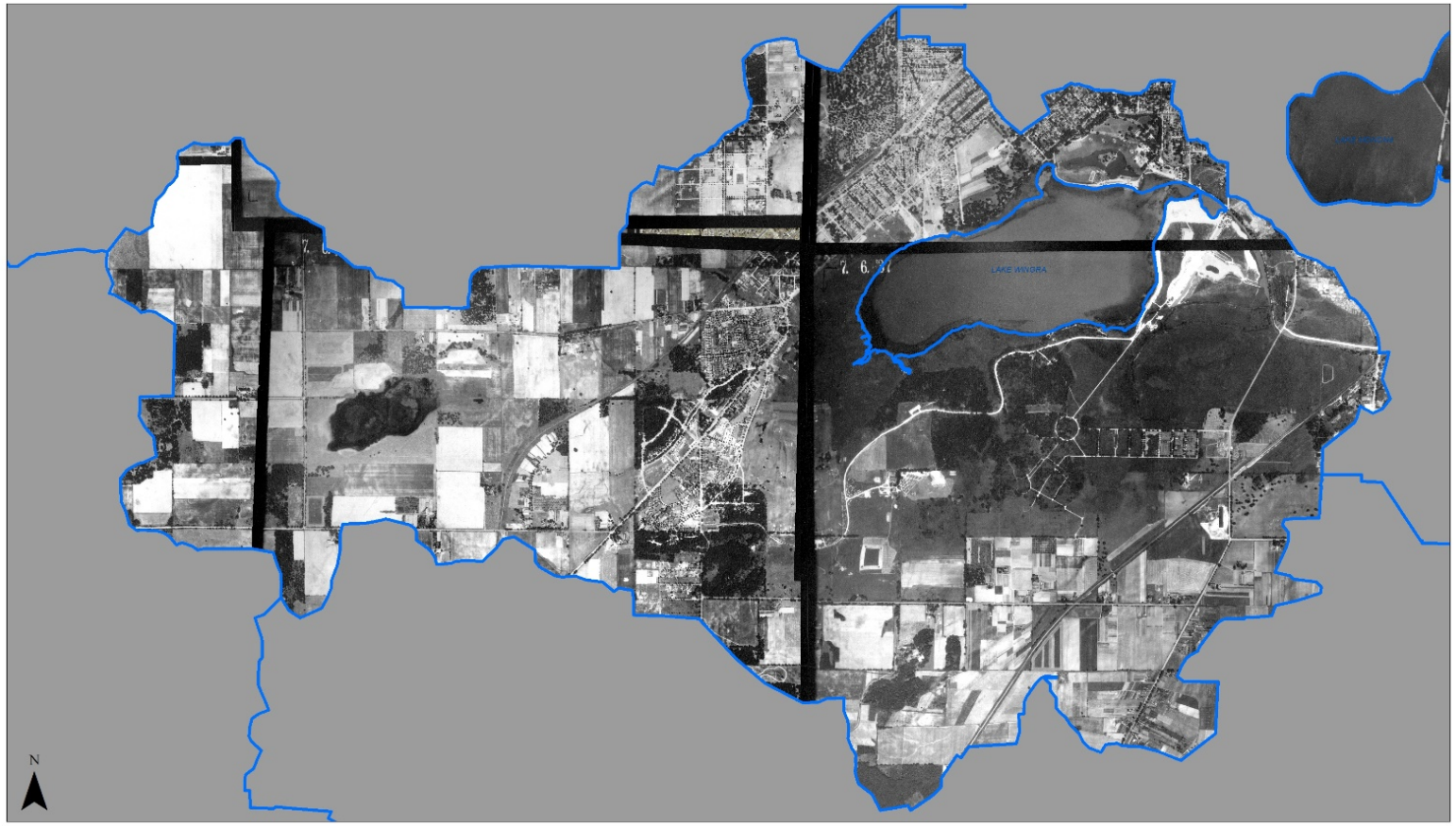
Lake Wingra Watershed – 1937



Lake Wingra Watershed 1937

Area = 1740.5 acres

0 0.25 0.5 Miles

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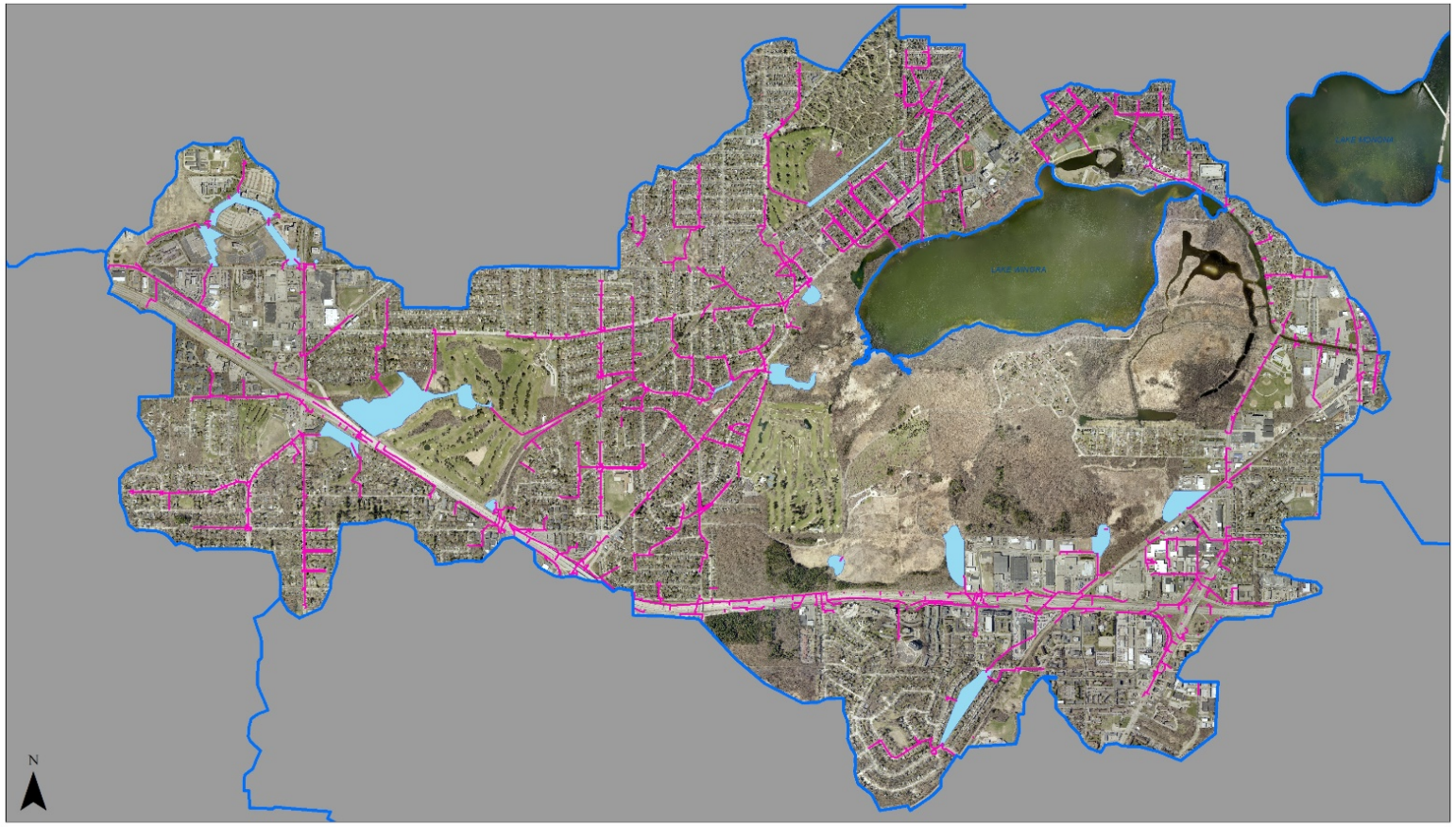
Lake Wingra Watershed – 2018



Lake Wingra Watershed 2018

Area = 1740.5 acres

- Lots of land is now impervious where stormwater cannot soak in
- Pink lines depict pipes that move stormwater quickly to Lake Wingra

Not only more runoff, but also faster….

This stresses the downstream waterways and infrastructure

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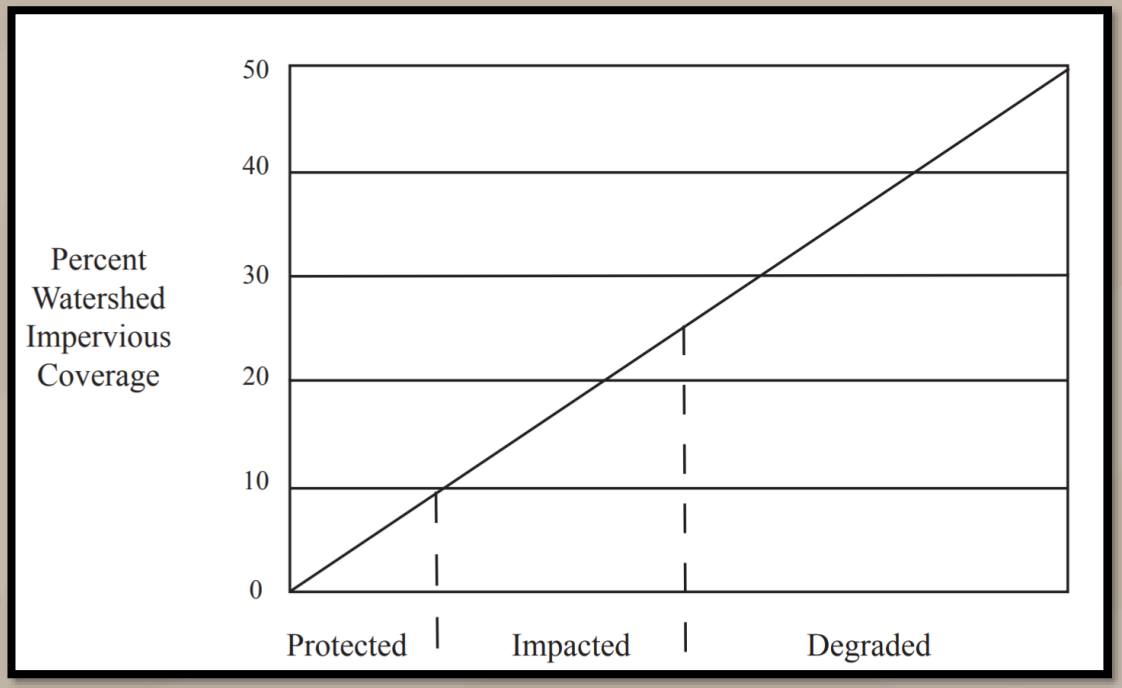
Urbanization Impairs Surface Waters



"…streams are impaired when impervious surfaces over just 10% of a watershed. Streams in watersheds where impervious surfaces cover 25% of the watershed area cannot support aquatic life."

Average % of impervious surface by land use type:

Land Use	Impervious Cover %
Forest	1%
Urban/Suburban Open Land	3%
Low Density Residential (0.5 units/acre)	12%
Low Density Residential (1 units/acre)	20%
Medium Density Residential (2 units/acre)	25%
Medium Density Residential (3 units/acre)	30%
Medium Density Residential (4 units/acre)	38%
High Density Residential (5-7 units/acre)	40%
Multifamily Townhouse (>7 units per acre)	65%
Commercial	85%
Parking – Unpaved	90%
Roads/Paved Parking	100%

Source: Center for Watershed Protection, 1998. "Rapid Watershed Planning Handbook"

Source: Center for Watershed Protection, 1998

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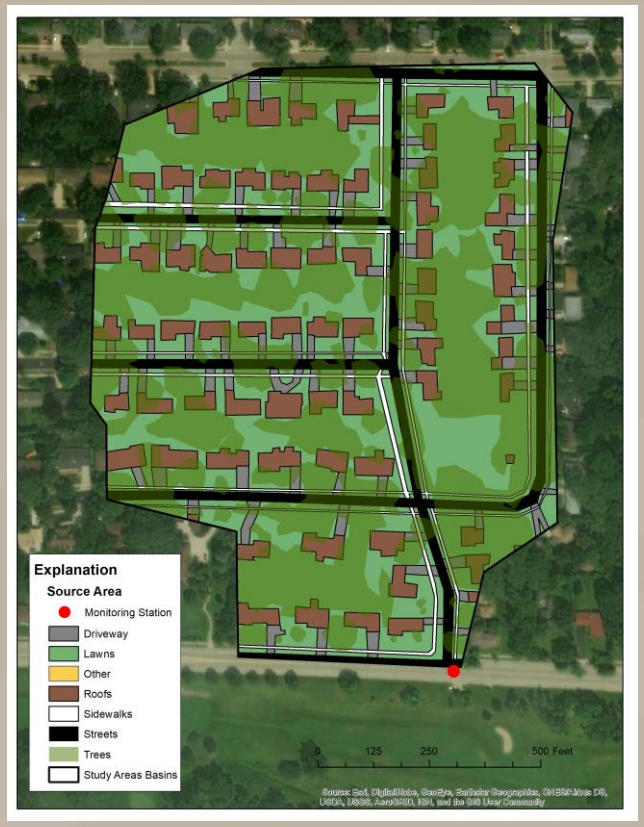
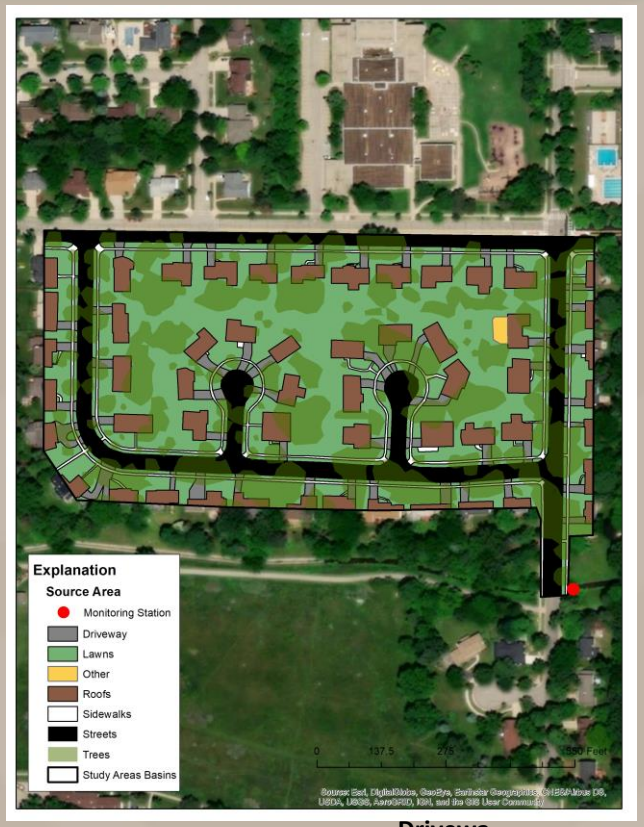
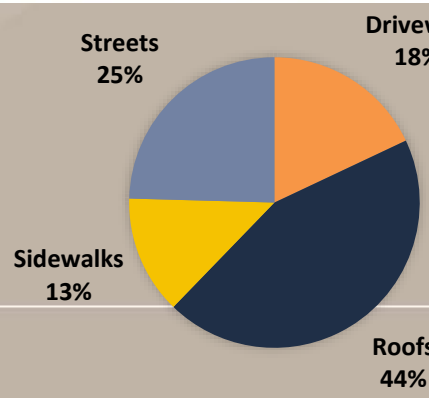
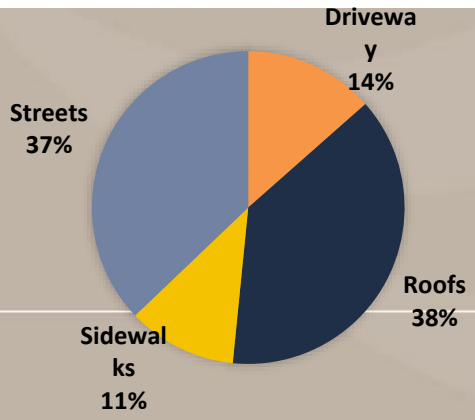
Impervious Surfaces in a Typical Medium-density Residential Neighborhood









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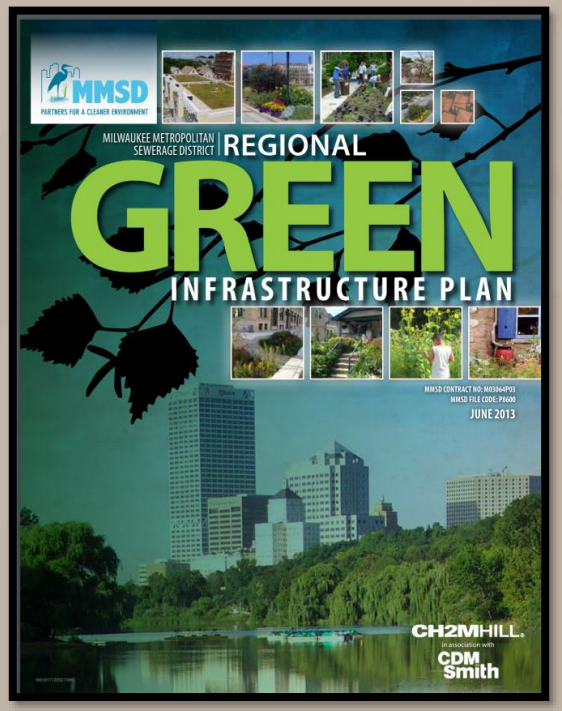
City Investment in Green Infrastructure

Other municipalities are investing in green infrastructure as well, such as:

Milwaukee: *FreshCoast740*: Capture the first 0.5 inch of rainfall (740 million gallons) by 2035



Philadelphia: *Green City, Clean Waters*: Reduce stormwater runoff by 85%

Urban Runoff Volume Reduction

Focus Area 3

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A USGS geonarrative

GLRI Urban Stormwater Monitoring: Assessing stormwater reduction using green infrastructure

The term **"urban stormwater"** refers to rainfall or snowmelt that flows off impervious surfaces (such as roads, roofs, and parking lots) instead of soaking into the ground. Stormwater runoff washes contaminants off impervious surfaces and carries them into storm sewers, where they are transported to nearby lakes, rivers, and streams. Excess amounts of stormwater can also cause flooding and, in some cities, sewer overflows.

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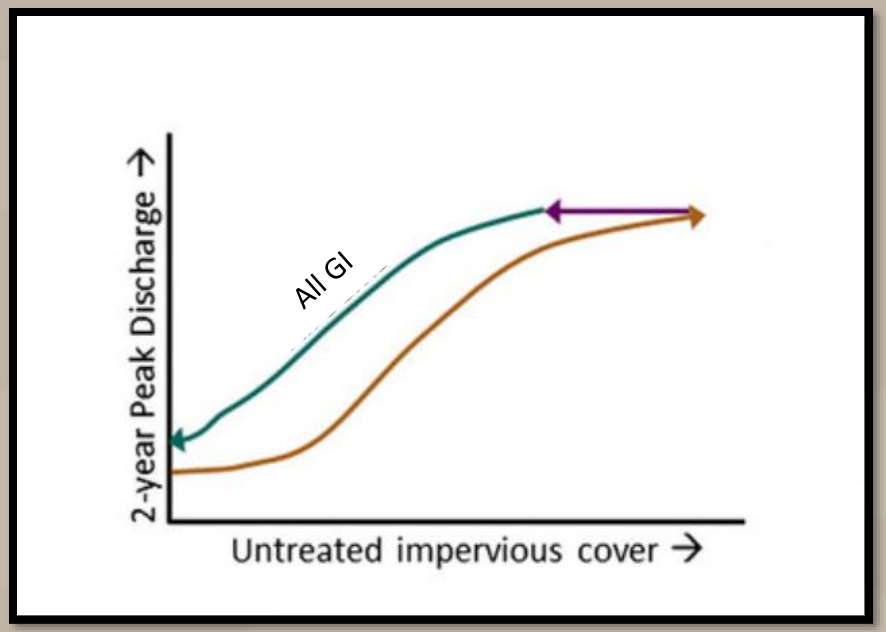
Google

USGS Urban Stormwater

Return to Pre-Settlement Hydrology



Converting impervious to pervious (where stormwater can't soak in, to where it can soak in) through Green Infrastructure (GI) will lead to reduced peak discharge, volume, and 'flashiness' of runoff…

…this process could take many years but eventually may lead to lower risk of urban flooding, improved water-quality, and replenishment of shallow aquifers.

Control and Test Study Basins

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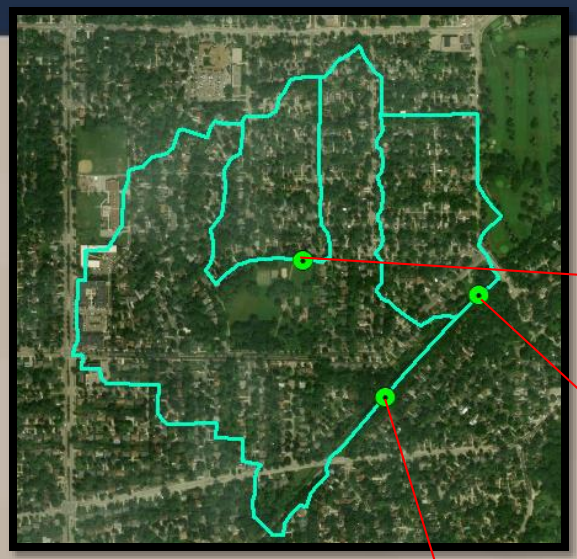
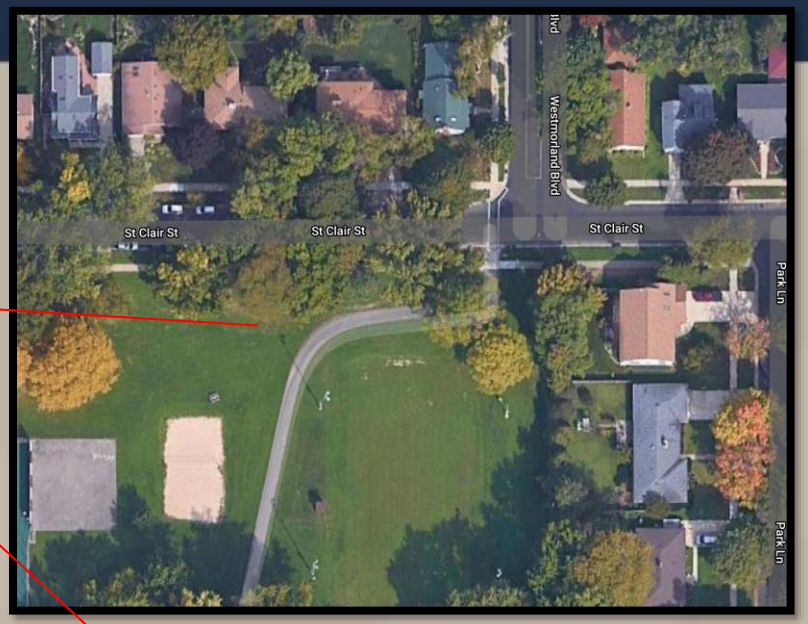
Monitoring Locations





USGS Monitoring Shelter

These boxes, installed by the USGS, hold the equipment used to monitor the volume of runoff in nearby pipes.

This will measure the impact of the green infrastructure that's installed.

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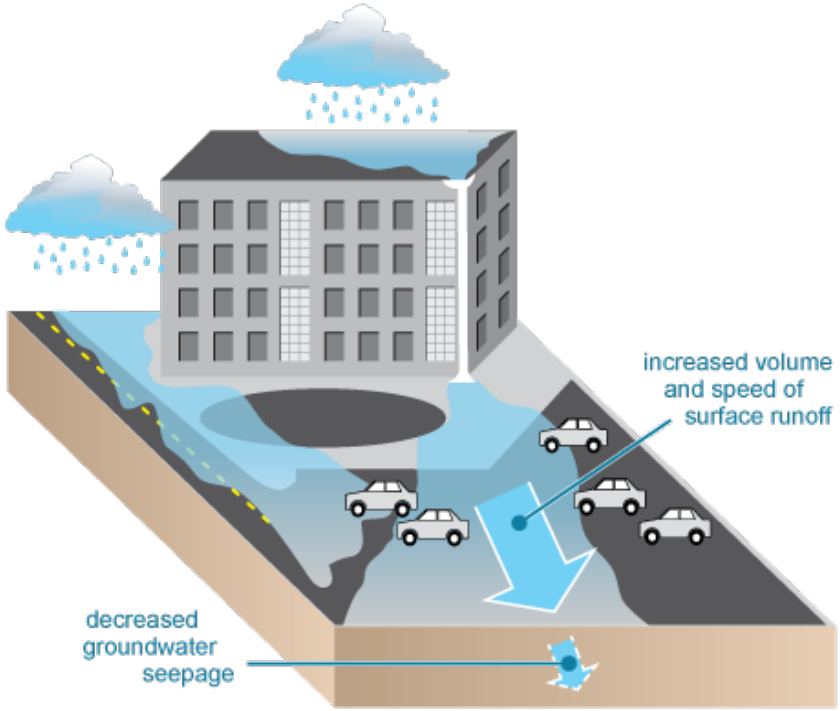
Green Infrastructure

Green Infrastructure (GI): reduces and treats stormwater at its source typically through routing pervious areas to impervious areas where runoff can soak in, and increasing infiltration (native plants)

- In Right of Way
  - Stormwater Terraces
    - Rain Gardens
    - Rain Basins
  - Permeable Streets
  - Rock Cribs
  - Sidewalk Drains

- On Private Property
  - Rain Gardens
  - Directing water to grass or a garden
  - Soil amendments
  - Permeable surfaces
  - Green Roofs

Impervious surfaces



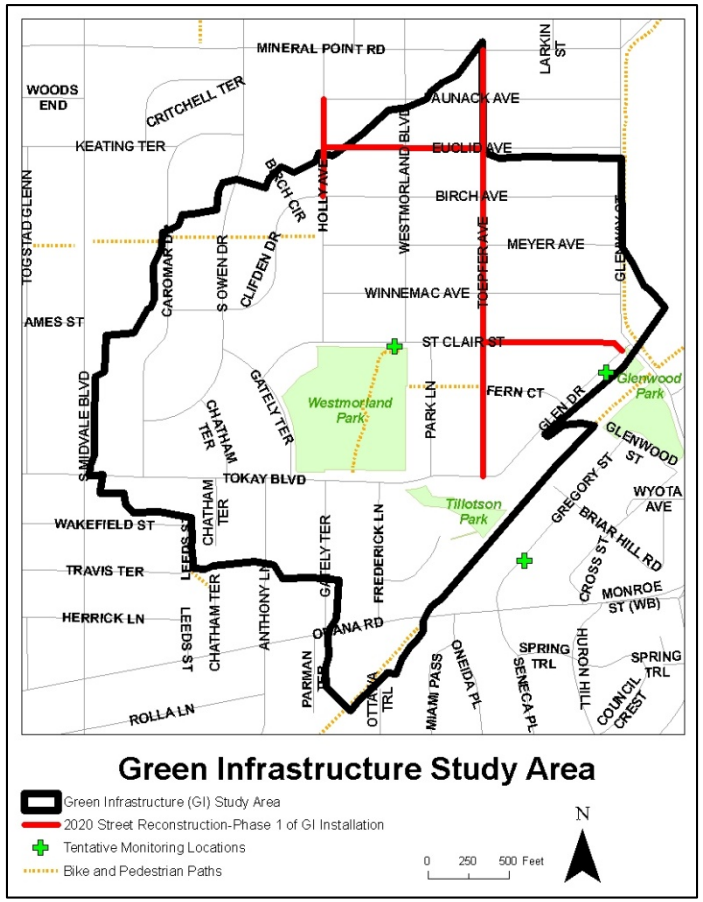
Impervious 'hard' surfaces (roofs, roads, large areas of pavement, and asphalt parking lots) increase the volume and speed of stormwater runoff. This swift surge of water erodes streambeds, reduces groundwater infiltration, and delivers many pollutants and sediment to downstream waters.

Pervious surfaces

Pervious 'soft' surfaces (green roofs, rain gardens, grass paver parking lots, and infiltration trenches) decrease volume and speed of stormwater runoff. The slowed water seeps into the ground, recharges the water table, and filters out many pollutants and sediment before they arrive in downstream waters.

Conceptual diagram illustrating impervious and pervious surfaces. Impervious surfaces are hard and increase stormwater runoff, causing pollutant and sediment delivery in downstream waters. Pervious surfaces are soft and decrease stromwater runoff, which filters out pollutants and sediments before they arrive in downstream waters.
Diagram courtesy of the Integration and Application Network (ian.umces.edu), University of Maryland Center for Environmental Science. Source: Chesapeake and Atlantic Coastal Bays Trust Fund, 2013. Stormwater Management: Reducing Water Quantity and Improving Water Quality. IAN press, newsletter publication.

Right of Way Projects



The current reconstruction project:

- Stormwater Terraces
  - Rain Gardens :13
  - Rain Basins: 14
- Permeable Streets
  - Parking lane of Euclid and St. Clair
- Rock Cribs : 14
- Sidewalk Drains :129

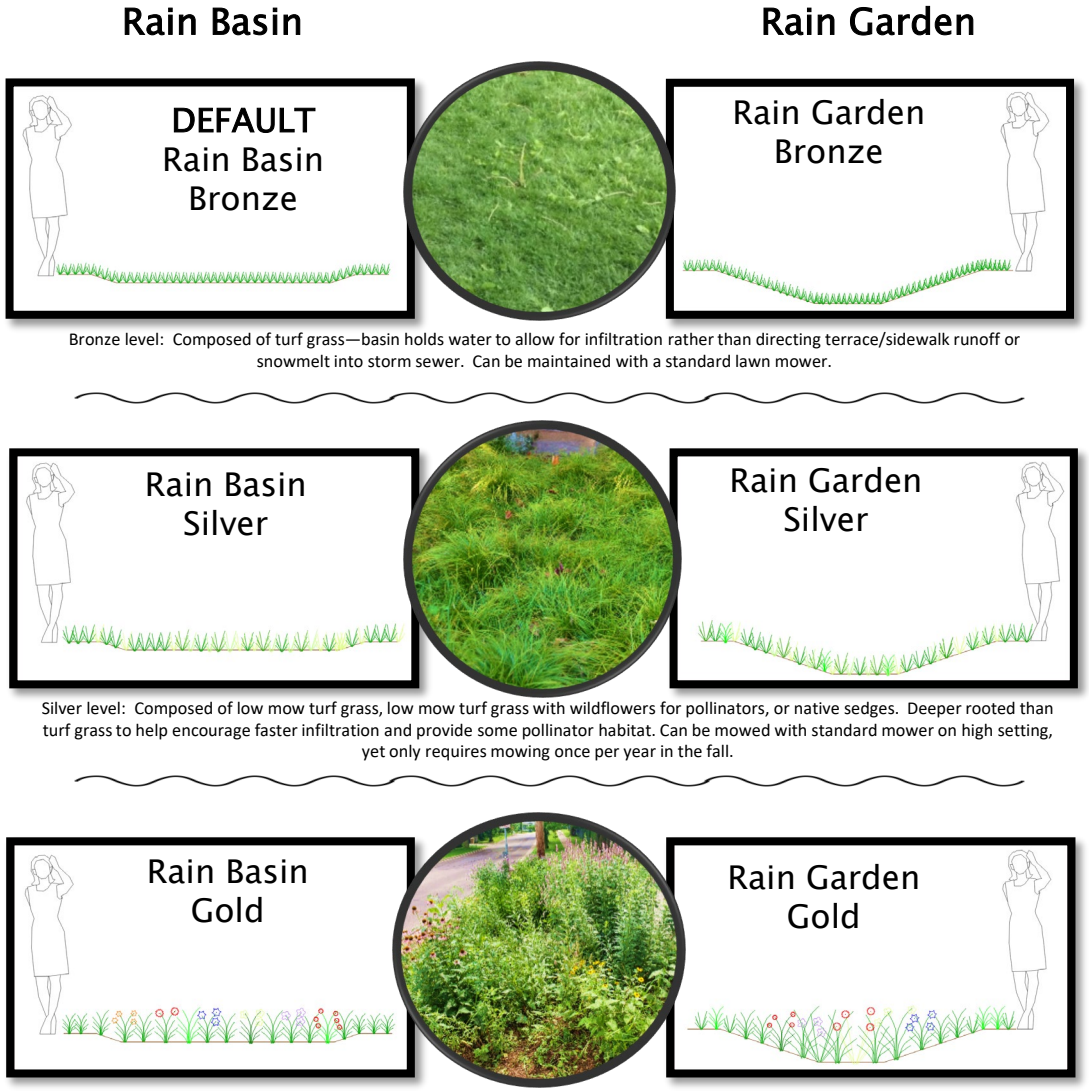
Terrace Rain Garden

- Collects runoff from road
- 1 foot deep measured from top of curb
- Planted with native vegetation
- Constructed and planted by City
- Maintained by residents

Stormwater Terraces

Rain Basin Details

- 4 inches deep
- Doesn't take street water, but you will have the option to eventually connect your roof downspout with slight modifications



Rain Garden Details

- 1 foot deep
- Cut in curb so that it can take and treat stormwater from the street
- More effective at treating stormwater

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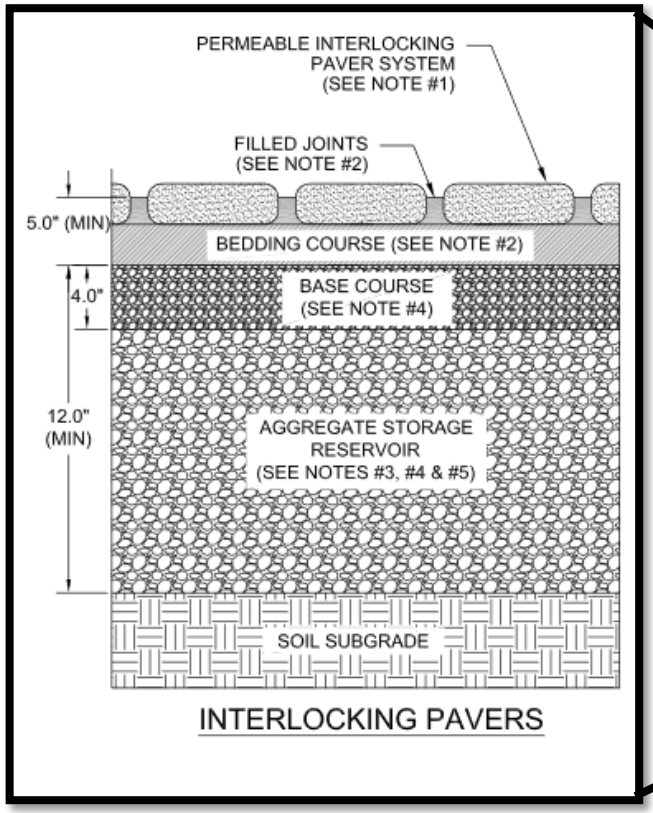
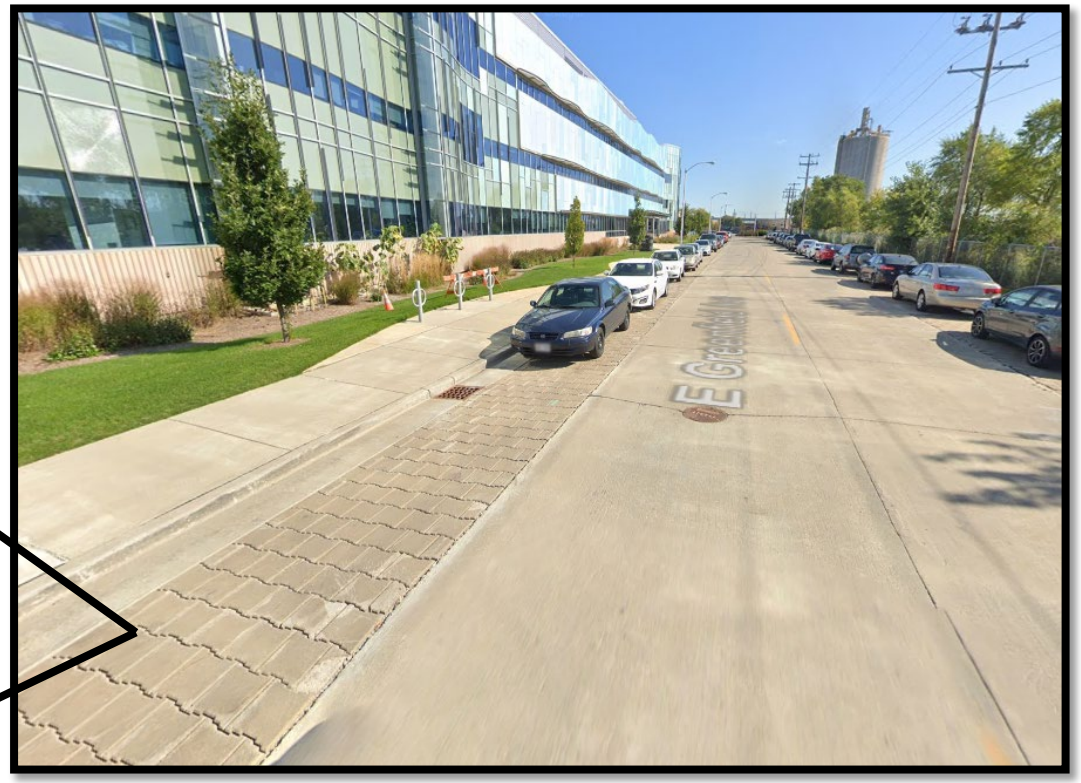
Permeable Road Surface

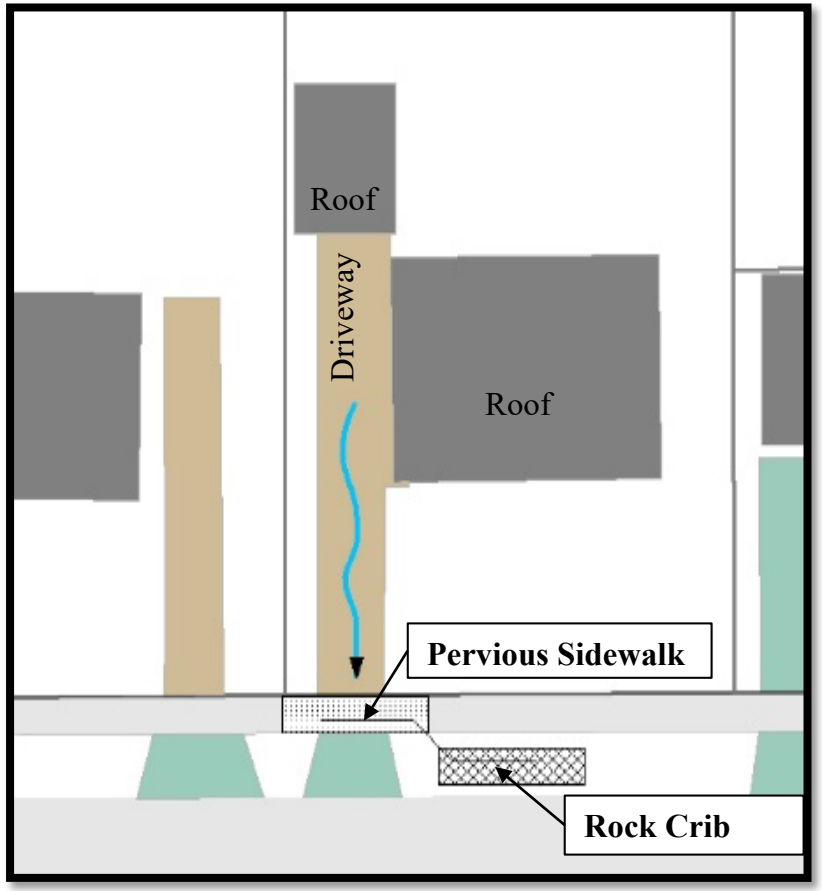


https://dnr.wi.gov/topic/stormwater/documents/1008PermeablePavement.pdf



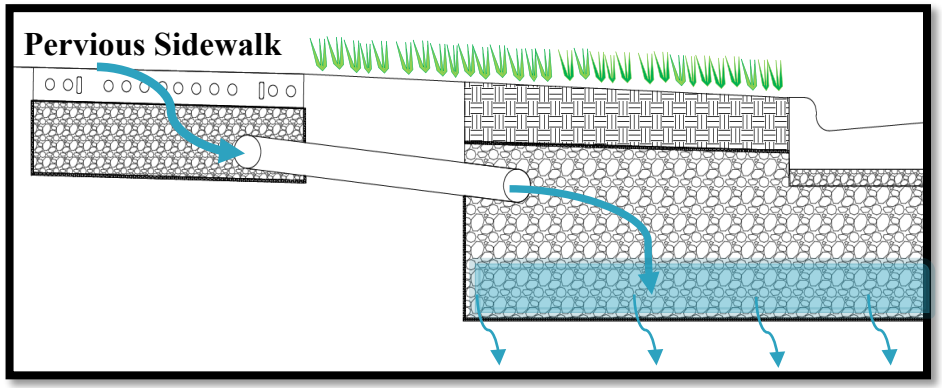
- Water flows through the driving surface into a rock crib
- This soaks into the ground or is carried to storm sewer Treats and slows runoff
- Needs Maintenance – Vacuuming
- Chloride is an issue as it can end up in ground water

Pervious Sidewalk with Rock Cribs



Water flows from the driveway, through the pervious sidewalk and is then routed to the rock crib in the terrace. Overflow water is directed to the storm sewer.

Comparison of Traditional and Pervious Sidewalk



The pervious sidewalk panels intercept and route water to a buried rock crib where it soaks into the ground.

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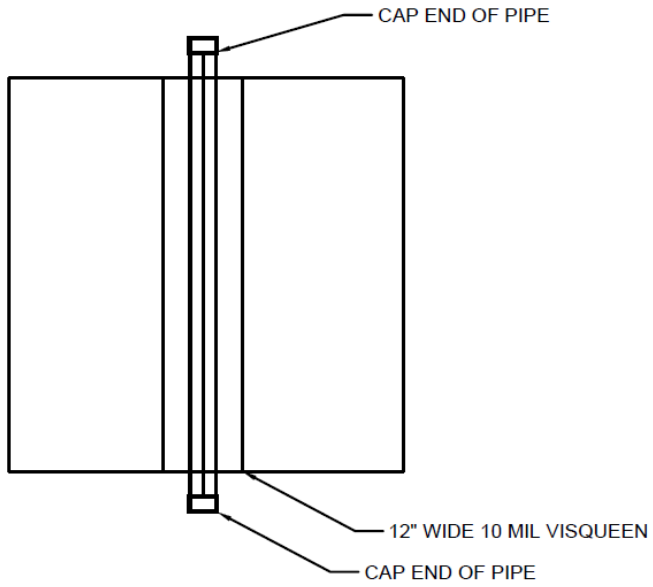
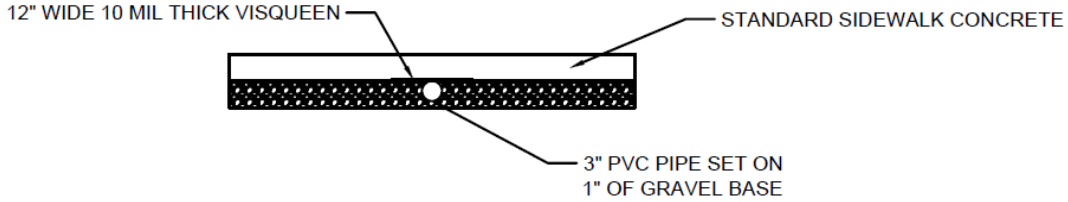
Sidewalk Drains





- Capped 3” PVC pipe
- Allows water to flow under the sidewalk to the terrace
- Can be utilized for future projects
- 1 installed at each property

Optional Private Property Rain Garden

Advantages

- More space in yards than in terraces
- Receives roof water instead of street water
  - Less pollutants in supply water
    - Reduces maintenance
    - Improves quality of groundwater recharge
- Less competition for space
- Eligible for reimbursements if in pilot study area
- Native plants provide habitat

Optional Private Property Rain Garden

Cost

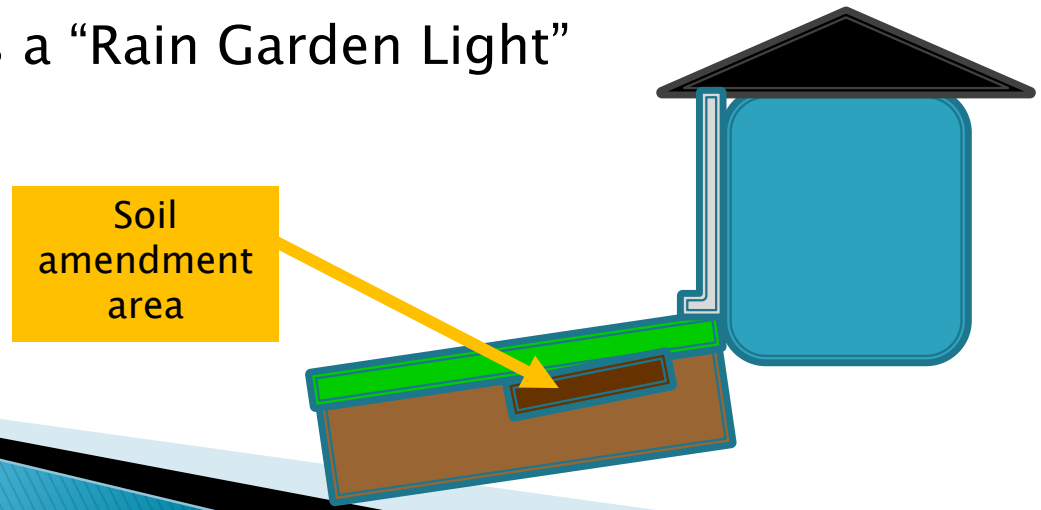
- Approximate cost of contractor: $1,200
- Approximate cost of DIY: $300 for plants + labor

Considerations

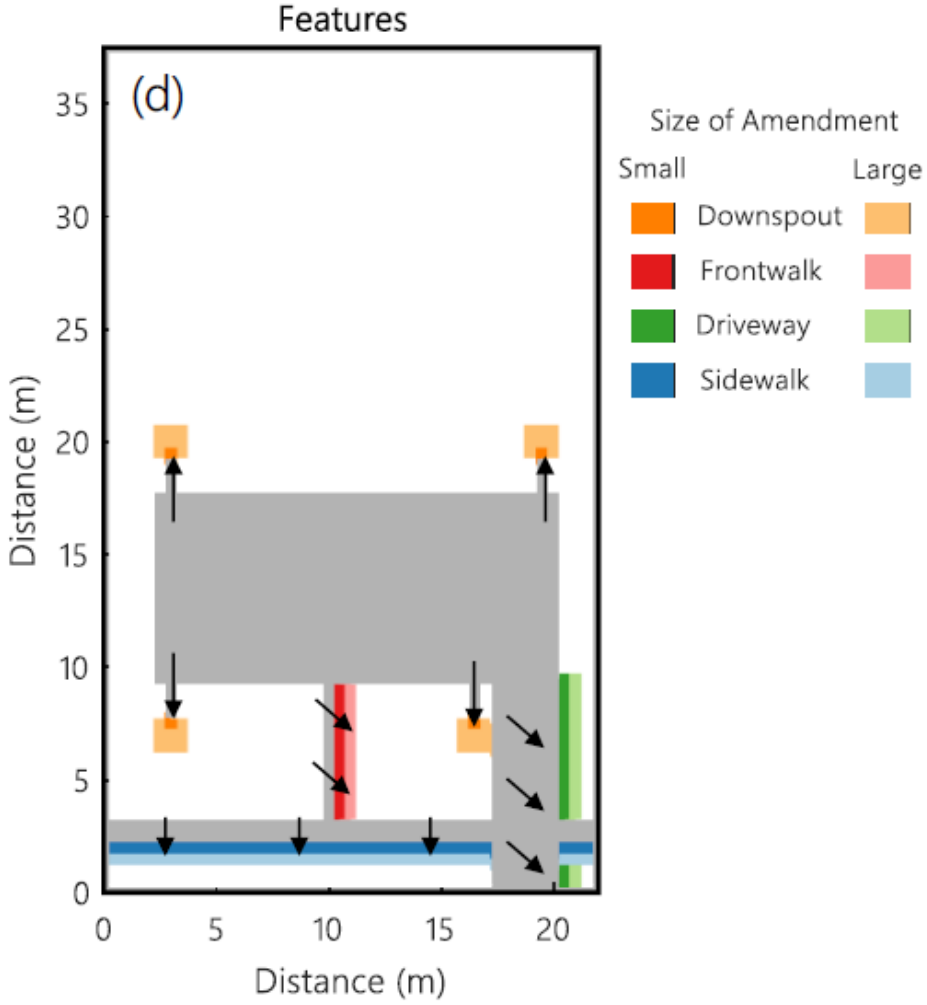
- Existing landscaping and trees
- Utility conflicts and ground water
- Excess soil
- Cost (terrace gardens are mostly paid for by City)

Optional Soil Amendments

- Decrease your downspout runoff by tilling compost into the soil around your down spouts
  - Improving a 5’ x 5’ square around downspouts is enough to notably increase infiltration
  - Can be planted in turf grass or native plants
  - Think of it as a “Rain Garden Light”



Soil Amendment Areas



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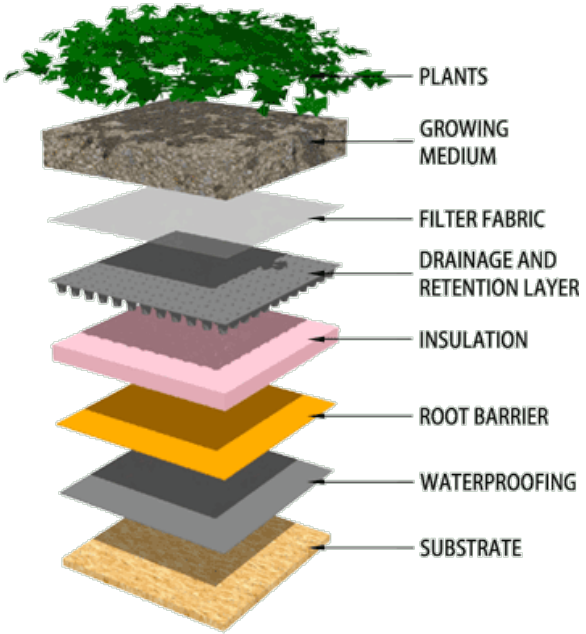
Optional Green Roof

https://mngreenroofs.org/2012/02/leatherman-garage/

- A green roof turns a surface that typically impervious surface into a pervious one
- Water is stored on the roof for plants to uptake and evapotranspire



Optional Green Roof

- Typically cost $25 or $30 per square foot
- For very small buildings, you could DIY install a green roof for less than $10 per square foot.
- While green roofs seem expensive up front, they also tend to last much longer than conventional roofs.

Rain Barrel

- Captures a small amount of water for reuse in a garden or lawn
- Reduces municipal water use
- Better water for plants
- Nice to use together with soil amendments or rain garden

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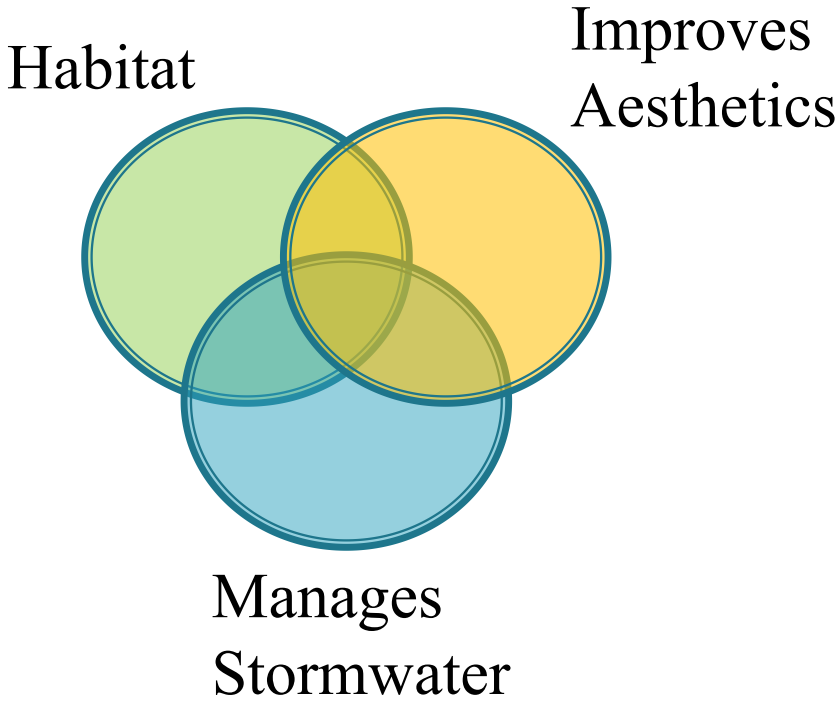
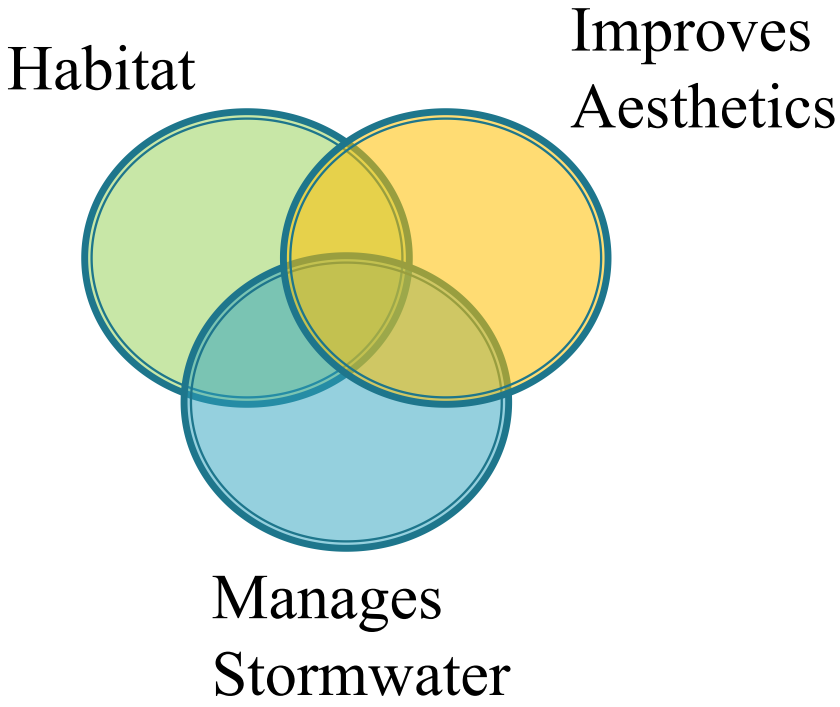
The Case for Rain Gardens

- Rain Garden with Native Plants
  - Habitat:
    - Bringing native plants into your yard helps to create needed habitat
    - The plants that thrive in rain gardens can be propagated at home
      - Seeds and seedlings can be shared or sold to reduce cost
    - Dane County has a team of volunteer native plant growers
      - You can learn to be one here:
      - https://lwrd.countyofdane.com/documents/pdf/Volunteer-to-grow-native-plants.pdf



The Case for Rain Gardens

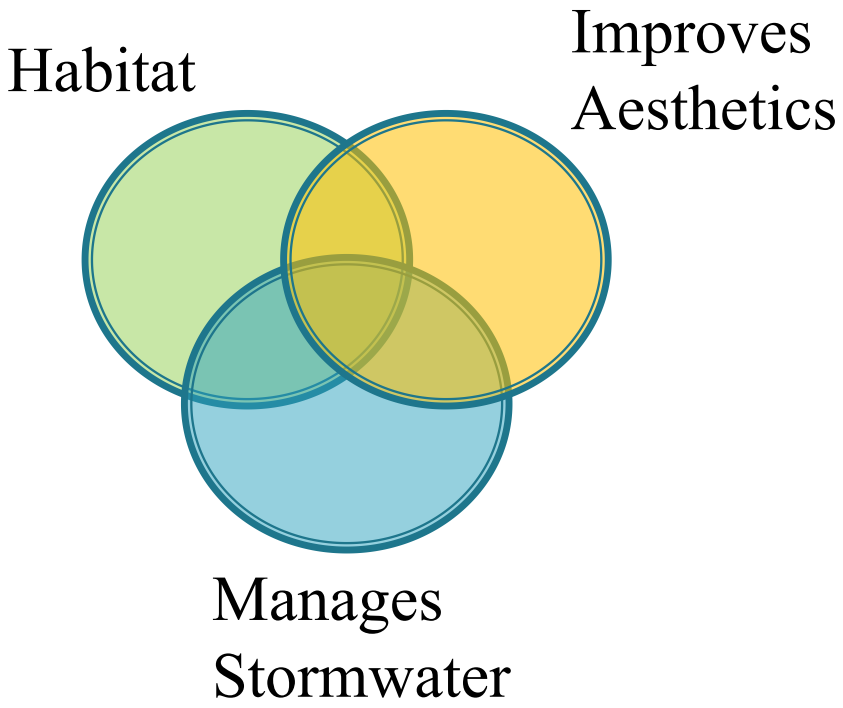
- Rain Garden with Native Plants
  - Stormwater:
    - Easy to have 90% of all the rain on your roof either water plants or soak into the ground
    - Roof water is relatively clean and this reduces maintenance
    - Best option for ground water recharge
    - Helps your yard act more like an oak savannah



The case for rain gardens

- Rain Garden with Native Plants
  - Aesthetics:
    - Gardens are interesting
    - Can be a place for art
    - Your garden can be an expression of you

These fish start a lot of conversations



Reimbursement Policy

- Needs to be within the Green Infrastructure Study area
- If contractor completes the work
  - 80% reimbursement up to $1,000
- If resident completes the work
  - 110% of expenses reimbursed up to $1,000
  - 90% if City hauls excess soil away
- Must have approved plan before purchase of supplies or paying contractor.

- Eligible projects with proof of installation :
  - Rain Gardens
  - Soil amendments
  - Rain barrels
  - Permeable pavements
  - Green Roofs

Collaboration

- United States Geological Survey (USGS)
  - Completing the monitoring and analysis
- Friend of Lake Wingra
  - Assisting with education, outreach and implementation of GI
- UW Arboretum
  - Partnering on additional grant opportunities

Working toward the Wingra Watershed Goals

Wingra Watershed Plan

- 1,000 private rain gardens
- 4 ac of permeable pavement
- Downspout Disconnection 35%
- 1,000 Terrace Rain Gardens
- Total infiltration of ~6 Millon gallons

The Pilot study is 7 % of the watershed. An area weighted goal for the pilot area is 420,000 gallons each year.

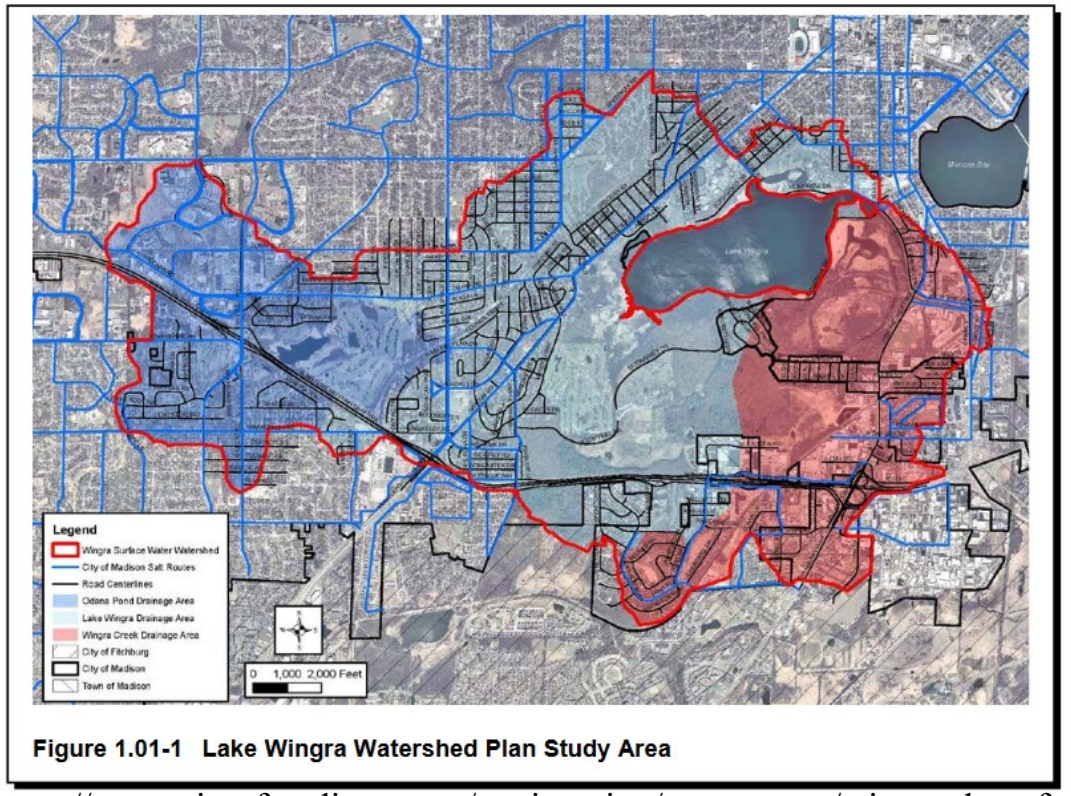


Figure 1.01-1 Lake Wingra Watershed Plan Study Area

https://www.cityofmadison.com/engineering/stormwater/wingraplan.cfm

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Working toward the Wingra Watershed Goals

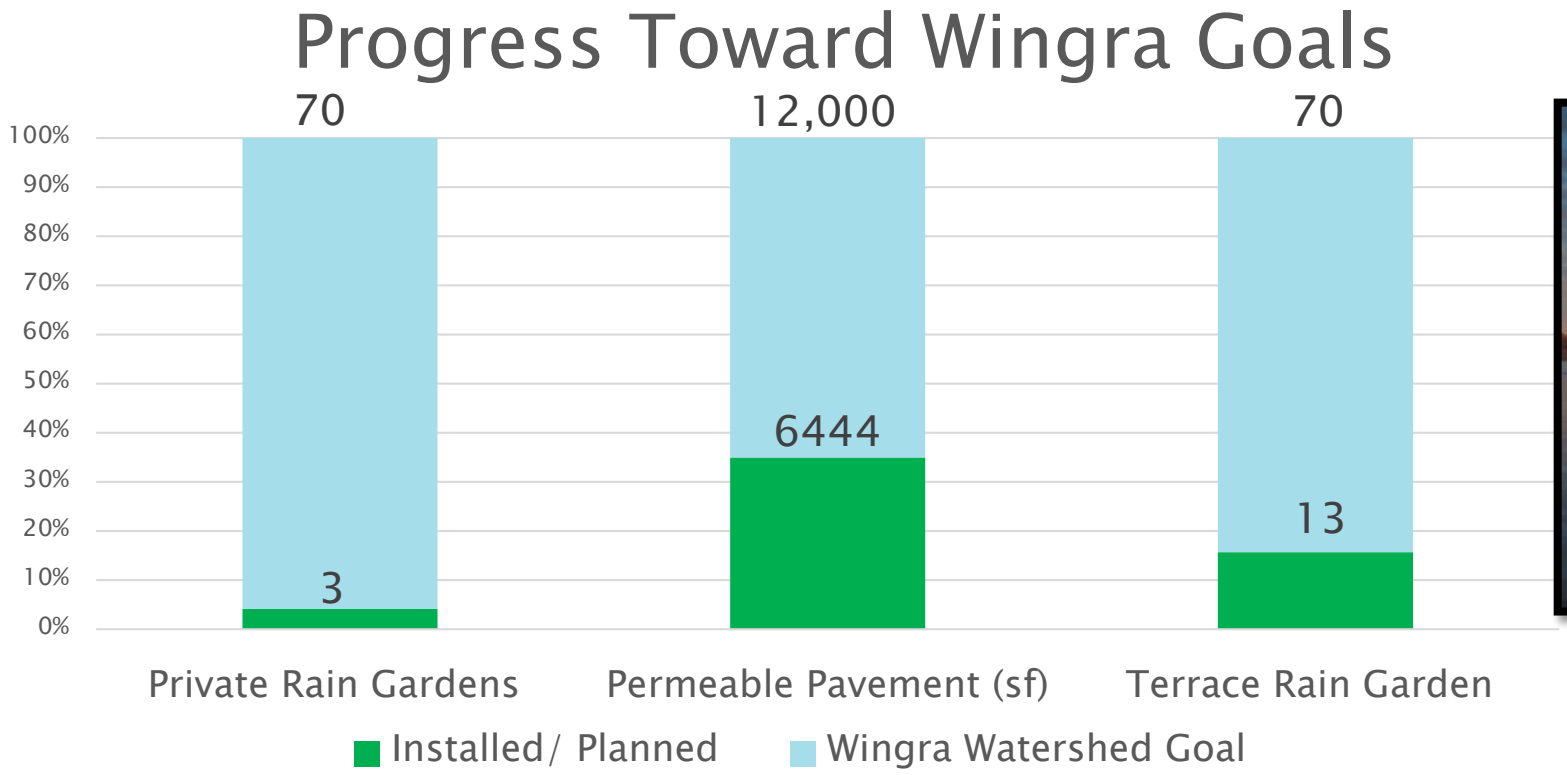

Photo credit: Richard Hurd

FOLW and the City is looking to support residents. You can fill out the survey to guide our efforts: https://www.lakewingra.org/gi-study-westmorland

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UW Arboretum – W.A.T.E.R project

- The Arboretum and our partners are excited to partner with Lake Wingra Watershed neighborhoods to address stormwater concerns through our new *Water Action To Encourage Responsibility (WATER)* project. Here are just a few ways you can be involved:
  - Receive tools and training to understand and communicate effectively about urban stormwater issues
  - Attend community events, classes, lectures and neighborhood tours focused on green infrastructure and stormwater management actions you can take
  - Let us highlight YOUR efforts to reduce the impacts of stormwater and be a model for your community!

Project Schedule

- Equipment Installed: Spring 2020
- Toepfer, Euclid, St. Clair reconstruction project: Summer/Fall 2020
- Private Property Retrofit & Reimbursement: 2020-2025
- UW Arboretum Grant to Encourage Green Infrastructure: Fall 2020 – Fall 2021

What is the process

- If interested in installing Green Infrastructure on your property:
  1. E-mail Richie Breidenbach, rbreidenbach@cityofmadison.com
  2. Put together a plan and submit to Engineering
     - https://www.ripple-effects.com/rainGardens is a great resource
     - There will be an example submittal on the project page
  3. Wait for approval
  4. Get quotes and or estimate your expenses
  5. Construct and document what you did
     - A few photos and receipts
  6. Submit for reimbursement
  7. Give us feedback on the process

Not Convinced That Green Infrastructure Is For You?

- We are happy to answer questions.
- We can show you examples of where rain gardens and other GI practices are installed. (There are lots nearby)
- Talk with neighbors about their experiences.
- Fill out the survey for more learning opportunities
  - https://www.lakewingra.org/gi-study-westmorland

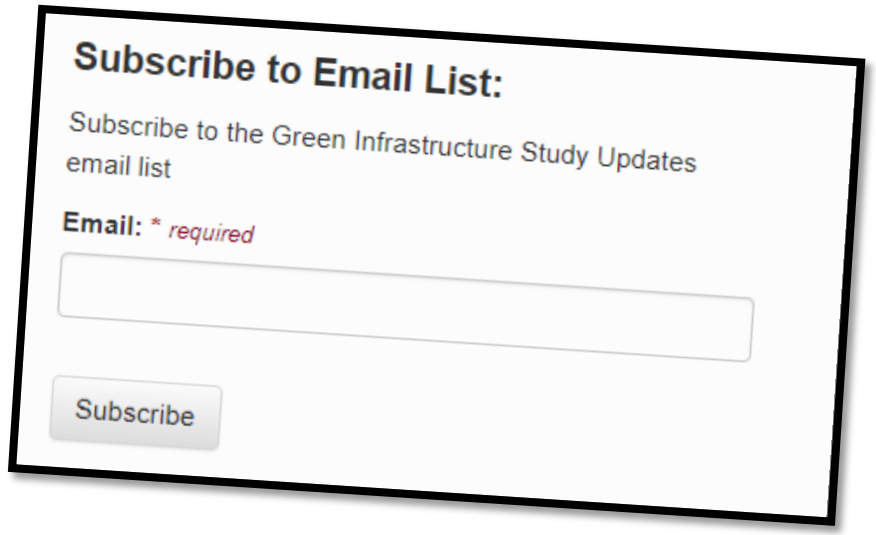
Rain garden at the entrance of Winga Park

Contact Information & Resources

- Engineering
  - Water Resources Engineer , Phil Gaebler, pgaebler@cityofmadison.com
  - Water Resources Engineer, Jojo O'Brien, jobrien@cityofmadison.com
  - Water Resources Engineer, Richie Breidenbach, rbreidenbach@cityofmadison.com
  - Landscape Architect, Carissa Wegner, cwegner@cityofmadison.com

- Project Website: www.cityofmadison.com/engineering/projects/green-infrastructure-study
  - Sign-up for project email updates on the website
  - Progress will be posted to the project website

- Facebook – City of Madison Engineering
- Twitter: @MadisonEngr
- Podcast: EverydayEngineering on Apple iTunes and GooglePlay



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Questions?

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Type	Infiltration	Slows Down Runoff	Habitat	Concerns
Terrace Rain Garden	x	x	x	Chloride Maintenance
Rain Basin	x	x	?	Terrace Use Conflicts
Permeable Pavement	x	x	–	Chloride
Rock Crib	x	x	–	Maintenance of Pervious Sidewalk
Rain Barrel	–	x	–	Small volume
Private Rain Garden	x	x	x	Design
Green Roof	–	x	x	Structural Requirements
Soil Amendment	x	x	–	