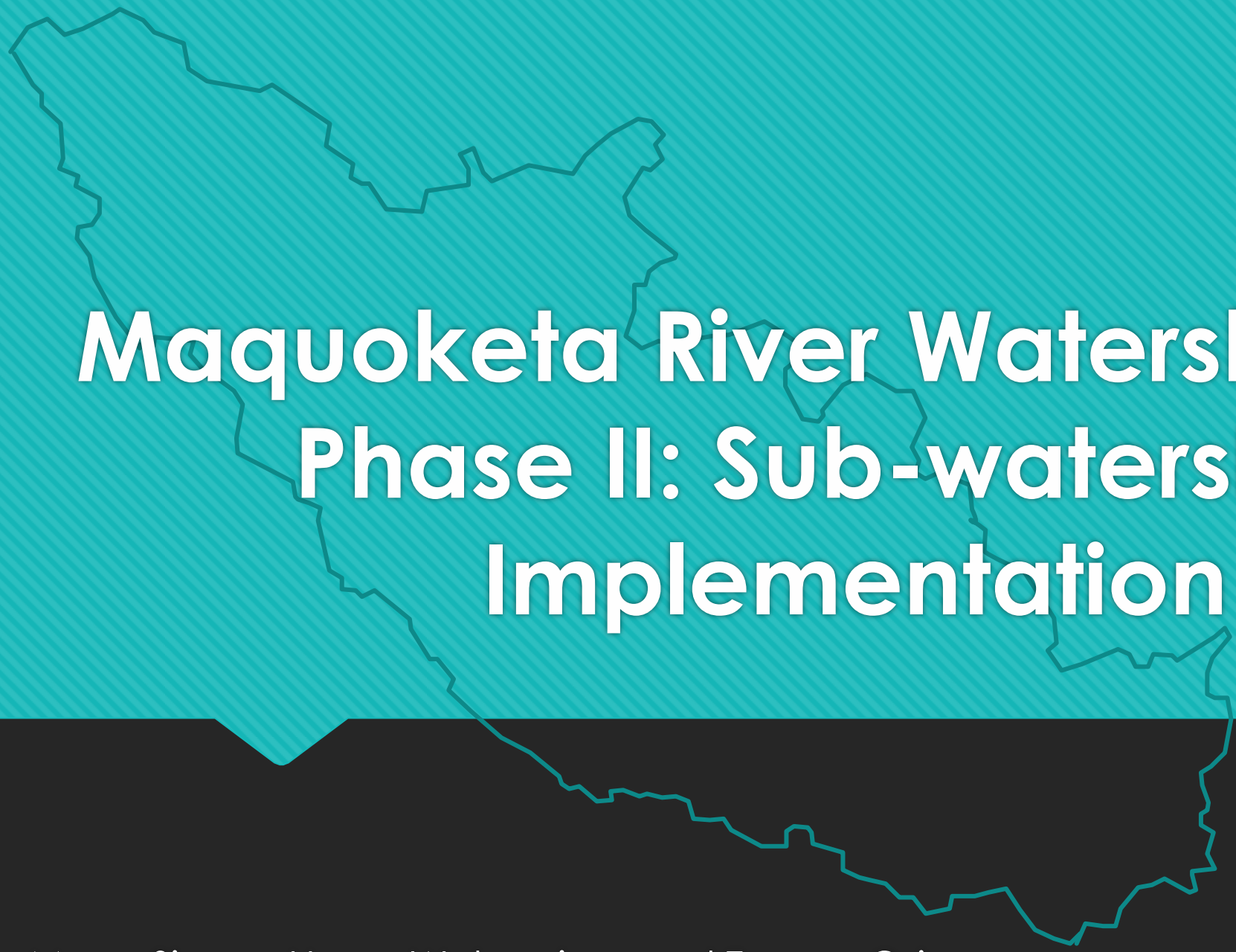

Maquoketa River Watershed Plan Phase II: Sub-watershed Implementation

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MAQUOKETA RIVER WMA

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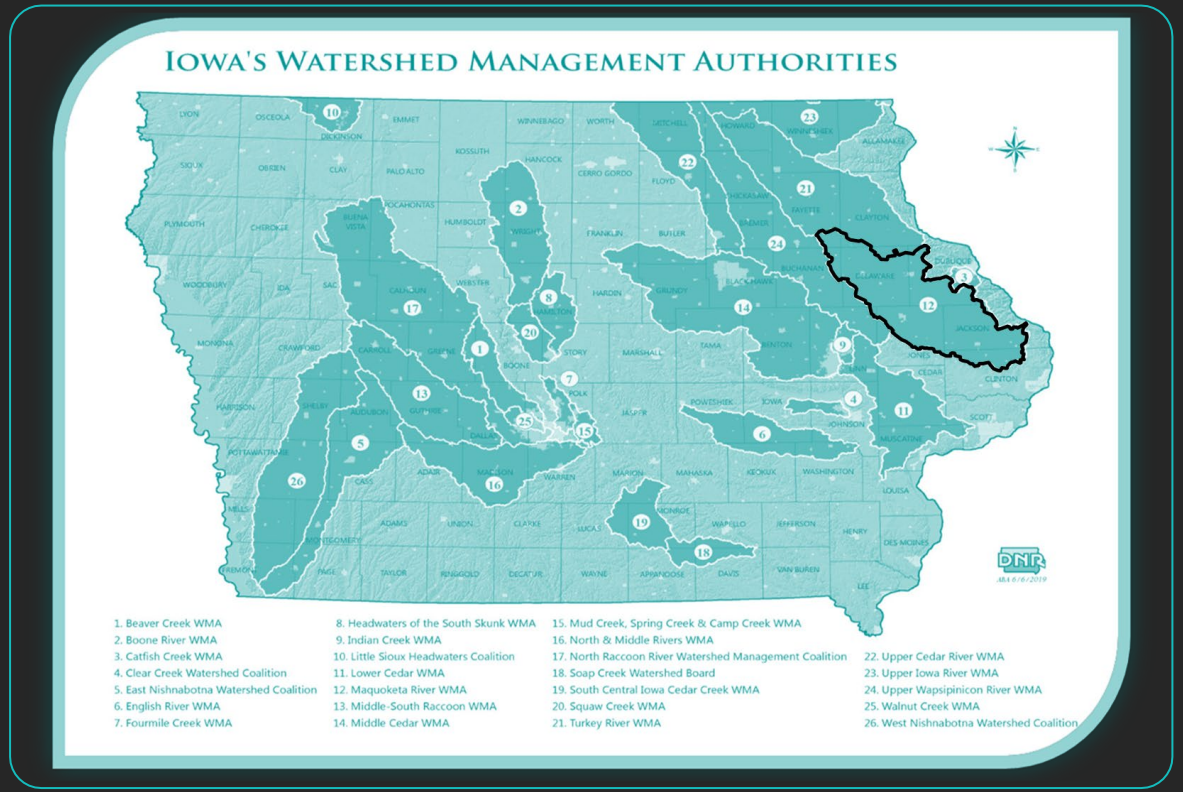
The University of Iowa
IOWA INITIATIVE FOR SUSTAINABLE COMMUNITIES

Travis Kraus, Director

What is a Watershed Management Authority (WMA)?

- An intergovernmental agreement between jurisdictions to address flood risk, water quality, and watershed education
- WMAs authorized in 2010 by the Iowa Legislature
- Maquoketa River WMA established in 2017



Maquoketa River Watershed Authority Board

City of Andrew
City of Baldwin
City of Cascade
City of Delaware
City of Delhi
City of Dyersville
City of Epworth

City of Goose Lake
City of Hopkinton
City of Lamont
City of La Motte
City of Manchester
City of Maquoketa
City of Monticello

City of Preston
City of Ryan
City of Spragueville
City of Strawberry Point
City of Worthington
City of Wyoming
Lake Delhi District

Buchanan County
Clinton County
Delaware County
Dubuque County
Jackson County
Jones County
Linn County

Delaware County SWCD

Dubuque County SWCD

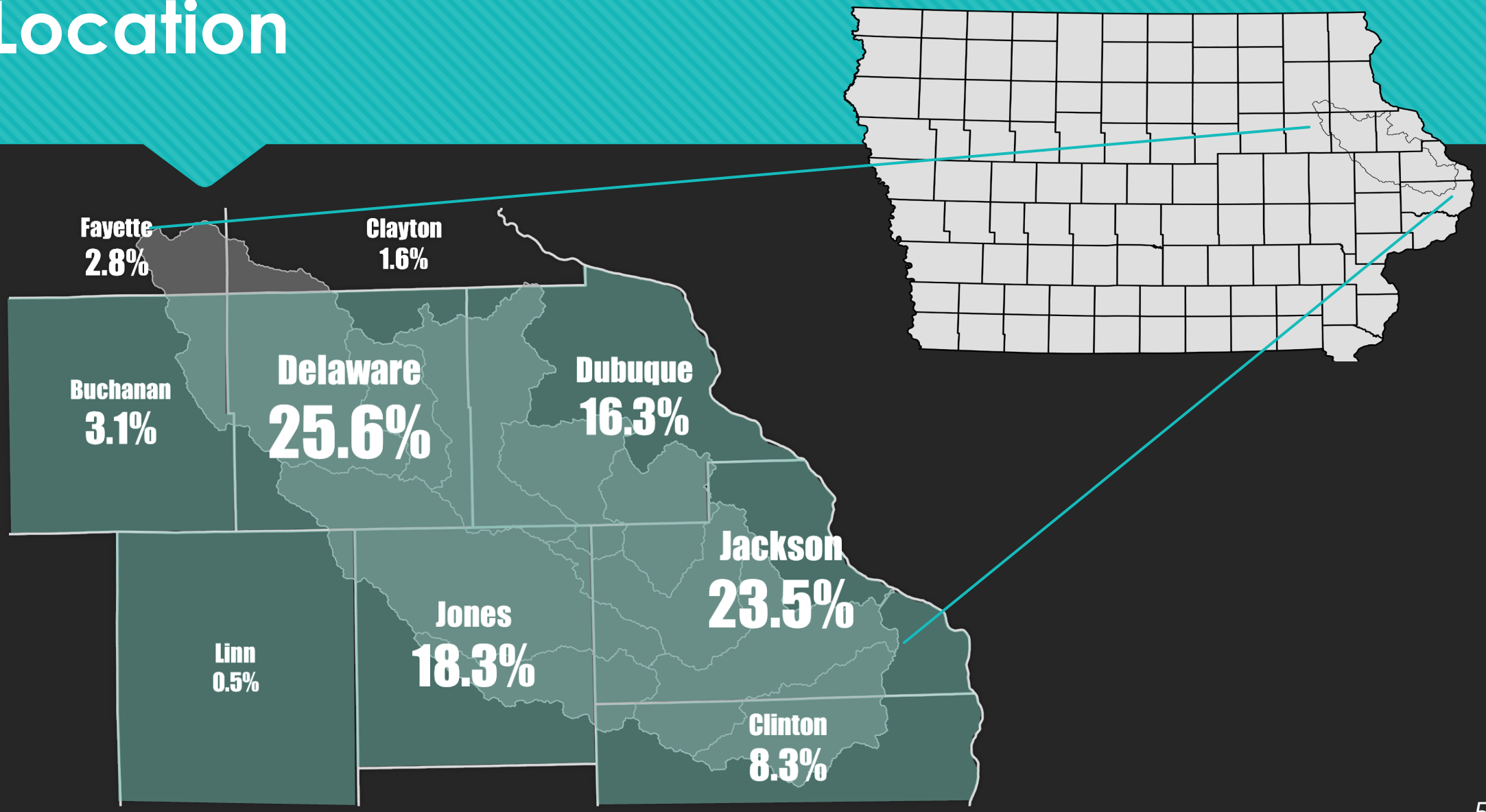
Fayette County SWCD

Jackson County SWCD

Jones County SWCD

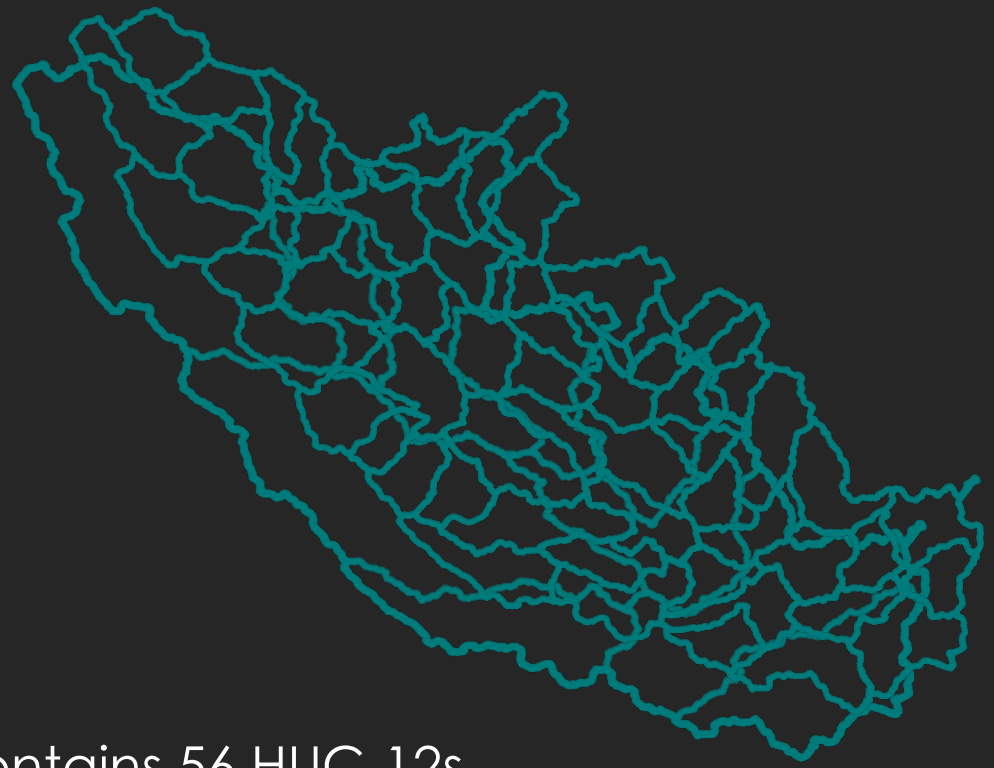
Linn County SWCD

Location


Fayette
2.8%
Clayton
1.6%
Buchanan
3.1%
Delaware
25.6%
Dubuque
16.3%
Jackson
23.5%
Jones
18.3%
Linn
0.5%
Clinton
8.3%

What is a watershed?

- An area that channels water to a common outlet
- Watersheds come in a variety of sizes
- MRW is a HUC-8 watershed, 1,100,000 acres, containing smaller sub-watersheds
- HUC stands for Hydrological Unit Code



- MRW contains 56 HUC-12s
- 10,000 to 40,000 acres in size

Brief Overview of MRW Planning Efforts

- **Maquoketa Watershed Plan Phase I**
  - Identified 5 broad management goals for the entire watershed that focused on flooding, water quality, awareness, and habitat health
- **Maquoketa Watershed Plan Phase II**
  - Prioritize sub-watersheds to implement Phase I management practices
  - Provide guidance on site-specific project selection

What's in the plan?

Stakeholder Interviews

- Leaders from MRW communities (13 of 41)
- Farm Service Providers

HUC-10 Sub-watershed Profiles

- Individualized "community profiles" for each HUC-10 in the MRW

HUC-12 Sub-watershed Analysis

- Analysis of variables for each key issues: Flooding, Nitrates, Phosphorus & Soil Loss, and Diminished Recreation

HUC-12 Sub-watershed Prioritization and Individualized Plans

- Prioritized sub-watersheds based on analysis results
- Individualized plans for the top five priority sub-watersheds

Engagement Results

Communities

10 of 13 showed interest in projects that benefit recreation and economic development

12 of 13 mentioned water-related assets

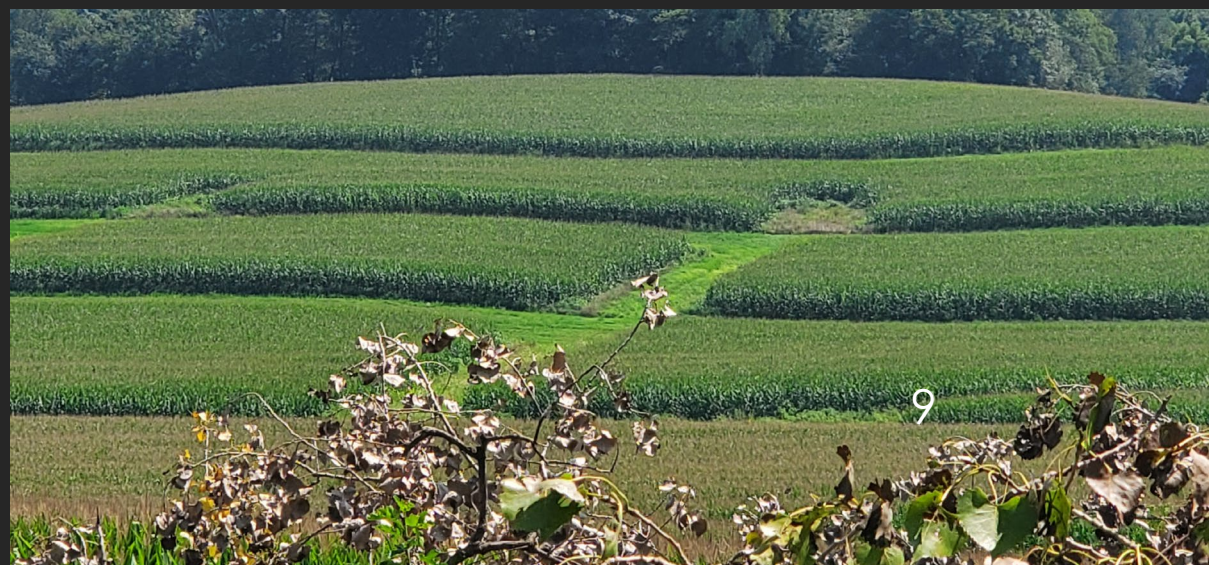
6 of 13 communities have extensive water management practices are underway

All communities showed widespread support for WMA activities

Farm Service Providers

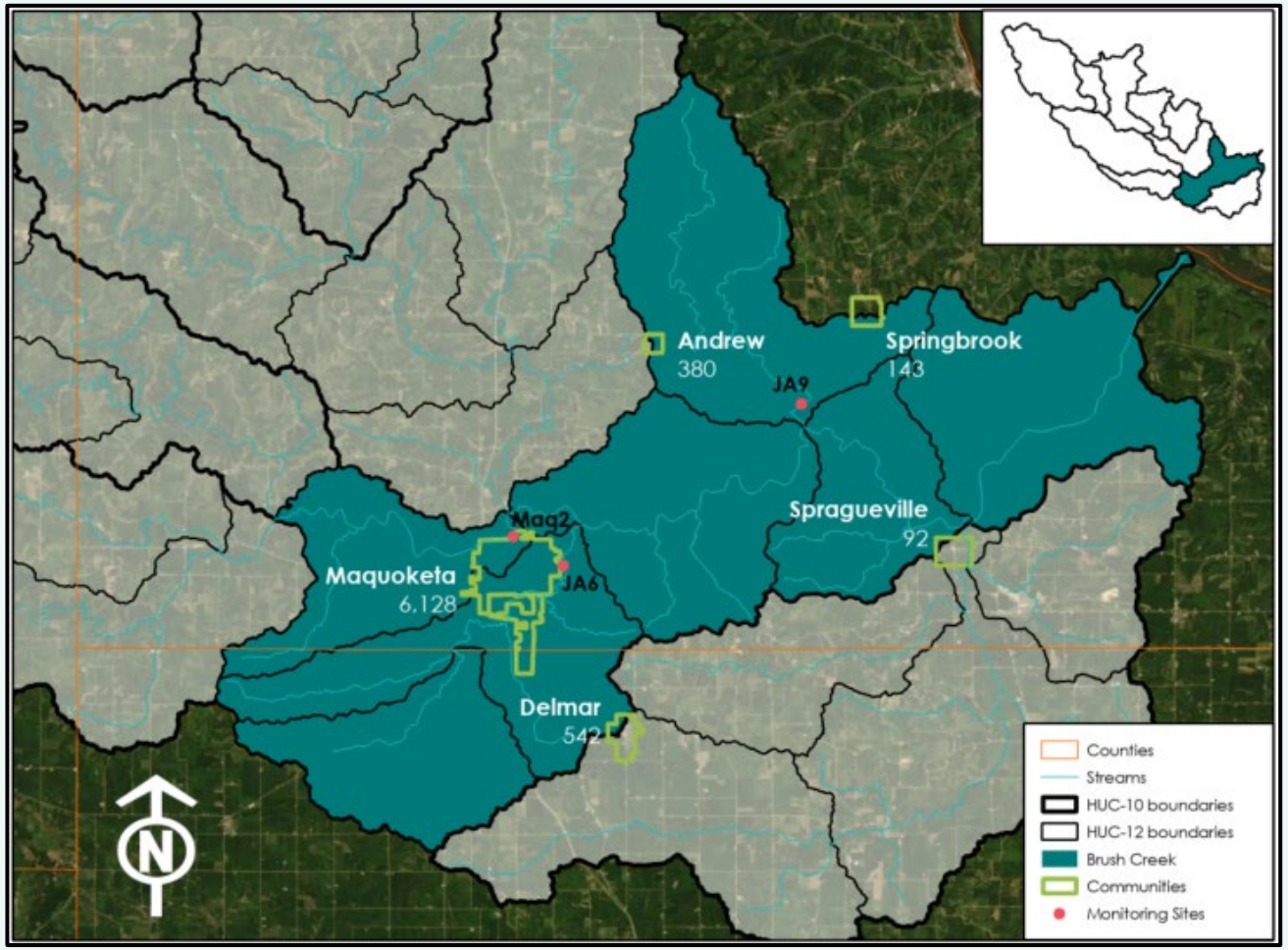
Conservation practice adoption largely depends on:

- Initial success
- Seeing neighbors' success



HUC-10 Profile: Brush Creek

Brush Creek is in the southern portion of the Maquoketa River Watershed and drains the watershed to the Mississippi River. It comprises 130,889 acres and seven HUC-12s. This sub-watershed contains the City of Maquoketa as well as all or part of four other smaller incorporated cities and is split between Jackson and Jones counties. Notable features include the Prairie Creek Recreation Area, a 273-area that features limestone bluffs and woodlands, and the Jackson County Recreation Trail, a 7-mile long limestone path.



Existing Management Practices:

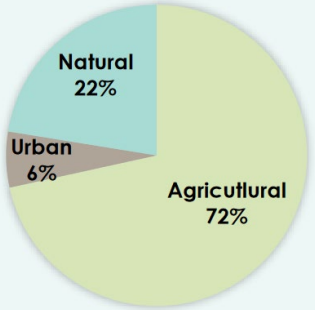
- 220 buffer strips
- 9,400 grassed waterways
- 285 terraces
- 494 water and sediment control basins
- 446 pond dams
- 41 strip crop sites

Existing Point-Source Pollution:

17 Permitted CAFOs and Open Feed Lots

4 Permitted wastewater treatment facilities

Land Use:



Total Miles of Streams: 126.7

Impaired, 32.54	Unimpaired, 94.16

Reasons for impairment include fish kills, loss of native mussels, and E. Coli.

Water Quality Monitoring Results (2019-2021 average)

Sites	Chloride (mg/L)	Dissolved Phosphorous (mg/L)	E. Coli Bacteria (CFU/100ml)	Nitrate (mg/L)	Sulfate (mg/L)	Turbidity (NTUs)
JA6	18.21	0.24	661.88	4.47	19.28	36.33
JA9	13.14	0.27	4,054.13	4.75	15.06	25.83
Maq2	15.09	0.08	131.00	3.62	19.19	25.67
Standard	5 to 250	1	235	10	500 to 2000	25

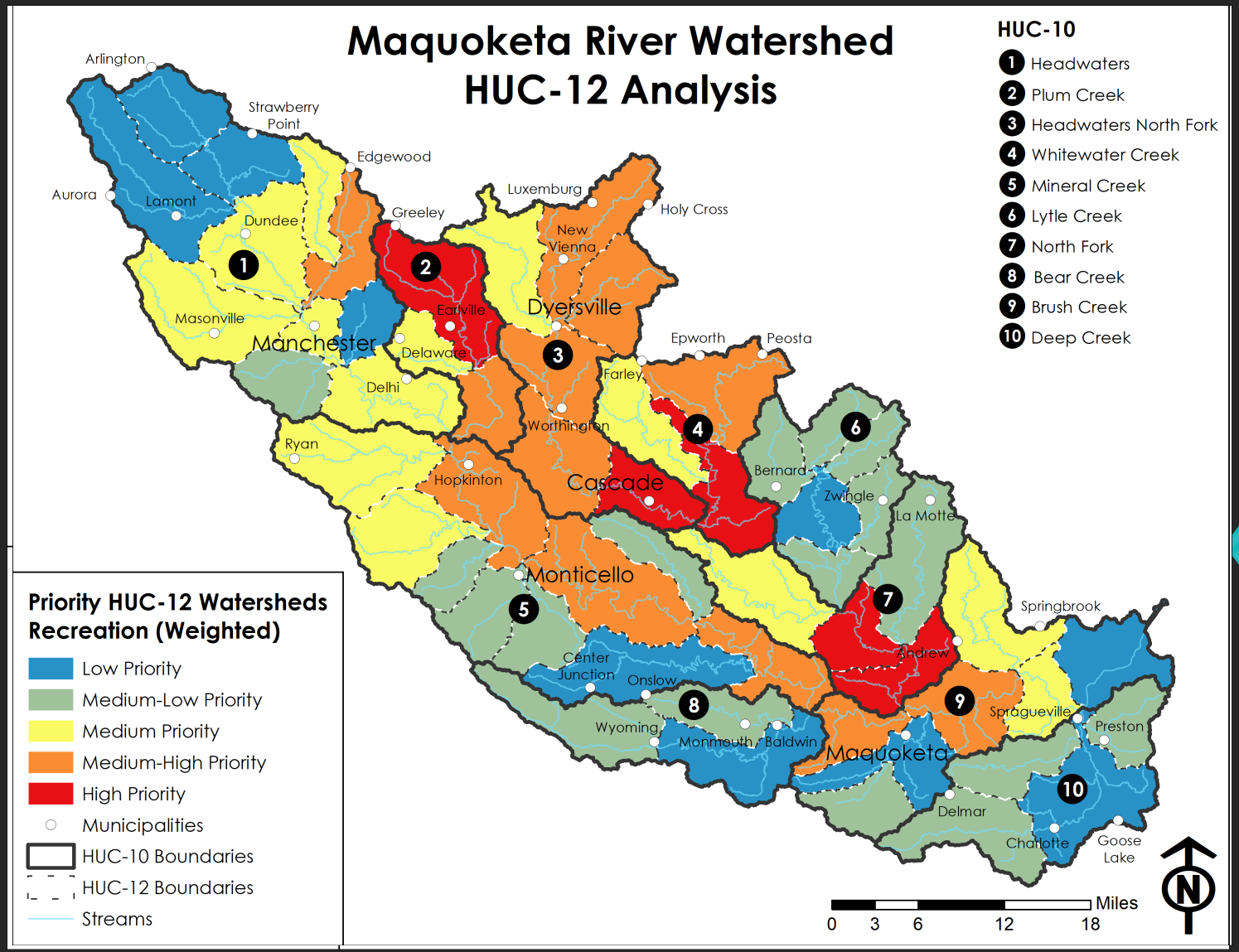
Standards are from the US EPA and IA DNR. Chloride and sulfate standards depend on the water hardness. E. Coli criteria listed is for waterbodies designated for swimming. Turbidity listed is the limit for each point source.

Sub-watershed Analysis

Key issues: Flooding, Nitrate Pollution, Phosphorus/Soil loss, Diminished Recreation

Maps of 17 metrics to understand HUC-12 variation

Identified priority HUC-12s for planning efforts



HUC-12 Priority Ranking: Issues

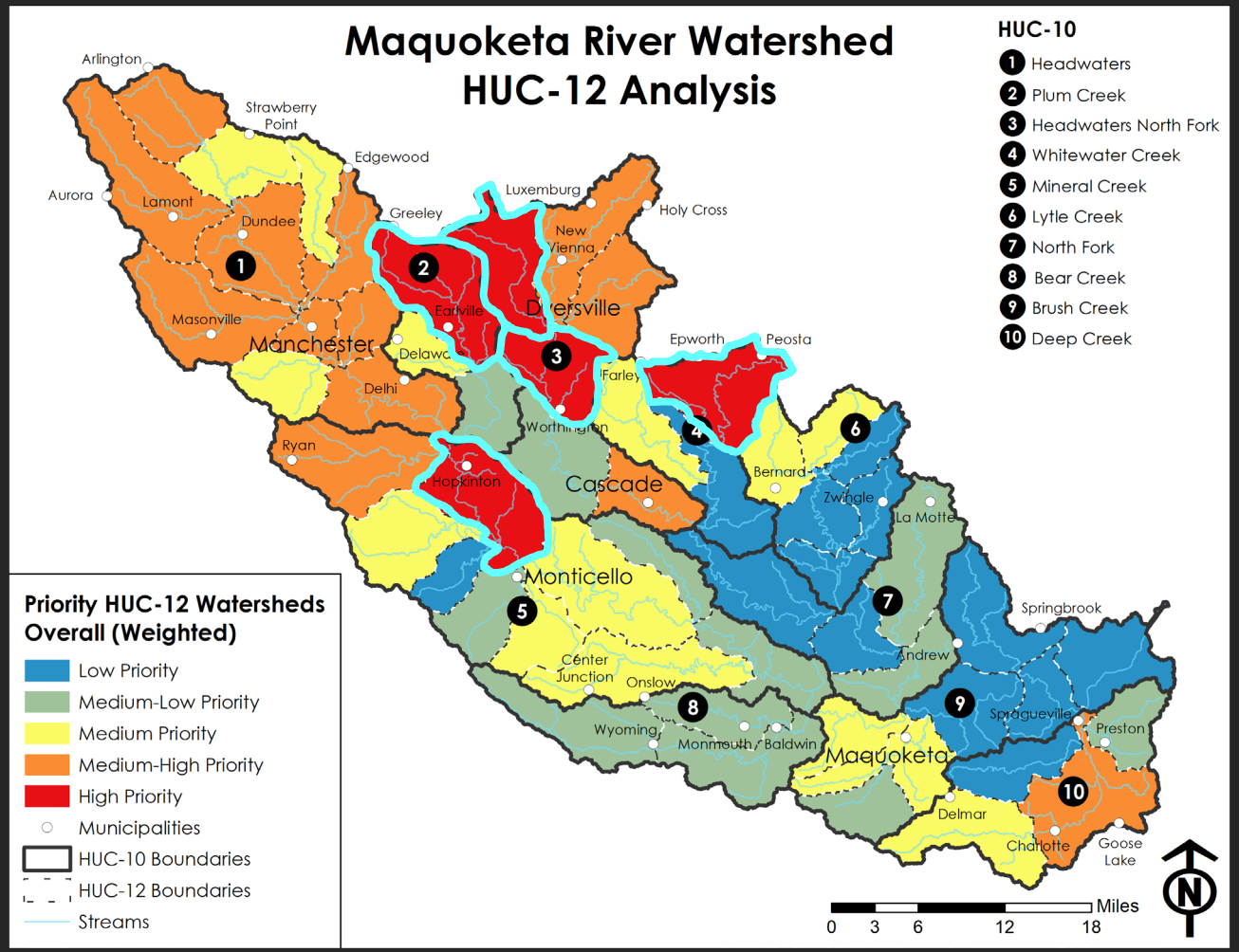
Flood Risk

Nitrate Pollution

Phosphorous and Soil Loss

Diminished Recreation

Overall HUC-12 Priority Ranking



Priority HUC-12 Plans

HUC-12 RANKING

AGRICULTURAL PROJECTS

URBAN PROJECTS

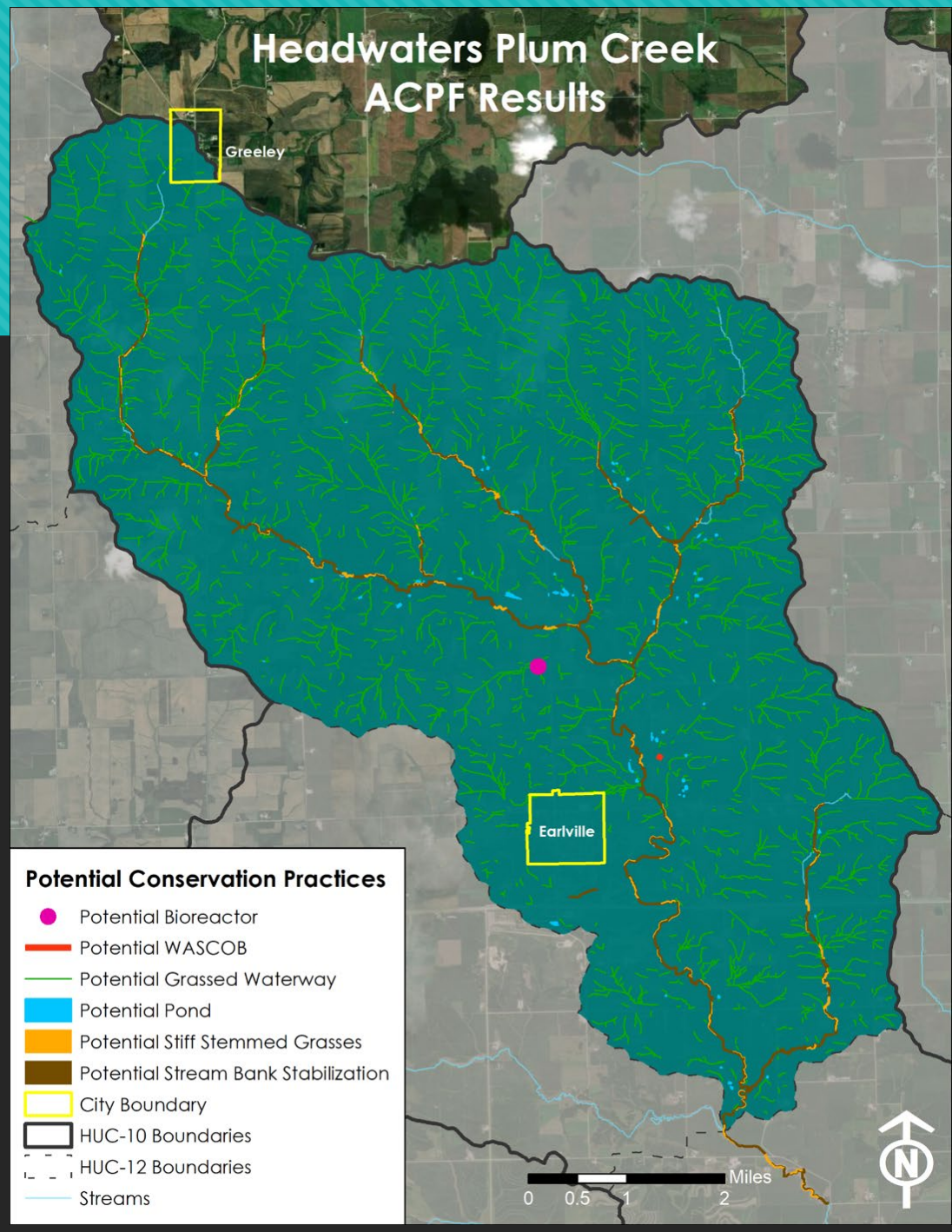
PRIORITIZE

Why Headwaters Plum Creek?

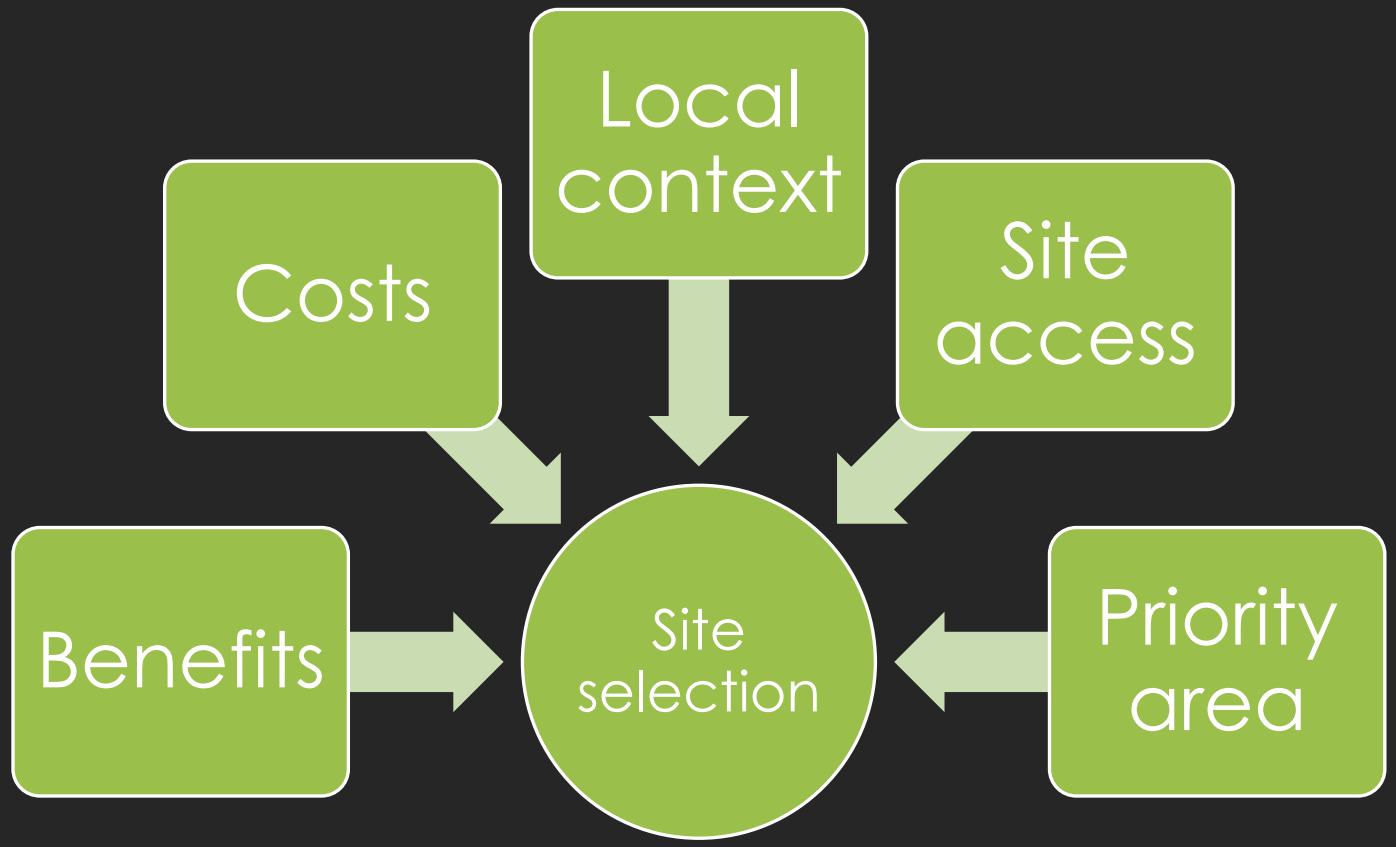
The **Headwaters Plum Creek** HUC-12 is in the upper part of the Maquoketa River Watershed, within the Plum Creek HUC-10. Out of the 56 HUC-12 sub-watersheds in the MRW, Headwaters Plum Creek is the highest priority, based on the combined scores from the sub-watershed analysis. For each of the four key issues, this sub-watershed ranked 7th in flooding risk, tied for 2nd in nitrate pollution, 5th in phosphorous and soil runoff, and 5th in diminished recreation.

Phase 1 Goals & Objectives	Priority	Indicators
Goal 1: Improve water quality through techniques for nutrient management, erosion reduction, and increased infiltration		
1.1: Engage with the agricultural community to encourage techniques that increase field infiltration and reduce soil erosion	MEDIUM	• ACPF • RUSLE
1.2: Engage with agricultural community to reduce and maximize efficiency of agricultural nutrient application	HIGH	• Monitored Nitrate • Monitored E.coli • CAFOs
1.3: Encourage practices that slow the flow of urban stormwater to increase infiltration and reduce erosion	LOW	• Community size • Impervious surfaces
1.4: Encourage the use of bacteria management to reduce E. Coli and other bacteria levels	HIGH	• Impaired streams • Monitored E.coli
1.5: Encourage and increase the implementation of wetlands to filter water pollutants	HIGH	• Acres of wetlands • ACPF
1.6: Continue to document and report water quality indicators	HIGH	• Water quality monitoring data (all indicators)

Management Practice	ACPF Suggestion	IA BMP Mapping Project
Bioreactor	1	Not analyzed
Grassed waterways	1,674 (286 miles)	584 (194 miles)
Ponds	56	5 pond dams
WASCOBs	1 (0.06 miles)	17 (0.75 miles)
Terraces	Not analyzed	26
Contour buffer strips	Not analyzed	6 (462 acres)
Stream bank stiff stemmed grasses	135 acres	Not analyzed
Stream bank stabilization	335 acres	Not analyzed



Plan Implementation: Guidance



Funding Sources

- IDALS, USDA, US EPA, IA DNR

Phase I Objectives Prioritized

- High, Medium, or Low

Plan Implementation: Next Steps

- Follow sub-watershed plans for priority HUC-12s
- Identify larger-scale site specific projects in priority HUC-12s
- Develop sub-watershed plans for lower-priority HUC-12s
- Continue support for projects and programs in lower-priority HUC-12s
- Reassess key issues and variables used in the Sub-watershed Analysis every 5 years

Who is this plan for?

WMA staff to focus their efforts.

Landowners to choose appropriate conservation practices and get WMA support.

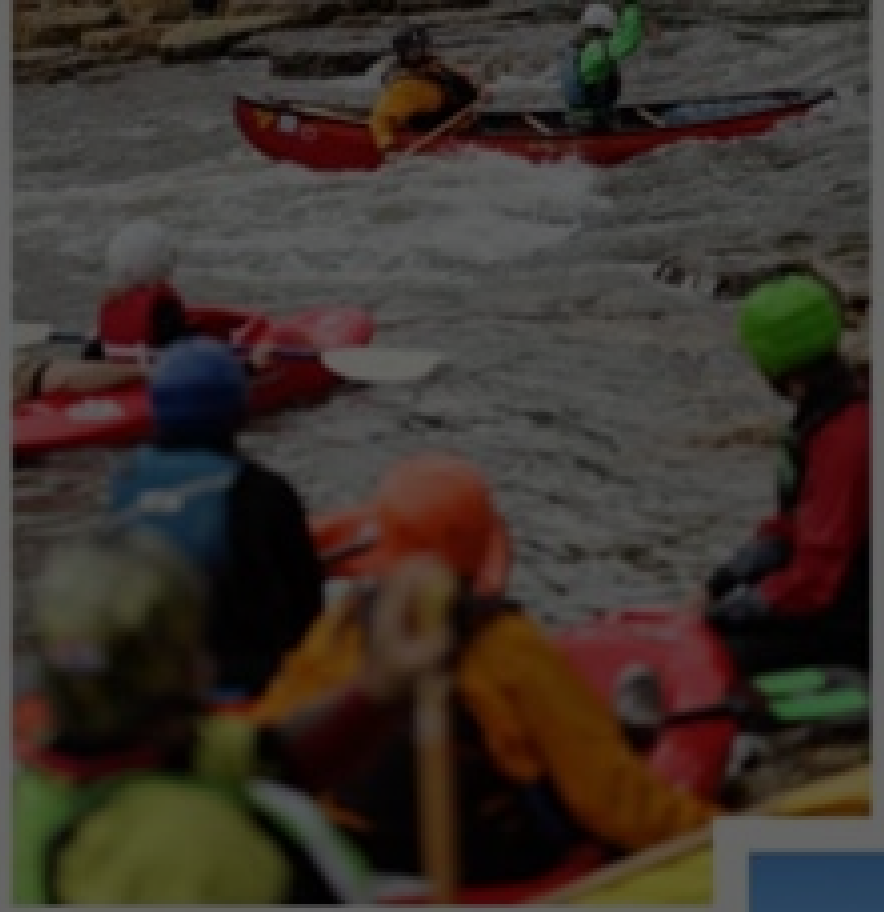
Local communities to understand broader conditions and foster collaboration between cities and the WMA.

Read profiles and sub-watershed analysis to understand **existing** conditions.

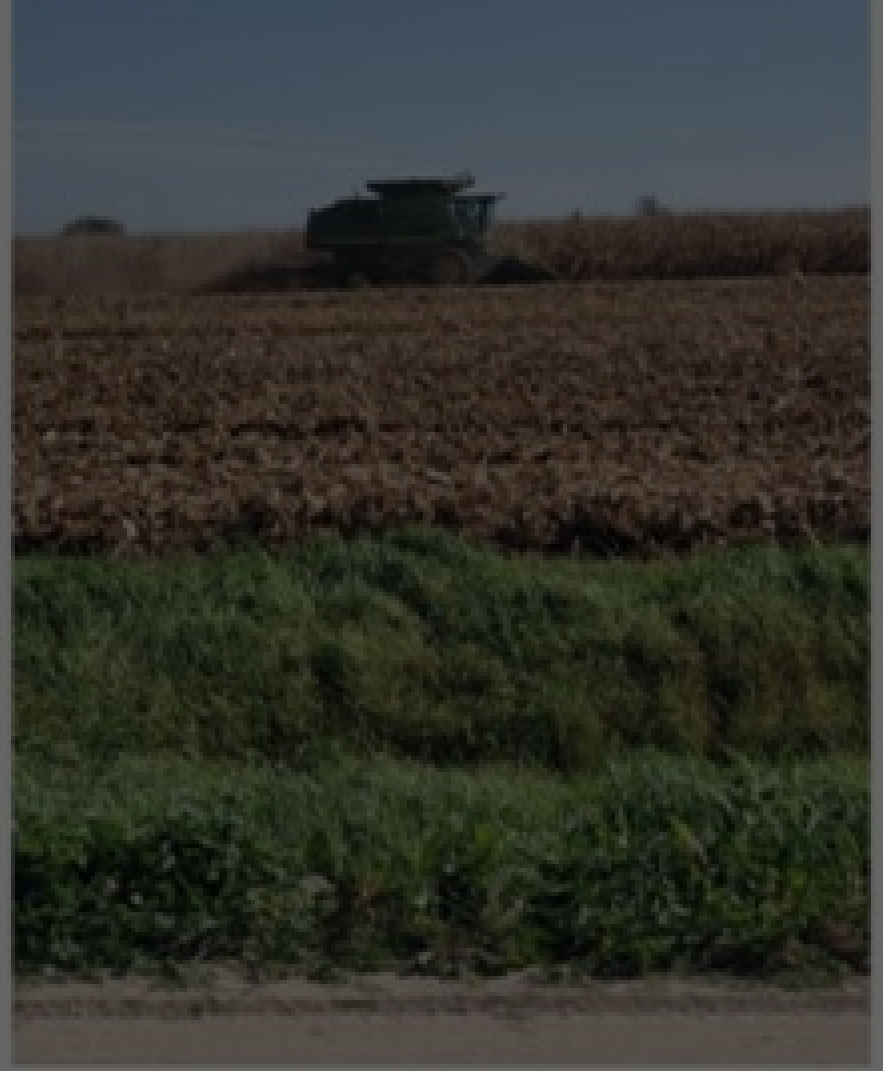
Look at ranking maps and priority HUC-12 plans to identify areas for **short-term** project implementation.

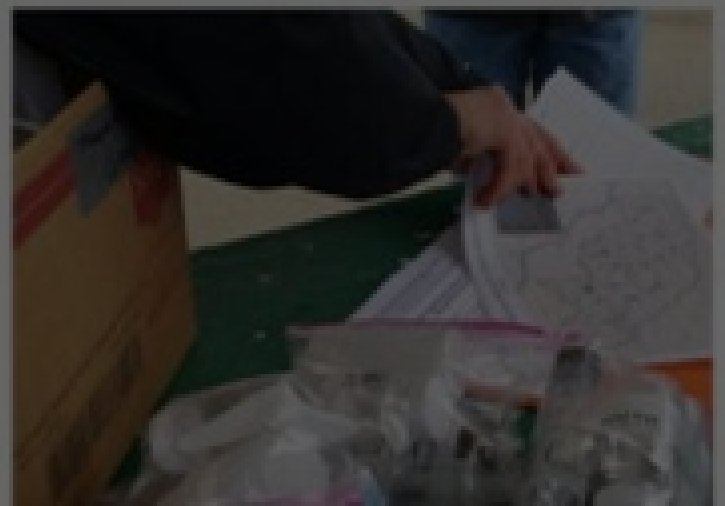
Follow project selection guidance and objective priorities to maximize available resources and **meet long-term** watershed goals.

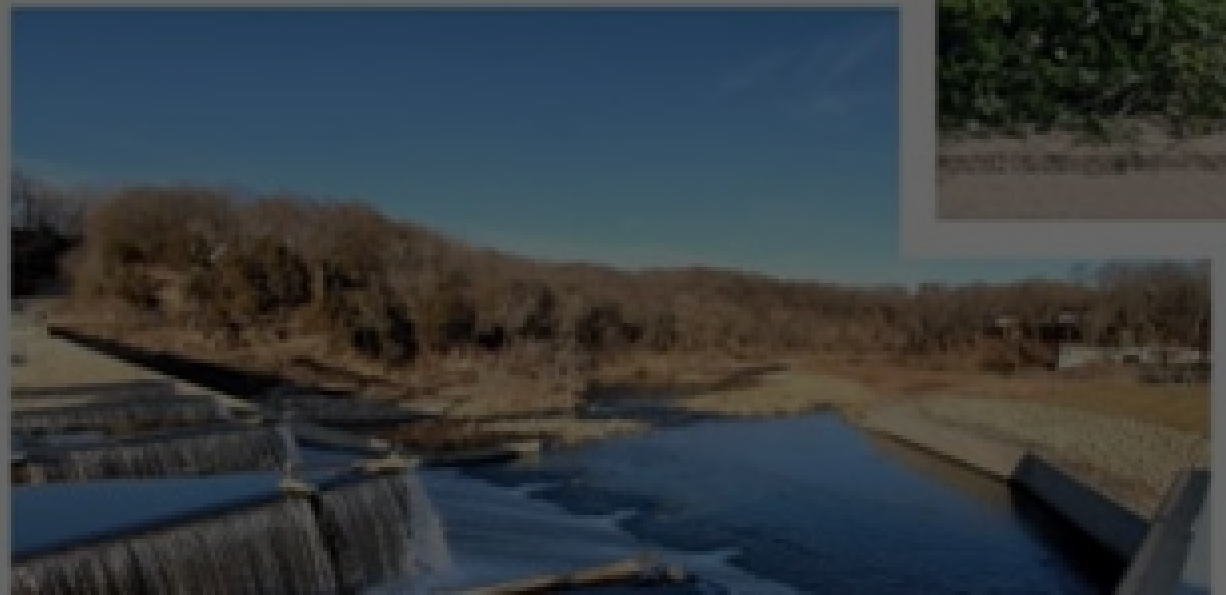
- Reduced flood risk
- Enhanced recreational opportunities
- Improved water quality indicators
- Greater collaboration between communities

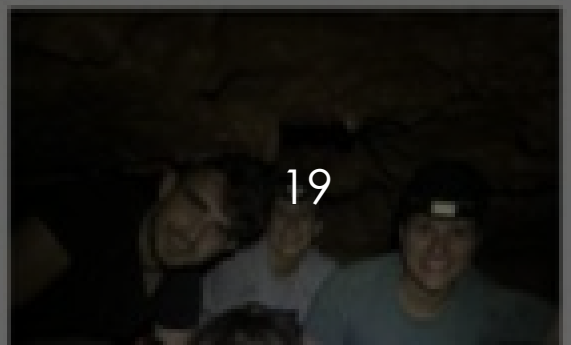


Thank You









Appendix

Variable Weights

Metric	Weight	Justification for including
Flooding risk (40%)		
Acres of public conservation and recreation land	20%	Impact: estimates potential flood damage to public resources
Total building value in the FHA	7%	Impact: estimates potential flood damage to private property
Total crop value in the FHA	16%	Impact: estimates potential flood damage to private property
Total population in the FHA	18%	Impact: proxy for people who will be affected the most by flooding
Number of existing management practices	25%	Mitigation: proxy for areas that are already willing to implement projects
Percent of area that is impervious surfaces	14%	Cause: proxy for areas that contribute more to flooding

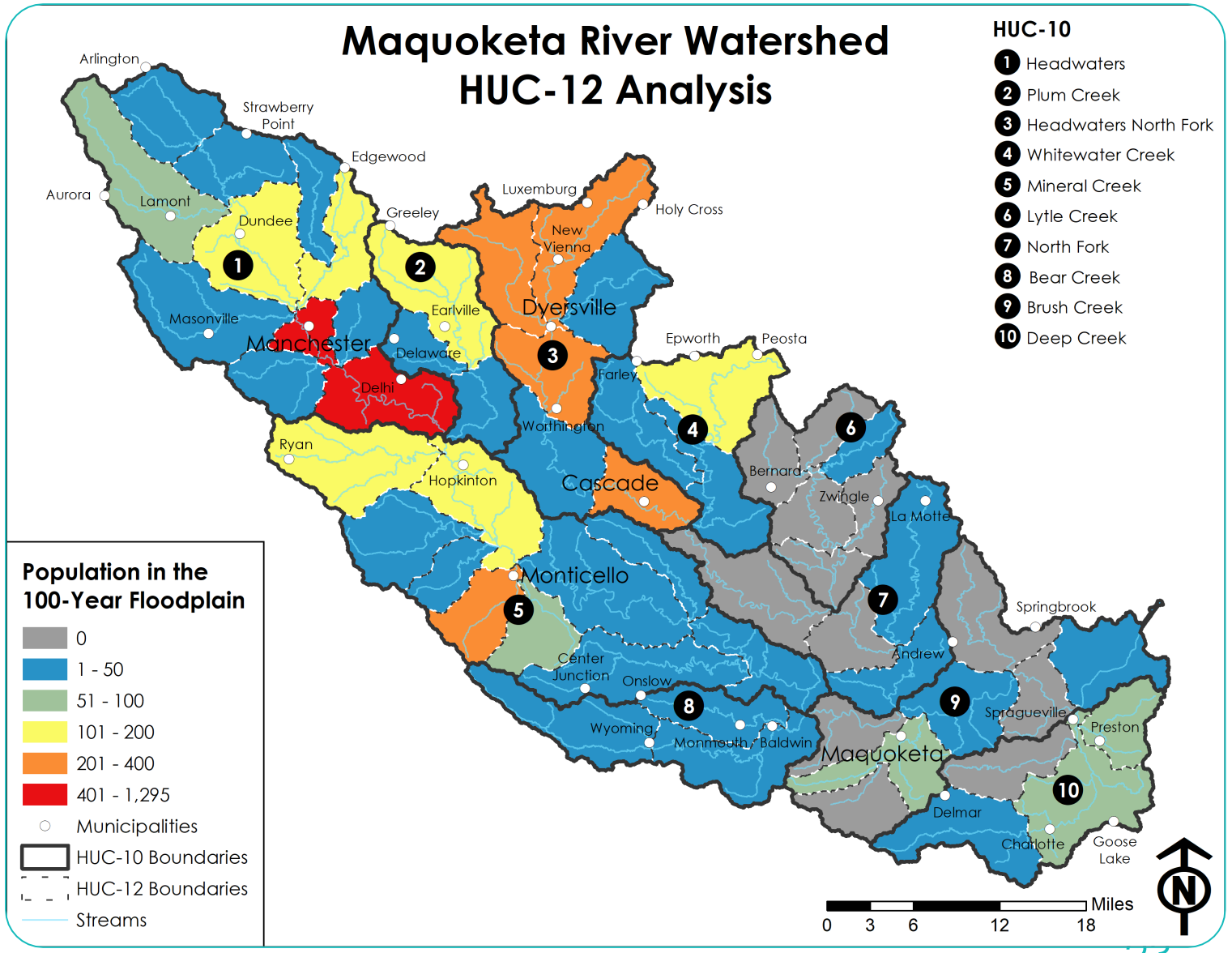
Metric	Weight	Justification for including
Nitrate Pollution (30%)		
Number of susceptible active wells	30%	Impact: proxy for public cost of treatment to avoid human exposure to nitrates
Tons per acre of soil runoff	10%	Cause: estimates magnitude of non-point sources of nitrogen
Number of CAFOs and water treatment facilities	23%	Cause: identifies point sources of nitrogen
Number of existing management practices	12%	Mitigation: proxy for areas already willing to implement projects
Monitored nitrate concentrations	25%	Impact: identifies most recent measured nitrate levels

Variable Weights

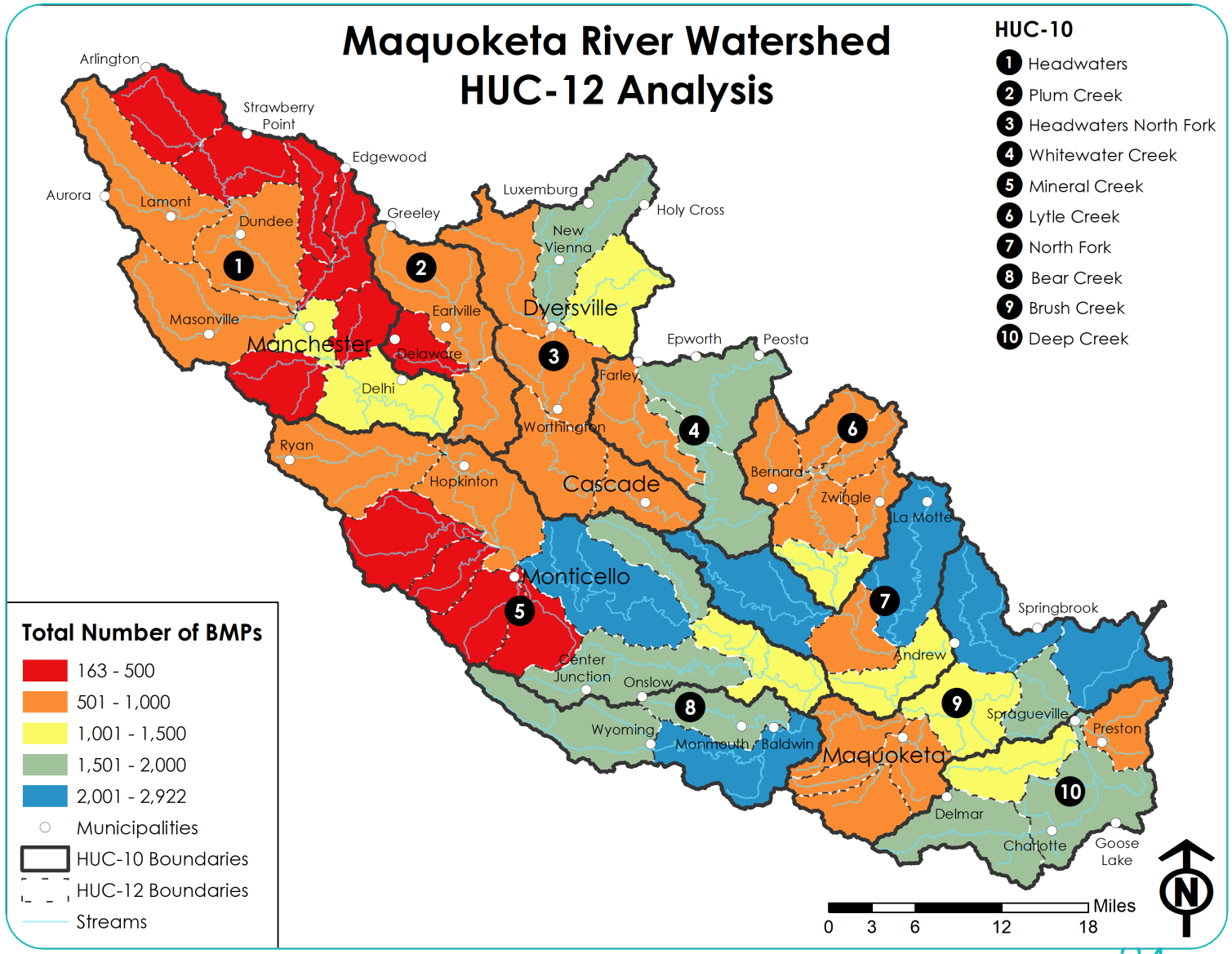
Metric	Weight	Justification for including
Phosphorous and Soil Loss (30%)		
Tons per acre of soil runoff	22%	Cause: estimates magnitude of non-point sources of phosphorous, which bonds with soil particles as they enter waterways
Number of CAFOs and water treatment facilities	25%	Cause: identifies point sources of phosphorous
Number of existing management practices	16%	Mitigation: proxy for areas already willing to implement projects
Monitored phosphorous concentrations	13%	Impact: identifies most recent measured phosphorous levels
Monitored turbidity	11%	Impact: proxy for sedimentation levels in waterways
Percent of area that is hydrologic group D	13%	Cause: proxy for soil loss based on runoff potential

Metric	Weight	Justification for including
Recreation (10%)		
Acres of public conservation and recreation land	20%	Mitigation: identifies areas open to the public for recreation
Acres of Wetlands	5%	Mitigation: estimates magnitude of existing wetland habitat for wildlife
Miles of streams impaired by fish kills	35%	Impact: proxy for magnitude of impairment, which is determined by ability to use a stream for various levels of recreation
Miles of streams impaired by E. Coli	27%	Impact: proxy for magnitude of impairment, which is determined by ability to use a stream for various levels of recreation
Miles of streams impaired by native mussel loss	13%	Impact: proxy for magnitude of impairment, which is determined by ability to use a stream for various levels of recreation

Flooding: Impact



Flooding: Mitigation



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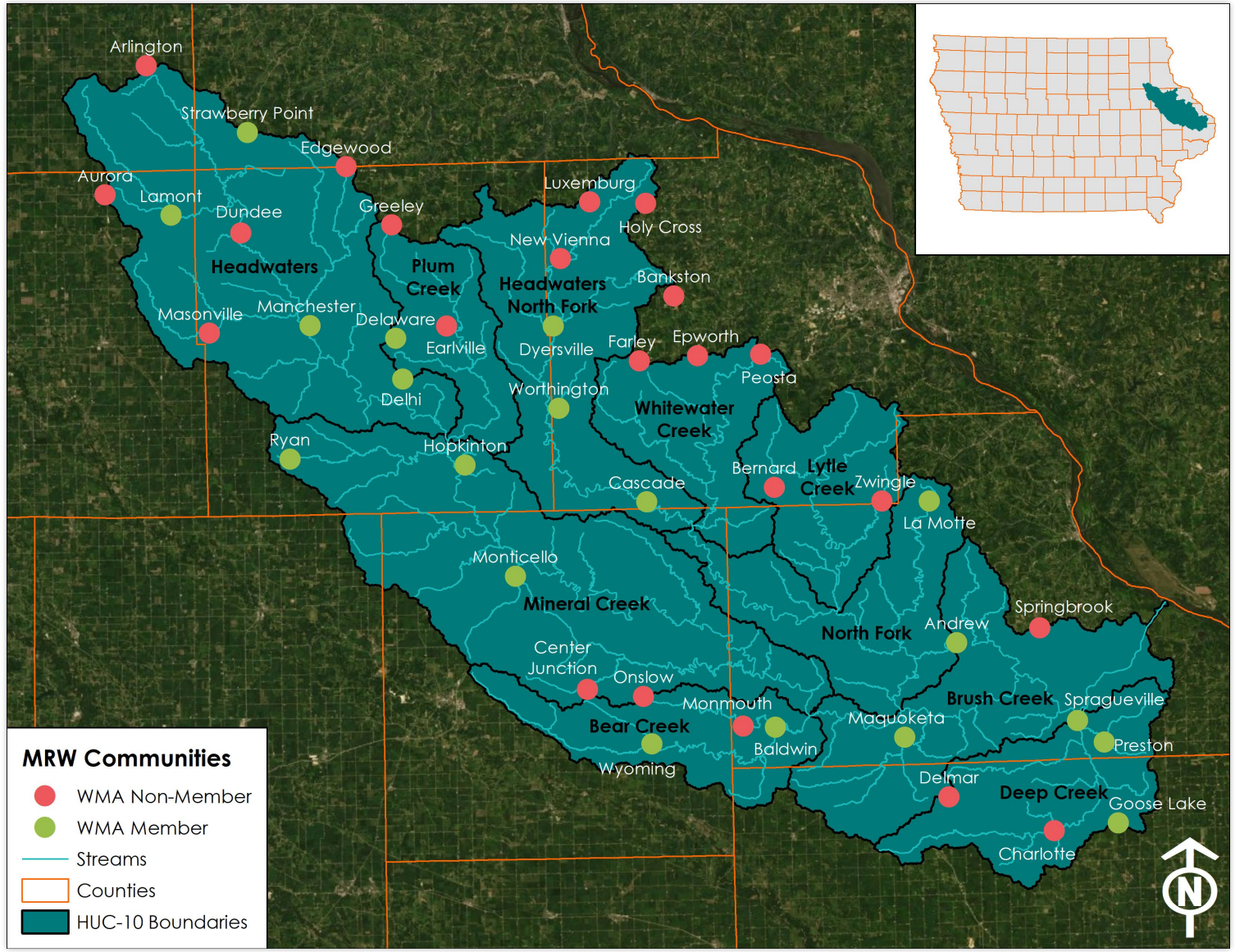
Communities

- 41 communities in MRW
- 20 WMA
- 10 HUC-10s



Timeline

August 2021

- Planning team site visit
- Define plan scope

September

- Identify stakeholders
- Methodology research

October

- Gather data layers
- Contact partners and experts

November

- Interview farm service providers
- Map existing conditions

December

- Create HUC-10 profiles
- Write fall semester report

January 2022

- Interview community representatives

February

- Develop metric weighting process
- Determine priority areas

March

- Compile priority HUC-12 plan information

April

- Write final plan
- Consult with project partners

May

- Present final plan to the MR WMA

HUC-10 Sub-watershed Profiles

- Purpose: Profile sub-watersheds at the HUC-10 level to provide the MR WMA with an outreach piece and show local issues
- What's included?
  - Reference Map
  - Population and Land Use Characteristics
  - Physical and natural features
  - Waterbody conditions
  - Local issues

Community Interviews

- **Goal**: Contact & interview all 41 communities in the MRW
- **Purpose**: Understand water issues, watershed planning efforts, and willingness to collaborate on future projects
- **Interview topics**:
  - Water management issues facing the community
  - Past & future projects and policies that affect water management
  - Perceptions of watershed planning and importance to the community
- **Outcome**: Provide MRWMA with an understanding of potential project partners and where support or more outreach is needed

Communities we interviewed

- Monticello, Maquoketa, Cascade, Manchester, Dyersville, Bankston, Arlington, Aurora, Epworth, Worthington, Spragueville, Lamont, Preston

Community Interview Results

- Key findings:
  - Interest in projects that benefit recreation and economic development
  - Widespread support for WMA activities
  - Understanding impacts to other communities
  - Abundant water-related assets
  - Extensive water management practices are underway

Farm Service Provider Interview Results

- Interviewed 6 farm service providers from ISU extension, IDALS, NRCS, SWCD
- Results:
  - Confirmed expectations about trends in conservation practices and farmers' willingness to implement new practices
  - Sustained implementation depends on initial success and seeing neighbors' success

Community Interview Questions

Communities

1. How would you describe your community? Thinking of aspects such as demographics, history of development, government structure.
2. What are some assets of the water resources in your community?
3. What water-related issues, if any, have you identified in your community?
4. How is watershed-level planning important to you?
   a. What would you like to get out of this process?
5. Are you a member of the WMA?
   a. How involved are you and why or why not?
6. Have you implemented projects within the watershed?
   a. Did the project(s) focus primarily on flooding, water quality, or something else?
   b. Were there other benefits to the project (e.g. social, economic, recreational)?
7. Are there any projects that you would like to implement?
   a. What are constraints?
8. Does your community have any programs or policies on water infrastructure (e.g. stormwater runoff ordinance, retention requirements, or erosion and sediment controls)?
   a. What was the process like to adopt these? Or why have these not been adopted?
9. As a follow-up, would you be willing to note watershed project ideas of interest to your community on a document that we will send via email?

Community Interviews: Results

Completed and Future Community Projects	
Gains	Constraints
+ recreational trails	- limited city budget
+ levees for flood protection	- technical expertise and cost
+ buyouts of buildings in the floodplain	- community support
+ community amenities	- land, public or able to acquire

Farm Service Provider Interviews

- **Goal**: Interview organizations who work with farmers
- **Purpose**: Understand changes in conservation practice adoption and farmers' perception of conservation practices
- **Interview topics**:
  - Changes in services over time
  - Farmer perceptions and willingness to adopt conservation practices
- **Outcomes**:
  - Understand landscape and potential hurdles for more widespread adoption of BMPs
  - Discover how to market BMPs to farmers that show hesitancy

Farm Service Provider Questions

Farm Service Providers

1. What is your name and profession?
2. How long have you been a farm service provider and why did you choose to become one?
3. What is the role of a farm service provider and what sorts of services do you provide?
4. How have the services you provide changed over time?
   a. Has the emphasis on conservation practices changed as well?
5. How is watershed-level planning important to you?
   a. What would you like to get out of this process?
6. How many farms have you worked with in the MRW?
   a. Are they primarily small-scale farms or large-scale farms? Both?
   b. Family farms or more agri-business operations?
7. What is your main strategy to market your services?
   a. i.e. Do you go directly to farmers? Recommended by word-of-mouth? Work as an intermediary between suppliers and farmers?
8. How much do your services cost? How does this compare to average farm expenses?
9. What has the feedback been like from farmers that have adopted BMP?
10. What holds other farmers back from implementing BMP?
    a. Cost? Traditions? Lack of resources/knowledge?

Farm Service Provider Interviews: Results

Service Provider Focus on Conservation Over Time	Reaction of Farmers who Implement Management Practices	Hesitations of Farmers who have not Implemented Management Practices
- has always been a focus, but type of practices have changed - 1980s: focus on structural projects (terraces, tiling) - Today: focus on soil health (no-till and cover crops)	- continuation depends on success of the first try - if successful first year, practices tend to continue - neighbors see successes and start implementing their own practices	- highly-specific to individual farmers, but general concerns include: ➢ "traditional" farming mindset ➢ Cost of implementation or potential yield losses ➢ Technical expertise to successfully implement on the first try

Data Layers Used	EPA	English River	Turkey River	Upper Wapsipinicon	Catfish Creek	Technical Committee
Watershed boundaries	X	X	X	X	X	
Hydrology	X	X	X	X		
Topography	X	X	X	X	X	
Soils	X	X	X	X	X	
Erodibility				X	X	X
Climate	X	X	X	X	X	
Habitat (wetlands, conservation easements, etc)	X	X	X	X	X*	X
Wildlife (endangered species list)	X			X		X
Land use/cover	X	X	X	X	X	
Land ownership				X	X	
Public park and trail locations					X	
Existing management practices	X	X		X	X	
Demographics	X	X	X	X	X	
Water quality standards**	X	X	X	X	X	X
Water quality monitoring results		X	X	X	X	X
Impaired waters list	X		X	X	X	
Point source polluters (CAFOs, water treatment facilities, etc)	X			X	X	
Non-point source polluters (animal units, applied fertilizer, urban runoff, etc)	X			X	X	X
Private wells				X	X	
Public wells					X	X
Measure of flooding (peak flood discharge, acres in FHA, etc)		X		X	X	X
Property and crop value in FHA				X	X	
Public infrastructure at flood risk				X	X	

*The Catfish Creek plan includes a manual habitat condition classification.
**Indicators measured differ by plan. The following is a comprehensive list across resources: ammonia, bacteria, chloride, dissolved oxygen, phosphorous, phosphate, pH, nitrogen, nitrate, sediment, sulfate, temperature, and turbidity.

Best Practice Research

Prioritizing Phase I Objectives

Goal 1: Improve water quality through techniques for nutrient management, erosion reduction, and increased infiltration

- Objective 1.1: Engage with the agricultural community to encourage techniques that increase field infiltration and reduce soil erosion.
- Objective 1.2: Engage with the agricultural community to reduce and maximize efficiency of agricultural nutrient application.
- Objective 1.3: Encourage practices that slow the flow of urban stormwater to increase infiltration and reduce erosion.
- Objective 1.4: Encourage and increase bacteria management to reduce E. Coli and other bacteria levels.
- Objective 1.5: Encourage and increase the implementation of wetlands to filter water pollutants.
- Objective 1.6: Continue to document and report water quality indicators.

Goal 2: Improve watershed flood management

- Objective 2.1: Advance the mission and goals of the WMA by fostering partnerships between agencies, organizations, and political entities regarding flood prevention and recovery.
- Objective 2.2: Implement a comprehensive program of targeted activities designed to reduce flood risk and improve water quality in the Maquoketa River Watershed.
- Objective 2.3: Increase awareness related to water quantity and strengthen connections between land use management practices and flooding.

Goal 3: Increase watershed awareness and involvement among stakeholders

- Objective 3.1: Educate the local residents to make individual efforts and connections with the watershed.
- Objective 3.2: Ensure all stakeholders in the watershed are included in activities and programs.
- Objective 3.3: Expand WMA network within the watershed through outreach.
- Objective 3.4: Work to achieve an effective interagency corporation with the upriver and adjacent WMAs, the State, the County, the Local Municipalities as well as the Soil and Water Conservation Authorities in the region.

Goal 4: Preserve, protect, and improve ecologically sensitive habitats and ecosystems in the watershed

- Objective 4.1: Prioritize natural resource sites in the watershed for preservation, protection, and restoration.
- Objective 4.2: Protect streambanks, shorelines, and buffer areas within the watershed.
- Objective 4.3: Restore wetlands and riparian areas in the watershed.
- Objective 4.4: Improve habitat conditions for native flora, fauna, and marine lives in the watershed.
- Objective 4.5: Restore floodplain connectivity within the watershed.
- Objective 4.6: Protect source water sites in the watershed.

Goal 5: Establish the WMA as a trusted community resource

- Objective 5.1 Make the WMA representative of the people and interests in the watershed.
- Objective 5.2 Connect communities with resources specific to the watershed.
- Objective 5.3 Recognize and identify vulnerable populations in the watershed that may be affected by poor water quality and flooding.

Decision-Making Criteria

Strength of impact

Projects that address the key issues in the HUC-12, and have a high potentional for pollutant load or flooding reduction, should be prioritized. The WMA should consult with the MRW technical committee, NRCS staff, and the Iowa Flood Center to determine reductions.

Any co-benefits

While management projects are designed to improve one aspectof water resources, they may have co-benefits that address issues in this plan and beyond it. Projects that can improve the watershed in multple ways, such as reducing pollutnants, mitigating flooding, creating recreational amenities, improving wildlife habitat, increasing economic opportunity, and/or promoting equity should be given higher consideration.

Cost of project

After identifying the direct and indirect benefits, the cost of the potential project should be calculated. Costs to consider include access to the land, site design and engineering, installation, operation, and long-term maintenance for the practice. The WMA should work with the MRW technical committee, NRCS staff, Iowa Flood Center, and conservation funding sources to estimate a project's cost.

Negative impacts

While having unintended impacts should not automatically rule out a project, it should be noted that there will be trade-offs in each possible practice. For instance, a project that controls one pollutant may increase another. If the benefits outweight the consquences, or if consquences can be mitigated, the project should move forward.

Local concerns

Successful conservation projects require collaboration between the WMA, local governments, and residents. The WMA should consult impacted groups and design projects to address any concerns. Stakeholder interviews for this plan identified project implementation barriers, including city and farmer budget constraints, lack of technical expertise, and political support for conservation.

Located in priority area

Projects within HUC-12s ranked highly overall and for individual key issues should be prioritized for management practices that address those issues. However, if a site is not in a priority area identified by this plan, but meets many other criteria, the WMA and partners should still work towards implementation.

Site access and physical constraints

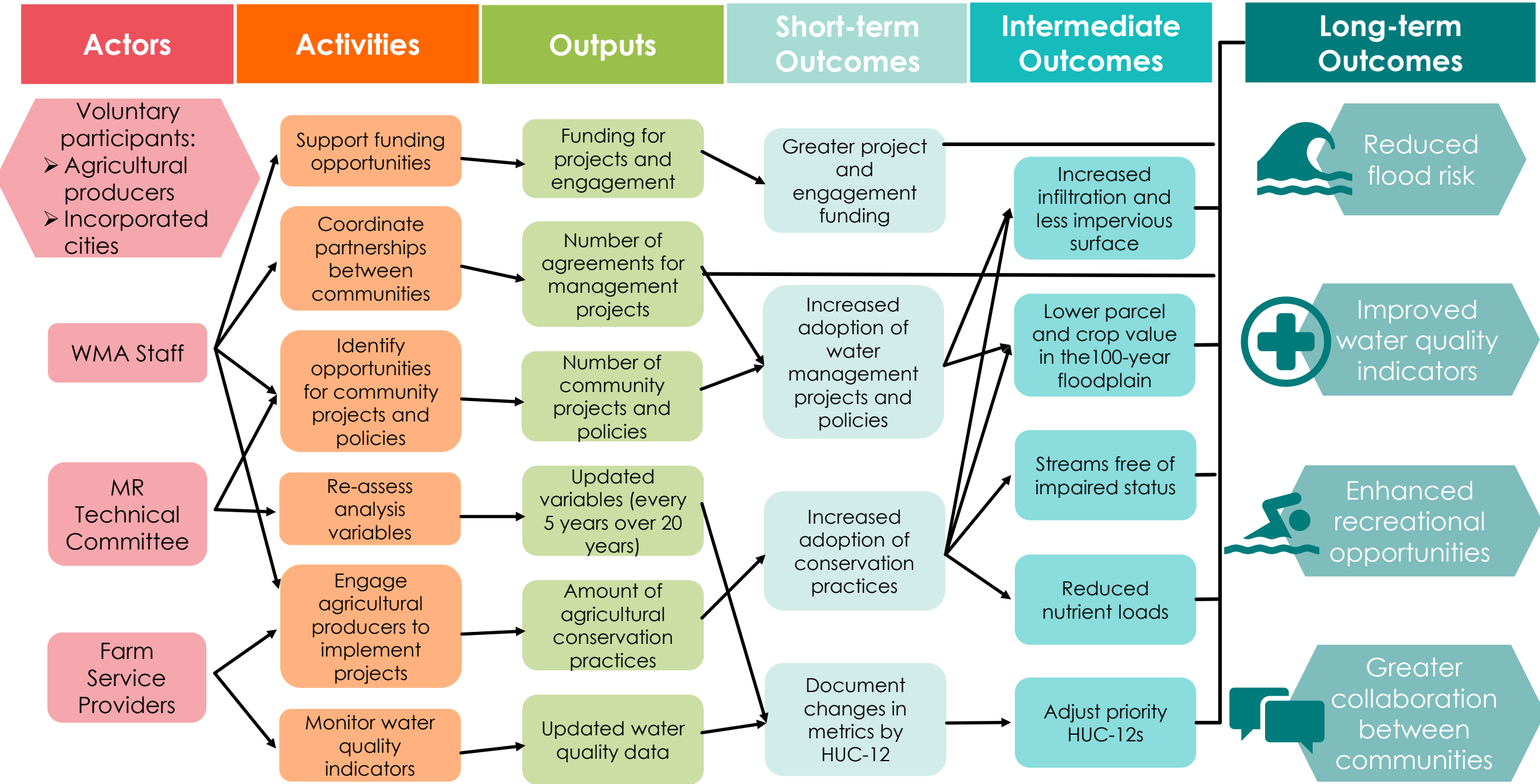
The chosen site must be accessible, through public land or permission on private land, and able to accomodate the necessary construction equipment. Additionally, the site should be visited before project design to ensure there are no physical features that would impede project construction, such as steep slopes, high water tables, existing buildings, or buried utilities.

Public or private land

Projects on publically-owned land may be quicker and easier to implement, but ones on private land should also be considered as the owner could sell the land, provide an easement, or collaborate on the project. Stakeholder interviews indicated that farmers are more likely to adopt practices if they have financial and technical assistance and see successful projects on neighboring properties, while cities provided a list of projects that they would explore implementing.

Any applicable regulations

Finally, project selection should address possible legal requirements, and how they may increase implmentation cost. Projects will need to follow and federal, state, and local policies that may regulate grading and construction permits, zoning laws, land access or easements, environmental and wildlife protection, funding requirements, and/or other regulations that apply to the site.


Actors
Activities
Outputs
Short-term Outcomes
Intermediate Outcomes
Long-term Outcomes
Voluntary participants:
Agricultural producers
Incorporated cities
WMA Staff
MR Technical Committee
Farm Service Providers
Support funding opportunities
Coordinate partnerships between communities
Identify opportunities for community projects and policies
Re-assess analysis variables
Engage agricultural producers to implement projects
Monitor water quality indicators
Funding for projects and engagement
Number of agreements for management projects
Number of community projects and policies
Updated variables (every 5 years over 20 years)
Amount of agricultural conservation practices
Updated water quality data
Greater project and engagement funding
Increased adoption of water management projects and policies
Increased adoption of conservation practices
Document changes in metrics by HUC-12
Increased infiltration and less impervious surface
Lower parcel and crop value in the100-year floodplain
Streams free of impaired status
Reduced nutrient loads
Adjust priority HUC-12s
Reduced flood risk
Improved water quality indicators
Enhanced recreational opportunities
Greater collaboration between communities