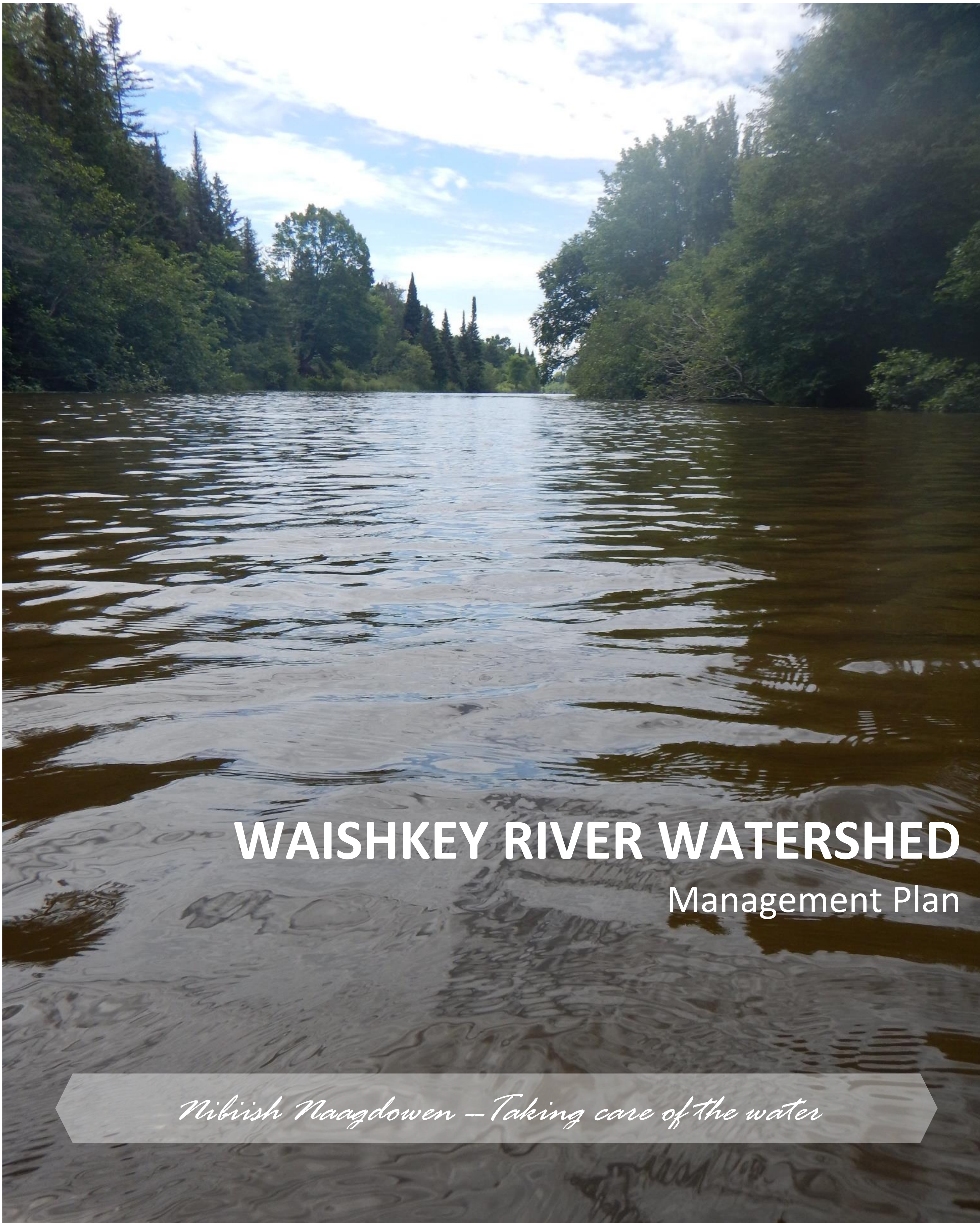

WAISHKEY RIVER WATERSHED

Management Plan

Nibiish Naagdowen – Taking care of the water

Prepared By: Waishkey River watershed management partners
Bay Mills Indian Community, Biological Services
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2020

APPROVALS

Bay Mills Indian Community, Executive Council Approved: 12/14/2020

Submitted: 12/15/2020
EPA Approved:
EGLE Approved:

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ABOUT THE PROJECT

Background

The Waishkey River Watershed Management Plan was created by a management committee of interested professionals and stakeholders from within the watershed and the surrounding area in order to address water quality concerns in an organized and efficient manner.

In July 2012, the United States Environmental Protection Agency (USEPA) Region 5 and Michigan Department of Environmental Quality (MDEQ now EGLE) published, "Total Maximum Daily Load and Implementation Plan for E. coli in Sault Sainte Marie Area Tributaries." This document included large amounts of information and data concerning the Waishkey River's background and *E. coli* concentrations.

Two years later, Bay Mills Indian Community (BMIC) and Inter-Tribal Council of Michigan, Inc. (MITC) produced the, "Waishkey River Watershed Assessment." This document provided further background information and recommendations for future efforts. However, it did not give detailed plans for future management and monitoring efforts.

This management plan for the Waishkey River Watershed expands upon the base set by the two aforementioned documents and greatly expands the management and monitoring sections. Assessment data used in the production of the watershed management plan were compiled from the EGLE, DNR, BMIC, Chippewa County Health Department, Chippewa Ottawa Resource Authority (CCRC), MITC, USEPA, US Geologic Survey (USGS), US Forest Service (USFS), and Chippewa Luce Mackinac Conservation District (CLMCD).

In addition to the traditional boundaries of the Waishkey River Watershed, this management plan also encompasses the western half of the Waishkey Creek-Frontal Saint Mary's River sub watershed (HUC-040700010201); the eastern half of this sub watershed of the St. Mary's River watershed was included in the Sault Area Watershed Management Plan. For the purposes of this plan, the term Waishkey River Watershed and all figures and tables refer to this additional area as a portion of the Waishkey River Watershed. This additional area was included in the plan to address nonpoint-source issues affecting Back Bay near the mouth of the river.

The United States Environmental Protection Agency provided funding for this project through Section 319 of the Clean Water Act as well as the Bureau of Indian Affairs through the Great Lakes Restoration Initiative.

Waishkey River Watershed Management Team

The Waishkey River Watershed Management Plan was completed with contributions from many partners, as well as numerous interested stakeholders and citizens. A complete list would not be possible, but special appreciation is in order to the project partners listed below:

- Bay Mills Indian Community
- Chippewa County Health Department
- Chippewa County Road Commission
- Chippewa Luce Mackinac Conservation District
- Chippewa Ottawa Resource Authority
- Inter-Tribal Council of Michigan
- Michigan Department of Environmental Quality (Department of Environment, Great Lakes, and Energy)
- Michigan Department of Natural Resources
- Superior Township
- USDA Natural Resources Conservation Service
- US Forest Service

History of River Name

The river, now called the Waishkey River, has been called a variety of names in the past few centuries. The mouth of the river (then called the Pississowining River) was a summer hunting camp of a Native man named Waishkey, the eldest son of Chief Waub Ojeeg of LaPointe, WI. Waishkey and his family settled at the mouth of the river which took on his name as Waishkey River. The location was also referred to as *Gnoozhekaaning*, "place of many pike" (Cleland, 2001). His name was recorded on treaties, journals, and reports as Wayishkee, Whaiskee, Wayishkey, Waish-key, Washkee, and Waishkey.

Confusion about the river name is also seen in maps from the time. Many maps published between 1842 and 1920 called the river Waske, Waiska, Carp, and Red Carp River. Some of this name confusion may stem from the numerous “Carp Rivers” along Lake Superior and beyond. “Waishkey River” is now the locally recognized name for the river and will be used for the remainder of this management plan.

Acronyms & Abbreviations

BIA:	Bureau of Indian Affairs
BMIC:	Bay Mills Indian Community
BMP:	Best Management Practice
CCHD	Chippewa County Health Department
CCRC:	Chippewa County Road Commission
CFU:	Colony-Forming Unit
CLMCD:	Chippewa, Luce, Mackinac Conservation District
CORA:	Chippewa Ottawa Resource Authority
DUI:	Designated Use Impairment
E. coli:	*Escherichia coli*
EPA:	Environmental Protection Agency
MITC:	Inter-Tribal Council of Michigan, Inc.
LCHD:	Lenawee County Health Department
MDEQ:	Michigan Department of Environmental Quality
MDNR:	Michigan Department of Natural Resources
MSU:	Michigan State University
NPDES:	National Pollutant Discharge Elimination System
NPS:	Nonpoint Source Pollution
NRCS:	Natural Resources Conservation Service
OSDS:	On-Site Disposal System
OSWTS:	Onsite Wastewater Treatment Systems
qPCR:	Quantitative Polymerase Chain Reaction
TCE:	Trichloroethylene
TMDL:	Total Maximum Daily Load
USEPA:	United States Environmental Protection Agency

Executive Summary

Humans have occupied the Waishkey River and St. Marys River area for thousands of years; the region has been the cultural heart of the Ojibwe (or Anishinaabe) people. Bay Mills Indian Community is a signatory of the 1836 Treaty of Washington, which ceded territory to the United States for the creation of the State of Michigan. In that treaty, Bay Mills and other tribes reserved the right to fish, hunt, and gather throughout the ceded territory which spans west across much of the Upper Peninsula and south into the northern Lower Peninsula. The Waishkey River and watershed are culturally, spiritually, nutritionally, and economically important to tribes. In present, as in the past, many citizens rely on subsistence harvesting to feed their families and themselves. Today, the Waishkey River and its watershed are relied on by tribal and non-tribal citizens for a number of uses. Among countless others, these uses include fishing, hunting, ceremony, recreation, tourism, and agriculture.

Watershed health is critical to the survival of native ecosystems and their human and non-human inhabitants. An intact and healthy watershed system will maintain a wide range of uses, including the use of this system by tribal members for subsistence, spiritual, and economic needs as well as uses designated by state and federal government. Fifty-five percent of rivers in the United States are considered unsuitable to aquatic life according to the EPA National Rivers and Streams Assessment of 2008-2009 (U.S. Environmental Protection Agency, 2013). The report also states, "Biological condition is the most comprehensive indicator of water body health," and that healthy biota typically indicates good physical and chemical qualities as well. The Waishkey River watershed is in fair biological condition based on surveys conducted by various agencies over the past ten years and more.

In facilitating the creation of this document, the Waishkey River Watershed management committee has prioritized long-term health and management solutions over short term "quick fixes" to problems. The committee has organized a diverse group of conservation professionals to represent the views of local and state agencies, individual and corporate landowners, and other interested parties to prioritize our concerns in a way that allows everyone to be heard. Waishkey River watershed partners will continue to evolve and adapt management plans to conserve and protect the Waishkey River Watershed, for now, and for the benefit of the next seven generations. This management plan is not a legal document. It is a set of goals, objectives, and preparatory plans created collaboratively by our community that serves as guidance for future action to protect the Waishkey River Watershed. We hope you will consider taking part in the effort to protect this area and restore areas of degradation for the long-term benefit of both human and non-human relatives.

The Waishkey River Watershed management committee would like to especially thank Bay Mills Indian Community, Biological Services Department for leading this initiative and largely authoring this document. Their leadership and dedication to protecting Mother Earth is admirable. *Nibiish Naagdowen*, this is how we will "take care of the water."

Sincerely,

Waishkey River Watershed writing team

The Nibi Song (The Water Song)

Nibi gizaage'igoo	Water, we love you.
Gii-miigwetch iweniimiigoo	We thank you.
Gii-zhaawenimiigoo	We respect you.

Chapter 1. THE NATURAL ENVIRONMENT

1.1 Watershed Description

The Waishkey River Watershed (8 Digit Hydrologic Unit Code [HUC] 04020203) is a 125,925 acre sub watershed of the Waishkey Watershed located in the Eastern Upper Peninsula, Chippewa County, Michigan (Figure 1). The Waishkey River Watershed is predominantly rural and is characterized by federal and state forest, agricultural, open and relatively small areas of commercial, residential and transportation lands. The villages of Brimley, Bay Mills, Dafter and a portion of Kinross are located within the Watershed, as well as the Bay Mills Indian Community, Sault Ste. Marie Tribe of Chippewa Indians, Bay Mills Township, Dafter Township, Kinross Township, Soo Township, Superior Township, and the City of Sault Ste. Marie. The watershed also encompasses a portion of the Hiawatha National Forest.

The Waishkey River, Waishkey Bay, Back Bay, and Saint Mary's River are all recipients of the Waishkey River Watershed and are consequently influenced by the activities that take place within the Watershed's boundaries. The watershed is composed of seven sub watersheds: South Branch of the Waishkey, East Branch of the Waishkey, West Branch of the Waishkey, South Branch of East Branch of the Waishkey, Hickler Creek, Orrs Creek, and Waiska Creek-Frontal St. Mary's River (Figure 2).

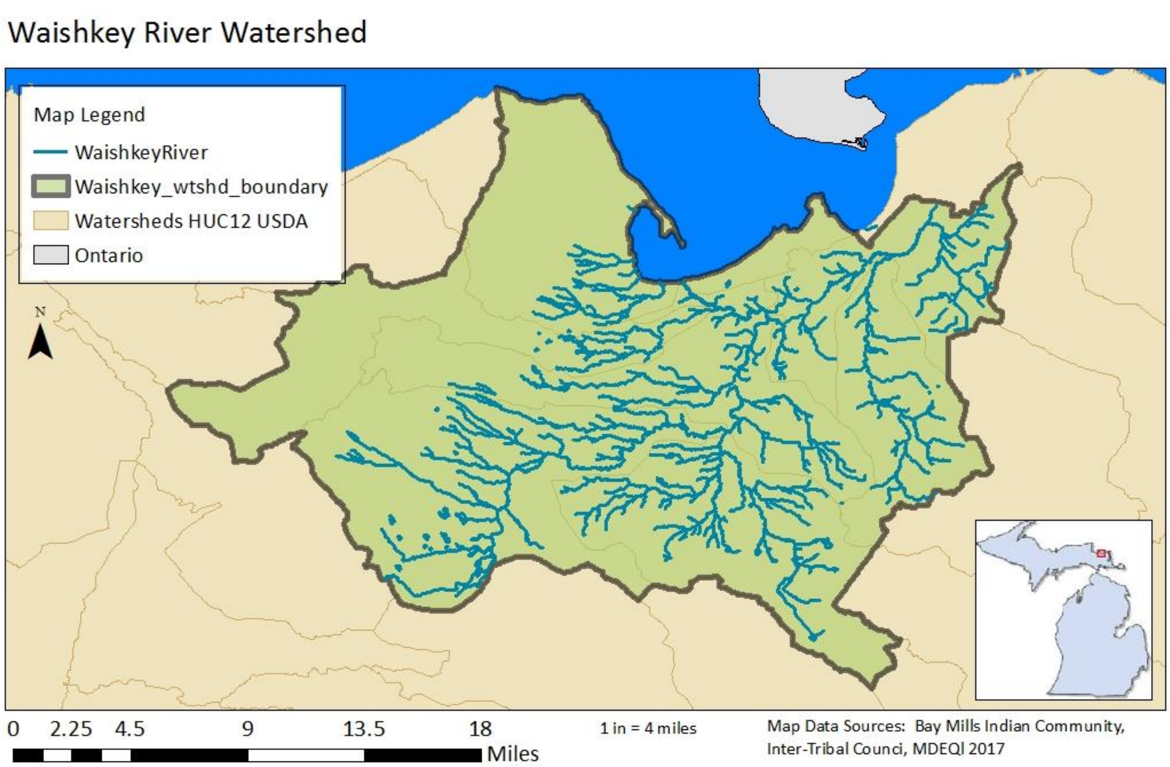


Figure 1. Waishkey River and Waishkey River Watershed

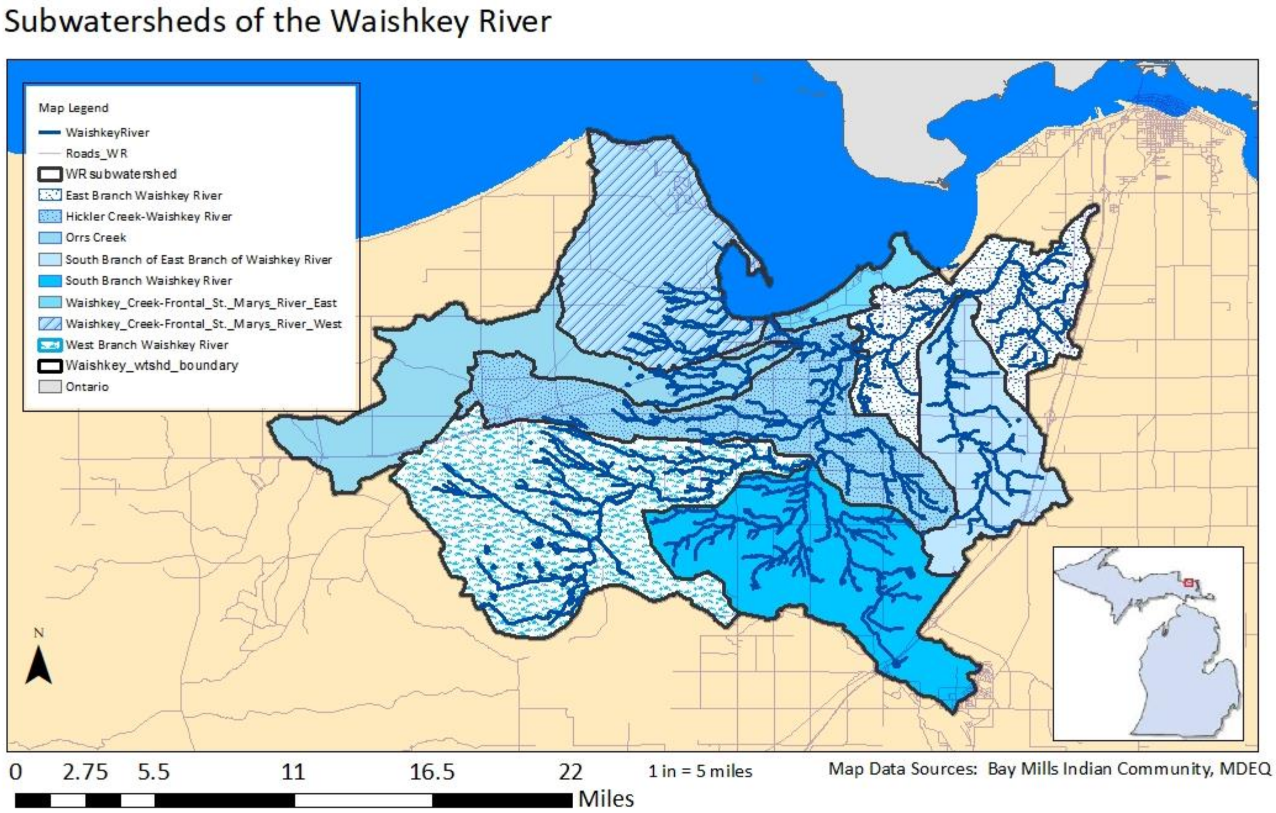


Figure 2. Subwatersheds of Waishkey River

1.2 Hydrology

The Waishkey River watershed is located in the north central portion of Chippewa County and confluences with Saint Marys River in Waishkey Bay, north of Brimley, MI. Approximately 217 river miles (173 perennial stream miles) drain the 435 square mile, 1,461 acre watershed. The main branch of the stream is approximately 15 miles long with an average gradient of just over 7 feet per mile. Numerous local tributaries are tied to the Watershed and include Beaver Meadow Creek, Besseau Creek, Bons Creek, Clear Creek, East Branch Waishkey River, Hickler Creek, Horseshoe Creek, Little Waiska, McMahen's Creek, North Branch Orrs Creek, Orrs Creek, Seymour Creek, South Branch of East Branch of Waishkey River, South Branch Besseau Creek, South Branch Orrs Creek, South Branch Waishkey River, Sylvester's Creek, Waishkey River, West Branch Waishkey River and White Creek. These surface waters become the conduits of the Watershed's land managers, residents and various other land users and their activities as water moves down gradient towards the Waishkey Bay and Saint Mary's River.

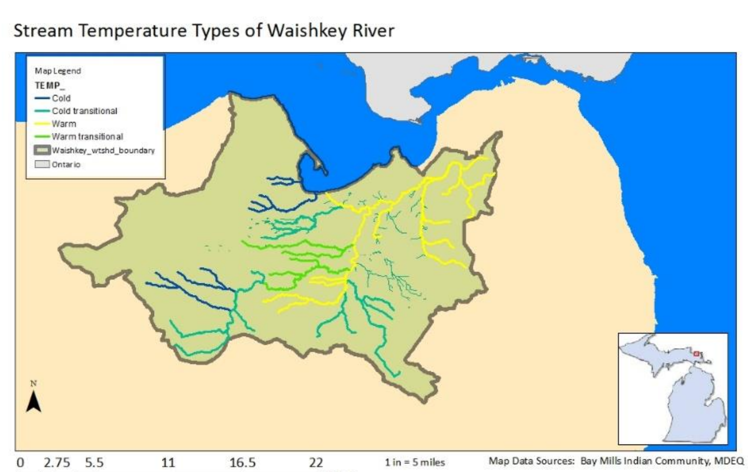


Figure 3. Map of cold-water fisheries in West Branch of watershed.

Rivers in Michigan have been delineated into individual classifications called river segments that are based on flow and temperature characteristics as related to available groundwater and local geology and geomorphology. The eastern Upper Peninsula streams are divided into five different flow/temperature characteristic types based on an assemblage of valley segment data provided by the Michigan Department of Natural Resources. These characteristics are:

1. Small Cool/Cold - small headwater streams with moderate to relatively significant groundwater influence draining a basin that is less than 40 mi^2.
2. Small Warm - considered to be low volume warm-water headwater streams with insignificant groundwater influence draining a basin that is less than 40 mi^2.
3. Medium Warm - medium sized warm-water streams. Summer flows may be reduced significantly as source flows are of relatively low yield. Drainage area is 41-179 mi^2.
4. Large Warm - includes the larger tributaries and/or portions of the main stem of a river system. Drainage areas are 180-620 mi^2 and contain large fish species.
5. Coastal Tributaries - very short, typically less than 10 miles long and connecting directly to a Great Lake. Coastal tributaries may be warm or cold water streams.

Figure 3 depicts warm, cool, and cold water streams throughout the watershed.

Wetlands provide an important function for water quality and watersheds. Watersheds that have experienced significant wetland losses experience the loss of important wetland water quality functions. Wetlands filter out sediment and contaminants, provide storage and retention and provide habitat for wildlife. Currently in the Waishkey River Watershed, there is an estimated 34,695 acres of wetland (MDEQ , 2019) (Figure 4). It is estimated that pre-settlement wetland acreages totalled 44,496 acres, a loss of approximately 25% of the wetlands in the watershed. Today the Waishkey River Watershed is 2.5% open water and 21.5% wetlands. The dominant wetland type is forested wetlands at 17% (Clark, 1992).

There is a correlation between wetland loss and degraded surface water quality. With acres of wetland lost, wetland function on the landscape level may also be lost and should be incorporated into watershed management. The U.S. Fish and Wildlife Service (USFWS) has developed a technique to include additional information related to wetland function (i.e. landscape position, landform, and water flow path) to the National Wetland Inventory database to characterize wetland function at a landscape level. Additionally the Michigan Department of Environmental Quality (MDEQ) uses the Landscape Level Wetland Functional Assessment (LLWFA) to combine the National Wetland Inventory with data on hydric soils, hydric soil complexes, land cover, base map, pre-settlement wetlands, and urban areas. This approach addresses both a current (2005) wetland inventory and a Pre-European Settlement inventory, to approximate change over time, and provide the best information possible on wetland status and trends from original condition through today. Restoring lost wetland functionality shows great promise in addressing the systemic cause of much of the non-point source pollution occurring in the watershed. Figure 5 highlights “high potential” areas for wetland restoration in red and “medium potential” in yellow. This information assisted in the development of wetland conservation and restoration strategies outlined in Chapter 6 of this management plan.

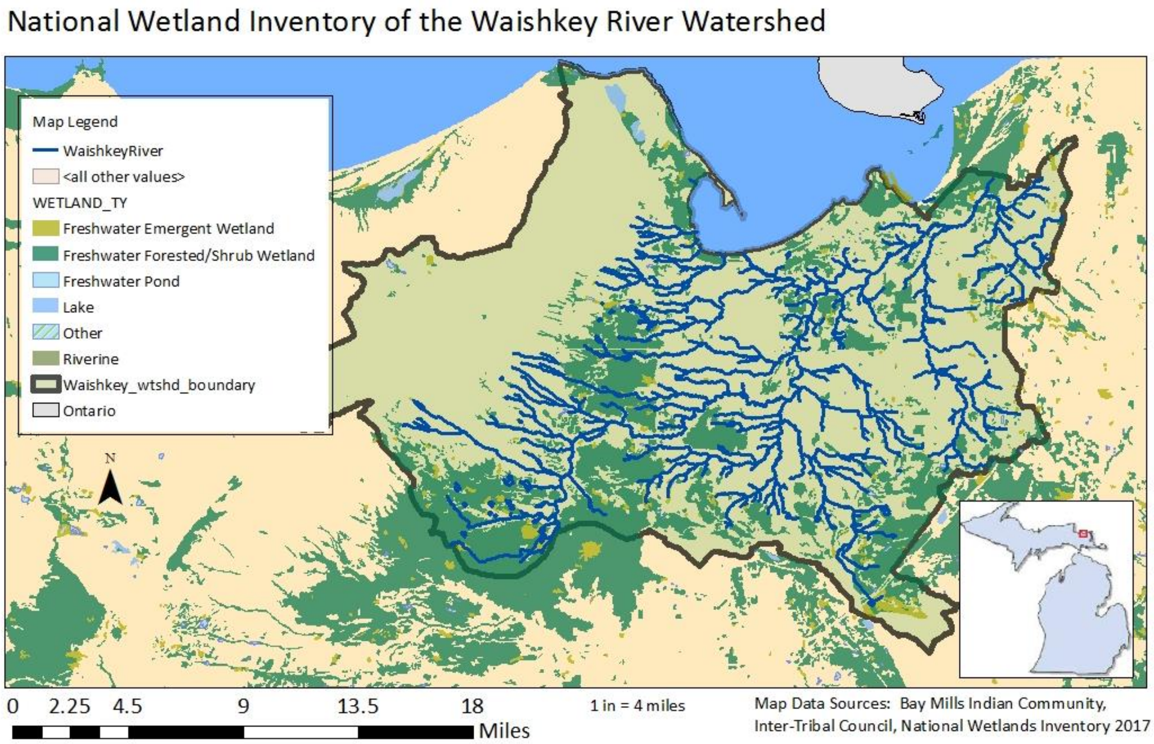


Figure 4. Waishkey River watershed National Wetland Inventory

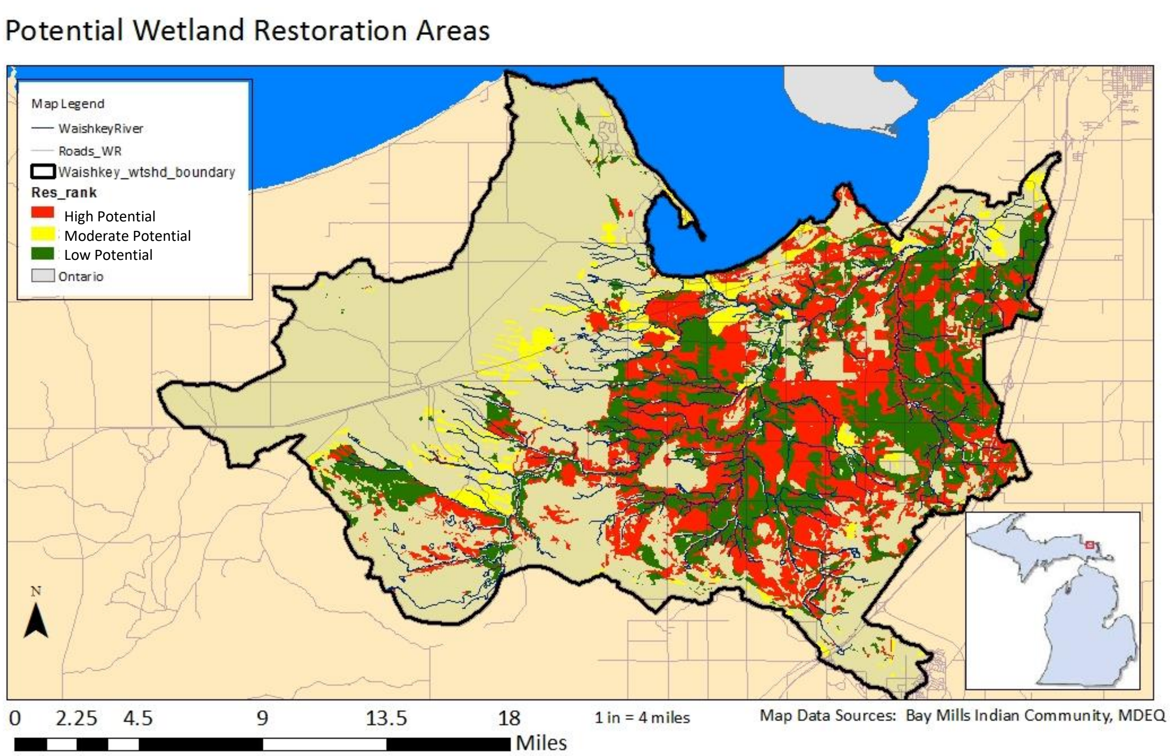


Figure 5. Waishkey River watershed Potential Wetland Restoration Areas

Wetland losses by watershed were determined using pre-settlement map data and current map data to calculate changes (Table 1). The wetland loss has largely been for land conversion to agriculture with the exception of the South Branch of the Waishkey River. A 40% loss of wetlands within the South Branch Watershed did occur but the land was largely converted to forest lands.

Table 1. Wetland loss by subwatershed (MEGLE 2019. Michigan's E. coli Pollution Solution Mapper**)**

Subwatershed	Vegetated Riparian Zone	Historic Wetland	Current Wetland	% Loss
East Branch	78%, mod impacted	5,968ac	3,939ac	34%; highly impacted
Hickler-Waishkey	70%, mod impacted	5,771ac	3,232ac	44%; highly impacted
Orrs Creek	92%, unimpacted	1,515ac	1,212ac	20%; moderately Impacted
South Branch of East Brnch of WR	53%, mod impacted	2,951ac	2,066ac	30%; highly impacted
South Branch of WR	87%, unimpacted	8,329ac	6,913ac	17%; moderately impacted
Waiska, St Marys River frontal (east and west)	69%, mod impacted	7,769ac	6,604ac	15%; moderately impacted
West Branch of WR	96%, unimpacted	12,192ac	10,729ac	12%; moderately impacted
Entire watershed	78%	44,496ac	34,695ac	

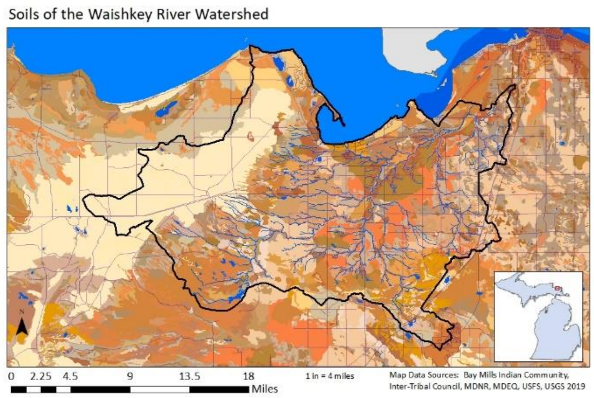
1.2.i Groundwater

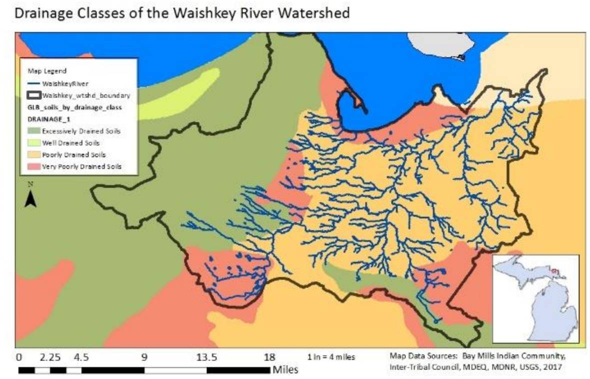
Groundwater in the Waishkey River Watershed is primarily drawn from the glacial aquifer made up of sand and gravel and unconsolidated rock which was deposited during the final or Wisconsin stage of the Pleistocene Epoch. These deposits made up of glacial drift up to 100 up to 500 feet below ground surface, provide the majority of the drinking water in the area. Groundwater may also be produced in acceptable volumes in the underlying Jacobsville Sandstone Aquifer which is connected to the glacial aquifer. The glacial aquifer in the Waishkey river watershed, in some areas, is overlain by clay/sand-clay layer that could possibly protect the aquifer from potential sources of contamination. In areas where the water table is near the ground surface, the shallow portions of the aquifer may be vulnerable to some sources of contamination, particularly, individual septic systems.

Well records and seismic data indicate that at least three and possible four major pre-Pleistocene valleys or channels were cut into bedrock in Chippewa County. These drift-filled, buried, pre-glacial valleys are the best sources of groundwater in the area, and they coincide roughly with the present day drainage systems. One such valley extends from Brimley along the Waishkey and Pine rivers to Rudyard on to Lake Huron, forming a preglacial connection between Lake Superior and Lake Huron.

1.3 Soils

The Waishkey River Watershed is part of the Clay Lake Plain Complex in the Eastern Upper Peninsula (Figure 6). The clay was laid at the bottom of the large proglacial lakes, Algonquin and Minong (Schaetzl, 2012). The watershed is comprised for many soil types, including sands, silty loams, and muck (Figure 6) with varying infiltration potential (Figure 7). Hay grows on the clay plains very well and proved to be an important resource for the 1840s timber industry by supplying feed for the horses that hauled the logs. Today hay is a cash crop and the area is used to raise dairy cows, beef cattle, and horses. See Appendix F for complete list of soil types by subwatershed.





Figures 6 and 7. Waishkey River watershed soils; Waishkey River watershed soils infiltration potential

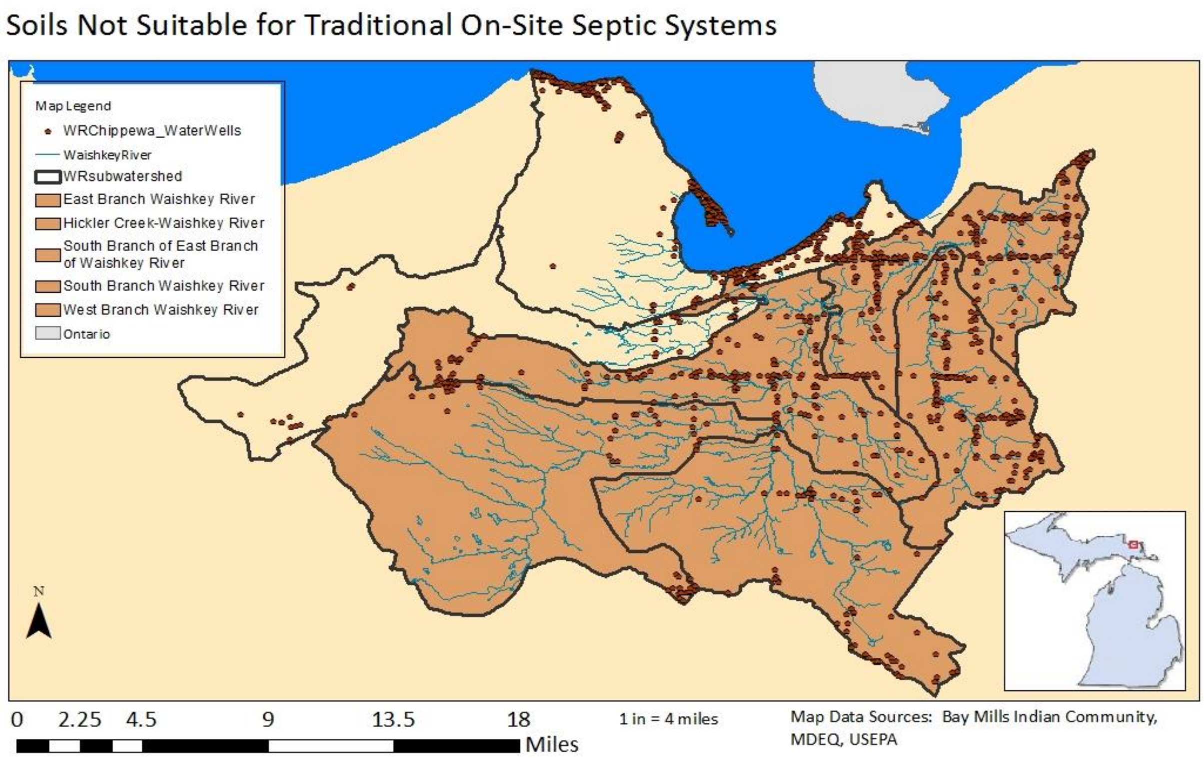


Figure 8. Waishkey River watershed soils not suitable for traditional on-site septic systems.

The clay lake plain deposits are great places to grow hay, but difficult areas to manage waste. The low percolation rates and high ground water increase the potential for surface water contamination if wastes are not managed and treated properly (Figure 8). Cows produce 120.5 pounds of waste a day (USEPA, 2012) with a concentration of 10^6 to 10^7 faecal organisms/gram of waste (Meals & Braun, 2006). Good management and treatment are important to protect water quality. Fresh waste generated from dairy cows fed hay, produce enough *E. coli* to contaminate over 21 million gallons of water above the 300 cfu/100 ml State of Michigan surface water quality standard.

These clay lake plain deposits cause difficulty in installing onsite wastewater treatment systems. The low percolation rates and seasonally high ground water table can cause premature system failure. Failed septic systems are potential sources of *E. coli* for the watershed. Soils in the hydrologic soils group D very slow infiltration rates and are considered not suitable for traditional septic tank and drain field treatment systems.

These poorly drained soils do not allow the downward percolation which provides both filtration and time for natural processes to treat the waste.

Most of the shaded areas in Figure 8 were once wetlands that have been drained for residential or agricultural use. As demonstrated by the well water locations, this is also the area where most of the residential development has concentrated. Many of these rural residential locations have out-dated septic systems that are located near creeks and streams. These potential poorly functioning septic systems can be high and low flow contributors of bacteria and pathogens to the streams and creeks due their year around usage. Residential housing units in this critical area of concern will be the target of an extensive educational program described in the implementation and information and education strategies in Chapter 9 of this plan.

1.4 Topography

The majority of the Waishkey River Watershed consists of gentle slopes below 5% or between 5-10% (Figure 9). The abundance of flat terrain is beneficial in reducing runoff from agricultural and urban areas into the Waishkey River. However, slopes increase dramatically directly adjacent to the river, exceeding twenty percent in many areas. Due to these high slope percentages, management efforts should be focused on the areas nearest to the river itself. Efforts should include reduction of pollution sources in these areas, as well as the construction of buffer zones to increase the natural filtration processes. Soil stabilization best management practices (BMPs) should also be employed in these areas to further reduce sources of pollution.

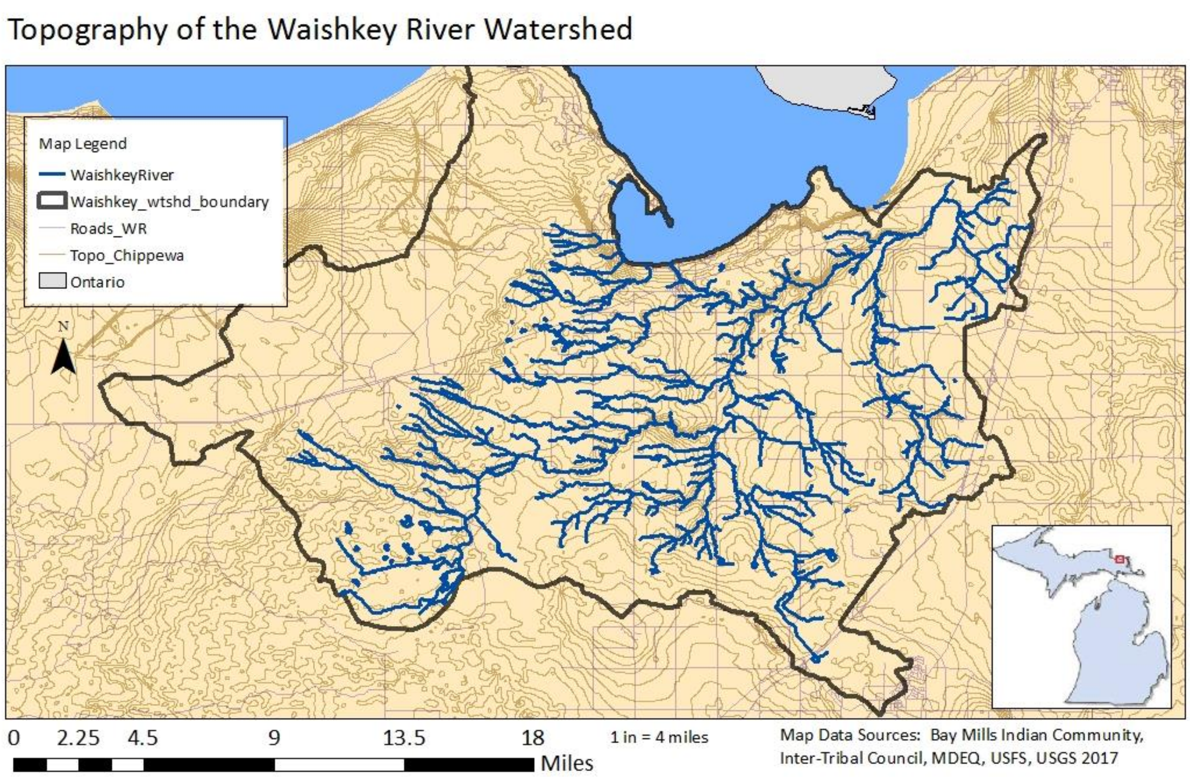


Figure 9. Waishkey River watershed topographic slopes

1.5 Condition of Flora and Fauna in the Watershed

1.5.i Vegetation Species and Cover Types

Approximately 70% of the watershed is covered in forests and wetlands. These areas are dominated by Balsam Fir, Black Ash, Black Spruce, Paper Birch, Red Maple, Tamarack, Northern White Cedar, and Aspen species (Figure 10). But the land immediately adjacent to the river has seen more disturbance due to land clearing and mowing for residences. Additionally, the region has seen significant declines in certain species due to Beech Bark Disease, Emerald Ash Borer, and Spruce Budworm. Large die-offs of trees adjacent to the river could have significant impacts on water quality as they provide shade and bank stability.

The upland landscape varies from 25-75% forest in the watershed. Forest types include aspen-beech, spruce-fir, pine-oak, and maple-beech-hemlock associations. Typical vegetation on abandoned cropland includes shrub willows, alder, tamarack, elm, and ash. Crops produced on the poorly drained clay soils are predominately perennial pasture, hay, and small grains (MDEQ 2002).

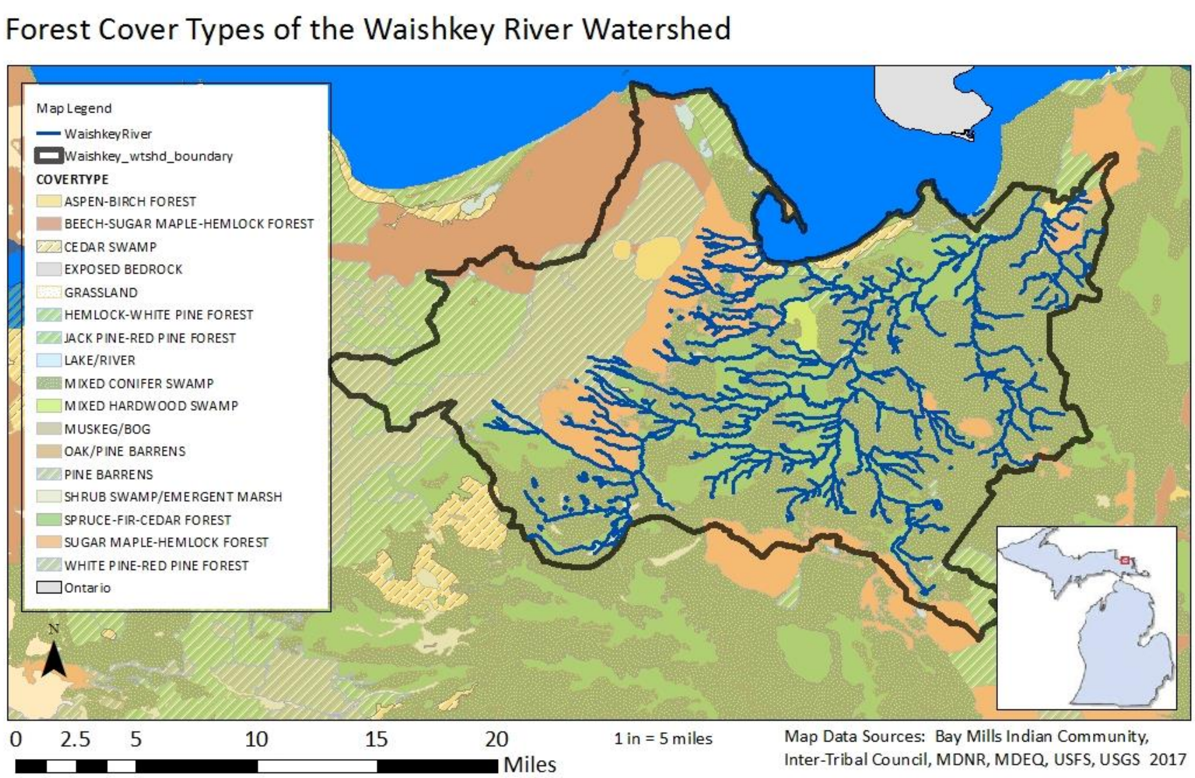


Figure 10. Waishkey River watershed forest cover types as of 1800 (does not represent current land use)**.**

1.5.ii Unique or Critical Habitat

Waishkey River Watershed includes a number of unique or critical habitats like wetlands, ephemeral pools and coastal sand dunes. Their presence in the watershed is well known, but has not been thoroughly mapped.

Michigan's shoreline includes 275,000 acres of sand dune formations. An interaction between blustery winds and waves has moved and carved fine sands into the largest display of freshwater dunes in the world. The dunes are not only one of the State's most spectacular natural features, they also are one of its most fragile. Development and recreational pressures are increasing as more and more people seek the scenery the dunes provide. This makes it imperative that people understand and appreciate the environmental sensitivity of sand dunes. Only 40% of the coastal dunes are in public ownership and managed by federal, state, or local units of government (MDNR 2017). Part 353 of the Natural Resources & Environmental Protection Act (Act 451 of 1994) designated certain areas throughout the State of Michigan as critical dune areas, and provided regulations for the protection of these dunes from sand mining as well as developmental, silvicultural and recreational activities. Local units of government have the opportunity to assume permitting authority under the Act by adopting or amending a zoning ordinance. The local ordinance must provide the same or a greater level of protection for critical dune areas as the state regulations, and must be approved by the MDEQ. In Bay Mills Township, a critical sand dune exists immediately to the west of Monocle Lake (Figure 11). The critical area covers 660 acres, 87% of which is inside the Hiawatha National Forest. Bay Mills Township should take special consideration with possible development in that area (Bay Mills Township 2011).

Vernal pools or ephemeral ponds are small bodies of standing water that form in the spring from meltwater and are often dry by midsummer. While not usually considered in official definitions of wetlands, vernal ponds are very important in the life cycles of many wildlife species. Ephemeral ponds are important refugia and breeding sites for amphibians and aquatic macroinvertebrates within forested landscapes, and protecting them would benefit a wide range of amphibian and invertebrate species. Some of the ponds may exhibit very high macroinvertebrate richness; others harbor invertebrates that are highly adapted to temporary aquatic habitats and are only known from these temporary vernal pools. Whenever possible ephemeral ponds should remain embedded within forested habitats. To protect these habitats, the ponds should not be isolated by clearcutting around them, and efforts should be made to minimize or prevent negative impacts to hydrology by limiting road, ditch, or dike construction. Also, the timing of management activities around ephemeral ponds can be critical. (WDNR 2005)

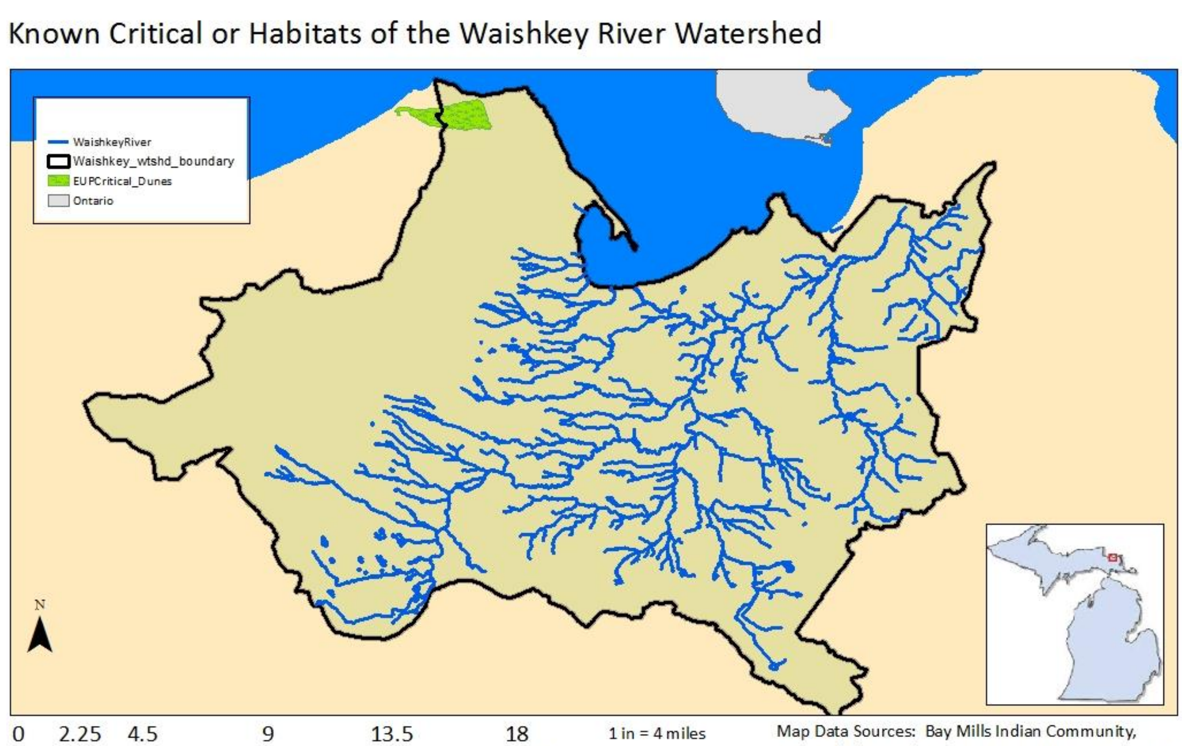


Figure 11. Unique or Critical Habitats of the Waishkey River Watershed; Critical Sand Dunes.

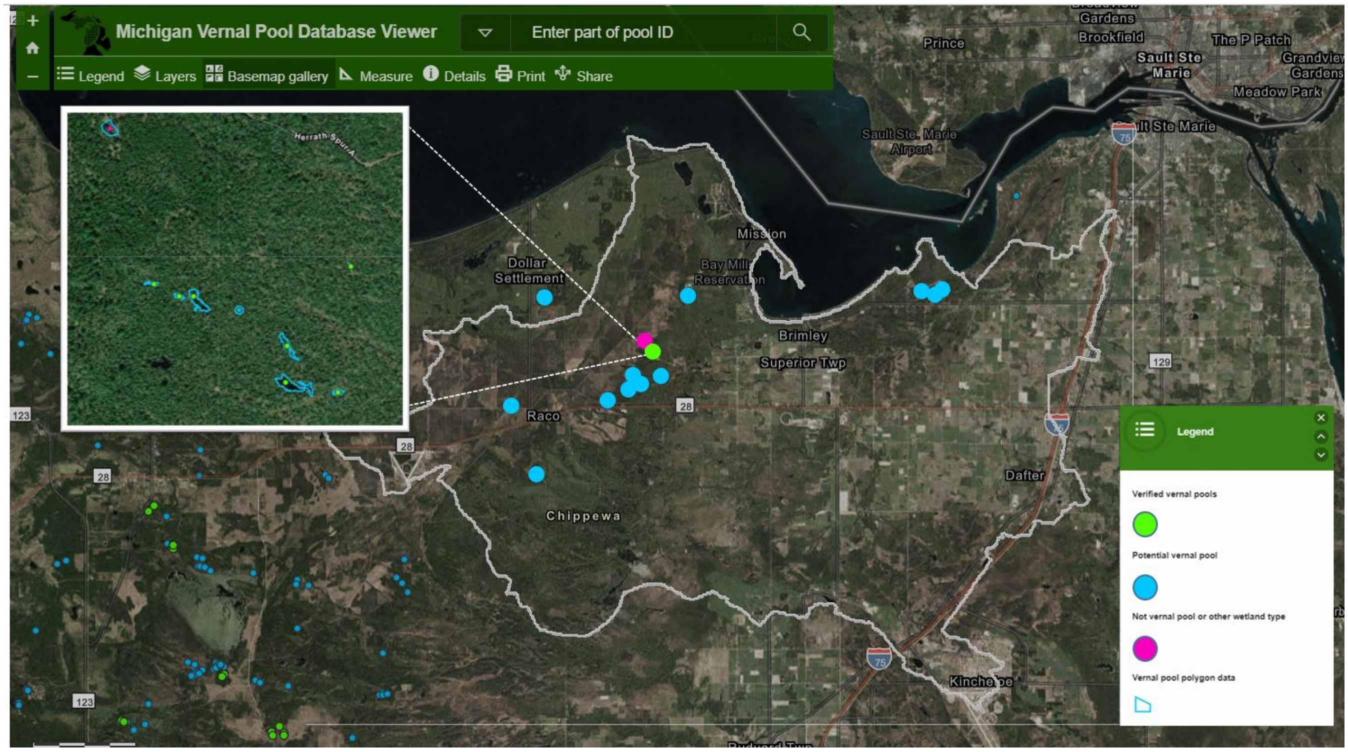


Figure 12. Michigan Vernal Pools Database Viewer. Mapper from Michigan State University – Michigan Natural Features Inventory

The Michigan Vernal Pool database consists of verified vernal pools, potential vernal pools, and sites that are verified to not be vernal pools or some other wetland type. The Vernal Pool Database and map viewer are still in development and updated as data becomes available. The database shows a handful of verified vernal pools in the watershed as well as numerous potential sites within the watershed (Figure 12). With the high percentage of wetlands in the watershed, there are likely more vernal pools that have yet to be identified.

1.5.iii Fish and Aquatic Organisms

The Waishkey River supports a diverse fish community as found during fisheries surveys conducted by Michigan DNR Fisheries Division, US Forest Service (USFS), and US Fish and Wildlife Service (USFWS). The Waishkey River drainage can be separated into two fish communities, warmwater and coldwater fisheries. A total of 69.9 river miles are considered warmwater, while another 77.4 miles are coldwater. The warmwater fish community is dominated by white sucker. Other species present are walleye, northern pike, rock bass, yellow perch, pumpkinseed, sunfish, redhorse sucker, black bullhead, brown bullhead, creek chub, golden shiner, longnose dace, northern redbelly dace, johnny darter, common shiner, central mud minnow, and brook stickleback. The sport fishery is known for the spring spawning runs of walleye and suckers and northern pike available in the lower reaches throughout the year. A total of 44.9 miles are designated trout streams and 77.4 miles are considered cold streams. Coldwater fisheries are located in the upper tributaries of the West Branch subwatershed (Clear Creek, Hutton Creek, Sylvester Creek, and West Branch Waishkey River) where good groundwater inputs are present and are listed as designated trout streams. Brook trout have been documented here and also in Bons Creek, Horseshoe Creek, McMahen Creek, and White Creek. These four streams are non-designated trout streams, but have been identified as high priority coldwater streams by the USFS that require further protection during timber management. Other fish species present in the coldwater streams are blacknose dace, coho salmon, and mottled sculpin.

Common carp, sea lamprey, ruffe, stickleback, and rainbow smelt are known invasive species in the Waishkey River drainage. Since 1960 the USFWS has conducted 11 lampricide treatments for invasive sea lamprey. On average the USFWS treats the South Branch and West Branch Waishkey River every four years. Treatments target larval lamprey to reduce and in some cases eliminate them before they recruit to Lake Superior as parasitic adults. The treatments coincide with larval assessments to determine the effectiveness and necessity of these treatments.

Fish stocking has occurred over the years in the watershed with most being walleye at the river mouth (Table 2). Brook trout were stocked in the 1950's in various streams, but were discontinued in 1961 due to the lack of interest by anglers.

Table 2. Michigan Department of Natural Resources, Fisheries Division Waishkey River stocking

Species Stocked	Number	Date	Approx Age
Walleye	8,000	6/30/2002	Spring Fingerling
Walleye	30,909	7/5/2001	Spring Fingerling
Walleye	56,579	7/5/2001	Spring Fingerling
Walleye	19,775	6/28/2000	Spring Fingerling
Walleye	39,500	6/21/2000	Spring Fingerling
Walleye	34,400	6/20/2000	Spring Fingerling
Walleye	25,800	6/19/2000	Spring Fingerling
Walleye	104,240	7/17/1994	Spring Fingerling
Walleye	34,500	7/11/1993	Spring Fingerling
Walleye	47,460	7/9/1993	Spring Fingerling
Walleye	37,275	7/7/1993	Spring Fingerling
Walleye	11,426	7/20/1992	Spring Fingerling
Walleye	63,918	6/25/1992	Spring Fingerling
Walleye	2,740	7/6/1990	Spring Fingerling
Walleye	11,105	7/29/1988	Spring Fingerling
Walleye	8,696	7/5/1988	Spring Fingerling
Walleye	13,500	7/11/1986	Spring Fingerling
Walleye	12,750	7/10/1986	Spring Fingerling
Walleye	24,192	7/7/1986	Spring Fingerling
Brook Trout		1950-1961	Various

1.5.iv Wildlife Communities

The watershed is home the typical array of northern Michigan mammals, birds, reptiles, and amphibians. Charismatic megafauna include black bear, gray wolves, white-tailed deer, and some moose. Active public land management occurs for the following species: American marten, ruffed grouse, sharp-tailed grouse, Kirtland's warblers, and white-tailed deer. Additionally the area creates a natural migration corridor for tens of thousands of birds travelling along popular migration routes. Over 330 species of birds have been spotted nearby at the Whitefish Point Bird Observatory, including various species of hawks and owls.

Figure 13. Beaver lodge on Waishkey River with purple loosestrife growing out of top.

Beaver and their lodges have been observed at dozens of points in the watershed. Beavers are nature's ecosystem engineers, felling trees and building dams, and changing waterways for their own benefit. But they also benefit other species in the process. Their dams help to control the quantity and quality of water downstream, which both humans and animals use. Their ponds and flooded areas create habitat for many plants and animals, such as fish, birds, insects, and amphibians. Beavers dramatically change their environment, and those changes can last for hundreds of years, even after the beaver have moved on. Challenges do occur in the Waishkey River where some human road stream crossings and beaver construction converge.

PRIORITY COASTAL WETLANDS FOR BREEDING MARSH BIRDS

With historical wetland loss and degradation, many marsh bird populations have experienced steep declines. The Audubon Society (Great Lakes) developed a spatial prioritization tool to identify the most important coastal wetlands for 11 species of marsh birds representing high-quality wetland habitat (Marsh Wren, Pied-billed Grebe, Sandhill Crane, Swamp Sparrow, Virginia Rail, American Bittern, Black-crowned Night Heron, Common Gallinule, Least Bittern, Sedge Wren, and Sora.). The tool combines data to rank wetlands based on their importance to each of these species (2019 Audubon). Portions of every subwatershed within the Waishkey River watershed contain some high priority habitat with the largest pockets located in the West Branch subwatershed (Figure 14). Known as the Delirium Wilderness Area, this high priority habitat is managed by the United States Forest Service for biodiversity and rare species.

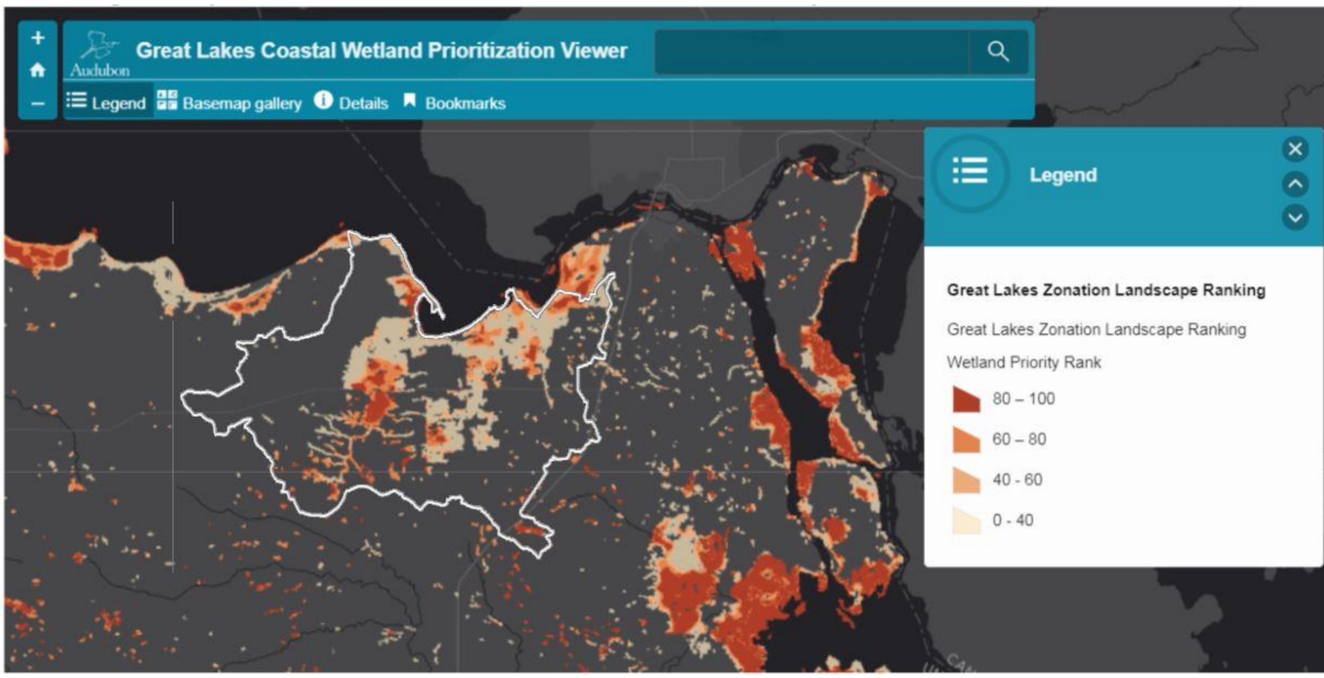


Figure 14. Priority Coast Wetlands for Breeding Marsh Birds. Mapper from Audubon Society 2019.

1.5.v Threatened & Endangered Species

Numerous threatened and endangered species have been documented within Chippewa County, almost all of which reside within or in close proximity to the Waishkey River watershed. Table 3 lists all of these species with their appropriate designation (USFWS).

Table 3. Threatened & endangered species of Chippewa County

Common Name	Scientific Name	Designation
American Hart's Tongue Fern	*Asplenium scolopendium*	Threatened
Rufa Red Knot	*Calidris canutus rufa*	Threatened
Gray Wolf	*Canis lupus*	Endangered
Piping Plover	*Charadrius melodus*	Endangered
Pitcher's Thistle	*Cirsium pitcheri*	Threatened
Dwarf Lake Iris	*Iris lacustris*	Threatened
Canada Lynx	*Lynx canadensis*	Threatened
Northern Long-Eared Bat	*Myotis septentrionalis*	Threatened
Kirtland's Warbler	*Setophaga kirtlandii*	Endangered
Houghton's Goldenrod	*Solidago houghtonii*	Threatened

These species face many threats including, but not limited to, pollution, habitat destruction and fragmentation, climate change, and invasive species. These threats must be minimized or, if possible, eliminated to restore populations of these important species and create a healthy watershed.

1.5.vi Invasive Species

Invasive species constitute a major threat to all habitat types. Numerous invasive species already exist within the Waishkey River watershed, and several others are threatening invasion. Table 4 includes many of the invasive species already residing within the watershed as well as several species which may pose a threat in the near future. Some invasive species are legally designated by the State of Michigan as either "prohibited" or "restricted."

If a species is prohibited or restricted, it is unlawful to possess, introduce, import, sell or offer that species for sale as a live organism, except under certain circumstances. The term "prohibited" is used for species that are not widely distributed in the state. Often, management or control techniques for prohibited species are not available (www.Michigan.gov/invasives/). The term "restricted" is applied to species that are established in the state. Management and control practices are usually available for restricted species. A number of the following species use rivers as corridors to further spread and take hold, such as emerald ash borer, purple loosestrife, and Himalayan balsam. Regular monitoring and prevention campaigns can limit their spread.

Table 4. Invasive species of concern for Waishkey River Watershed.

Common Name	Scientific Name	State designated Invasive Species	DNR Watch List	Present in watershed
Emerald Ash Borer	*Agrilus planipennis*	Prohibited		x
Garlic Mustard	*Allaria petiolate*			X
Spotted Knapweed	*Centaurea maculosa*			X
Canada Thistle	*Cirsium arvense*			X
European Swamp Thistle	*Cirsium palustre*			X
Asian Clam	*Corbicula fluminea*			
Carp species	*various species*	Prohibited	X	X
Leafy Spurge	*Euphorbia esula*			X
Glossy Buckthorn	*Frangula alnus*			X
Eurasian Ruffe	*Gymnocephalus cernua*	Prohibited		X
European Frog-bit	*Hydrocharis morsus-ranae*	Prohibited	X	
Himalayan Balsam	*Impatiens glandulifera*		X	X
Purple Loosestrife	*Lythrum salicaria*	Restricted		X
White Sweet Clover	*Melilotus alba*			X
Yellow Sweet Clover	*Melilotus officinalis*			X
Eurasian Water-milfoil	*Myriophyllum spicatum*	Restricted		X
Round Goby	*Neogobius melanostomus*	Prohibited		X
Rusty Crayfish	*Orconectes rusticus*	Restricted		X
Wild Parsnip	*Pastinaca sativa*			X
Reed Canary Grass	*Phalaris arundinacea*			X
Eurasian Phragmites	*Phragmites australis*	Restricted		X
Scots Pine	*Pinus sylvestris*			X
Sea Lamprey	*Petromyzon marinus*			X
Japanese Knotweed	*Polygonum cuspidatum*	Prohibited		X
Giant Knotweed	*Polygonum sachalinense*			
Curly-Leaf Pondweed	*Potamogeton crispus*	Restricted		X
New Zealand Mudsnail	*Potamopyrgus antipodarum*	Prohibited	X	
Common Buckthorn	*Rhamnus cathartica*			X
Climbing Nightshade	*Solanum dulcamara*			X
Narrow-Leaved Cattail	*Typha angustifolia*			X

The Midwest Invasive Species Information Network (MISIN) is a regional effort to develop and provide early detection and response resources for invasive species. Their goal is to assist both experts and citizen scientists in the detection and identification of invasive species in support of successful management. This effort is being led by researchers with the Michigan State University Department of Entomology laboratory for Applied Spatial

Ecology and Technical Services in conjunction with a growing consortium of supporting partners. Access the MISIN database for up to date invasive species information or to report a siting https://www.misin.msu.edu/.

Chapter 2. THE HUMAN ENVIRONMENT

2.1 Current Land Use

Of the Waishkey River Watershed's 122,620 acres, 74% is designated as wetland, forest, open water, and other. These numbers were generated from the Spreadsheet Tool for Estimating Pollutant Load (STEPL) website based on data collected by the National Land Cover Database in 2006.The remaining acreage is 5.8% urban development and feedlots, and 19.7% cropland and pasture (Figure 15; Table 5). The main agricultural crop produced are predominately perennial pasture, hay, and small grains. Livestock produced include dairy and beef cattle, horses, hogs, and sheep (see Figure 6) (MDEQ 2002).

Table 5. Land cover of subwatersheds (USEPA STEPL 2018).

Subwatershed	Open Water	Developed (Urban/ Feedlots)	Pasture/ Cropland	Forest/ Wetland	Other	Total Acres
East Branch	0	512.6	3974.9	7129.5	4.7	11621.6
Hickler Creek	30	1041.1	6355	9136.4	29.2	16591.1
Orrs Creek	15.2	1101.7	2662.8	10211.3	10.7	14001.4
South Branch of East Branch	6.7	731.1	6134.1	3864.6	18.5	10754.8
South Branch	8.7	1018.5	2527.8	14147.4	23.8	17726
Waiska Creek-Frontal	609	2222.3	1623.1	23041.9	127.5	27623.4
West Branch	37.8	501.1	860.9	22872.6	29.4	24301.7
Entire Watershed	707.4	7128.4	24138.6	90403.7	243.8	122620

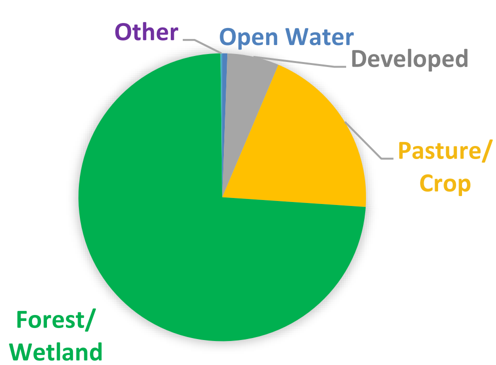


Figure 15. Percentage of Land Cover Types across Entire Waishkey River Watershed

Table 6. Human Land Uses and Livestock Counts by Subwatershed (MEGLE 2019. Michigan's E. coli Pollution Solution Mapper).

Subwatershed	Population	Housing Units	Septic	Impervious Surfaces	Hogs	Cattle	Manure Applied	Total Acres
East Branch	820	360	360	>1.0 low	>10	200	>320ac	11,621.55
Hickler Creek	550	310	200	1.2% midrange	10	300	>320ac	16,591.05
Orrs Creek	130	64	28	1.2% midrange	>10	40	>320ac	14,001.35
South Branch of East Branch	550	240	240	1.2% midrange	10	400	>320ac	10,754.75
South Branch	2,500	330	170	1.4% midrange	>10	100	>320ac	17,725.96
Waiska Creek-Frontal	4,200	2,200	810	1.4% midrange	>10	40	>320ac	27,623.4
West Branch	93	68	68	>1.0% low	>10	20	>320ac	24,301.69
Entire Watershed	8,843	3,572	1,876		40	1100		122,619.7

***NOTE: the South Branch subwatershed has a high population to housing unit ratio due to prison facilities.*

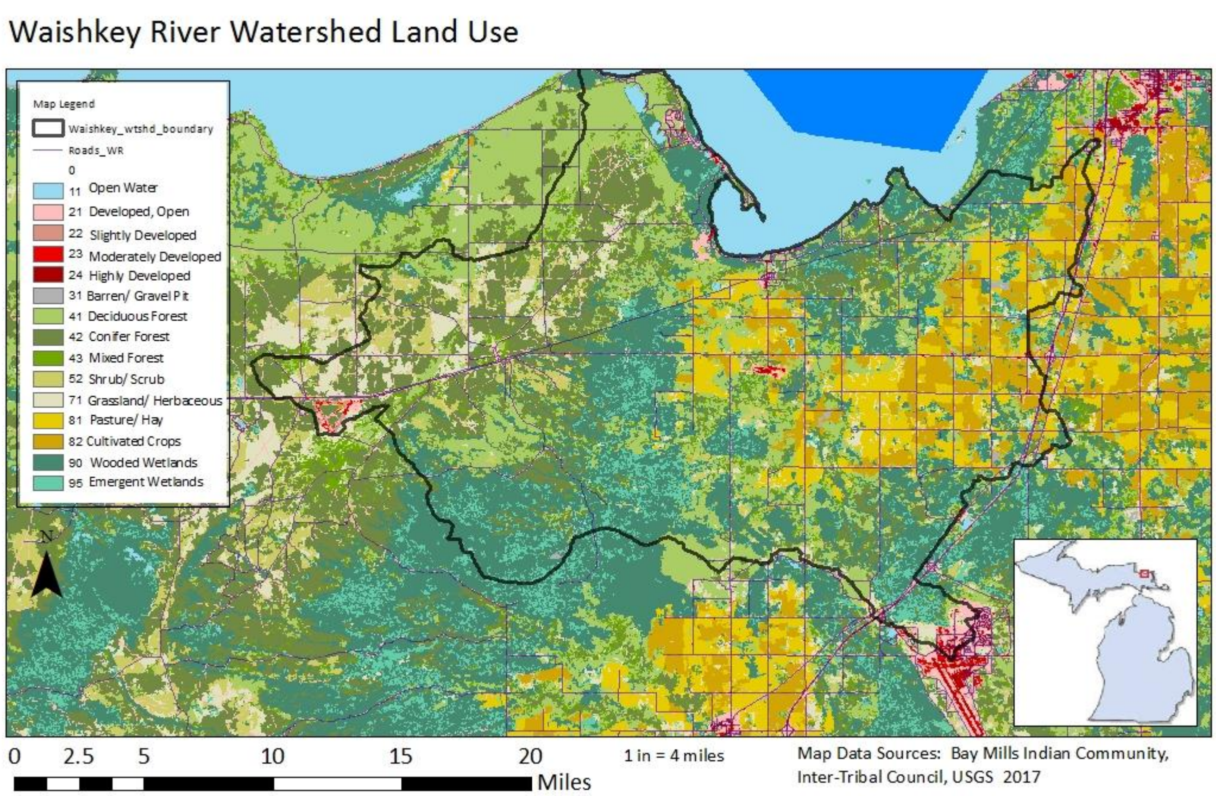


Figure 16. Waishkey River watershed land use

The Waishkey River headwaters are located to the south, southwest, and southeast of its mouth, which enters the St. Mary's River just west of Brimley State Park (Figure 16). The western headwaters, located south of Raco, drain an area composed of over 92% forest and wetlands. The southern headwater's drainage area is slightly more altered by agricultural practices, but the large majority (82%) is comprised of forests and wetlands. The eastern headwaters drain the most altered land of the watershed, which includes approximately 30% pasture and cropland (USEPA 2012).

The South Branch of East Branch watershed has significant agricultural activity, with 33% cropland and 19% pasture. The East Branch watershed has less agriculture (15% cropland and 15% pasture) and more wetlands and forest (32% and 33%, respectively). Wooded buffers are common on the main stem of the East Branch, however many headwater reaches of its tributaries lack buffers. The South and West Branches have predominantly natural land cover, with combined wetland and forest cover of 82% and 92%, respectively. The Hickler Creek Watershed has more agricultural land cover, with 12% cropland and 19% pasture. Vegetative buffers are very common along the South and West Branches, but large portions of Hickler Creek in agricultural areas lack buffers. Orrs Creek has 93% natural land cover (forest, wetland and grassland) with little development or agriculture. Wooded buffers are present along most of Orrs Creek. (USEPA 2012).

Table 7. Descriptions of Land Use Classifications

Land Classification Description
Open Water - areas of open water, generally with less than 25% cover of vegetation or soil.
Developed, Open Space - areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
Developed, Low Intensity - areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover. These areas most commonly include single-family housing units.
Developed, Medium Intensity - areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover. These areas most commonly include single-family housing units.
Developed High Intensity -highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80% to 100% of the total cover.
Barren Land (Rock/Sand/Clay) - areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
Barren Land (Rock/Sand/Clay) - areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
Deciduous Forest - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change.
Evergreen Forest - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.
Mixed Forest - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover.
Shrub/Scrub - areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.
Grassland/Herbaceous - areas dominated by gramanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
Pasture/Hay - areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.
Cultivated Crops - areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.
Woody Wetlands - areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
Emergent Herbaceous Wetlands - Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

2.2 Political Boundaries and Demographics

The Watershed has 2,612 housing units and 7,111 residents reported in the 2010 census (USEPA 2012). The highest area of residential development is along the South Branch of Waishkey River with 3,193 residents. The least populated portion of the Watershed is the West Branch area that includes mostly Forest Service lands including the Delirium Wilderness Area.

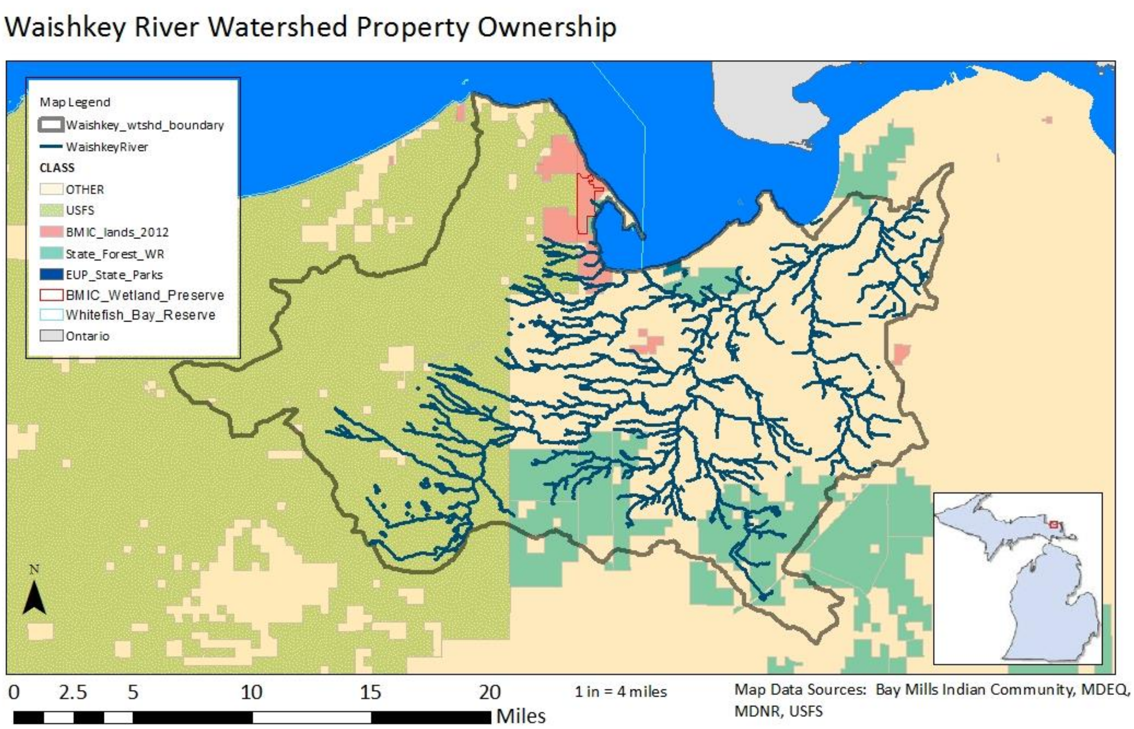


Figure 17. Property ownership in the Waishkey River watershed.

The Waishkey River watershed ownership is comprised of a mixture of tribal, state, federal, and private properties (Figure 17). The mixed ownership creates a diversity of management strategies and goals, but much of the land is open to the public for access which allows for many recreation opportunities such as fishing, skiing, kayaking, hunting, and many more.

Land cared for by the US Forest Service makes up nearly one third of the watershed. Land owned by the State of Michigan, as either forest or state park, is fragmented throughout the watershed. Bay Mills Indian Community has approximately 3000 acres of land within the Waishkey River watershed including the Bay Mills Wetland Preserve. The entire watershed lies within the ceded territory of five tribes, including Bay Mills, who reserve hunting, fishing and gathering rights in the Treaty of 1836 with the United States government. The remainder of the watershed is private land, much of it farmed.

2.3 Culverts, Bridges, Obstructions

Culverts and bridges are sources pollutants and erosion. Salts, grease, oils, and automotive chemicals can gain direct access to the watershed through these structures. Runoff and storm water funneled through these structures washes these chemicals into the water, and also erodes banks resulting in elevated sedimentation and turbidity, as well as releasing nutrients and other buried substances into the water. Additionally, culverts and other anthropogenic obstructions in waterways obstruct the passage of aquatic animals, most notably fish, and alter habitat.

Mapping and recording all stream crossings and obstructions in the watershed is an ever-changing task. The Waishkey River Watershed Management Committee mapped and recorded the status of stream crossings, including bridges, culverts, and other man-made structures. More information on road stream crossing monitoring may be found in Appendices A and B. While the maintenance and replacement of these structures is largely the jurisdiction of counties, railroad companies, and individual citizens, efforts should be made to encourage restoration efforts where necessary.

2.4 Community History

PRE-COLONIAL SETTLEMENT

Humans have occupied the Waishkey River and St. Marys River area for 11,000 years, and evidence of permanent settlements along the river date back to 5,000 years ago when the people of the upper Great Lakes began to utilize spring spawning fish as a subsistence food source. For 4,500 years, the St. Marys River has been the cultural heart of the Ojibwe people (Sault Ste. Marie Region Conservation Authority). The Inside Passage was a travel route starting at the mouth of the Waishkey River, continuing up the West Branch of the Waishkey River. After a short portage southward, travellers connected with the headwaters of the Pine River; from there they could travel on to Mackinac Island and the Straits. This route was especially favoured in winter. (Chapman, 1939). Today, many of the inhabitants of the region are descendants of the Ojibwe and belong to the Bay Mills Indian Community and Sault Ste. Marie Tribe of Chippewa Indians.

COLONIAL SETTLEMENT

The first Europeans encountered the St. Marys River rapids and Lake Superior in the early 1600s. The St. Marys River became the center of French activity in the Upper Great Lakes soon thereafter. Trade, maple-sugaring, and the whitefish fishery encouraged settlement and led to the establishment of the European settlement of Sault Ste. Marie in 1668 (Arbic 2004, Duffy et al. 1987). In the early 18th century, Great Britain extended its influence in the St. Marys River region, drawn by the profitable fur trade. However, depletions in beaver populations in the early 1800s caused a shift in the focus of commerce from the fur trade to Lake Superior's fisheries, surrounding forest lands, and mineral deposits for export.

The beginning of the Bay Mills Point area around the mouth of the Waishkey River was due largely to efforts of missionaries. The 1840s proved hard for Sault Ste. Marie area, as a crash in the international fur market and decline in population. In 1875 a lumber mill was built on what is now Bay Mills Point across the bay from the mouth of the river. Soon two other mills were added, and a lumber town grew up. By 1895 a pulp and paper mill and a sash and blind factory were in operation. A railroad trestle linked Bay Mills Point and Brimley. The pilings are still visible today. Almost two-thousand non-natives settled at this site, where houses, two churches, and a post office were established. It was the establishment of these mills that the area name Bay Mills was derived. In 1904 most of the lumber mill complex burned. By 1909, the forests had been cut-over and the mills on Bay Mills Point were abandoned.

RESOURCE USE IN THE REGION: FISHERIES, FORESTRY, AGRICULTURE, MINING

In pre-colonial times, thousands of Ojibwe gathered at the St. Marys Rapids and lived primarily on whitefish and sturgeon. Calculations by Charles Cleland indicate that fish supplied 66% of the meat obtained by Ojibwe (Cleland 2001). During European settlement, the St. Marys River supported sport and commercial fisheries. However, by the late 1800s, concerns over the health of the sport fishery led to greater restrictions of the commercial fishing industry and its eventual closure (Gebhardt et al. 2002). A commercial whitefish industry still exists in Whitefish Bay, the headwaters of the St. Marys River. Native American and First Nation tribes also have fishing rights throughout the St. Marys River.

Commercial timber harvesting in the eastern Upper Peninsula of Michigan developed into a successful industry by the late 1800s. White pine was the primary source of timber extracted due to its abundance and the low density of the wood, which floated easily and facilitated transport by river. At the end of 19th century, during the height of this period, a single sawmill at Bay Mills could produce 31 million board feet of white pine (Duffy et al. 1987). By the beginning of the 1900s, the white pine forests of the region were depleted and the timber industry shifted its emphasis to hardwood species. Today, pulp woods including spruce, balsam fir, tamarack, aspen, and jack pine are the primary timber species in the region.

Figures 18, 19, 20, 21. Logging along Waishkey River. Timber staged for transport to saw mill. Bay Mills Point mills as seen from Brimley. Hall and Munson Saw Mill. Photos courtesy of Bay Mills Ojibwe History Department.

Agricultural development of the Waishkey River region followed the growth of the timber industry during the latter half of the 1800s. Hay and grain were needed since logging operations depended heavily on horses, and logging camps required a supply of beef and pork. Regional agriculture is limited to an average growing season of 4.5 months. Agriculture is also constrained by the shallow, poorly drained soils of the region. Current agricultural practices are focused primarily on dairy and beef production. Hay is currently the major crop in the region. Today over 24,100 acres of the watershed were under cultivation in Michigan (USEPA STEPL 2012).

Historically, quarries in the Easter Upper Peninsula produced large amounts of dolomite. In recent years, however, production has declined significantly. Currently, small gravel mining operations exist in the upper river St Marys River, providing a minor contribution to the local economy (The Nature Conservancy 2008).

THE CCC ERA

Shortly after the establishment of the Civilian Conservation Corps (CCC), the counterpart Indian Emergency Conservation Work (IECW) program was established. A camp was setup near Eckerman, MI in 1935 and housed 153 enrollees—many from Bay Mills (Cleland 2001). Among their projects were forest restoration, stream restoration, and road building. Many red pine were planted in plantation rows from the Raco Plains east towards the reservation. In the 1970s a YCC crew of tribal youth planted much of the scotch pine. For more information on the CCC Camp Marquette contact the Bay Mills Ojibwe History Department.

Chapter 3. WATERSHED CONDITIONS

The geographical extent of the Waishkey River Watershed results in a wide variety of habitat types, land uses, and water quality issues. The water quality issues have, therefore, been broken down into sub-watersheds which are designated with 12-digit hydrologic unit codes (HUCs) (Table 4). Water quality must meet certain guidelines, referred to as “designated uses.” If water quality does not meet these standards, it is referred to as impaired or a designated use impairment (DUI).

3.1 Designated Uses and Pollutants of Concern

The ultimate goal of the Waishkey River Watershed management plan is to restore and maintain water quality. The desired designated uses for the Waishkey River watershed are the standards set by the State of Michigan in Michigan’s Environmental Protection Act (P.A. 451 of 1994, Part 31, Chapter1). The nine designated uses are:

- Agriculture
- Navigation
- Industrial Water Supply
- Warm/Cold-Water Fishery
- Other Indigenous Aquatic Life and Wildlife
- Partial Body Contact Recreation
- Total Body Contact Recreation between May 1- Oct 1
- Fish Consumption
- Public Water Supply

If a body of water does not meet the water quality standards for a specific designated use, then it is considered in non-attainment or impaired. The nine designated uses set by the State of Michigan correspond well with the nine water quality objectives set forth by the Great Lakes Water Quality Agreement (GLWQA) between the Unites States and Canada. The agreement established formal commitments for the countries to “protect, restore, and enhance water quality of the Waters of the Great Lakes and their intention to prevent further pollution and degradation of the Great Lakes Basin Ecosystems” (Canada and United States, 2012). The GLWQA General Objectives state that water should: be a source of safe, high quality drinking water; allow for swimming and other recreational uses; allow for human consumption of fish and wildlife; be free from pollutants harmful to human health, aquatic organisms, and wildlife; support healthy wetlands and other habitats sustainable to native species, be free from nutrients that may cause harmful algal blooms; be free from the spread of invasive species; and be free from other substances which may affect the chemical, physical, and biological integrity of the Great Lakes.

3.2 Desired Watershed Uses

Along with designated uses, desired uses were identified in the Waishkey River watershed. Desired uses constitute how the community might want the watershed to look like, the character of the watershed, recreational opportunities, etc. Watershed users were surveyed through an online survey, paper survey, or at the public engagement meeting. Additionally meetings with the steering committee, municipalities, local tribes, agencies, residents and one-on-one discussions with landowners determined similar themes.

Stakeholders in the Waishkey River Watershed Plan project identified many desired uses for the watershed.

In the winter of 2020, the steering committee surveyed community members on their desired uses for the watershed. Forty-four responses were collected via the online survey and paper. Within the survey, respondents were asked to list their top needs and/or values around the Waishkey River and watershed. These could include tangible uses and activities or intangible feelings. Survey results shown in Figure 22 lumped into 31 categories; words mentioned more frequently are displayed in larger font. Results of the survey found fisheries and fishing (20%) to be very important, which was closely followed by clean water (14%). Beyond that, answers were diverse. The importance of gathering traditional foods and value for the sacredness of water and ceremony was also evident in the results.

Figure 22. Desired uses survey results of top needs and values. (*Words mentioned more frequently are displayed in larger font).*

3.3 Impaired and Threatened Designated Uses

Currently, four of the Waishkey River's designated uses are listed as impaired (Table 8; Table 9) (Michigan Department of Environmental Quality Water Resources Division, Appendix B).

Table 8. Summary of DUIs and causes of impairment.

Designated Uses	Status	Cause of Impairment
Agriculture	Designated Use Being Met	n/a
Navigation	Designated Use Being Met	n/a
Industrial Water Supply	Designated Use Being Met	n/a
Warm/Cold-Water Fishery	Designated Use Being Met	n/a
Other Indigenous Aquatic Life and Wildlife	***Impaired***	Mercury in Water Column
Partial Body Contact Recreation	***Impaired***	*Escherichia coli*
Total Body Contact Recreation	***Impaired***	*Escherichia coli*
Fish Consumption	***Impaired***	Mercury in Water Column
Public Water Supply	Designated Use Being Met	n/a

Table 9. Summary of DUIs and causes of impairment by subwatershed. **Courtesy of Michigan Department of Environmental Quality Water Resources Division*

	Designated Use											
Stream HUC-12/ AUID	**Total Body Contact Rec**	**Partial Body Contact Rec**	**Navigation**	**Industrial Water Supply**	**Agriculture**	**Warm Water Fishery**	**Other Aquatic Life**	**Public water supply**	**Cold water fishery**	**Fish consumption**	**Cause for Impairment**
East Branch of WR, Beaver Meadow Creek 040202030204-01	**NS**	FS					FS			FS	Not supporting due to *E. coli*
Hickler Creek, Waishkey River 040202030206-01	**NS**	FS					FS			FS	Not supporting due to *E. coli*
Orrs Creek 040202030205-01	**NS**	FS					FS			FS	Not supporting due to *E. coli*
South Branch of East Branch of WR 040202030201-01 & 02	**NS**	**NS**					FS			FS	Not supporting due to *E. coli*
South Branch of WR, Hutton Creek 040202030202-01 & 02	**NS**	**NS**					FS			FS	Not supporting due to *E. coli*
Waiska- Frontal St Marys River 040202030105-02	**NS**	**NS**					FS			FS	Not supporting due to *E. coli*
West Branch of WR, Bons, Sylvester Creeks 040202030203-01	FS	FS					**NS**			**NS**	Not supporting due to mercury

NS refers to sites not supporting designated use; FS refers to sites fully supporting designated use.

The first step in resolving the impairment of *E. coli* must be to identify the source utilizing quantitative polymerase chain reaction (qPCR). Once the source of *E. coli* is determined to be derived from human or livestock waste, appropriate efforts will need to be taken. Further efforts to remove this impairment are outlined in Chapter 9.

The impairment caused by mercury is a result of fossil fuel combustion, mining, various industrial processes, and waste incineration. While the overwhelming majority of mercury enters from outside the watershed, mercury inputs may be somewhat diminished by ensuring proper recycling and disposal of mercury-containing items, and reducing the use of fossil fuels within the watershed. A second step in addressing this impairment is ensuring that the public is educated on the subject and in regards to fish consumption advisories. The implementation strategies for dealing with this DUI are listed in Chapter 9.

3.4 Available Monitoring and Resource Data

The Michigan Department of Environmental Quality and the Bay Mills Biological Service Department have been conducting regular water quality monitoring in the watershed for a number of years. Incidental water quality monitoring also occurs by other agencies and organizations such as the USEPA and USGS.

3.4.i Pathogens, Nutrients, Mercury Data/Results

The MDEQ has historically collected or currently collects data at 20 sites in the Waishkey River watershed. Data collected includes biological, chemical, and physical parameters, and is stored on the USEPA's STORET online database. Bay Mills Biological Services staff currently collects data at 13 sites along the Waishkey River, as well as 10 sites along smaller streams directly inputting to Waishkey Bay. Only a handful of these sites overlap with the MDEQ's monitoring sites. Data collected includes chemical, biological, and physical parameters. This data is also entered into the USEPA's STORET online database. The locations of these monitoring sites are shown along with BMIC monitoring sites in Figure 23. The MDEQ sampled some of these locations of mercury in 1999, 2004, and 2013 (see Table 10). The most recent results indicate water quality concerns resulting from nutrients, temperature, pH, *E. coli*, and dissolved oxygen (Table 11, 12) (BMIC 2018). Nutrient levels and *E. coli* levels are known to exceed the water quality criterion at times; these are graphed in Appendix D. Most sites had median values within State of Michigan water quality standards for dissolved oxygen, pH, and temperature. All stream sites had median values that exceeded ecoregion levels for turbidity. Anecdotally, the sites whose subwatershed were mostly forested had the lowest nutrient levels, whereas, sites in open agricultural areas had the highest nutrient levels. Total phosphorus and total nitrogen should continue to be monitored to build on baseline dataset.

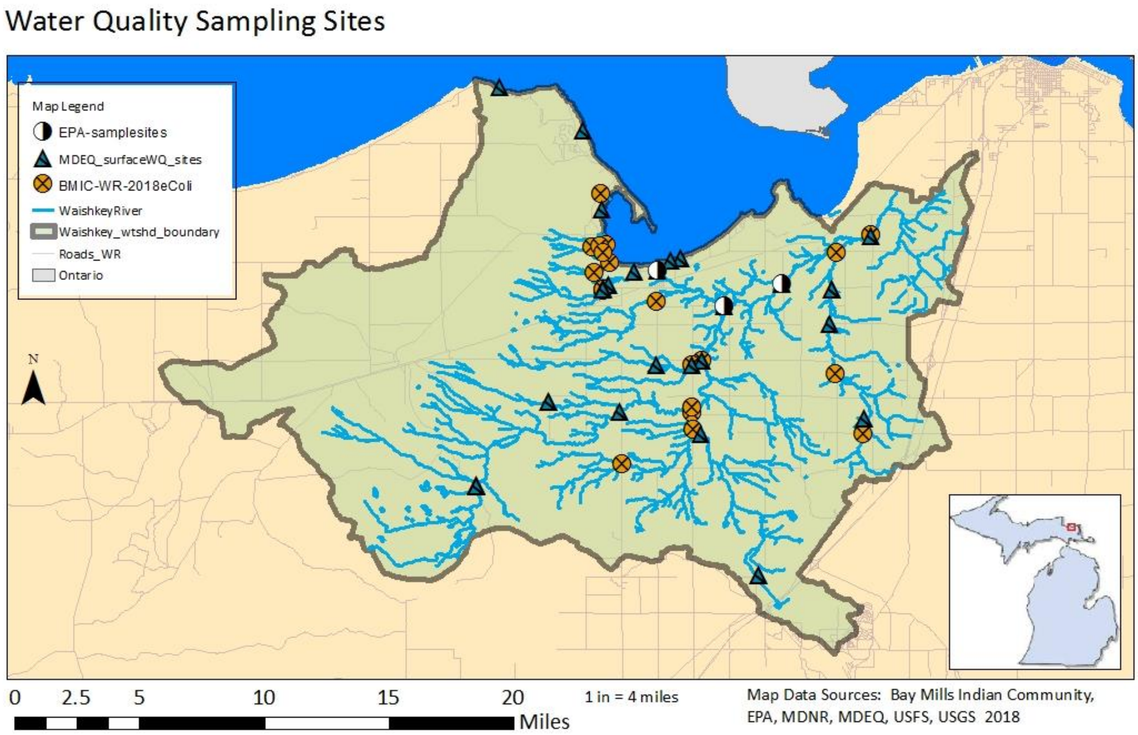


Figure 23. Waishkey River water quality sampling sites monitored by MDEQ, USEPA, BMIC.

Table 10. Mercury monitoring in the Waishkey River Watershed. Highlighted results indicate numbers that were above detection and exceeded the water quality criterion. (MDEQ 2002, 2005, 2014)

Subwatershed	SiteName	Report Site Name	Mercury	Date
West Branch	DEQ10	6	<.2	7/1/1999
South of East	DEQ11	8	<.2	7/1/1999
South Branch	DEQ12	9	<.2	7/1/1999
West Branch	DEQ13	10	<.2	7/1/1999
South Branch	DEQ4	3	<.2	7/1/1999
South of East	DEQ6	2	<.2	7/1/1999
Waiska Creek-Frontal St Marys	DEQ8	4	<.2	7/1/1999
Waiska Creek-Frontal St Marys	DEQ9	5	<.2	7/1/1999
South Branch	DEQ4	H	<.2	9/1/2004
South of East	DEQ5	F	<.2	9/1/2004
South of East	DEQ6	G	<.2	9/1/2004
Hickler	DEQ1	4	<.2	9/2/2004
South Branch	DEQ15	7	<.2	9/2/2004
Waiska Creek-Frontal St Marys	DEQ2	5	<.2	9/2/2004
Hickler	DEQ3	6	<.2	9/2/2004
West Branch	DEQ14	n/a	4.669	11/11/2013

Table 11. Waishkey River watershed sampling sites that do not meet water quality criteria for select parameters. (X) denotes that median value exceeded the water quality criterion. (BMIC 2018, MDEQ 2002, 2005)

Subwatershed	Site	DO	pH	Temp C	Turb	TP	TN	Source
Waiska Ck- Frontal	CLUBAB					X	X	BMIC '18
Waiska Ck- Frontal	CLUBBL					X	X	BMIC '18
Waiska Ck- Frontal	DEEP	X	X			X	X	BMIC '18
Waiska Ck- Frontal	LWAB					X	X	BMIC '18
Waiska Ck- Frontal	LWBL					X	X	BMIC '18
Waiska Ck- Frontal	PAR1					X	X	BMIC '18
Waiska Ck- Frontal	PAR2					X	X	BMIC '18
Waiska Ck- Frontal	PARAB					X	X	BMIC '18
Waiska Ck- Frontal	PARBL					X	X	BMIC '18
Waiska Ck- Frontal	PONTY					X	X	BMIC '18
Hickler	WR					X	X	BMIC '18
Hickler	WR1a					X	X	BMIC '18
East Branch	WR4a					X	X	BMIC '18
South of East	WR5					X	X	BMIC '18
South of East	WR6					X	X	BMIC '18
South of East	WR7					X	X	BMIC '18
Hickler	WR8					X	X	BMIC '18
South Branch	WR9					X	X	BMIC '18
West Branch	WR10					X	X	BMIC '18
South Branch	WR11					X	X	BMIC '18
South Branch	WR12					X	X	BMIC '18
East Branch	WR13					X	X	BMIC '18
Orrs Crk	WR14					X	X	BMIC '18
Hickler	DEQ1					X	X	DEQ '04
Waiska Ck- Frontal	DEQ8					X	X	DEQ '99
Waiska Ck- Frontal	DEQ9					X	X	DEQ '99
West Branch	DEQ10						X	DEQ '99

South of East	DEQ11					X	X	DEQ '99
South Branch	DEQ12					X	X	DEQ '99
West Branch	DEQ13					X	X	DEQ '99
Waiska Ck- Frontal	DEQ2					X	X	DEQ '04
Hickler	DEQ3					X	X	DEQ '04
South Branch	DEQ15					X	X	DEQ '04
South Branch	DEQ4					X	X	DEQ '04
South Branch	DEQ4					X	X	DEQ '99
South of East	DEQ5					X	X	DEQ '04
South of East	DEQ6					X	X	DEQ '04
South of East	DEQ6					X	X	DEQ '99
East Branch	DEQ7					X	X	DEQ '99

Table 12. Waishkey River watershed sampling sites that do not meet water quality criteria for select parameters. (*) denotes that individual *E. coli* samples were collected that exceeded the water quality criterion at the most recent sampling events. (BMIC 2018, USEPA 2012, USGS 2012)

Subwatershed	Site	*E. coli*	*Source*
Waiska Ck- Frontal	CLUBAB	*	BMIC '18
Waiska Ck- Frontal	CLUBBL	*	BMIC '18
Waiska Ck- Frontal	DEEP	*	BMIC '18
Waiska Ck- Frontal	LWAB	*	BMIC '18
Waiska Ck- Frontal	LWBL	*	BMIC '18
Waiska Ck- Frontal	PAR1	*	BMIC '18
Waiska Ck- Frontal	PAR2	*	BMIC '18
Waiska Ck- Frontal	PARAB	*	BMIC '18
Waiska Ck- Frontal	PARBL	*	BMIC '18
Waiska Ck- Frontal	PONTY	*	BMIC '18
Hickler	WR	*	BMIC '18
Hickler	WR1a	*	BMIC '18
East Branch	WR4a		BMIC '18
South of East	WR5	*	BMIC '18
South of East	WR6	*	BMIC '18
South of East	WR7	*	BMIC '18
Hickler	WR8	*	BMIC '18
South Branch	WR9	*	BMIC '18
West Branch	WR10	*	BMIC '18
South Branch	WR11	*	BMIC '18
South Branch	WR12		BMIC '18
East Branch	WR13	*	BMIC '18
Orrs Crk	WR14	*	BMIC '18
Hickler	Wa1	*	EPA '12
South Branch	Wa2	*	EPA '12
East Branch	Wa3	*	EPA '12
Waiska Ck- Frontal	StatePark	*	USGS '12
Waiska Ck- Frontal	StatePark	*	USGS '12
Hickler	CG2	*	USGS '12
Waiska Ck- Frontal	CG3	*	USGS '12
Waiska Ck- Frontal	CG4	*	USGS '12
Waiska Ck- Frontal	CG5	*	USGS '12
Waiska Ck- Frontal	CG6	*	USGS '12

BRIMLEY STATE PARK PATHOGENS

Brimley State Park is a popular recreation area and swimming beach. It is regularly monitored throughout the swimming season for E. coli and the beach is occasionally closed when bacteria levels become too high for safe body contact. In an effort to better understand what may be causing beach closures, the United States Geological Survey (USGS) conducted a study in 2012 to intensively monitor pathogens in the water, sediment, and algae near the state park. Samples were collected one or more times per week from May to September 2012. Overall *Campylobacter* sp were detected most often followed by shiga-toxin producing *E. coli*, *Shigella* spp, *Salmonella* sp, and other *E. coli* (Oster, R.J. et al. 2014). Human waste is a common source for pathogens such as *Shigella sp*, while bird and ruminants for *Campylobacter* sp. Average abundance of shiga-toxin producing *E. coli* was greater in water than in sediment. The study showed correlations between water level, wind speed, temperature and detection frequencies (Oster, R.J. et al. 2014). There is also a correlation with stormwater inputs across a beach; Brimley State Park has many creeks and storm drains flowing over the beach.

An additional in 2012 study by USGS looked at stormwater systems as a possible reservoir for pathogens *E.coli*, *Salmonella* sp., *Campylobacter* sp., *Enterococcus* sp., and *Staphylococcus* sp.). Study samples were collected four times during the 2012 recreational season at the six locations. The study showed all four state park beach samples had at least one pathogen gene detected (USGS, 2012). Several human-associated pathogen genes were frequently detected (>50%) suggesting a potential human source of contamination. Additionally, 6 out of 14 pathogen genes (43%) were detected at both the beach and one of the storm drains (USGS, 2012). . The largest number of pathogen genes found in any beach sample was five (out of a possible total of 14 or 36%) and the largest number of pathogen genes found in any storm drain sample was 11 (out of a possible total of 14 or 79%) (USGS, 2012). As many as four pathogen genes were detected in beach samples that met the 235 CFU/100 mL *E. coli* standard and as many as 11 pathogen genes in storm drains on the same day.

3.4.ii Biological (Macroinvertebrate and Habitat) Data/Results

Michigan DEQ conducted biological surveys in 1999, 2001, and 2004 (MDEQ 2002; MDEQ 2005). Procedure 51 protocols were used on most sites (11 of 17). The benthic macroinvertebrate communities ranked acceptable at seven sites in 1999 and 2001. In 2004 different sites were used in the sample and the macroinvertebrate community still received an "acceptable" score. Across the surveys common taxa represented were water mites, dragonflies, damselflies, water striders, and midges. Taxa recognized as high quality water indicators were present, but not common (mayflies, stoneflies, and caddisflies). Habitat conditions ranked "fair to good" across the sites in 1999 and 2001 and ranked "marginal to good" across the sites used in the 2004 survey. Biologists found that the stream bottom was mostly clay; however, most of the macroinvertebrates sampled were located on bank vegetation and a modest amount of LWD along the stream banks. Despite the relatively poor substrates, the macroinvertebrate community was rated as acceptable and supported by an overall riverine habitat that was rated in the lower portion of the good range. Table 13 tracks water temperatures at branches of the Waishkey River; an important consideration for suitable trout habitat.

Bay Mills Indian Community conducted water quality and biota surveys from 2005-2017 (BMIC 2018). Macroinvertebrates and fish communities were sampled at 10 sites in the Waiska Cr-St Marys Frontal subwatershed. The data have continually shown that the biological communities within BMIC's waters demonstrate a diverse set of conditions. Of macroinvertebrates, 8-19 taxa have been observed at these sites with EPT Richness ranging from 1.2 to 9.0. Stream fish populations were also sampled. There are historic incidents of Coho salmon, brook trout, and rainbow trout in some of these streams

1998-200. More recently, a single smallmouth bass was captured at CLUBBL in 2017. Although formal biota assessment surveys were not conducted at the other thirteen Waishkey monitoring locations, the presence of freshwater mussels (Family: Unionidae) has been noted at sites WR4a, WR5, WR6, WR7, WR9, WR12, and WR13.

Table 13. Michigan Department of Natural Resources water temperature monitoring data on the Waishkey River from 2007-2018.

Stream	Site	Year	July Average daily Temperature (F°)	Designated Trout stream (Y/N)
Clear Creek	Waishkey River Truck Tl	2007	59.5°	Yes
East Branch Waishkey River	Forest Rd. Forest Rd.	2007 2015	72.5° 72.8°	No No
East Branch Waishkey River	Six Mile Rd.	2015	70.8°	No
Hutton Creek	Lockhart Rd.	2018	63.0°	Yes
No Name Creek	Midway Rd.	2007	64.7°	No
Orrs Creek	M-221 Bridge M-221 Bridge	2007 2018	65.8° 66.7°	No No
South Branch Waishkey River	12 Mile Rd	2007	58.8°	No
West Branch Waishkey River	Tilson Rd. Tilson Rd.	2007 2018	68.7° 67.0°	Yes No

3.4.iii Additional Monitoring Efforts

Additional water quality monitoring is collected by other agencies and organizations. Data must be collected using approved methods to ensure accurate and precise data. Additionally, data should be entered into the USEPA's STORET online database in order to compile all data in one convenient location. The technical committee will provide assistance to any organization necessary regarding data collection, water quality monitoring, and data entry into the STORET database.

3.5 Streambank Inventory

Members of the Waishkey River Watershed Management Committee walked and canoed several sections of the river. These sections were selected in an attempt to represent the various types of land use within the watershed. Inspections were focused on erosion, sources of pollution, and habitat degradation, but any cause for concern was documented. Specific sites of concern are included in Chapter 9.

Chapter 4. WATERSHED CONCERNS

Both point and nonpoint sources of pollution are present in the watershed. Nonpoint sources, however, are the largest contributor of harmful substances into the watershed. Invasive species and habitat degradation also pose significant threats to the Waishkey River Watershed.

4.1 Point Sources of Pollution

Current point sources of pollution in the Waishkey River watershed include permitted NPDES sites, LUSTs, and 201 sites. Chippewa County, through the Chippewa County Health Department Environmental Health, regulates potential sources of *E. coli* in the watershed by permitting On-site Wastewater Treatment Systems (OSWTS). The State of Michigan through the Department of

Environmental Quality Regulates large entities and issues National Pollutant Discharge Elimination System (NPDES) permits in the watershed. E. coli is a concern in all the subwatersheds; the Waishkey River was designated Total Maximum Daily Loads (TMDLs) for *E. coli* in 2012 (USEPA, 2012). NPDES-permitted point source dischargers in the Waishkey River Watershed include the Dafter Sanitary Landfill, the Continental Teves-Brimley Wastewater Stabilization Lagoon (WWSL), Superior Township WWSL and the Kinross Township Waste Water Treatment Facility (Figure 24 and Table 14). These facilities discharge into South Besseau Creek, Hickler Creek, Little Waiska Creek, and Hutton Creek/ Mud Lake respectively. The Kinross Township Wastewater Treatment Facility (WWTF) serves the residences around the former Kincheloe Air Force Base. Although virtually all of the area served by the facility is located in a different watershed, the discharge point for the Kinross WWTF is located in the Waishkey Creek Watershed. Biosolids are treated to reduce pathogens and land-applied to agricultural land within Superior and Pickford Townships in the Waishkey watershed (USEPA, 2012). *(Note that the Superior Township WWSL discharges were not included in the TMDL report (USEPA 2012) because it is outside of the TMDL watershed. However it is included in the area of interest for this management plan)*.

According to discharge figures provided by MDEQ Municipal Permits Unit, over 3,709 million gallons of wastewater is permitted to be discharged into the Waishkey Watershed by Dafter, Kinross, Superior, and Continental Teves. Typical pollutant loads for wastewater as mentioned in section 4.2 magnify with this volume of water.

Table 14. Municipal Wastewater Pollutant Loads (MDEQ 2019)

Permitted Annual Discharge of all NPDES sites combined (2019)	Wastewater Pollutant	Average Pollutant Concentration (mg/L)	Total Pollutant Load/Year
Over 14,040 million liters/yr or 3,709 MGY	Nitrogen	2.26 mg/L	13,730 lbs
	Phosphate	.78 mg/L	10,951 lbs
	Toxics	100mg/L	1.4million lbs
	Pathogens	1,000 viral units/L	14 million viral units

Figure 24 displays the locations of all four NPDES sites within the Waishkey River watershed. Water quality impacted by these sites may be found in section 3.4 Available Monitoring and Resource Data.

Leaking Undersground Storage Tanks (or LUSTs) are sites where there are or was confirmed leaking of a hazardous substance, for example, a gas station storage tank. The 201 Sites, also shown in this map (Figure 24), include other sites that have expereinced releases of hazardous substances.

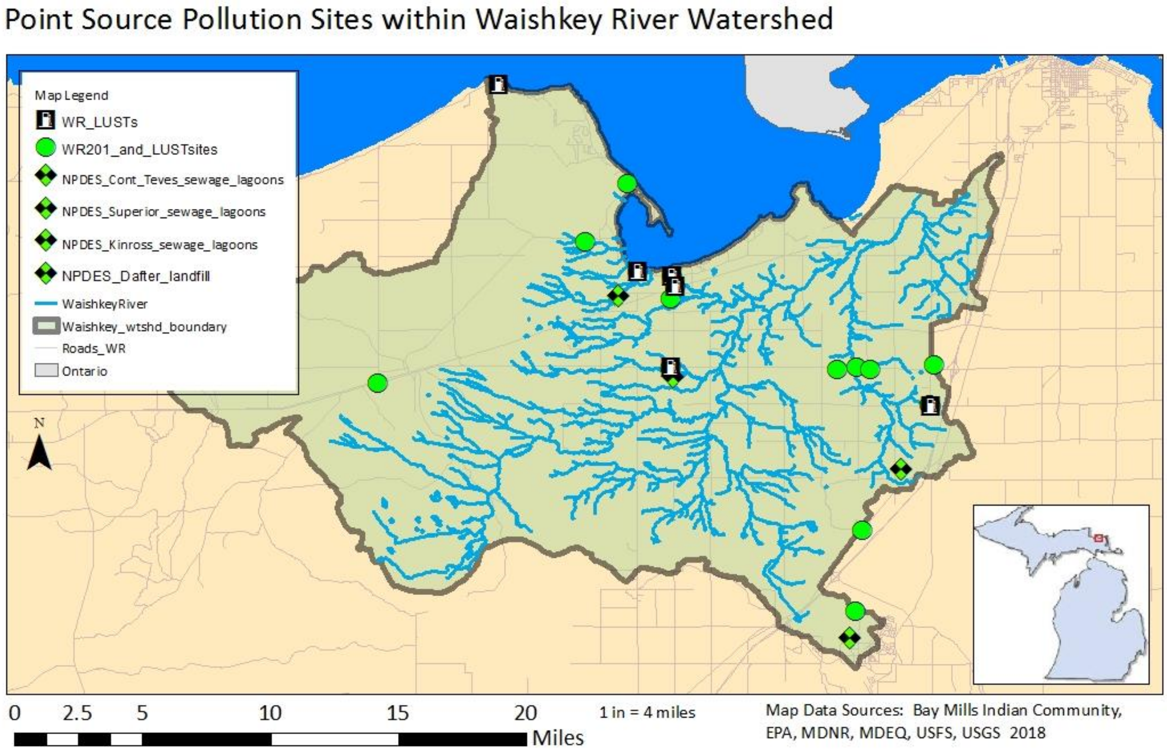
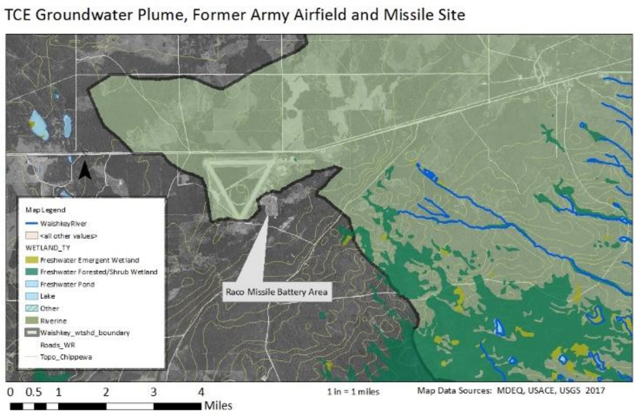
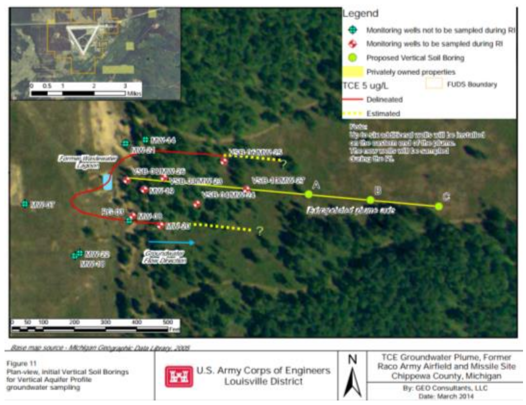


Figure 24. National Pollutant Discharge Elimination System (NPDES) sites and sites of contaminations including Leaking Underground Storage Tanks and 201 sites.

The former Raco Army Airfield and Bomarc Missile Base is another point source of contamination, specifically trichloroethylene (TCE) (GEO Consultants, LLC.). The plume is located just outside the watershed but could enter the area if the plume moves (Figure 25 and 26). It is currently under investigation. The former Kincheloe Air Force Base is also a potential point source of contamination to the watershed (for example PFAS has been detected) (Kinross 2018). While the Base is located just outside of the watershed boundary, TCE and volatile compounds have been documented beneath the Base and could potentially impact the watershed via groundwater (U.S. Army Corps of Engineers – Louisville District).





Figures 25 and 26. Location of TCE groundwater plume at former army airfield and missile site. On left: map by BMIC of Raco Missile Battery Area with watershed boundary. On right: Delineated and estimated plume extent by GEO Consultants, LLC for USACE.

Other users in the Watershed that have the potential to be large sources of *E. coli* are agricultural operations with manure storage lagoons. Implementation of appropriate agricultural management practices is necessary to successfully operate manure storage/treatment operations and protect surface waters (USEPA, 2012).

Historic, unregulated dumping sites are present in the watershed.

Drainage pipes from agricultural areas, lawns, roads, bridges, parking lots, and buildings are prevalent throughout the watershed. Sometimes these drain indirectly into the watershed, but many enter directly into a water body. A wide variety of pollutants enter the watershed through these pipes including faecal coliforms, salts, nutrients, fertilizers, pesticides, grease, and oils. As many of these outlets occur on private property, education will be an important tool in reaching out to landowners and in efforts to direct these pipes into more environmentally-sound areas such as rain gardens.

4.2 Nonpoint Sources of Pollution

A wide variety of nonpoint sources of pollution are present with in the Waishkey River watershed from agriculture, residences, infrastructure and others. Potential nonpoint sources of E. coli and nutrients include failing, poorly designed or overflowing on-site sewage disposal systems (OSDS), illicit connections to surface water, runoff from poorly-managed livestock pasture and poorly-scheduled land-application of manure, poorly-placed manure stockpiling, livestock with direct access to streams or wetlands, concentrated wildlife and pets. Roadways, bridges, and culverts are another problem and provide access into the Waishkey River for salts, sedimentation, pesticides, herbicides, and automotive chemicals. Improperly sized and perched culverts are of special concern, as significant erosion and fish passage problems can result. Urban development composes less than 3.0% of the watershed. Therefore, the impacts of urban development are low overall, yet significant in certain areas. In addition to pollutants listed previously, urban areas also contribute wastewater if systems are improperly managed and maintained. Poor forestry practices also are a potential source of sedimentation, chemical spills, and herbicides. However, no such problems have been discovered within the watershed to date. Hydrological modifications, such as channelization, habitat destruction and alteration, drains, and dams, are ever-present problems. Restoration is much more difficult than protection. Therefore, protection is the main goal of the Waishkey River watershed management committee. Restoration efforts will also be pursued, however, especially within rare or important habitat types. Natural processes should always be considered when working with pollution. While *E. coli* and mercury levels may be elevated to levels of concern, these levels may be naturally high, especially in wetland areas. Efforts must be made to distinguish these natural sources from anthropogenic sources.

4.2.i Road Stream Crossings Concerns

Data collected from the stream-crossings surveys revealed point- and nonpoint sources of contamination. Many of the culverts in the watershed how are undersized and should be considered for replacement. Additionally their style may be ill-suited for the flashy, clay streams they are placed in. Two survey types were conducted across over 300 crossings (see Appendix B). However, to better compare and prioritize improvements, all these stream crossings should be surveyed with the Great Lakes Road Stream Crossing Inventory instructions.

4.2.ii Agricultural Runoff Concerns

A significant pollution source is poorly-managed agricultural operations, which includes nutrient, pesticide, and herbicide runoff, as well as sedimentation problems and pathogen introduction.

Livestock access (to surface waters) can introduce *E. coli*, other pathogens, nutrients, antibiotics, and increase erosion and sedimentation. Projects and implementation strategies to correct or mitigate these pollution sources are found in Chapter 9.

Of these, the highest priority concern is livestock access to surface water and concentrated feeding activity near surface water, resulting in poor manure and nutrient management and significant bacteria, sediment, and nutrient pollution. Wet weather runoff carrying livestock waste from pastures is a probable bacteria source in many watersheds, especially where fencing or vegetated buffers are lacking. Additionally, water testing in dry weather conditions with low water flows demonstrated exceedances of the daily maximum total body contact water quality standard indicating a constant source of *E. coli* contamination in areas where livestock have direct stream access. These problems may be mitigated with fencing, grazing management, manure piling management and numerous Farm Bills and MAEAP programs. A Comprehensive Nutrient Management Plan may also be appropriate for complex sites.

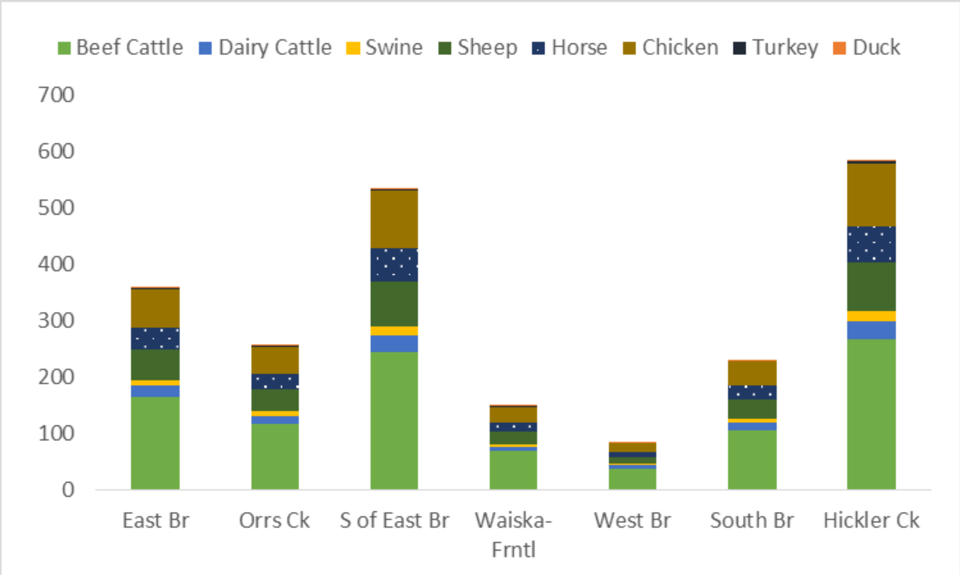


Figure 27. Counts of Livestock by subwatershed (STEPL Tool, 2018).

Number of livestock per subwatershed directly correlates with land use. Hickler Creek and South Branch of the East Branch subwatersheds are largely agricultural land use and high numbers of livestock (Figure 27).

4.2.iii Septic Systems

Using natural processes to treat and dispose of household wastewater onsite, a septic system is an underground, highly efficient wastewater treatment system which is relatively inexpensive to install and maintain. Various categories of compromised on-site septic systems threaten the Waishkey River area surface water and drinking water: Poorly-maintained, inadequately designed systems, and failed systems (all characteristic of older developments), are all contributing insufficiently treated waste directly or indirectly into surface waters. Due to a predominance of soils poorly-suited for traditional on-site sewage disposal treatment systems (OSDTS) adsorption fields, lagoons are frequently used as an alternative. OSDTS lagoons function in place of an adsorption field, and are designed to allow evaporation and solar disinfection of liquid waste. Some OSDTS in the Waishkey River Watershed have been observed to be closer to streams than the 75-foot setback required by the Superior Environmental Health Code for lagoon systems, creating a higher potential risk of bacterial contamination of streams, especially during flood events. According to MDEQ's The Status of the On-Site Wastewater Industry in Michigan report (MDEQ 2001), almost 10% of systems in Michigan are

failing. As of 2019 there were over 1876 septic systems in the watershed (MEGLE, 2019, Michigan's E. coli Pollution Solution Mapper). Speculating similarities with the Waishkey area, this equates to approximately 187.6 failing systems. The USEPA STEPL tool estimates average wastewater use to be 70 gallons per person per day (70 gallons x 2 people per household = 140 gallons/household.
The Superior Environmental Health Code estimates average wastewater use to be 150 gallons per bedroom per day (150 gallons x 3 bedroom average = 450 gallons/household). Thus at least 26,264 gallons and at most 84,420 gallons of wastewater reaching the Waishkey and possibly drinking water supplies through failing systems each day. That wastewater contains, typically, 50mg/L of total nitrogen, 9 mg/L of total phosphorus, 100 mg/L of fats, oil and grease, 0.3 mg/L volatile organic compounds, and 100 million organisms/100ml of wastewater, and 1,000 to 10,000 infectious viral units/L (USEPA, 2020, Region 5 Model for Estimating Load Reductions). Calculations are shown below in Table 15.

Table 15. Waishkey River Watershed On-site Septic Pollutant Loads (estm 187 failing systems).

Pollutant	Typical wastewater concentration (milligrams/Liter)	Typical wastewater concentration lbs/gallon	Pollutant Load per household/ day	Pollutant Load per household /per year[13]	**Total Watershed Pollutant Load/year**
LOW END ESTIMATE (26,264 gallons/day) USEPA STEPL					
Nitrogen	50mg/L	0.00041727	0.0584178	21.3	**4,000 lbs**
Phosphate	9mg/L	7.5109E-05	0.01051526	3.8	**720 lbs**
Toxics (fats, oils, grease; volatile organic compounds)	100mg/L	0.00083454	0.1168356	42.6	**8,000 lbs**
	0.3 mg/L	2.5036E-06	0.0003505	0.1	**24 lbs**
Organisms	100million/ 100mL	0.0264172	3.698408	1,350	**253,245 organisms**
Pathogens	1,000 viral units/L	264.172	36984.08	13,499,189	**2,532,447,894 viral units (2.5 billion)**
HIGH END ESTIMATE (84,420 gallons/day) Superior Environmental Health Code					
Nitrogen	50mg/L	0.00041727	0.1877715	68.5	**12,857 lbs**
Phosphate	9mg/L	7.5109E-05	0.03379905	12.3	**2,314 lbs**
Toxics (fats, oils, grease; volatile organic compounds)	100mg/L	0.00083454	0.375543	137.1	**25,715 lbs**
	0.3 mg/L	2.5036E-06	0.00112662	0.4	**77 lbs**
Organisms	100million/ 100mL	0.0264172	11.88774	4,339	**814,001 organisms**
Pathogens	1,000 viral units/L	264.172	118877.4	43,390,251	**8,140,011,088 viral units (8.1 billion)**

4.2.iv Atmospheric Deposition

As is the case in many water bodies across the state, atmospheric deposition is affecting the Waishkey River Watershed. According to the 2014 MDEQ Water Resources Division Secs 303(d), 305(b), and 314 Integrated Report, "a statewide mercury-based fish consumption advisory applies to all of Michigan's inland lakes, reservoirs, and impoundments. The majority of Michigan's public access lakes have moderate or low nutrient levels; however, nutrient levels are high enough in several lakes to warrant corrective action through the development and implementation of a TMDL" (MDEQ 2014).

In Michigan, site-specific water column and fish tissue data are used together to determine fish consumption designated use support. The water column mercury concentrations are compared to the Human Non-cancer Value (non-drinking water) Water Quality Standard (1.8 ng/L or 1.8 ppt); fish tissue mercury concentrations in edible portions are compared to Michigan's fish tissue value for mercury (0.35 mg/kg wet weight or .35 ppm) (MDEQ, 2014).

The portions of the watershed that are not supporting the established designated uses (fish consumption and other indigenous aquatic life and wildlife) are receiving a high concentration of

mercury through the atmosphere due to anthropogenic activities like fossil fuel combustion, mining, and other industrial activities. The Michigan DEQ is working to establish a state-wide Total Maximum Daily Load (TMDL) for inland water bodies polluted by mercury emissions statewide. The purpose of the TMDL is to gather data, identify sources, and develop appropriate goals and reasonable assurance that will restore the designated uses to the water bodies. An 82% reduction of atmospheric mercury from anthropogenic sources is needed from 2001 levels (7.6 kg/day) to meet the allowable mercury load of 2.61 kg/day (MDEQ, 2015).
Separate fish consumption guidelines have not been developed specifically for the Waishkey River, so general statewide guidelines should be followed.

4.3 Threats from Invasive Species

Threats from Invasive Species are very species dependent. While some invasive species grow so densely they inhibit the movement of fish and wildlife, other invasive species may cause dissolved oxygen to plummet or release allelopathic chemicals to suppress the growth of native vegetation. Efforts must be made to map, control, and eliminate populations of these species, as well as to watch for new invasive species and quickly control infestations. Education of watershed residents and stakeholders are a necessity in such an effort and should be made a high priority. Benefits of controlling invasive species will include more natural nutrient cycling, food webs, and physical processes. Control efforts can also improve human health and restoration efforts of threatened and endangered species.

4.4 Climate Change Concerns

4.4.i Observed Changes in Climate

The Waishkey River watershed and the Great Lakes region has observed noticeable changes in weather in recent years. These changes have been measured in mean season temperatures, percentage of ice cover, frequency of severe storms and many other parameters. Since 1950 the mean temperatures in winter and spring more in the northern Great Lakes than in other areas. Figure 28 shows the Eastern Upper Peninsula has witnessed warmer winters and warmer springs. Warmer winters change survival outcomes for wildlife such as deer as well as pests such as ticks.

Not surprisingly, changes in ice cover have also been observed on the Great Lakes over time. According to a report by Inter-Tribal Council of Michigan, ice cover declined in all five Great Lakes by 71% from 1973 to 2010. Ice has declined in Lake Erie by 50%, Lake Huron by 62%, Lake Michigan by 77%, Lake Superior by 79%, and Lake Ontario by 88% (ITCMI, 2016). "At the current rate of ice cover decline, Lake Superior may have little to no open lake ice cover by mid-century (ITCMI, 2016)." Ice cover is important for ecological, economical, and climatic reasons. Ice cover protects fragile whitefish eggs from destructive wind and wave action. Ice cover with little or no snow cover allows light penetration at the surface to promote algae growth which supports the food web including valuable commercial and sportfish species (NOAA GLERL, 2017). Stable ice also protects wetlands and the shoreline from erosion. Heavy ice cover can reduce the amount of evaporation from the Great Lakes in winter, thus contributing to higher water levels and benefiting those who spend millions to dredge boat slips, channels, and harbors when lake levels are low (NOAA GLERL, 2017). Ice cover also controls lake effect snow.

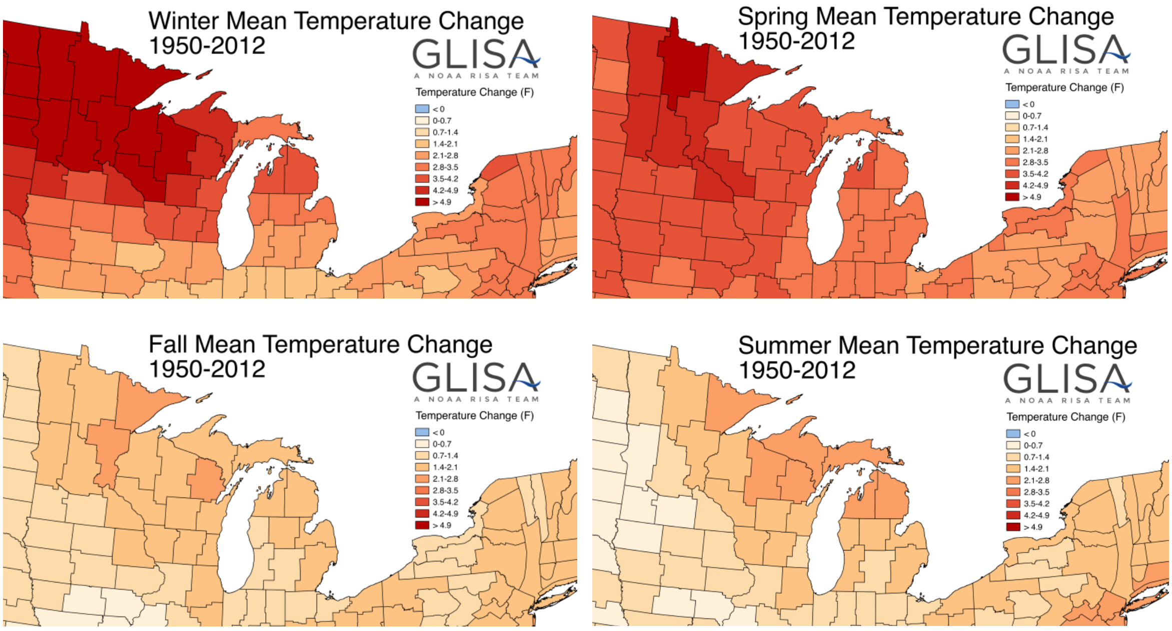


Figure 28. Great Lakes Region Mean Temperature Changes by Season (Inter-Tribal Council of Michigan, 2016).

The frequency and intensity of storms in the Great Lakes region has also changed in the last fifty years. GLISA reported that precipitation from 1981-2010 is 5.1% more intense and frequency has increased 23.6% when compared to 1951-1980 (GLISA, Extreme Precipitation, 2015). Severe or intense precipitation has numerous consequences that are cause for concern. Flooding and storm water runoff are priority concerns, as rain from extreme participation events has inadequate time to infiltrate the soil. Instead, it erodes land surfaces, infiltrates and damages infrastructure, and carries soils, nutrients, and/or contaminants directly to surface waters (ITCMI, 2016). Storm water runoff has the potential to impact natural and manmade systems and structures (ITCMI, 2016).

4.4.ii Species Vulnerable to Climate Change

Changing weather patterns naturally impacts the flora and fauna exposed to it. Warmer temperatures and reduced snow pack indicate good overwinter survival for mammals. According to Angie Gupta, this could mean high birth rates this spring which can lead to greater forest herbivory and significantly browsed trees and forest plants. But changes beneficial to some are detrimental to others. Common themes effecting vulnerability of the below species was ability to adapt to changing water quantity/quality, habitat connectivity to move to better habitat, temperature.

Table 16. Selected plant, wildlife, and fish species determined vulnerable by Climate Change Vulnerability Index (ITCMI 2016)

Common Name	Scientific Name	Vulnerability Rating
PLANT SPECIES		
Bog Rosemary	*Andromeda polifolia*	Extremely Vulnerable
Paper Birch	*Betula papyrifera*	Highly Vulnerable
Yellow Lady's Slipper	*Cypripedium parviflorum*	Highly Vulnerable
Black Ash	*Fraxinus nigra*	Highly Vulnerable
Labrador Tea	*Ledum groenlandicum*	Highly Vulnerable
Partridge Berry	*Mitchella repens*	Highly Vulnerable
Black Spruce	*Picea mariana*	Highly Vulnerable

Northern White Cedar	*Thuja occidentalis*	Highly Vulnerable
Large Cranberry	*Vaccinium macrocarpon*	Highly Vulnerable
Southern Wild Rice	*Zizania aquatica*	Highly Vulnerable
Northern Wild Rice	*Zizania palustris*	Highly Vulnerable
Balsam Fir	*Abies balsamea*	Moderately Vulnerable
Sugar Maple	*Acer saccharum*	Moderately Vulnerable
Sweetflag	*Acorus americanus*	Moderately Vulnerable
Swamp Milkweed	*Asclepias incarnata*	Moderately Vulnerable
Ladyfern	*Athyrium filix-femina ssp. Angustum*	Moderately Vulnerable
Yellow Birch	*Betula alleghaniensis*	Moderately Vulnerable
Pink Lady's Slipper	*Cypripedium acaule*	Moderately Vulnerable
American Beech	*Fagus grandifolia*	Moderately Vulnerable
Sweetgrass	*Hierochloe odorata*	Moderately Vulnerable
Tamarack	*Larix laricina*	Moderately Vulnerable
Sweetgale	*Myrica gale*	Moderately Vulnerable
White Pine	*Pinus strobus*	Moderately Vulnerable
Broadleaf Arrowhead	*Sagittaria latifolia*	Moderately Vulnerable
Common Trillium	*Trillium grandiflorum*	Moderately Vulnerable
Hemlock	*Tsuga canadensis*	Moderately Vulnerable
Lowbush Blueberry	*Vaccinium angustifolium*	Moderately Vulnerable
Small Cranberry	*Vaccinium oxycoccos*	Moderately Vulnerable
WILDLIFE SPECIES		
Moose	*Alces alces*	Extremely Vulnerable
Snowshoe Hare	*Lepus americanus*	Extremely Vulnerable
American Beaver	*Castor canadensis*	Moderately Vulnerable
Spruce Grouse	*Falcipennes canadensis*	Moderately Vulnerable
Common Loon	*Gavia immer*	Moderately Vulnerable
American Marten	*Martes americana*	Moderately Vulnerable
Fisher	*Martes pennanti*	Moderately Vulnerable
FISH SPECIES		
Lake Sturgeon	*Acipenser fulvescens*	Extremely Vulnerable
Cisco/Lake Herring	*Coregonus artedi*	Moderately Vulnerable
Whitefish	*Coregonus clupeaformis*	Moderately Vulnerable
Burbot/ Loche	*Lota lota*	Moderately Vulnerable
Brook Trout	*Salvelinus fontinalis*	Moderately Vulnerable
Lake Trout	*Salvelinus namaycush*	Moderately Vulnerable
Walleye	*Sander vitreus*	Moderately Vulnerable

4.4.iii Climate Change and Human Dimensions Concerns

ROADWAYS AND TRANSPORTATION

Roadways and paved infrastructure are the primary means of transportation in Chippewa Co. The projected warming climate will cause accelerated asphalt deterioration and with more frequent heat waves, pavement buckling may become a growing issue. Also, extreme precipitation events will increase flows in streams and accelerate wear and tear on bridges and culverts. In contrast, the possibility of milder winters and less snow fall may reduce the cost and effects of snow removal (Schwartz et al. 2014). Seiches and storms have become more relevant in recent years and have shown to flood marina areas as well as the parking lot, causing wear and tear on paved infrastructure.

Figure 29 shows a culvert in northern Wisconsin that failed during a severe rain event in 2016. So many culverts failed, closing so many roads, that stranded residents had to be transported by helicopter for regular medical treatment. The soils and topography in this location are similar to those of the Waishkey River watershed.

Limited roadways during an extreme event can also leave the community vulnerable. Areas of the watershed with the densest housing has limited roadways and the communities are susceptible to being trapped during an extreme weather event or natural disaster. For example, Bay Mills Indian Community only has two paved exits on their reservation, heading east or west, along with two dirt road exits that head west and southwest; one of which may be difficult to be driven on with a small car and/or a two wheel drive vehicle.

Energy use within the watershed is projected to change from climate change; less energy to heat during the winter months, but more energy to cool during the summer months. Also, more frequent severe weather events may cause interruptions within the electric grid more often. The most beneficial adaptation strategy is alternate energy sources. The less the community is reliant on the electrical grid and other energy sources, the greater the community's adaptive capacity to climate changes. Environmentally friendly energy sources including solar panels and wind turbines would increase the communities' adaptive capacity and resilience to climate change while also lessening the impacts and rate of climate change. Another strategy would include the installation of energy efficient heating and cooling systems within structures (Li et al. 2012; Melilli et al. 2014).

Figure 29. Failed culvert after severe storm on 7/11/16. Photo courtesy of the Bad River Band of Lake Superior Tribe of Chippewa Indians.

ECONOMIC CONCERNS

Tourism is greatly relied upon by the residents of Chippewa Co to generate revenue. Based on climate change projections, summer months in upper Michigan should not become unfavourable to tourists by 2050. However, winter months may become unfavourable to tourists that travel to northern Michigan for winter activities. Communities that rely on hotels/resorts, casinos, snowmobiling and attractions have low adaptive capacity with tourism changes. Due to low awareness and implementation done on climate change and tourism, there are not many strategies to reduce climate change on tourism. It is suggested to collaborate with tourism stakeholders and brainstorm alternative technologies, management practices and policies to reduce climate change impacts on tourism (GLISA Change in Frost-Free Season Length. 2014; Hales et al. 2014; Simpson et al. 2008).

Forest management through timber harvest also occurs in Chippewa Co. The impacts of warmer spring and winter temperatures and reduced snow pack can also be economically challenging. A warm winter can mean challenging conditions for logging operations. Without a hard frost, loggers can find it difficult to bring equipment into the woods to harvest. Road restrictions also makes moving timber out of the woods a challenge. All this compounds to make a very short harvesting window in the watershed. Herbivory is another concern for forests. Good overwinter survival for herbivores like deer and rabbits could mean high birth rates in spring. This can lead to greater browsing on trees and seedlings. Commercial forests trying to regenerate trees for the future could see decreased survival on both natural and planted tree seedlings. Warmer springs also correlate to higher spring fire danger.

Commercial and recreational fisheries may be affected by climate change. Ways to reduce the impacts of climate change on the fishery is to try to reduce pre-existing anthropogenic stressors on the fishery. Examples of anthropogenic stressors which can be managed for are invasive species management; reduce or eliminate deforestation by near shore areas and along streams; increase riparian habitat in near shore areas and on streams; avoid overexploitation of fish species; and avoid unfavourable land use changes near lakes and streams. Any management to reduce the impacts of runoff, invasive species, critical habitat destruction, changes in water temperature and changes in water chemistry will reduce stresses on fish (Ficke et al. 2007; Melilli et al. 2014).

HEALTH AND SAFETY

Climate change is predicted to increase the number of extreme weather events and also decrease our air quality which will impact human health and disease in many ways. With the projected increases in temperature and frequency of extreme weather events, data suggests ground level ozone and particulate matter will increase which causes many problems including decreased lung function, increase in asthma attacks and increase in premature deaths. Also with the increase in frost-free days and warmer seasonal temperatures, allergenic plants are projected to have longer pollen seasons and affect people with allergies. Buildings may also have increases in mold growth due to the warmer temperatures and increased precipitation. Doctors may have a harder time aiding people with allergies and asthma in the future (Luber et al. 2014). In addition with these health risks, the projected increase in temperature may increase heat-related illness including heat exhaustion, heat stroke and death. Human health impacts from insect-borne diseases are projected to become more prevalent as well.

Attacks on plants and animals from pests and diseases will become more prevalent as forest composition and range alters. Climatic factors that could influence the ability of a species to invade include warmer temperatures, earlier springs, and reduced snowpack. Disturbances such as flooding and wildfire can open forest canopies, expose mineral soil, and reduce tree cover, providing greater opportunities for invasion (Ryan and Vose, 2012). Once established, invasive species can also limit regeneration of native tree species through increased competition. One pest in particular that would have a large negative impact on jack pine stands in Michigan would be the mountain pine beetle, which has been expanding its range north and east from the west coast due to warming conditions; they were typically controlled by cold winter conditions (Safranyik, 2010). Pests can also have an effect on human health. Many of the participating Tribes are located in rural areas and maintain significant outdoor cultural and recreational activities. These communities may experience greater interactions with insects such as ticks and mosquitoes, increasing risks of Lyme's disease and the West Nile Virus (Hales et al. 2014).

DEGRADATION OF HUNTING AND GATHERING OPPORTUNITIES, CULTURE

Many species mentioned above in Table 16 are vulnerable to climate change. The human opportunity to harvest these plants and animals may be impacted by climate change. For example, a wild rice crop may be destroyed by a flood during the vulnerable floating leaf stage or a severe storm as rice ripens. Late frosts may kill off blueberry blossoms. This is of particular concern for tribal communities. "With the loss of beings/species, many of the cultural connections to the natural world are changing or are being lost. For example, tribal members have expressed concern that younger generations will never see a snowshoe hare in their backyard, and traditional knowledge and stories about snowshoe hares will soon only be memories. Collectively, climate change threatens local plant and animal beings/species, ecosystems, and tribal sovereignty, economy, and culture" (GLIFWC 2018).

4.5 Concerns for Rare Habitats

Habitat alteration creates concerns for native species, allows easier access for invasive species, and increases the amount of pollutants entering waterbodies. Therefore habitat assessments within the watershed, habitat restoration, and land preservation should be made a priority. Habitats near bodies of water and environments important to threatened and endangered species are vital to the health of the watershed and should be focused on.

Habitat assessments, habitat restoration, and land protection will all require cooperation with other groups outside the Waishkey River watershed management committee. Protection will be a priority but restoration is also important, especially in rare or important habitat types. Assessments will be integral in identifying and prioritizing areas which require protection and restoration.

Chapter 5. PRIORITY POLLUTANTS AND BEST MANAGEMENT PRACTICES

5.1 Priority Pollutants and their Sources

The results of the nonpoint source pollution inventories provided data and a more thorough understanding of the problems and threats to the watershed. Using the results of the inventories, the pollutants and pollutant sources were prioritized based on their overall impact to waters in the watershed (Table 17). The priorities and rankings were determined by Waishkey River Watershed management committee. Two pollutants were given top priority ranking: pathogens and nutrients.

Table 17. Pollutant Prioritization Matrix

Pollutant	Priority Ranking
Pathogens	1
Nutrients	2
Pesticide/herbicide	3
Sediment	4
Heavy metals	5

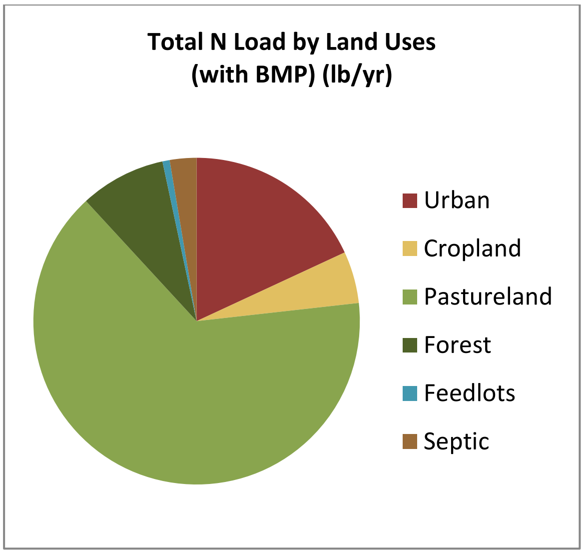
Different pollutants have different effects on water uses. Refer to Table 18 for full list of effects. For example, large amounts of pathogens in the water make the water unsafe for swimming, but pathogens have little if any effect on navigation. Pathogens, especially E. coli, in the Waishkey River watershed are at times unsafe for both total and partial body contact. Nutrients encourage algae and aquatic plant growth. When the aquatic plants die and decompose they use up large amounts of oxygen, potentially depleting sources for fish. Nutrient pollution also can stimulate the growth of aquatic nuisance species such as Eurasian water-milfoil. Pesticides/herbicides inhibit the growth of many forms of aquatic life. The impact can be compounding; reduction in vegetation may cause a reduction in macroinvertebrates, which may cause a reduction in fish. Sediment pollution covers gravel areas harming aquatic insects and spawning areas for fish. Sediments suspended in water make it difficult for fish to forage and the particles can harm fish gills. Heavy metals, such as atmospheric deposition of mercury, often come from outside the watershed and may only be limited with regional policy changes.

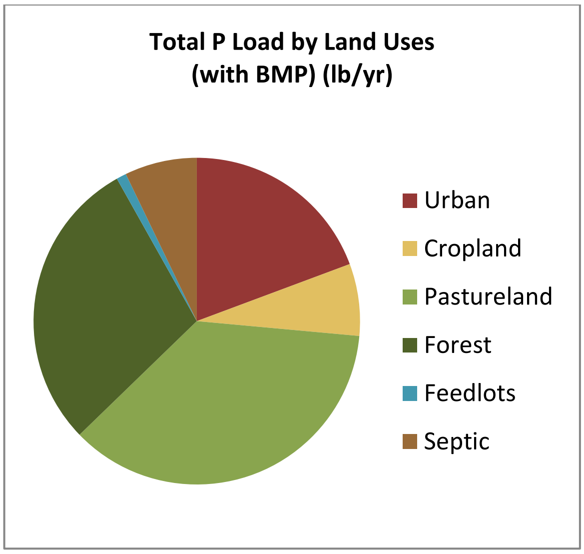
Table 18. Priority Pollutants and Sources in the Waishkey River Watershed

Pollutant	Sources (Ranked in priority order)	Causes (Ranked in priority order)
Pathogens (1)	a. Agriculture b. Septic systems	a. Manure piles and livestock in streams. b. Malfunctioning septic systems.

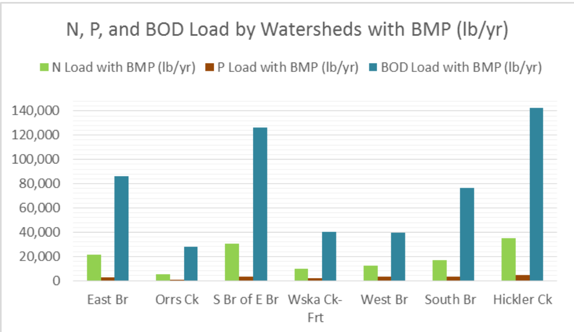
	c. Wildlife	c. Wildlife waste (beaver ponds, flocks of waterfowl)
Nutrients (2)	a. Septic systems/ WWTP b. Agriculture (Livestock; manure application) c. Road/stream crossings d. Stormwater e. Lawn care/ shoreline property management f. Golf courses	a. Older systems with inadequate system design. Lack of septic system maintenance. b. Unrestricted livestock access to streams and flooded pastures. Over application of manure on agricultural fields without testing soil needs. c. Undersized and short culverts. Lack of runoff diversions. Inadequate fill on road surface. Lack of vegetation. d. Fertilizer applications by businesses and residents in urban areas. e. Fertilizer applications. Removal of native vegetation. f. Fertilizer applications. Lack of buffer strips between course and streams.
Pesticides/ herbicides (3)	a. Golf courses b. Lawn care c. Agriculture fields	a. Pesticide use on courses. b. Pesticide use on lawns by businesses, shoreline homeowners, and urban residents. c. Pesticide use on fields.
Sediment (4)	a. Streambank erosion b. Road/stream crossings; Stormwater c. Shoreline development/ construction d. Access sites (boat launches, etc) e. Poorly- managed tree removal f. Varied Zoning g. Livestock access to streams.	a. Lack of proper erosion control measures. Recreational access and use. b. Undersized and short culverts. Lack of runoff diversions. Inadequate fill on road surface. Lack of vegetation; direct discharge of urban runoff. Varied street sweeping c. Lack of proper erosion control measures. Removal of native vegetation. Increase in runoff (causing erosion) from impervious surfaces. d. Lack of runoff diversions and erosion control. e. Lack of use of best management practices. f. Lack of consistent standards and provisions to require shoreline protection strips. g. Unrestricted access to tributaries.
Heavy Metals (5)	a. Atmospheric deposition b. Road/stream crossings; Stormwater	a. Atmospheric deposition b. Lack of runoff diversions. Inadequate fill on road surface. Lack of vegetation. No treatment of urban runoff before discharge to rivers, lakes, and Bay.

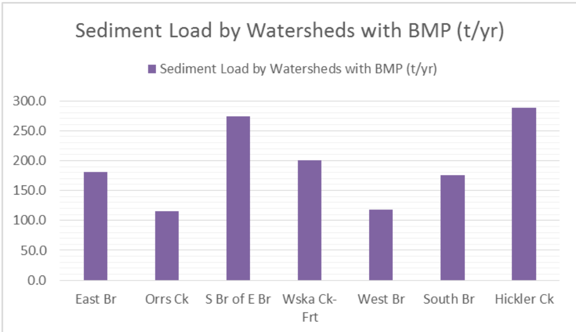
The Spreadsheet Tool for Estimating Pollutant Load (STEPL) uses simple algorithms to calculate nutrient and sediment loads from different land uses and the load reductions that would result from the implementation of various best management practices (BMPs). The following figures were generated from STEPL model based on data collected by the National Land Cover Database in 2006. According to the STEPL model, pastureland contributes large amounts of both Total Nitrogen and Total Phosphorus to the watershed. Septic systems contribute nearly as much TP as cropland. According to MDEQ's The Status of the On-Site Wastewater Industry in Michigan in 2001, almost 10% of systems in Michigan are failing. Also graphed below are N, P, BOD, sediment and E.coli by subwatershed. There is high variability between the subwatersheds (Figure 32, 33, 34). Sediment and nutrients are very higher in Hickler Creek subwatershed and South Branch of East Branch. *E.coli* levels in subwatershed show different trends with higher levels being in the South Branch and Waiska Creek-Frontal St Marys River subwatersheds.

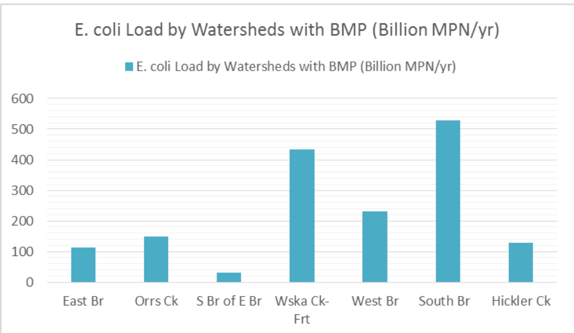




Figures 30, 31. Graphs generated by USEPA Spreadsheet Tool for Estimating Pollutant Load (STEPL) tool. Total Nitrogen and Total Phosphorus by land use.







Figures 32, 33, 34. Graphs generated by USEPA Spreadsheet Tool for Estimating Pollutant Load (STEPL) tool. Nitrogen, Phosphorus, BOD loads by subwatershed. Sediment load by subwatershed. *E. coli* load by subwatershed.

The Total Maximum Daily Load and Implementation Plan for *E. coli* in Sault Sainte Marie Area Tributaries, including the Charlette River, Munuscong River, Little Munuscong River, Waishkey River, and Sault Area Creeks plan conducted a linkage analysis for *E. coli* in the watershed. It found that *E. coli* concentrations with daily precipitation indicated that the highest concentrations occurred in September 2010, which was the wettest part of the monitoring period. This suggests a runoff-related bacteria source. Exceedances of the total body contact daily maximum WQS occurred at Wa3 during dry to moist conditions, with no exceedances during low flows. This suggests that bacteria are being transported from the upstream area during runoff events, with pastures being the most probable source. The three highest daily loads occurred approximately two days after rainfalls of 0.27 to 0.75

inches. This suggests a time lag between runoff events and delivery of bacteria downstream, which is consistent with the large watershed area and forest cover which has a slower response to rainfall. The most probable bacteria source is runoff affected by unregulated livestock pastures, manure stockpiling, and land application of livestock waste. The land-application of biosolids is a potential source, although the contribution would be minor given that the land area available for application is relatively small, the waste receives treatment to reduce pathogens, and the land-application is closely regulated by the MDEQ. (Excerpts from USEPA 2012 TMDL plan).

5.2 Proposed Best Management Practices (BMPs)

To address the sources and causes of priority pollutants in the Waishkey River Watershed, a series of best management practices (BMPs) will be implemented. BMPs are techniques, measures, or structural controls designed to minimize or eliminate runoff and pollutants from entering surface and ground waters.

TYPES OF BMPs

Non-structural BMPs are 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 (including a dedicated funding source for open space acquisition). Other examples are providing buffers along sensitive water bodies, minimizing impervious surfaces, and minimizing disturbance of soils and vegetation. Additional nonstructural BMPs can be education programs for homeowners, students, businesses, developers, and local officials about project designs and everyday actions that minimize water quality impacts.

Structural BMPs are physical systems that are constructed to reduce the impact of development and stormwater runoff on water quality. They can include storage practices such as wet ponds and extended-detention outlet structures; filtration practices such as grassed swales, sand filters, and filter strips; and infiltration practices such as infiltration basins and infiltration trenches.

Since priority pollutants and their sources and causes have been identified in the Waishkey River Watershed, we can determine which BMPs can be used to address these water quality issues. Structural and non-structural BMPs will be used in combination in the Watershed to obtain the maximum reduction or elimination of a pollutant or pollutants.

BMP EFFECTIVENESS

The actual effectiveness or efficiency of a BMP is determined by the size of the BMP implemented (e.g., feet of vegetated buffer or acres of stormwater detention ponds), and how much pollution was initially coming from the source. Table 19 lists estimates of pollutant removal efficiencies for stormwater BMPs that may be used in the Watershed.

Table 19. Pollutant Removal Efficiencies of Stormwater BMPs (Huron River Watershed Council, 2003)

	Pollutant Removal Efficiencies					
Management Practice	**Total Phosphorus**	**Total Nitrogen**	**TSS**	**Metals**	**Pathogen**	**Oil & Grease**
High-powered street sweeping	30-90%	45-90%				
Riparian buffers Forested: 20-40m w	Forested: 23-42%; Grass:	Forested: 85%; Grass: 17-99%	Grass: 63-89%			

Grass: 4-9m w	39-78%					
Vegetated roofs	70-100% runoff reduction, 40-50% of snow/rainfall. 60% temperature reduction. Structural addition of plants over a traditional roof system.					
Vegetated filter strips 7.5m l; 45m w	40-80%	20-80%	40-90%			
Bioretention	65-98%	49%	81%	51-71%	90%	
Wet extended detention pond	48-90%	31-90%	50-99%	29-73%	38-100%	66%
Constructed wetland	39-83%	56%	69%	(-80)-63%	76%	
Infiltration trench	50-100%	42-100%	50-100%			
Infiltration basin	60-100%	50-100%	50-100%	85-90%	90%	
Grassed swales	15-77%	15-45%	65-95%	14-71%	(-50)-(-25)%	
Catch basin inlet devices		30-40% sand filter	30-90%			
Sand and organic filter	41-84%	22-54%	63-109%	26-100%	(-23)-98%	
Soil stabilization on construction sites			80-90%			
Sediment basins/ traps at construction sites			65%			
Porous pavement	65%	80-85%	82-95%	98-99%		

Information regarding pollutant removal efficiency, designs of BMPs, and costs are constantly evolving and improving. The information contained in the table above is subject to change, and research to use the most current information will continue throughout the implementation phase.

LOCATION OF BMPs IN THE WATERSHED

The location of structural BMPs depends on the site and site conditions. Table 20 lists general guidelines for the placement of structural BMPs that have been adapted from the rapid assessment protocol of the Center for Watershed Protection.

Table 20. General Guidelines for Locating Structural BMPs (Huron River Watershed Council, 2003)

Amount of development	Undeveloped	Developing	Developed
Philosophy	Preserve	Protect	Retrofit
Amount of impervious surface	<10%	11-26%	>26%
Water quality	Good	Fair	Fair-Poor
Stream biodiversity	Good -Excellent	Fair-Good	Poor
Channel stability	Stable	Unstable	Highly unstable
Stream protection objectives	Preserve biodiversity & channel stability	Maintain key elements of stream quality	Minimize pollutant loads delivered to downstream waters
Water quality objectives	Sediment and temperature	Nutrients and metals	Bacteria

<table>
<tr><td rowspan="3">BMP selection and design criteria</td><td colspan="2">Maintain pre-development hydrology</td><td>Maximize pollutant removal and quantity control</td></tr>
<tr><td>Minimize stream warming and sediment</td><td>Maximize pollutant removal, remove nutrients</td><td rowspan="2">Remove nutrients, metals, and toxics</td></tr>
<tr><td colspan="2">Emphasize filtering systems</td></tr>
</table>

Chapter 6. WATERSHED GOALS AND OBJECTIVES

The first action is to continue monitoring of the Waishkey River and its watershed, as this will be a vital source of data and knowledge for restoration and protection efforts. Additional data will need to be collected regarding river obstructions, construction projects, sources of pollution, and pre- and post-monitoring of best-management practices.

The remaining implementation strategies need to address the five watershed concerns presented in the previous section: Point sources and nonpoint sources of pollution, invasive species, threatened and endangered species, and habitat concerns. These are outlined in Tables 21-26.

Point-source pollution strategies will focus on the two main issues present within the watershed: Drainage pipes and leaking sewage lagoons. Table 21 lists the main sources of point-source pollution and proposed implementation strategies.

Table 21. Point source pollution goals and proposed implementation strategies for all Waishkey River subwatersheds.

Goals	Implementation Strategies	Project Partners	Milestone/Timeline
Reduce pollution from drainage pipes	a. Education & outreach b. Install rain gardens/ bioswales to slow and filter water with vegetation. c. Install rain barrels to save/slow Stormwater before d. Promote and install graywater systems	BMIC, CLMCD, Townships	a. Ongoing b. Ongoing c. Ongoing d. Ongoing
Eliminate all leaking sewage lagoons	e. Find and map all leaking lagoons f. Repair leakages g. Connect homes on Bay Mills point to sewer	BMIC, CCHD, CLMCD, MITC, Townships	e. 2020 f. 2050
Clean up open dump sites and brownfields to eliminate leachate pollution	h. Coordinate with EUP Brownfield Coalition i. Inspect and remove trash and debris	BMIC, CCHD	g. Ongoing h. 2050
Assessment of benthos in Waishkey Bay	j. Assess the extent of legacy pollution and debris in the bay		i. 2050

Non-point source pollution implementation strategies addressing will focus on three broad categories: Agriculture, infrastructure, and natural sources. Table 22 lists the main sources of nonpoint-source pollution and proposed implementation strategies.

Table 22. Nonpoint source pollution goals and proposed implementation strategies for all Waishkey River subwatersheds.

Goals	Implementation Strategies	Project Partners	Milestone/Timeline
Reduce the negative impacts of fertilizers, herbicides, pesticides, nutrients	a. Education & outreach of causes, impacts, and solutions and technical/financial resources to reduce pollutants. b. Employ use of buffer strips if chemicals are applied	BMCC, BMIC, CLMCD, Townships, NRCS, Farm Bill programs	a. Ongoing b. Ongoing
Eliminate the negative impacts of livestock access to streams	c. Find and map all access locations d. Education & outreach of causes, impacts, and solutions and technical/financial resources to reduce pollutants.	BMCC, BMIC, CLMCD, Townships, NRCS, Farm Bill programs	c. 2020 d. Ongoing

Reduce road runoff	e. Reseed problem areas with native plants to filter runoff f. Encourage MDOT to reduce road salt applications g. Encourage County Road Commission to install curbs on bridges to redirect runoff through vegetation	BMIC, CCRC, CLMCD, MITC, Townships	e. Ongoing f. Ongoing g. Ongoing
Reduce streambank erosion (due to culverts & other anthropogenic causes)	h. Stabilize slopes i. Reseed areas with native plants j. Replace undersized culverts k. Encourage the use of bottomless culverts and bridges	BMIC, CCRC, CLMCD, MITC, Townships	h. Ongoing i. Ongoing j. 2050 k. 2050
Reduce mercury (Hg) levels in the watershed	l. Encourage recycling m. Encourage proper disposal of mercury-containing items n. Encourage renewable energy and the reduction of fossil-fuel use	BMCC, BMIC, CCHD, MITC, Townships	l. Ongoing m. Ongoing n. Ongoing
Reduce *E. coli* levels in the watershed	o. Education & outreach of causes, impacts, and solutions and technical/financial resources to reduce pollutants. p. Utilize qPCR to determine sources of *E. coli* q. Restrict livestock access r. Identify and resolve septic issues on Bay Mills Point s. Resolve leaking sewage lagoons and septic systems t. Plant native vegetation and leave it unmoved along shorelines to reduce the mass congregation of waterfowl (e.g. gulls and geese)	BMIC, CCHD, CLMCD, MITC, LSSU, Townships, NRCS, Farm Bill programs	o. 2025 p. 2030 q. 2030 r. 2050 s. ongoing

Invasive Species should be approached from two angles. First, the continued spread of invasive species must be prevented. Second, the existing populations of invasive species need to be controlled. Table 23 lists the proposed implementation strategies for these two priorities.

Table 23. Invasive species goals and proposed implementation strategies for all Waishkey River subwatersheds.

Goals	Implementation Strategies	Project Partners	Milestone/Timeline
Stop or at least slow the spread of non-native invasive Species	a. Education & Outreach b. Encourage planting of native plants in gardens and landscaping c. Conduct Clean Boats Clean Waters trainings d. Install boat washing station within or near watershed	BMIC, CLMCD, MDNR, USFWS, USFS	a. Ongoing b. Ongoing c. Every 5yrs, starting in 2020 d. 2030
Control populations of Invasive Species	e. Educate public on effects of invasive species, control and prevention methods, and identification of invasive species f. Continue to map new and existing populations of invasive species g. Control existing populations of invasive species h. Research and implement, when possible, biological control methods rather than chemical control	BMIC, CCRC, CISMA, CLMCD, MDNR, USFWS, USFS	e. Ongoing f. Ongoing g. Ongoing h. Ongoing

Threatened and endangered species protection is necessary to maintain a healthy and diverse ecosystem. Table 24 lists the challenges facing these species and the associated proposed implementation strategies.

Table 24. Threatened/endangered species goals and proposed implementation strategies for all Waishkey River subwatersheds.

Goals	Implementation Strategies	Project Partners	Milestone/Timeline
Reduce development/ Habitat Destruction	a. Education & Outreach b. Land protection	BMIC, CLMCD, MDNR, USFWS, USFS	a. Ongoing b. Ongoing
Remove/Replace perched culverts	c. Map all perched culverts d. Replace perched culverts, preferably with open-bottomed culverts or bridges	BMIC, CCRC, MDNR	c. 2020 d. 2050
Remove and prevent the spread of invasive Species	e. Pursue implementation strategies in Table 10	BMIC, CCRC, CISMA, CLMCD, , MDNR, USFWS, USFS	e. Various milestones/ timelines

Degraded habitats are the fifth major challenge facing the Waishkey River watershed. This is not as large of a problem as in many other watersheds, but at least 35% of the watershed has been altered, resulting in low-quality habitat and greater stress for species already experiencing significant stress. Table 25 lists the main habitat goals within the watershed along with the proposed implementation strategies.

Table 25. Major habitat goals and proposed implementation strategies for all Waishkey River subwatersheds.

Goals	Implementation Strategies	Project Partners	Milestone/Timeline
Decrease or eliminate habitat alteration destruction	a. Map sites of major habitat degradation within watershed b. Perform habitat restoration projects at degraded sites c. Map rare and fragile habitats as well as habitats important to rare species d. Prioritize rare and fragile habitats for protection and restoration e. Restoring habitat, including restoration to agriculturally-impacted wetlands using Farm Bills programs.	BMIC, CLMCD, MDNR, USFWS, USFS, Townships, NRCS, Farm Bill programs	a. 2040 b. 2070 c. 2040 d. 2045 e. Ongoing
Protect unaltered land within the watershed	f. Acquire land and protect g. Protection habitat through Conservation Easements	BMIC, CLMCD, MDNR, USFS, NRCS	f. Ongoing g. Ongoing

Flashier floods brought about by climate changes are a major concern for the Waishkey River watershed. Resilient infrastructure and flood risk mitigation are proposed strategies in the following table.

Table 26. Climate change goals and proposed implementation strategies for all Waishkey River subwatersheds.

Goals	Implementation Strategies	Project Partners	Milestone/Timeline
Reduce the risk posed by flashier floods	a. Identify and map high priority road stream crossings b. Replace inadequate high priority road stream crossings; ensure they can sustain at least a 100-year flow event. c. Encourage the use of bottomless culverts and bridges. d. Implement adaptive plant and forestry management practices that stabilize slopes and enhance riparian forest diversity and resiliency.	BMIC, CLMCD, MDNR, USFWS, USFS, Townships	a. Ongoing b. Ongoing c. Ongoing d. Ongoing
Invest in resilient infrastructure	a. Replace inadequate high priority road stream crossings; ensure they can sustain at least a 100-year flow event. b. Implement stricter building code requirements such as proximity to wetlands, septic/drain field regulations, etc	BMIC, CCHD, CLMCD, MITC, Townships	a. 2050 b. 2070

Chapter 7. CRITICAL AREAS

7.1 Critical Areas for Protection

- Riparian Areas: Riparian areas are important in stabilizing stream banks, reducing erosion, and providing high quality wildlife habitat. Forested riparian areas also help regulate stream temperature.
- Wetlands, Lakes and Ponds: Wetlands, lakes, and ponds provide critical fish and wildlife habitat, prevent shoreline erosion, and protect water quality. Wetlands are the most biologically productive ecosystems in the Great Lakes region.
- Forested Areas: Forests play an important role in watershed health by providing certain benefits. Trees intercept rainfall in their canopy, reducing the amount of rain that reaches the ground. Forested land produces very little runoff, which can reduce downstream flood flows that erode stream channels, damage property and destroy habitat. Trees take up stormwater pollutants such as nitrogen from soil and groundwater. Forested areas can filter sediment and associated pollutants from runoff. Forest litter such as branches, leaves, fruits, and flowers, form the basis of the food web for stream organisms.
- Cultural and Recreational Areas: River recreation helps people discover their rivers and improve quality of life for communities. Recreation connects rural and urban communities to important places like parks, forests, and refugees. As people spend more time exploring their rivers and riverside parks and lands, support for protecting these special places increases, creating a legacy that honours the past, enriches the present, and provides a precious gift to future generations. Rivers have the power to connect us to our heritage by preserving historic places and providing access to them. Through these cultural, historic and natural places, rivers enhance a sense of community identity and pride. Protecting cultural and recreational areas protects public access to these areas.

7.2 Ranking of Parcels for Land Acquisition

A prioritized list of target areas has been identified and are discussed below. Methods to evaluate and determine which areas are of highest priority for land acquisition include a ranking system. The ranking system is based on points for presence of aquatic and terrestrial attributes including riparian corridor, wetlands/lakes/ponds, upland/lowland forest, and cultural/recreational areas. Table 27 is a prioritization matrix of how parcels wound be ranked if a land acquisition opportunity should arise.

Table 27. Prioritization of Parcels for Land Acquisition

Land Parcel Characteristics	Points Possible	Points Awarded
Riparian Corridor Attributes		
River frontage	10	
Areas of surface water recharge	9	
Headwaters region	8	
Steep banks/severe topography	7	
Source water areas	6	
Connectivity with tributaries	5	
Waterfalls	5	
Sub-total Riparian Corridor Points		
Wetlands/Lakes/Ponds Attributes		
Direct hydrological connection to stream	8	
Entirely undeveloped	7	
Isolated	3	
Ephemeral	1	
Sub-total Wetlands/Lakes/Ponds Points		
Upland/Lowland Forest Attributes		

Rare/Threatened/Endangered Species	10	
Floristic Quality Index* of 35 or higher	8	
Adjacent to other protected area	6	
Connection between two protected areas	5	
Sub-Total Upland/Lowland Forest Points		
Cultural/Recreational Attributes		
Documented historical site	10	
Public access point	8	
Food/medicine collection	7	
Recreational opportunities	6	
Educational setting	4	
Sub-total Cultural/Recreational		
Total Score for Reviewed Parcel		

7.3 Priority Areas for Total Maximum Daily Load and Implementation for *E. coli* Reduction

The Total Maximum Daily Load and Implementation Plan for *E. coli* in Sault Sainte Marie Area Tributaries, including the Charlette River, Munuscong River, Little Munuscong River, Waishkey River, and Sault Area Creeks document offers four following suggestions to deal with E. coli in the Waishkey River watershed:

1. *Fencing projects to reduce livestock access to waterways be implemented in the grazed portions of the following subwatersheds; South Branch of East Branch of Waishkey River, South Branch of Waishkey River, West Branch of Waishkey River, East Branch of Waishkey River, Orrs Creek, and Hickler Creek-Waishkey River. (see Figure 35).*
2. *Establishing forested riparian buffers typically costs $434.50 per acre. It is recommended that projects to create riparian vegetated buffers be implemented in the agricultural portions of the following areas; Hickler Creek-Waishkey River. (see Figure 36).*
3. *Projects to improve feedlot management practices be implemented in the agricultural portions of the following subwatersheds; South Branch of East Branch of Waishkey River, South Branch of Waishkey River, West Branch of Waishkey River, East Branch of Waishkey River, Orrs Creek, and Hickler Creek-Waishkey River. (see Figure 37).*
4. *Identify landowners interested in restoring wetlands in the following areas; South Branch of East Branch of Waishkey River, South Branch of Waishkey River, West Branch of Waishkey River, East Branch of Waishkey River, Orrs Creek, and Hickler Creek-Waishkey River. (see Figure 38).*

*(*USEPA 2012 Total Maximum Daily Load and Implementation Plan for *E. coli* in Sault Sainte Marie Area Tributaries, including the Charlette River, Munuscong River, Little Munuscong River, Waishkey River, and Sault Area Creeks*)*

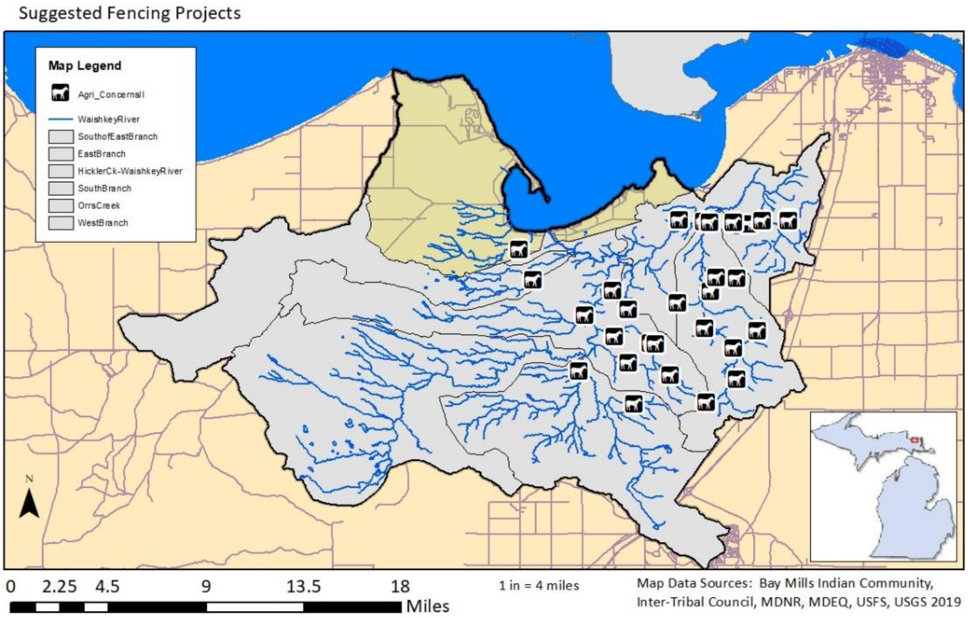


Figure 35. TMDL suggested fencing projects for subwatersheds East Branch, Hickler Creek, Orrs Creek, South Branch, South Branch of East Branch, and West Branch of Waishkey River.

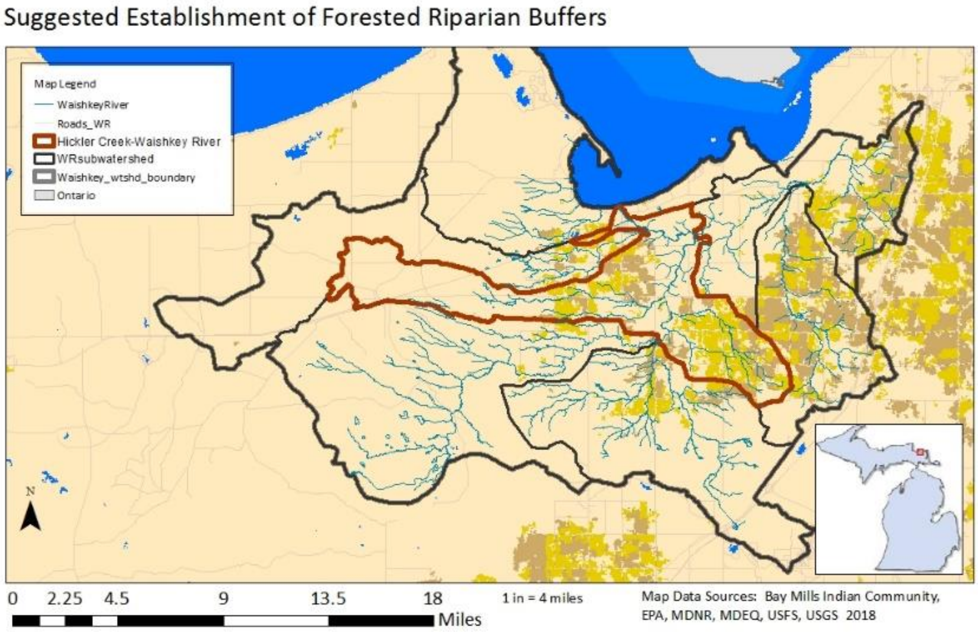


Figure 36. TMDL forested riparian buffers suggested for Hickler Creek subwatershed.

Suggested Project to Improve Feedlot Management Practices

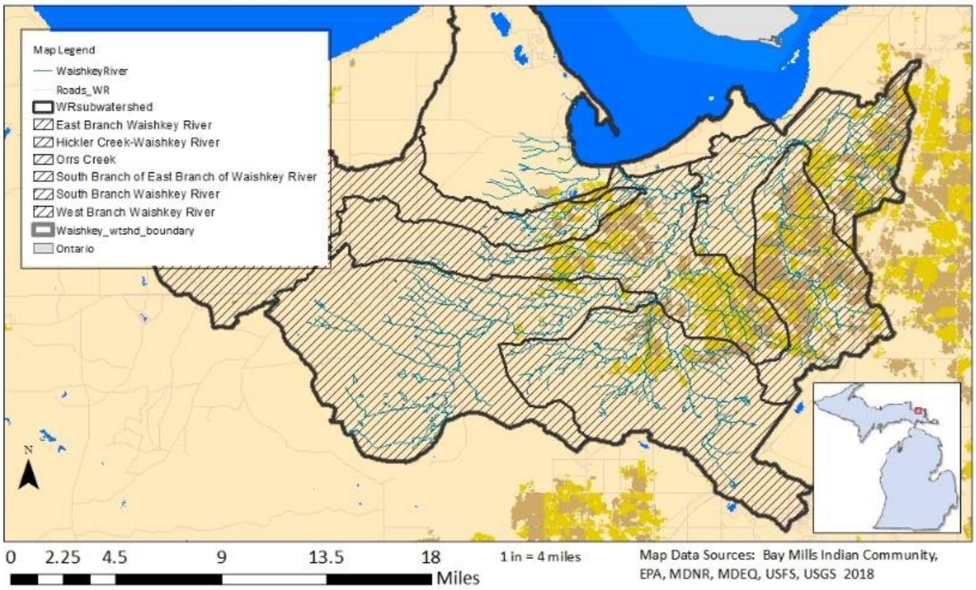


Figure 37. TMDL suggested feedlot management projects for subwatersheds East Branch, Hickler Creek, Orrs Creek, South Branch, South Branch of East Branch, and West Branch of Waishkey River.

Suggested Wetland Restoration

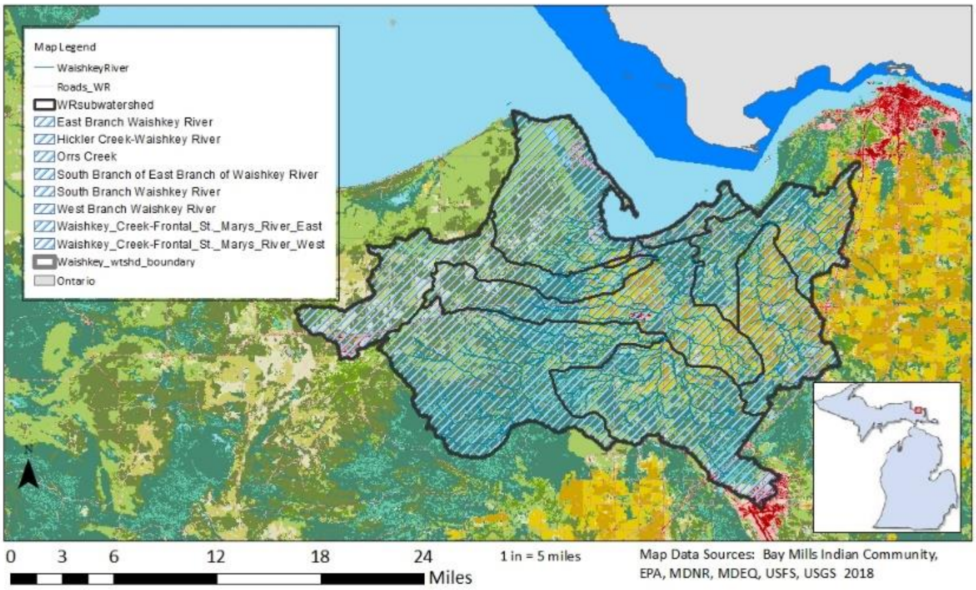


Figure 38. TMDL suggested wetland restoration projects for subwatersheds East Branch, Hickler Creek, Orrs Creek, South Branch, South Branch of East Branch, and West Branch of Waishkey River.

7.4 Critical Areas and Prioritization of Watershed Improvement Projects

1. Critical areas are those included in the USEPA 2012 Total Maximum Daily Load and Implementation Plan for *E. coli* in Sault Sainte Marie Area Tributaries, including the Charlette River, Munuscong River, Little Munuscong River, Waishkey River, and Sault Area Creeks.
2. Projects with that anticipate the greatest reduction in the five priority pollutants; pathogens, nutrients, pesticides/herbicides, sediment, heavy metals.
3. Projects that may benefit cool and cold water stream segments.
4. Projects that connect or improve the connection between high quality habitats.
5. Projects involving any of the top five priority pollutants; pathogens, nutrients, pesticides/herbicides, sediment, and heavy metals.
6. Feasibility.

Chapter 8. MANAGEMENT STRATEGIES

A variety of management strategies will be necessary to acquire, maintain, or improve protections for priority areas of natural conservation value listed in Chapter 7. Chapter 8 identifies existing management strategies and strategies that are needed to accomplish the watershed planning goals identified in previous chapters.

Chapter 8.1 Existing Management Strategies

Many management strategies have already been implemented, including both passive and active management actions. In the past, several active management projects have been conducted to restore critical areas of concern, including: streambank stabilization using Best Management Practices (BMPs), invasive species removal, replanting wetlands and trails with native seeds, and trail maintenance for erosion control. Passive management actions have included the use of conservation easements, designation of wilderness areas, and non-governmental protection of land through direct acquisition by nonprofits.

Chapter 8.1.i Passive Land Management Actions

As stated in Chapter 2 the Human Environment, land use in the watershed is made up largely of forestry and agricultural activities, with secondary uses including suburban development, recreation, and infrastructure. Currently, the Waishkey River Watershed (236,204 acres) has 88,600 acres (37%) of land managed by USFS, 29,114 acres (12.3%) by MDNR and Parks, and 955 acres (0.4%) BMIC wetland preserve.

LAND ACQUISITION AND PUBLIC SECTOR STEWARDSHIP

This strategy includes the fee simple purchase, conservation purchase, or donation of real property. Ideally, the property would meet the priority criteria established in this plan. However, property is occasionally donated and accepted even when not ranking high on the criteria list. Whichever method of acquiring land is utilized, the preference would be to have it in the hands of the public sector. This could mean ownership by governments of any level but also land trusts that keep their preserves open to the public for recreation. This ensures that the community can be involved in the stewardship and care of these priority parcels.

PRIVATE LANDOWNER STEWARDSHIP

In addition to the above mentioned strategies, conservation stewardship by private landowners is a potential tool to be utilized at a relatively low cost. Reaching out to private landowners through education and public outreach will assist in the effort to actively manage land in a way that is congruent with this plan. There are numerous programs available that provide incentive to landowners for managing their property under certain guidelines.

A large portion of the Waishkey River Watershed consists of private property. As a result, many of the restoration priorities presented in this plan will depend on community and stakeholder involvement. There are a variety of land management options available, and many organizations exist to help guide landowners through these processes. Some of these organizations include the Chippewa Luce Mackinac Conservation District, Michigan State University Extension, Lake Superior State University, the Nature Conservancy, Michigan Department of Environmental Quality, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and the Michigan Department of Natural Resources. A few land management options are listed below:

1. Install buffer strips to prevent soil erosion, runoff, and pollution. These areas also provide habitat for native wildlife.
2. Protect land in future years by obtaining a conservation easement.
3. Eliminate livestock access to waterbodies. Livestock can increase erosion, introduce *E. coli* into the aquatic environment, and destroy natural habitat.
4. Evaluate septic systems and sewage lagoon. Repair any leaks or pipes entering waterways.
5. Direct drain pipes away from waterways and into rain gardens which filter any contaminants prior to release of water.
6. Learn to identify and properly control invasive species.
7. Plant only native plants and do not transport invasive species, including bait. Clean boats and gear, especially when transporting from one waterbody to another, to prevent the spread of aquatic invasive species.
8. Limit the use of fertilizers, herbicides, and pesticides, especially near waterways.
9. Maintain boats to prevent leakages of oil, gasoline, and fluids.

ZONING AND ORDINANCES

Zoning and ordinances are ways for local governments to regulate land use in their communities. In essence, ordinances and zoning are laws that restrict use and development in order to protect the surrounding natural environment and community. However, local regulation must comply with applicable state and federal laws. In Michigan, a great deal of local authority has been removed by the adoption of the Township Zoning Act of 2009. This act states that local governments may not enact ordinances that restrict timber harvest, mining, and other resource extraction endeavors. Nonetheless, other zoning and ordinances can still be very valuable in protecting aquatic and terrestrial ecosystems. The list of current zoning and ordinances that promote a healthy watershed are listed below arranged by township.

8.2 Public Outreach, Education, and Stakeholder Involvement

Stakeholders are an integral part of the watershed-management process. Therefore, contacting all stakeholders should be a priority during all stages of the development of the Waishkey River Watershed Management Plan. Target audiences will include:

1. Students
2. Households and Landowners
3. Local Organizations/Societies
4. Businesses and Industries
5. Farmers
6. Governments (state, federal, local, tribal)
7. Municipalities
8. Developers & Construction Entities

A stakeholder meeting will be held prior to the submission of the Waishkey Watershed Management Plan in order to address any and all concerns held by the stakeholder community which are not addressed in the original draft. Upon completion of the initial draft of this document, comments will also be sought during a 30-day public-comment period. Following the public comment period, the management committee will compile all comments and decide which comments need to be incorporated into the plan.

Stakeholders will be encouraged to attend ongoing management committee meetings upon approval of the watershed management plan. Meetings will be aimed at completing the management goals.

Annual update articles will be produced by the management committee and shared with local newspapers and the Bay Mills Biological Services Department newsletter. The purpose of these articles will be to educate stakeholders on emerging issues, highlight successes, release important dates, and attract new stakeholders and volunteers. These will be made available on the Bay Mills Biological Services Department website.

All restoration and protection projects and programs planned within the watershed will require consultation with the affected stakeholders prior to implementation. Consultation will be continued throughout the entire course of projects and programs to monitor stakeholder approval and suggestions.

Interested stakeholders will be encouraged to aid in ongoing monitoring efforts. If numerous stakeholders are interested in such monitoring efforts, additional sites may be added for enhanced effectiveness of monitoring efforts.

Outreach will also be a priority, in which these organizations present information and educational materials to local academic institutions and interested organizations/clubs. Social media is an effective tool which should be used to engage the public, especially the younger generations. Facebook or Twitter accounts may be created and used to update stakeholders and interested citizens on current news, scheduled activities within the watershed, and dates of management committee meetings.

Priority outreach and education topics will include:

1. The Major Watershed Concerns—point and non-point source pollution, invasive species, threatened and endangered species, habitat, and climate change
2. Land Use Strategies and BMPs
3. Restoration and Protection Projects
4. Water Quality
5. Invasive Species
6. Habitat Protection
7. Septic Systems and Sewage Lagoons
8. Erosion, Runoff, and Pollution
9. Livestock Access
10. Monitoring

Chapter 9. IMPLEMENTATION PROGRAM DESIGN

This first draft of the Waishkey River Watershed Management Plan is intended to outline 10 years of projects, and is scheduled for review, revision, and revaluation after ten years. The tasks and milestones are included for reference during funding acquisition and implementation stages. Maps of project locations are available upon request.

9.1 Schedule of Activities and Specific Projects

The specific projects listed below were designed to achieve the tasks set forth in Chapter 6 Watershed Goals and Objectives. To ensure the continuous effectiveness of this management plan, new projects will need to be continuously added as others are completed. Therefore, this list focuses on the most pressing problems within the watershed. Projects that address a priority pollutant are listed first.

** Estimates of pollutant load reductions of: S—Sediment (tons per year); P—Phosphorus (pounds per year); N— Nitrogen (pounds per year)*

Table 28. Specific Projects for Agricultural Concerns Related to Pathogens and Nutrients (see Appendix for details)

Priority (H, M, L)	Watershed Concern Addressed	Project	Subwatershed	Pollutant Reduction (S, P, N)*	Potential Partners	Cost	Possible Funding Sources	Timeline
H	Priority Pollutant: Pathogens and Nutrients;	Agr22: Prescribed grazing; Critical area planting; Exclusion Fencing, Runoff Mgmt. System;	Waiska	S=40, P=209, N=461	MAEAP, NRCS, CLMCD	$200,000	Farm Bill EQIP, 319	2030
H	Priority Pollutant: Pathogens and Nutrients;	Agr2/ Agr16: Filter Strips, Critical Area Planting, waste mgmt system, waste storage facility and Filter strips, prescribed grazing, conservation cover, exclusion fencing	Hickler	S=1333, P=2222, N=4575 S=38, P=79, N=157	MAEAP, NRCS, CLMCD	$350,000	Farm Bill EQIP, 319	2030
H	Priority Pollutant: Pathogens and Nutrients;	Agr1: Prescribed Grazing, Exclusion fencing	S of E	S=12, P=25, N=50	MAEAP, NRCS, CLMCD	$300,000	Farm Bill EQIP, 319	2030
H	Priority Pollutant: Pathogens and Nutrients;	Agr11: Prescribed grazing, filter strips, Waste Storage Fac.; Waste Mgmt. System	S of E	S=5, P=192, N=590	MAEAP, NRCS, CLMCD	$300,000	Farm Bill EQIP, 319	2030
H	Priority Pollutant: Pathogens and Nutrients;	Agr12: Prescribed grazing; Filter strips, Waste Storage Fac.; Waste Mgmt. System	S of E	S=20, P=35, N=88	MAEAP, NRCS, CLMCD	$100,000	Farm Bill EQIP, 319	2030
H	Priority Pollutant: Pathogens and Nutrients;	Agr14: Filter Strips, prescribed grazing, fence	S of E	S=0, P=1, N=2	MAEAP, NRCS, CLMCD	$300,000	Farm Bill EQIP, 319	2030
H	Priority Pollutant: Pathogens and Nutrients;	Agr15: Prescribed Grazing, Exclusion fencing, filter strips	S of E	S=4, P=5, N=9	MAEAP, NRCS, CLMCD	$100,000	Farm Bill EQIP, 319	2030
H	Priority Pollutant: Pathogens and Nutrients;	Agr18: Fencing	S of E	S=1, P=1, N=3	MAEAP, NRCS, CLMCD	$150,000	Farm Bill EQIP, 319	2030
H	Priority Pollutant: Pathogens and Nutrients;	Agr25 Filter strips, prescribed grazing, waste mgmt, waste storage fac.	S of E	S=2, P=110, N=320	MAEAP, NRCS, CLMCD	$150,000	Farm Bill EQIP, 319	2030
H	Priority Pollutant: Pathogens and Nutrients;	Agr27 Prescribed grazing, conservation cover, filter strips, runoff mgmt system, waste	S of E	S=1, P=97, N=210	MAEAP, NRCS, CLMCD	$200,000	Farm Bill EQIP, 319	2030
H	Priority Pollutant: Pathogens and Nutrients;	Agr28 Prescribed grazing, Waste Management System, Waste Storage Facility	S of E	S=8, P=126, N=536	MAEAP, NRCS, CLMCD	$100,000	Farm Bill EQIP, 319	2030

H	Priority Pollutant: Pathogens and Nutrients;	Agr29 Prescribed grazing, critical area planting, fencing, Filter Strip, waste management	S of E	S=6, P=80, N=268	MAEAP, NRCS, CLMCD	$50,000	Farm Bill EQIP, 319	2030
H	Priority Pollutant: Pathogens and Nutrients;	Agr30 fencing setback	South	S=4, P=5, N=15	MAEAP, NRCS, CLMCD	$20,000	Farm Bill EQIP, 319	2030
H	Priority Pollutant: Pathogens and Nutrients;	Agr10 Prescribed grazing	South	S=0, P=1, N=2	MAEAP, NRCS, CLMCD	$20,000	Farm Bill EQIP, 319	2030
M	Priority Pollutant: Pathogens and Nutrients;	Agr17 Prescribed Grazing	East	S=1, P=1, N=3	MAEAP, NRCS, CLMCD	$200,000	Farm Bill EQIP, 319	2030
M	Priority Pollutant: Pathogens and Nutrients;	Agr4 Prescribed grazing; Exclusion fencing; Stream crossing or move all grazing to west	East	S=0, P=1, N=2	MAEAP, NRCS, CLMCD	$5,000	Farm Bill EQIP, 319	2030
M	Priority Pollutant: Pathogens and Nutrients;	Agr21: Critical area planting; Exclusion fencing; Stream crossing	East	S=1, P=1, N=3	MAEAP, NRCS, CLMCD	$300,000	Farm Bill EQIP, 319	2030
M	Priority Pollutant: Pathogens and Nutrients;	Agr6 Prescribed grazing, filter strips (also has stormwater and culvert issues which compound livestock issues)	East	S=0, P=0, N=1	MAEAP, NRCS, CLMCD	$20,000	Farm Bill EQIP, 319	2030
M	Priority Pollutant: Pathogens and Nutrients;	Agr20 Prescribed grazing	East	S=1, P=1, N=2	MAEAP, NRCS, CLMCD	$250,000	Farm Bill EQIP, 319	2030
M	Priority Pollutant: Pathogens and Nutrients;	Agr9: Filter strips, prescribed grazing, conservation cover, exclusion fencing, animal crossing, waste mgmt system, waste storage system	Hickler	S=7, P=82, N=238	MAEAP, NRCS, CLMCD	$10,000	Farm Bill EQIP, 319	2030
M	Priority Pollutant: Pathogens and Nutrients;	Agr3 Prescribed grazing, filter strips (site too small for effective livestock management)	Hickler	S=1, P=2, N=3	MAEAP, NRCS, CLMCD	$20,000	not EQIP	2030
M	Priority Pollutant: Pathogens and Nutrients;	Agr8 Prescribed Grazing	Hickler	S=0, P=0, N=0	MAEAP, NRCS, CLMCD	$5,000	Farm Bill EQIP, 319	2030
M	Priority Pollutant: Pathogens and Nutrients;	Agr24 Prescribed grazing, critical area planting, exclusion fencing	Hickler	S=1, P=3, N=5	MAEAP, NRCS, CLMCD	$100,000	Farm Bill EQIP, 319	2030
M	Priority Pollutant: Pathogens and Nutrients;	Agr26 Prescribed grazing, filter strips, Waste Storage Fac.; Waste Mgmt. System	Hickler	S=2, P=110, N=320	MAEAP, NRCS, CLMCD	$200,000	Farm Bill EQIP, 319	2030
M	Priority Pollutant: Pathogens and Nutrients;	Agr23 Prescribed grazing, Filter strip; Waste Mgmt. System; Waste Storage Fac.	Orrs Cr	S=4, P=59, N=165	MAEAP, NRCS, CLMCD	$300,000	Farm Bill EQIP, 319	2030
M	Priority Pollutant: Pathogens and Nutrients;	Agri31 Prescribed grazing	Hickler	S=0, P=1, N=2	MAEAP, NRCS, CLMCD	$5,000	Farm Bill EQIP, 319	2030
M	Priority Pollutant: Pathogens and Nutrients;	Agri32 Prescribed grazing; Filter strips	S of E	S=1, P=3, N=7	MAEAP, NRCS, CLMCD	$20,000	Farm Bill EQIP, 319	2030
L	Priority Pollutant: Pathogens and Nutrients; Sediment	Farm Eco-Economics Education campaign: Discuss the environmental and economic benefits of grazing cattle naturally on pasture instead of concentrated on feedlots.	All		MAEAP, NRCS, CLMCD	$5,000	Farm Bill EQIP, 319	2030
L	Priority Pollutant: Pathogens and Nutrients; Habitat Concerns	Seek conservation easements and WRP for agricultural sites plagued by flooding.	All	-	NRCS		Farm Bill EQIP, 319	2030

L	Priority Pollutant: Pathogens and Nutrients	O&E public service announcement on agricultural runoff BMPs (such as a 60 second video)	all		CCHD, MAEAP	$10,000	Farm Bill EQIP, 319	2025

***Estimates of pollutant load reductions of: S—Sediment (tons per year); P—Phosphorus (pounds per year); N— Nitrogen (pounds per year)*

Table 29. Specific Projects for Septic Concerns Related to Pathogens and Nutrients (see Appendix for details)

Priority (H, M, L)	**Watershed Concern Addressed**	**Project**	**Pollutant Reduction (S, P, N)***	**Potential Partners**	**Cost**	**Possible Funding Sources**	**Timeline**
H	Priority Pollutant: Pathogens and Nutrients	Septic system education campaign: Discuss OSDTS maintenance and regulatory codes with landowners not serviced by municipal wastewater treatment. Distribute OSDTS technical O/E literature and complete OSDTS compliance plans with landowners to initiate process of voluntary compliance with current and/or future OSDTS regulations. Assist interested landowners with financial planning to gain CCHD OSDTS compliance. Literature distributed/consultation with targeted audience. Develop a locally-based, comprehensive public education/awareness program dealing with on-site septic systems. Meet with individual OSDTS owners. Refer to section 4.2.iii.	P=23.07, N=1280.8, Toxics= 2564, Organisms= 81 billion, Viral units= 810 million	CCHD, MGSP, MDEQ, MSU Extension	$10,000 per year	319, IHS, GLRI	2030
H	Priority Pollutant: Pathogens and Nutrients	Map non-compliant and failing septic systems/ OSDTS audit; GIS aerial imagery assessment OSDTS audit; GIS aerial imagery assessment to confirm that they are meeting the SEHC requirements; and utilize geographic informational systems (GIS) to map lagoon and conventional type OSDS (confirm presence within zone of 500' adjacent water bodies) and analyze for conformance with required surface water setbacks. After evaluation, utilize approved methods to conduct field inspection and system evaluations. Refer to section 4.2.iii.	Step towards implementation	CCHD, Townships	$100,000	319, GLRI	2023
H	Priority Pollutant: Pathogens and Nutrients	Address non-compliant and failing septic systems. Refer to Section 4.2.iii.	S=0, P=230.7, N= 12,808 Toxics =25,646 organisms = 810 billion Viral units = 8.1 billion	CCHD, MDEQ, Townships	variable	Rural Development loan program	2040

H	Priority Pollutant: Pathogens and Nutrients	Work with the CCHD to modify the Superior Environmental Health Code (SEHC) to require time-of-sale inspections at the time of property transfer, and reporting of existing septic systems. Refer to section 4.2.iii.	Increase of 200-300 inspections per year	CCHD			2030
H	Priority Pollutant: Pathogens and Nutrients	Conduct a visual inspection, dry-weather testing, and dye testing of properties with suspected illicit discharges. Locate properties by analyzing maps and aerial photography, and walking length of stream. Perform E.coli with Bacterial Source Tracking (BST) sampling where suspected discharges/connections are located.	Step towards implementation	CCHD	$100,000	319, GLRI	2030
L	Priority Pollutant: Pathogens and Nutrients	O&E public service announcement such as a video (60 seconds) on septic BMPs	P=23.07, N=1280.8, Toxics= 2564, Organisms= 81 billion, Viral units= 810 million	CCHD, MAEAP	$10,000	319, GLRI, IHS	2030

***Estimates of pollutant load reductions of: S—Sediment (tons per year); P—Phosphorus (pounds per year); N— Nitrogen (pounds per year)*

Table 30. Specific Road Stream Crossing Projects (see Appendix for details)

Priority (H, M, L)	Watershed Concern Addressed	Project	Subwatershed	Pollutant Reduction (S, P, N)*	Potential Partners	Cost	Possible Funding Sources	Timeline
H	All	Inventory all RSC in watershed using Great Lakes Rd Stream Crossing Inventory methods	all	Step towards implementation	BMIC	$20,000	GLRI, EPA 319	2023
H	Aquatic Orgn Passage	RSC 29/ CCRC 1632: located at 6 Mile Rd, (BMIC WR7) 46.419, -84.468 replace crossing with bridge.	S of E	S= 0.3, P= 0.4, N=0.8	CCRC	$1.2M	BIA, Michigan Critical Bridge Fund	2023
H	Priority Pollutant: Sediment; Aquatic Orgn Passage	RSC 115: Located at M28. Undersized and perched culvert eroding downstream bank. 46.37524, -84.56621	Hickler	S= 15.3, P= 15.3 N=30.6	MDOT	$2 M	GLRI, EPA 319	2030
H	Priority Pollutant: Sediment	RSC 116: Located at south M221 near M28. Erosion is severe 46.37676, -84.57219	Hickler	S=13.6, P=13.6, N=27.2	CCRC	$250,000	GLRI, EPA 319	2030
H	Priority Pollutant: Sediment; Aquatic Orgn Passage	RSC 12: Located at White Rd, (BMIC WR13) 46.426, -84.448 replace structure with box culvert, 2 of 3 are plugged.	East	S= 47.6, P= 47.6, N= 95.2	CCRC	$250,000	GLRI, EPA 319	2035
H	Priority Pollutant: Sediment; Aquatic Orgn Passage	RSC 17/18: located at 6 Mile Rd and Soo Line railroad crossing. 80% plugged. Replace multi-structure culverts	East	S= 0.3, P= 0.3, N= 0.5	CCRC	$600,000	BIA GLRI, EPA 319	2030
H	Priority Pollutant: Sediment, Aquatic Orgn Passage	RSC 87: Located at Hwy 221 bank stability poor. Severe erosion likely from culvert misalignment.	Orrs Cr	S=261.9, P= 301.3, N= 602.4	CCRC	$200,000	GLRI, EPA 319	2040
M	Priority Pollutant: Sediment; Aquatic Orgn Passage; Pesticide	RSC 282/283: Located at Lakeshore Dr BMRC, BMIC RSX PAR & RSX PARe 46.421 -84.605 replace/ realign structures crossing road and driveway, buffer strip	Waiska	S=0.8,P= 0.8, N=1.5	CCRC, BMIC	$250,000	BIA, GLRI, EPA 319	2030
M	Priority Pollutant: Sediment; Aquatic Orgn Passage	Develop engineering plans for all listed road stream crossing projects	all	Step towards implementation	USFS, BMIC CCRC	$30,000/ site	GLRI, EPA 319	2030
M	Priority Pollutant: Sediment	RSC 167: Located at 12 Mile culvert too short and somewhat undersized due to roadway slopes. Cutting back into roadbed. Downstream bank erosion. misalignment	South	S= 0.5, P= 0.5, N= 1.1	CCRC	$175,000	GLRI, EPA 319	2040
M	Priority Pollutant: Sediment	RSC 234: Located at Goldade Rd, this double culvert crossings has upstm and dwnstm erosion	West	S= 3.1, P=3.1, N=6.3	CCRC	$250,000	GLRI, EPA 319	2040
M	Priority Pollutant: Sediment	RSC 197: Located at Lockhart Rd	South	S= 0.3, P= 0.3, N= 0.9	CCRC	$250,000	GLRI, EPA 319	2040
M	Aquatic Orgn Passage	RSC 252: Located at Waishkey River Truck Trail. Bons Creek Replace with box culvert (north Spile Dam)	West	Not recently measured	USFS Stewardship	$120,000	GLRI	2030

M	Aquatic Orgn Passage	RSC 253: Located at Waishkey River Truck Trail. Unnamed Creek Replace with box culvert	West	Not recently measured	USFS, CCRC	$120,000	GLRI	2030
M	Aquatic Orgn Passage	RSC 255: Located at Waishkey River Truck Trail/ Forest Service Footpath. Spiles Dam and West Branch. Replace with box culvert	West	S=0.3, P=0.3, N=0.6	USFS, CCRC	$120,000	GLRI	2030
M	Aquatic Orgn Passage	RSC 256: located at Clear Creek and USFS RD 3352. Undersized	West	Not recently measured	USFS, CCRC	$120,000	GLRI	2030
M	Habitat Concern	RSC 262: in Delirium Wilderness, hydrology impeded. Remove culvert and obliterate the road.	West	Not recently measured	USFS	$2,000	GLRI	2025
M	Priority Pollutant: Sediment	RSC 6: 5 Mile. Plugged, partially crushed upward. Moderate eroding at inlet. Large wetland pond upstream	East	S=3.9, P=4.4, N=8.9	CCRC	$250,000	GLRI, EPA 319	2040
M	Priority Pollutant: Sediment, AOP	RSC 3: 5 Mile. Perched, plugged and minor eroding at inlet	East	S=35.7, P=41.1, N=82.1	CCRC	$250,000	GLRI, EPA 319	2040
M	Priority Pollutant: Sediment, AOP	RSC 113: Perched, eroding upstream. Broken side of culvert	Hickler	S=111.6, P=128.3, N=256.6	CCRC	$250,000	GLRI, EPA 319	2040
L	Priority Pollutant: Sediment	RSC 119: Eroding upstream	Hickler	S=71.4, P=82.1, N=164.2	CCRC	$250,000	GLRI, EPA 319	2040
L	Aquatic Orgn Passage	RSC126: Located at Goldade Rd. replace multi-structure with box culvert; constricted by vegetation	Hickler	Not yet measured	CCRC	$200,000	GLRI	2030
L	Aquatic Orgn Passage	RSC 121/263: located at M28 Erosion, Drainage – minor erosion; perched due to beaver dams upstm 46.375232, -84.591239	Hickler	S= 0, P= 0, N= 0	DOT, CCHD, CLMCD	$2 M	GLRI, EPA 319	2030
L	Aquatic Orgn Passage,	RSC 254: snowmobile trail bridge/ Spile Dam Rd, pending engineer's design	West	S= 1.7, P= 1.7, N=5.0	USFS, Snowmobile Club	$200,000	GLRI	2040

***Estimates of pollutant load reductions of: S—Sediment (tons per year); P—Phosphorus (pounds per year); N— Nitrogen (pounds per year)*

Table 34. Additional Projects (see Appendix for details)

Priority *(H, M, L)*	**Watershed Concern Addressed**	**Project**	**Subwatershed**	**Measure of Progress**	**Potential Partners**	**Cost**	**Possible Funding Sources**	**Timeline**
H	Point Source	Cleanup "Dump Creek" open dump site 46.424, -84.622	Waiska	Steps taken to arrange cleanup	USFS, BMIC	Varies with clean-up strategy		2030
H	Habitat Concerns	Protect and preserve critical dune habitat from erosion; advocate for BMPs and install at homes north of Bay Mills Point.	Waiska	Erosion rate halted	BMIC, USFS	varies		
H	Habitat Concerns	Work with the NRCS Service to promote the Wetland Restoration Program and other Farm Bill wetland protection programs to landowners of high potential restoration distinction (LLWFA, HS, HSG). Pursue cost-share to implement restoration activity with willing landowners, and follow with implementation of restoration activity. CLMCD staff will identify priority wetland sites and contact landowners.	all	Apply for grant	MAEAP, NRCS, CLMCD	$100,000	Farm Bill programs	
H	Invasive Species	Improve and install invasive species prevention signage at BMRC boat launch	Waiska	Install kiosk	BMIC	$1000	GLRI	2020
H	Invasive Species	Install invasive species prevention signage at Superior Township park boat launch	Hickler	Install kiosk	Superior Twp, CISMA	$1000	GLRI	2025
H	Invasive Species	Improve invasive species prevention signage at USFS boat launch at Monocle Lake Campground	Waiska	Install kiosk	USFS, CISMA	$300	GLRI	2020
M	Invasive Species	Install boat washing mobile station within or near the watershed, BMRC boat launch	Waiska	# Boaters contacted	BMIC	$10,000	GLRI	2020
M	Habitat Concerns	Map High-Impact Habitat Areas	All	# Acres surveyed	CLMCD, BMIC, USFS, MITC, LSSU, BMCC	No Cost	GLRI	2025
M	Habitat Concerns, Threatened/ Endangered Species	Map High-Quality Habitat Areas	all	# Acres surveyed	CLMCD, BMIC, USFS, USFWS, MITC, LSSU, BMCC	No Cost	NFWS	2025
M	Priority Pollutant: Herbicide/Pesticide, Sediment, Heavy Metals; Habitat Concerns	Install stormwater best management practices (road/parking lot sweeping, rain gardens, constructed wetlands, vegetated swales, snow removal, etc.) at Bay Mills Resort and Casino	Waiska	# Acres improved	BMIC	$3M	GLRI, 319	2050

M	Invasive Species	Eradicate Himalayan Balsam from Brimley area	Hickler, Waiska	# Acres treated, surveyed	BMIC, CLMCD	$16,000	GLRI	2025
L	Priority Pollutant: Herbicide/Pesticide, Sediment, Heavy Metals;	Plant buffer strip along Parish Creek at Bay Mills Resort and Casino	Waiska		BMIC	$1000	GLRI	2030
L	Invasive Species	Encourage native species, such as wild rice on Spectacle Lake	Waiska	Species encouraged; acres	BMIC	$5000	GLRI	Ongoing

9.2 Expected Pollutant Load Reduction

The STEPL tool combines loading information with predicted BMP implementation to estimate load reductions for pollutants. Assuming all applicable BMPs are implemented, Nitrogen, Phosphorus, and Biological Oxygen Demand would be greatly reduced. Sediment loads would be cut in half to a third if BMPs are implemented. (Please note: the E. coli Load Reduction figure was intentionally left blank because the STEPL model cannot calculate this.)

Figures 39, 40, 41. The STEPL tool calculated and graphed nutrient, sediment, and E. coli loading in the watershed based on soils, climate, land use and livestock (shown on the left side). Figures 42, 43, and 44. When anticipated BMPs are applied, the nutrient, sediment, and E. coli loading was calculated and graphed (right side).

Table 35. Expected Pollutant Reduction by Subwatershed

Watershed	% N Reduction	% P Reduction	% BOD Reduction	% Sediment Reduction	% E. coli Reduction
East Br Waishkey River	22.2	16.8	0.4	24.9	0.0
Orrs Creek	35.1	23.9	1.4	37.3	0.0
South Br of East Branch Waishkey River	23.6	20.6	0.4	27.2	0.0
Little Waiska Creek-Frontal Lake Superior	16.4	9.1	0.3	19.7	0.0

West Br Waishkey River	1.8	1.6	0.0	8.0	0.0
South Br Waishkey River	29.0	16.2	0.4	28.0	0.0
Hickler Creek-Waishkey River	21.6	16.6	0.3	22.6	0.0
Total	22.0	14.9	0.4	24.7	0.0

Table 36. Expected Pollutant Total Load by Land Uses Incorporating Best Management Practices.

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)	E. coli Load (Billion MPN/yr)
Urban	27,623.34	4,170.30	117,103.98	588.97	0.00
Cropland	4,634.85	983.81	15,973.05	130.86	0.00
Pastureland	79,081.39	6,693.93	351,384.85	450.74	0.00
Forest	14,310.62	7,088.00	35,483.88	182.92	0.00
Feedlots	1,196.66	49.39	1,595.54	0.00	0.00
User Defined	0.00	0.00	0.00	0.00	0.00
Septic	4,453.70	1,744.76	18,190.02	0.00	0.00
Total	131,300.55	20,730.18	539,731.31	1,353.50	0.00

For calculating pollution reduction for the specific projects listed in the Implementation Tables (Tables 29-34) , managers used the EPA Region 5 Model for Estimating Load Reductions. The EPA Region 5 Model is a calculation tool that provides an estimate of sediment and nutrient load reductions from the implementation of Best Management Practices (BMPs). The Region 5 model was used with projects because managers found it easier to input data on single sites collected late in the writing process after STEPL analysis had been completed. This allowed the writing team to add priority sites last minute as they were discovered.

Agriculture sites of concern were initially identified using aerial imagery, roadside inspection and known sites of concern by local managers. These sites were then inspected again for vegetative cover and condition, animal units present onsite bank stabilization and BMP's for each site. Information collected from these site visits was used to run the EPA Region 5 Model specifically for agricultural fields and filter strips and, when applicable, feedlots and bank stabilization to determine potential load reductions of sediment, phosphorous and nitrogen. Table 28 in section 9.1 lists each site of concern and potential load reductions possible through installation of BMP's. Overall, if each agricultural site of concern was able to implement BMPs, 1,455 tons of sediment, 3,373 pounds of phosphorus and 8,037 pounds of nitrogen per year could be reduced within the watershed.

Septic-related pollution estimates were calculated incorporating data from Chippewa County Health Department. Refer to section 4.2.iii. Table 15 estimates that there is 12,808 pounds of nitrogen and 230.7 pounds of phosphorus entering the watershed through failing on-site septic systems. Discussions with CCHD staff reveal that system failures are rarely due to lack of maintenance (pumping) (10-20%); siting and capacity most commonly are. Nevertheless, assuming that outreach and education projects yielded maintenance activities by homeowners, then 10% of system failures and 10% of pollutants could be reduced. These numbers are reflected in Table 29 in section 9.1.

For road stream crossings and estimates on bank stabilization, lateral rescission rate had to be estimated as surveys were done at a single point in time. In many cases, the lateral rescission rate was estimated as "severe" meaning the bank is "bare of vegetation with rills and severe vegetative overhang. Many exposed tree roots and some fallen trees and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross-section becomes more U-shaped as opposed to V-shaped." For gully stabilization estimates, it was generally assumed that pollution has been occurring for at least 5 years. It is more likely that pollution has been occurring since the installation of many of these culverts, but this number had to be estimated as surveys were done at a single point in time. Given these measurements, pollution load reductions were calculated with EPA Region 5 Model as well. Actual road stream crossing surveys are included in Appendix B.

9.3 Potential Funding Sources

Funding diversity is encouraged for the long-term sustainability of the work. Funding can come from federal, state, local and private funding sources, but this list is by no means exhaustive and can be adjusted and added to as necessary.

- Bureau of Indian Affairs (BIA)
- Community Forest Program
- Clean Michigan Initiative - Nonpoint Source Pollution Control Grants
- EPA Environmental Education Grants
- EPA 319 Non-Point Source Pollution grants
- Federal Clean Water Act, Section 319(h)
- Freshwater Future
- Great Lakes Commission: Michigan Clean Water Corps
- Great Lakes Sediment and Nutrient Reduction Program (formally known as the Great Lakes Basin Program for Soil Erosion and Sediment Control)
- Great Lakes Restoration Initiative (GLRI)
- Great Lakes Stewardship Initiative
- Healing Our Waters Coalition
- MDEQ Coastal Zone Management Program
- MDNR Aquatic Habitat Grant Program
- MDNR Michigan Invasive Species Grant Program
- Michigan Natural Resources Trust Fund
- National Fish and Wildlife Foundation
- National Oceanic and Atmospheric Administration
- National Wildlife Federation
- New Belgium Brewing Company
- North American Wetlands Conservation Act Small Grants Program
- Patagonia
- Superior Health Foundation
- Sustain Our Great Lakes
- Woollam Foundation
- Other Private Foundations
- Donations

Chapter 10. EVALUATION FRAMEWORK

Changes to the watershed planning tasks can be anticipated when external factors affect watershed conditions or planning resources. There may be changes in funding sources, new developments that may shift priorities, and even implemented projects that may not produce the desired effect. It is critically important to continue to evaluate progress and identify where change is necessary. An annual evaluation of the management plan progress will be carried out by the watershed committee with input requested from the stakeholder group. The components of this annual evaluation are outlined below. ‘

10.1 Evaluation Methods

Continuous evaluation will be essential to ensure the continuous improvement of the Waishkey River watershed and to monitor the success of improvement, protection, and restoration efforts. Continued evaluation will also be of great value for future projects as compiled data can be used to inform decisions and confirm the need for further funding.

The prioritized tasks outlined in section eight of this document will also be evaluated on a continuous basis. These projects will be evaluated by using the project milestones/timeline. Projects should also include pre- and post-project monitoring to assess the success of the projects and provide data and information for additional projects.

Education and outreach efforts will be evaluated based on public attendance at management committee meetings, responses to newsletters and social media efforts, public involvement in monitoring efforts, and the use of watershed-based internships. If these outreach efforts are not effectively engaging the public, the management committee may consider different avenues of reaching stakeholders and interested citizens or certain groups which are underrepresented. Such efforts may include classroom visits to local schools or presentations at local colleges, universities, and organizations.

To account for any necessary changes, the Waishkey River Watershed Management Committee should update the management plan every ten years. Prior to making changes, the committee should plan to meet with stakeholders discuss and evaluate the plan. These public comments, in combination with the evaluation from the management committee, will guide the revisions.

10.2 Continued Monitoring

The MDEQ and BMIC Biological Services Department will continue to monitor the Waishkey River. Additional monitoring is encouraged, as long as proper procedures and techniques are utilized. All data collected should be entered into the USEPA's STORET online database to combine all applicable data into one convenient location.

Furthermore, restoration and enhancement projects should always include pre- and post-project monitoring to measure the success of efforts. In addition to data collection, projects should also include continuous photographic documentation. These photographs will be particularly valuable in education and outreach efforts.

Whenever possible, the public should be involved in monitoring efforts. This will enhance education and instill in these stakeholders a personal sense of responsibility and care. By building upon these sentiments, future projects should prove to be more efficient and effective.

10.3 Annual Assessment Questions

- Is monitoring complete for the year? Explain.
- Have any new trends been discovered in the data? Explain.
- Have there been any suggested changes for the goals, objectives, or tasks? Do you suggest changes now? Explain.
- Have these changes been made? Explain.
- Which recommended actions have been completed or addressed? Explain.
- Are the completed actions following the timeline? Explain.
- How is progress being measured? Explain.

- Is the most essential, relevant and useful datasheet being used to collect monitoring data? Do we need to update it? Explain.
- Do we need more partners in the planning process? Explain.

10.4 Quantitative Methods

The MDEQ and BMIC Biological Services Department will continue to monitor the Waishkey River. Additional monitoring is encouraged, as long as proper procedures and techniques are utilized. All data collected is entered into the USEPA's STORET online database to combine all applicable data into one convenient location. BMIC Biological Services Department follows a surface water quality monitoring Quality Assurance Program Plan (QAPP) approved by the EPA. The QAPP follows MI Rule 47 and EPA Ambient Water Quality Criteria Recommendations. Refer to the BMIC QAPP (BMIC 2018) for more information.

Additionally the monitoring efforts listed below will help determine whether load reductions are being achieved. Progress on pollution load reduction will be reviewed every 10 years when the management plan is revisited (see section 10.1).

- Volunteer Stream Monitoring Results (biological and physical characteristics)
- USGS chemical monitoring of the surface waters (pH, dissolved oxygen, heavy metals)
- USGS stream flow monitoring
- Water quality, *E. coli* and nutrient monitoring
- Number of new ordinances
- Number of acres protected
- Number of tasks completed

10.5 Qualitative Methods

- Stakeholder meeting and public workshop evaluations.
- Level of public understanding of watershed concerns.
- Volunteer and partner participation in watershed projects including annual evaluation.
- Stories of cooperation between participating agencies.

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APPENDICES

Appendices are included in a separate document.

APPENDIX A: Road Stream Crossing Inventory Instructions and Data Form

APPENDIX B: Road Stream Crossing Inventory

APPENDIX C: BMIC E coli and Nutrient Monitoring Results

APPENDIX D: Selected Monitoring Results and Recommendations from the Total Maximum Daily Load and Implementation Plan for E. coli

APPENDIX E: Watershed Project Implementation

APPENDIX F: Watershed Soil Descriptions

APPENDIX G: Watershed Desired Uses Public Survey