A Green Infrastructure Plan for the Black Earth Creek Watershed

WAFSCM 2022 Annual Conference
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Motivation for Plan

- Class 1 trout stream in western Dane County
- Flood hazard to communities, including Cross Plains, Black Earth and Mazomanie

Collaborators

PROJECT PARTNERS:

CONSULTING TEAM:

Goal

To identify specific *projects* and *practices* that provide a quantifiable level of **flood protection** to communities, **water quality benefits** to Black Earth Creek and its tributaries, and **recreational, economic, and ecological benefits** to the watershed as a whole.

Green Infrastructure Approach

Green infrastructure is a nature-based approach that uses soil and vegetation to retain and infiltrate water in urban and rural areas, creating multiple benefits.

Watershed Context

Woodlands

- 37% of watershed
- Steep slopes
- High infiltration capacity

Valley Bottoms

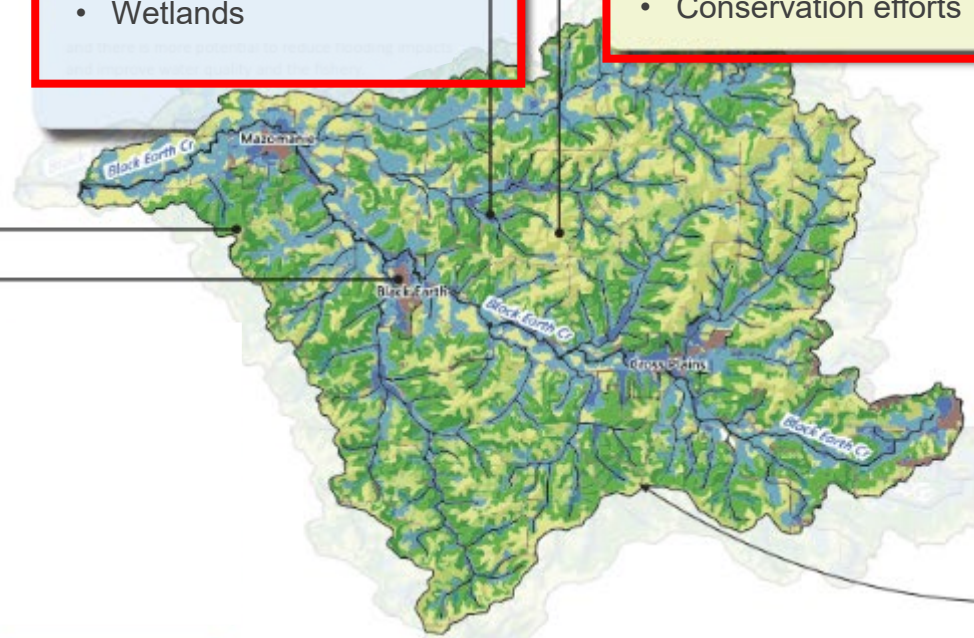
- Urban & rural
- Trout habitat
- Flood prone
- Wetlands

Farmland

- 53% of watershed
- Ridges & valley bottoms
- Cash grain & dairy
- Conservation efforts

Urban Areas

- 3% of watershed
- Population centers
- Older development lacks stormwater controls.



GOALS AND CONTEXT

Black Earth Creek Watershed

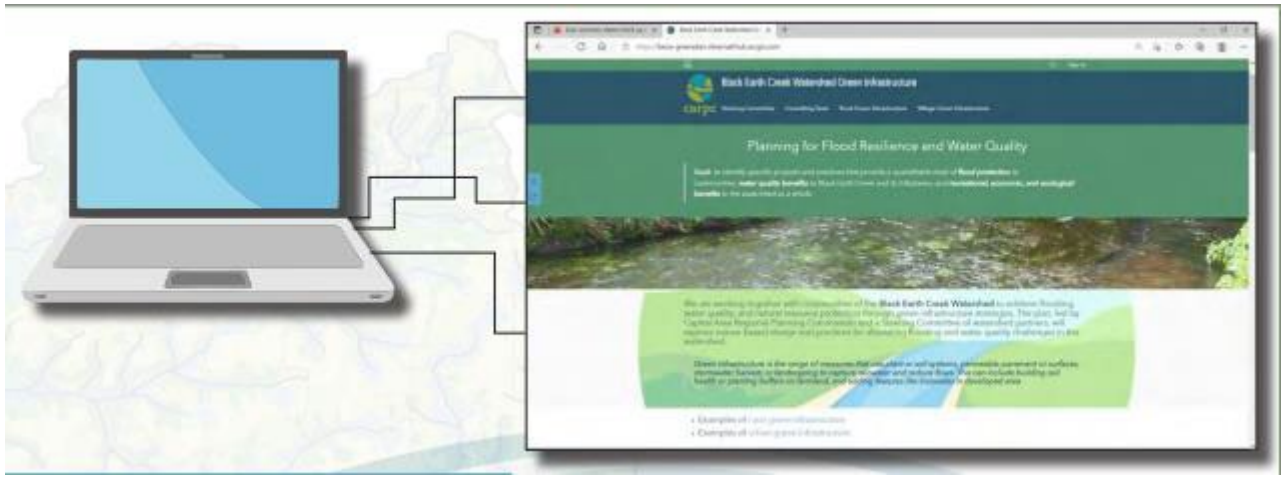
Green Infrastructure Plan

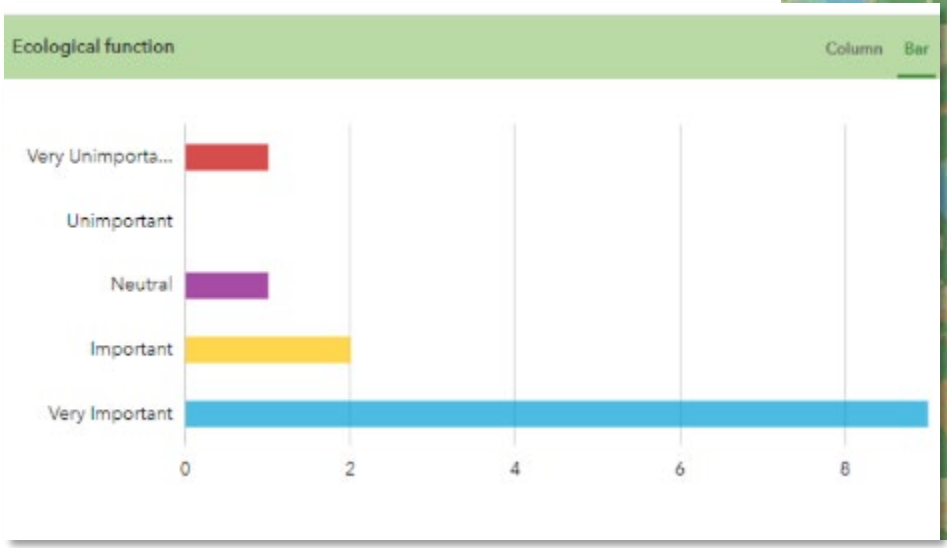
Public Engagement

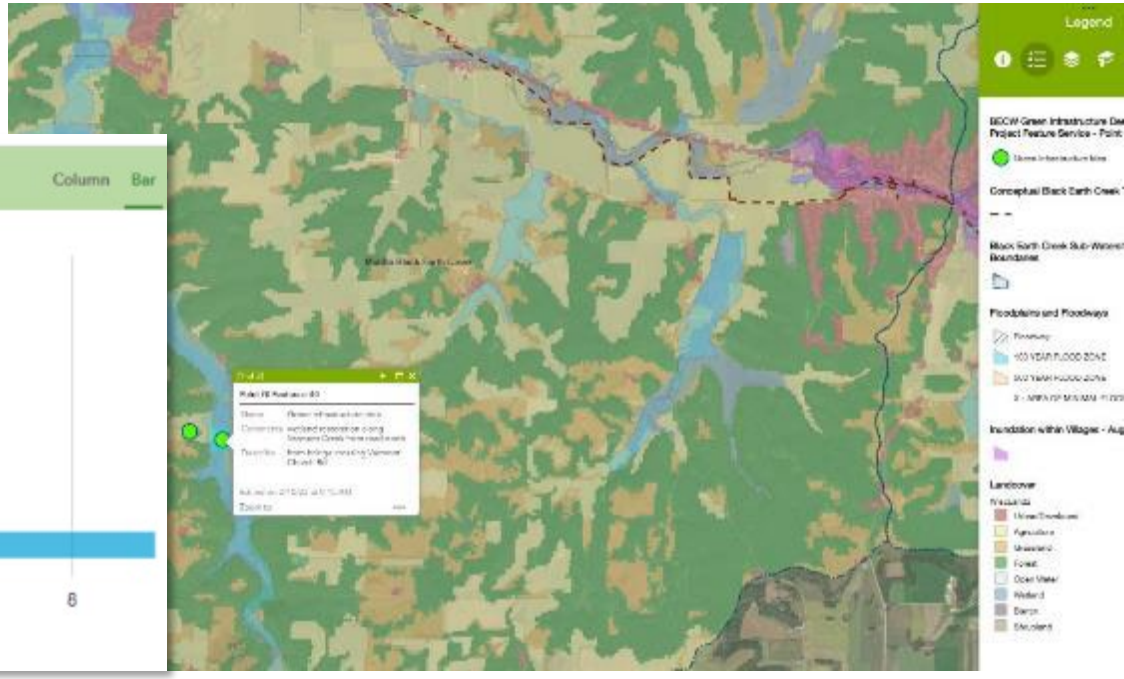
- Steering committee
- Open house in Black Earth
- Black Earth Community Field Day
- Farmer pizza night
- Three public webinars
- Cover crop seminar & coffee
- Calls, emails & mailings to towns, farmers and riparian landowners

Project Website (ArcGIS Hub)

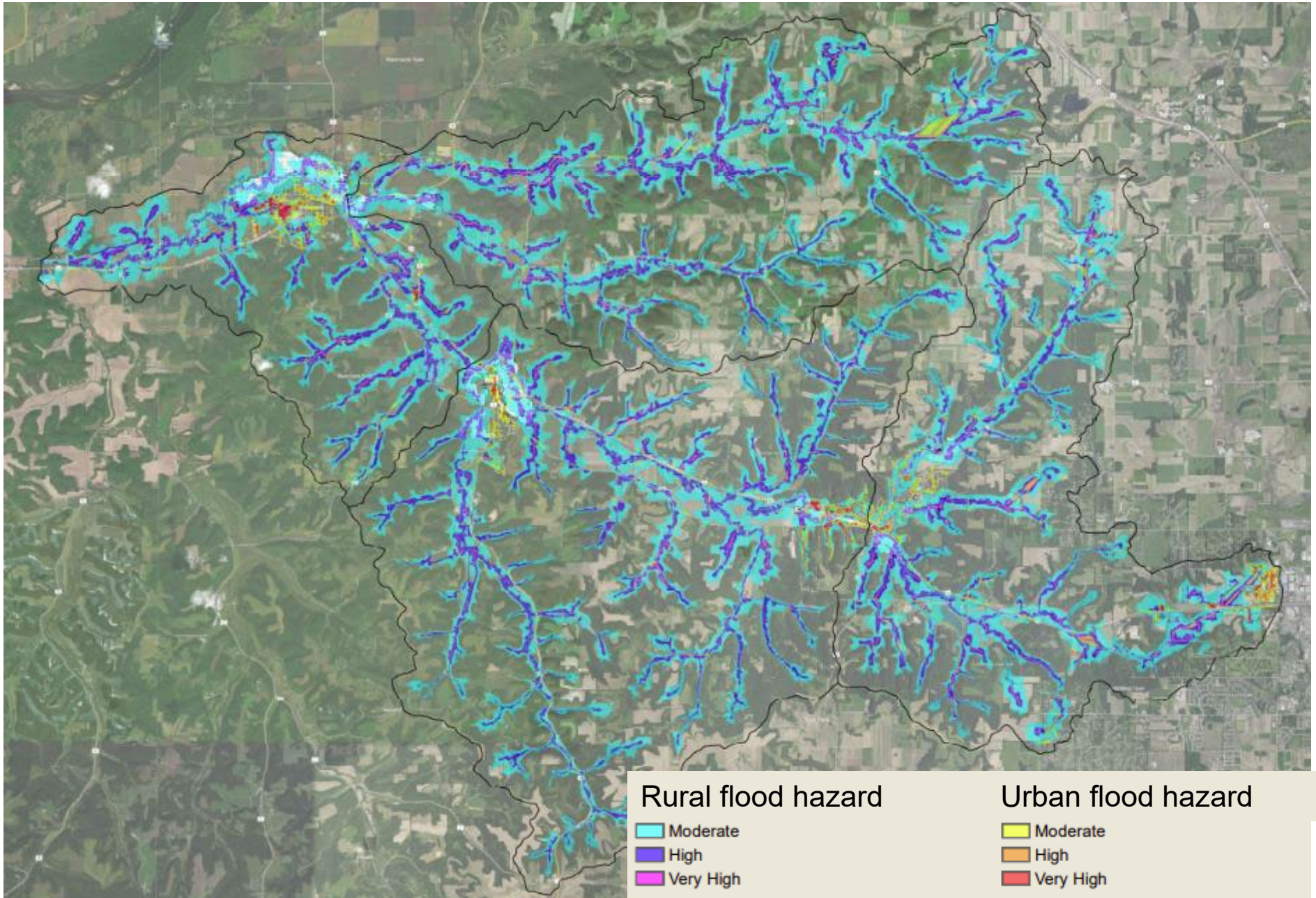
- Events, watershed information & surveys
- Web maps to view information & collect ideas on green infrastructure







Flood Vulnerability



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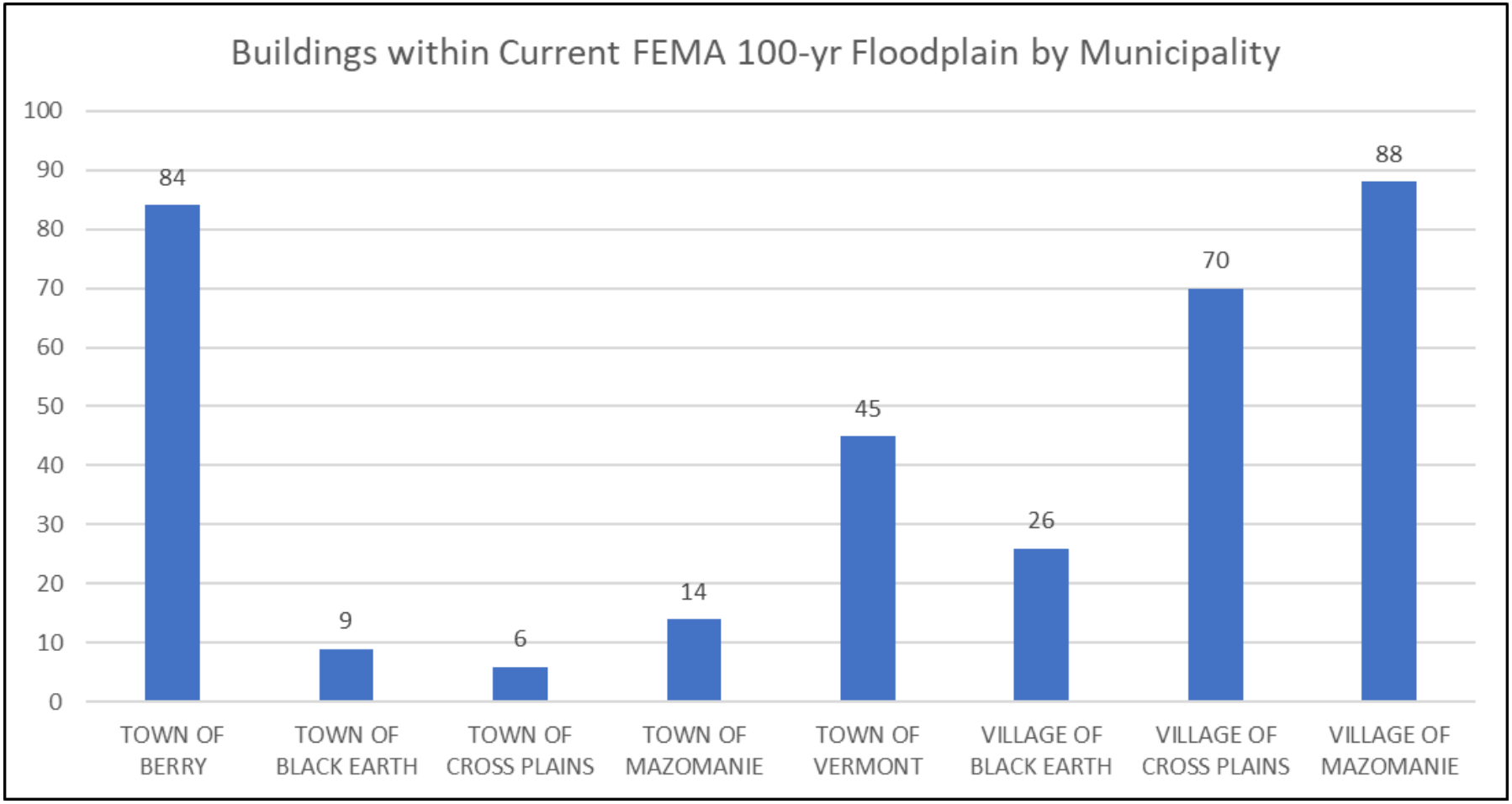

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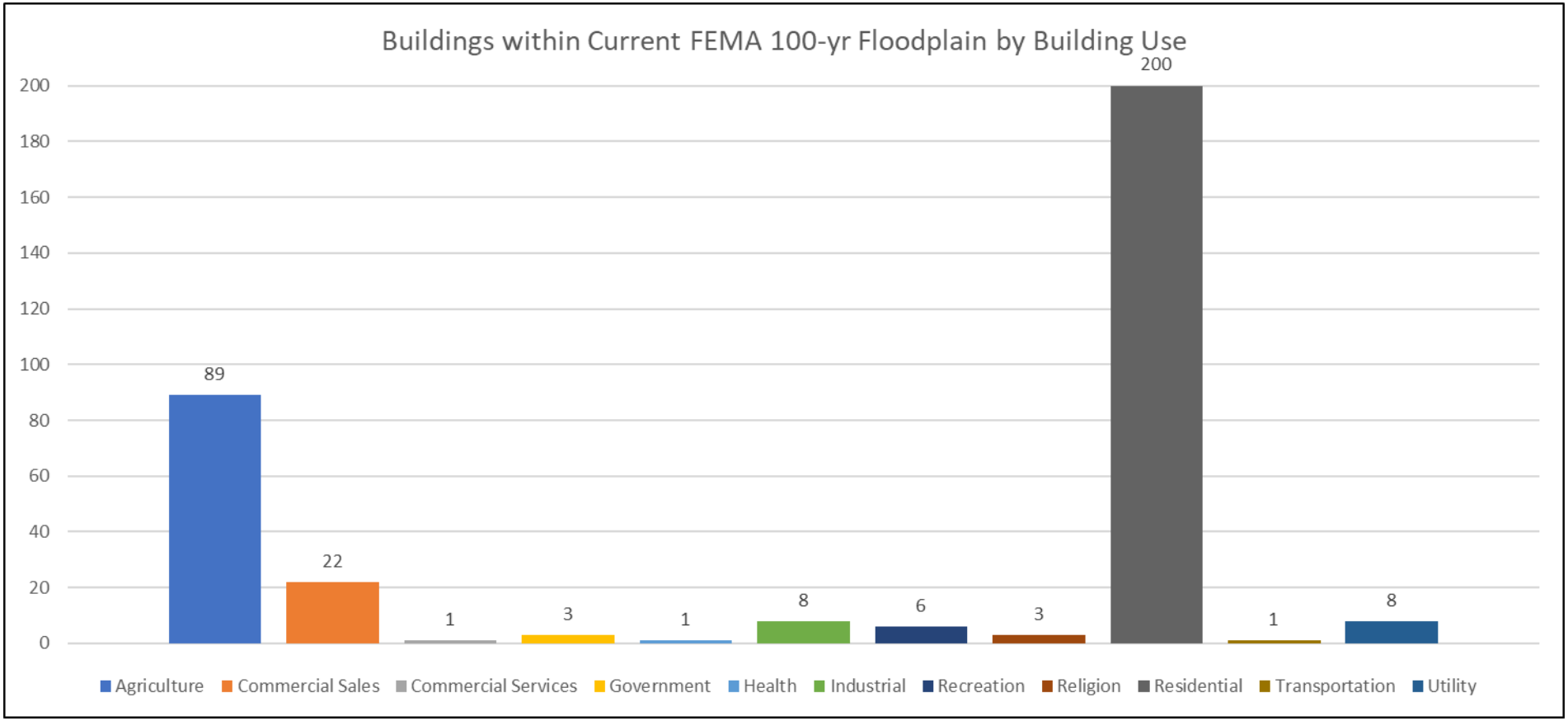


Recommendations

GREEN INFRASTRUCTURE EVALUATION

A wide range of green infrastructure practices we evaluated using stakeholder input, computer modeling, literature review, site visits and map analysis. In urban areas, the emphasis was on green infrastructure practices that reduce the impact of impervious surfaces such as roofs and streets that rapidly shed water and contribute to downstream flooding and water quality problems. For farmland, green infrastructure practices were identified that fit into the working landscape while reducing floods and enhancing water quality, while improving farms' soil health and resiliency. Valley bottoms have the highest risk of riverine and groundwater flooding, but also have abundant opportunities to restore wetlands and connections between the stream and its floodplain, while enhancing recreational opportunities. Woodlands are part of the existing green infrastructure in the watershed, providing wildlife habitat and infiltrating rainwater to reduce flooding and improve water quality. These areas should be maintained to preserve these valuable watershed functions.

URBAN AREAS

1. Permeable Pavement:
Paved surfaces designed to allow water to infiltrate through them to an underlying storage layer can reduce runoff, remove pollutants, and recharge groundwater.

2. Stormwater Infiltration:
Engineered basins with native vegetation that collect and infiltrate runoff from roofs, streets, and parking lots can reduce and filter runoff, while providing aesthetic and ecological benefits.

3. Downspout Disconnection:
The simple step of directing roof downspouts to vegetated areas can substantially reduce runoff.

4. Rainwater Harvesting and Reuse:
Stormwater can be collected and reused for irrigation, toilet flushing, and industrial processes, turning a waste product into a valuable resource.

FARMLAND

1. Cover Crops:
Rotating cover crops with cash crops maintains root networks in the soil that absorb more water, builds organic matter, and feeds soil organisms. This reduces runoff and soil loss while enhancing agricultural resilience.

1. No Till or Reduced Till:
Minimizing tillage can reduce soil disturbance and erosion, building plant root networks, organic matter, and soil health.

3. Prairie Strips:
Strategically place strips of native perennial vegetation within farm fields help infiltrate rainwater and filter runoff, while enhancing biodiversity.

4. Native Plant Vegetation:
Where farmland is too wet to be profitable, there are opportunities to consider transitioning land to native vegetation to provide valuable watershed services.

VALLEY BOTTOMS

1. Wetland Restoration:
Restoring drained wetlands can detain and infiltrate runoff, store floodwaters, improve water quality, and provide valuable habitat.

2. Floodplain Restoration:
A functional floodplain that is connected to the stream lets floodwaters spread out, attenuating floods peaks, dissipating energy, enhancing water quality, and improving stream habitat.

EOR water ecology community
rpc Capital Area
Dane County Land & Water Foundation
SILVERNAIL STUDIO FOR GEODESIGN

WATERSHED RECOMMENDATIONS

Black Earth Creek Watershed

Green Infrastructure Plan

Recommendations

Different practices in different settings based on:

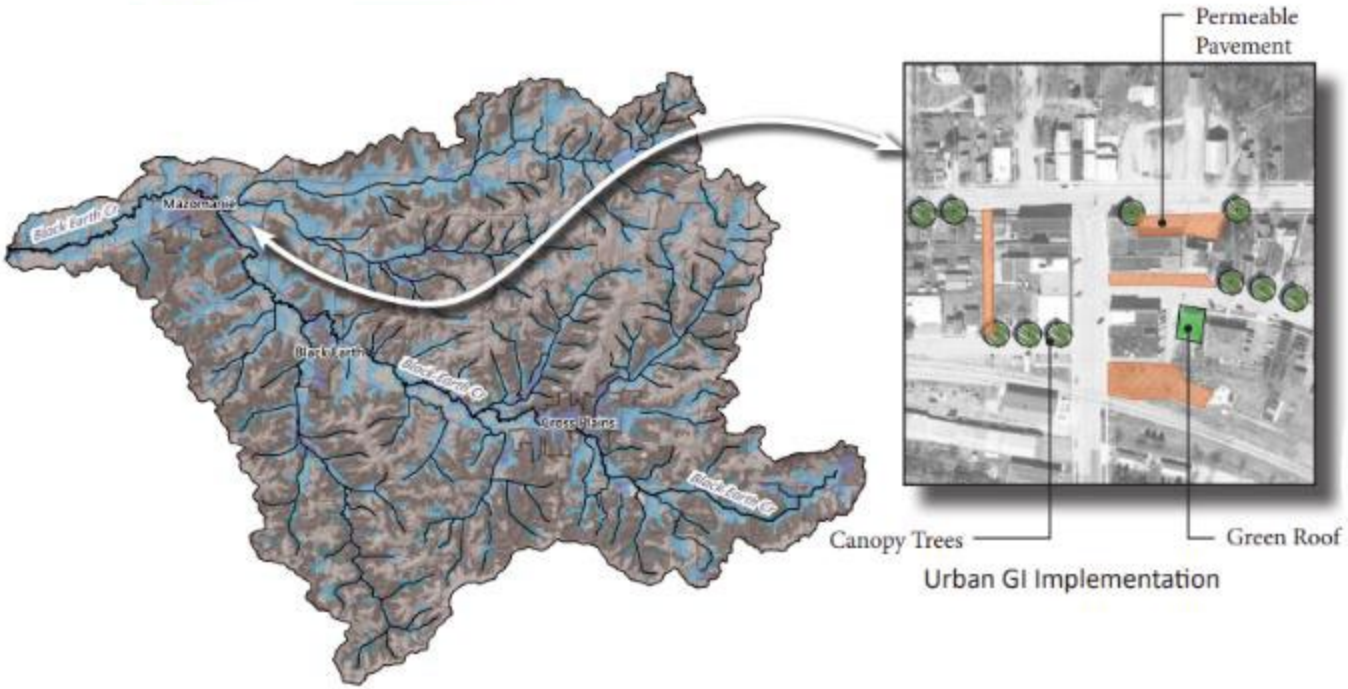
- Landowner preferences & stakeholder input
- Literature on effectiveness
- Modeling (EPA National Stormwater Calculator)
- Multiple benefits

URBAN AREAS

1. Permeable pavement: large footprint
2. Stormwater infiltration: variety of practices & benefits
3. Downspout disconnection: simple & effective
4. Rainwater harvesting & reuse: irrigation, toilet flushing, industrial processes.

Urban GI Modeling

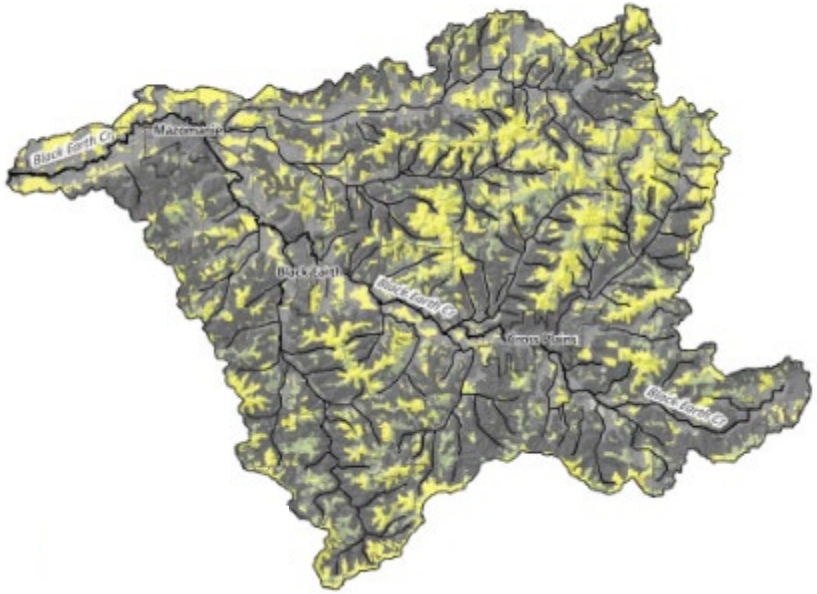
- Ambitious but feasible scenarios
- Treat 35-50% of impervious surfaces
- Peak flood flow reduction 0-4%
- Benefit greater if treat more impervious surfaces
- Local benefits likely greater
- Water quality benefits



Recommendations

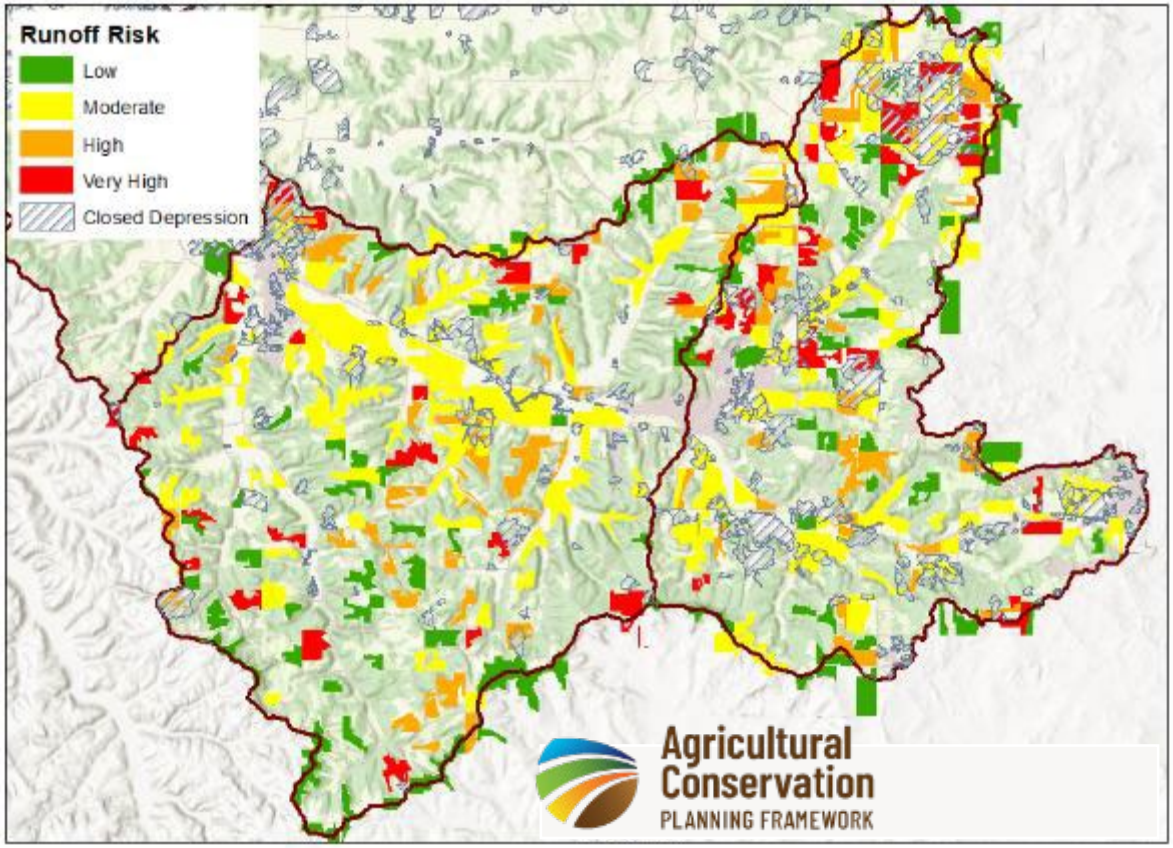
FARMLAND

1. Cover crops: maintain root networks & reduce runoff
2. No till or reduced till: reduce soil disturbance & runoff
3. Prairie strips: infiltrate & filter water, enhance biodiversity
4. Native vegetation: transition marginal farmland



Cover crops and no till already increasing in watershed because they build soil health and improve profitability.

Farmland



Potential Practices in Upper & Middle Subwatersheds

- 524,000 ft of buffer/prairie strips
- 29 ac-ft of water & sediment basins
- 12,400 ft of grassed waterways

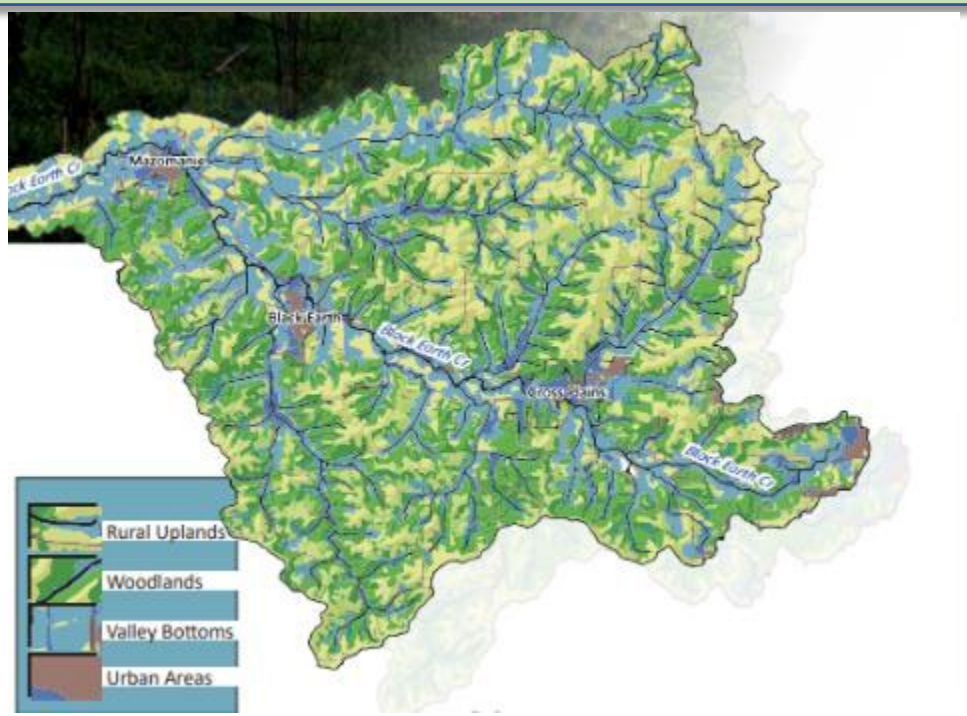
GI Practice	Peak Flow Reduction
Cover crops	4 – 16%
Cover crops + no-till	6 – 21%
Prairie strips	2 – 9%

Theoretical potential for full application on crop lands throughout whole watershed (simulated by Corps)

Recommendations

WOODLANDS

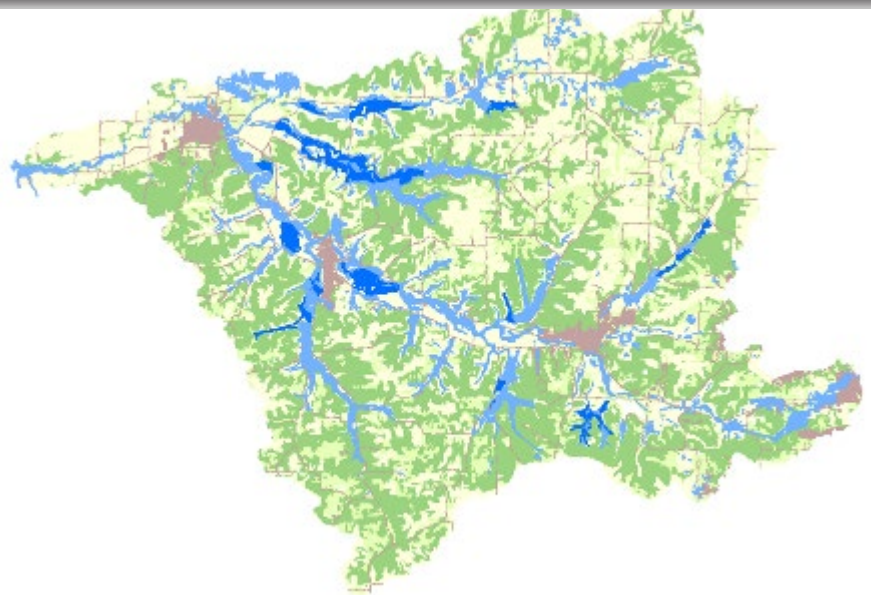
1. Manage to maintain hydrologic & ecological functions
2. Consider in floodplain & wetland restoration plans



Recommendations

VALLEY BOTTOMS

1. Wetland restoration: store & infiltrate floodwater, improve water quality & habitat
2. Floodplain restoration: attenuate flood peaks, dissipate energy, improve water quality & habitat



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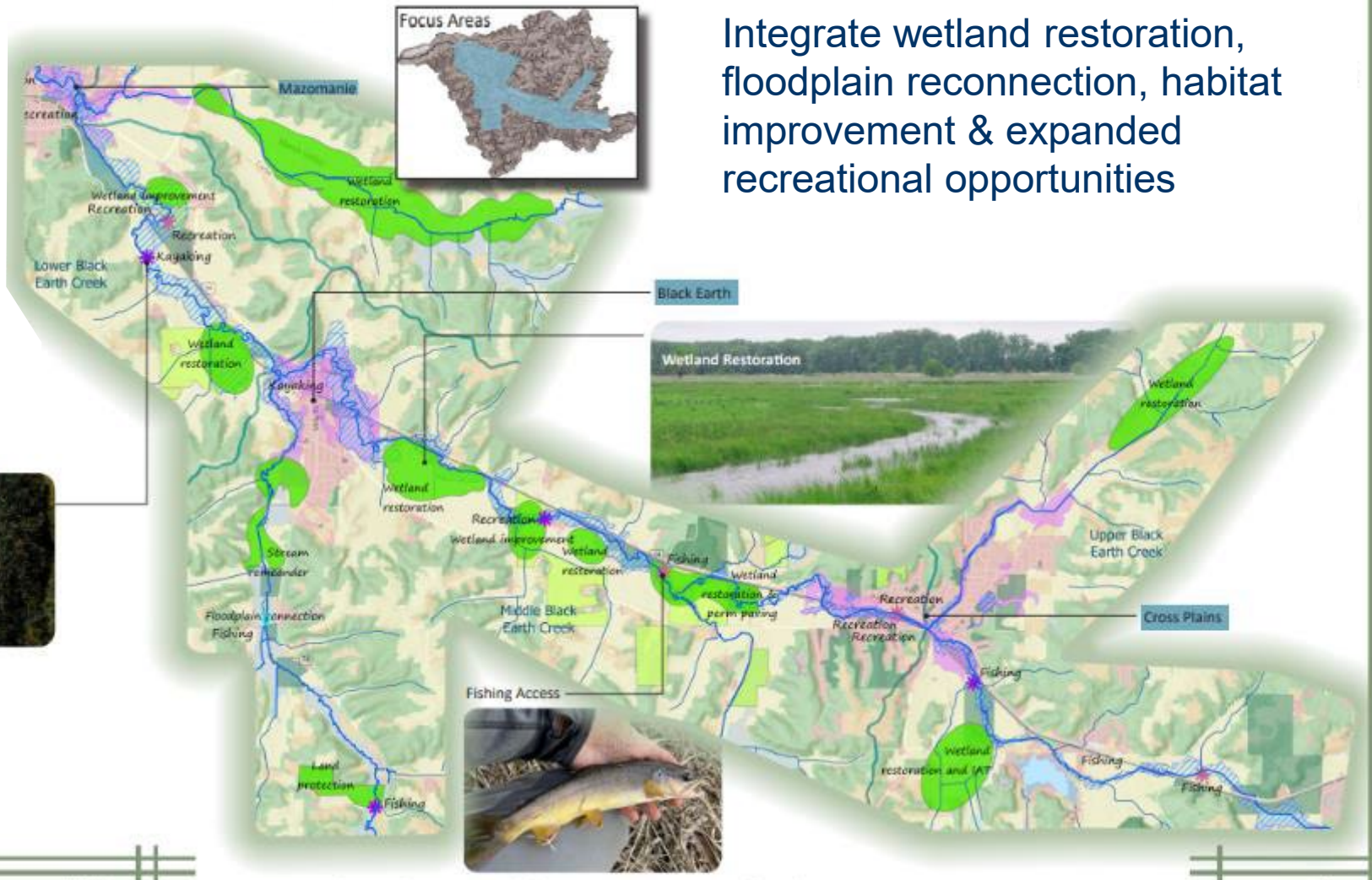


Integrate wetland restoration, floodplain reconnection, habitat improvement & expanded recreational opportunities

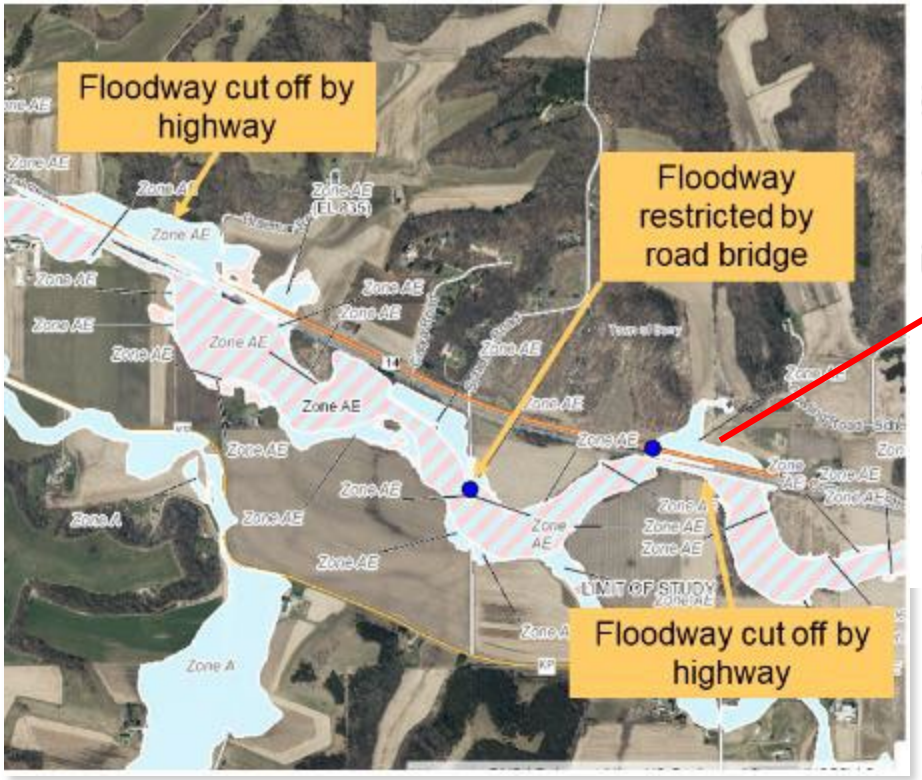
VALLEY BOTTOM RECOMMENDATIONS

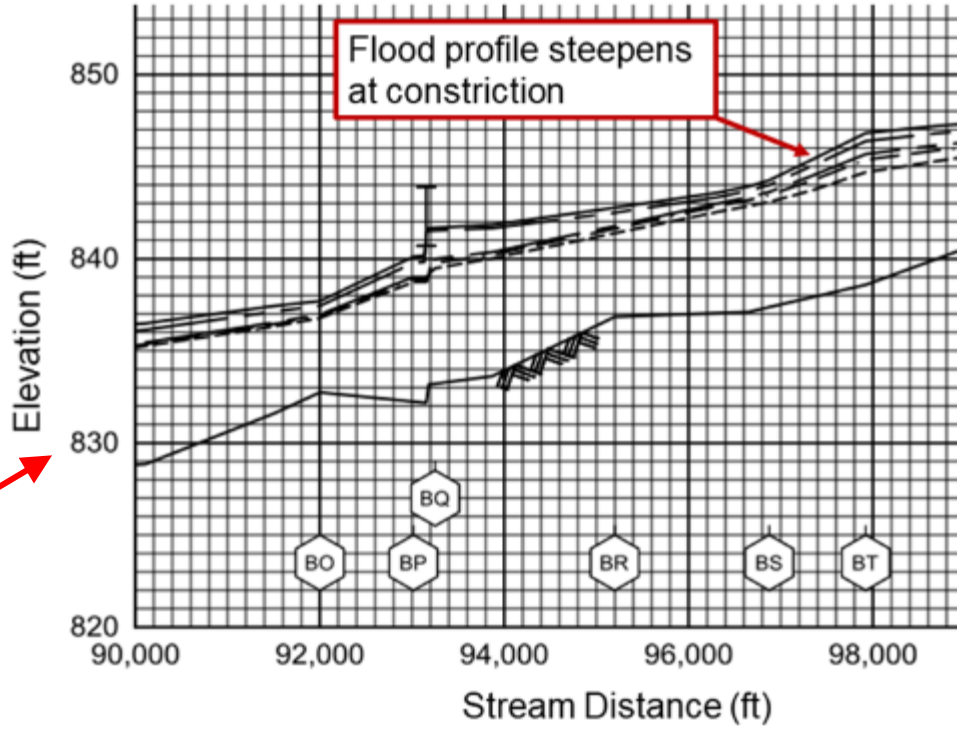
Black Earth Creek Watershed

Green Infrastructure Plan

Valley Bottoms

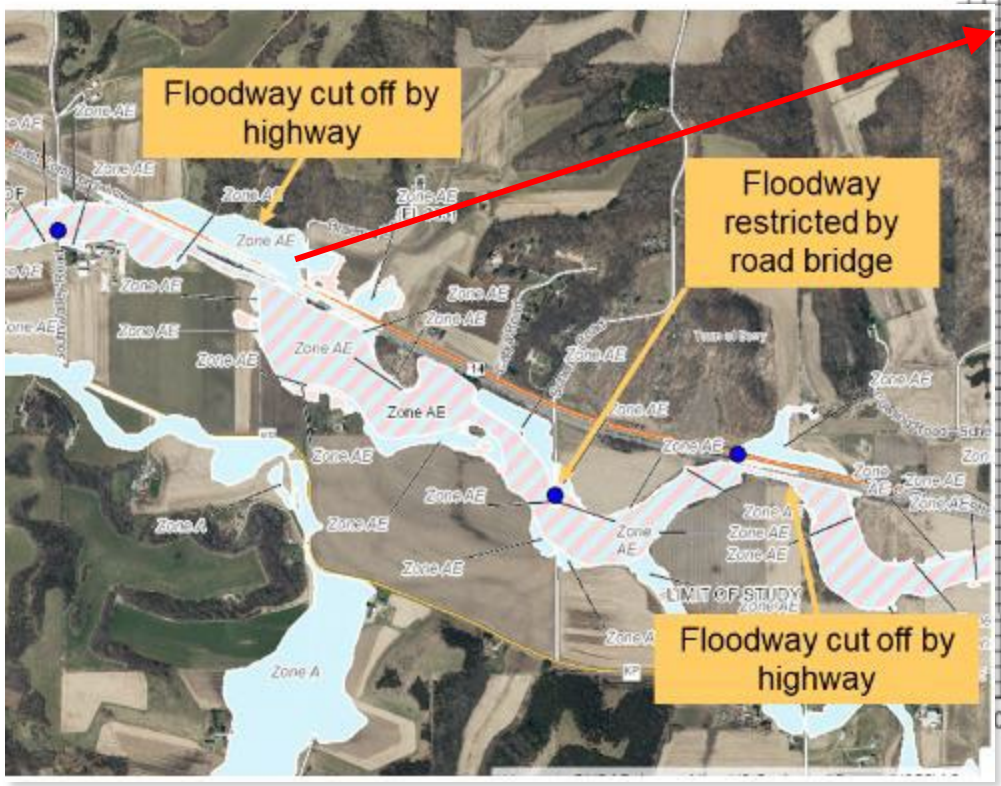
Floodplain constrictions at highway raise flood elevation & reduce floodplain connectivity

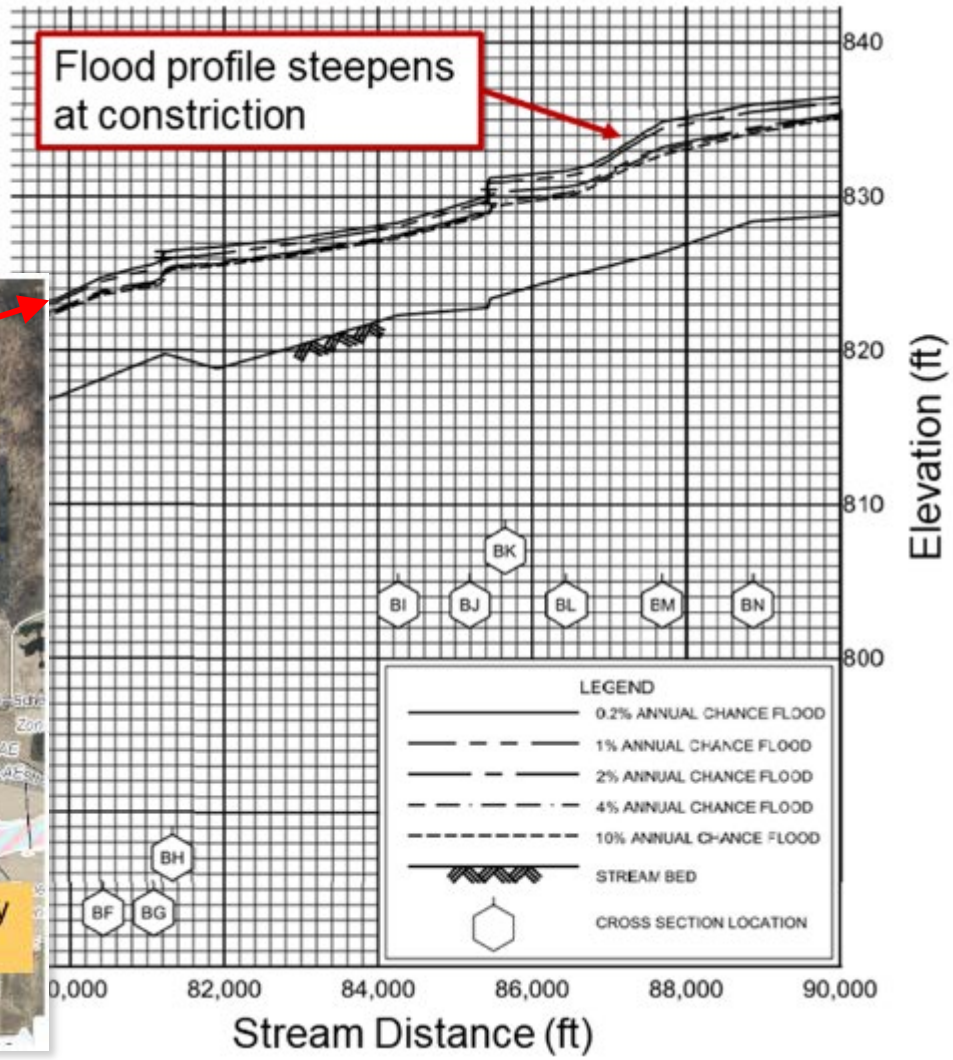




Valley Bottoms

Floodplain constrictions at highway raise flood elevation & reduce floodplain connectivity





Flood Abatement Benefits

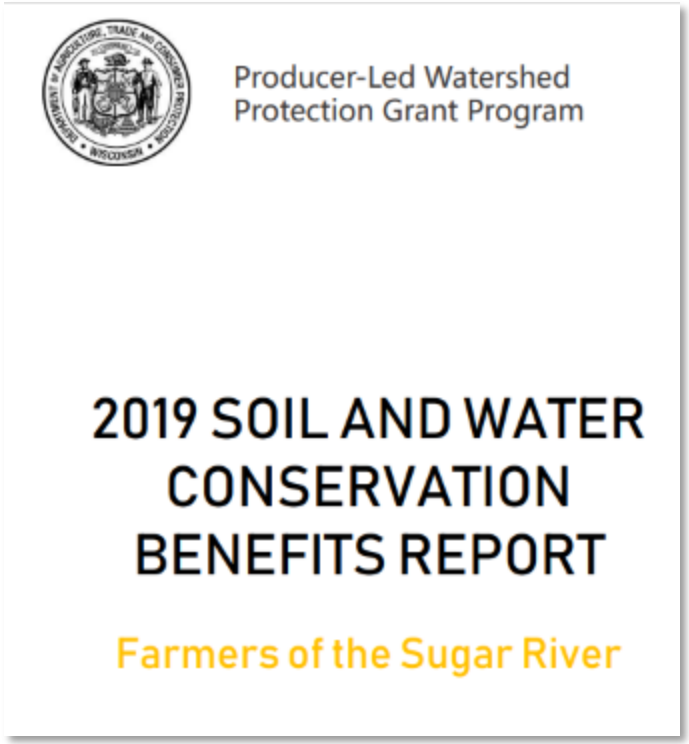
Modeled mid-range flood reduction estimates

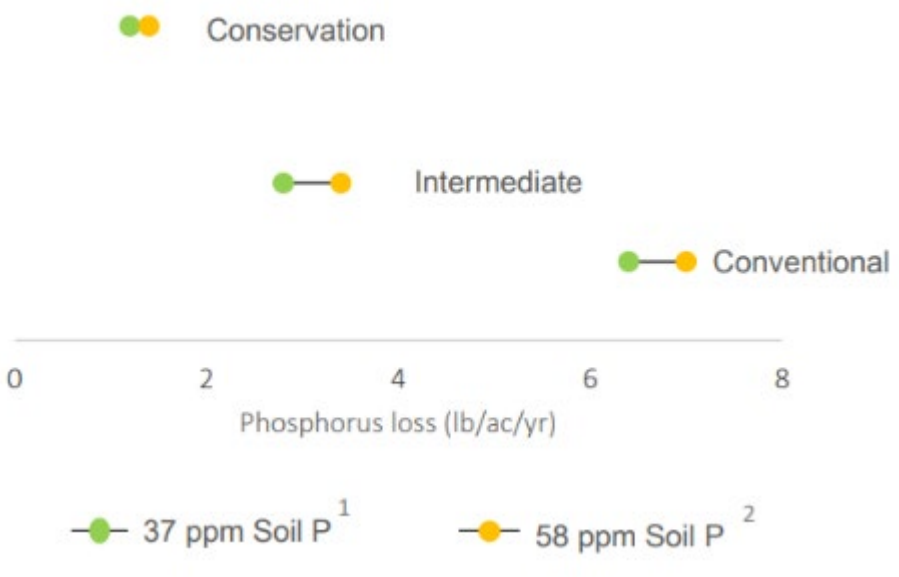
GI Scenario	Peak Flow	Flooded Area
100% cover crop + no-till	9%	5%
100% prairie strips	5%	3%
Wetland restoration (top 9)	2%	2%
Urban stormwater controls	2%	1%
Theoretical Potential Combine all 4 above	19%	10%
Ambitious but more realistic implementation	5-10%	3 – 5%

A 10% reduction in 100-yr discharge on the main stem would remove 22 structures from the floodplain (17.5% decrease).

Water Quality Benefits

- Total phosphorus is above state criterion (0.075 mg/L)
- 98% of load from nonpoint sources (*per Adaptive Mgmt. Plan*)
- Convert 800 – 1600 ac to conservation rotations
- Additional reductions through urban & valley bottom GI

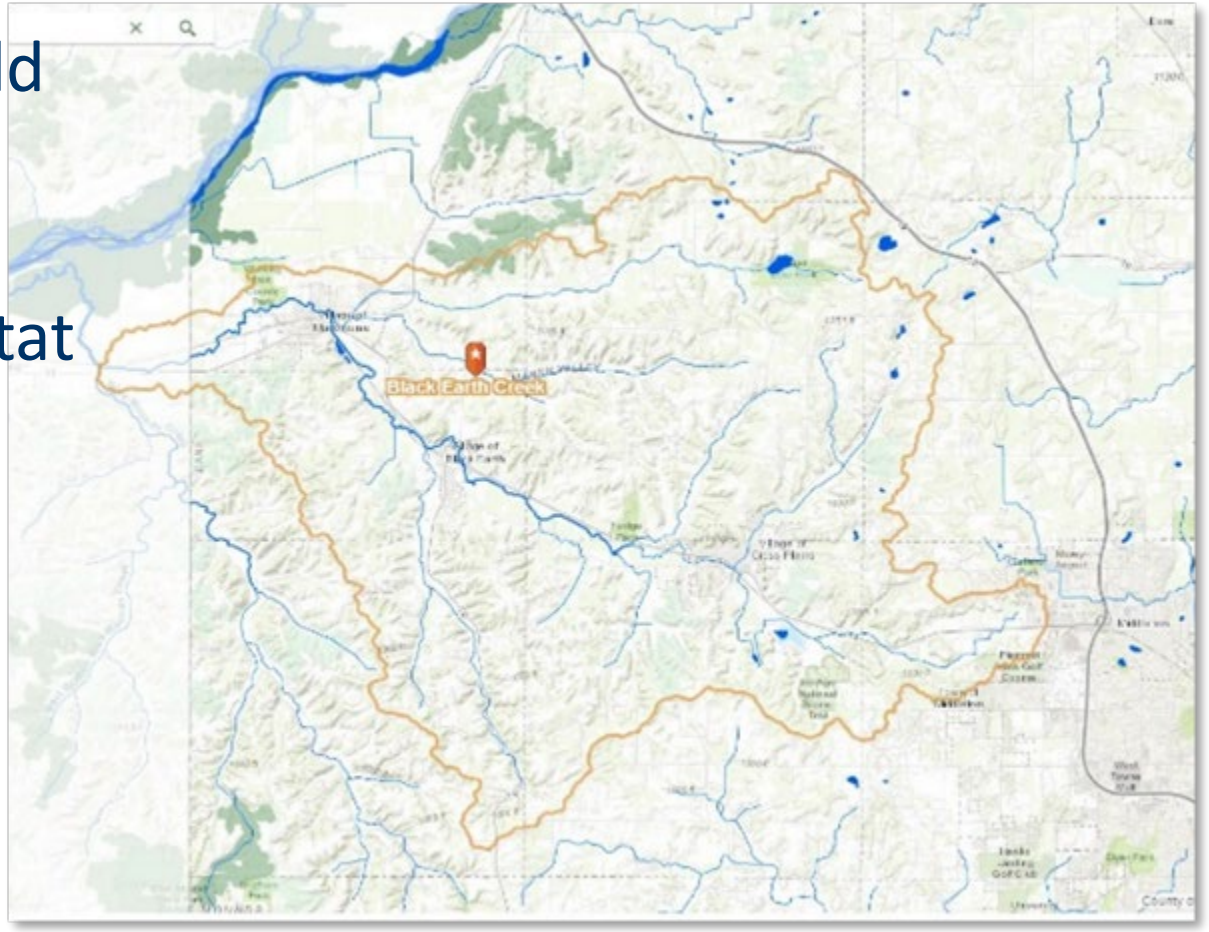




Habitat Benefits

High potential to build regional connectivity

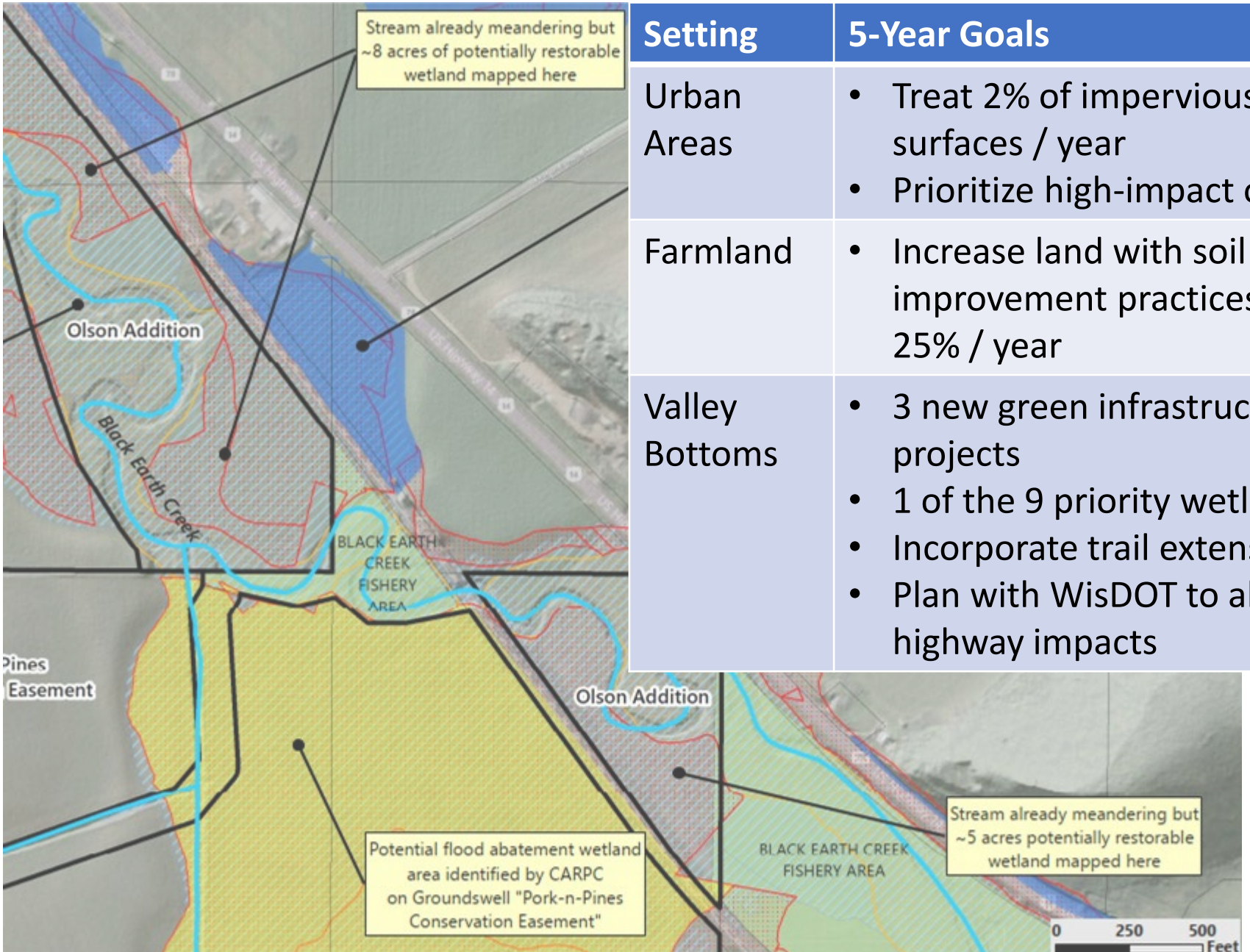
- BEC watershed has only 3% intact habitat core areas
- 6% in Dane Co.
- 14% in Iowa Co.
- 40% statewide



Social & Economic Benefits

- Reduced flooding of structures:
  - $7 – 19M based on FEMA cost-benefit values
- FEMA ecosystem services values
  - Millions $ / year for new valley bottom green infrastructure and existing forests
- Fishery value ~ $4M / year (*based on Trout Unlimited data*)
  - Restoration efforts make anglers more likely to fish in Driftless Area
- Recreational trails have generated several million $ / year & raised adjacent property values
- Urban
  - Not enough information to quantify
  - GI can be less expensive than gray infrastructure

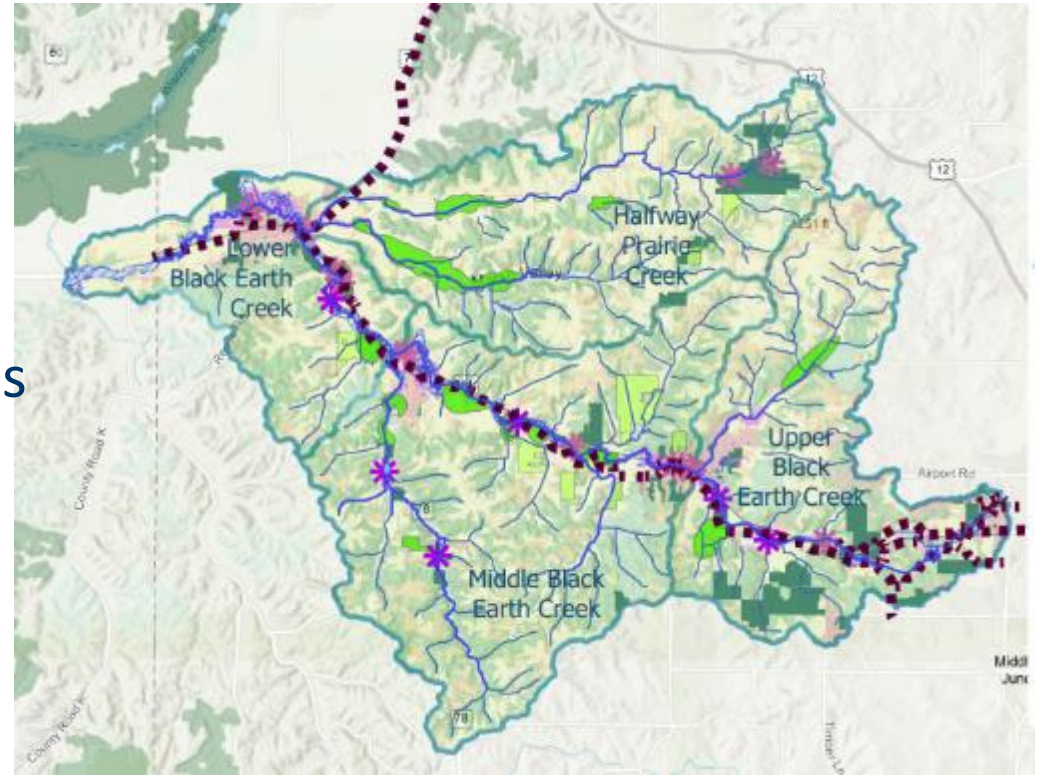
Implementation



Setting	5-Year Goals
Urban Areas	• Treat 2% of impervious surfaces / year • Prioritize high-impact outfalls
Farmland	• Increase land with soil health improvement practices by 25% / year
Valley Bottoms	• 3 new green infrastructure projects • 1 of the 9 priority wetlands • Incorporate trail extensions • Plan with WisDOT to alleviate highway impacts

Funding Sources & Partners

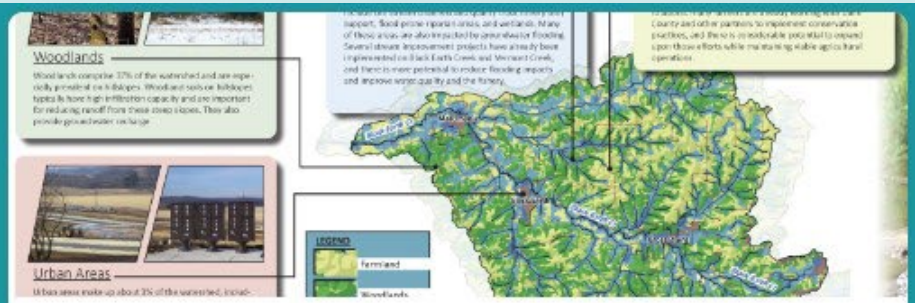
- EDA: Economic Adjustment Assistance Fund
- FEMA: BRIC
- USDA: CRP & EQIP
- WDNR: Several programs
- WDATCP: Producer-Led Grants
- WisDOT
- Dane Co.: Continuous Cover Program & Urban WQ Grants
- Dane-Iowa Adaptive Mgmt.
- Municipal capital improvement programs



Next Steps

Black Earth Creek Watershed Green Infrastructure Plan

- Landowner outreach & partnership building
- Green infrastructure project identification
- Funding applications
- Design & construction
- Monitoring & maintenance



Executive Summary

Set of seven 11 x 17 plates that form the Executive Summary of the Black Earth Creek Watershed Green Infrastructure Plan.

View

Black Earth Creek Watershed Green Infrastructure Plan

Final plan approved in August 2022

View

https://becw-gi-carpc.hub.arcgis.com/