

PORTAGE RIVER WATERSHED

Landscape Level Wetland Functional Assessment

(Enhanced NWI)



PORTAGE RIVER WATERSHED

Wetland Resources Status and Trends

Pre-settlement Wetland conditions

- 23,773 Acres of Wetlands
- 695 Polygons
- Average Size – 34 Acres

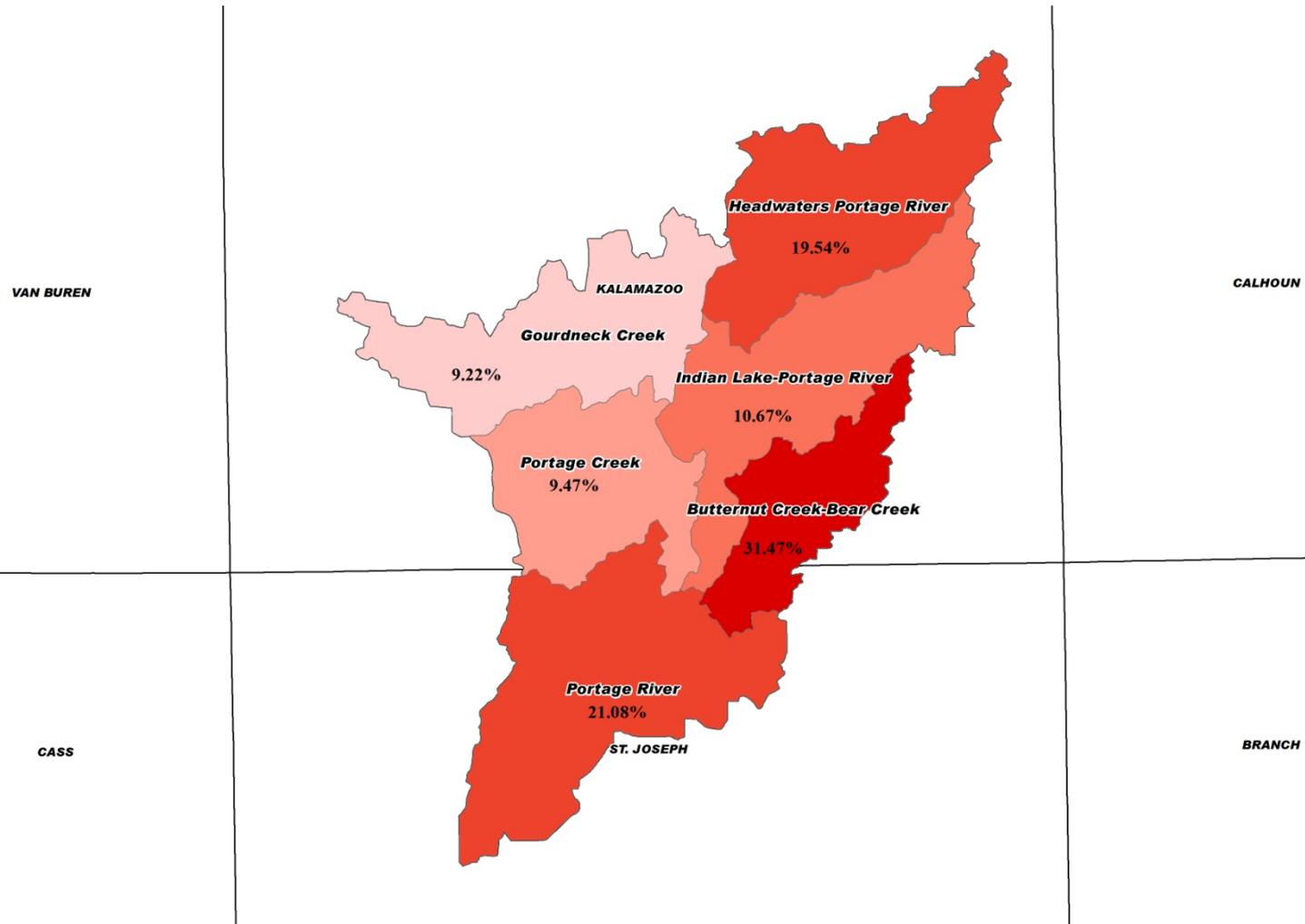
2005 Wetland Condition

- 18,725 Acres of Wetlands
- 2,879 Polygons
- Average Size – 6.5 Acres

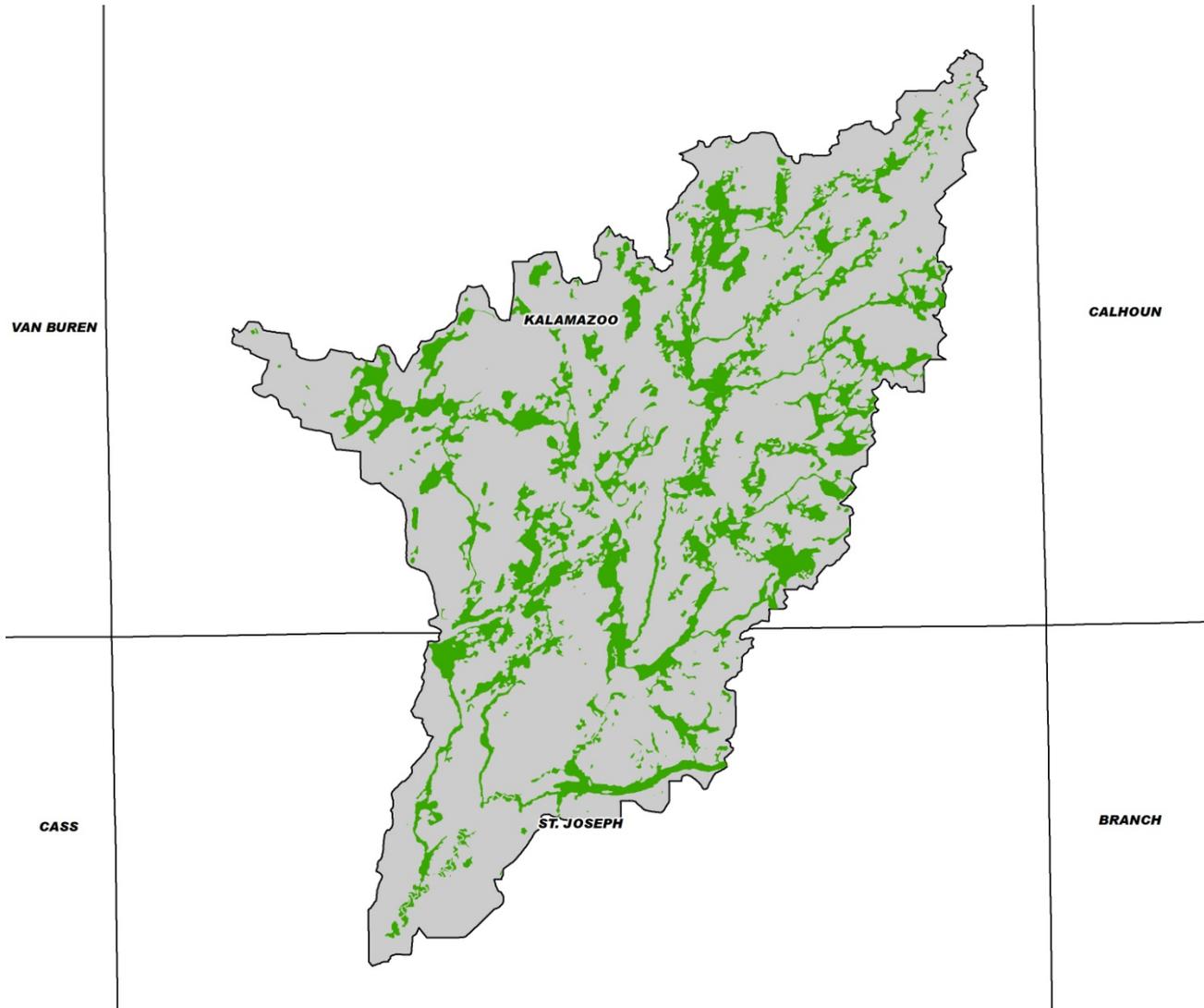
**78% OF ORIGINAL WETLAND ACREAGE REMAINS
22% LOSS OF TOTAL WETLAND RESOURCE**

TOTAL ACREAGE LOSS OF:
5,048 ACRES

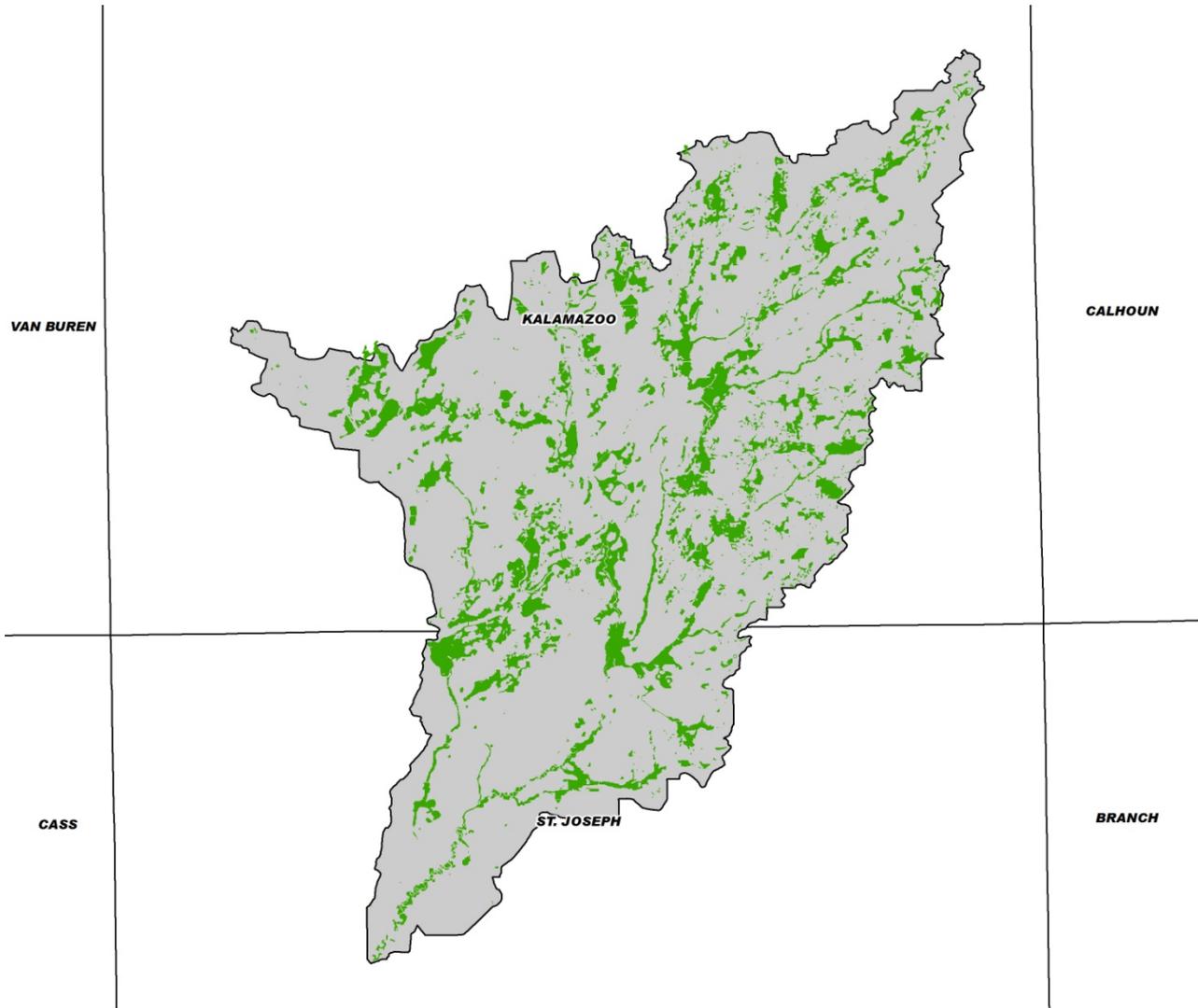
Percentage of Wetland Loss



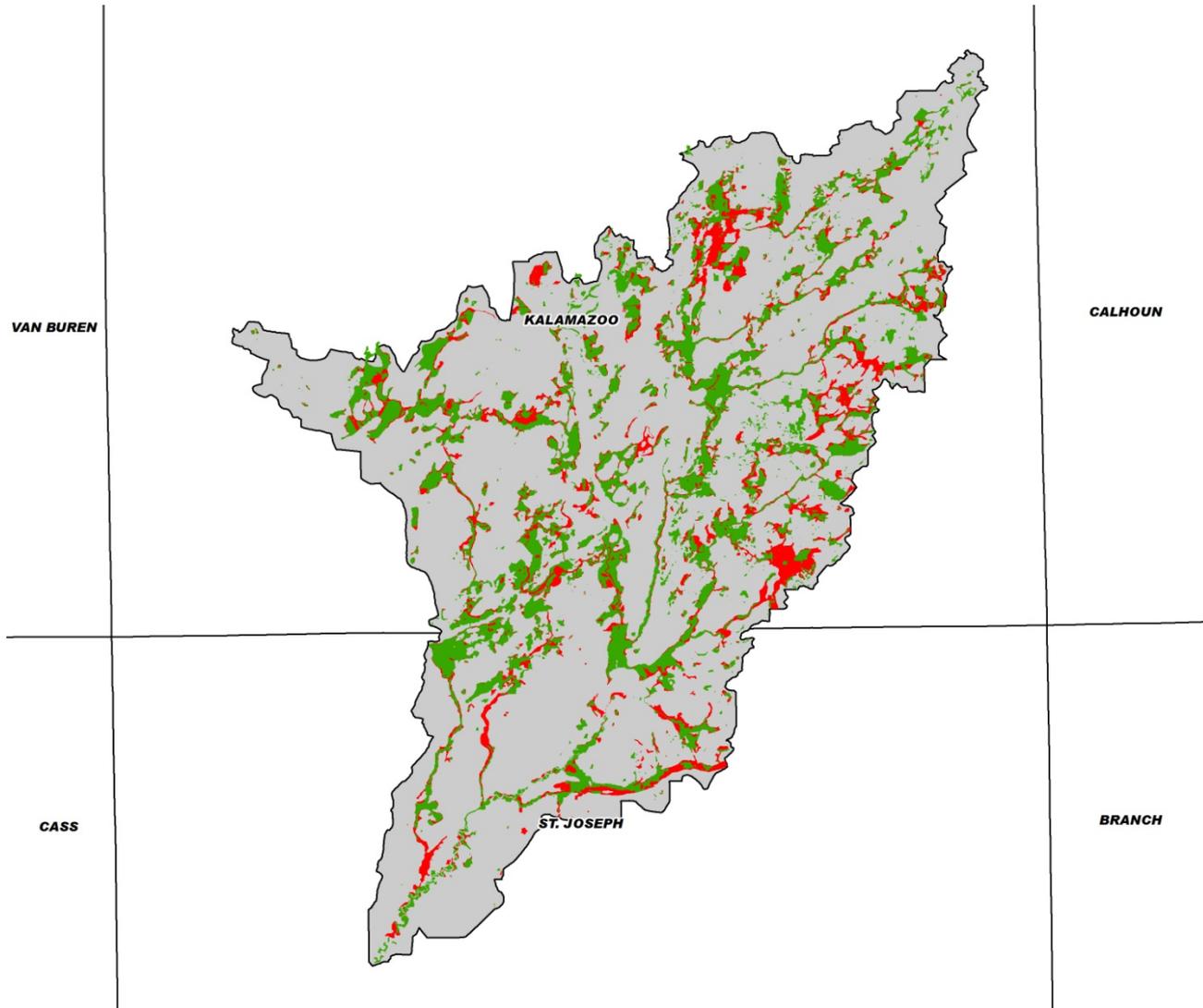
PRE-EUROPEAN SETTLEMENT WETLAND COVERAGE



2005 WETLAND COVERAGE



APPROXIMATE WETLAND LOSS PRE-EUROPEAN SETTLEMENT TO 2005



NWI TYPE COMPARISON

Table 1: Generalized NWI type comparison

Wetland Type	Pre-European Settlement Acres	2005 Acres of Wetlands	Net Acres Loss/Gained
Palustrine Emergent	522	4,990*	10%
Palustrine Forested	14,655	10,054**	32%
Palustrine Shrub-Scrub	8,596***	3,193****	63%
Other Palustrine			
Ponds	0*****	419	100%
Total	23,773	18,237	24%

* Includes mixed emergent wetland classes and mixed communities where subclasses include Forested and Shrub-Scrub Areas

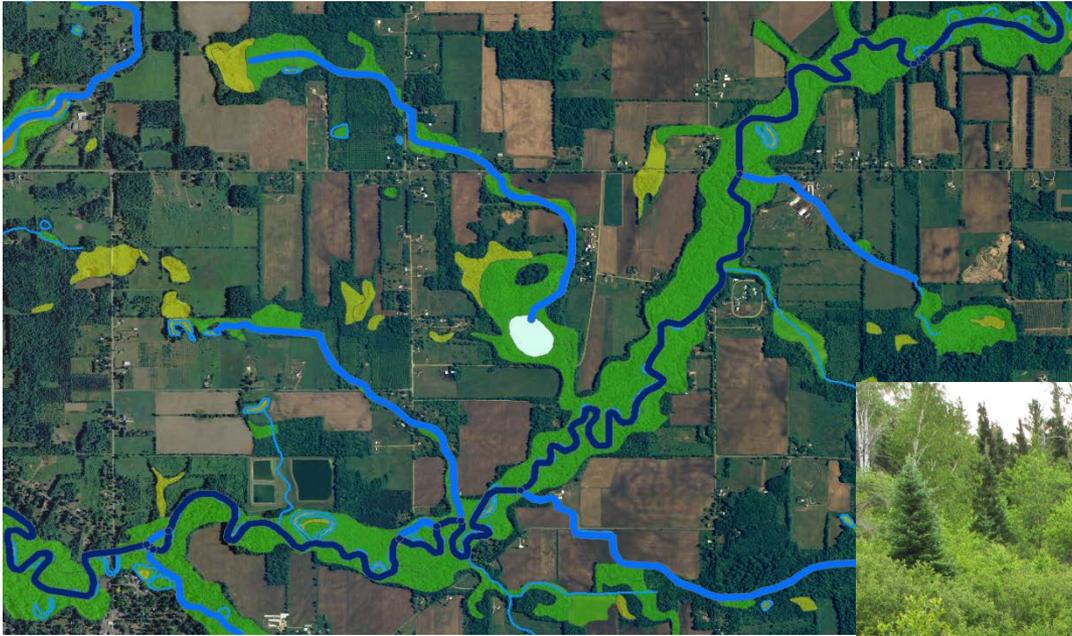
** Includes mixed forested wetland classes and mixed communities where subclasses include Emergent and Shrub-Scrub Areas

*** Includes mixed Shrub-Scrub/Emergent communities

**** Includes mixed shrub-scrub wetland classes and mixed communities where subclasses include Emergent, Forested and Shrub-Scrub

***** No acreage in ponds due to mapping differences between Pre-Settlement and Current wetland coverage's.

ENHANCING NWI FOR LANDSCAPE-LEVEL WETLAND FUNCTIONAL ASSESSMENT IN THE PORTAGE RIVER WATERSHED



Using NWI for Functional Assessment

- Lack of hydro-geomorphic (HGM) information
 - No landscape position
 - No landform
 - No water flow direction
 - General pond classification
 - Features important for assessing many functions are lacking
- *Most of these features can be interpreted from the maps*

What information can we extract from NWI?

How many wetlands are there?

What is the size range of wetlands?

What is the average size of a given wetland type?

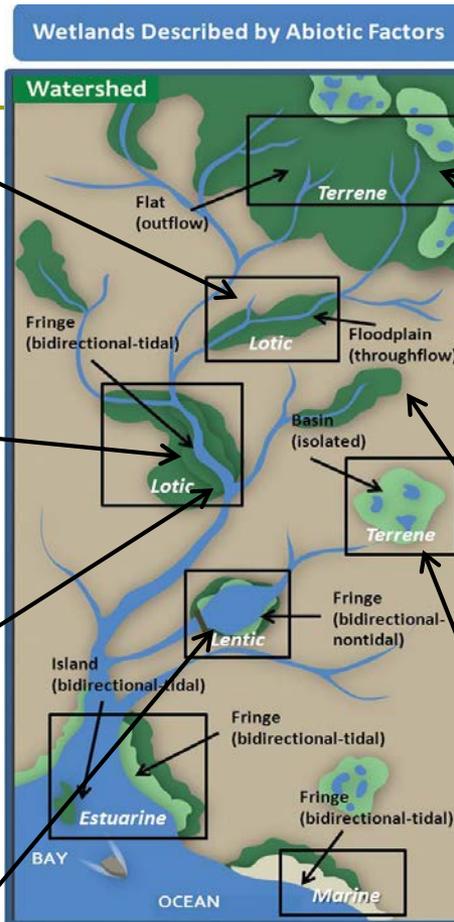
How many wetlands are in various size classes?

...With HGM information added?

How much and how many

- occur along rivers?
- along streams?
- in lake basins?
- are isolated?
- are sources of streams?
- have inflow but no outflow?
- are connected to other wetlands?
- What types of ponds are there and what is their extent?

WETLAND LANDSCAPE POSITIONS



Key: Landscape position – white italicized, Landform – text from arrow, Water flow path – in parenthesis

Terrene - isolated wetlands, headwater outflow wetlands, and wetlands along streams but not subject to overflow due to their elevation

Lotic - wetlands along rivers and streams and subject to periodic overflows (e.g., floodplains), including freshwater tidal wetlands

Lentic - wetlands within the basins of lakes and reservoirs where their hydrology is greatly affected by fluctuating lake or reservoir water levels

Estuarine - salt and brackish tidal wetlands associated with estuaries

Marine - saltwater tidal wetlands along the shores of the ocean and its open embayments

TERRENE



LENTIC



LOTIC



RIVER



STREAM

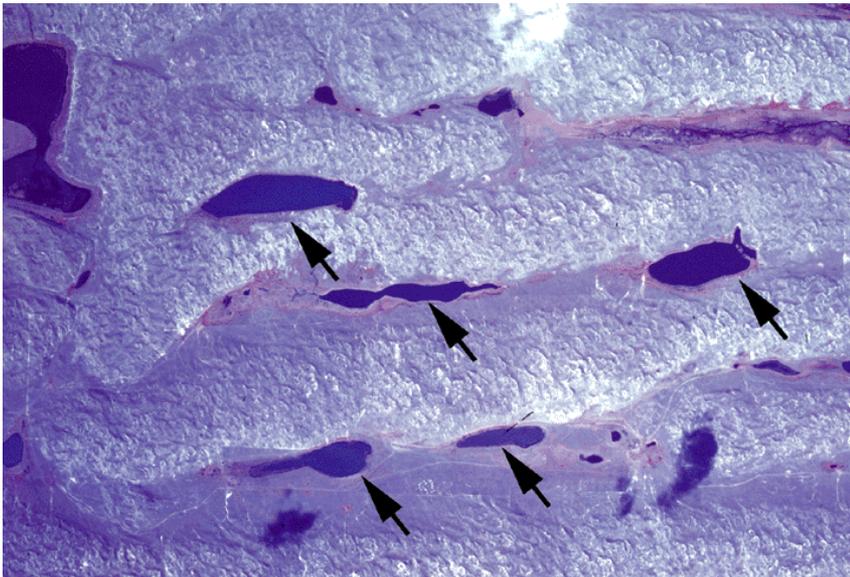
Wetland Landform Types

- Fringe
- Basin
- Flat
- Floodplain
- Slope

FRINGE



BASIN



FLAT



FLOODPLAIN



SLOPE

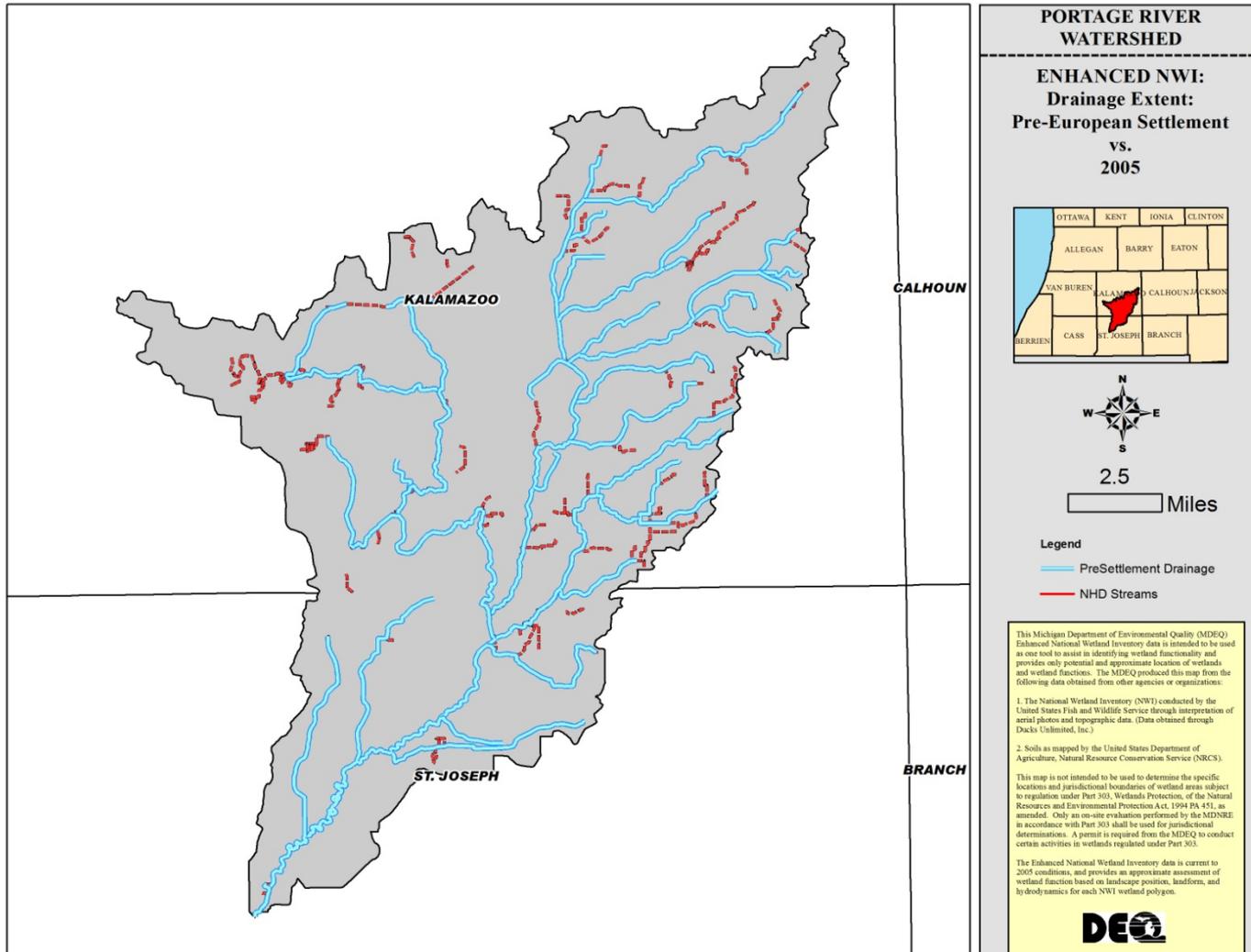


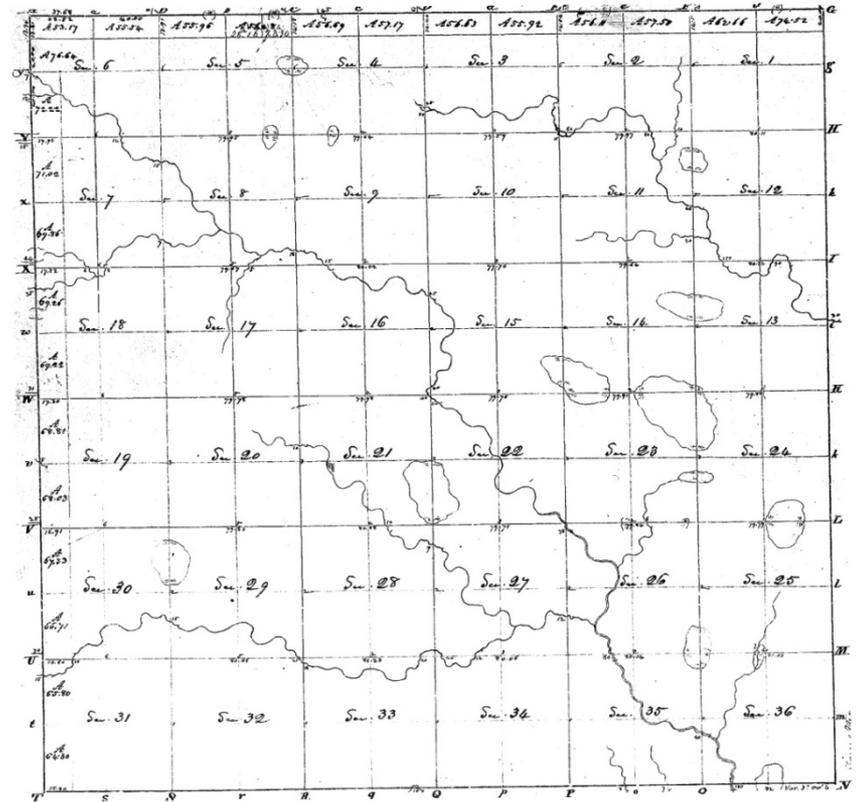
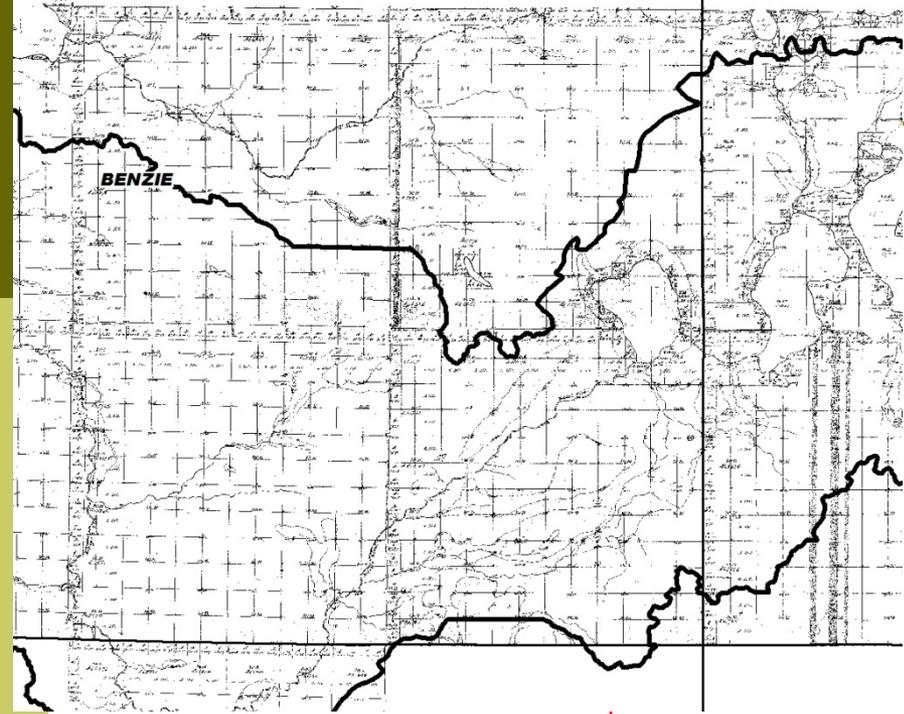
Photo by: T. Losee

Evaluated Wetland Functions

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

DRAINAGE EXTENT





DETAILED FUNCTIONAL COMPARISONS

Table 2: Detailed Functional Comparisons

Function	Potential Significance	Pre-European Settlement Acreage	2005 Acreage	% Change in Acreage
Flood Water Storage	High	11047.14	8244.53	-25
	Moderate	12259.14	4509.72	-63
	<i>Total</i>	23,306.28	12,754.25	-45
Streamflow Maintenance	High	23,444.05	15,480.68	-34
	Moderate	2,876.82	5,672.78	97 *
	<i>Total</i>	26,320.86	21,153.45	-20
Nutrient Transformation	High	16,987.52	16,704.35	-2
	Moderate	6,785.51	2,096.87	-69
	<i>Total</i>	23,773.03	18,801.21	-21
Sediment and Retention of Other Particulates	High	13,047.10	7,496.23	-43
	Moderate	6,557.24	8,271.22	26 *
	<i>Total</i>	19,604.34	15,767.45	-20
Shoreline Stabilization	High	11,646.37	7,013.99	-40
	Moderate	9,645.59	7,694.56	-20
	<i>Total</i>	21,291.96	14,708.55	-31
Fish Habitat	High	26,615.15	13,079.54	-51
	Moderate	577.84	7,321.99	1167 *
	<i>Total</i>	27,192.99	20,401.52	-25
Stream Shading	High	7,584.21	2,123.30	-72
	Moderate	1,018.72	1,604.88	58 *
	<i>Total</i>	8,602.93	3,728.18	-57

* Increases in the moderate & high category in the functions above can be attributed to the mapping differences in the two wetland layers and may not represent the current conditions on the ground.

DETAILED FUNCTIONAL COMPARISONS CONT...

Function	Potential Significance	Pre-European Settlement Acreage	2005 Acreage	% Change in Acreage
Waterfowl/Waterbird Habitat	High	7,153.54	7,480.63	5 *
	Moderate	4,899.68	8,783.56	79 *
	<i>Total</i>	12,053.23	16,264.20	35 *
Shorebird Habitat	High	0.00	183.08	Null
	Moderate	9,771.93	18,116.94	85 *
	<i>Total</i>	9,771.93	18,300.01	87 *
Interior Forest Bird Habitat	High	9,112.92	3,537.02	-61
	Moderate	14,137.66	9,710.01	-31
	<i>Total</i>	23,250.58	13,247.03	-43
Amphibian Habitat	High	9,853.84	3,483.13	-65
	Moderate	608.93	2,581.68	324 *
	<i>Total</i>	10,462.78	6,064.81	-42
Carbon Sequestration	High	203.99	2,073.96	917 *
	Moderate	2,677.34	7,323.40	174 *
	<i>Total</i>	2,881.33	9,397.36	226 *
Ground Water Influence	High	11.26	13.53	20 *
	Moderate	24,318.60	18,930.52	-22
	<i>Total</i>	24,329.85	18,944.06	-22
Conservation of Rare & Imperiled Wetlands & Species	High	Null	6,270.74	Null
	Moderate	Null	18,361.58	Null
	<i>Total</i>	Null	24,632.32	Null

* Increases in the moderate & high categories in the functions above can be attributed to the mapping differences in the two wetland layers and may not represent the current conditions on the ground.

FUNCTIONAL ACRES COMPARISON

Table 3: Functional Acres comparison

Function	Pre-European Settlement Functional Acres	2005 Functional Acres	Predicted % of Original Capacity Left	Predicted % Change in Functional Capacity
Flood Water Storage	34,353.42	20,998.78	61	-39
Streamflow Maintenance	49,764.91	36,634.13	74	-26
Nutrient Transformation	40,760.55	35,505.56	87	-13
Sediment and Other Particulate Retention	32,651.44	23,263.68	71	-29
Shoreline Stabilization	32,938.33	21,722.54	66	-34
Fish Habitat	53,808.14	33,481.06	62	-38
Stream Shading	16,187.14	5,851.48	36	-64
Waterfowl and Waterbird Habitat	19,206.77	23,744.83	124	24 *
Shorebird Habitat	9,771.93	18,483.09	189	89 *
Interior Forest Bird Habitat	32,363.50	16,784.05	52	-48
Amphibian Habitat	20,316.62	9,547.94	47	-53
Carbon Sequestration	3,085.31	11,471.31	372	272 *
Ground Water Influence	24,341.11	18,957.59	78	-22
Conservation of Rare & Imperiled Wetlands & Species	0	30,903.06	100	100

*Increases in the predicted percent change functional capacity in the functions above can be attributed to the mapping differences in the two wetland layers and may not represent the current conditions on the ground.

Frequency of Functions

Pre-Settlement

Current

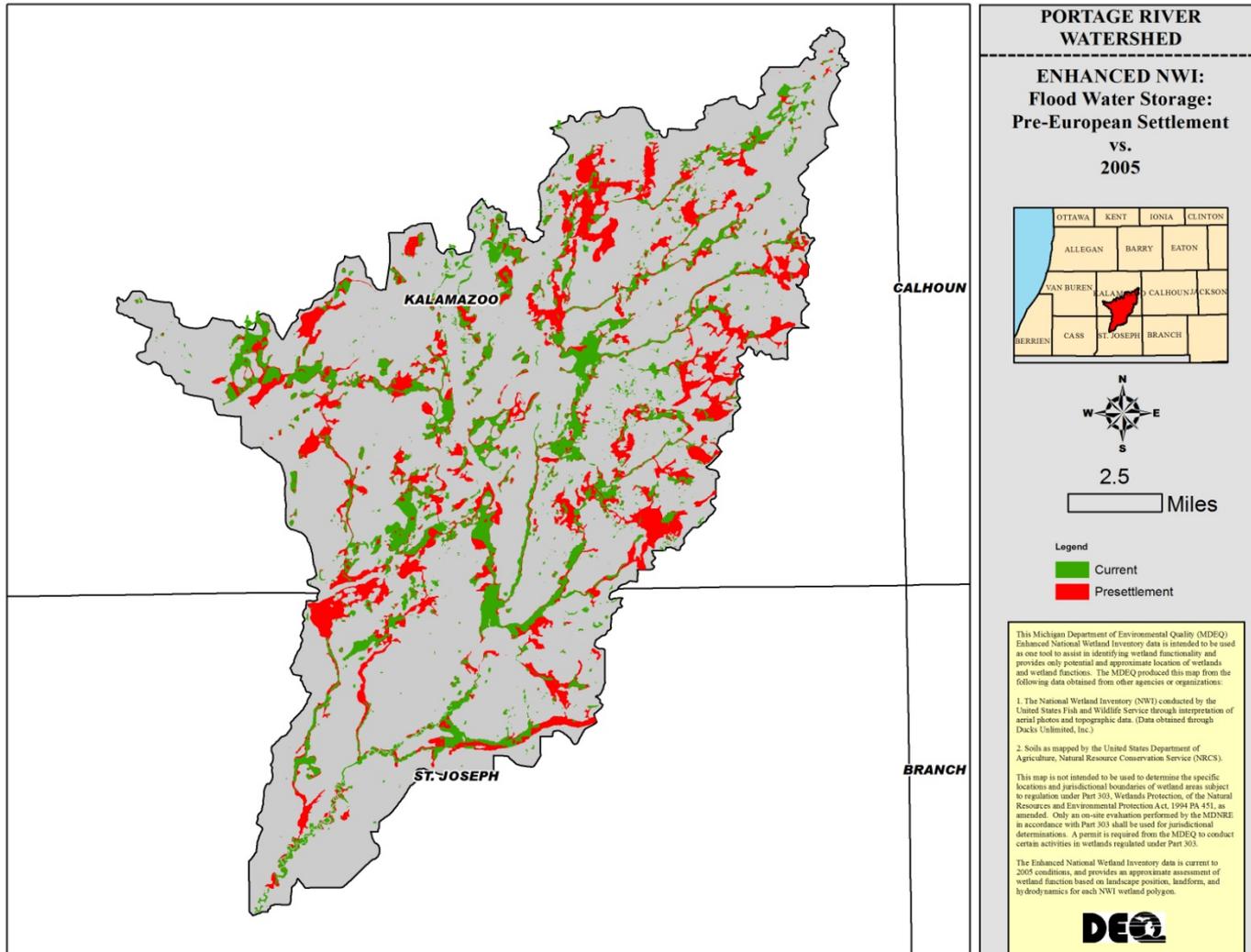
# of Wetlands	# of Functions	ACRES
11	2	704
35	3	5,092
30	4	290
30	5	434
57	6	928
62	7	796
120	8	3,581
150	9	6,874
147	10	8,418
37	11	713
46	12	1,596

# of Wetlands	# of Functions	ACRES
13	1	17
312	2	363
367	3	623
96	4	5,016
101	5	272
143	6	367
89	7	544
319	8	1,875
765	9	4,299
659	10	4,342
336	11	2,504
281	12	1,821
166	13	2,836
28	14	54

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).

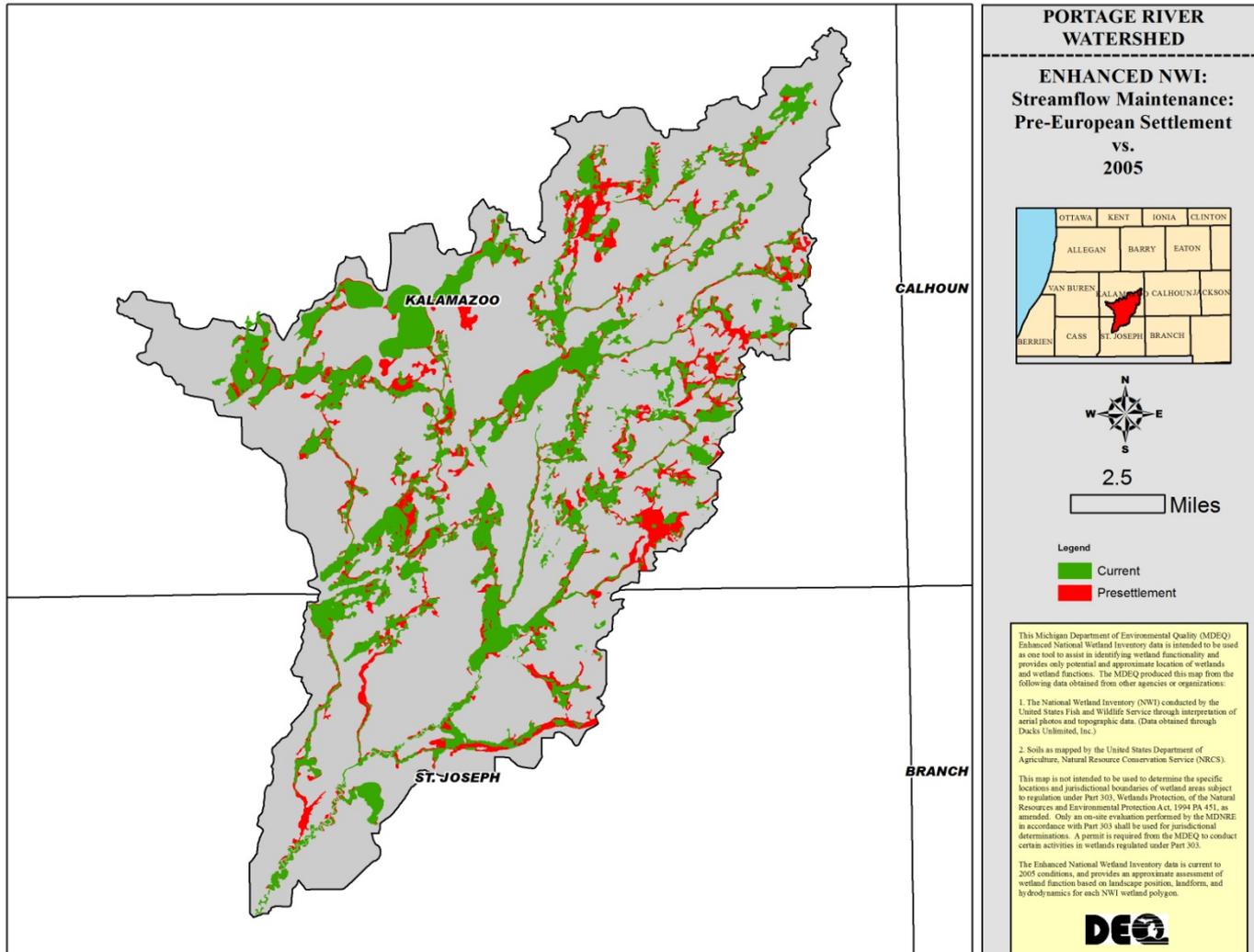
FLOOD WATER STORAGE



STREAMFLOW MAINTENANCE

- ❑ Wetlands that are sources of groundwater discharge that sustain streamflow in the watershed. Such wetlands are critically important for supporting aquatic life in streams. All wetlands classified as headwater wetlands are important for streamflow.
- ❑ 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).

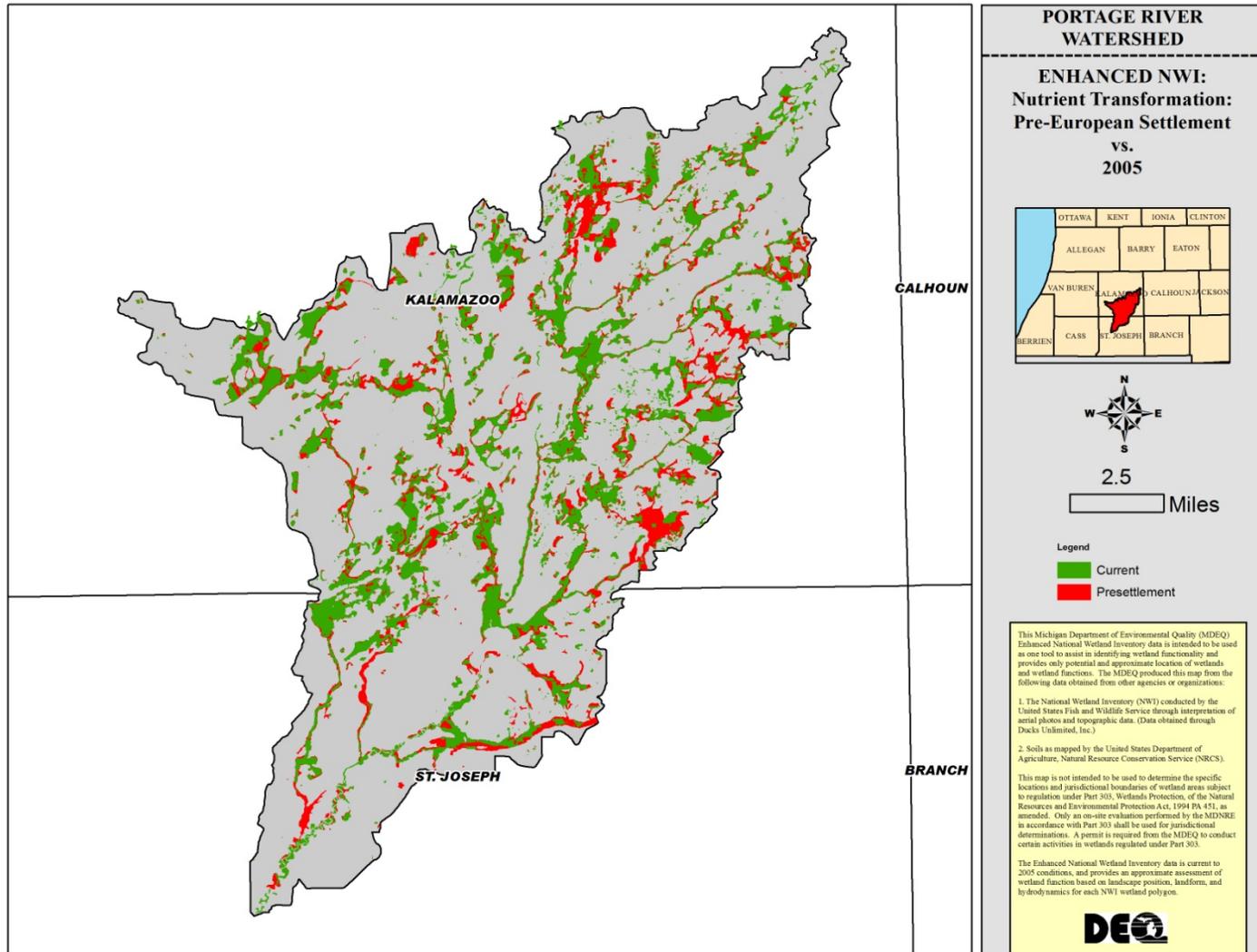
STREAMFLOW MAINTENANCE



NUTRIENT TRANSFORMATION

- ❑ Wetlands that have a fluctuating water table are best able to recycle nutrients. Natural wetlands performing this function help improve local water quality of streams and other watercourses.
- ❑ 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).

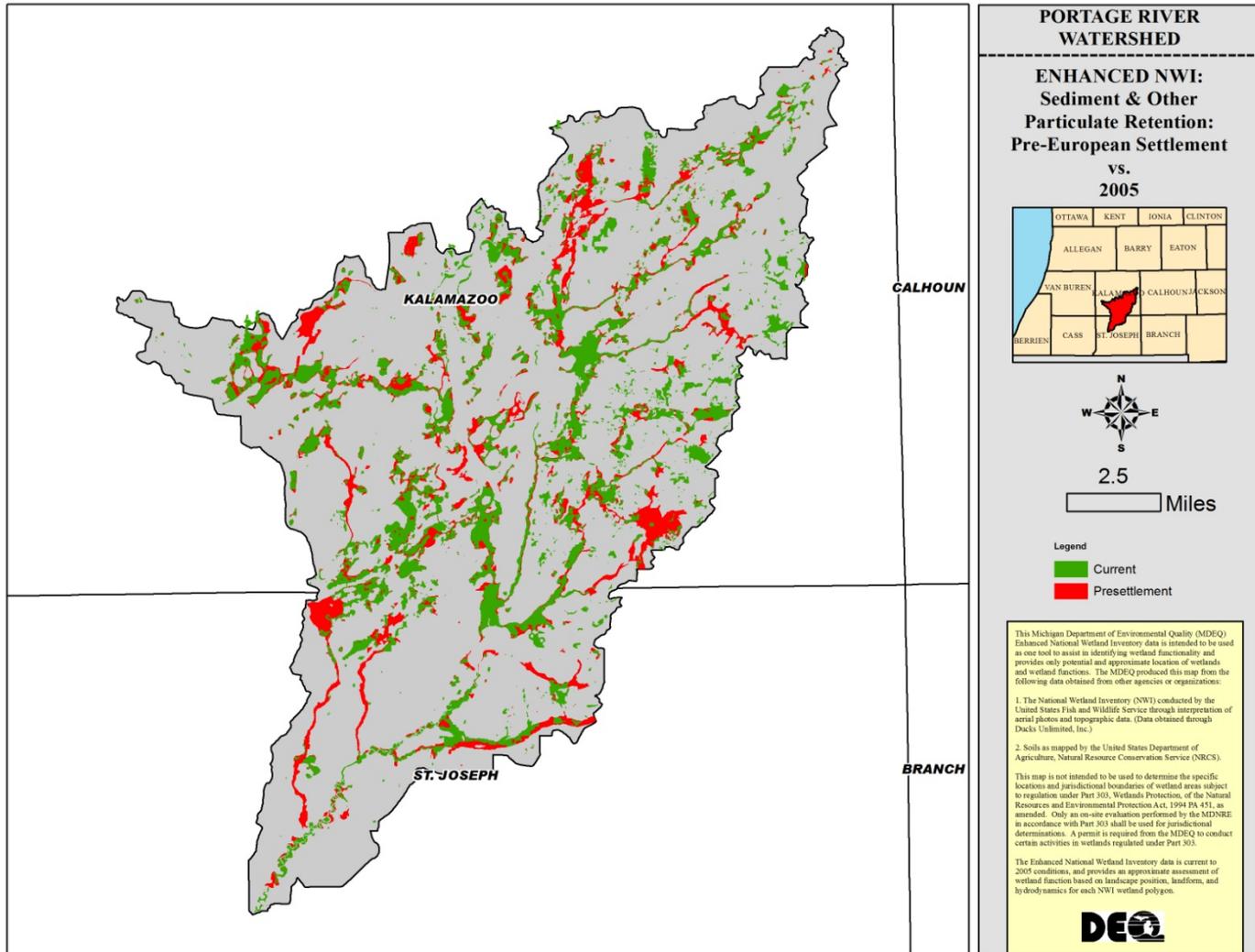
NUTRIENT TRANSFORMATION



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).

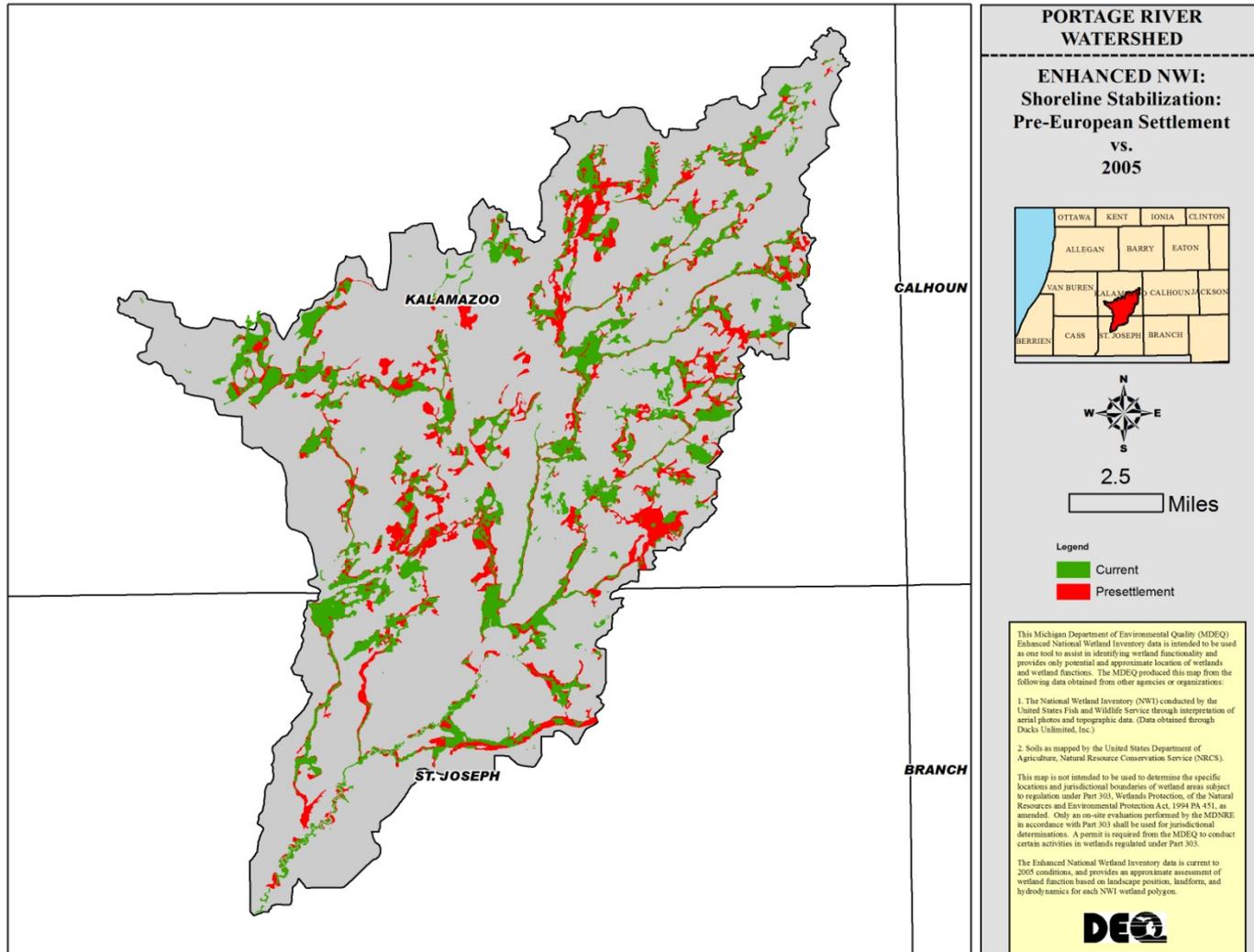
SEDIMENT AND OTHER PARTICULATE RETENTION



SHORELINE STABILIZATION

- ❑ Vegetated wetland along all waterbodies (e.g. estuaries, lakes, rivers, and streams) provide this function. Vegetation stabilizes the soil or substrate and diminished wave action, thereby reducing shoreline erosion potential.
- ❑ 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).

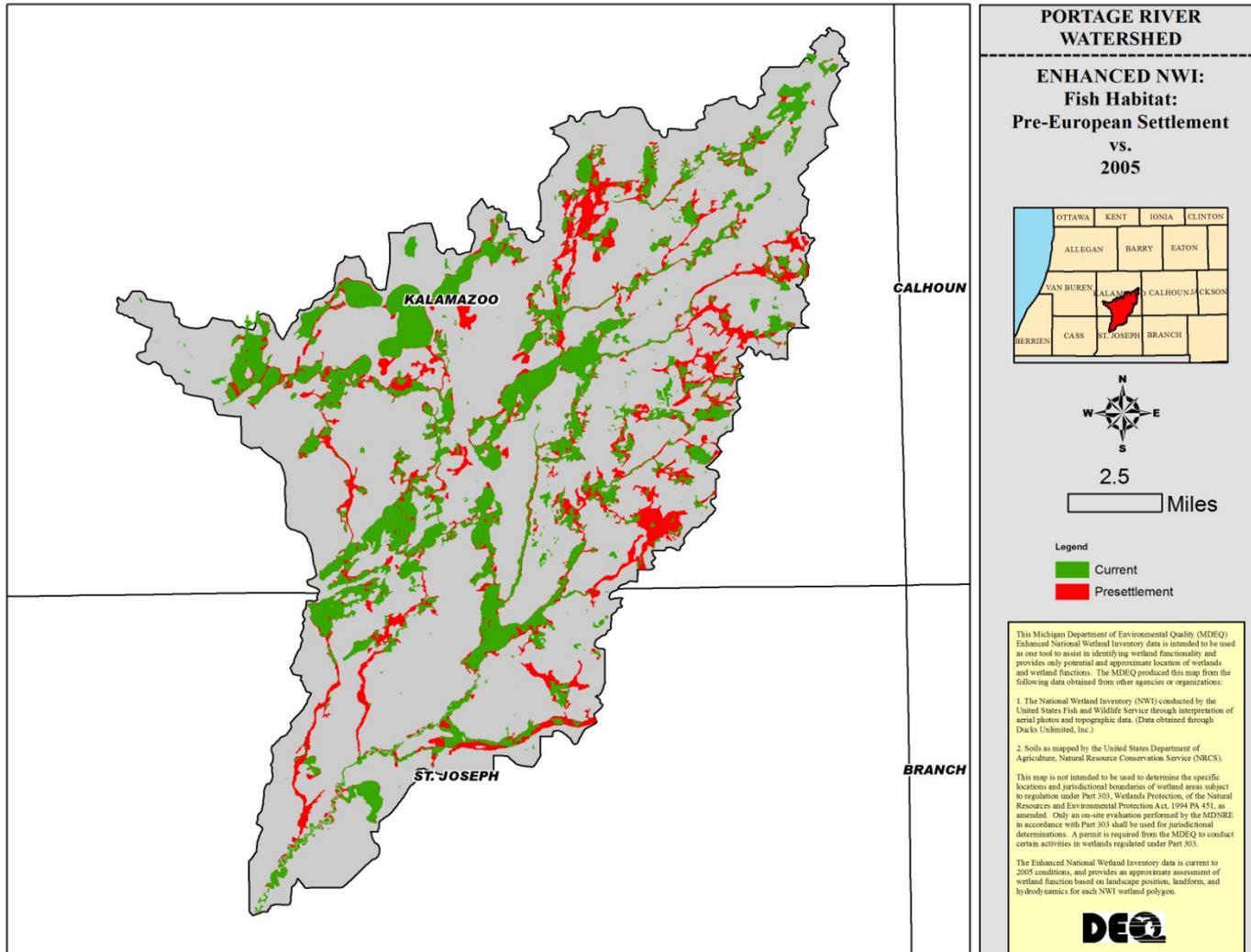
SHORELINE STABILIZATION



FISH HABITAT

- ❑ Wetlands that are considered essential to one or more parts of fish life cycles. Wetlands designated as important for fish are generally those used for reproduction, or feeding.
- ❑ 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).

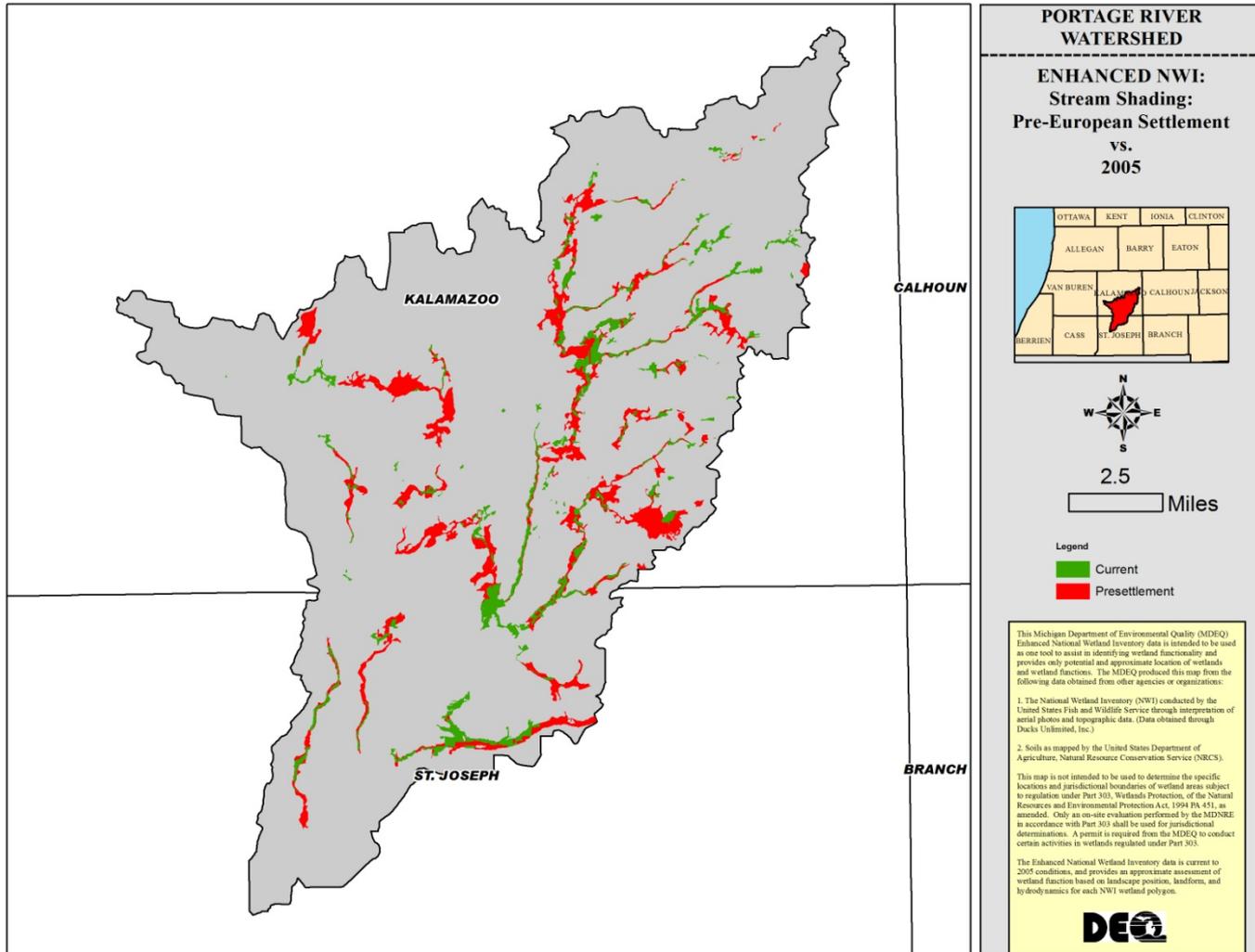
FISH HABITAT



STREAM SHADING

- ❑ Wetlands that perform water temperature control due to the proximity to streams and waterways. These wetlands generally are Palustrine Forested or Scrub-Shrub.
- ❑ 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).

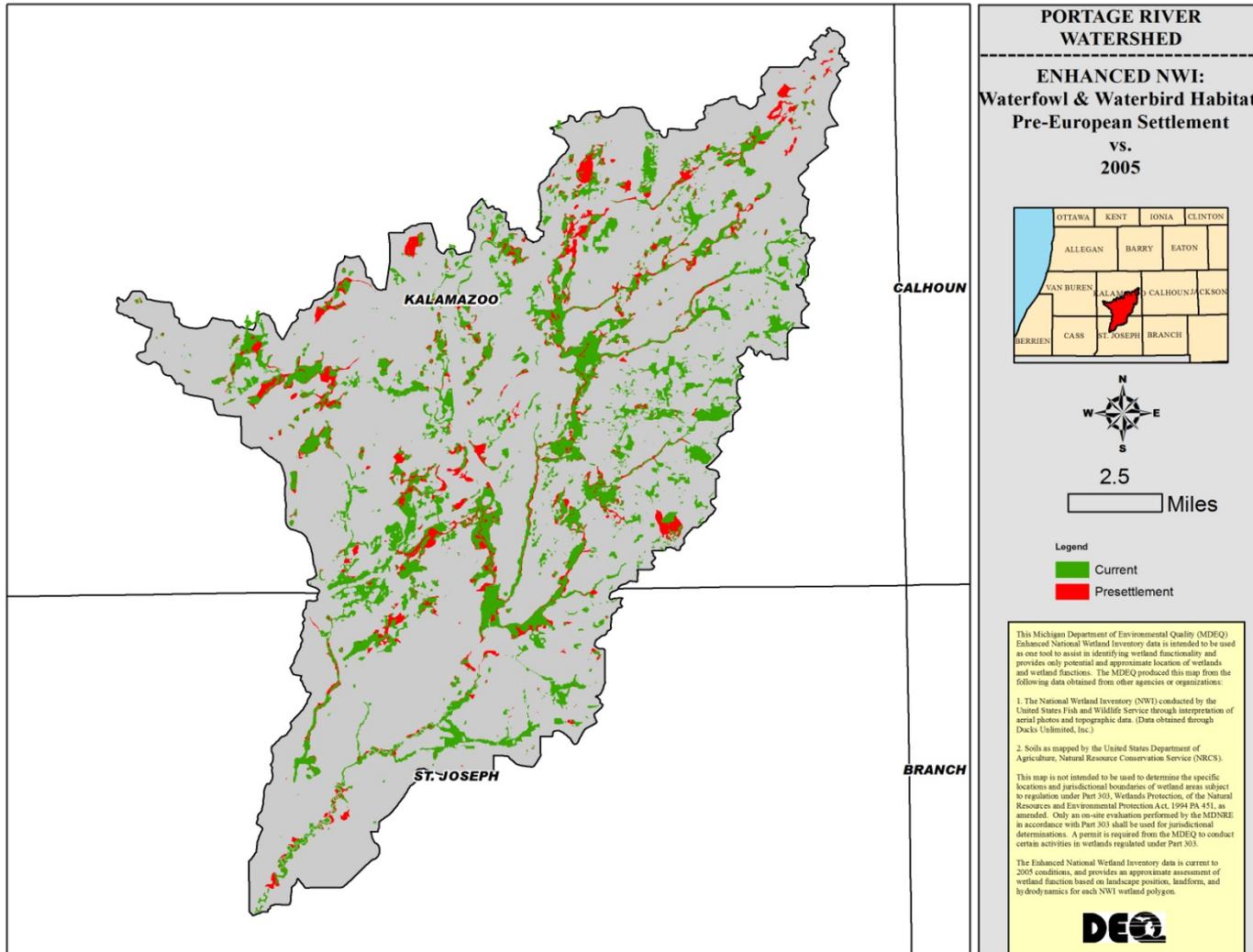
STREAM SHADING



WATERFOWL AND WATERBIRD HABITAT

- ❑ Wetlands designated as important for waterfowl and waterbirds are generally those used for nesting, reproduction, or feeding. The emphasis is on the wetter wetlands and ones that are frequently flooded for long periods.
- ❑ 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).

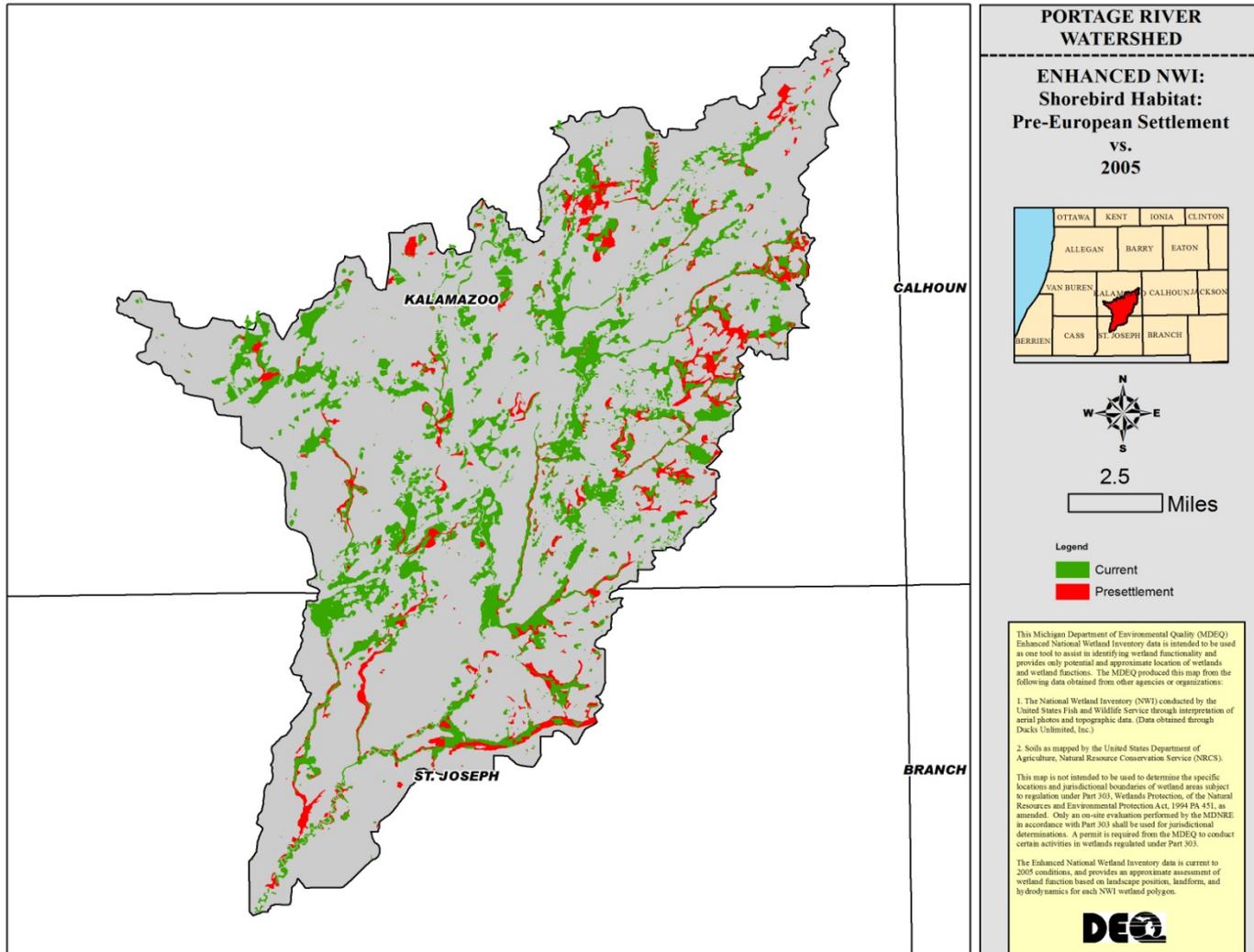
WATERFOWL & WATERBIRD HABITAT



SHOREBIRD HABITAT

- ❑ Shorebirds generally inhabit open areas of beaches, grasslands, wetlands, and tundra and undertake some of the longest migrations known. Along their migration pathway, many shorebirds feed in coastal and inland wetlands where they accumulate fat reserves needed to continue their flight. Common species include; plovers, oystercatchers, avocets, stilts, and sandpipers. This function attempts to capture wetland types most likely to provide habitat for these species.
- ❑ 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).

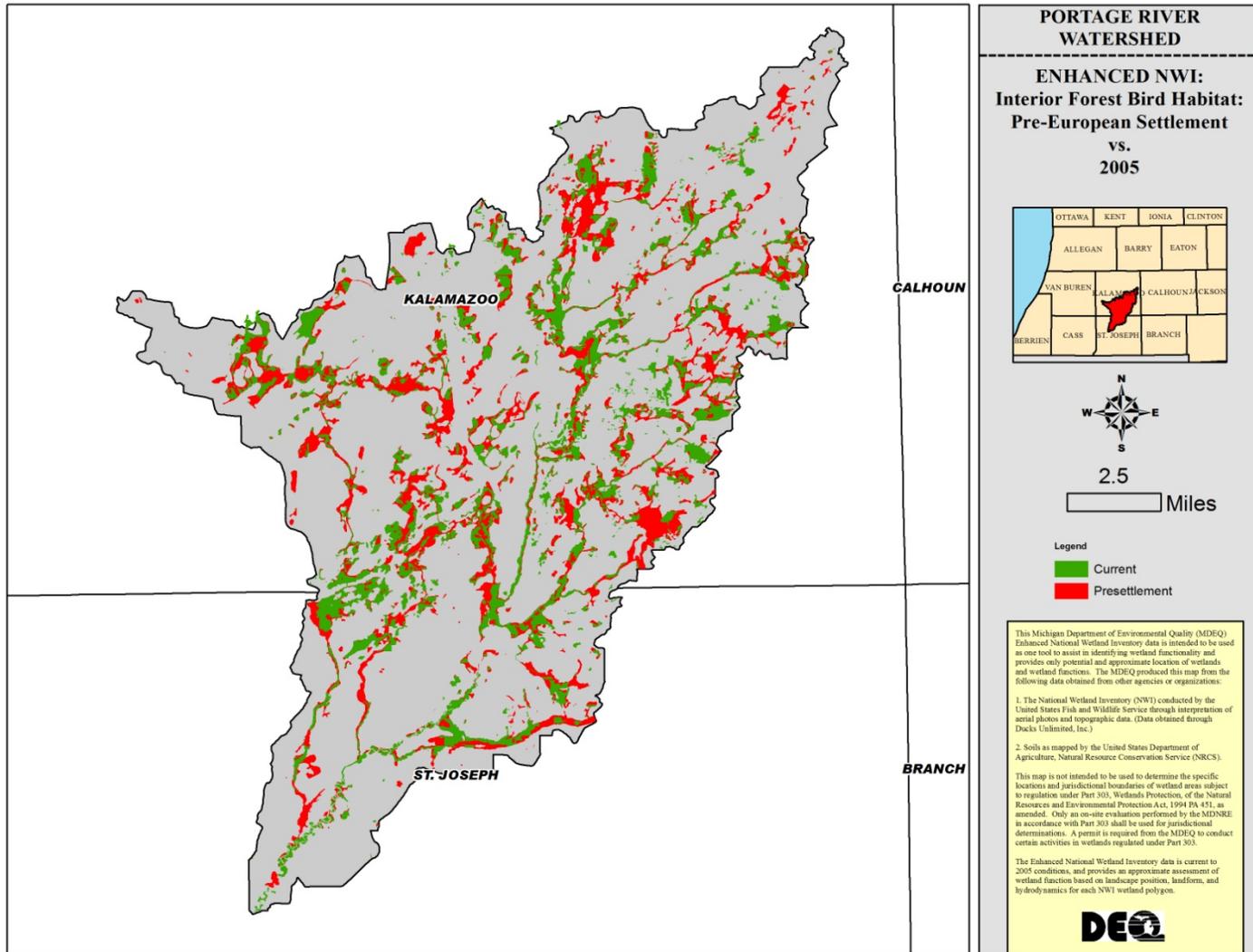
SHORE BIRD HABITAT



INTERIOR FOREST BIRDS

- ❑ Interior Forest Birds require large forested areas to breed successfully and maintain viable populations. This diverse group includes colorful songbirds such as; tanagers, warblers, vireos that breed in North America and winter in the Caribbean, Central and South America, as well as residents and short-distance migrants such as; woodpeckers, hawks, and owls. They depend on large forested tracts, including streamside and floodplain forests. It is important to note that adjacent upland forest to these riparian areas are critical habitat for these species as well. This function attempts to capture wetland types most likely to provide habitat for these species.
- ❑ 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).

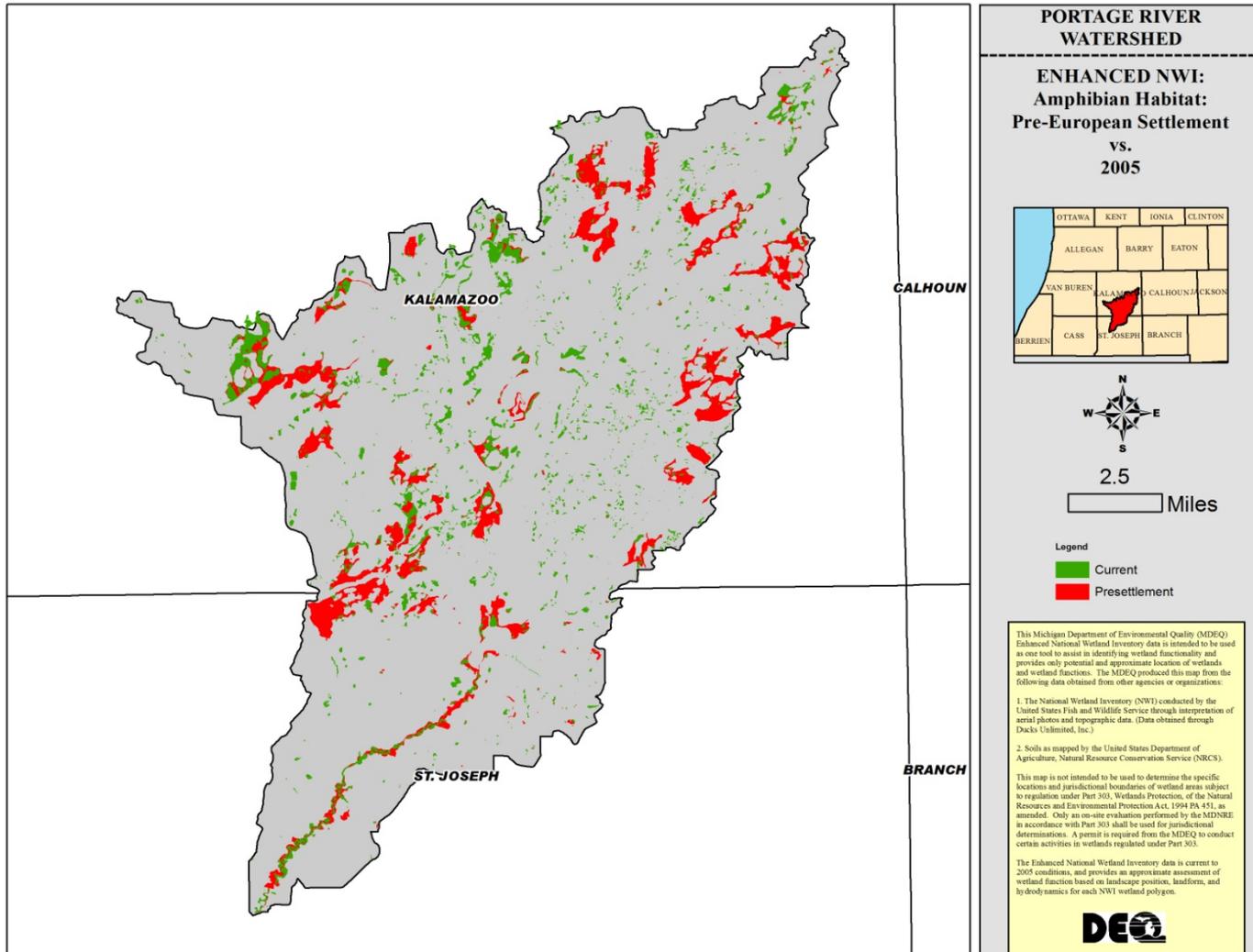
INTERIOR FOREST BIRD HABITAT



AMPHIBIAN HABITAT

- ❑ Amphibians share several characteristics in common including wet skin that functions in respiration and gelatinous eggs that require water or moist soil for development. Most amphibians have an aquatic stage and a terrestrial stage and thus live in both aquatic and terrestrial habitats. Aquatic stages of these organisms are often eaten by fish and so for certain species, successful reproduction may occur only in fish-free ponds. Common sub-groups of amphibians are salamanders, frogs, and toads. This function attempts to capture wetland types most likely to provide habitat for these species.
- ❑ 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).

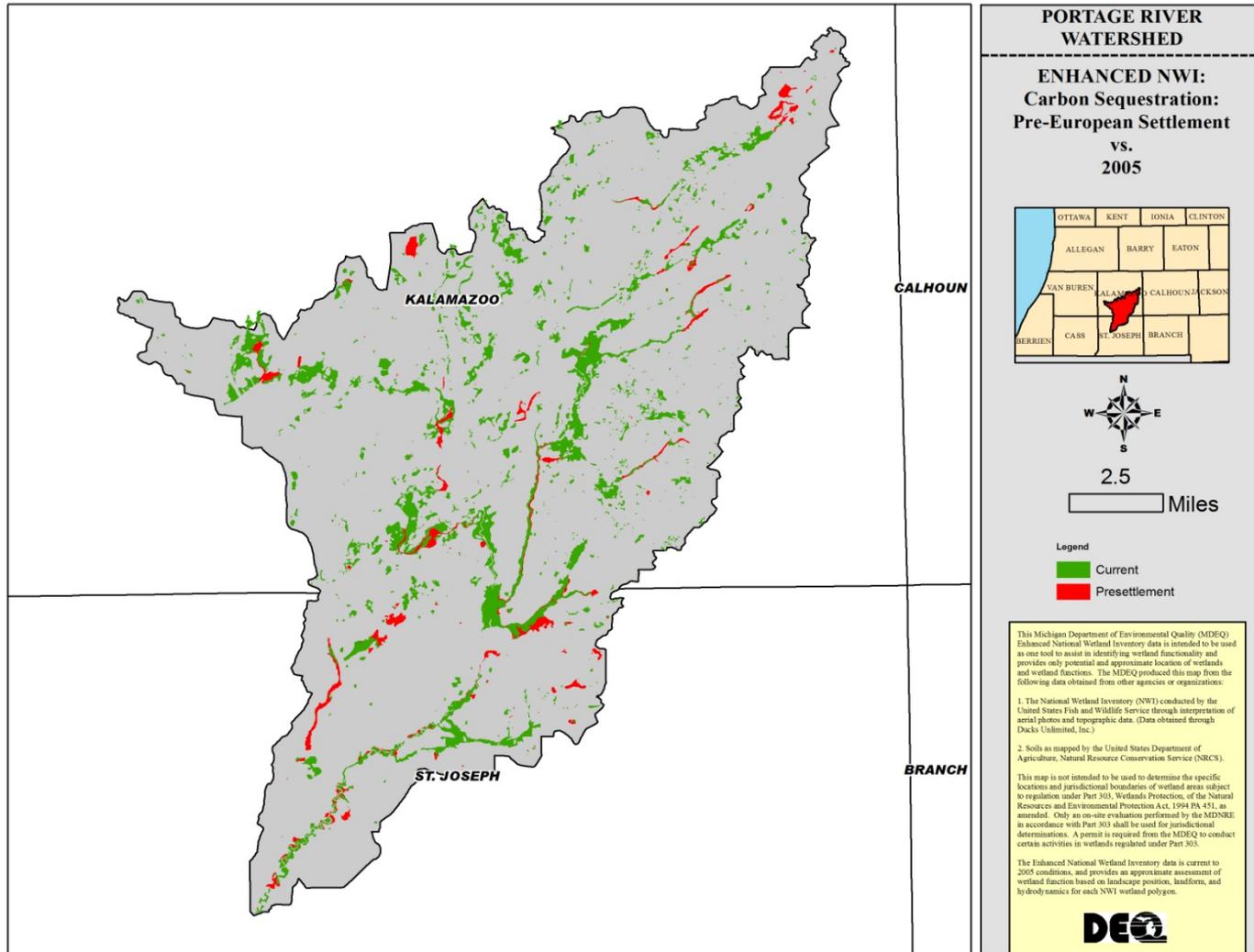
AMPHIBIAN HABITAT



CARBON SEQUESTRATION

- ❑ Wetlands are different from other biomes in their ability to sequester large amounts of carbon, as a consequence of high primary production and then deposition of decaying matter in the anaerobic areas of their inundated soils.
- ❑ 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).

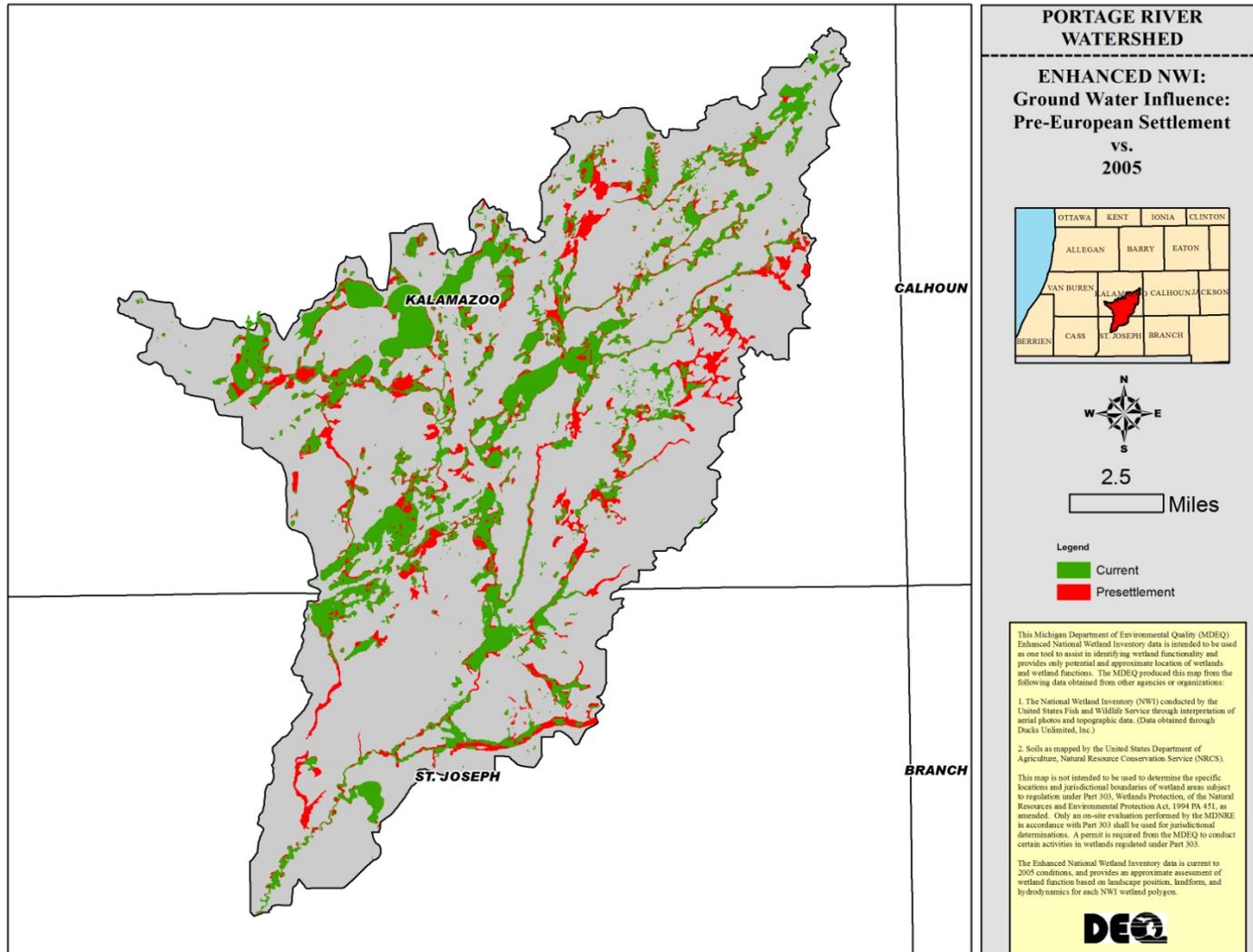
CARBON SEQUESTRATION



GROUND WATER INFLUENCE

- ❑ Wetlands categorized as High or Moderate for Groundwater Influence are areas that receive some or all of their hydrologic input from groundwater reflected at the surface. The DARCY (definition of acronym) model was the data source utilized to determine this wetland/groundwater connection, which is based upon soil transmissivity and topography. Wetlands rated for this function are important for maintaining streamflows and temperature control in waterbodies.
- ❑ 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).

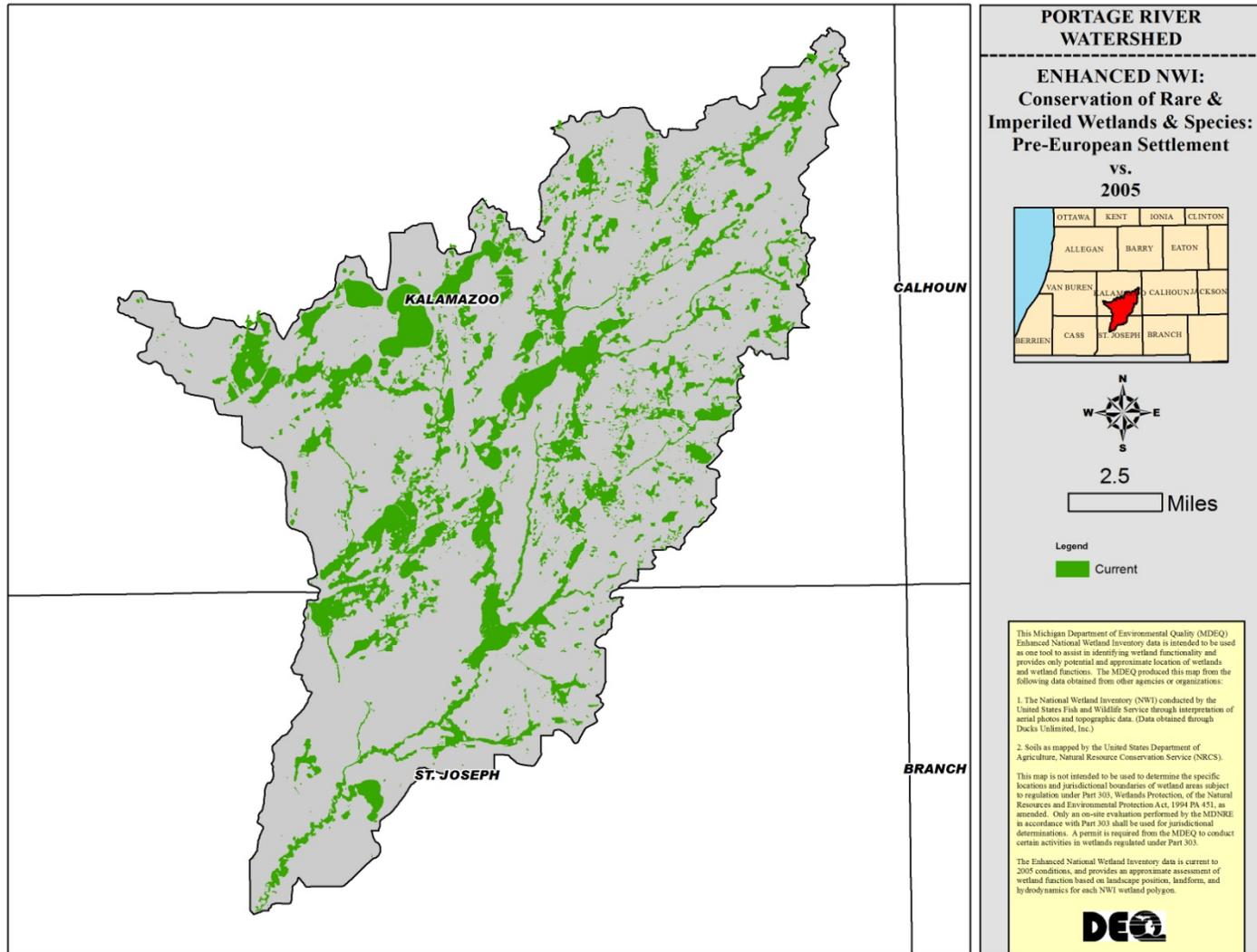
GROUND WATER INFLUENCE



CONSERVATION OF RARE AND IMPERILED WETLANDS & SPECIES

- ❑ Wetlands that are considered rare either globally or at the state level. They are likely to contain a wide variety of flora and fauna, or contain threatened or endangered species.
- ❑ This function is derived from the Michigan Natural Features Dataset (MNFI) of known sightings of threatened, endangered, or special concern species and high quality natural communities. The model values are reported on a 40 acre polygon grid for the state of Michigan, or a subset of MI. Due to this the dataset should not be used as a comprehensive inventory of Rare and Imperiled 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 (green) circa 2005.

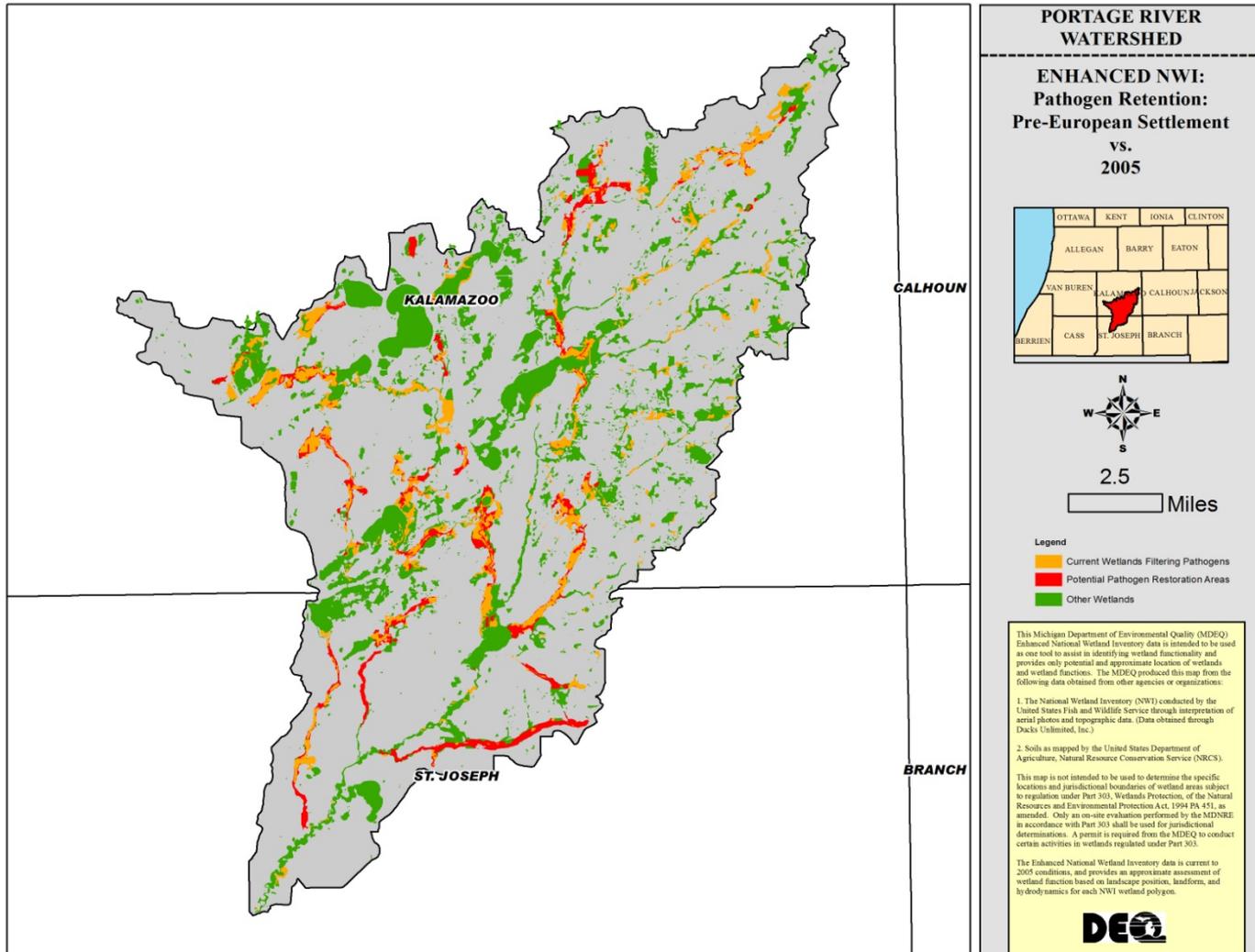
CONSERVATION OF RARE IMPERILED WETLANDS, & SPECIES



PATHOGEN RETENTION

- ❑ Wetlands can improve water quality through natural processes of filtration for sedimentation, nutrients and *Escherichia coli* (*E. coli*). *E. coli* is a sub-set of fecal coli forms whose presence in water indicates fecal contamination from warm blooded animals. The presence of *E. coli* indicates that contamination has occurred, and other harmful pathogens may also be present.
- ❑ 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 at a high level are mapped in (orange) circa 2005. Wetlands deemed valuable for restoration for this function are mapped in (red). All other wetland areas are mapped in (green).

PATHOGEN RETENTION



Data Limitations and Disclaimer

National Wetlands Inventory Plus (NWI)

- Wetland boundaries determined from Aerial Imagery
- Last updated in 2005
- Obvious limitations to Aerial Photo Interpretation:
 - Errors of Omission (forested and drier-end wetlands)
 - Errors of Commission (misinterpretation of aerials)

The 2005 NWI data was used in this analysis to report status and trends, as this is currently the best data source available. However, this data may not accurately reflect current conditions on the ground.

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Landscape Level Wetland Functional Assessment (LLWFA)

- ▣ Source data are a primary limiting factor.
- ▣ Wetland mapping limitations due to scale, photo quality, and date and time of year of the photos.
- ▣ Functional assessment is a preliminary one based on:
 - Wetland Characteristics interpreted through remote sensing
 - Professional Judgment of various specialists to develop correlations between those wetlands and their functions.
- ▣ Watershed-based Preliminary Assessment of wetland functions:
 - Applies general knowledge about wetlands and their functions
 - Develops a watershed overview that highlights possible wetlands of significance
 - Does not consider the condition of the adjacent upland
 - Does not obviate the need for more detailed assessment of various functions
- ▣ This analysis is a "Landscape Level" assessment and used to identify wetlands that are likely to perform a given function at a level above that of other wetlands not designated