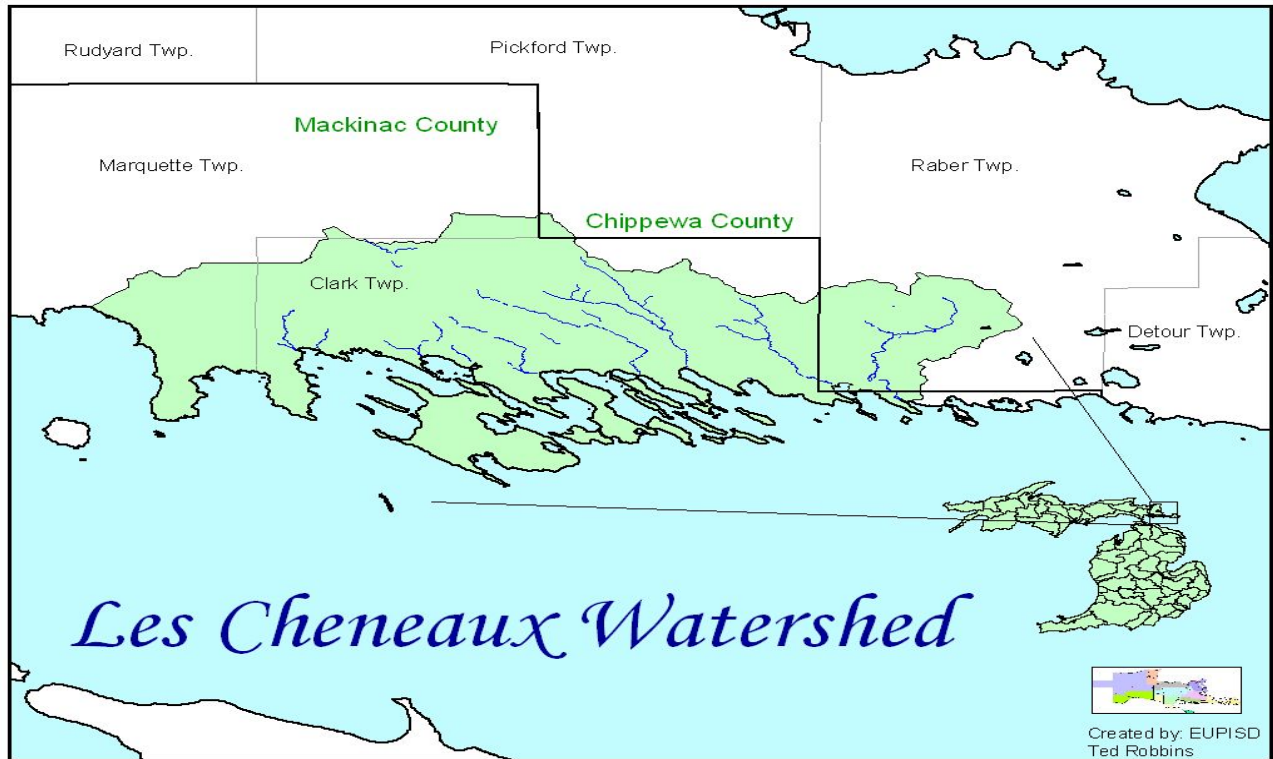


LES CHENEAUX WATERSHED

MANAGEMENT PLAN



May 2006

Chippewa / East Mackinac Conservation District
2847 Ashmun Street
Sault Ste. Marie, Michigan 49783



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The United States Environmental Protection Agency (U.S. EPA) provided support and funding through Section 604 (b) of the Clean Water Act.

The Michigan Department of Environmental Quality has overseen and administered this grant from the EPA. We thank Mitch Koetje from the Upper Peninsula District Office for his time and patience in our first go around at watershed management planning.

The project steering committee officially organized in February 2003, but they have been around a long time in the Les Cheneaux community beating the drum, so to speak, for protecting the unique treasures of the Les Cheneaux area. The committee formally organized into the Les Cheneaux Watershed Council in order to better serve the environment as a state and federally recognized 501(c) 3 non-profit organization. The current board consists of (President) Christine Perreault (Michigan Groundwater Stewardship Program), Randy Dunn (Vice President), Wendy Wagoner (Secretary), Carol Murray (Treasurer), Phil Milan, Robert Smith, Susan Letts, Jessie Hadley, Lesa Hester, Linda Hudson (Clark Township Supervisor) and Pat Carr (Chippewa/East Mackinac Conservation District Watershed Project Manager).

We owe a great debt of gratitude to former board and steering committee members including Dusty King (Chippewa/East Mackinac Conservation District), Joyce Cram, Jud Brown, John Torsky, Amy Polk, Jim Struble, and Dave Dunning.

Special thanks goes out to Hank Lotoszinski (Michigan Department of Transportation - Retired) for hundreds of hours of volunteer time in organizing volumes of data compiled during the inventory of watershed concerns. He has seen every corner of the watershed and truly took this project under his wing. Hank's involvement was a perfect example of the effectiveness community volunteers can have with any project they set out to accomplish.

We'd like to thank the several local, state, and federal technical advisors assisted with this project in obtaining and interpreting data, and the formulation of management plan strategies: Luce-Mackinac-Alger-Schoolcraft Environmental Health (Peggy French and Nick Derusha), Chippewa County Health Department (Joe Davis and Dave Martin), Clark Township personnel (Bob Smith, Jim Landreville, and Tony Hamel), Frank Sims (Building Inspector, Clark Township), Dave Fielder (Michigan Department of Natural Resources), Dave Westjohn (U.S.G.S.), Mary Kay O'Donnell (Little Traverse Conservancy), Tina Hall (The Nature Conservancy), Selden Collins and Christine Bonde (Natural Resources Conservation Service), Kevin St. Onge (Les Cheneaux Community Schools), Paul Webb (University of Michigan), Mike Grant (Aqua Terra Labs), Detour Water Lab.

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- Eastern Upper Peninsula Intermediate School District's Michelle Ribant and Ted Robbins for completing GIS Maps and for historical health information.
- Lake Superior State University's Dave Szlag, Barb Keller, Mary St. Antoine, and Greg Zimmerman for research projects, water chemistry analysis, and project guidance. This partnership provided impetus for the Sault Area Watershed Project.
- Michigan Natural Features Inventory for completing the GIS models for endangered and threatened species in Mackinac and Chippewa Counties.

Project Partners

Success in the planning phase and eventually in the plan implementation hinges on the people involved. The project manager worked closely with several community representatives (steering committee), which eventually became the Les Cheneaux Watershed Council (LCWC). The group provides a good representation of local organizations and watershed management philosophies. Coupled with technical advisors spanning a wide-range of technical expertise, the partnership realized success with addressing community concerns, developing corrective action to reduce pollution, and putting into place an effective program to protect the Les Cheneaux watershed for future generations.

Table A.1 Representative Organizations

Steering Committee (LCWC) Past and Present	Affiliation/Membership	Technical Advisors	Affiliation
Wendy Wagoner	Native Plant Coop, Riparian Landowner	Dave Szlag Barb Keller Greg Zimmerman Mary St. Antoine	Lake Superior State University
Christine Perreault	Michigan Groundwater Stewardship Program	Dave Westjohn Patrick Hudson Margi Chriscinski	US Geological Survey
Randy Dunn	Business Owner, Chamber of Commerce, Artisans Coop	Dave Fielder Dave Borgeson Rex Ainslie	Michigan Department of Natural Resources
Bob Smith	Les Cheneaux Islands Association	Tina Hall Jessie Hadley	The Nature Conservancy
Phil Milan	Marquette Township Zoning Board	Sea Lamprey Survey and Control	U.S. Fish & Wildlife Service
Carol Murray	Clark Township Clerk	Hiawatha National Forest Staff	USDA Forest Service
Linda Hudson	Clark Township trustee and Supervisor	Paul Webb Jen Jacobus	University of Michigan
Susan Letts	Little Traverse Conservancy	Tom Burton	Michigan State University
Pat Carr	Project Manager Chippewa/East Mackinac Conservation District	Don Uzarski	Grand Valley State University
Dave Dunning	Clark Township Planning Commission	Nick Derusha Peggy French	LMAS Health Department
Mark Engle	Les Cheneaux Islands Association	Joe Davis Dave Martin	Chippewa County Health Department
Amy Polk	St. Ignace News, NRTF	John Duncan Craig Kelso	Mackinac County Road Commission
Dusty King	Chippewa/East Mackinac Conservation District	Jim Landreville Tony Hamel	Clark Township Department of Public Works
Joyce Cram	Shoreline landowner	Mitch Koetje	Michigan Department of Environmental Quality
Lesa Hester Jud Brown Jim Struble	Landowner	Michelle Ribant Ted Robbins	Eastern Upper Peninsula Intermediate School District
Jessie Hadley	Business owner	Kevin St. Onge	Les Cheneaux Community Schools
John Torsky	Business owner; shoreline landowner	Christine Bonde, Selden Collins	USDA NRCS
Hank Lotoszinski	Ret. (Michigan DOT)	Paul Van Ryzin Randy Wilkinson	USDA RC&D

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Abbreviations and Acronyms

Responsible Party Acronyms

CCHD	Chippewa County Health Department
CCRC	Chippewa County Road Commission
CEMCD	Chippewa/East Mackinac Conservation District
CFED	Corporation for Enterprise Development
CORA	Chippewa/Ottawa Resource Authority
CT	Clark Township Officials
CTPC	Clark Township Planning Commission
EPA(USEPA)	Environmental Protection Agency
EUPISD	Eastern Upper Peninsula Intermediate School District
EUPRPDC	Eastern Upper Peninsula Regional Planning and Development Commission
GLEAS 51	Great Lakes Environmental Assessment Section
LCCC	Les Cheneaux Chamber of Commerce
LCCS	Les Cheneaux Community Schools
LCHS	Les Cheneaux High School
LCIA	Les Cheneaux Islands Association
LCTA	Les Cheneaux Tourist Association
LCWC	Les Cheneaux Watershed Council
Little T	Little Traverse Conservancy
LMAS	Luce-Mackinac-Alger-Schoolcraft Environmental Health Department
LSSU	Lake Superior State University
MCHD	Mackinac County Health Department
MCRC	Mackinac County Road Commission
MCSSAG	Mill Creek Subwatershed Stakeholder Advisory Group
MDEQ	Michigan Department of Environmental Quality
MDOT	Michigan Department of Transportation
MDNR	Michigan Department of Natural Resources
MGSP	Michigan Groundwater Stewardship Program
MNFI	Michigan Natural Features Inventory
MSU	Michigan State University
MSUE	Michigan State University Extension
NRCS	USDA Natural Resources Conservation Service
NRTF	Natural Resource Task Force
PICD	Presque Isle Conservation District
RC&D	Huron Pines Resource, Conservation and Development Council
TNC	The Nature Conservancy (Michigan Chapter)
TWP's	Local Township Officials (Clark, Marquette, and Raber)
U of M	University of Michigan
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	United States Geological Survey

Acronyms

I/E	Information and education
GIS	Geographic Information System
OSS	On-site septic system
SESC	Soil Erosion Sediment Control (Part 91)
WQRMP	Water quality resource management plan

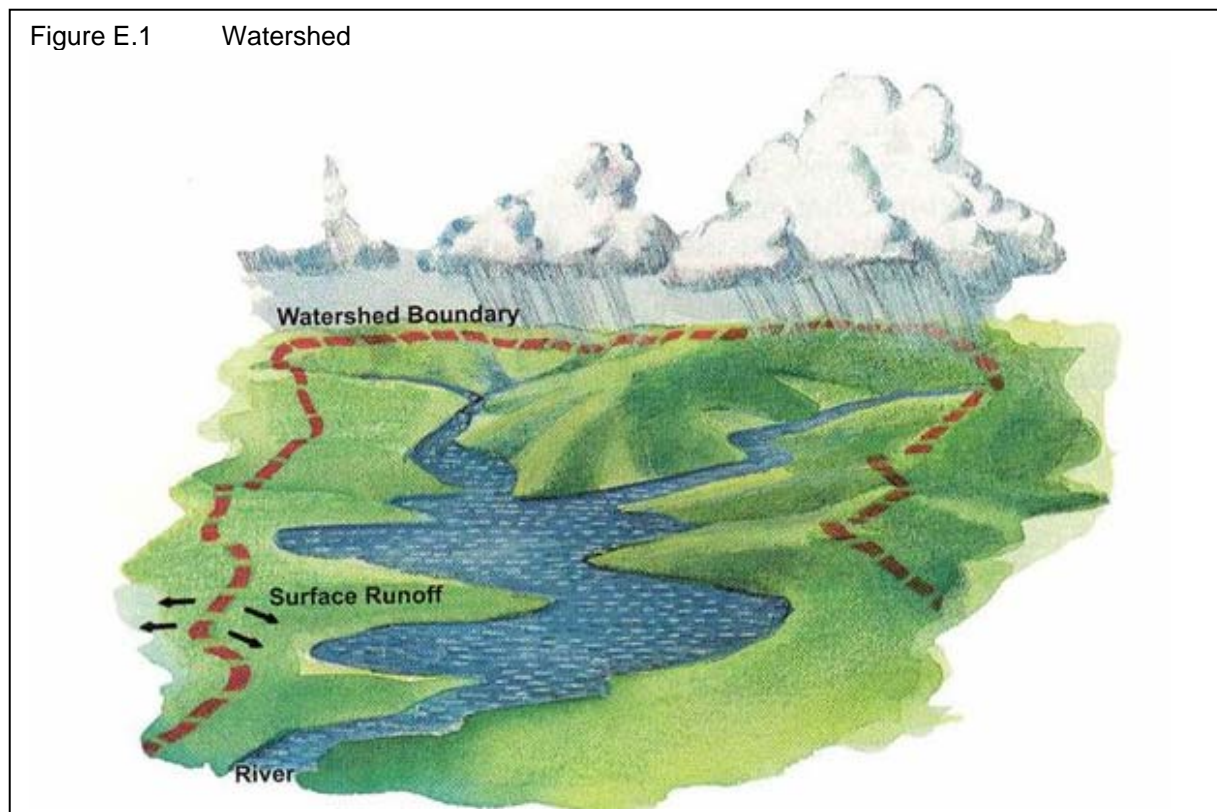
Executive Summary

Nestled in the northwest corner of Lake Huron lies the Les Cheneaux Islands watershed -- a 36-island archipelago, characterized by an intricate complex of channels, shallow bays, and rock-studded peninsulas, and boasting almost 200 linear miles of Great Lakes Shoreline. These natural resource attractions make “the Snows” a popular destination spot for tourists, outdoor enthusiasts, and vacation homeowners, as well as home for over 2,000 full time residents. Fortunately, the Les Cheneaux community is committed to protecting this special place. In November of 2002, a community partnership led by the Chippewa/East Mackinac Conservation District, secured a watershed management-planning grant for the Les Cheneaux Islands area from the U.S. Environmental Protection Agency (USEPA) and the Michigan Department of Environmental Quality (MDEQ). The grant and awarded funds were authorized by section 604(b) of the federal Clean Water Act and were used to develop this management plan for the Les Cheneaux watershed.

Les Cheneaux Watershed Management Plan is a tool for the community to reduce non-point source pollution and plan for the protection of Les Cheneaux area's natural resources for future generations. The plan provides a description of the watershed including its people and the condition of its aquatic resources. The plan was developed over a two-year period and outlines a detailed strategy for the reduction of point and non-point sources of pollution and the protection of natural features and the designated uses of water.

A watershed is an area of land that drains to a common place (MDEQ; February 2000). Precipitation in the form of rain and melting snow fall on land and that water runs downhill into the lowest areas in the surrounding landscape (i.e. the creeks, inland lakes and wetlands). That water runoff can carry pollutants that exist throughout the landscape, including bare soils, toxins such as oils, and wastes from both animals and humans. These pollutants originate from diverse sources, or *non-point* sources, and

Figure E.1 Watershed



threaten the water bodies where they are deposited. This is the rationale for managing pollution on a watershed scale. If we properly manage activities on lands that drain to our water bodies, we will protect those water resources. If we maintain the integrity of the watershed in our plans for land use, we will guarantee the sustainability of our resources and our way of life (MDEQ 2001).

The Les Cheneaux watershed includes 115 square miles in both Mackinac and Chippewa County in the Michigan's Eastern Upper Peninsula that drains to Lake Huron within the 36-island archipelago known as the Les Cheneaux Islands. That landscape area contains several small creeks, drains, and inland lakes that constitute the area's surface water. Fortunately, these waters are relatively protected by forest cover, which makes up the majority of the watershed's land cover (71%). Wetlands also help to protect these surface waters, with at least 16% of the land cover classified as such. The remaining landscape consists of 8% urban, 1% agricultural, and approximately 4% open or barren. That urban concentration is centered in the two villages of Cedarville and Hessel. The watershed falls within three townships, including Marquette, Clark, and Raber townships (EUPRPDC 1999).



The Les Cheneaux area watershed is highlighted by the 200 mile stretch of shoreline rimming both the north shore of Lake Huron and the Les Cheneaux chain of islands (CTPC 1994). The northern shoreline of Lake Huron at Les Cheneaux can be considered the watershed's most fragile biological indicator. It has been identified in a report of the State of the Lakes Environmental Conference (SOLEC), *Land by the Lakes: Nearshore Terrestrial Ecosystems*, as one of the priority "Biodiversity Investment Areas" in the Great Lakes basin. This area was similarly identified in The Nature Conservancy's report, *Conservation of Biological Diversity*, as an important resource, as well as one of the Conservancy's first *Last Great Places* in the western hemisphere. Biological inventories of the shoreline show nine globally-rare natural communities (for example, Great Lakes marsh, cobble beach, dune and swale, northern fen, alvar) that provide habitat to thirteen federally-listed threatened or endangered species (including bald eagle, grey wolf, Houghton's goldenrod, Hart's tongue fern, Hines emerald dragonfly and hillside daisy), and more than 60 state-listed species. Due to the size of the water bodies and the delayed phenology of the coast, the forested northern shores of Lake Huron provide important stopover areas where neotropical migrant birds concentrate during fall and spring migrations. The coastal marshes and remaining high quality wetlands are important to the health of Great Lakes' waterfowl and fisheries, where they provide nesting and spawning grounds, forage, and protection for numerous species (TNC 1993). In addition, the area contains several Michigan Department of Environmental Quality designated "environmental areas" which are ecologically unique areas that are maintained in their natural state and sheltered from development.

Threats

These resources provide a unique quality of life for year-round residents and draw thousands of visitors each year for aquatic recreational opportunities. Unfortunately, these same resources, which sustain the community, are coming under pressure to support increased activity and development. Development and development's "associated infrastructure" threaten both aquatic and terrestrial wildlife habitat and other components of environmental quality (TNC 1993). Stresses include habitat fragmentation and destruction, altered hydrological processes, and increased pathogens, nutrients, and toxins along the shoreline and other riparian areas. The Les Cheneaux Watershed Management Plan will focus on these

stresses and the designated uses¹ they threaten. The plan will outline a strategy to reduce pollution threats through the promotion of wise land use planning. It will also offer strategies that minimize the negative effects of development on the area's natural resources. Stresses to designated uses were determined through field observations, consultation with local, state, and federal environmental agencies, and through research of local ecosystems.

The Les Cheneaux watershed continues to meet minimum water quality goals set forth in the Federal Clean Water Act and Michigan's Designated Uses for surface water. However, the Luce-Mackinac-Alger-Schoolcraft (LMAS) Environmental Health Department has documented several cases of bacterial contamination in on-site drinking water wells, but a moratorium on installing new wells in the contaminated shallow aquifers has halted that direct impairment. Unfortunately, many existing homes still rely on shallow wells and older non-compliant² on-site septic systems (OSS) as well as use surface water intakes for water supplies, and these residents are in danger of bacterial contamination of their drinking and total/partial body contact use of water. The threat also exists that deeper wells, now mandated by LMAS, could become contaminated if careful consideration is not afforded to the inherent characteristics of the watershed that facilitated the contamination of the shallower aquifers.

Archaic, non-compliant OSS still exist throughout the watershed, including many shoreline properties that are close to the water table and marginal in effectiveness at accommodating wastes. The Les Cheneaux watershed area is part of the Niagaran Escarpment, and much of the project area is characterized by *Karst* topography. Karst is defined as a type of topography that is formed over limestone, dolomite, or gypsum by dissolving or solution, and is characterized by closed depressions or sinkholes, caves, and underground drainage and cracked bedrock at the grounds surface. The accompanying lack of deep filtering soils keep Les Cheneaux waters quite susceptible to contamination from surface and subsurface non-point sources of pollution, including these OSS. Migration of these wastes into surface and ground waters affects both drinking water and total/partial body contact recreation.

The Les Cheneaux area will continue to attract development activity, especially near the Lake Huron shoreline. Development without regard to wise natural resource management threatens other specific designated uses. The Les Cheneaux area's fishery and other aquatic wildlife depend on coastal marshes and stable littoral environments to survive. Activity on or near shore, consequently, results in increasing evidence of pollutants, including boat fuels, sediments from dredging and prop wash, and habitat degradation from building site preparation and other development requirements. Finally, both the fishery and ability to navigate in Cedarville Bay are both threatened by accelerated eutrophication, hastened by nutrient loading from both point³ and non-point sources along Cedarville's waterfront properties.

Solutions

The project steering committee, upon confirming the occurrence and frequency of watershed pollutants, ranked and prioritized them for remediation on the relative importance of each threatened designated use, the ability of the project partners to affect change, and on the availability of resources to realize project goals and objectives. Since all pollutants, sources and causes could be attributed, in part, to poor land use planning, the focus of work for the project partners will be facilitating wise land use planning to guarantee economic and environmental sustainability.

Priority Area

Defining priority areas within the watershed was a necessary task for the project steering committee in order to concentrate resources to reduce the most pollution causes. Priority areas were determined by a) identifying the major areas where pollutant sources and causes were originating and b) by determining

¹ Designated Uses are recognized uses of water established by state and federal water quality programs. Michigan's surface waters are protected by Water Quality Standards for specific designated uses. (*R323.1100 of Part 4, Part 31 of PA 451, 1994, revised 4/99*)

² LMAS On-site septic system codes

³ Clark Township municipal wastewater discharge

the areas most sensitive to pollutant impacts having the greatest likelihood to affect water quality and aquatic habitat. The committee associated all the pollutants with their causes and location of those causes and defined these areas as priority to the focus of watershed management resources. The priority areas of the Les Cheneaux Watershed Project include shoreline and creek riparian areas, urban concentrations, and wetlands.

Several characteristics make the Lake Huron shoreline a tenuous area for human settlement. *Karst* topography, shallow soils, coastal wetlands, and a propensity for habitat for priority species all necessitate careful management of this priority area.

Creek riparian areas were considered by the project steering committee to be the 100 feet of land parallel to the creek's bank. These areas serve as the drainage basin for each subwatershed and maintaining vegetative cover and stream bank stability is key to protecting these priority areas.

Urban concentrations are centered around the villages of Cedarville and Hessel. These municipalities exhibit a concentration of impervious surfaces with a network of storm drains and ditches coursing to Lake Huron. Both villages have marinas with fuel stations, launch areas, and concentrated human activity. These areas are highly susceptible to pollutants associated with human activity.

The Les Cheneaux watershed abounds with wetlands, including interior and coastal, which both provide countless benefits to water quality. Polluted runoff is filtered, stormwater flows are controlled naturally, and wildlife depends upon their productive ecosystems. Unfortunately, Les Cheneaux wetlands are being filled in for homes and other settlement infrastructure. Coastal wetlands and adjacent littoral zones are crucial wildlife habitat and need to be managed as priority areas.

The Les Cheneaux project will focus attention on all these areas to reduce existing and future sources and causes of pollution.

Goals

Early on in the planning process, the steering committee listed a number of watershed concerns. Upon addressing those concerns through observations, research reports, technical advisor consultations, the group formulated a number of goals for the management of the watershed:

- *Protect drinking water quality*
- *Protect partial body contact recreational use*
- *Protect total body contact recreational use*
- *Protect the integrity of aquatic and terrestrial ecosystems within the watershed*
- *Establish, promote, and execute land and water management practices that conserve and protect the natural resources of the watershed*
- *Protect navigation opportunities*
- *Provide appropriate opportunities for public enjoyment of aquatic/terrestrial resources including but not limited to walking trails, scenic overlooks, boat launches, and public access areas*
- *Establish and promote education/information programs that promote stewardship and low impact recreational enjoyment of aquatic and terrestrial resources*
- *Preserve the unique nature-based aesthetic character of the Les Cheneaux Islands area*
- *Identify and protect priority habitat for threatened and endangered species*

The Implementation Plan

To realize these goals, the steering committee has developed a plan of action, called an implementation plan. The implementation plan is organized by a number of pollution objectives organized by the different sources or conditions promoting pollution or habitat degradation. Objectives are organized by source since treating sources can address a number of different pollutants or conditions. To realize the objectives, a number of tasks have been suggested along with responsible partners that will work with the watershed project's lead agency, the steering committee, which has now developed into the non-profit group, the Les Cheneaux Watershed Council (LCWC). LCWC will begin implementing tasks contingent upon available funding and volunteer participation. Activities proposed include the following:

- Road/stream crossing structural improvement
- Streambank structural improvement
- Develop local stormwater management protocols
- Protect priority wildlife habitat with conservation easements and other land protection measures
- Continue monitoring programs that provide environmental indicators of sustainability

A key component of the Les Cheneaux Watershed Management Plan is creating awareness to the causes of water pollution. This component is described in the information and education plan (I/E). Members of LCWC have continuously suggested various I/E strategies during monthly meetings and consultation with other civic groups. The goal of the I/E strategy is to instill a stewardship ethic in the community. Education projects include:

- Workshops for contractors to increase awareness about wetland and other habitat protection
- Work with local schools to implement watershed education in current curriculum
- Provide opportunities for community to enjoy aquatic resource in order to promote environmental stewardship

Successes of the Les Cheneaux Watershed Management Plan will be evaluated based on the completion of the various best management practices (BMP's) and I/E strategies contained within the plan. Success of the project will also hinge on the success of LCWC to obtain funding and human resources to implement the different BMP's suggested in the plan. Success will also be determined by results from ongoing water quality monitoring activities. Finally, the most accurate measure of success will be the longevity of the partnership between the Les Cheneaux Watershed Council, the local conservation district, other regional partners, and the Les Cheneaux community to protect their unique area.

Chapter 1 - The Les Cheneaux Watershed

Natural Features

The Les Cheneaux watershed is considered a subwatershed of the Pine-Carp Watershed located in Michigan's Eastern Upper Peninsula. Specifically, the Les Cheneaux watershed is located in eastern Mackinac County with one subwatershed located in south-central Chippewa County. Natural features define the Les Cheneaux watershed. The area boasts 200 miles of Lake Huron coastline, which includes a 36-island archipelago known as the Les Cheneaux Islands.



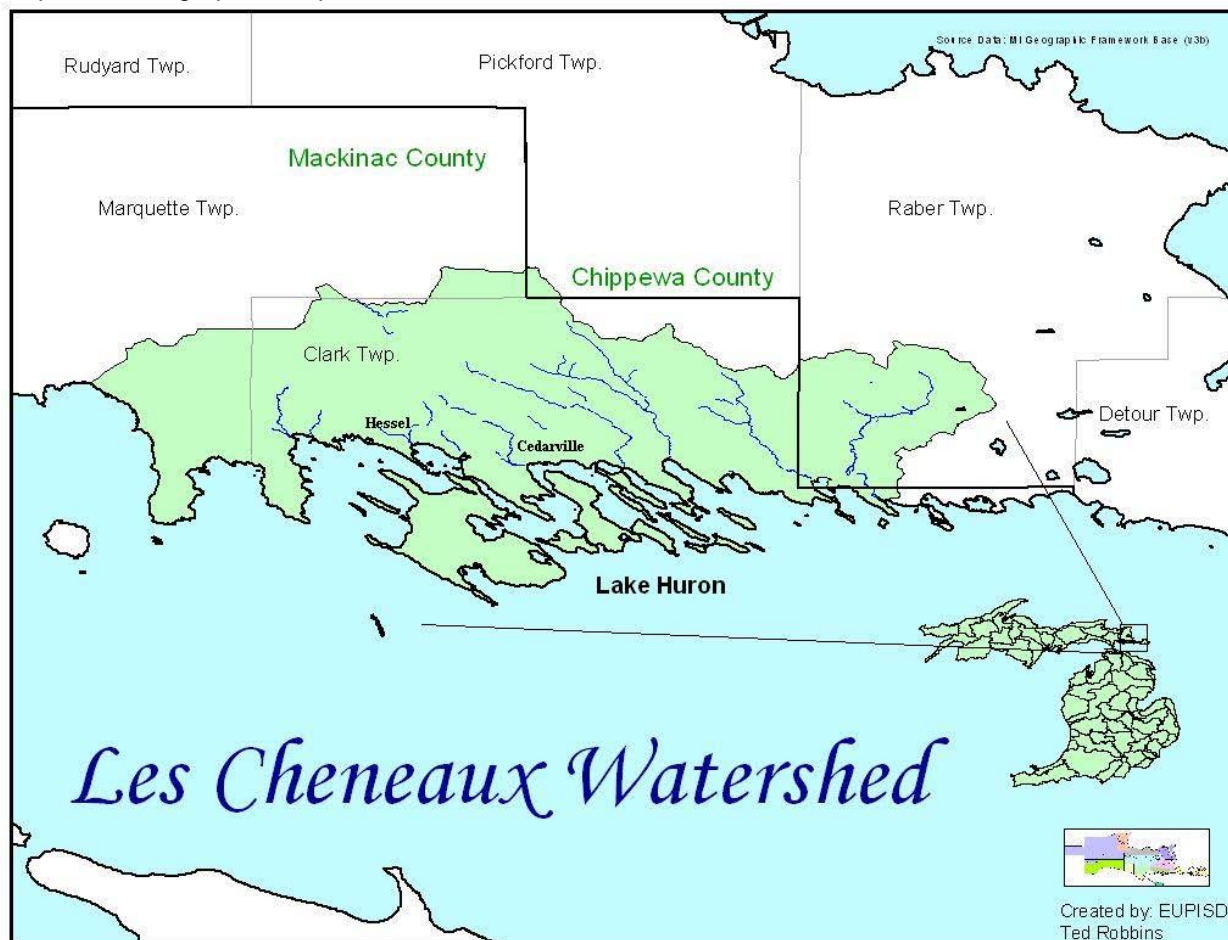
The islands area is strewn with bays, coastal marshes, dune and swale communities, rock and sand beaches, fens, swamps, peat bogs, and relatively undamaged northern forests. In fact, natural features inventories indicate that some of the best examples of Great Lakes coastal marsh, interdunal wetlands, and northern fen remain intact in the watershed.

These habitats support numerous rare species, including bald eagles, ospreys, wolves, colonial nesting birds, caspian and black terns, threatened fish species, and moose. The coastline supports such threatened flora including dwarf-lake iris, Houghton's goldenrod, Pitcher's thistle, Hart's tongue fern and the Lake Huron tansy. The State of Michigan also recognizes several areas within the watershed as environmental areas (Artizone), including parts of St. Martin Bay, Mismar Bay, Mackinac Bay, Goose Island, Voights Bay, Duck Bay, Sheppard Bay, Scottys Bay, Crow Island, and Prentiss Bay (TNC 1993).

Geographic Scope

The Les Cheneaux watershed drains approximately 115 square miles within the Carp-Pine watershed. The watershed covers all of Mackinac County's Clark Township (80 square miles) and approximately 35 square miles in both Marquette (Mackinac) and Raber (Chippewa) Townships. The project area is bordered on the west by the Nunn's Creek watershed, to the east by several lake drainages including Trout and Albany Creeks, and to the north by the Munuscong watershed, which drains into the St. Mary's River. The most concentrated developments within the watershed are located at the villages of Cedarville and Hessel.

Map 1.1 Geographic Scope

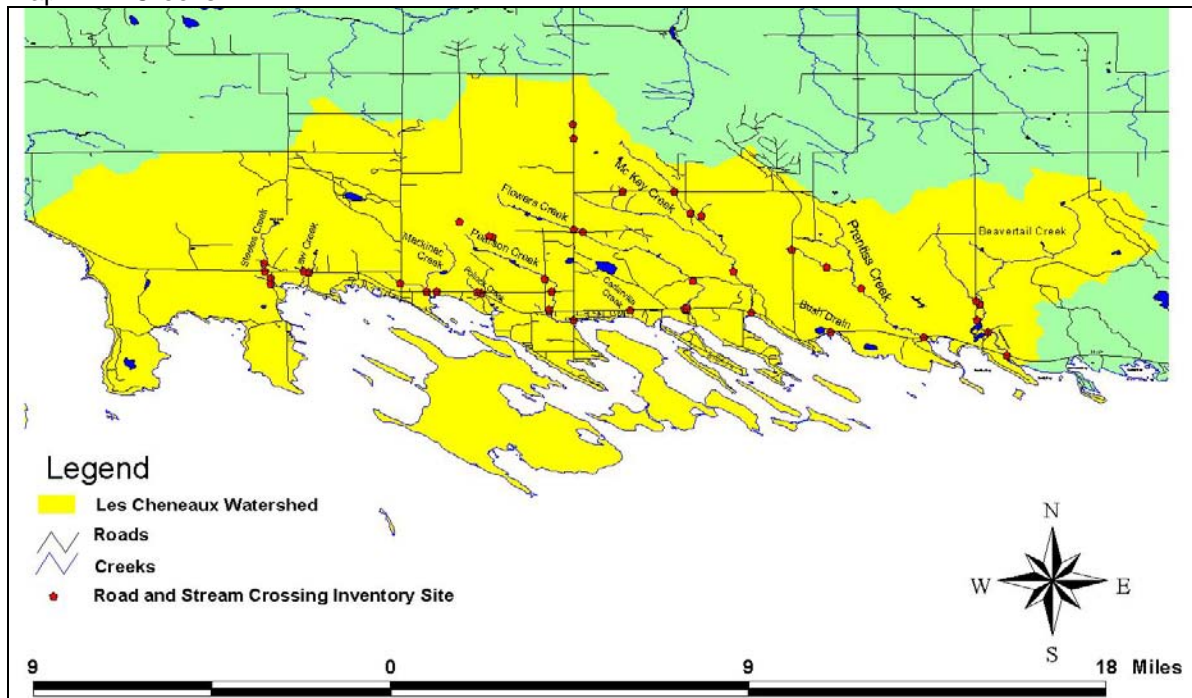


Hydrology

The watershed can be broken up into distinct sub-watersheds, which are each drained by their own respective low gradient creek. These creeks include Steeles Creek, Law Creek, Mackinac Creek, Pollock Creek, Pearson Creek, Cedarville Creek⁴, Flowers Creek, McKay Creek, Prentiss Creek, and Beavertail Creek as well as several shoreline drainage regions. Chemical and biological surveys completed by project volunteers, Les Cheneaux Community Schools, and MDEQ personnel indicated that these surface waters and their aquatic wildlife are relatively healthy and enjoy a relatively good diversity of macro-invertebrates (MDEQ, LCCS).

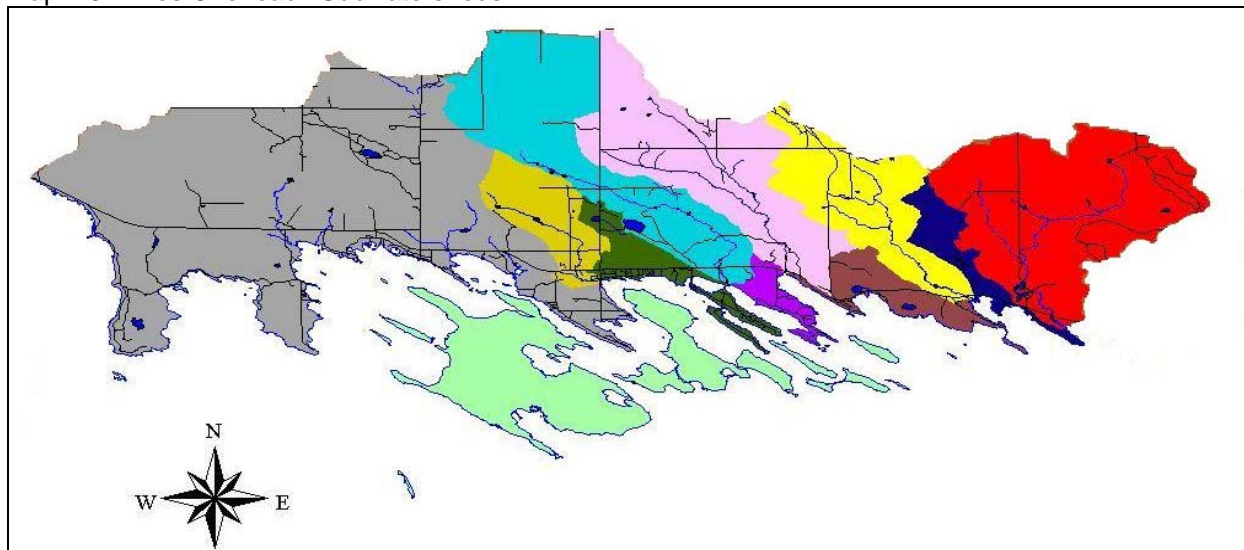
⁴ Cedarville Creek name is only used for reference in this report. There is no nomenclature documentation of this water body.

Map 1.2 Creeks



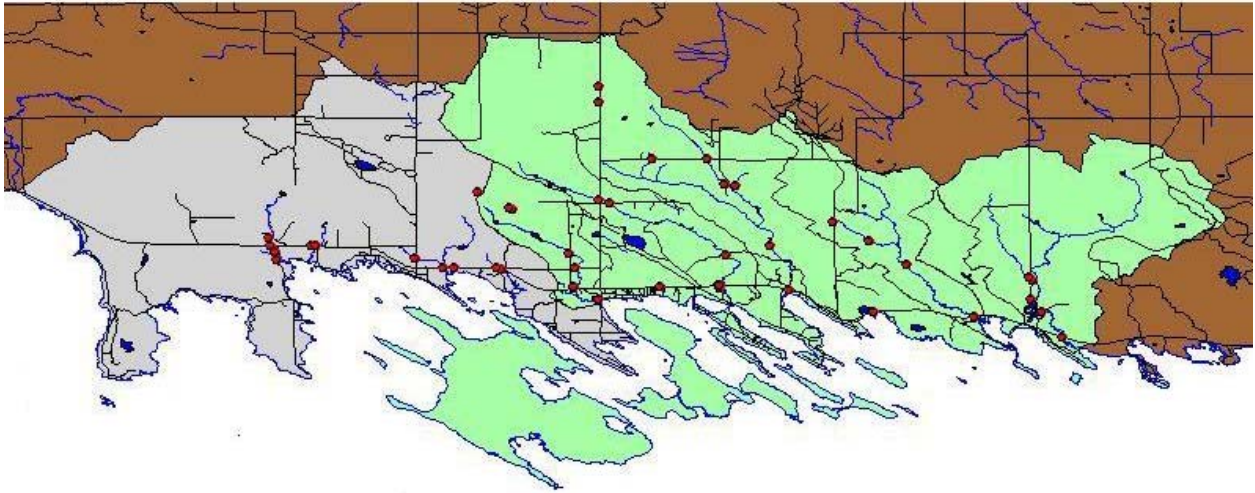
Source: MDNR, Michigan Resource Information System (MIRIS)
Adapted by the LCWC

Map 1.3 Les Cheneaux Subwatersheds

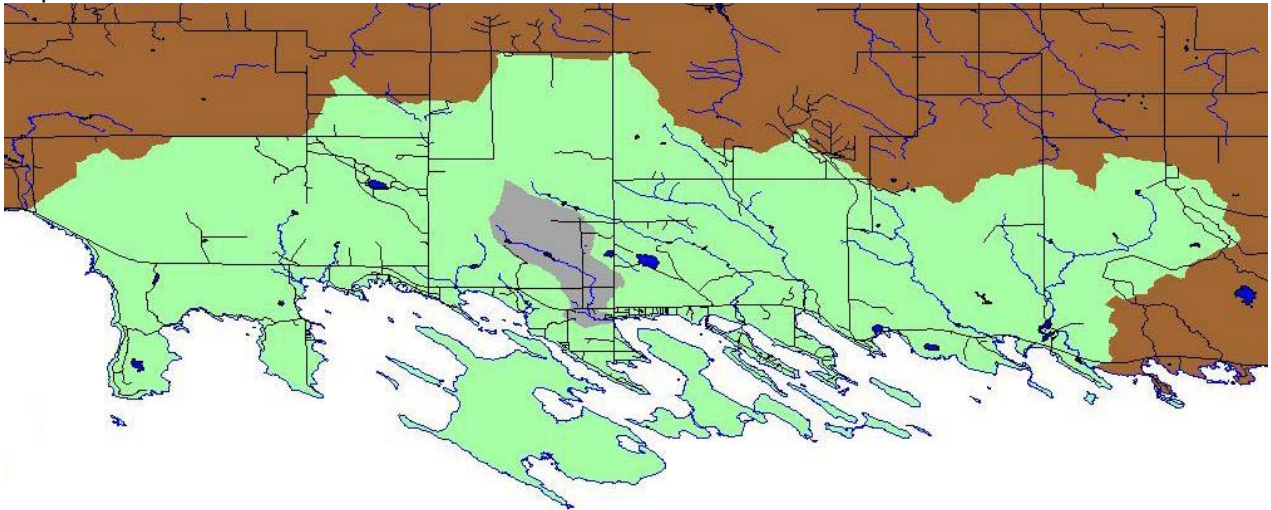


Source: MDNR, Michigan Resource Information System (MIRIS)
Adapted by the LCWC

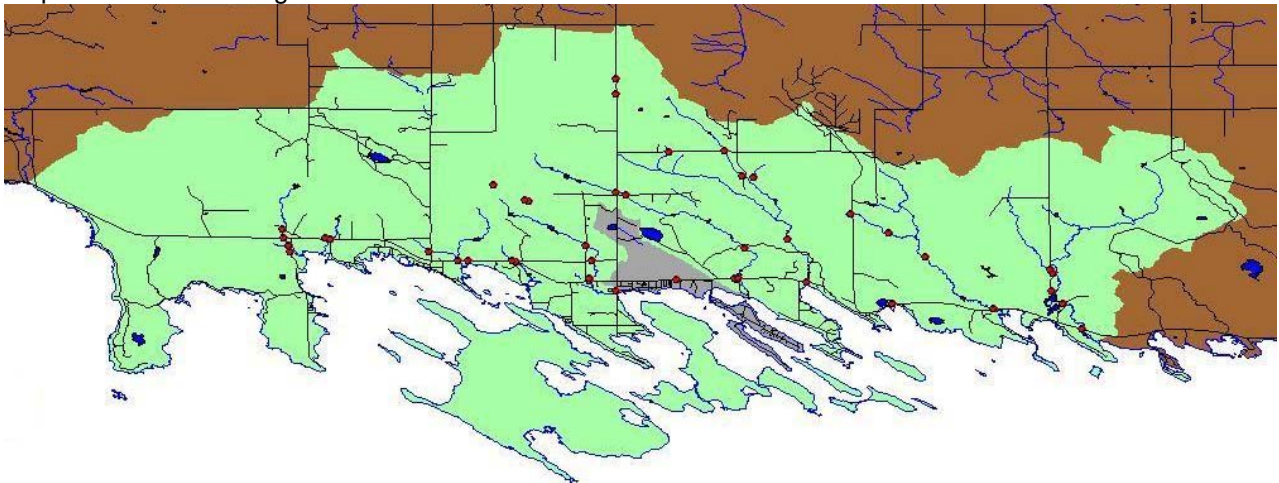
Map 1.4 Lake Drainage Area – Steeles, Law, Pollock and Mackinac Creeks



Map 1.5 Pearson Creek Subwatershed

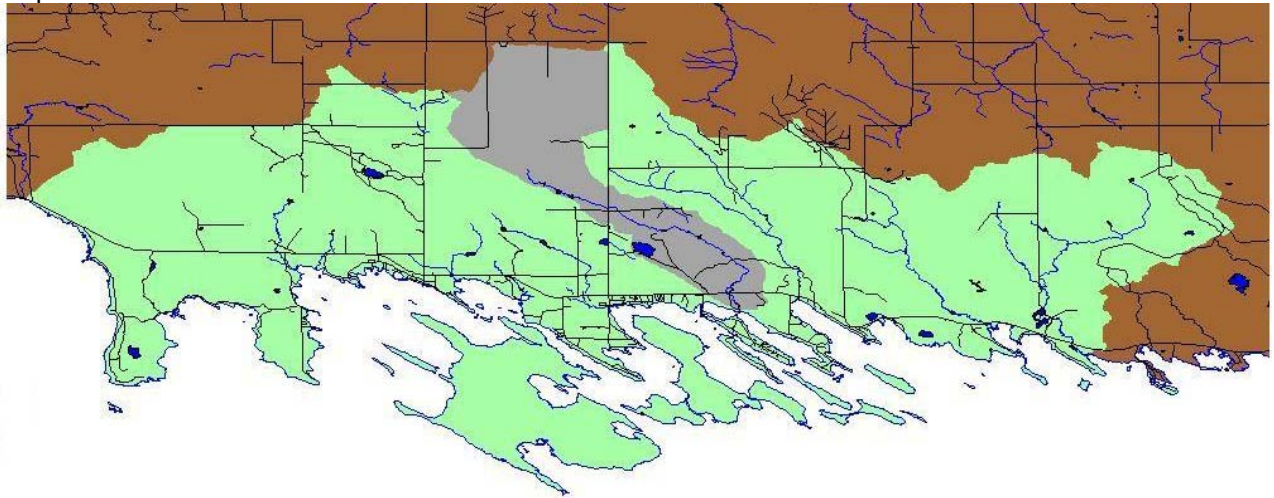


Map 1.6 Lake Drainage Area – Cedarville Creek

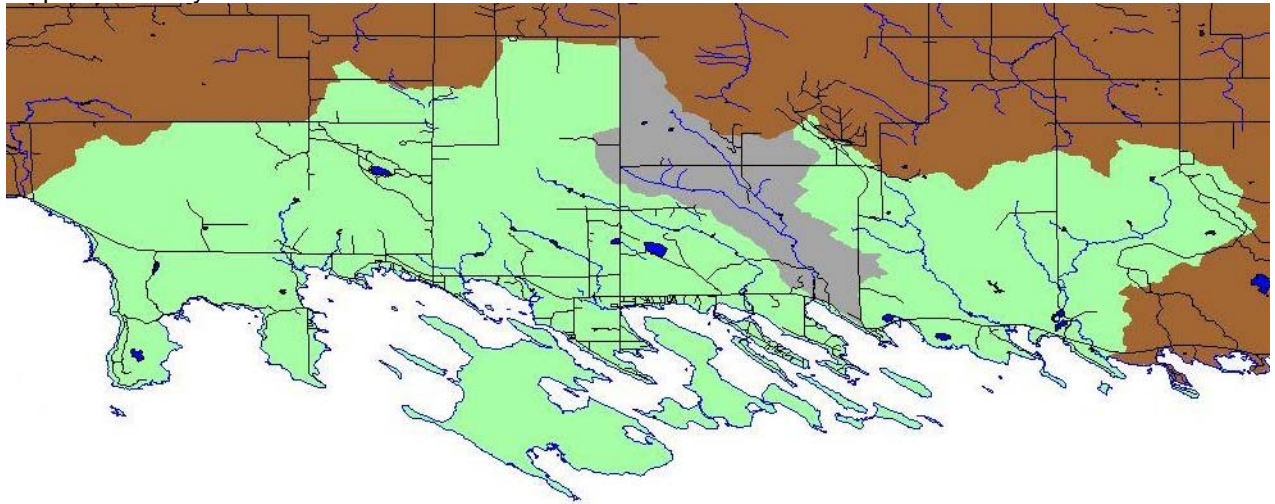


Source: MDNR, Michigan Resource Information System (MIRIS)
Adapted by the LCWC

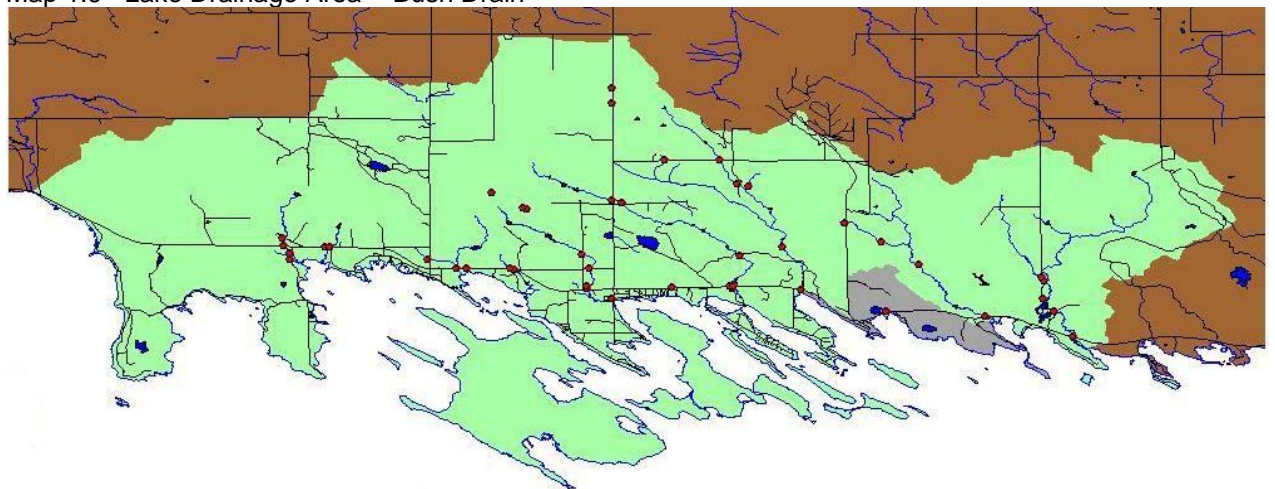
Map 1.7 Flowers Creek Subwatershed



Map 1.8 McKay Creek Subwatershed

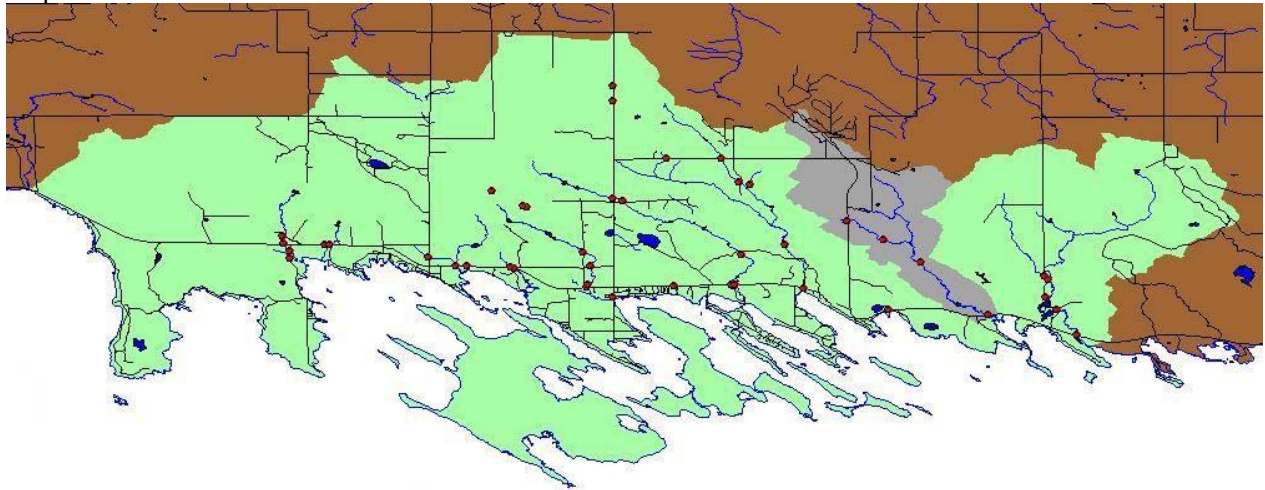


Map 1.9 Lake Drainage Area - Bush Drain

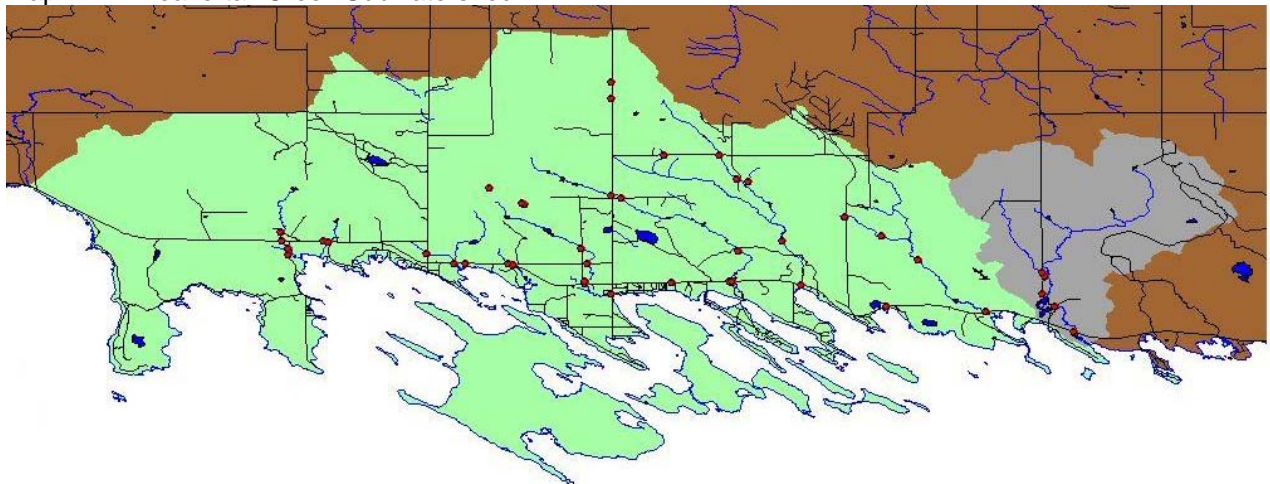


Source: MDNR, Michigan Resource Information System (MIRIS)
Adapted by the LCWC

Map 1.10 Prentiss Creek Subwatershed



Map 1.11 Beavertail Creek Subwatershed

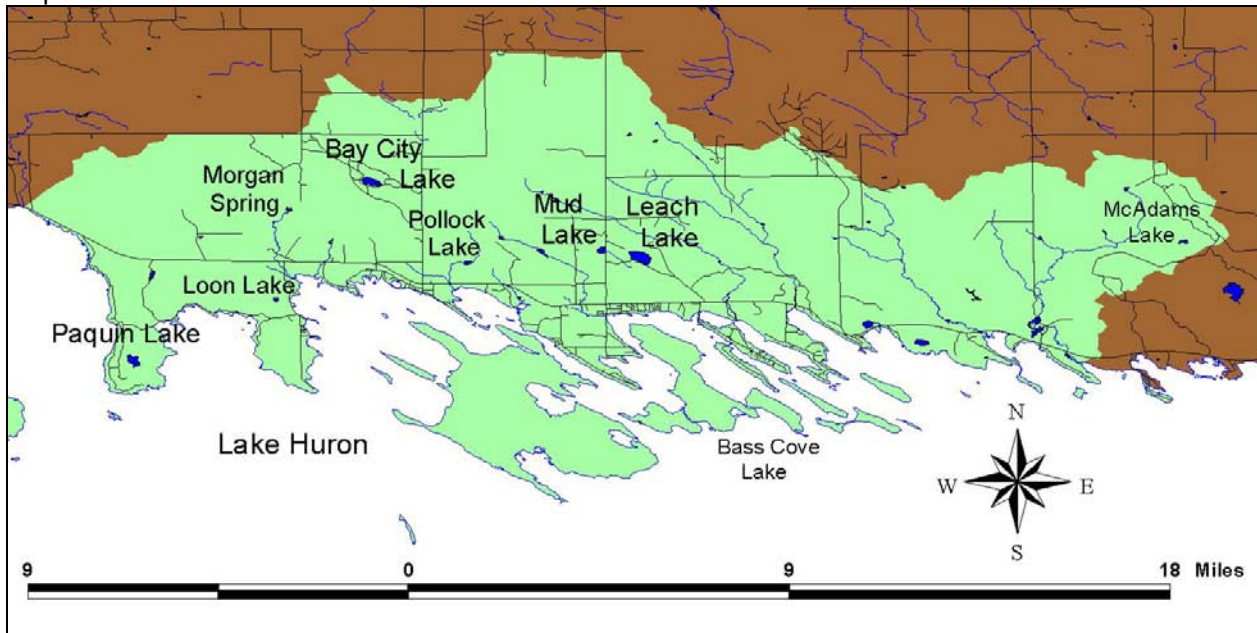


Source: MDNR, Michigan Resource Information System (MIRIS)
Adapted by the LCWC

The principle water source for these creeks is groundwater, so flows are relatively stable, year around. That groundwater occurs in several aquifer layers below the ground's surface. A shallow unconfined aquifer underlies the ground surface in areas of glacial drift, including the higher elevated areas at the north end of the watershed. Where this shallow aquifer intersects the surface in topographical depressions or valley bottoms between ridges, the resulting water materializes as creek or contributing spring. Groundwater is of special concern in the watershed due to past on-site well bacterial contamination, the prevalence of older on-site septic systems, and the limitations of the geographic area to sustain residential development and accompanying infrastructure. As a result, the watershed community adheres to a moratorium on drilling wells less than 100 feet and special well casing protective measures (LMAS 2004).

Inland lakes throughout the watershed include Bay City Lake, Mud Lake, Bass Cove Lake, Leach Lake, Loon Lake, Pollock Lake, McAdams Lake and a few small, unnamed lakes.

Map 1.12 Lakes



Source: MDNR, Michigan Resource Information System (MIRIS)
Adapted by the LCWC

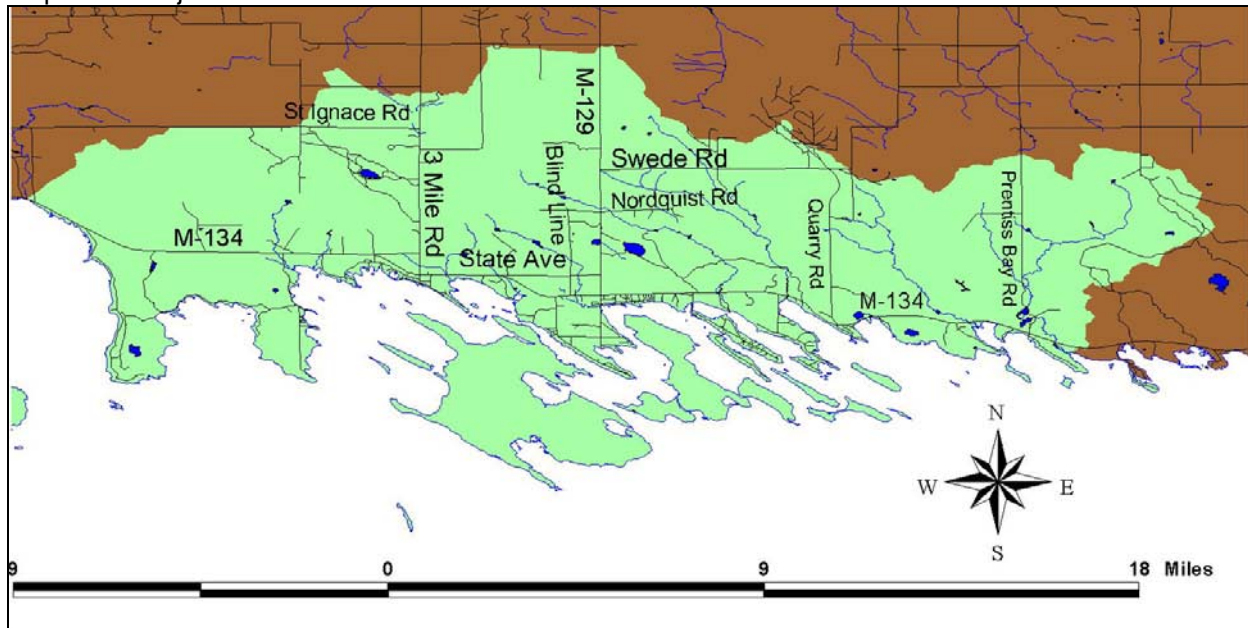
Land Use

Much of the watershed is covered with second growth timber (71%), primarily upland conifer, cedar, aspen, and maple. Over 16% is classified as some form of wetland, the majority of which dominated by lowland conifers. Agriculture is scarce, accounting for only about 1% of the total land area. The urban landscape makes up about 8% of the total acreage in the landscape. The remaining 4% consists of open and barren lands (CTPC Comprehensive Plan 1994; EUPRPDC 1997).

The urban landscape includes the two small villages, Cedarville and Hessel, that are joined by M-134, a state trunk line that intersects the entire watershed from west to east. The other major road is M-129, which runs directly north and south through Cedarville. Cedarville is located at the approximate center of the watershed and enjoys the most activity of the population centers, including Les Cheneaux Community Schools (LCCS). The majority of development and growth is occurring along both highways as well as to the north on Three Mile Road, which runs directly north of Hessel. According to Eastern Upper Peninsula Regional Planning and Development Commission's (EUPRPDC) *Comparison Analysis of Land Use in Clark Township*, residential areas are also expanding along West St. Ignace Road, West Chard Road, Swede Road, and Nordquist Road.⁵ Additional growth is occurring along the shoreline and expanding more to the Les Cheneaux Islands. The growth patterns determined through this study suggest a need for zoning revisions along the lakeshore in Clark Township. Suggestions include a waterfront or shoreline district should be added to existing districts, and developed in a manner that provides the township with as much control as is legally acceptable over future development along the Great Lakes shoreline. (EUPRPDC 1997).

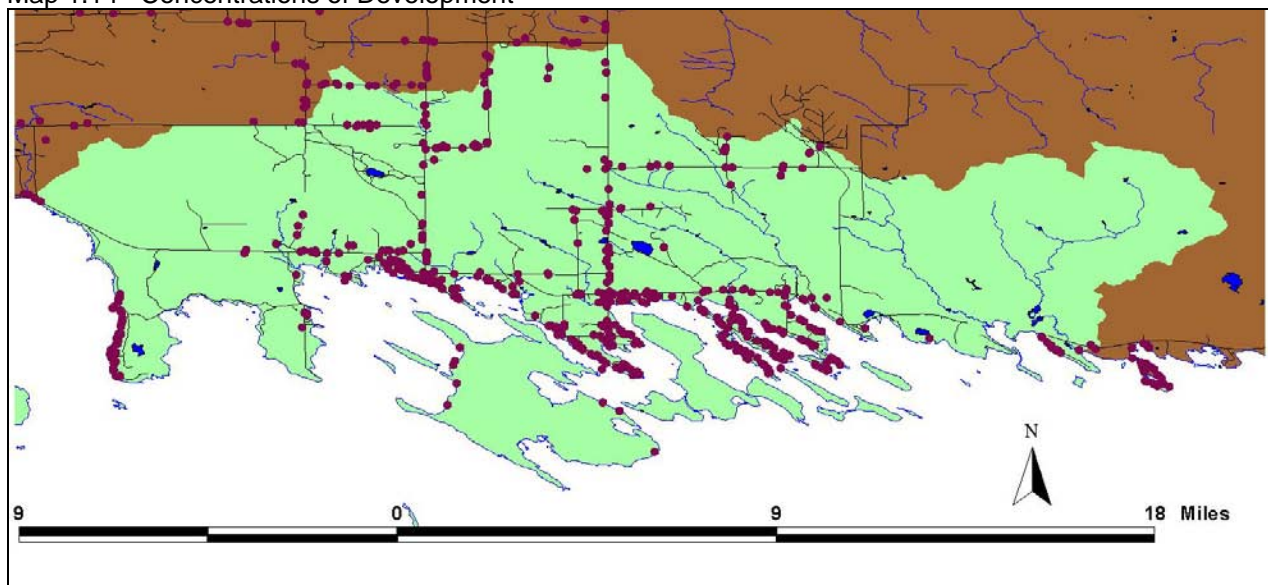
⁵ Two types of urban settings were classified in this study and are generalized as one for this determination. "Growth" includes residential and business developments as well as roads, outdoor recreation areas and cemeteries.

Map 1.13 Major Roads



Source: MDNR, Michigan Resource Information System (MIRIS)
Adapted by the LCWC

Map 1.14 Concentrations of Development

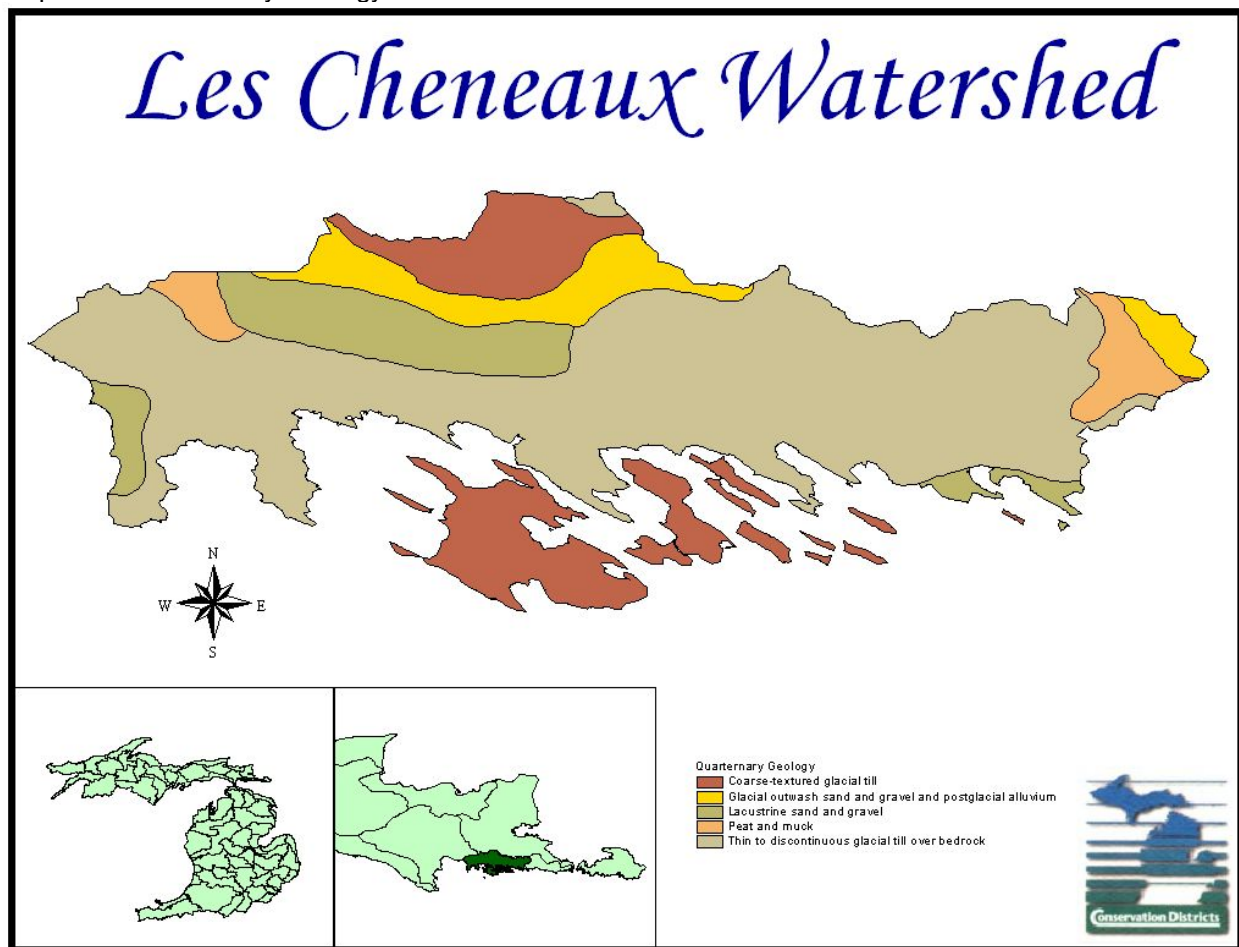


Source: MDNR, Michigan Resource Information System (MIRIS) – Well logs.
Adapted by the LCWC

Physiography

Walk through the Les Cheneaux watershed and you'll notice characteristics of the Niagaran Escarpment within which the watershed is located. The Niagaran Escarpment is a complex landform consisting of sedimentary bedrock of marine (salt water) origin overlain by glacial deposits. More specifically, the geology of the watershed consists of a thin mantle of lacustrine clays and sands underlain by Paleozoic sedimentary limestones, dolomites, shales, and sandstones. Limestone and dolomite of the Middle Niagara Series forms the bedrock surface of the watershed, covering cherty dolomite of the Manistique and Burnt Bluff Groups. The limestones, dolostones, shales and sandstones of the Niagaran Escarpment bedrock date from the Ordovician and Silurian Periods. They were formed between 425 and 450 million years ago when the area was inundated by a tropical salt-water sea. However, the watershed we see today was formed as a result of erosion that occurred over the last 250 million years. Softer shales have eroded away, leaving the more resistant limestone, which can be viewed at or near the ground surface throughout the watershed. In fact, more than half of the Les Cheneaux watershed area has bedrock within ten feet of the ground surface (St. Antoine 2004).

Map 1.15 Quaternary Geology

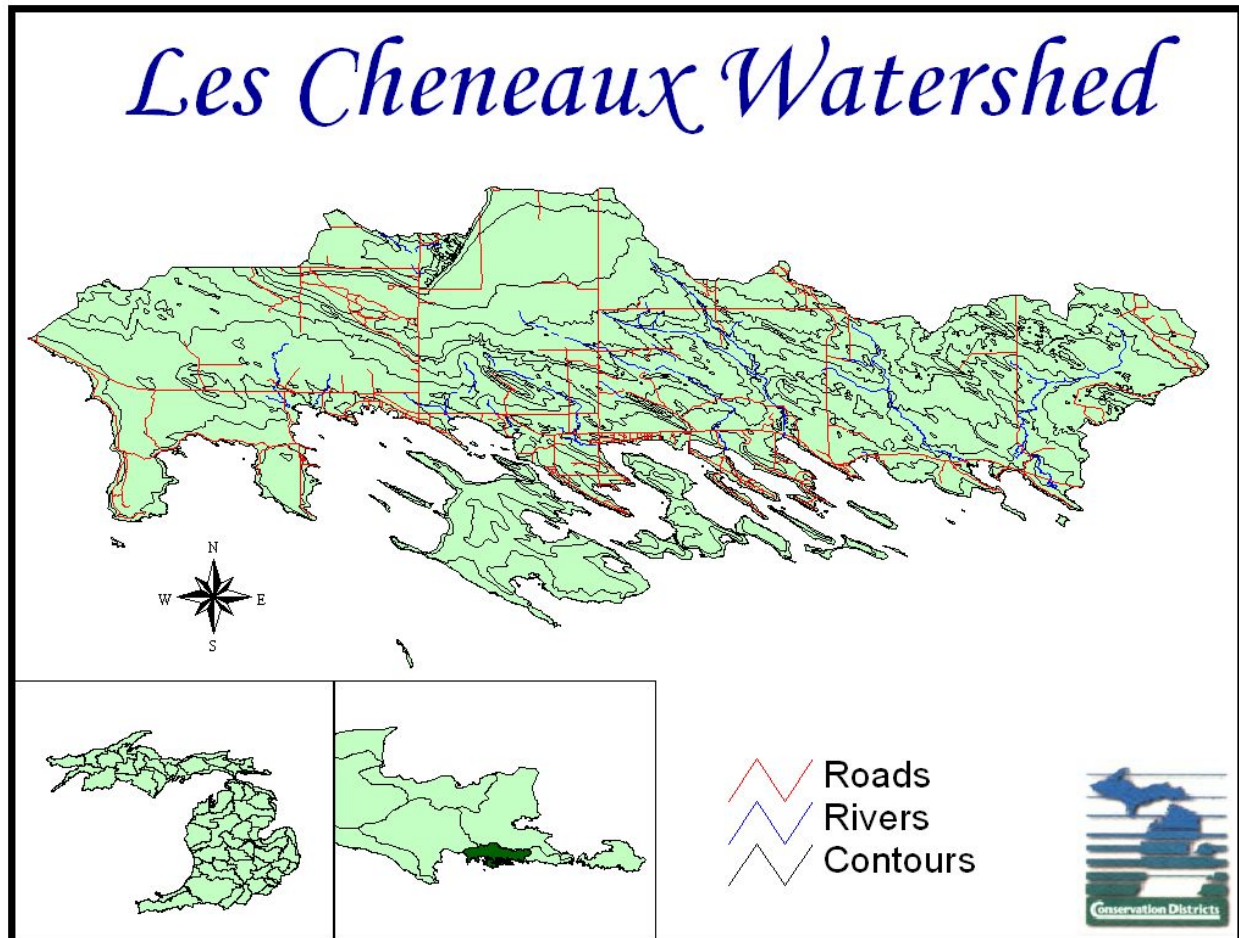


Source: MDNR, Michigan Resource Information System (MIRIS)

At the onset of the ice age, about two million years ago, the Niagaran Escarpment lay buried from time to time under several hundred yards of ice. However, the oldest Ice Age (glacial) deposits associated with the Escarpment today are less than 25,000 years old. The glaciers also left trademarks such as the polished, scratched and cracked bedrock surfaces. Boulders of granites (called erratics), were brought by the glaciers from Canada and lie haphazardly in forests and fields, may be seen many areas in the watershed (St. Antoine 2004).

Glaciers also influenced the level to gently rolling topography of the Les Cheneaux watershed. The hills and ridges, including the islands which rise out of Lake Huron (called drumlins) all are generally angled in a southeasterly direction and were formed by the underlying sediments being streamlined in the direction of the glacial movement by the advancing glacier. Retreating glaciers left behind deposits of lake plain sand, gravel and clay (till) in the form of various topographic features – or moraines - that cover the Les Cheneaux watershed bedrock. These moraines of the Les Cheneaux Watershed lack the steep inclines, which can contribute to erosive conditions. Gently rolling plateaus with slopes of less than 10% dominate the landscape. The elevation of the region ranges from 580 feet above sea level to approximately 1000 feet in the northwest half of the watershed near the Rockview Ridge area. The islands, with their elaborate system of cobble beaches and exposed bedrock, consist of elevations around 50 to 60 feet above lake level (St. Antoine 2004; CTPC Comprehensive Plan 1994).

Map 1.16 Contours

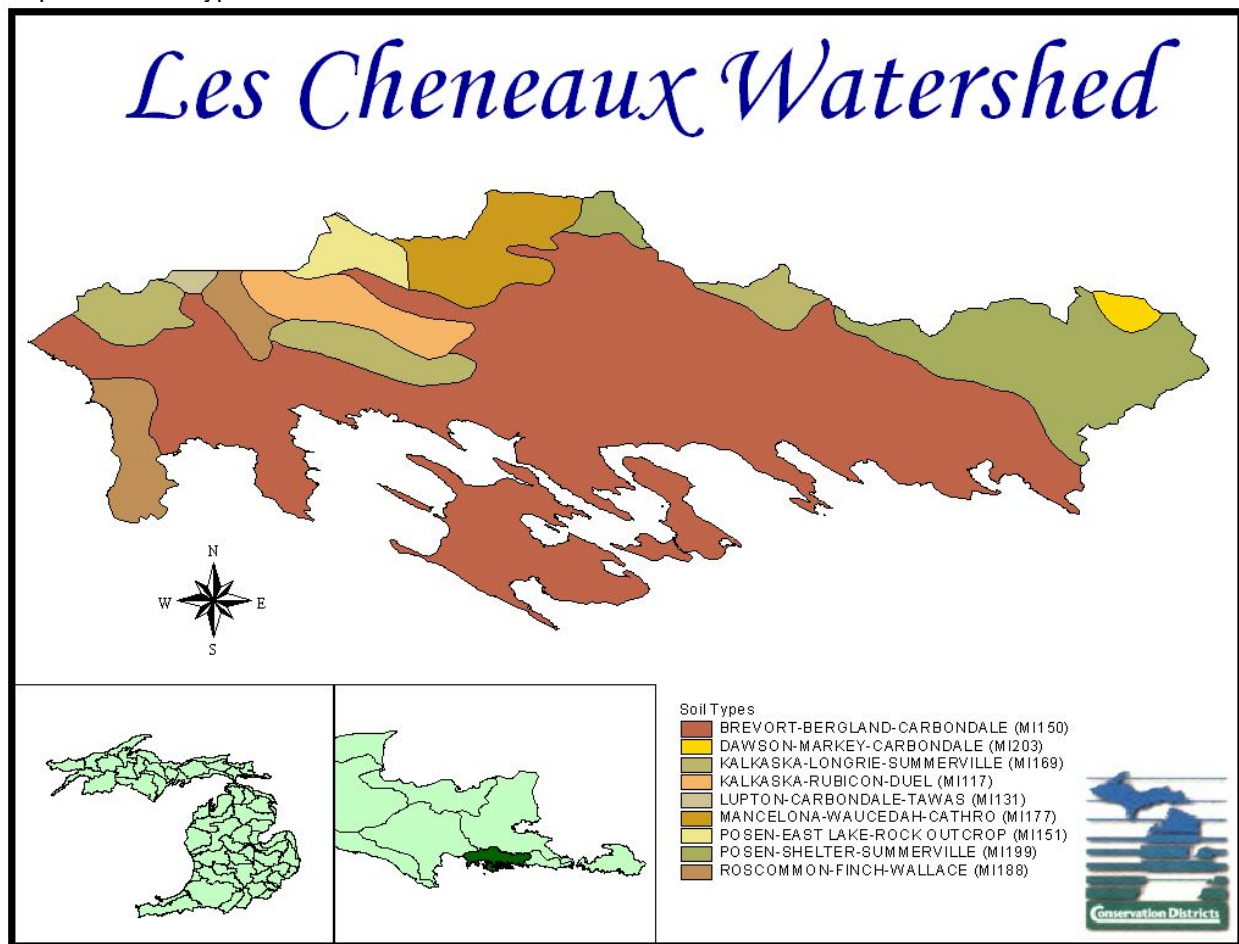


Source: MDNR, Michigan Resource Information System (MIRIS)

Topography

What we gain from the glaciers in the aesthetics of our landforms, we lose in potential for effective use of these landforms in terms of development. The lack of soil cover allows water to seep into cracks in the carbonate bedrock (i.e. limestone or dolomite). Over thousands of years, rain falling through the atmosphere, picks up carbon dioxide (CO_2), which dissolves in the droplets. Once the rain hits the ground, it percolates through the soil and picks up more CO_2 to form a weak solution of carbonic acid: $\text{H}_2\text{O} + \text{CO}_2 = \text{H}_2\text{CO}_3$. The infiltrating water naturally exploits any cracks or crevices in the rock. Over long periods, with a continuous supply of carbon dioxide enriched water, carbonate bedrock begins to dissolve. Openings in the bedrock increase in size and an underground drainage system begins to develop, allowing more water to pass, further accelerating the formation of karst. Eventually this underground water moving by laminar flow within narrow fissures leads to the development of subsurface caves (PICD). This geological process, which has occurred over many thousands of years, has resulted in unusual surface and subsurface features ranging from sinkholes (i.e. Swede Road), vertical shafts, disappearing streams (i.e. Flowers Creek), and springs, to complex underground drainage systems and caves. Add to this the fact that much of our watershed contains very little glacial till, which leaves too little filtering soil for ridding surface waters of contaminants before entering the groundwater through the cracks of the limestone. The thin, excessively permeable soil cover that occurs in the area includes stony (calcareous) soils throughout, as well as sandy soils to the north of the watershed consistent with the Carbondale-Shelter-Alpena Association indicated by the Mackinac County Soil Survey (USDA 1987, 1993).

Map 1.17 Soil Types



Source: MDNR, Michigan Resource Information System (MIRIS)

Climate

The Les Cheneaux watershed being directly adjacent to northern Lake Huron, enjoys a relatively milder climate than its upland regions. The area enjoys cooler springs with later leaf-flush and less chance of frost. The autumn warm season tends to be longer as is the growing season (period in which the average temperature each day exceeds a base temperature (50 degrees F)) (USDA 1987, 1993). In winter, snowfall is lower compared to upland areas as little as 10 miles north. In fact the watershed realizes an average snowfall of 70 inches per year compared to over 180 inches for neighbors to the north (Lake Superior watershed). The average rainfall per year is approximately 26.9 inches, with the majority of that falling between April and September. Average temperature is 41 degrees F with the winter average being a cool 19.5 degrees and the summer average being 63 degrees F (USDA 1987, 1993).

Socio-Economical Character

According to the U.S Census Bureau (2000), Eastern Upper Peninsula Regional Planning and Development Commission, the Clark Township Master Plan, and Corporation for Enterprise Development (CFED), the Les Cheneaux watershed's economic prosperity is directly linked to the beauty, abundance, and health of the area's natural resources. Over 60% of the community's employment centers on resource utilization and recreation. Traditional economic factors in the watershed include Michigan Limestone Operations' limestone extraction operations, lumbering and other wood-related operations, as well as recreation and resort-oriented economic activities (CFED 1998; CTPC 1994). In the past, a thriving perch fishery drew fishermen and helped sustain the economy. However, in the 1980's the bottom dropped out of the fishery, ultimately changing economic resources. The change spurred community leaders into planning for sustainable growth with the desire to protect natural resources. This sustainable development planning revealed the dependency of the local economy on the areas' natural resources (CFED 1998).

Despite the change in the local economy, the resident population has changed little over the past few decades. The full-time resident population of the Les Cheneaux watershed is approximately 2,200 people, with approximately equal numbers male and females, with a median age of 44.6 years. Over 88% of the residents have at least a high school diploma with almost 20% attaining a bachelor's degree or higher (Census Bureau). According to EUPRPDC, there are 739 seasonal dwellings in the watershed, with an approximated 3.2 visitors per dwelling, or 2,364 tourist visitors. On a beautiful summer day, the 259 resorts, motels and campgrounds, consisting of 1,295 rental units could bring that total up by 2,000 people (EUPRPDC-Clark Plan updates).

Chapter 2 - Designated Uses, Desired Uses, Pollutants - Their Sources and Causes

2.1 Designated Uses in the State of Michigan

The primary criteria for water quality, according to Michigan's Department of Environmental Quality, is whether the waterbody meets certain designated uses. The Water Resources Commission Act (P.A. 451 of 1994, Part 31, Chapter 1) requires all waters of the State of Michigan to be of the quality to meet eight designated uses (2000). The Les Cheneaux watershed project is a direct result of community concerns over these following designated uses and the pursuit of several community-based desired uses for the watershed.

Table 2.1.1. Designated Uses for Surface Waters in the State of Michigan

All surface waters of the State of Michigan are designated for and shall be protected for all of the following uses⁶:

1. Agriculture
2. Industrial water supply
3. Public water supply at the point of intake
4. Navigation
5. Warmwater fishery (Some waterbodies are also protected as a coldwater fishery⁷)
6. Other indigenous aquatic life and wildlife
7. Partial body contact recreation
8. Total body contact recreation between May 1 and October 1

2.2 Watershed Concerns

Early in this project's planning phase, the Les Cheneaux community, including several civic organizations, business owners, landowners, and local, state, and federal agency personnel were solicited for involvement in watershed protection planning and to confirm their water quality concerns and desired uses for the watershed. Local and regional agencies were also contacted to request existing documentation of watershed conditions. In January 2003 an initial public meeting was also held to invite individual landowners to express their concerns and provide direction for the project through participation with a steering committee. The group prioritized the following concerns and determined the corresponding water quality impacts.

Table 2.2.1. Watershed Concerns/Impaired and Threatened Designated Uses

Watershed Concerns	Threatened Designated Uses
Contaminated aquifers	Public water supply (private wells)
Elevated bacteria levels	Public water supply (well and surface water intakes), body contact recreation
Poor fishing	Warm/coldwater fishery and indigenous aquatic wildlife
Algal blooms	Warm/coldwater fishery, indigenous aquatic wildlife
Invasive species	Navigation, coldwater fishery, other indigenous aquatic life and wildlife
Loss/degradation of Habitat	Warm/coldwater fishery, other indigenous aquatic habitat

2.3 Desired Uses

Along with designated uses, desired uses were identified in the watershed. Desired uses constitute how the community might want the watershed to look like, the character of the watershed, etc. The desired uses of the watershed center around the community's desire to promote the natural features and aesthetic qualities of the area (CFED). Meetings with civic groups, the steering committee, and one-on-

⁶ If a body of water or stream reach is not meeting the water quality standards set for a specific designated use, then it is said to be in 'non-attainment'. An bi-annually published listing of the bodies of water and stream reaches in the state of Michigan that are in non-attainment, can be found in the MDEQ's "integrated report (MDEQ 2006).

⁷ Fishery will be classified as warm/coldwater in this plan based on Michigan DNR Fisheries Biologist suggestion based on species composition and typical water temperature regimes.

one discussions with business owners and landowners determined that the following themes consistently pervaded through the different suggestions:

Preserve the nature-based aesthetic character of the Les Cheneaux Islands area, which sustains the environmental and socio-economic livelihood of the community.

The community's livelihood and economy historically depended upon nature based tourism, specifically, fishing. With the decline in that fishery, the community sought alternative sources for sustainability and answers to the fishery problem. Consequently, the community is committed to restoring the fishery and preserving that heritage through the preservation of natural resources, attract visitors, and sustain full time and seasonal residents.

Protect threatened and endangered species habitats in the watershed.

The Les Cheneaux watershed supports a myriad of unique flora and fauna species and their habitats. Maintain and enhance that exclusive distinction.

Provide opportunities for public enjoyment of aquatic resources including fishing, hunting, bird watching, swimming, boating, hiking, camping, kayaking/canoeing.

Sustainability of the Les Cheneaux community depends upon tourist and resident enjoyment of natural resource recreation. Maintain and enhance available opportunities.

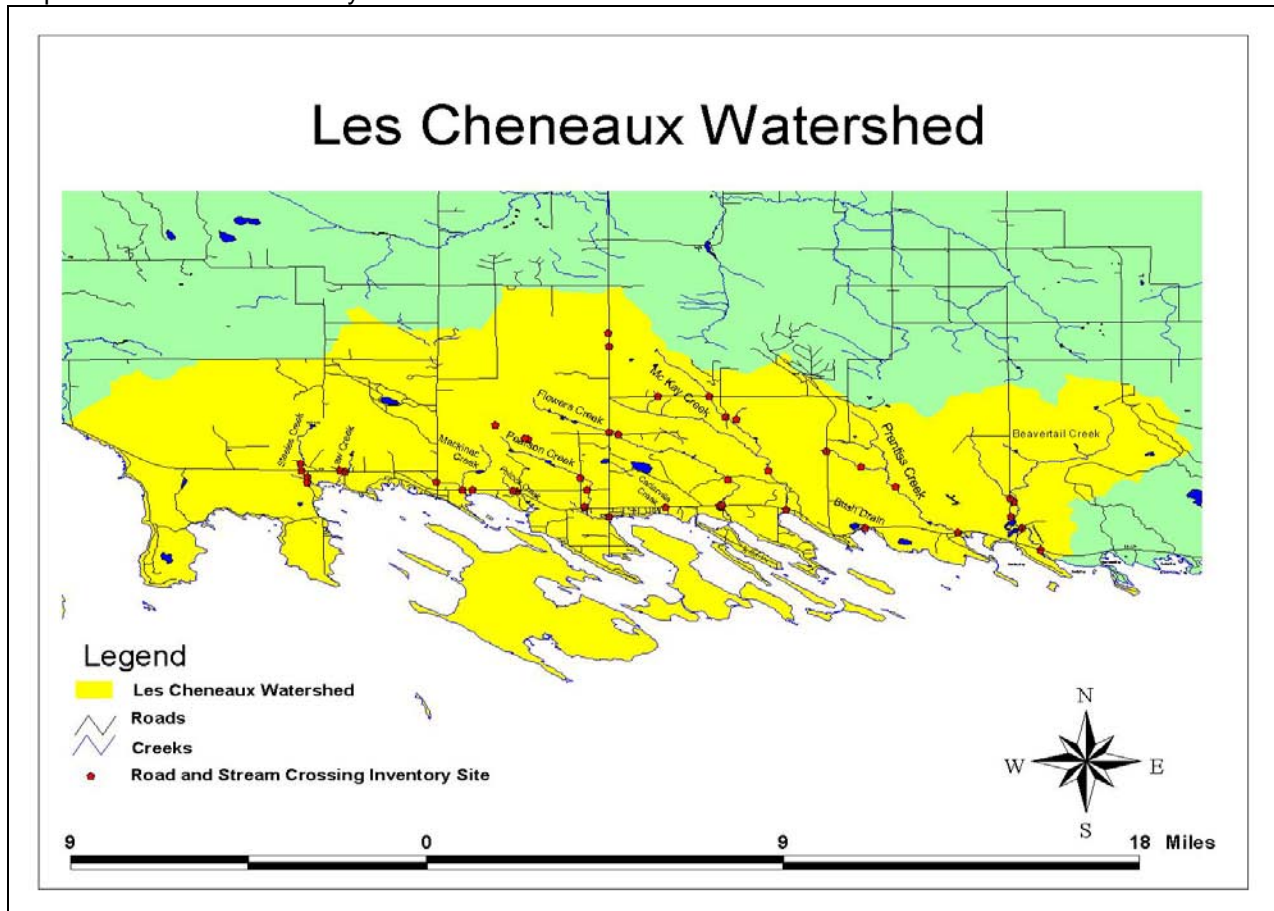
2.4 The Address of Concerns: Inventory of the Watershed

In the spring of 2003, the project manager and members of the project steering committee enlisted Les Cheneaux community volunteers from several sources to investigate watershed concerns and confirm community support for aforementioned desired uses. Project participants included Les Cheneaux Community Schools, several civic organizations including Les Cheneaux Islands' Association, Islands Wildlife Association, and the Artisans Cooperative, and Lake Superior State University. Volunteers joined the project manager in walking alongside creeks looking for erosion sites and habitat degradation, surveying Great Lakes shoreline, attending focus meetings with local health departments, MDEQ and MDNR personnel, and performing chemical and biological assessments of area surface waters. The following sections summarize details of the inventory and the resulting pollutant loads, prevalence of sources, and the conditions of designated uses.

Creek Survey

A watershed survey was performed with guidance from the MDEQ Stream Crossing Watershed Survey Procedure (2000). Creeks in the watershed were surveyed from sites where roads crossed their courses as well as along their courses where accessible. Observations determined that many of the actual road stream crossing structures were impacting the integrity of several creeks in the watershed, including the embankments, or the culverts, or the road surface. A road/stream assessment was completed at each road/crossing throughout the watershed using protocols and data sheets used by a previous survey completed by the Huron Pines Resource Conservation and Development Council (RC&D 1996). The *Road and Stream Crossing Inventory* (see appendix) includes a description of current conditions, pollutant loads, and recommended BMP's at each crossing in the watershed. Suggestions are also summarized on the BMP Cost sheet and within chapter 7 of this report. Using MDEQ's *Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual*, it was determined that 199 tons of sediment per year is coming from 27 road/stream crossings in the Les Cheneaux watershed (MDEQ 1999). Recommended treatments to stabilize the road crossings and reduce erosive conditions total over \$1,200,000 (MCRC and CCRC 2006).

Map 2.4.1. Creek Survey Sites

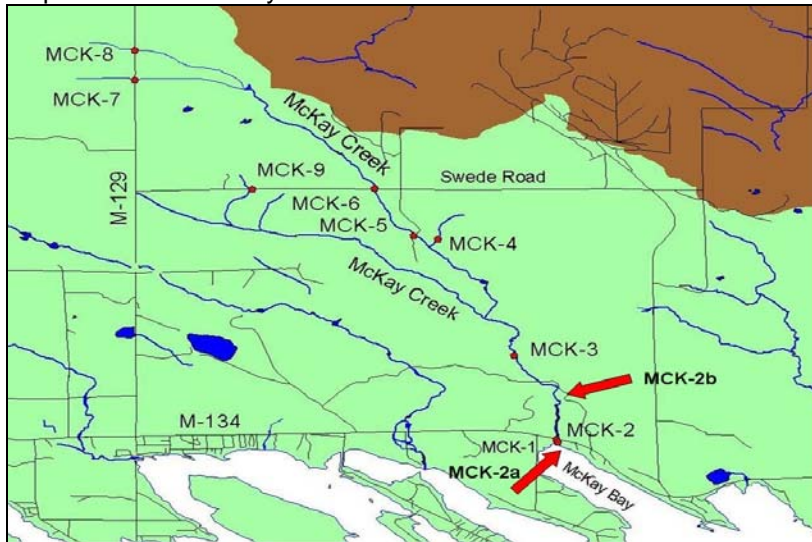


2.4.1. Summary of Road/Stream Crossings

Type of Crossing	Count	Estimated Cost	Estimated Pollutant Load Reduction/year
Total Number of Crossings	45	\$1,369,630	199 tons
High Priority Crossings	19	\$ 947,880	193 tons
Low Priority Crossings	8	\$ 421,750	6 tons
No Treatment	18		

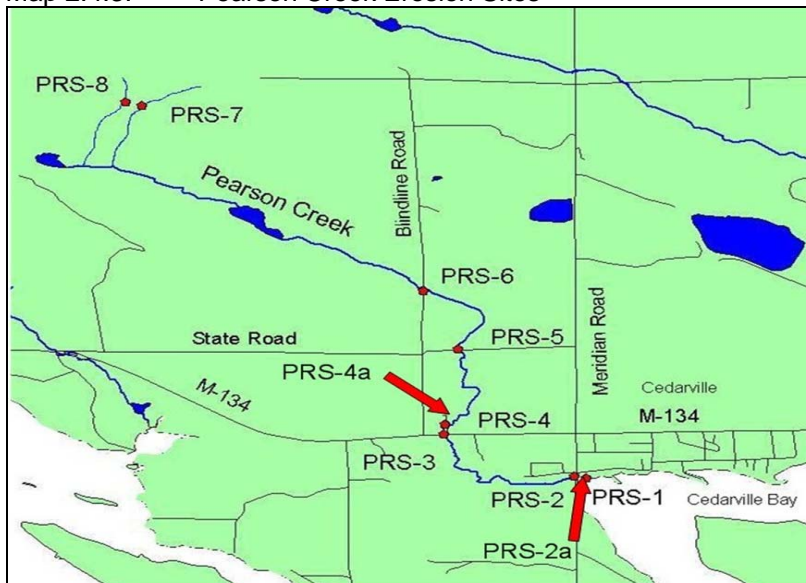
Creek corridors were also inventoried to determine priority areas for habitat protection and erosion and sediment control. Priority sites needing streambank stabilization include PRS-2a (Cattails Cove parking lot in Cedarville); PRS-4a (upstream of Perkins Bridge); MCK-2a (downstream of M-134); and MCK-2a ("clay banks" area approximately 0.5 miles north of the M-134 crossing) These sites are collectively contributing over 58 tons of sediment each year into their respective creeks and Lake Huron (MDEQ 1999). The LCWC will work with landowners to install riparian buffers and stabilize eroded stream banks at these locations at a cost of \$26,700 (CRA 2001) A water quality resource management plan (WQRMP) will be developed for each site. The plan will detail the proposed projects with site plans, cost estimates, and certified engineering plans for MDEQ approval.

Map 2.4.2. McKay Creek Erosion Sites



Source: MDNR, Michigan Resource Information System (MIRIS)
Adapted by the LCWC

Map 2.4.3. Pearson Creek Erosion Sites



Source: MDNR, Michigan Resource Information System (MIRIS)
Adapted by the LCWC

Stormwater Inventory

Rain and snowmelt that doesn't percolate into the ground or evaporate flows across the watershed and picks up pollutants that have accumulated on the land surface and washes them into receiving waters, including the creeks in our watershed and eventually Lake Huron. In the Les Cheneaux watershed, those pollutants are sediment, nutrients (phosphorus, nitrogen), and toxic materials like gas, oils, salts, and cleaners. These pollutants impact aquatic organisms and the quality of surface and groundwaters.

Most of the water that runs off the Les Cheneaux watershed is filtered by vegetation, since the majority of the land cover is in some form of significant vegetation. Wetlands and remaining forest cover are suitable for filtration of stormwater and significant wetlands still exist to help filter polluted stormwater. Urban infrastructure does exist in the watershed villages of Cedarville and Hessel. Streets within the villages are curbed and guttered with subsurface storm drainage pipes emptying into Lake Huron. These storm sewers help prevent rain and snowmelt from building and flooding urban areas, causing damage and transportation hazards. In addition, gravel roads exist adjacent the village areas with accompanying roadside ditching emptying sediments into area water bodies. These ditches lack adequate erosion control measures to curb their continued sedimentation into receiving waters.

Using geographic information systems (GIS) coupled with an empirical stormwater calculation model, *the Simple Method*, the project manager characterized the significance of stormwater pollution in the most urban areas of the watershed.⁸ Based on this empirical model, estimates of pollutants originating from the most developed parts of the watershed totaled over 90 tons per year of nutrients (phosphorous and nitrogen), 176 tons of sediment, and billions of coliform bacteria. To the contrary, partner communications with the Les Cheneaux Community illustrated the popular belief that point source pollution sources are the culprit for water quality degradation. Consequently, non-point stormwater pollution will be a major education and information component of the Implementation activity.

Shoreline Survey

Several volunteers boated, canoed, kayaked, and walked a significant portion of the 200 miles of Great Lakes shoreline over the course of two summers. The volunteers focused attention on observing pollution trends, including development, invasive species, eroding shoreline, and natural features. Attempts were made to identify and quantify *cladophora* algae to assess OSS wastewater pollution, but low water conditions hampered efforts. Instead, volunteers consulted watershed government officials, the Luce, Mackinac, Alger, Schoolcraft County Health Department (LMAS), local contractors, and information from local and state reports regarding on-site septic system failure to characterize pollution concerns from failing on site septic systems in the watershed. LMAS provided information from historical landowner correspondence and summaries of past septic installations, repairs, and improvements. Contractors provided historical accounts of septic system conditions on building projects.

The shoreline survey also addressed concerns over shoreline erosion and aquatic habitat loss. A local contractor and shoreline property owners provided assistance in assessing lakeshore building trends and the occurrence of accompanying erosion controls on lakefront building projects. At the onset of this inventory, several stakeholders had indicated that a source of sediments and habitat degradation was the lack of compliance with *Part 91, Soil Erosion and Sedimentation Control (SESC) of the Natural Resources and Environmental Protection Act, 1994, PA 451 As Amended* on lakefront construction sites⁹. Visual observations proved that very few erosion control measures were consistently installed, permitting tons of sediment to reach local water bodies.

The Clark Township Building Inspector was also consulted to assess the threat of near-shore/riparian zone habitat loss in the watershed. Estimates of loss were computed by averaging the number of building permits issued per year along shorelines and riparian zones and calculating the habitat loss based on the typical alteration of 100 foot property frontages (average shoreline lot frontage in watershed (CTCP). The entire frontage length was used since field reviews proved that typical building project impacts and

⁸ The Simple Method estimates pollutant loads for chemical constituents as a product of annual runoff volume and pollutant concentration, as: **Load=0.226(unit conversion factor) x annual runoff (inches) x pollutant concentration (mg/l) x area (acres)**

⁹ For building projects disturbing an acre or more or within 500 feet of a water body, a SESC permit is needed and soil erosion measures must be installed to eliminate pollution from reaching the surrounding water bodies. LMAS Environmental Health Agency is responsible for enforcing the law in the watershed.

accompanying infrastructure (boat traffic, dockage, dredging, and vegetation removal) impact at least 100 feet of frontage at each property (CTBA).

The survey revealed that the northern shoreline of Lake Huron is relatively intact with large areas of undeveloped land remaining. Unfortunately, over 1,000 tons of sediment is reaching the water from shoreline building projects and other activity each year and over 3,000 feet of shoreline is being developed each year. With these threats in mind, the Les Cheneaux Watershed Project will focus on slowing these trends through land protection strategies and creating a stewardship ethic among the community to comply with appropriate shoreline development regulation and low impact development techniques.

2.5 Summary of Threats to Designated Uses (Pollutants, Sources, and Causes)

Based on the watershed surveys, historical research documents, and personal interviews, the steering committee has determined that the Les Cheneaux watershed enjoys excellent surface water quality and currently meets all of the eight designated uses for water in the state. Unfortunately, this inventory work did identify that certain designated and desired uses are being threatened by a variety of human perturbations, landscape limitations, and lack of effective land use planning. Threatened uses include partial and total body contact recreation, warm/coldwater fishery and other indigenous aquatic life, navigation, and public water supply¹⁰.

Table 2.5.1. Condition of Designated Uses

Designated Use	Condition of Designated Use
Public water supply at the point of intake	Threatened (individual wells and surface water intakes-Lake Huron)
Navigation	Threatened (<i>Cedarville Bay</i>)
Warm/coldwater fishery	Threatened
Other indigenous aquatic life and wildlife	Threatened
Partial body contact recreation	Threatened
Total body contact recreation (May 1 / Oct 31)	Threatened

Public Water Supply at Point of Intake

The majority of Les Cheneaux residents have individual, private wells from which they obtain their domestic water supply. In addition, a few shoreline owners still obtain water through surface intakes from Lake Huron (EUPISD 2004). That supply has been impacted by bacterial contamination, nutrients, and toxins from several sources, including failing septic systems, the Clark Township municipal wastewater discharge, and untreated stormwater from the area watershed.

Failing On-site Septic Systems

Various categories of compromised on-site septic systems threaten the Les Cheneaux area drinking water: Old septic systems¹¹, inadequately designed systems, and failed systems (all characteristic of older developments), are all contributing insufficiently treated waste directly into surface waters. In fact, according to MDEQ's *The Status of the On-Site Wastewater Industry in Michigan (2001)*, almost 10% of systems in Michigan are failing. Speculating similarities with the Les Cheneaux area with 1,000 systems, that equates to approximately 100 systems¹², which serve 2.5 people per household, and thus 15,000 gallons of wastewater each day reaching drinking water supplies through failing systems (Sacks 2004). That wastewater contains, typically, 50mg/L of total nitrogen, 9 mg/L of total phosphorus, 100 mg/L of fats, oil and grease, .3 mg/L volatile organic compounds, and 100 million organisms/100ml of wastewater, and 1,000 to 10,000 infectious viral units/L (USEPA). In fact, the Luce-Mackinac-Alger-Schoolcraft County Health Department (LMAS) has issued a moratorium on well drilling into shallow aquifers due to the historical high occurrence of contaminated well water. Mr. Joe Davis, former LMAS sanitarian, indicated

¹⁰ There exists no common municipal water supply. This designates individual on-site water wells and surface intakes as public water supply.

¹¹ On-site septic systems over 25 years old (Davis 2004)

¹² According to Jim Landreville, Clark Township's wastewater treatment system manager, approximately 1000 area households depend upon the municipal wastewater system, leaving 1000 homes (2.5 persons) relying on on-site septic systems (Landreville 2004). Since the daily volume of on-site sewage disposal is 150 gallons per household system (USEPA), there are approximately 150,000 gallons of OSS wastewater produced in the Les Cheneaux Watershed each day (Sacks 2004)

that Mackinac County experiences relatively high incidences of OSS repairs and upgrades in comparison to new installations (CCHD 2004).

Table 2.5.2. Les Cheneaux Watershed On-site Septic Pollutant Loads

Pollutant	Typical wastewater concentration (milligrams/Liter)	Pollutant Load lbs/household/day	Pollutant Load lbs/ per household/per year ¹³	Total Watershed Pollutant Load/year
Nitrogen	50mg/L	.062 lbs	23 lbs	2,300 lbs
Phosphate	9mg/L	.011 lbs	4 lbs	400 lbs
Toxics (fats,oils,grease) (volatile organic compounds)	100mg/L .3 mg/L	.12 lbs .00037 lbs	44 lbs .14 lbs	4,400 lbs 14 lbs
Pathogens	1,000 viral units/L	568,000 viral units	200,000,000 viral units	20,000,000,000 viral units

Municipal Wastewater Discharge

According to discharge figures provided by the Clark Township Municipal wastewater treatment manager, an average of 56 million gallons of tertiary-treated wastewater was discharged into Pearson Creek (2000-2003) which flows into Lake Huron at Cedarville Bay, the geographic center of the watershed. Typical pollutant loads for wastewater as mentioned above magnify with this volume of water and significantly threaten shoreline residents who still use surface water for household activities.

Table 2.5.3. Municipal Wastewater Pollutant Loads (MDEQ 2000-2003)

Average Annual Discharge (2000-2003) 56 million gallons	Wastewater Pollutant	Average Pollutant Concentration (mg/L)	Total Pollutant Load/Year
	Nitrogen	2.26 mg/L	1283 lbs
	Phosphate	.78 mg/L	232 lbs
	Toxics	100mg/L	46,000 lbs
	Pathogens	1,000 viral units/L	21 million viral units

Stormwater

Since surface waters interact with groundwater so readily in the watershed due to karst topography, there is considerable potential for water supply contamination from other pollutants carried by stormwater. These include nutrients (phosphates and nitrates), heavy metals, and petroleum products. Sources of these pollutants include salts from roads and parking lots, nutrients from failing septic systems, heavy metals and hydrocarbons from urban areas and fueling areas (LMAS 2004).

Table 2.5.4. Urban Storm Water Survey Summary

	<i>Hessel</i>	<i>Cedarville</i>
Area of stormwater drainage (acres)	263	594
Land Use (% of coverage)		
Undeveloped/natural	12 (32 acres)	9 (53 acres)
Commercial/industrial	7 (18 acres)	4 (24 acres)
Residential	81 (213 acres)	87 (517 acres)
Overall impervious Cover (%)	10	10
Number of Storm Sewer Outfalls and contributing ditches to receiving waters	3	6
Estimated Annual Pollutant Export (lbs)		
Phosphorus	51,285	115,830
Nitrogen	3922	8910
Sediment	107,830	243,653
Coliform bacteria ¹⁴	536 (billion colonies)	1211 (billion colonies)

¹³ Based on 60 gallons/person/day wastewater (USEPA); 2.5 persons/household (CTCP); 365 days/year = 54,750 gallons wastewater generated/per watershed household/year.

¹⁴ For bacteria, the equation is slightly different, to account for the differences in units. The equation is: **Annual load (billions colonies)=annual runoff x bacteria concentration (typical creek sample) x area x .00103(unit conversion factor)**

Navigation

Navigation threats are limited to Cedarville Bay, the center of recreational activity in the watershed. There exists a public boat launch, numerous private docks, and Cedarville Marine, a sales and service private marina with several dock slips. Two main sources are enabling both nutrients and sediments to reach Lake Huron at Cedarville Bay.

Municipal Wastewater Discharge

The municipal wastewater discharge (Table 2.6.3) has contributed tons of phosphorus to the bay over the past decade, generating aquatic plant and algae growth. The periodic algal blooms and thickening aquatic plant growth, both native and invasive, have caused problems for boaters navigating the confines of the bay.

Road/Stream Crossings

In addition, upstream, failing road/stream crossings are eroding and contributing sediments to Pearson Creek (see *Road/Stream Crossing Inventory*), the tributary feeding Lake Huron at Cedarville Bay. The increased flows of spring runoff eventually transfer those sediments to the bay, hampering navigation near the municipal docks and the boat launch.

Warm/coldwater Fishery and Other Indigenous Aquatic Wildlife

The Les Cheneaux watershed supports both fish species characteristic of warm and coldwater fisheries. The area once boasted a high quality perch fishery, as well as Lake Trout and Whitefish, until the mid-1980's when MDNR creel surveys plummeted (MDNR 2004). Several theories exist for the decline, from increased cormorant population to commercial fishing pressure. What remains clear is that quality nesting and nursery habitats for both perch and their forage base will be priority in any restoration of perch populations (MDNR 2004). Quality creek habitat is priority to maintaining populations of game and forage fish in area creeks, as well as macro-invertebrates on which they depend. Development near coastal marshes and creek riparian corridors threaten perch population recovery and creek species, as well as other indigenous wildlife. Regulations are in place to minimize impacts such as priority habitat encroachment and sedimentation, but evidence suggests that non-compliance is occurring (LMAS 2004). Other pollutants threatening the local fishery include excessive nutrients from municipal wastewater discharge, failing on-site septic systems, and stormwater. In addition, Sediments are threatening the fishery from shoreline and riparian areas, failing road/stream crossings, construction/development and stormwater. Hydrological changes from stormwater and road/stream crossings are limiting fish migration. Lastly, invasive species and toxins are growing threats as activity grows in the watershed.

Construction

Sediment loss was calculated from one representative, active 2 acre (100' long lakefront lot) lakeshore building site lacking typical erosion controls using the *Revised Universal Soil Loss Equation*. For the sight, the annual sediment load without erosion controls was estimated at 42 tons (MDEQ 2004). During this planning project (2003, 2004), 155 building permits were issued from the Clark/Marquette Township Building Inspector. Site addresses were plotted with water body locations, and estimates of potential SESC regulated projects were 25% of the total permits issued (CTBI 2005). The potential for serious sedimentation could be as high as 1,638 tons of sediment per year (CTBI 2005).

Development

Whitefish, lake herring, and lake trout are all historically important commercial and sport fish species in the Les Cheneaux area. According to Chippewa/Ottawa (Tribes) Resource Authority's (CORA) Environmental Coordinator, the Les Cheneaux Islands area contains quality habitat for all the species. The near shore cobble lake bottoms and shoals are priority nesting sights worthy of protection. That protection will be key to improving current fragile populations (CORA 2002). Coastal marshes serve as nursery habitat for several fish species and habitat for macro-invertebrates (Conlon et.al. 2003). Research conducted by University of Michigan has suggested that several areas throughout the islands have been impacted by habitat fragmentation due to local development activity, including shoreline development and dredging. Forage fish as well as game fish use shallow marsh areas as nurseries during their early development. Fragmentation of these areas contributes to a necessary change in fishery behavior attributed to higher predation pressure and lack of protection from high wave action. Clearing of shoreline vegetation eliminates natural woody debris from littoral zones, decreasing spawning

cover and macro-invertebrate habitat. Macro-invertebrate surveys will continue to monitor diversity in developed and undeveloped areas. With 25.5% of building projects on average occurring near aquatic habitat, over 3800 linear feet of shoreline and/or riparian habitat is impacted each year in the watershed (CTBI 2005).

Bank/Shoreline Erosion

A few isolated riparian areas are contributing sediment to area waters, as reported previously in section 2.4.1 (pictures 2.4.2.1 and 2.4.1.2) An additional 58 tons of sediment each year is threatening area creeks and Lake Huron from these few sites upstream in the watershed.

The Municipal Wastewater Discharge

Clark Township's municipal wastewater discharge (Table 2.6.3) has contributed tons of nutrients and toxins to Cedarville Bay over the past decade, generating aquatic plant and algae growth and degrading general water quality. The periodic algal blooms and thickening aquatic plant growth, both native and invasive, have altered the natural ecosystems in the bay and threaten dissolved oxygen levels during plant respiration periods. The bay was historically a prosperous fishing area as noted by local fisherman and a spawning area for yellow perch, but recent reports indicate a decline in fishing success.

Invasive Species

As mentioned, another threat to water quality and the aquatic life on which it depends, is invasive species. MDNR has confirmed through creel surveys that round gobies are turning up in Hessel Bay. This non-native intruder competes with other fish for food and preys on some indigenous eggs. Concern is also apparent over the impact of zebra mussels, which are prevalent throughout the Les Cheneaux Islands, and dynamic populations of alewives. A quantifiable threat to aquatic resources, especially within Cedarville Bay is the invasive exotic, Eurasian Milfoil (*Myriophyllum spicatum*). A survey completed by the Michigan Department of Environmental Quality in Cedarville Bay showed that 78% (225 acres of 289) of the study area was inundated with the invasive exotic with at least a 2% coverage in each survey transect (Esman and Bacon 2003).

Road/Stream Crossings

Discussions with local fishermen indicate that several creeks in the watershed have supported good brook trout populations in the past. Beavertail, Prentiss, McKay, Pearson, and Mackinac Creeks have been proven as supporting a natural reproducing brook trout fishery, and providing spawning habitat for both rainbow trout and chinook salmon (MDNR 2004). Water quality and habitat in several of these creeks are threatened by stream bank and road embankment erosion from impounded waters caused by failing road/stream crossings (see *Road/Stream Crossing Report*). Small culverts inhibit natural flows and increase upstream depths which promote erosion of the streambank. Photographs confirm that embankments then erode, degrading creek habitat. Perched culverts and constricted flow both inhibit fish migration throughout the entire length of the creek. Further assessment comparing aquatic life upstream and downstream of failing crossing is needed, but the obvious effects of sedimentation are evident.

Failing On-site Septic Systems and Stormwater

The remaining sources threatening fisheries and other indigenous aquatic wildlife have been described and quantified in threats to other designated uses. Failing on-site septic systems and stormwater, contribute tons of nutrients and toxins to surface waters, especially in Cedarville Bay due to the prevalence of urban infrastructure. Stormwater, again, contributes tons of sediments in addition to the other pollutants, especially to Cedarville Bay.

Partial Body Contact Recreation

Under most conditions, the opportunity for enjoying partial body contact recreation in the watershed exists, but in certain sheltered bays and channels within the Les Cheneaux Islands, activity is threatened due to reports of coliform levels approaching, and in some cases, exceeding state thresholds of water quality are also deterring recreational enjoyment of area waters (LMAS 2004, Wicks 2001).

Failing On-site Septic Systems

Sources of bacteria and thus pathogens depend on areas of occurrence. Failing septic systems are potential sources throughout the Les Cheneaux Islands due to the prevalence of older lakefront cottages with original, non-compliant (LMAS Environmental Health Codes) onsite septic systems (OSS), and the

poor filtering soils and fractured bedrock on which they are built (LMAS 2004). The municipal wastewater discharge is a centralized source mainly affecting activity in Cedarville Bay and nearby areas. In addition, stormwater at concentrations affecting body contact recreation is limited to the urban centers of Cedarville Bay and Hessel Bay.

Municipal Wastewater Discharge

Compounding this problem, the Clark Township wastewater discharge into Lake Huron occurs at the geographic center of the watershed. The township discharges approximately 50 million gallons of secondary treated wastewater per year into Pearson Creek at its crossing on Blindline Road. The water ends up in Cedarville Bay in northern Lake Huron, at the heart of the Les Cheneaux Watershed project area, and in a highly used recreation area. Fortunately, the MDEQ permitted discharge regularly complies with public health thresholds for water quality, but past and present discharges continue to deposit wastewater that contains E.coliform bacteria into a high aquatic recreation area.

Stormwater

Additional pollutants threatening recreational opportunities include toxins such as oils and gases as well as salts from winter road applications. Two recreational centers, Cedarville and Hessel Bays both support marinas that provide fuel service to recreational boaters and both areas have public launches, which create concentrated boat traffic in a relatively small area. Fuel sheens near boats were evidence of these toxins entering our waters. During significant traffic periods, the potential for these types of pollutants increases.

Total Body Contact Recreation Between May 1 and October 31

Threats to total body contact recreation are consistent with partial body contact recreation. LMAS Environmental Health, EUPISD, and local contractors have reported conditions favorable for untreated wastewater pollution throughout the islands. Since swimming recreation is popular throughout the warmer and more congested summer months when coliforms proliferate, there exists a real threat to full body contact recreation. Municipal wastewater discharge, gas and oil contamination from boat motors, and aquatic plant growth have all but discouraged body contact in Cedarville Bay, one of the most priority recreational and environmental areas of the watershed.

The following table was constructed to summarize all the watershed pollutants, their sources and causes determined through project inventories, and the designated uses they threaten.

Table 2.5.5. Watershed Pollutants, Sources and Causes

Threatened Use	Pollutant <i>k=known s=suspected</i>	Source <i>k=known s=suspected</i>	Cause <i>k=known s=suspected</i>
Public Water Supply	Pathogens(s)	Failing septic systems (s)	<ul style="list-style-type: none"> • Poor land use planning (k) • Improperly designed and maintained on-site septic system (k) • Lack of awareness, education/information as to maintenance (k)
		Municipal wastewater discharge (s)	<ul style="list-style-type: none"> • Poor land use planning (k) • Direct discharge into surface waters (k)
		Stormwater (s)	<ul style="list-style-type: none"> • Lack of stormwater management strategies/structures/awareness (k) • Karst topography (k) • Untreated connection between impervious surfaces/stormdrains and water bodies (k)

Threatened Use	Pollutant <i>k=known s=suspected</i>	Source <i>k=known s=suspected</i>	Cause <i>k=known s=suspected</i>
	Nutrients (k) (total phosphorous and nitrogen)	Failing septic systems (s)	<ul style="list-style-type: none"> Poor land use planning (k) Improperly designed and maintained on-site septic system (k) Lack of awareness, education/information as to maintenance (k)
		Municipal wastewater discharge (k)	<ul style="list-style-type: none"> Poor land use planning (k) Direct discharge into surface waters (k)
		Stormwater (s)	<ul style="list-style-type: none"> Lack of stormwater management strategies/structures/awareness (k) Karst topography (k) Untreated connection between impervious surfaces/stormdrains and water bodies (k)
	Toxins (k)	Failing septic systems (s)	<ul style="list-style-type: none"> Poor land use planning (k) Improperly designed and maintained on-site septic system (k) Lack of awareness, education/information as to maintenance (k)
		Municipal wastewater discharge (k)	<ul style="list-style-type: none"> Poor land use planning (k) Direct discharge into surface waters (k)
		Stormwater (s)	<ul style="list-style-type: none"> Untreated connection between impervious surfaces/stormdrains and water bodies (k) Lack of awareness to the sources of toxins (k) Poor land use planning/lack of stormwater management (k)
Total Body Contact	Pathogens (s)	Municipal wastewater discharge (s)	<ul style="list-style-type: none"> Poor land use planning (k) Direct discharge into surface waters (k)
		Failing septic systems (s)	<ul style="list-style-type: none"> Poor land use planning (k) Improperly designed and maintained on-site septic system (k) Lack of awareness, education/information as to maintenance (k)
		Stormwater (s)	<ul style="list-style-type: none"> Lack of stormwater management strategies/structures/awareness (k) Karst topography (k) Untreated connection between impervious surfaces/stormdrains and water bodies (k)
Partial Body Contact	Pathogens (s)	Municipal wastewater discharge (s)	<ul style="list-style-type: none"> Poor land use planning (k) Direct discharge into surface waters (k)
		Failing septic systems (s)	<ul style="list-style-type: none"> Poor land use planning (k) Improperly designed and maintained on-site septic system (k) Lack of awareness, education/information as to maintenance (k)

Threatened Use	Pollutant <i>k=known s=suspected</i>	Source <i>k=known s=suspected</i>	Cause <i>k=known s=suspected</i>
		Stormwater (s)	<ul style="list-style-type: none"> • Lack of stormwater management strategies/structures/awareness (k) • Karst topography (k) • Untreated connection between impervious surfaces/stormdrains and water bodies (k)
Warm/cold water fishery and other indigenous aquatic wildlife	Nutrients (k) (total phosphorous and nitrogen)	Municipal wastewater discharge (k)	<ul style="list-style-type: none"> • Poor land use planning (k) • Direct discharge into surface waters (k)
		Failing septic systems (s)	<ul style="list-style-type: none"> • Poor land use planning (k) • Improperly designed and maintained on-site septic system (k) • Lack of awareness, education/information as to maintenance (k)
		Stormwater (s)	<ul style="list-style-type: none"> • Lack of stormwater management strategies/structures/awareness (k) • Karst topography (k) • Untreated connection between impervious surfaces/stormdrains and water bodies (k)
	Sediments (k)	Bank/shoreline erosion (k)	<ul style="list-style-type: none"> • Stream obstructions/impoundments (k) • Altered stream channel (k) • Altered riparian areas (k)
		Failing road/stream crossings (k)	<ul style="list-style-type: none"> • No erosion/runoff control structures (k) • Undersized & improperly placed culverts (k) • Erosive road / embankment surface (k) • Poor land use planning (k)
		Construction/development (k)	<ul style="list-style-type: none"> • Poor site planning (k) • Lack of compliance with resource protection regulation (k) • Inadequate inspection & enforcement of protection laws (k) • No stormwater management planning (k) • Development near riparian areas (k)
		Stormwater (k)	<ul style="list-style-type: none"> • Wetland filling (k) • Poor land use planning/no stormwater management planning (k) • Development with impervious surfaces (k) • Impoundments damming flow (culverts and snowmobile bridges) (k)
	Alteration of hydrology (k)	Stormwater (k)	<ul style="list-style-type: none"> • Wetland filling (k) • Poor land use planning/no stormwater management planning (k) • Development with impervious surfaces (k) • Impoundments damming flow (culverts and snowmobile bridges) (k)
		Road/Stream Crossings (k)	<ul style="list-style-type: none"> • Undersized culverts (k) • Damaged culverts (k) • Poorly designed crossings (k)

Threatened Use	Pollutant <i>k=known s=suspected</i>	Source <i>k=known s=suspected</i>	Cause <i>k=known s=suspected</i>
	Invasive species (k)	Inadequate information/ education about I.S. (k)	<ul style="list-style-type: none"> Lack of awareness of I.S. origin and prevention (s)
		Connected waterways (k)	<ul style="list-style-type: none"> Great Lakes connection with Atlantic Ocean provides route for invasive species migration and shipping which can transport exotics (k)
	Toxins (k)	Failing septic systems (s)	<ul style="list-style-type: none"> Poor land use planning (k) Improperly designed and maintained on-site septic system (k) Lack of awareness, education/information as to maintenance (k)
		Municipal wastewater discharge (s)	<ul style="list-style-type: none"> Poor land use planning (k) Direct discharge into surface waters (k)
		Stormwater (s)	<ul style="list-style-type: none"> Untreated connection between impervious surfaces/stormdrains and water bodies (k) Lack of awareness to the sources of toxins (k) Poor land use planning/lack of stormwater management (k)
Navigation	Nutrients (k) (Total Phosphorous & Nitrogen)	Municipal wastewater discharge (k)	<ul style="list-style-type: none"> Poor land use planning (k) Direct discharge into surface waters (k)
	Sediment (k)	Bank/shoreline erosion (s)	<ul style="list-style-type: none"> Altered riparian areas (k) Stream obstructions/impoundments (k) Altered stream channel (k)
		Failing road/stream crossing (k)	<ul style="list-style-type: none"> Undersized culverts (k) Erosive road / embankment surface (k) Poor land use planning (k)

2.6 Watershed Goals

Watershed goals outlined here are based on combating aforementioned pollution, sources, and causes in order to protect threatened designated uses of water and facilitate the desired uses of the watershed. These goals are broad but declare the end product of eliminating the threats to designated uses and promote the realization of desired uses. These goals were developed from monthly steering committee meetings, correspondence with local, state, and federal personnel experienced with the local community, and through summarizing community development projects, where community representatives suggested the direction of the environmental as well as social and economic sustainability. Detailed objectives and tasks to realize these goals are outlined in the remaining plan.

Table 2.6 Watershed Goals

Threatened Uses	Goal
Public water supply	Protect individual on site water well surface water intake drinking water quality by eliminating pollution (8 tons nitrogen, 84 tons phosphorus, 25 tons toxics, and 10^8 coliform organisms per 100ml wastewater and stormwater/year) inputs into area waters.
Partial body contact recreation	Restore/protect water quality to sustain partial body contact recreational use by decreasing coliform bacteria (10^8 million organisms/100mg/L wastewater) loading to surface waters.
Total body contact recreation	Restore/protect water quality to sustain total body contact recreational use by decreasing coliform bacteria loading (10^8 million organisms/100mg/L wastewater) to surface waters.
Warm/coldwater fishery	Establish, promote, and execute land and water management practices that conserve and protect the natural resources of the watershed, including the elimination of 350 tons of sediment, 92 tons of nutrients, 25 tons of toxics, and billions of coliform bacteria. Secure at least 1(100 linear feet) coastal wetland and/or riparian property each year in conservation easement. Eliminate 27 failing road/stream crossings altering hydrology and contributing 116 tons of sediment/year. Restore eroding streambanks to eliminate 58 tons of sediment/year.
Navigation	Restore/protect navigation opportunities by eliminating 350 tons of sediment and 6 tons of nutrients loading to Cedarville Bay.
Desired Uses	Goal
Aquatic recreation	Provide appropriate opportunities for public enjoyment of aquatic/terrestrial resources including but not limited to installation of at least 10 miles of the M-134 bike trail within the watershed, one walking trail at the Les Cheneaux Community Schools <i>outdoor classroom</i> , improvement of the Mackinac Bay overlook and development of one overlook of McKay Bay, installment of boat washing equipment at 2 boat launches, development of a public access area at Prentiss Bay, and improve access at the Woodland Park fire road.
	Establish and host at least one Les Cheneaux Area education/information tour of priority aquatic habitats each summer to promote stewardship and low impact recreational enjoyment of aquatic and terrestrial resources. Develop accompanying literature (1 brochure type/year) description of subject matter to be distributed to attendees and to local businesses and at least 1500 residents.
Natural aesthetic character	Preserve the unique nature-based aesthetic character of the Les Cheneaux Islands area by promoting and executing (upon available funding) shoreline and riparian conservation easements, land acquisitions, and deed restrictions to all the Little Traverse Conservancy <i>tier 1 and 2 property owners</i> in the watershed (82).

Threatened and endangered species habitat	Identify and protect priority habitat for threatened and endangered species by promoting and executing (upon available funding) conservation easements, land acquisitions, and deed restrictions to landowners within the 10-25%+ probability range for threatened and endangered species occurrence (LIAA map chapter 3(180 quarter sections)) and Little Traverse Conservancy <i>tier 1 and 2</i> properties (82). Develop and distribute at least one form of appropriate literature (brochure type) or other media (video) each year (3) to provide information and education to these landowners.
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Chapter 3 - Priority Area

Priority Areas

A priority area is the geographic portion of the watershed that is contributing a majority of the pollutants and is having a significant impact on the water body (MDEQ 2000). Priority areas are also natural habitats that remain in excellent, undeveloped condition and warrant long term protection to protect water quality.

The priority areas of the Les Cheneaux watershed were identified through analysis of pollutant causes, priority habitats, and the goals of the watershed project participants. The project partners also consulted the community to gain perspective with the community's concern over future growth and the need for appropriate planning to maintain a certain quality of life.

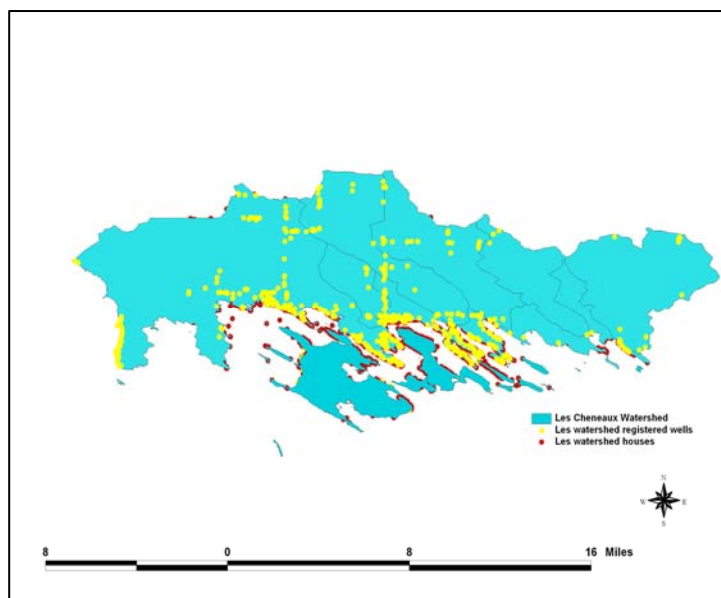
The project participants determined that the general priority areas of the Les Cheneaux watershed project include:

- Developed Great Lakes shoreline
- Creek erosion sites
- Urban concentrations in the watershed
- Threatened and endangered species habitats
- Priority areas for long-term protection

Great Lakes Shoreline

The Les Cheneaux watershed boasts over 200 miles of shoreline, including diverse habitats such as rock-strewn beaches, dune and swale areas, and coastal marshes. Historical boathouses and cottages which dot the shoreline landscape also contribute to the visual allure that attracts thousands to the Les Cheneaux Islands. Unfortunately, these areas and the water quality adjacent them are threatened by many pollutants and their causes. Failing onsite septic systems emit untreated wastewater into near shore environs, the *karst* topography characteristic of the islands provides a poor landscape on which to develop, shoreline acreage stripped of protective vegetation facilitates erosion and the delivery of sediment into Lake Huron waters. Shoreline development and its accompanying infrastructure displaces and destroys habitat for fish and their forage base as well as habitat for migratory and neotropical birds, and other animals that use shoreline habitats.

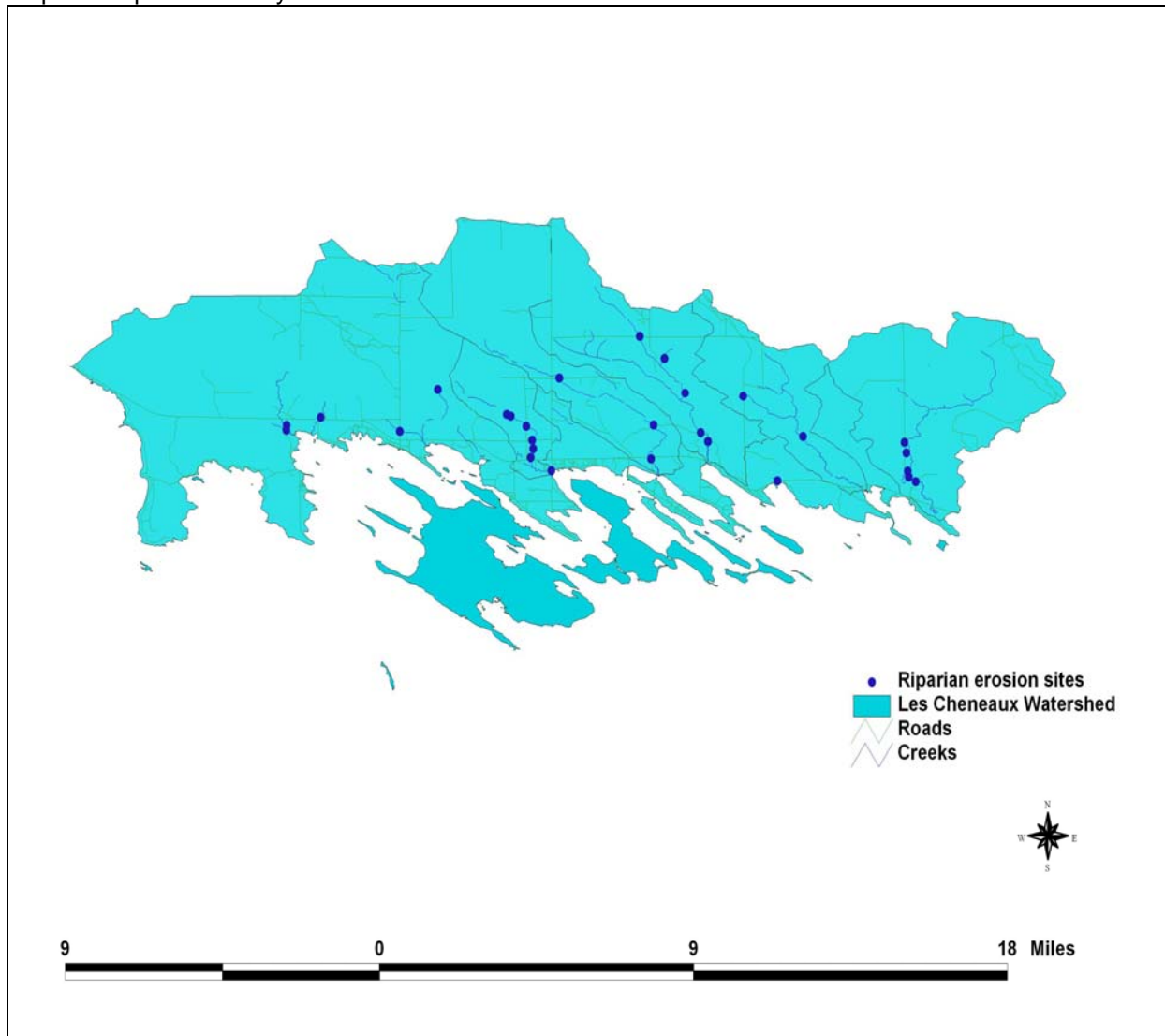
Map 3.1 Developed Great Lakes Shoreline (Source: DNR, Michigan Resource Information System (MIRIS)
Adapted by the LCWC)



Several shoreline residents living on the Les Cheneaux Islands, the shoreline west of the village of Hessel, and those on the shore at the eastern reaches of the watershed continue to depend on on-site septic systems (OSS). Several continue to depend on shallow water wells not registered on Michigan's well log database or surface water for home use. These clusters of older developments are priority areas of suspected OSS failures based on local Health Department speculation that these homes also continue to depend on associated older, failing OSS. They are also priority areas for further aquatic habitat degradation from anticipated residential development improvements.

Several small creeks course through the Les Cheneaux watershed and provide habitat for fish and other indigenous aquatic wildlife. Unfortunately, several road/stream crossings and streambanks have become priority erosion sites, threatening water quality. The watershed project will focus on these poorly engineered road/stream crossings exhibiting eroding embankments hydrology alteration. Additional focus will be on eroding stream banks depositing sediment on priority aquatic habitats. Furthermore, a well-vegetated, undisturbed riparian zone helps to buffer the effects of these pollution sources, and project partners have recognized the need to protect remaining undeveloped riparian zone properties, especially those containing ¼ mile or more of undeveloped creek frontage (Little Traverse Conservancy 2004).

Map 3.2 Riparian Priority Sites

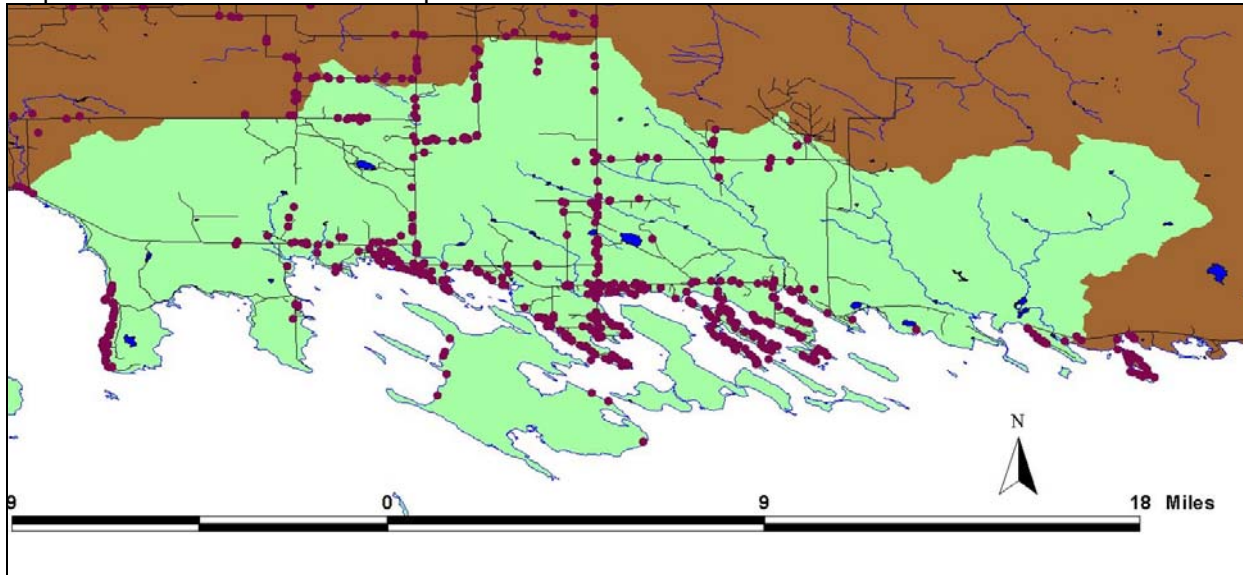


Source: MDNR, Michigan Resource Information System (MIRIS)
Adapted by the LCWC

Urban Concentrations

The villages of Cedarville and Hessel are the major urban areas of a mostly rural watershed. Although small, these municipalities exhibit a concentration of impervious surfaces with an associated network of storm drains and ditches coursing to Lake Huron. Both villages have marinas with fuel stations, launch areas, and concentrated human activity that can contribute pollutants. Cedarville is also the site of the municipal wastewater discharge, which dumps over 50 million gallons of wastewater containing tons of nutrients into northern Lake Huron. Compile these pollutants and both areas warrant priority area attention.

Map 3.3 Concentrations of Development

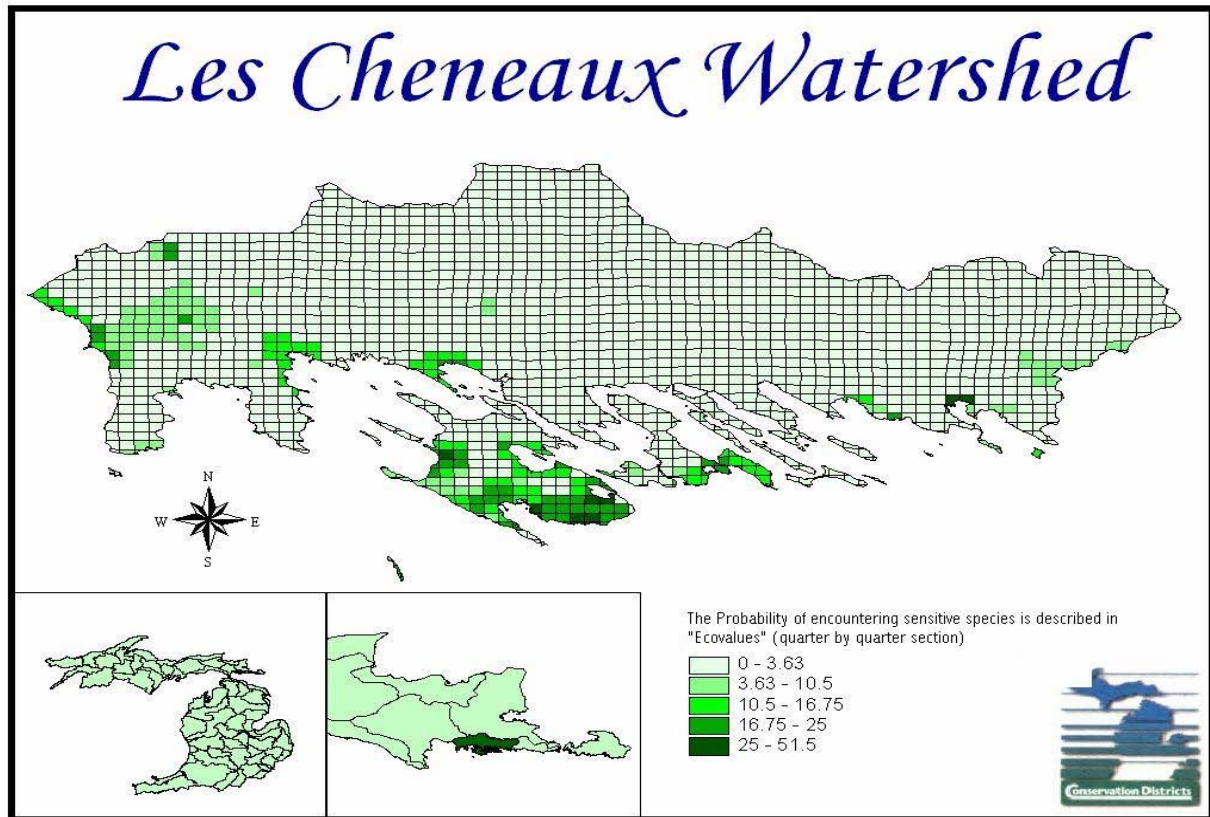


Source: MDNR, Michigan Resource Information System (MIRIS)
Adapted by the LCWC

Threatened and Endangered Species Habitat

Certain areas across the watershed continue to provide a level of habitat biodiversity or “Eco-value” such that there is a high probability of threatened or endangered (T/E) species occurrence therein. Either T/E species have been seen here or their appropriate habitat still exists. Property parcels within these areas are targets for long term protection through conservation easements and other strategies outlined in this management plan.

Map 3.4 Probability (%) of threatened and endangered species occurrence



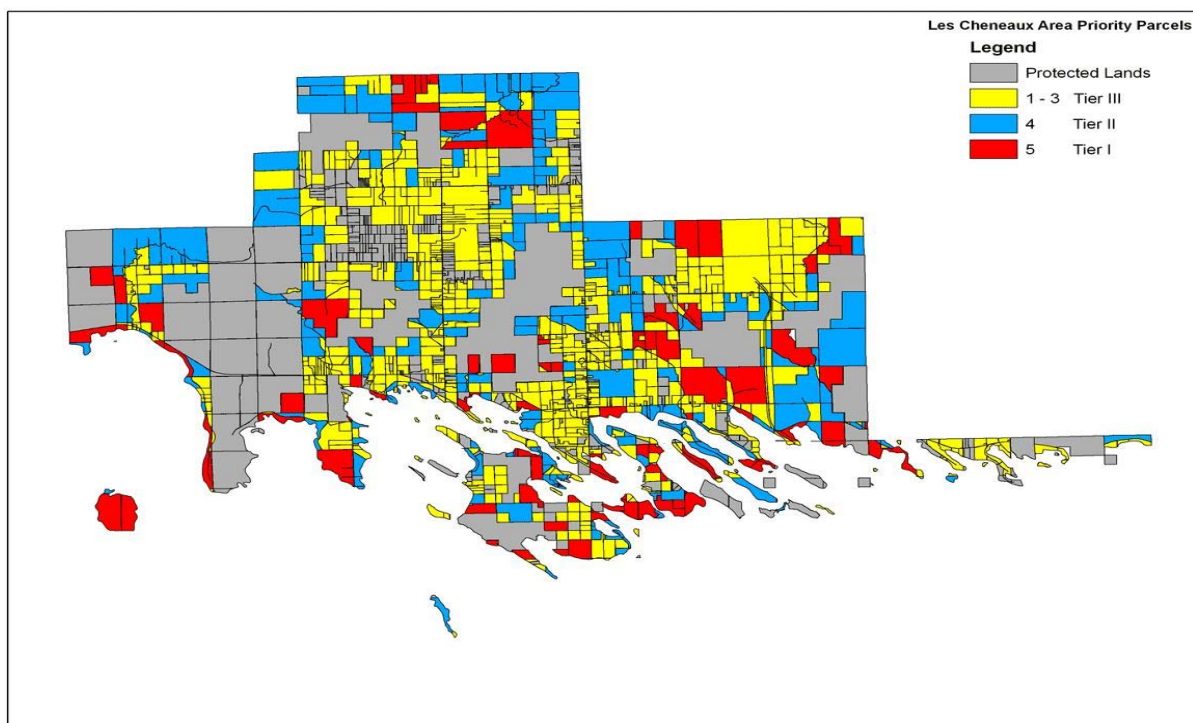
Source: Michigan Natural Features Inventory (MNFI)
Adapted by the LCWC

Priority Areas for Long Term Protection

Certain parcels in Clark Township¹⁵ exhibit various levels of characteristics priority for protecting long-term water quality and the local community's desired use of the watershed. Priority level for protecting these parcels is based on five weighted criteria¹⁶ developed by Little Traverse Conservancy, a leading land protection organization in northern Michigan (Little Traverse Conservancy 2004).

- Water Frontage
 - * ¼ mile or more shoreline (2 points)
- Wetlands¹⁷
 - * wetland (1 point)
- Large parcels
 - *80 acres or more (1 point)
- Parcel location
 - *adjacent to permanently protected land (1 point)

Map 3.5 Priority Parcels for Protection



According to Little Traverse Conservancy criteria scoring system, 16 parcels in the watershed warrant high priority protection, 66 parcels are medium, and 1,373 are low priority. Design of future protection activities will be based on this ranking, funding resources, landowner cooperation, and the water quality goals of the Les Cheneaux Community.

¹⁵ Most of Raber Township located within watershed (Beavertail sub watershed) is protected (State Land). Insufficient parcel data remains for private properties.

¹⁶ 6 points total (5-6 High priority; 4 medium priority; 1-3 low priority) No parcels scored 6. Protected parcels, such as State land, scored as a 0.

¹⁷ Verifiable wetland must make up a reasonable and viable part of the property, represent northern habitat types (bogs, fens, cedar swamps, coastal wetland, etc.), or be located within a riparian area along undeveloped section of a creek)

Chapter 4 - Prioritizing Pollutants, Sources and Causes

4.1 Designated Use Ranking

Different pollutants and conditions exist in the Les Cheneaux watershed that negatively affect water quality, designated, and desired uses of water. This plan is a guide to help Les Cheneaux watershed project partners minimize and even eradicate those pollutants, their sources, and causes, and maintain both designated and desired uses for aquatic resources. Unfortunately, resources to accomplish this goal are limited. Prioritization of these pollutants is necessary in order to systematically focus available resources to manage the most priority pollutants, the most priority sources and causes, at the most priority areas, with the least amount of time, money, and manpower.

The project steering committee ranked designated uses, threatening pollutants, sources, and causes using a number of relevant criteria. First in the prioritization process, designated uses were prioritized based on their direct individual relationship with both human and wildlife health and well being, respectively. For example, the community and the wildlife that share the watershed both need clean water to sustain life. Drinking water is the most priority of the designated uses. Total and partial body contact recreation can be extrapolated to include similar uses in the home, including bathing and washing and will be considered next in priority. Designated uses for both warm/coldwater fishery and other indigenous life are next in importance as also an indicator of the health of surface waters for our use. If organisms can no longer thrive in our surface waters, those waters won't be suitable for our use either. The remaining designated uses either indirectly affect human and wildlife health or affected the basic enjoyment of aquatic resources.

Table 4.1.1 Designated Use Prioritization

Designated Use	Priority Ranking for Protection
Public water supply at the point of intake	1
Total body contact recreation between May 1 and October 31	2
Partial body contact recreation	3
Warm/coldwater fishery	4
Other indigenous aquatic life and wildlife	5
Navigation	6
Agriculture	7
Industrial water supply	8

4.2 Prioritization of Pollutants for Each Designated Use

Since each pollutant has different effects on the threatened designated uses it was important for LCWC to prioritize the pollutants for the threatened uses. This enables water quality managers to see the relationship between pollutants and multiple threatened uses. Prioritizing pollutants for each threatened designated use provided insight into the prevalence of certain pollutants impacting several designated uses. This also provided the logical course for general prioritizations, and later source and cause prioritizations.

Similarities exist between the pollutants affecting our water supply, partial body contact, and full body contact. These designated uses describe our everyday use of water at home and in our everyday lives. Due to LMAS reports of widespread bacteria contamination in wells across the watershed and the ratio of

new OSS and those needing repair, pathogens and nutrients earned the highest prioritization from project stakeholders. Toxins have the potential to do great harm, but lack of documented occurrence limits their priority.



Cedarville Bay



Navigation has been difficult in Cedarville Bay at the center of the watershed project area for the past few years. The main cause has been the long period of lower lake levels during much of the late 1990's and the addition of nutrients from the local municipal discharge.

Picture (left): Dock in Cedarville Bay (September 29, 2003).

The result is algal blooms and increasing aquatic plant growth. Several sources to these pollutants have been verified through visual observations and analysis of local land use practices adjacent the bay.



Clark Township discharges municipal wastewater into Pearson Creek. This process was permitted by state and federal regulators with stipulation that the discharge meets several water quality parameter thresholds. However, considering the large volume of discharge, low amounts of nutrients in the form of phosphates and nitrates accumulate to such an extent that tons of nutrients have entered Cedarville Bay since discharging began, and that nutrient base increases the growth potential for algae and other aquatic vegetation.

Picture (left): Algal bloom near Township dock in Cedarville (September 18, 2003).



Sediment also plays a part in hindering navigation in this heavy-use bay. The last decade has seen an island appear in the bay adjacent to the mouth of Pearson Creek, which enters into the bay at Meridian Road.

Picture (left): The island is the green area in the background - behind the dock (July 10, 2004).



Several upstream road crossings are failing with eroding embankments eventually adding sediment to Pearson Creek and Cedarville Bay.

Picture (left): The crossing of Pearson Creek at State Road (May 6, 2004).

Table 4.2.1 **Watershed Prioritization of Pollutants for Each Designated Use**

Threatened Designated Uses	Pollutants	Priority Ranking
Public water supply at the point of intake	Pathogens	1
	Toxins	2
	Nutrients	3
Total body contact recreation (May 1 / Oct 31)	Pathogens	1
Partial body contact recreation	Pathogens	1
Warm/coldwater fishery	Toxins	1
	Hydro Flow Changes	2
	Sediments	3
	Nutrients	4
	Invasive Species	5
Other indigenous aquatic life and wildlife	Toxins	1
	Hydro Flow Changes	2
	Sediments	3
	Nutrients	4
	Invasive Species	5
Navigation	Nutrients	1
	Sediment	2

According to Michigan Department of Natural Resources fisheries biologist, Dave Fielder, several factors may be considered for the decreasing Les Cheneaux area creel counts documented by MDNR creel clerks since 1985. Increasing cormorant predations and both sport and commercial fishing have been suggested as reasons, and are increasing concerns among local fishermen, but further attention to these activities will be needed to affirm their roles in fishery populations and diversity. Verification of these sources will take a much larger regional management approach than the watershed project partners can take, but for which the watershed project partners will be in full support. On the local level, several pollutants and conditions, according to Fielder, may hinder fishery recovery, and should be managed accordingly.

According to project partners, maintaining sufficient quality aquatic habitat is the highest priority concept for maintaining aquatic biota in the Les Cheneaux area. Increasing development and activity is threatening existing habitat, and the watershed project will focus much time and effort in protecting that which remains and improving that which is degraded.

High priority has to be placed on toxins such as oils, gases, and cleaners because of their potential to harm aquatic and human life. Sources in the watershed tend to be everywhere from parking lots to leaking boat motors to machinery service stations. Rain and snowmelt transport the toxins into water bodies, where they remain to affect both human and aquatic organisms. Toxins enter Les Cheneaux water bodies from a myriad of different routes, including storm drains, ditches, parking lots, and through boat motors.

Nutrients also come from many different sources. However they may affect aquatic organisms in the Les Cheneaux watershed to a lesser degree. Cedarville Bay has received tons of verifiable nutrients from the Clark Township wastewater discharge. Additional sources come from storm drains which take parking lot and road wastes from Cedarville and transport them into Cedarville Bay. Dissolved oxygen tests suggest priority low levels, especially during the early morning, just after expected plant respiration, where dissolved oxygen is used to sustain plant life.

Hydrological flow changes and sediment exist with one causing the other in the watershed. Les Cheneaux watershed project inventories have delineated several road/stream crossings that are insufficient for the amount of discharge that typically runs through them. Water gets dammed during spring and fall and other large rain events. That water overcomes banks, strips the topsoil off and

transports it downstream. Sedimentation is also a problem on lakefront properties where development activity scours the soil and rains wash the soil into littoral areas where aquatic invertebrates and small fish thrive.

The lowest priority pollutant determined by project partners to affect aquatic organisms is invasive species (also known as exotic and non-native species). Low priority is only given in this case because of the difficulty in managing invasive species by the Les Cheneaux watershed project. It is true that invasive species have the greatest potential to affect aquatic organisms in the Great Lakes, including the Les Cheneaux Islands. Nonetheless, invasives will be managed on a much broader scale than what this project is equipped to do.

All these pollutants are important and should be priorities for maintaining the ecological health of the watershed. Low prioritization only classifies the possible timeline for the project to address the pollutants. In fact, as funding sources and participation change, prioritizations may change.

4.3 Prioritization of Pollutants and Sources

In keeping with human health as a criterion for prioritizing aquatic use, so goes prioritizing the pollutants affecting those uses. The highest priority pollutants, according to local and regional stakeholders are pathogens, toxins and nutrients due to their potential affect on human health and the ease at which they can contaminate water used for so many important designated uses.

Table 4.3.1 Prioritization of Pollutants and Sources

Pollutant or Condition <i>k=known s=suspected</i>	Ranking	Source <i>k=known s=suspected</i>	Ranking
Pathogens (s)	1	Failing Septic Systems (s) Municipal Wastewater Discharge (s) Stormwater (s)	1 2 3
Toxins (k)	2	Stormwater (s) Failing Septic Systems (s) Municipal Wastewater Discharge (s)	1 2 3
Nutrients (k) (Total Phosphorous & Nitrogen)	3	Failing Septic Systems (s) Municipal Wastewater Discharge (s) Stormwater (s)	1 2 3
Sediments (k)	4	Failing road/stream crossing (k) Construction/ development (k) Stormwater (k) Bank/shoreline erosion (k)	1 2 3 4
Alteration of hydrology (k)	5	Road/Stream Crossings (k) Stormwater (k)	1 2
Invasive species (k)	6	Connected waterways (k) Inadequate information/ education about I.S. (k)	1 2

4.4 Prioritization Method for Pollutant Sources and Causes

The next step in the prioritization process is to prioritize the sources and causes of pollutants. To eliminate pollution and conditions that contribute to water quality degradation, the source and cause of that pollution or condition need to be determined. Address the causes and one may, in fact, eliminate

several pollution sources and conditions throughout the watershed. Consequently, prioritizing the different sources and causes of pollution can help focus attention on those origins for much of the pollution problems and negative conditions impacting water quality in the watershed.

The method used to prioritize these sources and causes takes into account the magnitude of the source/cause and the ease at which the pollutants move to the water body. Again, an important criterion is the ability of the project partners to realize success in addressing the sources and causes of pollution in the watershed. LCWC's highest priority sources and causes facilitate the greatest number of pollutants across the widest area and proved to be the most numerous in occurrence. Direct pollutant transfer, such as stormwater and erosion from failing road crossings, warranted a higher priority for LCWC, than an indirect transfer, such as the use of hazardous waste around the home.

Table 4.4.1 Prioritization of Sources and Causes

Known or Suspected Source	Ranking	Known or suspected cause	Ranking
Failing on-site septic systems	1	Poor land use planning Lack of awareness/maintenance Poor system design	1 2 3
Stormwater	2	Developed areas/impervious/disturbed surfaces lacking soil protection and erosion protection Direct unprotected connections between storm drains and creeks/lakes Increase in impervious, filled areas Few stormwater control structures Impervious surfaces directly connected to storm sewers Lack of stormwater management program Impoundments creating <i>flashy</i> flows Karst topography Lack of home owner awareness of motorized machinery pollutants	1 2 3 4 5 6 7 8
Failing road and stream crossings	3	Undersized culverts Insufficient runoff deterrents Improperly placed culverts Unstabilized embankments	1 2 3 4
Construction and development	4	Lack of environmental awareness/stewardship ethic Lack of appropriate land use planning/regulation Insufficient site planning Lack of awareness to stormwater management Increasing development/activity adjacent riparian areas	1 2 3 4 5
Municipal wastewater discharge	5	Poor land use planning Poor system design	1 2
Bank/shoreline erosion	6	Lack of awareness of erosion causes and solutions Altered hydrology from impoundments, and lack of stormwater management Destructive construction practices Lack of riparian buffer	1 2 3 4

Known or Suspected Source	Ranking	Known or suspected cause	Ranking
Connected waterways	7	Great Lakes connection with Ocean provides route for exotic migration, facilitate shipping to watershed port	1
Inadequate information/education about invasive species	8	Lack of awareness of I.S. origin and prevention	1

Chapter 5 - Les Cheneaux Watershed Goals and Objectives

5.1 Goals

The goals stated in the Les Cheneaux Watershed Management Plan are aimed at protecting the designated and desired uses mentioned earlier in the plan. The objectives outline how project partners will reach the determined goals. Later, tasks will be designed to reach objectives. This plan of action will help maintain the Les Cheneaux watershed as a recognized high quality water body worthy of protection.

Table 5.1.1. Watershed Goals and the Designated/Desired Use They Address

Threatened Uses	Goal
Public water supply	Protect individual on site water well surface water intake drinking water quality.
Partial body contact recreation	Restore/protect water quality to sustain partial body contact recreational use.
Total body contact recreation	Restore/protect water quality to sustain total body contact recreational use.
Warm/coldwater fishery and other indigenous life/wildlife	Establish, promote, and execute land and water management practices that conserve and protect the natural resources of the watershed.
Navigation	Restore/protect navigation opportunities by decreasing sediment and nutrient loading to navigable surface waters.
Desired Uses	Goal
Aquatic recreation	Provide appropriate opportunities for public enjoyment of aquatic/terrestrial resources including but not limited to walking trails, scenic overlooks, boat launches, and public access areas.
	Establish and promote education/information programs that promote stewardship and low impact recreational enjoyment of aquatic and terrestrial resources.
Natural aesthetic character	Preserve the unique nature-based aesthetic character of the Les Cheneaux Islands area.
Threatened and endangered species habitat	Identify and protect priority habitat for threatened and endangered species.
All designated and desired uses	Establish education and information programs that promote the conservation, education, protection, restoration, and sustainability of aquatic resources within the Les Cheneaux watershed.

Objectives for Watershed Goals and Pollutants Addressed

The following table defines the objectives for each watershed goal and the tasks needed to realize objectives. Pollutants addressed by each goal and set of objectives and task are also listed.

Table 5.2.1. Goals and Objectives

Goal	Objectives by Source/Cause	Pollutants Addressed
Protect drinking water quality (public water supply)	<p>Reduce the input of pathogens reaching groundwater and surface water by:</p> <ul style="list-style-type: none"> • Identify and correct failing septic systems • Identify noncompliant systems and assist landowners with planning to gain Health Department OSS compliance in a feasible time frame • Identify and implement alternative municipal and on-site wastewater management strategies • Establish a funding program to assist landowners with correcting failing systems and pursuing compliant systems • Providing I/E to shoreline landowners as to aquatic wildlife management and ecosystems • Provide I/E to township, and county regarding stormwater processes. • Work with county and townships to design and implement stormwater management programs • Protect groundwater and surface water recharge areas (wetlands, headwaters) and discourage water withdrawals that negatively impact aquatic systems • Identify and close all abandoned wells <p>Reduce the input of nutrients reaching groundwater and surface water by: Same as above</p> <p>Reduce the input of toxins reaching groundwater and surface water by: In addition to above:</p> <ul style="list-style-type: none"> • Educate public to the appropriate disposal and management of hazardous waste, onsite water well and septic maintenance • Provide I/E to community, especially aquatic recreationists and businesses, regarding toxin sources, pollution controls. Assist group in implementing controls 	Pathogens Toxins Nutrients
Restore/protect full and partial body contact recreational use	<p>Reduce the input of pathogens reaching groundwater and surface water by:</p> <ul style="list-style-type: none"> • Identify and correct failing septic systems • Identify noncompliant systems and assist landowners with planning to gain Health Dept. OSS compliance in a feasible time frame • Identify and implement alternative municipal and on-site wastewater management strategies • Establish a funding program to assist landowners with correcting failing systems and pursuing compliant systems • Providing I/E to shoreline landowners as to aquatic wildlife management and ecosystems 	Pathogens
Restore and protect the Warm/coldwater fishery	<p>Reduce hydrology alterations by:</p> <ul style="list-style-type: none"> • Restore and maintain natural hydrology in creeks 	Toxins Altered

Goal	Objectives by Source/Cause	Pollutants Addressed
and other indigenous aquatic and terrestrial wildlife	<p>and wetlands through road/water body crossings improvements</p> <ul style="list-style-type: none"> • Provide I/E to township, and county regarding stormwater processes • Work with county and townships to design and implement stormwater management programs <p>Reduce sediment by:</p> <ul style="list-style-type: none"> • Stabilizing eroding stream banks • Pursuing SESC compliance from riparian development projects • Providing I/E to community regarding erosion/sedimentation threats • Minimize filling of wetlands, dredging, and other land-use activities disturbing soils near water bodies <p>Reduce the amount and potential of toxins impacting wildlife by:</p> <ul style="list-style-type: none"> • Creating awareness as to hazardous waste and its management • Pursue a hazardous waste collection site in watershed <p>Reduce nutrients from impacting aquatic life by:</p> <ul style="list-style-type: none"> • Provide I/E to township, and county regarding stormwater processes • Work with county and townships to design and implement stormwater management programs • Identify and implement alternative municipal and on-site wastewater management strategies • Providing I/E to shoreline landowners as to aquatic wildlife management and ecosystems <p>Reduce invasive species impacts by:</p> <ul style="list-style-type: none"> • Provide I/E regarding invasive species threats, techniques for control 	<p>Hydrology Sediments Nutrients Invasive Species</p>
Restore/protect navigation opportunities	<p>Reduce input of nutrients entering Cedarville Bay by:</p> <ul style="list-style-type: none"> • Identifying and implementing alternatives to the municipal wastewater discharge. • Restore eroded stream banks, road embankments, and eliminate direct runoff paths from road surfaces. • Assess stormwater nutrient/sediment inputs and design management plan. <p>Reduce input of sediments entering Cedarville Bay by:</p> <ul style="list-style-type: none"> • Restore eroded stream banks, road embankments, and eliminate direct runoff paths from road surfaces. • Assess stormwater nutrient/sediment inputs and design management plan 	<p>Nutrients Sediments</p>
Provide appropriate opportunities for public enjoyment of aquatic/terrestrial resources including but not	<p>Create appropriate low-environmental impact recreational opportunities and access to the enjoyment of aquatic and terrestrial resources:</p> <ul style="list-style-type: none"> • Identify appropriate locations for trails to provide recreation opportunities and promote the installation, 	<p>Nutrients Sediment</p>

Goal	Objectives by Source/Cause	Pollutants Addressed
limited to walking trails, scenic overlooks, boat launches, and public access areas.	<p>maintenance, and monitoring of them for appropriate use.</p> <ul style="list-style-type: none"> Identify appropriate areas for public access to Lake Huron, inland lakes, and creeks and promote and facilitate the acquisition or use of properties and the installation of appropriate access facilities. Provide education/information opportunities for the public as to the available aquatic and terrestrial recreation opportunities in the watershed and the management responsibility of resources to maintain those opportunities Facilitate creek walks, kayaking, fishing, hunting, and other low impact recreational workshops and opportunities 	
Preserve the unique nature-based aesthetic character of the Les Cheneaux Islands area by promoting and executing shoreline and riparian conservation easements, land acquisitions, and deed restrictions.	<p>Preserve character by promoting and executing undeveloped land protection by:</p> <ul style="list-style-type: none"> Educate community and promote shoreline and riparian conservation easements, land acquisitions, and deed restrictions. Facilitate workshops, activities, and land use planning regulation that supports the sustainability of environmental and economic livelihood. Assess regulations, ordinances, attitudes, and trends in relation to undeveloped land protection and facilitate the improvement of those entities for the protection of undeveloped lands. <p>Preserve existing historical, cultural, and environmental features by:</p> <ul style="list-style-type: none"> Assess regulations, ordinances, attitudes, and trends in relation to developed land protection and facilitate the improvement of those entities for the protection of aesthetic character of the watershed. Facilitating I/E for landowners creating awareness as to environmentally-friendly development practices 	<p>Sediment Nutrient Toxins Altered Hydrology Invasive Species Pathogens</p>
Identify and protect priority habitat for threatened and endangered species	<p>Protect habitats by:</p> <ul style="list-style-type: none"> Identify and publicize priority threatened and endangered species habitats Provide stewardship information, education, and volunteer opportunities to landowners, business owners, and students Promote and execute threatened and endangered species habitat protection through conservation easements, land acquisitions, and deed restrictions. Pursue tax incentives to landowners who possess priority habitats Provide technical assistance to developers, realtors, and contractors in dealing with development on priority habitats Assist townships with land use planning and regulation including development of ordinances to protect aquatic and terrestrial resources Improve stormwater management throughout the watershed Increase the awareness of developers, township 	All

Goal	Objectives by Source/Cause	Pollutants Addressed
	officials, and businesses on the impacts of development on natural resources and biological communities	
Establish education and information programs that promote the conservation, education, protection, restoration, and sustainability of aquatic resources within the Les Cheneaux watershed.	<ul style="list-style-type: none"> • Raise awareness and knowledge about water quality concerns in the watershed, pollutants, their sources and causes, and strategies to reduce pollution and realize water quality protection. • Increase community involvement in the implementation of the management plan, the reduction of pollutants and guaranteed designated uses for future generations. • Motivate the community to develop a positive stewardship ethic towards the protection of aquatic resources and natural systems in the watershed. 	All

Chapter 6 Project Implementation Strategies

6.0 Best Management Practices

Included in this chapter are land management practices that landowners implement to control sources or causes of pollutants in the Les Cheneaux watershed and pollutant load reduction estimates. These practices are considered *Best Management Practices*, or *BMP's*. There are three types of BMP's:

- Structural: "brick and mortar" practices that require construction activities to install, such as stormwater basins, grade stabilization structures, and rock and riprap.
- Vegetative: Use plants, including grasses, trees, and shrubs, to stabilize eroding areas.
- Managerial: Involve changing the operating procedures at a site.

6.1 Systems of BMP's

Best Management Practices are typically applied as systems of practices because one practice rarely solves all water quality problems at a site, and the same practice will not work for all the sources and causes of a pollutant. All three types of BMP's may be needed to address a source of pollutants. Several manuals of reference were used to develop the BMP's for the Les Cheneaux watershed:

Table 6.1.1. BMP References

Source	BMP Manual	System of BMP's
On-site septic systems and municipal discharge	Information and education	Seek alternative wastewater discharge management; Information and education; ordinance development
Stormwater-roadside ditches, lot boundary drainages, Impervious surfaces	Guidebook of BMP's for Michigan Watersheds; Stormwater Management Guidebook; Information and education	Land use planning, ordinances, riparian buffers, check dams, grassed waterways and ditches, Information and education
Improper hazardous material/waste management	Information and education	Information and education; develop local hazardous waste management program
Development and human disturbance, high impact recreation	Guidebook of BMP's for Michigan Watersheds; Information and education	Habitat protection ordinances, SESC and wetland law education and enforcement; construction strategies (staging and scheduling), conservation easements, deed restrictions, land trusts
Invasive species	Information and Education	Information and Education
Eroding road/stream crossing embankments, streambanks, shoreline erosion	Guidebook of BMP's for Michigan Watersheds	Riparian buffers, stream course clean up, riparian landowner education, stream bank stabilization. Culvert replacement, embankment stabilization, run-off deterrents
Water quality monitoring	GLEAS Procedure 51	Information and education; develop local monitoring program
Desired Uses		
Low impact recreation	Information and Education	Information and Education
Promote natural character	Information and Education	Information and Education
Protect threatened and Endangered species	Information and Education	Information and Education

6.2 Recommended BMP's

The goal of this watershed implementation plan is to suggest activities that will provide the most benefit for the Les Cheneaux watershed in terms of restoring degraded areas, preventing further pollution, and protecting aquatic resources. The following strategy for protecting water quality is organized by pollution sources found in the watershed. Some sources can contribute many different pollutants. Consequently, treating a pollution source may reap multiple pollution control benefits. There are a number of objectives for each source of pollution, a task to reach the objective along with partners who will help perform the respective task. Typical systems of BMP's are described along with, milestones, and a timeline within which the BMP's are proposed to occur. The BMP's are designed to eliminate the total pollutant loads described in chapter 2 and these pollutant load totals serve as benchmarks or criteria for evaluation. Success will come with realizing a respective goal in the time frame proposed or a measure of pollutant load reduced. Short-term objectives are slated for completion and adoption within the first 3-5 years and long-term objectives were determined to require 5-10 years. These time proposals, however, are suggestions and will depend on the type and availability of funding.

Structural cost estimates are based on Conservation Resource Alliance's *unit costs for road crossing repair estimates* (CRA 2001), Natural Resource Conservation Service (NRCS 2002), and the Grand Traverse Bay Watershed Plan (U'ren 2003).

Estimated milestones and the timeline are based on the LCWC volunteers coordinating the project for the first year with a full time project manager coordinating the project for the subsequent minimum 3-5 years. Many of the costs associated with coordinating workshops, meetings, and other I/E activities will not be broken down into specific dollar amounts. They are included in the manager's salary, since minimal extraneous costs would be incurred other than work performed by the project manager.

6.3 Description of Project Implementation Tasks

Descriptions include objective by source, task number, system of best management practice (task), responsible party, milestones/pollutant load reduction¹⁸/timeline, estimated cost/per site, and number of sites where applicable. Many of the following strategies include informational/education activities that are developed in the I/E plan.

1. Objective by Source: Reduce Pathogens, nutrients, and toxins from on-site septic systems by restoring approximately 170 failing on site septic systems.

Task A

Reduce the input of pollutants (pathogens, nutrients, and toxins) reaching groundwater and surface water from on-site septic systems by completing shoreline and creek surveys to determine potential failing septic system sites based on *Cladophora* populations, observations of illicit discharges, or discussions with landowners with no State well log registration. Enter data into GIS format. Number and location of sites: 200 linear miles of shoreline.

Responsible Party:	LCWC, LCIA, LSSU, LCCS
Milestones/timeline:	Total linear mileage of shoreline surveyed/year 2; GIS map complete/year 2
Estimated Total Cost:	\$5,000

Task B

Conduct focus meetings with LMAS Health Department to devise a strategy for local OSS problems to be suggested for Clark/Marquette Township Ordinances. Poor building sites, consideration for alternative OSS for special situation residents in watershed, lack of inspections, etc. will be considered in strategic planning. Include 20 hours preparation time per meeting.

¹⁸ Objectives designed to eliminate total pollutant load mentioned in chapter 2 from each corresponding pollutant source.

Responsible party: LCWC, LMAS, MDEQ, LCIA
 Milestones/Timeline: Host introductory strategic planning during year 1. Ordinance developed by year 3.
 Estimated Cost: Manager's salary; \$250/meeting

Task C

Reduce the input of pollutants (pathogens, nutrients, and toxins) reaching groundwater and surface water by consulting area financing institutions, civic groups, regional funding organizations to create a funding system to provide resources to local landowners to repair failing OSS and upgrade non-compliant OSS. An endowment fund will be explored to provide funding for this project goal.

Responsible Party: LCWC, LCIA, CEMCD, LMAS Health, MDEQ
 Milestones/ Timeline: Proposal presented to local and regional groups by year 3; Establish endowment fund by year 5
 Estimated Cost/Site: Manager's salary

Task D

Work with LMAS, MDEQ, Township Officials, and other appropriate parties to develop a strategic plan to protect drinking water. Project staff will work with USGS, MDEQ, MDNR to identify priority groundwater discharge and recharge areas, groundwater flow, and aquifer characteristics, produce local aquifer maps, and determine strategic activities to protect existing water sources. Project staff will also assess prevalence of abandoned wells throughout watershed and assess applicability of MDEQ's Wellhead Protection Program for groundwater protection. The product will be a groundwater protection plan including I/E strategies and management actions based on this focused inventory and assessment.

Responsible parties: LMAS, CEMCD, TWP's, MDEQ, MGSP
 Milestones/Timeline: Gather and present existing groundwater concerns/data into a locally-based characterization including ground-proofing wetland areas; potential recharge areas by year 3
 Estimated Total Cost: Manager's salary; \$6,500

2.	Objective by Source: Eliminate pollutants originating from discharge of the Clark Township municipal wastewater treatment facility.
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Task A

Reduce the input of pollutants (pathogens, nutrients, and toxins) reaching Pearson Creek and Cedarville Bay from the municipal wastewater discharge by seeking and providing technical assistance to Clark Township officials to explore feasibility of discharge alternatives and/or treatment strategies to eliminate nutrients, toxins, and potential pathogens from wastewater discharge and from the water bodies in which it is discharged. Members from LCWC will seek technical assistance from wastewater treatment industry to explore feasibility of tertiary treatment of wastewater as well as industry suggested alternatives. Feasibility of alternative discharge methods will be investigated, including constructed wetlands, land spray, and deeper water discharge. Industry leaders will be solicited to provide preliminary alternative systems with competitive cost, low maintenance guarantees, and low impacts to aquatic and terrestrial systems as criteria for consideration. LCWC will sponsor at least 1 meeting to introduce respective vendors and other successful officials to township officials.

Responsible Party: LCWC, CT, MDEQ, LMAS
 Milestones/ Timeline: Implement iron chloride BMP during year 1.
 Contract consultant by year 2
 Estimated Total Cost: Manager's salary; \$60/hr for consultant services

3.	Objective by Source: Reduce the input of pollutants (pathogens, nutrients, sediment, and toxins from urban and rural stormwater.
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Task A

Reduce the input of pollutants (pathogens, nutrients, toxins, sediment) reaching groundwater and surface water and altered hydrology from urban and rural stormwater by organizing appropriate Mackinac County

officials, township officials, LCWC, and local hydrology specialists to develop a stormwater management plans and/or ordinances for Cedarville and Hessel and the surrounding watershed. LCWC will present priority concerns to group, state and federal regulations and facilitate strategic planning to adopt local stormwater management in local ordinances. A planning consultant will be hired to develop ordinance regulations such as stormwater retention/detention requirements, into Clark Township zoning ordinances. The planner, LCWC, and project manager will assist the township in promoting and adopting protective ordinance for stormwater management.

Responsible Parties:	LMAS, TWP's, LCWC, MDEQ, CCRC, MCRC
Milestone/Timeline:	Host focus meetings/public meetings by year 3
Estimated Cost:	Video development \$6000; photo presentation \$250; public meeting \$250; coordination \$1,200, ordinance development council \$8,000 = \$15,700 per ordinance

Task B

Work with aforementioned group to install appropriate stormwater BMP's in urban and rural areas where appropriate based on information obtained from stormwater management plan. Preliminary BMP's include revegetate all county maintained ditches entering several creek sites including PRS-3, PRS-5, PRS-6, CED-2, FLR-5, FLR-7, MCK-4, MCK-5, BVR-5, and BVR-6); and install BMP's including check dams and turnouts along same routes according to MDEQ consultation.

Prior to installing BMP's several tasks will need to be completed: A water quality resource management plan (WQRMP) will be developed for each BMP site. The plan will detail the proposed system of BMP's, site plan, cost estimates, and certified engineering plans for MDEQ approval. A contract with the landowner will also be affirmed to facilitate the project and future maintenance. All permits will be secured upon initial project approval.

Responsible Parties:	LCWC, CEMCD, LMAS, TWP's, MDEQ, CCRC, MCRC
Milestones/Timeline:	Define BMP needs by year 2; Begin installation of corrective BMP's by year 3
Estimated Cost:	\$25,000/year salary for coordination; BMP's \$10,000 per site; 10 sites

4. Objective by Source: Improve hazardous waste management

Task A

Work with township, hazardous waste hauler, and other successful (hazardous waste program) communities to develop a regular hazardous waste pick-station to provide opportunity for watershed residents to regularly discard hazardous waste.

Responsible parties:	LCWC, CEMCD, MDEQ, LMAS, Waste Management
Milestone/Timeline:	Sponsor one hazardous waste collection in watershed per year
Estimated Costs:	\$5,000 per collection

5. Objective by Source: Reduce development and other human disturbance impacts to warm/coldwater fishery; other indigenous aquatic and terrestrial wildlife; and threatened and endangered species

Task A

Host strategic workshops for contractors, developers, realtors, local government, and other appropriate organizations to recommend BMP's and wise land use planning guidance during construction activities, real estate development, local township decision-making and other activities impacting the local fishery and aquatic organisms. Activities to promote will include increased enforcement of SESC and wetland regulations, water quality protective ordinances, development of indicators, point of sale disclosure/protection, stormwater management. Evaluation and product will be confirmation from local building inspector, realtor partners, and township officials of voluntary regulation compliance, low impact construction techniques, and other stewardship activity through strategies from participating stakeholders.

Responsible parties:	TWP's, LMAS, MDEQ, MNFI, realtors, contractors, LCIA, CEMCD, and LCWC.
Milestones/Timeline:	Host at least one SESC, Real Estate, and Township Planning workshop each year.
Estimated Cost:	\$11,000 per year

Task B

The group will work to guarantee SESC and wetland regulation compliance at construction sites through monthly compliance communications with local regulators. LCWC will keep track of local SESC permits and building permits to assess compliance.

Responsible party:	LCWC, LMAS, MDEQ, local contractors
Milestones/Timeline:	Partnership with LMAS to monitor SESC/Wetland Regulations where appropriate by year 3
Estimated Cost:	\$12,500/year

Task C

The CEMCD will develop resources to assist contractors, prospective landowners, and realtors with site plan review, building site review, permit applications, and strategies to minimize development impacts on priority fishery and other indigenous wildlife habitat. A consultant will be hired to work with project manager to provide technical assistance on site plan development, SESC measure selection, land use assessment for purchase and development as well as low impact development techniques. Consultant will provide technical assistance to contractors and landowners with permit requirements, for contractors and developers.

Responsible Party:	CEMCD, LMAS, CCHD, LCWC
Milestones/Timeline:	Partners will hire consultant, host one low impact building/development workshop by end of first year.
Estimated Cost:	\$50,000/year

Task D

LCWC and local township officials will review current master plans and zoning ordinances and enforcement trends for counties and townships to determine the effectiveness of protection given to water quality and natural resources. A planner will be consulted to assist townships and counties with land management regulations to develop guidelines that protect water quality and natural resources. Activities include assistance with improving ordinances concerning land splits, setbacks from water bodies, wetland protection, and point of sale protections.

Responsible Parties:	LCWC, TWP's, LMAS, MDEQ
Milestones/Timeline:	All documents assessed by year 3; recommendations made to boards, commissions, etc.
Estimated Cost:	\$8,000 per ordinance; \$250 per meeting: \$30,000 by year 3

Task E

Little Traverse Conservancy will work with the project manager to promote land protection strategies to local township officials, the State of Michigan, and owners of tier 1 and 2 (see Chapter 3) lands to protect priority habitats through purchasing development rights/conservation easement or outright purchase. Focus would be on lands priority to water quality, wildlife habitat, and lands that would protect against degradation of these entities. The partnership will provide technical assistance and promotional materials to priority landowners throughout the project.

Responsible Parties:	MDNR, TWP's, TNC, Little T, LCWC, LCIA
Milestones/Timeline:	Contact all tier 1 and 2 landowners by year 3.
Estimated Cost:	\$7,000 year (\$500/workshop, \$500 site reviews, \$200 site inspections, \$4,000 coordination, \$1000 presentation materials (pictures, maps))

Task F

Provide technical assistance to local townships and counties to promote the development and/or improvement of zoning regulations that preserve habitats priority to warm/coldwater fishery and other indigenous wildlife, especially priority areas defined by MNFI and Little T. (Chapter 3)

Responsible Party:	Mackinac County Officials, Local Township officials, MNFI, LCWC, Little T, TNC
Milestones/Timeline:	Local Zoning ordinance updated with protective language by year 3
Estimated Cost:	\$18,000 plus Manager's salary

Task G

Work with Little Traverse Conservancy, The Nature Conservancy, and other land trusts to protect lands priority to water quality and aquatic and terrestrial organisms, especially undeveloped shoreline, riparian, and wetland parcels following Little Traverse Conservancy land protection criteria (Chapter 3). Work together to develop a strategy including short and long term land protection priorities, landowner contacts, promotion addressed to the specific community, and financial resource attainment. Purchase lands and easements and other strategies upon available funding.

Responsible Party:	Little T, TNC, LCWC, LCIA, TWP's
Milestones/Timeline:	Ongoing
Estimated Cost:	\$18,000 plus Manager's salary

Task H

Consult Les Cheneaux Community Foundation to develop, advertise, seek funding, and implement land protection endowment fund to assist local land conservancies and the Les Cheneaux Watershed Council in purchasing conservation easements on Little Traverse Conservancy tier 1 and 2 priority parcels.

Responsible Party:	Little T, TNC, LCWC, MDNR, Les Cheneaux Community Foundation
Milestones/Timeline:	Endowment fund established in first year
Estimated Total Cost:	\$1,500,000

Task I

Develop a Revolving Conservation Land Acquisition Fund for conservancies to purchase lands for conservation easement implementation and resale. This would be for Little Traverse Conservancy tier 1 and 2 priority properties that are on the market or in cases where landowners are unwilling to sell the conservation easement, but would rather sell the land outright. This would provide a mechanism to allow local land conservancies, including LCWC to purchase the land, restrict the land with a conservation easement prohibiting or severely limiting building /development, and then resell the land to conservation buyers: at its restricted value. This would require funds to cover the cost of the conservation easement (i.e. difference in value).

Potential Project Partners:	Little T, TNC, LCWC
Milestones/Timeline:	Consult local land trusts, local community foundations, and suggested philanthropists within 1 st year. Establish fund within 3 years
Estimated Cost:	\$1,500,000 for 3 years

Task J

Following Little Traverse Conservancy criteria for tier 1 properties, present to local units of government feasibility of a locally funded purchase of development rights/conservation easement acquisition and protection of appropriate tier 1 properties priority to water quality and wildlife habitat preservation where public support exists. An initial public opinion poll will be administered to determine public voter support.

Responsible Parties:	Local Township officials, LCWC, Little T, TNC
Milestones/Timeline:	Public survey complete within 2 years
Estimated Cost:	\$15,000/survey

Task K

Consult MDNR to assess availability of remaining transferable State lands and most fragile tier 1 and 2 properties (Chapter 3) for addition as Designated Natural Areas throughout the watershed for recreation, education, and protections. Upon selection, consult Little T to assist MDNR with pursuit of properties for protection.

Responsible Party: LCWC, Little T, TNC, MDNR, MDEQ, MNFI
Milestones/Timeline: Partner consultation begun within first year. Landowner contacts by end of year 2.
Estimated Total Cost: \$18,000

Task L

Conduct watershed survey following MDEQ watershed survey protocol (MDEQ 2000) at creek locations developed in planning project before installation of any suggested BMP's. In addition, conduct visual survey of entire watershed shoreline to document aquatic habitat conditions and development trends prior to implementation activities. Conduct follow up surveys near end of first phase of implementation (after BMP installation) to evaluate success of BMP's implemented as part of the Watershed Implementation Project.

Responsible Party: LCWC, LCCS, LSSU, LCIA
Milestone/Timeline: Conduct initial survey during spring 2007; progress survey summer 2008, follow up, evaluation survey late summer 2009.
Estimated Cost: \$25,000 per year salary; 10 creeks; 200 miles of shoreline

Task M

Provide assistance to MDNR in their effort to enhance fishery and other indigenous wildlife habitat including collecting information, conducting surveys, and evaluating lacustrine and riparian sites for installation of habitat enhancing structures.

Responsible Party: MDNR, Trout Unlimited, LC Sportsman's Club, LCWC
Milestone/Timeline: Host organizational meeting within first year to define MDNR needs, partner involvement, and develop work plan
Estimated Costs: \$500

Task N

Install in-stream and lake habitat improvements in consultation with MDNR and appropriate partners, including at priority road/stream crossing sites in addition to sediment and hydrological improvements, MCK 2a and PRS 4a.

Responsible Party: MDNR, LCWC, CEMCD, Trout Unlimited, LC Sportsman's Club
Milestone/Timeline: Fish enhancement structures installed within 10 years
Estimated Cost: \$100,000

6. Objective by Source: Reduce warm/coldwater fishery, threatened and endangered species, and other indigenous organism habitat impacts from invasive species.

Task A

Work with the Clark Township to install boat washing stations at the Cedarville (Site # PRS-2 and Hessel Marina launches (Site # HES-1) along with informational kiosks with Invasive species information to reduce potential for spread of invasive species.

Responsible Party: Clark Township, MDNR, LCWC
Milestones/Timeline: Installation within 3 years
Estimated Costs: \$10,000 total for project coordination, design, and meetings
\$25,000 for two structures

Task B

LCWC will perform visual surveys of Lake Huron shoreline and watershed creeks at project start (2007) to assess purple loosestrife and eurasian milfoil infestation each summer and monitor spread of both. After MDEQ consultation, surveyors will attempt to control both species and survey locations each year (spring 2007, summer 2008, late summer 2009) to monitor success and perform continuous control methods.

Responsible Party: LCWC, LCCS, LSSU, LCIA
Milestone/Timeline: Conduct initial survey during spring 2007; progress survey summer 2008, follow up, evaluation survey late summer 2009.
Estimated Cost: \$25,000 per year salary; 10 creeks; 200 miles of shoreline

Task C

Consult regional biological experts to develop appropriate invasive species (purple loosestrife, Eurasian milfoil) control methods. (Prior to #7task B (above))

Responsible Parties: LCWC, CEMCD, U of M, USGS, MSU, Little T, TNC
Milestone/Timeline: Comprehensive, local plan developed within first year.
Estimate Cost: Manager's salary with \$500 for focus workshop

7. Objective by Source: Reduce impacts from erosion/sediment on coldwater fishery, threatened and endangered species, and other indigenous organisms.
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Task A (Same as Task 5L and 6B)

Continue watershed survey (MDEQ 2000) of riparian corridors and lakeshore at project start (spring 2007) to affirm priority areas where riparian vegetated creek and lakeshore buffers and other possible BMP's should be installed, at mid project to assess installation and project success (summer 2008), and near project end (late summer 2009) to evaluate success of BMP's installed during watershed implementation project.

Responsible Party: LCWC, LCCS, LSSU, LCIA
Milestone/Timeline: Conduct initial survey during spring 2007; progress survey summer 2008, follow up, evaluation survey late summer 2009.
Estimated Cost: \$25,000 per year salary; 10 creeks; 200 miles of shoreline

Task B

Work with landowners to install riparian buffers and stabilize eroded stream banks on private lands that have been inventoried and prioritized, including revegetation to PRS-2a (Cattails Cove parking lot), PRS-4a (upstream of Perkins Bridge); and MCK-2a (downstream of M-134), and MCK-2b (Clay Banks erosion sites approximately 0.5 miles upstream of M-134).

Prior to installing BMP's several tasks will need to be completed: A water quality resource management plan (WQRMP) will be developed for each BMP site. The plan will detail the proposed system of BMP's, site plan, cost estimates, and certified engineering plans for MDEQ approval. A contract with the landowner will also be affirmed to facilitate the project and future maintenance. All permits will be secured upon initial project approval.

Responsible Party: LCWC, LCIA, TWP's, MDNR
Milestone/Timeline: Install buffers recommended PRS-2a, PRS-4a, MCK-2a, and MCK-2b upstream and downstream. Complete all sites by year 3
Estimated Cost: Total project cost = \$54,000

Task C

Establish shoreline and riparian buffer demonstration sites throughout the watershed to promote landscaping for habitat protection and erosion and sediment control, including sites PRS-2a, PRS-4a, MCK-2a, and MCK-2b. Work with LCIA to solicit high traffic area landowners to volunteer lakefront properties for buffer demonstration. Work with creek riparian landowners to install buffers for later demonstration activities. Also, solicit potential new homeowners to install buffers and landscaping around building site to control erosion and sediment transport.

Prior to installing BMP's several tasks will need to be completed: A water quality resource management plan (WQRMP) will be developed for each BMP site. The plan will detail the proposed system of BMP's, site plan, cost estimates, and certified engineering plans for MDEQ approval. A contract with the landowner will also be affirmed to facilitate the project and future maintenance. All permits will be secured upon initial project approval.

Responsible Party:	LCWC, LCIA, CEMCD, MDEQ
Milestone/Timeline:	Demonstration areas planted within 5 years
Estimated Cost:	All four riparian locations \$54,000; Shoreline demonstrations = \$5,000 per 100 foot lot

Task D

Identify, contact, promote to shoreline owners needing shoreline stabilization practices biotechnical and soft engineering erosion stabilization and habitat protection techniques. Pursue local funding for a demonstration project on BMP installation, and supervise installation and maintenance of BMP's.

Prior to installing BMP's several tasks will need to be completed: A water quality resource management plan (WQRMP) will be developed for each BMP site. The plan will detail the proposed system of BMP's, site plan, cost estimates, and certified engineering plans for MDEQ approval. A contract with the landowner will also be affirmed to facilitate the project and future maintenance. All permits will be secured upon initial project approval.

Responsible Party:	LCIA, LCWC, USACE, MDEQ, MDNR, CEMCD
Milestones/Timeline:	Conduct watershed assessment, determine potential demonstration sites, implement promotional campaign and distribute by year 2, including newspaper article, brochure, and presentation to LCIA membership.
Estimated Costs:	\$1,000 for print advertisement

Task E

Where priority road/stream crossings have been identified, improve, repair, or replace outdated, failing, or eroding road/stream crossing by implementing the appropriate BMPs from the following:

- 1) Road Crossings
 - Remove obstructions that restrict flow through the culvert
 - Replace undersized (too small or too short) culvert
 - Remove and replace perched or misaligned culverts to avoid erosion and provide for fish passage
 - Install bottomless culverts and bridges where possible upon MDEQ approval
 - Replace culverts with a length that allows for $\geq 3:1$ slope on embankments
 - Revegetate all disturbed or bare soils on embankments
- 2) Road Approaches
 - Create diversion outlets and spillways to direct road runoff and stormwater away from streams
 - Dig or maintain (vegetated) ditches where needed. Insure that ditches are properly installed with erosion control structures such as check dams, vegetated surfaces, etc.
- 3) Road Maintenance
 - Encourage Road Commissions to look at the long-term savings of crossing improvements over cumulative maintenance costs.
 - Encourage Road Commissions to accommodate creek ecosystem integrity when maintaining road crossings, Install erosion controls, work to maintain low impacts to creek channel, and stabilize embankments adequately.

Project Cost by Site:

STL-2	\$90,000	FLR-6	\$50,000
STL-3	20,000	FLR-7	90,000
LAW-3	7,000	MCK-3	50,000
MAC-4	50,000	MCK-4	7,680
MAC-5	300	MCK-5	15,000
PRS-2	150,000	MCK-6	50,000
PRS-3	7,500	BSH-2	136,000
PRS-5	200,000	PRN-3	150,000
PRS-6	60,000	PRN-5	450
PRS-7	3,000	BVR-3	20,000
PRS-8	3,000	BVR-4	20,000
CED-2	200	BVR-5	20,000
FLR-2/3	150,000	BVR-6	20,000

Note: See Road and Stream Crossing Inventory for detailed BMP description and priority.

Prior to installing BMP's several tasks will need to be completed: A water quality resource management plan (WQRMP) will be developed for each BMP site. The plan will detail the proposed system of BMP's, site plan, cost estimates, and certified engineering plans for MDEQ approval. A contract with the landowner will also be affirmed to facilitate the project and future maintenance. All permits will be secured upon initial project approval.

Responsible Party: MCRC, CCRC, LCWC, MDEQ, MDOT
Milestones/Timeline: 9 crossings improved by end of 3rd year; all crossing complete withing 10 years
Estimated Costs: \$1,369,630

8. Objective by Source: Water quality monitoring

Task A

Land Information Access Association (LIAA) will work with the project manager and LSSU to create an on-line interactive water quality database which will provide community access to research results and other water quality associated information about the Les Cheneaux area watershed. LIAA will be contracted to develop the database, create a web page to access the information and web tools to enable users to continuously update information. LSSU will help enter available research reports.

Responsible Party: LCWC, LSSU, LCCS
Milestones/Timeline: Organize database, interactive GIS tool for LCCS schools, residents, landowners by year 3
Estimated Cost: \$16,000 plus manager's salary

Task B

Implement beach monitoring of E. coli bacteria at local swimming areas with LMAS. Pursue funding resources, and utilize LSSU volunteers to collect water samples during summer recreation months to monitor bacteria levels.

Responsible Party: LMAS, LCIA, LSSU, Chippewa County Health Dept.
Milestones/Timeline: Create partnership with LMAS, CCHD, to create a beach-monitoring program in Mackinac County; pursue monitoring funds by year 2
Estimated Costs: \$10,000 plus Manager's Salary

Task C

Conduct hydrological analysis of subwatersheds (following MDEQ consultation) slated for BMP installation prior to installation and near end of project to assess success of BMP's.

Responsible Party: LSSU, MDEQ, LCWC

Milestone/Timeline: Perform hydrology study summer of 2007 and 2009
 Estimated Costs: Manager's salary

Task D (Same as task 5L, 6B, and 7A)

Perform watershed survey (DEQ 2000) of creeks, inland lakes, and other water bodies, including wetland areas using visual assessment through walking, canoeing, obtaining annual aerial photographs to document current water quality conditions prior to BMP implementation and near project end to assess installed BMP success.

Responsible Party: LCWC, LCCS, LSSU, LCIA
 Milestone/Timeline: Conduct initial survey during spring 2007; progress survey summer 2008, follow up, evaluation survey late summer 2009.
 Estimated Cost: \$25,000 per year salary; 10 creeks; 200 miles of shoreline

9. Objective by Source: Create appropriate low environmental impact recreational opportunities and access to the enjoyment of aquatic and terrestrial resources.

Task A

Provide water quality technical assistance to township and interested community in developing M-134 bike path, recreation park, and in improving public boat launch areas. Project manager will facilitate partnership with Clark Township recreation planners and similar regional successful recreation planners to help Clark Township realize these recreational opportunities while minimizing effects on water quality and other indigenous wildlife.

Responsible Party: TWP's, MDNR, LCWC, USACE, MDEQ
 Milestones/Timeline: Facilitate group communications and consultations for each project by year 2
 Estimated Cost: Manager's salary

Task B

Consult MDNR to assess availability of remaining transferable State lands and most fragile tier 1 and 2 properties (Chapter 3) for addition as Designated Natural Areas throughout the watershed for recreation, education, and protections. Upon selection, consult Little T to assist MDNR with pursuit of properties for protection.

Responsible Party: LCWC, Little T, TNC, MDNR, MDEQ, MNFI
 Milestones/Timeline: Partner consultation begun within first year. Landowner contacts by end of year 2.
 Estimated Total Cost: \$18,000

10. Objective by Source: Promote the preservation of existing environmental and social features that defines the character of the Les Cheneaux Islands area. See I/E strategies #10.

Task A

Work with the township, MDNR, LCWC, and other appropriate groups to host at least one creek walks, kayaking, fishing, hunting, and other low impact recreational workshops per year and one information/education opportunity per year to foster an appreciation for protection of natural resources. Partnership will meet regularly to devise ways to promote stewardship ethic about local environment and protective activities to guarantee the natural integrity of the environment.

Responsible Party: LCIA, MDNR, TWP's, LCWC
 Milestones/Timeline: Two stewardship tours/workshops/or presentations/per year
 Estimated Costs: \$10,000/year

Chapter 7 Information and Education Strategies

7.1 Information and Education Strategy

The following information and education (I/E) strategy is a result of LCWC's determination that the crux of activity needed to protect water quality in the Les Cheneaux watershed is voluntary behavioral change. To foster that change, the Les Cheneaux watershed project will focus on helping the local community understand watershed concerns and how their individual activities can help protect the quality of their water. The goal of this I/E strategy is to increase public participation in watershed management and to provide information to those who are most likely to have an impact on water quality and motivate them to make necessary changes. Suggestions for protecting water quality were formulated at several steering committee meetings and through many consultations with the local community and technical advisors.

7.2 I/E Strategy Goals

Upon reviewing the steering committee goals and objectives, as well as the pollutants, their sources and causes, the following I/E goals and objectives were formulated:

Establish education and information programs that promote the conservation, education, protection, restoration, and sustainability of aquatic resources within the Les Cheneaux watershed.

7.3 I/E Strategy Objectives

The objectives of the I/E plan focus on realizing this goal:

- *Raise awareness and knowledge about water quality concerns in the watershed, pollutants, their sources and causes, and strategies to reduce pollution and realize water quality protection.*
- *Increase community involvement in the implementation of the management plan, the reduction of pollutants and guaranteed designated uses for future generations.*
- *Motivate the community to develop a positive stewardship ethic towards the protection of aquatic resources and natural systems in the watershed*

7.4 Target Audiences

The Les Cheneaux community can be divided into the following general audiences so that specific I/E activities can be directed accordingly:

Households - The general public.

Homeowners - Those who own homes or are responsible for rentals, buildings, etc.

Riparian/Shoreline Owners - Residents living within creek corridors or on the shores of inland lakes or Lake Huron - includes Island residents. An important group since increased activity will be toward the water.

Tourists - The area population increases significantly during the summer months as people travel to the Islands area to enjoy aquatic resources, especially our aesthetic qualities. Since tourists help sustain the community and sometimes impact the environment, it is imperative to educate and inform them of their role in protecting water quality.

Contractors/Developers/Realtors - This group consists of all involved in the process of developing land including carpenters, excavators, and those promoting land sales and development. As awareness of this beautiful area increases, so will the development of priority habitats that will affect our water quality.

Awareness, knowledge, and appreciation of healthy aquatic resources will have to be promoted to sustain the watershed through this growth.

Students of Les Cheneaux Community Schools (K-12) - Here is the future of the Les Cheneaux watershed. Fostering an appreciation of natural systems now will pay water quality dividends in the future.

Township Officials - Area township government personnel, such as supervisors, clerks, trustees, and planning commissions. They administrate regulations and lead certain initiatives. We will work closely with them toward land use planning that accommodates our natural resources.

Table 7.4.1 Targeted Audiences

Watershed Pollutant Sources	Target Audiences	Priority Target Audiences	Priority
Failing septic systems	Homeowners	Riparian homeowners with non-compliant well/septic systems	1
Development and human disturbance	All	Township officials, building inspector; local contractors; local realtors	2
Hazardous waste (roads, machinery, motors, recreation, etc.)	All	Marinas, shoreline businesses, boating enthusiasts, dock and dredge companies, and landowners	3
Invasive Species	All	All	4
Municipal waste water discharge	Clark Township Officials	Clark Township Supervisor; wastewater program manager	5
Stormwater	All	Chippewa/Mackinac Road Commissioners; Clark, Marquette, and Raber Township Supervisors; local contractors	6
Erosion/ Sedimentation (stream banks, road crossings)	Riparian landowners, county road commissions	Riparian landowners, Chippewa and Mackinac County Road Commissions	7
<i>Desired Use</i>			
Low impact recreation	All	All	N/A
Promote natural character	All	All	N/A
Protect threatened and Endangered Species	All	All	N/A

7.5 Public Participation Summary

The Les Cheneaux Watershed project has been bringing people together to protect water quality for many years. Through a partnership including the Chippewa/East Mackinac Conservation District, The Nature Conservancy, and community representation from the Natural Resource Task Force (NRTF)¹⁹, a Section 319 grant proposal was submitted on behalf of many concerned citizens. The project was funded in November 2002, and a steering committee was developed from an initial public meeting in January 2003. The steering committee met every month during the planning project (MDEQ tracking code 2002-0078) and will continue to meet regularly to coordinate the implementation of the management plan. The steering committee formally became a certified non-profit 501(c)(3) group, the Les Cheneaux Watershed Council, in July 2004 in order to work more effectively at water quality management.

During the development of the planning process, the project manager presented the watershed project to many civic groups and discussed their watershed concerns, desired uses for the watershed, and requested support and participation from respective members. Since the community consisted of only 2,500 full time residents and a little more than twice that for seasonal residents, a good representation of the community was accommodated through these group and one-on-one contacts. This process helped prioritize and match I/E strategies with appropriate audiences, and the specific messages to convey to these audiences (Table 8.4.1). This process demonstrated that basic education about water quality was needed throughout the planning process and continued through implementation. Consequently, project partners published and distributed several newsletters to targeted audiences throughout the planning process to provide basic water quality information and solicit involvement in the project. The project manager provided several informational tours throughout the watershed to help stakeholders become aware of the many influences on water quality in the watershed. Several articles concerning the project were published in *The St. Ignace News* and the Chippewa/East Mackinac Conservation District newsletter. Project information was displayed at several annual home shows in Chippewa and Mackinac County, the Chippewa County Fair, and the very well attended Hessel Antique Wooden Boat Show.

The watershed project involved the community throughout the pollution inventory process. Local volunteers assisted with a stream crossing watershed survey. Les Cheneaux Community Schools assisted the project with chemical and biological surveys, as well as creating a web page for the project. Lake Superior State University assisted the project with several chemical analysis projects, and with analysis of water samples by other local volunteers. The project steering committee, which formally organized into the Les Cheneaux Watershed Council midway through the project, met every month to direct the project and evaluate its progress. Technical advisors including local, state, and federal agency personnel assisted the project and the final editing of the management plan.

7.6 Completed Planning Project Information/Education Activities

In order to publicize the watershed project and provide basic education in watershed management, project partners enjoyed the following I/E successes:

- Newsletters: Quarterly newsletters were published and distributed to the watershed community.
- Project Brochure: A brochure describing the project steering committee (LCWC) and project inventories was distributed to stakeholders and the general public.

¹⁹ NRTF was a committee formed out of the Les Cheneaux Economic Forum, “a voluntary coalition of concerned residents, business owners and local leaders created by the Les Cheneaux Chamber of Commerce in 1996 (continued on next page footnote), with the goal of creating ‘a plan for economic development that preserves the beauty and nature of the Les Cheneaux area, and that inspires those who live here and those who will come in the future to maintain and enhance the quality of life in the community’” (Plan for Les Cheneaux) NRTF was charged with investigating the importance of natural resources in the area and how they could be improved and preserved for the benefit of present and future residents.

- Focus/Civic Groups: Obtained watershed concerns and presented watershed project logistics to several business and civic groups throughout the community. Groups included:
 Les Cheneaux Islands Association
 Les Cheneaux Islands Wildlife Association
 Chamber of Commerce
 Lions Club
 Clark Township officials
 Les Cheneaux Community Schools
 Chippewa and LMAS Health Department
 Lake Superior State University
 Mackinac County Commissioners
 EUPRC&D
- Project Website: LC Community Schools developed a project website that will be placed on the Chippewa/East Mackinac Conservation District website during the implementation phase of the project.
- Steering Committee Meetings: Each month, steering committee members met to organize the LCWMP. Group members discussed concerns, pollutants, sources, and causes, as well as BMP's and evaluation. The meetings also facilitated the establishment of the Les Cheneaux Watershed Council.
- Public Meetings: The project began with a public meeting which helped gain support for a steering committee, introduced the project to the public, and discussed watershed concerns. The planning phase ended with a public meeting to enable the public to discuss the first draft of the management plan with LCWC and provide final evaluation of the planning phase.
- News Articles: Articles were published in the *St. Ignace News* a widely read local newspaper servicing much of Eastern Upper Peninsula
- Civic Event Presentations: LCWC and CEMCD presented project information and education at several annual events, including the Sault Home Show, Mackinac Home Show, Chippewa County Fair, Binational Public Advisor Council annual summit, Hessel Antique Wooden Boat Show, LC Artisans Coop *Art Dockside*, Les Cheneaux Area Frog Fest.
- Community Education Projects: Several watershed tours were conducted to provide opportunities for the project manager, LCWC, and other technical advisors to help provide information and education to local residents. Tours included Mackinac County Karst Tour, Michigan Limestone Operations Tour, Elderhostel Alvar Tour, several road/stream crossing tours, stream bank erosion tour, shoreline surveys, and chemical and biological analysis trainings.

7.7 The Future of LCWC

Several activities listed above will continue in the implementation of the I/E strategy. All civic groups will be continuously updated and solicited for involvement and support of the project. Newsletter publishing will continue, contingent upon sufficient funding. An additional project brochure is being prepared through a grant from Boat US Foundation (spring 2005) that will help secure support from additional stakeholders. The I/E strategy includes plans for several community education and training events with local contractors, realtors, and government officials. The project website will be updated with the management plan upon MDEQ approval. LCWC will continue its success presenting project updates and education at local civic events as well as public presentations. The LCWC submitted grant proposals to host a watershed summit to be held the summer of 2005 in Cedarville, Michigan to publicize the finished Les Cheneaux Watershed Management Plan and to provide comprehensive updates of current research taking place in the Les Cheneaux watershed.

7.8 Information/Education Strategy

The Les Cheneaux Watershed Council feels that the most priority necessity of the I/E strategy and for sustainability of the watershed project will be to create an information resource in the community, housing a library of research, baseline data, and a staff resource professional able to provide the local community with natural resource management technical assistance. Many of the activities described in the I/E Plan will be daily tasks for the project manager and costs will be incurred in the manager's salary including those tasks described below that will be the sole responsibility of the lead organization.

Milestone:	Continue operating out of the project office and secure funding program to pay a full-time project manager by 2006.
Estimated Cost:	\$150/month office; \$50,920/year staff (Includes \$1000/year mileage, \$8,320 in fringes (20%))

The Les Cheneaux Watershed Council or project lead agency will attempt to perform the following activities continuously over the course of the project. Many of these activities were started in the planning phase by CEMCD and adopted by the council as vehicles for distributing information and education.

Summary of LCWC Responsibilities:

- LCWC will continue to publish the quarterly newsletter *The Watershed News*.
Estimated Cost: \$3,000/year
- LCWC will publish an annual report of water quality conditions throughout the watershed, including baseline water chemistry data from groups collecting information, new research findings, and other information influencing water quality.
Estimated Cost: \$1,000/year
- LCWC staff person will provide watershed information and news to the local regional media on a regular basis in the form of press releases, public service announcements, feature stories, story ideas, editorials, etc.
Estimated Cost: Cost included in resource professional salary
- Develop TV and radio ads, public service announcements, print ads, etc., focusing on relevant water quality issues and basic watershed messages.
Estimated Cost: \$10,000/year
- Maintain and promote a comprehensive website containing the watershed management plan, information about the watershed, project participation information, and links to other relevant information and organizations. Project Plan will be posted on CEMCD website in 2005 and LCWC will construct and maintain a website by 2006.
Estimated Cost: \$1,000/year

- LCWC will host an annual information and education symposium to inform the community of the latest research and other information regarding water quality each summer.
Estimated Cost: \$250/year
- LCWC will develop and distribute informational signage throughout the watershed, including stenciling stormdrains with LCCS, kiosks at boat launches with Clark Township, road crossing creek signs with Mackinac County Road Commission, lake signs with local landowners, and information boards at scenic and biological unique and priority areas with local landowners and land trusts.
Estimated Cost: \$90/sign \$1800 total
- LCWC will host a series of watershed tours for the community several times/year to highlight natural features and build support for preservation. Quarterly tours will be hosted to highlight projects, natural features, issues, etc.
Estimated Cost: \$200/tour
- LCWC will facilitate the development of an educational video about the watershed project, including priority watershed issues and pollution prevention and water quality protection tips by 2006.
Estimated Cost: \$6,000/video

7.9 LCWC I/E Plan

The following I/E strategy is a combination of educational and informational events and outreach materials geared toward empowering the Les Cheneaux community to protect and enhance their aquatic environment. Tasks include delivery mechanisms, responsible organizations, milestones, timeline, and estimated costs, where available. They are organized by pollutant source.

1. Objective by Source: Pathogens, nutrients, and toxins from on-site septic systems.
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Task A

Reduce the input of pollutants (pathogens, nutrients, and toxins) reaching groundwater and surface water by assessing the occurrence of noncompliant systems through landowner survey and GIS information. Discuss OSS maintenance and regulatory codes with landowners not serviced by municipal wastewater treatment. Distribute OSS technical I/E literature and complete OSS compliance plans with landowners to initiate process of voluntary compliance with current and/or future OSS regulations. Assist interested landowners with financial planning to gain LMAS OSS compliance.

Responsible Party:	LCWC, LCIA, LMAS, MGSP
Milestones/ Timeline:	Literature distributed/consultation with targeted audience/year 10. LMAS Environmental Health, MDEQ, MSU Extension, MGSP, and LCWC will develop a locally based, comprehensive public education/awareness program dealing with on-site septic systems. Meet with individual OSS owners. (\$7,200 consultant/part-time employee; and \$2,800 for materials and research)
Estimated Cost:	\$10,000 per year

Task B

Continue focus meetings with LMAS Health Department to devise funding, personnel, and training strategies for local OSS problems as needs are assessed. Continuous meetings will also evaluate present OSS regulatory and I/E activities performed by project partners.

Responsible party:	LCWC, LMAS, MDEQ, LCIA
Milestones/Timeline:	Ongoing
Estimated Cost:	Manager's salary/ \$250 meeting

Task C

Work with LMAS, MDEQ, township officials, and other appropriate parties to develop and distribute education and information materials to the community to protect drinking water. Project staff will “ground truth” existing maps with consultation with USGS, MDEQ, MDNR to identify priority groundwater discharge and recharge areas, groundwater flow, and aquifer characteristics, produce local aquifer maps, and distribute I/E to community through video summary, brochures, etc. News articles, brochures, newsletter articles will be designed, printed, and distributed. The product will be a groundwater protection I/E campaign that provides the community with knowledge to protect groundwater.

Responsible parties:	LMAS, CEMCD, TWP's, MDEQ, MGSP
Milestones/Timeline:	Media distributed to watershed residents (1,500) by year 5.
Estimated Cost:	Manager's salary; \$6,500

Task D

LCWC will work with LMAS to hold annual workshops for local contractors, township official, developers, and realtors regarding current OSS installation codes/suggestions/certification as well as trends and suggestions for future real estate development. LMAS would have the opportunity to discuss problems, logistics for current OSS codes and procedures and update contractors on future legislation, procedures, etc.

Responsible Party:	LCWC, LMAS, MDEQ, TWP's
Milestones/Timeline:	Workshop organized and held by year 3
Estimated Cost:	Manager's salary; \$500/workshop

Task E

LCWC, LMAS, MDEQ, and MGSP will promote voluntary comprehensive testing of individual water wells throughout the watershed. Assist landowners in interpreting results, and recording information on their wells. Work with MGSP to create management plans with landowners to protect existing wells from contamination and promote financial planning for updating noncompliant shallow wells. The project will record the number and types of wells and surface water intakes throughout the watershed.

Responsible Party:	LCWC, LMAS, MDEQ, MGSP
Milestones/Timeline:	Advertising campaign designed and distributed by year 3
Estimated Cost:	Manager's salary; \$600/brochure

2. Objective by Source: Reduce pollutants originating from Clark Township municipal discharge.

Task A

Design, print and distribute informational literature educating the community regarding the present municipal wastewater treatment system. Include any alternatives considered by Clark Twp, LMAS, and MDEQ, which have been developed through the Les Cheneaux planning project (2002-0078) and future focus group meetings. The community will be informed of general schematics, historical information, threats, and future efforts of the LCWP to promote ecologically sound wastewater treatment for the watershed community. LCWC, LCIA, will work with Clark Township Public Works Department to develop a small informational brochure detailing the municipal wastewater treatment system in order to create awareness about the system's capacity, management, impacts on water resources, benefits of the system, and pollution preventative measures. Purpose will be to increase awareness of system's pollution potential and the continued threat of non-point nutrient sources within Cedarville Bay and Pearson Creek.

Milestones/Timeline:	Brochure developed and distributed to watershed population 1,500 by year 3.
Estimated Cost:	Manager's salary; \$2,000/printing and design

3. Objective by Source: Reduce the input of pollutants (pathogens, nutrients, and toxins) from urban and rural stormwater.

Task A

Provide general stormwater education for local units of government, contractors, realtors, and local students that defines the cause and effect relationship between several factors influencing stormwater problems. Provide general stormwater education program for local community, including BMP's that homeowners, and businesses can do on site to limit stormwater runoff. Programs like MSU Extension's *Home*A*Syst* will be used as a guide. Activities include:

- Host presentations to civic groups
- Publish articles in newsletter focusing on stormwater education
- Present stormwater education events with local schools
- Implement a storm drain stenciling event at local school

After initial development of media materials and mode, LCWC will present stormwater education to different civic groups and students. Student presentations will include a tour of stormwater routes, including a stenciling event. Project activities will be implemented within the first five years of the project.

Responsible Party:	LCWC
Milestones/Timeline:	Complete comprehensive civic group and school presentations by year 3 Distribute newsletter articles within 1 st year. Complete a storm drain stenciling event at school by year 3.
Estimated Cost:	Manager's salary; \$10,000

4. Objective by Source: Improve hazardous waste management

Task A

Reduce the input of toxins (gases, oils, hazardous wastes) reaching groundwater and surface water by educating the public to the appropriate disposal and management of hazardous waste. Provide I/E to community, especially aquatic recreationists and businesses, regarding toxin sources and pollution controls.

Work with local MSU Extension offices to increase *Home*A*Syst*, *Farm*A*Syst*, and *Lake*A*Syst* presentations to appropriate individual homeowners, businesses, and civic groups. Possibly create an incentive program to increase presentations. Present appropriate "A*Syst" program to all civic (focus) groups in watershed within the first three years of project. Work with marinas and all automobile service stations, golf courses, and area resorts to inform customers of hazardous waste management and to install and promote BMP's (spill response kits, bilge sponges, etc.) that will reduce the amount of pollution coming from automobile, boat, snowmobile fuels, and wastewater. Correspond with all businesses dealing with hazardous waste within the first three years of project. Provide education regarding groundwater threats from underground fuel tanks. Provide a resource for reporting tanks, managing them to prevent pollution, and assistance with their removal. Issue will be addressed in newsletters within the first three years of the project. An inventory of all existing tanks and their conditions will be completed. Prepare correspondence with owners.

Responsible Party:	LCWC, MSUE
Milestones/Timeline:	Develop incentive plan by year 2; Present "A*Syst" program to all civic Groups by year 5. Correspond with all businesses handling hazardous Wastes by year 3; Publish newsletter article within the first 3 years; Inventory and provide status reports of existing tanks within 5 years.
Estimated Cost:	Manager's salary

5. Objective by Source: Reduce development and other human disturbance impacts to warm/coldwater fishery, threatened and endangered species, and other indigenous aquatic and terrestrial wildlife.

Task A

Educate local governments, developers, contractors, students, and the community on the ecological significance of developing wetlands, shorelines, riparian areas, and other priority wildlife habitats, especially near coastal marshes, groundwater recharge areas, and near threatened and endangered species habitats. LCWC will coordinate regional environmental experts, state and federal agency personnel to hold occasional educational events, including workshops, tours, and other information media to educate and inform landowners as to wildlife habitat management, habitat enhancement and protective measures, the importance of maintaining diverse wildlife habitat, and the impacts of land and marsh fragmentation on wildlife habitat. Two seasonal tours will be provided each year along with accompanying workshops and workshop materials. LCWC will address all members of the target audience within the first five years of the project. (1500).

Responsible Party: LCWC
Milestones/Timeline: I/E presented to 1,500 participants by year 5
Estimated Costs: Manager's salary; \$5,000

Task B

LCWC in cooperation with LMAS Environmental Health and MDEQ, will host annual training opportunities for local decision-makers, developers, contractors, realtors, etc., as to habitat protection regulations and recommendations including SESC and wetland regulations, especially near coastal waters, wetlands, and erodable areas. Discuss current regulation requirements and promote ecological stewardship.

Responsible Party: LCWC, LMAS, MDEQ, USACE
Milestone/Timeline: Annual workshop will be coordinated with others proposed and begin within 3 years.
Estimated Cost: Manager's salary; \$1,000 per year

Task C

LCWC will work with The Nature Conservancy and Little Traverse Conservancy to provide landowner education regarding conservation easements and other land protection activities through civic group presentations, individual consultation, mailings, article publications, etc. LCWC will present goals to all civic groups, township governments and public within first five years of project (1,500 residents). Partnership will publish advertisement campaign and solicit involvement within the first three years of project.

Responsible Party: LCWC, TNC, Little T
Milestones/Timeline: LCWC will present goals to all civic groups, township governments and public within first five years of project; Partnership will publish advertisement campaign and solicit involvement within the first three years of project.
Estimated Cost: Brochure \$1,000; Workshop \$500/year;
Coordination incurred in manager's salary

Task D

Provide demonstration seminars, training, or workshops for local contractors as to less ecologically impacting building design, construction, and maintenance activities. Provide information regarding BMP's that can be installed on site to protect against stormwater problems, priority habitat loss, etc.

Responsible Party: LCWC, Contractor vendors
Milestones/Timeline: Host at least one I/E event within first three years of project. Evaluation based on percentage of local contractors attending.
Estimated Cost: \$500 per training session

Task E

Work with township governing officials and planning commissions to determine deficiencies with zoning, ordinances, and land use planning strategies to protect water quality. Facilitate strategic planning to protect water quality, including stormwater management, land protection, and environmental protective regulation. LCWC will host focus group meetings/presentations on a regular basis within the first three years of project and facilitate an outside consultant to assist government with sustainable development training.

Responsible Party:	LCWC, TWP's, Consultants, TNC
Milestones/Timeline:	Develop ordinance/zoning/sustainability plan by year 5
Estimated Cost:	Manager's salary; \$250/meeting

Task F

LCWC will work with LSSU and EUPRDC to develop a build out analysis of the watershed and present to township officials for land use planning strategy.

Responsible Party:	LCWC, LSSU, EUPRDC
Milestones/Timeline:	Build Out analysis available to township within three years
Estimated Cost:	\$10,000

Task G

LCWC will implement a campaign focused on reducing the feeding of waterfowl, deer, and seagulls in the watershed by developing signage, articles, etc. The campaign will include wildlife management principles on which the program is based, including carrying capacity, habitat needs/destruction, and dangers to reliance on artificial food sources. Provide information regarding fecal coliform bacteria, stormwater transport, and pathogen threats. Program will include signage @ \$90/sign; brochure development for shoreline owners @ \$ 600/brochure; and an annual wildlife management training/information workshop @ \$500/year.

Responsible Party:	LCWC
Milestone/Timeline:	Complete I/E project implemented by year 5
Estimated Cost:	\$1,200/year

Task H

LCWC, NRCS, MGSP and CEMCD will approach all livestock farmers in the watershed to promote the development of conservation plans, resource management plans, or progressive plans with focus on protecting water quality and wildlife habitat. Plans for interested farmers will be completed to help access resource management cost share programs that are aimed at these goals

Milestones/Timeline:	100% farmers contacted within first year
Estimated Cost:	Manager's salary

6. Objective by Source: Reduce warm/coldwater fishery, threatened and endangered species, and other indigenous organism habitat impacts from invasive species.

Task A

LCWC will work with MDNR, MNFI, and other appropriate interested groups to develop and distribute locally based brochures, fact sheets, and presentations creating awareness about invasive species, their management and impacts to civic groups, businesses, landowners, and students.

Milestone/Timeline:	Print materials and presentation will be designed and distributed within the first three years of the project; All civic organizations will be presented to within the first five years of the project.
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Estimated Cost:	Literature \$1,000 design and print each brochure; \$500 for each fact sheet; \$6,000/video presentation
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7. Objective by Source: Reduce impacts from erosion/sediment on warm/coldwater fishery, threatened and endangered species, and other indigenous organisms.

Task A

Conduct shoreline and riparian landowner workshops to create awareness of natural ecosystems, priority habitats, and the benefits of riparian buffers to protect water quality. LCWC, LCIA, and CEMCD will establish lakeshore and creek corridor properties landscaped with riparian buffers in order to present workshops to interested landowners.

Milestone/Timeline: At least one shoreline and creek corridor project will be completed by year 5.

Estimated Cost: \$500/workshop; \$1,000/property for native landscaping

Task B

See development I/E strategies in objective 6 for building sites and general land use planning/practices.

Task C

Develop resources and presentation materials regarding dredging impacts on water quality and distribute to community. Develop alternatives to dredging and promote to shoreline owners, developers, and contractors. LCWC will work with the US Army Corps of Engineers and researchers with the University of Michigan to develop a video documentary along with accompanying booklets describing the negative environmental effects of dredging. Video will be played at LCIA and other civic group meetings and brochures will be distributed to shoreline landowners, realtors, and contractors.

Milestones/Timeline: I/E media complete and available by year 5

Estimated Cost: \$10,000

Task D

Develop a road stream crossing demonstration project for road commissioners, landowners, and other interested parties. Project would highlight a priority concern road/stream crossing and its impacts on the respective water body and the process of remediating it. Improvements in stream ecology would be presented upon remediation of the crossing. Project would be used to promote accommodating stream ecology in crossing design and installation.

Responsible Party: LCWC, contractors, MDEQ

Milestones/Timeline: Demonstration Project funded by year 3; two demonstrations (before and after restoration) complete by year 5

Estimated Cost: Three workshops during construction phase - \$750
Restoration cost \$50,000

8. Objective by Source: Water quality monitoring

Task A

Provide ongoing information to stakeholders regarding research and monitoring efforts conducted by project partners in the watershed. Information will be publicized through newspaper articles, newsletters, radio and t.v. and the LCWC and CEMCD website

Responsible Party: LCWC, CEMCD, LSSU

Milestones/Timeline: Publish quarterly newsletter; monthly submission of press releases, articles, etc.

Estimated Cost: Manager's salary

9. Objective by Source: Create appropriate low environmental impact recreational opportunities and access to the enjoyment of aquatic and terrestrial resources.

Task A

LCWC, LCIA, LCTA, and LCCC will create and implement a tourists and seasonal visitor I/E campaign with focus on promoting low impact recreational ideas and local opportunities to enjoy natural features.

Milestone/Timeline: Create brochures, radio and television adds and distribute through local chamber of commerce and tourism association and realtors within first five years of project.

Estimated Cost: \$30,000 for the outreach package

10. Objective by Source: Promote the preservation of existing environmental and social features that defines the character of the Les Cheneaux Islands area.

Task A

Work with local historical society to create and present historical perspective of development and resource impacts to community and local resources. Presentation may be a video or presentation material appropriate for presentations at summer festivals, civic groups, public meetings, and schools.

Milestones/Timeline: LCWC and LCHS will develop a historic video and presentation format by year 3. Present to community over years 4 & 5.

Estimated Cost: Manager's salary: \$10,000

Chapter 8 Community Projects, Programs and Local Initiatives

Section 8.1 Community Projects

Many of the Les Cheneaux project implementation tasks are designed to build on projects, programs, and regulations that are currently influencing water quality. Several research activities continue throughout the watershed to gain more insight into the local influences of water quality. There have also been comprehensive programs active in the watershed that used a broad array of personnel and activity to pursue information about many facets of water quality. Also, there exist regulations and local controls to maintain the natural character of the watershed. Included here are just a few projects, programs, controls and local initiatives that are underway and will be supported by the watershed project.

Les Cheneaux Islands Association - Phosphorus and Chlorophyll Analysis

Bob Smith, the chairman of the LCIA environmental committee, has been studying the occurrence and effects of nutrients in various locations in the Les Cheneaux Islands. The project, which began with Mike Grant and Aqua Terra Labs in 1994 as a result of concern over the effects of the Clark Township municipal discharge into Lake Huron. The research continues to add weight to that same concern and the watershed project will continue with any support possible to alleviate that concern.

University of Michigan Research

Do low levels of human development affect marsh fish assemblages?

University of Michigan Biological Station,

Abstract: "Juvenile and adult fishes were surveyed in three northern Lake Huron Great Lakes coastal marshes in Les Cheneaux Island bays during June and July, 1996 to 1999. Human activity was quantified in terms of shoreline building density, the density of boat docks and boat houses, impervious surface area, and an aggregate Index of Human Activity (IHA). Human activity levels were low, and the bays selected included the full range of development in Les Cheneaux. Various gear were evaluated for sampling fishes in permanent and seasonal marshes: beach seines, electroshocking, gill nets, fyke nets and baited minnow traps. The active methods were not effective because of substrate conditions and the density of macrophytes. Fishes sampled by passive methods were compared in terms of: species richness, the number of native cyprinid species, the percent of selected tolerant fishes, and catch rates. No relationships were found between human activity and gill net samples. Significant relationships were found, especially for shoreline building density and IHA with species richness and the number of native cyprinid species for fyke net and minnow trap samples. Catch rates were not related to human activity measures using these methods. These results show that even low levels of human activity affect marsh fishes. We suggest that minnow traps in permanent marsh provide the most sensitive, cost effective, and safe method for monitoring Great Lakes coastal marsh fish assemblages".

The watershed project will continue support of research of this caliber to help the community make informed decisions in regards to development and its' effect on clean water.

Lake Superior State University

LSSU students and faculty have performed a variety of research projects in Les Cheneaux area. Everything from coliform bacteria contamination in Cedarville Bay to phosphorus levels in Pearson Creek is studied depending much on the concerns of the people. The watershed project will continue this partnership, as it provides the project with a vehicle for water chemistry analysis and the knowledge to make informed decisions.

Les Cheneaux Community Schools

The Les Cheneaux High School (LCHS) science classes have been performing chemical and biological assessments of at least two creeks within the Les Cheneaux Island watershed. Pearson and Beavertail

Creeks are as different as night and day. One courses through the most urban landscape in the watershed, and the other is a trout stream which has almost no development on its banks. The LCHS teacher provides students with applied learning examples, as well as the building of baseline data to track trends in water chemistry and biological communities. The Les Cheneaux Project has also empowered LCHS's Alternative Community Education Program (ACE) to participate in watershed monitoring. In each of the past two years, ACE students collected macro-invertebrates at each creek in the watershed. They continue to learn various habitats, macro-invertebrate taxonomy and identification, and those things that influence water quality. The watershed project will continue to sponsor ACE work with the environment.

The Nature Conservancy Partnership

The Nature Conservancy has identified the Great Lakes' marsh in the Les Cheneaux area as one of seven ecologically significant natural communities along the northern shore of Lake Huron. Since the early 1990's, the Nature Conservancy has partnered with the Les Cheneaux community through providing resources and collecting biodiversity information along the Lake Huron shoreline. During the 1990's, the Nature Conservancy helped to administer and facilitate funding to be used for beginning wetland plant and animal community descriptions and understanding of the natural and human-created factors affecting them. The University of Michigan (U of M), Michigan State University (MSU), and U.S. Geological Survey (USGS) research team collected data over a three-year period.

In October 1999, the research team compiled their results and submitted a report to Michigan Coastal Management Program titled, "Les Cheneaux Coastal Wetland Project: A Synthesis". Overall, the integrity of Les Cheneaux marshes were found to be in excellent ecological health and very diverse. In addition, a report on invertebrates was published in the December 1999 issue of *Wetlands*, "Development of a Preliminary Invertebrate Index of Biotic Integrity for Lake Huron Coastal Wetlands." Reports, such as these, were shared with the Les Cheneaux community and other partnering groups who make decisions about land and water use in and around marshes.

In July 1999, a community-wide Marsh Forum was held in Les Cheneaux to provide an opportunity for researchers to discuss with residents the results from the collaborative wetland project. The success of the public forum began excitement and awareness in the community for future research projects. Following the public forum, MSU, U of M, and USGS researchers designed projects that included local citizens in monitoring particular species and groups of organisms. Monitoring of yellow perch and other fishes, burrowing mayflies, dragonflies and damselflies, frogs and toads, and invertebrates comprised the primary indices of long-term biotic health measurement.

The perch skein survey, in its second year, was developed by the US Geological Survey to identify priority spawning habitats and fish egg mass quantities. A large number of local residents and a high school science class combed the shoreline marshes looking for perch skeins, counting their numbers, and measuring their sizes. This survey takes place during a two-week period in late April or as soon as the ice melts away from the shoreline. Also developed by the U.S. Geological Survey, were the Odonata (dragonfly and damselfly) and burrowing mayfly surveys. Volunteers scoured six bays for dragonfly and damselfly larval skins found attached to emergent vegetation during the summer months. Mayflies are widely recognized as excellent indicators of water quality and through collecting hatching dates and population estimates residents can track marsh health.

The University of Michigan developed a marsh fish survey, in which volunteers set out minnow traps baited with cat food at four bays. For a two-week period, the number of each species captured and water depths were documented. Minnow species have been determined to be susceptible and sensitive to polluted or disturbed habitat more than other fish species. Therefore, the percentage of minnows versus other fish more tolerant of disturbed habitat can provide an indication of marsh health and water quality. Michigan State University developed a study of aquatic invertebrates. The presence and percentage of water quality sensitive invertebrates can reveal an indication of wetland system health and diversity.

The Nature Conservancy and Les Cheneaux community have established a long-term and vital partnership with collegiate and governmental institutions for continuing research and expertise. These

projects provide an opportunity for the community to conduct research each year and use the information collected for making empowered decisions regarding shoreline threats. As the Les Cheneaux community begins further development of their economic base through nature-based tourism, monitoring programs such as these will be available for ongoing stewardship and measuring success for maintaining these special coastal marshes (Hadley 2000). The watershed project is committed to continuing this type of environmental activity in the watershed. It brings community together with technical service providers to work toward protecting our environment.

The Economic Forum

The Les Cheneaux Economic Forum is a voluntary coalition of concerned residents, business owners and local leaders created by the Les Cheneaux Chamber of Commerce in 1996. The goal of the forum is “a plan for economic development that preserves the beauty and nature of the area, and that inspires those who live here and those who will come in the future to maintain and enhance the quality of life in the community.” (CFED 1998) The forum is currently not active but the watershed project is committed to helping those involved in the past to carry on that goal, because it is consistent with the goals of the watershed project to protect the natural resources of this great place.

Section 8.2 Review of Local Ordinances

Les Cheneaux Watershed Council Assessment of Local Protective Regulations

Members of the Les Cheneaux Watershed Council, including the Clark Township Supervisor, a member of the Clark Township Planning Commission, and a reporter with the *St. Ignace News* assessed the Clark Township Comprehensive Plan, which is a guide for policy and decision making for all future land use within Clark Township, which is the dominant political district of the Les Cheneaux watershed. The plan was updated by the Clark Township Planning Commission in 1994 with the assistance of the Planning and Zoning Center, Inc. of Lansing, Michigan.

The Clark Township Comprehensive Plan was prepared as a foundation for, and depends primarily on, the Township’s zoning ordinance, subdivision regulations, and capital improvement program for its implementation. The plan has no regulatory power, but it does serve to document information key to the planning process for the future of the Les Cheneaux watershed. This assessment and report will provide an opportunity to inform the community about the relationship between public policy and the protection of natural resources, which is so important to the sustainability of the Les Cheneaux community. It is also coming in time for the Planning Commission’s plans for updating the plan and local ordinances. There is some opposition to more stringent land use or design regulations, particularly those that are made to protect the environment or ecology, etc. This report and eventual action through the Les Cheneaux Watershed Project’s implementation phase, will help motivate the community to participate in the revision process, and make their voices heard if they want Clark Township to enact and enforce better protection regulations for the environment, especially water quality.

The review considered two categories: surface water and ground water. The committee tried to identify the negative factors affecting each area.

The Comprehensive Plan

The plan goals and objectives are very compatible with water and environmental quality. The plan repeatedly addresses the need to preserve the watershed. Specific items that are included in the plan that when enforced will undoubtedly protect water quality:

- Open space preservation (retains vegetation for watershed health).
- Island properties should be minimum 200-foot waterfront. (Maintains shoreline vegetation)

- Vegetation buffering. (There are no ordinances dealing with this. Natural edges should be maintained to protect character. There are no ordinances protecting shoreline and natural character.)
- Density. (The plan calls for one acre for areas not served by sewer.)
- Stormwater runoff. (There are no guidelines for how to deal with runoff; i.e. retention basins etc)

While these are items that are specifically not covered in the ordinances, it is the general orientation of the ordinances that need to be modified to protect our natural resources.

The conclusion is that the existing Comprehensive Plan parallels watershed protection. Unfortunately, review of the Clark Township ordinances, illustrated that little is documented to protect the environment and water quality. In fact, the concepts above were not addressed. If the Township reworks the ordinances to conform to the plan, protection of the watershed would be vastly improved from the current status. If the ordinances are modernized to conform to the plan, methods must be instituted to ensure enforcement.

Ordinances

Review of the existing Clark Township zoning ordinances finds that the ordinances do not address the importance of watershed protection at all. Fortunately, there was recently a planning commission proposal to update the Comprehensive Plan and ordinances, and the township is applying for grant money to fund those changes. The Les Cheneaux watershed project will also be working with Clark Township to pursue resources to update the plan and create stronger regulations for the protection of natural resources. In the implementation phase of the Les Cheneaux Watershed Management Plan, project partners will:

- Research other ordinances for examples of success in watershed protection.
- Make a list of deficiencies in the existing ordinances (Shoreline protection, vegetation buffers, open space preservation, shorefront public areas and parks, island specific zoning, stormwater retention, etc.).
- Formally petition the township to bring the issue to the forefront.
- Sponsor education sessions for the key township decision makers.
- Try to get other area groups to join in the effort, which will increase the awareness and add to pressure to improve the ordinances and enforcement. (Islands Wildlife, Les Cheneaux Islands Association, Sportsman Club, Chippewa Tribe, etc.)
- Propose specific ordinance language for changes.
- Attend township and planning commission meetings to show an interest and show a presence.
- Get articles in the newspaper and club mailings to increase awareness.
- Recommend that LMAS chart what places in the watershed are most suitable for septic systems based on current soils data.
- Recommend low-density development on the islands because of the environmentally sensitive areas there and unique habitat, etc. A 200-foot minimum frontage requirement was adopted by the Planning Commission in the mid-1990s, but has never been enforced. The rule may have been tossed out. This should be revisited, since island development probably has some of the highest density, and seems to be getting worse with family compounds being broken up and sold as smaller lots. Islands lack adequate sewage disposal systems and public water supplies.

- Assess the need for a public water system. The Chippewa County Health Department once recommended Clark Township pursue a public system because of all the groundwater contamination in the area. According to the Comprehensive Plan, *“Private wells in select areas of the Township have become contaminated by failing septic systems. Most existing private wells are shallow; less than 100 feet deep. Furthermore, groundwater is in unconfined aquifers so there is no cap (clay, or other impervious material) between the upper and lower aquifer layers found within bedrock. The bedrock is comprised of dolomite limestone and is fractured due to glaciation and weathering over time. These fractures permit contaminants to easily migrate from upper to lower aquifers. The Chippewa County Health Department has recently required that all new wells be drilled to depths greater than 100 and that a grouting system, which seals the entire casing, be employed in an attempt to mitigate the migration of contaminants.”* (CTCP 1994)

Recently, the Clark Township Planning Commission announced firm plans to revise its master plan and zoning ordinance. Clark Township Officials and the Les Cheneaux watershed project partners will be seeking grant money to help fund the revisions.

Chapter 9 Evaluating Success²⁰

Section 9.1 Qualitative Evaluation Techniques

Effective evaluation is an important part of any watershed management plan. An evaluation process will provide measures of the effectiveness of implementing the watershed management plan. Showing success will gain support from the community and increase the potential for project sustainability. LCWC developed evaluation techniques to fit categories of their implementation tasks based on suggestions outlined by MDEQ (2000).

The implementation plan is directed toward activities dealing with informing, educating, or involving people, the restoration of degraded habitat (i.e. structural improvements), and with restoring and protecting water quality.

The following set of qualitative evaluation techniques and criteria can be used to determine whether pollutant-loading reductions are being achieved over time and whether substantial progress is being made towards attaining water quality goals in the Les Cheneaux watershed. The criteria can be used for determining whether this plan needs to be revised at a future time in order to meet water quality goals.

These evaluation techniques will provide the LCWC partners with a better perspective of the community's response to the project and the implementation plan's success of reaching water quality goals. This evaluation will also provide insight into which activities the partnership should discontinue, continue, or improve. Section 10.2 will describe quantification evaluation techniques.

These evaluation methods are not direct measurements of water quality. Nonetheless, the success of these tasks and objectives, collectively and over time, will have a positive impact on the actual water quality in the watershed.

Table 9.1.1 Qualitative Evaluation Techniques

Task or Objective	Evaluation Technique	Measurement/ Criteria for success	Pros and Cons	Implementation
(I/E) Public education or involvement in the project	Public survey (perform at beginning of implementation phase, midway through project, and at the 3-year mark)	Level of awareness; participation in project; before/after knowledge; opinions; attitudes (proof of behavior change)	Moderate costs. Instant feedback. Low response rate.	Pre and post surveys by mail, telephone, or focus group; attendance lists; suggestion box-feedback forms; determine progress on goals/objectives; initial survey 2006; mid-point 2008; and final review 2010
(I/E) Public meetings; workshops; education and involvement projects	Written evaluations	Level of awareness; participation in project; before/after knowledge; opinions; attitudes (proof of behavior change)	Good response rate. Low cost	Post-event participants will complete brief evaluations requesting what was learned, deficiencies in event, and suggestions for improvement. Evaluations done at event Continuous throughout project after events

²⁰ The LCWMP evaluation and monitoring strategy is based up the Huron River Watershed Association's *Mill Creek Subwatershed Management Plan* evaluation strategy. (MCSSAG 2003)

Task or Objective	Evaluation Technique	Measurement/ Criteria for success	Pros and Cons	Implementation
(I/E) Education efforts, brochures, public outreach, public consultation	Surveys, phone calls. Maintain office hours. Document correspondence and complaint records	Level of awareness; participation in project; before/after knowledge; opinions; attitudes (proof of behavior change) Public concerns Location of problem areas	Subjective information from limited number of community	Answer phones, emails, and letters. Document correspondence Assess success from content Years 1-3
(I/E) Public involvement and education projects	Participation tracking	Number of people participating. Geographic distribution of participants. Amount of pollution removed. (Stream clean up, hazardous waste removal)	Low cost. Easy to track and understand	Attendance/informational sign up sheets Document pollution materials removed
(I/E) Information and education programs	Focus groups, Civic groups	Level of awareness; participation in project; before/after knowledge; opinions; attitudes (proof of behavior change)	Medium to high cost. Instant identification of motivators and barriers to behavior change	Select random sample population as participant. 6-8 people per group. Plan questions, facilitate. Record and transcribe discussion
Structural Improvements (Designated Uses)	Photographs, calculations, models, monitoring	Pollutant load, BMP' s installed, physical outcomes, before and after results Aesthetics	Photos are easy to do, moderate costs; calculations are relatively easy to implement, moderate costs	Photograph sites before and after BMP installation, measure erodable soils before and after installation, and design and implement computer and mathematical models; gather continuous physical, chemical, and biological data.
Identify riparian and aquatic improvements. Identify recreational and improvements/ opportunities. Aesthetics (Desired Uses)	Stream surveys Shoreline surveys	Habitat; flow; erosion; recreation potential; impacts	Current and first-hand information. Time-consuming. Relatively high cost	Identify parameters to evaluate. Record on standardized form using standardized protocol (GLEAS 51) Assess success; Continue implementation as data directs

Among some of the programmatic indicators that can be studied to evaluate recommended strategies using these qualitative techniques are number of illicit connections identified/corrected, number of BMPs installed, inspected and maintained, permitting and compliance, and growth and development (e.g. impervious amounts), and on-site BMP performance monitoring.

9.2 Quantitative Evaluation Techniques

In addition to qualitative evaluation of implementation tasks and objectives to assess success with effectiveness of certain specific programs and projects within communities or agencies, it is beneficial to monitor the long-term progress and effectiveness of the cumulative implementation plan efforts in terms of a water quality, quantity and biological monitoring. The following quantitative evaluation will address the watershed project goal to improve “in stream” monitoring of the watershed. The watershed project partners consider the following evaluation goals and strategies necessary to assess success of the watershed project and the community’s adoption of the Les Cheneaux Watershed Management Plan’s pollution control activities. Comprehensive monitoring of water quality will provide baseline data and continuous comparative data to help the Les Cheneaux community manage land use for the protection of the designated uses of water in the Les Cheneaux watershed.

9.2.1 Water Quality Monitoring Design

A significant goal of the LCWC is to compile all the past information that went into this management plan and expand upon that information through a monitoring program that has significant survey locations, frequencies, including wet weather events, and appropriate parameters for assessment. The following monitoring program description will help the Les Cheneaux community more accurately identify the significance of present and future water quality impairments and their sources, as well as how these impairments are impacting the biological communities that serve as indicators of improvements. The program will also track the eventual improvements in water quality as the Les Cheneaux Watershed Management Plan is implemented.

Parameters

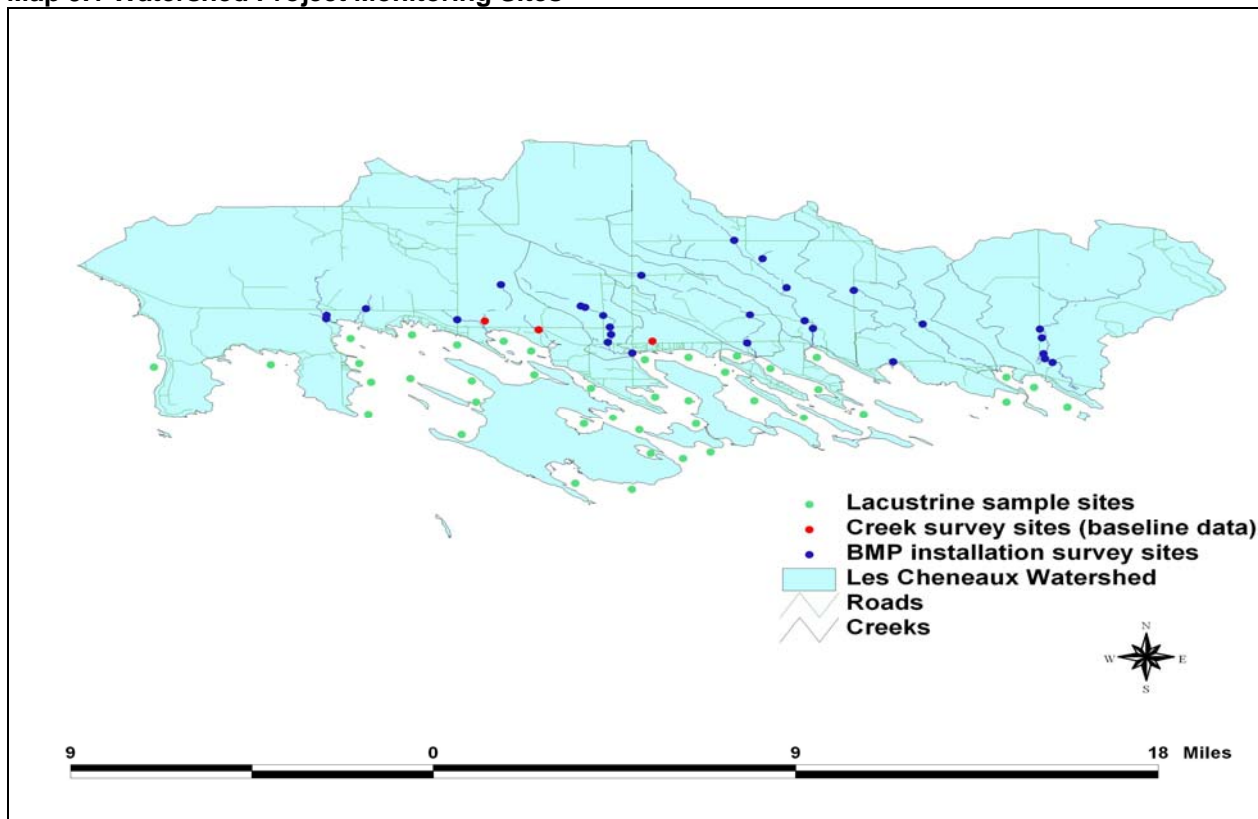
Establish a long-term monitoring program so that progress can be measured over time that includes the following components:

- Increase stream flow monitoring to determine base flows and track preservation and restoration activities upstream. Include as physical and hydrological indicators: stream widening/down cutting; physical habitat monitoring; impacted dry weather flows; increased flooding frequency; and stream temperature monitoring.
- Collect wet and dry weather water quality data in the subwatersheds and Lake Huron to better identify specific pollution source areas within these areas, and measure impacts of preservation and restoration activities upstream and onshore. Include as water quality indicators: water quality pollutant constituent monitoring, loadings, exceedence frequencies of water quality standards, sediment contamination, and human health criteria.
- Increase biological data monitoring (fish, macro invertebrates, and mussels) and use these as indicators of the potential quality and health of the stream and lake ecosystems. Include as biological indicators: fish assemblage; macro invertebrate assemblage; single species indicator; composite indicator; and other biological indicators.
- Identify major riparian corridors and other natural areas in order to plan for recreational opportunities, restoration and linkages.
- Review and revise currently established benchmarks and dates based on new data.
- Increase the use of volunteers where possible, for monitoring program (habitat, macro invertebrates) to encourage involvement and stewardship.

The monitoring plan will employ local volunteers trained by MDEQ personnel or qualified Lake Superior State University faculty to measure dissolved oxygen (DO), biological oxygen demand (BOD), bacteria (E. coli), phosphorus (P) and its forms, nitrogen (N) and its forms, and conductivity at each lacustrine sites on

Map 9.1 at least once each summer to screen for negative differences from target measures outlined below. Additional testing will be completed at added adjacent sites to target specific pollution sources if significant differences are discovered. Each creek (10) will be sampled for these parameters at the sites indicated on the map at least once each summer to follow up MDEQ five-year surveys and to evaluate any changes brought on by BMP installation. Additional components to be monitored, included MDEQ suggested *Rosgen's Bank Erosion Hazard Index*, *streambank erosion with erosion pins*, and *creek flashiness* will be selected with MDEQ consultation during QAPP development.

Map 9.1 Watershed Project Monitoring Sites



Establishing Targets

Measuring parameters to evaluate progress toward a goal requires the establishment of targets or evaluation criteria against which observed measurements are compared. These targets are not necessarily goals themselves, because some of them may not be realistically obtainable. However, the targets do define either Water Quality Standards, as set forth by the State of Michigan, or scientifically-supported numbers that suggest measurements for achieving water quality, quantity and biological parameters to support state designated uses such as partial or total body contact, and fisheries and wildlife. Using these scientifically based targets as targets for success will assist the watershed in deciding how to improve programs to reach both restoration and preservation goals and know when these goals have been achieved. These targets are described below.

The Michigan Department of Environmental Quality (MDEQ) has established state standards for dissolved oxygen (DO). The requirement is no less than 5.0 mg/l as a daily average for all warm water fisheries. The Administrative Rules state:

... for waters of the state designated for use for warm water fish and other aquatic life, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below a minimum of 4 milligrams per liter, or below 5 milligrams per liter as a daily average, at the design flow during the warm

weather season in accordance with R 323.1090(3) and (4). At the design flows during other seasonal periods as provided in R 323.1090(4), a minimum of 5 milligrams per liter shall be maintained. At flows greater than the design flows, dissolved oxygen shall be higher than the respective minimum values specified in this subdivision.

(Michigan State Legislature. 1999)

State standards are established for bacteria (*E. coli*) by the MDEQ. For the designated use of total body contact (swimming), the state requires measurements of no more than 130 *E. coli* per 100 milliliters as a 30-day geometric mean during 5 or more sampling events representatively spread over a 30-day period. For partial body contact (wading, fishing, and canoeing) the state requires measurements of no more than 1,000 *E. coli* per 100 milliliters based on the geometric mean of 3 or more samples, taken during the same sampling event. These uses and standards will be appropriate for and applied to the creeks and those tributaries with a base flow of, or greater than, 2 cubic feet per second and lakefront concentrated development areas. *E. coli* measures will be taken in creeks following the regular monitoring schedule for the other mentioned parameters. Lacustrine measures will also be at the same sites and schedule as the other parameters.

Conductivity measures the amount of dissolved ions in the water column and is considered an indicator for the relative amount of suspended material in the stream. The scientifically established standard for conductivity in a healthy Michigan stream is 800 microSiemens (μ S), which should be the goal for the creeks and lacustrine areas in the Les Cheneaux watershed. Levels higher than the standard indicate the presence of stormwater runoff generated suspended materials or possible nutrient inputs from failing on-site septic system. The Les Cheneaux Project will employ local volunteers to measure conductivity in each creek as part of the monitoring schedule mentioned. Developed lake front areas (Map 9.1) will also be measured as part of a comprehensive monitoring campaign to assess possible OSS failure.

To determine sediment load, embeddedness of the substrate (how much of the stream bottom is covered with fine silts) and the bottom deposition (what percentage of the bottom is covered with soft muck, indicating deposition of fine silts) will be measured at the selected sites. These are measurements taken by the GLEAS protocol habitat assessment conducted by MDEQ every five years. Rating categories are from "poor" to "excellent." The target for this measurement is to maintain ratings consistent with quality systems and improve ratings where possible. The Les Cheneaux project will employ local volunteers to continue evaluating MDEQ established sites each year along with assessment of upstream and downstream areas where BMP's will be installed as part of the restoration of hydrology and elimination of erosion areas.

Stream flow, or discharge, for surface waters do not have a numerical standard set by the state. Using the health of the fish and macro invertebrate communities as the ultimate indicators of stream and river health is most useful in assessing appropriate flow. More recent peak flow data is needed to more accurately compare observed flow to the target flow. Each creek in the watershed will be fitted for a gauging station following USGS consultation, and results will be compared with data generated for similar creeks by USGS to assist in reviewing current discharges for the individual Les Cheneaux subwatersheds.

Numerical or fish community standards have not been set by the state. However, the Michigan Department of Environmental Quality has developed a system to estimate the health of the predicted fish communities through the GLEAS 51 (Great Lakes Environmental Assessment Section) sampling protocol. This method collects fish at various sites in the creek and based on whether or not certain expected fish species are present, as well as other habitat parameters, fish communities are assessed as poor, fair, good, or excellent. The target will be to maintain GLEAS 51 scores of "excellent" at sites where they are attained, "good" at sites where they are attained, improve "fair" sites to "good", and improve "poor" to "good" through the implementation of this plan. The GLEAS 51 protocol also identifies whether or not there are sensitive species present in the creek, which would indicate a healthy ecosystem. Certain species are especially useful for demonstrating improving conditions. These species tend to be sensitive to turbidity, prefer cleaner, cooler water. A goal of the Les Cheneaux watershed project is to restore, protect, and enhance threatened and endangered species, so the target is to continue to find these

species indigenous to the watershed and assume that stable or increasing numbers mean that habitat and water quality is maintained or improved. The project will employ LSSU *Aquatic Research Laboratory* students each summer to electroshock 300' creek sections upstream and downstream of sites being fitted with BMP improvements, once in 2007, prior to installations, and then each summer thereafter to monitor population assemblages and possible success of BMP's. One site possessing representative habitat will be selected for each creek not being fitted with BMP's to provide baseline population assemblages.

Similar to the assessment of fish communities, the state employs the GLEAS 51 protocol for assessing macro invertebrate communities on a five-year cycle in the State's watersheds. LCWC will utilize state sampling sites in the watershed and perform macro invertebrate assessments using the GLEAS 51 procedures each year along with physical habitat health assessment. The monitoring target for macro invertebrate communities will be to increase the number of sites to improve the existing database and attain GLEAS 51 scores of at least "fair" at sites that are determined "poor," and improve "fair" sites to "good," and maintain "good" and "excellent" conditions at the remaining sites.

A wetland review for the Les Cheneaux watershed will be conducted to determine a baseline acreage and number of wetlands remaining. An annual review of MDEQ wetland permit information and local records in order to track wetland fills, mitigations, restoration and protection to establish net loss or gain in wetlands in the watershed. The target for this parameter is to track the net acres of wetland in the Les Cheneaux watershed to determine action for further protection or restoration activities. An initial survey of wetlands using aerial photos, state maps, soil maps (NRCS Soil Survey), and MDEQ field staff consultation will be conducted by project volunteers to document base acreage of wetlands. Further evaluative survey will be conducted every year to assess wetland development and protection trends.

The state standard lists temperature standards only for point source discharges and mixing zones – not ambient water temperatures in surface water. Temperature studies will be conducted for the Les Cheneaux area in order to determine the average daily temperatures and whether increased temperatures are a problem for creek and lake health. Data loggers will be installed in each creek and at three sites in northern Lake Huron, one each in Hessel Bay and Cedarville Bay, to monitor areas with significant stormwater and other urban influences, and one in Mackinac Bay to monitor a relatively untouched area.

State standards do not exist for aesthetics or recreation potential. However, an area with high aesthetic qualities will add, in either a passive or active context, recreational opportunities for the public and a greater appreciation or awareness of the area's natural resources. Measuring aesthetics of an area is inherently a qualitative effort. However, progress toward attaining aesthetically pleasing places can be measured and evaluated effectively using a standard tool, such as a survey, at regular intervals in time. The visual field survey completed by Clark Township in 2000 will be followed by one including regular field investigations of specific sites in the watershed where aesthetics are of most concern, most likely along a stretch of a creek or shoreline. Measurements in the survey, dependent upon community and subwatershed priorities, will include assessing water clarity, ambient odors, vegetative diversity, wildlife use, streambank erosion, debris, evidence of public use, and other parameters that indicate positive or negative aesthetic qualities. Volunteers and/or community field staff will most likely be utilized for this effort.

Measuring and mapping areas with recreation potential should be a community and a watershed effort and should be done by or closely with local or county officials and staff. The first component of this effort will be a one-time recreational opportunities study of the watershed to determine where opportunities and access can be improved. The goal is to identify areas in the watershed, both along the riparian corridor and on the landscape that can provide passive recreation or active recreation. Within the watershed, these areas will be linked where possible to provide linear corridors that connect, or greenways, for both people (hiking, biking trails) and wildlife. This activity will begin with mapping existing areas (with help from Little Traverse Conservancy and Michigan Natural Features Inventory and their current land protection maps) dedicated to recreation or preservation, and then completing a watershed exploration to record information including: evidence of current public use, potential for public access, linkages to other natural areas (greenways potential), ownership of property, vegetation types (forested, wetland area, in

need of riparian cover, etc.), excessive woody debris, etc. This survey will include photographs of potential recreation areas which will assist the community and project partners in prioritizing new areas for preservation and recreation for the public, offering the public more opportunity for using and appreciating Les Cheneaux natural resources. Finally, these activities will lead to the identification of funding mechanisms for purchase of land and conservation easements, as well as any necessary infrastructure (construction of trails, boardwalks, canoe livery, etc.) that would support new or improved recreational opportunities. Details regarding responsible parties, monitoring standards, sampling sites, and frequency of monitoring for the qualitative and quantitative evaluation techniques will be defined in a MDEQ approved quality assurance project plan prior to monitoring activity. (MCSSAG 2003)

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