MARENGO RIVER WATERSHED PARTNERSHIP PROJECT
WATERSHED ACTION PLAN

Bad River Watershed Association
P.O. Box 875
Ashland, WI 54806

Funding for the Marengo River Watershed Partnership Project Watershed Action Plan has been provided by the National Fish and Wildlife Foundation, Laura Jane Musser Fund, Wisconsin Department of Natural Resource, Secure Rural Schools Act Chequamegon Resource Advisory Committee, with technical and financial assistance from the United States Environmental Protection Agency

This Page Intentionally Left Blank

Table of Contents

LIST OF FIGURES ..... **iv**

LIST OF TABLES ..... **viii**

PROJECT PARTNERS ..... **x**

EXECUTIVE SUMMARY ..... **xi**

CHAPTER ONE: INTRODUCTION **1**

1. WHY THE MARENGO? 1
2. THE MARENGO RIVER WATERSHED PARTNERSHIP PROJECT 2
3. FORMING THE MRWP 3
   - 3.1 CITIZEN INVOLVEMENT TEAM 3
   - 3.2 TECHNICAL TEAM 3
   - 3.3 STEERING TEAM 5
4. US EPA NINE ELEMENT WATERSHED MANAGEMENT PLANS 5
5. EXISTING RESOURCE MANAGEMENT AND COMPREHENSIVE PLANS 6

CHAPTER TWO: CHARACTERIZING THE MARENGO RIVER WATERSHED **7**

1. GENERAL DESCRIPTION AND ADMINISTRATIVE BOUNDARIES 7
   - 1.1 COMMON WATERSHED FEATURES 8
   - 1.2 HISTORY 8
   - 1.3 HISTORIC PRESERVATION 10
   - 1.4 DEMOGRAPHICS 11
   - 1.5 ECONOMICS 12
   - 1.6 LOCAL COMMUNITY SURVEY SUMMARY 12
2. WATERSHED CHARACTERISTICS 20
   - 2.1 ECOLOGICAL LANDSCAPES 20
   - 2.2 LAND COVER AND USES 21
   - 2.3 HYDROLOGY AND GEOMORPHOLOGY 23
     - *2.3.1 BRWA "GET TO KNOW YOUR WATERSHED" STREAM ASSESSMENTS 31*
     - *2.3.2 "SLOW THE FLOW" 33*
   - 2.4 DRAINAGE: ROADS, CULVERTS, AND AGRICULTURE 39
   - 2.5 FOREST OWNERSHIP AND MANAGEMENT 44
   - 2.6 AGRICULTURE 47
   - 2.7 DAMS AND NATURAL BARRIERS 49
   - 2.8 LAKES 50
   - 2.9 GROUNDWATER 51
   - 2.10 CONTAMINATED SITES 53
   - 2.11 INVASIVE SPECIES 55

2.12 THREATENED AND ENDANGERED RESOURCES 57
2.12.1 WISCONSIN'S WILDLIFE ACTION PLAN 57
2.12.2 STATE NATURAL AREAS 58
2.13 RECREATION 59
2.14 WATER QUALITY 60
2.14.1 BAD RIVER TRIBE WATER QUALITY STANDARDS 60
2.14.2 STATE OF WISCONSIN WATER QUALITY STANDARDS 62
2.14.3 INTEGRATING STATE AND TRIBAL WATER QUALITY ASSESSMENTS 64

CHAPTER THREE: PRIORITIZING CHALLENGES AND CAUSES 81

1. IDENTIFYING CHALLENGES AND CAUSES 81

2. TECHNICAL TEAM SURVEY 81

CHAPTER FOUR: VISION, GOALS, HEALTHY WATERSHED TARGETS, AND TARGET OBJECTIVES 89

1. VISION AND WATERSHED GOALS 89

2. HEALTHY WATERSHED TARGETS AND TARGET OBJECTIVES 89

CHAPTER FIVE: BEST MANAGEMENT PRACTICES AND SELECTED MANAGEMENT ALTERNATIVES, MANAGEMENT AREAS, AND WATERSHED OUTREACH AND CITIZEN INVOLVEMENT 95

1. BEST MANAGEMENT PRACTICES AND SELECTED MANAGEMENT ALTERNATIVES 95
1.1 IMPLEMENTING BMPs AND MANAGEMENT ALTERNATIVES 101
1.1.1 LANDOWNER INCENTIVE PROGRAMS 101
1.1.2 FOREST MANAGEMENT 103
1.1.3 POWTS 105
1.1.4 OTHER "SLOW THE FLOW" MANAGEMENT ALTERNATIVES 106
1.1.5 BRWA CULVERT PROGRAM 107
1.1.6 INVASIVE SPECIES MANAGEMENT 108
1.1.7 LAND PROTECTION 110

2. MANAGEMENT AREAS 111
2.1 SOIL TRANSITION AND CLAY PLAIN 112
2.2 UPPER MARENGO RIVER WATERSHED 112

3. WATERSHED OUTREACH AND CITIZEN INVOLVEMENT 113
3.1 OUTREACH AND CITIZEN INVOLVEMENT IN THE PLANNING PHASE 114
3.2 COMMUNICATIONS PLAN 123
3.2.1. GOAL AND OBJECTIVES OF THE COMMUNICATIONS PLAN 123
3.2.2 TARGET AUDIENCES AND MESSAGES 123
3.3 OUTREACH AND CITIZEN INVOLVEMENT STRATEGY 125

CHAPTER SIX: MARENGO RIVER WATERSHED 10-YEAR ACTION PLAN 127

CHAPTER SEVEN: MONITORING AND EVALUATION STRATEGY 150

CHAPTER EIGHT: IMPLEMENTATION AND CAPACITY BUILDING STRATEGIES 158

1. IMPLEMENTATION STRATEGY 158

2. CAPACITY BUILDING STRATEGY 160

REFERENCES 162

APPENDICES 169

LIST OF FIGURES

Figure 2.1. Location of the Marengo River Watershed and administrative boundaries. 7
Figure 2.2. Marengo River Watershed map (LSBPT 2007) and pictures of common features. 8
Figure 2.3. Original vegetation cover map of the Marengo River Watershed based on Finley's "Original Vegetation Cover of Wisconsin" map (Finley 1976). Data source: WDNR Public GIS FTP site: ftp://dnrftp01.wi.gov/geodata/, retrieved on 9/27/10.)..... 9
Figure 2.4. Marengo River watershed town resident responses to question 5 of Ashland County Comprehensive Plan Survey (2003): "Do you believe existing regulatory controls (i.e. zoning, subdivision, land division, sanitary permits, well permits) are sufficient to achieve your vision of your community's future?" 13
Figure 2.5. Marengo River watershed town resident responses to question 14 of Ashland County Comprehensive Plan Survey when asked to rank the importance of Ashland County efforts and services related to land and water resources. 14
Figure 2.6. Marengo River watershed town resident responses to Natural Resources question 2 of the Bayfield County Comprehensive Plan Survey (2008): "Bayfield County should further ensure that its lakes, rivers, streams, and wetlands are protected from degradation."..... 16
Figure 2.7. Marengo River watershed town resident responses to Natural Resources question 3 of the Bayfield County Comprehensive Plan Survey (2008): "Additional development restrictions should be put in place to protect the aesthetic beauty and ecological functioning of lake, river, and stream shorelines." 16
Figure 2.8. Marengo River watershed town resident responses to Land Use question 1 of the Bayfield County Comprehensive Plan Survey (2008): "Opinions on the existing Bayfield County regulations for rivers/ inland lakes and wetlands."..... 18
Figure 2.9.Ecological Landscapes in the Marengo River Watershed (WDNR 2010a)..... 20
Figure 2.10. Land cover map for the Marengo River Watershed (2006) from National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center, Coastal Change Analysis Program (C-CAP). 22
Figure 2.11. Longitudinal profile of the Marengo River compared to the Bad River. Average slopes are given for key erosional and depositional reaches of the Marengo River (Fitzpatrick 2010). 24
Figure 2.12. Stream channel cross sections as part of a geomorphic assessment of the Marengo River (Fitzpatrick 2005). The cross sections reveal evidence of historical channel incision upstream and sedimentation downstream near the river mouth (courtesy of F. Fitzpatrick). 25
Figure 2.13. Levee building as a result of sand deposition near the mouth of the Marengo River (photo courtesy of Bad River Natural Resources Department). 26
Figure 2.14. Location of Fish Creek watershed (includes North Fish Creek) relative to the Marengo River Watershed in the Lake Superior Basin of northern Wisconsin. Surficial deposits are shown to give an indication of the similar geologic setting of the two watersheds. 27
Figure 2.15. North Fish Creek longitudinal profile changes (Fitzpatrick et al. 1999)..... 28
Figure 2.16. Storm hydrographs and sediment loads for North Fish Creek near Moquah, WI, for a historical storm on September 3, 1991, under four land-cover conditions (Fitzpatrick et al. 1999). 28

Figure 2.17. Relationship of the amount of open land in a subwatershed to the change in peak flow (Verry, 2001). 29
Figure 2.18. The Marengo River Watershed and specific areas of concern identified in the Marengo Test Case (LSBPT 2007). 31
Figure 2.19. BRWA "Get to Know Your Watershed" survey stream bank erosion locations and example pictures of some erosion sites. The size of the dots is based on the area (in ft^2) of the eroding stream bank. The surveys were conducted in the high sedimentation area of concern identified in the Marengo Test Case (LSBPT 2007). 32
Figure 2.20. Wisconsin Department of Natural Resources 2008 open lands assessment data for Marengo River Watershed hydrologic units. 34
Figure 2.21. Acres of open land needing re-forestation to achieve 40% open land in Marengo River Watershed hydrologic units. Data from WDNR's 2008 open lands assessment (Community GIS 2009). 35
Figure 2.22. Results from National Streamflow Statistics Program (USGS 2010) modeling for 30 sub-watersheds in the Marengo River. Predicted 2-year peak discharge per square mile, percent open lands, and each subwatershed's percentage of total Marengo River Watershed land area is plotted. Analysis completed by Tom Hollenhorst, USEPA. 38
Figure 2.23. Results from National Streamflow Statistics Program (USGS 2010) modeling for 30 sub-watersheds in the Marengo River. The dots, or "pour points" (many of which overlap) for each watershed are sized by predicted 2-year peak discharge per square mile. Highlighted subwatersheds are those with a predicted 2-year peak discharge per square mile greater than 20 cfs/sq.mile and greater than 20% open lands. Analysis completed by Tom Hollenhorst, USEPA. 39
Figure 2.24. Marengo River Watershed road/stream crossings from the Bad River Watershed Association culvert inventory database. Red dots indicate culverts with a drop of 6 inches or greater at the downstream end. Blue stars indicate known restoration sites or planned restoration sites (as of 2010). 41
Figure 2.25. Example of a typical perched culvert in the Marengo River Watershed. 42
Figure 2.26. Examples of typical road/stream interaction at culverts in the soil transition zone of the Marengo River Watershed (courtesy of F. Fitzpatrick). Sediment accumulation upstream and erosion downstream. 42
Figure 2.27. Examples of failed culverts in the Marengo River Watershed. 43
Figure 2.28. Aerial photo showing an example of an existing agricultural drainage network in the Marengo River Watershed (photo – USDA Farm Service Agency 2008, from Google Earth). 44
Figure 2.29. Forest land in the Marengo River Watershed known to have a forest management plan. CNNF (Chequamegon-Nicolet National Forest, data from 2000), MFL (Managed Forest Law, data from 2006), FCL (Forest Crop Land, data from 2006), LFC (Living Forest Cooperative, Inc., data from 2010), Tribal Fee Mgd (Managed) Forest and Trust Lands are lumped together as lands managed by the Bad River Tribe (data from 2006). Gray areas indicate non-forested land or areas where forest management status is unknown. 46
Figure 2.30. Location of natural barriers, dams identified as "abandoned," dams defined as "large" and not having been inspected in greater than 10 years, and other dams within the Marengo River Watershed. Data Source: WDNR's Dam Safety Database (WDNR 2010c). 50

Figure 2.31. Groundwater contamination susceptibility in the Marengo River Watershed. Low scores represent areas that are more susceptible to contamination, and high scores represent areas that are less susceptible (Data source: WDNR Surface Water Data Viewer, retrieved on 11/17/10 metadata: ftp://dnrftp01.wi.gov/geodata/gcsm/GCSM_data.pdf). 53
Figure 2.32. Location of contaminated (open) and previously contaminated (closed) sites in the Marengo River Watershed. These sites are all classified as "Leaking Underground Storage Tank" (LUST) sites. Data Source: WDNR Remediation and Redevelopment online sites map, retrieved on 11/17/10. 54
Figure 2.33. Marengo River Watershed State Natural Areas. 59
Figure 2.34. Waters designated as Outstanding Resource Waters (ORW) by the Bad River Band of the Lake Superior Tribe of Chippewa Indians within the Marengo River Watershed..... 62
Figure 2.35. Sample locations (numbers in red text) utilized either separately or jointly by the Bad River Natural Resources Department, Wisconsin Department of Natural Resources, and the Bad River Watershed Association to collect environmental monitoring samples. The numbers correspond to the site locations listed in Table 2.8. 67
Figure 2.36. Bad River Natural Resources Department E. coli data collected from 2010-2011 at four monitoring locations within the Reservation boundaries. The Tribal E. coli criterion for a single sample is shown (235 CFU/100 mL). Three monitoring events associated with storm events are highlighted. 70
Figure 2.37. Marengo River Watershed sites evaluated by the Bad River Watershed Association and Center for Watershed Protection (BRWA 2010b) in 2009. (a & b) Cattle access contributes excess sediment and nutrients to the stream as evidenced by turbid water and excessive algae growth; (c) Excessive algal growth and stagnant turbid water behind a beaver dam indicate a potential illicit discharge or connection upstream; (d, e, f) Small tributary in the Village of Marengo with potential illicit discharge. 71
Figure 2.38. Bad River Natural Resources Department Total Phosphorus (TP) data collected from 2010-2011 at four monitoring locations within the Reservation boundaries. The State of Wisconsin's TP criterion is shown as a screening level. Two monitoring events associated with storm events along with the 2011 snowmelt monitoring event are highlighted. 76
Figure 2.39. Seasonal (Sp = March-May, S = June-August, F = September-November, W = December-February) and overall average turbidity concentrations (collected between 2003 and 2007) at Marengo River Watershed sites monitored by Bad River Watershed Association volunteers (BRWA 2010a). Site locations are identified in Figure 2.35 and Table 2.8. 79
Figure 2.40. Bad River Natural Resources Department total suspended solids (TSS) data collected from 2010-2011 at seven monitoring locations within the Marengo River Watershed, including four locations within the Reservation boundaries (see site locations identified in Figure 2.35 and Table 2.8). Sites located on the main stem of Marengo River are listed in the legend from upstream to downstream location . Two monitoring events associated with storm events along with the 2011 snowmelt monitoring event are highlighted. 80
Figure 3.1. Marengo River Watershed Partnership Technical Team survey respondents grouped by technical interest area..... 82
Figure 5.1. Percent of monitored timber harvests where Wisconsin Department of Natural Resources forestry best management practices (BMPs) for timber harvest, RMZ (riparian management zone), forest roads, and all BMP categories combined were applied correctly... 104

Figure 5.2. The Bayfield Regional Conservancy's Marengo River Watershed Priority Conservation Area. *111*
Figure 5.3. Management areas for the Marengo River Watershed Action Plan. *113*
Figure 5.4. "Make Your Mark on the Marengo" Watershed Map with project ideas gathered via citizen input. Project ideas are incorporated within the actions of the Action Plan table. *116*
Figure 5.5. Responses to the BRWA MRWP Project Survey when asked "indicate the types of things you do in the watershed." *118*
Figure 5.6. Responses to the MWRP Project Survey when asked "indicate what your concerns are about the quality of the watershed." *119*
Figure 8.1. Potential Watershed Action Plan implementation annual cycle as carried out by the Marengo River Watershed Partnership. *159*

LIST OF TABLES

Table 2.1. Population change for towns (excluding Namekagon and Sanborn) within the Marengo River Watershed, 1990-2000 (Ashland County 2006, Bayfield County 2010)..... 11
Table 2.2. Median household income for select Towns in the Marengo River Watershed. (Ashland County 2006, Bayfield County 2010)..... 12
Table 2.3. Land cover percentages for the Marengo River Watershed (2006) from National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center, Coastal Change Analysis Program (C-CAP). 21
Table 2.4. National Streamflow Statistics Program (USGS 2010) model inputs, predicted two-year peak discharge (cubic feet per second) results, and discharge results normalized per square mile of area for each of 30 subwatersheds within the Marengo River Watershed. Also included within each subwatershed is percent open land and forests <16 years old (Community GIS 2009). Highlighted subwatersheds are those with a normalized discharge greater than 20 cfs/sq.mile and greater than 20% open lands. Analysis completed by Tom Hollenhorst, USEPA..... 37
Table 2.5. Acres of forest land in the Marengo River Watershed known to have a forest management plan..... 45
Table 2.6. Wisconsin Department of Natural Resources (WDNR) Fisheries management codes for Marengo River Watershed lakes. Data source: WDNR Surface Water Data Viewer, retrieved on 10/19/10. 51
Table 2.7. Restricted (Wisconsin Administrative Code Chapter NR40) terrestrial and wetland invasive plant species documented within a five-mile radius of the Marengo River Watershed. Data source: Great Lakes Indian Fish and Wildlife Commission, retrieved 7/6/10. 56
Table 2.8. Known rare macroinvertebrate species present in the Marengo River Watershed (Epstein et. al 1997). 57
Table 2.9. Sample locations utilized either separately or jointly by the Bad River Natural Resources Department, Wisconsin Department of Natural Resources, and the Bad River Watershed Association to collect environmental monitoring samples. The numbers in the "Map ID #" field correspond to the red numbers shown in Figure 2.34. 68
Table 2.10. Summary of BRWA E. coli data collected from Marengo River Watershed sites. Average and standard deviation is given for samples collected associated with runoff events and non-runoff events. A ratio of the total number of samples collected at each site and the total number of samples that exceeded 235 CFU/100mL is also given. 69
Table 2.11. Summary of Bad River Natural Resources Department E. coli data collected from Marengo River Watershed sites since 1997..... 70
Table 2.12. Summary of Wisconsin Department of Natural Resources (WDNR) nitrogen (total Kjeldahl [TKN], ammonia (NH3-N], nitrate plus nitrite [NO2+NO3-N]) and total phosphorus (TP) data collected from Marengo River Watershed sites over the past 10 years. 74
Table 2.13. Summary of Bad River Natural Resources Department total phosphorus data collected from the Marengo River Watershed..... 75
Table 2.14. Summary of Bad River Natural Resources Department nitrate plus nitrite data collected from the Marengo River Watershed..... 75
Table 2.15. Summary of Bad River Natural Resources Department total Kjeldahl nitrogen (TKN) data collected from the Marengo River Watershed. 76

Table 2.16. Summary of Wisconsin Department of Natural Resources (WDNR) transparency (Trans Tube) and total suspended solids (TSS) data collected from Marengo River Watershed sites over the past 10 years..... 78
Table 2.17. Summary of Bad River Natural Resources Department turbidity data collected from the Marengo River Watershed..... 79
Table 2.18. Summary of Bad River Natural Resources Department total suspended solids (TSS) data collected from the Marengo River Watershed. 80
Table 3.1.Marengo River Watershed Partnership Technical Team survey results for severity and scope ranking of watershed challenges..... 83
Table 3.2. Marengo River Watershed Partnership Technical Team survey weighted ranking results for sources of each watershed challenge..... 84
Table 3.3. Marengo River Watershed Partnership Technical Team survey results for sources weighted based on priority watershed challenges and frequency of listing under multiple challenges. 85
Table 3.4. Marengo River Watershed Partnership Technical Team survey average recovery potential for each source. 87
Table 3.5. Prioritization of sources (left column) for each of the watershed challenges for the Marengo River Watershed based on results from the Marengo River Watershed Partnership Technical Team survey. Watershed challenges are listed in priority order. The numbers under each challenge correspond to the ranking of each source for that challenge (for instance, "Drained wetlands" were the #4 source for the "unstable hydrologic system" and the #6 source for "excess sediment" challenge. Average recovery potential for each source is also given. 88
Table 4.1. Healthy watershed targets for the Marengo River Watershed. The targets are linked to broad watershed goals and challenges, an assessment of current conditions related to the challenges, and a series of target objectives, which provide more specific direction on management and outreach activities needed to meet the healthy watershed targets..... 91
Table 5.1. Prioritized target objectives, selected best management practices and management alternatives, and some examples of current programs that could be used to implement the BMP or management alternative. EQIP refers to the Environmental Quality Incentives Program and all current, approved practices for Wisconsin (NRCS 2012). ATCP 50 refers to current, approved practices listed in Chapter Agriculture, Trade, and Consumer Protection (ATCP) 50 of Wisconsin Administrative Code (WAC 2012). 96
Table 5.2. Conservation Target Acreages identified by Bayfield Regional Conservancy for the Marengo River Watershed..... 110
Table 6.1. Marengo River Watershed 10 Year Action Plan..... 130
Table 7.1 Monitoring Strategy for the Marengo River Watershed Action Plan. 151
Table 7.2 Validation monitoring to support meeting Marengo River Watershed Action Plan long-term goals. 157

MARENGO RIVER WATERSHED PARTNERSHIP PROJECT

PROJECT PARTNERS

Ashland County Land and Water Conservation Department
Bad River Band of the Lake Superior Tribe of Chippewa Indians
Bad River Watershed Association
Bayfield County Land and Water Conservation Department
Bayfield Regional Conservancy
Great Lakes Indian Fish and Wildlife Commission
Northland College and the Sigurd Olson Environmental Institute
Northwoods Cooperative Weed Management Area
Town of Ashland
Town of Gordon
Town of Grand View
Town of Kelly
Town of Lincoln
Town of Marengo
Town of Morse
Town of White River
Trout Unlimited – Wild Rivers Chapter
University of Wisconsin-Extension
University of Wisconsin- Madison
USDA Natural Resource Conservation Service
US Environmental Protection Agency
US Bureau of Indian Affairs
US Fish and Wildlife Service
US Forest Service
US Geological Survey
West Wisconsin Land Trust
Wisconsin Department of Natural Resources
Watershed Citizens

Project Coordinators and Primary Authors of the Watershed Action Plan:
Matt Hudson and Valerie Damstra, Bad River Watershed Association

With Support From:
Naomi Tillison, Bad River Natural Resources Department; Nancy Larson, Lisa Helmuth, Joe Graham, and Cordell Manz, Wisconsin Department of Natural Resources

And Technical Assistance By:
Cynthia Curtis and Janette Marsh, United States Environmental Protection Agency

EXECUTIVE SUMMARY

The Marengo River is truly a river of change. From its sleepy beginnings in the wetlands of the Penokee hills of northern Wisconsin, to its journey through a large valley that once formed the shoreline of glacial Lake Duluth, and its final leg through the flat, agricultural areas of the Lake Superior clay plain, this river and all the streams that flow into it are truly special.

However, the Marengo River is not unaffected by human activity. The Marengo River Watershed experienced extensive logging and farming activities around the turn of the 20th Century. The effects of this large-scale land cover conversion had tremendous impacts on streams and rivers that are still felt today.

The people that live, work, and play here recognize this and the Marengo River Watershed Partnership (MRWP) was formed as a way for watershed residents, local government leaders, and natural resource professionals to express things they value about the watershed, concerns they have about its health, and to identify actions needed to maintain and improve the health of the watershed for future generations.

The resulting Watershed Action Plan outlined in this document provides a tool for local governments, agencies, organizations, and watershed residents to carry out these actions and attract the resources needed to do it.

Vision and Watershed Goals

The MRWP developed a vision statement that reads:
"We would like to see a Marengo River Watershed that has clean, flowing water; supports healthy, diverse, and resilient plant and animal communities free of invasive species; and is a vital community of watershed stewards who take actions to care for the watershed, while enabling a productive livelihood."

To achieve this vision the Marengo River Watershed Action Plan provides a framework to accomplish the following goals:
Goal #1: The hydrologic system in the Marengo River Watershed is stable and resilient.
Goal #2: Safe water and healthy, productive soil are available and maintained for all human and wildlife uses.
Goal #3: The Marengo River Watershed has diverse, healthy, and resilient native communities of plants and animals and their habitats on land and in water.
Goal #4: Citizens of the Marengo River Watershed are active and engaged in maintaining the integrity of the watershed.

Watershed Challenges and Sources

Challenges are the existing stresses or issues and concerns that prevent watershed goals from being met. Challenges specific to the Marengo River Watershed and their sources, were identified and prioritized by the MRWP based on their "severity" and "scope." The challenges are: 1) Unstable hydrologic system; 2) excess sediment; 3) excess nutrients; 4) high bacteria

counts; 5) loss of aquatic habitat; 6) terrestrial habitat fragmentation and alteration. Sources of these challenges are generally from nonpoint source pollution.

The most widespread challenges facing the Marengo River Watershed (and many other watersheds in the Lake Superior Basin of Wisconsin) are related to the altered and unstable hydrologic system caused by past land uses. The sources of these challenges are part of a natural watershed response to disturbance, but in many cases are being exacerbated by current human activity. They prevent the watershed from achieving its full habitat potential and improving its resilience to climate change and other potential disturbances. Improving the unstable hydrologic system, reducing sediment loads, and establishing a more stable and resilient Marengo River Watershed will take time. While these challenges are widespread and require management responses on a watershed scale, the sources of other challenges such as pathogen and nutrient concerns are more localized. Better implementation of human and livestock waste management practices will be required to see improvement. Improvement for these localized concerns is more readily achievable in the short term and much good work has already been done. Success will be related to the willingness of the watershed community to embrace and implement solutions that meet these challenges.

Watershed Action Plan

In order to realize the vision and long-term goals for the Marengo River Watershed, a short term (10-year) Watershed Action Plan was developed. Nearly 100 recommended action items set the stage for work that is needed to prevent future impairments, build upon, and maintain the watershed's high quality features. From protection to restoration to outreach, the action steps are designed to reduce or prevent nonpoint source pollution and also to build a base of knowledge about the watershed that will allow future management efforts to adapt to changes in our understanding of watersheds and changes in human needs and pressures on watershed resources. For each action item, the partner organization(s) best suited to implement the task was identified, along with an estimated cost and potential funding source(s). A measure of success was also identified for each action item to assist in evaluation of plan progress. A timeframe of 10 years was used to determine the scope of activities.

Conclusion

Meeting the vision and goals for the Marengo River Watershed will ultimately require both the widespread and localized challenges to be met. Addressing these challenges will take time, resources, and a watershed community committed to its vision for a healthy watershed. The Marengo River Watershed community is up to the challenge.

GO MARENGO!*

*GO MARENGO! - Phrase is taken from the book, *Fly Fishing with MacQuarrie*. Compiled and edited by Zack Taylor and published by Willow Creek Press, 1995.

CHAPTER ONE: INTRODUCTION

1. WHY THE MARENGO?

Excess sedimentation is the most widespread nonpoint source pollution challenge in Wisconsin's Lake Superior Basin (Fitzpatrick *et al*. 1999, Cahow & Fitzpatrick 2005, LSBPT 2007, WDNR 2010j). Excess sedimentation affects Lake Superior Basin streams by covering up important fish spawning areas for species such as brook trout and lake sturgeon and by altering stream hydrologic function that contributes to habitat degradation and makes streams less able to buffer effects from extreme flood events. The Marengo River is thought to be the largest contributor of sediment to the Bad River, with current estimates suggesting more than a third of the annual suspended sediment load from the Bad River (~64,000 tons) comes from the Marengo River (Fitzpatrick 2010). The Bad River is the largest contributor of sediment to Lake Superior along the United States shoreline. While sediment pollution receives much attention, other challenges such as livestock and human waste management and land fragmentation and conversion affect both aquatic and terrestrial habitats in the Marengo River Watershed.

The cause of much of the sediment affecting the health of the Marengo River (and other watersheds of Wisconsin's Lake Superior Basin) can be traced back to extensive logging and farming activities around the turn of the 20th Century. This large-scale land cover conversion caused streams to become unstable, overloaded them with sediment, and reduced the quality of habitat for aquatic species such as trout and sturgeon. These impacts on the Marengo River Watershed are still being felt today. While they are part of a natural watershed response to disturbance, in many cases, they are being exacerbated by current human activity. This slows the pace of watershed recovery and limits the ability of watershed ecosystems to be resilient to future changes such as those from climate change and the potential for large-scale iron mining in the east-central portion of the watershed.

The Marengo River Watershed has become an important focus area for highlighting the key management strategy to reducing sedimentation in Wisconsin's Lake Superior Basin. This management strategy, called "slow the flow," recognizes that reducing the volume and velocity of runoff to streams is critical to improving watershed health. This strategy involves both restoration and protection activities. Because Wisconsin's Lake Superior Basin has not seen the level of significant degradation seen in other areas of the Great Lakes, restoration potential in watersheds such as the Marengo is viewed by local resource managers to be very achievable and provides an opportunity for a quicker return on investment than restoring habitats in highly degraded ecosystems. Protection of high quality habitat areas provides an immediate return on investment and ensures valuable services such as clean water and healthy, diverse ecosystems will continue to endure.

The Marengo River Watershed Action Plan was created to provide opportunity to implement and apply the concepts of "slow the flow" and other watershed management activities to improve watershed resources for future generations. It was also created to engage and involve

the local watershed community in taking care of its home watershed. While the plan is specific to the Marengo River Watershed, many of the management strategies and actions apply to improving watershed health in all of Wisconsin's Lake Superior Basin.

2. THE MARENGO RIVER WATERSHED PARTNERSHIP PROJECT

The Marengo River Watershed Partnership (MRWP) Project builds upon previous work by the Wisconsin's Lake Superior Basin Partner Team (Partner Team), the United States Geological Survey (USGS), and the Bad River Band of the Lake Superior Tribe of Chippewa Indians (Bad River Tribe).

A USGS summary of sediment and phosphorus loading data to Lakes Superior and Michigan identified the Bad River as the largest sediment contributor to Lake Superior along the United States shoreline (Robertson 1997). The vast majority of the sediment loading was due to episodic transport events, such as those associated with spring snowmelt and runoff. The report indicated the Bad River Watershed's geologic characteristics, particularly the combination of steep topography and highly erodible soils, made the watershed susceptible to significant sediment loads.

Subsequent geomorphic investigations by the USGS and Bad River Tribe identified the Marengo River subwatershed as a likely key sediment contributor to the Bad River because of its geology and watershed position (Cahow and Fitzpatrick 2005).

In addition to these studies, work by the United States Forest Service showed that when the amount of open land and/or young forest (age class 0 to 15 years) in a watershed exceeds 60%, runoff rates increase and stream channels become unstable (Verry 2006). These conditions are of particular interest in Wisconsin's Lake Superior Basin because of steep topography, erodible soils, and land that was cleared for timber and agriculture around the turn of the 20th Century.

In an effort to begin applying this research and identify management priorities that could be implemented to improve the health of Lake Superior watersheds, the Partner Team selected the Marengo River Watershed as its test area to develop and demonstrate a process for assessing the hydrologic condition of Lake Superior watersheds. The Partner Team was originally formed in 1998 by the Wisconsin Department of Natural Resources (WDNR), to help implement the Lake Superior Bi-national Program and Lakewide Management Plan in Wisconsin. The Partner Team has since evolved into a unique blend of public, private and nonprofit organizations and individuals, whose mission today is to implement a watershed health initiative known as "slow the flow."

The result of Partner Team efforts was the *Marengo River Watershed Test Case: Assessing the Hydrologic Condition of the Marengo River Watershed, Wisconsin* (LSBPT, 2007). The Marengo Test Case, as it is known, laid the foundation for developing a watershed management plan. In 2008, the Bad River Watershed Association (BRWA) applied for funding from the National Fish and Wildlife Foundation, the Laura Jane Musser Fund, and the Wisconsin Department of

Natural Resources (WDNR) to continue this work and develop a Watershed Action Plan through a collaborative process known as the Marengo River Watershed Partnership (MRWP).

The Bad River Tribe has utilized funds through the USEPA to support this collaborative effort.

3. FORMING THE MRWP

Community-based partnerships are essential to effective watershed planning and management. Through a partnership, different people and organizations work together to address common interests and concerns. Partnerships represent the easiest way to develop and implement a successful Watershed Action Plan because everyone is involved from the beginning. To garner information needed for the Watershed Action Plan, as well as cultivate the necessary buy-in to achieve plan implementation, the Marengo River Watershed Partnership (MRWP) was formed, with the goal to maintain and improve the health of the Marengo River Watershed by investing citizens, governments, and agencies to create a Watershed Action Plan.

Throughout the course of the project, BRWA sought input from both the watershed citizens who work and play in the watershed, and from the technical experts who study and work on natural resources issues in the watershed through the MRWP. The following teams were convened as part of the MRWP to help facilitate stakeholder involvement for the development of the Watershed Action Plan.

3.1 CITIZEN INVOLVEMENT TEAM

The Citizen Involvement Team (CI Team) was charged with identifying the concerns and interests of local citizens related to the land and water resources in our area. The goals of the CI Team were to:

1. Gather what is known about public interests and concerns, and summarize it for incorporation into the Watershed Action Plan.
2. Offer ideas on citizen involvement opportunities and assist in efforts to plan, recruit participants, and spread the word.
3. Develop an outreach and citizen involvement strategy for plan implementation.
4. Develop plan recommendations and project ideas.

Participants:

- Ruth Oppedahl, University of Wisconsin-Extension
- Pam Roberts, Bad River Natural Resources Department
- Valerie Damstra, Bad River Watershed Association
- Matt Hudson, Bad River Watershed Association
- Bill Heart, Bad River Watershed Association, watershed citizen
- George Einar Bussey, watershed citizen

3.2 TECHNICAL TEAM

The Technical Team was charged with providing technical expertise and guidance to support the development of the Watershed Action Plan. The goals of the Technical Team were to:

1. Draft watershed challenges and goals based on citizen and technical input.
2. Review available information and data on the Marengo River Watershed, prioritize challenges, and make specific recommendations on priority projects/actions that are likely to improve the health of the watershed in the short and long term.
3. Develop monitoring component to support Watershed Action Plan implementation.

Participants:

- Naomi Tillison, Bad River Natural Resources Department
- Faith Fitzpatrick, United States Geological Survey
- Dale Higgins, United States Forest Service
- John Jereczek, Wisconsin Department of Natural Resources
- Nancy Larson, Wisconsin Department of Natural Resources
- Scott Toshner, Wisconsin Department of Natural Resources
- Cordell Manz, Wisconsin Department of Natural Resources
- Carmen Hardin, Wisconsin Department of Natural Resources
- Colleen Matula, Wisconsin Department of Natural Resources
- Ryan Magana, Wisconsin Department of Natural Resources
- Mike Gardner, Northland College, Sigurd Olson Environmental Institute
- Randy Lehr, Northland College, Sigurd Olson Environmental Institute
- Sharon Anthony, Northland College
- Darienne McNamara, Northwoods Cooperative Weed Management Area
- Tom Fratt, Ashland County Land and Water Conservation Department
- Kim Bro, Ashland County Land and Water Conservation Department
- Ben Dufford, Bayfield County Land and Water Conservation Department
- Tom Hollenhorst, United States Environmental Protection Agency
- Michele Wheeler, Bad River Watershed Association
- Bill Heart, Bad River Watershed Association
- Kevin Brewster, Bad River Watershed Association
- Matt Hudson, Bad River Watershed Association
- Valerie Damstra, Bad River Watershed Association
- Ted Koehler, United States Fish and Wildlife Service
- Pam Dryer, United States Fish and Wildlife Service
- Gary Haughn, Natural Resources Conservation Service
- Jason Fischbach, University of Wisconsin-Extension
- Sue Reinecke, United States Forest Service
- Jedd Ungrodt, Bureau of Indian Affairs
- Al Kirschbaum, National Park Service
- John Hoopes, University of Wisconsin-Madison
- Ben Lee, University of Wisconsin-Madison
- Dara Olson, Great Lakes Indian Fish and Wildlife Commission
- Ellen Kwiatkowski, Bayfield Regional Conservancy
- Jane Anklam, West Wisconsin Land Trust
- Tracey Ledder, Red Cliff Environmental Department
- Ruth Oppedahl, University of Wisconsin-Extension

- Dane Bonk, watershed citizen
- Mark Dryer, watershed citizen

3.3 STEERING TEAM

The Steering Team was initially charged with taking recommendations from the CI and Technical Teams to draft and recommend a Watershed Action Plan. The goals of the Steering Team were revised during the course of the project to provide more specific tasks as follows:

1. Work closely with BRWA to provide review and comment during drafting of Watershed Action Plan.
2. Help build support and buy-in for plan among local government officials and heads of natural resource agencies.
3. Develop implementation strategy for plan.

Participants:

- Ruth Oppedahl, University of Wisconsin-Extension
- Naomi Tillison, Bad River Natural Resources Department
- Grant Herman, Northland College, Sigurd Olson Environmental Institute
- Randy Lehr, Northland College, Sigurd Olson Environmental Institute
- Valerie Damstra, Bad River Watershed Association
- Matt Hudson, Bad River Watershed Association
- Tom Fratt, Ashland County Land and Water Conservation Department

4. US EPA NINE ELEMENT WATERSHED MANAGEMENT PLANS

BRWA decided early on in the planning process to develop and seek formal approval of the Watershed Action Plan as a United States Environmental Protection Agency (EPA) nine-element watershed management plan, utilizing EPA's "Watershed Handbook for Developing Watershed Plans to Restore and Protect Our Waters" (EPA 2008).

While nine-element watershed management plans are typically developed as a tool to identify and prioritize management activities that will restore watersheds with listed 303(d) impairments, EPA recently launched a new program called the "Healthy Watersheds Initiative," which *"…encourages states, local governments, watershed organizations, and others to take a strategic, systems approach to conserve healthy components of watersheds, and, therefore, avoid additional water quality impairments in the future* (http://water.epa.gov/polwaste/nps/watershed/index.cfm)**."** In the spirit of the Healthy Watersheds Initiative, the focus of the Marengo River Watershed Action Plan is to identify management activities that will prevent future impaired listings and maximize its healthy ecosystem potential. Although the Marengo River Watershed has been altered by human activities, it has not been significantly degraded like many watersheds in the Great Lakes basin.

The watershed is unique in that its mouth and lower reaches are within the boundary of the Bad River Indian Reservation. Both the Bad River Tribe and the State of Wisconsin have

authority to set and enforce water quality standards within the Marengo River Watershed. During the development and approval of this plan, the Bad River Tribe completed its water quality standards and they were approved by EPA. In addition, the State of Wisconsin is in the process of developing its approval process for EPA nine-element watershed plans. Recognizing this, EPA Region 5 staff agreed to provide technical assistance to approve both the on-reservation and off-reservation portions of the Marengo River Watershed Action Plan for meeting the EPA nine-elements.

5. EXISTING RESOURCE MANAGEMENT AND COMPREHENSIVE PLANS

A significant amount of planning related to community growth, zoning, and natural resource management has occurred in recent years in the various management jurisdictions contained within the Marengo River Watershed. The intent of the Marengo River Watershed Action Plan is to coordinate these efforts, enhance their effectiveness by providing additional opportunities to apply for resources to implement them, and provide a clear path to turn these planning objectives into actions that will maintain and improve the health of the Marengo River Watershed.

Here is a summary of relevant natural resource management and comprehensive planning documents that have been utilized and referenced for information to complete the Marengo River Watershed Action Plan:

Lake Superior Lakewide Management Plan (2008)
Wisconsin's Great Lakes Strategy (2009)
Great Lakes Restoration Initiative Action Plan, FY 2010-2014 (2010)
Bad River Band of the Lake Superior Tribe of Chippewa Indians Integrated Resource Management Plan (2001)
Bad River Band of the Lake Superior Tribe of Chippewa Indians Clean Water Act Non-Point Source Management Plan (2006)
Wisconsin DNR Lake Superior Basin Water Quality Management Plan (1999)
Wisconsin Lake Superior Basin Brook Trout Plan (2005)
Ashland and Bayfield County Land and Water Resource Management Plans (2010)
Ashland County Comprehensive Plan (2006)
Bayfield County Comprehensive Plan (2010)
Watershed Town Comprehensive Plans (11 total, completed in various years)
Bayfield Regional Conservancy Strategic Conservation Plan for Lake Superior's Bayfield Peninsula (2009)
Wisconsin's Strategy for Wildlife Species of Greatest Conservation Need (2005)
United States Forest Service Watershed Restoration Action Plan, Headwaters Marengo River (2011)

CHAPTER TWO: CHARACTERIZING THE MARENGO RIVER WATERSHED

1. GENERAL DESCRIPTION AND ADMINISTRATIVE BOUNDARIES

The Marengo River Watershed is located in central Ashland and south central Bayfield counties in the Lake Superior Basin of northern Wisconsin. It is one of 334 level-five hydrologic unit code (HUC) watersheds in Wisconsin and one of six level-five HUC watersheds contained within the Bad–Montreal Watershed (HUC code: 04010302, Figure 2.1). It covers an area spanning 218 square miles or approximately 139,313 acres (NOAA 2010).

The western third of the Marengo watershed is located within Bayfield County and the eastern two thirds within Ashland County. Parts of ten townships, including: Ashland, Gordon, Grand View, Kelly, Lincoln, Marengo, Morse, Namakagon, Sanborn, and White River are located within the watershed. The northeast corner of the watershed, which includes the mouth of the Marengo River, is located within the reservation of the Bad River Band of the Lake Superior Tribe of Chippewa Indians.

There are no incorporated cities or villages within the watershed. Some of the unincorporated villages include: Marengo, Highbridge, Sanborn, and North York (Figure 2.1).

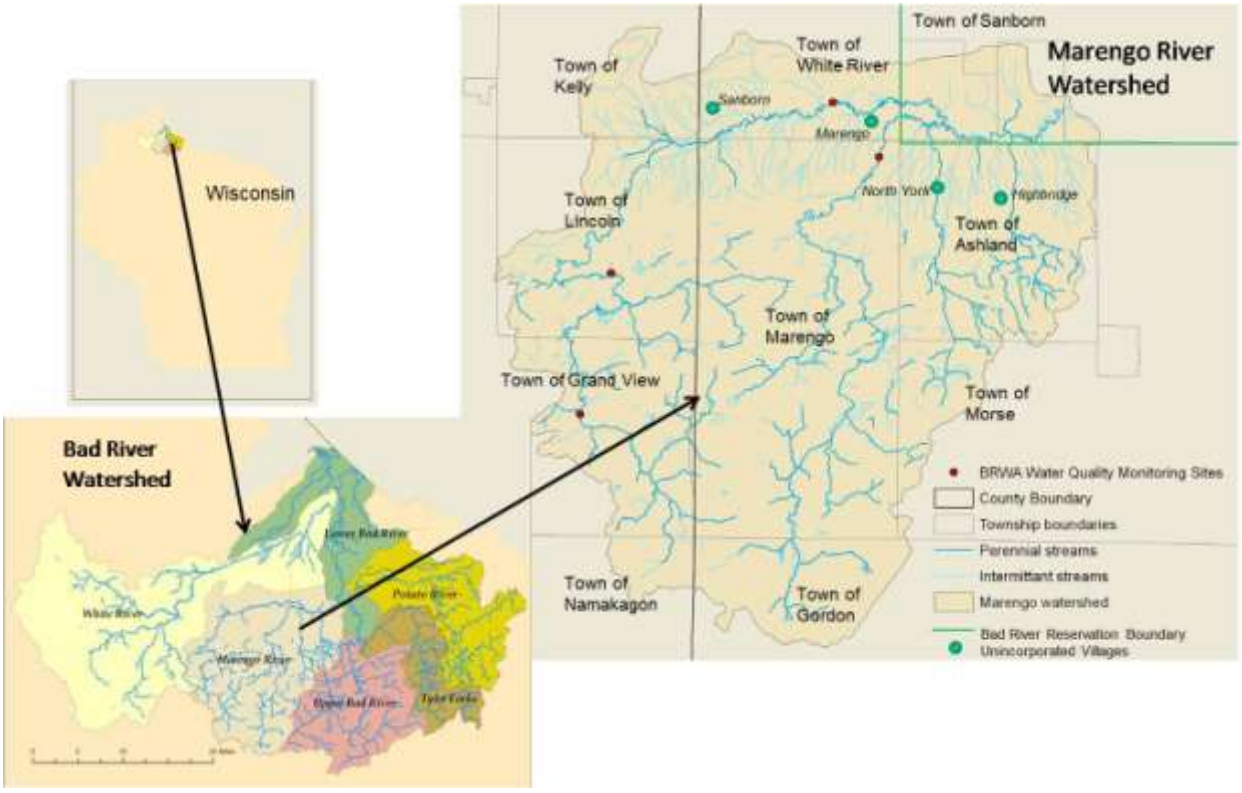


Figure 2.1. Location of the Marengo River Watershed and administrative boundaries.

1.1 COMMON WATERSHED FEATURES

Morgan Falls and Mineral Lake are examples of typical features found in the upper portion of the watershed, which is mostly contained within the Chequamegon-Nicolet National Forest (CNNF). The large, eroding sand bank is a common feature in the middle portion of the watershed. Agriculture and excess sand deposition are typical features of the lower portion of the watershed (Figure 2.2).

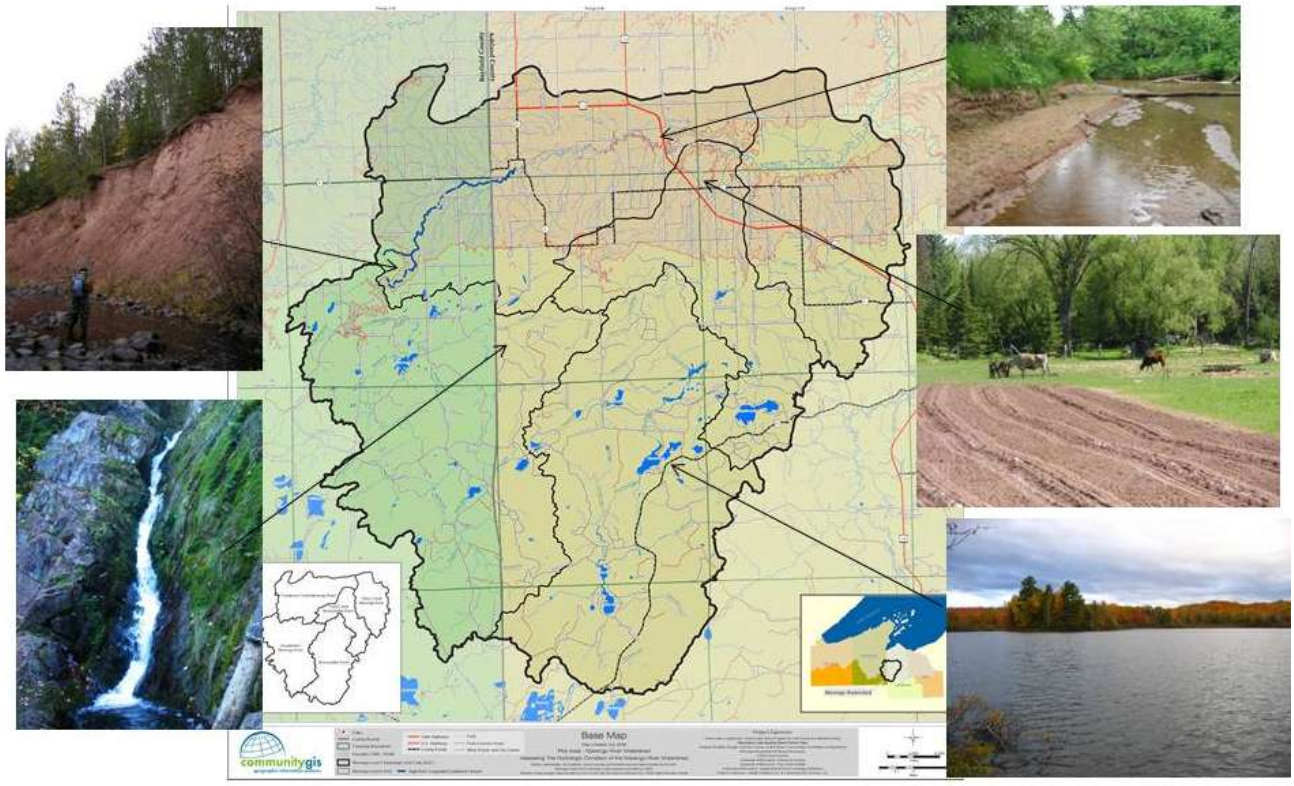


Figure 2.2. Marengo River Watershed map (LSBPT 2007) and pictures of common features.

1.2 HISTORY

The landscape of northern Wisconsin and the Marengo River Watershed underwent significant change following European settlement of the region and exploitation of the region's rich natural resources in the late 1800s and early 1900s. Government Land Office survey notes indicate that the Marengo River Watershed was 100% forested in the 1850s. Original vegetation consisted primarily of mixed coniferous/deciduous forest (hemlock, sugar maple, yellow birch, white pine, red pine), boreal forest (white spruce, balsam fir, tamarack, white cedar, white birch), and wetland areas (Figure 2.3, Finley 1976).

Forests played a key role in slowing the rate of runoff to watershed streams from rain and snowmelt events, particularly in the northern, clay portion of the watershed where soil infiltration rates are naturally slower. The forests slowed the rate of snowmelt in spring and

provided abundant wood to streams that helped create excellent habitat for native aquatic species like brook trout (*Salvelinus fontinalis*, WDNR and USFWS 2007).

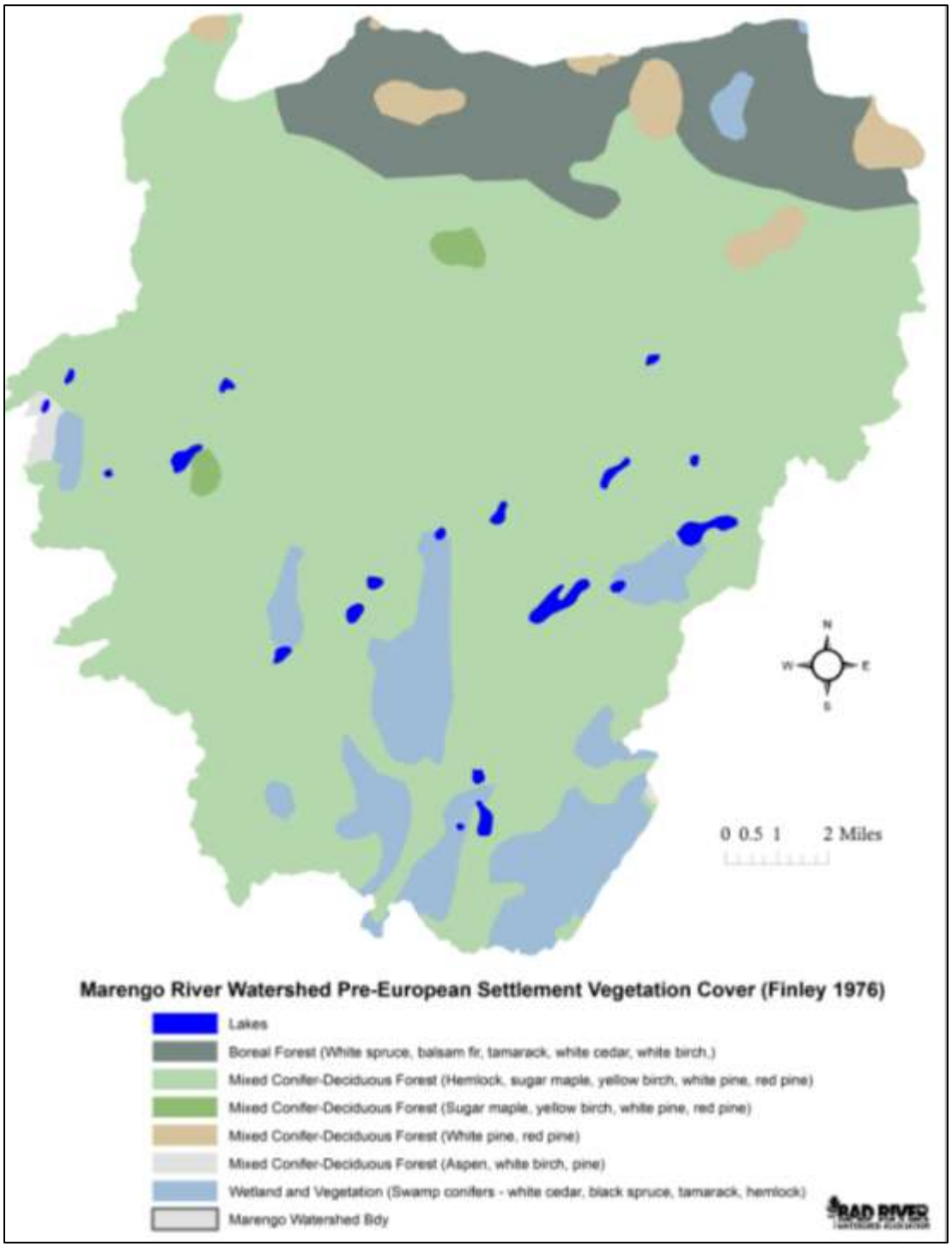


Figure 2.3. Original vegetation cover map of the Marengo River Watershed based on Finley's "Original Vegetation Cover of Wisconsin" map (Finley 1976). Data source: WDNR Public GIS FTP site: ftp://dnrftp01.wi.gov/geodata/, retrieved on 9/27/10.).

A comprehensive analysis of past land cover changes and their effects on erosion and sedimentation in the nearby North Fish Creek Watershed was conducted by the United States Geological Survey (USGS, Fitzpatrick *et al*. 1999). Similar land cover changes to those documented for North Fish Creek occurred throughout the Lake Superior Basin of Wisconsin, including the Marengo River Watershed. Removal of the forests began in the late 1800s and continued through the early 1900s. Along with removing the forest, fires burned much of the organic layer that acted as a sponge, particularly on the clay soils. Streams were used to transport logs to area mills, which widened stream channels, scoured banks, and removed most of the woody material in streams that provided excellent aquatic habitat.

After the decline in logging, major agricultural development in the region occurred from 1895 to 1920 (Mahaffey and Bassuk, 1978). Agricultural activity peaked in the mid-1920's to mid-1930's, with much of the upland areas consisting of cropland (forage crops and some corn) and pasture for dairy cattle (Fitzpatrick *et al*. 1999). Field drainage networks helped to rapidly channel water off the land and into streams.

Logging and agriculture also led to an extensive transportation network in the Lake Superior region. Road and rail grades can damage watersheds by blocking passage for aquatic species, combining drainages, and accelerating surface runoff (WDNR & USFWS 2005).

The combination of forest removal and agricultural development had a tremendous effect on the landscape and stream channels of the Lake Superior Basin that is still being felt today. Evidence indicates that watersheds have recovered to some extent (Fitzpatrick *et al*. 1999). However, legacy effects from past land use, often exacerbated by current human activity, limits the terrestrial and aquatic habitat potential of these watersheds, including the Marengo. Despite this, the Marengo and other Lake Superior Basin watersheds in Wisconsin still retain many high quality habitats and areas of habitat potential.

1.3 HISTORIC PRESERVATION

Recognizing and understanding historic places and cultural resources is an important part of the social fabric of a community and understanding how past use and relationship to the land affects what we see today in our communities, land and water resources. The Marengo River Watershed has been home to the Anishinaabe (also known as Ojibwe or Chippewa) people for many centuries. Beginning in the 1600s, Europeans began settling in the area. Both cultures have utilized the area for its abundant natural resources and as time passes, previous generations leave behind important evidence of their way of life. These places hold historic significance by providing important reminders of religious and cultural significance to those who live here today. Often, the location of these important sites goes unnoticed and is not properly documented, thus losing a portion of the area's history.

The Bad River Tribal Historic Preservation Office and the Wisconsin National Register of Historic Places work to identify these important historic sites, such as buildings, burial sites, resource harvest camps, and aesthetic resources so they can be preserved and protected. Wisconsin has a series of statutes that apply to historic preservation. These are described on the website for

Wisconsin's Historical Society (http://www.wisconsinhistory.org/hp/handouts/statutes.pdf). The Wisconsin National Register of Historic Places maintains a database of some of these known locations. The location of some sites remains restricted from public view in order to protect them from being vandalized or disturbed. There are currently no sites publicly listed for the Ashland or Bayfield County portions of the Marengo River Watershed in the database.

The Gidakiiminaan atlas, published by the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) (http://www.glifwc.org), is an 80-page atlas that identifies the Anishinaabe names of lakes, rivers, islands, bays, and other locations in northern Wisconsin, the Upper Peninsula of Michigan, and east central Minnesota. Some of these are pre-European names. Included in the atlas is a translation of the original Ojibwe name and a table that identifies the modern location name with the Anishinaabe name. Areas of the Marengo River Watershed are included in the atlas.

Surveys and documentation of historic cultural and natural resources is needed for the Marengo River Watershed.

1.4 DEMOGRAPHICS

The Marengo River Watershed is primarily rural and most of the human habitation is located in the northern third of the watershed. Bayfield and Ashland County Comprehensive Plan documents contain summary demographic information for each county and the jurisdictions within the county. Data from Towns were used to give a general summary of demographic information applicable to the Marengo River Watershed (Table 2.1).

Table 2.1. Population change for towns (excluding Namekagon and Sanborn) within the Marengo River Watershed, 1990-2000 (Ashland County 2006, Bayfield County 2010).

	1990	**2000**
Ashland County Towns		
Ashland	567	603
Gordon	301	357
Marengo	284	362
Morse	481	515
White River	771	892
Bayfield County Towns		
Grand View	419	483
Kelly	383	377
Lincoln	294	293

General trends for the region are an increase in people age 35 and older and a decrease in people less than 35. In general, young people tend to leave the region in search of employment opportunities elsewhere and the resident population continues to age. A regional trend has been the sale of large tracts of industrial forest that are often broken up into smaller chunks of property bought by individuals for recreational purposes. The Marengo River Watershed has

approximately 1,146 private landowners as of 2009 (BRWA data). Most of the private ownership is in the northern third of the watershed. Many of these are individuals who live outside the area and use the property for recreational opportunities such as hunting and fishing and may build a second home, particularly in waterfront areas.

1.5 ECONOMICS

Unemployment rates in Ashland and Bayfield Counties tend to be higher than the state average and median household incomes and property values lower than the state average (Ashland County 2006, Bayfield County 2010). Table 2.2 lists median household incomes for some of the townships in the Marengo River Watershed. They are among the poorest in the state of Wisconsin.

Table 2.2. Median household income for select Towns in the Marengo River Watershed. (Ashland County 2006, Bayfield County 2010).

	Median Household Income - 2000
State of Wisconsin	$43,791
Town of Lincoln	$27,917
Town of Ashland	$34,063
Town of Marengo	$33,036
Town of Morse	$39,000
Town of White River	$38,250

Historically, farming and forestry have provided employment opportunity for watershed residents. While these sectors remain important in the watershed and the region, they have generally declined in recent decades, while occupations related to the tourism industry have increased. There are very few places of employment within the Marengo River Watershed aside from local governments themselves, a school, a sawmill, individual farms, and a few taverns. Most residents commute to work in local population centers such as Ashland and Mellen.

1.6 LOCAL COMMUNITY SURVEY SUMMARY

The CI Team reviewed survey results from subsequent community planning efforts as one tool to begin to assess some of the citizen interests and concerns related to land and water resources in the area. Community surveys were conducted in Ashland County (2003) and Bayfield County (2008) for the purposes of comprehensive plan development. A survey of woodland landowners in the Lake Superior Basin was conducted by University of Wisconsin and the Wisconsin Department of Natural Resources (2009) to learn more about their forest activities and effects on water quality in the Lake Superior Basin, of which the Marengo River Watershed is a part. A summary of these results, tailored to the Marengo River Watershed community when possible, are summarized here.

Ashland County Comprehensive Plan Survey (2003)

As part of the Ashland County and participating communities' Comprehensive Planning program(s) a random sample survey was designed and implemented in 2003. Ashland County has five townships (Ashland, Marengo, White River, Morse, and Gordon) that are completely within or part of the Marengo River Watershed. BRWA summarized the survey responses specific to those townships to tailor survey results for the purposes of the MRWP project.

Regulatory Environment

In Ashland County, existing county level regulatory controls include: 1) Private sewage system ordinance, 2) flood plain ordinance, 3) shoreland amendatory ordinance, 3) scenic ordinance, 4)subdivision control ordinance, 5) junkyard ordinance, 6) scenic ordinance, 7) zoning ordinance, 8) nonmetallic mining ordinance, and 9) fee schedule. In the towns of Morse, White River, Ashland, Marengo, and Gordon there is no local zoning, and so these towns are subject to county zoning regulations. Respondents were asked about their level of willingness to be additionally regulated to achieve individual visions of what the county should become. In the Marengo Watershed towns, over 50% of respondents felt that existing regulatory controls are sufficient (Figure 2.4).

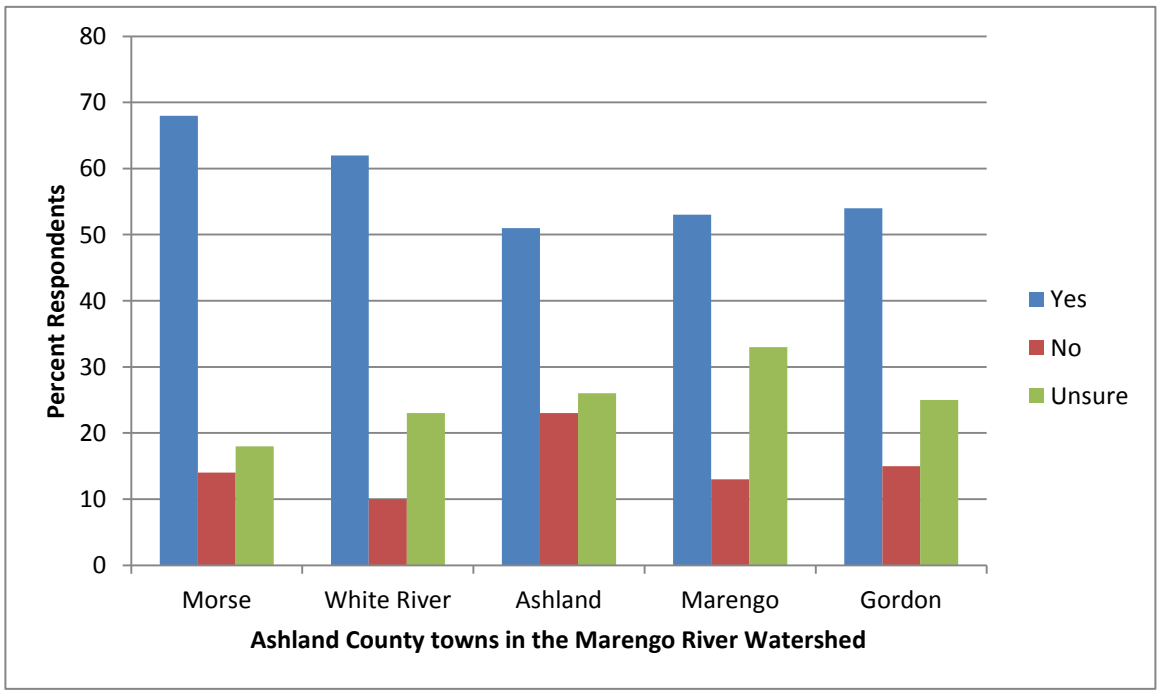


Figure 2.4. Marengo River watershed town resident responses to question 5 of Ashland County Comprehensive Plan Survey (2003): "Do you believe existing regulatory controls (i.e. zoning, subdivision, land division, sanitary permits, well permits) are sufficient to achieve your vision of your community's future?"

However, when asked if any additional regulations should be adopted to manage growth, the town of Marengo responded with a positive indication for stormwater and erosion control (57%), density standards (50%), local shoreland zoning control (50%), and local subdivision control (50%). The town of Gordon responded with a positive indication for local land division control (50%) and local subdivision control (54%).

These responses indicate that in general the residents feel that the existing regulatory environment is sufficient to meet the challenges of the next twenty years in these towns. However, there is also recognition that ordinance strengthening and some limited local ordinance adoption and local control may be needed to meet these challenges. Efforts to strengthen existing ordinances and their enforcement along with local efforts to adopt regulatory measures on perceived local need and issues should be successful and supported (Ashland County 2003).

About Ashland County

When asked to rank the importance of County level efforts and services, doing more to protect water quality and protect open space received a consensus of more than 60% support in the Marengo Watershed towns, while comparatively these efforts received a consensus of just over 30% county-wide (Figure 2.5). These results indicate that respondents from the Marengo Watershed highly value the natural resources of the watershed.

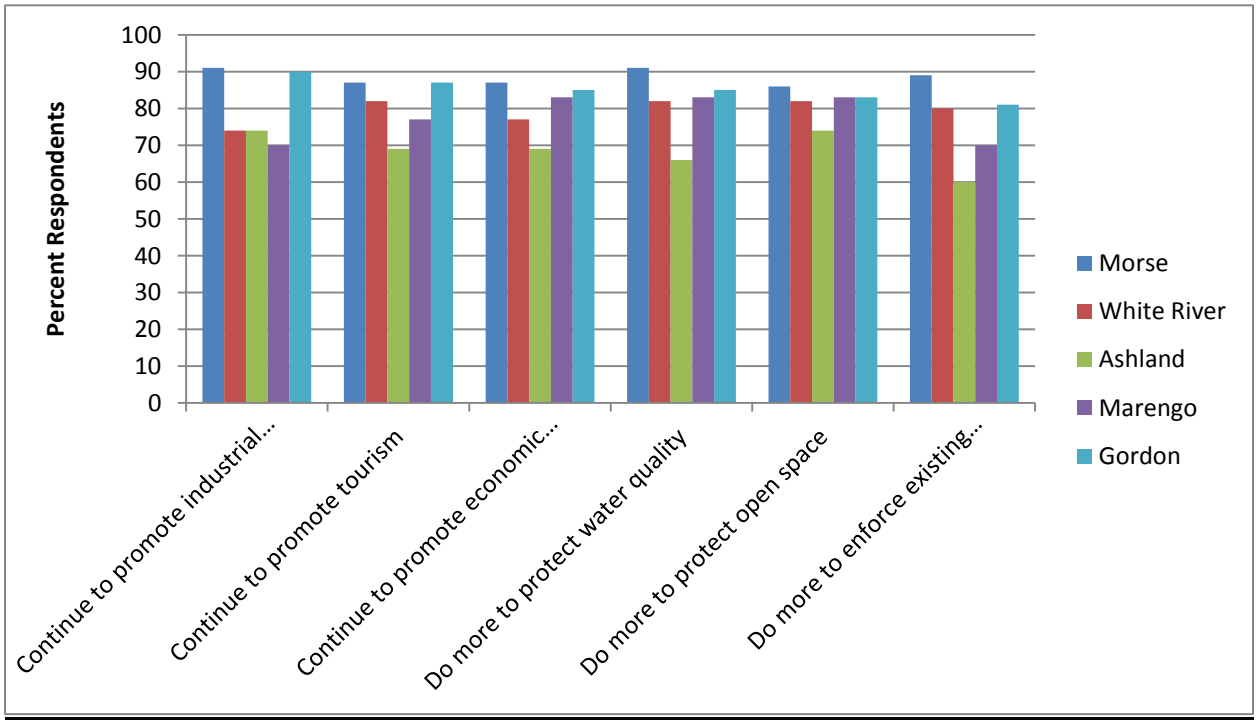


Figure 2.5. Marengo River watershed town resident responses to question 14 of Ashland County Comprehensive Plan Survey when asked to rank the importance of Ashland County efforts and services related to land and water resources.

However, other Ashland County efforts and services that received a consensus of more than 60% were promoting industrial development, tourism, economic diversification, and enforcing existing ordinances. Continuing to promote industrial development was the effort that received the greatest consensus from all Ashland County respondents (54%). Promoting tourism and economic diversification received less support county-wide (36% each), and enforcing existing ordinances was not as well supported county-wide (15%).

The responses indicate that residents in these towns are supportive of industrial expansion and recruitment, building upon the existing economic base, continuing to grow the tourism market sector, and enforcing existing regulations. However, it is also evident that the area's natural resources are highly valued, and that part of preserving the quality of life in the Marengo Watershed portion of Ashland County includes protecting natural resources in addition to maintaining a good local economy.

Bayfield County Comprehensive Plan Survey (2008)

A county-wide survey was completed in Bayfield County in 2008 to determine issues and opportunities to address in the Bayfield County Comprehensive Plan Update. The survey data collected was broken down by town, age, and length of residence in Bayfield County. BRWA reviewed the data by town, to review the responses from residents of the four townships (Lincoln, Kelly, Grand View, and Namakagon) that represent a portion of the Marengo River Watershed.

Natural Resources

In general, residents are passionate about maintaining the unique natural environment that Bayfield County has to offer. Accordingly, the majority of the respondents wanted greater protection and regulation of these natural resources. However, recreational enjoyment of the environment is a concern.

Over 80% of respondents from each of the four towns agreed or strongly agreed that Bayfield County should further ensure that its lakes, rivers, streams and wetlands are protected (Figure 2.6). Only 5% in Lincoln, Grand View, and Namakagon disagreed or strongly disagreed that Bayfield County should not further ensure its natural resources are protected from degradation; 15% disagreed or strongly disagreed in town of Kelly. However, given the larger percentage (60% +) of respondents strongly agreeing, natural resource protection is an important issue in maintaining these resources for future residents and tourists. The numerous natural resources are features of Bayfield County, and also the Marengo River Watershed, that make it a unique place to live and play.

Sixty-nine percent of respondents from the four towns agreed or strongly agreed that additional development restrictions should be put in place to protect the aesthetic beauty and ecological functioning of lake, river and stream shorelines (Figure 2.7). This response also shows support for protection of land and water resources in this portion of Bayfield County.

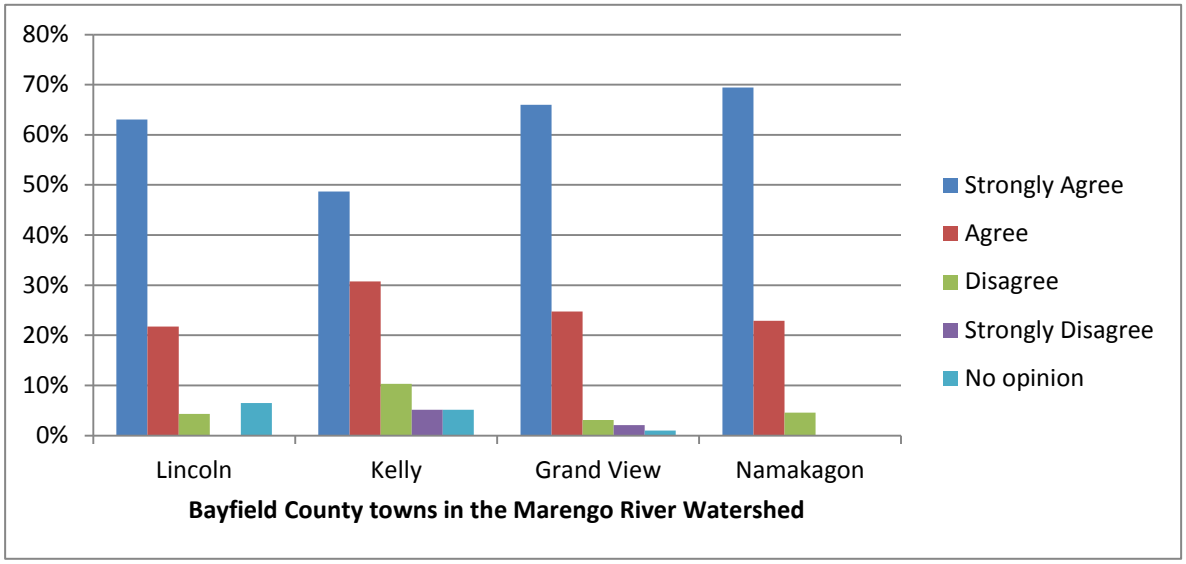


Figure 2.7. Marengo River watershed town resident responses to Natural Resources question 2 of the Bayfield County Comprehensive Plan Survey (2008): "Bayfield County should further ensure that its lakes, rivers, streams, and wetlands are protected from degradation."

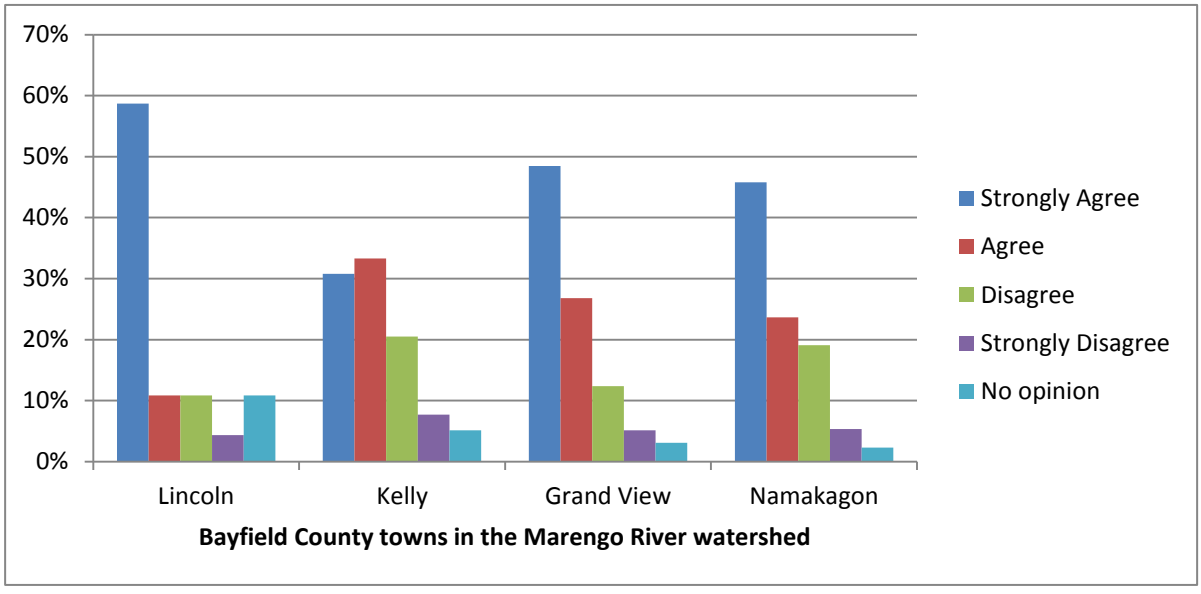


Figure 2.6. Marengo River watershed town resident responses to Natural Resources question 3 of the Bayfield County Comprehensive Plan Survey (2008): "Additional development restrictions should be put in place to protect the aesthetic beauty and ecological functioning of lake, river, and stream shorelines."

Agricultural Resources

Along with the lakes, rivers, and wetlands, agricultural lands are also an important attribute of Bayfield County, particularly in the town of Kelly, which is in the lower part of the watershed where more farming is occurring.

In the town of Kelly, 64% of respondents agreed or strongly agreed that agricultural lands should be preserved exclusively for farming use in Bayfield County. Respondents from Grand View, Lincoln, and Namakagon were lower, but still averaged at 48% agreeing or strongly agreeing. However, 52% of respondents agreed or strongly agreed that single-family residences should be allowed to be constructed on agricultural lands. These were contradictory answers found within the survey; however, the responses may relate to the importance of preserving natural resources.

Thirty-four percent of respondents in the four towns believed that the current residential density within agricultural area should remain the same, while 51% of respondents believed that the density should be lowered.

Land Use

Land uses in the four towns included private forest land, agricultural land, residential, commercial, industrial, rivers/inland lakes, and wetlands.

About 70 percent of respondents from all of Bayfield County agreed that the county should allow the option of clustering single-family residences on a large acreage. Since the residents are very concerned about preserving environmental resources, the findings are consistent with other environmental questions. However, other questions found that the majority of respondents wanted a minimum lot size. This is slightly inconsistent, but the awareness of preserving natural resources is still considered.

In the four towns, an average of 52% of respondents felt that private forest lands were most adequately regulated by County regulations out of all land uses. For water resources (rivers/ inland lakes and wetlands), there was mixed opinion on the adequacy of regulations on rivers/ inland lakes and wetlands.

The town of Kelly had the greatest percentage of respondents that felt regulations for water resources were excessive (23%), while the other three towns had higher percentages of respondents that said regulations for water resources was not adequate (Figure 2.8).

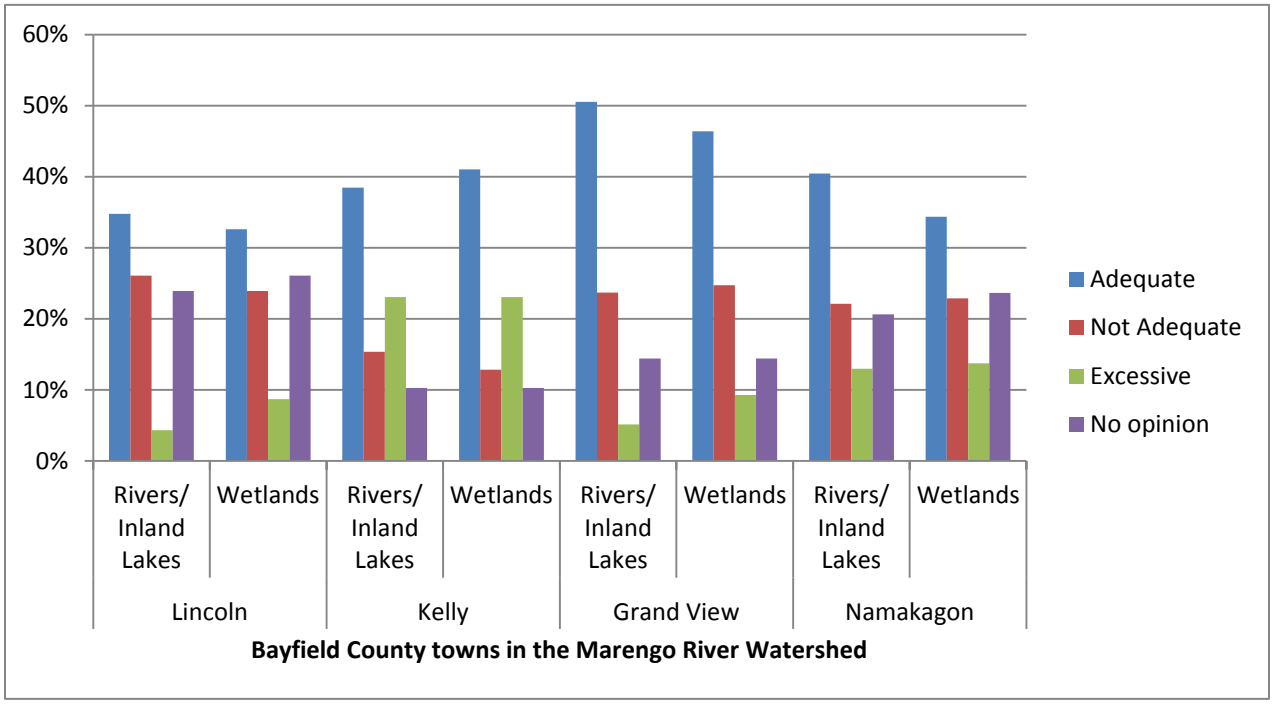


Figure 2.8. Marengo River watershed town resident responses to Land Use question 1 of the Bayfield County Comprehensive Plan Survey (2008): "Opinions on the existing Bayfield County regulations for rivers/ inland lakes and wetlands."

When asked about regulations for agricultural lands, respondents from the town of Kelly felt most strongly out of the four towns that regulations for agricultural lands were inadequate (18%), while the other three towns felt that agricultural lands were adequately regulated (47%). This could be a reflection of the higher value that town of Kelly respondents may place on agricultural lands, as it is more prevalent in that town and more important to livelihoods here than in the other towns.

It is worth noting that land use was indicated to be the most important element to the residents in the towns of Grand View, Lincoln, and Namakagon, with agricultural, natural, and cultural resources being second. In the town of Kelly, the importance of land use was second to agricultural, natural, and cultural resources. Economic development was the third most important element to all of these towns.

These results indicate that agricultural lands are valued more to respondents from the town of Kelly, where more farming is occurring in this area of the Marengo River Watershed.

Lake Superior Basin Natural Resources Survey (2009)

A survey of Wisconsin landowners in the Lake Superior Basin was carried out in May-June 2009 by the University of Wisconsin and the Wisconsin Department of Natural Resources. The survey population of interest was private woodland landowners with ten acres or more, without forest

management plans, who own land in the Lake Superior Basin. 981 surveys were sent out with 478 being returned, for a return rate of 49%.

The results of this survey indicate that landowners in the Lake Superior Basin have the sense that our water resources are in pretty good shape. A high percentage of respondents rated the water quality okay or excellent for scenic beauty, swimming, catching, and eating fish. In the Lake Superior Basin, fish managers and hydrogeologists are very concerned about sand eroding from stream banks smothering gravel spawning beds and degrading fish habitat. This is an even larger concern in the Marengo River Watershed, as it is the largest contributor of sediment to the Bad River, and in turn the Bad River is the largest contributor of sediment to Lake Superior. However, this survey showed that most of the public surveyed (76%) doesn't believe the water quality is affecting fish, and another 20-21% did not know.

Respondents in this survey were less sure about the quality of their drinking water. One third (35%) of the respondents didn't know the quality of their drinking water, and more than half thought their drinking water was just okay or poor.

The strongest response in the survey came from questions about water quality and economic development. In general, respondents valued water quality over economic development. 20% of respondents strongly agreed and 55% agreed when asked generally "it is important to protect water quality even if it slows economic development." However, when asked specifically about themselves, if they would be willing pay more to protect water quality, then 6% strongly agreed and 43% agreed. As the question became more specific to the individual level, the willingness to pay for water protection decreased, but respondents still agreed it was important. When asked about the top considerations when making a decision to do a management activity on their land, the top consideration was the out-of-pocket expense, followed by their own views about effective woodland management, then the environmental benefits of the management activity and the environmental damage that may be caused by the management activity.

When asked about water pollutants of concern, 34% of respondents indicated that the biggest perceived pollutant is trash and litter. This may be because it's more visible than other pollutants, such as sand and clay. Interestingly, sand and clay were not identified as much of a problem by the respondents, but are indeed serious pollutants in streams like the Marengo River and the bays of Lake Superior. A large majority of the respondents did not perceive any problem, or perceived only a slight problem, with the sources listed in the survey as contributors to water quality problems, such as litter, septic systems, roads, slumping stream banks, parking lots, harvested areas, etc.

When asked about landowner's experience with forest management activities that affect water quality, there were high numbers of "does not apply" answers coupled with high numbers of willingness to try a practice. More than half of the landowners that responded didn't think practices like stream crossings, improving logging roads, relocating roads off steep slopes and delaying a harvest for 3-5 years applied to them. Yet, those same practices were identified by

slightly fewer landowners as ones they are willing to try. High levels of willingness to try some forest practices bode well for future efforts to get more landowners to implement forest management activities.

2. WATERSHED CHARACTERISTICS

The following summary of Marengo River Watershed characteristics involved reviewing available literature, reports, data, interviewing technical experts familiar with the watershed, and hosting a "MRWP Technical Team Workshop" where several technical experts were asked to present "what we know" about watershed along with strategies on "what we should do about it."

Chapter 2.2 is a summary of "what we know" about the Marengo River Watershed that forms the basis of the goals, objectives, and management actions that will help this watershed community achieve its vision.

2.1 ECOLOGICAL LANDSCAPES

The Wisconsin Department of Natural Resources (WDNR) has defined 23 different Ecological Landscapes within Wisconsin (WDNR 2010a). Ecological Landscapes are areas that differ from each other in ecological attributes and management opportunities. They have unique combinations of physical and biological characteristics that make up the ecosystem, such as climate, geology, soils, water, or vegetation. They differ in levels of biological productivity, habitat suitability for wildlife, presence of rare species and natural communities, and in many other ways that affect land use and management.

Figure 2.9.Ecological Landscapes in the Marengo River Watershed (WDNR 2010a).

Two Ecological Landscapes occur within the Marengo River Watershed, the Superior Coastal Plain Landscape covering the northern third; and the North Central Forest Landscape covering the southern two thirds of the watershed (Figure 2.9).

The Superior Coastal Plain is Wisconsin's northernmost Ecological Landscape. Its major landform is a nearly level plain of lacustrine clays that slopes gently northward toward Lake Superior. Historically the Superior Coastal Plain was almost entirely forested and included a distinctive mixture of white pine, white spruce, balsam fir, paper birch, balsam poplar, trembling aspen, and white cedar (Figure 2.3).

The North Central Forest has landforms characterized by end and ground moraines with some pitted outwash and bedrock controlled areas. Kettle depressions and steep ridges are found in the northern portion. Soils consist of sandy loam, sand, and silts. The historic vegetation was primarily hemlock-hardwood forest dominated by hemlock, sugar maple, and yellow birch (Figure 2.3).

2.2 LAND COVER AND USES

Several sources for land cover data specific to the Marengo River Watershed are available. The Marengo Test Case study used a land cover analysis for Wisconsin called "WISCLAND," (Wisconsin Initiative for Statewide Cooperation on Landscape Analysis and Data) published in 1992. A more recent land cover analysis in the Great Lakes coastal region was conducted by the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center according to Coastal Change Analysis Program (C-CAP) standards (NOAA 2010). The land cover and land cover change analyses were conducted using Landsat Thematic Mapper and Landsat Enhanced Thematic Mapper satellite imagery for the years 1996, 2001, and 2006.

In order to give the most recent picture of land cover in the Marengo River Watershed, data were extracted from the NOAA Great Lakes C-CAP dataset for 2006. Land cover data for the Marengo River Watershed indicate that it is almost 70% forested, 12% wetland, 13% actively cultivated or in pasture/hay or grassland, less than 1% developed, and about 5% water or other categories (Table 2.3). Details on land cover classification categories are available from the NOAA website (NOAA 2010).

Table 2.3. Land cover percentages for the Marengo River Watershed (2006) from National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center, Coastal Change Analysis Program (C-CAP).

Land Cover Category	Acres	Percent
Developed	718.6	0.5%
Cultivated	3,384.2	2.4%
Pasture/Hay	14,263.0	10.2%
Grassland	408.6	0.3%
Deciduous Forest	70,743.7	50.8%
Evergreen Forest	8,198.4	5.9%
Mixed Forest	17,555.2	12.6%
Scrub/Shrub	5,234.8	3.8%
Palustrine Scrub/Shrub Wetland	6,953.6	5.0%
Palustrine Emergent Wetland	99.3	0.1%
Palustrine Forested Wetland	9,771.2	7.0%
Bare Land	2.2	0.0%
Water	1,980.5	1.4%
Total Watershed	139,313.3	100.0%

The majority of the forest and wetland area is located in the southern two thirds of the watershed. Much of this area is within the Chequamegon-Nicolet National Forest. The majority of the open land associated with agriculture (row crops, pasture/hay, or grassland) is located in the northern third of the watershed (Figure 2.10).

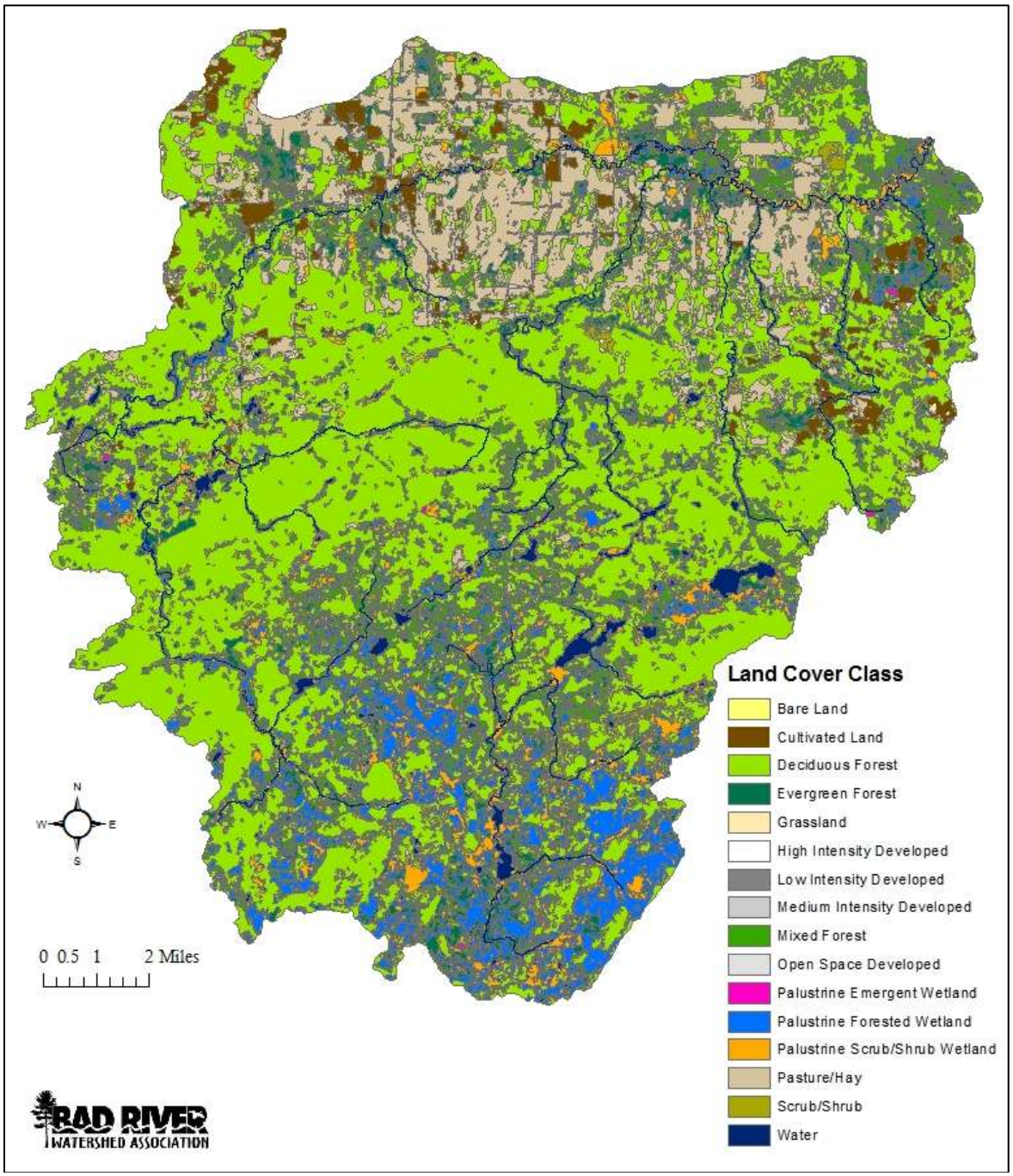


Figure 2.10. Land cover map for the Marengo River Watershed (2006) from National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center, Coastal Change Analysis Program (C-CAP).

2.3 HYDROLOGY AND GEOMORPHOLOGY

The Marengo River and its watershed have been the focus of several recent studies focused on characterizing its geomorphology and hydrologic condition (Fitzpatrick 2005, Cahow and Fitzpatrick 2005, LSBPT 2007, BRWA 2010). The focus on the Marengo River comes in large part because it is estimated to be the greatest contributor of sediment to the Bad River. The Bad River is the largest U.S. sediment contributor to Lake Superior (Robertson 1997). Sedimentation and its causes are perhaps the greatest issues facing the health of Wisconsin's Lake Superior basin streams.

These studies have revealed evidence of how historical land cover change created unstable stream channel conditions that the Marengo River and other, similar Lake Superior watersheds are still responding to about 100 years later. It is these unstable conditions and current human influences that exacerbate the conditions, which lead to many of the challenges discussed in this Watershed Action Plan. The following is a summary of key findings associated with these studies.

Streams in the Bad River Watershed tend to be characterized as "flashy," meaning high flows are intense but short in duration (Robertson 1997). The flashiness of these streams is a result of steep gradients, surficial deposits with high clay content, and land cover characteristics (Robertson 1997, Verry 2001). As a result, these streams are susceptible to erosion and sedimentation impacts.

The Marengo River Watershed begins at an elevation of approximately 1,443 ft. above sea level and ends where the Marengo River flows into the Bad River at an elevation of about 690 ft. above sea level. The main stem of the Marengo River is approximately 52 miles in length.

Elevations above 1,050 ft. are characterized by sandy glacial till with rock outcroppings frequent, a poorly developed stream network with no valleys, and relatively stable geomorphic conditions (Fitzpatrick 2005). Elevations below 750 ft. correspond to the Lake Superior clay plain, which is a relatively flat landscape except for frequent entrenched, alluvial valleys.

Between elevations of 1,050 to 750 feet above sea level, the Marengo River Watershed and other Lake Superior basin watersheds in Wisconsin are divided and defined, in part, by a post-glacial lake shoreline (glacial Lake Duluth) that is the boundary between the North Central Forest and Superior Coastal Plain Ecological Landscapes described in Chapter 2.2.1. The abandoned shoreline has wave-planed topography developed in sandy unconsolidated deposits. A combination of high relief, clay over sand, and clearing or road development in this area leads to high erosion rates (Fitzpatrick 2005).

A longitudinal profile of the mainstem of the Marengo River reveals the average slope of the stream channel below Marengo Lake, which is near the transition between the more stable upper and unstable middle portion of the watershed (Figure 2.11). The steep slope between 830ft and 1010ft of elevation corresponds to the soil transitional area (steep, wave-planed glacial topography) and unstable conditions characterized by severe valley and stream bank

erosion. Elevations below 750 ft. correspond to the clay plain with more gentle slopes and deposition of sand eroded from the soil transition zone.

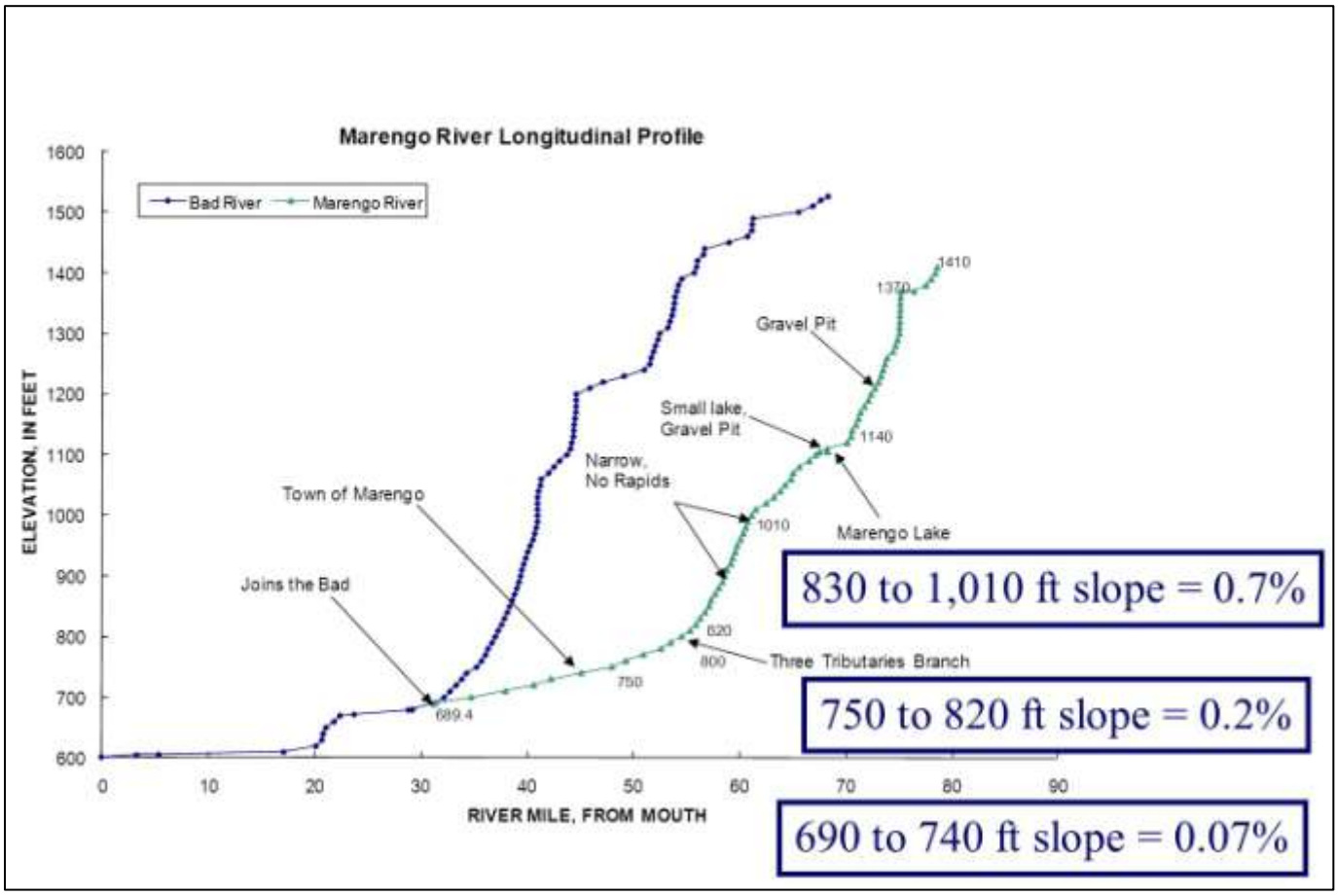


Figure 2.11. Longitudinal profile of the Marengo River compared to the Bad River. Average slopes are given for key erosional and depositional reaches of the Marengo River (Fitzpatrick 2010).

The lower portion of the Marengo River displays evidence of sediment overload, likely transported during episodic flood events. USGS developed stream channel cross sections as part of a geomorphic assessment of the Marengo River (Fitzpatrick 2005). The cross sections reveal evidence of historical channel incision upstream and sedimentation downstream near the river mouth (Figure 2.12). A cross section of the stream in the soil transition area reveals evidence of about 0.3 meters of historical incision compared to 1-2 meters of historical overbank deposition, natural levee formation, possibly 0.4 meters of channel aggradation based on a channel abandoned between 1870 and 1930 near the river mouth.

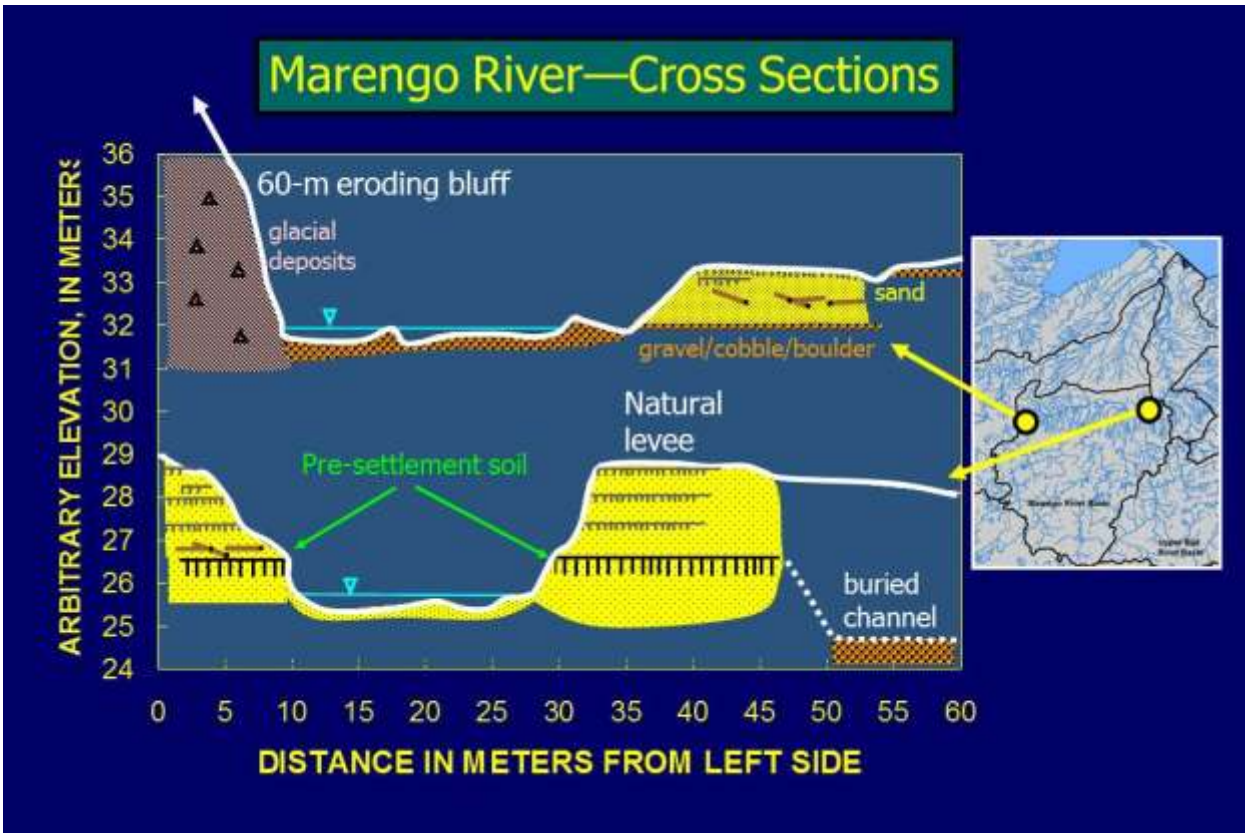


Figure 2.12. Stream channel cross sections as part of a geomorphic assessment of the Marengo River (Fitzpatrick 2005). The cross sections reveal evidence of historical channel incision upstream and sedimentation downstream near the river mouth (courtesy of F. Fitzpatrick).

Excessive lateral migration and channel instability exist at the confluence of the Marengo and Bad Rivers. Increased overbank sedimentation (levee building) disconnects the river from its floodplain and increases flood power to downstream reaches (Fitzpatrick 2005). The overbank sedimentation is primarily sand, presumably eroded from the wave-planed topography in the soil transition zone (Figure 2.13).

Figure 2.13. Levee building as a result of sand deposition near the mouth of the Marengo River (photo courtesy of Bad River Natural Resources Department).

Similar evidence of stream channel change following European settlement was documented as part of a more detailed geomorphic and sediment processes study conducted on the North Fish Creek watershed, just north of the Marengo River Watershed (Fitzpatrick et al. 1999, Figure 2.14). Like the Marengo River Watershed, North Fish Creek has a similar geologic setting, longitudinal profile, and historical land cover changes and provides a good proxy for ways in which historical land cover changes likely have affected flooding and sedimentation in the Marengo River Watershed.

Figure 2.15 shows how the amount of geomorphic change in North Fish Creek over the past 120 years (following European settlement of the area) is equal to that of the previous 2,000 years. In addition, peak flood flows are about twice as high and sediment loading about 2.5 times higher than pre-European settlement rates (Figure 2.16).

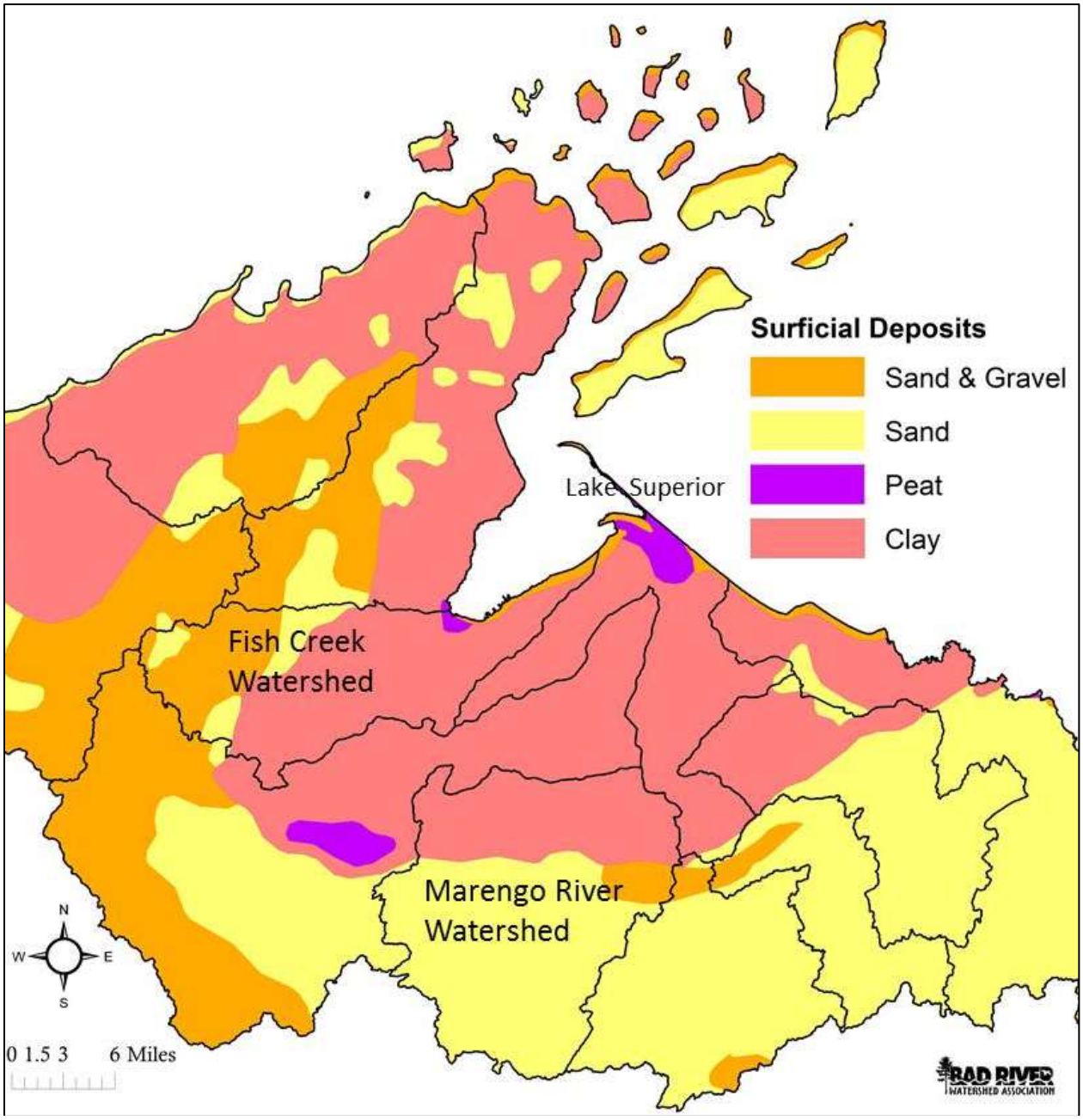


Figure 2.14. Location of Fish Creek watershed (includes North Fish Creek) relative to the Marengo River Watershed in the Lake Superior Basin of northern Wisconsin. Surficial deposits are shown to give an indication of the similar geologic setting of the two watersheds.

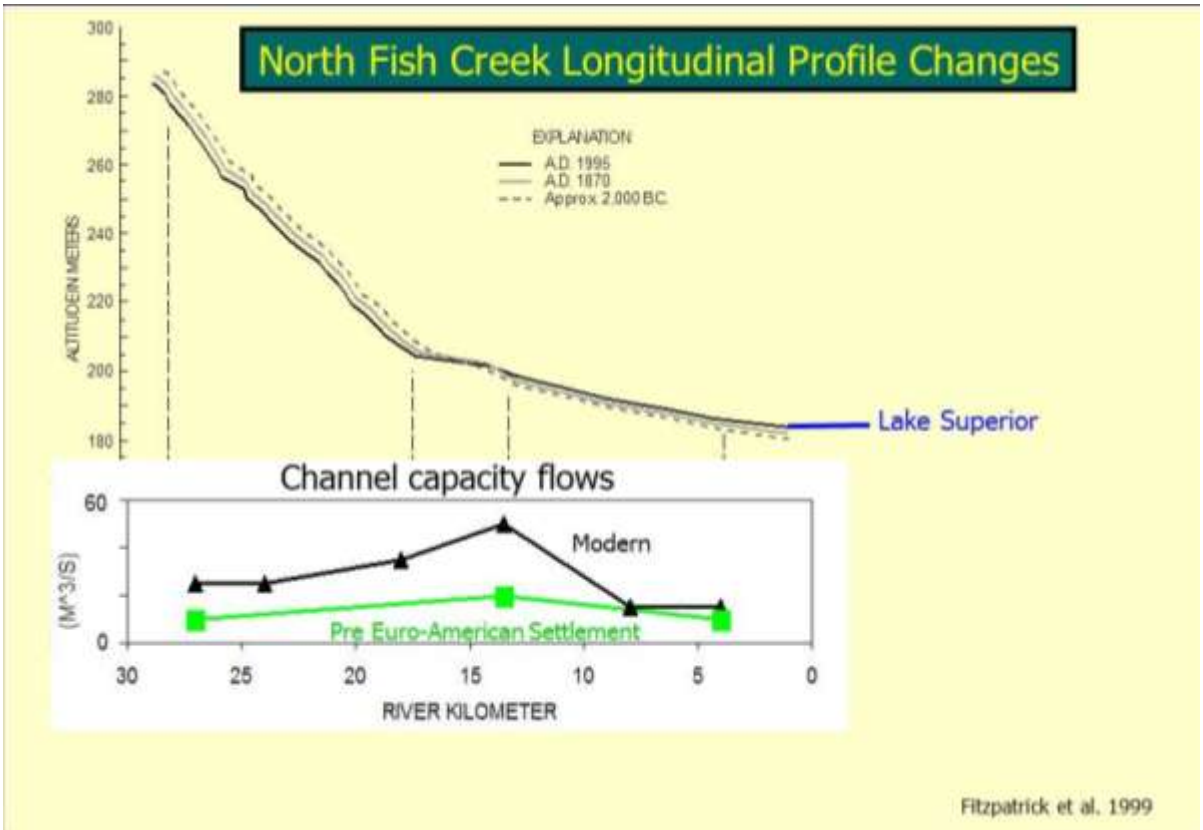


Figure 2.15. North Fish Creek longitudinal profile changes (Fitzpatrick et al. 1999).

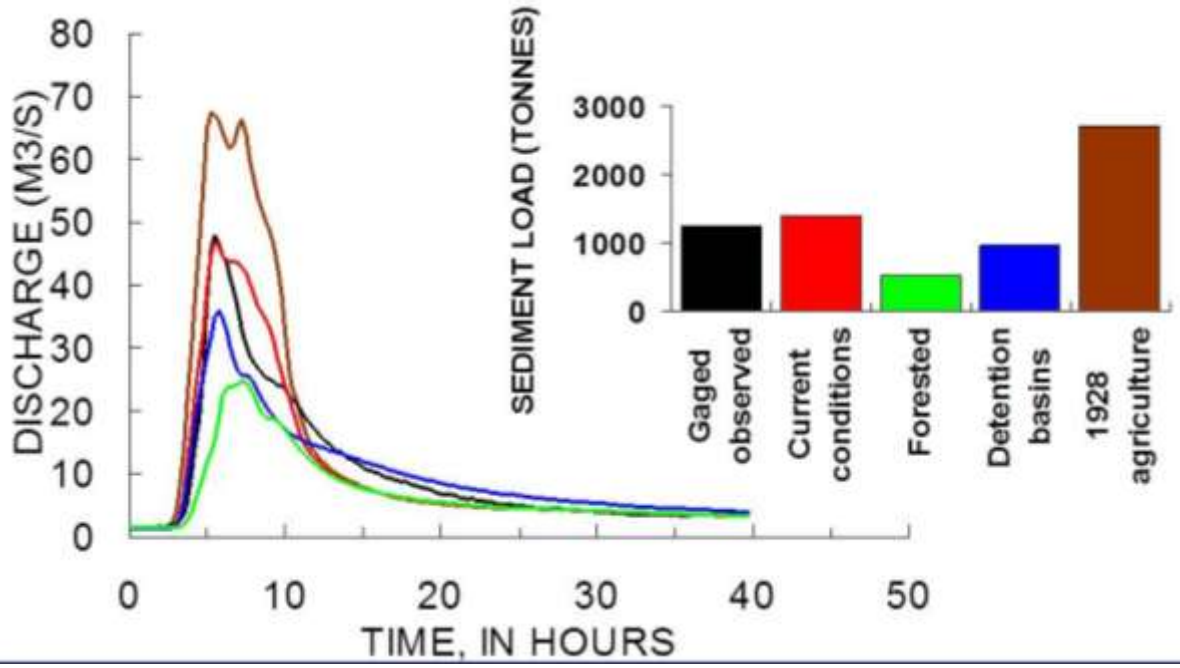


Figure 2.16. Storm hydrographs and sediment loads for North Fish Creek near Moquah, WI, for a historical storm on September 3, 1991, under four land-cover conditions (Fitzpatrick et al. 1999).

Evidence for how land cover change causes geomorphic change to stream channels in the upper Midwest comes from the work of Dr. Elon S. Verry and others (i.e. Verry *et al*. 1983, Verry 2001). Dr. Verry researched the relationship of the amount of open land in a watershed to the change in channel-forming peak flows (1.5-year bankfull flow). The removal of forest cover corresponds to an increase in snowmelt and other surface runoff events. These effects are particularly prevalent in the upper Midwest where significant logging and farming activities took place around the turn of the 20th Century and in areas with soils high in clay content. Verry showed that young forests (0-15 year age class) affect runoff rates in the same way as open land. The threshold for these impacts occurs at about 60% open land or young forest in watersheds only 2.5 km^2 in size where hill slopes are 3 to 45%. In flat basins (<3% hillslopes) in channel erosion does not occur in basins smaller than 25 km^2 (Verry 2001, Figure 2.17).

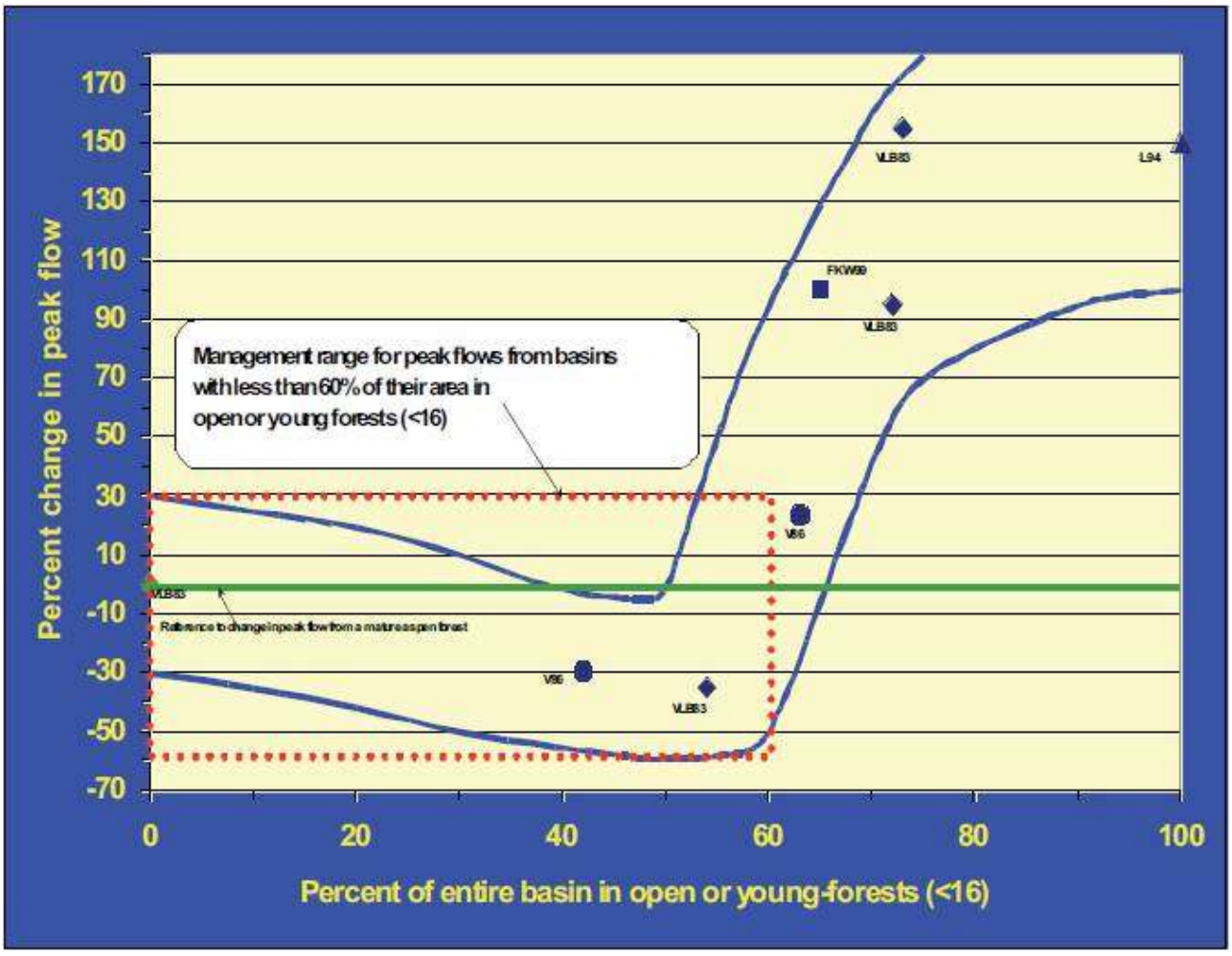


Figure 2.17. Relationship of the amount of open land in a subwatershed to the change in peak flow (Verry, 2001).

Other studies have shown that if forest vegetation is allowed to return, recovery to pre-logging hydrologic conditions may take from only a few years to several decades (Reinhart *et al*., 1963). However, in areas where natural vegetation is permanently converted to agriculture,

substantial long-term changes in flooding and sedimentation occur (Knox, 1977; Jacobson and Primm, 1997).

The Marengo River Watershed is of particular interest because of its geologic setting and past and present human activity that corresponds with the erosion-prone soil transition and clay plain areas. There are a high number of small tributaries flowing into the main stem of the Marengo River off the wave-planed topography in the soil transition zone from the south (Figure 2.18). These tributaries lie in the area of the watershed with the majority of farming activities, open land, clay soils, and an extensive road network. Because of these converging factors, the Marengo River was estimated to have the highest potential erosion problems of all the Bad River tributaries, and is likely to be the main contributor of sedimentation to the Bad River (Fitzpatrick 2005). Using the Bad River USGS stream gage sediment rating curve, it is estimated that more than a third of the annual suspended sediment load from the Bad River (~64,000 tons) comes from the Marengo River Watershed (Fitzpatrick 2010).

The Marengo River Watershed is prone to erosion and sedimentation because of its geology and landscape position, but geomorphic evidence suggests that these natural processes have been altered and increased due to past and current land use activities. The question exists as to how much human activity is affecting stream conditions and what can be done to improve those conditions and maximize ecosystem services the watershed is able to provide? In 2006, Wisconsin's Lake Superior Basin Partner Team set out to begin to tackle this question and learn which hydrologic factors had the most influence on the timing, quality and quantity of water in the Marengo River Watershed to help identify and prioritize projects in the watershed and lay the foundation for a watershed planning effort. The result was the *Marengo River Watershed Test Case: Assessing the Hydrologic Condition of the Marengo River Watershed, Wisconsin*.

The hydrologic assessment identified the following specific concerns or areas of concern in the Marengo River Watershed:

- areas with more than 50 or 60% open land or young forest;
- sand deposition in the lower reaches of the watershed and at the confluence with the Bad River, filling in and channelizing flow and restricting access to floodplains;
- cropland tillage, rotation and surface drainage;
- water channeled by road and ditch systems; and
- drained wetlands contributing to the overall volume and velocity of water added to the river system during major runoff events.

In addition, other ongoing projects in the Marengo River Watershed have identified the following specific areas of concern (Figure 2.18):

- The area within elevations 750–1,150 feet above sea level, known as the "soil transition zone" of the Lake Superior clay plain, is considered an erodible area. This band cuts across the entire Wisconsin portion of the Lake Superior Basin.

- A stretch of the Marengo River located between Kyster Road and County Highway C, has been identified, through a cooperative study by the US Geological Survey and the Bad River Natural Resources Department, as a high risk area for suspended sediment contributions.

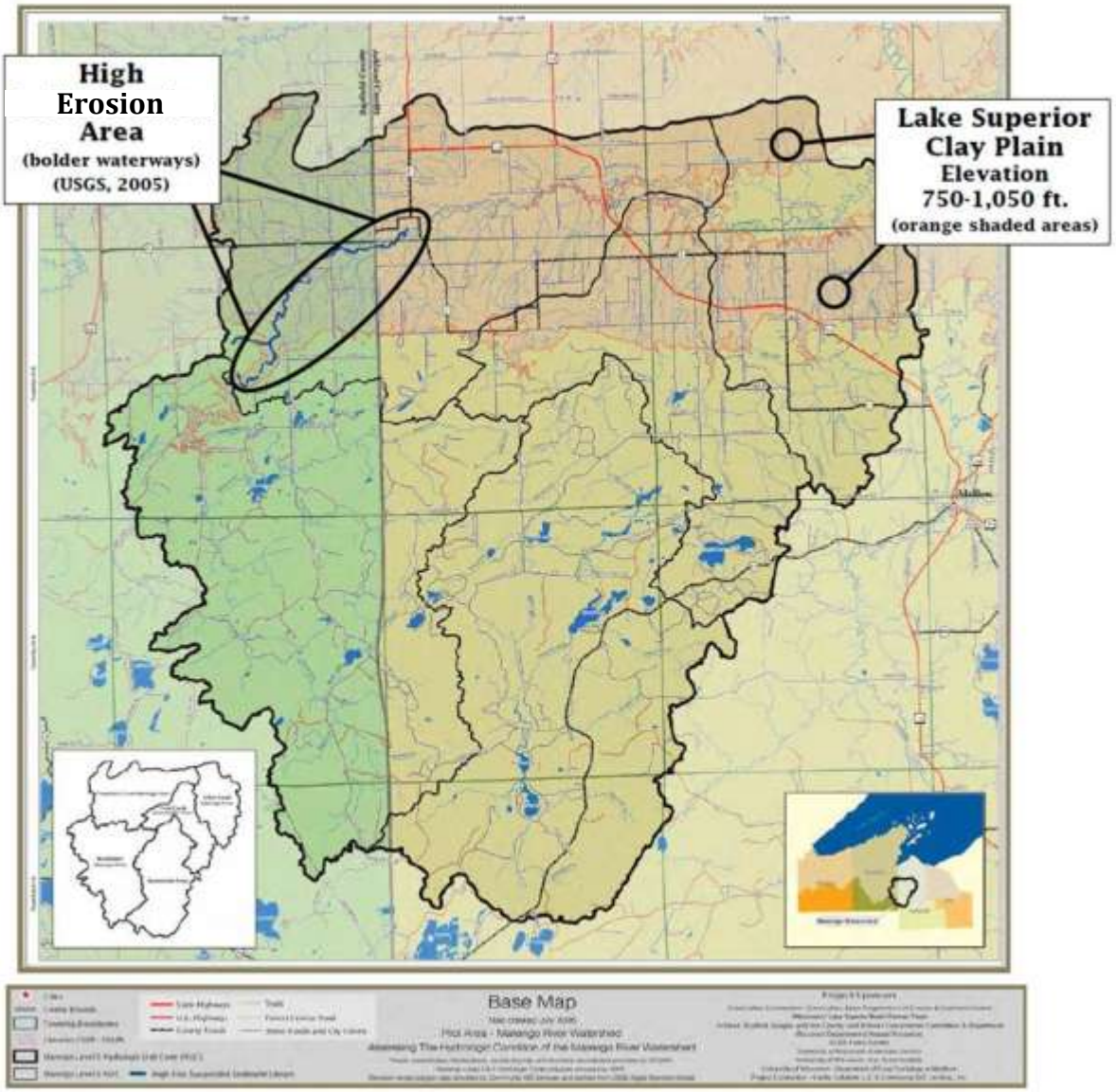


Figure 2.18. The Marengo River Watershed and specific areas of concern identified in the Marengo Test Case (LSBPT 2007).

2.3.1 BRWA "GET TO KNOW YOUR WATERSHED" STREAM ASSESSMENTS

During summer 2009, BRWA worked with staff at the Center for Watershed Protection (CWP) and hydrologists from the USGS and USFS, to modify existing stream assessment forms (Kitchell and Schueler 2005) to evaluate the severity of bluff and stream bank erosion and channel instability in the high risk area for suspended sediment contributions highlighted in the Marengo Test Case.

During fall 2009 and spring/summer 2010, BRWA staff, along with citizen and professional volunteers, surveyed approximately six miles of the Marengo River between Altamont Rd. and Ashland Bayfield Rd. and approximately one mile above Marengo Lake Rd (Figure 2.19). The program was called "Get to Know Your Watershed" and surveyors identified and assessed 97 stream bank erosion sites, 135 depositional bars, 16 log jams and 23 beaver dams. Figure 2.19 displays examples of some of the severe stream bank erosion surveyed as part of the program.

BRWA worked with WDNR staff to develop a Google Earth application to display the resulting data for stream bank erosion (Figure 2.19). The application provides a tool for citizens and resource managers to view photos and data collected from each of the stream bank erosion sites, as well as evaluate and prioritize potential sites for stabilization or remediation activities.

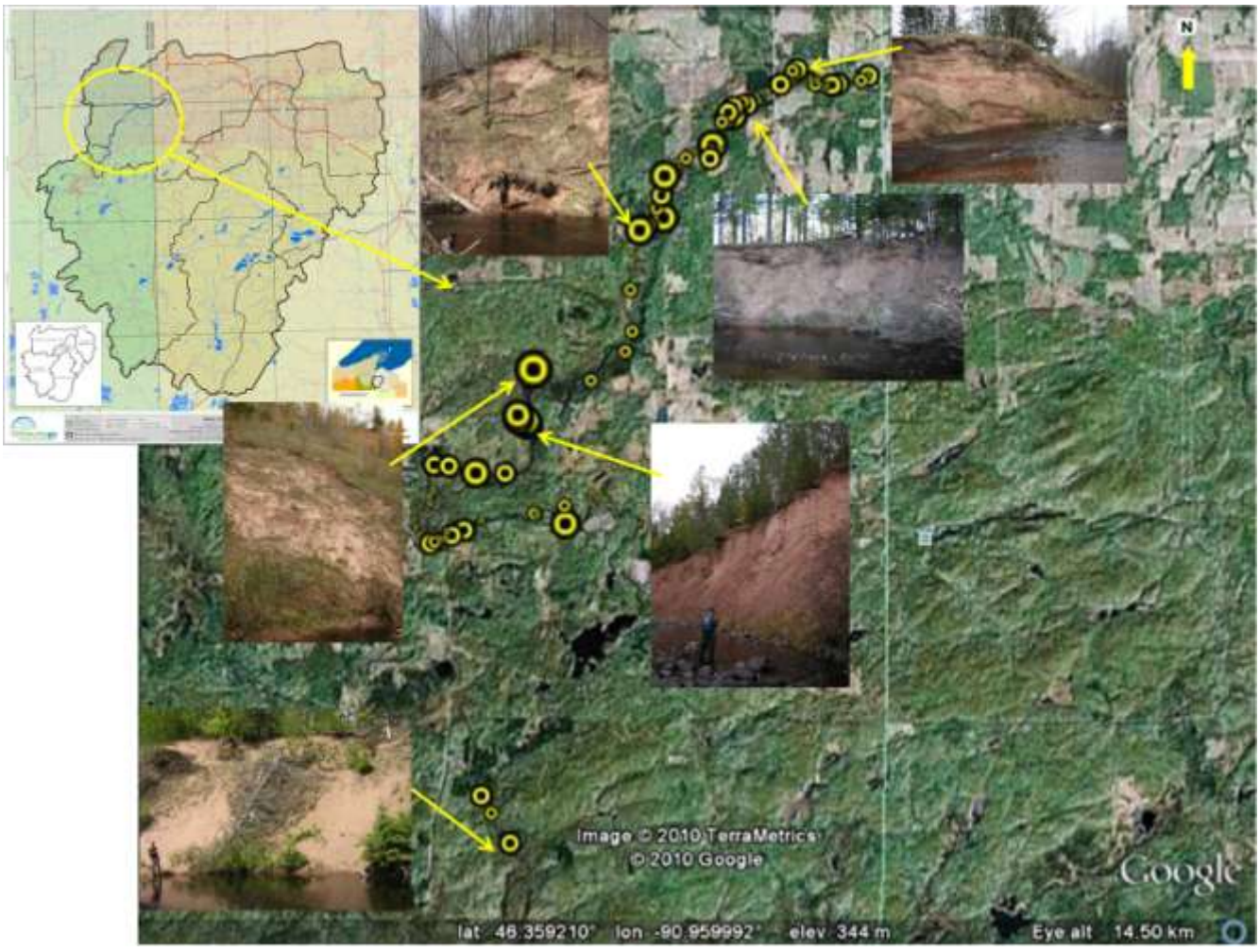


Figure 2.19. BRWA "Get to Know Your Watershed" survey stream bank erosion locations and example pictures of some erosion sites. The size of the dots is based on the area (in ft^2) of the eroding stream bank. The surveys were conducted in the high sedimentation area of concern identified in the Marengo Test Case (LSBPT 2007).

The BRWA surveys document the severity of bluff and stream bank erosion in the soil transition zone of the main stem of the Marengo River. Using the amount of bare, eroding area measured (270,000 ft^2), assuming a 1 ft/year retreat rate, and assuming 85 lbs/ft^3 volume/weight conversion, a rough estimate of annual sediment loading from the soil transition zone in the main stem of the Marengo River is about 11,000 tons (Fitzpatrick 2010). The suspended sediment loading estimate from the entire Marengo River Watershed based on the Bad River sediment rating curve is about 64,000 tons (Fitzpatrick 2010). These estimates suggest a significant amount of the sediment loading from the Marengo River Watershed could be coming not only from the main stem but also from the tributaries. This would make sense given the geologic setting of the watershed and that many of the tributaries to the main stem flow north off the soil transition zone. While these estimates can provide preliminary clues to erosion and sedimentation problems in the Marengo River Watershed, a full sediment budget is needed to characterize these issues, direct management activities, and document future improvements.

2.3.2 "SLOW THE FLOW"

While erosion and sedimentation are important challenges to maintaining and improving the health of the Marengo River Watershed, as learned from the work of Verry and others, they are symptoms of watersheds responding to increased runoff rates largely from land cover changes. The Lake Superior Basin Partner Team has adopted a slogan called "slow the flow" to help draw attention to the key non-point source issue affecting the health of streams in the Lake Superior Basin of Wisconsin. The concept recognizes that holding water back on the landscape and delaying its delivery to streams, particularly in the soil transition zone and clay plain areas, will protect stream channels and improve habitat for aquatic species.

The Lake Superior Basin Partner Team and WDNR have worked with Dr. Verry and Community GIS, Inc. over the past several years to apply the open lands concept developed by Dr. Verry to identify critical areas for management activities to slow the flow. Using 16 years of satellite imagery of the entire Lake Superior basin in Wisconsin and subdividing the watershed into smaller "hydrologic units" based on stream sinuosity, slope, and length, the percent open land and forest less than 16 years old was calculated for each of the hydrologic units. This process was completed using data through 2004 and repeated again using data through 2008 (Community GIS, Inc. 2006, 2009).

The open lands assessment is designed to determine the areas of the Lake Superior Basin currently exceeding the 60% open land/young forest threshold in order to focus slow the flow efforts on the landscape that will eventually reduce 2-year peak flow volumes and improve stream health.

In order to apply the open lands assessment to slow the flow management activities, a recommendation from the Nemadji River Basin Project Report (NRCS 1998) was to avoid exceeding 40% open land in a subwatershed to help control erosion and improve fish habitat.

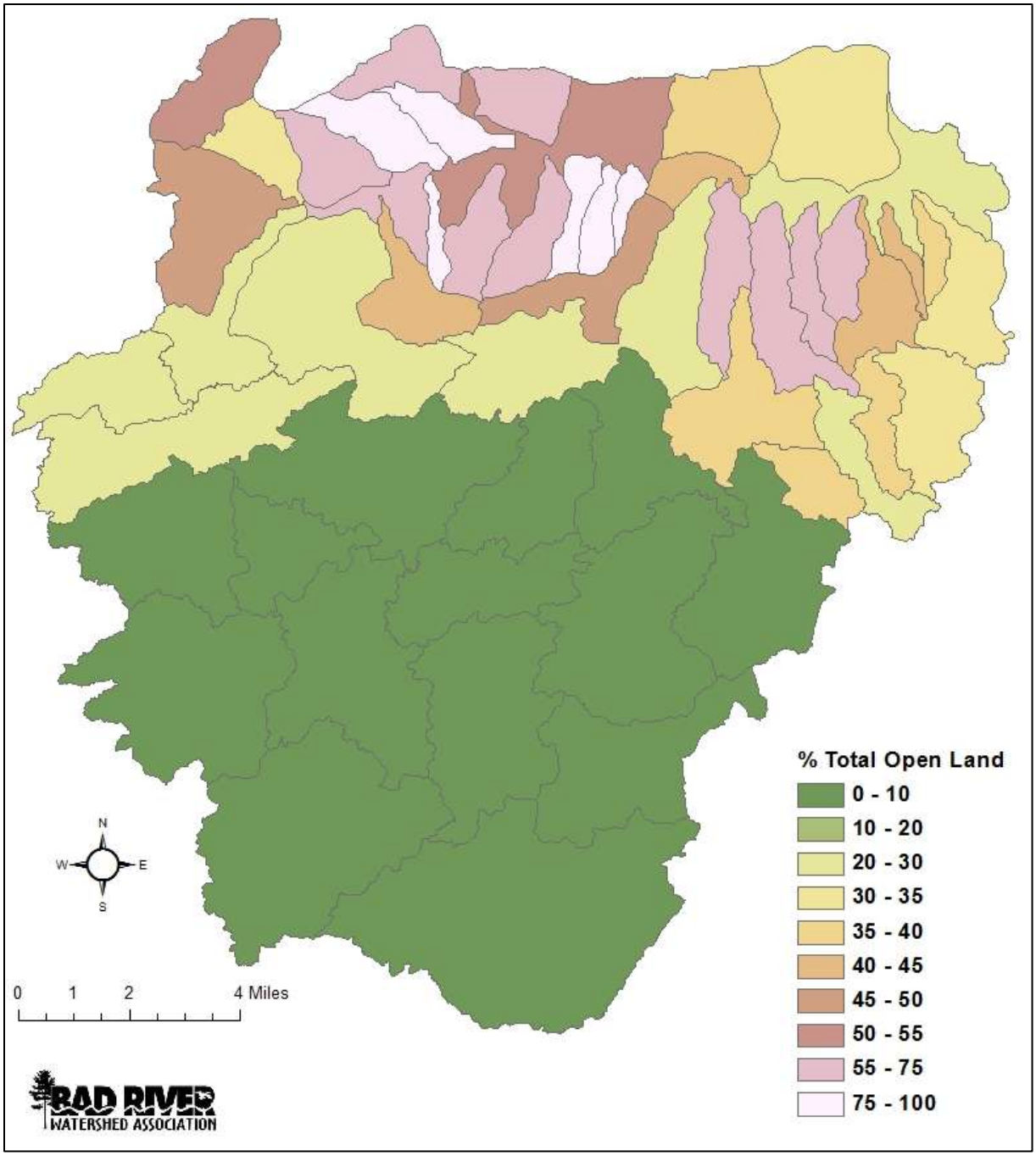


Figure 2.20. Wisconsin Department of Natural Resources 2008 open lands assessment data for Marengo River Watershed hydrologic units.

WDNR has recently proposed the following strategy related to open lands management in the Lake Superior basin that provides further detail (Wagner and Matula 2010):

- Priority for Restoration Efforts: Hydrologic units at 55% or more open lands
- Priority for Landowner Education Efforts: Hydrologic units at 40%-55% open lands
- Priority for Maintaining Working Forests: Hydrologic units at less than 40% open lands

For the purposes of identifying a management target for the Marengo River Watershed, the amount of open land needing re-forestation was calculated to achieve the 40% guideline within the hydrologic units delineated for WDNR's 2008 open lands assessment (Figure 2.22). The total amount of open land needing re-forestation to achieve 40% open land or less in all hydrologic units in the Marengo River Watershed is 7,643 acres.

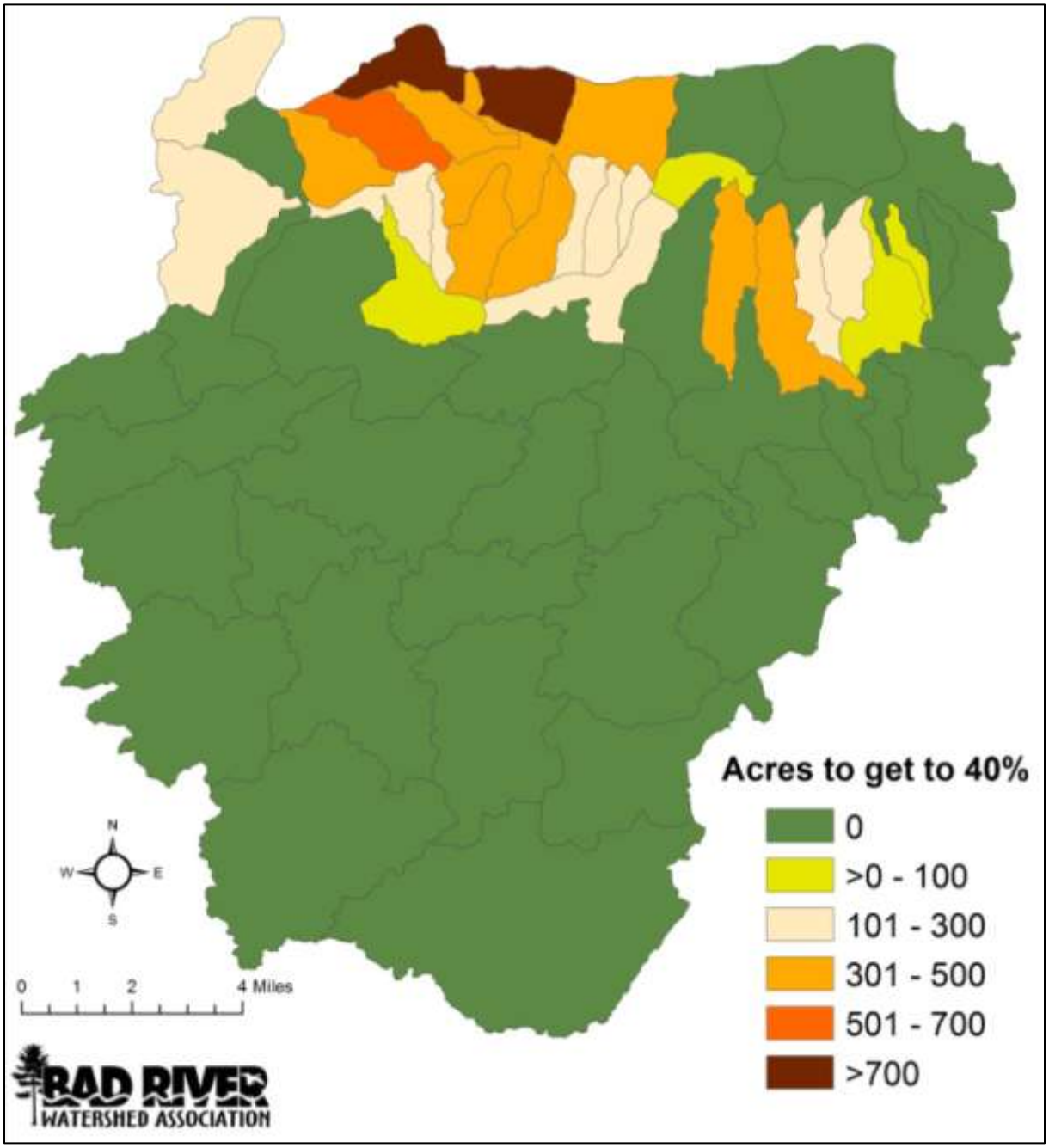


Figure 2.21. Acres of open land needing re-forestation to achieve 40% open land in Marengo River Watershed hydrologic units. Data from WDNR's 2008 open lands assessment (Community GIS 2009).

As part of the Marengo Test Case, the USGS National Flood Frequency Model (NFF) was used to estimate peak discharge rates from each of the 6th-level hydrologic units in the Marengo River Watershed. The estimates were used to identify areas in the watershed that are likely to be more "flashy," unstable, prone to erosion, and susceptible to impacts from land cover changes.

As part of this watershed planning effort, staff at the US EPA Office of Research and Development laboratory in Duluth, MN modeled peak discharge for the same five subwatersheds as the Marengo Test Case and again for a higher resolution set of 30 subwatersheds using the National Streamflow Statistics Program (NSSP, a later version of the NFF model, Hollenhorst and Hudson 2011).

A second application using the open lands assessment data was applied to the USEPA NSSP analysis (Hollenhorst and Hudson 2011). The NSSP modeling results were combined with the open lands summary data to give a picture of whether the flood flow modeling results lined up with areas having the most open land and young forest from the DNR analysis. Table 2.4 lists input parameters for the NSSP model, model results, and associated percent open land for the 30 subwatersheds.

Each of the 2-year peak discharge estimates (normalized to discharge [cubic feet per second] per square mile) and the percent open land for the 30 subwatersheds in the NSSP analysis, (scaled as each sub-watershed's percent of the total Marengo River Watershed area) were plotted (Figure 2.22). The plot shows what appears to be a threshold at a normalized 2-year peak discharge of greater than 20 cfs/sq. mile and more than 20% open land. The threshold only becomes relevant in sub-watersheds that are about 10% of the total Marengo River Watershed area or less. Eight of these sub-watersheds are highlighted in Figure 2.23. They correspond to the soil transition zone and clay plain and the greatest concentration of agriculture and road density in the watershed. The analysis provides another tool for focusing "slow the flow" management activities in sub-watersheds likely to have the greatest potential for erosion and sedimentation.

The open lands assessment and modeled peak discharge estimates show which areas of the Marengo River Watershed are most susceptible to excessive peak flow volumes leading to erosion and sedimentation problems that in turn affect aquatic habitat and water quality. They also give land managers hints as to where implementing slow the flow projects are likely to have the most benefit. However, further work should be done to refine what combination of management strategies at what appropriate watershed scale will be most effective at slowing surface runoff rates and reducing sedimentation.

For instance, the watershed scale used in each of these analyses are different, prompting the question of what scale is most appropriate for implementing slow the flow projects and being able to measure their results? In addition, the open lands assessment does not factor in parameters like storage capacity or soil type and neither of these analyses factor in road or agricultural drainage systems (see section 2.4). It's not realistic to expect re-forestation efforts

Table 2.4. National Streamflow Statistics Program (USGS 2010) model inputs, predicted two-year peak discharge (cubic feet per second) results, and discharge results normalized per square mile of area for each of 30 subwatersheds within the Marengo River Watershed. Also included within each subwatershed is percent open land and forests <16 years old (Community GIS 2009). Highlighted subwatersheds are those with a normalized discharge greater than 20 cfs/sq.mile and greater than 20% open lands. Analysis completed by Tom Hollenhorst, USEPA.

Watershed ID	Drainage area (sq. miles)	Soil Permeability	Annual Snowfall	Storage (%)	SLOPE (ft./mile)	Peak Discharge (2 yr.)	Discharge per mile	Percent open lands
1	217.3	1.16	85.20	14.50	21.56	2500	**11.507**	**20.9**
2	103.7	1.09	79.64	10.64	17.44	1330	**12.821**	**25.8**
3	84.8	1.47	88.41	21.14	27.15	1020	**12.032**	**10.0**
4	65.1	1.60	86.03	24.60	25.50	740	**11.373**	**4.4**
5	69.1	1.53	86.34	23.20	25.50	803	**11.620**	**7.1**
6	15.5	1.21	97.81	12.18	86.91	418	**27.054**	**23.4**
7	4.0	0.46	91.80	0.64	57.38	264	**66.218**	**50.1**
8	4.9	0.10	89.33	32.22	24.06	147	**29.982**	**30.4**
9	194.1	1.23	83.90	15.00	21.21	2190	**11.282**	**19.8**
10	200.5	1.20	84.07	15.31	21.21	2260	**11.273**	**20.3**
11	9.1	1.26	101.77	5.22	57.62	298	**32.684**	**31.0**
12	4.3	0.10	74.40	0.16	46.11	391	**90.123**	**44.4**
13	4.8	0.18	77.50	1.41	49.08	307	**63.859**	**41.0**
14	9.2	0.14	76.09	0.81	63.64	659	**72.005**	**42.6**
15	69.1	1.42	78.92	13.32	15.96	801	**11.599**	**11.6**
16	59.6	1.63	79.32	15.21	28.10	772	**12.954**	**6.8**
17	5.9	0.84	82.17	4.31	31.17	181	**30.572**	**31.8**
18	9.5	1.65	89.25	12.84	33.98	185	**19.374**	**5.0**
19	47.7	1.65	85.02	30.40	16.59	466	**9.771**	**1.3**
20	33.8	1.65	76.91	18.44	9.65	326	**9.651**	**1.5**
21	13.8	1.65	86.00	9.55	46.69	295	**21.453**	**4.7**
22	28.1	1.65	81.13	37.97	4.19	184	**6.538**	**1.2**
23	5.6	1.65	84.50	28.67	31.53	88	**15.788**	**1.9**
24	6.8	1.65	80.44	23.02	12.55	84	**12.308**	**0.3**
25	10.6	1.65	76.15	21.65	33.96	162	**15.307**	**0.2**
26	5.4	1.65	77.14	35.17	3.52	42	**7.786**	**1.7**
27	12.1	1.65	81.17	43.03	3.30	80	**6.625**	**2.0**
28	6.9	1.65	79.80	38.77	2.71	48	**6.919**	**2.6**
29	4.9	1.65	82.88	49.10	28.10	64	**13.183**	**1.3**
30	58.1	1.65	79.27	15.34	13.85	616	**10.605**	**6.2**

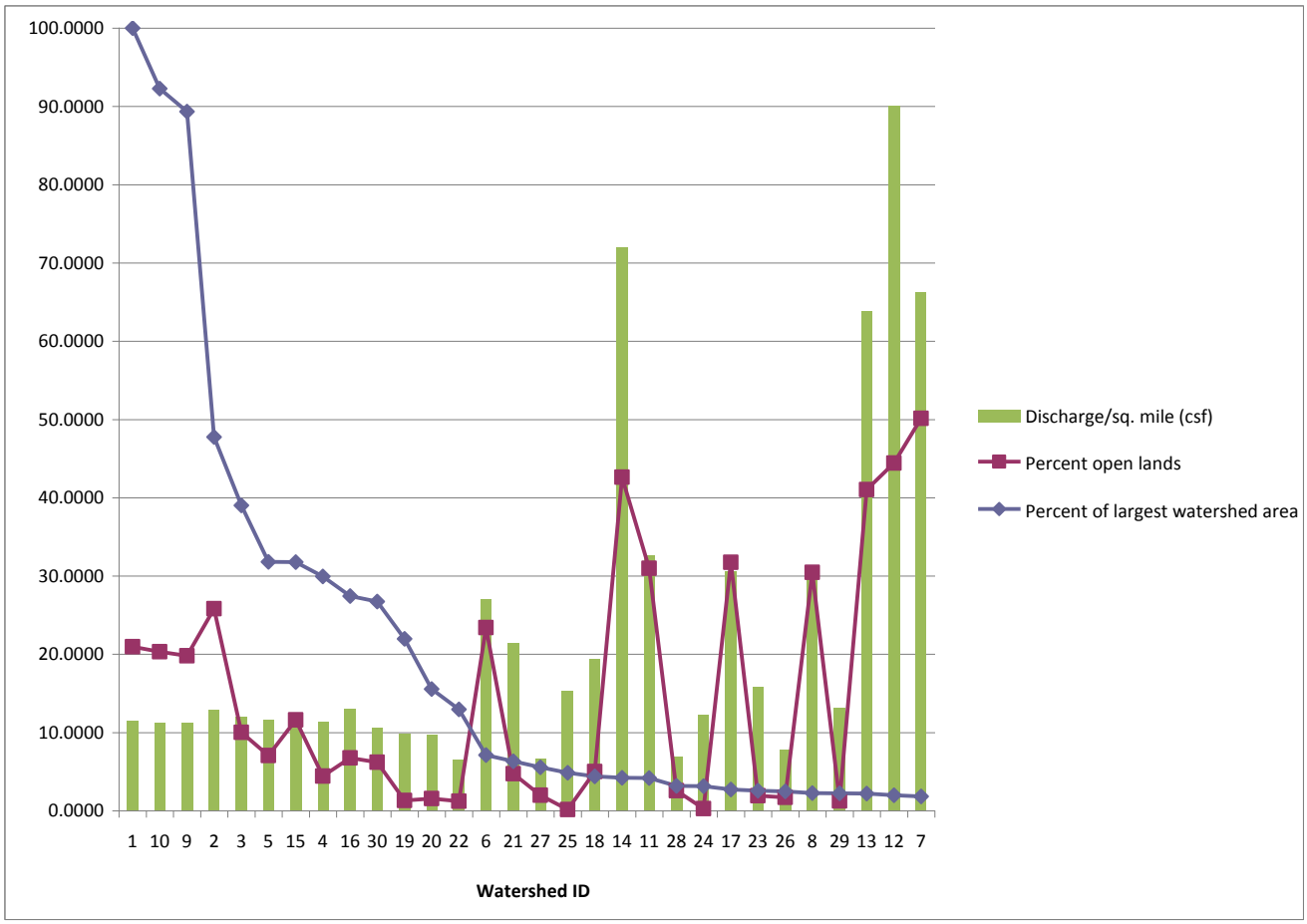


Figure 2.22. Results from National Streamflow Statistics Program (USGS 2010) modeling for 30 sub-watersheds in the Marengo River. Predicted 2-year peak discharge per square mile, percent open lands, and each subwatershed's percentage of total Marengo River Watershed land area is plotted. Analysis completed by Tom Hollenhorst, USEPA.

alone will be acceptable or even feasible on a scale large enough to achieve a goal of 40% open land or less in all hydrologic units, or that the hydrologic units used in the DNR analysis are the most appropriate to use for targeting actual land management activities. Some areas remain in active agricultural production and others are desirable to remain open for species of grassland birds, for instance. Thus, integrating wetland restoration efforts, tree planting, improvements to agricultural drainage, and other practices that will lead to reductions in surface runoff rates and peak flow volumes need to be done strategically in a way that best balances slow the flow needs with other land management objectives.

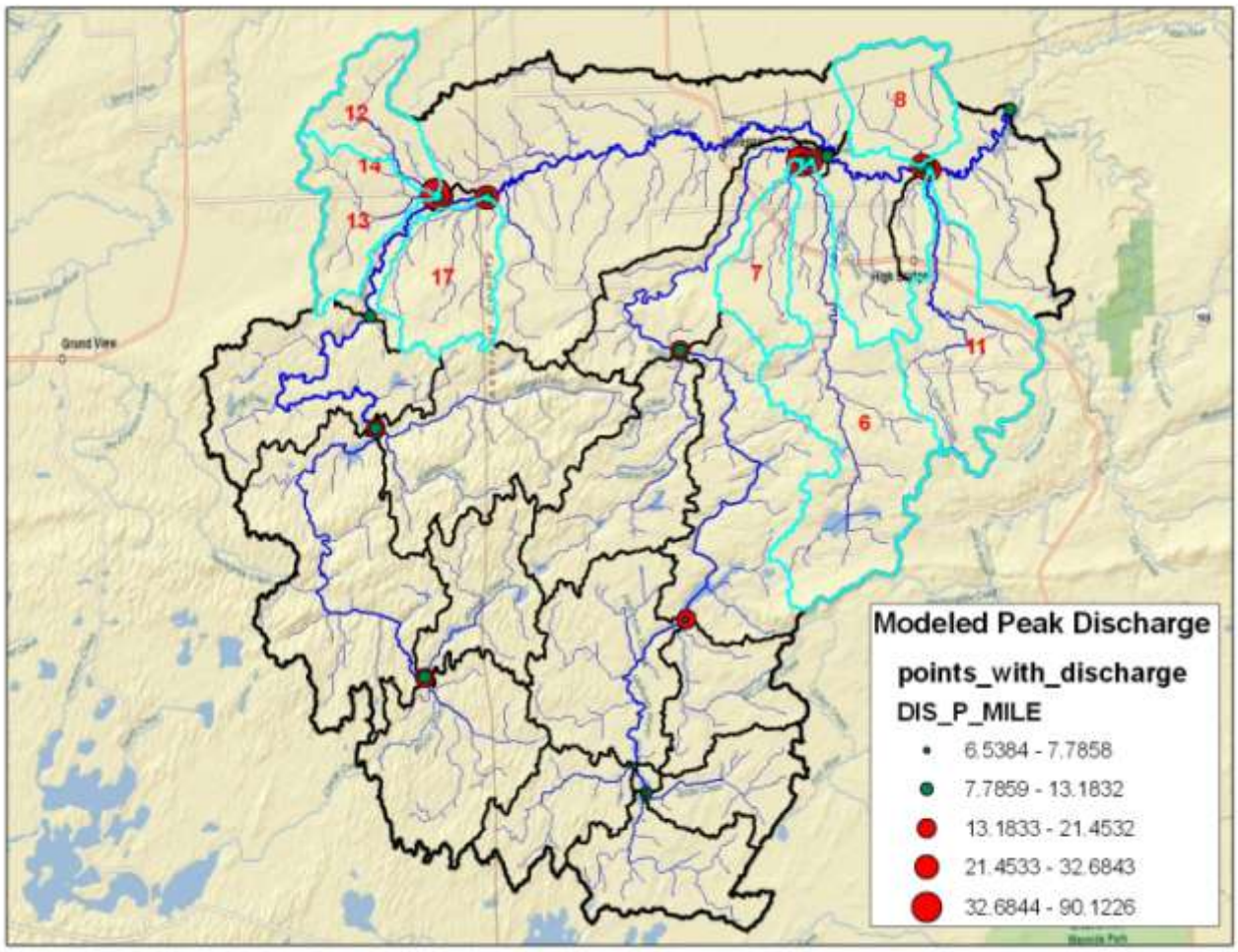


Figure 2.23. Results from National Streamflow Statistics Program (USGS 2010) modeling for 30 sub-watersheds in the Marengo River. The dots, or "pour points" (many of which overlap) for each watershed are sized by predicted 2-year peak discharge per square mile. Highlighted subwatersheds are those with a predicted 2-year peak discharge per square mile greater than 20 cfs/sq.mile and greater than 20% open lands. Analysis completed by Tom Hollenhorst, USEPA.

2.4 DRAINAGE: ROADS, CULVERTS, AND AGRICULTURE

When roads were first built, the focus was on getting vehicles across streams and draining water away from roads via ditches. Agricultural drainage systems are designed to channel water quickly off the land to facilitate the growth and maintenance of crops. Both of these types of drainage systems create hydrologic connectivity between uplands and river systems. Harr (1975) showed that when the amount of total roads and other compacted areas exceeds 12% of a watershed area, peak flows increased significantly.

In addition to channelizing runoff faster to streams, road/stream interactions at crossings can also pose major problems for passage of fish and other aquatic life and sedimentation. Culverts can act as barriers to fish and other aquatic life by blocking access to quality habitat upstream.

There may be a drop at the outlet that prevents fish from getting into the pipe. Or the water velocity in the culvert may be too fast for fish to make it all the way through the pipe.

Road/stream crossings can also cause sedimentation problems in streams. Extra sediment can come from a road failure, or from a regularly eroding road/stream crossing. This extra sediment covers the stream bottom, filling in spaces for insects which are the food for fish, and also limits spawning success.

Currently there are about 406 known road/stream crossings in the Marengo River Watershed. Of these:

- 326 have been inventoried.
- 47 are listed has having a steep embankment
- 117 are listed as being on perennial streams
- 165 are not embedded
- 61 have at least a 6" drop - 90% of these are on perennial streams, 59% occur within the soil transition zone (Figure 2.24).
- 7 sites have been or are scheduled to be restored.

Crossings associated with recreational trails such as those used by snowmobiles, all-terrain vehicles, hikers, etc, or those associated with railroads, have generally not been inventoried and may pose fish passage and/or sedimentation problems as well. Crossings impacting wetland resources have generally not been inventoried and may hinder valuable functions provided by these resources.

In steep areas, when culverts are not embedded or aligned with the slope of the stream channel, erosion at the downstream end of the culvert gradually leads to a drop between the end of the culvert and the continuation of the stream channel (Figure 2.25). Sediment often accumulates at the upstream end of the culvert (Figure 2.26). Often these small tributaries start as springs or seeps coming out of the sand/clay transition area. Many aren't listed as perennial streams on current management maps, yet field work through the culvert program and conversations with local citizens reveals that many of these "intermittent" streams are actually perennial. Some may offer high-quality, cold water aquatic habitats or habitat potential that may often be inhibited by culvert crossings.

In addition to the fish passage issues that can occur more frequently in the steep, soil transition areas, these sites are also prone to erosion due to steep channel gradients. When culverts fail (Figure 2.27) or are replaced, if care is not taken to stabilize the stream channel grade, sediment that was held behind the upstream end of the culvert is released and incision caused by the downstream erosion migrates upstream, causing further channel and habitat degradation upstream of the culvert.

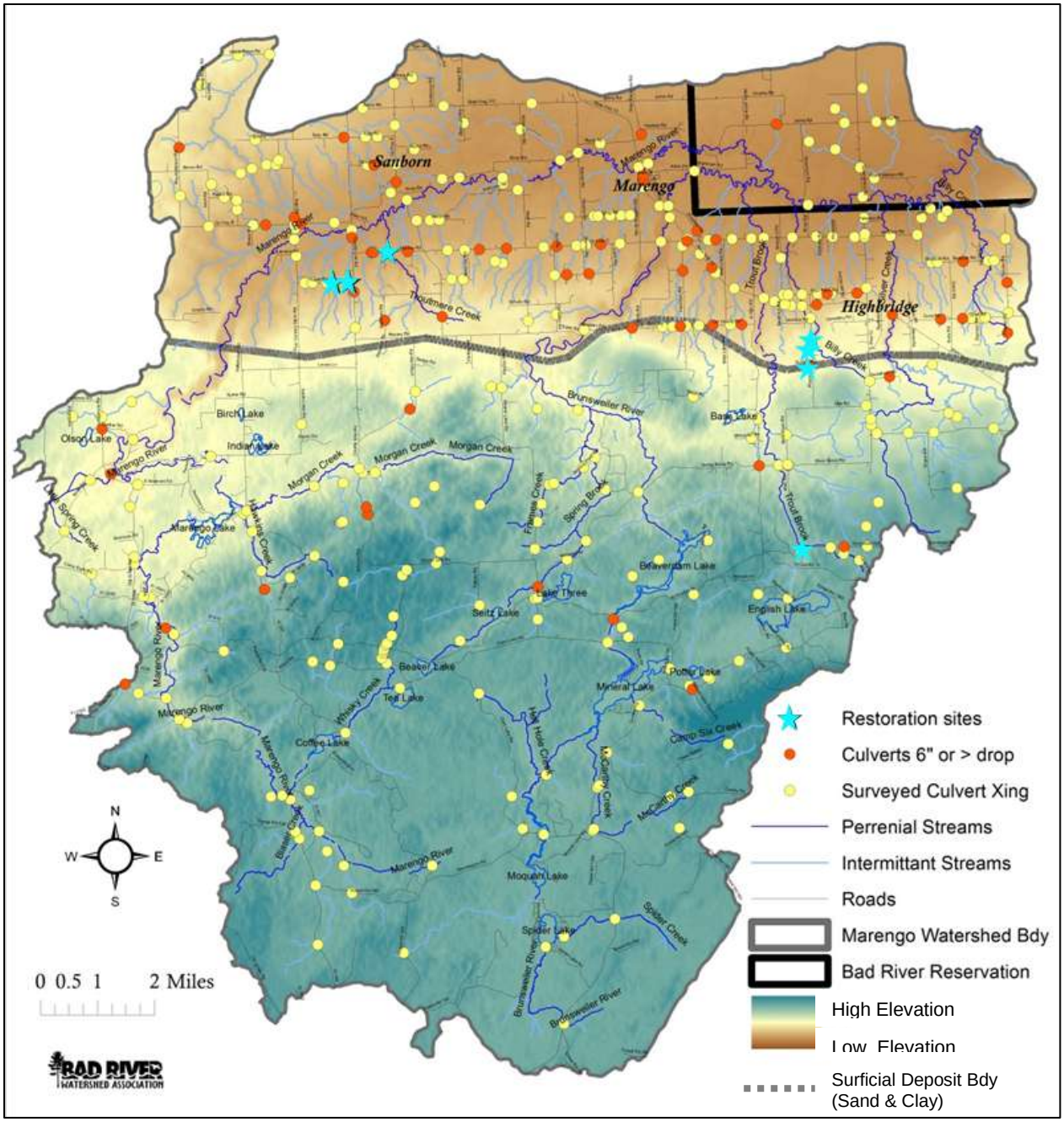


Figure 2.24. Marengo River Watershed road/stream crossings from the Bad River Watershed Association culvert inventory database. Red dots indicate culverts with a drop of 6 inches or greater at the downstream end. Blue stars indicate known restoration sites or planned restoration sites (as of 2010).

Figure 2.25. Example of a typical perched culvert in the Marengo River Watershed.

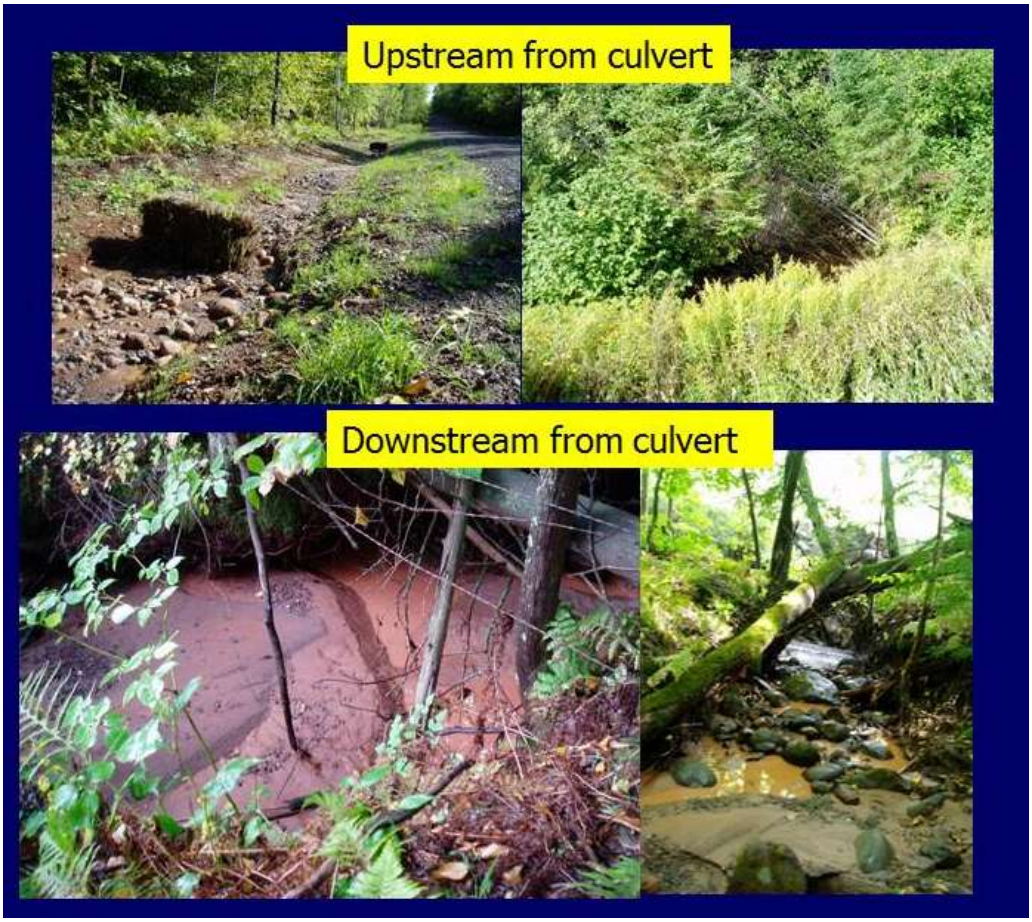


Figure 2.26. Examples of typical road/stream interaction at culverts in the soil transition zone of the Marengo River Watershed (courtesy of F. Fitzpatrick). Sediment accumulation upstream and erosion downstream.

Figure 2.27. Examples of failed culverts in the Marengo River Watershed.

Outside of road/stream crossings, very little is understood about the effect of roads, ditches, and agricultural drainage systems on hydrologic function in the Marengo River Watershed. The Marengo Test Case identifies the road system and agricultural surface drainage as "significant" factors in affecting the hydrology of the Marengo River Watershed and affecting the velocity and volume of water delivered to streams during runoff events. Recommendations include determining the percentage of road and road/ditch systems in the watershed to see how it relates to Harr's 12% threshold and identify target areas where management activities to slow the flow of runoff from the road system will have the greatest benefit. Particular focus should be on the soil transition zone and clay plain areas, but the road system in the headwaters area should also be evaluated both for existing roads and abandoned roads that may be increasing flow to the downstream soil transition and clay plain areas.

Most of the agricultural drainage exists in the northern portion of the watershed in the soil transition and clay plain areas (Figure 2.28). The drainage systems are designed to move water off the land as quickly as possible to facilitate farming activities. Breaking drainages on fallow lands, and creating temporary storage by restoring wetlands, and planting trees in marginal agricultural areas are ways that the rate of runoff can be slowed from agricultural land.

Figure 2.28. Aerial photo showing an example of an existing agricultural drainage network in the Marengo River Watershed (photo – USDA Farm Service Agency 2008, from Google Earth).

2.5 FOREST OWNERSHIP AND MANAGEMENT

The Marengo River Watershed contains approximately 97,000 acres of forest land cover or about 70% of its total land area (NOAA 2010). Therefore, the manner in which forests are managed plays a significant role in the quality of aquatic and terrestrial resources of the watershed.

Wisconsin's Forestry Best Management Practices (BMPs) for Water Quality were developed in 1995 (updated in 2010) in response to requirements of the Clean Water Act. Sec 319 of the 1987 Amendments to the Clean Water Act requiring states to develop a management program to control non-point sources of water pollution, including those from silvicultural activities, and to identify BMPs that would be undertaken to reduce such pollution (Shy and Wagner 2007a, WDNR 2010b). In 2003, WDNR published Wisconsin Forest Management Guidelines, designed to integrate multiple BMPs related to forest management to help landowners, resource managers, and loggers determine how to protect the functions and values of forest resources during forest management activities. In 2007, WDNR published forest management and harvest

guidelines specific to the unique nature of the Lake Superior Basin red clay soils (Schultz 2003, Shy and Wagner 2007b, Shy and Wagner 2007c).

The Bad River Tribe developed an Integrated Resources Management Plan in 2001 for the conservation and sustainable use of the natural resources within the exterior boundaries of the Bad River Reservation. The Reservation was divided into four resource management areas based on forest management and timber harvest issues and other ecological principles. The management areas provide the foundation of natural resources protection and enhancement and include Conservation Areas, Watershed Protection Areas, Restoration Areas, and Timber Management Areas (Bad River, 2001). The Bad River Tribe is currently in the process of reviewing and updating their Forestry Best Management Practices.

Approximately 74,000 acres or about 76% of the forest land in the Marengo River Watershed has a plan that includes some version of third party oversight in harvest and management activities (Figure 2.29). In general, management activities on these lands follow or are similar to the recommendations in Wisconsin's Forest Management Guidelines. Table 2.5 details the acreage in each type of ownership/management category.

Table 2.5. Acres of forest land in the Marengo River Watershed known to have a forest management plan.

Forest Manager (Year of Data)	**Acres In Marengo River Watershed**
Bureau of Indian Affairs, Bad River Tribe (2006)	3,467 (includes tribal fee managed forest and trust lands)
MFL Program (WDNR, 2006)	11,959
FCL Program (WDNR, 2006)	1,441
Living Forest Cooperative, Inc. (2010)	1,530
U.S. Federal Government (2000)	55,285
Management Unknown	25,628 (estimate based on NOAA 2010 Land Cover)

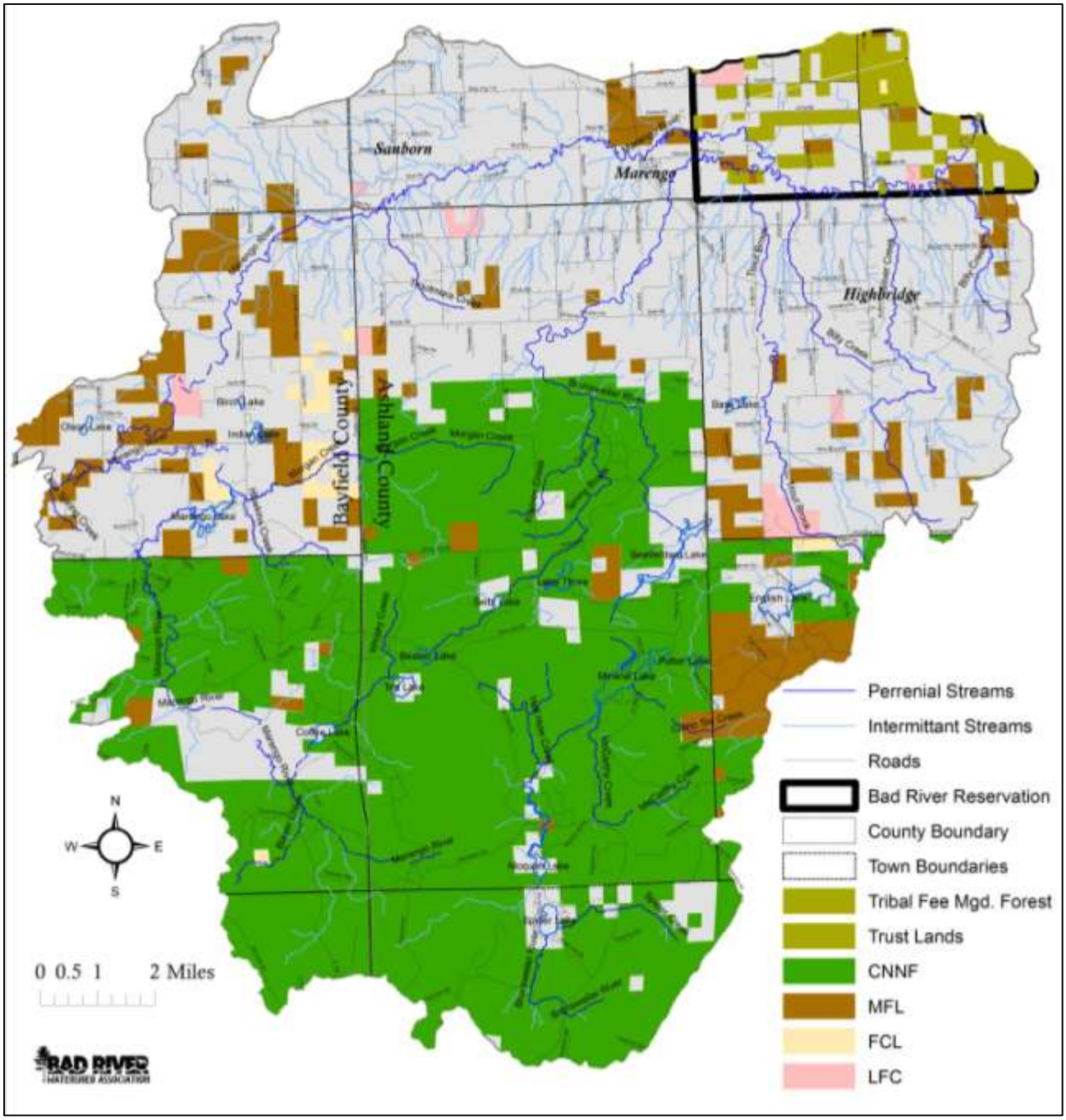


Figure 2.29. Forest land in the Marengo River Watershed known to have a forest management plan. CNNF (Chequamegon-Nicolet National Forest, data from 2000), MFL (Managed Forest Law, data from 2006), FCL (Forest Crop Land, data from 2006), LFC (Living Forest Cooperative, Inc., data from 2010), Tribal Fee Mgd (Managed) Forest and Trust Lands are lumped together as lands managed by the Bad River Tribe (data from 2006). Gray areas indicate non-forested land or areas where forest management status is unknown.

2.6 AGRICULTURE

Agriculture production in the Lake Superior Basin of Wisconsin has steadily declined since the 1920s and 1930s. The region's cool temperatures and relatively infertile and highly erodible clay soils limit agriculture activity mostly to dairy and beef operations. Ashland and Bayfield County rank near the bottom of Wisconsin counties for agricultural production and income from farming. The following narrative from the Ashland County Land and Water Conservation Plan (2010) describes the state of agriculture and trends that also apply to neighboring counties in the Lake Superior Basin of Wisconsin.

"Trends in farm ownership are continuing to affect our area. Farms are being purchased as recreational properties and taken out of production or converted to "hobby farms", small family dairy operations are being replaced with larger multi-family operations with larger numbers of animals, and partnerships and family corporations are now in place. There continues to be a switch from dairy to beef production on some farms. Smaller organic farm operations are an emerging trend in Ashland and adjacent counties, providing low input produce, fruit and plants to the local communities. Within the last 3 years, production of crops for bio-diesel took a sharp rise, and then subsided in 2009 with diminished markets.

Although most farms in Ashland County are dairy and beef operations; other farming activities are increasing. They include organic truck-type farms, flower and landscape plant producers and small orchard fruit growers. These important industries provide valuable services by raising native and organic produce for local consumption. Crops produced in the county include sunflowers, oats, trefoil (forage and seed), turf grass seed, corn, legumes, grass hay, fruits, vegetable crops (cabbage, pumpkins and various other crops), and nursery stock.

Animal operations must address an increasingly difficult part of farming – manure management. Manure is generally stockpiled or stored and spread on fields when condition allow. Some producers still allow cattle unlimited access to streams, and in many cases this has contributed to streambank erosion, sedimentation, nutrient loading, and shoreland degradation. The Ashland County LWCD is actively encouraging the development of nutrient management plans by providing "farmer education" in coordination with UWEX and NRCS in DATCP-approved training courses. Over $50,000 in cost-share has been provided to Ashland County producers for development of nutrient management plans in 2008 and 2009, although the demand for this program greatly exceeds the available cost-share funds. Cropland soil erosion is not generally an issue due to long hay rotations and limited row crop production."

Although agriculture is a small portion of the land area in the Lake Superior Basin, the northern portion of the Marengo River Watershed is one of the areas where it is concentrated. The NOAA C-CAP land cover dataset indicates that about 13% of the land area (about 18,000 acres) in the Marengo River Watershed is actively cultivated or in pasture/hay or grassland (Table 2.3). The majority of the agriculture also occurs in the soil transition zone and clay plain areas, which are more susceptible to runoff, erosion, and sedimentation issues. Therefore, agriculture activities, while covering a small area of the watershed, play a very important, localized role in maintaining a healthy watershed. The most important effects agriculture operations currently

have on the health of Marengo River Watershed resources are related to drainage (concentrated flow areas, field drainage networks, etc.) and the management of dairy, beef, and other livestock (pasturing, water crossings, etc.) and their waste.

NR 151 of Wisconsin Administrative Code defines the minimum performance standards and prohibitions for farms, rural development, and urban areas needed to achieve water quality standards by limiting nonpoint source pollution. Implementation of the standards is the responsibility of landowners and is done with technical and cost-share assistance from County Land and Water Conservation Departments, UW-Extension, USDA Farm Service Agency and the Natural Resources Conservation Service. Enforcement of NR 151 occurs through WDNR.

The predominant forms of agriculture in Wisconsin's Lake Superior Basin (including the Marengo River watershed) are dairy and beef operations. As a result, managing livestock and livestock waste in ways that reduce impacts to streams are key to meeting NR 151 standards. Both Ashland and Bayfield County rely on voluntary compliance and providing technical assistance and cost-sharing of best management practice installation to meet NR 151 standards and Tribal WQS. Neither county currently has adopted an ordinance regulating animal waste management. Both Ashland and Bayfield County have described strategies for implementing NR 151 in their 2010 Land and Water Resource Management Plans.

Overall, the number of farms and the footprint of agriculture in the Marengo River watershed is confined to a relatively small area and is much less than watersheds of similar size in other parts of Wisconsin. Therefore, the ability to reduce nonpoint source pollution is achievable in the short term, particularly if limited resources are devoted to improving sites most in need of best management practices. While this may provide more immediate improvements to watershed resources, efforts to research and encourage longer term solutions to producing agricultural products that enhance ecosystem services and provide greater opportunity for farmers to make a living should be explored and encouraged. Reducing impacts from livestock and livestock waste management will reduce high bacteria counts, nutrients associated with animal waste, sediment runoff, and will help slow the flow of runoff to watershed streams.

Trends in agriculture continue to force farmers into planting more crops and having more livestock to keep up with stagnant prices and dwindling profit margins. These financial pressures continue to put additional pressure on land and water resources to handle more crop production, more animals, and more waste. Traditional Farm Bill programs are designed to reduce impacts to land and water resources from these activities. An alternative is to find agricultural products that take advantage of emerging markets, offer better and more diverse revenue streams for farmers, and reduce impacts from agriculture on water quality and wildlife habitat. Changing traditional thinking about agriculture production will take time, but has the potential to provide economic opportunity for watershed residents while enhancing watershed health and other ecosystem services.

2.7 DAMS AND NATURAL BARRIERS

WDNR's webpage on Dam Safety (http://dnr.wi.gov/org/water/wm/dsfm/dams/) gives considerable information about the history of dam building and regulation in Wisconsin, along with considerations and procedures for maintaining and removing dams. Many dams in Wisconsin are aging and falling into disrepair and require decisions to be made whether to repair or remove them.

Removal of dams can have significant ecological benefits including, but not limited to: re-connection of important seasonal fish habitat, normalized water temperature regimes, and improved biological diversity (WDNR 2010c). While many benefits exist to removing dams, both human-made dams and natural barriers can prevent the upstream movement of undesirable invasive species such as sea lamprey and may provide opportunities for refugia for native species such as brook trout. Many considerations need to be weighed before decisions are made whether to maintain or remove existing dams.

According to Wisconsin's Dam Safety database, there are 12 dams within the Marengo River Watershed (WDNR 2010c, Figure 2.30). Three of these dams are listed as abandoned, one of which is confirmed as having been removed (Marengo Dam). It is not specified whether the other two have had the abandoned structure removed. Of the nine remaining dams, five are classified as "large" dams. Large dams are defined as "a dam with a structural height of over 6 feet and impounding 50 acre-feet or more, or having a structural height of 25 feet or more and impounding more than 15 acre-feet" (WDNR 2010c). WDNR is required to inspect "large" dams at least once every 10 years to ensure their safety. According to Wisconsin's Dam Safety Database, Only one of these five "large" dams has been inspected within the past 10 years (Figure 2.29). The remaining four dams are classified as "small." Three natural barriers occur at Marengo Falls, Morgan Falls, and Spring Brook Falls (Figure 2.30).

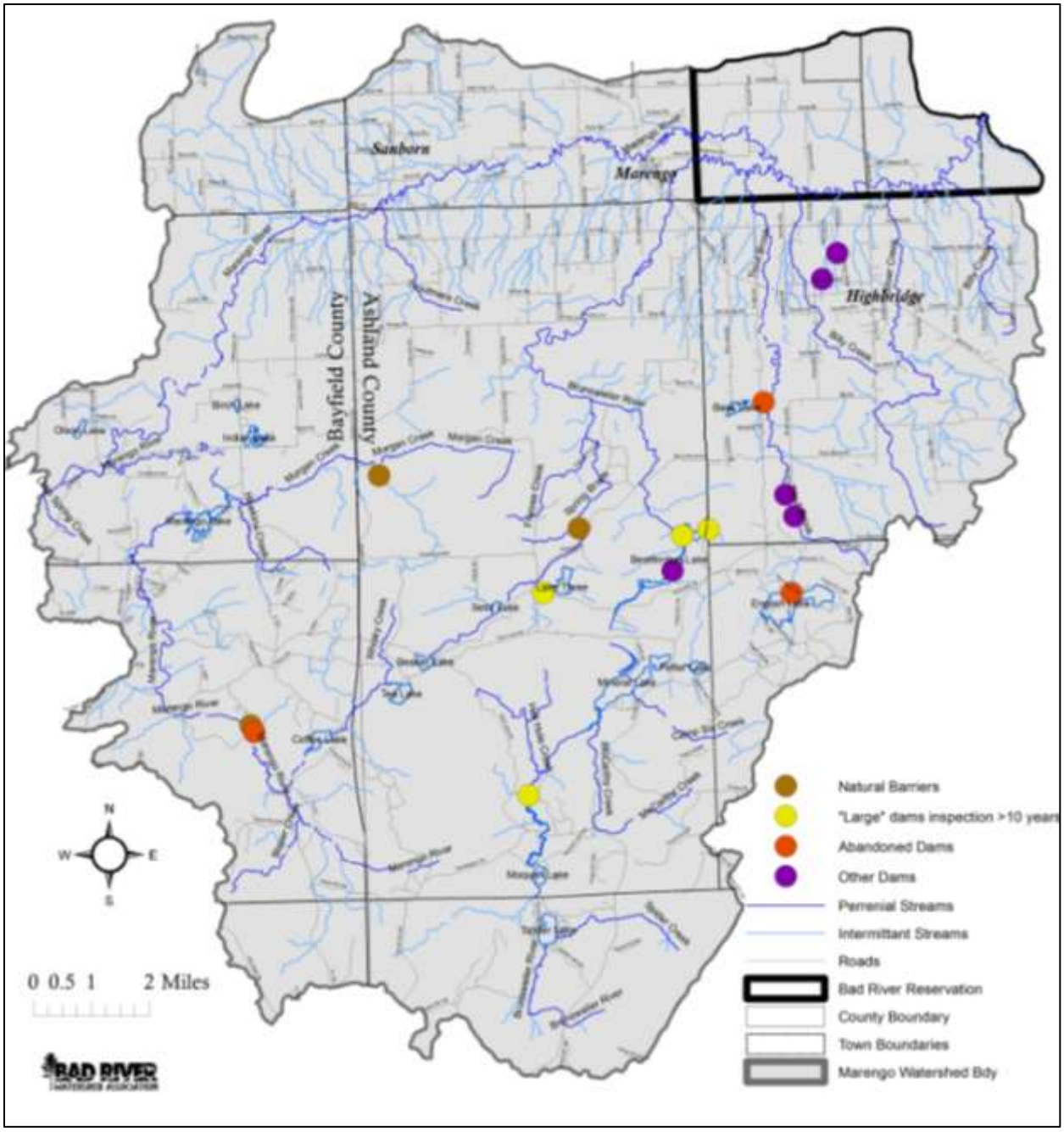


Figure 2.30. Location of natural barriers, dams identified as "abandoned," dams defined as "large" and not having been inspected in greater than 10 years, and other dams within the Marengo River Watershed. Data Source: WDNR's Dam Safety Database (WDNR 2010c).

2.8 LAKES

There are 20 named lakes or impoundments within the Marengo River Watershed and many other unnamed ponds and wetland areas. The lakes and impoundments all occur within the

southern two-thirds of the watershed associated with the North Central Forest Ecological Landscape described in Chapter 2.2.1.

Loon populations are currently being monitored by volunteers in the following watershed lakes through Northland College's Loon Watch Program: Bass Lake, Beaver Lake, Beaverdam Lake, Coffee Lake, English Lake, Lake Three, Marengo Lake, Mineral Lake, Tea Lake (Northland College 2010).

Mineral Lake is one of WDNR's Citizen Lake Monitoring Network, Lakes Baseline and Trends Monitoring sites (WDNR 2010d).

Some of the lakes in the Marengo River Watershed are managed by WDNR for walleye or muskellunge (Table 2.6).

Table 2.6. Wisconsin Department of Natural Resources (WDNR) Fisheries management codes for Marengo River Watershed lakes. Data source: WDNR Surface Water Data Viewer, retrieved on 10/19/10.

Lake	Walleye Code		Muskellunge Code		
	NR	C-NR	Cat 1	Cat 2	Cat 0
Beaverdam					X
English				X	
John Frank					X
Marengo	X				
Mineral			X		
Moquah				X	
Potter			X		
Seitz					X
Spider				X	
Tea	X				

Codes: Walleye waters
NR - Natural reproduction only
C-NR - Stocking plus natural reproduction

Codes: Muskellunge waters
Natural reproduction only (Cat 1)
Natural reproduction plus stocking (Cat 2)
Reproduction unknown, stocking occurs (Cat 0)

2.9 GROUNDWATER

Groundwater is an important resource in the Marengo River Watershed that is not very well understood. Groundwater feeds many streams, seeps, wetlands, and lakes and is essential for supporting trout populations in over 130 miles of designated trout streams in the watershed. Understanding groundwater contributions to baseflow in streams and wetlands is important to identifying and managing aquatic habitats.

Residents of the Marengo River Watershed rely on private wells for their drinking water needs. There are no municipal water systems currently within the watershed (UW-Extension and USGS 2008). Areas associated with clay surficial deposits in the northern third of the watershed tend

to have low susceptibility to groundwater contamination, while areas in the southern two thirds (associated with sand and sand/gravel surficial deposits) tend to have higher susceptibility to groundwater contamination (Figure 2.31).

The UW-Extension Center for Land Use Education and the USGS Wisconsin Water Science Center have compiled extensive information about groundwater resources in Wisconsin through an online resource titled: Protecting Wisconsin's Groundwater through Comprehensive Planning (UW-Extension and USGS 2008, http://wi.water.usgs.gov/gwcomp/)**.** The resource provides information specific to each county and is intended to provide local communities information and suggestions on how to incorporate groundwater protection into their comprehensive planning processes. Some relevant points from the report include:

- 100% of 103 private well samples collected in Bayfield County and 56 in Ashland County from 1990-2006 met the health-based drinking water limit for nitrate-nitrogen.
- A 2002 study estimated that 25% of private drinking water wells in the region of Wisconsin that includes Bayfield County and 12% in the region that includes Ashland County contained a detectable level of an herbicide or herbicide metabolite. Pesticides occur in groundwater more commonly in agricultural regions, but can occur anywhere pesticides are stored or applied (Vanden Brook *et al.* 2002).
- Neither Ashland nor Bayfield County has adopted an animal waste management ordinance, generally designed to protect surface and groundwater resources.

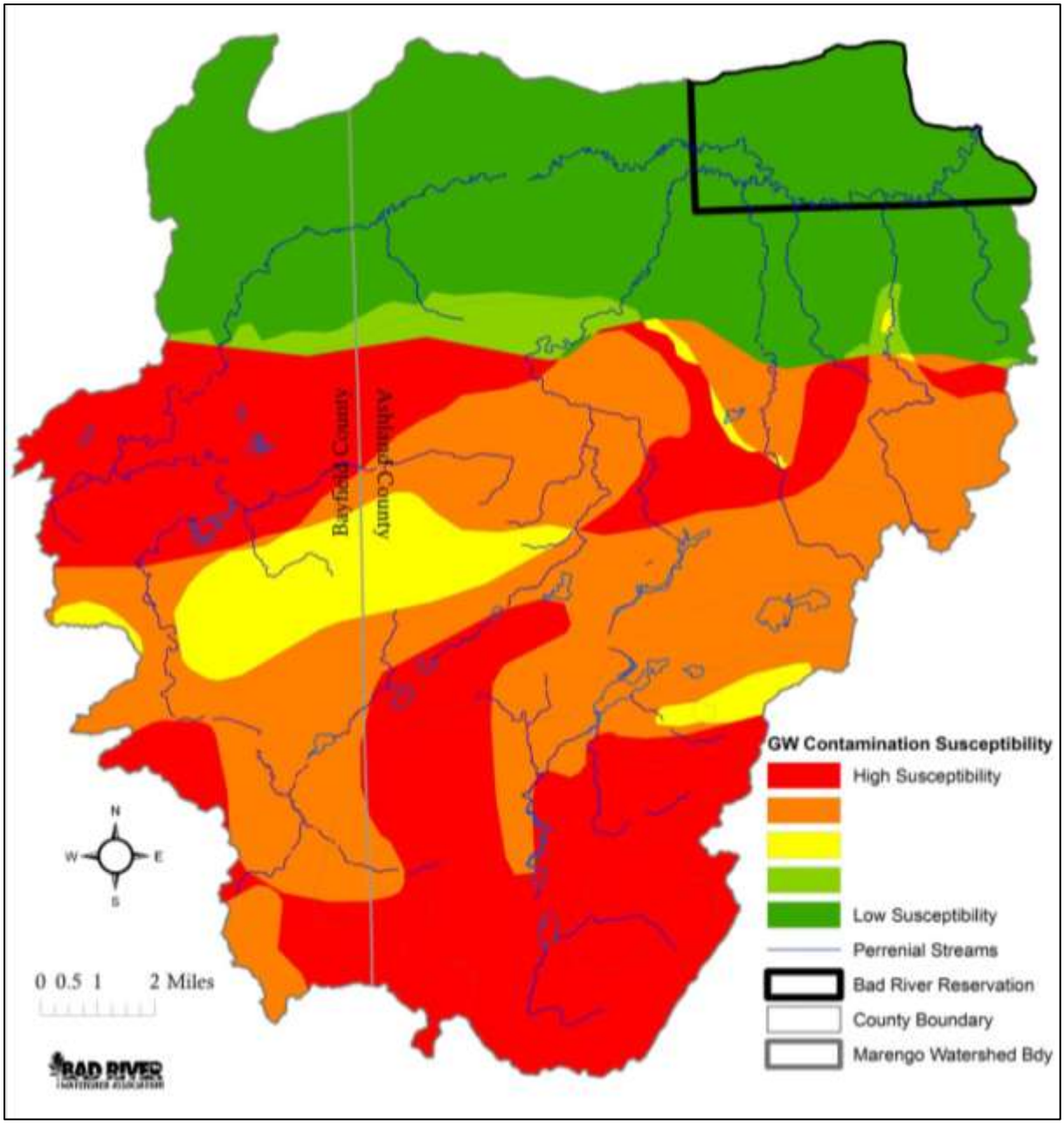


Figure 2.31. Groundwater contamination susceptibility in the Marengo River Watershed. Low scores represent areas that are more susceptible to contamination, and high scores represent areas that are less susceptible (Data source: WDNR *Surface Water Data Viewer,* retrieved on 11/17/10 *metadata: ftp://dnrftp01.wi.gov/geodata/gcsm/GCSM_data.pdf).*

2.10 CONTAMINATED SITES

WDNR's Remediation and Redevelopment (RR) Program oversees the investigation and cleanup of environmental contamination and the redevelopment of contaminated properties. The RR Program provides information about contaminated properties and other activities related to

the investigation and cleanup of contaminated soil or groundwater in Wisconsin through its Bureau for Remediation and Redevelopment Tracking System (BRRTS) database (WDNR 2010e).

The database lists one leaking underground storage tank (LUST) site in the Marengo River Watershed that is classified as "open," meaning "contamination has affected soil, groundwater, or more and the environmental investigation and cleanup need to begin or are underway." The other six sites are classified as "closed," meaning "contamination has affected soil, groundwater or more but the environmental cleanup has been completed and approved" (Figure 2.32). Additional brownfield inventory work is needed, particularly on the Bad River Reservation.

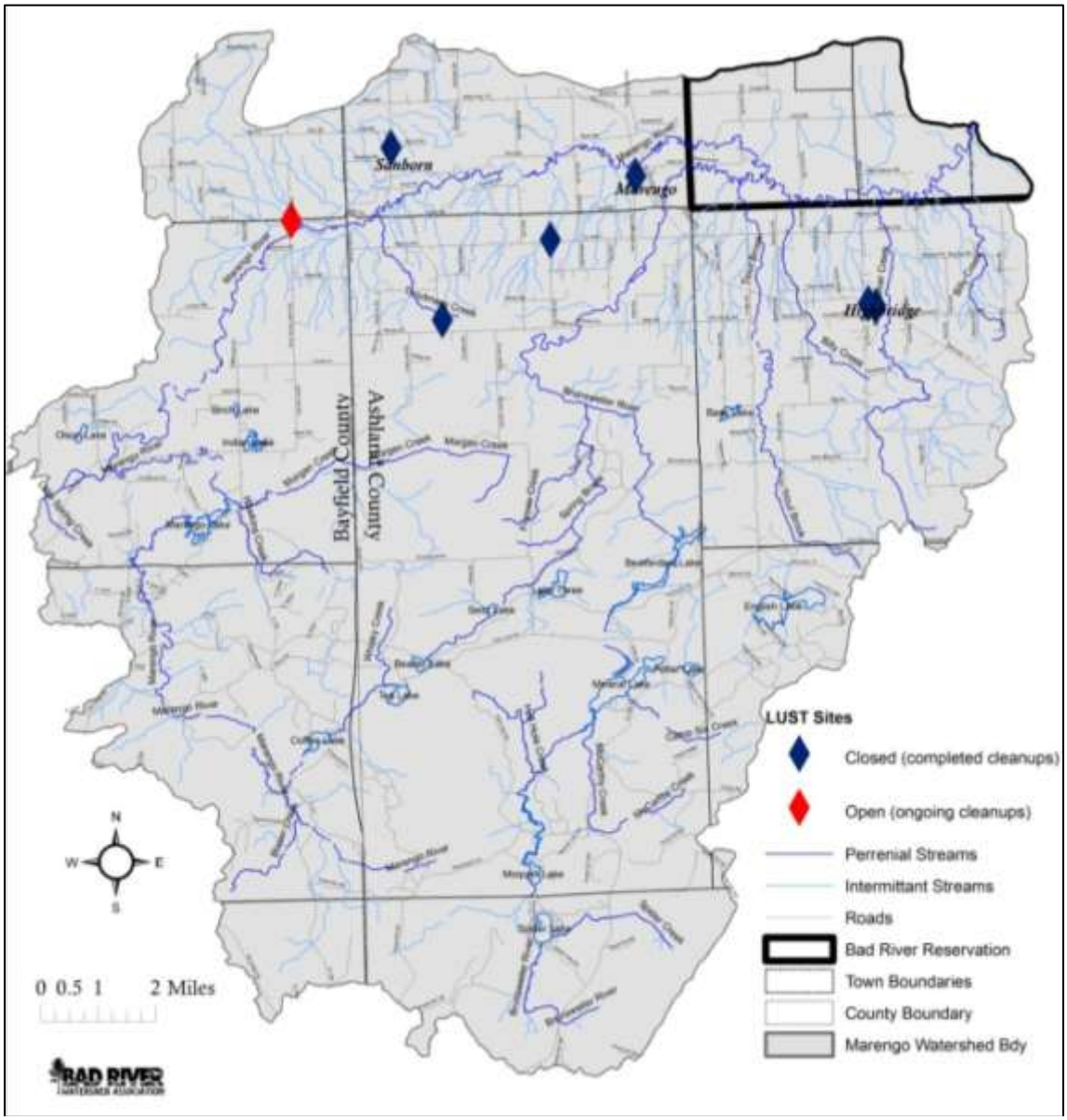


Figure 2.32. Location of contaminated (open) and previously contaminated (closed) sites in the Marengo River Watershed. These sites are all classified as "Leaking Underground Storage Tank" (LUST) sites. Data Source: WDNR Remediation and Redevelopment online sites map, retrieved on 11/17/10.

2.11 INVASIVE SPECIES

Invasive non-native plants and animals can have devastating impacts on native plant communities, fish and wildlife habitat and populations, agricultural yields, recreational, cultural, and subsistence opportunities, and ultimately, local economies.

Chapter NR 40 is Wisconsin's Invasive Species Identification, Classification and Control Rule, which became effective on 9/1/09. The rule classifies invasive species into 2 categories: "Prohibited" and "Restricted". With certain exceptions, the transport, possession, transfer and introduction of Prohibited species is banned. Restricted species are also subject to a ban on transport, transfer and introduction, but possession is allowed, with the exception of fish and crayfish (WDNR 2010g).

Invasive species data in the Marengo River Watershed is sporadic and mostly available for terrestrial plant species along roadways. Currently, the Great Lakes Indian Fish & Wildlife Commission (GLIFWC) maintains an online database of invasive species (www.glifwc-maps.org), including those within the Marengo River Watershed. In the future, these data will be uploaded onto the Global Invasive Species Information Network (GISIN) website, www.gisin.org, where the information will be publicly accessible and searchable. Until the data are transferred, the GLIFWC website is the most useful for searching known infestations within the Marengo River Watershed.

Currently (as of July 2010), there are no known infestations of prohibited or restricted (Chapter NR 40) fish, algae or aquatic invertebrates invasive species within the Marengo River Watershed. Restricted aquatic species that have been documented within five miles of the watershed include the Chinese Mystery Snail (*Cipangopaludina chinensis*) and Ruffe (*Gymnocephalus cernuus*).

Table 2.7 lists known infestations (as of July 2010) of restricted terrestrial and wetland invasive plant species (Chapter NR 40) within a five mile radius of the Marengo River Watershed. There are currently no known infestations of prohibited species.

A fish species on the restricted list known to occur in the Marengo River Watershed is the sea lamprey (*Petromyzon marinus*). The Bad River Watershed is one of the largest sea lamprey producing watersheds in the Lake Superior Basin (Patronski *et al*. 2009). Adult sea lamprey spawn within the Bad River Watershed and their larvae grow for approximately three years in the streambed before migrating back to Lake Superior. Once in the lake, sea lampreys parasitize and kill adult fish, especially lake trout (Salvelinus namaycush). Because much of the Marengo River and its tributaries are open to Lake Superior, it is known to be an important area for sea lamprey spawning and areas of the watershed are part of multi-agency lampricide treatment efforts.

The Marengo River and Brunsweiler River systems produce 36% of the larval lamprey in the Bad River Watershed based on the 2008 maximum larval production estimates (excluding young of year; M. Fodale, personal communication with N. Tillison, 7/10/2012).

A full list of known invasive species infestations (including species not listed as prohibited or restricted in Chapter NR 40) in the Marengo River Watershed is in Appendix B.

Even though invasive species survey data are limited, the Marengo River Watershed has generally not seen the level of infestation by terrestrial and aquatic invasive species as more populated areas of the Great Lakes region. Thus, focusing on prevention, education, and identification and treatment of new infestations can limit the effects of invasive species on native plant and animal communities and maintain high quality natural areas and productive forests and farms. However, control of current known infestations can be critical in key areas.

For example, the seed/seedling sources of purple loosestrife (*Lythrum salicaria*) found in the downstream portion of the Bad River Watershed are most likely coming from large populations near the village of Highbridge and along Silver Creek to its confluence with the Marengo River (Soltis, 1999). There are an estimated 90 hectacres of loosestrife in the Highbridge area containing approximately 3,355,000 plants (Gilbert, 1995).

Table 2.7. Restricted (Wisconsin Administrative Code Chapter NR40) terrestrial and wetland invasive plant species documented within a five-mile radius of the Marengo River Watershed. Data source: Great Lakes Indian Fish and Wildlife Commission, retrieved 7/6/10.

GENUS	SPECIES	COMMON NAME
Lonicera	*X bella*	Bell's honeysuckle
Cirsium	*arvense*	Canada thistle
Rhamnus	*cathartica*	common buckthorn
Tanacetum	*vulgare*	common tansy
Hesperis	*matronalis*	dame's rocket
Alliaria	*petiolata*	garlic mustard
Frangula	*alnus*	glossy buckthorn
Euphorbia	*esula*	leafy spurge
Lonicera	*morrowii*	Morrow's honeysuckle
Typha	*angustifolia*	narrow-leaved cattail
Lythrum	*salicaria*	purple loosestrife
Centaurea	*biebersteinii*	spotted knapweed
Pastinaca	*sativa*	wild parsnip

Currently, invasive species survey and management activities are coordinated in a four county area that includes the Marengo River Watershed (Ashland, Bayfield, Douglas, and Iron Counties) through the Northwoods Cooperative Weed Management Area (NCWMA, http://www.northwoodscwma.org/). Some of the activities the NCWMA has engaged in within the Marengo River Watershed include:

- Municipal officials and employees trained regarding invasive species best management practices (Ashland Co, Bayfield Co, Town of Lincoln).

- Limited surveys along roadsides.
- Limited treatment of isolated infestations.
- Introduction of biological control agents for purple loosestrife.

2.12 THREATENED AND ENDANGERED RESOURCES

2.12.1 WISCONSIN'S WILDLIFE ACTION PLAN

Also known as the comprehensive Wildlife Conservation Plan, it is the result of a statewide effort to identify which native Wisconsin species are of greatest conservation need. The Action Plan presents priority conservation actions to protect the species and their habitats (WDNR 2010h).

Species of Greatest Conservation Need have low and/or declining populations that are in need of conservation action (WDNR 2010h). They include various birds, fish, mammals, reptiles, amphibians, and invertebrates (e.g. dragonflies, butterflies, and freshwater mussels) that are:

- Already listed as threatened or endangered;
- At risk because of threats to their life history needs or their habitats;
- Stable in number in Wisconsin, but declining in adjacent states or nationally.
- Of unknown status in Wisconsin and suspected to be vulnerable.

The Marengo River Watershed contains two Ecological Landscapes (see Chapter 2.2.1). Species of Greatest Conservation Need, management opportunities for natural communities, and more general management opportunities for each Ecological Landscape are available on WDNR's website (http://dnr.wi.gov/landscapes/index.asp).

WDNR's Natural Heritage Inventory Database indicates that the following water-dependent endangered, threatened or special concern species and/or communities have been sighted in the Marengo River Watershed within the last 20 years (Table 2.8).

Table 2.8. Known rare macroinvertebrate species present in the Marengo River Watershed (Epstein *et. al* 1997).

Common Name	Latin Name	Habitat
Ephemeroptera; Family Ephemerellidae	*Drunella cornutella*	Trout Brook
Odonata; Family Gomphidae	*Ophiogomphus carolus*	Brunsweiler River, Hawkins Creek, Marengo River

2.12.2 STATE NATURAL AREAS

Wisconsin's State Natural Areas (SNAs) protect outstanding examples of native natural communities, significant geological formations, and archaeological sites. They harbor natural features essentially unaltered by human-caused disturbances or that have substantially recovered from disturbance over time. SNAs also provide the last refuges in Wisconsin for rare plants and animals (WDNR 2010i).

The following State Natural Areas are designated within the Marengo River Watershed (Figure 2.33). All are located in the Chequamegon-Nicolet National Forest:

- St. Peter's Dome - A unique geologic feature in an exposed granite dome with shaded cliffs, deep stream gorges, older hemlock forest and several rare plant species.
- Brunsweiler River and Mineral Lake - Features a scenic, rocky river gorge incised in an upland of Keweenawan granite bedrock, and several high quality old growth hemlock-hardwood stands embedded in a large tract of maturing northern mesic hardwoods that includes some of the largest yellow birch on the forest.
- North Country Trail Hardwoods - Includes good examples of most major community types known from the Penokee/Gogebic Iron Range Landtype. In particular, several significant pockets of older sugar maple-basswood forest with a rich, mesic understory.
- Spider Lake Ash Swamp - A high quality stand of swamp hardwoods dominated by black ash of various age and size classes with canopy associates of red maple, paper birch, white cedar, and white spruce.
- Chequamegon Hardwoods - An old second-growth northern mesic hardwood forest with an undisturbed understory.
- English Lake Hemlocks - Contains an excellent example of upland and swamp hemlock and white cedar forest with an intact gradient from upland to lowland.

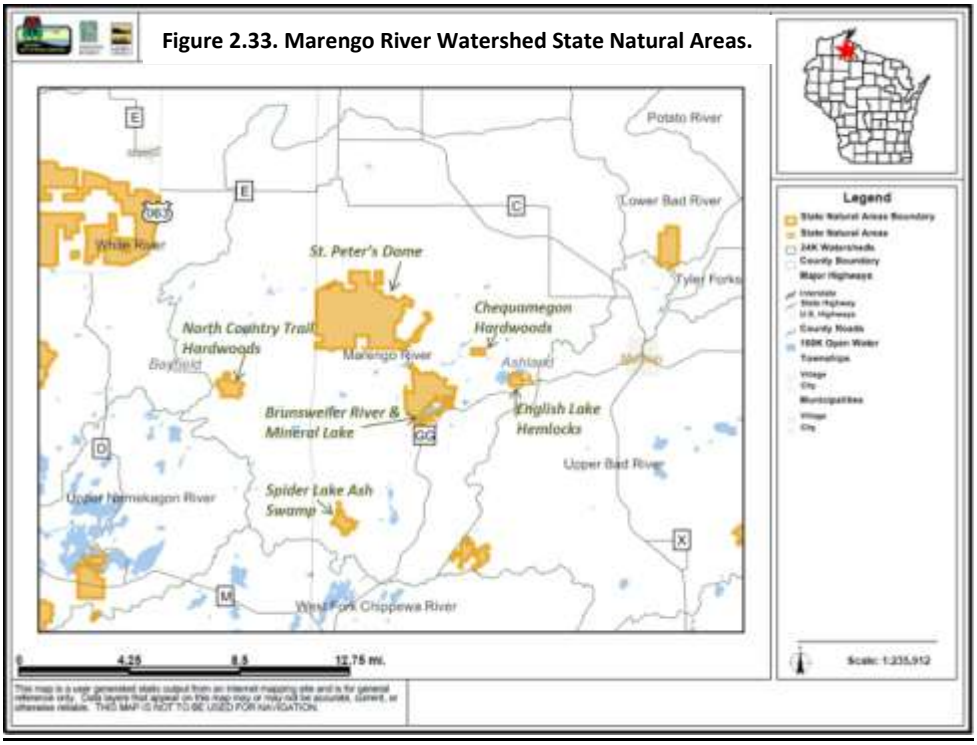


Figure 2.33. Marengo River Watershed State Natural Areas.

2.13 RECREATION

Recreation opportunities are abundant within the Marengo River Watershed. Fishing, hunting, hiking, ATV riding, snowmobiling, skiing, boating (motorized and canoeing/kayaking), biking, and bird watching are some examples of popular recreation activities enjoyed by watershed residents and visitors. Clean water, clean air, scenic beauty, and abundant fish and wildlife resources draw people to the area and provide economic opportunity to local businesses.

While recreation provides opportunities for residents and visitors to enjoy watershed resources, it can also lead to conflicts between user groups (such as motorized and non-motorized trail users) and cause damage to the resources people come to the watershed to enjoy (air and water pollution from motorboats, invasive species transported by all trail users, damage to wetlands and vegetation primarily from motorized recreation). In addition, trail networks often cross streams and the same erosion, sedimentation, and fish passage issues that occur with the road network can occur on trails.

Major concerns related to recreation in the Marengo River Watershed include: providing opportunities for access to watershed resources for all user groups, resolving conflicts between user groups (such as: motorized and non-motorized uses, management of habitat for game species and non-game species), aquatic and terrestrial invasive species transport from recreational activities, and trail/stream interactions that may cause erosion, sedimentation, and passage issues for fish and other aquatic life.

2.14 WATER QUALITY

The federal Clean Water Act (CWA) requires that states and federally recognized Indian tribes adopt water quality standards to protect waters from pollution. These standards set the water quality goals for a lake, river, stream, or wetland by stating the maximum amount of a pollutant that can be found in the water while still allowing it to be used for fishing, swimming, and allowing aquatic organisms and wildlife to thrive.

In general, water quality standards define the goals for a waterbody by designating its uses, setting criteria to protect those uses, and establishing provisions to protect water quality from pollutants. Water quality standards consists of three basic elements:

- Designated uses of the water (e.g., fish and aquatic life, recreation, fish consumption, wildlife, etc.),
- Water quality criteria to protect designated uses (numeric pollutant concentrations and narrative requirements), and
- An antidegradation policy to maintain and protect existing uses and high quality waters.

2.14.1 BAD RIVER TRIBE WATER QUALITY STANDARDS

(Taken from Bad River Tribe's Water Quality Standards, July 2011)

The Bad River Tribe was granted water quality standards program authorization by the United States Environmental Protection Agency in June 2009. The Bad River Tribe finalized its water quality standards in July 2011, and the U.S. EPA concluded these standards were consistent with the Clean Water Act and federal law in a letter dated September 21, 2011.

Designated Uses and Water Quality Criteria

Within the Bad River Reservation, waterbodies fall into the following designated uses:

- **Cultural:** The Cultural Designated use consists of water-based activities essential to maintain the Tribe's cultural heritage, including ceremonial and subsistence fishing, hunting, and harvesting activities. This designated use applies to all surface waters within the Reservation boundary.
- **Wild Rice:** A waterbody that supports or has the potential to support wild rice habitat for sustainable growth and safe consumption is assigned a Wild Rice designated use.
- **Wildlife:** The wildlife designated use applies to all waterbodies within the Reservation boundary and is summarized as supporting the proper habitat for propagation of wildlife.
- **Aquatic Life and Fish:** All waters are considered appropriate for the aquatic life and fish designated use, described as supporting conditions for a balanced aquatic community.
- **Cold Water Fishery:** A waterbody that supports or has the potential to support to existence of cold water fishery communities and/or spawning areas is assigned a Cold Water Fishery use.

- **Cool Water Fishery:** A waterbody that supports or has the potential to support to existence of cool water fishery communities and/or spawning areas is assigned a Cool Water Fishery use.
- **Recreational:** All surface waters are considered appropriate for the recreational use, which includes both primary and secondary contact activities.
- **Commercial:** A waterbody that supports the use of water in propagation of fish fry for the Tribal Hatchery and/or irrigation of community agricultural projects is assigned a Commercial designated use.
- **Navigation:** The goal of the Navigation designated use is that quality of a waterbody is adequate for navigation in and on the water.
- **Wetland**: All wetlands are considered appropriate for the Wetland designated use. This use is described as an area that will be protected and maintained for at least some of the following uses: maintaining biological diversity, preserving wildlife habitat, providing recreational activities, erosion control, groundwater recharge, low flow augmentation, storm water retention, prevention of stream sedimentation, and the propagation of wild rice.

Water quality numeric criteria to support these designated uses are described in Provision E.7 and Provision H of the Bad River Tribe's Water Quality Standards (2011). Narrative criteria are described in Provision E.6.

Antidegradation

Under its antidegradation policy, the Tribe has classified the Tribal water resources as Outstanding Tribal Resources Waters (OTRWs), Outstanding Resource Waters (ORWs), or Exceptional Resource Waters (ERWs). The Tribe's definitions of ORWs and ERWs slightly differ from the State's definitions. The OTRW designation provides the highest level of protection for the Tribe's waters followed by the ORW and ERW designations, respectively.

The Marengo River Watershed contains over 14 miles of waters designated as ORWs by the Bad River Tribe, including the main stems of the Marengo and Brunsweiler Rivers. Tribal ORWs within the Marengo River Watershed are shown on Figure 2.34. The remaining surface water resources (including wetlands) within the Reservation portion of the Marengo River Watershed are classified as ERWs. Although there are no OTRWs within the Marengo River Watershed, the Marengo River empties into the Bad River, which is designated as an OTRW through the confluence with the White River.

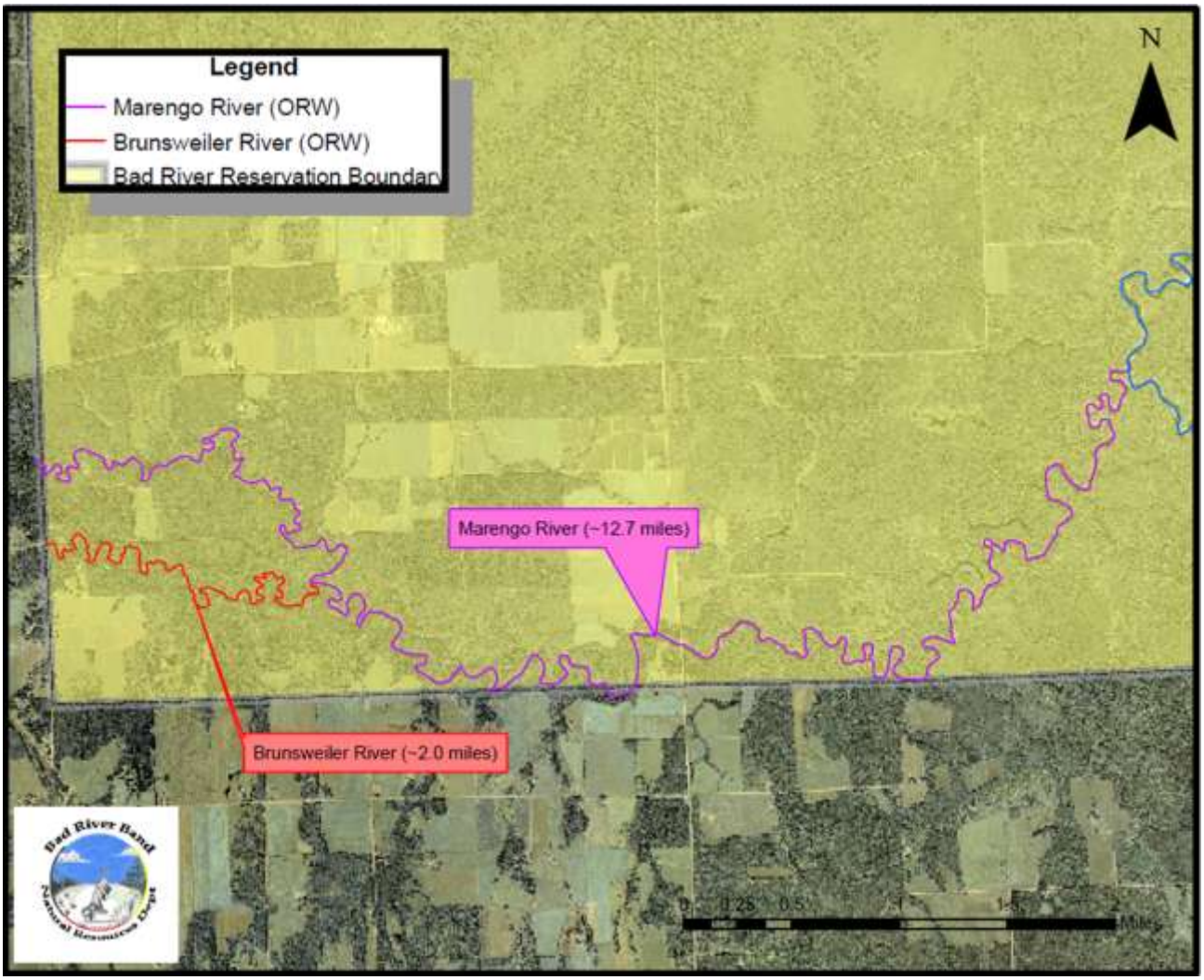


Figure 2.34. Waters designated as Outstanding Resource Waters (ORW) by the Bad River Band of the Lake Superior Tribe of Chippewa Indians within the Marengo River Watershed.

2.14.2 STATE OF WISCONSIN WATER QUALITY STANDARDS

(Taken from Wisconsin's 2010 Water Quality Report to Congress, *WDNR* 2010f*)*

Designated Uses and Water Quality Criteria

Wisconsin Statutes provide WDNR with the authority to regulate and manage how waters are used to ensure the protection of water quality and the general public interest in Wisconsin's waters.

Water quality standards, including narrative and numeric criteria for surface waters, are described in Chapters NR 102, 104, and 105 of the Wisconsin Administrative Code. These rules include general policies and detailed provisions describing implementation issues such as mixing zone provisions, variances, etc.

In Wisconsin, waterbodies fall into the following designated uses:

- **Fish and Aquatic Life:** All surface waters are considered appropriate for the protection of fish and other aquatic life. Surface waters vary naturally with respect to factors like temperature, flow, habitat, and water chemistry. This variation allows different types of fish and aquatic life communities to be supported. The Fish and Aquatic Life category contains many sub-categories in order to differentiate the range of sensitivities among Wisconsin's varied aquatic ecosystems (see *WDNR 2004* for details).
- **Recreational Use:** All surface waters are considered appropriate for recreational use unless a sanitary survey has been completed to show that humans are unlikely to participate in activities requiring full body immersion.
- **Public Health and Welfare:** All surface waters are considered appropriate to protect for incidental contact and ingestion by humans. All waters of the Great Lakes as well as a small number of inland water bodies are also identified as public water supplies and have associated water quality criteria to account for human consumption. *Fish Consumption Use* also falls under this category.
- **Wildlife:** All surface waters are considered appropriate for the protection of wildlife that relies directly on the water to exist or rely on it to provide food for existence. The Fish and Aquatic Life (FAL) use is further divided into several subcategories for Streams/Rivers and Lakes. Updates to the Streams/Rivers subcategories are being considered by WDNR.

In exercising this statutory authority, WDNR establishes water quality standards for individual surface waters based on the potential or attainable uses of the water. This mandate also clearly applies to all waters of the State whether they are natural or artificially created. In addition to state statutory requirements, WDNR is required by the Federal Clean Water Act (PL92-500) to "provide, wherever attainable, water quality for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water." Wisconsin has interpreted the wherever attainable clause to mean that all surface waters in the State shall meet the water quality standards associated with the proposed Diverse Fish and Aquatic Life (DFAL) use sub-category.
In practice, this means that all surface waters are designated DFAL until an evaluation of the surface water shows that either:

- A DFAL use is not attainable due to natural limitations that prevent the water from supporting a DFAL community, or
- The water segment is capable of supporting a Coldwater community, or
- Irreversible conditions exist in a water segment that prevents the DFAL use from being attained.

Antidegradation
Wisconsin has designated many of the state's highest quality waters as Outstanding Resource Waters (ORWs) or Exceptional Resource Waters (ERWs). Waters designated as ORW or ERW are surface waters which provide outstanding recreational opportunities, support valuable fisheries

and wildlife habitat, have good water quality, and are not significantly impacted by human activities. ORW and ERW status identifies waters that the State of Wisconsin has determined warrant additional protection from the effects of pollution. These designations are intended to meet federal Clean Water Act obligations requiring Wisconsin to adopt "antidegradation" policy that is designed to prevent any lowering of water quality – especially in those waters having significant ecological or cultural value (see WDNR 2011a for details on ORW/ERW waters in off-reservation areas of the Marengo River Watershed).

2.14.3 INTEGRATING STATE AND TRIBAL WATER QUALITY ASSESSMENTS

The BRWA worked with WDNR and Bad River Natural Resources Department (BRNRD) staff through a joint assessment of water quality condition in order to ensure recommendations in the Marengo River Watershed Action Plan would be consistent with water quality standards in both jurisdictions. A process used by WDNR to assess condition of Wisconsin's watersheds was used as an opportunity to bring partners together to discuss condition with respect to each jurisdiction's water quality standards and to develop recommendations for the Marengo River Watershed Action Plan.

The Marengo River Watershed Water Quality Management Plan

Each year, Wisconsin selects one watershed (roughly equivalent to USGS level-5 or 10-digit HUC codes) in each of its 24 basins for water quality management planning (CWA section 208). The water quality management plans are considered updates to the State's Areawide Water Quality Management Plans under Wisconsin Administrative Rule NR121. These plans provide the following key pieces of information:

- General Assessments of lakes/impoundments, streams, wetlands, Great Lakes shoreline, and beaches.
- Specific or detailed assessments for determining whether waterbodies are impaired, for the state's Clean Water Act 303(d) Impaired Waters List.
- Updates to key watershed information including: land use change, population growth, key resource priorities or issues and recommendations, resource management projects in place or planned, and narrative summaries of waters and watersheds.

Because of the efforts of the BRWA to develop this EPA nine-element plan, the WDNR selected the Marengo River Watershed for completion of its 2011 water quality management plan for the Lake Superior Basin. The plan serves as an assessment of current conditions and designated use attainment in terms of waters in the Marengo River Watershed outside of the Bad River Tribe's Reservation. It also lays part of the foundation for developing integrated recommendations for the EPA nine-element Watershed Action Plan that encompasses both on- and off-reservation portions of the Marengo River Watershed.

A working draft of the WDNR Marengo River Watershed Water Quality Management Plan was completed with input from staff of the BRWA, BRNRD, and the USFS and was written to integrate most of the details of the current draft of Marengo River Watershed Action Plan (that was in place at the time of the Water Quality Management process). As of the completion of

the Marengo River Watershed Action Plan, the WDNR Marengo River Watershed Water Quality Management Plan was still in working draft form. Much of the background information about the Marengo River Watershed discussed in Chapter 2 of this document is also covered in the WDNR water quality management plan (WDNR 2011a).

The WDNR water quality management planning process provided an opportunity for BRWA, WDNR, BRNRD, and also USFS staffs to share monitoring data, share knowledge and jointly assess stream health, and develop joint recommendations that feed into the Marengo River Watershed Action Plan. The recommendations from this effort combine with those from the rest of the Marengo River Watershed Partnership to form a collective vision for maintaining and improving the health of the Marengo River Watershed.

Current water quality conditions

The streams of the Marengo River Watershed are flashy, particularly in the soil transition and clay plain areas where more open land, agriculture and road drainage systems create conditions where surface water is rapidly transported to streams. Streams that appear clear most of the time will turn turbid during and following rain and snowmelt events. In addition, intermittent streams and drainages may only have flow in them during and following rain events, carrying surface runoff to the Marengo River and perennial tributaries.

These episodic runoff events play a major role in determining when sediment, nutrients, pathogens, and other materials are delivered to and transported in Marengo River Watershed streams, but these events are poorly understood. Pollutants from poorly managed livestock and/or human waste disposal can sit on the landscape or in stagnant drainages during dry times and then be flushed into streams during rain or snowmelt events. Water samples collected during dry times may miss the majority of these pollutants and sampling during runoff events can be difficult and costly. Existing sampling programs are generally set up to collect samples on a scheduled basis that may or may not coincide with runoff events. As a result, it is difficult to quantify potential beneficial use impairments without flow and event-based monitoring data. Available water quality and geomorphic assessment data from the Bad River Tribe, WDNR, BRWA, and USGS indicates three primary categories of pollutants that are of concern in the Marengo River Watershed. These are: 1) bacteria, 2) nutrients, and 3) sediment. The following designated uses evaluation utilizes available water quality and geomorphic assessment data to support a joint (WDNR and BRNRD) assessment of current water quality conditions in the Marengo River Watershed.

Bacteria

Designated uses potentially affected by high bacteria counts include *Recreational Use* and *Public Health and Welfare* under the State of Wisconsin standards and *Cultural (C1)* and *Recreational (R)* under the Bad River Tribe's standards. These uses are generally intended to encompass human incidental contact and ingestion of surface waters.

Federal criteria for *Escherichia coli* (*E. coli*) were developed after consideration of risk to the swimming public. All of the data used to establish the federal criteria were collected from

swimming beaches. In general, flowing rivers and streams do not provide comparable recreational activities for full body immersion (WDNR 2011b). For flowing rivers and streams, the State of Wisconsin utilizes the long-standing water quality criterion for fecal coliform to evaluate recreational uses. The criterion in s. NR 102.04(6), Wis. Adm. Code, requires that: *…the membrane filter fecal coliform count may not exceed 200 per 100 ml as a geometric mean based on not less than 5 samples per month, nor exceed 400 per 100 ml in more than 10% of all samples during any month.*

The Bad River Tribe's standards state that for all waters within the Bad River Reservation: *the geometric mean of not less than 5 samples equally spaced over a 30-day period shall not exceed an E. coli count of 126 Colony Forming Units (CFU) per 100 milliliters (mL) for fresh waters. Any single sample shall not exceed an E. coli count of 235 CFU per 100 mL.*

The BRWA and Bad River Tribe have collected *E. coli* samples from streams and rivers in the Marengo River Watershed over the past several years to evaluate the potential health risk of contact with water through recreational activities. Both use the Coliscan EasyGel Method (Micrology Laboratories, Inc. 2010). Utilizing the Bad River Tribe's single-sample numeric criteria for *E. coli* (235 CFU per 100 mL), available data from BRWA and BRNRD indicates that elevated bacteria counts have been documented at several locations in the soil transition zone and clay plain area (Locations given in Figure 2.35 and Table 2.9; results are in Tables 2.10 & 2.11 and Figure 2.36). Some general patterns emerge from the data:

- Sites in the lower watershed often have *E. coli* counts exceeding 235 CFU/100mL. These sites correspond to areas of agriculture land use and human population.
- Samples from sites draining areas with little or no agriculture land use and human population have low *E. coli* counts.
- *E. coli* counts in the lower watershed are highly variable and tend to increase when associated with runoff events.
- Site specific evaluations reveal the source or potential source of high *E. coli* counts to the lower main stem of the Marengo River associated with runoff events.

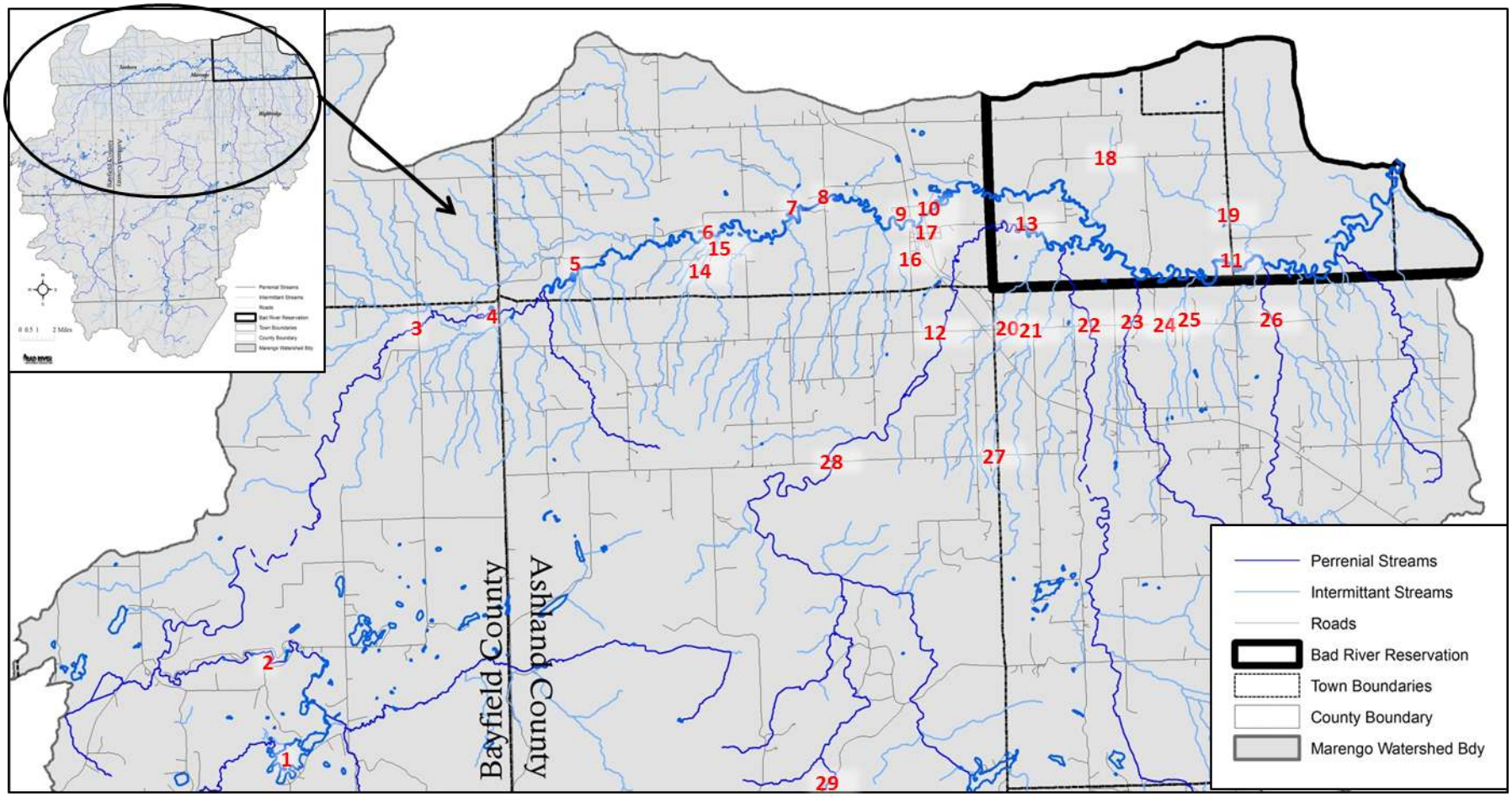


Figure 2.35. Sample locations (numbers in red text) utilized either separately or jointly by the Bad River Natural Resources Department, Wisconsin Department of Natural Resources, and the Bad River Watershed Association to collect environmental monitoring samples. The numbers correspond to the site locations listed in Table 2.9.

Table 2.9. Sample locations utilized either separately or jointly by the Bad River Natural Resources Department, Wisconsin Department of Natural Resources, and the Bad River Watershed Association to collect environmental monitoring samples. The numbers in the "Map ID #" field correspond to the red numbers shown in Figure 2.34.

River	Site	Map ID #
Marengo Lake	Marengo Lake Cottages	1
Marengo River	Altamont Road	2
Marengo River	Four Corner Store Rd	3
Marengo River	Ashland Bayfield Rd	4
Marengo River	County Hwy C	5
Marengo River	Mika Rd	6
Marengo River	Marengo River Rd	7
Marengo River	Riemer Rd	8
Marengo River	Hwy 13	9
Marengo River	Downstream of Trib Mouth	10
Marengo River	Government Rd	11
Brunsweiler River	County Hwy C	12
Brunsweiler River	Adler Rd	13
Unnamed Marengo Trib	Upstream livestock impact	14
Unnamed Marengo Trib	Downstream livestock impact	15
Unnamed Marengo Trib	Upstream Village Marengo	16
Unnamed Marengo Trib	Downstream Village Marengo	17
Unnamed Marengo Trib	Jolma Rd	18
Unnamed Marengo Trib	Government Rd	19
NC 1 Unnamed Trib	County Hwy C	20
NC2 Unnamed Trib	County Hwy C	21
Trout Brook	County Hwy C	22
Billy Creek	County Hwy C	23
NC3 Unnamed Trib	County Hwy C	24
NC4Unnamed Trib	County Hwy C	25
Silver Creek	Delafield Rd	26
Unnamed Brunsweiler Trib	Old County Rd	27
Brunsweiler River	Maki Rd Dead End	28
Spring Brook	Wolanek Rd	29

Table 2.10. Summary of BRWA *E. coli* data collected from Marengo River Watershed sites. Average and standard deviation is given for samples collected associated with runoff events and non-runoff events. A ratio of the total number of samples collected at each site and the total number of samples that exceeded 235 CFU/100mL is also given.

River	Site	Map ID #*	Avg Runoff Event	St Dev Runoff Event	# above standard/ # samples	Avg Non-Runoff Event	St Dev Non-Runoff Event	# above standard/ # samples
Brunsweiler River	County Hwy C	12	60	0	0/1	15	21	0/2
Marengo Lake	Marengo Lake Cottages	1	40	0	0/1	0	0	0/1
Marengo River	Altamont Road	2	0	0	0/0	48	54	0/5
Marengo River	Four Corner Store Road	3	0	0	0/0	0	0	0/1
Marengo River	County Hwy C	5	0	0	0/0	0	0	0/0
Marengo River	Marengo River Road	7	0	0	0/0	0	0	0/0
Marengo River	Riemer Road	8	225	110	1/5	84	64	0/4
Marengo River	Upstream livestock impact	6	323	360	2/4	40	29	0/7
Unnamed Marengo Trib	Upstream livestock impact	14	388	111	2/2	93	146	0/4
Unnamed Marengo Trib	Downstream livestock impact	15	2690	3312	5/5	1285	1336	5/5
Unnamed Marengo Trib	Upstream Village Marengo	16	62	98	0/3	0	0	0/0
Unnamed Marengo Trib	Downstream Village Marengo	17	3121	5004	2/5	55	7	0/2
Marengo River	Hwy 13	9	616	1051	2/8	47	31	0/3
Marengo River	Downstream of Trib Mouth	10	562	920	2/5	40	0	0/1
Billy Creek*	County Hwy C	23	0	0	0/0	45	58	0/4
NC 1 Unnamed Trib**	County Hwy C	20	0	0	0/0	47	0	0/1
NC2 Unnamed Trib**	County Hwy C	21	0	0	0/0	35	21	0/2
NC3 Unnamed Trib**	County Hwy C	24	0	0	0/0	0	0	0/1
NC4Unnamed Trib**	County Hwy C	25	0	0	0/0	103	60	0/2
Silver Creek**	Delafield Road	26	0	0	0/0	13	12	0/3
Trout Brook**	County Hwy C	22	0	0	0/0	26	5	0/2

"Background" Sites

Site assessment-Livestock

Site assessment-Village of Marengo

* Map ID # - These numbers are used to display site locations for BRWA, BRNRD, and WDNR on the map in Figure 2.35 and Table 2.9.

** These sites all included one or more samples with E. coli counts above 235 CFU/100mL but are not listed because incubation time of samples is not known.

Table 2.11. Summary of Bad River Natural Resources Department *E. coli* data collected from Marengo River Watershed sites since 1997.

				Basic Statistics of E.coli Data (CFU/100 mL)						
Site Name	Reservation*	Map ID#**	Sampling Years	Max	Min	Median	Average	Standard Dev	% Exceedances****	# of Samples
Brunsweiler @ Adler	X	13	2007-2011	240	0	30	46	58	5	20
Marengo @ 4 Corners		3	2007-2009***	80	0	40	41	29	0	8
Marengo @ AshBay		4	2007-2011	140	0	20	37	38	0	24
Marengo @ Govt Rd	X	11	1997-2011	11500	0	60	365	11	11	73
Marengo @ Hwy 13		9	1997-2011	18687	0	63	647	2693	15	54
Marengo @ Mika		6	2007-2009	160	0	60	68	48	0	9
Marengo @ Riemer		8	2004-2011	1520	0	70	115	247	8	37
Marengo Trib @ Govt	X	19	2004-2011	4240	0	120	357	712	33	45
Marengo Trib @ Jolma	X	18	2011	1920	20	540	756	672	80	10

*An "X" in the Reservation column indicates the monitoring location is within the exterior boundaries of the Bad River Reservation.

**Map ID # - These numbers are used to display site locations for BRWA, BRNRD, and WDNR on the map in Figure 2.35 and Table 2.8.

***Summary includes one sample collected in 2002.

**** % exceedances means the percentage of samples collected from a given site with E. coli concentrations that were greater than or equal to 235 CFU/100 mL.

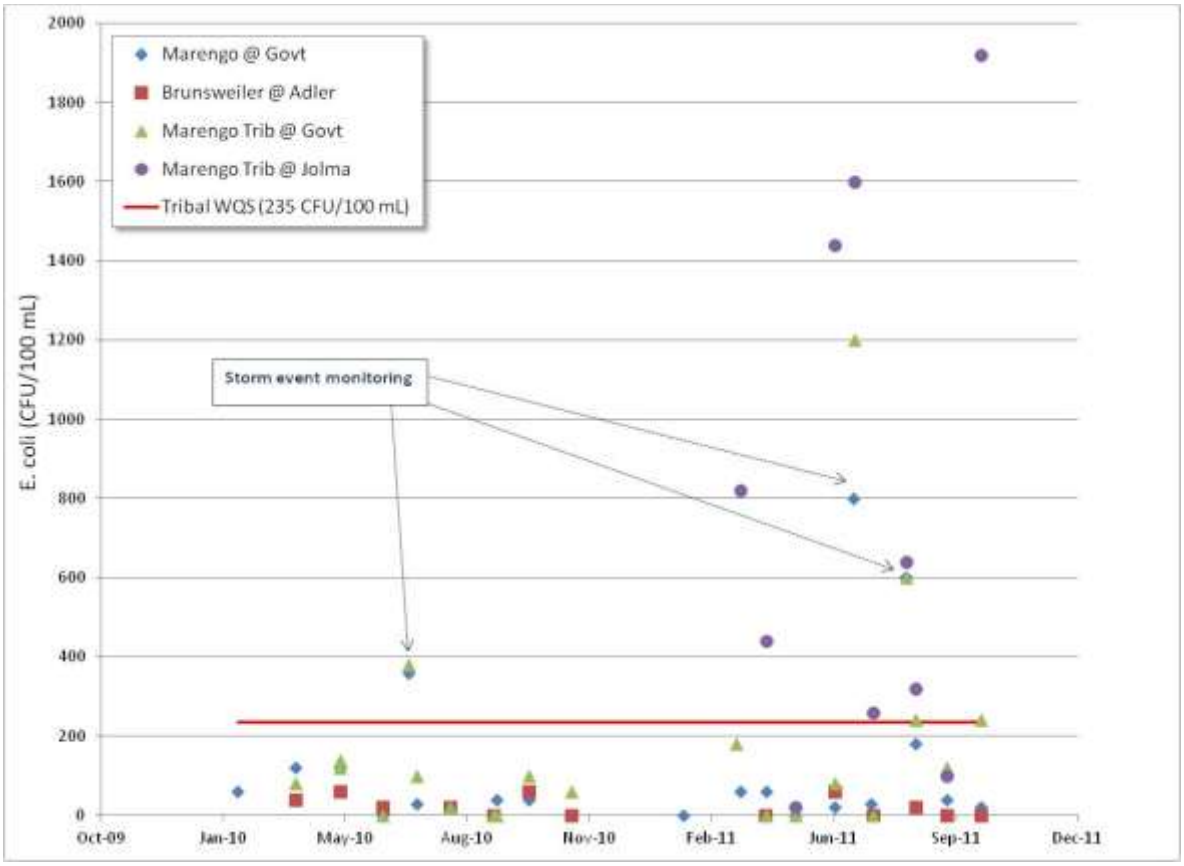
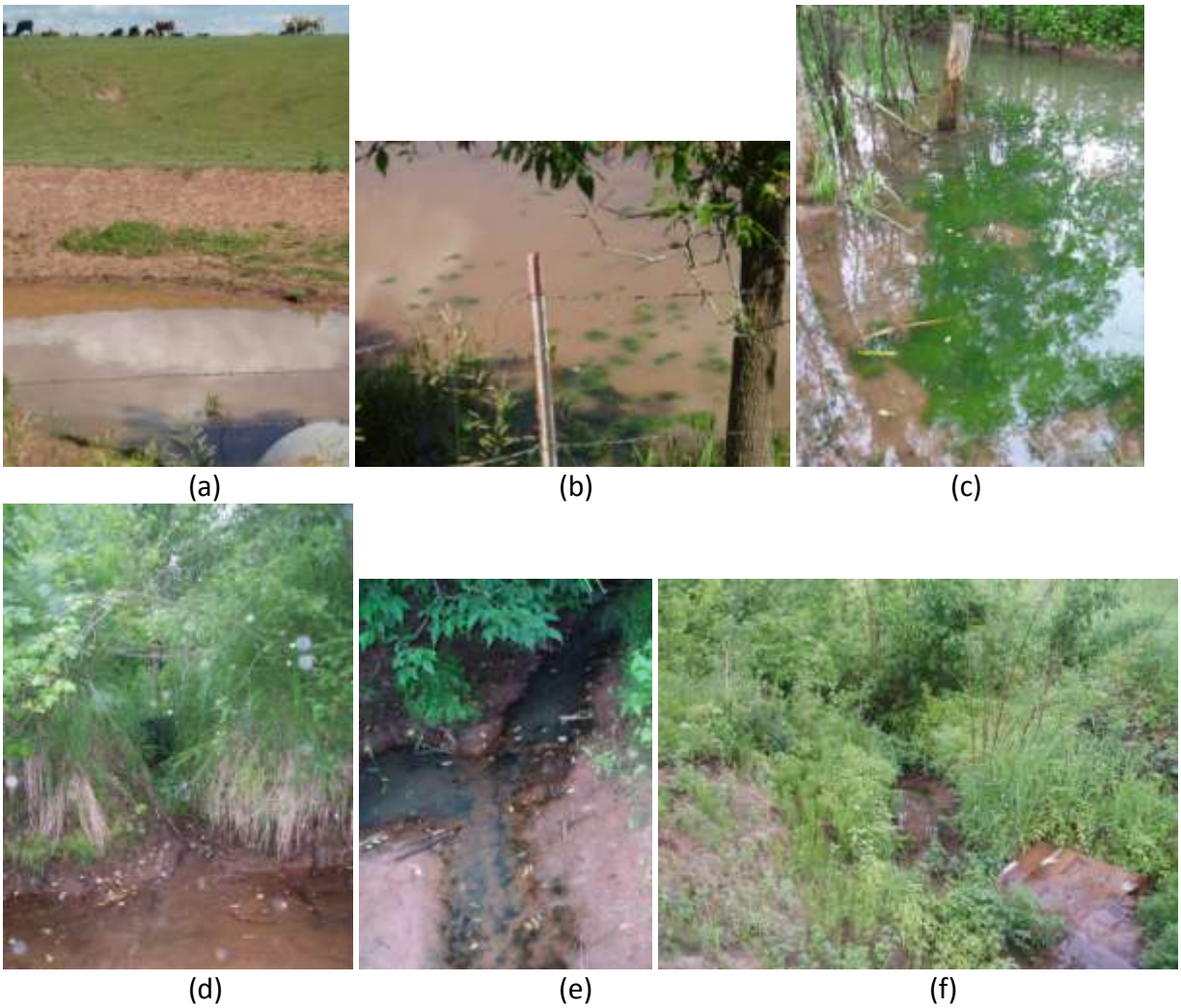


Figure 2.36. Bad River Natural Resources Department E. coli data collected from 2010-2011 at four monitoring locations within the Reservation boundaries. The Tribal E. coli criterion for a single sample is shown (235 CFU/100 mL). Three monitoring events associated with storm events are highlighted.

In 2009 BRWA completed a watershed assessment of the Marengo River Watershed with the help of the Center for Watershed Protection (BRWA 2010b). Using the Unified Stream Assessment (USA, Kitchell and Schueler 2005) protocol for assessing stream health, BRWA and CWP assessed several sites that could be improved with implementation of best management practices or need further investigation to determine the source and cause of suspected impairments (Figure 2.37).



(a) (b) (c)

(d) (e) (f)

Figure 2.37. Marengo River Watershed sites evaluated by the Bad River Watershed Association and Center for Watershed Protection (BRWA 2010b) in 2009. (a & b) Cattle access contributes excess sediment and nutrients to the stream as evidenced by turbid water and excessive algae growth; (c) Excessive algal growth and stagnant turbid water behind a beaver dam indicate a potential illicit discharge or connection upstream; (d, e, f) Small tributary in the Village of Marengo with potential illicit discharge.

BRWA conducted follow-up volunteer monitoring for *E. coli* upstream and downstream of the two sites depicted in Figure 2.37 a, b and Figure 2.37 d, e, f in 2009 and 2010. Efforts were made to sample during or following rain events, along with sampling once per month from May through October.

Results from the site in Figure 2.37 a, b show all ten of the samples (regardless of whether they were collected following a rain event) collected downstream of the site exceeded 235 colony forming units (CFU) per 100 mL. Five of these samples were greater than 1000 CFU/mL. *E. coli* counts were consistently greater from samples collected downstream of the impacted site (Table 2.10).

These results clearly show pasturing cattle in this tributary are contributing high *E. coli* counts to the tributary and to the Marengo River just downstream. Contributions are typically greatest associated with runoff events. Implementation of best management practices is needed at this site.

Results from the site in Figure 2.37d, e, f show two of seven samples collected downstream from the Village of Marengo with *E. coli* counts greater than 235 CFU per 100mL. Both of these samples exceeded 3000 CFU per 100mL and were associated with rain events. All samples collected upstream of the Village of Marengo were below 235 CFU per 100 mL. Elevated *E. coli* counts and reports of milky, turbid water in the tributary suggest that an illicit connection delivering septage may be present and human or animal contact with the water in the tributary may be a health hazard. Farm runoff is not a likely source of the *E. coli* here because of low *E. coli* counts found upstream of the village and the lack of pastured cattle or feedlots/barnyards in the vicinity of the tributary.

E. coli monitoring reveals that the lower Marengo River is receiving non-point sources of pollution likely from livestock and/or human waste. The high *E. coli* counts tend to be associated with runoff events. The amount and frequency of bacteria data collected was not enough to make a decision on recommending the Marengo River or any of its tributaries for Wisconsin's impaired waters (303[d]) list. Instead, the Marengo River was placed on WDNR's Watch Water list, which includes …*waterbodies that have insufficient or conflicting data such that an impairment decision cannot be made, and, therefore, are identified for further monitoring* (WDNR 2011b).

Under its CWA Section 319 Program, the Bad River Tribe has determined the Marengo River is not fully supporting its designated uses, partly caused by elevated pathogen concentrations (Ledder, 2006). The *E. coli* data collected by BRNRD for sites occurring within the Reservation boundaries (refer to Table 2.11 and Figure 2.36) confirms that concentrations above the Tribe's pathogen criteria are still occurring, which tend to be associated with runoff events.
The *E. coli* monitoring for pathogens needs to be continued and expanded in the Marengo River Watershed, particularly in the soil transition zone and clay plain area. Therefore, the joint recommendation is to evaluate the extent of pathogen concerns and establish a baseline in the soil transition zone and clay plain area. WDNR will try to evaluate fecal coliform and *E. coli* levels in the Marengo River Watershed as funding allows. BRNRD will continue its pathogen monitoring in the downstream portion of the Marengo River Watershed utilizing Clean Water Act Section 106 funds.

Nutrients

The State of Wisconsin has several numeric criteria for nutrients (nitrogen and phosphorus) protecting fish and aquatic life uses established in NR 102.04 (3). The total phosphorus criterion that would apply to flowing rivers and streams in the Marengo River Watershed is 0.075 milligrams per liter (mg/L, NR 102.06 (3)). The total phosphorus criterion applicable to lakes depends on how each lake is classified. Numeric criteria for nitrogen to protect fish and aquatic life in surface waters are the acute and chronic values for ammonia (ss. NR 105.05 & N 105.06, Wis. Adm. Code).

The State of Wisconsin's narrative criteria (NR 102.04(1)) for water quality could also apply to waters with excess nitrogen and/or phosphorus concentrations.

The Bad River Tribe currently does not have numeric criteria for nitrogen or phosphorus in surface waters, with the exception of ammonia. Acute and chronic values for ammonia are derived to protect aquatic life and fish as described in provision H.10 of the Tribe's standards. The Tribe's standards have several narrative criteria for aesthetic water quality (Chapter E.6.i) and general narrative criteria (Chapter E.6.ii) that are applicable to waters with excess nitrogen and/or phosphorus concentrations.

Not enough current nutrient data exist to complete a full condition assessment for the Marengo River or any of its tributaries. The source of pathogen concerns indicates that nutrients may also be a concern in the soil transition and clay plain area of the Marengo River Watershed. Elevated nutrient concentrations have been documented (Tables 2.12-2.15). Two of 12 samples collected by WDNR between October 2008 and September 2009 on the lower Marengo River exceeded the state's total phosphorus criterion (Table 2.12). One sample from an unnamed tributary to the Brunsweiler River exceeded the standard very slightly (only 2 ug/L), but is not sufficient information to evaluate stream condition.

Total phosphorus (TP), nitrate-nitrite, and total Kjedahl nitrogen (TKN) data collected by BRNRD is summarized in Tables 2.13, 2.14, and 2.15 and Figure 2.38. Additionally, phosphate and nitrate data are also available for these sites. As indicated in Table 2.13, some of the samples collected and analyzed for TP had concentrations greater than 0.075 mg/L, particularly in the downstream portion of the watershed. Storm event monitoring have been conducted at selected sites over the years, and these results illustrate elevated nutrient concentrations are associated with runoff events.

The joint recommendation is to evaluate extent of nutrient concerns and establish a baseline in the soil transition zone and clay plain area. Parameter list should include total and reactive phosphorus, total Kjeldahl nitrogen, ammonia nitrogen, nitrate plus nitrite nitrogen, and total nitrogen. Flow measurements and response variables, such as algal biomass (e.g., chlorophyll-a) and water clarity (e.g., turbidity), should be included in baseline data collection efforts for a more holistic view of nutrient conditions in the water resources.

Table 2.12. Summary of Wisconsin Department of Natural Resources (WDNR) nitrogen (total Kjeldahl [TKN], ammonia (NH3-N], nitrate plus nitrite [NO2+NO3-N]) and total phosphorus (TP) data collected from Marengo River Watershed sites over the past 10 years.

Waterbody Name	WDNR Station Name	Map ID #*	Date	Result Description	TP ug/L	TKN mg/L	NH3-N dissolved mg/L	NO2+NO3-N dissolved mg/L
Silver Creek	Silver Creek - Upstream Of Delafield Rd	26	11/8/2007	Single Sample	10	0.27	ND	0.267
Spring Brook	Spring Brook - Upstream Of Wolanek Rd	29	11/8/2007	Single Sample	22	0.51	ND	0.088
Unnamed	Unnamed trib. to Brunsweiler River	27	8/12/2011	Single Sample	77	.	.	.
Brunsweiler River	Brunsweiler River Upstream of Maki Rd. Dead-End	28	6/9/2009	Single Sample	30	0.71	0.016	0.049
Marengo River	Marengo River 18 meters upstream of County Line Rd.	4	8/11/2008	Single Sample	22	0.19	ND	0.085
Marengo River	Marengo River at Government Road, Near Highbridge (on the Bad River Reservation) Collected between 10/14/2008 and 9/15/2009	11	10/2008-9/2009	Mean	85**	0.62	0.266	0.213
				Min	22	0.27	ND	ND
				Max	455	2.01	0.445	0.741
				STDEV	131	0.53	0.22	0.22
				N	12	12	12	12

* Map ID # - These numbers are used to display site locations for BRWA, BRNRD, and WDNR on the map in Figure 2.35 and Table 2.9.

**Note only 2 of 12 events exceeded WI's total phosphorus criteria (75 ug/L)

Table 2.13. Summary of Bad River Natural Resources Department total phosphorus data collected from the Marengo River Watershed.

				Basic Statistics of Total Phosphorus Data (mg/L)					
Site Name	Reservation*	Map ID#**	Sampling Years	Max	Min	Median	Average	Standard Dev	# of Samples
Brunsweiler @ Adler	X	13	2007-2011	0.17	0.018	0.037	0.051	0.044	11
Marengo @ 4 Corners		3	2007-2009	0.043	ND***	0.020	0.021	0.013	8
Marengo @ AshBay		4	2007-2009	0.068	0.016	0.027	0.032	0.017	8
Marengo @ Govt Rd	X	11	2006-2011	0.69	0.021	0.053	0.094	0.14	24
Marengo @ Hwy 13		9	2006-2009	0.12	0.020	0.031	0.046	0.033	8
Marengo @ Mika		6	2007-2009	0.094	0.016	0.029	0.040	0.025	9
Marengo @ Riemer		8	2006-2009	0.11	0.023	0.041	0.048	0.029	9
Marengo Trib @ Govt	X	19	2006-2011	1.3	0.050	0.28	0.34	0.29	18
Marengo Trib @ Jolma	X	18	2011	1.6	0.41	0.83	0.83	0.38	10

*An "X" in the Reservation column indicates the monitoring location is within the exterior boundaries of the Bad River Reservation.

**Map ID # - These numbers are used to display site locations for BRWA, BRNRD, and WDNR on the map in Figure 2.35 and Table 2.8.

***ND indicates the sample result was non-detect and below the limit of detection, which is 0.0070 mg/L.

Table 2.14. Summary of Bad River Natural Resources Department nitrate plus nitrite data collected from the Marengo River Watershed.

				Basic Statistics of Nitrate-Nitrite Data (mg/L)					
Site Name	Reservation*	Map ID#**	Sampling Years	Max	Min	Median	Average	Standard Dev	# of Samples
Brunsweiler @ Adler	X	13	2007-2011	0.18	ND***	0.080	0.094	0.055	11
Marengo @ 4 Corners		3	2007-2009	0.31	0.033	0.11	0.12	0.083	8
Marengo @ AshBay		4	2007-2009	0.29	0.053	0.14	0.14	0.077	8
Marengo @ Govt Rd	X	11	2006-2011	0.43	ND***	0.14	0.16	0.093	24
Marengo @ Hwy 13		9	2006-2009	0.68	0.072	0.19	0.25	0.19	8
Marengo @ Mika		6	2007-2009	0.29	0.084	0.16	0.17	0.072	9
Marengo @ Riemer		8	2006-2009	0.30	0.088	0.200	0.192	0.056	9
Marengo Trib @ Govt	X	19	2006-2011	2.7	ND***	0.048	0.26	0.63	18
Marengo Trib @ Jolma	X	18	2011	0.85	ND***	0.15	0.26	0.31	10

*An "X" in the Reservation column indicates the monitoring location is within the exterior boundaries of the Bad River Reservation.

**Map ID # - These numbers are used to display site locations for BRWA, BRNRD, and WDNR on the map in Figure 2.35 and Table 2.8.

***ND indicates the sample result was non-detect and below the limit of detection, which is 0.025 mg/L.

Table 2.15. Summary of Bad River Natural Resources Department total Kjeldahl nitrogen (TKN) data collected from the Marengo River Watershed.

				Basic Statistics of TKN Data (mg/L)					
Site Name	Reservation*	Map ID#**	Sampling Years	Max	Min	Median	Average	Standard Dev	# of Samples
Brunsweiler @ Adler	X	13	2007-2011	0.81	0.12	0.55	0.53	0.21	10
Marengo @ 4 Corners		3	2007-2009	0.58	0.11	0.29	0.31	0.14	8
Marengo @ AshBay		4	2007-2009	0.63	0.23	0.37	0.41	0.15	8
Marengo @ Govt Rd	X	11	2006-2011	2.0	0.22	0.55	0.64	0.43	24
Marengo @ Hwy 13		9	2006-2009	0.69	0.17	0.25	0.38	0.23	8
Marengo @ Mika		6	2007-2009	0.62	0.14	0.26	0.32	0.17	9
Marengo @ Riemer		8	2006-2009	0.63	0.14	0.25	0.36	0.19	9
Marengo Trib @ Govt	X	19	2006-2011	4.1	0.49	1.9	2.0	0.89	18
Marengo Trib @ Jolma	X	18	2011	7.2	1.7	2.9	3.4	1.6	10

*An "X" in the Reservation column indicates the monitoring location is within the exterior boundaries of the Bad River Reservation.

**Map ID # - These numbers are used to display site locations for BRWA, BRNRD, and WDNR on the map in Figure 2.35 and Table 2.8.

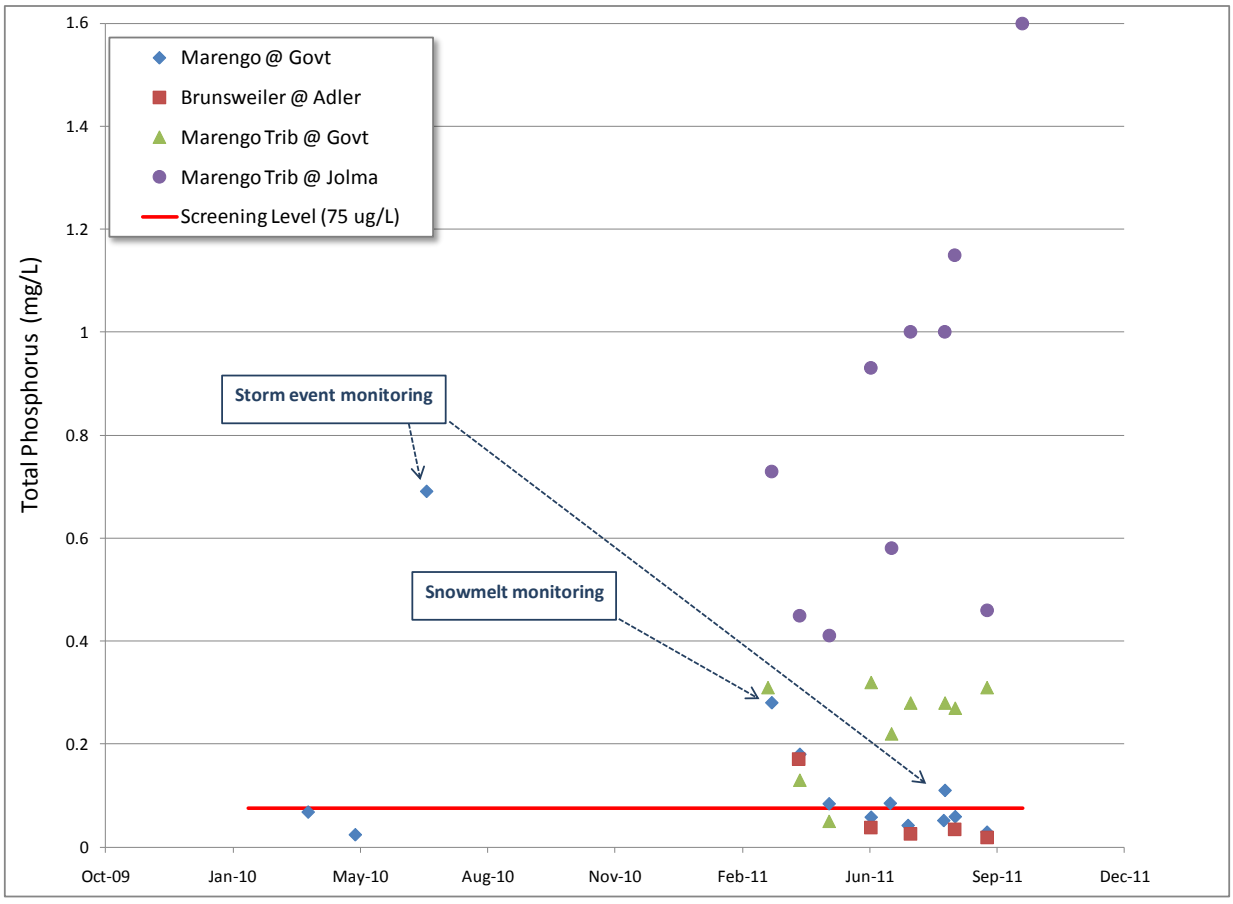


Figure 2.38. Bad River Natural Resources Department Total Phosphorus (TP) data collected from 2010-2011 at four monitoring locations within the Reservation boundaries. The State of Wisconsin's TP criterion is shown as a screening level. Two monitoring events associated with storm events along with the 2011 snowmelt monitoring event are highlighted.

Sediment
The State of Wisconsin currently does not have numeric criteria for sediment or turbidity in surface waters.

The Bad River Tribe has a numeric criterion for turbidity applying to all waters within the Bad River Reservation (Chapter E.7.iii). It states that turbidity *shall not exceed 5 NTU over natural background turbidity when the background turbidity is 50 NTU or less, or turbidity shall not increase more than 10 percent when the background turbidity is more than 50 NTU.*

The Bad River Tribe's narrative criterion that could apply to sediment pollution include: *Pollutants shall not be present in concentrations that cause or may contribute to an adverse effect to human, plant, animal or aquatic life, or in quantities that may interfere with the normal propagation, growth and survival of indigenous aquatic biota.*

Chapter 2.3 discusses at length current conditions related to sediment in the Marengo River Watershed. To summarize, sedimentation and its causes are perhaps the greatest issues facing the health of Wisconsin's Lake Superior basin streams. Historical land cover change, exacerbated by current land use, has increased surface runoff rates, created unstable stream channel conditions, and made streams susceptible to erosion and sedimentation impacts. Reducing surface runoff rates is a key component to reducing sedimentation in the Marengo River Watershed (and the rest of Wisconsin's Lake Superior Basin).

Estimates from the neighboring North Fish Creek Watershed indicate peak flood flows are about twice as high and sediment loading about 2.5 times higher than pre-European settlement rates (Fitzpatrick et al. 1999). The best available current estimate for the 2-year peak flood flow at the outlet of the Marengo River is 2,500 cubic feet per second (Hollenhorst & Hudson 2011). The Marengo River is the largest contributor of sediment to the Bad River, with current estimates suggesting about 64,000 tons of annual suspended sediment load (about a third of the sediment load from the Bad River) comes from the Marengo River (Fitzpatrick 2010). Approximately 11,000 tons annually is estimated to come from the soil transition zone in the main stem of the Marengo River (Fitzpatrick 2010). Much of the sediment transport is thought to occur during spring snowmelt and other episodic precipitation events.

Available turbidity, transparency, and total suspended solids (TSS) data from the WDNR, BRNRD, and BRWA indicates these parameters tend to increase associated with spring snowmelt sampling events and storm events, particularly at sites in the lower reaches of the Marengo River Watershed. Table 2.16 displays WDNR transparency and total suspended solids data available from Marengo River Watershed streams over the past 10 years. The site on the lower Marengo River (Government Rd. – on the Bad River Reservation) has monthly data collected between October 2008 and September 2009. The highest TSS concentration and the two lowest transparency measurements during this period occurred during February and March 2009. Weather records show warm temperatures around these sample dates, indicating the possibility of snowmelt runoff.

In 2010, BRWA completed a baseline monitoring report for three of its sites in the Marengo River Watershed that had at least four years of data (Figure 2.39). The report notes that turbidity was higher at the Riemer Rd. site during spring than other seasons and a similar peak was not observed at other sites.

Tables 2.17 and 2.18 summarize turbidity and TSS data collected by BRNRD since 1997. Figure 2.40 displays the TSS data collected BRNRD from February 2010 to October 2011 at seven sites located in the watershed and illustrates the highest TSS concentrations tend to occur during runoff events, such as spring snowmelt and summer storm events.

The joint recommendation is to establish more accurate baselines for peak flows and sediment loading in the Marengo River Watershed and to implement the "slow the flow" management strategy that has been broadly adopted by natural resource agencies in Wisconsin's Lake Superior Basin. Slow the flow is embodied in the concept that practices which reduce the rate of surface runoff are the key to reducing peak flows, reducing sedimentation, and improving aquatic habitat in Lake Superior Basin streams (see LSBPT 2007, WDNR 2007, WDNR 2010j).

Table 2.16. Summary of Wisconsin Department of Natural Resources (WDNR) transparency (Trans Tube) and total suspended solids (TSS) data collected from Marengo River Watershed sites over the past 10 years.

Waterbody Name	Station Name	Map ID #*	Date	Result Description	TSS mg/L	Trans Tube cm
Silver Creek	Silver Creek - Upstream Of Delafield Rd	26	11/8/2007	Single Sample	ND	> 120
Spring Brook	Spring Brook - Upstream Of Wolanek Rd	29	11/8/2007	Single Sample	ND	>120
Unnamed	Unnamed trib. to Brunsweiler River	27	8/12/2011	Single Sample	.	45
Brunsweiler River	Brunsweiler River Upstream of Maki Rd. Dead-End	28	6/9/2009	Single Sample	2	120
Marengo River	Marengo River 18 meters upstream of County Line Rd.	4	8/11/2008	Single Sample	ND	> 120
Marengo River	Marengo River at Government Road, Near Highbridge (on the Bad River Reservation) Collected between 10/14/2008 and 9/15/2009	11	10/2008-9/2009	Mean	6.5	86
				Min	2	28
				Max	18	>120
				STDEV	4.8	33
				N	12	14

* Map ID # - These numbers are used to display site locations for BRWA, BRNRD, and WDNR on the map in Figure 2.35 and Table 2.9.

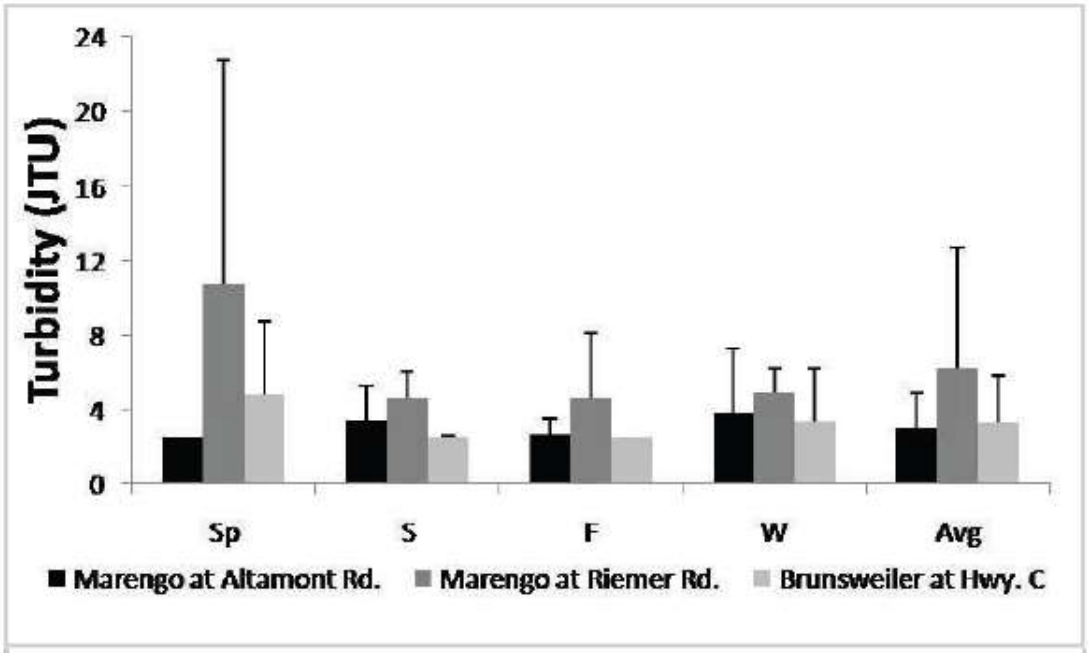


Figure 2.39. Seasonal (Sp = March-May, S = June-August, F = September-November, W = December-February) and overall average turbidity concentrations (collected between 2003 and 2007) at Marengo River Watershed sites monitored by Bad River Watershed Association volunteers (BRWA 2010a). Site locations are identified in Figure 2.35 and Table 2.9.

Table 2.17. Summary of Bad River Natural Resources Department turbidity data collected from the Marengo River Watershed.

				Basic Statistics of Turbidity Data (NTU)					
Site Name	Reservation*	Map ID#**	Sampling Years	Max	Min	Median	Average	Standard Dev	# of Samples
Brunsweiler @ Adler	X	13	2007-2011	23.8	1.8	12.2	10.8	7.1	22
Marengo @ 4 Corners		3	2007-2009***	22.5	1.0	11.7	10.8	7.5	10
Marengo @ AshBay		4	2007-2011	73.5	1.3	6.9	13.4	15.5	25
Marengo @ Govt Rd	X	11	1997-2011	1047.4	0.1	12.8	38.3	120.7	78
Marengo @ Hwy 13		9	1997-2011	803.0	0.7	14.9	31.9	103.0	60
Marengo @ Mika		6	2007-2009	63.3	11.5	19.6	23.7	15.8	9
Marengo @ Riemer		8	2004-2011	86.9	1.9	12.2	18.7	19.7	38
Marengo Trib @ Govt	X	19	2004-2011	349.8	2.6	52.4	72.6	70.7	46
Marengo Trib @ Jolma	X	18	2011	525.2	44.7	107.8	156.8	147.6	10

*An "X" in the Reservation column indicates the monitoring location is within the exterior boundaries of the Bad River Reservation.

**Map ID # - These numbers are used to display site locations for BRWA, BRNRD, and WDNR on the map in Figure 2.35 and Table 2.8.

***Summary includes one sample collected in 2002.

Table 2.18. Summary of Bad River Natural Resources Department total suspended solids (TSS) data collected from the Marengo River Watershed.

				Basic Statistics of Total Suspended Solids Data (mg/L)					
Site Name	Reservation*	Map ID#**	Sampling Years	Max	Min	Median	Average	Standard Dev	# of Samples
Brunsweiler @ Adler	X	13	2007-2011	77.6	1.4	9.5	14.6	18.7	16
Marengo @ 4 Corners		3	2007-2009***	19.8	2.9	5.2	8.3	6.6	6
Marengo @ AshBay		4	2007-2011	108.2	1.2	3.8	12.0	23.2	21
Marengo @ Govt Rd	X	11	1997-2011	345.5	1.0	8.8	22.7	45.5	112
Marengo @ Hwy 13		9	1997-2011	626.0	0.2	8.1	21.7	69.0	86
Marengo @ Mika		6	2007-2009	11.0	1.2	4.0	4.7	3.3	7
Marengo @ Riemer		8	2004-2011	89.0	0.8	5.5	12.5	18.1	36
Marengo Trib @ Govt	X	19	2004-2011	74.3	3.0	14.8	18.6	15.2	43
Marengo Trib @ Jolma	X	18	2011	203.3	27.4	86.7	90.1	56.9	8

*An "X" in the Reservation column indicates the monitoring location is within the exterior boundaries of the Bad River Reservation.

**Map ID # - These numbers are used to display site locations for BRWA, BRNRD, and WDNR on the map in Figure 2.35 and Table 2.8.

***Summary includes one sample collected in 2002.

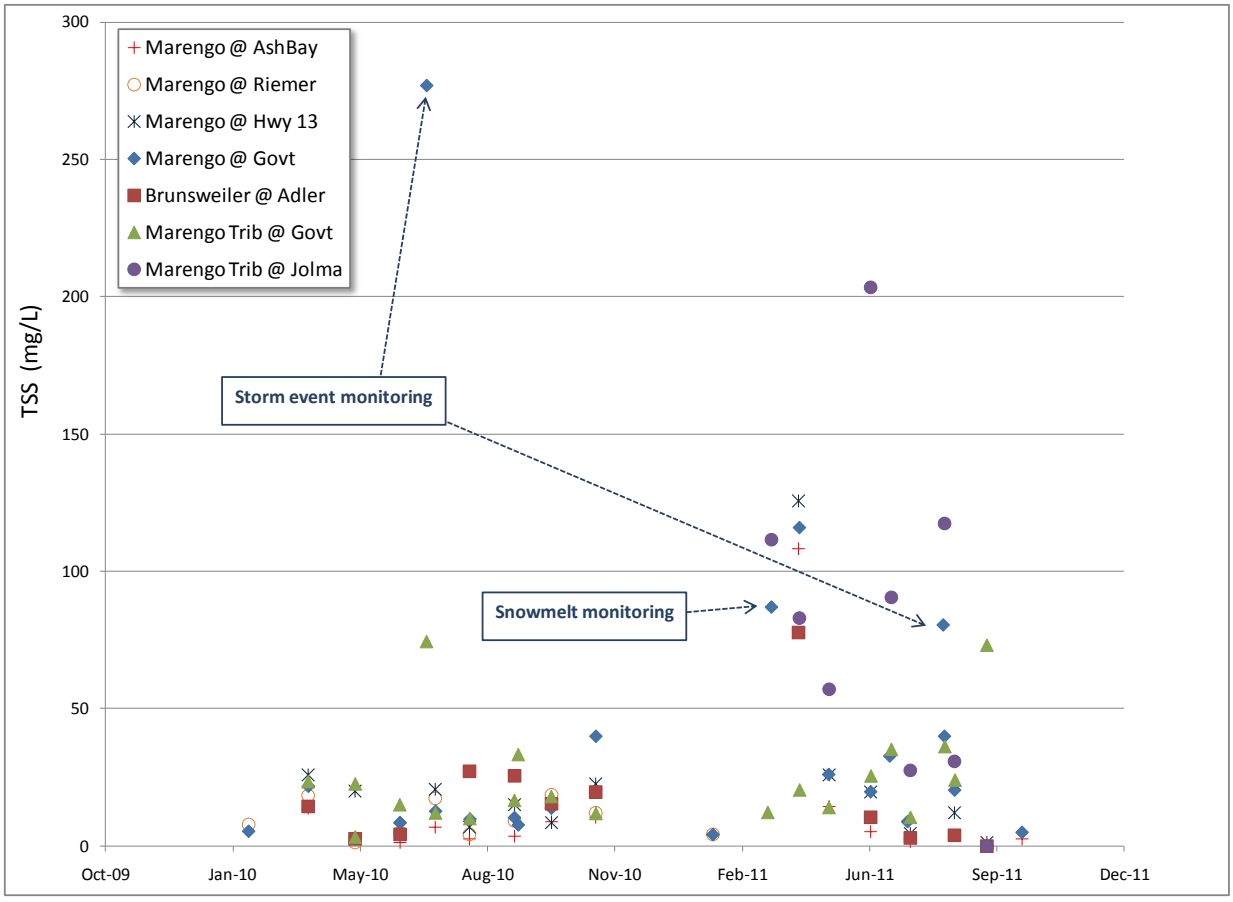


Figure 2.40. Bad River Natural Resources Department total suspended solids (TSS) data collected from 2010-2011 at seven monitoring locations within the Marengo River Watershed, including four locations within the Reservation boundaries (see site locations identified in Figure 2.35 and Table 2.9). Sites located on the main stem of Marengo River are listed in the legend from upstream to downstream location . Two monitoring events associated with storm events along with the 2011 snowmelt monitoring event are highlighted.

CHAPTER THREE: PRIORITIZING CHALLENGES AND CAUSES

1. IDENTIFYING CHALLENGES AND CAUSES

Identifying Marengo watershed issues and concerns or "challenges," was one of the first steps undertaken through the Marengo River Watershed Partnership (MRWP). At the first MRWP meeting on 12/16/09, watershed residents, technical experts, and other meeting participants were asked to identify issues and concerns they felt were important to maintaining and improving the health of the Marengo River Watershed. The ideas expressed at this meeting, along with reviewing available literature about the watershed, asking for feedback from MRWP Technical Team members, and reviewing available water quality standards resulted in the following six challenges to achieving the vision and goals (discussed in Chapter 4) for the Marengo River Watershed.

Marengo River Watershed challenges:

1. Unstable hydrologic system
2. Excess sediment
3. Terrestrial habitat fragmentation and alteration
4. Loss of aquatic habitat
5. Excess nutrients
6. High bacteria counts

2. TECHNICAL TEAM SURVEY

In order to prioritize the challenges and identify the most important sources of the challenges, the MRWP Technical Team was asked to complete an online survey. Questions asked in the survey, along with background information to help survey participants complete the survey are included in Appendix C and described below.

The prioritization exercise was done to provide a guide in focusing management actions that will have the greatest benefit to achieving the watershed vision and goals. While the prioritization is key to focusing management efforts, all of the challenges are considered important to achieving the vision and goals and will ultimately be implemented as resources and partner ambitions allow.

The survey was conducted September 20-27, 2010 and 27 MRWP Technical Team participants responded. Survey participants were asked to identify which of four focus areas they had the most interest in. Results indicate a good representation of input from each group (Figure 3.1).

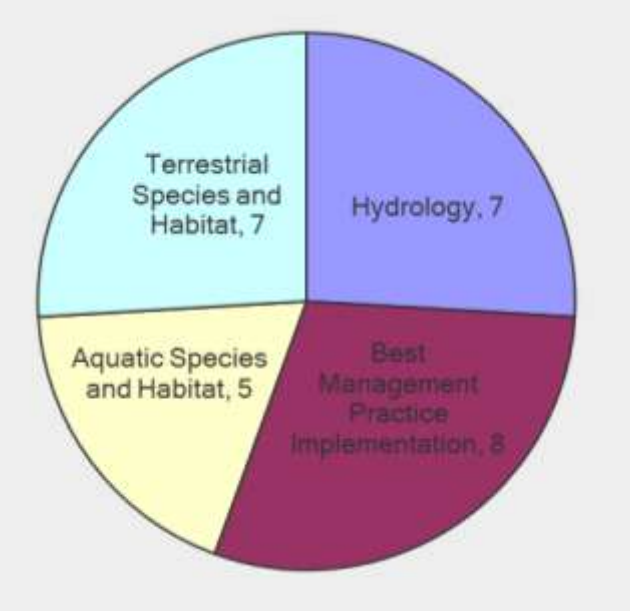


Figure 41.1. Marengo River Watershed Partnership Technical Team survey respondents grouped by technical interest area.

Survey participants were first asked to judge the "severity" and "scope" of the challenges compared to each other. They were asked to judge "severity" by considering how great the overall effect of each challenge has now or in the future on meeting the draft vision and goals for the watershed and its effect compared to the other challenges. The most "severe" challenge was given a ranking of 1 and the least "severe" a ranking of 6. The "scope" ranking was done in the same way and was designed to differentiate which challenges were most widespread and which were most localized in the watershed. A challenge ranked as being widespread was considered an overall higher priority than a localized one.

Ranking watershed challenges by priority was achieved by calculating a "weighted total score" for both the severity and the scope ranking for each challenge. The weighted total score is a method used to give greater weight to responses indicating greater severity and scope compared to those rated as having a low severity and scope. The challenge with the greatest total severity and scope score was considered the top priority and the least score the lowest priority for achieving the watershed vision and goals (Table 3.1).

Results indicate that an unstable hydrologic system is the challenge having the greatest effect and is most widespread in the Marengo River Watershed. Several comments were given by survey participants noting how interrelated some of the challenges are. For instance, an unstable hydrologic system has led to many of the issues with excess sediment, which also leads to loss of aquatic habitat. Excess nutrients and high bacteria counts ranked as having the least overall effect on the watershed and are least widespread compared to the others.

Table 3.1. Marengo River Watershed Partnership Technical Team survey results for severity and scope ranking of watershed challenges.				
Challenge	**Severity Weighted Score**	**Scope Weighted Score**	**Total Weighted Score**	**Priority Rank**
Unstable hydrologic system	226 (n=24)	215 (n=24)	441	1
Excess sediment	220 (n=24)	205 (n=24)	425	2
Terrestrial habitat fragmentation and alteration	194 (n=24)	202 (n=24)	396	3
Loss of aquatic habitat	198 (n=24)	188 (n=23)	386	4
Excess nutrients	172 (n=24)	159 (n=23)	331	5
High bacteria counts	166 (n=24)	152 (n=23)	318	6

Survey participants were then asked to evaluate the ten most important sources for each of the challenges and to evaluate the "recovery potential" or the ability of management actions to mitigate the source. Ranking sources and recovery potential provides a guide to selecting and prioritizing management objectives and actions that will be most effective at meeting the watershed challenges. It also provides a way to look at which sources may be similar across one or more of the other challenges and would achieve multiple benefits if mitigated.

Two methods were used to evaluate the source rankings. The first generated a list of top ten sources for each challenge by weighting the ranking given to each source by each survey respondent and summing the total weighted score for each source. The totals were ranked highest to lowest (Table 3.2). This method considered sources for each challenge separately from the others and gave greater importance to sources for the top priority challenges.

The second method looked at survey results based on frequency and rankings of a source appearing under multiple challenges. In this way, sources for multiple challenges are factored into evaluating top overall sources. This was done by weighting source rankings under the top priority challenges higher than those under the lowest ranked challenge (for instance, the #1 ranked source for the #1 challenge was given a score of 10*6 = 60, the #1 source for the #2 challenge was given a score of 10*5 = 50, the #2 ranked source for the #3 ranked challenge was given a score of 9*4 = 36). The weighed rankings were added together for each source and ranked by total weighted score. The results from this analysis are shown in Table 3.3.

Evaluating sources using both methods resulted in sources affecting runoff and erosion ranking highest (i.e. Hydrologic units with >60% open land/<16 year forests, Roads & road/stream crossings, Surface drainage from agricultural areas, Bluff/Streambank erosion).

Table 20.2. Marengo River Watershed Partnership Technical Team survey weighted ranking results for sources of each watershed challenge.		
Challenge	**Source**	**Score**
1. Unstable hydrologic system	Hydrologic units with >60% open land/<16 year forests	164
	Surface drainage from agricultural areas	133
	Roads & road/stream crossings	131
	Drained wetlands	116
	Stream channelization/incision	101
	Bluff/Streambank erosion	99
	Poor forest management and harvest	86
	Development (converting land use)	66
	Overbank sedimentation	42
	Climate change	32
2. Excess sediment	Bluff/Streambank erosion	176
	Roads & road/stream crossings	157
	Hydrologic units with >60% open land/<16 year forests	154
	Surface drainage from agricultural areas	116
	Stream channelization/incision	112
	Drained wetlands	87
	Poor forest management and harvest	73
	Overbank sedimentation	65
	Development (converting land use)	58
	Untreated storm water runoff	24
3. Terrestrial habitat fragmentation and alteration	Development (converting land use)	177
	Poor forest management and harvest	122
	Inconsistent/inadequate zoning	91
	Conflicting objectives in wildlife management	78
	Roads & road/stream crossings	68
	Invasive species	64
	Hydrologic units with >60% open land/<16 year forests	63
	Drained wetlands	61
	Climate change	32
	Bluff/Streambank erosion	22
4. Loss of aquatic habitat	Bluff/Streambank erosion	138
	Roads & road/stream crossings	115
	Drained wetlands	107
	Stream channelization/incision	97
	Elevated water temperatures	68
	Overbank sedimentation	62
	Poor forest management and harvest	51
	Surface drainage from agricultural areas	50
	Hydrologic units with >60% open land/<16 year forests	47
	Dams	45

Table 20.2. Marengo River Watershed Partnership Technical Team survey weighted ranking results for sources of each watershed challenge.		
Challenge	**Source**	**Score**
5. Excess nutrients	Surface drainage from agricultural areas	168
	Poorly designed/functioning septic systems	167
	Improperly applied/managed livestock waste	159
	Untreated storm water runoff	111
	Development (converting land use)	102
	Drained wetlands	68
	Hydrologic units with >60% open land/<16 year forests	49
	Inconsistent/inadequate zoning	37
	Roads & road/stream crossings	32
	Poor forest management and harvest	18
6. High bacteria counts	Improperly applied/managed livestock waste	171
	Poorly designed/functioning septic systems	155
	Surface drainage from agricultural areas	120
	Untreated storm water runoff	91
	Development (converting land use)	46
	Elevated water temperatures	42
	Inconsistent/inadequate zoning	32
	Drained wetlands	22
	Bluff/Streambank erosion	15
	Stream channelization/incision	11

Table 21.3. Marengo River Watershed Partnership Technical Team survey results for sources weighted based on priority watershed challenges and frequency of listing under multiple challenges.	
Source	**Weighted Score**
Roads & road/stream crossings	148
Hydrologic units with >60% open land/<16 year forests	130
Surface drainage from agricultural areas	126
Drained wetlands	116
Bluff/Streambank erosion	116
Poor forest management and harvest	94
Stream channelization/incision	88
Development (converting land use)	86
Overbank sedimentation	42
Inconsistent/inadequate zoning	42
Conflicting objectives in wildlife management	28
Poorly designed/functioning septic systems	27
Untreated storm water runoff	26
Improperly applied/managed livestock waste	26
Elevated water temperatures	23
Invasive species	20
Climate change	14
Dams	3
Mining (i.e. iron ore, gravel pits)	0

Finally, survey participants were asked to rate the recovery potential, or the ability of a source to be mitigated through management actions. This rating was intended to capture professional judgment to what degree humans can influence recovery of a source's contributions to watershed challenges in a general way as opposed to a specific condition. The rating required participants to think about what barriers exist to solving these problems, whether they are due to forces of nature, lack of regulatory will, significant cost, etc. The exercise was helpful in identifying "low hanging fruit" and refining the development of the watershed action plan priorities. For instance, a source with low scores with respect to scope and severity could also be one that could be easily improved through management activity. Recovery potential was rated on the following scale:

- **Very High**: The potential for the source to be mitigated through management actions is very likely (4 points).
- **High**: The potential for the source to be mitigated through management actions is likely (3 points).
- **Medium**: The potential for the source to be mitigated through management actions might be likely (2 points).
- **Low**: The potential for the source to be mitigated through management actions is unlikely (1 point).
- **Don't Know**: I don't know or feel comfortable rating the potential of the source to be mitigated through management actions (no score).

Results are displayed in Table 3.4. In general, the MRWP Technical Team felt that the recovery potential for many of the sources was greatest for those activities that human behavior can directly impact and lesser for those due to natural watershed response. For instance, reducing impacts to watershed health from agricultural runoff was seen as something that could be directly improved by management activity in the short term, while reducing the impacts of from streambank erosion is an issue much larger in scope and something humans have less immediate control over.

Overall, results from the survey indicate the unstable hydrologic system is the greatest challenge facing the Marengo River Watershed and the main sources of this challenge are related to surface runoff. Addressing these sources will help to meet other watershed challenges. Although, the scope and severity of the "excess nutrients" and "high bacteria counts" challenges were less on a watershed scale, recovery potential of their main sources is seen as greater than some of the sources for the "unstable hydrologic system" and "excess sediment." These factors were all considered together to come up with a prioritization of sources that was used to form the basis of prioritizing target objectives and management alternatives described in Chapters Four and Five (Table 3.5).

Table 3.22. Marengo River Watershed Partnership Technical Team survey average recovery potential for each source.	
Source	**Average Recovery Potential**
Poorly designed/functioning septic systems	3.1
Roads & road/stream crossings	3.0
Improperly applied/managed livestock waste	3.0
Surface drainage from agricultural areas	2.9
Inconsistent/inadequate zoning	2.8
Poor forest management and harvest	2.8
Untreated storm water runoff	2.8
Hydrologic units with >60% open land/<16 year forests	2.7
Drained wetlands	2.5
Dams	2.4
Conflicting objectives in wildlife management	2.4
Mining (i.e. iron ore, gravel pits)	2.3
Bluff/Streambank erosion	2.2
Overbank sedimentation	2.1
Stream channelization/incision	2.1
Development (converting land use)	2.1
Invasive species	1.9
Elevated water temperatures	1.8
Climate change	1.3

Table 3.23. Prioritization of sources (left column) for each of the watershed challenges for the Marengo River Watershed based on results from the Marengo River Watershed Partnership Technical Team survey. Watershed challenges are listed in priority order. The numbers under each challenge correspond to the ranking of each source for that challenge (for instance, "Drained wetlands" were the #4 source for the "unstable hydrologic system" and the #6 source for "excess sediment" challenge. Average recovery potential for each source is also given.

SOURCE (known or suspected)	CHALLENGE						RECOVERY POTENTIAL Very High=4, High=3, Medium=2, Low=1	
	1. Unstable hydrologic system	2. Excess Sediment	3. Terrestrial habitat fragmentation and alteration	4. Loss of aquatic habitat	5. Excess Nutrients	6. High Bacteria counts	Average Score	Likelihood* Ranking
1. Hydrologic units with >60% open land/<16 year forests	1	3	7	9	7		2.7	High/Medium
2. Surface drainage from agricultural areas	2	4		8	1	3	2.9	High
3. Roads & road/stream crossings	3	2	5	2	9		3.0	High
4. Drained wetlands	4	6	8	3	6	8	2.5	High/Medium
5. Bluff/Streambank erosion	6	1	10	1		9	2.2	Medium
6. Poor forest management and harvest	7	7	2	7	10		2.8	High
7. Improperly applied/managed livestock waste					3	1	3.0	High
8. Poorly designed/functioning septic systems					2	2	3.1	High
9. Stream channelization/ incision	5	5		4		10	2.1	Medium
10. Inconsistent/ inadequate zoning			3		8	7	2.8	High
11. Development (converting land use)	8	9	1		5	5	2.1	Medium
12. Overbank sedimentation	9	8		6			2.1	Medium
13. Untreated storm water runoff		10			4	4	2.8	High
14. Invasive species			6				1.9	Medium
15. Elevated water temperatures				5		6	1.8	Medium
16. Dams				10			2.4	Medium/High
17. Conflicting objectives in wildlife management			4				2.4	Medium/High
18. Climate change	10		9				1.3	Low/Medium
19. Mining (i.e. iron ore, gravel pits)							2.3	Medium/High

*Likelihood Ranking – 4.0-3.8=Very High, 3.8-3.5=Very High/High, 3.4-3.3=High/Very High, 3.2-2.8=High, etc.

CHAPTER FOUR: VISION, GOALS, HEALTHY WATERSHED TARGETS, AND TARGET OBJECTIVES

1. VISION AND WATERSHED GOALS

At the first MRWP meeting on 12/16/09, watershed residents, technical experts, and other meeting participants were asked to identify what words they would use to describe their vision for a Marengo River Watershed in the future. The draft watershed vision statement is a combination of those words.

Meeting participants were then asked to identify challenges they felt were important to maintaining and improving the health of the Marengo River Watershed (discussed in Chapter 3). The ideas expressed at this meeting, along with reviewing available literature about the watershed, asking for feedback from MRWP Technical Team members, and reviewing available water quality standards resulted in the first three watershed goals, which focused on addressing six challenges to achieving the vision for the Marengo River Watershed. A fourth goal was added with feedback from other members of the Partnership and Citizen Involvement Team to address watershed citizen engagement. The vision and goals are long-term; the action plan will be focused on what can be achieved in a 10-year time span.

Vision Statement
"We would like to see a Marengo River Watershed that has clean, flowing water; supports healthy, diverse, and resilient plant and animal communities free of invasive species; and is a vital community of watershed stewards who take actions to care for the watershed, while enabling a productive livelihood"

Watershed Goals
Goal #1: The hydrologic system in the Marengo River Watershed is stable and resilient.
Goal #2: Safe water and healthy, productive soil are available and maintained for all human and wildlife uses.
Goal #3: The Marengo River Watershed has diverse, healthy, and resilient native communities of plants and animals and their habitats on land and in water.
Goal #4: Citizens of the Marengo River Watershed are active and engaged in maintaining the integrity of the watershed.

2. HEALTHY WATERSHED TARGETS AND TARGET OBJECTIVES

The watershed goals describe a future state where the challenges identified through this effort are met. In order to meet these challenges and goals, a series of healthy watershed targets have been developed. The healthy watershed targets are a mix of regulatory and narrative criteria in existing water quality standards for the State of Wisconsin and the Bad River Tribe and non-regulatory guidelines developed as part of this watershed planning effort.

Typical EPA nine-element watershed plans include estimates of the amount of a pollutant or pollutants that need to be reduced in order for water quality standards to be met (referred to as “load reductions”). Aside from mercury in fish tissue, no streams or lakes in the Marengo River Watershed are currently listed as impaired by either the State of Wisconsin or the Bad River Tribe (see Chapter 2.14). Therefore, rather than estimating load reductions, the objective is to prevent future impairments by identifying and reducing existing pollution sources.

We learned in Chapter 2 and 3 that the sources and causes of watershed challenges such as excess sediment, high bacteria counts, and excess nutrients are known (in a general sense) and solutions to these challenges already exist. The Marengo River Watershed Action Plan is an attempt to be proactive about addressing potential pollution problems, to prevent impairment of watershed streams, and to protect and enhance healthy areas. The healthy watershed targets provide a starting point to assess watershed condition as implementation moves forward and these targets will be updated and adjusted (if necessary) as new data and information become available.

The healthy watershed targets also provide a way to integrate water quality standards from Wisconsin and the Bad River Tribe into a set of common objectives, “target objectives,” that will help ensure the entire watershed is in a healthy condition.

The target objectives provide more specific direction on management and outreach activities needed to meet the healthy watershed targets. These are specific or quantitative where possible and reflect current knowledge about the watershed and management activities needed. The target objectives are based on feedback from the MRWP Technical and Citizen Involvement Teams. The target objectives lay the foundation for the best management practices and management alternatives that will be most effective at reducing existing pollution sources, protecting high quality areas, and ensuring healthy watershed targets are met.

Table 4.1 reflects efforts by the Bad River Tribe, WDNR, and BRWA to jointly assess watershed condition and develop consistent targets that recognize the differences in water quality standards between the two jurisdictions and a pathway to achieve a healthy watershed that reflects the intent of both sets of water quality standards. Table 4.1 lists the healthy watershed targets and links them to the broad watershed goals from Chapter 4.1 and watershed challenges described in Chapter 3. Table 4.1 also provides the basis for the healthy watershed targets (whether state or tribal water quality standards or guidelines established through the watershed planning effort), an assessment of current conditions that reflects an evaluation of available data and information against the healthy watershed targets, and target objectives, which form the basis for management recommendations to meet the healthy watershed targets described in Chapter 5.

Table 4.24. Healthy watershed targets for the Marengo River Watershed. The targets are linked to broad watershed goals and challenges, an assessment of current conditions related to the challenges, and a series of target objectives, which provide more specific direction on management and outreach activities needed to meet the healthy watershed targets.

<table>
<tr><th rowspan="2">Watershed Goal</th><th rowspan="2">Challenge</th><th colspan="2">Healthy Watershed Targets</th><th colspan="2">Basis for Healthy Watershed Targets</th><th rowspan="2">Current Conditions</th><th rowspan="2">Target Objectives</th></tr>
<tr><th>State</th><th>Tribal</th><th>State (WAC*)</th><th>Tribal (BRWQS**)</th></tr>
<tr><td rowspan="4">The hydrologic system in the Marengo River Watershed is stable and resilient.</td><td rowspan="4">• Excess Sediment
• Unstable Hydrologic System
• Loss of Aquatic Habitat</td><td rowspan="2">Habitat is not impaired due to excessive bank erosion and sedimentation.</td><td>Habitat is not impaired due to excessive bank erosion and sedimentation.</td><td rowspan="2">Following references: Cahow & Fitzpatrick 2005, LSBPT 2007, WDNR 2010j.</td><td>Cahow & Fitzpatrick 2005, LSBPT 2007, WDNR 2010j.</td><td rowspan="4">Estimates from the neighboring North Fish Creek Watershed indicate peak flood flows are about twice as high and sediment loading about 2.5 times higher than pre-European settlement rates (Fitzpatrick et al. 1999). The best available current estimate for the 2-year peak flood flow (approximate interval for bankfull flow) at the outlet of the Marengo River is 2,500 cubic feet per second (Hollenhorst & Hudson 2011). The Marengo River is the largest contributor of sediment to the Bad River, with current estimates suggesting about 64,000 tons of annual suspended sediment load (about a third of the sediment load from the Bad River) comes from the Marengo River (Fitzpatrick 2010).</td><td rowspan="4">1. Reduce amount of open land and forests <16 years old by 7,600 acres, focusing in hydrologic units with 40% or more open land/<16-year forests (2008 baseline).
2. Slow the flow of runoff from upland areas to watershed streams.
3. Reduce hydrologic connectivity of road and recreational trail system to less than 12% of the surface area of the watershed.
4. Reduce sediment contributions from roads, recreational trail systems, and all waterway crossings.
5. Restore floodplain connectivity in incised reaches and reaches with excessive overbank sedimentation.
6. Increase channel roughness.
7. Reduce bluff/stream bank erosion.
8. Establish baselines for bankfull flow and annual suspended sediment load near the Marengo River Watershed outlet.
9. Map groundwater flow, quantity, and recharge areas.</td></tr>
<tr><td>Turbidity shall not exceed 5 NTU over natural background turbidity when the background turbidity is 50 NTU or less, or turbidity shall not increase more than 10% when background turbidity is more than 50 NTU.</td><td>Provision E.7.iii.</td></tr>
<tr><td colspan="2">Bankfull flows at the watershed outlet reduced from 2,500 cfs to 1250 cfs.</td><td colspan="2">Fitzpatrick et al. 1999, LSBPT 2007, Hollenhorst and Hudson 2011</td></tr>
<tr><td colspan="2">Annual suspended sediment load from the Marengo River reduced from 64,000 tons to 32,000 tons.</td><td colspan="2">Fitzpatrick et al. 1999, Fitzpatrick 2010</td></tr>
</table>

Watershed Goal	Challenge		Healthy Watershed Targets		Basis for Healthy Watershed Targets		Current Conditions	Target Objectives
			State	Tribal	State (WAC*)	Tribal (BRWQS**)		
Safe water and healthy, productive soil are available and maintained for all human and wildlife uses.	High Bacteria Counts		Membrane filter fecal coliform count may not exceed 400 per 100 ml in more than 10% of all samples during any month.	Any single sample shall not exceed an E.coli count of 235 CFU/100 mL.	NR 102.04(6), WisCALM	Provision E.7.iv.	Available data from BRWA and BRNRD indicates that elevated pathogen counts have been documented at several locations in the soil transition zone and clay plain area. (see Chapter 2.14).	1. Evaluate extent of nutrient and pathogen concerns & establish a baseline in the soil transition zone and clay plain area. 2. Implement agriculture conservation practices that improve manure storage and management. 3. Inventory and replace failing, poorly designed, and poorly functioning private on-site wastewater treatment systems (POWTS). 4. Insure POWTS are maintained on a regular basis. 5. Develop and encourage market-driven solutions to conservation on agricultural and forest land. 6. Strengthen local zoning ordinances and encourage practices that protect watershed health while meeting development needs. 7. Coordinate and increase opportunities for proper household hazardous waste, pharmaceuticals, pesticides, white goods (i.e. stoves, refrigerators, etc.), and tire disposal. 8. Remediate existing brownfield sites and leaking underground storage tanks. 9. Identify, close abandoned wells. 10. Monitor groundwater quality via private well testing.
			Membrane filter fecal coliform count may not exceed 200 per 100 ml as a geometric mean based on not less than 5 samples per month.	The geometric mean of not less than 5 samples equally spaced over a 30-day period shall not exceed an E. coli count of 126 CFU/100 mL.				
	Excess Nutrients	Narrative Criteria	General category of surface water uses and criteria.	Waters are free from substances that produce nutrients or other substances that stimulate algal growth producing nuisance aquatic vegetation, dominance of any nuisance species instream, or cause nuisance conditions in any other fashion.	NR 102.04(1)	Provision E.6.i.f.	The source of pathogen concerns indicates that nutrients may also be a concern in the soil transition and clay plain area. Available data from WDNR and BRNRD are limited but elevated nutrient concentrations have been documented on several occasions (see Chapter 2.14).	
		Nitrogen	Acute and chronic toxicity criteria for ammonia.	Acute and chronic toxicity criteria for ammonia.	NR 105.05 & NR 105.06	Provision H.10.		
				< 1 mg/L (nitrate nitrogen)****		screening level***		
		Phos-phorus	<0.075 mg/L Total Phosphorus***	< 0.1 mg/L (phosphate)****	NR102.06	screening level***		

Watershed Goal	Challenge	Healthy Watershed Targets		Basis for Healthy Watershed Targets		Current Conditions	Target Objectives
		State	Tribal	State (WAC*)	Tribal (BRWQS**)		
The Marengo River Watershed supports diverse, healthy, and resilient native communities of plants and animals and their habitats on land and in water.	• Terrestrial habitat fragmentation and alteration • Loss of aquatic habitat	Identify, restore, and maintain ecological processes and priority habitats for native communities of plants and animals.		Feedback from MRWP Technical Team		Approx. 3/4 of land area with some form of land management plan, 1/4 is unknown (various sources, see Chapter 2.5). Current trends are reduction in size of privately-owned parcels and increase in landowners which can lead to terrestrial habitat fragmentation. Terrestrial and aquatic invasive species are threats to terrestrial and aquatic habitat. Primary among these is that the Marengo River has been identified as an important area for sea lamprey spawning.	1. Inventory and control invasive species. 2. Identify available and potential habitat for terrestrial and riparian species of conservation interest. 3. Identify available and potential habitat for aquatic species of conservation interest. 4. Restore and improve priority aquatic and terrestrial habitats. 5. Secure protection of existing priority riparian, aquatic, and terrestrial conservation areas and habitats.
Citizens of the Marengo River Watershed are active and engaged in maintaining the integrity of the watershed.	A part of addressing all challenges.	Establish outreach and citizen involvement efforts to reduce pollution that impacts the Marengo River Watershed.		Feedback from MRWP Citizen Involvement Team		Local citizens care about protecting land and water resources, but don't always know how to get involved or what can be done to maintain or improve watershed health. A variety of communication and outreach approaches are needed to reach diverse audiences within the Marengo River Watershed (see Chapter 5.3).	1. Increase general public's awareness and knowledge of water quality issues and watershed health. 2. Increase public participation in watershed stewardship activities.
		Develop and improve recreational and cultural activities for watershed residents and visitors.					1. Develop and improve recreational opportunities for all types of users. 2. Resolve conflicts related to wildlife management.

Watershed Goal	Challenge	Healthy Watershed Targets		Basis for Healthy Watershed Targets		Current Conditions	Target Objectives
		State	Tribal	State (WAC*)	Tribal (BRWQS**)		

* WAC = Wisconsin Administrative Code

** BRWQS = Bad River Band of the Lake Superior Tribe of Chippewa Indians Water Quality Standards (7/6/2011). All BRWQS are applicable within the exterior boundaries of the Bad River Indian Reservation.

*** This criteria applies to streams and rivers, not lakes. Phosphorus criteria used as part of assessing lake condition are described in NR 102.06.

**** These screening levels are not regulatory criteria and do not replace regulatory criteria. These screening levels are from the Bad River Tribe's Surface Water Monitoring Quality Assurance Project Plan (2011).

CHAPTER FIVE: BEST MANAGEMENT PRACTICES AND SELECTED MANAGEMENT ALTERNATIVES, MANAGEMENT AREAS, AND WATERSHED OUTREACH AND CITIZEN INVOLVEMENT

Chapter 5 describes the final pieces needed to assemble the watershed action plan in Chapter 6. In Section 5.1, the target objectives from Table 4.1 are prioritized based on feedback from the Technical Team survey results described in Chapter 3 and connected to best management practices and management alternatives that will be utilized to implement them. Section 5.2 will describe two management focus areas for implementing the BMPs and management alternatives, and section 5.3 describes strategies that will be utilized to engage and involve citizens in implementing the watershed action plan.

1. BEST MANAGEMENT PRACTICES AND SELECTED MANAGEMENT ALTERNATIVES

The Technical Team survey described in Chapter 3 was an effort to provide guidance for prioritizing management activities that will have the greatest benefit to achieving the watershed vision and goals. Here, the results from the survey are utilized to prioritize the target objectives described in Chapter 4, list management activities needed to implement them, and list some existing programs that are currently in place to implement the management activity. While prioritization is important for focusing management efforts, all of the target objectives are considered important to achieving the vision and goals and will ultimately be implemented as resources and partner ambitions allow.

Best Management Practices, or BMPs, are techniques, measures, or structural controls that are designed to eliminate surface runoff and pollutants from entering surface and ground waters. BMPs can include preventative actions that involve management and source controls. This includes policies and ordinances that provide requirements and standards to direct growth of identified areas, protection of sensitive areas such as wetlands and riparian areas, and maintaining and/or increasing open space. Other examples are providing buffers along sensitive water bodies or minimizing disturbance of soils and vegetation. Additional nonstructural BMPs can be education programs for landowners, businesses, developers, and local officials about project designs and everyday actions that minimize water quality impacts.

Table 5.1 lists the target objectives, prioritized based on Technical Team survey input, BMPs and management alternatives needed to implement the target objectives, and along with some existing programs in place that implement the management activity. The existing programs are examples of how the BMP or management alternatives can be implemented. Further details on programs and practices that could be utilized to implement the target objectives are described in section 5.1.1.

Table 5.25. Prioritized target objectives, selected best management practices and management alternatives, and some examples of current programs that could be used to implement the BMP or management alternative. EQIP refers to the Environmental Quality Incentives Program and all current, approved practices for Wisconsin (NRCS 2012). ATCP 50 refers to current, approved practices listed in Chapter Agriculture, Trade, and Consumer Protection (ATCP) 50 of Wisconsin Administrative Code (WAC 2012).		
Target Objectives (Prioritized)	**Best Management Practices and Management Alternatives**	**Examples of Current Programs and Practice Implementation:**
1. Reduce amount of open land and forests <16 years old by 7,600 acres, focusing in hydrologic units with 40% or more open land/<16-year forests (2008 baseline).	A. Riparian and upland native tree planting	• Lake Superior Conservation Reserve Enhancement Program • Partners for Fish and Wildlife Program • Conservation Stewardship Program • Wildlife Habitat Incentive Program • All applicable EQIP and ATCP practices
	B. Provide forest management planning support to private watershed landowners.	• Wisconsin Forest Landowner Grant Program • All applicable EQIP and ATCP practices
	C. Coordinate & schedule timber harvests to maintain <40% open land/<16-year forests in WDNR hydrologic units.	• WDNR Forestry and Watershed Management Training Workshops • BRNRD Silviculture Monitoring Project
2. Slow the flow of runoff from upland areas to watershed streams.	A. "Precision conservation" or similar analysis to refine priority project implementation areas including protection and restoration activities.	• N/A
	B. Restore and protect wetlands.	• Partners for Fish and Wildlife Program • Wetland Reserve Program • Wildlife Habitat Incentive Program • All applicable EQIP and ATCP practices • WI Coastal Management Program
	C. Maintain and improve implementation of forestry best management practices.	• WDNR Forestry BMP implementation monitoring • WDNR Forestry and Watershed Management Training workshops

Table 5.25. Prioritized target objectives, selected best management practices and management alternatives, and some examples of current programs that could be used to implement the BMP or management alternative. EQIP refers to the Environmental Quality Incentives Program and all current, approved practices for Wisconsin (NRCS 2012). ATCP 50 refers to current, approved practices listed in Chapter Agriculture, Trade, and Consumer Protection (ATCP) 50 of Wisconsin Administrative Code (WAC 2012).		
Target Objectives (Prioritized)	**Best Management Practices and Management Alternatives**	**Examples of Current Programs and Practice Implementation:**
		• BRNRD Silviculture Monitoring Project • Shared Landscape Initiative (coordinated by USFS)
	D. Implement managed intensive (prescribed) grazing for livestock producers.	• Lake Superior Grazing Specialist • All applicable EQIP and ATCP practices
	E. Implement conservation practices associated with livestock exclusion fencing.	• All applicable EQIP and ATCP practices
	F. Implement conservation practices associated with livestock watering facilities.	• All applicable EQIP and ATCP practices
	G. Increase conservation tillage acreage.	• All applicable EQIP and ATCP practices
	H. Improve drainage from heavy-use areas.	• All applicable EQIP and ATCP practices
	I. Plug/break agricultural drainage systems no longer in use.	• All applicable EQIP and ATCP practices
3. Reduce hydrologic connectivity of road right of way and recreational trail system to less than 12% of the surface area of the watershed.	A. Establish baseline of road/ditch area and evaluate upland flow attenuation for road system.	• N/A
4. Reduce sediment contributions from roads, recreational trail systems, railroads, and all waterway crossings.	A. Replace or re-design eroding and poorly functioning crossings and sections of roads, trails, and railroads at interactions with all types of waterways (streams, wetlands, lakes, etc).	• BRWA Culvert Program • All applicable EQIP and ATCP practices
	B. Implement conservation practices associated with waterway crossings.	• All applicable EQIP and ATCP practices

Table 5.25. Prioritized target objectives, selected best management practices and management alternatives, and some examples of current programs that could be used to implement the BMP or management alternative. EQIP refers to the Environmental Quality Incentives Program and all current, approved practices for Wisconsin (NRCS 2012). ATCP 50 refers to current, approved practices listed in Chapter Agriculture, Trade, and Consumer Protection (ATCP) 50 of Wisconsin Administrative Code (WAC 2012).		
Target Objectives (Prioritized)	**Best Management Practices and Management Alternatives**	**Examples of Current Programs and Practice Implementation:**
5. Reduce bluff/stream bank erosion.	A. Stabilize eroding bluffs/streambanks.	• All applicable EQIP and ATCP practices • Wildlife Habitat Incentive Program • Partners for Fish and Wildlife Program
6. Evaluate extent of nutrient and pathogen concerns and establish a baseline in the soil transition zone and clay plain area.	A. Conduct impaired water assessment for fecal coliform/*E. coli* and total phosphorus.	• WDNR, Bad River Tribe water quality monitoring programs
7. Implement agriculture conservation practices that improve manure storage and management.	A. Develop and implement nutrient management plans.	• South Shore Nutrient Management Farmer Education Program • All applicable EQIP and ATCP practices
	B. Implement conservation programs to improve livestock waste management.	• All applicable EQIP and ATCP practices
8. Inventory and replace failing, poorly designed, and poorly functioning private on-site wastewater treatment systems (POWTS).	A. Replace/update priority sites.	• Wisconsin Fund, Private Sewage System Replacement or Rehabilitation Grant Program • Bad River POWTS program
9. Insure POWTS are maintained on a regular basis.	A. Expand and/or continue POWTS maintenance programs.	• Ashland and Bayfield Co., Bad River POWTS programs
10. Restore floodplain connectivity in incised reaches and reaches with excessive overbank sedimentation.	A. Legacy sediment/levee scrapes.	• Wildlife Habitat Incentive Program
	B. Grade control/stabilization.	• All applicable EQIP and ATCP practices
	C. Raise stream bed.	• N/A
11. Increase channel roughness.	A. Add natural material such as coarse woody debris, rock.	• All applicable EQIP and ATCP practices • Partners for Fish and Wildlife Program
12. Strengthen local zoning ordinances and encourage practices that protect watershed health while meeting development needs.	A. Utilize available zoning ordinance review and update tools, such as the Better Site Design Tools from the Center for Watershed Protection (CWP 2012).	• Ashland and Bayfield County NR 115 Update • BRNRD
13. Identify available and potential habitat for	A. Riparian and upland habitat assessments.	• WDNR, Bad River Tribe

Table 5.25. Prioritized target objectives, selected best management practices and management alternatives, and some examples of current programs that could be used to implement the BMP or management alternative. EQIP refers to the Environmental Quality Incentives Program and all current, approved practices for Wisconsin (NRCS 2012). ATCP 50 refers to current, approved practices listed in Chapter Agriculture, Trade, and Consumer Protection (ATCP) 50 of Wisconsin Administrative Code (WAC 2012).		
Target Objectives (Prioritized)	**Best Management Practices and Management Alternatives**	**Examples of Current Programs and Practice Implementation:**
terrestrial and riparian species of conservation interest.		
14. Identify available and potential habitat for aquatic species of conservation interest.	A. Identify/confirm perennial and intermittent streams. B. Conduct aquatic habitat assessments.	• WDNR, Bad River Tribe, BRWA
15. Secure protection of existing priority riparian, aquatic, and terrestrial conservation areas and habitats.	A. Special designations.	• WDNR, Bad River Tribe water quality standards
	B. Land acquisition/conservation easements.	• Wisconsin Knowles-Nelson Stewardship Program • Bayfield Regional Conservancy • West Wisconsin Land Trust • North American Wetlands Conservation Act
	C. Tax incentives to maintain ecosystem services.	• N/A
16. Restore and improve priority aquatic and terrestrial habitats.	A. Improve fish and other aquatic life passage at road crossings.	• BRWA Culvert Program • All applicable EQIP and ATCP practices • Partners for Fish and Wildlife Program
	B. Add natural material such as coarse woody debris, rock.	• All applicable EQIP and ATCP practices • Partners for Fish and Wildlife Program
	C. Improve riparian vegetation to promote growth of long lived species.	• All applicable EQIP and ATCP practices • Partners for Fish and Wildlife Program
	D. Dam inspections/removals.	• WDNR Dam Removal Grant Program
17. Inventory and control invasive species.	A. Increase and improve surveys and monitoring.	• Northwoods Cooperative Weed Management Area • WI Coastal Management Program
	B. Control terrestrial and aquatic infestations with established control methods.	

Table 5.25. Prioritized target objectives, selected best management practices and management alternatives, and some examples of current programs that could be used to implement the BMP or management alternative. EQIP refers to the Environmental Quality Incentives Program and all current, approved practices for Wisconsin (NRCS 2012). ATCP 50 refers to current, approved practices listed in Chapter Agriculture, Trade, and Consumer Protection (ATCP) 50 of Wisconsin Administrative Code (WAC 2012).		
Target Objectives (Prioritized)	**Best Management Practices and Management Alternatives**	**Examples of Current Programs and Practice Implementation:**
18. Develop and encourage market-driven solutions to conservation on agricultural and forest land.	A. Upland agroforestry.	• Agriculture and Energy Resource Center
	B. Utilize Wisconsin's Working Lands Initiative	• WI Working Lands Initiative
19. Coordinate and increase opportunities for proper household hazardous waste, pharmaceuticals, pesticides, white goods (i.e. stoves, refrigerators, etc.), and tire disposal.	A. Household hazardous waste collection events.	• Bad River, NW-Regional Planning Commission regional clean sweeps
20. Inventory and remediate existing brownfield sites and leaking underground storage tanks (LUST).	A. Inventory all brownfield/LUST sites. B. Remediate known brownfield/LUST sites.	• WDNR Remediation and Redevelopment Program
21. Identify and close abandoned wells.	A. Well decommissioning.	• All applicable EQIP and ATCP practices • BRNRD
22. Map groundwater flow, quantity, and recharge areas.	A. Complete seepage run.	• USGS
23. Monitor groundwater quality via private well testing.	A. Develop private well monitoring program.	• Community Drinking Water Program through UW-Stevens Point
24. Increase general public's awareness and knowledge of water quality and watershed health.	A. Continue implementing the Marengo River Watershed Partnership.	• Marengo River Watershed Partnership
25. Increase public participation in watershed stewardship activities.	A. Host watershed stewardship events.	• Marengo River Watershed Partnership
26. Develop and improve recreational opportunities for all types of users.	A. Evaluate recreational opportunities for all types of users.	• N/A
27. Resolve conflicts related to wildlife management.	A. Host community discussion event.	• N/A

1.1 IMPLEMENTING BMPs AND MANAGEMENT ALTERNATIVES

Table 5.1 provides a quick reference for seeing which BMPs and management alternatives will be utilized to implement the target objectives, but does not give details on how the programs that implement the BMPs and management alternatives work or describe gaps or other types of alternatives that could be used to achieve the target objectives. Details on these programs and ideas are described in Section 5.1.1.1.

1.1.1 LANDOWNER INCENTIVE PROGRAMS

Conservation programs are already available to help implement best management practices needed to reduce nonpoint source pollution to Marengo River Watershed streams from agriculture and forest management activities on private lands. Some of these practices include: nutrient management, management of concentrated flow areas, waterway crossings for farm machinery and cattle, livestock fencing, riparian buffers, streambank protection, conservation tillage, managed-intensive grazing, wetland restoration, and wildlife habitat enhancement. In 2010 the Bayfield Regional Conservancy and the Living Forest Cooperative summarized available landowner conservation incentive programs. The program summaries from the toolkit are listed below, along with a few additional programs. For more information or a full version of the toolkit visit: www.livingforestcoop.com. Complete information on these programs can be obtained by contacting the administering agency.

Conservation Reserve Enhancement Program (CREP): Land retirement program that provides technical and financial assistance to eligible farmers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. In the Marengo River watershed, the Lake Superior Conservation Reserve Enhancement Program is a modification of the CREP program available in other parts of Wisconsin and is designed to help achieve “slow the flow” objectives specific to the Lake Superior basin. As of 2010 there were two landowners in the Marengo River watershed that make a total of 33.1 acres in the program. *Lead Agencies*: United States Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS) – Ashland Service Center, Ashland and Bayfield County Land and Water Conservation Departments.

Conservation Stewardship Program (CSP): Cost-share conservation program that encourages producers to address resource concerns in a comprehensive manner by undertaking additional conservation activities; and improving, maintaining, and managing existing conservation activities. *Lead Agencies*: USDA-Natural Resources Conservation Service (NRCS) Ashland Service Center (715) 682-9117

Environmental Quality Incentives Program (EQIP) and State DATCP: Cost-share programs that provides technical and financial help to landowners for conservation practices that protect soil and water quality. This includes a variety of best management practices that help slow the flow, reduce sedimentation, and reduce bacteria and nutrient inputs. *Lead Agencies*: EQIP is a federal program administered by USDA-NRCS – Ashland Service Center. DATCP programs are administered by Ashland and Bayfield County Land and Water Conservation Departments. A list

of eligible EQIP practices for Wisconsin is available here: http://www.wi.nrcs.usda.gov/programs/eqip.html. A list of eligible DATCP practices is available here: https://docs.legis.wisconsin.gov/code/admin_code/atcp/50/I/01.

Managed Forest Law (MFL): Land management incentive program that encourages sustainable forestry on private woodlands by reducing and/or deferring property taxes. *Lead Agency:* Wisconsin Department of Natural Resources.

Wetland Reserve Program (WRP): Land retirement program to restore and protect wetlands on private property. *Lead Agency*: USDA-NRCS Ashland Service Center.

Wildlife Habitat Incentive Program (WHIP): Cost-share program to develop and improve wildlife habitat on agricultural land and nonindustrial private forest land. *Lead Agency*: USDA-NRCS Ashland Service Center.

Wisconsin Forest Landowner Grant Program (WFLGP): Cost-share program that provides assistance to protect and enhance their forested lands, prairies, and waters. *Lead Agency*: Wisconsin Department of Natural Resources.

Partners for Fish and Wildlife: Provides technical and cost-share funding assistance to landowners to restore wetland and other wildlife habitats on their property. From 2001-2010, eight wetland restoration projects in the Marengo River watershed have been completed through this program, for a total of 38 wetland acres to date. 76 upland acres have been enhanced for migratory bird nesting in the watershed. One additional project is scheduled for 2011 with the potential to restore 4 acres of wetland and enhance 15 upland acres. *Lead Agency*: United States Fish and Wildlife Service (USFWS) - Ashland Conservation Office.

Coastal Program- Great Lakes: Provides technical and cost-share funding assistance to private landowners in the planning, design, and construction phases of wetland restoration and other wildlife habitat activities. This multi-agency wetland restoration program exists between the USFWS and the local county land and water conservation departments. *Lead Agency*: USFWS - Ashland Conservation Office.

South Shore Nutrient Management Farmer Education Program: Cost-share and technical assistance program for developing and implementing nutrient management plans that help livestock producers comply with NR 151 Standards and Prohibitions. The program applies to the four counties in the Lake Superior Basin (Ashland, Bayfield, Douglas, Iron). Currently, there are at least nine farms in the Marengo River Watershed that have completed the training program and have nutrient management plans. *Lead Agencies*: USDA-NRCS – Ashland Service Center, Ashland and Bayfield County Land and Water Conservation Departments, University of Wisconsin-Extension, Ashland and Bayfield County.

Lake Superior Grazing Specialist: The Specialist is available through the Pri-Ru-Ta Resource Conservation & Development Council to provide technical assistance for developing and

implementing managed-intensive grazing plans for livestock producers. *Lead Agency*: USDA-NRCS Ashland Service Center.

Implementation of these programs is limited only by resources and staffing. Currently, priority is given to voluntary requests and these requests regularly are greater than the available funding and staff availability. As a result, areas most in need of implementation of conservation practices that may most benefit water quality may not be addressed. Water quality monitoring in the Marengo River watershed has shown at least two of these sites. Targeting these locations for priority implementation of limited cost share funding and enforcement of NR151 where necessary is likely to have the greatest benefit for reducing high *E. coli* counts and elevated nutrient concentrations, particularly where associated with poor livestock management practices in the Marengo River Watershed.

1.1.2 FOREST MANAGEMENT

WDNR's Forestry Best Management Practices (BMPs) for Water Quality were developed in 1995 and updated in 2010 (see discussion in Chapter 2.2.5). The BMPs are intended for loggers, landowners, and land managers and are described for the following categories (in more detail in WDNR 2010b):

1. *Forest Roads*
2. *Stream Crossings*
3. *Timber Harvestings*
4. *Riparian Management Zones*
5. *Wetlands*
6. *Fuels, Lubricants, Waste, and Spills*
7. *Chemicals*
8. *Mechanical Site Preparation and Tree Planting*
9. *Prescribed Burning and Wildfires*

WDNR has been monitoring the implementation and effectiveness of its forestry best management practices since 1995 and recently reported results on monitoring 521 federal, state, county, private, and industrial timber harvests between 1995 and 2006 (Shy and Wagner 2007). These results were further broken down into two of the ecological landscapes represented in Wisconsin's Lake Superior basin (Bayfield Sand-Plains and Superior-Ashland Clay Plain). Results indicate that forestry BMPs are generally being applied correctly both statewide and in the Lake Superior basin. However, application of timber harvesting, Riparian Management Zone (RMZ), and especially forest road BMPs could be improved in Superior-Ashland Clay Plain (Figure 5.1). Impacts to water quality were generally not observed during timber harvest monitoring when BMPs were correctly applied.

The Bad River Tribe initiated its Silviculture Monitoring Project in 2007, utilizing Clean Water Act Section 319 funds. As part of this project, BRNRD reviews timber harvests occurring within the Reservation boundaries and provides recommendations to minimize impacts to the water resources. BRNRD is currently reviewing and revising its timber harvests BMPs.

It is not currently known or being tracked what type of harvest and management techniques are being used (or not being used) on the approximately 27% of forest land in the Marengo River Watershed without a known forest management plan (see Chapter 2.2.5). There are approximately 1,146 private landowners in the watershed. Most of the private forest land is located in the soil transition zone and clay plain areas.

Recognizing the importance of forest management on private lands to achieving slow the flow and other natural resource management objectives unique to the Lake Superior Basin, WDNR recently completed an outreach and education project targeted at private woodland landowners in the Lake Superior basin. The project was part of WDNR's 2008 update to its open

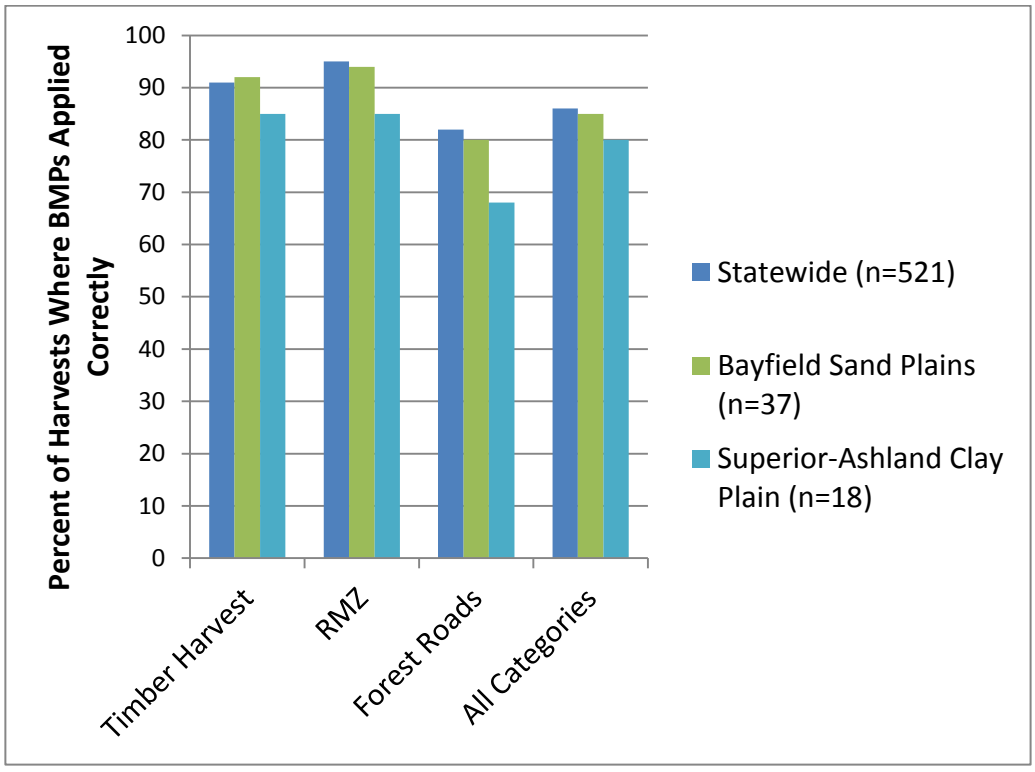


Figure 42.1. Percent of monitored timber harvests where Wisconsin Department of Natural Resources forestry best management practices (BMPs) for timber harvest, RMZ (riparian management zone), forest roads, and all BMP categories combined were applied correctly.

lands assessment data. The project included a survey of woodland landowners with greater than 10 acres. See Chapter 2.1.5 for a description of survey results. It also included a series of workshops targeted at private woodland landowners during spring 2010 and a workshop targeted at natural resource managers in September 2010. Funding has recently been made available for private woodland landowners to help defer the costs of developing a management plan for their woodlands.

Efforts to reach out to private woodland landowners and encourage the development of management plans that consider things like water quality and wildlife habitat need to continue, particularly as land is parcelized into smaller pieces and more individual landowners. Monitoring of BMP effectiveness has shown that, in general, BMPs are being followed during harvest management activities on lands with third-party oversight of harvest activities. Areas for improvement have been noted and education, outreach and monitoring must continue to ensure that strides that have been made in forest management and harvest continue. Providing additional and more diverse management opportunities and incentives that meet the needs of individual land owners are also needed.

One example of providing diverse management opportunities and incentives that is in its beginning stages is called the Shared Landscape Initiative (SLI, http://www.nrs.fs.fed.us/niacs/climate/Wisconsin/sli/). The SLI is a partnership effort that was launched in 2010 to provide a forum for the forestry community in northern Wisconsin to discuss climate change impacts on ecosystems, management responses, and cooperative activities across a variety of organizations. The SLI is intended to be a demonstration of climate change adaptation by providing real-world examples of forest management activities that enhance the ability of forests to cope with changing conditions, while meeting forest management goals. The SLI is focusing its efforts in the land areas near Mellen, WI, which includes portions of the headwaters area of the Marengo River Watershed. Efforts under the SLI are promising and should be promoted as part of implementing the Marengo River Watershed Action Plan.

1.1.3 POWTS

In addition to managing livestock waste, human waste management through update and maintenance of private on-site wastewater treatment systems (POWTS) is needed to reduce bacteria and nutrient inputs to the Marengo River. There are currently no centralized wastewater treatment facilities in the Marengo River Watershed.

The Bad River Tribe currently has a Private On-site Wastewater Treatment and Disposal Systems Ordinance (Ch. 406 of Tribal Code), which covers the design of systems along with maintenance and inspections. Various funding sources and mechanisms are used to support this program.

Regulation of POWTS in Wisconsin is described in Chapter SPS 383 (formerly COMM 83) of Wisconsin Administrative Code. Counties Zoning Departments typically act as the administrative agents for enforcing SPS 383 and other related code chapters relative to POWTS. Funding for developing and maintaining POWTS programs is not currently available from the State and counties use various mechanisms to implement their programs through taxes and fees.

Bayfield and Ashland County currently have different approaches to implementing SPS 383. These approaches and hindrances to implementing SPS 383 need to be further explored in order to identify specific needs each county has to ensure POWTS are adequately updated and

maintained and to ensure that water quality in the Marengo River Watershed meets appropriate recreational use standards and its ORW designation.

A sanitary survey and survey for potential illicit discharges should be conducted along the lower stem of the Marengo River from the Ashland County line to the river mouth. Providing technical and cost-share assistance to homeowners for updating or replacing poorly functioning POWTS and to local municipalities for installation of centralized sanitary districts or similar centralized waste treatment systems should be a priority.

1.1.4 OTHER "SLOW THE FLOW" MANAGEMENT ALTERNATIVES

- Complete a "flood flow reduction" or "precision conservation" analysis to pinpoint priority areas and best management practices in the Marengo River Watershed to increase surface runoff attenuation, reduce peak flows, and reduce sediment erosion (local example in Blodgett, 2009).
- CREP applies only to perennial streams, so concentrated flow areas and other drainages that may only carry runoff during snowmelt and storm events are not adequately addressed through this program. In addition CREP requirements and restrictions may not meet the needs of all landowners who qualify for the program. Re-evaluating CREP to address these issues or developing an innovative native-tree planting program that leverages methods utilized in CREP will help reduce the amount of open land in priority areas (see Chapter 2.3.2).
- Install flow-deflecting vanes and utilize other stream bank stabilization materials at priority eroding valley walls and banks (see Chapter 2.3.1 for survey map) in the Marengo River and tributaries. Use methods such as those described in Fitzpatrick *et al.* (2005).
- Prioritize watershed streams for instream restoration practices such as addition of wood and other material to increase stream roughness and application of selective wood removal (such as in Dumke 2009) as a technique to induce scour of the stream bed and exposing underlying coarse substrates for aquatic habitat improvement.
- Utilize "slow the flow" techniques that have been used in stepped grade control "hold the sand" in ephemeral channels.
- Utilizing ditch plugging and other tools to break drainages in agricultural fields no longer in production.
- Restore or enhance wetlands in critical locations to improve water storage (along with other beneficial functions). Protect wetlands currently providing this water storage function in critical locations. Evaluate and prioritize areas for wetland protection, enhancement, and restoration at the watershed scale.
- Floodplain re-connection by scraping off levees formed by excess sand deposition.
- Increase technical support for and development and implementation of managed intensive grazing for beef, dairy, and other livestock operations. Managed intensive grazing involves frequently moving livestock to new pasture and is being implemented on an increasing number of beef farms in the Marengo River Watershed. The system has many benefits such as fewer inputs from farm machinery (i.e. fertilizing fields,

harvesting and transporting forage), manure is delivered directly to fields as they are grazed, reduced exposure to disease that can occur with animals raised in confinement, improvements in soil and forage quality, and higher prices for meat produced in this fashion.

- Another example being explored locally (Ashland/Bayfield County UW-Extension) is producing woody biomass for emerging biofuels markets. Experiments are underway to determine what species and strains of various rapidly growing woody plants (such as hybrid poplar and willow) grow well in the climate and soils of the Lake Superior Basin and may provide alternative crops that feed increased local demand for woody biomass, provide income streams for local farmers and other landowners, and provide "slow the flow" benefits to Lake Superior watersheds.
- Further exploration and development of pilot and demonstration projects of alternative agriculture production that provide market-based solutions to enhancing ecosystem services should be a priority for the Marengo River watershed and other areas in the Lake Superior Basin.

1.1.5 BRWA CULVERT PROGRAM

Problems at road crossings are currently being addressed in the Bad River Watershed (including the Marengo) through a cooperative partnership coordinated by BRWA and involving USFWS, local towns, counties, USFS, Bad River Tribe, Northland College, and others. BRWA's Culvert Program aims to:

- Educate watershed citizens about the environmental and fiscal costs of improperly designed and/or installed culverts,
- Identify and inventory all stream/road crossings in the Bad River Watershed,
- Prioritize crossings in need of repair with respect to fish passage barriers and sedimentation, and
- Search for funding to help pay for new installations.

As of the end of 2010, over 900 of the approximately 1,000 known road crossings had been inventoried in the Bad River Watershed. A preliminary needs assessment (BRWA 2007) was conducted by applying the following critical criteria to the culvert inventory data: 1) Is the culvert embedded into the stream channel?; 2) Is there a drop of six inches or greater at the outlet?; 3) Is the velocity of water in the culvert 0.7ft/sec (0.2m/s) or greater?; 4) Is there moderate or severe bank erosion up or downstream of the culvert?; and 5) Is the embankment slope on the up or downstream side of the culvert greater than or equal to 1.5:1?

Following the preliminary needs assessment, a priority list of 21 culverts for restoration was developed by discussing needs assessment data with technical partners and town government officials. The list is presented in the BRWA Culvert Program Strategic Plan (BRWA 2008). Fourteen of the 21 culverts on the initial priority list are located in the Marengo River Watershed.

As additional inventory data becomes available the priority list may be amended. Recommendations from town or county road crews are also taken into consideration and can

change the priority ranking for a site. Program partners meet on an annual basis to revise the priority project list. To date, five culverts have been replaced in the Marengo River Watershed through the BRWA-led program, with another scheduled for completion in 2011. When project sites are chosen, all culvert remediation projects go through the following series of steps to ensure success:

Engineering: The engineering work to design the new crossing is typically completed by a county, state, federal or other engineer with training in fish friendly design. The engineer is selected on a site-to-site basis depending on the location of the crossing site.

Permitting: All permitting is the responsibility of the appropriate jurisdiction. Engineers that design fish friendly crossings in this plan work with those jurisdictions to complete required permits.

Funding: The BRWA Culvert Program is often involved with locating and providing funding for the pipe, with match for the project contributed by local townships or counties to install the pipe.

Installation: The installation is carried out by state, county, township, or tribal road crews or by a contractor of their choosing. Installers for BRWA's Culvert Program must be willing to work with all participating partners and install new structures according to design plans.

Monitoring: Monitoring is conducted to assess the effects of culvert replacement on fish and sediment delivery at the remediation sites. BRWA and partners coordinate and conduct this monitoring. The monitoring includes fish population assessments and habitat assessments.

Continuation of this collaborative program is a priority for reducing sedimentation and peak flows and improving aquatic habitat.

1.1.6 INVASIVE SPECIES MANAGEMENT

The Northwoods Cooperative Weed Management Area (NCWMA) is a collective group of federal, state, municipal, and tribal agencies, as well as nonprofit organizations and community groups working together to reduce the impacts of invasive species in the northern four counties of Wisconsin, which encompass the Marengo River Watershed. For the past five years, the NCWMA has met monthly to exchange information, collaborate on projects, and coordinate regional invasive species efforts. The NCWMA provides a great resource for invasive species efforts in the Marengo River Watershed by conducting outreach with the public; training professionals whose work is affected by invasive species; providing expertise in species identification, biology, and control methods; coordinating survey and control efforts; and obtaining additional funding for future projects.

More surveys need to be conducted (in high-quality and highly disturbed areas) to determine presence and absence of aquatic and terrestrial invasive species, particularly those listed as

"prohibited" and "restricted" in Chapter NR 40 of Wisconsin Administrative Code. This could be accomplished through the NCWMA.

Keeping high quality areas uninfested is a high priority. High quality areas could include high-quality wildlife habitat, but may also include highly productive farmlands in the Marengo River Watershed. New populations of invasive species that show up in relatively uninfested areas need to be dealt with quickly. "New populations" are defined as existing for approximately five years or less.

Many species will infest disturbed areas (roadsides, gravel yards, etc.) but may not readily spread into natural areas (forests, wetlands, etc.). These species, such as bull thistle or common mullein, are a lower priority than other species that are capable of spreading into uninfested natural areas. Species that would fall into this category would be *garlic mustard, leafy spurge, Japanese knotweed, Japanese barberry*, and possibly others.

To date, the NCWMA has worked to manage invasive species in the Marengo River Watershed by coordinating agencies working on invasive species; training municipal officials and employees on invasive species best management practices (Ashland Co, Bayfield Co, Town of Lincoln); conducting limited surveys along roadsides; conducting limited treatment of isolated infestations; and introducing biological control agents for purple loosestrife. These activities and more are addressed as actions in the Action Plan.

An invasive species treatment protocol has been recommended by the NCWMA for the Marengo River Watershed. The treatment protocol includes:

1) That treatment methods be chosen based on recommendations from:
    a. Local experts with experience doing control work in the region, such as agency staff and certified contractors
    b. Wisconsin DNR invasive species website – www.dnr.wi.gov/invasives/plants.asp
    c. "Invasive Plants of the Upper Midwest" by Elizabeth Czarapata, which outlines detailed options for controlling invasive plants in Wisconsin.
2) That integrated pest management (IPM) will be applied, utilizing manual, mechanical, and biological control methods whenever possible to minimize the impacts of pesticides in the watershed.
3) That landowners should receive financial assistance to control large-scale infestations (1 acre or more of an infested area.)

Treatment not only refers to invasive species that are already known to be in the watershed, but also refers to the control of new and potentially harmful species. "New species" could be defined as those that have only been known to occur in the area for five years or less. "Potentially harmful species" are those that will cause the most harm to the environment, economy, or human health. In the Marengo River Watershed, this may include species that would impact crop production (hay, corn, etc.), timber production, forest habitat, riparian habitat, open field habitat, and human health.

Monitoring and treatment for invasive sea lamprey and evaluation of treatment options that are effective but minimize damage or concern to other natural resource components should continue.

1.1.7 LAND PROTECTION

One of the most effective tools for long-term water quality protection is permanent protection of sensitive lands. Permanent protection is best achieved through purchase, donation, or conservation easement. Permanent protection of high priority areas will help maintain the ecological integrity of the most sensitive areas.

There are two local land trusts that work to protect land in the Watershed: Bayfield Regional Conservancy and West Wisconsin Land Trust. Local governments also participate in land protection efforts. The Bayfield Regional Conservancy, a local land trust located in Bayfield, Wisconsin (www.brcland.org) has identified the Marengo River Watershed as a Priority Conservation Area (PCA) in its "Strategic Conservation Plan for Lake Superior's Bayfield Peninsula" (2009). PCAs are defined as areas where several high quality conservation values (e.g. wildlife habitat, water quality, rare species, scenic features, and wetlands) overlap, creating a "hot spot" for conservation. The Marengo River Watershed was identified as a PCA primarily due to the high water quality of its rivers and streams, and the landscape context that provides important habitat areas. It should be noted that this Strategic Conservation Plan only covers the Bayfield County portion of the watershed. An Ashland County Strategic Conservation Plan for BRC will be completed at a later date, and the completion of this plan is a recommended action in the Action Table in Chapter Six. The area of the PCA is 44,878.41 acres and includes the following conservation targets (Table 5.2, Figure 5.2).

Table 5.26. Conservation Target Acreages identified by Bayfield Regional Conservancy for the Marengo River Watershed.

High Priority	**Medium Priority**
Public: 11, 720 acres	*Public:* 82 acres
Private: 8,653 acres	*Private:* 1,321 acres

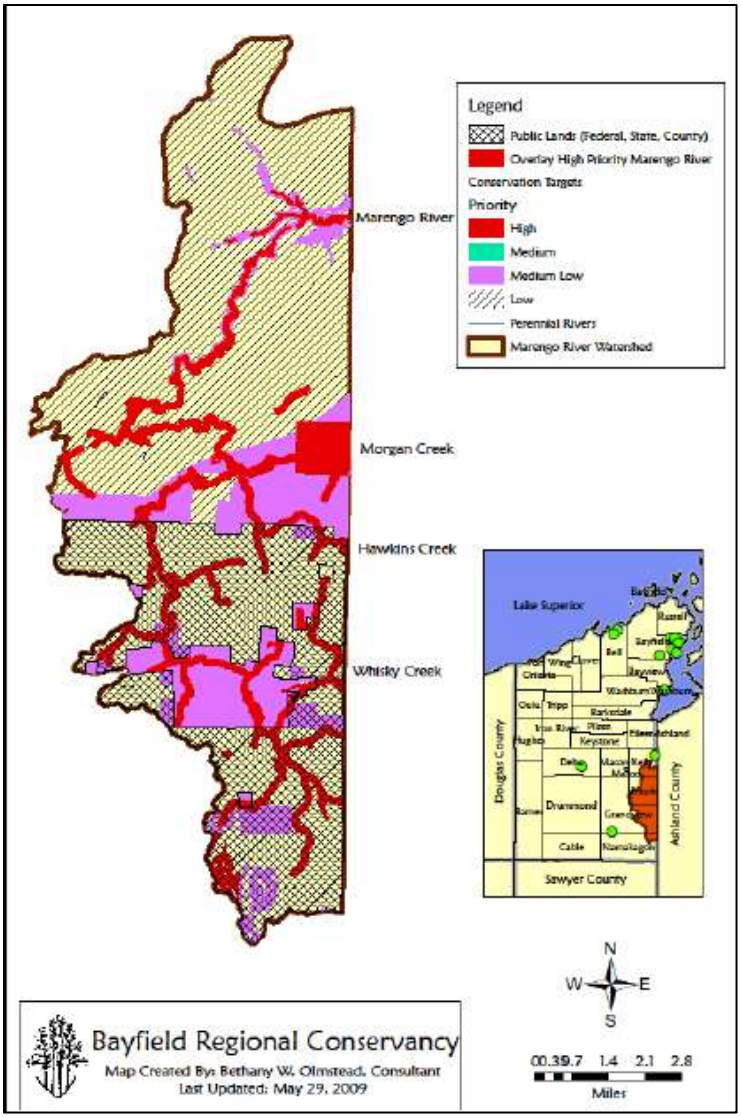


Figure 5.43. The Bayfield Regional Conservancy's Marengo River Watershed Priority Conservation Area.

2. MANAGEMENT AREAS

The Marengo River Watershed has two distinct areas that differ in land use, land cover, and geology and form a logical break in terms of the approach to applying management practices that will help meet watershed goals. These areas will be referred to as the Soil Transition and Clay Plain and the Upper Marengo River Watershed. These two areas are roughly defined by the boundary between sand and sand/gravel surficial deposits and clay surficial deposits and an elevation of approximately 1,050 feet above sea level (Figure 5.3, also see Chapter 2.2.3). Although the overall goals for the Marengo exist for the whole watershed, the focus for management activities in these two areas will be different.

2.1 SOIL TRANSITION AND CLAY PLAIN

The lower, northern third of the watershed (approximate elevations 1,050 feet to 690 feet above sea level) is characterized by mostly private land ownership, the majority of farming activities and open land/young forest, erodible sand over clay and clayey soils, an extensive road network, severe streambank/valley erosion, sediment overload, and overall unstable hydrologic conditions. The open lands assessment, modeled peak discharge estimates, and streambank/valley erosion surveys described in Chapter 2.2 show that areas within the soil transition and clay plain are most susceptible to excessive peak flow volumes leading to erosion and sedimentation problems that in turn affect aquatic habitat and water quality. These converging factors make this management area the key place for implementing practices that reduce the volume and rate of surface runoff to watershed streams, or "slow the flow," sedimentation, and reducing nutrient and bacteria concerns from human and livestock waste management. Many programs are currently in place to help reduce surface runoff, erosion and sedimentation, and improve human and livestock waste management. Coordination and delivery of these programs as well as new and innovative approaches for delivering these types of management practices to where they are most needed can be improved and are priorities. Areas that are already high quality need to be identified and conservation planning efforts should be undertaken with the goal of protecting these areas. Overall, restoration activities that attempt to blend human needs for the landscape with management practices that improve watershed function and build watershed resilience to climate change will be focused in this management area.

2.2 UPPER MARENGO RIVER WATERSHED

The southern, forested two-thirds of the watershed (approximate elevations 1,443 feet to 1,050 feet above sea level) is primarily in federal ownership as part of the Chequamegon-Nicolet National Forest (CNNF), has a relatively stable hydrologic system, and is characterized by sandy, glacial till soils, rock outcroppings, and a significant amount of the watershed's wetland acreage. Because it contains the headwaters this is the most critical portion of the watershed to protect. This part of the watershed is vulnerable to the potential impacts of large-scale iron mining and will also serve as an important area to build and expand watershed resilience to impacts of climate change. In these areas, the focus should be on continuing to identify and improve road and surface water interactions, identifying and removing stream barriers and old ditching or drainage systems that contribute increased runoff and stream power to lower watershed reaches, monitoring and removing populations of priority terrestrial and aquatic invasive species, protecting and restoring wetlands, and stabilizing streambank erosion sites.

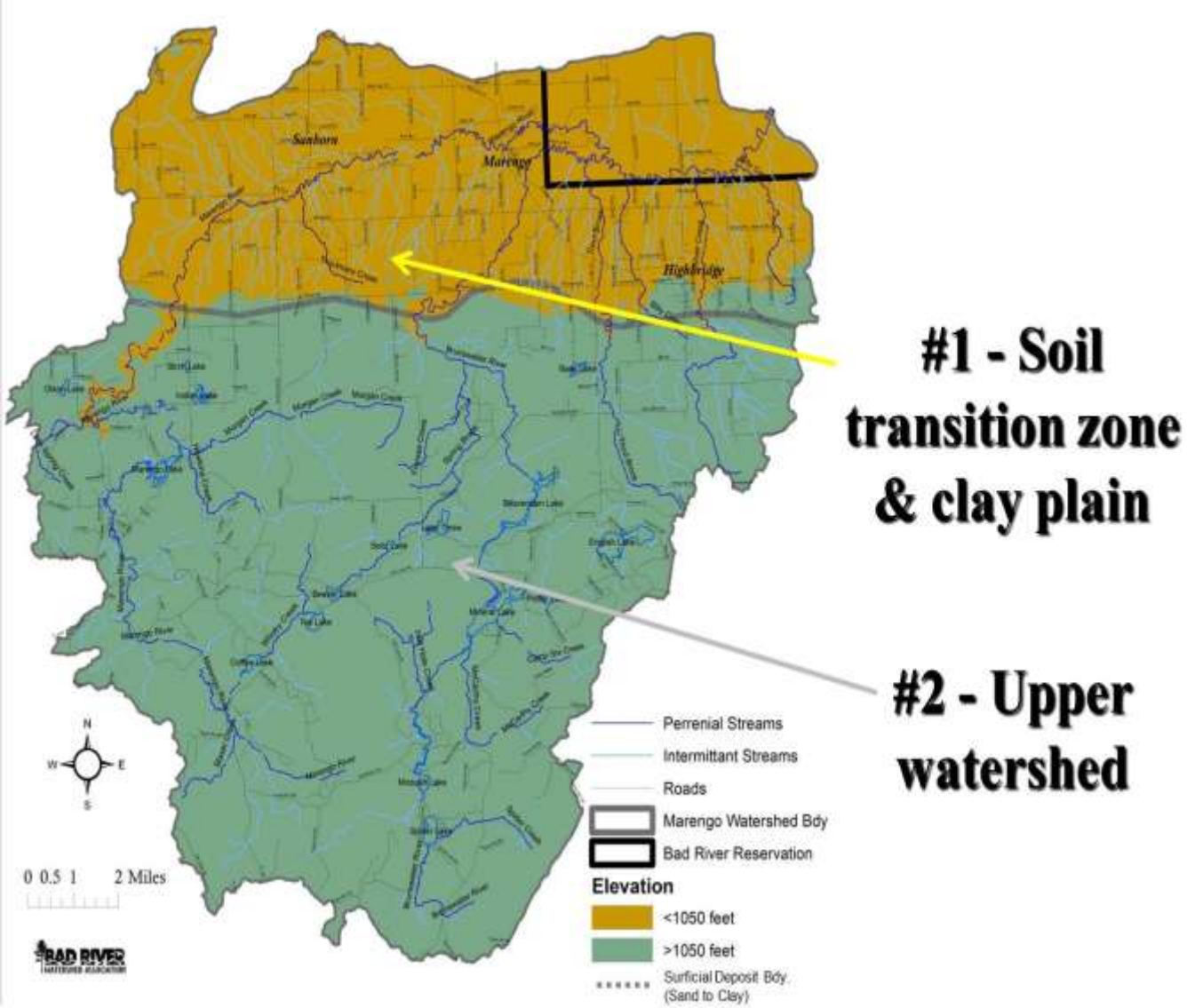


Figure 44.3. Management areas for the Marengo River Watershed Action Plan.

3. WATERSHED OUTREACH AND CITIZEN INVOLVEMENT

Management alternatives utilized to engage and involve citizens are critical to meeting the watershed vision and goals. As was just described in Section 5.2, most of the land in the soil transition and clay plain area is in private ownership and implementing many of the BMPs and management alternatives described in Section 5.1 will require strong interest and cooperation from watershed landowners. Section 5.3 describes watershed outreach and citizen involvement activities utilized during the planning process and the outreach and citizen involvement strategies needed to implement the watershed action plan.

3.1 OUTREACH AND CITIZEN INVOLVEMENT IN THE PLANNING PHASE

Involving watershed citizens in the planning process to develop the Marengo River Watershed Action Plan was a very important part of the MRWP Project. Efforts were made to engage watershed stakeholders in the process of creating the Watershed Action Plan, and to foster water and natural resource stewardship in watershed citizens through project outreach. A Citizen Involvement Team (CIT) was formed to identify the concerns and interests of local citizens related to the land and water resources in the watershed, and identify outreach and citizen involvement opportunities for watershed citizens (a more complete description of the CIT is in Chapter One).

Various opportunities for citizen involvement were created to appeal to different levels of interest. Through the outreach and citizen involvement activities, citizens contributed either water quality data, their vision for the future of the watershed, issues and concerns about the watershed, as well as identifying specific project ideas and their locations in the watershed. The following is a summary of the outreach and citizen involvement activities that were conducted for the MRWP Project. The citizen input received was translated into action items and incorporated into the Watershed Action Plan.

"Marengo Riffles" Newsletter

The CIT with input from citizens at the December 2009 MRWP Project Partners meeting collaborated to create a newsletter specific to the MRWP Project. In a rural community where its residents are widespread, or absentee, it was recommended by some local residents that a mailing piece was needed to keep landowners informed of project happenings. Two editions of the "Marengo Riffles" newsletter were distributed, one in February 2010 and another in September 2010. The newsletter was mailed to over 1,100 property owners that own land within the Marengo River Watershed. Many positive comments were received from residents that they would like to see the newsletter continue as the Watershed Action Plan continues into the implementation phase.

Community Events

BRWA staff attended several community events to present a display on the MRWP Project and talk with citizens about their issues and concerns for the watershed. Certain events were also attended to learn more about land use and water quality issues in the Lake Superior Basin. Events attended were:

- "Coffee and Conversation" at Four Corners Saloon
- Bay Area Farm and Garden Show
- Wild Rivers Chapter of Trout Unlimited fundraiser
- "Learn About Your Land" Woodland Owner Class Series
- "Critical Issues in the Forest Industry" Conference and Workshop
- Bayfield Regional Conservancy and Living Forest Cooperative Forest Landowner Workshop

- "Slow the Flow: Forests, Water Quality, and Land Management in the Lake Superior Basin" Workshop

"Make Your Mark on the Marengo" Watershed Map and Project Ideas

BRWA staff developed a traveling watershed map display to take to community events as a visual aide to help citizens think of projects they would like to see occur in the watershed. Sticker "dots" were provided for citizens to mark their project location in the watershed. The "dots" were numbered and a corresponding numbered card was filled out to give more detail on the location of the project and a project description. The contributors contact information was also included so that they could be contacted at a later date if BRWA staff had questions about their idea. Over 140 projects and project ideas were submitted, and fit into one of the following categories: 1) streambank erosion, 2) road/culverts, 3) habitat, 4) education & outreach, 5) waste disposal, 6) economy, 7) invasive species, 8) monitoring, 9) recreation, 10) streamside buffers, and 11) special designation (Figure 5.4). The full list of projects and project ideas submitted is in Appendix D.

Project Website

In the winter of 2010, project webpages were created on BRWA's website to provide information to the public during the development of the Watershed Action Plan for the Marengo River Watershed. Topics covered on the website include:

- A general description of the watershed and the MRWP Project
- MRWP Project meeting announcements, notes, and presentations
- The draft Marengo River Watershed Action Plan
- Events and participation opportunities related to the MRWP Project
- Links of interest related to the Marengo River Watershed

The website is located at www.badriverwatershed.org.

Project Partner Community Meetings

The MRWP Project Partner Community meetings were convened to work on parts of the Watershed Action Plan, and to inform the public of the status of the project. Six community meetings were held in different locations in the watershed (August, December 2009; March, June, October, December 2010). Over 150 people attended the MRWP Project Partner Community Meetings.

At the MRWP Project Partner community meeting held in December 2009, agency representatives and interested citizens came together to learn about the project and the process of action plan development. The first contributions of citizen input were gathered at this meeting through a visioning exercise facilitated by Ruth Oppedahl, Lake Superior Basin Educator with the UW-Extension. Notes from the Vision Statement exercise can be found in Appendix E. The CIT developed drafts of a vision statement and presented these at the MRWP Project Partners meeting in March 2010 for comment. The vision statement appears in several locations throughout the Watershed Action Plan.

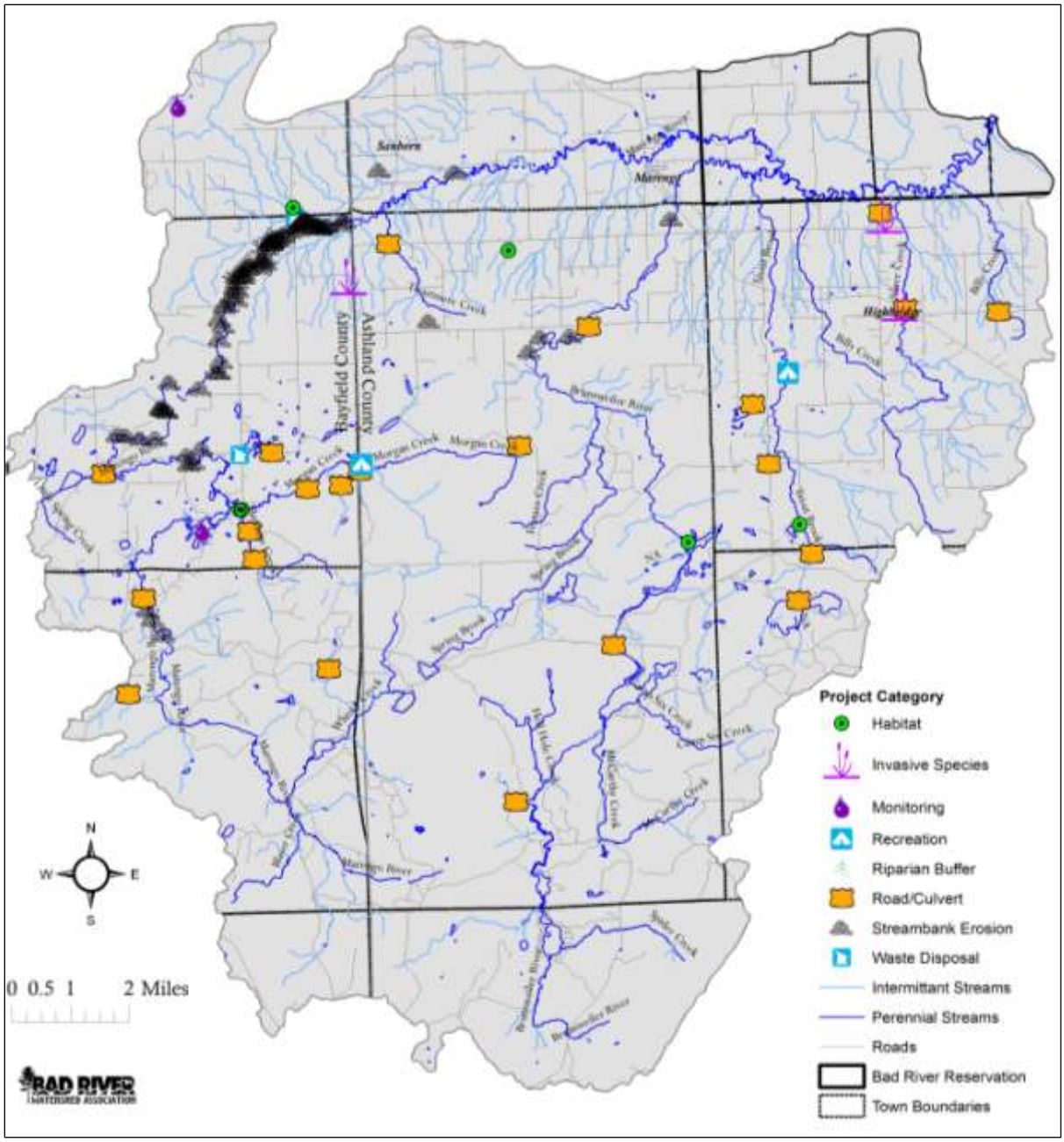


Figure 5.45. "Make Your Mark on the Marengo" Watershed Map with project ideas gathered via citizen input. Project ideas are incorporated within the actions of the Action Plan table.

Volunteer Water Quality Monitoring and Stream Assessments

Water quality monitoring is the flagship program of BRWA, and one of the ways the organization has involved citizens in protecting and caring for their home watershed. As part of the MRWP Project, water quality monitoring in the Marengo River Watershed was continued with the work of water quality volunteers. Ten sites were monitored on the Marengo River and its tributaries. Data was collected by citizens for water chemistry, bacteria, and macroinvertebrates.

Additional sites on Marengo River tributaries were monitored by Sharon Anthony's May 2009 and 2010 term Ecological Chemistry classes at Northland College. Students from this class were able to sample seven additional sites and collect data on water chemistry and bacteria. Additionally, a new citizen involvement field activity was initiated with the MRWP Project. Volunteers helped conduct stream assessments during "Get to Know Your Watershed" field days on the Marengo River to identify eroding banks, depositional areas, and beaver dams and/or log jams that are impeding flow on the river. Nineteen volunteers spent 12 days in the field collecting data that is used in the Watershed Action Plan to identify sites in need of restoration.

Local Community Survey Review and Summary

One tool that BRWA used to assess the interests and concerns of watershed citizens are the local community surveys that have been conducted over the last few years. Community surveys have been conducted in Ashland County (2003) and Bayfield County (2008) for the purposes of comprehensive plan development. A survey of woodland landowners in the Lake Superior Basin was conducted by UW-Extension and WDNR (2009) to learn more about their forest activities and effects on water quality in the Lake Superior Basin, of which the Marengo River Watershed is a part. Information that was relevant to towns within the Marengo River Watershed was selected out, and reviewed and summarized to capture thoughts related to land and water resource protection.

General themes that emerged from this review include:

- Local citizens recognize the importance of and care about protecting land and water resources in the area.
- Keeping the watershed natural, preserving wild and scenic characteristics, and maintaining rural character of the area are very important.
- Many citizens feel that water resources are currently in pretty good shape, but are concerned about more visible pollutants such as trash and litter, rather than sediment and nutrients that are less visible.
- Preserving or improving water quality is important to local citizens. In general, water quality was valued more than economic development. However, willingness to pay as an individual for water protection is of concern even though citizens agree it is important.
- Agricultural lands are favored just as much as lakes, rivers, and wetlands to local citizens.
- Land use and agricultural, natural, and cultural resources ranked of higher importance than economic development (at least, in the Bayfield County towns).

A more detailed report of the findings of this local community survey review and summary can be found in Chapter 2.1.6.

MRWP Project Survey

BRWA developed a simple questionnaire to learn more from Marengo River Watershed

landowners, how they use the watershed, and what their concerns might be for watershed health. The questionnaire was not a scientific survey of the population, rather an attempt to get feedback and ideas from people in an informal way. It was mailed to 1,100 Marengo River Watershed landowners in the spring 2010 issue of the *Marengo Riffles*, a newsletter developed to inform the public about the MRWP Project. The questionnaire was also made available on BRWA's website to respond online, and was made available at events that BRWA attended to promote the MRWP project. We received 18 responses to the questionnaire (n=13 mail or event responses, n= 5 online responses).

The first question in the MRWP Project Survey asked respondents about what types of things they do in the watershed. Fishing was the most common response for what people do in the watershed (22%), followed by hiking (18%) and hunting (15%) and canoeing (15%) (Figure 5.5).

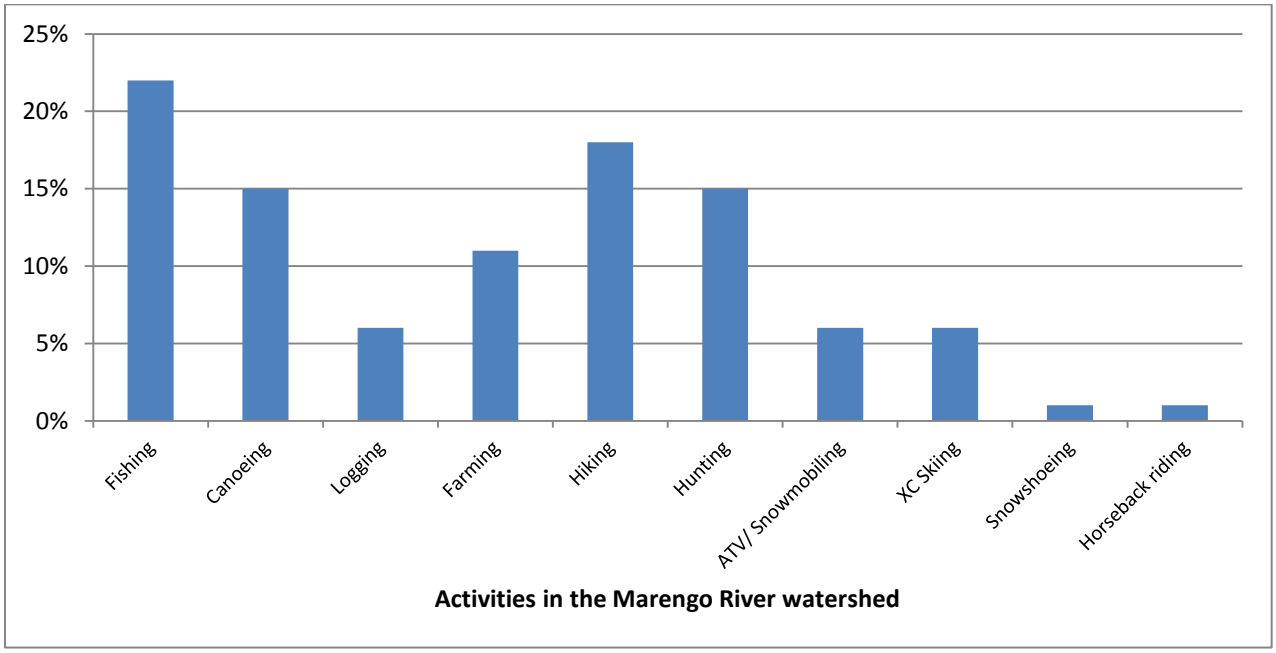


Figure 5.46. Responses to the BRWA MRWP Project Survey when asked "indicate the types of things you do in the watershed."

When asked about the most common water quality concerns in the watershed, bank erosion (19%) was the most common concern (Figure 5.6). Other important concerns were invasive species (14%) and bacteria contamination (14%), as well as degraded fish habitat (13%), development (13%), and poor water quality (13%). Drained wetlands were also of concern (8%), and some indicated flooding, deforestation, and drought.

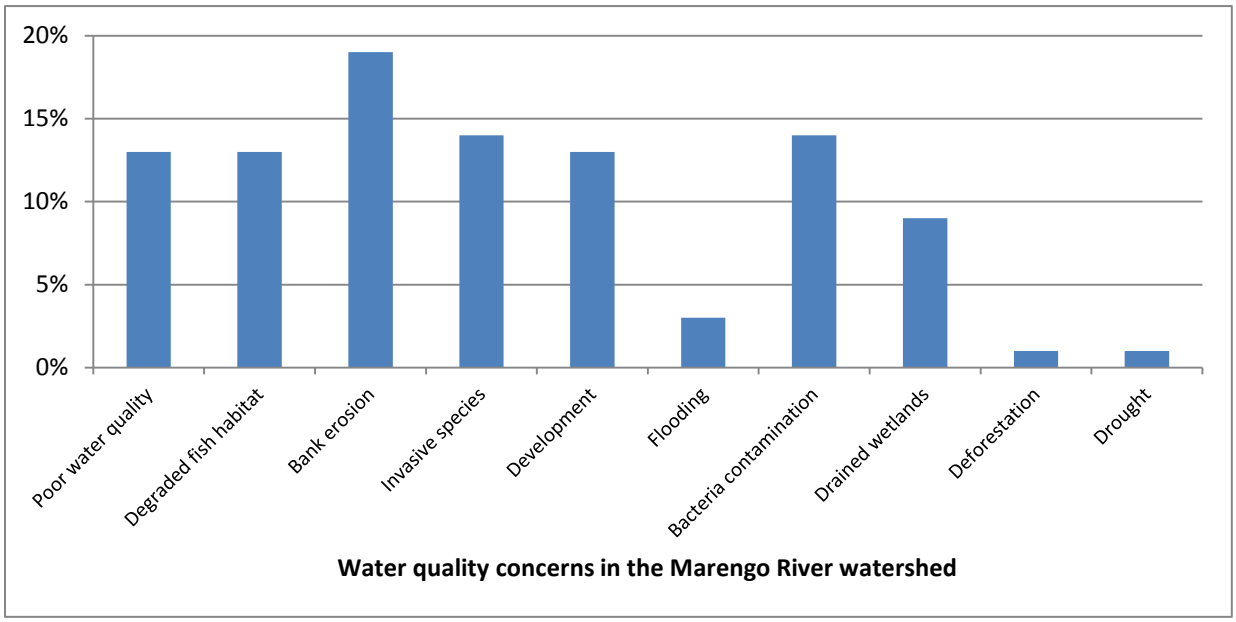


Figure 5.47. Responses to the MWRP Project Survey when asked "indicate what your concerns are about the quality of the watershed."

When asked about hopes for the watershed into the future, responses were consistent with other area community surveys, and input we have received to date for developing the vision statement for the Watershed Action Plan. Themes emerged of maintaining rural character, keeping the watershed natural and wild, preserving scenic qualities, limited and careful development, and preserving or improving water quality.

Respondents were also asked to submit ideas for projects that would protect the health of the watershed. Most responses were general and did not indicate real specifics or project locations in the watershed. However, suggestions indicate support for projects such as:

- Educational opportunities or programs for farmers to help reduce chemical use on farms; also conservation programs for farmers to help keep cattle out of creeks or improve manure management
- Working with local government and agencies for stronger enforcement of ordinances, rules and regulations
- Improved help for landowners to protect stream banks and control erosion
- Invasive species control or eradication
- Nonpoint source pollution control
- Drinking water testing

An additional comment was the importance of partnering with the US Forest Service, particularly in relation to issues in the headwaters of the watershed, of which the majority is a portion of the Chequamegon-Nicolet National Forest.

Site visits and one-on-one interviews

Town leaders and road crews: One of BRWA's most well-known programs, particularly in working with local towns, is its Culvert Inventory and Restoration Program. BRWA has worked to inventory and restore problem culverts that were having a negative impact on fish passage and contributing sediment to streams at road/stream crossings. This program has provided a benefit not only to water resources, but also to towns with limited budgets that have roads and culverts to maintain. BRWA staff visited with town leaders from six towns in the Marengo River Watershed and talked to 23 people, including representatives from the town boards and road crews. These meetings were held to identify town concerns with culverts or road maintenance that could be addressed in the Marengo River Watershed Action Plan.

At these meetings, priority culverts were identified based on inventory data and the on-the-ground knowledge of the road crews, as well as road maintenance schedules and what the towns have planned for maintenance in the upcoming years. Issues with road shoulder erosion were also discussed and areas in need of help were identified. Another topic of discussion for towns was waste disposal. Garbage and recycling options are typically good, but tire disposal is an issue for many towns. Since this seemed to be a common issue, there is great potential for towns to partner together to resolve this and conserve resources and cost. Another potential area for towns to partner together and should be explored through the Watershed Action Plan is landowner education and assistance with septic system maintenance. Support for this at the county level differs between Ashland and Bayfield County, and so more proactive measures taken by the towns could help with this issue.

Farmers: Many watershed residents' livelihoods depend on agricultural uses. About 13% of the land area (about 18,000 acres) in the Marengo River Watershed is actively cultivated or in pasture/hay or grassland (see Table 2.3). Farming in the watershed includes primarily beef and dairy farming, although there are some vegetable crops farmed as well. Even though agriculture activities cover a small area of the watershed, they play a very important, localized role in maintaining a healthy watershed (see sections 2.3, 2.4 and 2.6). A selection of farms was visited in the watershed to identify common issues and concerns related to farming in the watershed, and to see their farming operations firsthand. BRWA staff visited seven farms (3 conventional beef farms, 3 conventional dairy farms, and one USDA certified organic vegetable and fruit farm).

Generally, there is a great effort being made by local farmers to be good stewards of the land. One example noted by farmers is that many are now keeping their cattle out of ravines, unless there is a pressing need to do otherwise. Some of the farmers visited said that the ravines are in better shape than they used to be because people are more aware. Farmers all want to do the right thing, and keep a good image and be good neighbors. Nutrient management, such as manure spreading and storage is an issue. Many farmers have nutrient management plans, but actually implementing them and getting assistance from UWEX or other government agencies is where the plans fall short due to limited staffing and budgets. In fact, participation by farmers in government conservation programs is virtually none in this watershed. There are only two

farms that are enrolled in CREP (Conservation Reserve Enhancement Program). The general feeling by the farmers we talked to is that they do not have enough time to learn about available programs, that the financial incentives are not enough to make it worthwhile, and there is too much red tape and restriction to get through. There is interest though by farmers in the Marengo to do conservation practices, such as restoring wetlands on their property where they are no longer farming, but perhaps other means besides government programs should be explored to provide additional options and alternatives.

The economics of farming is an issue in the Marengo River Watershed, as it is across the country. In the Marengo, economics are driving farms to change from dairy to beef. Or in the case of dairy farming, there is pressure to increase the number of cows to keep up with competition, even though there is no profit increase from doing so because milk prices are down. Also as farmers increase in age, not many children are taking over because farming is not economically viable. There is concern about what the future of farming may be in the Marengo if there are no young farmers to take over. An alternative to the more conventional farms in the watershed is the USDA certified organic farm that is operating with a CSA (community supported agriculture) model. We discussed if the CSA model would work well for other small farms in this area. This may not be a viable option for many farms, in that currently there is not enough demand for the food products. The one CSA has difficulty selling all of its shares for a year, and with multiple farms there may not be enough demand to support all of them. However, a more cooperative model (i.e. South Shore Meats, Pasture Perfect Poultry) is something that could work well for small farms in the watershed, and is something that is currently being implemented by some farms in the area.

Educators: The watershed has one public school, and several groups of rural home-school families. The Marengo Valley Elementary School is part of the Ashland Public School system and is a K-5 school that has about 180 students that live throughout the watershed. The MVS also has an active Home and School Association that brings together MVS staff and parents to discuss school activities. BRWA staff met with the co-principals of the MVS to discuss the MRWP Project and learn more about how watershed concepts are incorporated into the curriculum. Watersheds and water quality concepts are currently not covered specifically in a "water unit", but the school is receptive to working with a group like BRWA or partner organizations to make the watershed connection, particularly as it can relate to multiple disciplines (English, art, etc. in addition to science). Opportunities to engage the students (and families through the Home and School Association) in water quality monitoring or other water resource activities should be explored.

Foresters and Loggers: Forests are a major land use in the Marengo River Watershed (cover ~75% of the basin) and thus, the management of forests plays a critical role in water quality. In developing the Watershed Action Plan, we have the goal to maintain a healthy watershed, while recognizing that people utilize forest products to make a living. As part of this, we worked to capture ideas, concerns, tools, and projects related to forestry. BRWA staff talked with local foresters and a small, private logger, as well as attended and received information at a conference in Ashland that addressed "Critical Issues in the Forest Industry" in Wisconsin.

In northern Wisconsin, the forest industry has suffered the effects of the economic downturn, leading to a number of paper and sawmill closures. The number employed in the industry has dropped from about 100,000 in 1996 to about 66,000 today. The "big players" in the local market for timber (such as Flambeau Paper, Xcel Energy, Sappi, etc.) seek to ensure they have enough raw materials to meet the demands for their industry. Because of their size, they can bid higher on area timber sales, which puts small loggers at a huge disadvantage because the larger companies have the market control.

The private logger we talked to discussed the low-impact logging services he provides to Ashland and Bayfield county clients. Despite having to compete with larger companies for work, He has strived to reduce negative impacts of his operation through close adherence to the Wisconsin DNR's Best Management Practices (BMPs). This is a set of voluntary guidelines that have been developed to lessen environmental damage associated with logging, including soil compaction, non-harvested tree damage, and erosion. He also described his struggles to make ends meet as a "small guy" who is competing against big economic forces. For an independent logger, he has lots of overhead to cover, such as the cost of owning his own equipment. To keep up with the larger businesses he has to own comparable equipment, and with increasing fuel costs, it is difficult to cover costs and come out ahead to make a living. A niche he can fill as a private logger is small firewood cuts. He is often is looking for small sales that the bigger companies won't consider, which helps with getting some work.

In general, it seems like the industry has accepted some level of "sustainable" harvest and third party certifications, such as FSC (Forest Stewardship Council) or SFI (Sustainable Forest Initiative). While these often can be cumbersome and time intensive, they do provide a baseline for timber harvest practices. According to one forester we talked to, probably the worst forest management practices are typically happening on lands that are not federal or state forest, not in an MFL program, or not subject to third-party certifications. In the Marengo, there is very little forest land that does not fit in one of these categories, therefore the feeling is that forest management is done pretty well in the watershed.

Biomass production for fuel is often discussed and looked to as a way to revive the forest industry and contribute to more use of renewable energy. However, the current information states that biomass production produces a fraction of the amount of jobs as does a paper mill. One representative from Flambeau Paper talked about how at their mills they are developing on-site biorefineries that can produce fuel for the operations, which may be one way that may ensure the viability of paper mills into the future. WDNR has developed biomass guidelines that recommend you need to leave about 30% of the biomass on the land to not degrade soil quality, however this varies depending on soil type. In Wisconsin, there currently appears to be enough biomass availability to support the major industries that are currently vying for raw material, such as Xcel Energy, Flambeau Paper, and wood pellet mills. It was concluded though from the remarks at the conference that using woody biomass will only be a small part of the renewable fuel solution, and that there just isn't enough available in Wisconsin for significant fuel production on a larger scale.

Public Comment Period on Watershed Action Plan

The public was invited to review and provide comment on the draft Watershed Action Plan. The review and comment period was announced in the fall issue of the "Marengo Riffles" project newsletter, BRWA's fall newsletter, on the BRWA website, as well as announced at the MRWP Project community meeting on October 7, 2010. The announcements described how and when the draft plan could be accessed and how comments could be submitted. After the comment period ended (November 12, 2010), the Watershed Action Plan was revised according to the comments received during this period. A final draft of the plan was presented to the public at the MRWP Project Partners Community Meeting on December 16, 2010.

3.2 COMMUNICATIONS PLAN

A communications plan for the Marengo River Watershed was initially developed as part of the MRWP Project for the planning phase of the project, and later adapted for the implementation phase. A goal, objectives, target audiences, and messages for the watershed were developed as well as a strategy to implement the communications plan. Pieces of the plan were developed by the citizen involvement coordinator and discussed and reviewed by members of the Citizen Involvement Team and BRWA staff.

3.2.1. GOAL AND OBJECTIVES OF THE COMMUNICATIONS PLAN

The goal of the communications plan is to ensure that citizens of the Marengo River Watershed are active and engaged in maintaining the integrity of the watershed.

The objectives of the plan are to:

1. Establish outreach and citizen involvement efforts to reduce pollution that impacts the Marengo River Watershed;
2. Increase general public's awareness and knowledge of water quality issues and watershed health;
3. Increase public participation in watershed stewardship activities;
4. Reduce pollution that impacts the watershed by providing practical knowledge to key watershed audiences; and
5. Increase citizen involvement opportunities that results in restoration, preservation, and protection of watershed health.

3.2.2 TARGET AUDIENCES AND MESSAGES

After developing a goal and objectives for the communications plan, the CIT discussed key audiences in the watershed. Based on the current knowledge of audiences in the watershed and their behaviors, outreach messages were developed. The target audiences and messages are listed here:

Households/ General Watershed Citizens

1. Watershed awareness: preserving sense of place and rural character of the watershed

2. Responsibility to care for the watershed: the water cycle, our land and water resources, and how we impact them
3. Healthy watershed for our children and future generations
4. Help protect water quality and your investment
5. Septic system maintenance

Private Woodland Landowners

1. Watershed awareness: preserving sense of place and rural character of the watershed
2. Responsibility to care for the watershed: the water cycle, our land and water resources, and how we impact them
3. Healthy watershed for our children and future generations
4. Good forestry practices means good hunting and fishing
5. Controlling spread of invasive species and invasive species management

Local Officials

1. Good land use decisions protect quality of life (rural character), property values, and water quality
2. Participation in Watershed Action Plan network (the MRWP)
3. Coordinate comprehensive plans and planning issues with neighboring towns
4. Identification and protection of key features and habitats: aquatic buffers, woodlands, wetlands, steep slopes, etc.

Farmers/ Agricultural Community

1. Watershed awareness: preserving sense of place and rural character of the watershed
2. Impacts of livestock in streams, livestock waste, and mitigation options
3. Advantages of and opportunities for vegetated buffer and filter strips
4. Impact of tillage methods/Importance of agricultural soil erosion and sedimentation control practices
5. Opportunities for market-driven solutions to conservation on agricultural and forest lands

River Riparian and Lakeshore Landowners

1. Watershed awareness: preserving sense of place and rural character of the watershed
2. Responsibility to care for the watershed: the water cycle, our land and water resources, and how we impact it
3. Riparian/ shoreline land management and importance of vegetated buffers
4. Septic system maintenance
5. Water-friendly lawn and garden practices: mowing habits, fertilizer/pesticide use, yard waste disposal, erosion control, landscaping with native plants, controlling spread of invasive species

Recreational Users

1. Watershed awareness: preserving sense of place and rural character of the watershed

2. Responsibility to care for the watershed: the water cycle, our land and water resources, and how we impact it
3. Protecting water quality preserves recreational opportunities
4. Controlling the spread of invasive species (waders, kayaks/ canoes)

Educators

1. Incorporating water quality and watershed concepts into curriculum
2. Watershed awareness: preserving sense of place and rural character of the watershed
3. Active participation in watershed activities and stewardship projects
4. Partnerships with community organizations or private sector

Tribal Members

1. Watershed awareness: preserving sense of place and cultural significance of the watershed
2. Healthy watershed for our children and future generations
3. Participate in Watershed Action Plan network (the MRWP)

Partner Organizations

1. Watershed awareness: preserving sense of place and rural character of the watershed
2. Active participation in watershed activities and stewardship projects
3. Communicate watershed issues to members and residents
4. Participate in Watershed Action Plan network (the MRWP)

3.3 OUTREACH AND CITIZEN INVOLVEMENT STRATEGY

An Outreach and Citizen Involvement Strategy was developed and projected for 10 years, which is the same timeframe projected for the Watershed Action Plan. The Outreach and Citizen Involvement Strategy is incorporated throughout the Watershed Action Plan, but also more specifically into actions #24-27 (Table 6.1).

Effectiveness of the outreach and citizen involvement strategy should be evaluated annually through an annual survey of the Partnership and relevant education and natural resource partner agencies. Results from the evaluation should be used to assess the previous year's efforts and be a guide to shape the work in the coming year. The level of effort is expected to change as outreach and citizen involvement activities are achieved and behavioral changes are seen to occur. A full review of the communications plan and outreach strategy should be conducted upon completion of the third and fifth years of the implementation phase.

The Outreach and Citizen Involvement Strategy is a two-pronged approach. The "outreach" part of the strategy is focused on education and distributing information, where mechanisms will be developed and implemented to educate and inform watershed citizens. The "citizen involvement" part of the strategy takes the next step, by developing and providing opportunity for citizens to participate in watershed stewardship and put into practice a stewardship ethic. While these two parts of the strategy are certainly interlinked, we wanted to differentiate the

two parts of the strategy- education and information activities versus involvement activities that engage citizens in taking care of their home watershed.

The Outreach Strategy will involve passive mechanisms to reach target audiences via multiple mass media outlets. This part of the strategy can include printed materials distributed via direct mail, such as the "Marengo Riffles" newsletter and articles in BRWA's organizational newsletter and partner organization newsletters; press releases in local papers; and a website. This broader approach will focus on larger audiences in the watershed, such as households/ general watershed citizens throughout the watershed. For some audiences, such as local officials and farmers, a more personal communication style is likely to be more effective, as we learned in the planning phase of the project.

The Citizen Involvement Strategy will involve creating active opportunities for watershed citizens to engage in stewardship activities in the watershed. This could include participation in the Volunteer Water Quality Monitoring Program, data collection and assisting with the Culvert Program, hands-on workshops, river clean-ups, invasive species workdays, citizen participation in the Marengo River Watershed Partnership, or other similar volunteer opportunities.
The groundwork of raising awareness about watershed issues was laid during the planning phase of the project, but communication with households and landowners in the watershed will continue into the first year of the implementation phase. The primary goal of the first and second years will be to continue to develop awareness within the watershed of the water cycle and watershed health, and how we impact it, including key pollutant sources, and reinforcing a sense of place within the watershed. Educating citizens on practices and behaviors they can implement in their lives which will result in improvement and protection of the watershed will be an emphasis as well. Additionally, we hope this will also reinforce watershed citizen support for implementation of the Action Plan.

The Watershed Action Plan table (Table 6.1) presents recommended outreach and citizen involvement activities with details about frequency, costs, potential partners, timeframe, milestones, and so on.

CHAPTER SIX: MARENGO RIVER WATERSHED 10-YEAR ACTION PLAN

The Marengo River Watershed Partnership presents the following plan of actions needed over the next 10 years to achieve healthy watershed targets and ultimately the broad watershed goals and vision for the Marengo River Watershed. Chapter 3 described the challenges and causes that must be addressed. Chapter 4 described a broad vision for a healthy watershed, long-term goals to meet that vision, healthy watershed targets that describe broad management goals, and target objectives that provide specific direction on management and outreach activities needed to meet the healthy watershed targets. Chapter 5 lists best management practices and management alternatives that will be utilized to meet the target objectives, areas of the watershed where the management focus will be different, and a watershed outreach and citizen involvement strategy. Chapter 6 brings all these pieces together into the watershed action plan.

The purpose for this watershed action plan is to provide a blueprint for managing human activities in a way that achieves the collective vision for the watershed. This will be done not by trying to restore the watershed to a condition it was in prior to European settlement, but by protecting and enhancing healthy areas and improving areas where potential problems have been identified. This stewardship approach will allow us to maximize ecosystem services and resilience to climate change provided by a healthy watershed.

The watershed action plan flows in order of priority established in Table 5.1. Underneath each of the management alternatives are the actions needed to implement the management alternative. The "recommendations" column lists each target objective, management alternative, and actions color-coded as follows:

Target Objectives (from Table 5.1)
Best Management Practices and Management Alternatives (from Table 5.1)
Actions

<u>The remaining columns describe additional information about each of the ACTIONS ONLY as follows:</u>

Location:
ST/CP = Soil Transition and Clay Plain Management Area
UW = Upper Watershed Management Area
Appendix D: Refers reader to the list of project ideas and concerns submitted by Marengo River Watershed citizens, local government representatives, other partners and individuals during the course of the project.
Appendix F: Refers reader to projects identified in the USDA Forest Service Watershed Condition Framework. FY2011 Transition Watershed Restoration Action Plan. Chequamegon-

Nicolet National Forest. Headwaters Marengo River 040103020402.

Time Frame:

A. Ongoing project category. Continue implementation.
B. Projects that have cooperating partners, can move to implementation quickly. Timeframe 1 to 3 years.
C. Project sites identified, do not have cooperating partners. Timeframe 1 to 3 years.
D. Need to identify priority sites and cooperating partners. Timeframe 3 to 5 years.
E. A concept or idea. Needs a lead, planning & discussion. Timeframe 5-10 years.

Measure of Success: Within the time frame specified, what measure will indicate the action is being met.

Cost Estimate: An estimated cost of implementing the action.

Funding: Potential funding sources to implement the action.

Implementation: List of potential partners who would be likely to implement the action.

Acronyms and abbreviations used in Table 6.1:

AERC – Agriculture and Energy Resource Center
BIA – Bureau of Indian Affairs
BRNRD – Bad River Natural Resources Department
BRWA – Bad River Watershed Association
Co. – County
CBAP – Chequamegon Bay Area Partnership
County LWCDs – County Land and Water Conservation Departments
DATCP – Department of Agriculture, Trade, and Consumer Protection (Wisconsin)
EPA – United States Environmental Protection Agency
EPA 319 – Environmental Protection Agency, Clean Water Act, Section 319
EPA ORD – Environmental Protection Agency, Office of Research and Development, Duluth, MN
EPA SDWA – Environmental Protection Agency, Safe Drinking Water Act
GLC – Great Lakes Commission
GLFC – Great Lakes Fishery Commission
GLIFWC – Great Lakes Indian Fish and Wildlife Commission
GLRI – Great Lakes Restoration Initiative
LFC – Living Forest Cooperative
LSBPT – Lake Superior Basin Partner Team
NC – Northland College
NCWMA – Northwoods Cooperative Weed Management Area
NFWF – National Fish and Wildlife Foundation
NOAA – National Oceanic and Atmospheric Administration
NRCS – Natural Resources Conservation Service
Pri-Ru-Ta – Price-Rusk-Taylor Resource Conservation District

TU – Trout Unlimited
USACE – United States Army Corps of Engineers
USFS – United States Forest Service
USFWS – United States Fish and Wildlife Service
USGS – United States Geological Survey
UWEX – University of Wisconsin-Extension
UWSP – University of Wisconsin-Stevens Point
WCMP – Wisconsin Coastal Management Program
WDNR – Wisconsin Department of Natural Resources
WFLGP – Wisconsin Forest Landowner Grant Program
WKNSF – Wisconsin Knowles-Nelson Stewardship Fund
Wkshp. – Workshop
Yr. - Year

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
1. Reduce amount of open land and forests <16 years old by 7,600 acres, focusing in hydrologic units with 40% or more open land/<16-year forests.						
A. Riparian and upland native tree planting.						
1. Increase capacity to implement riparian and upland native tree planting projects and programs (i.e. Lake Superior Conservation Reserve Enhancement and Partners in Fish and Wildlife).	ST/CP (use Figure 2.21 for priority locations)	A	200 acres in 5 years. 50% tree survival.	$800-$1600 per acre	Farm Bill, DATCP, GLRI, EPA 319	NRCS, County LWCDs, USFWS, Pri-Ru-Ta, Landowners
2. Explore and develop market-driven or other innovative program.	ST/CP (use Figure 2.21 for priority locations)	E	Pilot project developed & funded.	Unknown	UWEX, local investments	NRCS, County LWCDs, USFWS, UWEX CBAP
B. Provide forest management planning support to private watershed landowners.						
1. Continue current WFLGP or similar cost-share program.	ST/CP, UW	A	5 new plans developed per yr.	$5,000-$10,000 per plan	WDNR, NRCS	WDNR, LFC, NRCS, UWEX
2. Increase diversity of management opportunities and incentives available to private landowners.	ST/CP, UW	B	Meeting to discuss options held.	Staff time	WDNR	WDNR, UWEX
C. Coordinate & schedule timber harvests to maintain <40% open land/<16-year forests in WDNR hydrologic units.						
1. Continue outreach and education efforts to watershed managers, timber harvesters, landowners.	ST/CP, UW	A	One training workshop per yr.	$2,000-4,000/ wkshop	WCMP, USFS	WDNR, UWEX, BRNRD/BIA, USFS
2. Slow the flow of runoff from upland areas to watershed streams.						
A. Refine priority project implementation areas.						

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
1. Complete a "flood flow reduction" or "precision conservation" analysis to pinpoint priority areas and management alternatives for "slow the flow" (e.g. expand Hollenhorst work from Chapter 2.3.2 and/or consider using EPA's Recovery Potential Screening Tool [EPA 2012]).	ST/CP, UW	B	Completed model & implementation recommendations.	$30,000-$50,000	GLRI, GLC, EPA 319	Universities, USGS, EPA, BRNRD, WDNR
2. Conduct outreach to promote "slow the flow" concept to watershed landowners and citizens.	ST/CP, UW	B	One Learn About Your Land series or similar per yr.	$4,000/ series + staff time	WCMP, WDNR, GLRI	WDNR, BRNRD, UWEX, LFC, Land Trusts, BRWA
3. Identify landowners willing to implement projects on their property, focusing on areas identified in #1.	ST/CP, UW	B	25 landowners identified and database developed in 2 yrs.	$20,000-$30,000 per yr.	GLRI, Foundations	BRWA, NC, County LWCDs, BRNRD, NRCS, USFWS
B. Restore and protect wetlands.						
1. Implement Partners for Fish and Wildlife, DATCP, Wetland Reserve Programs.	ST/CP, Appendix D, see #2	A	Work with 5 landowners to restore/enhance 5 wetlands in 5 yrs.	$3,000-$10,000 per project	Farm Bill, DATCP, GLRI	USFWS, County LWCDs, NRCS
2. Complete wetland mapping, landscape-level functional wetland assessment, and wetland change analysis to pinpoint priority wetland restoration/protection sites (could be completed as part of 2.A.1 above).	ST/CP, UW	B	Completed analysis & implementation recommendations.	$150,000-$200,000	USEPA, USACE	WDNR, BRNRD, USACE, St. Mary's University (tech support)
C. Maintain and improve implementation of forest best management practices.						
1. Continue monitoring effectiveness of forest best management practices.	ST/CP, UW	A	Achieve 90% compliance with all BMPs implementation.	$10,000/ yr	WDNR, BRNRD/BIA	WDNR, BRNRD/BIA
D. Implement managed intensive (prescribed) grazing for livestock producers.						

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
1. Develop and implement prescribed grazing plans, demonstration sites.	ST/CP	A	5 new grazing plans developed & implemented in 5 yrs.	$90,000/ yr, FTE Grazing Specialist	Farm Bill, DATCP, GLRI	Pri-Ru-Ta, NRCS, County LWCDs, Farmers
2. Provide cost share and technical support for infrastructure improvements needed to implement prescribed grazing plans (i.e. livestock fencing, livestock watering, waterway crossings, etc.).	ST/CP	A	5 new grazing plans developed & implemented in 5 yrs.	Varies based on need.	Farm Bill, DATCP, EPA 319	NRCS, County LWCDs, Farmers
3. Establish equipment rental/marketing coop.	ST/CP	E	Regional coop established.	Varies based on equip. needs.	Farm Bill, DATCP, GLRI	Pri-Ru-Ta, UWEX, Farmers
E. Implement conservation practices associated with livestock exclusion fencing.						
1. Implement current programs.	ST/CP, UW	A	Improve 2-4 sites per yr.	$2800 per 1000 ft of fencing	Farm Bill, DATCP, GLRI, EPA 319	NRCS, County LWCDs, UWEX, Farmers
F. Implement conservation practices associated with livestock watering facilities.						
1. Implement current programs.	ST/CP, UW	A	Improve 2-4 sites per yr.	$10,000 per site	Farm Bill, DATCP, GLRI, EPA 319	NRCS, County LWCDs, UWEX, Farmers
G. Increase acreage using conservation tillage.						
1. Promote conservation tillage through field demonstrations and rental of no-till and reduced-till technologies.	ST/CP	A	500 acres/yr. using conservation tillage in 5 yrs.	$10,000 (purchase rental drill)	Farm Bill, DATCP, GLRI, EPA 319	NRCS, County LWCDs, UWEX, Pri-Ru-Ta, Farmers

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
H. Implement conservation practices associated with protecting heavy-use areas.						
1. Implement current programs.	ST/CP, UW	A	Improve 2-4 sites per yr.	$1-$8 per sq.ft.	Farm Bill, DATCP, GLRI, EPA 319	NRCS, County LWCDs, UWEX, Farmers
I. Plug/break agricultural drainage systems no longer in use.						
1. Evaluate agricultural drainage systems and their impact on peak flows as part of modeling analysis in action 2.A.1. Identify priority locations for plugging/breaking these drainages.	ST/CP, UW	B	Complete flow reduction model in 2.A.1 above.	See 2.A.1 above	See 2.A.1 above	See 2.A.1 above
3. Reduce hydrologic connectivity of road right of way and recreational trail system to less than 12% of the surface area of the watershed.						
A. Establish baseline of road/ditch area and evaluate upland flow attenuation for road system.						
1. Evaluate road and trail drainage systems and their impact on peak flows as part of modeling analysis in action 2.A.1. Develop baseline of road/ditch area at appropriate HUC-level.	ST/CP, UW	B	See action 2.A.1.	See action 2.A.1	See action 2.A.1	See action 2.A.1
4. Reduce sediment contributions from roads, recreational trail systems, railroads, and all waterway crossings.						
A. Replace or re-design eroding and poorly functioning crossings and sections of roads, trails, and railroads at interactions with all types of waterways (streams, wetlands, lakes, etc).						

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
1. Implement BRWA Culvert Program Partnership.	Priority sites in BRWA 2008, Appendix D, Appendix F	A	10 priority sites remediated and monitored for improvement in 5 yrs.	$10,000 - $50,000 per site	GLRI, USFWS, NFWF, USFS, EPA 319, Towns, Counties, NOAA	BRWA Culvert Program Partnership
2. Inventory all crossings and sections of roads, trails, and railroads at interactions with all types of waterways (streams, wetlands, lakes, etc). Recruit volunteers to assist.	ST/CP, UW	B	50 crossings surveyed in 2 yrs.	$5,000/yr Staff time to recruit & manage volunteer	GLRI, USFWS, NFWF, Towns, Counties, NOAA	BRWA Culvert Program Partnership
3. Control and prevent erosion and/or disconnect ditches at road, recreational trail, and railroad crossings.	ST/CP, UW	A	1 site every 5 years	$25,000 to $150,000	GLRI, USFWS, NFWF, USFS, Towns, Counties, NOAA	County LWCDs, Highway Depts., Towns, USFS, DNR
B. Implement conservation practices associated with waterway crossings.						
1. Implement current programs.	ST/CP, UW	A	Improve 2-5 waterway crossings per yr.	$10,000-$50,000 per yr.	Farm Bill, DATCP, GLRI, EPA 319	NRCS, County LWCDs, UWEX, Farmers
2. Install dry detention culverts or similar structures to minimize peak flow discharge.	ST/CP, UW	D	Install & maintain 2 sites in 5 yrs.	$10,000 - $15,000 install., $1,000/yr maintain	GLRI, NFWF, Counties	County LWCDs, NRCS, Landowners
5. Reduce bluff/streambank erosion.						
A. Stabilize eroding bluffs/streambanks.						
1. Stabilize/restore priority sites.	ST/CP, UW,	B	2 priority bluffs	$30,000 -	USFS, GLRI,	USGS, USFS,

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
	see pg. 32, Appendix D, Appendix F		stabilized in 5 yrs.	$100,000 per site	GLC, USFWS, NFWF, EPA 319	Universities, County LWCDs, BRWA
2. Quantify sediment loading from key areas of watershed.	ST/CP	C	USGS stream gage near watershed outlet in 5 yrs.	$15,000/ yr	USGS, GLC	USGS, Universities, BRWA, BRNRD
3. Conduct geomorphic assessments at existing long-term sites.	ST/CP	A	Sites assessed once every two years.	Staff time	USGS, BRNRD, Universities	USGS, BRNRD, Universities
4. Survey additional streams with erosion issues.	ST/CP	B	Survey other major tribs. In 5 yrs.	$5,000/yr	Foundations, NFWF	BRWA
5. Educate landowners, developers, and contractors about proper streambank and shoreline erosion control techniques to protect water quality.	ST/CP, UW	A	One educational workshop per yr.	$2,000-4,000 per wkshop	WCMP, USFS	WDNR, UWEX, BRNRD/BIA, USFS
6. Evaluate extent of nutrient and pathogen concerns and establish a baseline in the soil transition zone and clay plain area.						
A. Conduct impaired water assessment for fecal coliform/*E. coli* and nutrients such as total phosphorus.						
1. Complete impaired water assessment, evaluate results.	ST/CP	A	Assessment completed w/in 2 yrs.	$20,000	WDNR, BRNRD	WDNR, BRNRD
7. Implement agriculture conservation practices that improve manure storage and management.						
A. Develop and implement nutrient management plans.						

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
1. Increase local capacity to implement South Shore Nutrient Management Farmer Education Program.	ST/CP	A	2 new nutrient management plans completed per yr.	$28/acre+ staff time	Farm Bill, DATCP	NRCS, County LWCDs, UWEX, Farmers
2. Conduct survey to determine compliance and implementation.	ST/CP	B	All completed plans are implemented.	Staff time, varies based on need.	Farm Bill, DATCP	NRCS, County LWCDs, UWEX
B. Implement conservation programs to improve livestock waste management.						
1. Increase local capacity to implement current programs.	ST/CP	A	5 new or updated manure storage structures.	$28/acre+ staff time	Farm Bill, DATCP, EPA 319	NRCS, County LWCDs, UWEX, Farmers
8. Inventory and replace failing, poorly designed, and poorly functioning private on-site wastewater treatment systems (POWTS).						
A. Replace/update priority sites.						
1. Complete state mandated POWTS inventory.	ST/CP, UW	A	Completed inventory.	$15000-$25000	Counties	Co. Zoning, LWCDs
2. Replace/update priority sites.	ST/CP, UW	A	1 priority site updated per yr.	$15000-$20,000 per site	Wisconsin Fund, EPA 319, EPA SDWA, Home-owners	Co. Zoning, WDNR, BRNRD, Towns, Landowners
3. Develop electronic database and tracking capability for POWTS in Ashland Co.	ST/CP, UW	E	System completed and operational.	$10,000	EPA 319, EPA SDWA	Ashland Co. Zoning

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
4. Continue to implement Bad River and Bayfield Co. POWTS update and maintenance programs. Expand POWTS program in Ashland Co.	ST/CP, UW	A	Continued support and implementation of program.	$40,000-$60,000/ yr per program	Wisconsin Fund, Local tax levy	BRNRD, Bayfield and Ashland Co. Zoning
9. Insure POWTS are maintained on a regular basis.						
A. Develop and/or implement POWTS maintenance programs.						
1. Continue to implement Bad River and Bayfield Co. POWTS update and maintenance programs.	ST/CP, UW	A	See Action 4 in previous.	$15,000-$20,000/ yr per program	Wisconsin Fund, Local tax levy	BRNRD, Bayfield Co. Zoning
2. Expand program in Ashland Co.	ST/CP, UW	E	County Board support for joining Wisconsin Fund.	$50,000	Wisconsin Fund, Local tax levy, EPA SDWA	Ashland Co. Board, Zoning
10. Restore floodplain connectivity in incised reaches and reaches with excessive overbank sedimentation.						
A. Legacy sediment/levee scrapes.						
1. Identify and map key areas of overbank sedimentation.	ST/CP	D	Map of priority areas completed.	~$10,000-$15,000	GLRI, GLC, WCMP	USGS, Universities, BRNRD, County LWCDs, BRWA
B. Grade control/stabilization.						
1. Identify and map key areas of channel incision.	ST/CP	D	Map of priority areas completed.	~$10,000-$15,000	GLRI, GLC, WCMP	USGS, Universities, BRNRD, County LWCDs, BRWA
C. Raise stream bed.						

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
1. Identify locations using stream channel surveys.	ST/CP	D	Map of priority areas completed.	~$10,000-$15,000	GLRI, GLC, WCMP	USGS, Universities, BRNRD, County LWCDs, BRWA
11. Increase stream channel roughness.						
A. Add natural material such as coarse woody debris, rock.						
1. Develop map of priority areas. Utilize Dumke (2009) and Kaesar and Litts (2010) for guidance.	ST/CP, UW, Appendix F	D	Map of priority areas completed.	~$10,000-$15,000	WCMP, WDNR, Foundations	USGS, Universities, BRNRD, County LWCDs, BRWA
2. Implement project based on priority area map.	Determined in #1	D	One project completed in 5 yrs.	$10,000	GLRI, NFWF, WDNR	WDNR, BRNRD, USFWS, County LWCDs, BRWA
12. Strengthen local zoning ordinances and encourage practices that protect watershed health while meeting development needs.						
A. Utilize available zoning ordinance review and update tools, such as the Better Site Design Tools from the Center for Watershed Protection (CWP 2012).						
1. Review current ordinances and identify gaps in water resource protection.	ST/CP, UW	D	Complete NR 115 update.	Staff time	Local governments.	County Zoning, UWEX
2. Review current ordinances and identify gaps in water resource protection.	ST/CP, UW	D	Complete gap analysis document	Staff time	BRNRD	BRNRD

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
3. Work with local governments to amend current ordinances or adopt new ordinances to protect water quality.	ST/CP, UW	D	Host training zoning officials and/or Tribal Council.	$2,000/ event + staff time	WCMP, Local governments	BRNRD, County Boards, UWEX
4. Educate landowners and developers about good riparian and shoreline property management.	ST/CP, UW	A	Host annual training event.	$2,000/ event + staff time	WCMP, WDNR, Local governments	UWEX, BRNRD, Co. Zoning/LWCDs, BRWA
5. Provide water quality information to local decision makers to promote responsible and effective decision-making on watershed issues.	ST/CP, UW	A	At least one fee-for-service contract annually.	$5,000	Local governments.	BRWA
6. Provide water quality information to local decision makers to promote responsible and effective decision-making on watershed issues.	ST/CP, UW	A	Participate in at least one meeting with local decision makers annually	$5,000	EPA, BIA	BRNRD
13. Identify available and potential habitat for terrestrial and riparian species of conservation interest.						
A. Riparian and upland habitat assessments.						
1. Identify and monitor species of conservation interest and habitats.	ST/CP, UW, Appendix D, Appendix F	D	Completed report & recommendations for actions.	Personnel - $25,000-$50,000/ yr	WDNR State Wildlife Grant, BIA, USFWS	Conservation groups, Universities, WDNR, BRNRD, GLIFWC, USFWS
14. Identify available and potential habitat for aquatic species of conservation interest.						
A. Identify/confirm perennial and intermittent streams.						

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
1. Conduct baseflow surveys or seepage runs.	ST/CP, UW	D	Conduct annual intermittent & perennial stream survey for 5 yrs.	$15,000-$20,000/yr	Foundations, USGS, BIA, EPA	USGS, NC, BRNRD, BRWA
2. Collect water temperature data to identify cold, cool, and warm water habitat.	ST/CP, UW	A	100% of perennial streams surveyed in 5 yrs.	Personnel-$15,000-$20,000/yr	Foundations, Cons. groups, WDNR, EPA, BIA, USFWS, WCMP	BRWA, USFWS, NC, BRNRD
B. Conduct aquatic habitat assessments.						
1. Identify and survey species of conservation interest & habitats.	ST/CP, UW, Appendix D, Appendix F	A	Completed report & recommendations for actions.	Personnel $25,000-$50,000/yr	WDNR Wildlife Grant, USFWS, BIA	WDNR, BRNRD, USFWS, Universities, BRWA
15. Secure protection of priority riparian, aquatic, and terrestrial conservation areas and habitats.						
A. Land acquisition/conservation easements.						
1. Complete strategic conservation plan for Ashland Co.	ST/CP, UW	B	Completed plan.	$10,000-$15,000	Foundations, WDNR	Land trusts
2. Increase outreach and opportunities for landowners to learn about and implement land protection options.	ST/CP, UW	A	One Learn About Your Land series or similar per yr.	$4,000/series + staff time	WCMP, WDNR, GLRI	WDNR, UWEX, LFC, Land Trusts, BRNRD, BRWA
3. Secure funding to acquire or secure conservation easements on priority parcels.	ST/CP, UW	A	5 Land acquisitions/ Conservation easements secured per yr.	$50,000-$200,000/yr	WKNSF Foundations, USFWS, USFS	UWEX, Land Trusts, WDNR, Bad River Tribe Private landowners
B. Special Designations						

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
1. Establish clear protocol for utilizing volunteer and other aquatic and terrestrial habitat data for state and/or tribal special use designations (such as ORW/ERW).	ST/CP, UW	A	BRWA programs updated & data used for designated use evaluations.	$5,000	WDNR, Foundations	WDNR, BRNRD, BRWA
2. Collect water quality and habitat assessment data and evaluate data for special use designations.	ST/CP, UW	A	Assessment report & designated use recommendations.	Personnel $50,000/ yr	WDNR, EPA Foundations	WDNR, BRNRD, BRWA
3. Recommend and encourage water bodies or terrestrial areas for state and or tribal special designation status.	ST/CP, UW	D	List submitted to NR Board, Tribal Council.	$5,000	WDNR, Foundations	WDNR, BRNRD, BRWA
4. Evaluate special designation status on a regular basis.	ST/CP, UW	B	Report completed every 3 yrs.	Personnel $30,000/ yr	WDNR, Foundations, EPA	WDNR, BRNRD, BRWA
5. Continue to improve and implement BRWA Volunteer Water Quality Monitoring Program: Recruit and train additional volunteers, support new and current volunteers, improve communication with volunteers to ensure long-term viability of the program.	ST/CP, UW	A	Recruit 10 new volunteers per yr.	See 15.A.4	Foundations, Local contri-butions	BRWA, WDNR, BRNRD
C. Tax incentives to maintain ecosystem services.						
1. Complete value assessment of watershed ecosystem services.	ST/CP, UW	E	Completed value assessment.	Unknown	Unknown	EPA ORD, Universities
2. Integrate ecosystem valuation into local tax code.	ST/CP, UW	E	1 local govt. conducts pilot project.	Unknown	Unknown	UWEX, Bad River, Towns, Counties
16. Restore and improve priority aquatic and terrestrial habitats.						
A. Improve fish and other aquatic life passage at road						

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
crossings.						
1. Implement BRWA Culvert Program Partnership.	See action 4.B.1	A	See action 4.B.1.	See action 4.B.1	See action 4.B.1	See action 4.B.1
B. Add natural material such as coarse woody debris, rock.						
1. Develop map of priority areas. Utilize Dumke (2009) and Kaesar and Litts (2010) for guidance.	See action 10.A.1	D	See action 11.A.1.	See action 11.A.1	See action 11.A.1	See action 11.A.1
2. Implement project based on priority area map.	Based on completed map.	D	See action 11.A.1.	See action 11.A.1	See action 11.A.1	See action 11.A.1
C. Improve riparian vegetation to promote growth of long lived species.						
1. Implement projects identified in USFS Headwaters Marengo FY2011 Action Plan.	See Appendix F	B	Identified projects completed.	$16,000	USFS	USFS
D. Dam inspections/removals.						
1. Utilize WDNR decision-making process outlined at: http://dnr.wi.gov/org/water/wm/dsfm/dams/removal.html	ST/CP, UW, Appendix D	A	All large dams inspected, recommendations on repair/ removal.	Staff time	WDNR Dam Removal Grant Program	WDNR
17. Inventory and control invasive species.						
A. Increase and improve surveys and monitoring.						
1. Continue coordination among agencies and capacity support for working on invasive species through the Northwoods Cooperative Weed Management Area (NCWMA).	ST/CP, UW	A	Full-time NCWMA coordinator.	Personnel $45,000-$50,000	NFWF, USFS, GLRI	NCWMA
2. Establish SWAT teams or seasonal crews of 2-4 workers to inventory, control, and monitor terrestrial and aquatic invasive species on public and private property.	ST/CP, UW	A	Annual seasonal full crew, project manager, vehicle, supplies.	Personnel $200,000-$300,000	GLRI	NCWMA, private landowners

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
3. Continue to implement and improve training and education opportunities for right-of-way managers, land managers, and landowners on invasive species identification, prevention, and treatment options.	ST/CP, UW	A	Each watershed Town has invasive species management plan.	Personnel $45,000-$50,000	NFWF, WCMP, USFS	NCWMA
B. Control terrestrial and aquatic infestations with established control methods.						
Continue to evaluate and implement practices to control sea lamprey.	ST/CP	A	Base treatment on maintaining GLFC goals of 5 lamprey wounds per 100 lake trout; total Lake Superior-wide population of 30,000 adult lamprey	$90,000/ Yr for Bad River watershed	Great Lakes Fishery Commission, USFWS	USFWS, GLIFWC, BRNRD, WDNR
1. Establish SWAT teams or seasonal crews of 2-4 workers to inventory, control, and monitor terrestrial and aquatic invasive species on public and private property.	ST/CP, UW	A	See action 17.A.2.	See action 17.A.2.	See action 17.A.2.	See action 17.A.2.
2. Treat invasives based on risk, cost, and opportunities.	ST/CP, UW, Appendix D	A	1. No prohibited species in watershed. 2. No new species introduced to watershed. 3. Reduction in effected acreage or abundance of known invasive	Included in action 17.A.2	Included in action 17.A.2	Included in action 17.A.2.

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
			species.			
3. Identify use for invasive woody biomass removed through treatment.	ST/CP, UW	E	Use identified and promoted by NCWMA.	Included in action 17.A.1	Included in action 17.A.1	NCWMA partners
18. Develop and encourage market-driven solutions to conservation on agriculture and forest land.						
A. Upland agroforestry.						
1. Explore options such as expanding research test trials.	ST/CP	D	Develop plan to implement field trials based on research results.	Staff time	Existing staff time	UWEX, Universities, County LWCDs, AERC, Farmers
2. Develop Discovery Farms or willing farmers and landowners to provide research and demonstration sites.	ST/CP	D	Establish research trial at 1 watershed farm.	Varies based on site need	Private companies, GLRI, WDNR, USGS	UWEX, County LWCDs, NC, USGS, Land Trusts
B. Utilize Wisconsin's Working Lands Initiative.						
1. Explore opportunities with landowners.	ST/CP	A	Farmland preservation agreements or easements with landowners.	Staff time	Existing or expanded staff time	County LWCDs, Land Trusts, UWEX
C. Implement climate change adaptation actions that are aligned with the Lake Superior Ecosystem Climate Change Adaptation Plan (draft under development by the Lake Superior Binational Program as of 8/2012).						
1. Continue to implement and expand work conducted as part of the Shared Landscapes Initiative (discussed on pg. 107).	ST/CP, UW	A	Add a new climate change demonstration project in 2 years.	Staff time	Existing or expanded staff time	BRNRD, USFS, Universities, private landowners, BRWA, WDNR< Land Trusts

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
19. Coordinate and increase opportunities for proper household hazardous waste, pesticides, pharmaceuticals, white goods (stoves, refrigerators, etc.), and tire disposal.						
A. Household hazardous waste collection events.						
1. Scope interest and set up meeting to discuss possibilities.	ST/CP, UW	D	Host one meeting.	Staff time	Existing staff time	Towns, Counties, UWEX, NWRPC
2. Hold household hazardous waste (HHW) disposal event.	ST/CP, UW	D	One HHW within 2 yrs; then annually.	$10,000-$80,000 depends on event scope	WDNR, Bad River, EPA 319	Bad River, Towns, Counties, UWEX, NWRPC
20. Inventory and remediate existing brownfield sites and leaking underground storage tanks (LUST).						
A. Inventory all brownfield/LUST sites.						
1. Complete inventory on Bad River Reservation.	ST/CP	E	Completed inventory	$10,000	EPA 319, BIA	BRNRD
B. Remediate known brownfield/LUST sites.						
1. Complete cleanup at Four Corners site.	See Figure 2.32	A	Cleanup completed within 5 yrs.	$200,000	WDNR	WDNR
21. Identify and close abandoned wells.						
A. Well decommissioning.						
1. Implement current programs.	ST/CP, UW	A	Close 1-5 abandoned wells in 5 yrs	$6-$22/ ft.	Farm Bill, DATCP	County LWCDs, WDNR, NRCS, BRNRD

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
22. Map groundwater flow, quantity, and recharge areas.						
A. Identify perennial streams.	ST/CP,UW					
1. Complete seepage run.	ST/CP,UW	D	See action 14.B.1.	See action 14.B.1.	See action 14.B.1.	See action 14.B.1.
23. Monitor groundwater quality via private well testing.						
A. Develop private well monitoring program.	ST/CP, UW					
1. Coordination meeting among partners to discuss options, develop proposal.	ST/CP, UW	D	Pilot project implemented.	Unknown	Existing staff time	County LWCDs, BRWA, BRNRD, UWSP Groundwater Center
24. Increase general public's awareness and knowledge of water quality and watershed health.						
A. Continue implementing the Marengo River Watershed Partnership.	ST/CP, UW					
1. Continue to develop and distribute the "Marengo Riffles" newsletter to keep public informed re: the Partnership, updates related to plan implementation, and opportunities for involvement.	ST/CP, UW	A	2-3 times per yr.	$700/ issue	Foundations, Local donations	BRWA, UWEX, NC
2. Hold watershed tours and/or field trips.	ST/CP, UW	A	1 annually.	$300 per event hosted	Foundations, Local donations	BRWA, UWEX, NC, County LWCDs, BRNRD
3. Present at community events or host additional informational events at local establishments in the watershed.	ST/CP, UW	A	Attend one established event/ yr; host one additional event/ yr.	$300 per event hosted	Foundations, Local donations	BRWA, UWEX, NC, County LWCDs, BRNRD

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
4. Host "Learn from your Neighbor" informational gatherings to learn what citizens are doing on their land to protect land and water (i.e. conservation easement, BMP implementation, participation in landowner incentive program, etc.).	ST/CP, UW	A	First event in yr 1; then at least 1 annually.	$300 per event hosted	Foundations, Local donations	BRWA, UWEX, NC, County LWCDs, BRNRD
5. Increase general publicity about implementation projects i.e. press releases in Daily Press or partner organization newsletters; BRWA website; LSBPT website.	ST/CP, UW	A	Distribute 2 press releases annually.	$100/yr.	Foundations, Local donations	BRWA, UWEX, NC
6. Improve and maintain MRWP Project website for outreach and information on citizen involvement activities; link to LSBPT website.	ST/CP, UW	A	Update website quarterly.	$1500/ yr	Foundations, Local donations	BRWA, UWEX
7. Develop and distribute information on water quality threats to fish and fishing.	ST/CP, UW	E	Completed brochure.	$1,000	Foundations, Local donations	UWEX, WDNR, BRNRD, BRWA
8. Continue updates and distribution of fish consumption advice.	ST/CP, UW	A	Current state and tribal outreach materials updated every 1-3 years.	$100,000-$200,000/ yr. to maintain current state and tribal programs.	EPA, BIA	WDNR, BRNRD, GLIFWC
9. Complete review and update of Marengo River Watershed Action Plan.	ST/CP, UW	A	Plan update completed.	$20,000	EPA 319, Foundations	BRWA, WDNR, BRNRD
25. Increase public participation in general watershed stewardship activities.						
A. Host watershed stewardship events.						

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
1. Host river clean-up in the Marengo River or other tributaries.	ST/CP, UW	D	1 scheduled event per yr.	$1,000 volunteer support	Foundations, Local donations.	BRWA, UWEX, TU, BRNRD
2. Work with Marengo Valley School to engage students and families in water resource activities.	ST/CP, UW	B	1 scheduled event per yr.	$5,000 for coord.	Foundations, Local donations.	BRWA, UWEX, TU
26. Develop and improve recreational opportunities for all types of users.						
A. Evaluate recreational opportunities for all types of users.						
1. Meet with local user groups to identify needs and project interests.	ST/CP, UW	E	Hold meeting, identify list of needs.	Volunteer	Volunteer	Local user groups, Conservation groups, WDNR, USFS
2. Develop informational brochures or similar to promote recreation (i.e. canoeing fact sheets, locations of access points, etc.)	ST/CP, UW	E	Completed brochure.	$1,000	Foundations, Local donations.	WDNR, TU, Local user groups
3. Organize fishing and hunting events.	ST/CP, UW	E	1 scheduled event per yr.	Volunteer	Volunteer	Local user groups, Conservation groups
27. Resolve conflicts related to wildlife management.						
A. Host community discussion event.						
1. Organize and implement annual event reporting on state of deer, turkey, fish, and other game populations and habitats to encourage discussion on management issues and concerns.	ST/CP, UW	E	1 scheduled event per yr.	Volunteer	Volunteer	Conservation groups, WDNR, BRNRD
28. Surveys and documentation of historic cultural and natural resources.						

Table 6.27. Marengo River Watershed 10 Year Action Plan						
Recommendations	**Location**	**Time Frame**	**Measure of Success**	**Cost Estimate**	**Funding**	**Implementation**
A. Evaluate interest and opportunities.						
1. Consult with Bad River Tribal Historic Preservation Office (THPO) and Wisconsin Historical Society (WHS) to identify needs and project interests.	ST/CP, UW	E	Hold meeting, identify list of needs.	Existing staff time	Existing staff time	Bad River THPO, WHS, BRWA

CHAPTER SEVEN: MONITORING AND EVALUATION STRATEGY

The actions proposed in this plan differ both in scale and in scope. While some of the challenges are likely to exhibit a shorter lag time between implementation of management actions and measured improvement (such as reducing high bacteria counts), others are large, watershed-scale issues that will require more time to observe change (such as reducing peak flows). The monitoring strategy for the Marengo River Watershed attempts to recognize this and is intended to support the concept of adaptive management (or "learning by doing").

The monitoring strategy for this plan uses components discussed in Monitoring Stream and Watershed Restoration, edited by Philip Roni (2005). The strategy is designed to provide information to fill in gaps in our knowledge of existing conditions (baseline monitoring), to help show whether short-term goals of an implementation project are met (implementation monitoring), determine if management actions are having an effect on meeting healthy watershed targets and target objectives (effectiveness monitoring) and to evaluate whether management actions have led to meeting long-term watershed goals (validation monitoring).

Many of the components of this monitoring strategy are embedded within the Watershed Action Plan. In order to meet many of the healthy watershed targets stated in the plan, a better understanding of baseline conditions is needed to support implementation efforts, to show improvements over time, and to build a basis for an adaptive management strategy.

Table 7.1 identifies components of the monitoring strategy (baseline, implementation, and effectiveness monitoring) and how they relate to the healthy watershed targets for the Marengo River Watershed Action Plan. Table 7.2 identifies validation monitoring to support meeting long-term watershed goals. Some of the components overlap and ones that are embedded within the Watershed Action Plan itself are identified. Unless noted, baseline monitoring activities will be conducted a

The Marengo River Watershed Partnership (MRWP) provides a forum for discussing monitoring needs, results, and tracking plan implementation. An important function of the MRWP will be to establish a regular system where agencies and groups working on plan implementation report results of their annual project work to BRWA (or other group leading the MRWP). BRWA should provide an annual report on MRWP implementation and a meeting with project stakeholders to discuss progress and priorities for the upcoming year. This idea is captured in greater detail in Chapter 8. By tracking and evaluating progress on an annual basis, the MRWP will become ingrained in the annual cycles of agencies and groups and will ensure that work is coordinated at the watershed scale and increase the likelihood that management actions will occur on the landscape in the areas where they are most needed to benefit watershed health.

Table 7.28 Monitoring Strategy for the Marengo River Watershed Action Plan.			
Healthy Watershed Target (Target origin from Table 4.1)	**Baseline Monitoring**	**Implementation Monitoring (Update annually unless noted)**	**Effectiveness Monitoring**
• Bankfull flows at the watershed outlet reduced from 2,500 cfs to 1250 cfs (MRWP recommendation).	A. Establish stream gaging station near Marengo River Watershed mouth to measure continuous discharge. Maintain minimum of 5 years. B. Monitor/model peak flows at priority tributaries. Utilize established USGS/BRNRD geomorphology monitoring sites in the Marengo Watershed. Establish additional reference sites, particularly in the soil transition zone and in subwatersheds where restoration activities occur or where potential impacts are suspected. Use Figure 2.23 as guide. Monitor parameters such as stream flow and stage (enough to develop a rating curve) and channel morphology over the course of one year. C. Conduct one baseflow stream survey or "seepage run" (WAP Recommendation 14.A.1). Target all intermittent and perennial streams north of National Forest boundary in late summer/early fall.	A. Acres of open land reduced compared to goal for each hydrologic unit (WAP Recommendation 1). Track acres of trees planted through CREP, EQIP, and other programs annually. Conduct DNR Open Lands Assessment (see Community GIS 2009) approx. every 3-5 years. B. Survival rate of tree planting exceeds 50% (WAP Recommendation 1.A.1). C. Number of wetlands and wetland acres restored or enhanced (WAP Recommendation 2.B.1). D. Number of managed intensive grazing plans developed and implemented (WAP Recommendation 2.D.1 and 2.D.2). E. Acres of forest land with a third party management plan.	A. Complete flood flow reduction or "precision conservation" analysis (uses available monitoring data to help focus effectiveness monitoring efforts, WAP Recommendation 2.A.1). B. Establish stream gaging station near Marengo River Watershed mouth to measure continuous discharge. Maintain indefinitely. C. Monitor/model peak flows at priority tributaries. Continue work from "Baseline Monitoring B" every 3-5 years. Could develop volunteer or student program to conduct this monitoring. D. Monitor forestry BMP implementation (WAP Recommendation 2.C.1).

Table 7.28 Monitoring Strategy for the Marengo River Watershed Action Plan.			
Healthy Watershed Target (Target origin from Table 4.1)	**Baseline Monitoring**	**Implementation Monitoring (Update annually unless noted)**	**Effectiveness Monitoring**
	D. Map groundwater recharge areas based on survey.		
• Annual suspended sediment load from the Marengo River reduced from 64,000 tons to 32,000 tons (MRWP recommendation). • Habitat is not impaired due to excessive bank erosion and sedimentation (State and Tribal Water Quality Standards (WQS) Criteria). • Turbidity shall not exceed 5 NTU over natural background turbidity when the background turbidity is 50 NTU or less, or turbidity shall not increase more than 10% when background turbidity is more than 50 NTU (Tribal WQS Criteria).	E. Establish stream gaging station near Marengo River Watershed mouth. Monitor turbidity, suspended sediment concentration (SSC), and total suspended solids (TSS) across a wide range of flow conditions. Maintain minimum of 5 years. Establish relationship between SSC and TSS at the site. Maintain minimum of 5 years. F. Monitor turbidity, suspended sediment, and/or transparency monthly at priority tributaries identified in "Baseline Monitoring B" for a minimum of one year. G. Conduct a BRWA "Get to Know Your Watershed" or other stream assessment to identify areas of streambank erosion in the soil transition zone area of main watershed tributaries. (WAP Recommendation 5.A.3). H. Complete sediment budget for Marengo River Watershed. I. Conduct habitat assessments	F. Tons of annual sediment reduced by stabilizing eroding bluffs/streambanks. Install erosion pins at priority sites using BRWA's "Get to Know Your Watershed Survey (Figure 2.19). Estimate bank slumping rates by collecting data from the pins 2-4 times per year. G. Number of acres per year using conservation tillage (WAP Recommendation 2.G.1). H. Number of waterway crossings improved per year (WAP Recommendation 4.B.1).	E. Establish stream gaging station near Marengo River Watershed mouth. Monitor turbidity, SSC, and TSS across a wide range of flow conditions. Establish relationship between SSC and TSS at the site. Maintain indefinitely. F. Inventory and monitor sand deposition in Marengo River high erosion area (see Figure 2.18). Conduct sedimentation mapping, determine channel morphology, complete habitat surveys, and pebble counts. Conduct initial survey prior to restoration activities and follow-up surveys every 3-5 years as restoration proceeds.

Table 7.28 Monitoring Strategy for the Marengo River Watershed Action Plan.			
Healthy Watershed Target (Target origin from Table 4.1)	**Baseline Monitoring**	**Implementation Monitoring (Update annually unless noted)**	**Effectiveness Monitoring**
	(such as pebble counts) at priority tributaries identified in "Baseline Monitoring B" every 2-3 years. J. Conduct biological assessment (such as macroinvertebrate and fish Indexes of Biotic Integrity, etc.) at priority tributaries identified in "Baseline Monitoring B" every 2-3 years.		
• Any single sample shall not exceed an E.coli count of 235 CFU/100 mL (Tribal WQS Criteria). • The geometric mean of not less than 5 samples equally spaced over a 30-day period shall not exceed an E. coli count of 126 CFU/100 mL (Tribal WQS Criteria). • Membrane filter fecal coliform count may not exceed 400 per 100 ml in more than 10% of all samples during any month (State WQS Criteria). • Membrane filter fecal coliform	K. Conduct impaired water assessment (see WAP Recommendation 6.A.1) for bacteria (fecal coliform and *E.coli*), total phosphorus, and nitrogen species. Establish reference sites and impact sites based on section 2.14. Utilize WDNR WisCALM 2012 and Bad River water quality standards as guidance for specific parameters and sample frequency. L. E. coli and/or fecal coliform monitoring to identify areas in need of BMP implementation. Utilize WDNR WisCALM 2012 and Bad River water quality standards as guidance for	I. Number of watershed livestock farms with a nutrient management plan (WAP Recommendation 7.A.1). J. Percentage of nutrient management plans implemented (WAP Recommendation 7.A.2). K. Number of new manure storage facilities constructed or updated (WAP Recommendation 7.B.1). L. Number of POWTS inventories completed (WAP Recommendation 8.A.1). M. Number of POWTS updated or replaced per year (WAP recommendation 8.A.2). N. Number of private wells sampled per year.	G. Monitor bacteria counts (fecal coliform and *E. coli*) total phosphorus, nitrogen, or other parameters at reference sites as established in "Baseline Monitoring K and L" and above and below BMP implementation sites before and after implementation. H. Complete biennial designated use assessments. I. Evaluate private well testing results compared to applicable state and federal drinking water standards to determine if healthy watershed targets for groundwater should be established.

Table 7.28 Monitoring Strategy for the Marengo River Watershed Action Plan.			
Healthy Watershed Target (Target origin from Table 4.1)	**Baseline Monitoring**	**Implementation Monitoring (Update annually unless noted)**	**Effectiveness Monitoring**
count may not exceed 200 per 100 ml as a geometric mean based on not less than 5 samples per month (State WQS Criteria). • Waters are free from substances that produce nutrients or other substances that stimulate algal growth producing nuisance aquatic vegetation, dominance of any nuisance species instream, or cause nuisance conditions in any other fashion (Tribal WQS Criteria). • General category of surface water uses and criteria (State WQS Criteria). • Acute and chronic toxicity criteria for ammonia (Multiple State and Tribal WQS Criteria). • <0.075 mg/L Total Phosphorus (State WQS Criteria) • < 1 mg/L (nitrate nitrogen) (Tribal QAPP Screening Level)	sample frequency. Consider conducting sanitary surveys and/or use microbial source tracking techniques to identify sources and differentiate areas affected by human and livestock waste. M. Develop private well monitoring program (WAP Recommendation 23.A.1). Offer program every 2-3 years. Consider UW-Stevens Point Community Drinking Water Program, Homeowner and/or Metals Package analyses.		

Table 7.28 Monitoring Strategy for the Marengo River Watershed Action Plan.			
Healthy Watershed Target (Target origin from Table 4.1)	**Baseline Monitoring**	**Implementation Monitoring (Update annually unless noted)**	**Effectiveness Monitoring**
• < 0.1 mg/L (phosphate) (Tribal QAPP Screening Level)			
• Identify, restore, and maintain ecological processes and priority habitats for native communities of plants and animals.	N. Collect water temperature data using data loggers (e.g. TidbiT v2 thermistors). Deploy loggers at a minimum between May and September with a logging interval of one hour. Assess data, including calculating maximum daily mean temp. to identify cold, cool, and warm water habitat (WAP Recommendation 14.A.2). O. Complete aquatic habitat connectivity analysis to focus culvert restorations for fish passage. P. Identify and survey aquatic and terrestrial species of conservation interest & habitats (WAP Recommendations 13.A.1 & 14.B.1). Q. Identify and survey terrestrial and aquatic invasive species (WAP Recommendation 17.A.1).	O. Miles of aquatic habitat re-connected by replacing culverts (ongoing total for watershed). P. Acres (or other relevant measure) of invasive species removed or treated per year. Q. Acres of aquatic habitat and terrestrial habitat restored. R. Miles of perennial stream surveyed for aquatic habitat. S. Sea lamprey population surveys conducted. T. Acres of wetland habitat surveyed for species of conservation interest. U. Acres of terrestrial habitat surveyed for species of conservation interest. V. Number and acres of conservation easements, other land management agreements completed per year (WAP Recommendation 15.A.3).	J. Continue BRWA Culvert Program habitat monitoring before and after restorations. Utilize WDNR habitat guidelines. K. Continue BRWA macroinvertebrate monitoring program and methodology. Sample spring and fall of each year, target of 4 years data at each site. Calculate Hilsenhoff Family Biotic Index with taxonomic results. L. Continue BRNRD and WDNR biological monitoring programs, such as macroinvertebrate monitoring. M. Lamprey treatment threshold for entire Bad River system is met. N. Repeat surveys conducted in "Baseline Monitoring N." Frequency dependent upon species of interest.

Table 7.28 Monitoring Strategy for the Marengo River Watershed Action Plan.			
Healthy Watershed Target (Target origin from Table 4.1)	**Baseline Monitoring**	**Implementation Monitoring (Update annually unless noted)**	**Effectiveness Monitoring**
	R. Complete valuation of watershed ecosystem services (WAP Recommendation 15.C.1). S. Establish long-term climate change monitoring stations.	W. Number of climate change adaptation projects implemented.	O. Conduct temperature, biological, or other applicable monitoring pre and post implementation of management actions, such as invasive species control efforts and climate change adaptation demonstrations.
• Establish outreach and citizen involvement efforts to reduce pollution that impacts the Marengo River Watershed.		X. Number of "Learn About Your Land" series or similar per year (WAP Recommendation 2.A.3). Y. Number of new water quality volunteers per year (WAP Recommendation 15.A.5). Z. Number of watershed clean-up events per year (i.e. trash pick-ups, HHW collections, etc.). AA. Number of newsletter articles or similar per year	P. Track number of conservation easements, other land management agreements completed per year (WAP Recommendation 15.A.3). Q. Track attendance at MRWP meetings and events. R. Assess quantities of various HHW collected over the years.
• Develop and improve recreational activities for watershed residents and visitors.		BB. Number of recreational events (i.e. fishing, hunting, canoeing, hiking, etc.) events organized per year. CC. Number of recreational improvement projects implemented per year.	

Table 7.29 Validation monitoring to support meeting Marengo River Watershed Action Plan long-term goals.	
Long Term Watershed Goal	**Validation Monitoring**
The hydrologic system in the Marengo River Watershed is stable and resilient.	A. Establish and maintain indefinitely, a stream gaging station near Marengo River Watershed mouth to measure peak flows and monitoring of sediment loading. B. Identify other validation monitoring as plan is implemented and evaluated.
Safe water and healthy, productive soil are available and maintained for all uses by humans and wildlife.	C. Long-term water quality monitoring programs (i.e. Bad River Tribe, WDNR, BRWA) are maintained to support and assist biennial designated use evaluations of Marengo River Watershed surface waters. D. Evaluate trends of biennial designated use evaluations for Marengo River Watershed surface waters. E. Establish metric for evaluating long-term soil productivity. F. Identify other validation monitoring as plan is implemented and evaluated.
The Marengo River Watershed supports diverse, healthy, and resilient native communities of plants and animals and their habitats on land and in water.	G. Conduct valuation of watershed ecosystem services every 5 years. H. Evaluate trends of species of conservation interest. I. Identify other validation monitoring as plan is implemented and evaluated.
Citizens of the Marengo River Watershed are active and engaged in maintaining the integrity of the watershed.	J. Marengo River Watershed Partnership is active and supported financially by the watershed community. K. 100% of 10-year Watershed Action Plan “actions” are completed by 2021. L. Identify other validation monitoring as plan is implemented and evaluated.

CHAPTER EIGHT: IMPLEMENTATION AND CAPACITY BUILDING STRATEGIES

1. IMPLEMENTATION STRATEGY

Success of the Marengo River Watershed Action Plan (WAP) depends on consistent involvement and support from watershed stakeholders, such as citizens, local, county, state, federal, and tribal governments, agencies, and institutions. This involvement depends on having an established forum for implementation and an organization to coordinate implementation. The Bad River Watershed Association (BRWA) is in a unique position to coordinate WAP implementation because of the connections it has with the Marengo River Watershed community, local governments, and agencies, along with its ability to work across jurisdictional boundaries to achieve management at the watershed scale.

Implementation of the WAP is likely to occur through the following means:

A) Marengo River Watershed Partnership - Continuation of the Partnership will help ensure plan implementation, coordination, evaluation, and revision. The MRWP will be coordinated by the BRWA and serve as a forum for discussing Marengo River Watershed issues and generating support for plan implementation and improved watershed planning. More specifically, the purpose of the Partnership would be to:

    1) Provide a forum for learning about and discussing watershed challenges.
    2) Exchange information on what is happening in the watershed and what watershed partners are doing to implement the plan.
    3) Coordinate activities, discuss project ideas, and identify funding sources to further watershed plan implementation.
    4) Provide a forum for developing collaborative proposals and applying for funding to implement plan.
    5) Identify accomplishments and review/update plan actions/recommendations.

    The MRWP may meet on a quarterly basis to accomplish these objectives, or as often as identified by the Partnership. One of these meetings could be an annual project scoping meeting, where partners submit project ideas and opportunities for the upcoming year are identified (Figure 8.1).

B) Partner Organizations and Agencies – Ongoing program work from partner organizations and agencies will further the goals and objectives of the WAP and sustain implementation efforts. With the BRWA as the coordinator, the MRWP Project and the Partnership will be connected to and integrated into other local and regional partnerships such as the Chequamegon Bay Area Partnership, the Wisconsin Lake Superior Basin Partner Team, and the Lake Superior Binational Program. Participation in the Partnership will help ensure that

program work and implementation activities are coordinated and working to achieve watershed-based goals and objectives.

C) Tribal and Local Governments - Comprehensive plans that have recently been completed by local towns and counties in the Marengo River Watershed and tribal nonpoint source management and integrated resource management plans will further the goals and objectives of the WAP and sustain implementation efforts. Active involvement by tribal and local governments as watershed stakeholders in the Partnership may help to further the goals of these comprehensive plans while also implementing actions in the WAP.

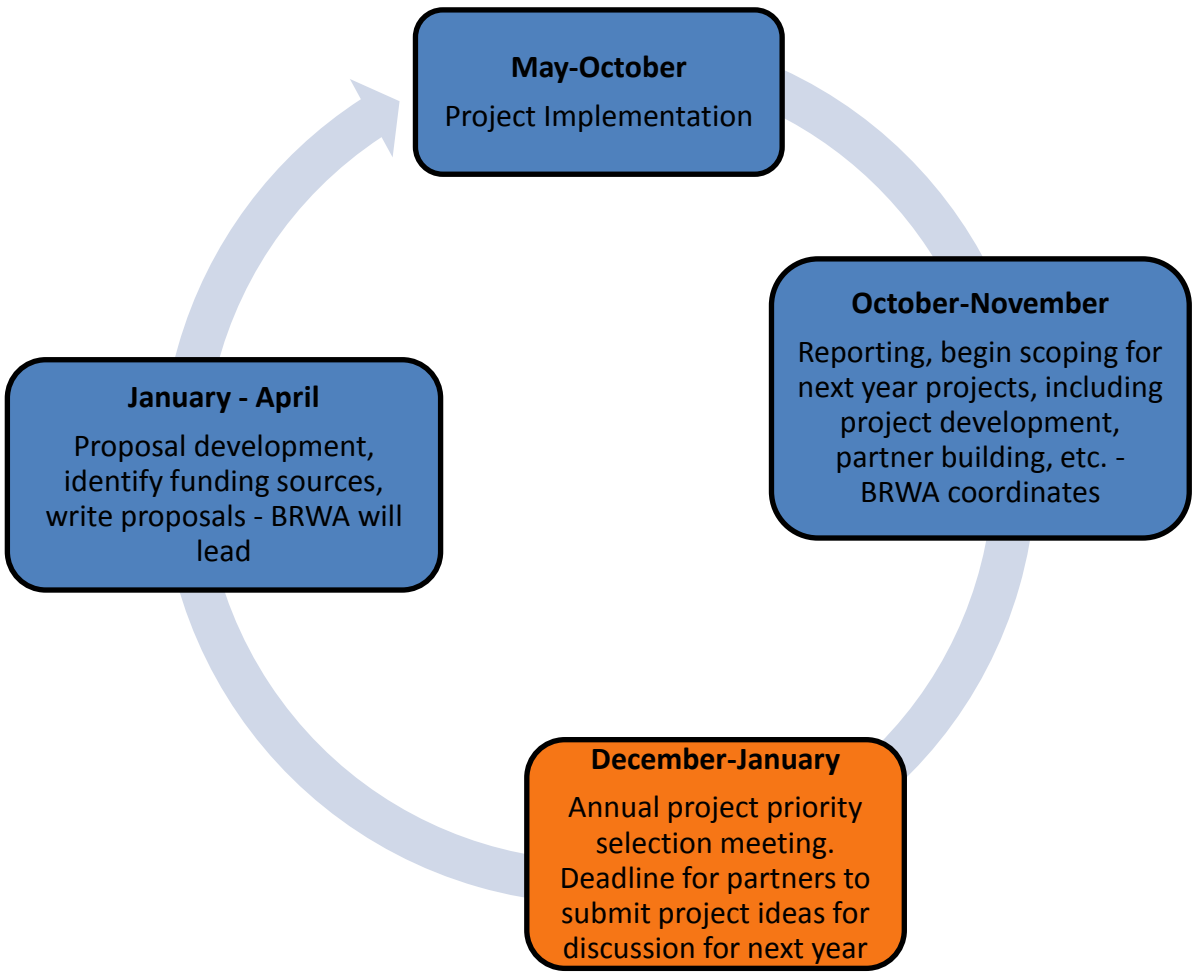


Figure 8.48. Potential Watershed Action Plan implementation annual cycle as carried out by the Marengo River Watershed Partnership.

2. CAPACITY BUILDING STRATEGY

An ongoing problem to implementing natural resources management actions is the number of projects almost always outweighs the available staff and resources devoted to completing them. The actions described in this project are ambitious and achieving full plan implementation will require additional local capacity in the form of staff at agencies and organizations and capacity to help facilitate and coordinate local partnerships that already exist in Wisconsin's Lake Superior Basin.

Due to the small nature of most natural resource organizations and agencies in the area, a strong network of partnerships has historically and continues to bring more efficient use of limited resources and assures that management activities are coordinated across jurisdictional boundaries. Examples include the Wisconsin Lake Superior Basin Partner Team, Chequamegon Bay Area Partnership, Bad River Watershed Association Culvert Program, and partnerships between County Land and Water Conservation Departments, USFWS, and USDA Farm Service Agency and NRCS to implement agriculture and other best management practices. Ensuring the resources are available to invest in the continuation and building the functional capacity of these partnerships is a top priority to take full advantage of current resources to implement the Marengo River Watershed Action Plan and other local natural resource management initiatives. Adding new capacity in the form of full or part time positions to implement specific projects and to ensure the long-term stability of partnerships will need to be continually explored.

Following is a list of specific local capacity needed to implement some of the actions described in the Marengo River Watershed Action Plan. This list will be updated and revised as projects are completed and as new priorities emerge.

- At minimum, continue current staffing levels devoted to implementing natural resources programs at the federal, tribal, state, and county agencies and at institutions and non-profit organizations. In order to achieve the Marengo River Watershed Action Plan implementation strategy (described in Chapter 7), the following positions are needed:

    - ✓ Watershed Action Director, Bad River Watershed Association: Coordination of plan implementation, project scoping and connection to local governments and local and regional agencies and partnerships, grant writing support, assist with Marengo River Watershed Partnership events, plan updating and reporting.
    - ✓ Citizen Involvement Coordinator, Bad River Watershed Association: Coordination of outreach and education component of plan, connecting citizen interests to agency programs through Watershed Action Director, coordinating Marengo River Watershed Partnership events.
    - ✓ Lake Superior Basin Educator, University of Wisconsin-Extension: Technical expertise related to outreach and education component, Connection to Lake Superior Basin Partner Team, grant writing support.

- Additional support needed to ensure plan implementation

  - ✓ Chequamegon Bay Area Partnership Coordinator: Coordinate regional partnership projects, Connect watershed planning efforts (including Marengo River Watershed Action Plan) to larger, regional efforts, define partnership roles, support for planning and grant writing, connection to statewide and Great Lakes regional programs and funding opportunities.
  - ✓ Watershed Scientists: Provide technical expertise for landscape-level precision conservation analysis, coordination of monitoring strategy, conducting various monitoring, analysis of monitoring data, etc.
  - ✓ Watershed Restoration Engineers: Provide technical engineering assistance and project oversight for stream, lake and wetland restoration projects. Often project implementation needs exceed local capacity to implement them. Engineering expertise specific to the restoration needs in the Chequamegon Bay area would expand project implementation capabilities.
  - ✓ Conservation First Responder Specialist: (http://www.huronpines.org/project/75). One-on-one visits to landowners to match their natural resource interests to available programs (such as CREP, Partners for Fish and Wildlife, forest management planning, etc.) Could be tied in with BRWA Citizen Involvement Coordinator. This type of position was seen as a need because often citizens are not aware of available technical and financial assistance available to them to help meet their conservation goals along with broader agency goals.
  - ✓ Invasive Species SWAT Teams: These teams would be deployed to treat and/or remove priority invasive species at locations identified by the Northwoods Cooperative Weed Management Area. Summer internship opportunity for Northland College or other interested students/citizens.
  - ✓ Invasive Species Coordinators for Ashland and Bayfield County and Bad River Natural Resources Department: Coordinate trainings, inventory, control, education/outreach with landowners and community groups.

REFERENCES

Ashland County. 2003. Ashland County Comprehensive Plan Confidential Community Survey. Ashland, WI.

Ashland County. 2006. Ashland County Comprehensive Plan 2006 to 2025. Retrieved 12/9/10, from http://www.co.ashland.wi.us/.

Ashland County. 2010. Ashland County Land and Water Resource Management Plan 2010-2019. Submitted by the Ashland County Land Conservation Committee and the Land and Water Conservation Department. 118 p.

Bad River Band of the Lake Superior Tribe of Chippewa Indians. 2001. Integrated Resource Management Plan. Odanah, WI.

Bad River Band of Lake Superior Tribe of Chippewa Indians. August 2006. Non-Point Source Assessment Report. Odanah, WI.

Bad River Band of Lake Superior Tribe of Chippewa Indians. August 2006. Non-Point Source Management Plan. Odanah, WI.

Bad River Band of the Lake Superior Tribe of Chippewa Indians. July 2011. Water Quality Standards. Adopted by Resolution No. 7-6-11-441 of the Bad River Band of Lake Superior Tribe of Chippewa Indians. Odanah, WI. 27 p.

Bad River Watershed Association (BRWA). 2007. Bad River Watershed Association Culvert Restoration Project. Preliminary Needs Assessment. Ashland, WI. 174 p.

Bad River Watershed Association (BRWA). 2008. Culvert Program Strategic Plan. Ashland, WI. 24 p.

Bad River Watershed Association (BRWA). 2010a. Baseline Water Quality Monitoring Report: Marengo River Basin - Marengo River at Altamont & Riemer Road, Brunsweiler River at Highway C, 2009. Ashland, WI. 4p.

Bad River Watershed Association (BRWA). 2010b. Field Findings Report – Marengo River Watershed. Technical Capacity Mini-grants, Center for Watershed Protection. Ashland, WI. 145 p.

Bayfield County. 2008. Bayfield County Comprehensive Planning Survey. Washburn, WI.

Bayfield County 2010. Imagine Bayfield. Bayfield County Comprehensive Plan. 2010 Update. Retrieved 12/9/10, from http://www.bayfieldcounty.org/planning.asp.

Bayfield County. 2010. Land and Water Resource Management Plan for Bayfield County, for Implementation 2010-2020. Submitted by the Bayfield County Land Conservation Committee and Land and Water Conservation Department. 58 p.

Bayfield Regional Conservancy. 2009. Strategic Conservation Plan for Lake Superior's Bayfield Peninsula. Bayfield, WI. 101 p.

Blodgett, D.L. 2009. Modeling Flood Flow Reduction for Bluff Erosion Mitigation Using Upland Runoff Attenuation on North Fish Creek, Bayfield County, WI. A Best Management Practice Implementation Location Prioritization. Master's Thesis. University of Wisconsin-Madison December 18, 2009.

Cahow K. and F.A. Fitzpatrick. 2005. Summary of Findings for the Marengo River Bad River Tribe/USGS geomorphic study of the Bad River watershed. February 8, 2005.

Center for Watershed Protection (CWP). 2012. Better Site Design Publications. Retrieved 3/22/12, from http://www.cwp.org/documents/cat_view/77-better-site-design-publications.html.

Community GIS Services, Inc. 2006. Lake Superior Watershed Open Land Classification and Percentages.

Community GIS Services, Inc. 2009. Lake Superior Watershed Open Land Classification and Percentages.

Dumke, J.D. 2009. Channel Morphology and Biotic Response to a Selective Wood Removal Technique in a Sand-Laden Lake Superior Tributary *in* Lake Superior Basin Regional Assessment and Report Compendium. Wisconsin Department of Natural Resources, Division of Forestry. PUB-FR-468-2010. Madison, WI. 85 p.

Epstein, E.J., E. J. Judziewicz, W.A. Smith. 1997. Wisconsin's Lake Superior Coastal Wetlands Evaluation, Including Other Selected Natural Features of the Lake Superior Basin. Wisconsin Department of Natural Resources, Bureau of Endangered Resources, Wisconsin's Natural Heritage Inventory Program, PUB ER-095 99, Madison, WI. 325p.

Finley, R.W. 1976. Original Vegetation Cover of Wisconsin Map. University of Wisconsin-Madison.

Fitzpatrick, F.A., Knox, J.C., and Whitman, H.E., 1999. Effects of Historical Land-Cover Changes on Flooding and Sedimentation, North Fish Creek, Wisconsin: Water-Resources Investigations Report 99-4083.

Fitzpatrick, F. A. and M.C. Peppler. 2003. Preliminary Investigation of Erosion, Sedimentation, Channel Migration, and Streamflow Trends in the Bad River Basin, Wisconsin. Project Update 1/21/2003.

Fitzpatrick, F. A. 2005. Investigation of Erosion, Sedimentation, Channel Migration, and Streamflow Trends in the Bad River Basin, Wisconsin. Project Update 3/7/2005.

Fitzpatrick, F.A, M.C. Peppler, H.E. Schwar, J.A. Hoopes, and M.W. Diebel. 2005. Monitoring Channel Morphology and Bluff Erosion at Two Installations of Flow-Deflecting Vanes, North Fish Creek, Wisconsin, 2000-03 *in* Lake Superior Basin Regional Assessment and Report Compendium. Wisconsin Department of Natural Resources, Division of Forestry. PUB-FR-468-2010. Madison, WI. 85 p.

Fitzpatrick F.A. 2010. Marengo River Watershed Sediment Processes. Presentation at the Marengo River Watershed Partnership Technical Team Workshop. August 31, 2010. Ashland, WI.

Gilbert, J., B. Carlson, and R. LaRue. 1995. Purple loosestrife survey of the Bad River Watershed, 1994. Great Lakes Indian Fish and Wildlife Commission. Administrative Report 95-01. 27 p.

Harr, R.D., W.C. Harper, J.T. Krygier, and F.S. Hsieh. 1975. Changes in Storm Hydrographs After Road Building and Clear-Cutting in the Oregon Coast Range. *Water Resources Research*, vol. 11, no. 3, p. 436-444.

Hilsenhoff, W.L. 1988. Rapid field assessment of organic pollution with a family-level biotic index. *J. N. Am. Benthol. Soc.* vol. 7, no. 1, p. 65-68.

Hollenhorst, T. and M.J. Hudson. 2011. Modeling Peak Discharge within the Marengo River Watershed – Lessons for Restoration in the Saint Louis River Watershed. Poster presentation at the Saint Louis River Estuary Summit. 2/7-2/8/11.

Jacobson, R.B. and A.T. Primm. 1997. Historical land-use changes and potential effects on stream disturbance in the Ozark Plateaus, Missouri: U.S. Geological Survey Water-Supply Paper 2484, 85 p.

Kaesar, A.J. and T.L. Litts. 2010. A novel technique for mapping habitat in navigable streams using low-cost side scan sonar. *Fisheries* vol. 35, no. 4, p. 163-174.

Kitchell, A. and T. Schueler. 2005. *Unified Stream Assessment: A User's Manual-Version 2.0.* Manual 10 in the Urban Subwatershed Restoration Manual Series. Center for Watershed Protection. Ellicott City, MD.

Knox, J.C. 1977. Human impacts on Wisconsin stream channels: Annals of the Association of American Geographers, vol. 67, no. 3, p. 323–342.

Lake Superior Basin Partner Team (LSBPT) 2007. Marengo River Watershed Test Case: Assessing the Hydrologic Condition of the Marengo River Watershed, Wisconsin. Prepared for Wisconsin Lake Superior Basin Partner Team by Stable Solutions, LLC. and Community GIS, Inc.

Lake Superior Binational Program (LSBP). 2008. Lake Superior Lakewide Management Plan. Prepared by the Superior Work Group . 209 pages. Toronto and Chicago.

Micrology Laboratories, Inc. 2010. Coliscan Easygel. Retrieved 11/23/10, from http://www.micrologylabs.com/Home/Our_Methods/Coliscan_Media/Coliscan_Easygel.

National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center 2010. Land Cover Analysis. Coastal Great Lakes Land Cover. Retrieved 11/10/10, from http://www.csc.noaa.gov/crs/lca/greatlakes.html.

Natural Resources Conservation Service (NRCS) 1998. Erosion and Sedimentation in the Nemadji River Basin Project Final Report. U.S. Forest Service. January. Ashland, WI.

Natural Resources Conservation Service (NRCS) 2012. Environmental Quality Incentives Program. Retrieved 5/30/12, from http://www.wi.nrcs.usda.gov/programs/eqip.html.

Northland College 2010. The LoonWatch Program. Retrieved 12/10/10, from http://www.northland.edu/sigurd-olson-environmental-institute-loon-watch.htm.

Patronski, T., C. Charbonneau, P. Dryer, J. Cochrane, D. R. Smith, A. Ania, C. Deloria and C. Kaye. 2009. Fish Passage and Stream Barrier Management in the Bad River Watershed in Northern Wisconsin. A Case Study from the Structured Decision Making Workshop. December 8-12, 2008. National Conservation Training Center, Shepherdstown, WV, USA.

Reinhart, K.G., A.R. Eschner, and G.R. Trimble. 1963. Effect on streamflow of four forest practices in the mountains of West Virginia: U.S. Forest Service Research Paper NE-I, 79 p.

Ries, K.G., III, and Crouse, M.Y., 2002. The National Flood Frequency Program, Version 3: A Computer Program for Estimating Magnitude and Frequency of Floods for Ungaged Sites, 2002: U.S. Geological Survey Water-Resources Investigations Report 02-4168, 42 p.

Robertson, D. M. 1997. Regionalized Loads of Sediment and Phosphorus to Lakes Michigan and Superior – High Flow and Long-term Average. *J. Great Lakes Res.* 23(4):416-439.

Roni, P., editor. 2005. Monitoring stream and watershed restoration. American Fisheries Society, Bethesda, MD.

Schultz, S.D. 2003. Best Management Practice Guidelines for the Wisconsin Portion of the Lake Superior Basin. Prepared for the Wisconsin Department of Natural Resources and Ashland, Bayfield, Douglas, and Iron County Land Conservation Department.

Shy, K. and C. Wagner, 2007a. Wisconsin's Forestry Best Management Practices (BMPs) for Water Quality, 2006 BMP Monitoring Report. Wisconsin Department of Natural Resources, Division of Forestry, PUB-FR-391-2007, Madison, WI. 35 p.

Shy, K. and C. Wagner, 2007b. Managing Woodlands on Lake Superior's Red Clay Plain: Information and Training Workbook. Department of Natural Resources, Madison, WI.

Shy, K. and C. Wagner, 2007c. Management Recommendations for Forestry Practices along Wisconsin's Coastal Trout Streams. Department of Natural Resources, Madison, WI.

Soltis, D. G. 1999. Purple Loosestrife (*Lythrum salicaria*): An Overview of the Plant and Techniques for Its Management on the Bad River Reservation.

Turville-Heitz, M. 1999. Lake Superior Basin Water Quality Management Plan: A Five-Year Plan to Protect and Enhance Our Water Resources. Wisconsin Department of Natural Resources, Bureau of Watershed Management.

United States Geological Survey (USGS) 2010. National Streamflow Statistics Program. Retrieved 12/20/10, from http://water.usgs.gov/osw/programs/nss/summary.html.

United States Environmental Protection Agency (EPA). 2008. Handbook for Developing Watershed Plans to Restore and Protect Our Waters. Office of Water, Nonpoint Source Control Branch, Washington DC 20460. EPA 841-B-08-002.

United States Environmental Protection Agency (EPA). 2010. Great Lakes Restoration Initiative. Retrieved 1/14/11, from http://www.epa.gov/greatlakes/glri/.

United States Environmental Protection Agency (EPA). 2012. Recovery Potential Screening: Tools for Comparing Impaired Waters Restorability. Retrieved 3/22/12, from http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/recovery/index.cfm.

University of Wisconsin-Extension Center for Land Use Education (UW-Extension) and United States Geological Survey (USGS) Wisconsin Water Science Center 2008. Protecting Wisconsin's Groundwater through Comprehensive Planning. Retrieved 11/17/10, from http://wi.water.usgs.gov/gwcomp/.

University of Wisconsin-Extension and Wisconsin Department of Natural Resources. 2009. Your Views on Lake Superior Basin Natural Resources Woodland Landowner Survey. 12 p.

Vanden Brook, James P., and others, 2002. Agricultural Chemicals in Wisconsin Groundwater, Final Report: Madison, Wis., Wisconsin Department of Agriculture, Trade and Consumer Protection, 21 p.

Verry, E.S., J.R. Lewis, and K.N. Brooks. 1983. Aspen clearcutting increases snowmelt and storm flow peaks in north central Minnesota. *Water Resources Bulletin*. vol. 19, no.1, p. 59-67.

Verry, E.S. 2001. Land fragmentation and impacts to streams and fish in the central and upper Midwest. In: Proceedings, Society of American Foresters 2000 national convention. SAF Publ. 01-02. Bethesda, MD. Society of American Foresters, p. 38-44.

Wagner, C. and C. Matula. 2010. Forestry and BMP Implementation. Wisconsin Department of Natural Resources, Division of Forestry. Presentation at the Marengo River Watershed Partnership Technical Team Workshop. August 31, 2010. Ashland, WI.

Weigel, B.M., L. Wang, P.W. Rasmussen, J.T. Butcher, P.M. Stewart, T.P. Simon, and M.J. Wiley. 2003. Relative influence of variables at multiple spatial scales on stream macroinvertebrates in the Northern Lakes and Forest Ecoregion, U.S.A. *Freshwater Biology* 48:1440–1461.

Wisconsin Administrative Code (WAC) 2012. Chapter ATCP 50. Soil and Water Resource Management Program. Retrieved 5/30/12, from https://docs.legis.wisconsin.gov/code/admin_code/atcp/50/I/01.

Wisconsin Department of Natural Resources (WDNR). 2003. Wisconsin's Forest Management Guidelines. Division of Forestry. PUB-FR-226 2003. Madison, WI. 306 p.

Wisconsin Department of Natural Resources (WDNR). 2004. State of Wisconsin Guidelines for Designating Fish & Aquatic Life Uses for Wisconsin Surface Waters. Bureau of Watershed Management. PUBL-WT-807-04. Madison, WI. 75 p.

Wisconsin Department of Natural Resources (WDNR). 2007. Managing Woodlands on Lake Superior's Red Clay Plain. Slowing the Flow of Runoff. PUB-FR-385 2007. 8p.

Wisconsin Department of Natural Resources (WDNR) and United States Fish and Wildlife Service (USFWS) 2005. Wisconsin Lake Superior Basin Brook Trout Plan. 47 p.

Wisconsin Department of Natural Resources (WDNR). 2009. Wisconsin's Great Lakes Strategy: Restoring and Protecting Our Great Lakes, 2009 Update. Office of the Great Lakes. 50 p.

Wisconsin Department of Natural Resources (WDNR). 2010a. Ecological Landscapes of Wisconsin. Retrieved 10/19/10, from http://dnr.wi.gov/landscapes/.

Wisconsin Department of Natural Resources (WDNR). 2010b. Wisconsin's Forestry Best Management Practices for Water Quality. Division of Forestry. PUB FR-093 2010. Madison, WI. 162 p.

Wisconsin Department of Natural Resources (WDNR). 2010c. Dam Data. Retrieved 11/17/10, from http://dnr.wi.gov/org/water/wm/dsfm/dams/datacentral.html.

Wisconsin Department of Natural Resources (WDNR). 2010d. Wisconsin's Citizen Lake Monitoring Network. Retrieved 10/19/10, from http://dnr.wi.gov/org/water/fhp/lakes/selfhelp/.

Wisconsin Department of Natural Resources (WDNR). 2010e. Remediation and Redevelopment Program. Retrieved 11/17/10, from http://dnr.wi.gov/org/aw/rr/index.htm.

Wisconsin Department of Natural Resources (WDNR). 2010f. 2010 Wisconsin Water Quality Report to Congress. WDNR Pub WT-924-2010. 151 p.

Wisconsin Department of Natural Resources (WDNR). 2010g. Invasive Species Program. Retrieved 12/21/10, from http://dnr.wi.gov/invasives/.

Wisconsin Department of Natural Resources (WDNR). 2010h. Wildlife Action Plan. Retrieved 12/21/10, from http://dnr.wi.gov/org/land/er/WWAP/.

Wisconsin Department of Natural Resources (WDNR). 2010i. State Natural Areas Program. Retrieved 12/21/10, from http://dnr.wi.gov/org/land/er/sna/.

Wisconsin Department of Natural Resources (WDNR). 2010j. Lake Superior Basin Regional Assessment and Report Compendium. PUB-FR-468-2010. 85 p.

Wisconsin Department of Natural Resources (WDNR). 2011a. Marengo River Watershed. 2011 Water Quality Management Plan Update. Working Draft December 2, 2011. 28 p.

Wisconsin Department of Natural Resources (WDNR). 2011b. Wisconsin 2012 Consolidated Assessment and Listing Methodology (WisCALM). Clean Water Act Section 305(b), 314, and 303(d) Integrated Reporting. 3200-2011-01. 113 p.

APPENDICES

APPENDIX A. Marengo River Watershed Action Plan Implementation Resolutions and Letters of Support.

APPENDIX B. List of known terrestrial and aquatic invasive species in the Marengo River Watershed and a five-mile buffer around the watershed as of July 2010.

APPENDIX C. Marengo River Watershed Partnership Technical Team online survey of priority challenges and sources – survey questions and background information.

APPENDIX D. List of project ideas and concerns submitted by Marengo River Watershed citizens, local government representatives, other partners and individuals during the course of the project.

APPENDIX E. Visioning exercise words/phrases, draft, and final vision statements.

APPENDIX F. USDA Forest Service Watershed Condition Framework. FY2011 Transition Watershed Restoration Action Plan. Chequamegon-Nicolet National Forest. Headwaters Marengo River 040103020402.

APPENDIX A.

Marengo River Watershed Action Plan Implementation Resolutions and Letters of Support. These may be added upon approval of plan.

Marengo River Watershed Action Plan
Potential text for use in resolutions/letters of support

We, the supporters of the Marengo River Watershed Partnership, would like to see a Marengo River Watershed that has clean, flowing water; supports healthy, diverse, and resilient plant and animal communities free of invasive species; and is a vital community of watershed stewards who take actions to care for the watershed, while enabling a productive livelihood. Moreover, we recognize that achieving this vision for the watershed can be accomplished by implementing the Marengo River Watershed Action Plan. Therefore, we approve of and we shall implement, where feasible, the recommendations contained in the Watershed Action Plan to maintain and improve the health of the Marengo River Watershed. We understand that this agreement is voluntary and non-binding.

APPENDIX B.

Invasive species identified within the Marengo River Watershed and a 5-mile buffer around the watershed boundary. Database maintained by the Great Lakes Indian Fish and Wildlife Commission. Data retrieved on 7/6/10.

GENUS	SPECIES	COMMON NAME
Miscanthus	*sacchariflorus*	Amur silver grass
Elaeagnus	*umbellata*	autumn olive
Campanula	*trachelium*	bat in the belfry
Lonicera	*X bella*	Bell's honeysuckle
Lupinus	*polyphyllus*	bigleaf lupine
Aegopodium	*podagraria*	bishop's goutweed
Solanum	*dulcamara*	bittersweet nightshade
Robinia	*pseudoacacia*	black locust
Knautia	*arvensis*	blue buttons
Saponaria	*officinalis*	bouncing bet
Cirsium	*vulgare*	bull thistle
Linaria	*vulgaris*	butter and eggs
Cirsium	*arvense*	Canada thistle
Cipangopaludina	*chinensis*	Chinese mystery snail
Rhamnus	*cathartica*	common buckthorn
Veronica	*officinalis*	common gypsyweed
Leonurus	*cardiaca*	common motherwort
Verbascum	*thapsus*	common mullein
Vinca	*minor*	common periwinkle
Phragmites	*australis*	common reed
Veronica	*arvensis*	common speedwell
Hypericum	*perforatum*	common St. John's wort
Tanacetum	*vulgare*	common tansy
Salix	*fragilis*	crack willow
Campanula	*rapunculoides*	creeping bellflower
Glechoma	*hederacea*	creeping Charlie
Coronilla	*varia*	crown vetch
Euphorbia	*cyparissias*	cypress spurge
Hesperis	*matronalis*	dame's rocket
Rosa	*majalis*	double cinnamon rose
Helictotrichon	*pubescens*	downy alpineoatgrass
Hedera	*helix*	English ivy
Convallaria	*majalis*	European lily-of-the-valley
Sorbus	*aucuparia*	European mountain ash

GENUS	SPECIES	COMMON NAME
Phlox	*paniculata*	fall phlox
Lathyrus	*sylvestris*	flat pea
Rumex	*acetosa*	garden sorrel
Valeriana	*officinalis*	garden valerian
Alliaria	*petiolata*	garlic mustard
Myosoton	*aquaticum*	giant chickweed
Frangula	*alnus*	glossy buckthorn
Lonicera		honeysuckle
Typha	*X glauca*	hybrid cattail
Salix	*X rubens*	hybrid crack willow
Berberis	*thunbergii*	Japanese barberry
Pachysandra	*terminalis*	Japanese pachysandra
Petasites	*japonicus*	Japanese sweet coltsfoot
Euphorbia	*esula*	leafy spurge
Mentha		mint
Lysimachia	*nummularia*	moneywort
Lonicera	*morrowii*	Morrow's honeysuckle
Typha	*angustifolia*	narrow-leaved cattail
Lapsana	*communis*	nipplewort
Picea	*abies*	Norway spruce
Hemerocallis	*fulva*	orange daylily
Lythrum	*salicaria*	purple loosestrife
Mentha	*X gracilis*	red mint
Phalaris	*arundinacea*	reed canary grass
Juncus	*compressus*	roundfruit rush
Gymnocephalus	*cernuus*	ruffe
Ulmus	*pumila*	Siberian elm
Petromyzon	*marinus*	sea lamprey
Caragana	*arborescens*	Siberian pea-shrub
Bromus	*inermis*	smooth brome
Achillea	*ptarmica*	sneezeweed
Centaurea	*biebersteinii*	spotted knapweed
Draba	*verna*	spring Whitlow-grass
Anthoxanthum	*odoratum*	sweet vernal grass
Dianthus	*barbatus*	sweet William
Juncus	*ensifolius*	sword-leaved rush
Lonicera	*tatarica*	Tartarian honeysuckle
Deschampsia	*cespitosa ssp. cespitosa*	tufted hairgrass
Campanula	*carpatica*	tussock bellflower

GENUS	SPECIES	COMMON NAME
Myosotis	*scorpioides*	water forget-me-not
Viburnum	*lantana*	wayfaring tree
Salix	*alba*	white willow
Pastinaca	*sativa*	wild parsnip
Hylotelephium	*telephium ssp. telephium*	witch's moneybags
Poa	*nemoralis*	wood bluegrass
Myosotis	*sylvatica*	woodland forget-me-not
Hemerocallis	*lilioasphodelus*	yellow daylily
Iris	*pseudacorus*	yellow flag iris
Galium	*verum*	yellow spring bedstraw

APPENDIX C.

Marengo River Watershed Partnership Technical Team Online Survey of Priority Challenges and Sources – September 20-27, 2010

Survey Questions:

1. Please identify which of the following groups you have the greatest interest in?

   Answer Options:
   - Hydrology
   - Best Management Practice Implementation
   - Aquatic Species and Habitat
   - Terrestrial Species and Habitat
   - Comment

2. Severity-Please select the severity of identified challenges as they currently exist or what they might be in the future. How great is the overall effect of each challenge on the Marengo River watershed compared to the others? Consider the overall effect each challenge has on meeting the draft vision and goals for the watershed. 1=greatest effect on the watershed, 6=least effect on the watershed.

   Answer Options:
   - Unstable hydrology
   - Sediment
   - Excess nutrients
   - High bacteria counts
   - Loss of aquatic habitat
   - Terrestrial habitat fragmentation and alteration
   - Comment

3. Scope – How widespread is each challenge throughout the Marengo River watershed? Is it very localized or is it a challenge occurring through a large portion of the watershed?

   Answer Options:
   - Unstable hydrology
   - Sediment
   - Excess nutrients
   - High bacteria counts
   - Loss of aquatic habitat
   - Terrestrial habitat fragmentation and alteration
   - Comment

4. If you feel there are any challenges in the Marengo River watershed that are not listed and should be considered as having an effect on meeting the watershed goals, please list.

5. Unstable hydrology - What are the top ten sources contributing to unstable hydrology? (From the list, pick your top ten, leave the rest blank.) 1=most important source 10=least.
    - Hydrologic units with >60% open land/<16 year forests
    - Drained wetlands
    - Stream channelization/incision
    - Overbank sedimentation
    - Roads & road/stream crossings
    - Surface drainage from agricultural areas
    - Improperly applied/managed livestock waste
    - Bluff/Streambank erosion
    - Poorly designed/functioning septic systems
    - Mining (i.e. iron ore, gravel pits)
    - Elevated water temperatures
    - Dams
    - Invasive species
    - Untreated storm water runoff
    - Climate change
    - Inconsistent/inadequate zoning
    - Conflicting objectives in wildlife management
    - Development (converting land use)
    - Poor forest management and harvest
    - Other (please specify)

6. Excess sediment - What are the top ten sources contributing to excess sediment? (From the list, pick your top ten, leave the rest blank.) 1=most important source 10=least.
    - Hydrologic units with >60% open land/<16 year forests
    - Drained wetlands
    - Stream channelization/incision
    - Overbank sedimentation
    - Roads & road/stream crossings
    - Surface drainage from agricultural areas
    - Improperly applied/managed livestock waste
    - Bluff/Streambank erosion
    - Poorly designed/functioning septic systems
    - Mining (i.e. iron ore, gravel pits)
    - Elevated water temperatures

- Dams
- Invasive species
- Untreated storm water runoff
- Climate change
- Inconsistent/inadequate zoning
- Conflicting objectives in wildlife management
- Development (converting land use)
- Poor forest management and harvest
- Other (please specify)

7. Excess nutrients - What are the top ten sources contributing to excess nutrients? (From the list, pick your top ten, leave the rest blank.) 1=most important source 10=least.
    - Hydrologic units with >60% open land/<16 year forests
    - Drained wetlands
    - Stream channelization/incision
    - Overbank sedimentation
    - Roads & road/stream crossings
    - Surface drainage from agricultural areas
    - Improperly applied/managed livestock waste
    - Bluff/Streambank erosion
    - Poorly designed/functioning septic systems
    - Mining (i.e. iron ore, gravel pits)
    - Elevated water temperatures
    - Dams
    - Invasive species
    - Untreated storm water runoff
    - Climate change
    - Inconsistent/inadequate zoning
    - Conflicting objectives in wildlife management
    - Development (converting land use)
    - Poor forest management and harvest
    - Other (please specify)

8. High bacteria counts - What are the top ten sources contributing to high bacteria counts? (From the list, pick your top ten, leave the rest blank.) 1=most important source 10=least.
    - Hydrologic units with >60% open land/<16 year forests
    - Drained wetlands
    - Stream channelization/incision
    - Overbank sedimentation
    - Roads & road/stream crossings
    - Surface drainage from agricultural areas

- Improperly applied/managed livestock waste
- Bluff/Streambank erosion
- Poorly designed/functioning septic systems
- Mining (i.e. iron ore, gravel pits)
- Elevated water temperatures
- Dams
- Invasive species
- Untreated storm water runoff
- Climate change
- Inconsistent/inadequate zoning
- Conflicting objectives in wildlife management
- Development (converting land use)
- Poor forest management and harvest
- Other (please specify)

9. Loss of aquatic habitat - What are the top ten sources contributing to loss of aquatic habitat? (From the list, pick your top ten, leave the rest blank.) 1=most important source 10=least.
    - Hydrologic units with >60% open land/<16 year forests
    - Drained wetlands
    - Stream channelization/incision
    - Overbank sedimentation
    - Roads & road/stream crossings
    - Surface drainage from agricultural areas
    - Improperly applied/managed livestock waste
    - Bluff/Streambank erosion
    - Poorly designed/functioning septic systems
    - Mining (i.e. iron ore, gravel pits)
    - Elevated water temperatures
    - Dams
    - Invasive species
    - Untreated storm water runoff
    - Climate change
    - Inconsistent/inadequate zoning
    - Conflicting objectives in wildlife management
    - Development (converting land use)
    - Poor forest management and harvest
    - Other (please specify)

10. Terrestrial habitat fragmentation and alteration - What are the top ten sources contributing to terrestrial habitat fragmentation and alteration? (From the list, pick your top ten, leave the rest blank.) 1=most important source 10=least.

- Hydrologic units with >60% open land/<16 year forests
- Drained wetlands
- Stream channelization/incision
- Overbank sedimentation
- Roads & road/stream crossings
- Surface drainage from agricultural areas
- Improperly applied/managed livestock waste
- Bluff/Streambank erosion
- Poorly designed/functioning septic systems
- Mining (i.e. iron ore, gravel pits)
- Elevated water temperatures
- Dams
- Invasive species
- Untreated storm water runoff
- Climate change
- Inconsistent/inadequate zoning
- Conflicting objectives in wildlife management
- Development (converting land use)
- Poor forest management and harvest
- Other (please specify)

11. Recovery Potential - Please select the recovery potential (defined as the likelihood of management actions to mitigate the source).

    Answer Options:
    - Very High
    - High
    - Medium
    - Low
    - Don't Know

    Sources:
    - Hydrologic units with >60% open land/<16 year forests
    - Drained wetlands
    - Stream channelization/incision
    - Overbank sedimentation
    - Roads & road/stream crossings
    - Surface drainage from agricultural areas
    - Improperly applied/managed livestock waste
    - Bluff/Streambank erosion
    - Poorly designed/functioning septic systems
    - Mining (i.e. iron ore, gravel pits)
    - Elevated water temperatures

- Dams
- Invasive species
- Untreated storm water runoff
- Climate change
- Inconsistent/inadequate zoning
- Conflicting objectives in wildlife management
- Development (converting land use)
- Poor forest management and harvest
- Other (please specify)

Resources to help you complete the Marengo River Watershed Partnership (MRWP) Technical Team Survey of Priority Challenges and Sources (sent via email along with survey link to Technical Team participants)

Why are we doing this? As we learned from the EPA representatives at the workshop on 8/31, one of the missing pieces we need is a prioritization of the challenges or stresses that form the basis for our goals, objectives and actions. Thus, the feedback from you all at the workshop will be very important to shaping the management objectives and actions in the plan, but what we're missing is the prioritization piece (hence the survey!).

What will we do with this information? The resulting severity and scope rankings will be added together for each challenge and averaged to give an overall priority value. The overall value should give an indication of what challenges facing the Marengo River watershed are most important to work on in order to achieve the watershed vision and goals. The ranking of challenges then leads to the ranking of sources for each of the challenges. This ranking will help narrow down what the most important sources are and thus what the appropriate management actions should be to address the sources. Again, an average will be used to rate each of the sources as they relate to each of the challenges. The ranking information you are providing will provide a guide to BRWA as to what the priorities should be when drafting the watershed action plan. Of course, these will be open to comment and further consideration for things like feasibility, cost, and willingness of citizens in the watershed to implement the actions.

Additional Information/Clarification on Completing the Survey

This exercise will force you to think from a watershed perspective about what challenges or stressors are really driving the condition of the Marengo watershed we see today and should be improved in order for the watershed vision to be achieved. Think about what you know based on your work in the Marengo watershed and the greater Lake Superior basin of Wisconsin (because the challenges are very similar) and what we learned from the Technical Team workshop on August 31.

Draft Marengo River Watershed Vision Statement: *We would like to see a Marengo River watershed that has clean, flowing water; supports healthy, diverse, and resilient plant and animal communities free of invasive species; and is a vital community of watershed stewards who take actions to care for the watershed, while enabling a productive livelihood.*

Watershed Goal #1: The hydrologic system in the Marengo River watershed is stable and resilient.
Watershed Goal #2: Safe water and healthy, productive soil are available and maintained for all uses by humans and wildlife.
Watershed Goal #3: The Marengo River watershed has diverse, healthy, and resilient native communities of plants and animals and their habitats on land and in water.

What do we mean by:

1. Goal – A desired or targeted state for the watershed in the future. The goals are long-term, the action plan we are developing will be focused on what we can achieve in a 10-year time span.
2. Challenge – An existing stress that is caused by human activity and currently prevents a watershed goal from being met.
   - Unstable hydrology – This challenge encompasses multiple, related challenges that affect the hydrologic condition of the Marengo River watershed including things like: altered peak flows, channelization, groundwater contribution to base flow, drained wetlands, open lands, etc.
   - Excess sediment – This challenge assumes that there is currently more sediment loading and erosion occurring in the Marengo River watershed than we would see in a natural or stable condition. The challenge encompasses issues such as bluff erosion, levee building, road/stream crossings, surface drainage, sediment impacts on aquatic habitat, etc.
   - Excess nutrients – This challenge relates to available water quality data indicating some areas in the Marengo River watershed have phosphorus and nitrogen concentrations elevated above benchmark values (Because nutrient criteria for surface water in Wisconsin's Lake Superior basin are not finalized, the benchmarks BRWA uses are from USGS for typical stream nutrient concentrations in the U.S.)
   - High bacteria counts – Monitoring by BRWA and the Bad River Tribe has indicated several areas in the lower reaches of the Marengo River watershed that periodically have bacteria counts that are of a human health concern.
   - Loss of aquatic habitat – This challenge assumes that current available habitat for aquatic communities is not achieving its potential.
   - Terrestrial habitat fragmentation and alteration - This challenge assumes that current available habitat for terrestrial communities of plants and animals is not achieving its potential.

Monitoring, as well as citizen involvement considerations (including education and outreach), are overarching concerns that will be addressed as part of the nine-element watershed planning process. A monitoring and citizen involvement strategies will flow from this exercise to prioritize the most important challenges facing the health of the watershed.

Summary from MRWP Technical Team Workshop – You may want to consider the results from the group discussions at the workshop while doing your rankings. If you would like any information from the presentations at the workshop to help you make your choices, please contact me. Below are the top recommended objectives (strategies) to maintain and improve the health of the Marengo River watershed from the small group discussions.

Hydrology

3. Reduce in-stream sources of sediment (such as bluff erosion, road/stream crossings, channel incision).

4. Reduce peak flows (such as restore/protect wetlands, open lands, increase stream roughness, assist landowners)
5. Restore floodplain connectivity in incised reaches with excessive overbank sedimentation.
6. Understand groundwater contributions to baseflow and water supply.

BMP Implementers – this group felt a fundamental strategy was to continue to implement forestry BMPs with an emphasis on improving application of road, riparian management zone, and timber harvest BMPs.

1. Educate landowners and developers about good riparian and shoreline property management (including forest management plans for landowners).
2. Strengthen local zoning ordinances and encourage practices that protect watershed health while meeting development needs.
3. Implement agriculture conservation practices associated with waterway crossings, access roads, fencing, riparian buffers, and streambank protection.

Aquatic Species and Habitat

1. Identify habitat types present throughout the watershed including:
    a. Cold, cool, warm water streams and lakes.
    b. Riparian areas and wetlands
    c. Perennial streams
    d. Water temperature data
2. Identify indicator species by habitat type to represent general community.
    a. Survey streams
    b. Identify habitat potential and to what extent it is currently being met.
3. Identify and implement restoration options based on habitat type.

Terrestrial Species and Habitat

1. Secure protection of priority riparian, aquatic, and terrestrial conservation areas through tools such as land acquisition and conservation easements.
2. Develop and provide mechanisms for watershed landowners to implement land management practices, programs, etc. (such as tax incentives, BMPs).
3. Identify, restore, and maintain ecological processes and priority habitats.
    a. Identify indicator species
    b. Identify location of invasive species
    c. Restoration for endangered species or ecological processes

Thank you for your input!

APPENDIX D. List of project ideas and concerns submitted by Marengo River watershed citizens, local government representatives, other partners and individuals, and BRWA stream survey locations as part of the citizen involvement component of the Marengo River Watershed Action Plan. Several of the actions listed in the Watershed Action Plan in Chapter 5 reference this table for specific ideas on project locations.

Point	Project Idea or Concern	Type	Stream	County	Town	Underway?	Submitted By
1	Replace Troutmere Creek crossing on Midway Rd.	Road/Culvert	Troutmere Creek	Ashland	Marengo	Y	BRWA
2	Stabilize 170ft. Eroding bluff on Marengo River	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
3	Stabilize ~50ft sand bluff actively eroding on river bend. Access limited.	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
4	Road floods & washes out. Move road, allow for floodplain access	Road/Culvert	Hawkins Creek	Bayfield	Lincoln	N	Watershed Citizen
5	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
6	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
7	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
8	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
9	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
10	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
11	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
12	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
13	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
14	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
15	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
16	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
17	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
18	Stabilize eroding streambank	Streambank Erosion	Marengo River	Ashland	White River	N	Watershed Citizen
19	#598 Culvert database, replace culvert, road floods & erodes in spring	Road/Culvert	Hawkins Creek	Bayfield	Lincoln	N	Local Government
20	Fix bridge crossing on Mineral Lake Rd., too narrow, eroding	Road/Culvert	Brunsweiler River	Ashland	Marengo	N	Watershed Citizen
21	Replace culvert, Quarry Rd.	Road/Culvert	Trout Brook	Ashland	Morse	Y	BRWA
22	Erosion problem on Mineral Lake Rd., clogs trout stream with silt	Road/Culvert	Canyon Creek	Ashland	Marengo	N	Watershed Citizen
23	Eroding stream banks near Cemetery Rd. crossing	Streambank Erosion	Brunsweiler River	Ashland	Marengo	N	Watershed Citizen
24	Water quality monitoring on Marengo Lake and tributaries needed	Monitoring	Marengo Lake	Bayfield	Lincoln	N	Watershed Citizen
25	Remove old gas tanks buried at Four Corners Bar	Waste Disposal	Upland	Bayfield	Lincoln	Y	Watershed Citizen
26	Wetland monitoring-keep wood ducks	Monitoring	Upland	Bayfield	Kelly	N	Watershed Citizen
27	Replace Silver Creek culvert under Hwy. 13	Road/Culvert	Silver Creek	Ashland	Ashland	N	Watershed Citizen
28	Survey/Protect native wood turtle habitat along Marengo River	Habitat	Marengo River	Bayfield	Lincoln	N	Other Project Partner
29	Purple loostrife seed source/potential treatment area, Highbridge	Invasive Species	Upland	Ashland	Ashland	N	Other Project Partner
30	Walking trail up Trout Brook-in T. Ashland Comp Plan	Recreation	Upland	Ashland	Ashland	N	Watershed Citizen
31	Beaver dams causing problems above/below Marengo Lake - restore trout habitat	Habitat	Marengo River	Bayfield	Lincoln	N	Local Government

Point	Project Idea or Concern	Type	Stream	County	Town	Underway?	Submitted By
32	Make loop out of St. Peter's Dome trail using old ski trail along Canyon Creek	Recreation	Canyon Creek	Ashland	Marengo	N	Watershed Citizen
33	Culvert replacement	Road/Culvert	Silver Creek	Ashland	Ashland	N	Watershed Citizen
34	Invasive plant control/ removal	Invasive Species	Silver Creek	Ashland	Ashland	N	Watershed Citizen
35	Sustainable/ eco forest management	Education/Outreach	Silver Creek	Ashland	Ashland	N	Watershed Citizen
36	Heritage and stories of the watershed (include native stories)	Education/Outreach	Silver Creek	Ashland	Ashland	N	Watershed Citizen
37	Plant & animal diversity surveys on private lands	Habitat	Watershed-wide			N	Watershed Citizen
38	Aid for small farmers to get started - high capital costs make it difficult.	Economy	Watershed-wide			N	Watershed Citizen
39	No organic beef processing facility in the area presents bottleneck for producers	Economy	Watershed-wide			N	Watershed Citizen
40	Would like to see farms work together in a cooperative model (like Orgnic Valley)	Economy	Watershed-wide			N	Watershed Citizen
41	Make disposal of white goods and tires easier	Waste Disposal	Watershed-wide			N	Watershed Citizen
42	More information for landowners on rain barrels, putting in greenhouses	Education/Outreach	Watershed-wide			N	Watershed Citizen
43	Better disposal option for plastic "Ag Bags."	Waste Disposal	Watershed-wide			N	Watershed Citizen
44	Make sure private septic systems updated & maintained. Needs to be affordable	Waste Disposal	Watershed-wide	Ashland		N	Multiple Citizens
45	Would like to put in a wetland on property	Habitat	Upland	Ashland	Marengo	Y	Watershed Citizen
46	Potential culvert replacement, check #443 & 451	Road/Culvert	Unnamed Marengo Trib	Bayfield	Grand View	N	Local Government
47	Culverts along Wisco Rd. frequently flood road	Road/Culvert	Unnamed Marengo Trib	Bayfield	Grand View	N	Local Government
48	Erosion issue at bridge on Marengo Lake Rd.	Road/Culvert	Marengo River	Bayfield	Grand View	N	Local Government
49	Pave before and after bridges on gravel roads to prevent erosion.	Road/Culvert	Watershed-wide			N	Local Government
50	Study restoration potential for perrenial stream that flows under Cty. E	Habitat	Unnamed Marengo Trib	Bayfield	Kelly	N	Local Government/BRWA
51	Steep, eroding clay banks, can we plant trees to stabilize?	Streambank Erosion	Unnamed Marengo Trib	Ashland	Marengo	N	Watershed Citizen
52	Plant trees in ravines to slow snow melt and runoff	Riparian Buffer	Watershed-wide			N	Watershed Citizen
53	Fish passage problem on culvert, Wildcat Rd.	Road/Culvert	Unnamed Marengo Trib	Ashland	Marengo	N	Local Government/BRWA
54	Repair or remove dam on Beaverdam Lake	Habitat	Brunsweiler River	Ashland	Marengo	N	Watershed Citizen
55	Water backs up and freezes over road in winter causing maintenance issue	Road/Culvert	Unnamed Marengo Trib	Ashland	Marengo	N	Local Government
56	Culverts and road floods frequently along Indian Lake Rd.	Road/Culvert	Unnamed Marengo Trib	Bayfield	Lincoln	N	Local Government
57	Check #625 Culvert database - Fiber Optic work there may have affected creek.	Road/Culvert	Little Spring Creek	Bayfield	Lincoln	N	Local Government
58	What would a Wild & Scenic River designation mean for the Marengo?	Special Designation	Watershed-wide			N	Watershed Citizen
59	Confluence of Hawkins & Morgan Creek more swampy than in past. Beavers?	Habitat	Morgan Creek	Bayfield	Lincoln	N	Local Government
60	Tire disposal on road sides is an issue - what can be done?	Waste Disposal	Watershed-wide			N	Multiple local governments
61	Large, eroding clay bank off Osredkar Rd.	Streambank Erosion	Unnamed Marengo Trib	Ashland	White River	N	Local Government
62	Overflow culvert from Bass Lake causes flooding and erosion problems	Road/Culvert	Unnamed Marengo Trib	Ashland	Ashland	N	Local Government
63	Culverts and erosion affecting Billy Creek	Road/Culvert	Billy Creek	Ashland	Ashland	N	Local Government
64	Culverts need to be replaced by junction of North York & Springbrook Rd.	Road/Culvert	Unnamed Marengo Trib	Ashland	Ashland	N	Local Government
65	Concern pond construction in upper Trout Brook led to warmer water	Habitat	Trout Brook	Ashland	Ashland	N	Multiple local governments
66	Landowner may have cow parsnip on property - if so would like to remove it.	Invasive Species	Upland	Bayfield	Lincoln	N	Watershed Citizen
67	Eroding stream bank on Brunsweiler	Streambank Erosion	Brunsweiler River	Ashland	Marengo	N	Watershed Citizen

Point	Project Idea or Concern	Type	Stream	County	Town	Underway?	Submitted By
68	Eroding stream bank on Brunsweiler	Streambank Erosion	Brunsweiler River	Ashland	Marengo	N	Watershed Citizen
69	Eroding stream bank on Brunsweiler	Streambank Erosion	Brunsweiler River	Ashland	Marengo	N	Watershed Citizen
70	Ravine eroding, landowner would like to stabilize	Streambank Erosion	Troutmere Creek	Ashland	Marengo	N	Watershed Citizen
71	More education of landowners on forestry best management practices	Education/Outreach	Watershed-wide			Y	6/3 MRWP mtng
72	More community events with panelists like 6/3 MRWP meeting. Farm tours?	Education/Outreach	Watershed-wide			Y	6/3 MRWP mtng
73	Make implementing things to help rivers easier - frustration with "red tape"	Education/Outreach	Watershed-wide			N	6/3 MRWP mtng
74	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
75	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
76	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
77	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
78	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
79	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
80	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
81	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
82	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
83	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
84	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
85	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
86	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
87	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
88	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
89	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
90	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
91	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
92	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
93	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
94	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
95	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
96	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
97	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
98	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
99	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
100	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
101	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
102	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
103	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey

Point	Project Idea or Concern	Type	Stream	County	Town	Underway?	Submitted By
104	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
105	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
106	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
107	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
108	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
109	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
110	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
111	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
112	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
113	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
114	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
115	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
116	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
117	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
118	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
119	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
120	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
121	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
122	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
123	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
124	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
125	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
126	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
127	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
128	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
129	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
130	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
131	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
132	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
133	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
134	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
135	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
136	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
137	Stabilize eroding streambank	Streambank Erosion	Marengo River	Bayfield	Lincoln	N	BRWA survey
138	Private road may be impacting headwaters of Trout Brook	Road/Culvert	Trout Brook	Ashland	Morse	N	Watershed Citizen
139	Culvert on Fox Farm Rd. - perennial stream, drop at outlet, may block fish passage	Road/Culvert	Brunsweiler River	Ashland	Marengo	N	Watershed Citizen

Point	Project Idea or Concern	Type	Stream	County	Town	Underway?	Submitted By
140	Concern about erosion from ATVs crossing Brunsweiler @ Cemetery Rd.	Road/Culvert	Brunsweiler River	Ashland	Marengo	N	Watershed Citizen
141	Check #597 in Culvert database - may be erosion issues to Morgan Creek	Road/Culvert	Morgan Creek	Bayfield	Lincoln	N	Local Government
142	Check #621 in Culvert database - driveway culvert may be causing erosion issues	Road/Culvert	Trib to Morgan Creek	Bayfield	Lincoln	N	Local Government

* See tab "T. Lincoln list" in this spreadsheet for additional estimates on project costs (gravel, pipes needed) submitted to BRWA by the Town of Lincoln, 6/2/2010.

APPENDIX E.

Visioning exercise words/phrases, draft, and final vision statements

Word List from Visioning exercise conducted as part of the 12/16/2009 Marengo River Watershed Partnership meeting (in no particular order):

- Clean
- Trout
- Connected (no blockages for fish)
- Diversity of plants and animals
- Uncut (natural forest)
- Accessible (river access)
- Resilient to changes
- Destination for visitors
- Productive for livelihood (making a living)
- Native plants and animals
- Agriculture present
- Watershed stewards
- Proud and involved citizens
- Being a model to others (inspiring)
- Retains rural character

First draft vision statement derived from the visioning exercise:

We would like to see a Marengo River watershed that is:

- A community of people who are proud of where they live, care about the river, and are involved in taking actions to benefit the watershed.
- A destination for visitors because of its natural beauty, river access and mix of forested landscape and farmland that define its rural character.
- A vital, productive community where people can live, and make a living.

- A clean, flowing river that is well-connected for fish passage and supports a healthy population of trout.
- A watershed that is resilient to changes because of its diversity of native plants and animals.

Theme:
Vital communities (community of people that care; healthy natural communities of fish, plants, and wildlife)

Revised drafts:

We would like to see a Marengo River watershed that is a community of people who are proud of where they live, care about the river, and are involved in taking actions to benefit the watershed; a vital, productive community where people can live, and make a living; with a clean, flowing river that is well-connected for fish passage and supports a healthy population of trout, and that is resilient to changes because of its diversity of native plants and animals; and a destination for visitors because of its natural beauty, river access and mix of forested landscape and farmland that define its rural character.

We would like to see a Marengo River watershed that contains a vital, productive community of people that can make a living off the land, while taking actions that care for the river and benefit the watershed; and a vital, productive diverse native plant and animal community that is well connected and resilient to change.

We would like to see a Marengo River Watershed that has clean, flowing water, and supports healthy, diverse, and resilient native plant and animal communities; that is also a vital community of watershed stewards who take actions to care for the river, while maintaining a productive livelihood off the land.

We would like to see a Marengo River watershed that has clean water to support: a community of people who are proud of where they live and are involved in taking actions to benefit the watershed; a vital, productive community where people can live, and make a living; a healthy, diverse, resilient native community of plants and animals; and a destination for visitors because of its natural beauty, river access and mix of forested landscape and farmland that define its rural character.

<u>Final Watershed Action Plan Vision Statement:</u>
We would like to see a Marengo River Watershed that has clean, flowing water; supports healthy, diverse, and resilient plant and animal communities free of invasive species; and is a vital community of watershed stewards who take actions to care for the watershed, while enabling a productive livelihood.

APPENDIX F.

USDA Forest Service Watershed Condition Framework
FY2011 TRANSITION WATERSHED RESTORATION ACTION PLAN
Chequamegon-Nicolet National Forest
Headwaters Marengo River 040103020402

USDA Forest Service Watershed Condition Framework
FY2011 TRANSITION WATERSHED RESTORATION ACTION PLAN
Chequamegon-Nicolet National Forest

1. Summary

a. **Watershed Name and HUC:** Headwaters Marengo River 040103020402
b. **General Location:** Located approximately 20 miles South of Ashland, WI within Bayfield and Ashland counties. Watershed is located within the Lake Superior basin.
c. **Total Watershed Area:** 37,144 acres**;** **NFS area within watershed:** 63%.
d. **Watershed Characterization:**

- **General Physiography:** Starting in the upper section of the basin 26% of the area is characterized by the Valhalla/Mareniso Moraines where some of the youngest glacial till exists. A fragipan is characteristic of this till and ephemeral ponds are common. Slopes range from 0 to 30% and soil textures range from fine sandy loam to loamy sand. The other dominant landform consists of the Chequamegon washed till and outwash (12%). It includes coarse glacial till that has been washed along with the sandy outwash which occupies old glacial drainage-ways. Slopes range from 0 to 15% and soil surface textures range from sandy loam to loamy sand over water worked till and/or outwash. Streams and wetlands are very common.
  The majority of the watershed (45%) is characterized by the Penokee Iron Range where the landscape is characterized by steep ridges that rise hundreds of feet above the adjacent lake and till plains. Slopes range from 5 to 30%. Where rock outcrops occur the slopes are a lot steeper and may approach the vertical. The drainage is well to moderately well on the ridge tops and somewhat poor in the drainage-ways. The bedrock perches the water in many places and seeps are common. Soils are rocky and have fine sandy loam, loam or sandy loam surfaces over sandy loam to loamy sand till, and or bedrock. This landform has shallow soils. The lower section of the basin, which is located off Forest, consists of undulating outwash and lake plain with old beaches and dunes. The soils are predominantly excessively drained loamy sand over outwash or loamy lacustrine.
- **Land Use:** 63% of the watershed is held in Forest Service ownership and 37% is private. The dominant land use is forested on federal land and managed for wood products and recreation. The majority of private land is located in the northwest corner of the watershed. Private land use consists of 735 acres agriculture, 11,633 acres forest land, and 286 acres urban (associated with residential dwellings or gravel pits). One private landowner owns approximately 1834 acres of forest land within the Forest boundary and the property is located in the headwaters of the Marengo River. Water resources within the watershed: 445 acres (2%) lakes and ponds, 5980 acres (16%) wetlands.
- **General Overview of Concerns:**
  Previous restoration work has included the replacement of 10 stream crossings to reduce erosion and restore aquatic organism passage, reconstruction of FR 199 to reduce a severe erosion problem and relocation of a trail to remove multiple stream

crossings. But because of the large size and complexity of the watershed, additional restoration remains to be completed.

- **Important Ecological Values:** Marengo River contains a variety of ecological stream types with high and lower quality native brook trout habitat. Hawkins Creek, Whisky Creek and Marengo River below Whisky Creek are all class I trout streams designated by WDNR. Blaser Creek and Morgan Creek are class II trout streams. These streams also have a no aspen regeneration buffer zone Forest plan standard; the Marengo River and tributaries have a 450 ft buffer zone and Whisky, Hawkins and Morgan Creeks all have a 300 ft no aspen regeneration zone. These areas are to be managed for species other than Aspen.
  Within the watershed there are two semi primitive non-motorized, low disturbance management areas. The Marengo non-motorized area located near the Forest boundary and St. Peter's Dome located near the NE corner of the watershed. These areas are characterized by large relatively continuous, late succession hardwood forests that are located within a natural appearing semi primitive non-motorized setting. The state of WI also recognizes St. Peters Dome as a State Natural Area as well as the North Country Trail Hardwoods, which is located in the middle of Marengo non motorized area.
- **Current Condition Class: 2 (Fair)** **Target Condition Class: 1 (Good)**

e. Key Watershed Issues

1) Attributes/Indicators within FS control to affect

ATTRIBUTES /INDICATOR-Rating	REASON FOR RATING
1.2 Water Quality Problems (Not Listed)-2	Field inventory results have identified numerous road sections and road/stream crossings where erosion problems contribute sediment to adjacent riparian areas.
3.1 Aquatic Habitat- Habitat Fragmentation-2	Field road stream crossing inventory results have identified aquatic organism passage problems at select road stream crossings.
3.2 Aquatic Habitat- Large Woody Debris-3	Impacts from past logging activities have reduced the amount of future large woody debris recruitment in select streams and lakes.
3.3 Aquatic Habitat- Channel Shape and Function-2	Field road stream crossing inventory results have identified numerous locations where the crossing structure is causing stream geomorphology impacts. Also there are select areas along the Marengo River where the stream channel has been impacted by historical logging practices.
5.1 Riparian Vegetation- 2	Impacts from past logging activities have reduced the amount of future LWD recruitment in select streams and

	lakes. Also there is a need to convert short lived species within riparian areas to long lived species or promote the health of existing long lived species within those areas for future LWD recruitment.
6.2 Roads and trails-Road Maintenance-2	Field inventory results have identified numerous road sections where improvements to the road bed and drainage structures are needed to reduce erosion and sedimentation problems.
6.3 Roads and trails- Proximity to water-2	Field inventory results have identified roads located within riparian areas where erosion and sedimentation are annual problems.

2) Attributes/Indicators that require other parties to address

ATTRIBUTES /INDICATOR	**REASON FOR RATING**
3.1 Habitat Fragmentation	14 road-stream crossings off NF lands.

2. Watershed Characteristics and Conditions

a. General Context/Overview of the Watershed

The Headwaters Marengo River watershed is characterized with high peak flows as result of the Penokee Iron Range landscape condition. Also the bedrock perches the water in many places and seeps and ephemeral ponds are common. The watershed contains a variety of ecological stream types including high and lower quality native brook trout habitat but has been impacted by historic logging, a number of road problems and high beaver activity.

b. Watershed Conditions

Historical logging activities from the late 1800s to 1980s removed large quantities of wood along riparian areas of streams and lakes both for the wood itself and to make rivers suitable for log drives. There are approximately 670 acres of Aspen within the selected no aspen regeneration zones where stand age is greater than 46 years. These stands could be converted to long lived species to improve the overall health of the riparian ecosystem. Many of the roads within the area have been in place since the early logging era where they have contributed to changes in drainage patterns, increased sediment loads, fish passage problems, and loss of riparian habitat.

3. Restoration Goals, Objectives, and Opportunities

a. Goal Identification and Desired Condition

The Goals listed below are consistent with the CNNF's 2004 Forest Plan.

CNNF Forest Plan Goal 1.3 Aquatic Ecosystems- provide for ecologically healthy streams, riparian areas, lakes, and wetlands including a decline in the occurrence of exotics.
CNNF Forest Plan Goal 1.5 Wildlife and Fish Habitat- conserve habitat capable of supporting viable populations of existing native and desires non-native species, and retain the integrity and function of key habitat areas.

b. Objectives

i. CNNF Forest Plan Objective 1.3a- Reduce the number of road and trail stream crossings. Reduce sedimentation and improve fish passage in existing road and trail stream crossings.

ii. CNNF Forest Plan Objective 1.3d- Relocate some existing roads and trails out of Riparian Management Zones. Where relocation is not feasible, reconstruct road and trail segments as needed to minimize erosion, sedimentation and hydrologic impacts.

iii. CNNF Forest Plan Objective 1.3e- Improve or restore aquatic/riparian habitat in streams and lakes.

iv. This action plan would align with work to be completed through the Bad River Watershed Association Marengo River Watershed Action plan.

c. Opportunities

i. Partnership Involvement: Headwaters Marengo River watershed provides one of the best partnership opportunities on the Forest because it lies within the 5th level Marengo WS. The Bad River Watershed Association (BRWA) is currently preparing a WS Action plan for the entire Marengo WS. Other partners include the Towns of Grandview, Lincoln and Marengo, Wisconsin Department of Natural Resources (WDNR), Bad River Tribe, NRCS, FWS, Lake Superior Basin Team and Trout Unlimited.

ii. Outcomes/Output

a) Performance Measure Accomplishment: 19 acres riparian improvements to promote long lived species, 54 acres lake habitat enhancements, ~15 miles Marengo River and tributaries surveyed to determine additional restoration opportunities, 36 road and/or trail stream crossing improvements, 4.3 miles of road re-construction to reduce sedimentation and erosion problems, 16,833 acres TAP to identify additional road decommissioning projects

b) Socioeconomic Considerations: Some of the road stream crossing replacements or road re-construction projects and riparian under planting projects may go into contract where a local construction company would potentially complete the work.

d. Specific Project Activities (Essential Projects)

a. <u>Essential Project #1: Complete TAP for areas located outside Twentymile EIS</u>

- Attribute/Indicator Addressed: Roads and Trails 6.1 Open Road Density, 6.2 Road Maintenance and 6.3 Proximity to Water

- Project Description: 37% of the watershed is located within the Twentymile EIS project area which included NEPA decisions for road decommissioning and other road related improvements through the RAP. There are 16,833 acres within the HW Marengo watershed that were not evaluated during the Twentymile RAP. The remaining acreage would be evaluated through a TAP to identify if there are additional road related projects.
- Partners Involvement: None
- Timeline: Starting in 2012
    - Road reconnaissance start Fall 2012
    - Complete TAP Winter 2012
- Estimated costs and associated Budget Line Item: $42,000 in NFVW, CMRD

b. <u>Essential Project #2: Coffee Lake LWD Habitat Improvement</u>

- Attribute/Indicator Addressed: 3.2 Aquatic Habitat Large Woody Debris
- Project Description: The project is geared at restoring LWD in Coffee Lake. Coffee lake supports warmwater fishing for largemouth bass, northern pike and panfish. Because of past logging practices LWD is lacking.
- Partners Involvement: Wisconsin Department of Natural Resources and private landowners.
- Timeline: Starting in 2013 and continuing for 1 year
    - NEPA 2013
    - Project Implementation 2014
- Estimated costs and associated Budget Line Item: $8,000 in NFWF

c. <u>Essential Project #3: Geomorphic/Habitat Survey of Marengo R and tributaries</u>

- Attribute/Indicator Addressed: Aquatic Habitat 3.1 Habitat Fragmentation, 3.2 Large Woody Debris and 3.3 Channel Shape and Function; 1.2 Water Quality Problems (not listed); Aquatic Habitat 4.1 Life Form Presence, 4.2 Native Species and 4.3 Invasive Species
- Project Description: This project would involve a comprehensive geomorphic/habitat survey of the Marengo River and selected tributaries. The purpose of the inventory would be to identify all in-stream habitat restoration needs. The Forest has some idea of pressing habitat needs from a limited survey done in the early 1980's but does not know the full extent of the habitat issues. Once completed all essential projects can then be identified from the inventory. Along with the geomorphic survey a fisheries survey would be conducted. Part of this project would be to develop a working relationship with one particular private landowner who has significant ownership along the Marengo River that is surrounded by FS lands. Marengo River supports a cool/coldwater fishery, including native brook trout. Water temperature has been identified as an issue.

- Partners Involvement: WDNR would assist with fisheries surveys as well as some habitat work. Bad River Watershed Association would assist the FS with developing a working relationship with the private landowner.
- Timeline: Starting in 2012 and continuing for 1 year
    - Inventory start in 2012 and continue into 2013
- Estimated costs and associated Budget Line Item: $70,000 in NFWF and NFIM

d. <u>Essential Project #4: Eroding Banks along Marengo River</u>

- Attribute/Indicator Addressed: 3.3Aquatic Habitat Channel Shape and Function; 1.2 Water Quality Problems (not listed)
- Project Description: Stabilize 3 eroding sand banks on the Marengo River. Partners have identified 3 banks with significant erosion. This project would include the survey, design and implementation for stabilization at each site. Currently little is known about each site other than that they exist.
- Partners Involvement: Bad River Watershed Association (potential)
- Timeline: Starting in 2012 and continuing for 3 years
    - 2012 Inventory sites and start project design
    - 2013 finish design and complete NEPA
    - 2014 project implementation
- Estimated costs and associated Budget Line Item: $57,000 in NFWF and NFVW

e. <u>Essential Project #5: FR202 Reconstruction at HW of Unt Marengo</u>

- Attribute/Indicator Addressed: 1.1 Water Quality Problems (Not Listed), 6.2 Road Maintenance
- Project Description: Reconstruct 0.4 mi of FR202 to reduce runoff and sedimentation into the headwaters of an unnamed tributary to Marengo River. This road segment consists of 3 700-ft segments of through cuts and will require larger rock lined ditches to carry the runoff. Project consists of adding gravel surfacing, crowning the road, clearing, laying back cut-slopes, re-establishing ditches, rock lining about half of the ditch length, and installing 3 larger cross-drain culverts.
- Partners Involvement: Town of Grandview (potential)
- Timeline: Starting in 2013 and continuing for 3 years
    - NEPA 2013
    - Clearing Timber Sale: 2014
    - Road Reconstruction: 2015
- Estimated costs and associated Budget Line Item : $75,000 in CMLG, CMRD

f. <u>Essential Project #6: FR383 Reconstruction Along Unt Hawkins (NF)</u>

- Attribute/ Indicator Addressed: 1.1 Water Quality Problems (Not Listed), 6.2 Road Maintenance
- Project Description: Reconstruct 0.85 mi of FR 383 along an unnamed tributary to Hawkins Cr to reduce erosion and sedimentation. This segment of road is

located on federal land within the NF boundary. The tributary contains spawning and rearing habitat for native brook trout. Project consists of adding gravel surfacing, crowning the road, clearing, laying back some cut-slopes, re-establishing ditches, and installing about 20 cross-drain culverts.

- Partners Involvement: Township of Grandview
- Timeline: Starting in 2013 and continuing for 3 years
    - Survey, design and NEPA 2013
    - Clearing: 2014
    - Road Reconstruction: 2015
        - Estimated costs and associated Budget Line item: $100,000 in CMLG, CMRD

g. <u>Essential Project #7 : FR383 Reconstruction Along Hawkins (Non-NF)</u>

- Attribute/ Indicator Addressed: 1.1 Water Quality Problems (Not Listed), 6.2 Road Maintenance
- Project Description: Reconstruct 0.5 mi of FR 383 along Hawkins Cr to reduce erosion and sedimentation. This segment of road is located on private land just north of the NF boundary. The stream contains native brook trout. Project consists of adding gravel surfacing, crowning the road, clearing, laying back some cut-slopes, re-establishing ditches, and installing about 10 cross-drain culverts.
- Partners Involvement: Bad River Watershed Association and Townships of Grandview and Lincoln (potential)
- Timeline: Starting in 2013 and continuing for 3 years
    - NEPA 2013
    - Clearing: 2014
    - Road Reconstruction: 2015
- Estimated costs and associated Budget Line Item: $50,500 in CMLG, CMRD, or partner funds.

h. <u>Essential Project #8: FR187 in Headwaters of Morgan Cr</u>

- Attribute/ Indicator Addressed: 1.1 Water Quality Problems (Not Listed), 6.2 Road Maintenance
- Project Description: Reconstruct 1.15 mi of FR 187 in the headwaters of Morgan Cr to reduce erosion and sedimentation. Morgan Cr contains native brook trout. Project consists of adding gravel surfacing, crowning the road, clearing, laying back some cut-slopes, re-establishing ditches, rock lining a few sections of ditch, installing outlet ditches, and installing 5 cross-drain and 3 30" culverts.
- Partners Involvement: Town of Marengo
- Timeline: Starting in 2013 and continuing for 3 years
    - NEPA 2013/2014
    - Clearing: 2014

- Road Reconstruction: 2015
- Estimated costs and associated Budget Line Item: $113,500 in CMLG, CMRD, or partner funds.

i. <u>Essential Project #9: FR198 and Wetland in HW of Marengo</u>

- Attribute/ Indicator Addressed: 1.1 Water Quality Problems (Not Listed), 6.2 Road Maintenance
- Project Description: Reconstruct 0.45 mi of FR 198 draining to a wetland to reduce erosion and sedimentation. Project consists of adding gravel surfacing, crowning the road, clearing, laying back some cut-slopes, re-establishing ditches, rock lining a few sections of ditch, installing outlet ditches, and installing 4 cross-drain culverts and 1 30" culvert.
- Partners Involvement: Town of Grandview
- Timeline: Starting in 2013 and continuing for 3 years
  - NEPA 2014
  - Clearing: 2014
  - Road Reconstruction: 2015
- Estimated costs and associated Budget Line Item: $50,000 in CMLG, CMRD, or partner funds.

j. <u>Essential Project #10: FR493 in Headwaters of Hawkins Cr</u>

- Attribute/ Indicator Addressed: 1.1 Water Quality Problems (Not Listed), 6.2 Road Maintenance
- Project Description: Reconstruct 0.45 mi of FR 493 including 1 segment on a steep slope draining to Hawkins Cr and another in the headwater to an unnamed tributary to Whisky Cr. This work would reduce erosion and sedimentation. Project consists of adding gravel surfacing, crowning the road, some clearing, laying back some cut-slopes, re-establishing ditches, installing outlet ditches, and installing 2 cross-drain and 3 30" culverts. Based on TAP results more specifics would be identified as to whether we can decommission this section of road or improve the section for future timber access.
- Partners Involvement: none
- Timeline: Starting in 2013 and continuing for 3 years
  - NEPA 2013/2014
  - Clearing: 2014/2015
  - Road Reconstruction: 2015
- Estimated costs and associated Budget Line Item: $45,000 in CMLG, CMRD.

k. <u>Essential Project #11: FR198 Relocation Along Unt Marengo R</u>

- Attribute/ Indicator Addressed: 1.1 Water Quality Problems (Not Listed), 6.2 Road Maintenance

- Project Description: Relocate 0.5 mi of FR 198 including 1 perennial stream crossing and 1 intermittent stream crossing to reduce erosion and sedimentation and move the road out of a wetland. The project would restore 1,500 ft of wetland and AOP at 1 crossing.
- Partners Involvement: none
- Timeline: Starting in 2012 and continuing for 3 years
    - NEPA 2012/2013
    - Clearing: 2014
    - Road Reconstruction: 2014
- Estimated costs and associated Budget Line Item: $185,000 in CMLG, CMRD.

l. <u>Essential Project #12: North Country Trail footbridge across drain to Whisky Cr</u>

- Attribute/ Indicator Addressed: 1.1 Water Quality Problems (Not Listed), 6.2 Road Maintenance
- Project Description: The footbridge across ephermeral drainage to Whisky Creek has collapsed and needs to be replaced. Survey has been completed. Project would include design and installation of a new footbridge.
- Partners Involvement:
- Timeline: Starting in 2012 and continuing for 1 year
    - NEPA 2012
    - Construction: 2013
- Estimated costs and associated Budget Line Item: $50,000 in CMLG, CMRD

m. <u>Essential Project #13: Replace snowmobile trail bridge across Morgan Creek</u>

- Attribute/ Indicator Addressed: 1.1 Water Quality Problems (Not Listed), 6.2 Road Maintenance, 3.3 Channel Shape and Function
- Project Description: The existing bridge is short and the approaches are steep. Project would include design and installation of a new snowmobile bridge.
- Partners Involvement:
- Timeline: Starting in 2013 and continuing for 3 years
    - Survey, design and NEPA 2013
    - Construction: 2014-2015
- Estimated costs and associated Budget Line Item: $100,000 in CMLG

n. <u>Essential Project #14:</u>
<u>Improvement of riparian vegetation to promote growth of long lived species</u>

- Attribute/ Indicator Addressed: 5.1 Riparian Vegetation
- Project Description: Within riparian management zones (100ft buffer adjacent to streams and lakes) complete shelterwood harvests and improvement harvests to promote the growth and enhancement of long lived species. The total treatment acres located in RMZs is 19 acres. These harvests will provide recruitment of large woody debris into lakes and streams for future generations in Northern Hardwood stands.

- Partners Involvement: none
- Timeline: Starting in 2012 and continuing for 5+ years
    - NEPA completed 2007 through the Twentymile Vegetation Management EIS
    - Some sales have been sold already and the remaining sales would be dependent on timing of timber sale. Likely starting in 2014 and continuing for 1-5 years
- Estimated costs and associated Budget Line Item: $3,900 in NFTM

o. <u>Essential Project #15:</u>
<u>Identify additional treatment acres along riparian areas to promote the growth of long lived species</u>

- Attribute/ Indicator Addressed: 5.1 Riparian Vegetation
- Project Description: Within riparian management zones identify additional treatment acres to promote the conversion of Aspen to other long lived species. This would include a GIS query to identify potential stands along the Marengo River and its tributaries, Hawkins Creek, Morgan Creek and Whisky Creek. Some stands were identified through the Twentymile EIS but some were not ready for conversion. This project works toward the desired future condition for high quality coldwater streams to improve riparian conditions and reduce beaver conflicts.
- Partners Involvement: None
- Timeline: Starting in 2013 and continuing for 1 year
    - Start office work 2013
- Estimated costs and associated Budget Line Item: $4,000 in NFTM or NFVW

p. <u>Essential Project #16:</u>
<u>Complete additional road decommissioning based on 2012 TAP Essential</u>

- Attribute/Indicator Addressed: Roads and Trails 6.1 Open Road Density, 6.2 Road Maintenance and 6.3 Proximity to Water
- Project Description: Complete road improvements or decommissioning projects identified through the 2012 TAP.
- Partners Involvement: Local Townships (potential)
- Timeline: Starting in 2013 and continuing for 1 year
    - Start NEPA in 2013
    - Project implementation 2014
- Estimated costs and associated Budget Line Item: $45,000 in NFVW, CMRD, CMLG

q. <u>Essential Project #17: Unt Whisky at FR 198 Crossing Replacements</u>

- Attribute/ Indicator Addressed: 1.1 Water Quality Problems (Not Listed), 6.2 Road Maintenance

- Project Description: Replace culverts at 2 unnamed tributaries to Whisky Cr on FR 198. The existing culverts are undersized, in poor condition, restricting AOP and affecting channel morphology. Both tributaries contain native brook trout and other coldwater species.
- Partners Involvement: none
- Timeline: Starting in 2013 and continuing for 1 year
- Estimated costs and associated Budget Line Item: $32,500 in CMLG or CMRD.

r. <u>Essential Project #18: Hawkins Cr at FR 383 Crossing Replacement</u>

- Attribute/ Indicator Addressed: 1.1 Water Quality Problems (Not Listed), 6.2 Road Maintenance
- Project Description: Replace 2 undersized culverts at Hawkins Cr on FR 383 that are an AOP problem and in danger of failing. This project includes a full stream simulation design because the stream has higher gradient with coarse bedload movement. Hawkins Cr is a Class I trout stream and provide connectivity to the Forest. This stream may also provide a refuge for coldwater species with regard to climate change.
- Partners Involvement: Town of Lincoln, BRWA, USFWS
- Timeline: Starting in 2012 for survey and design with construction in 2013.
- Estimated costs and associated Budget Line Item: $228,000 in HTAP, CMLG or CMRD.

s. <u>Essential Project #19: Nine Road and Trail Stream Crossing Replacements</u>

- Attribute/ Indicator Addressed: 1.1 Water Quality Problems (Not Listed), 6.2 Road Maintenance
- Project Description: Replace culverts at 9 road and trail stream crossings. The existing culverts are undersized, in poor condition, restricting AOP and affecting channel morphology.
- Partners Involvement: none
- Timeline: Starting in 2014 and continuing for 1 year
- Estimated costs and associated Budget Line Item: $168,000 in CMLG, CMRD.

t. <u>Essential Project #20: Abandon and Restore 3 Crossings Pending TAP</u>

- Attribute/ Indicator Addressed: 1.1 Water Quality Problems (Not Listed), 6.2 Road Maintenance
- Project Description: Abandon and restore the channel at 3 road crossings pending the results of the transportation analysis process.
- Partners Involvement: none
- Timeline: Starting in 2014 and continuing for 1 year
- Estimated costs and associated Budget Line Item: $7,200 in CMLG, NFVW or CMRD.

u. <u>Essential Project #21: Unt Marengo at FR617 Culvert Replacement</u>

- Attribute/ Indicator Addressed: 1.1 Water Quality Problems (Not Listed), 6.2 Road Maintenance
- Project Description: Replace the culverts at an unnamed tributary to Marengo R at FR 617. The existing culvert is undersized, in poor condition, restricting AOP and affecting channel morphology.
- Partners Involvement: none
- Timeline: Starting in 2015 and continuing for 1 year
- Estimated costs and associated Budget Line Item: $129,600 in CMLG or CMRD.

v. <u>Essential Project #22: Three Bridge Replacements</u>

- Attribute/ Indicator Addressed: 1.1 Water Quality Problems (Not Listed), 6.2 Road Maintenance
- Project Description: Replace 3 older bridges on Marengo R at FR 196, Morgan at FR 199 and Whisky Cr at FR 194.
- Partners Involvement: none
- Timeline: Starting in 2016 or later.
- Estimated costs and associated Budget Line Item: $720,000 in CMLG, CMRD.

e. Costs:

	Planning	Design	Implementation	Project Monitoring
FS Contribution	$101,500	$352,300	$1,720,400	$1000
Partner Contribution (both in kind and $)	$10,000		$500	
Total	$111,500	$352,300	$1,720,900	$1,000

f. Timelines and Project Scheduling

FY	Task	FS Cost	Partner cost
2012	Design bridge at North Country trail footbridge across drain to Whisky Creek	$10,000	
2012	Complete TAP for areas located outside Twentymile EIS	$42,000	
2012	Inventory sites and start design at eroding banks along Marengo River	$2,500	
2012	Start geomorphic/ habitat survey of Marengo River and tributaries	$30,000	$5000
2012	Survey, design and NEPA at Hawkins Cr at FR 383 Crossing Replacement	$38,000	
2012-	NEPA at FR198 Relocation Along Unt Marengo R	$35,000	

2013			
2012+	Improvement of riparian vegetation to promote growth of long lived species	$3,900	
2013	Install bridge at North Country trail footbridge across drain to Whisky Creek	$40,000	
2013	Finish design and complete NEPA at eroding banks along Marengo River	$14,500	
2013	Complete Geomorphic/ Habitat survey of Marengo River and tributaries	$30,000	$5000
2013	Complete NEPA and Design at Coffee Lake LWD Habitat Improvement	$3500	
2013	Survey, design and NEPA at snowmobile trail bridge across Morgan Creek	$20,000	
2013	Survey, design and NEPA at FR202 Reconstruction at HW of Unt Marengo	$25,000	
2013	Survey, design and NEPA at FR383 Reconstruction Along Unt Hawkins (NF)	$35,000	
2013	Survey, design and NEPA at FR383 Reconstruction Along Unt Hawkins (Non-NF)	$15,000	
2013	Survey, design and NEPA at FR187 in Headwaters of Morgan Cr	$35,000	
2013	Survey, design and NEPA at FR198 and Wetland in HW of Marengo	$16,000	
2013	Survey, design and NEPA at FR493 in Headwaters of Hawkins Cr	$14,000	
2013	Identify additional treatment acres along riparian areas to promote the growth of long lived species	$4000	
2013	Survey, design and NEPA at Unt Whisky at FR 198 Crossing Replacements	$5,500	
2013	Construction at Hawkins Cr at FR 383 Crossing Replacement	$190,000	
2014	Implement improvements at eroding banks along Marengo River	$40,000	
2014	Install tree drops at Coffee Lake LWD Habitat Improvement	$3000	$500
2014-2015	Install bridge at snowmobile trail bridge across Morgan Creek	$80,000	
2014	Construction at Unt Whisky at FR 198 Crossing Replacements	$27,000	

2014-2015	Clearing and road construction at FR202 Reconstruction at HW of Unt Marengo	$50,000	
2014-2015	Clearing and road construction at FR383 Reconstruction Along Unt Hawkins (NF)	$65,000	
2014-2015	Clearing and road construction at FR383 Reconstruction Along Unt Hawkins (NonNF)	$35,500	
2014-2015	Clearing and road construction at FR187 in Headwaters of Morgan Cr	$78,500	
2014-2015	Clearing and road construction at FR198 and Wetland in HW of Marengo	$33,000	
2014-2015	Clearing and road construction at FR493 in Headwaters of Hawkins Cr	$28,500	
2014-2015	Clearing and road construction at FR198 Relocation Along Unt Marengo R	$150,000	
2014	Survey, design and NEPA at Nine Road and Trail Stream Crossing Replacements	$28,000	
2014	Survey, design and NEPA at Abandon and Restore 3 Crossings Pending TAP	$1,200	
2015	Monitor tree drop effectiveness at Coffee Lake LWD Habitat Improvement	$1000	
2015	Construction at Nine Road and Trail Stream Crossing Replacements	$140,000	
2015	Project implementation at Abandon and Restore 3 Crossings Pending TAP	$6,000	
2015	Survey, design and NEPA at Unt Marengo at FR617 Culvert Replacement	$21,600	
2016	Construction at Unt Marengo at FR617 Culvert Replacement	$108,000	
2016+	Survey, design and NEPA at Three Bridge Replacements	$120,000	
2017+	Construction at three bridge replacements	$600,000	

g. Other Partners

4. Restoration Project Monitoring and Evaluation

a. **The forest will monitor:** The Forest will monitor the effectiveness of the essential projects as they are completed.
b. **Monitoring will be done in cooperation with:** Wisconsin Department of Natural Resources would conduct periodic population monitoring on select streams and lakes where further restoration projects are identified. Also there may be opportunities to partner with the Bad River Watershed Association to complete monitoring.

Action Plan Date: September 30, 2011
Reviewing Official and Title: _____
Forest Contact Information: _____