Rogue River Watershed Wetland Initiative Action Plan

April 9, 2010
Project No. G07431

Fishbeck, Thompson, Carr & Huber
engineers • scientists • architects • constructors

ROGUE RIVER WATERSHED

WETLAND INITIATIVE ACTION PLAN

APRIL 9, 2010
PROJECT NO. G07431

Fishbeck, Thompson, Carr & Huber, Inc. Engineers • Scientists • Architects • Constructors
1515 Arboretum Drive, SE, Grand Rapids, MI 49546 Telephone: 616-575-3824

TABLE OF CONTENTS

INTRODUCTION 1

LANDSCAPE LEVEL WETLAND FUNCTION ASSESSMENT TOOL 1

ANALYSIS OF LLWFA RESULTS 1
- Qualifications and Limitations 1
- Wetland Areas 2
- Wetland Functions 2
  - Function Gains 3
  - Function Losses 3
- Rare and Imperiled Wetlands 4

PUBLIC COMMENT 4

PRIORITIES FOR WETLAND RESTORATION AND PRESERVATION 5

TOOLS FOR WETLAND RESTORATION 6
- Establishing Wetland Hydrology 8
- Establishing Wetland Function 9

TOOLS FOR WETLAND PRESERVATION AND PROTECTION 10
- Structural and Vegetative Tools 16
- Managerial Tools 16

FUTURE STEPS 17

REFERENCES CITED 20

LIST OF TABLES

Table 1	Wetland Functional Unit Comparison
Table 2	Wetland Impairments Discussed During the January 26, 2010, Public Meeting
Table 3	Wetland Restoration Assistance and Strategies
Table 4	Recommended Wetland Design Approaches to Restore Wetland Functions
Table 5	Wetland Preservation and Management Strategies
Table 6	Potential Wetland Restoration and Preservation Technical Partners

LIST OF APPENDICES

Appendix 1	Rogue River Watershed Final Report
Appendix 2	Maps
Appendix 3	Rogue Arcreader Conservation Lands

LIST OF ABBREVIATIONS/ACRONYMS

AWRI	Annis Water Resources Institute
BMP	Best Management Practice
CARL	Conservation and Recreation Lands
CCRP	Continuous Conservation Reserve Program
Council	Rogue River Watershed Council
CRP	Conservation Reserve Program
DU	Ducks Unlimited
FTC&H	Fishbeck, Thompson, Carr & Huber, Inc.
GAP	Government and Protected
GLARO	Great Lakes Atlantic Regional Office

TABLE OF CONTENTS

GLRI	Great Lakes Restoration Initiative
GVSU	Grand Valley State University
LGRW	Lower Grand River Watershed
LLWFA	Landscape Level Wetland Function Assessment
MDNRE	Michigan Department of Natural Resources and Environment
NAWCA	North American Wetlands Conservation Act
NPS	Nonpoint Source
NRCS	USDA Natural Resources Conservation Service
NWI	National Wetland Inventory
SESC	Soil Erosion and Sedimentation Control
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
Watershed	Rogue River Subwatershed
WMP	Watershed Management Plan
WRP	Wetlands Reserve Program

INTRODUCTION

The Lower Grand River Watershed (LGRW) Wetland Initiative project was awarded to Grand Valley State University's (GVSU) Annis Water Resources Institute (AWRI) in 2007. Grant funding was provided by the U.S. Environmental Protection Agency (USEPA) through the Clean Water Act Section 104 (b)(3) program. Project partners included the Michigan Department of Natural Resources and Environment (MDNRE) and Fishbeck, Thompson, Carr & Huber, Inc. (FTC&H).

Project tasks included modeling past and present wetland functions in the LGRW using the Landscape Level Wetland Function Assessment (LLWFA) tool. The goal of the project was to use this technique to produce an inventory and analysis of historic and current wetlands and their functions. An assessment of wetland function gains and losses could then be determined. As a separate task, Wetland Initiative Action Plans were developed for three subwatersheds of the LGRW: the Rogue River, Spring Lake, and Dickerson Creek Subwatersheds. The goal of this Wetland Initiative Action Plan is to: 1) summarize the results of the Rogue River Subwatershed LLWFA; 2) establish priorities for wetland restoration and preservation; and 3) detail approaches for wetland restoration and preservation.

LANDSCAPE LEVEL WETLAND FUNCTION ASSESSMENT TOOL

A LLWFA was conducted for the Rogue River Subwatershed (Watershed) to evaluate the extent that landscape development has impacted historic wetlands and impaired their functions. GVSU's AWRI, in collaboration with the MDNRE, completed this assessment in 2009. The summary report is located in Appendix 1. The assessment methodology is based upon the work of R.W. Tiner (2003 and 2005). It compared wetland databases for presettlement and contemporary landscapes (based on 1978 land use data) to determine changes in wetland location, type, and functions. The maps and tables generated by this study identify the locations of existing and former wetlands, the functions they provided, and the severity that site development has impacted these functions. This data provides an empirical foundation for establishing restoration and preservation priorities. Interested parties, such as governmental units, land preservation groups, and private citizens, may use the information obtained from the LLWFA to guide their wetland restoration and preservation efforts.

ANALYSIS OF LLWFA RESULTS

QUALIFICATIONS AND LIMITATIONS

The LLWFA includes many caveats regarding the reliability of the data upon which the analysis was completed. For some wetland functions, historic data is not available (i.e. the extent of rare and imperiled wetlands). In addition, the current wetland status was based upon the 1978 National Wetland Inventory (NWI), which was the best available data at the time of the analysis, although it may not accurately reflect current conditions. The 1978 NWI is currently being updated by Ducks Unlimited (DU) and MDNRE using

2005 aerial photographs. Also, the NWI is based upon interpretation of aerial photographs, which is subject to errors of omission (especially with regard to forested and drier-end wetlands) and errors of commission (misinterpretation of aerials). Despite these limitations, the LLWFA provides valuable insights into trends of wetland functional loss within the Watershed.

WETLAND AREAS

The LLWFA indicated that 45 percent of original wetland acreage has been lost in the Watershed, a reduction of 13,917 acres. In general, wetland loss appears to have primarily occurred in isolated wetlands and in wetlands associated with headwater streams. The wetlands that remain in the Watershed are primarily located along major drainageways. The average size of individual wetlands shrank from 18 acres to 6.5 acres, and the total number of wetland units increased from 1,722 to 2,658, indicating fragmentation of wetland habitat. Comparison of the Pre-European Settlement Wetland Coverage map, the 1978 Wetland Coverage map, and the Drainage Extent map suggests that many wetlands were drained through the construction of county drains and other drainageways.

The most significant block of wetland loss occurred west of Ransom Lake in Grant Township, at the northwest end of the Watershed. This area formerly contained Rice Lake, which drained into the headwaters of the Rogue River. According to the *Rogue River Watershed Management Plan* (AWRI, 2000), Rice Lake became dry in the 1900's and the area is now used for agriculture. The former Rice Lake area in Newaygo County contains a majority of the agricultural drains in the Watershed. A second significant block of lost wetlands is located at the south end of Grant Township, near 136th Street. This area also contains agricultural fields.

WETLAND FUNCTIONS

Table 1 summarizes the estimated percent loss or gain of wetland functions based upon functional unit comparison. In this analysis, highly functioning wetlands were weighed more highly compared to moderately functioning wetlands. Therefore, this analysis provides an estimate of cumulative function loss or gain, as opposed to merely the presence or absence of function. The LLWFA indicates losses for eleven of the thirteen evaluated wetland functions.

Table 1 - Wetland Functional Unit Comparison

Function	Pre-European Settlement Functional Units	1978 Functional Units	Predicted % of Original Capacity	Predicted % Change in Functional Capacity
Sediment and Other Particulate Retention	53518	21552	40	-60
Nutrient Transformation	56041	26364	47	-53
Flood Water Storage	35473	17298	49	-51
Interior Forest Bird Habitat	37945	18432	49	-51
Fish Habitat	50992	26005	51	-49
Streamflow Maintenance	45868	26148	57	-43
Ground Water Influence	17859	11297	63	-37
Amphibian Habitat	17705	11721	66	-34
Stream Shading	17252	11581	67	-33
Shoreline Stabilization	34021	23133	68	-32
Waterfowl and Waterbird Habitat	20211	17199	85	-15
Shorebird Habitat	14213	17352	122	22*
Conservation of Rare and Imperiled Wetlands	NA**	742	NA**	NA**
* Increases in the predicted percent change functional capacity can be attributed to the mapping differences in the two wetland layers and may not represent the current conditions on the ground.				
** Not applicable (NA) since rare and imperiled wetlands were not identified during pre-European settlement.				

FUNCTION GAINS

Shorebird habitat had an apparent increase in functional capacity. However, the predicted percent increase for shorebird habitat may be attributed to mapping differences in the two wetland layers and may not represent the current conditions on the ground.

FUNCTION LOSSES

In general, the wetland functions that were the most prevalent throughout the Watershed in presettlement conditions (i.e. had the greatest functional units) were also the functions that experienced the greatest percent loss in functional capacity by 1978. Sediment and other particulate retention (-60%), nutrient transformation (-53%), and floodwater storage (-51%) experienced the greatest functional capacity loss. All three of these functions are related to the ability of wetlands to manage storm water through detention and treatment. These functions are highly valued because they counteract the impairments experienced by storm water in areas with agricultural use and urban development (including soil erosion, nutrient enrichment, and flashy flow). Other known sources of sediment in storm water in the Watershed are stream banks and road/stream crossings (AWRI 2000).

With regard to wildlife habitat loss, two specific habitats have experienced significant loss within the Watershed: interior forest bird habitat (-51%) and fish habitat (-49%). The loss in interior forest bird habitat can be attributed to the significant loss in forested wetland area (an estimated loss of 57% of presettlement area). Fish habitat loss is related to landscape changes that prevent fish from completing their life cycle. Emergent wetlands and scrub shrub wetlands with standing water are appropriate

environments in which fish lay their eggs. These wetlands must have an adequate connection to a river to allow fish to enter them. They must also maintain adequate water levels during the hatching period so that once the eggs hatch, the young can thrive until they return to the river. By indicating a significant loss in fish habitat, the LLWFA is suggesting that emergent wetlands connected to rivers have been significantly impaired or drained.

A comparison has been made between the LLWFA wetland functional loss maps (Appendix 1), and the Watershed's Land Use Map and Fishery Type Map (Appendix 2), found in the Rogue River Watershed Management Plan (WMP). It is apparent that wetland functional loss is overall more prevalent in areas associated with the warm water streams in the western half of the Watershed than the cold water streams in the eastern half of the Watershed. The warm water stream area is generally flat and its predominant land use is cropland, forest, orchards, and open fields. The warm water stream area contains the majority of the constructed drainageways.

RARE AND IMPERILED WETLANDS

Five rare and imperiled wetlands (371 total acres) are located within the Watershed (Appendix 3). Based on the Conservation and Recreation Lands (CARL) and Government and Protected (GAP) land stewardship layers for Michigan, the vast majority of these five wetlands are not located on protected lands. Exceptions include the wetland located in Section 30 of Croton Township, Newaygo County. Approximately half of this wetland is located within the Manistee National Forest. In addition, less than five percent of the rare and imperiled wetland located in Section 29 of Pierson Township, Montcalm County is located on a state-owned forest reserve. The remaining wetland areas are in private ownership.

PUBLIC COMMENT

The Rogue River Watershed Council (Council) hosted a public meeting to present the results of the LLWFA and to solicit input. Attendees to the meeting included watershed residents, local government officials, Natural Resources Conservation Service staff, local business owners, and members of environmental groups active within the Watershed, including the Izaak Walton League, Trout Unlimited, and the Land Conservancy of West Michigan. The attendees reviewed the evaluated wetland functions and, drawing upon their knowledge of watershed conditions, provided input regarding site-specific impairments, areas of concern, and wetland function priorities. This information was incorporated into this Wetland Initiative Action Plan.

Table 2 summarizes the wetland functions and impairments noted by participants at the public meeting. During the meeting, the five habitat functions were combined into one function, and stream flow maintenance and groundwater influence were combined into one function (noted as groundwater influence). After listing specific impairments within the Watershed, teams of participants ranked the

wetland functions of greatest priority to them for restoration and preservation. Four functions were rated as a high-priority for restoration and preservation during this public meeting:

- Floodwater Storage Groundwater Influence
- Habitat
- Stream Shading

Table 2 - Wetland Impairments Discussed During the January 26, 2010 Public Meeting

Wetland Function	Impairment	Location of Impairment
Sediment and Other Particulate Retention	Urban storm water discharge with high energy flow	Rockford, Sparta, Cedar Springs
	Farm runoff due to row crops and no buffer	Nash Creek, Algoma Township
	Cattle crossings	Cedar Creek
Nutrient Transformation	Sewage discharge	Duke Creek in Village of Sand Lake
	Lawn fertilizer entering water bodies	Nash Creek, Wabasis Lake, Long Lake, Sand Lake
Flood Water Storage	Flooding	Rogue River/Grand River confluence, North Park area, City of Sparta, Summit Avenue/12 Mile Road intersection, behind Wolverine World Wide at White Pine Trail
Groundwater Influence	Maintaining cold water streams	Rogue River upstream from Rockford Dam, Cedar Creek, Stegman Creek, Duke Creek
Stream Shading	Loss of forest due to farming	Nash, Ball, and Duke Creeks
	Loss of forest due to residential development	Rum Creek
	Loss of forest due to golf course	Braeside Golf Course at Courtland Hills (Rum Creek at 10 Mile Road)
Shoreline Stabilization	Shoreline erosion	Stegman Creek, Rouge River south of 10 Mile Road
	Cattle crossings	Cedar and Duke Creeks
Habitat	Drained wetland	Rice Lake area

The group collectively expressed concern about maintaining the cold water streams located in the east half of the Watershed. Groundwater influence and stream shading are wetland functions that maintain cold water temperatures in cold water streams. As property owners within the Watershed, the participants were also concerned with property damage and other detrimental effects associated with flooding resulting from impaired floodwater storage. Finally, the group contained many environmentalists and sportsmen who place a high priority on habitat and the wildlife it supports.

PRIORITIES FOR WETLAND RESTORATION AND PRESERVATION

The Watershed has a highly agricultural land use and several areas of concentrated residential/commercial use. The cumulative impact of agricultural development (deforestation in the early 1900's and wetland draining through the construction of county drains and other drainageways throughout the 1900's) has resulted in significant loss in wetland function throughout the Watershed. Nowhere is this more evident than at the headwaters of the Rogue River, in the former Rice Lake area,

and in the Watershed's westernmost drainageways. The conversion of the 4,000-acre Rice Lake area to agricultural fields eliminated valuable floodwater storage capacity from the Watershed, and added additional stresses to wetland function by eliminating a means to remove suspended solids and dissolved nutrients from storm water. Development in the populated centers of the Watershed (especially the City of Rockford and the Villages of Sparta and Cedar Springs) and in rural residential areas throughout the Watershed has placed additional pressure on wetland function. This is due to changes in storm water flow patterns and volumes resulting from increased areas of impervious surfaces and altered topography. As a result, various portions of the Watershed flood routinely, as noted in Table 2.

Therefore, priorities for wetland restoration and preservation are focused on maintaining the quality of existing wetlands by managing storm water appropriately to prevent detrimental impacts to these wetlands, and by restoring former wetlands to reintroduce wetland function to the Watershed. Specifically, priorities for wetland management within the Watershed include:

- Identify potential wetland restoration sites and acreage goals that provide sediment and other particulate retention, nutrient transformation, and floodwater storage capacity (see figures in Appendix 1 for pre-European wetlands that performed these functions).
- Protect interior bird and fish habitat by preserving and appropriately managing existing wetlands (see figures in Appendix 1 for existing interior bird and fish wetland habitat areas).
- Protect the rare and imperiled wetland areas that are not located on permanently protected lands (see Appendix 3 for these rare and imperiled wetland areas).
- Install land management techniques that prevent flooding and translocation of sediment and fertilizer to protect wetlands and waterways.

TOOLS FOR WETLAND RESTORATION

The LLWFA tool may be used to select appropriate wetland restoration sites. Priority restoration sites include those located in a fragmented wetland system (i.e. a former wetland located near existing wetlands). Restoration of these areas creates a larger continuous and varied block of wetland habitat, supporting a greater diversity of wetland species. An additional consideration is to select a wetland area owned by one property owner, since it presents fewer logistical challenges than selecting a site owned by several owners. Table 3 provides information regarding the implementation of wetland restoration strategies.

Table 3 - Wetland Restoration Assistance and Strategies

Tool	Links	Description	Benefits	Strategies
RESTORATION ASSISTANCE				
Federal Programs				
USDA-NRCS, Wetlands Reserve Program (WRP)	www.nrcs.usda.gov/programs/wrp/states/mi.html	Government purchases permanent or 30-year conservation easements over the restored wetland and adjacent land	Restores wetland functions and habitat and provides long-term or permanent protection	Enroll through the local NRCS office. NRCS will assist landowner in all aspects of project
US Fish & Wildlife Service, Partners for Fish and Wildlife	http://ecos.fws.gov/partners/	Offers technical and financial assistance to landowners who wish to restore degraded wetlands, riparian corridors, streams, and other critical habitats. No payments to landowner	Restores natural communities	A voluntary program for private landowners. US F&WS will assist landowner in all aspects of project
Farm Service Agency Conservation Programs, Conservation Reserve Program (CRP), Continuous Conservation Reserve Program (CCRP)	www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=landing	Several programs that preserve and enhance wetlands and wetland buffers. Landowners receive annual payments for 10-15 years		Restore wetland hydrology to farmed wetlands or lands with a recent agricultural history
USDA NRCS Engineering Field Handbook	http://directives.sc.egov.usda.gov//OpenNonWebContent.aspx?content=17765.wba	Chapter 13. Wetland Restoration, Enhancement or Creation		
State Programs				
Matching Aid to Restore States Habitat (MARSH)	www.ducks.org/	A reimbursement program through Ducks Unlimited that provides funds for wetland restoration	Project must significantly benefit waterfowl	MDNRE Wildlife Division coordinates program in Michigan. Funds may be used for wetland acquisition, and habitat restoration and enhancement

Table 3 - Wetland Restoration Assistance and Strategies

Tool	Links	Description	Benefits	Strategies
MDNRE Landowner Incentive Program	www.michigan.gov/dnr/0,1607,7-153-10370_36649---,00.html	Helps private landowners create and manage habitat for species that are rare and/or declining by providing advice, management plans, and funding to individuals and organizations throughout the state that qualify	Wetland restoration	Specific to the species being addressed
Private Programs				
Michigan Wildlife Habitat Foundation's Private Wetlands Project	http://yosemite.epa.gov/water%5Cadopt.nsf/by+State/638EBC08C60D1F8E85257156005209EF?OpenDocument	Wetland restoration program using both trained volunteers and professional staff to identify potential wildlife restoration areas and help implement wetland restoration projects	Restores wetland functions and habitat on agricultural land	On private land only. Most projects involve removing underground drainage tiles and blocking small open ditches to restore wetland hydrology
RESTORATION STRATEGIES				
Blocking Existing Drainage Systems	www.dnr.state.mi.us/publications/pdfs/huntingwildlifehabitat/landowners_guide/Habitat_Mgmt/Wetland/Wetland_Restoration_Techniques.htm	Break or remove field drainage tiles, plug ditches, or install low-level berm	Restores wetland hydrology at a former or degraded wetland site	Most cost-effective method to restore a historic wetland. Projects impacting drains must be coordinated with the County Drain Commissioner
Water Control Structures	www.nwrc.usgs.gov/wdb/pub/wmh/13_4_8.pdf http://el.erdc.usace.army.mil/elpubs/pdf/hsem3-1.pdf	Man-made structures that control water flow in and out of wetlands	Provide control of water levels to ensure the establishment of wetland hydrology	Include spillways, pipes with drop inlets, pumps, sub-surface drain tiles, and other structures
Excavation		Removal of soil to create wetland hydrology within the rooting zone	These wetlands are simple to build and may require minimal engineering	Limited to relatively small areas of flat terrain. May remove sediment from wetland. Groundwater must be relatively near ground surface

ESTABLISHING WETLAND HYDROLOGY

The key to effective wetland restoration is restoring wetland hydrology to the degraded wetland. Groundwater must be present within the surface foot during a significant portion of the growing season in order for wetland vegetation to establish. Former wetlands have either been drained or filled to create dry

ground. Draining typically consists of constructing a network of ditches that discharge to a water body and/or installing buried drainage tile throughout a site. In some cases, the wetland may have dried up due to regional modifications of groundwater and/or surface water hydrology.

To reinstate wetland hydrology, the cause of hydrologic modification must be identified and appropriately modified. Ditches may be plugged or drainage tiles may be broken or removed. If the ditch is a designated county drain, the county Drain Commissioner should be involved in the project and must approve the modifications or changes.

Breaking or removing drainage tiles is one of the most cost-effective methods to restore a historic wetland. Another cost-effective approach is to use a ditch plug or low-level berm. In addition, water control structures may regulate water flow in and out of the wetland. Soil may also be excavated from filled wetlands, in order to restore wetland hydrology. However, this approach may be costly.

ESTABLISHING WETLAND FUNCTION

The specific historic wetlands targeted for restoration should be driven by the wetland functions of highest priority for reestablishment. The historic functions will dictate the required characteristics of appropriate restoration sites, and the ecological and hydrological nature of the reestablished wetland. Wetlands should be restored to pre-disturbed conditions to the greatest extent possible. Table 4 provides general guidelines for establishing specific wetland functions. Technical partners assisting in restoration projects can ensure that the proposed wetland design incorporates the needed elements to elicit the desired functions.

Table 4 - Recommended Wetland Design Approaches to Restore Wetland Functions

Wetland Function	Optimal Landform Placement	Targeted Plant Communities	Targeted Hydrology	Targeted Soil
Sediment and Other Particulate Retention	Basins and floodplains along water bodies, especially downgradient of urban areas and agricultural fields. Not areas with minimal watershed	Any vegetated community	Any	Any
Nutrient Transformation	Along water courses, especially low-order streams	Any densely vegetated community	Fluctuating water table, seasonally flooded or saturated	High organic matter and clay content
Flood Water Storage	Floodplains or large, flat areas adjacent to rivers and streams, large enough to accommodate expected storm water volumes	Any	Surface water fed	Any
Interior Forest Bird Habitat	Streamside and floodplain wetlands adjacent to large tracts of forested uplands	Forested uplands and forested wetlands	Any	Any

Table 4 - Recommended Wetland Design Approaches to Restore Wetland Functions

Wetland Function	Optimal Landform Placement	Targeted Plant Communities	Targeted Hydrology	Targeted Soil
Fish Habitat	Adjacent to lakes and streams with year-round flow	Forested wetland and shallow marsh-open water areas	Inundated long-term. Groundwater fed	
Streamflow Maintenance	Floodplain along headwater streams and outflow lakes	Any	Discharges groundwater into streams and lakes	Sandy
Groundwater Influence	Any	Any	Groundwater fed	Sandy
Amphibian Habitat	Depends upon targeted species (e.g. vernal pool)	Depends upon targeted species	Seasonally flooded	
Stream Shading	Along water courses	Forested or scrub shrub wetland, especially with adjacent upland forest	Any	Any
Shoreline Stabilization	Along a water course or lake	Any	Any	Any
Waterfowl and Waterbird Habitat	Depends upon targeted species	Depends upon targeted species (e.g. emergent wetland)	Frequently flooded for long periods or seasonally flooded	Any
Shorebird Habitat	Open areas along water bodies	Depends upon targeted species (e.g. mud flat)	Any (e.g. very shallow, bare mud)	Any

TOOLS FOR WETLAND PRESERVATION AND PROTECTION

Table 5 contains tools useful for preserving existing wetlands. The listed strategies include those that alter the landscape (structural and vegetative tools) and those involved in land use planning and management (managerial tools).

Table 5 - Wetland Preservation and Management Strategies

Tool	Targeted Wetland Function/ Intent	Links	Description	Benefits	Strategies
Protection					
Vegetative Buffer/ Greenbelt	Nutrient Transformation, Sediment and Particulate Retention, Shoreline Stabilization	http://www.michigan.gov/documents/deq/deq-wb-nps-bfs_250604_7.pdf	A strip of upland surrounding a wetland that is maintained in a natural vegetated state	Slows velocity of overland flow; captures excess sediment, nutrients, and pollutants. Provides wildlife habitat	50 to 300 feet wide, but the wider the buffer the better

Table 5 - Wetland Preservation and Management Strategies

Tool	Targeted Wetland Function/ Intent	Links	Description	Benefits	Strategies
Exclusion Fencing	Sediment and Particulate Retention, Shoreline Stabilization	http://efotg.nrcs.usda.gov/references/public/NM/382spec.pdf	Placement of a physical barrier to prevent livestock grazing, excessive human use, or vehicle traffic from degrading a wetland	Maintains wetland vegetation and stabilized soil	Place fencing as far from wetland as possible. Choose the correct fence material for the desired purpose to save money and maintenance time
Regulation and Ordinances					
Enforcement of Soil Erosion and Sedimentation Control (SESC) Statute (Part 91)	Nutrient Transformation, Sediment and Particulate Retention	www.michigan.gov/deq/0,1607,7-135-3311_4113---,00.html	A SESC Permit must be obtained prior to site development	Protects wetlands from sedimentation	The County Board of Commissioners must designate an agency to enforce compliance of SESC permits. This could be the county road or drain commission, or local government. The Kent and Newaygo County Road Commissions are enforcing agents in the Rogue River Watershed
Wetland Ordinance	Preservation	http://www.michigan.gov/deq/0,1607,7-135-3313_3687-24312--,00.html	Local regulation to control and preserve wetlands not protected under state or federal regulations	Protects otherwise unregulated wetlands from harmful impacts	Local government must produce a wetland map to accompany the wetland ordinance

Table 5 - Wetland Preservation and Management Strategies

Tool	Targeted Wetland Function/ Intent	Links	Description	Benefits	Strategies
Fertilizer Ordinance	Nutrient Transformation	www.state.nj.us/dep/watershedmgt/DOCS/TMDL/Fertilizer%20Application%20Model%20Ordinance.pdf www.waynecounty.com/doe/watershed/rougeriver/ordinance/pdfs/fertilizer.pdf	Regulates the use of manufactured fertilizers, especially those containing phosphorus	Prevents excess landscaping fertilizers from entering wetlands and water bodies, thus preventing growth of nuisance plants and the formation of anaerobic conditions	Regulates fertilizer application times, application locations, and acceptable fertilizer concentrations. May require soil testing to confirm the need for fertilization
Natural Feature Setback Ordinance	Sediment and Particulate Retention, Shoreline Stabilization, All Habitat	http://macombcountymi.gov/Planning/PDF_Files/Model%20Ord.%20Chapters/06-Setback%20Ordinance%201-14-04.pdf	Zoning regulations that prohibit development within a prescribed distance from rivers, lakes, or other natural features. Results in an unmowed, vegetated buffer between the natural feature and adjacent land uses	Minimizes the potential impacts of land uses on sensitive areas. Reduces surface water temperature and nutrient loads, filters sediments and other contaminants from storm water, and provides wildlife habitat	Setbacks may vary, depending upon the type of development (roads, buildings, septic systems, gas, oil, or salt-brine wells). They may also define minimum lot size and dimensions. The wider the setback, the greater protection it will provide. At a minimum, the buffer width should be at least twenty five feet

Table 5 - Wetland Preservation and Management Strategies

Tool	Targeted Wetland Function/ Intent	Links	Description	Benefits	Strategies
Open Space Zoning and Conservation Design	Preservation	www.epa.gov/nps/ordinance/openspace.htm	Zoning regulations that require the preservation of open, undeveloped areas. Design approaches that include such areas	Protects natural features, such as wetlands	Thoroughly inventory and map a site's natural features. Designate the location of the site's preserved open space. Locate buildings in a manner that protects sensitive natural features and maximizes open space size and quality. Maintain low visual impact, especially from roads and open water
Land Preservation					
Municipal Master Plan	Preservation		Future land use map may note sensitive areas, such as wetlands, that are valued for preservation	Allows for intentional development that preserves and protects natural features	Use in conjunction with ordinances that support preservation and appropriate land use of identified areas
Conservation Easement	Preservation	http://www.michigan.gov/documents/deq/lwm-wetlands-conservationeasements_263027_7.pdf http://www.michigan.gov/documents/deq/lwm-wetlands-conservationeasementchecklist_263028_7.pdf	A voluntary agreement that transfers certain rights concerning the use of the land to a qualified nonprofit organization, governmental body or other legal entity without transferring title to the land	Limits uses, or prohibits certain acts, on a parcel of land. Protects wetlands while allowing landowners to use property. Possible financial incentives to the landowner	May be drafted to meet particular circumstances and objectives of the landowner. It can specify allowed uses compatible with wetland protection. Financial incentives may exist

Table 5 - Wetland Preservation and Management Strategies

Tool	Targeted Wetland Function/ Intent	Links	Description	Benefits	Strategies
Public Floodplain Acquisition for Greenways and Parklands	Preservation		Local government purchases floodplain areas for passive recreation areas	Preserves and protects associated wetlands in the floodplain	A component in strategic long-range planning. May be used to connect existing parks along a linear greenway. Provides both environmental and societal benefits
Donation	Preservation	www.vbco.org/planninged uc0014.asp http://www.naturenearby.org/ProtectingLand.tab.aspx	Landowner gives property containing wetlands to a conservation organization or local government, with deed restrictions on future uses	Direct and cost effective method to preserve wetlands in their natural state	May be an outright donation, bargain sale (price is below market value), donation with a reserved life estate (donor retains possession and use during their lifetime), or a bequest (donation is noted in the owner's will)
Deed Restrictions and Covenants	Preservation	www.vbco.org/planninged uc0014.asp#INLINK003	Clauses placed in deeds restricting the future use of land; and contracts between a landowner and another party stating the acceptable and unacceptable uses of the landowner's land	A means for adjacent property owners to collectively control property use	Are generally not as effective as conservation easements. Enforcement is not as reliable. May be overturned

Table 5 - Wetland Preservation and Management Strategies

Tool	Targeted Wetland Function/ Intent	Links	Description	Benefits	Strategies
Purchase	Preservation	http://www.naturenearby.org/ProtectingLand.tab.aspx	Acquisition of wetland property by land conservancies, private individuals, or public agencies	Does not involve regulations	Should be coupled with a conservation easement to ensure protection in perpetuity. Financial assistance may be obtained from private sources, nonprofit organizations, local municipalities, and state and federal sources
Eminent Domain	Preservation		The power of federal, state, or local government to take private property for public use	A means for government to acquire land, although it is a costly and politically unattractive option	The acquired land must be taken for a public purpose, and the landowner must be fairly compensated
Voluntary Nonbinding Programs	Preservation	http://www.nature.org/wherewework/northamerica/states/michigan/ http://web4.msue.msu.edu/mnfi/about/index.cfm http://www.watershedcouncil.org/water%20resources/wetlands/wetland-groups/	Programs that provide support for wetland protection in a nonbinding, nonregulatory manner	Garner public support and educate landowners regarding the value of wetland protection	Programs include the Michigan Natural Areas Registry (administered through the Michigan Chapter of The Nature Conservancy), Natural Heritage Stewardship Award Program (coordinated by the Michigan Natural Features Inventory [MNFI]), and wetland stewardship programs (sponsored by watershed councils)

STRUCTURAL AND VEGETATIVE TOOLS

A key to preserving wetland quality is to properly manage storm water quality and quantity entering the wetland. Because the most prevalent land use within the Watershed is agriculture (cropland, orchard, and open fields), it is imperative to address potential impacts to wetlands from these uses. These impacts consist of soil disturbance due to plowing and tilling operations, and fertilization. These practices may potentially introduce sediment and nutrients into wetlands and water bodies. The Rogue River WMP provides a list of Best Management Practices (BMPs) to control nonpoint source (NPS) pollutants in the Watershed. Two of these recommended BMPs are vegetative buffers and fencing, which provide protective measures to control sediment and nutrients.

Buffers are strips of upland surrounding a wetland that is maintained in a natural, unmowed, vegetated state. The intent of the buffer is to intercept surface runoff and subsurface flow to remove nutrients, sediment, organic matter, pesticides, and other pollutants, preventing them from entering the wetland and associated water body. The buffer may be composed of three distinct zones. Zone 1 begins at the edge of the water body and extends a minimum distance of 25 feet. It contains undisturbed, native vegetation, including woody species, understory species, and a duff layer. Zone 2 extends immediately from the outer edge of Zone 1 for a minimum distance of 55 feet. This zone contains either an undisturbed or managed area of native vegetation and restricted, developed use (such as a bike path or two tracks). The presence of woody vegetation in both Zones 1 and 2 is encouraged because they effectively intercept storm water.

Zone 3 extends a minimum of 20 feet from the outer edge of Zone 2. This zone interfaces with developed land use and should encourage sheet flow into the buffer. This vegetated zone has few restrictions with regard to land use.

Exclusion fencing is a second BMP that effectively protects wetlands from storm water impairments. Soil enters wetlands and water bodies when the ground surface is disturbed due to livestock grazing, excessive human use, or vehicular traffic on unstable, wet slopes. Fencing provides a physical barrier that denies access to sensitive areas and redirects to drier, more stable areas. Fences should be placed as far away from the wetland as possible. While evaluating fencing options, the landowner should consider that type of animal needs to be excluded from the wetland and water body (i.e. cattle, sheep, goats, deer, or human). Typically, barb wire, non-electric fences or smooth wire, and electric fences are adequate for controlling access to sensitive areas.

MANAGERIAL TOOLS

Additional land management tools may be implemented to preserve native and restored wetlands in perpetuity. These tools are summarized in Table 5. Wetland preservation may be instigated by the individual landowner through a conservation easement, a deed restriction, or donation of the wetland to a conservation group. Local units of government may pave the way for intentional development that

protects wetlands by incorporating sensitive areas into the municipal master plan. Local government may also purchase wetlands in order to control their management, and perhaps incorporate these lands into greenways and parkland. In rare instances, local government may acquire wetlands through eminent domain, a politically unpopular approach to acquire private property.

Municipalities may exercise control over wetland impacts through the use of local ordinances. Wetland ordinances may restrict activities in those wetlands not protected by state and federal regulations. The State of Michigan provides guidelines for instituting a local wetland ordinance and requires that the local governmental unit produces a wetland map to accompany the wetland ordinance. Cannon Township adopted a wetland ordinance that could serve as a model ordinance for other local units of government in the Watershed.

A fertilizer ordinance restricts the use of manufactured fertilizer, especially those containing phosphorus. This prevents landscaping fertilizers from entering wetlands and water bodies, thus guarding against the growth of nuisance plants and impaired water quality. The fertilizer ordinance regulates fertilizer application times, locations, and concentrations.

A natural features setback ordinance prohibits development within prescribed distances from rivers, lakes, wetlands, and other natural features. The presence of an unmowed buffer slows storm water flow into water bodies, captures suspended sediment, and reduces nutrient load and temperature. The setback width will vary depending upon the type of development and the grade. However, the buffer should be at least 25-feet-wide.

Finally, local government may institute open space zoning and conservation design to protect Watershed wetlands. This zoning requires that the developer thoroughly inventory and map a site's natural features. Zoning regulations may require that open, undeveloped areas be preserved, and that buildings are located to protect sensitive areas and maximize open space size and quality.

FUTURE STEPS

The Council has committed to using this document, in coordination with the Rogue River WMP, as a guide to pursuing the restoration and preservation of wetlands in the Watershed. When embarking on this wetland initiative, the Council should work through the following action steps:

1. Contact technical partners experienced in wetland restoration and preservation,
2. Use the LLWFA to locate wetland areas meeting restoration and preservation priorities,
3. Contact and coordinate with owners of these priority wetland areas,
4. Identify restoration programs and funding sources,
5. Restore and preserve wetlands to maintain and reestablish priority functions, and
6. Evaluate long-term progress toward meeting restoration and preservation priorities.

DU has been active in the LGRW, where they have recently restored several wetland areas. DU would be a valuable technical partner in this initiative due to their vested interest in the area, expertise, and experience with grant funding. Wetland staff at MDNRE would also be a key partner since they are familiar with the use and capabilities of the LLWFA. Additional partners are listed in Table 6, as well as their contact information.

With assistance from the technical partners listed in Table 6, the LLWFA should be used to identify wetland areas based on the established priorities for wetland restoration and preservation. As previously mentioned, areas with fewer landowners will be easier to protect and restore. Large areas with only one or two landowners could mean the greatest benefit for the least amount of effort.

Appropriate funding programs should be determined with assistance from the technical partners. One program to consider is the Wetlands Reserve Program (WRP), administered by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS). This program is voluntary and provides incentive payments to the landowner. A second program to consider is the North American Wetlands Conservation Act (NAWCA) Grant Program. This program is administered by the U.S. Fish and Wildlife Service (USFWS) and provides matching grants to carry out wetland conservation and restoration projects. Lastly, the Great Lakes Restoration Initiative (GLRI) provides $475 million for projects that protect, maintain, and restore the integrity of the Great Lakes. Restoration costs can range from $500 for a simple tile break up to $5,000/acre for wetland restoration and the purchase of a conservation easement.

Restoration and preservation projects should consider the priority functions identified in this document to obtain the greatest benefit for the expended cost. Evaluating the progress toward meeting these priorities, in coordination with the Rogue River WMP, should be conducted on an annual basis to identify challenges early on and ensure success.

Table 6 - Potential Wetland Restoration and Preservation Technical Partners

	Name	Program	Website	Address	Contact Person	Phone No.	E-mail
Federal	USFWS	Partners for Fish and Wildlife Program	www.fws.gov	Michigan Private Land Office 2651 Coolidge Road East Lansing, MI 48823	Jim Hazelman, Assistant State Coordinator	(517) 351-6235	jim_hazelman@fws.gov
	NRCS	WRP	www.nrcs.usda.gov	Southwest Lower Peninsula Field Office 3260 Eagle Park Drive, NE, Suite 108 Grand Rapids, MI 49525	Tim Redder, WRP Program Coordinator	(517) 324-5257	tim.redder@mi.usda

Table 6 - Potential Wetland Restoration and Preservation Technical Partners

	Name	Program	Website	Address	Contact Person	Phone No.	E-mail
	U.S. Department of Agriculture (USDA) Michigan Farm Service Agency	CRP, CCRP	www.fsa.usda.gov	3001 Coolidge Road, Suite 350 East Lansing, MI 48823-6321	Dale Allen, Chief of Conservation Programs	(517) 324-5105	dale.allen@mi.usda.gov
State	MDNRE	Landowner Incentive Program	www.michigan.gov/dnrewildlife	Plainwell Service Center 621 N. 10th Street Plainwell, MI 49080	Chris Hoving	(269) 685-6851 ext. 142	hovingc@michigan.gov
State	MDNRE	Technical and Regulatory Assistance	www.michigan.gov/dnrewetlands	P.O. Box 30458 Lansing, Michigan 48909-7958	Rob Zbiciak, Wetlands Specialist	(517) 241-9021	ZBICIAKR@michigan.gov
Private	DU	NAWCA	www.ducks.org	Great Lakes Atlantic Regional Office (GLARO) 1220 Eisenhower Place, Ann Arbor, MI 48108	Mike Sertle, Regional Biologists (GLARO)	(734) 623-2000	msertle@ducks.org
Private	Land Conservancy of West Michigan		www.naturenearby.org	1345 Monroe Avenue Northwest Grand Rapids, MI 49505-4673	Pete DeBoer, Land Protection Specialist	(616) 451-9476	lcwm@naturenearby.org
Private	Michigan Wildlife Habitat Foundation		wildlife@mwhf.org	12120 Brant Road St. Charles, MI 48655-9533	Dennis Fijalkowski, Executive Director	(989) 865-6701	Not provided
Private	The Nature Conservancy		www.nature.org	West Michigan Office 3728 West River Drive, NE Comstock Park, MI 49321	West Michigan Office	(616) 785-7055	westmichigan@tnc.org

REFERENCES CITED

Annis Water Resources Institute. December 2000. *Rogue River Watershed Planning Project. Rogue River Watershed Management Plan. MR-2001-1.*

Tiner, Ralph W. 2005. *Assessing Cumulative Loss of Wetland Functions in the Nanticoke River Watershed Using Enhanced National Wetlands Inventory Data.* Wetlands, Vol. 25, No.2, June 2005, pp. 405-419.

Tiner, Ralph W. 2003. *Correlating Enhanced National Wetlands Inventory Data with Wetland Functions for Watershed Assessments: A Rationale for Northeastern U.S. Wetlands*. U.S. Fish and Wildlife Service, National Wetlands Inventory Program, Region 5, Hadley, MA. 26 pp.

Appendix 1

ROGUE RIVER WATERSHED

Landscape Level Wetland Functional Assessment

(Enhanced NWI)

Department of Environmental Quality

Land and Water Management Division

Data Limitations and Disclaimer

National Wetlands Inventory (NWI)

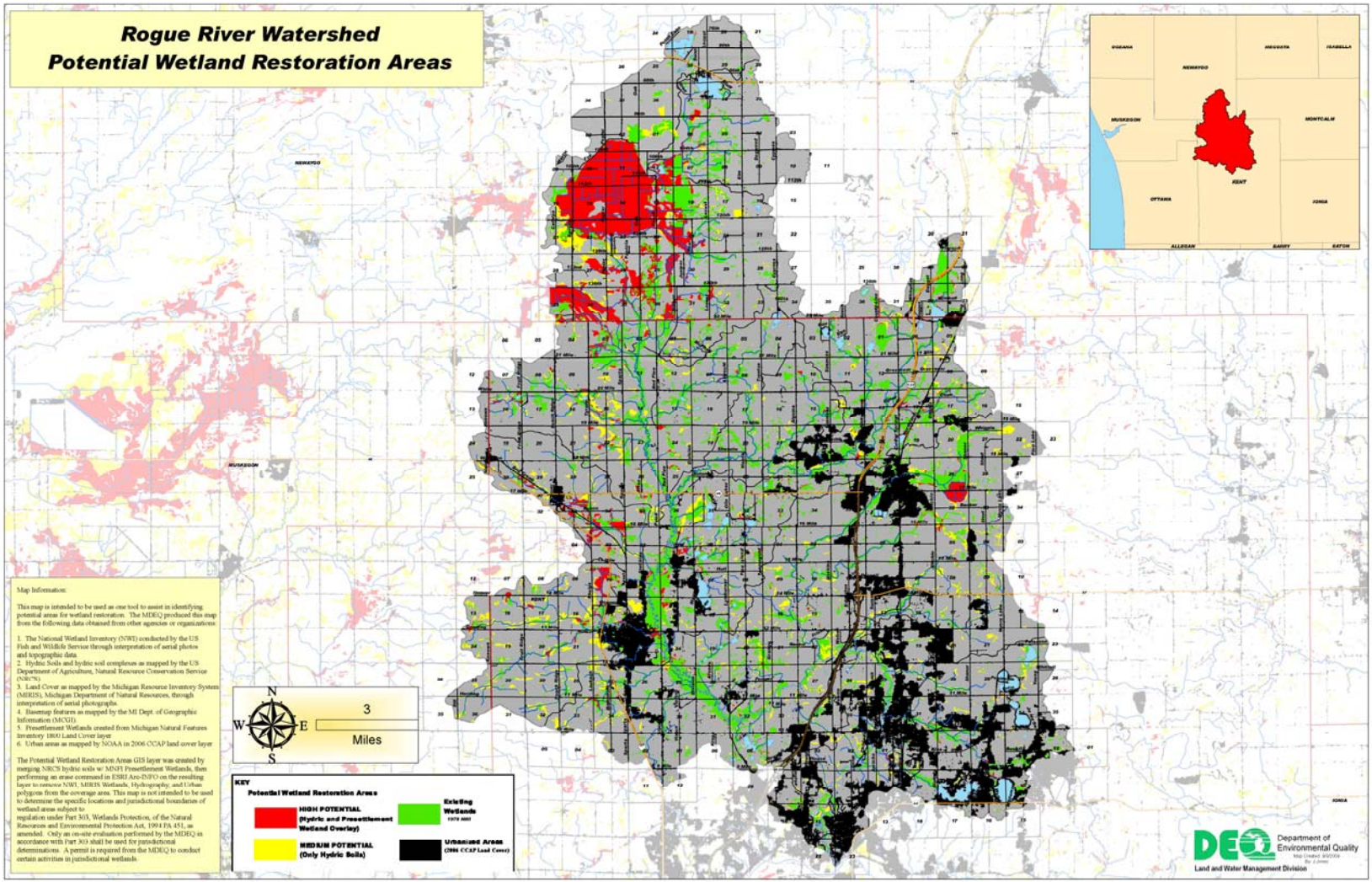
- Wetland boundaries determined from Aerial Imagery
- Last updated in 1978
- Obvious limitations to Aerial Photo Interpretation:
  - Errors of Omission (forested and drier-end wetlands)
  - Errors of Comission (misinterpretation of aerials)

The 1978 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.

THE MDEQ-Land and Water Mgmt Division has begun a joint project with Ducks Unlimited, Inc. to update the 1978 NWI using 1998 aerial imagery and 2005 aerial imagery. The project is on going, and this data will be used for all future Wetland Status and Trends analysis.

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.

ROGUE RIVER WATERSHED



Rogue River Watershed
Wetland Resources Status and Trends

Pre-settlement Wetland conditions

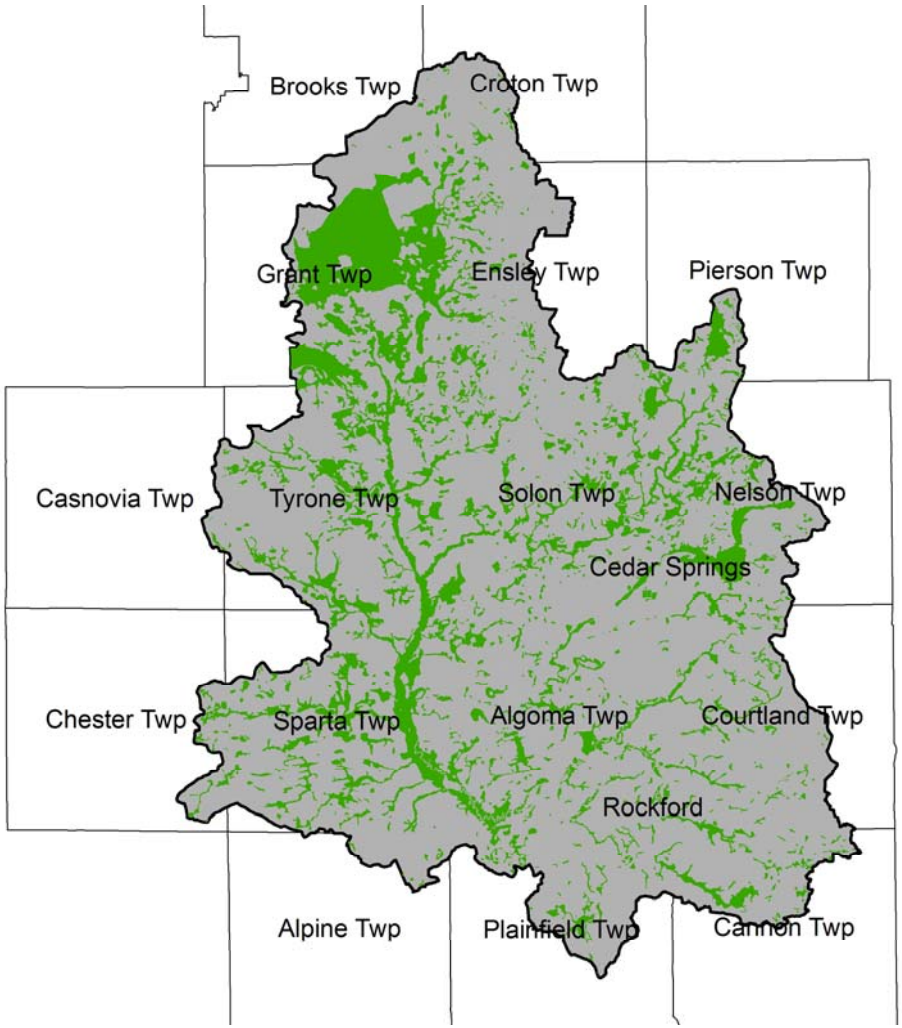
- 31,144 Acres of Wetlands
- 1,722 Polygons
- Average Size – 18 Acres

1978 Wetland Condition

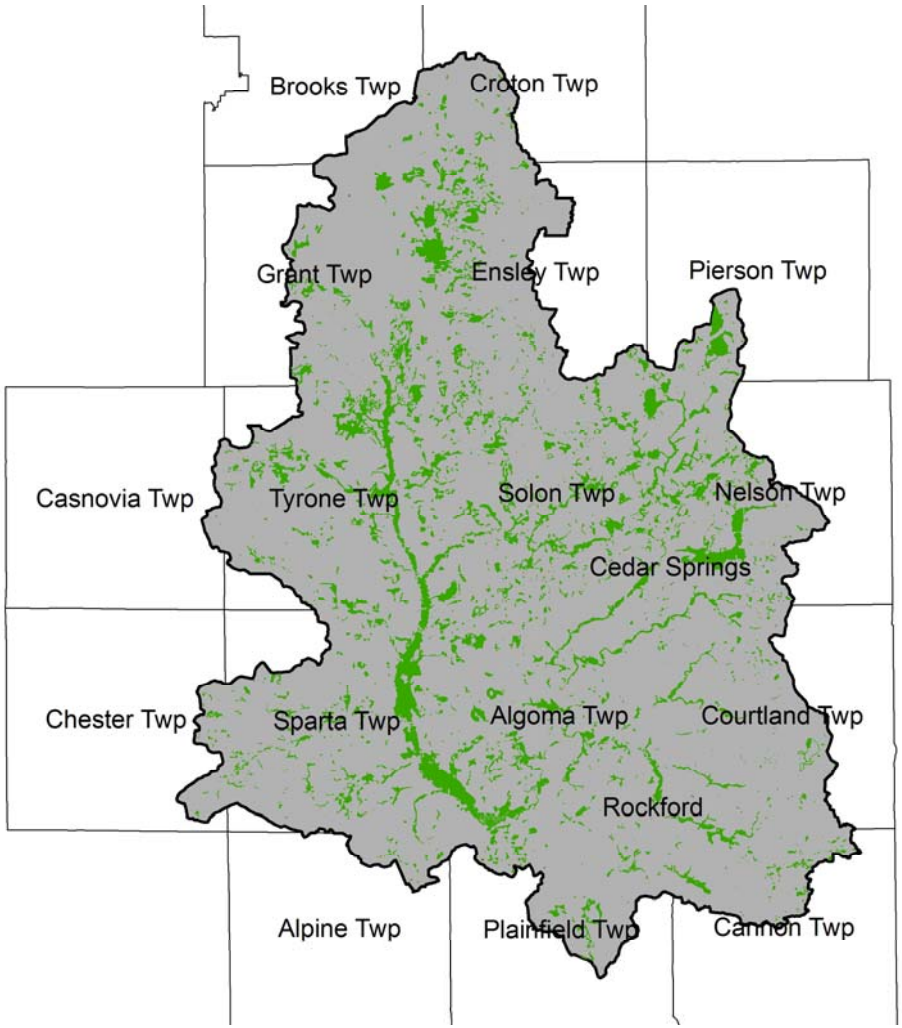
- 17,227 Acres of Wetlands
- 2,658 Polygons
- Average Size – 6.5 Acres

55% OF ORIGINAL WETLAND ACREAGE REMAINS
45% LOSS OF TOTAL WETLAND RESOURCE

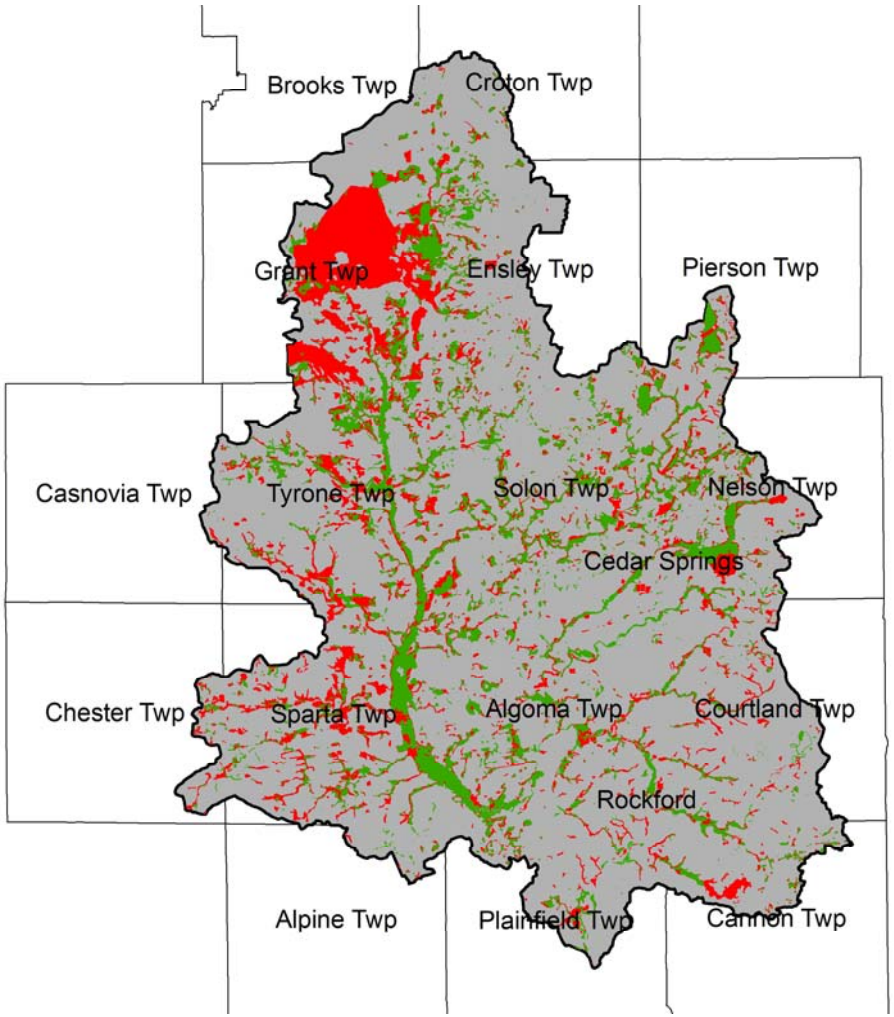
PRE-EUROPEAN SETTLEMET WETLAND COVERAGE



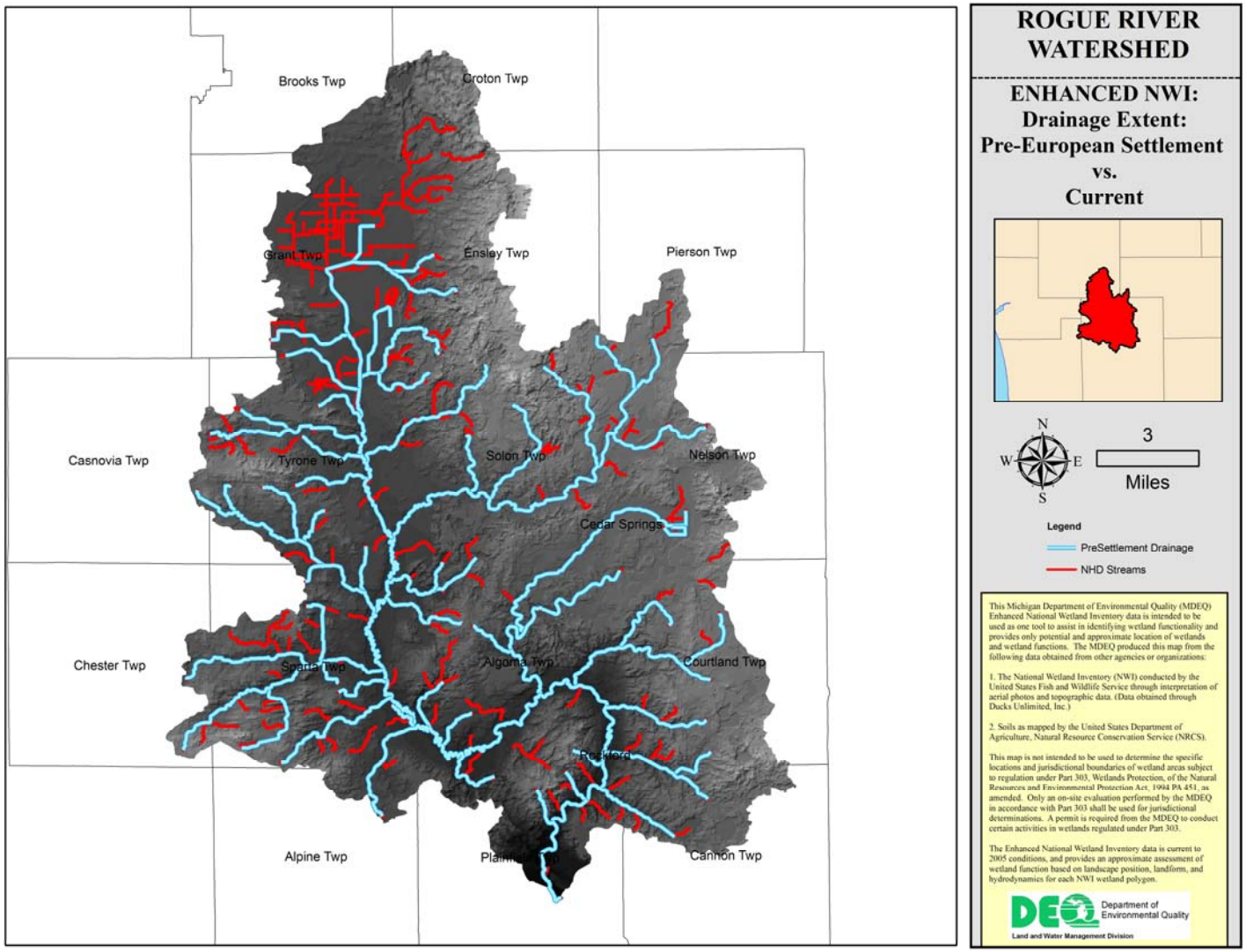
1978 WETLAND COVERAGE



APPROXIMATE WETLAND LOSS PRE-EUROPEAN SETTLEMENT TO 1978



DRAINAGE EXTENT



NWI TYPE COMPARISON

Table 1: Generalized NWI type comparison

Wetland Type	Pre-European Settlement Acres	1978 Acres of Wetlands	Net Acres Remaining
Palustrine Emergent	19.57	3,246.41*	100%
Palustrine Forested	26,506.46	11,444.67**	43%
Palustrine Shrub-Scrub	4,617.98***	2,371.18****	51%
Other Palustrine			
Ponds	0.00*****	1,149.45	100%
Total	31,144.01	18,211.71	58%

*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
***** Little acreage in ponds due to mapping differences between Pre-Settlement and Current wetland coverage's.

NWI CLASSES

Table 2: 1978 NWI Classes

NWI Wetland Type	Acreage
Lacustrine-Emergent	13.92
Aquatic Bed/Emergent	25.27
Aquatic Bed	126.14
Emergent	2,394.98
Mixed Emergent/Forested (Deciduous)	211.39
Mixed Emergent/Unconsolidated Bottom	59.56
Mixed Emergent/Scrub-Shrub (Deciduous)	563.91
Mixed Emergent/Aquatic Bed)	16.58
Broad-Leaved Deciduous Forested	9,403.32
Needle-Leaved Deciduous Forested	63.58
Deciduous Forest	196.72
Mixed Forested/Emergent (Deciduous)	282.74
Mixed Forested/Scrub Shrub (Deciduous)	1,498.31
Scrub-Shrub	1,194.30
Mixed Scrub-Shrub/Emergent	565.46
Mixed Scrub-Shrub / Forested	531.59
Unconsolidated Bottom/Vegetated	160.60
Unconsolidated Bottom	988.85
Total	18,297.22
Riverine-Unconsolidated Bottom	18.69
Lacustrine-Unconsolidated Bottom	1,820.58

DETAILED FUNCTIONAL COMPARISONS

Table 3: Detailed Functional Comparisons

Function	Potential Significance	Pre-European Settlement Acreage	1978 Acreage	% Change in Acreage
Flood Water Storage	High	10,881.79	7,031.24	-35
	Moderate	13,709.91	3,235.52	-76
	Total	24,591.70	10,266.76	-58
Streamflow Maintenance	High	20,916.79	11,548.86	-45
	Moderate	4,034.83	3,050.43	-24
	Total	24,951.62	14,599.29	-41
Nutrient Transformation	High	24,896.54	11,355.78	-54
	Moderate	6,247.46	3,652.73	-42
	Total	31,144.00	15,008.51	-52
Sediment and Retention of Other Particulates	High	24,574.43	8,806.76	-64
	Moderate	4,369.42	3,938.74	-10
	Total	28,943.85	12,745.50	-56
Shoreline Stabilization	High	11,192.45	10,046.27	-10
	Moderate	11,636.33	3,040.94	-74
	Total	22,828.78	13,087.21	-43
Fish Habitat	High	24,871.76	12,038.38	-52
	Moderate	1,248.45	1,928.71	54 *
	Total	26,120.21	13,967.09	-47
Stream Shading	High	8,609.88	5,733.74	-33
	Moderate	32.49	113.46	249 *
	Total	8,642.37	5,847.20	-32

* 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	1978 Acreage	% Change in Acreage
Waterfowl/Waterbird Habitat	High	4,389.34	4,097.82	-7
	Moderate	11,431.91	9,003.06	-21
	Total	15,821.25	13,100.88	-17
Shorebird Habitat	High	0.00	150.99	Null *
	Moderate	14,213.10	17,050.34	20 *
	Total	14,213.10	17,201.33	21
Interior Forest Bird Habitat	High	6,820.62	4,616.41	-32
	Moderate	24,303.82	9,199.44	-62
	Total	31,124.44	13,815.85	-56
Amphibian Habitat	High	7,824.40	4,713.93	-40
	Moderate	2,055.84	2,292.69	12 *
	Total	9,880.24	7,006.62	-29
Ground Water Influence	High	433.30	295.31	-32
	Moderate	16,992.35	10,706.46	-37
	Total	17,425.65	11,001.77	-37
Conservation of Rare and Imperiled Wetlands	High	Null	370.98	100
	Moderate	Null	Null	Null
	Total	Null	370.98	100

* 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 UNIT COMPARISON

Table 4: Functional Unit comparison

Function	Pre-European Settlement Functional Units	1978 Functional Units	Predicted % of Original Capacity Left	Predicted % Change in Functional Capacity
Flood Water Storage	35,473.49	17,298.00	49	-51
Streamflow Maintenance	45,868.41	26,148.15	57	-43
Nutrient Transformation	56,040.54	26,364.29	47	-53
Sediment and Other Particulate Retention	53,518.28	21,552.26	40	-60
Shoreline Stabilization	34,021.23	23,133.48	68	-32
Fish Habitat	50,991.97	26,005.47	51	-49
Stream Shading	17,252.25	11,580.94	67	-33
Waterfowl and Waterbird Habitat	20,210.59	17,198.70	85	-15
Shorebird Habitat	14,213.10	17,352.32	122	22 *
Interior Forest Bird Habitat	37,945.06	18,432.26	49	-51
Amphibian Habitat	17,704.64	11,720.55	66	-34
Ground Water Influence	17,858.95	11,297.08	63	-37
Conservation of Rare and Imperiled Wetlands	0	741.96	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.

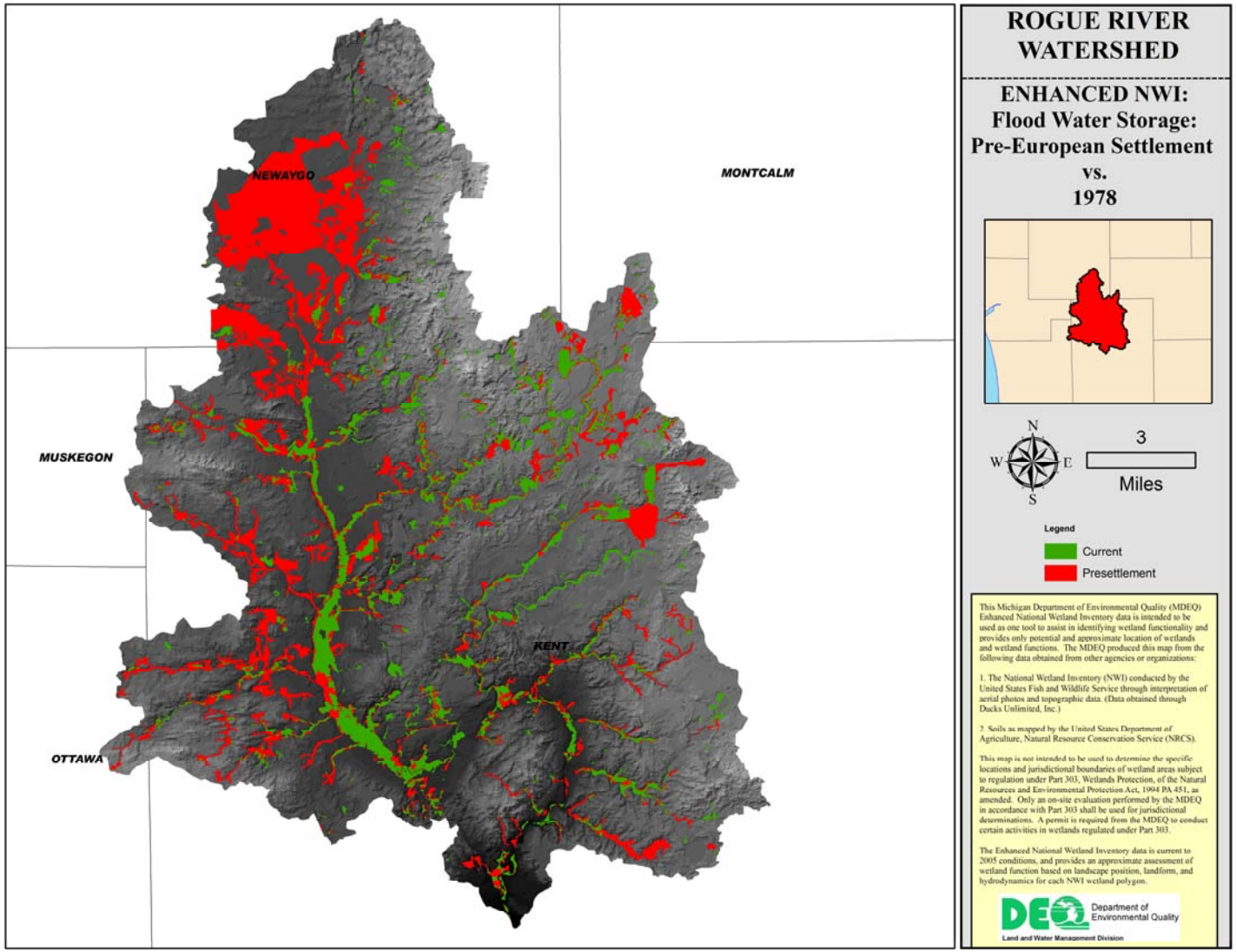
LIMITATIONS OF THE WETLAND FUNCTIONS FOR WATERSHED ASSESSMENT

- Source data are a primary limiting factor.
- Wetland mapping limitations due to scale, photo quality, and date and time of year of the photos.
- Difficulty of photo interpreting certain wetland types
  - Forested wetlands
  - Drier-end wetlands
- 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.

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).

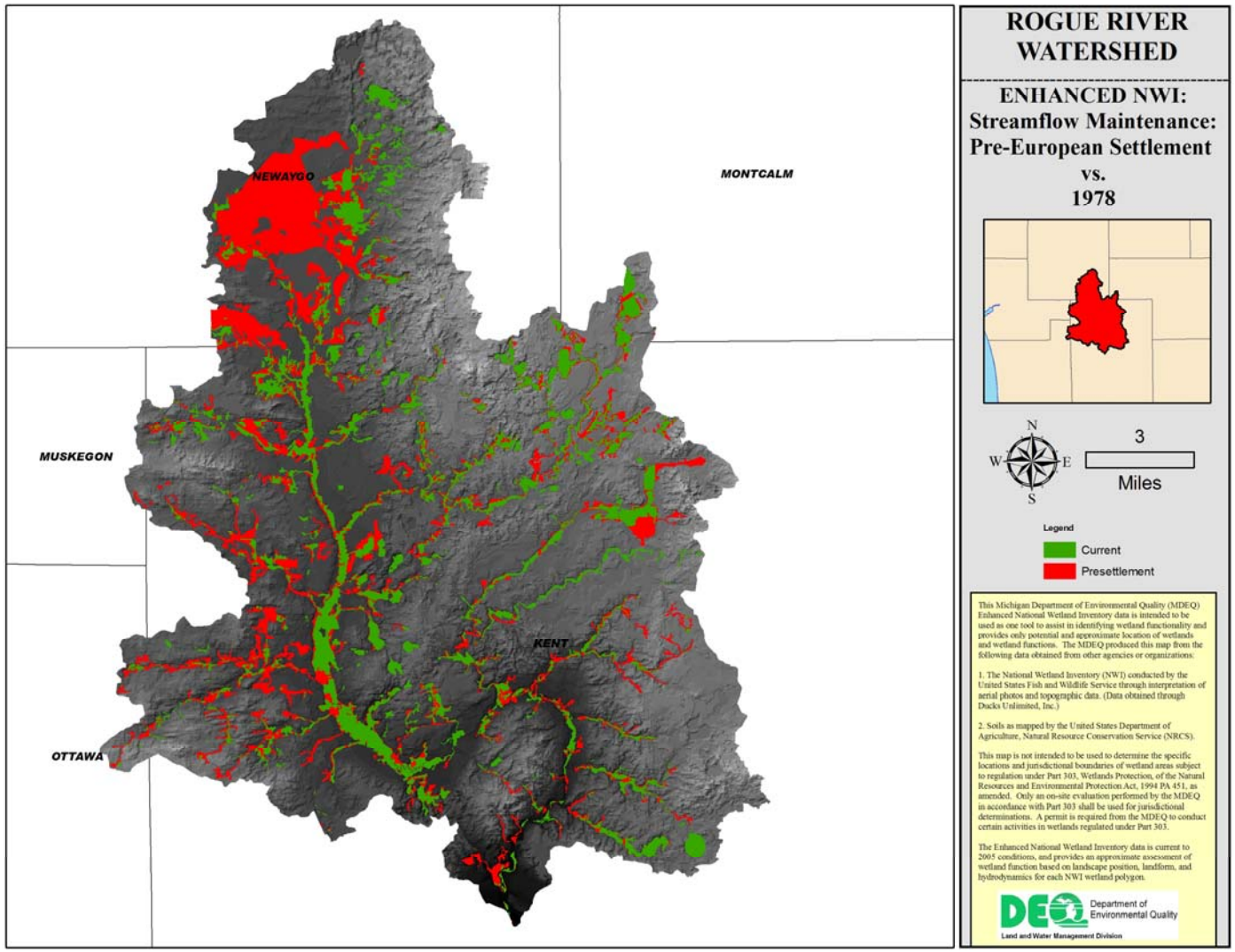
FLOOD WATER STORAGE



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).

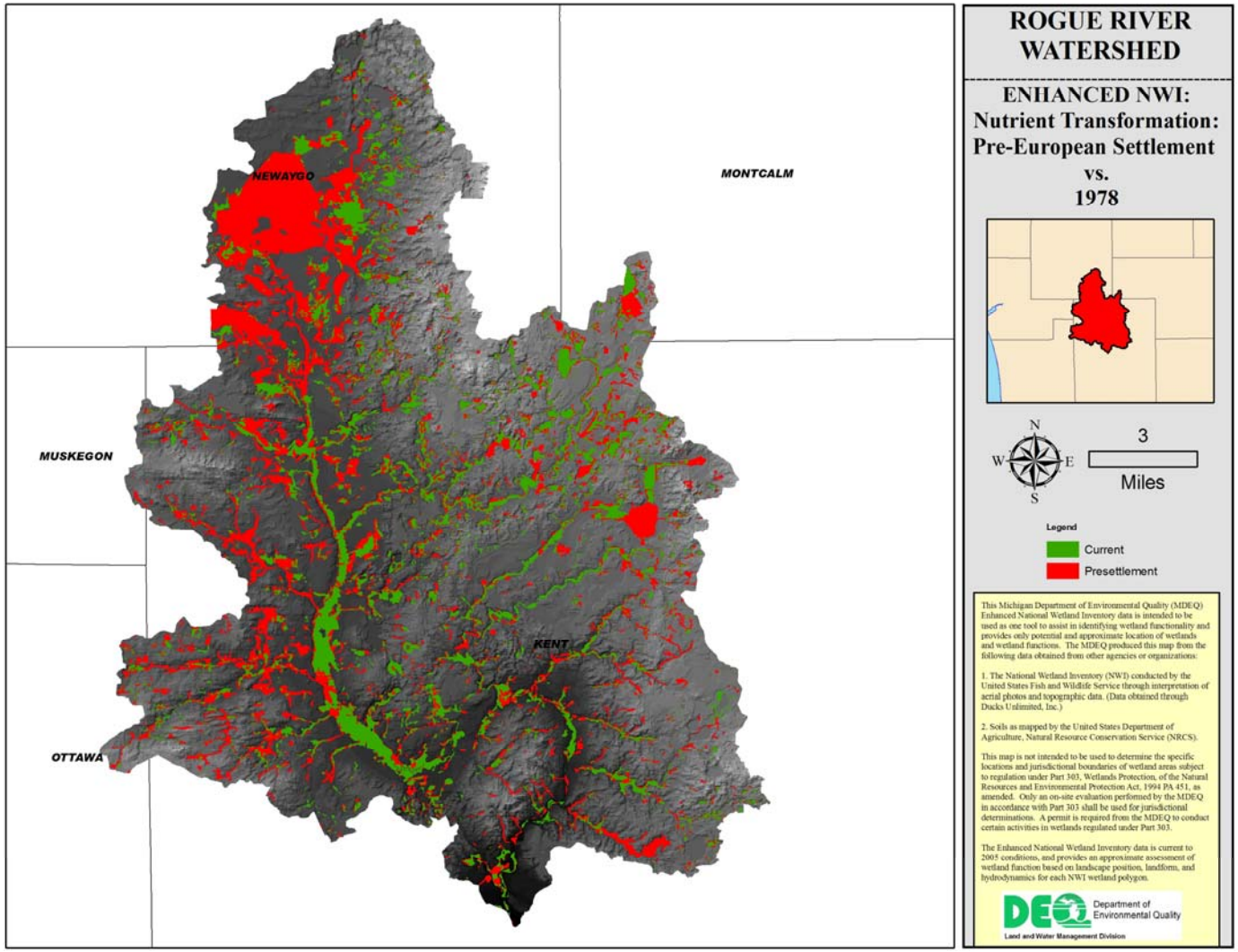
STREAMFLOW MAINTENANCE



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).

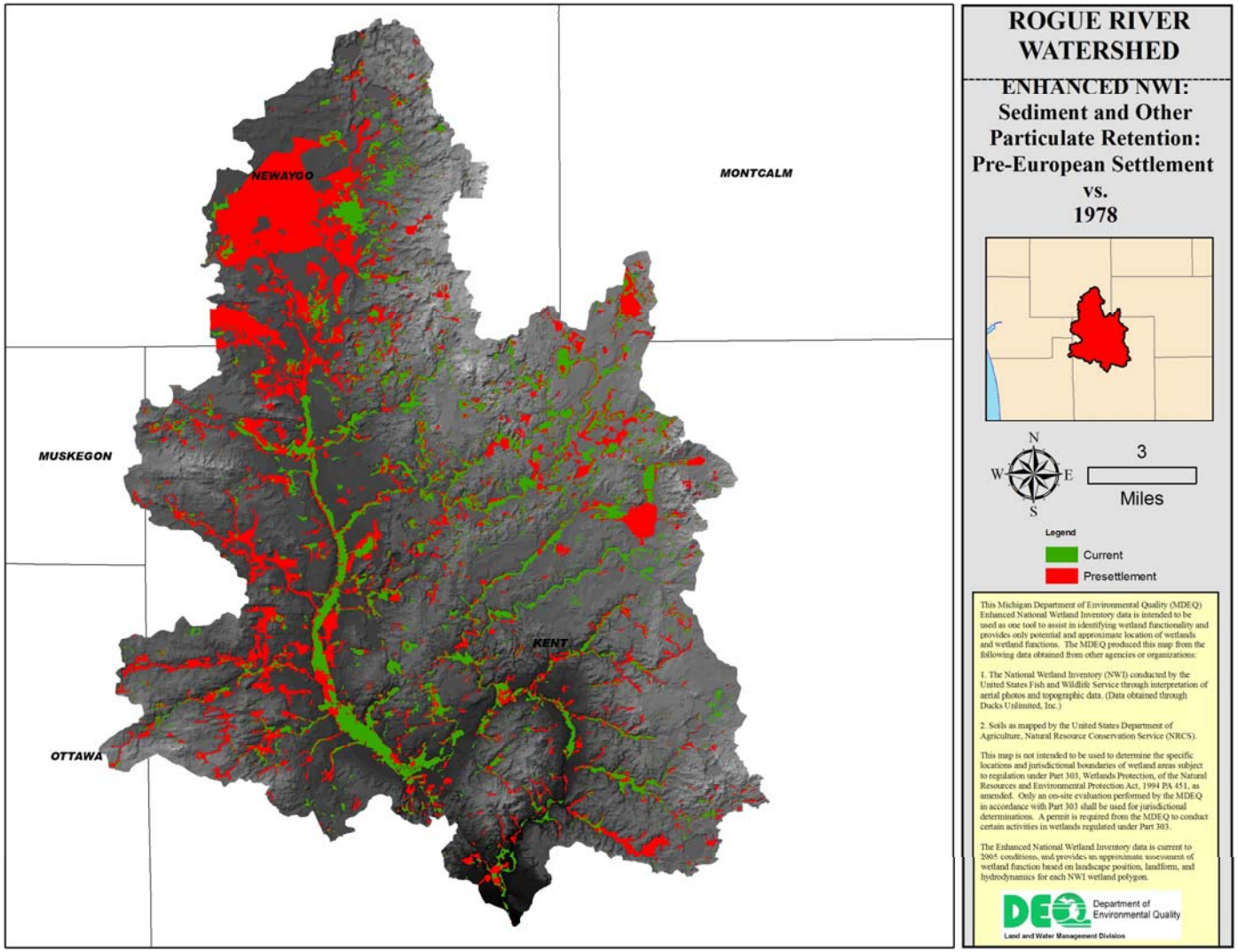
NUTRIENT TRANSFORMATION



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).

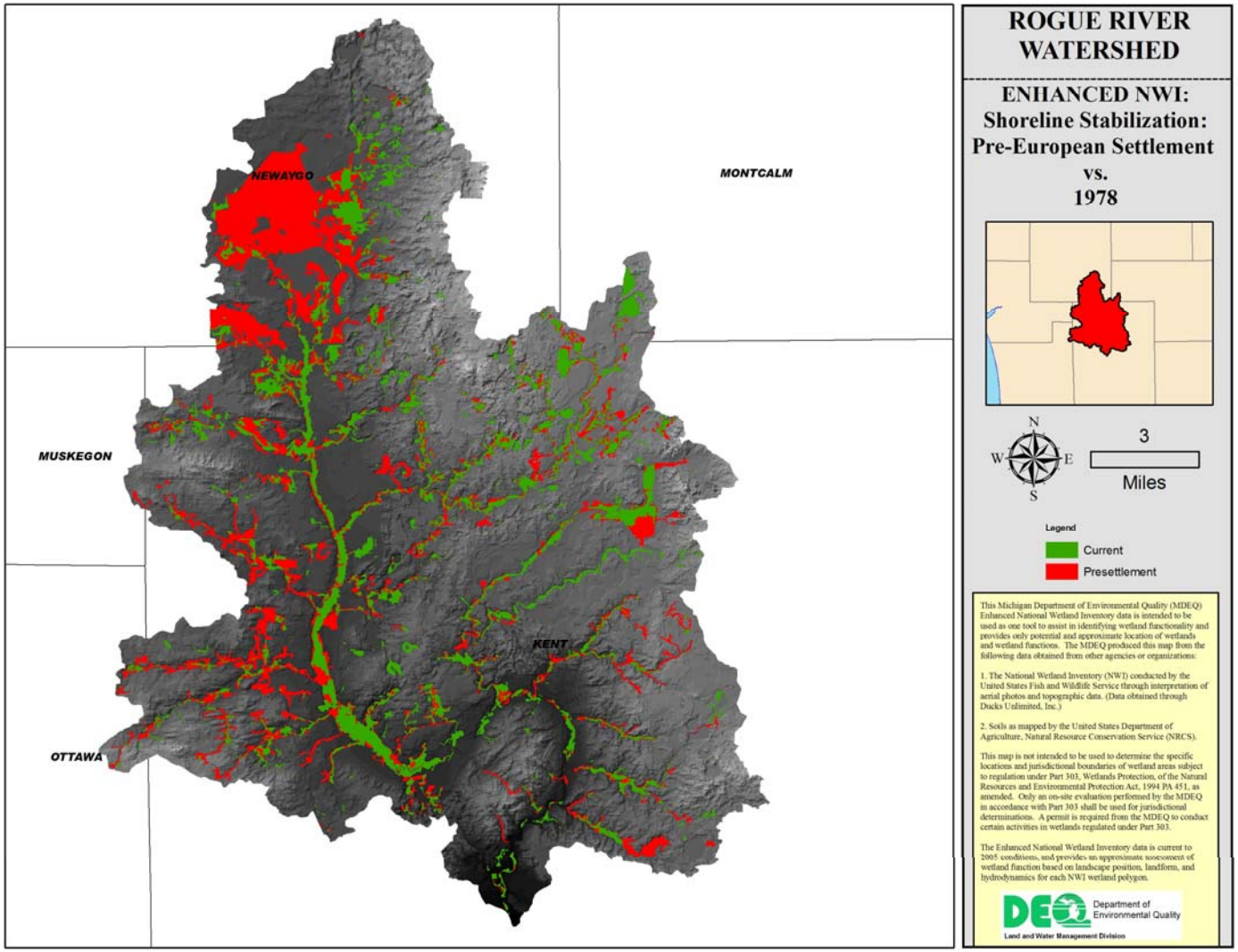
SEDIMENT AND OTHER PARTICULATE RETENTION



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).

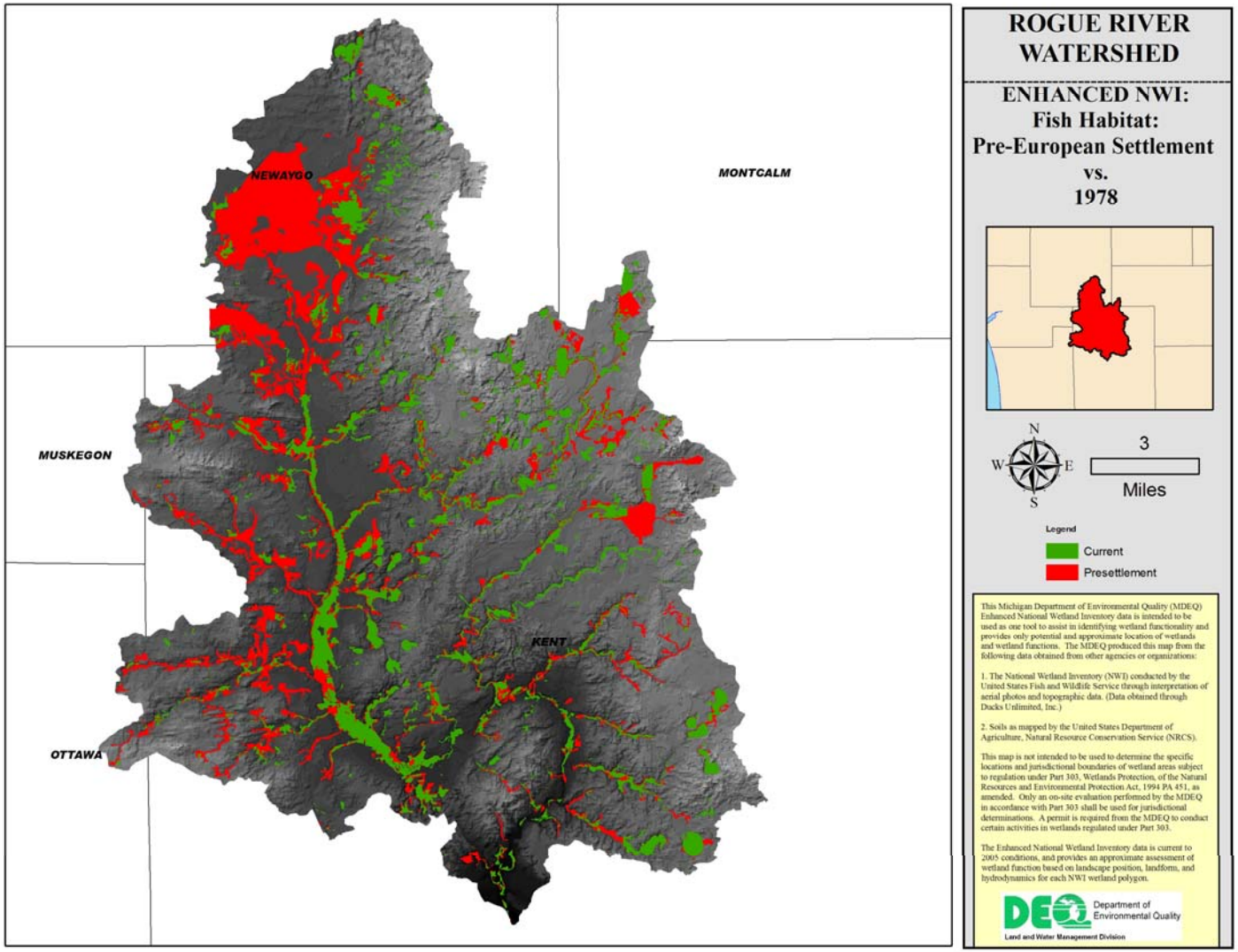
SHORELINE STABILIZATION



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).

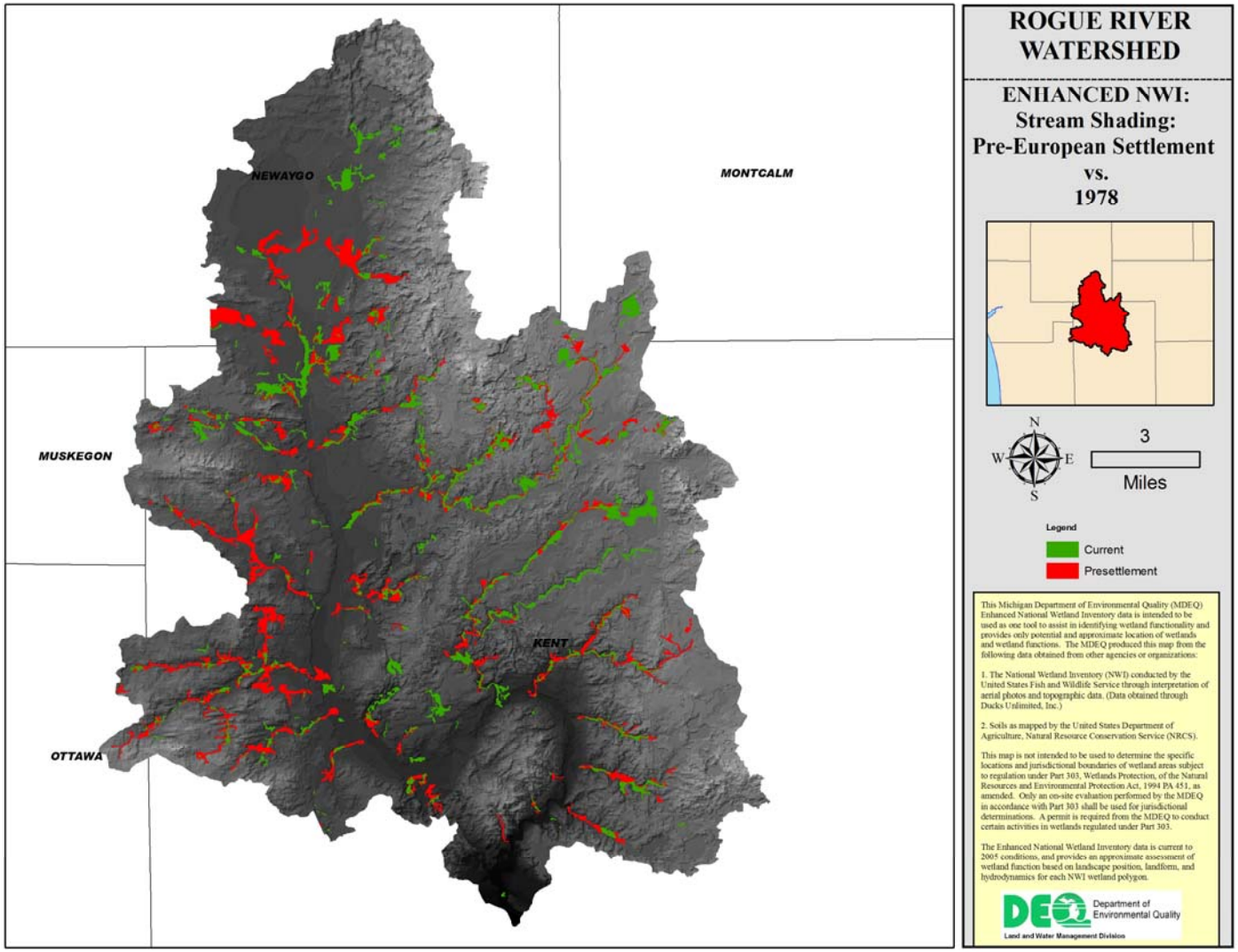
FISH HABITAT



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).

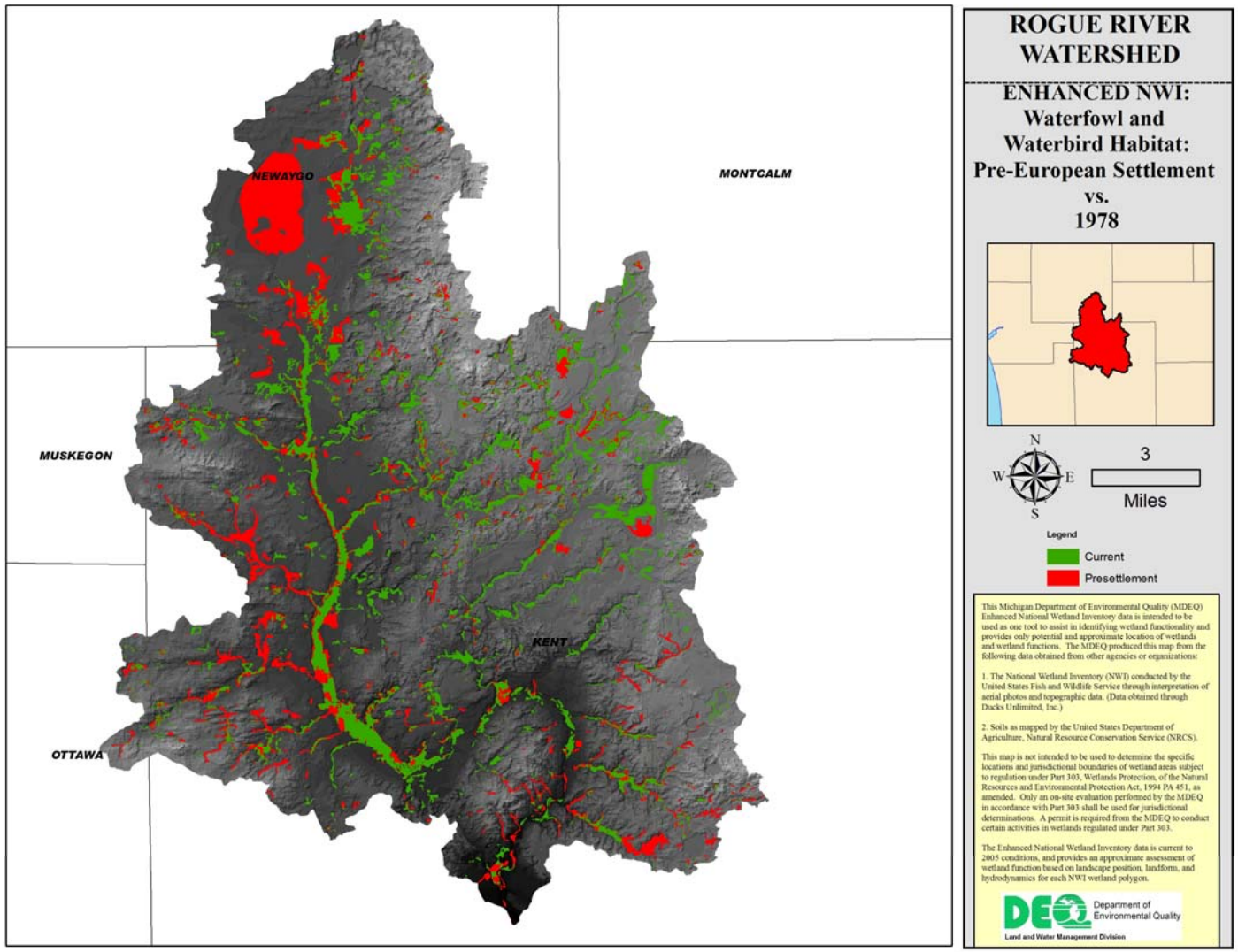
STREAM SHADING



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).

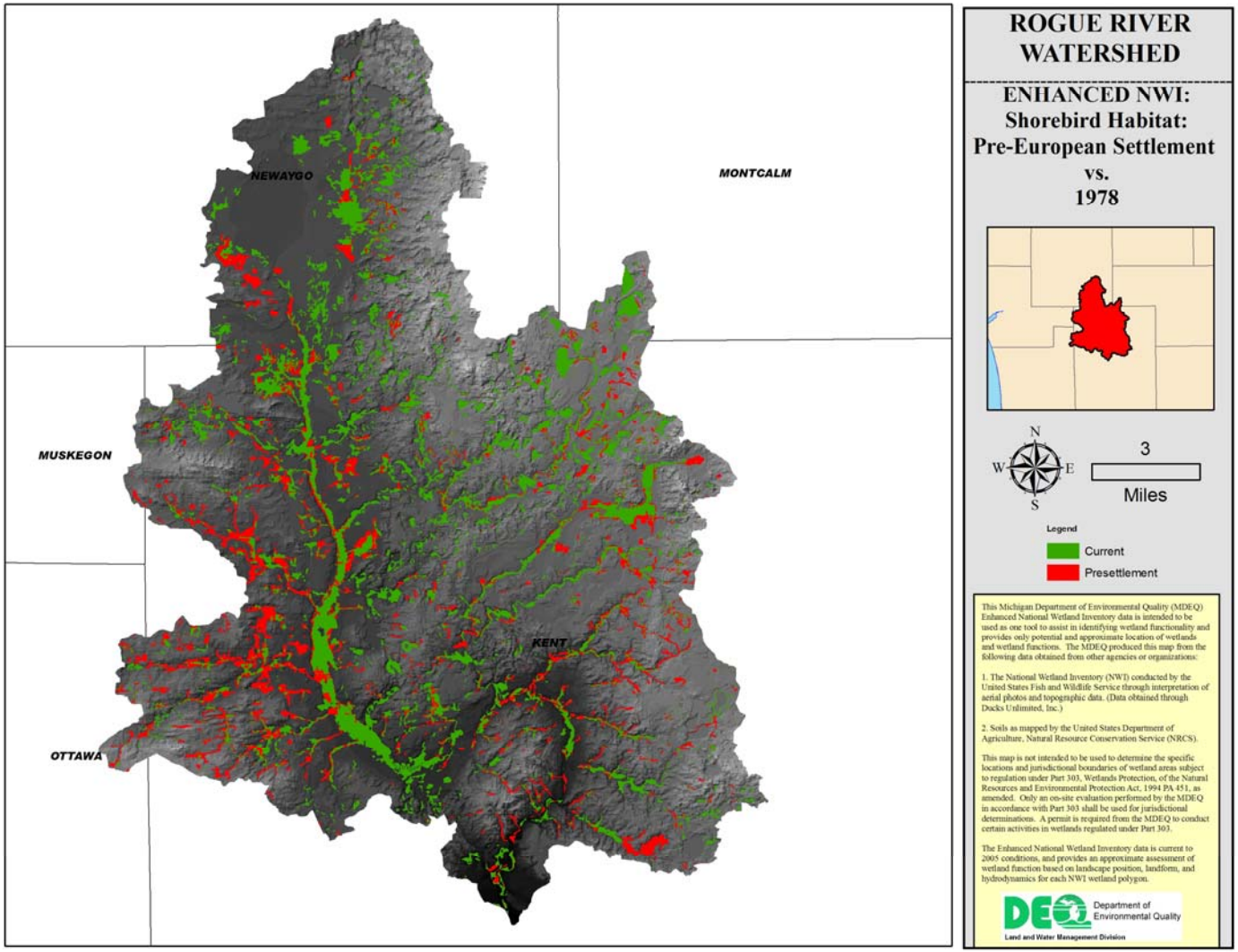
WATERFOWL & WATERBIRD HABITAT



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).

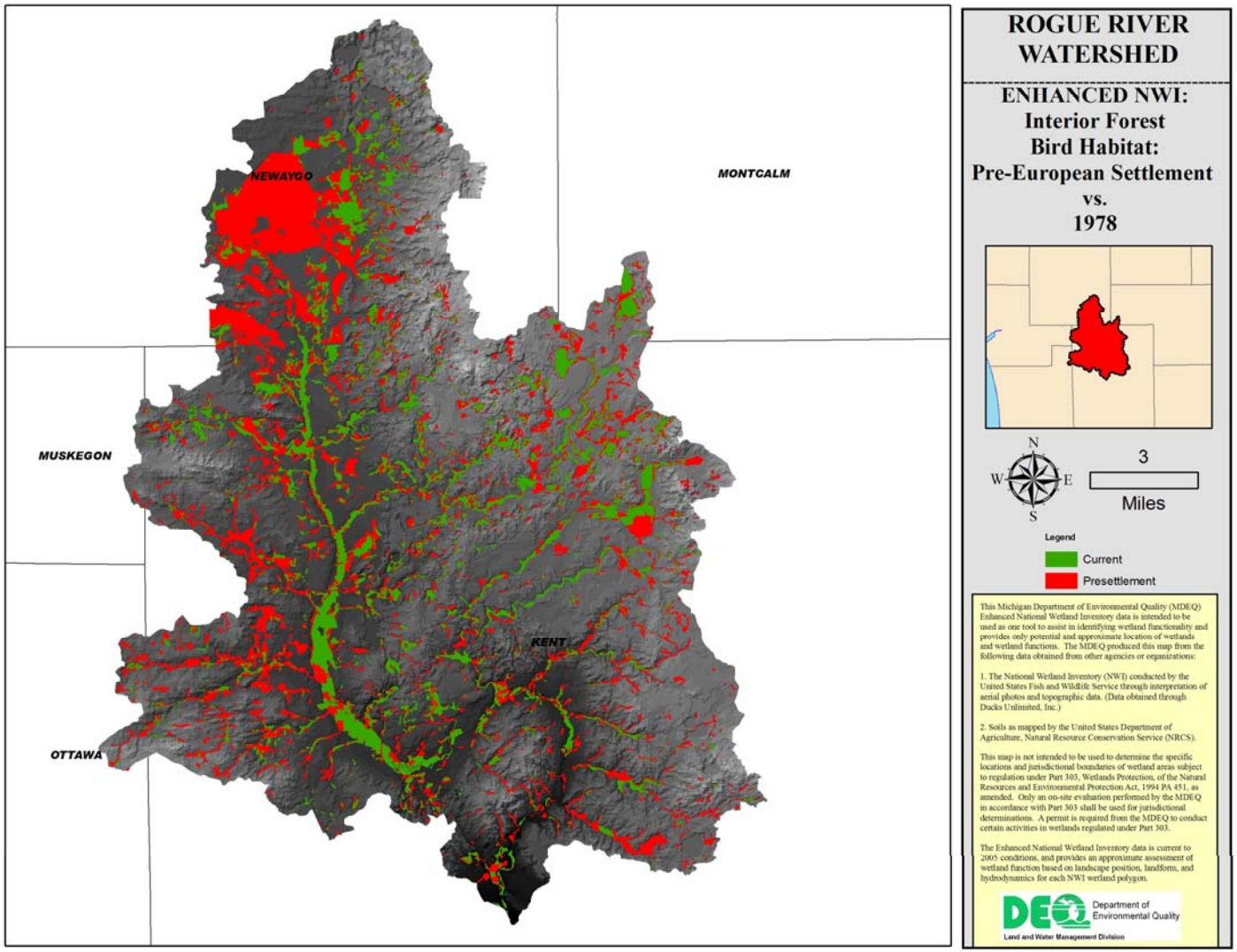
SHORE BIRD HABAITAT



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).

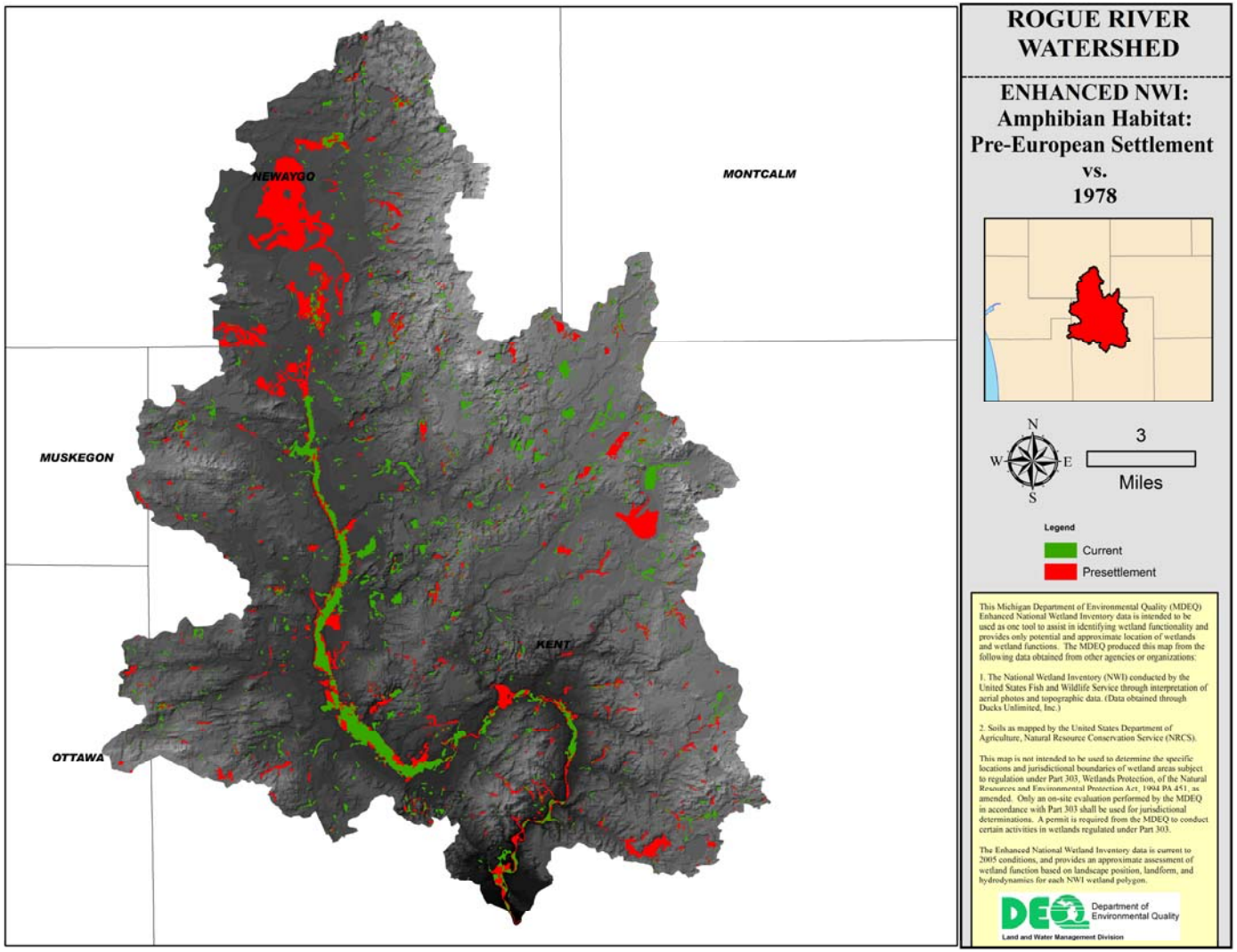
INTERIOR FOREST BIRD HABITAT



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).

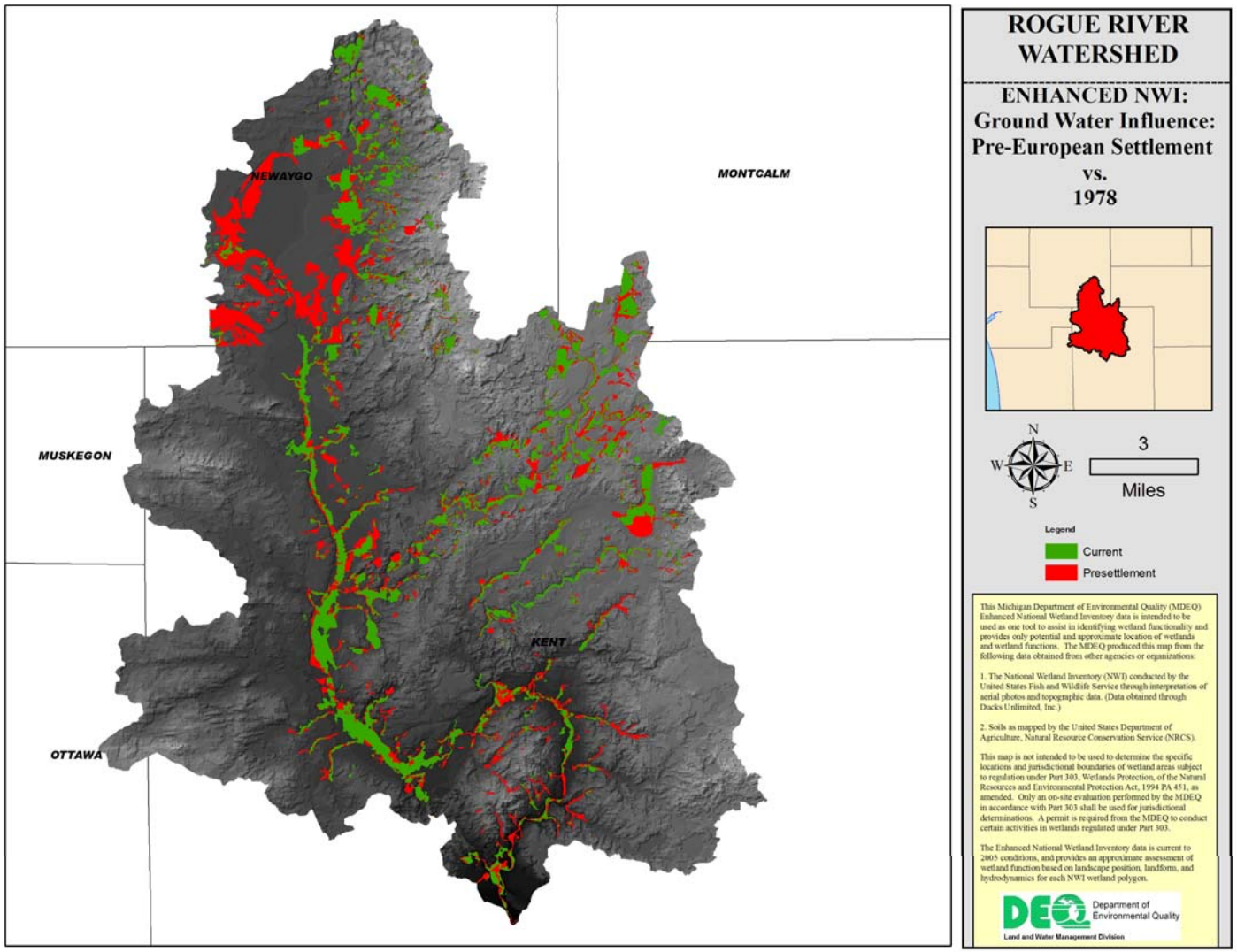
AMPHIBIAN HABITAT



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).

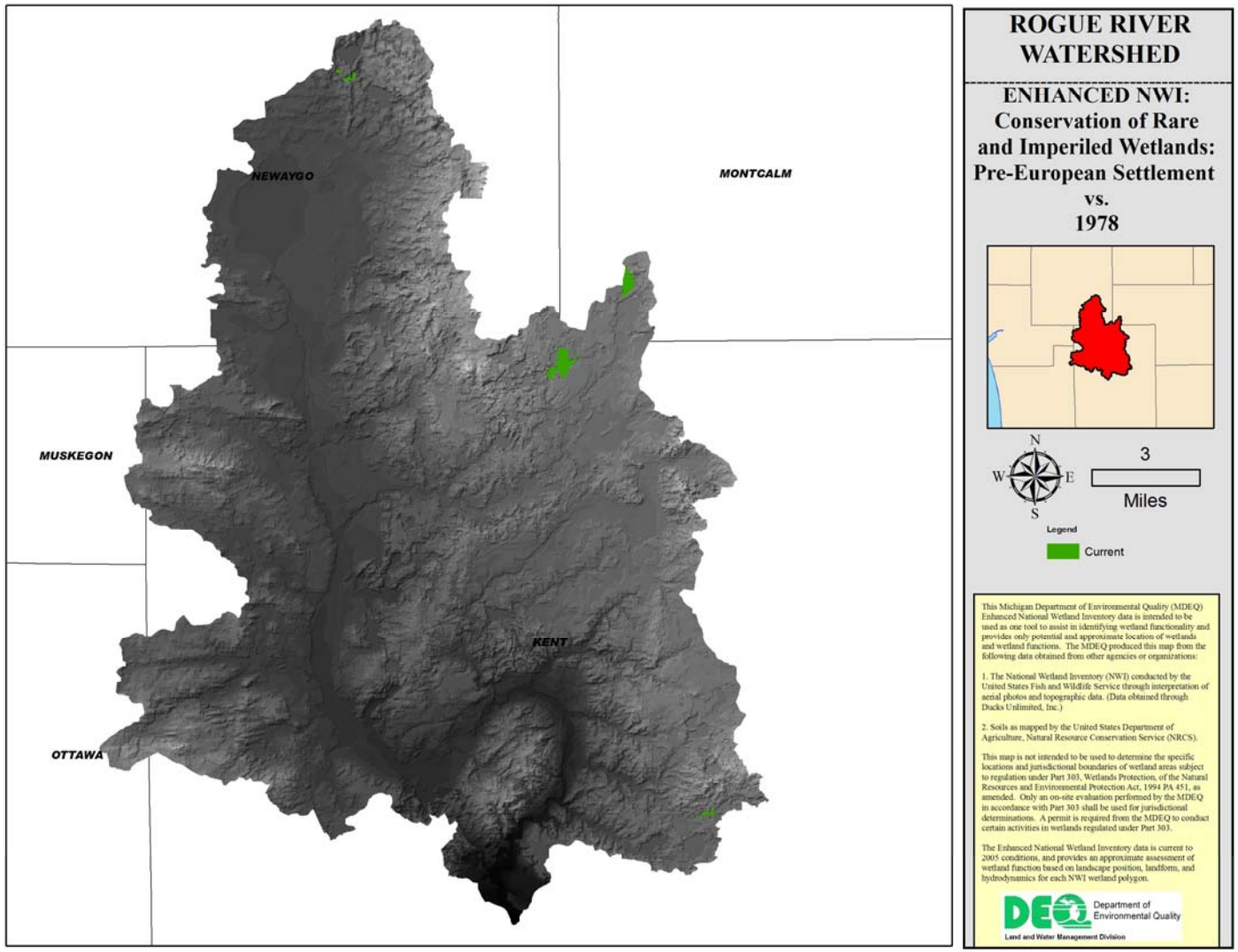
GROUND WATER INFLUENCE



CONSERVATION OF RARE AND IMPERILED WETLANDS

- 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) that only serves to inventory sites where staff biologists have performed surveys. 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.

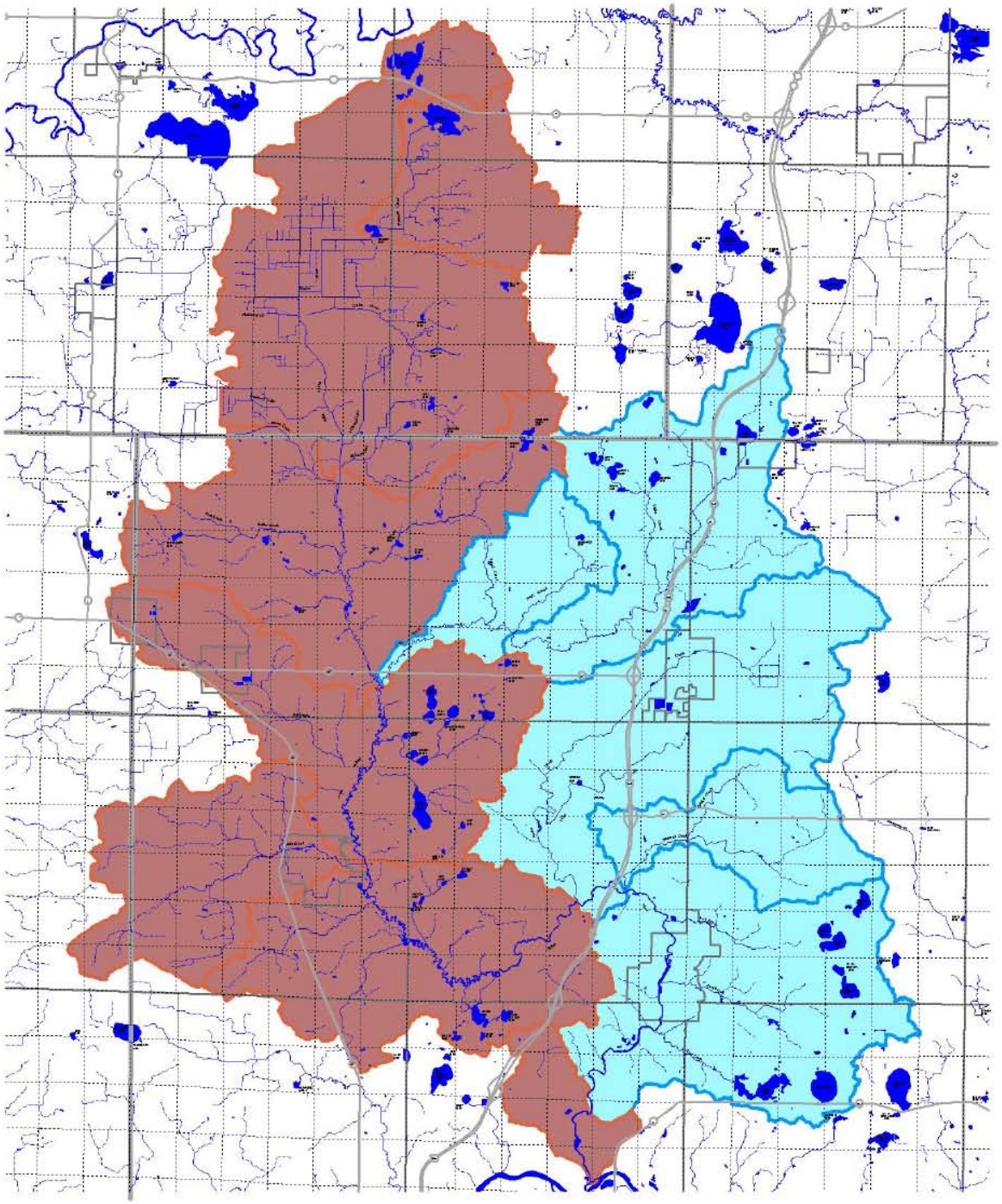
CONSERVATION OF RARE AND IMPERILED WETLANDS



Appendix 2

Figure 7

Fishery Type
Rogue River Watershed



Base Information

- State/Federal Highway
- Section Line
- River/Stream
- Drain/Intermittent Stream
- Township/City/Village Limits
- County Limits
- Lake/Pond

Fishery Type

- Cold Water
- Warm Water

1 0 1 2 Miles

1:140000

N

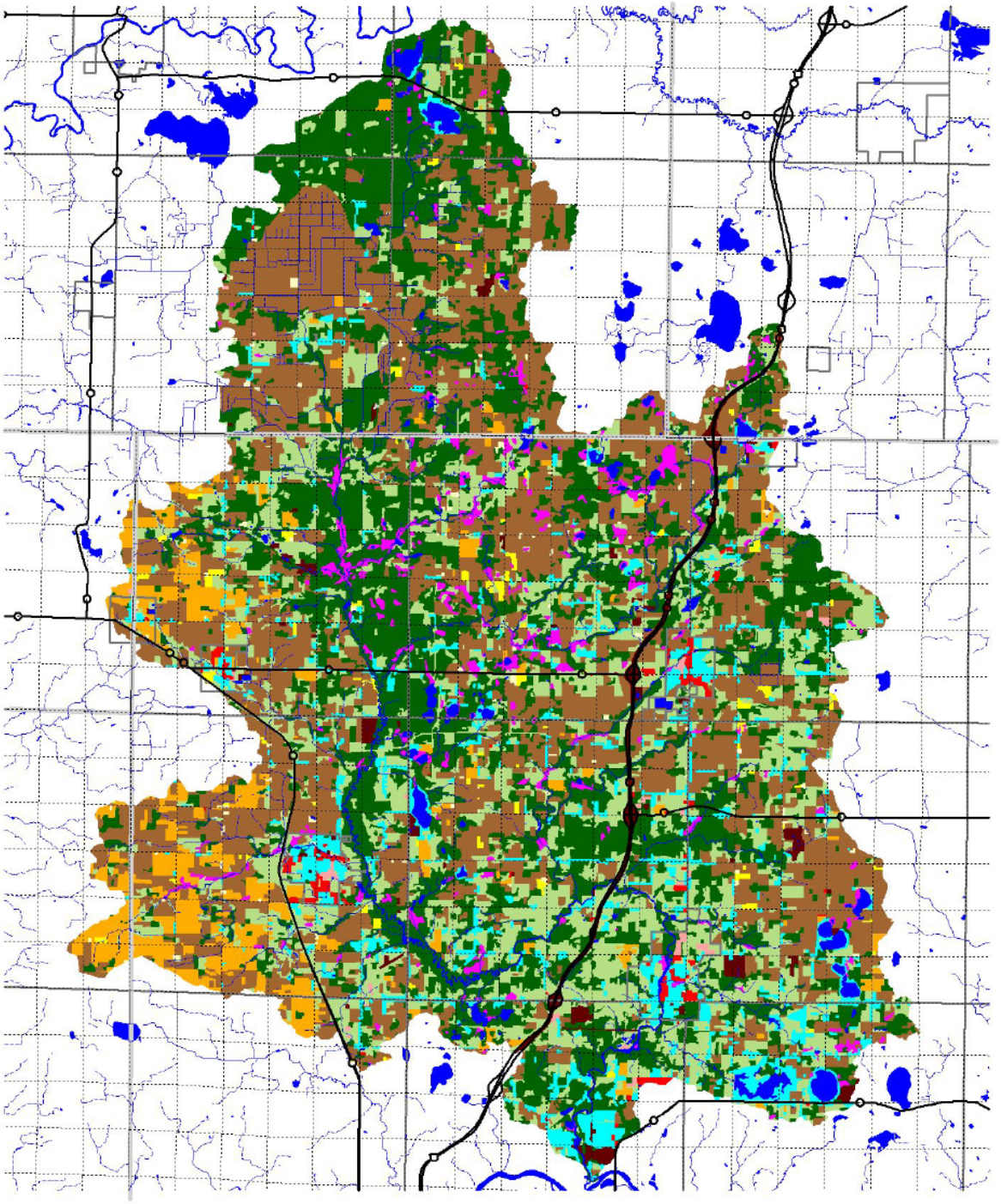
Information Services Center
Annis Water Resources Institute
Grand Valley State University

Map Prepared April 2000

Data Sources:
Base Information: MDNR, MIRIS, 1978
Fishery Type: Based on temperature data, GVSU-AWRI.

Figure 10

Land Use / Cover
Rogue River Watershed



Base Information
- State/Federal Highway
- Section Line
- River/Stream
- Drain/Intermittent Stream
- Township/City/Village Limits
- County Limits
- Lake/Pond

Land Use / Cover - 1990's
- Residential
- Commercial/Institutional
- Industrial
- Other Developed Area
- Cropland
- Orchard or Other Specialty Crop
- Confined Feeding and Permanent Pasture
- Other Agricultural Land
- Open Field
- Forest
- Water
- Wetland
- Barren/Sand Dune
- Transitional Land

1 0 1 2 Miles

1:140000

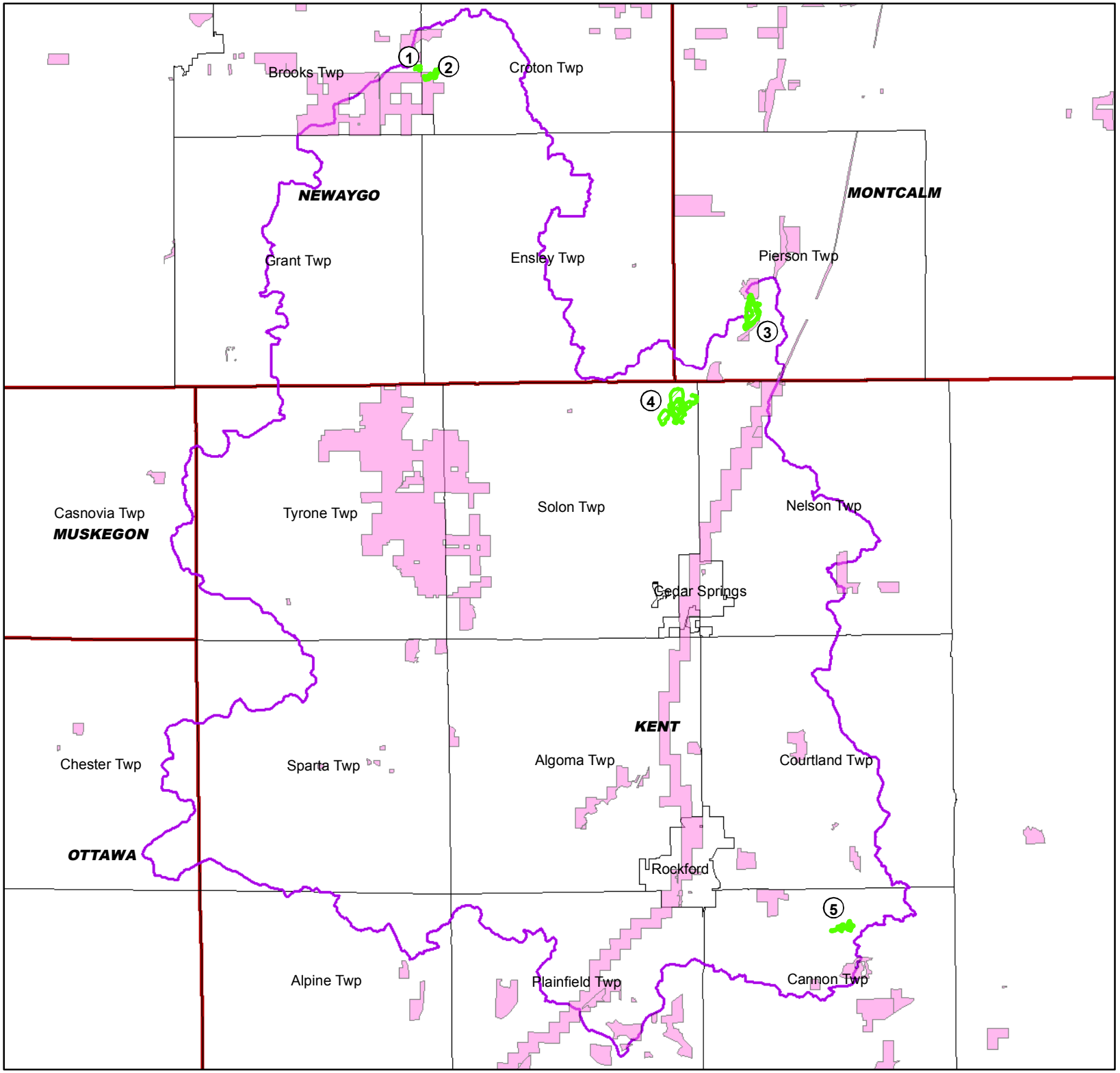
N

Information Services Center
Annis Water Resources Institute
Grand Valley State University

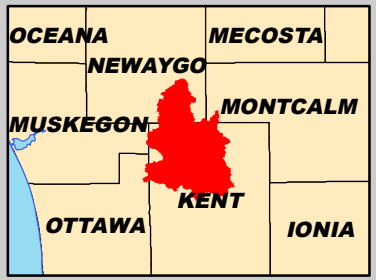
Map Prepared: April 2000

Data Sources:
Base Information: MDNR, MIRIS, 1978.
Land Use/Cover: Updated by AWRI using aerial photography, 1991, 1992, 1996, 1998.

Appendix 3



ROGUE RIVER WATERSHED



N
W
E
S

1
Miles

Active Functions

- Conservation Rare Imperiled Wetlands
- Conservation Lands

This Michigan Department of Environmental Quality (MDEQ) Enhanced National Wetland Inventory data is intended to be used as one tool to assist in identifying wetland functionality and provides only potential and approximate location of wetlands and wetland functions. The MDEQ produced this map from the following data obtained from other agencies or organizations:

1. The National Wetland Inventory (NWI) conducted by the United States Fish and Wildlife Service through interpretation of aerial photos and topographic data. (Data obtained through Ducks Unlimited, Inc.)

2. Soils as mapped by the United States Department of Agriculture, Natural Resource Conservation Service (NRCS).

This map is not intended to be used to determine the specific locations and jurisdictional boundaries of wetland areas subject to regulation under Part 303, Wetlands Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Only an on-site evaluation performed by the MDEQ in accordance with Part 303 shall be used for jurisdictional determinations. A permit is required from the MDEQ to conduct certain activities in wetlands regulated under Part 303.

The Enhanced National Wetland Inventory data is current to 2005 conditions, and provides an approximate assessment of wetland function based on landscape position, landform, and hydrodynamics for each NWI wetland polygon.

Department of Environmental Quality
Land and Water Management Division