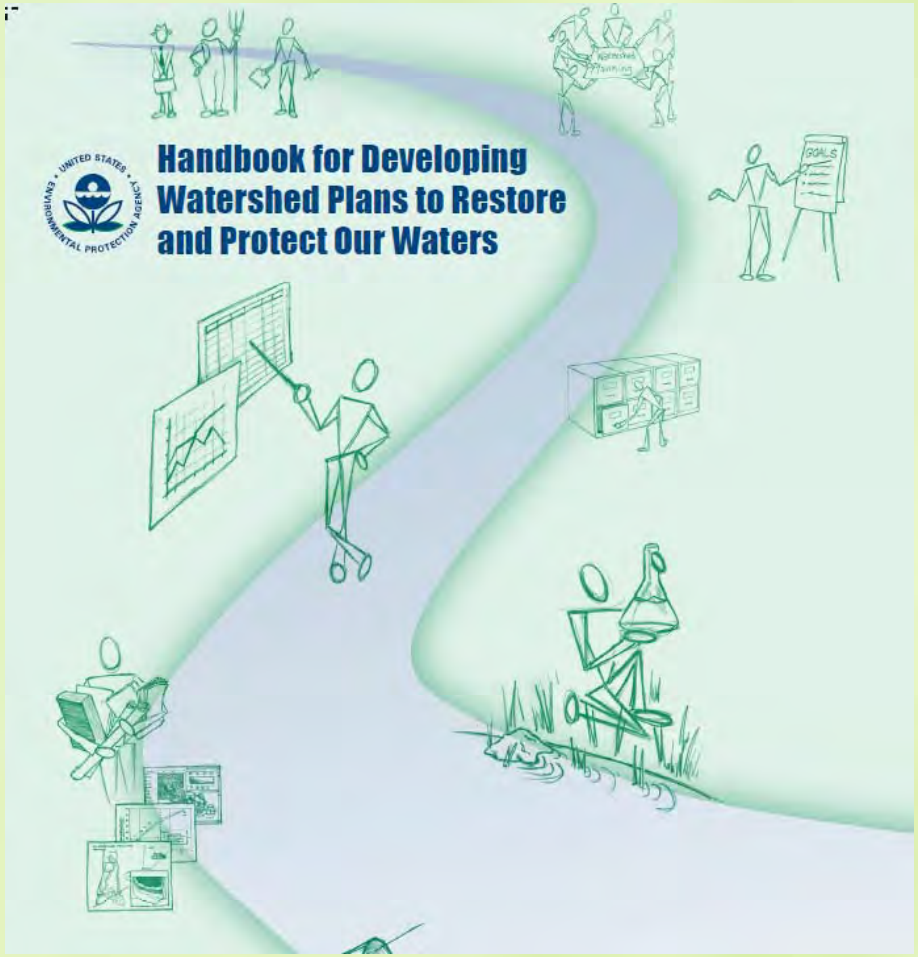
INCORPORATING WETLANDS INTO WATERSHED PLANNING

WETLANDS SUPPLEMENT to the WATERSHED HANDBOOK

EPA Region 5, Wetlands Branch
Contractor: PG Environmental, LLC
EPA Contract No. EP-R5-10-02

Watershed Handbook - 2008



Purpose

Encourage inclusion of proactive wetland management into watershed plans

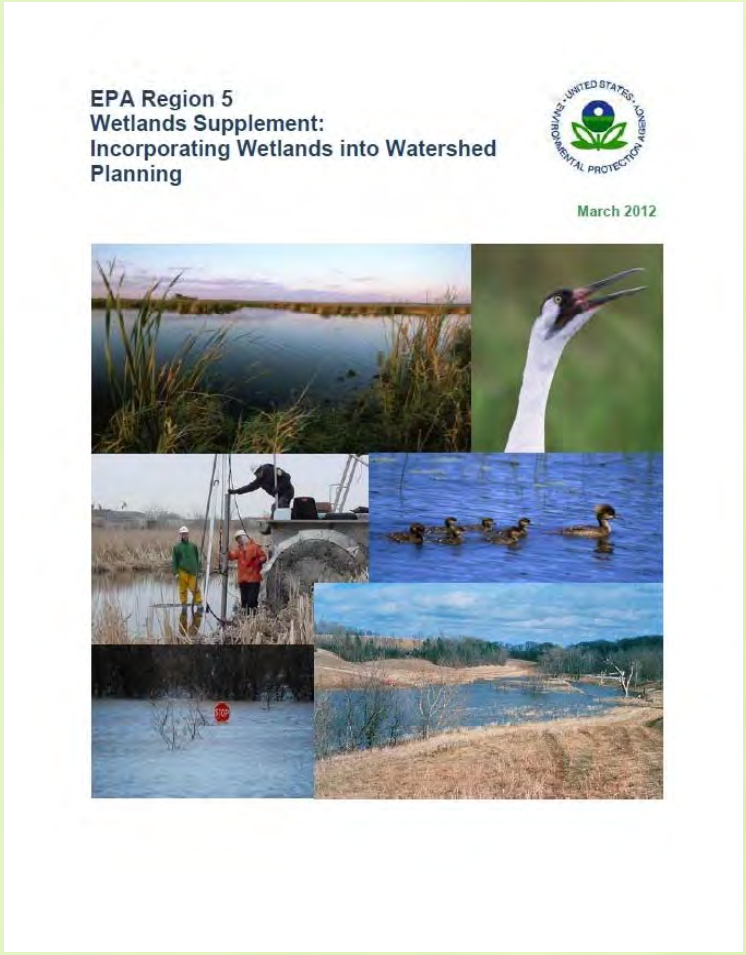
Wetlands and watershed health

Landscape level approach

Achieving water management goals

Watershed organizations & local/state agencies

Region 5 Supplement



Wetland Functions versus Wetland Values

Wetland Functions

Wetland functions relate to a process or series of processes (the physical, biological, chemical, and geologic interactions) that take place within a wetland. Major wetland functions include those that change the water regime in a watershed (hydrologic function), improve water quality (biochemical function), and provide habitat for plants and animals (food web and habitat functions).

Wetland Values

Values are generally associated with goods and services that society recognizes. Wetlands can have ecological, economic, and social values. It is important to note that not all environmental processes are recognized or valued.

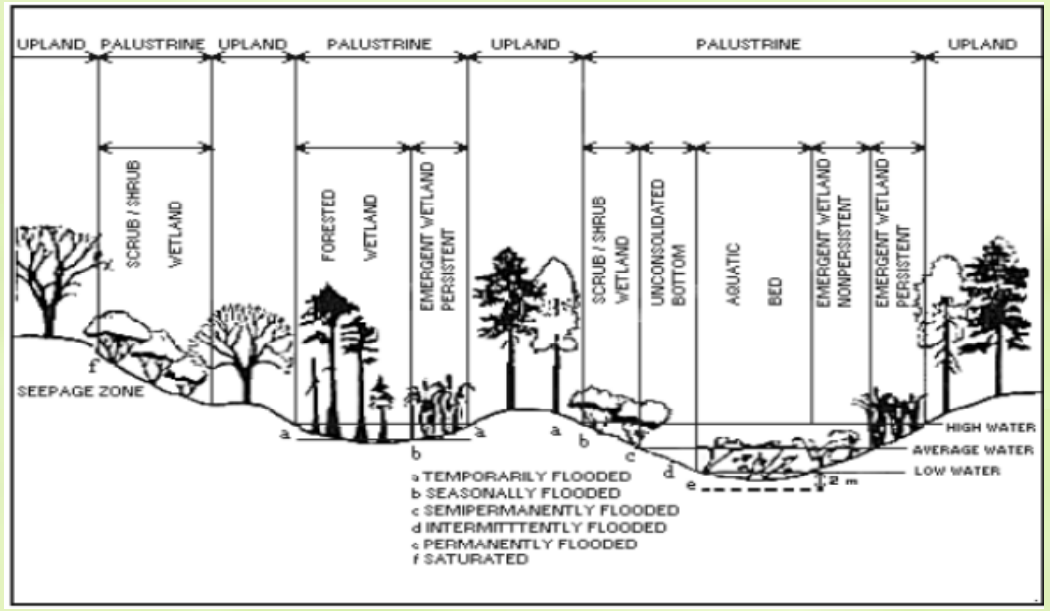
Sources: Novitzki et al. 1997; Sheldon et al. 2005.

Wetland Basics

Wetland definition

Wetland types

- Forested
- Emergent
- Scrub/shrub



Wetland classification systems

- National Wetland Inventory (NWI)
- Hydrogeomorphic (HGM)
- NWIPlus

What is the NWI?

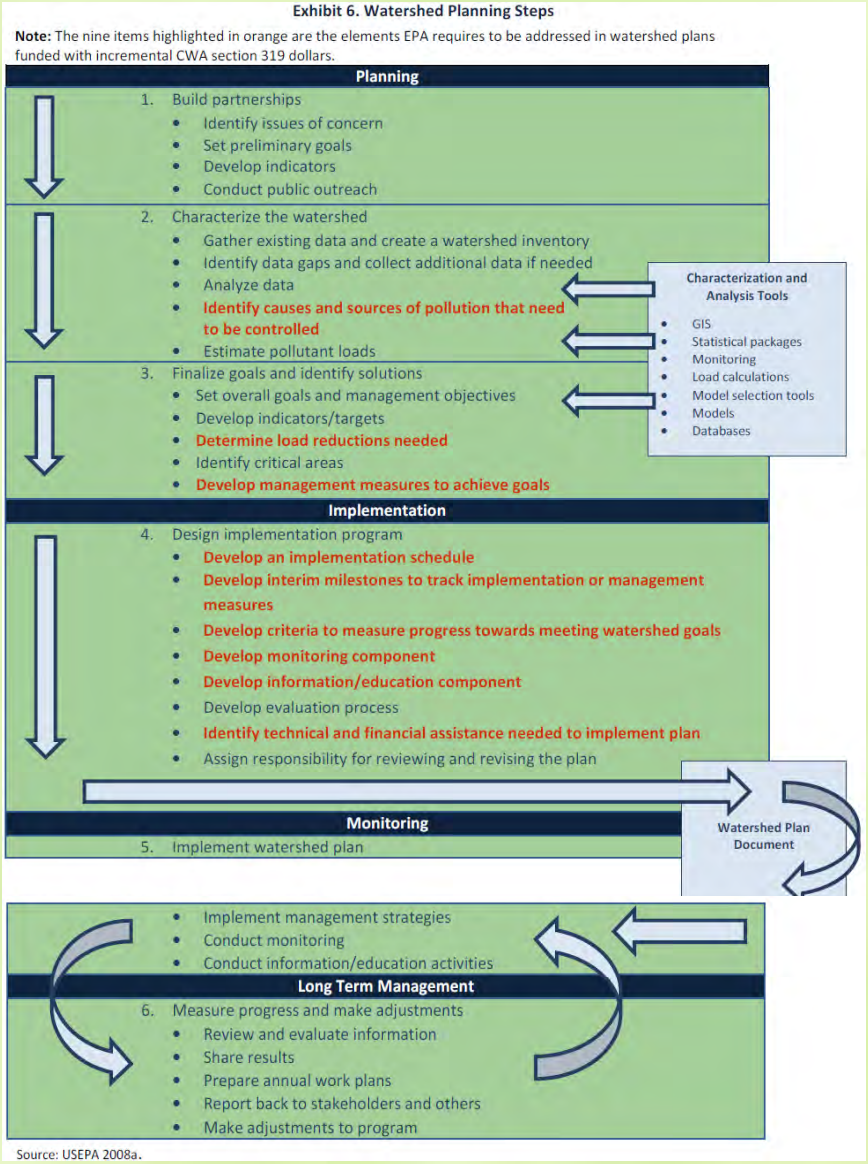
The National Wetlands Inventory is a database of information used to identify the status of wetlands across the United States. The system contains wetland data in map and digital formats (i.e., geographic information systems, or GIS). Wetlands are classified in the system according to the Cowardin system.

Source: USFWS 2010.

When to Include Wetlands in Watershed Plans

Steps

- Planning
  - Setting goals
  - Characterizing watershed
- Implementation
  - Design strategies
  - R/C/E Techniques
- Monitoring
  - Progress
- Long term management
  - Perpetuity



Case Studies

Michigan

Ohio

Virginia

Utah

Exhibit 18. Paw Paw River Watershed Management Plan Implementation Tasks Associated with Wetlands

Wetland–Related Tasks	Implementation Dates	Milestones	Evaluation Method(s)
Protect Wetlands	20092013	By 2015: 20 acres By 2018: 80 acres By 2023: 180 acres	• Number of acres protected • Number of landowners protecting wetlands • Estimate pollutant loading reduction
Protect Sensitive Lands	20142018	By 2020: 200 acres By 2023: 600 acres By 2028: 1,400 acres	• Number of acres protected • Estimate pollutant load reduction
Restore Wetlands	20092013	By 2015: 80 acres By 2018: 180 acres By 2023: 240 acres	• Number of acres restored • Number of landowners restoring wetlands • Estimate loading reduction
Protect Wetland Streambanks	20092013	By 2015: 120 acres By 2018: 320 acres By 2023: 720 acres	• Number of acres protected • Number of landowners protecting wetlands • Estimate pollutant load reduction

White & Fennessey 2005

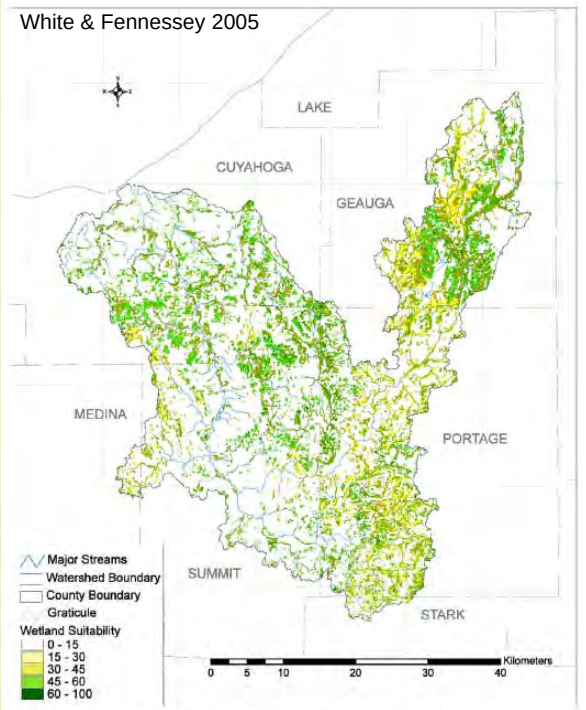
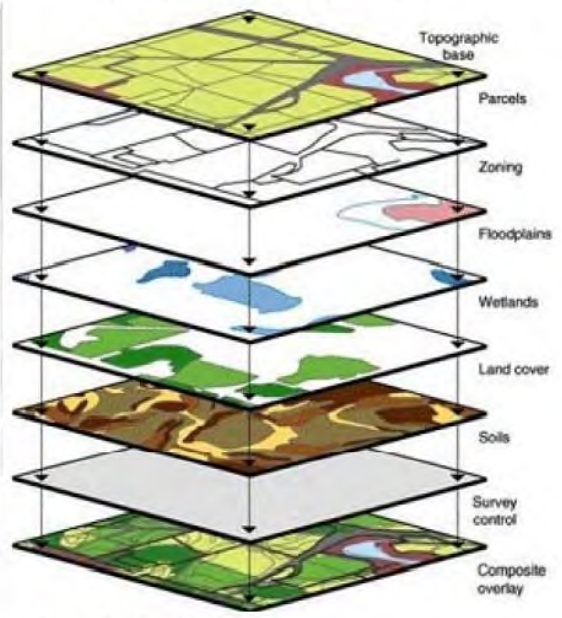


Fig. 7. The base model of site suitability of wetland restoration potential.

Exhibit 20. Map Layers for Inclusion in Clinton River Watershed Wetland Assessment



Source: Fizzell and Zbiciak. n.d.

Appendices

A: Federal Programs and Acts Affecting Wetlands in the United States

B: Example Assessment Data and Sources

C: Level 1-3 Assessment Methods

D: Restoration, Creation and Enhancement Techniques

Finding the Supplement

http://water.epa.gov/polwaste/nps/handbook_index.cfm

http://www.epa.gov/region5/agriculture/pdfs/wetlands-in-watershed-planning-supplement-region-5-201302.pdf

Contact: Kerryann Weaver
Region 5
Water Division, Wetlands Branch
weaver.kerryann@epa.gov
312-353-9483

Planning Wetland Restoration at a Hierarchy of Scales

Siobhan Fennessy

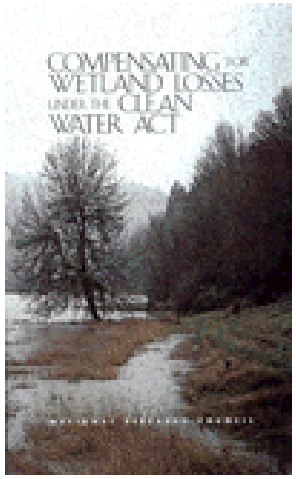
Kenyon College

Wetland values accrue at the watershed scale

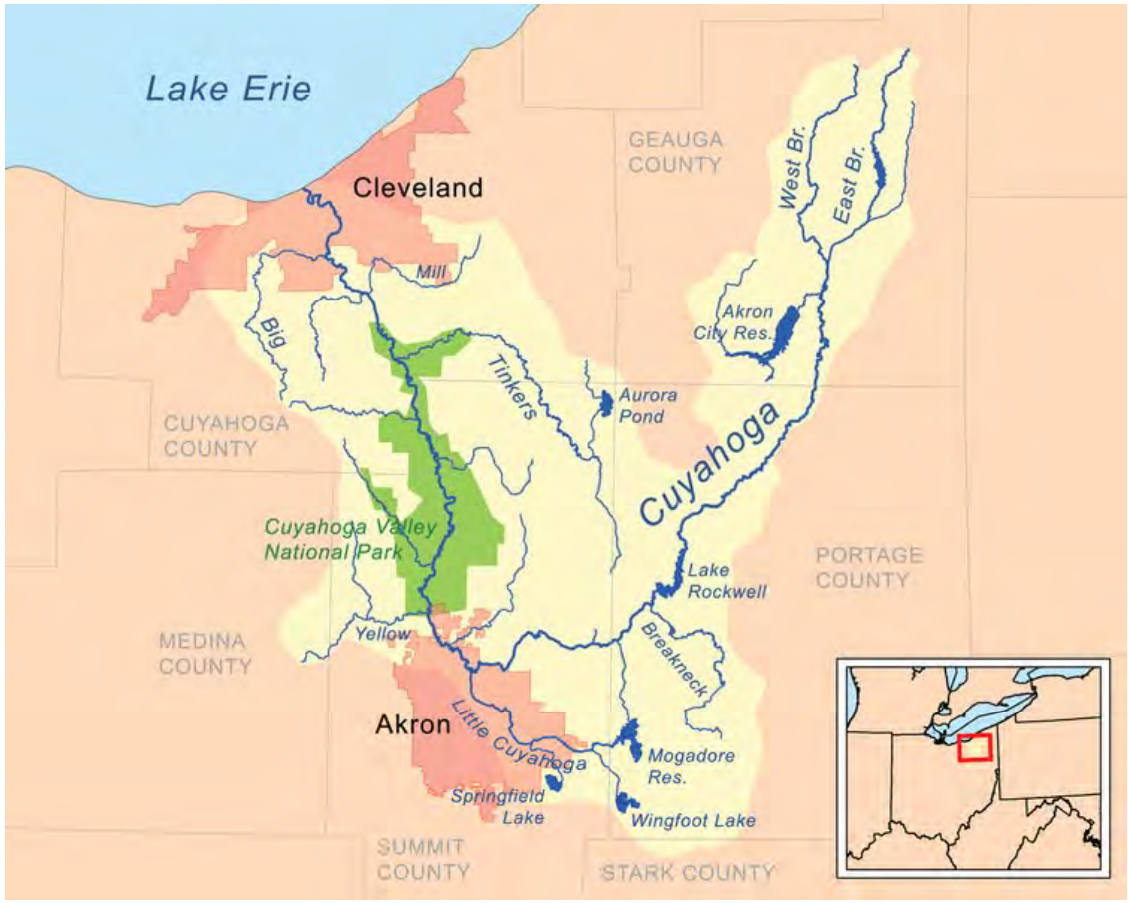
- The problem:
  - nearly half of nations waterways do not meet basic water quality standards
  - Non-point sources account for ~50% of water quality impairment
- Watershed based planning can restore ecosystem-level processes that maintain water resource integrity
- Spatial distribution of wetlands important

Issues in wetland mitigation

- Recent study by National Academy of Science: improvement is needed!
  - No preference for on-site, in-kind mitigation
  - Long-term sustainability critical
  - Consider hydrologic equivalence
  - Landscape degradation limits project success
  - Select sites on a watershed scale to mimic natural distribution of wetlands



The Cuyahoga River Basin



The Cuyahoga River Basin

- 813 square miles
- 3% of state land area, houses 16% of population
- Wetlands mapped by OWI
- Designated a Great Lakes *Area of Concern* due to industrial pollution

The Cuyahoga River fires: catalyst for water protection

Development of a site-suitability model for restoration

- Goals
  - Avoid site-specific decisions
  - Investigate how the spatial configuration of wetlands influences contribution to watershed
- Considerations in model development
  - Hydrogeologic setting (watershed characteristics that control flow of surface and groundwater)
  - Geomorphology
  - Land use

Restoration Site-Suitability Model: Two-phase approach

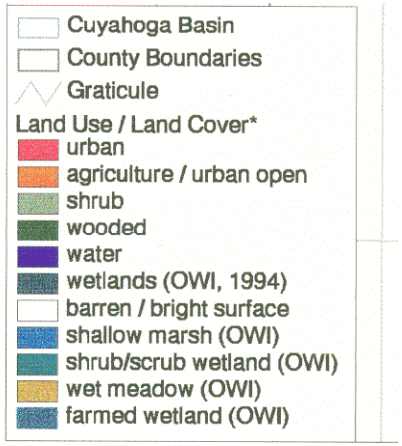
1. Identify total population of sites suitable for restoration
   - Those with high likelihood of success
   - Sustainable over the long-term

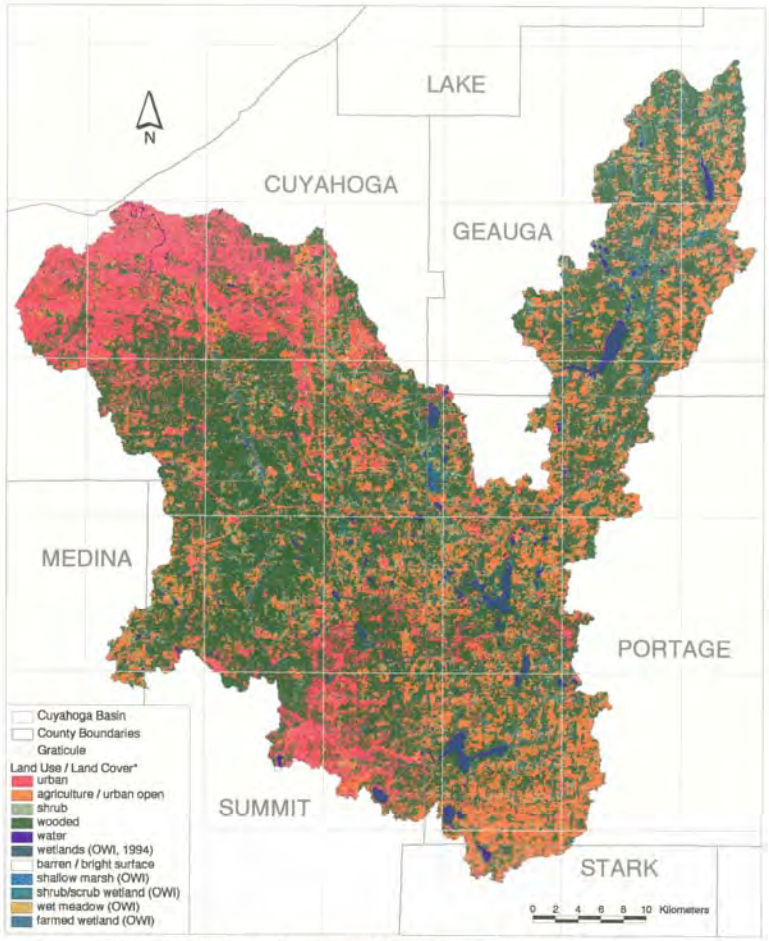
2. Of those, identify priority restoration areas
   - Contribute most to water resource integrity
     - Downstream systems
     - Adjacent wetlands

Suitability Modeling: a multi-criteria evaluation using GIS

- Landscape criteria
  - Physical parameters that characterize wetland form (local character)
    - Land use/land cover, existing wetlands, saturation index vegetation type, soils, topography
  - Parameters that characterize wetland function (neighborhood character)
    - Overland flow distance to perennial stream channel, stream order, in-stream water quality

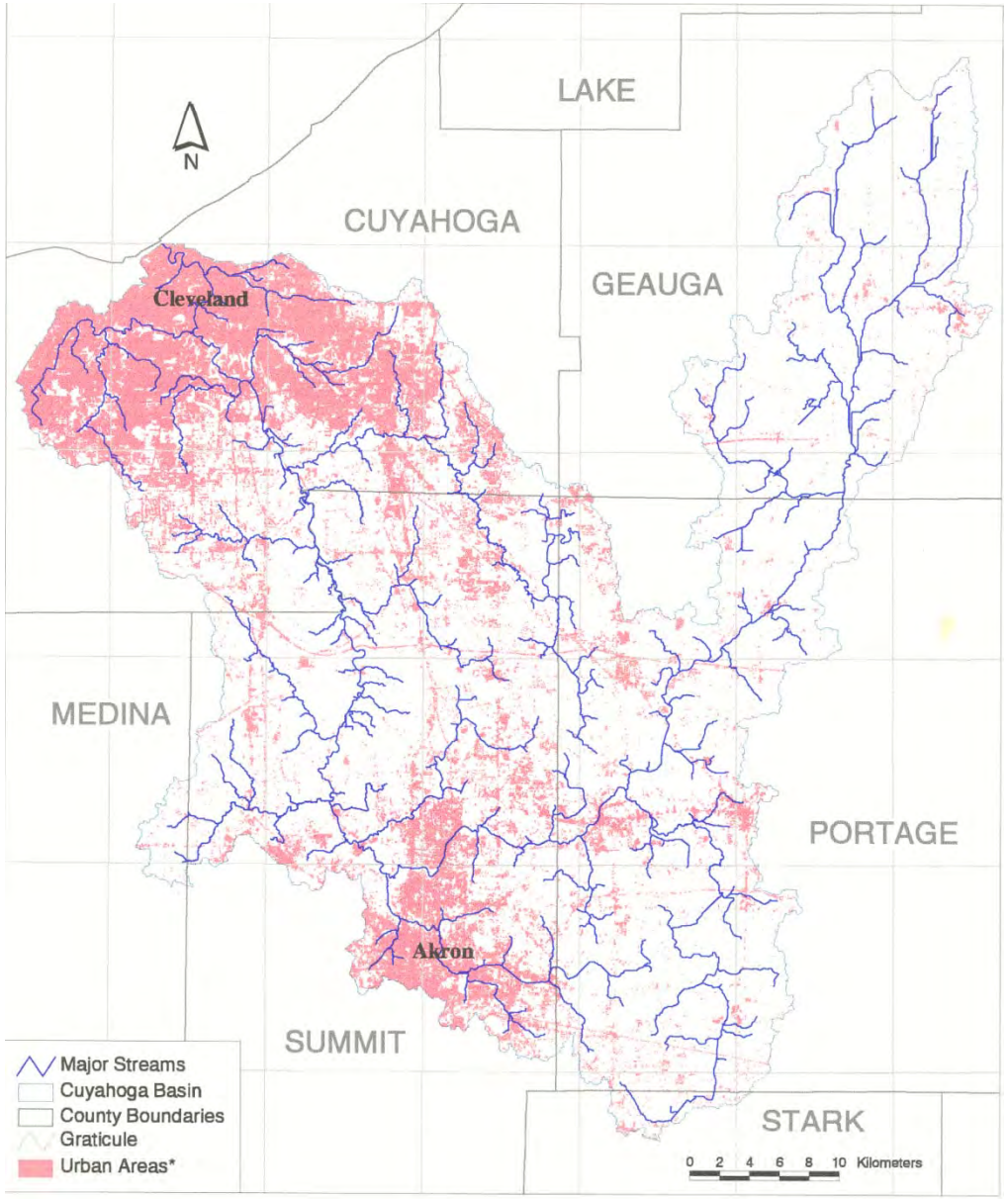
Cuyahoga Watershed: land use as a constraint





* Landuse / Landcover was classified by the Ohio Department of Natural Resources from Landsat TM satellite imagery.

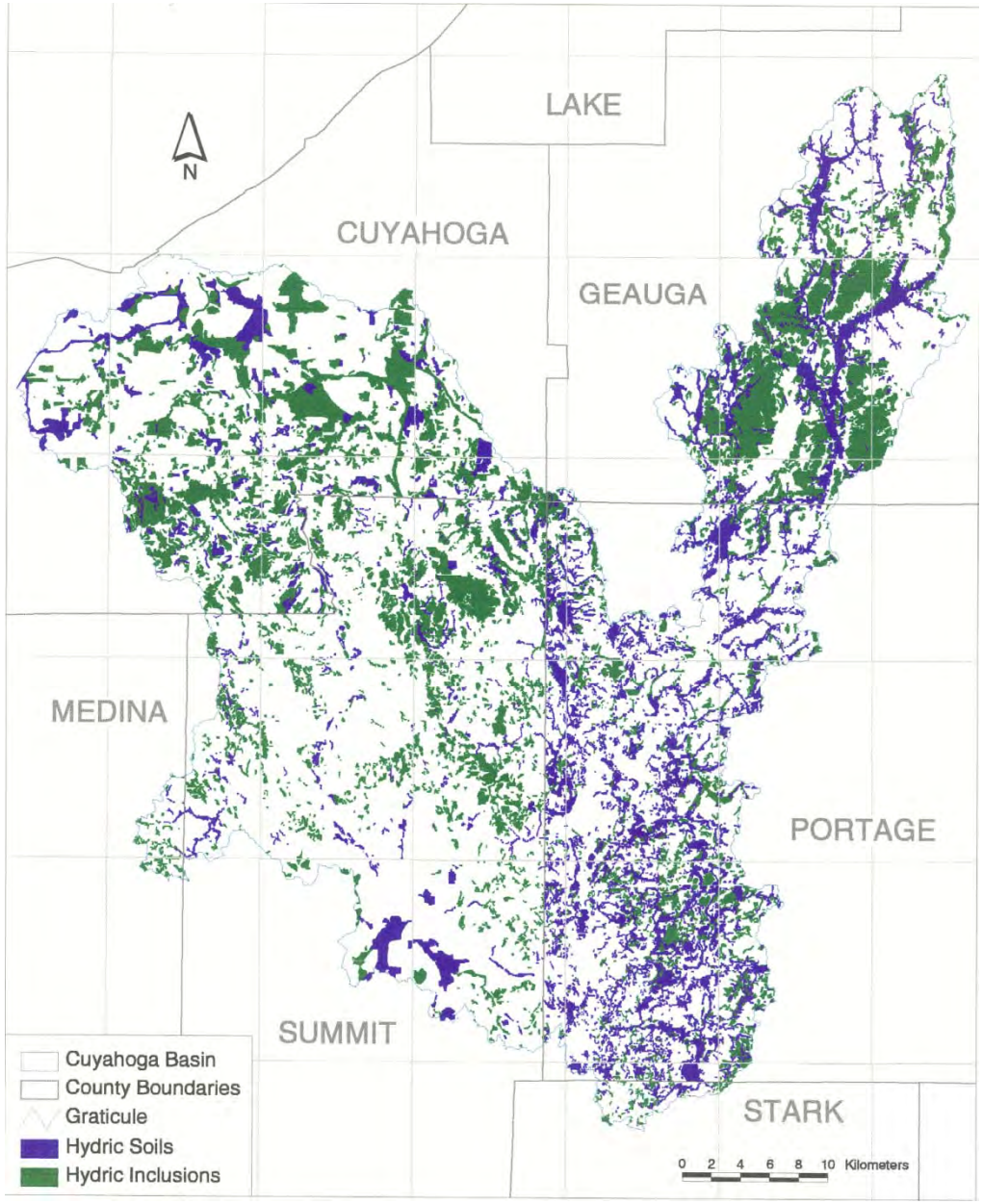
Cuyahoga Watershed: Urban land use



Suitability Modeling: multi-criteria evaluation using GIS

- Effectiveness matrix extracts all suitable sites
- Based on:
    - Land use type (urban, open water, transportation excluded)
    - Hydric soils and soils with hydric inclusions
    - Saturation index
    - Digital elevation model

Cuyahoga Watershed: Hydric soils



Suitability Modeling: multi-criteria evaluation using GIS

- A priority matrix summarizes importance to downstream areas
    - Stream order
    - Overland flow length
    - Saturation index
    - Stream condition in subwatershed (aquatic life use attainment)

Matrix algebra used to combine the pieces:

Restoration Potential =

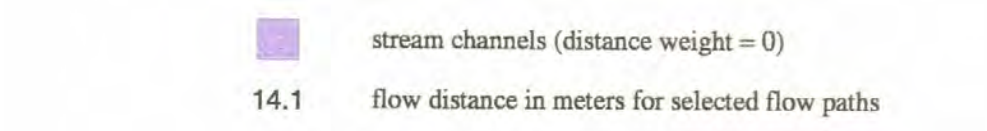
effectiveness matrix * priority matrix

Will the hydrology work? A topographic saturation index

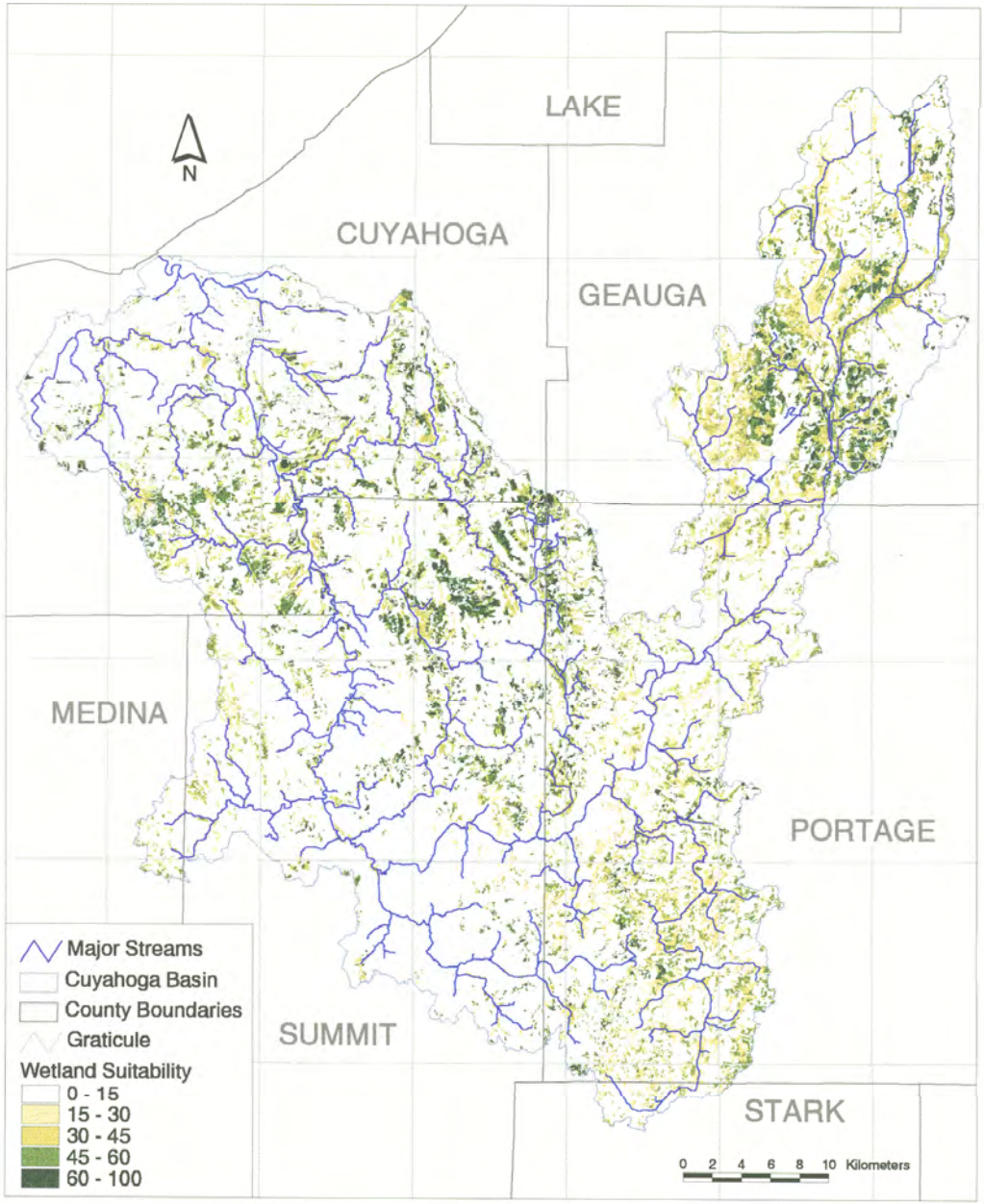
- Measures potential soil saturation for all grid cells in model
- Based on digital elevation model (DEM)
  - Slope
  - Flow accumulation (hydrologic length)
- Delineate subwatersheds to calculate drainage to any given point in study area

$$SI = \ln (a / \tan ß)$$

Flow path analysis: hydrologic distance



Cuyahoga Watershed: Wetland Restoration Model



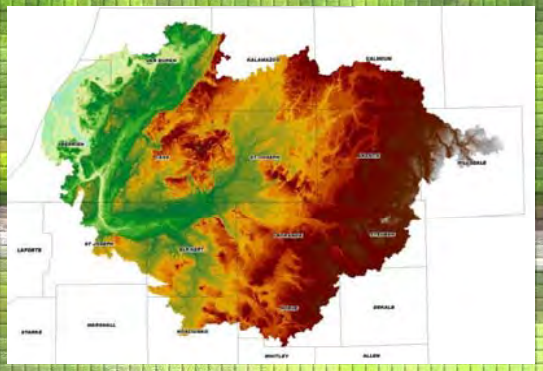
Restoration Site-Suitability Model: Two-phase approach

1. Resource Phase
   - Identify population of sites available for restoration
   - Have high likelihood of success
   - Sustainable over the long-term

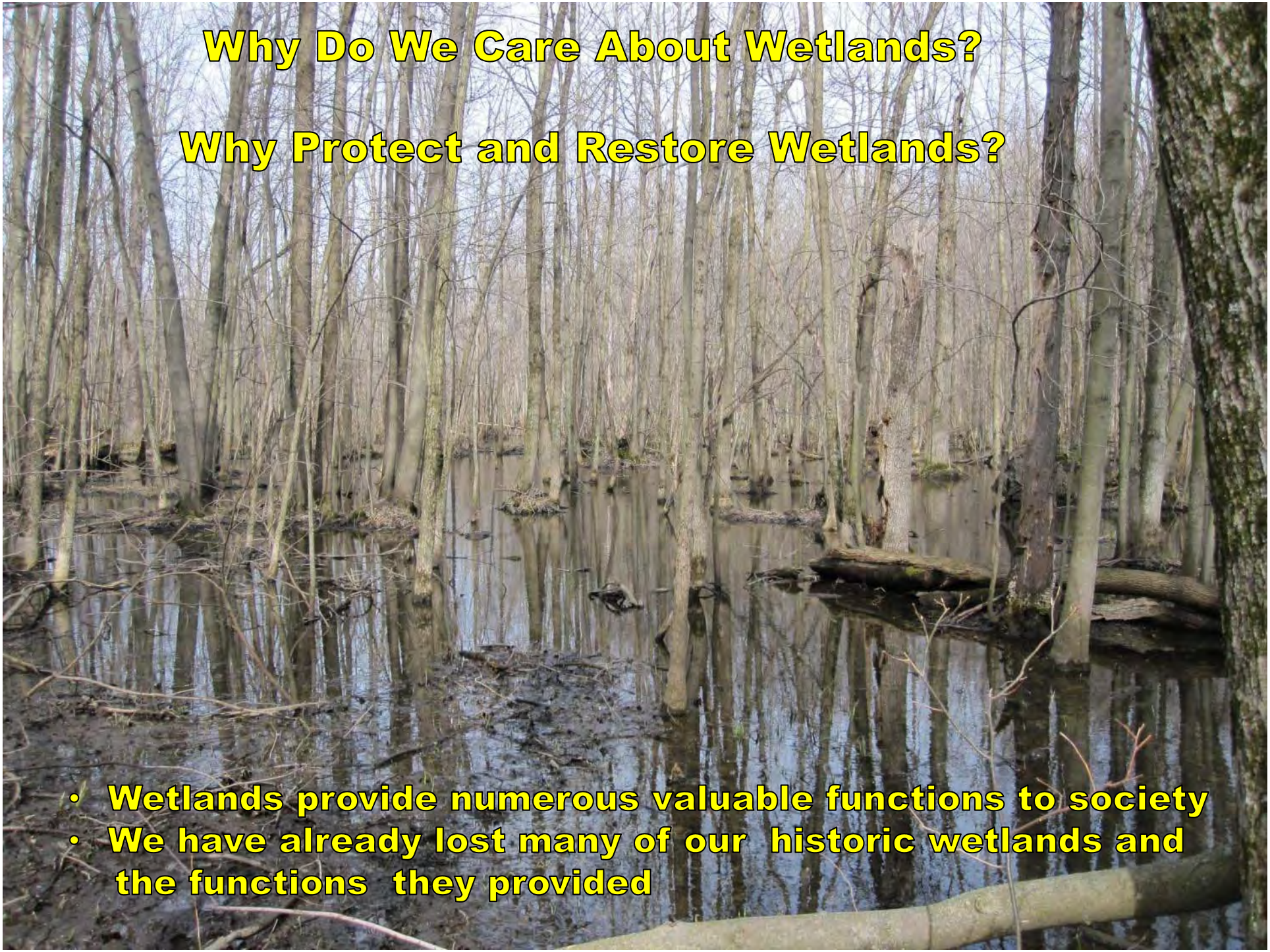
2. Application Phase
   - “Filter” the population of available sites based on watershed goals and regional priorities

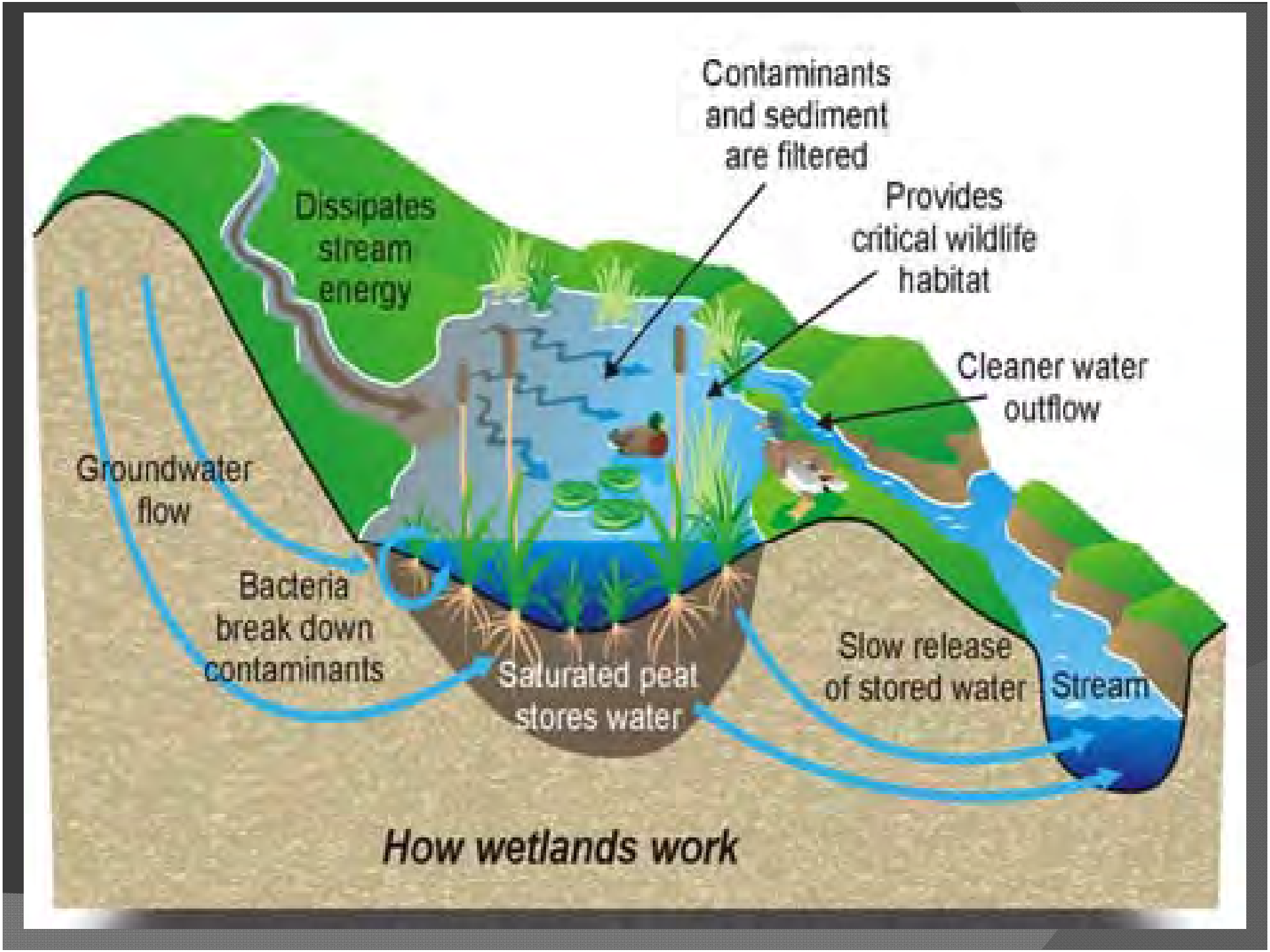
WETLANDS AND WATERSHED PLANNING IN MICHIGAN:

Landscape Level Wetland Functional Assessment



Department of Environmental Quality
Water Resources Division

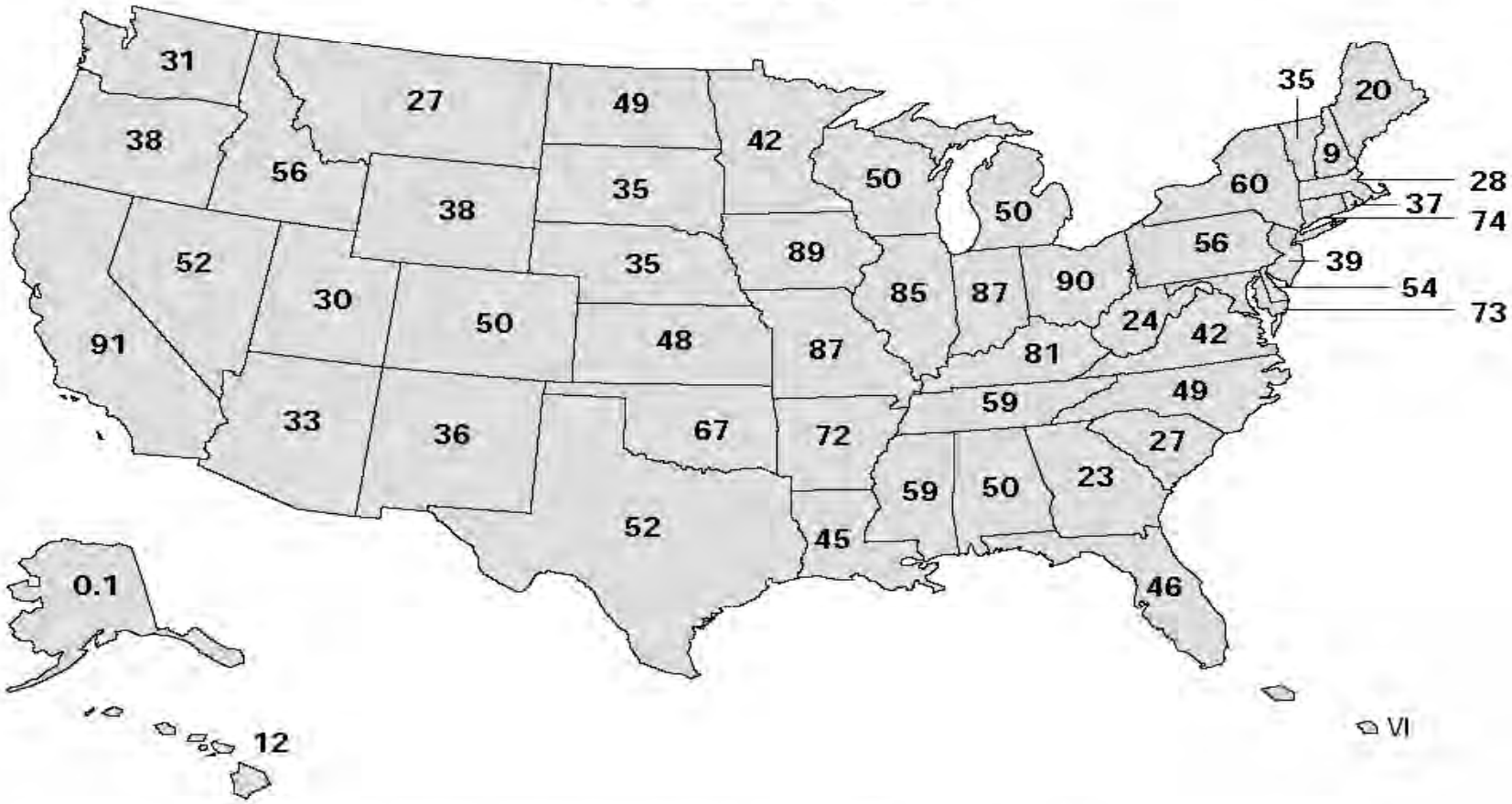

Why Do We Care About Wetlands?
Why Protect and Restore Wetlands?
• Wetlands provide numerous valuable functions to society
• We have already lost many of our historic wetlands and the functions they provided


Contaminants and sediment are filtered
Provides critical wildlife habitat
Dissipates stream energy
Cleaner water outflow
Groundwater flow
Bacteria break down contaminants
Saturated peat stores water
Slow release of stored water
Stream
How wetlands work

Flood Water Storage
Natures Sponges

- Reduced Flooding and Associated Damage During High Water Events
- Reduces Flashiness of Streams
  a) Reduces Bank Erosion
- Releases Water Slowly Over Time Which Provides Stable Stream Flows
  a) streams don't dry up in summer
  b) improves biological health of stream

Percentage of Wetland Acreage Lost, 1780s-1980s



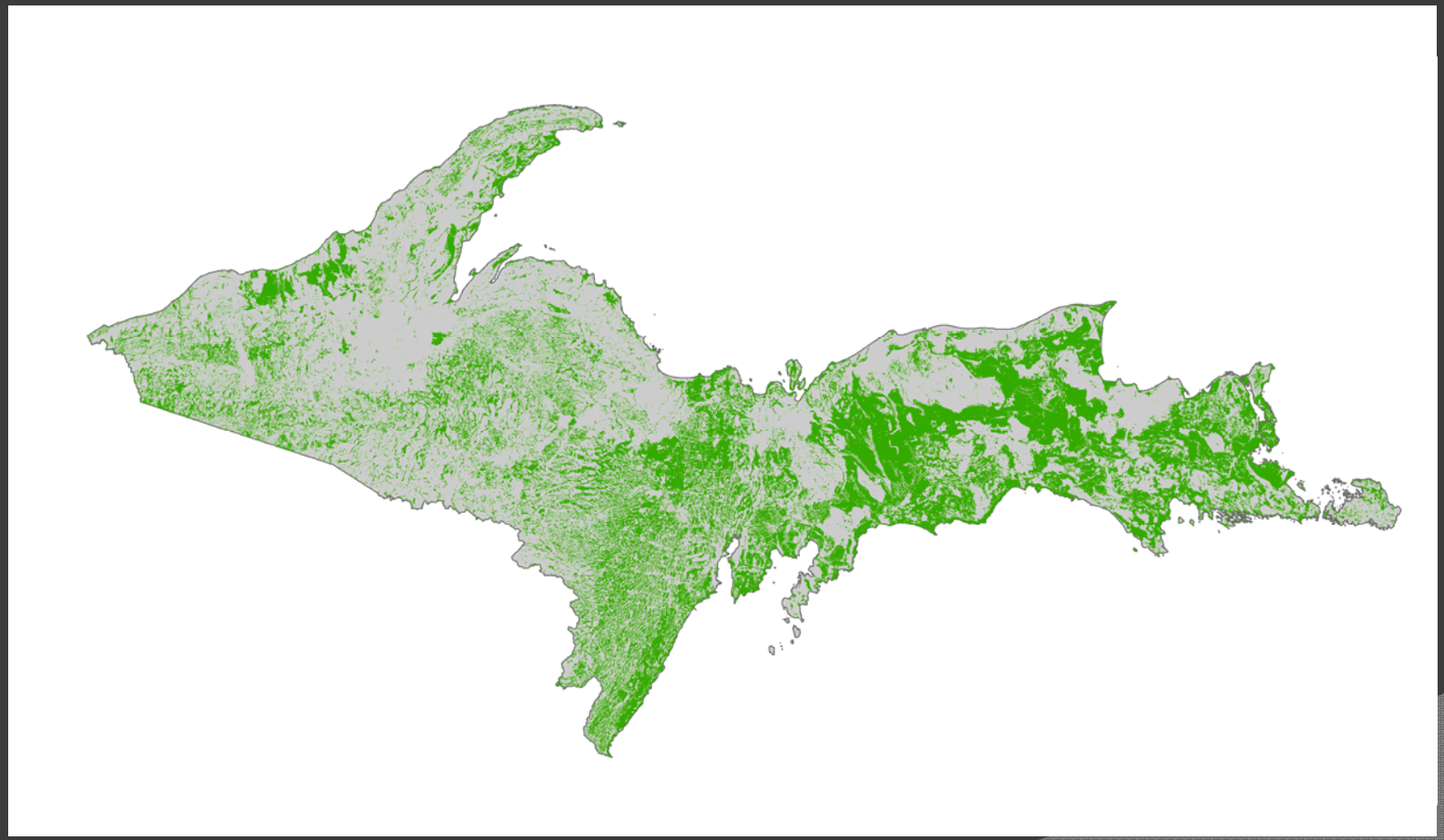
Twenty-two States have lost at least 50% of their original wetlands. Seven of these 22 (California, Indiana, Illinois, Iowa, Missouri, Kentucky, and Ohio) have lost more than 80% of their original wetlands.

Source: Dahl, T.E., 1990, *Wetlands Losses in the United States 1780's to 1980's*, U.S. Department of the Interior, Fish and Wildlife Service.

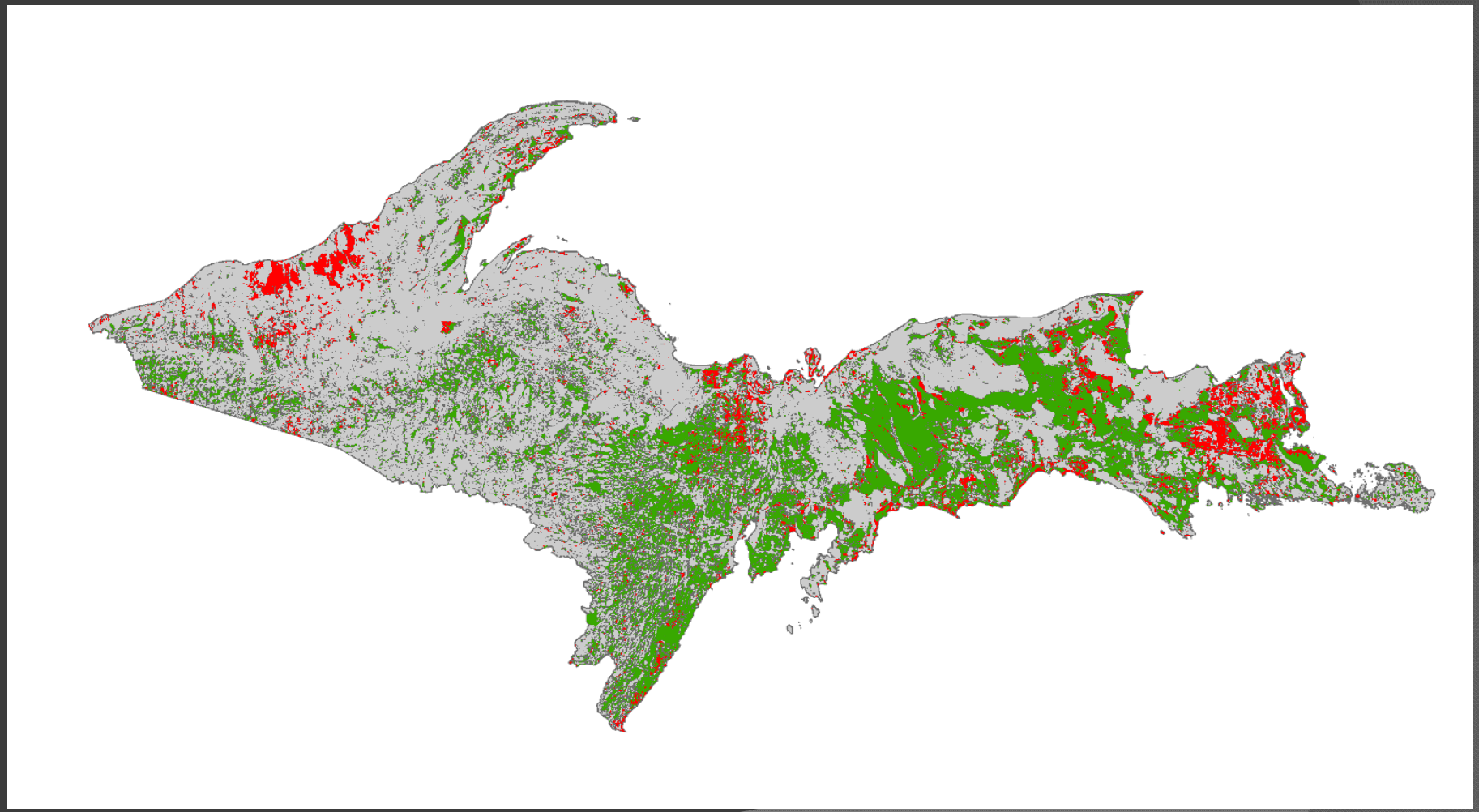
MICHIGAN'S WETLAND LOSES NOT UNIFORM

- UPPER PENINSULA – 17% LOSS (638,000 ACRES)
- NORTHERN LOWER PENINSULA – 20% LOSS (387,000 ACRES)
- SOUTHERN LOWER PENINSULA – 66% LOSS (3,320,000 ACRES)
- GREAT LAKES COASTAL WETLANDS – 71% LOSS

UPPER PENINSULA: PRE-SETTLEMENT WETLANDS

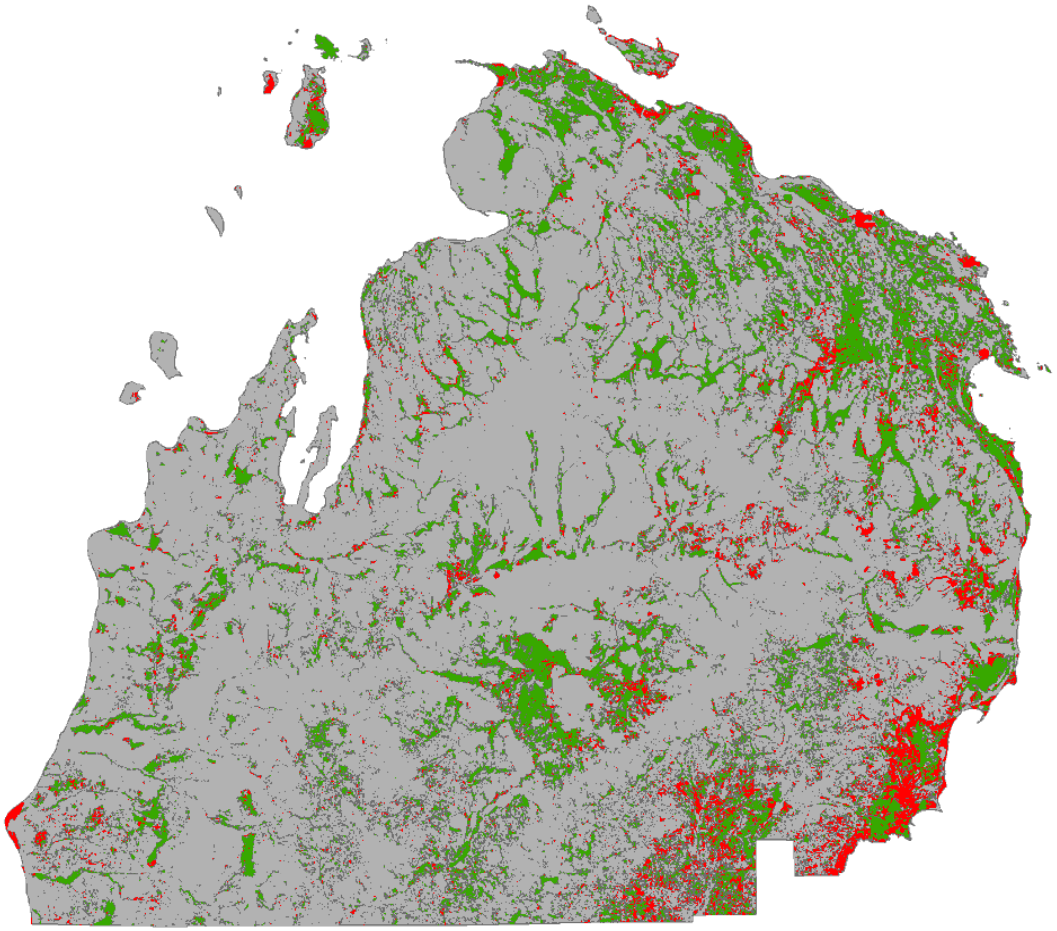


UPPER PENINSULA: APPROXIMATE AREAS OF WETLAND LOSS

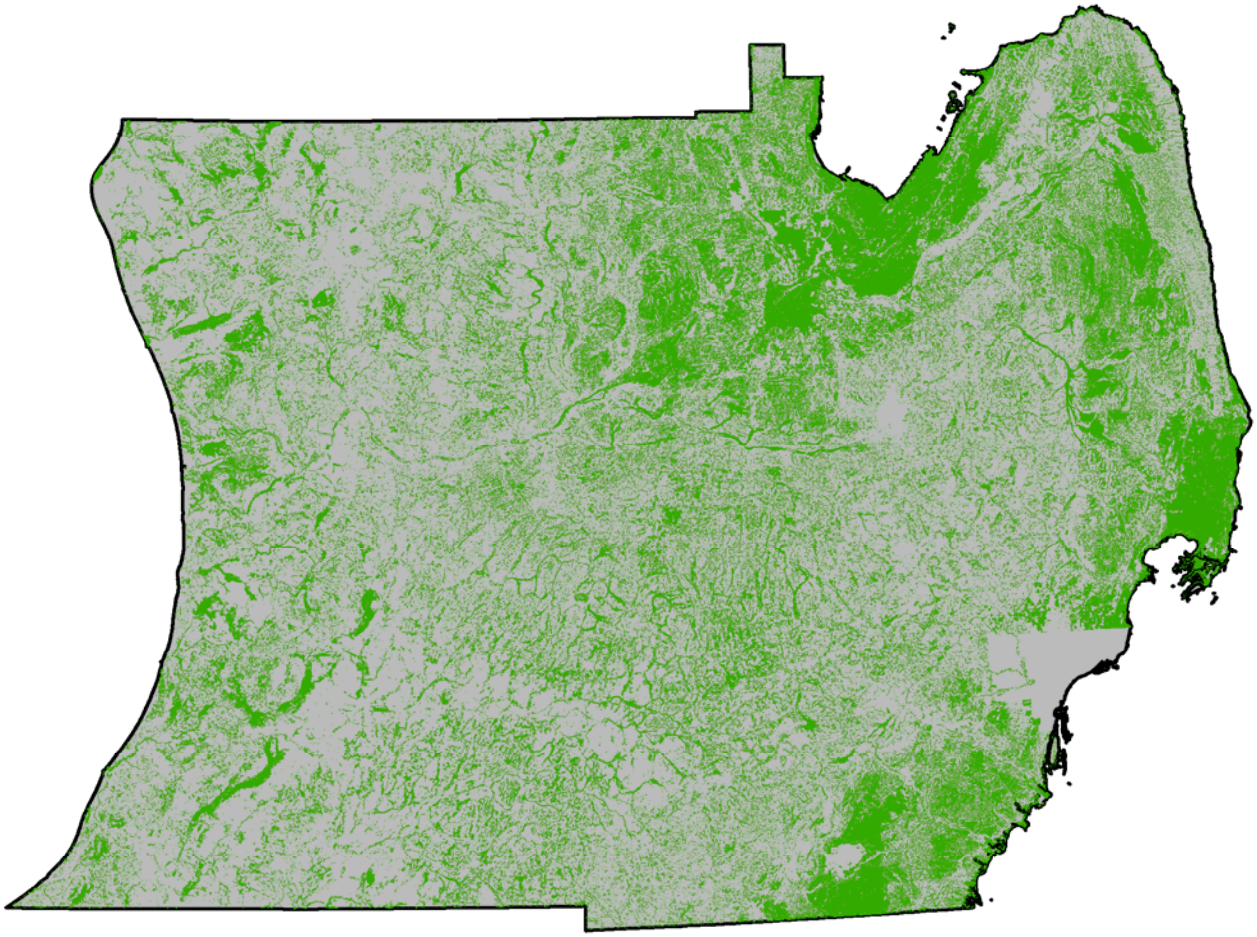


Northern Lower Peninsula: PRE-SETTLEMENT WETLANDS

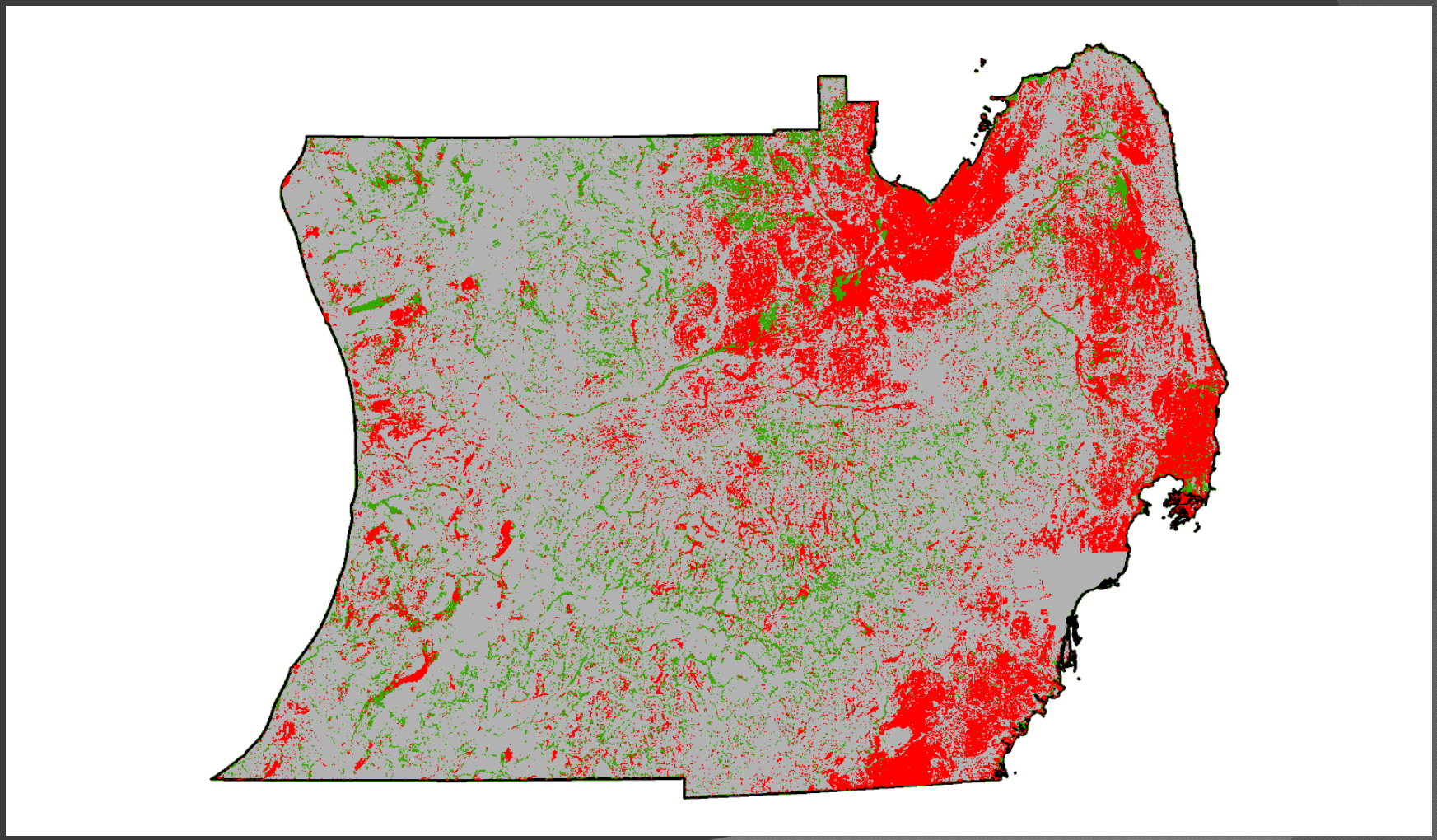
Northern Lower Peninsula:
APPROXIMATE AREAS OF WETLAND LOSS



Southern Lower Peninsula: PRE-SETTLEMENT WETLANDS



Southern Lower Peninsula:
APPROXIMATE AREAS OF WETLAND LOSS



Wetland Loss = Functions Lost

- Wetland loss has always been expressed as acreage loss.
- What does the loss 35,170 acres of wetlands really mean in the Thornapple River Watershed Less the Coldwater River Watershed?
- What does the loss 11,530 acres of wetlands really mean in the Coldwater River Watershed?
- LLWFA allows wetland loss to be expressed in terms of functions lost

3 Step process for watershed planning

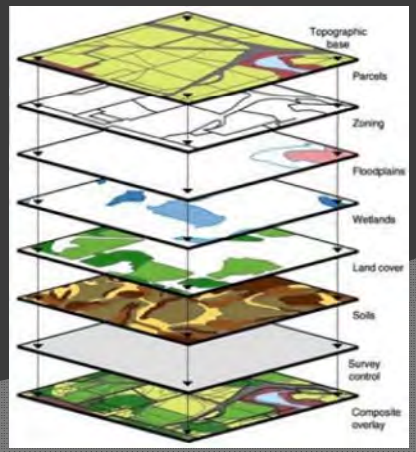
1. ENHANCE existing and historic wetland data

2. PRIORITIZE by geography to identify areas of priority

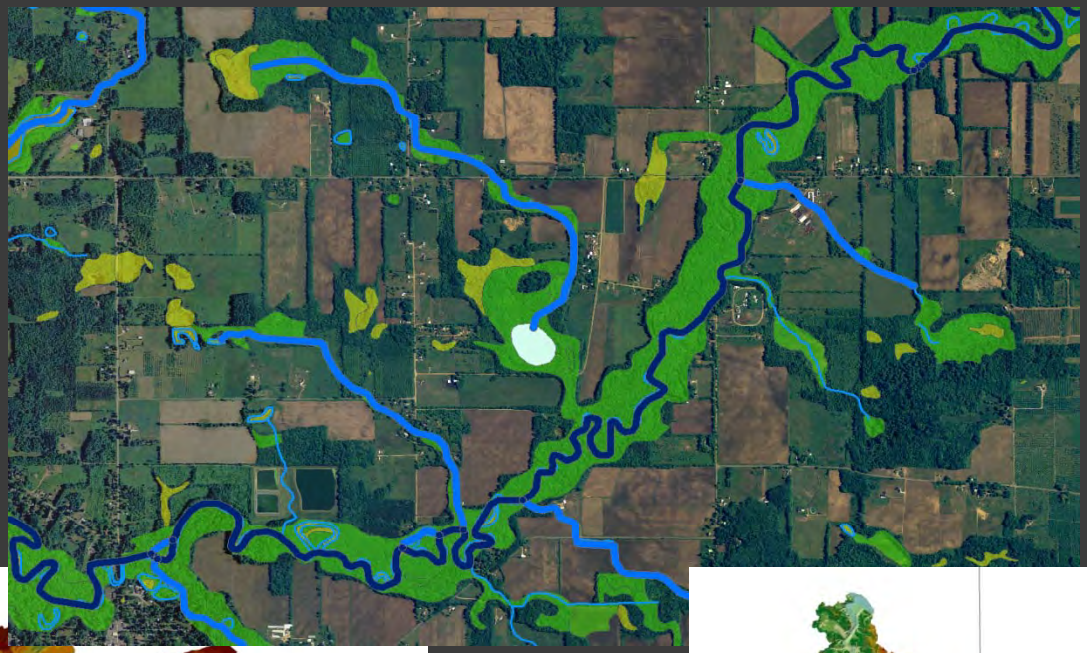
3. UTILIZE results to assist in the planning effort.

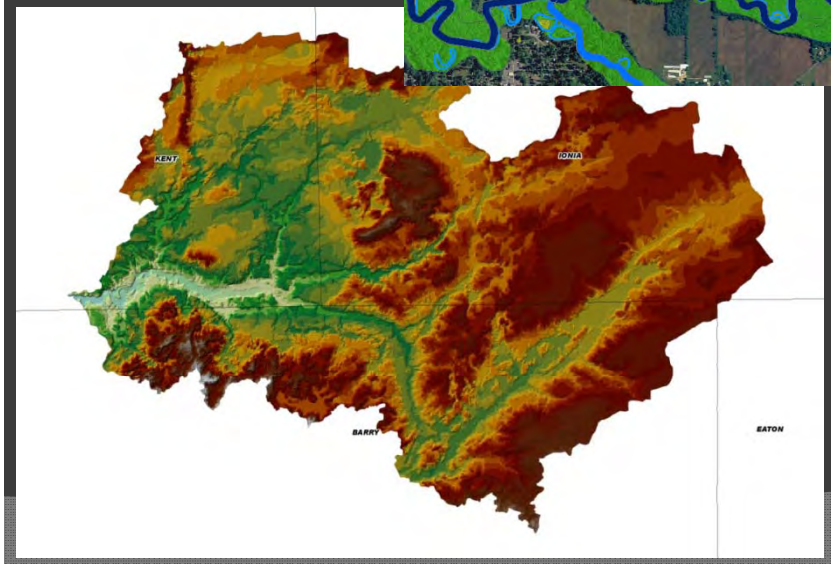
49% Acreage Lost in the Coldwater River Watershed

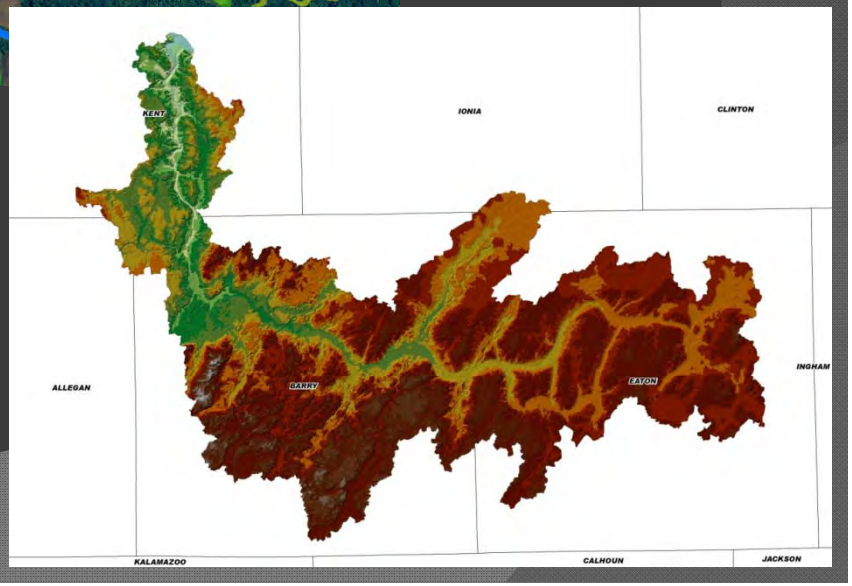
36% Flood Storage Capacity Lost



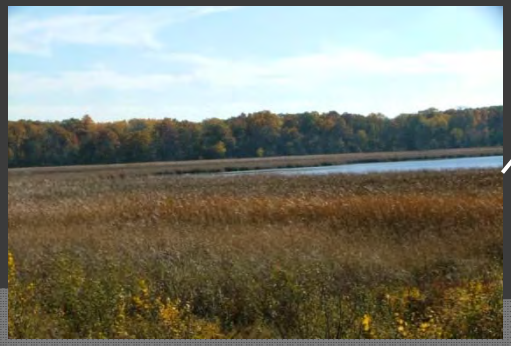
Step 1. ENHANCING NWI FOR LANDSCAPE-LEVEL WETLAND FUNCTIONAL ASSESSMENT

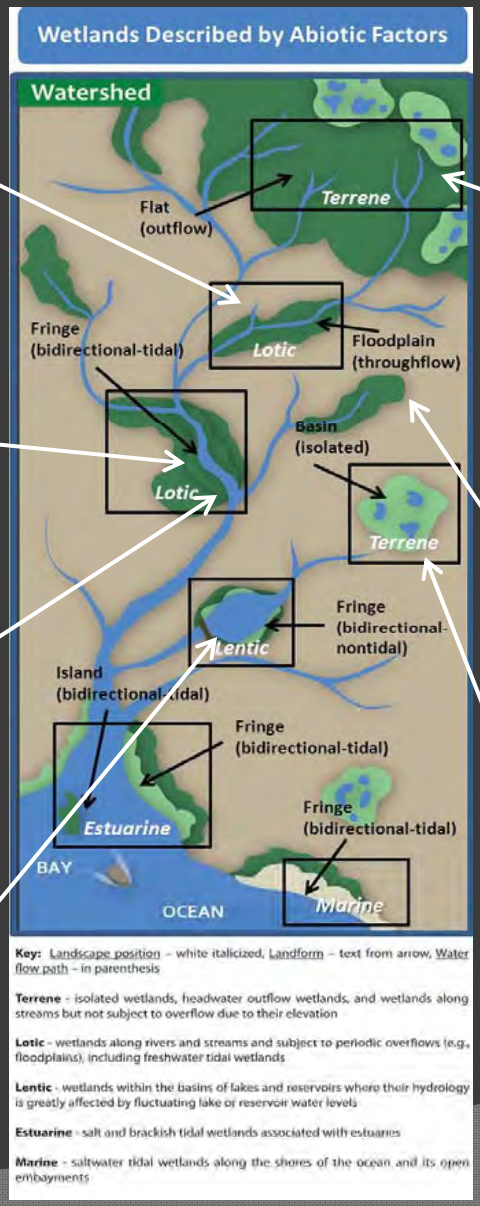


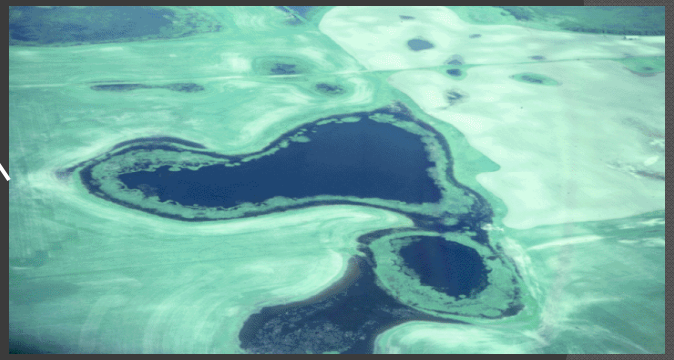




Step 1. enhance



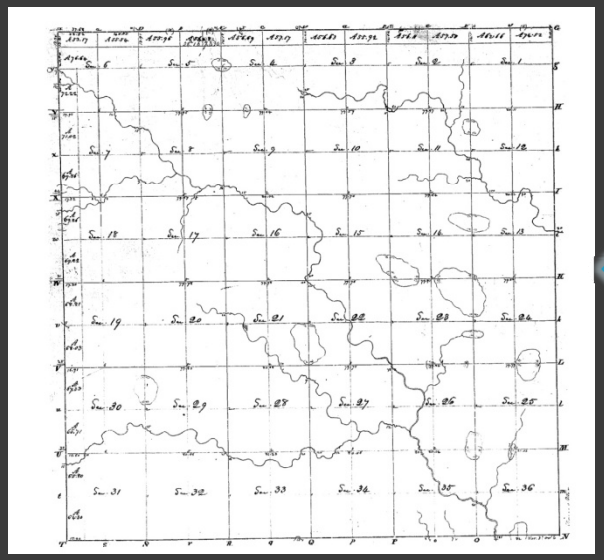


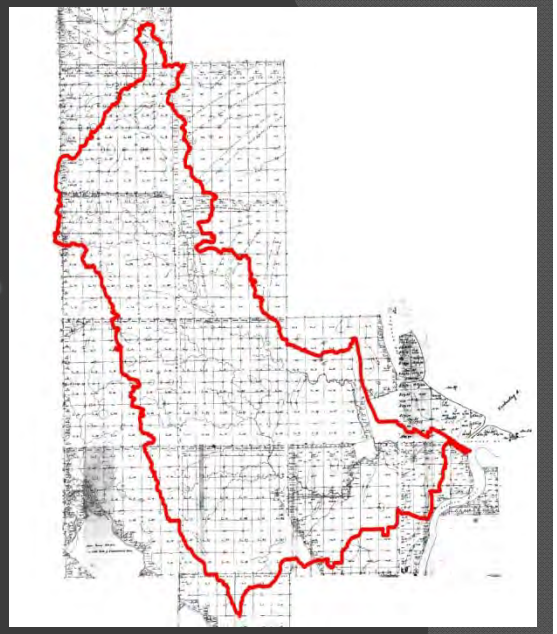


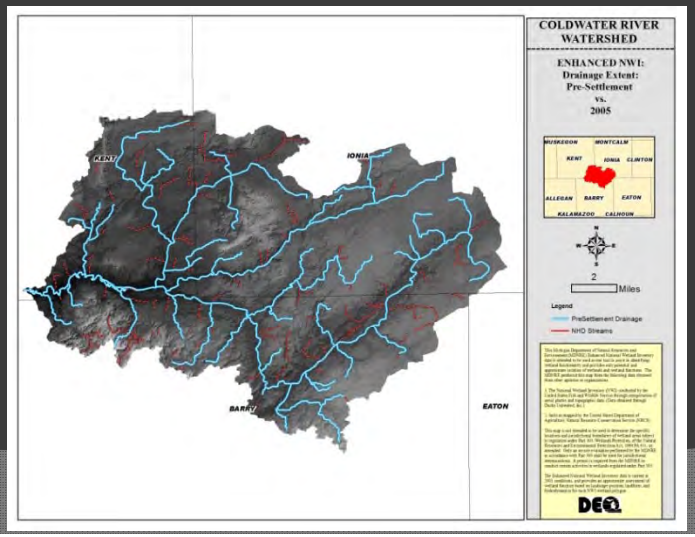
Step 1. Enhance

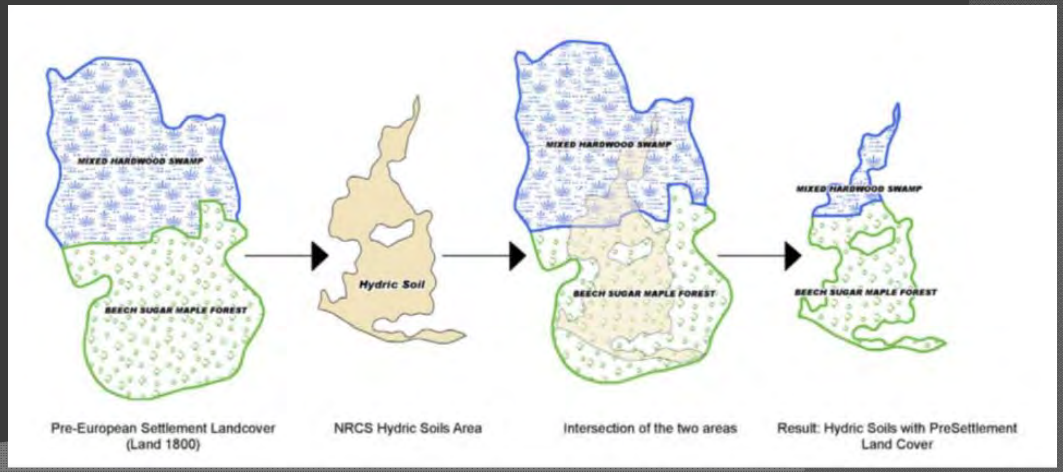
Create Pre-Settlement wetland data

- Based on the presence of hydric soils
- Utilize historic land cover data
- Determine historic drainage extent
- Add HGM attributes









Evaluated Wetland Functions

- Water Quality Functions
  - Flood Water Storage
  - Streamflow Maintenance
  - Nutrient Transformation
  - Sediment and Other Particulate Retention
  - Shoreline Stabilization
  - Stream Shading
  - Ground Water Influence
  - Carbon Sequestration
  - Pathogen Retention
- Habitat Functions
  - Fish Habitat
  - Waterfowl/Waterbird Habitat
  - Shorebird Habitat
  - Interior Forest Bird Habitat
  - Amphibian Habitat
  - Conservation of Rare and Imperiled Wetlands & Species

Step 2. Prioritize

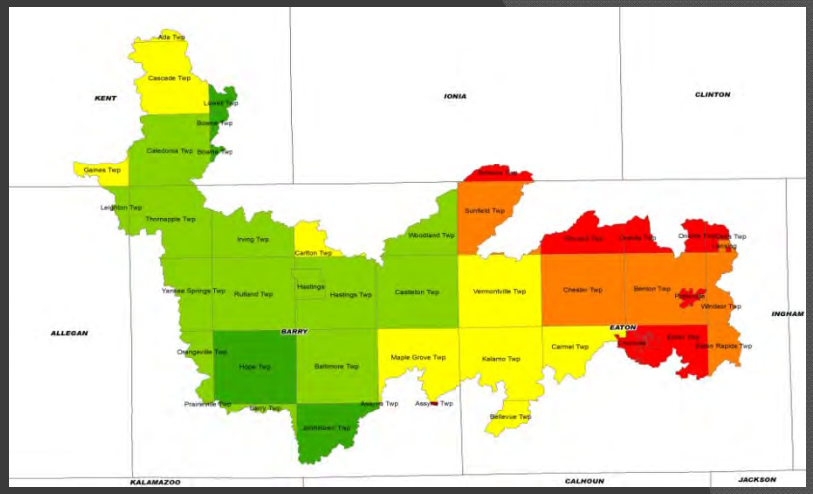
Understand Acreage vs. Function Loss

Area	Acreage Loss	Floodwater Storage Loss	Sediment Retention Loss	Nutrient Transformation	Combined Water Quality Loss	Habitat Loss
Thornapple River (Less Coldwater)	44%	40%	33%	44%	40%	32%
Chester Township	58%	61%	54%	65%	61%	66%
Coldwater River	49%	44%	32%	48%	45%	38%
Bear Creek Sub-basin	54%	52%	45%	54%	54%	46%

- **Water Quality**- Floodwater Storage, Sediment Retention, Nutrient Transformation, Shoreline Stabilization, Streamflow Maintenance, Carbon Sequestration, and Pathogen Retention
- **Wildlife Habitat**- Fish, Waterfowl, Interior Forest Bird, Shorebird, and Amphibian Habitat.

Step 2. Prioritize

Rank by Geography & Or Function



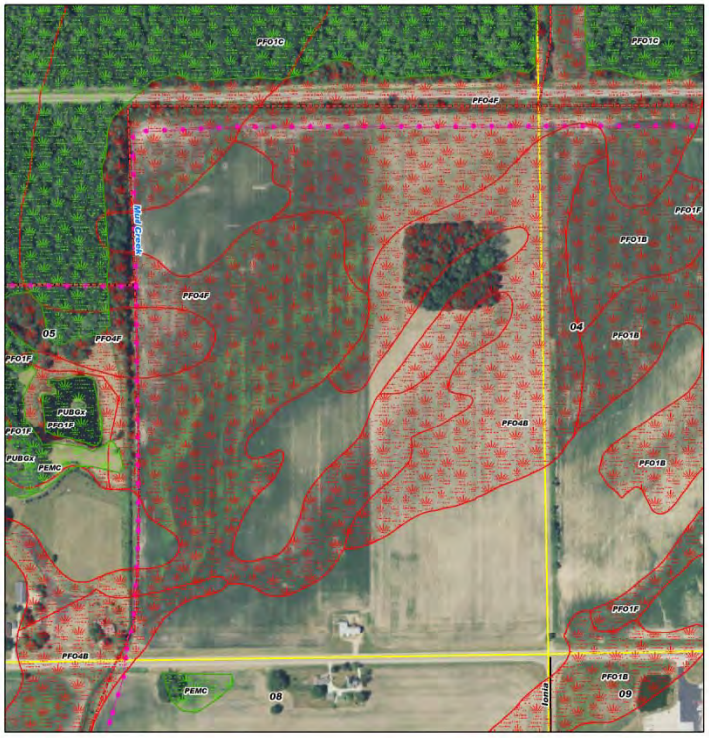
Sediment Retention Loss by Sub-Watershed

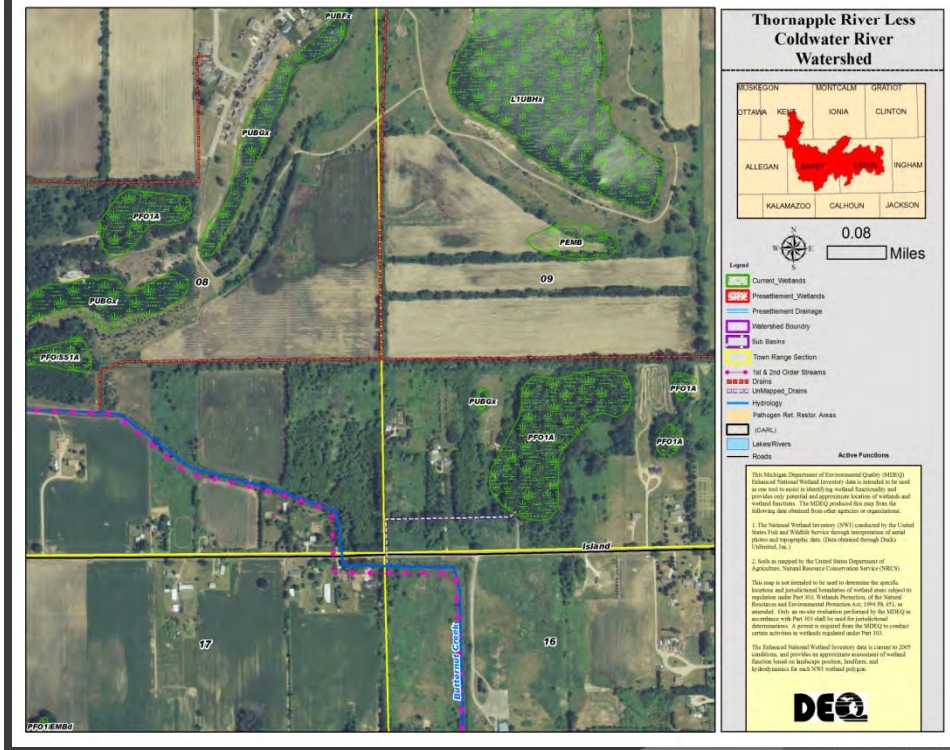
Rank	HU_12_NAME	Wetland Acreage	Sediment Retention Loss PCT
1	Duck Creek	923	57.8
2	Bear Creek	1,357	45.1
3	Messer Brook-Coldwater River	1,020	44.8
4	Jordan Lake-Little Thornapple River	1,025	42.2
5	Woodland Creek-Little Thornapple River	825	41.8
6	Pratt Lake Creek	1,401	8.4
7	Coldwater River	3,270	0.0

Wetland Loss By Township & Cities

Rank	NAME	Wetland Acres	Wetland Loss Percentage
1	Bowne Twp	251	0.0
2	Prairieville Twp	0	0.0
3	Johnstown Twp	1,611	2.6
4	Lowell Twp	368	5.7
5	Hope Twp	4,001	8.5
6	Castleton Twp	3,218	14.6
7	Leighton Twp	192	15.8
8	Orangeville Twp	334	17.0
9	Rutland Twp	2,998	19.7
10	Barry Twp	342	22.7
11	Thornapple Twp	1,590	23.8
12	Baltimore Twp	3,251	23.9
13	Yankee Springs Twp	1,060	24.6
14	Woodland Twp	1,080	25.6
15	Hastings	234	26.6
16	Irving Twp	1,430	27.1
17	Caledonia Twp	1,805	30.0
18	Hastings Twp	1,881	30.4
19	Carlton Twp	660	34.7
20	Bellevue Twp	672	36.2
21	Vermontville Twp	2,831	36.4
22	Ada Twp	163	42.6
23	Maple Grove Twp	1,977	45.8
24	Cascade Twp	947	47.1
25	Carmel Twp	1,149	47.8
26	Kalamo Twp	2,247	49.1
27	Gaines Twp	350	52.3
28	Chester Twp	2,084	58.6
29	Windsor Twp	750	63.0
30	Benton Twp	1,629	66.3
31	Sunfield Twp	1,159	67.8
32	Eaton Rapids Twp	457	71.2
33	Lansing	79	71.8
34	Eaton Twp	772	75.6
35	Assyria Twp	1	79.6
36	Delta Twp	169	81.8
37	Sebewa Twp	172	81.9
38	Roxand Twp	463	82.3
39	Potterville	21	83.6
40	Oneida Twp	342	86.4
41	Charlotte	81	88.6

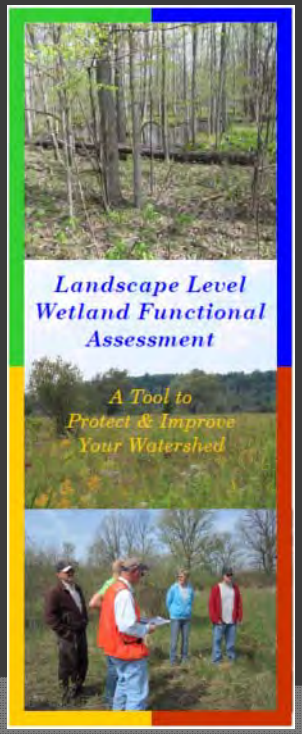
Step 3. utilize

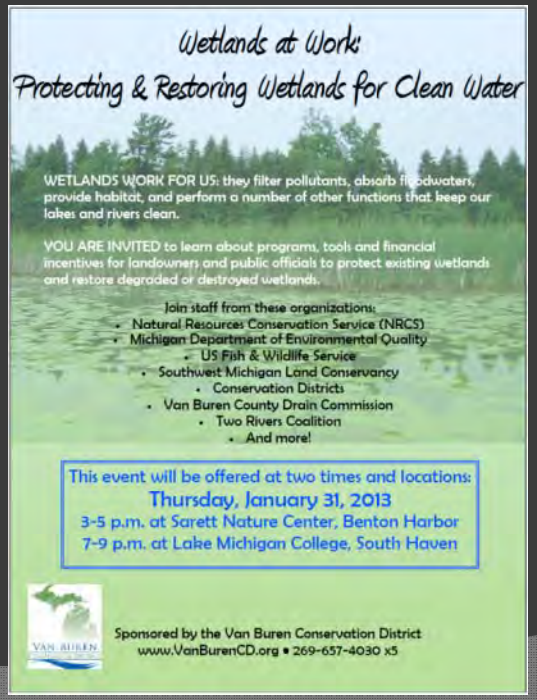


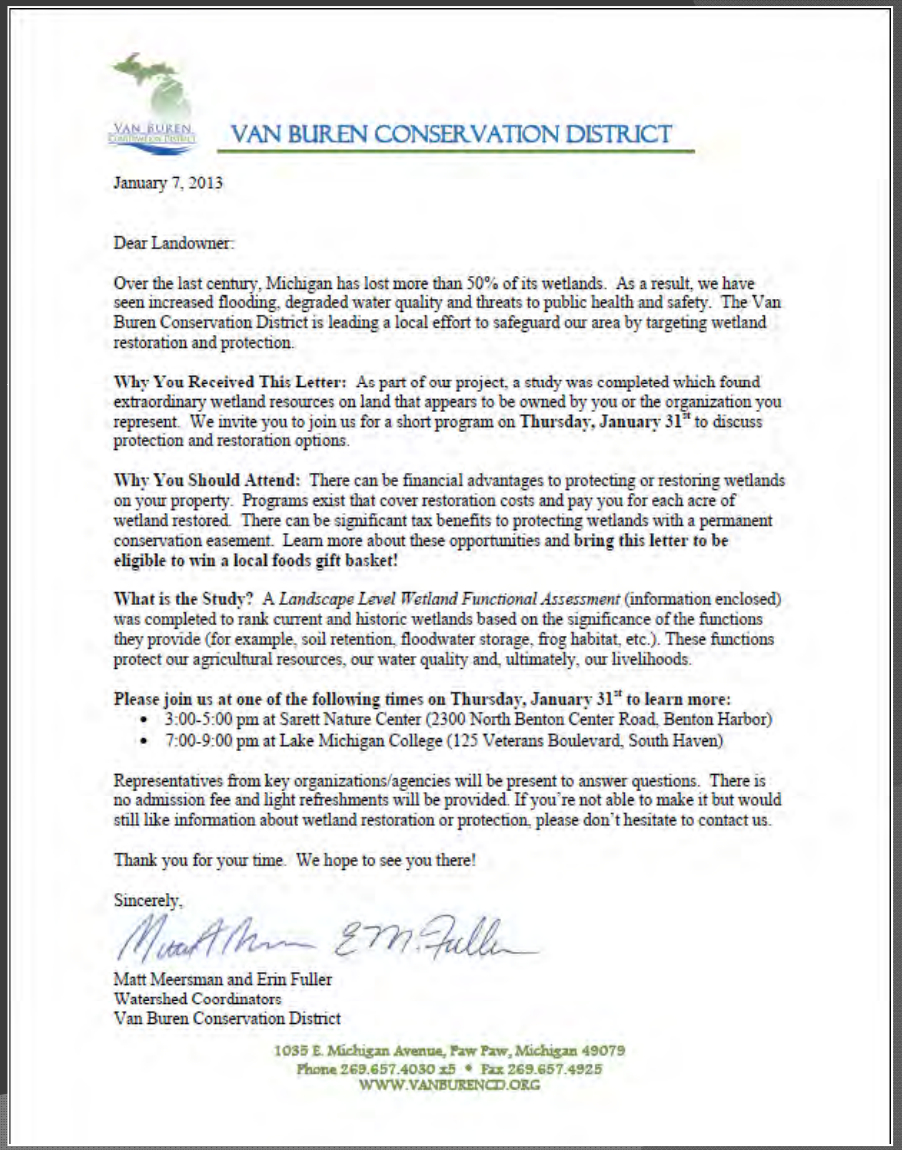


Step 3. Utilize

- Targeting Outreach
- Strategic Planning
- Decision Making







VAN BUREN CONSERVATION DISTRICT

January 7, 2013

Dear Landowner:

Over the last century, Michigan has lost more than 50% of its wetlands. As a result, we have seen increased flooding, degraded water quality and threats to public health and safety. The Van Buren Conservation District is leading a local effort to safeguard our area by targeting wetland restoration and protection.

Why You Received This Letter: As part of our project, a study was completed which found extraordinary wetland resources on land that appears to be owned by you or the organization you represent. We invite you to join us for a short program on **Thursday, January 31st** to discuss protection and restoration options.

Why You Should Attend: There can be financial advantages to protecting or restoring wetlands on your property. Programs exist that cover restoration costs and pay you for each acre of wetland restored. There can be significant tax benefits to protecting wetlands with a permanent conservation easement. Learn more about these opportunities and **bring this letter to be eligible to win a local foods gift basket!**

What is the Study? A *Landscape Level Wetland Functional Assessment* (information enclosed) was completed to rank current and historic wetlands based on the significance of the functions they provide (for example, soil retention, floodwater storage, frog habitat, etc.). These functions protect our agricultural resources, our water quality and, ultimately, our livelihoods.

Please join us at one of the following times on Thursday, January 31st to learn more:

- 3:00-5:00 pm at Sarett Nature Center (2300 North Benton Center Road, Benton Harbor)
- 7:00-9:00 pm at Lake Michigan College (125 Veterans Boulevard, South Haven)

Representatives from key organizations/agencies will be present to answer questions. There is no admission fee and light refreshments will be provided. If you're not able to make it but would still like information about wetland restoration or protection, please don't hesitate to contact us.

Thank you for your time. We hope to see you there!

Sincerely,

Matt Meersman and Erin Fuller
Watershed Coordinators
Van Buren Conservation District

1035 E. Michigan Avenue, Paw Paw, Michigan 49079
Phone 269.657.4030 x5 • Fax 269.657.4925
WWW.VANBURENCD.ORG

Step 3. Utilize

Decision Making

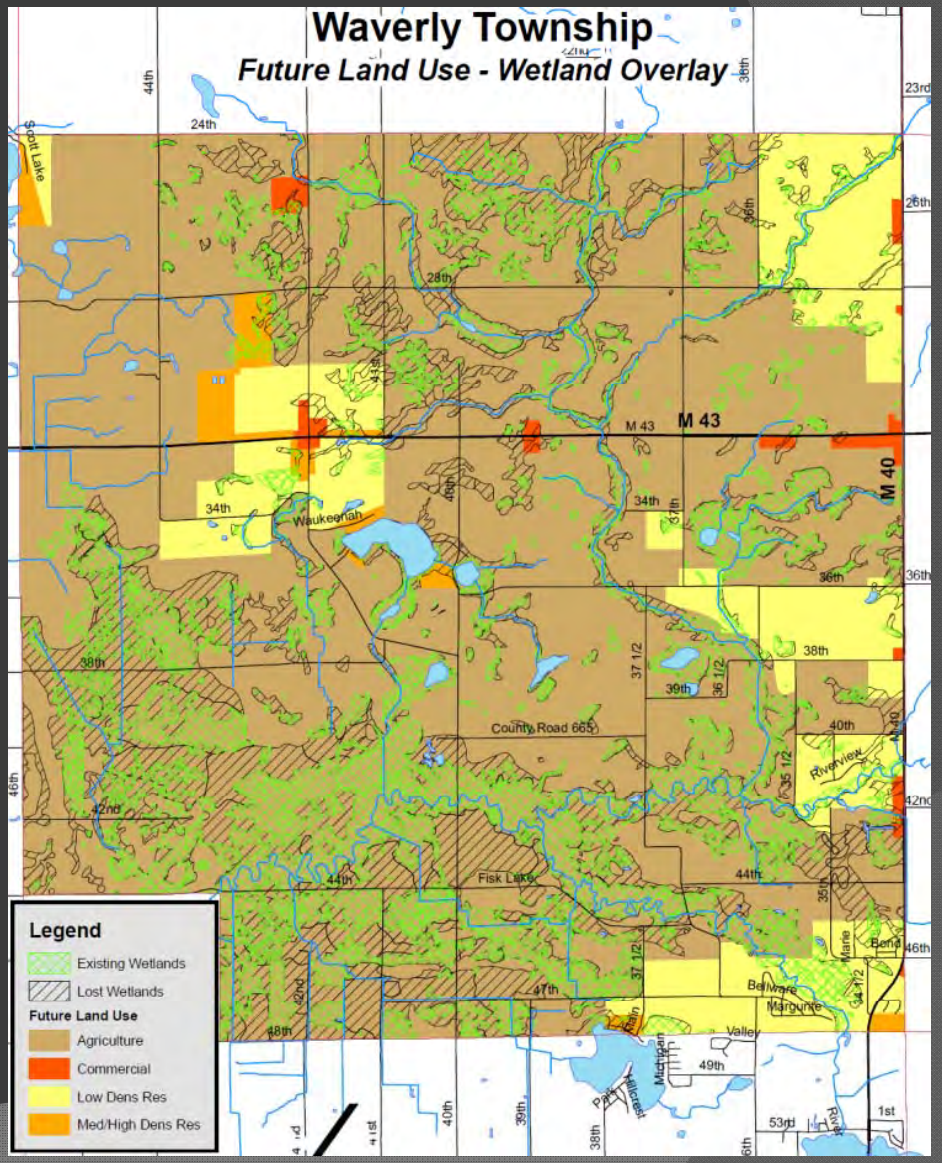
- Support more restrictive zoning and better land use planning

Legend

- Existing Wetlands
- Lost Wetlands

Future Land Use

- Agriculture
- Commercial
- Low Dens Res
- Med/High Dens Res

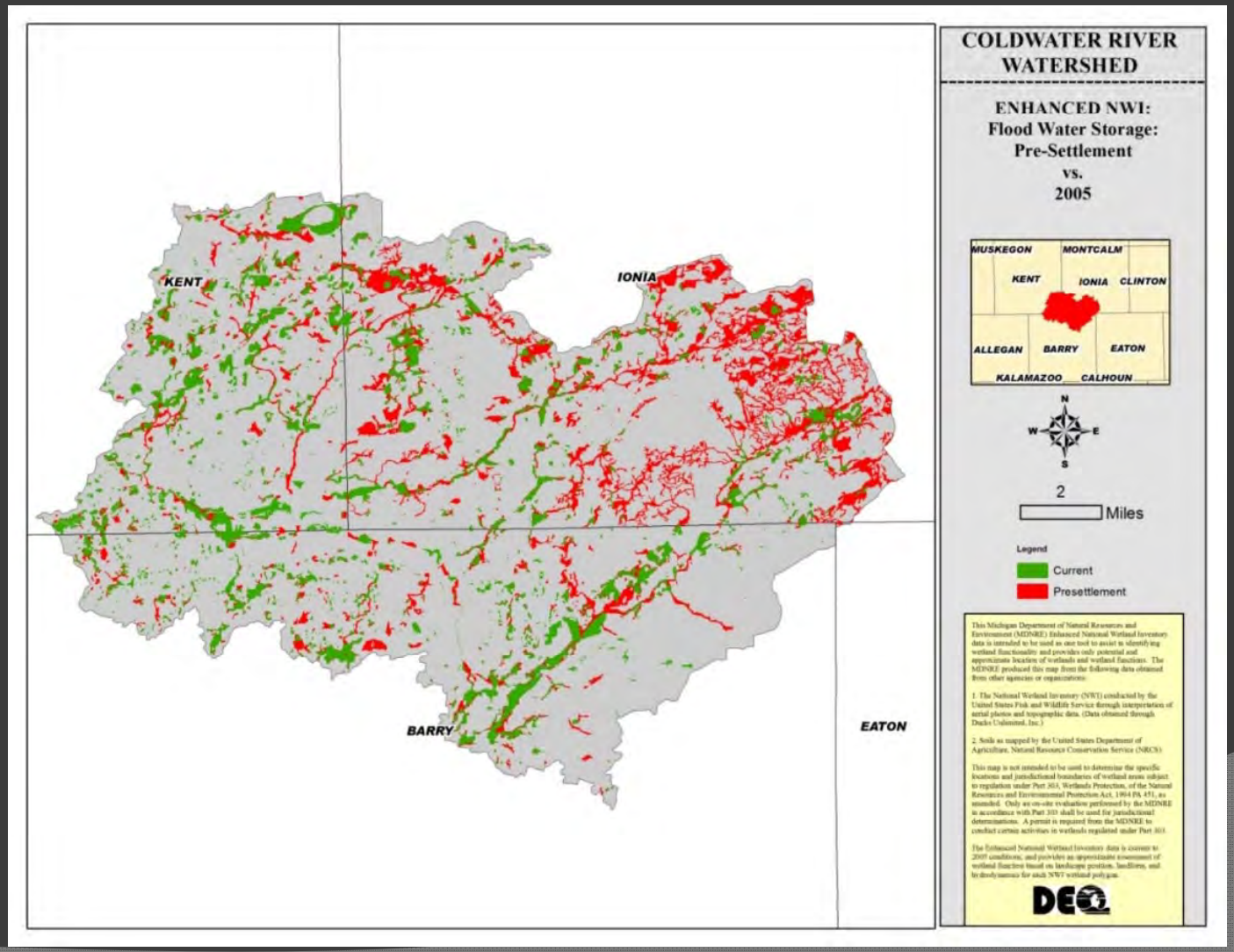


Keeping Opportunities for Protection and Restoration

FLOOD WATER STORAGE

- This function is important for reducing the downstream flooding and lowering flood heights, both of which aid in minimizing property damage and personal injury from such events.
- The following map illustrates wetlands that perform the above ecological service at a level of significance above that of wetlands not designated. Wetlands deemed to be performing this function are mapped in two distinct time periods; Pre-European settlement (red), and wetlands circa 2005 (green).

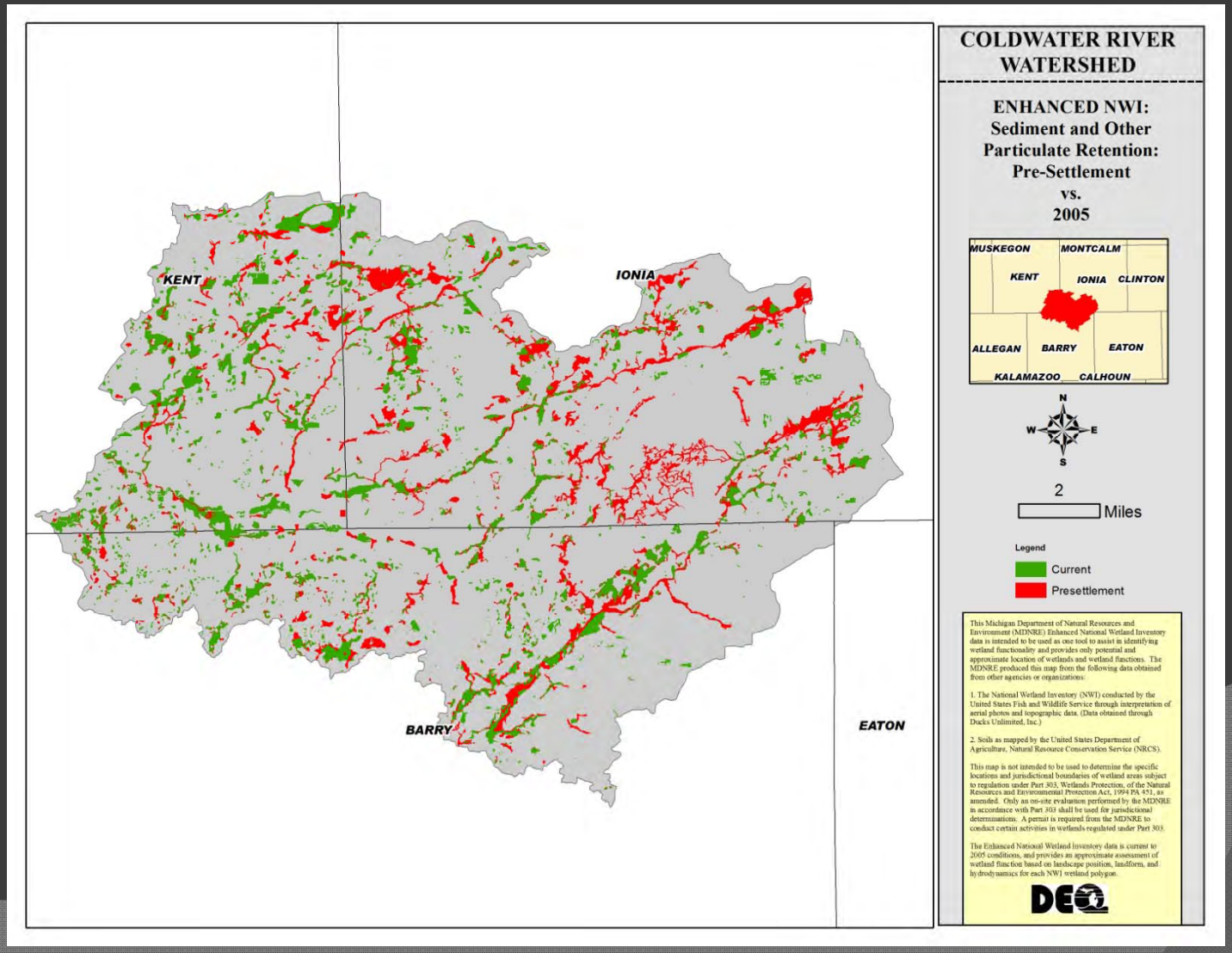
FLOOD WATER STORAGE



SEDIMENT AND OTHER PARTICULATE RETENTION

- This function supports water quality maintenance by capturing sediments with bonded nutrients or heavy metals. Vegetated wetlands will perform this function at higher levels than those of non-vegetated wetlands.
- The following map illustrates wetlands that perform the above ecological service at a level of significance above that of wetlands not designated. Wetlands deemed to be performing this function are mapped in two distinct time periods; Pre-European settlement (red), and wetlands circa 2005 (green).

SEDIMENT AND OTHER PARTICULATE RETENTION



Step 3. Utilize

Decision Making

- Strengthen grant funding requests
- Assist agencies in evaluating projects
- Identifying restoration, preservation sites

NRCS

DEQ
Wetlands, Lakes, & Streams

DEQ
Michigan's
Nonpoint Source
Program

U.S.
FISH & WILDLIFE
SERVICE
DEPARTMENT OF THE INTERIOR

Successful Watershed Applications

- Galien River Watershed
  - Functional data used to identify areas where restoration can benefit the reduction of nonpoint source pollutants.
- Black River and Paw Paw River Watersheds
  - Inventory of natural features includes wetlands and ecological services.
  - Selection of priority protection and restoration areas based in part on wetland function for watershed improvement.
- North Branch Clinton River
  - Functional data used to identify areas where restoration can benefit the reduction of nonpoint source pollutants. Location has been found for restoration and a 319 grant awarded for the project.

Applications Continued…

- Status and Trends of a particular Watershed
- Cumulative impact analysis of wetland Functions
- Illustration of the effective role that wetlands play within the larger landscape and the role that wetland destruction and degradation has played in reduced surface-water quality, habitat, and flood control over time.


LLWFA Watershed Status Map
1-22-2013
KEWEENAW
HOUGHTON
ONTONAGON
BARAGA
GOGEBIC
MARQUETTE
ALGER
LUCE
CHIPPEWA
IRON
SCHOOLCRAFT
MACKINAC
DICKINSON
DELTA
MENOMINEE
CHARLEVOIX
EMMET
CHEBOYGAN
PRESQUE ISLE
LEELANAU
ANTRIM
OTSEGO
MONTMORENCY
ALPENA
BENZIE
GRAND TRAVERSE
KALKASKA
CRAWFORD
OSCODA
ALCONA
MANISTEE
WEXFORD
MISSAUKEE
ROSCOMMON
OGEMAW
IOSCO
MASON
LAKE
OSCEOLA
CLARE
GLADWIN
ARENAC
HURON
OCEANA
NEWAYGO
MECOSTA
ISABELLA
MIDLAND
BAY
TUSCOLA
SANILAC
MONTCALM
GRATIOT
SAGINAW
MUSKEGON
LAPEER
GENESEE
IONIA
CLINTON
SHIAWASSEE
KENT
OTTAWA
ALLEGAN
BARRY
EATON
INGHAM
LIVINGSTON
OAKLAND
MACOMB
VAN BUREN
CALHOUN
JACKSON
WASHTENAW
WAYNE
BERRIEN
CASS
ST. JOSEPH
BRANCH
HILLSDALE
LENAWEE
MONROE
N
W
E
S
Legend
LLWFA Completed & Working Watersheds
Completed Watersheds
Watersheds In Progress
Wetlands, Lakes, Streams_Priority_Area
100
Miles

- If you would like more information on using NWI for Wetland Functional Assessment please contact MDEQ for a copy of our Methodology Report

- JonesJ28@michigan.gov
- Fizzellc@michigan.gov

- 517-241-3218