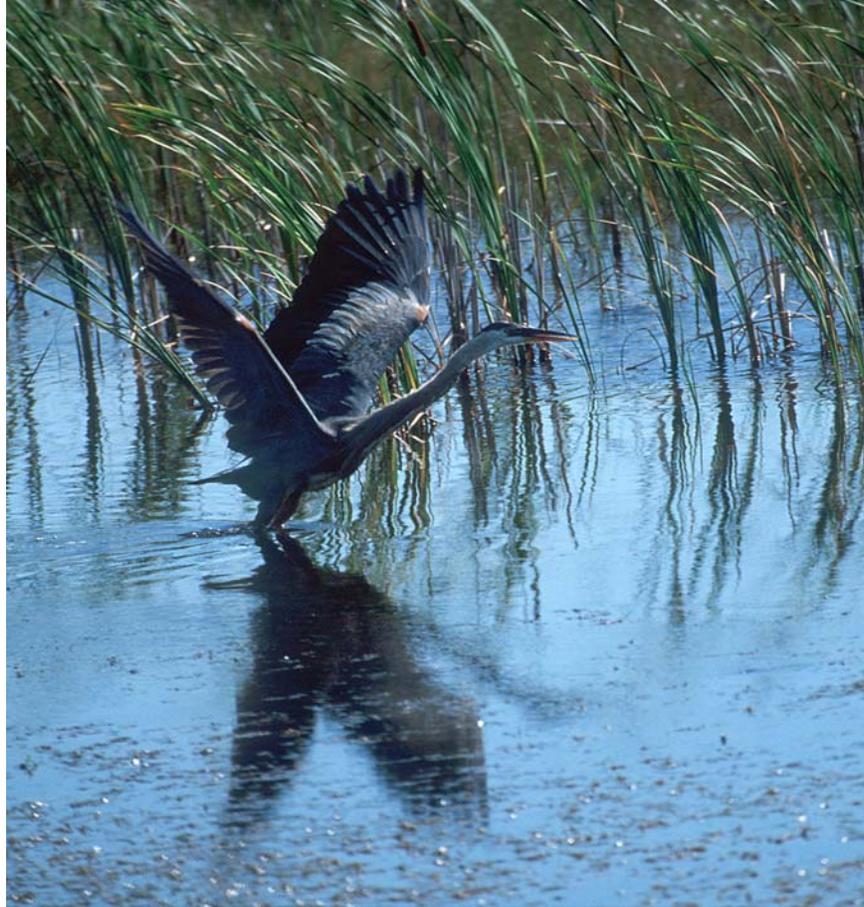


# Cheboygan River/Lower Black River Watershed Initiative 2003



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# CHEBOYGAN RIVER/LOWER BLACK RIVER WATERSHED INITIATIVE

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# **Cheboygan River/Lower Black River Watershed Initiative Project Partners**

*Cover Photo by: Jan Kellogg*

## **STEERING COMMITTEE**

City of Cheboygan  
Huron Pines Resource Conservation and Development Council  
Douglas Lake Association  
District Health Department #4  
Northeast Michigan Council of Governments (NEMCOG)  
Petoskey Regional Audubon Society  
Michigan Department of Environmental Quality (MDEQ)  
Little Traverse Conservancy  
United States Department of Agriculture-Natural Resource Conservation Service (USDA-NRCS)  
Michigan Groundwater Stewardship Program  
Tip of the Mitt Watershed Council  
Cheboygan Tribune  
Cheboygan Conservation District  
Michigan State University Extension (MSUE)  
Michigan Township Officials

## **TECHNICAL COMMITTEE**

### **NEMCOG**

#### *Responsibilities:*

- ❖ Organize steering committee meetings, send out meeting notices and agendas
- ❖ Development and dissemination of informational materials
- ❖ Provide information, gather input at township, county and area organization meetings
- ❖ Hold public meetings on draft plan to gather input and provide information
- ❖ Conduct Road/Stream Crossing Inventory of critical area
- ❖ Write up results of inventory. Include sections on: purpose and importance of inventory, tables that summarizes results, description of methods used in data collection including any formulas used in calculations, results, recommendations and BMP's, and a map indicating sites inventoried.
- ❖ Gather watershed information, write plan

### **TOMWC**

#### *Responsibilities:*

- ❖ Facilitate meetings
- ❖ Assist in development and dissemination of newsletters and informational materials.
- ❖ Provide assistance in plan write-up.
- ❖ Conduct Stormwater Inventory of critical area
- ❖ Conduct Shoreline Inventory of critical area

- ❖ Write up results of inventories. Include sections on: purpose and importance of inventory, tables that summarizes results, description of methods used in data collection including any formulas used in calculations, results, recommendations and BMP's, and a map indicating sites inventoried.

#### Conservation Districts/ USDA-NRCS

##### *Responsibilities:*

- ❖ Assist in organization and provide input and direction at meetings
- ❖ Assist in development and dissemination of newsletters and informational materials.
- ❖ Conduct Agriculture Site Inventory of critical area
- ❖ Participate in Streambank Inventory of tributaries in critical area
- ❖ Write up results of inventories. Include sections on: purpose and importance of inventory, tables that summarizes results, description of methods used in data collection including any formulas used in calculations, results, recommendations and BMP's, and a map indicating sites inventoried.

#### Huron Pines RC&D Council

##### *Responsibilities:*

- ❖ Assist in organization and provide input and direction at meetings
- ❖ Assist in development and dissemination of newsletters and informational materials.
- ❖ Conduct Stormwater Inventory of critical area
- ❖ Conduct Shoreline Inventory of critical area
- ❖ Write up results of inventories. Include sections on: purpose and importance of inventory, tables that summarizes results, description of methods used in data collection including any formulas used in calculations, results, recommendations and BMP's, and a map indicating sites inventoried.
- ❖ Research and compile zoning and ordinance information for watershed

## **MEETINGS**

Quarterly meetings were held during the Cheboygan River/Lower Black River Watershed Initiative planning phase. Input was provided from committee members on various issues concerning the watershed's system of rivers and lakes, as well as overall project direction.

The public meetings were intended to provide an overview of the planning process and to gather input on watershed issues and concerns. The development of the plan was driven by the participation of the steering committee members. The members reviewed the results of the critical area inventory, prioritized the pollutants, assisted in the development of the goals and objectives and finalized the recommendations.

A public meeting was held at the end of the two-year planning phase to review and finalize completion of the draft plan. The meeting was publicized locally and members of the community were encouraged to attend. This provided committee members and the general public an opportunity to comment on the results of the draft plan.

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## Chapter One: Getting To Know the Cheboygan River/Lower Black River Watershed

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### Overview

The Cheboygan River-Lower Black River Watershed located in northeastern Lower Michigan covers 94,130.65 acres, principally in Cheboygan County. Ranging over the northern one-third of Cheboygan County, the watershed includes all or parts of Aloha, Benton, Grant, Inverness, and Monroe townships and touches on Carp Lake, Center, Maple River, and McKinley Townships in Emmet County.

The Cheboygan River-Lower Black River Watershed is a sub-watershed of the larger Cheboygan River Watershed. Due to the difficulties encountered in developing a manageable non-point source pollution plan for a large watershed that would include several sizable inland lakes, the Cheboygan River Watershed was divided into several sub-watersheds, based on drainage patterns of the water bodies. In previous years, nonpoint source pollution management plans were developed for the Black Lake, Burt Lake, Crooked/Pickerel Lakes, and the Mullett Lake sub-watersheds within the Cheboygan River Watershed.

The Cheboygan River-Lower Black River Watershed includes portions of the Lake Sixteen Bog, the Lower Black River, the Cheboygan River, a section of Maple River, Terry Creek, Sipper Creek, Laperell Creek, Van Creek, the 529-acre Munro Lake, 400-acre Long Lake, 3733.5-acre Douglas Lake, the Twin Lakes, and the many tributaries of these water bodies. **Map 1** shows the boundaries of the Cheboygan River/Lower Black River Watershed. Approximately two-thirds of the watershed, including the Cheboygan and Lower Black rivers, lies in Cheboygan County. At the western edge of Cheboygan County and into Emmet County lies Douglas Lake and its tributaries.

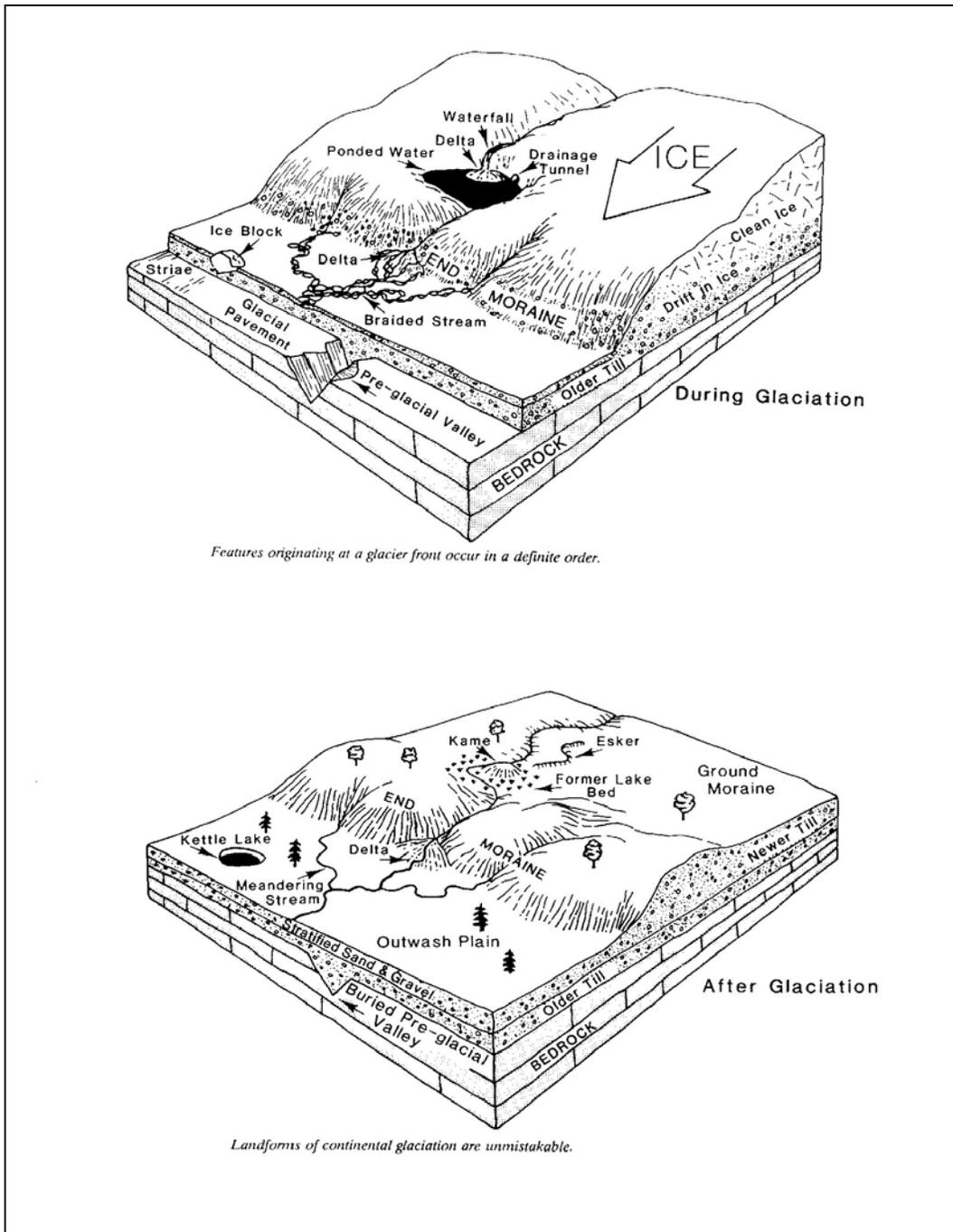
The Cheboygan River and the Lower Black River plus adjacent land are between 577 and 643 feet above sea level. The remaining watershed area is 644 to 709 feet above sea level, with the exception of the Douglas Lake portion, which has an elevation of 710 to 774 feet.

### Geology

Throughout prehistory of the Great Lakes Region glaciers advanced and retreated repeatedly, creating various surface and subsurface landforms. Occurring nearly 12,000 years ago, the last glacial advance was instrumental in the formation of the existing landscape. Three major surface types dominate the watershed area; *lacustrine sand and gravel*, *peat and muck*, and *glacial till*. (See **Figure 1** and **Map 2**)

### MAP 1 WATERSHED

**Figure 1: Glacial Formations**



Many northern Michigan lakes were formed when the glaciers melted, leaving behind large blocks of ice. The Douglas and Munro lakes of Cheboygan County were created in this way. As the ice receded further north, meltwaters flooded many areas of northern Michigan. The higher elevations, above water, formed islands. During this period the *lacustrine sands*, (sand and gravel deposited as sheet sands and beaches) covering much of the watershed were deposited on the lakebed of glacial Lake Algonquin.

## MAP 2 GEOLOGY

**Map 2** shows that *peat and muck* cover much of the watershed's western portion, surrounding Douglas Lake on three sides, and spreading into Emmet County. Peat and muck are both comprised of organic soil material, with muck containing more minerals than peat. In peat, the original plant parts are recognizable, but are unrecognizable in muck. North of Douglas Lake lies a three mile long *esker*, a long, narrow, sinuous, steep-sided ridge composed of irregularly stratified sand and gravel. (See **Figure 1**) This sand and gravel ridge was formed when a stream flowing between ice walls, or in an ice tunnel of a retreating glacier deposited materials

that were left behind when the ice melted. Eskers range in length from less than a mile to nearly 100 miles long.

*Glacial till* covers most of the eastern portion of the watershed. (See **Map 2**) Glacial till is unsorted material deposited by glacial ice and consists of a mixture of clay, silt, sand, gravel, stones, and boulders. A drumlin field can be found on the till plain in the southeast corner of the watershed, near Black Lake.

.Drumlins are low, smooth, spoon-shaped hills or mounds of compacted till. The tail of a drumlin always runs parallel to the glacier flow, so that all the drumlins in a field are oriented in the same direction.

Subsurface geology ranges from limestone in Benton and eastern Inverness townships to shale in western Inverness, and a combination of limestone and shale in most watershed portions located in Emmet County.

## Soils

Soils information is important in the determination of types and intensity of land uses. Water quality of a river system is partially based on the nature of the soils and the slope of the land within the drainage basin. These factors determine potential land use, soil infiltration rates, water-holding capacity and soil erodibility and therefore are directly related to the amount of non-point source pollution in the watershed. The construction of roads, buildings, and septic systems on steeply sloped areas or areas with organic and hydric soils require special design considerations. If developed improperly the impacts to natural resources, particularly water quality, can be far-reaching.

The soils of the Cheboygan River/Lower Black River Watershed cover moraines, drumlins, lake terraces, and till plains. These soils are often found on uplands and post-glacial lake islands. Slope gradients range from 0 to 50 per cent, but are predominantly 2 to 30 per cent. Soils are well drained or moderately well drained with low to high potential surface runoff, depending on slope. Permeability is moderately rapid in the upper sandy material and very slow in the lower loamy horizons. Most of the watershed soil is in woodland. Many of the steeper areas are kept in permanent forest vegetation, but a few areas are used as pasture. Nearly level to moderately sloping sites are frequently used for pasture or growing hay and small grains, especially in the western portion of the watershed.

The Natural Resource Conservation Service completed a detailed soil survey of Cheboygan and Emmet Counties. A digital or computerized version of the soil survey maps was acquired from the Michigan Department of Natural Resources, MIRIS program. Using information contained within the published soil survey books, a series of maps will be presented that depict hydric soils, slopes 12 percent and greater and soils with septic system limitations.

### *Hydric Soils and Steeply Sloped Areas*

**Map 3** is a color thematic map that classifies hydric soils and shows soils on steep slopes. Lower density and less intensive development should be directed to these areas with severe building constraints. Hydric soils are saturated, flooded or ponded during part of the growing season and are classified as poorly drained and very poorly drained. Hydric soils have poor potential for building site development and sanitary facilities. Wetness and frequent ponding are severe problems that are difficult and costly to overcome. Sites with high water tables may be classified as wetlands and a wetlands permit would be required to develop these areas.

According to information presented in the Cheboygan County and Emmet County Soil Surveys, areas with hydric soils make up roughly 13 percent of land in the watershed. Most of these wet areas are found in the western half of the watershed, from Douglas Lake in Munro Township, Cheboygan County, through McKinley and Carp Lake Townships, Emmet County. Much of the hydric soils in these townships are found on state land and on land owned by the University of Michigan Biological Station. While the threat of over-development is low on U. of M. and State lands, the threat remains high for hydric soils owned by the private sector, as large parcels are increasingly fragmented to accommodate the population's ever growing desire for rural and riparian housing.

While less prominent than in the western portion, hydric soils still have an influence on land use in the eastern half of the watershed. As can be seen in **Map 3** there are several pockets of hydric soils in Inverness Township, in the northwestern section of the eastern portion of the watershed. Several larger concentrations can be found in Benton, Grant and Aloha Townships on the watershed's east side.

Hills and steeply rolling terrain may provide opportunities for spectacular views of the landscape. However, steeply sloped sites have severe building constraints, are more difficult and costly to develop. Maintenance costs tend to be higher on steeply sloped terrain. Special design standards such as erosion control measures, limiting size of disturbed areas, retaining natural vegetation, revegetation, slope stabilization and on-site retention of water run-off from impervious surfaces would all serve to minimize resource impacts.

Information derived from the Cheboygan County and Emmet County Soil Surveys indicates that areas with slopes 12 percent and greater are minimal in the eastern portion of the watershed, with most steeply sloped areas found adjacent to the Cheboygan River. The western portion of the watershed is considerably more hilly, with several steeply sloped areas found in the vicinity of Douglas Lake and the Maple River. Steep slopes are also found scattered throughout Center, McKinley and Carp Lake Townships in the westernmost section of the watershed, as shown in **Map 3**.

## MAP 3 SOILS

## MAP 4 Septic Constraints

### *Septic System Limitations*

Using a computer mapping system, soils maps have been color coded to show areas with severe septic system limitations as defined by the USDA Natural Resource Conservation Service. Criteria include depth to water table, wetness, filtering capacity and ability to percolate water. Severe septic system limitations due to hydric soils and wet soils affect much of the watershed. Hydric soils are those that are saturated with water long enough during the plant growing season to become anaerobic. These soils will usually be characterized by anaerobic soil zones and wetland vegetation. Hydric soils cover a large area in the western half of the watershed. (See **Map 4**) The entire eastern half of the watershed also has severe septic system limitations. Much of this is caused by widespread hydric and wet soils. In addition, this portion of the Watershed contains sandy soils with severe limitations due to poor filtration of septic effluents. This is a critical issue when the water table is close to the surface or when high density development occurs. Limiting types and density of development or making public water and sewer available for high density development are likely the best options for protecting the groundwater resources in these areas. Other severe limiting factors affecting the watershed include steep slopes, soils that percolate slowly and areas of cemented pan.

### Hydrology

The Cheboygan and Black Rivers are a part of the Inland Water Route, a series of connecting waters that extend from the Village of Conway, located at the western end of Crooked Lake, 3 miles east of Lake Michigan, to Cheboygan, located on the Lake Huron end of the Straits of Mackinac. Cheboygan River (the fifteenth largest river in the state) flows roughly seven miles from its source on Mullett Lake through the city of Cheboygan to discharge into Lake Huron. The upper part of the river is separated from the lower by the Cheboygan Dam. Above the dam the Cheboygan River is wide and deep for 2 1/2 miles to its junction with Black River. The remaining 2 1/2 miles to Mullett Lake is littered with stumps and snags.

From Black Lake, located southeast of the watershed in Presque Isle County, the Black River courses approximately 10 miles to its confluence with the Cheboygan River. The water flow is restricted significantly for 4.3 miles between Black Lake and the Alverno Dam due to rapids in the river. Below the dam the shore widens and the river is shallow for about 2 3/4 miles, then becomes wide and deep as it continues its course another 2 1/2 miles to merge with the Cheboygan River.

Not considered part of the Inland Waterway, the east branch of the Maple River discharges from Douglas Lake and flows southwest roughly 5 miles to the 139 acre impoundment, Lake Kathleen. The waters of the east branch are joined by those of the west branch at the impoundment, and the main stem of the Maple River flows in a southeasterly direction from Lake Kathleen to discharge into Burt Lake. The west branch and the main stem of the Maple River lie outside the Cheboygan River/Lower Black River Watershed boundary. All the waters within the watershed eventually drain into Lake Huron. (See **Map 1**)

The amount of flow in rivers of the watershed changes throughout the year. In general, flow is greater in late winter and early spring when snowmelt and rainfall produce more surface runoff. Although summer is a period of high precipitation, much water is lost through evaporation and transpiration, causing river flow to be lowest in late summer.

One factor greatly affecting hydrology of the watershed is the *lake effect snow* produced by Lake Huron and Lake Michigan. Lake effect snow can occur when cold winds blow across a large lake. Evaporation of warm surface water increases the amount of moisture in the colder

drier air above the lakes surface, causing water vapor in the cold air to condense and form ice-crystal clouds. When these clouds reach the lake's edge, they deposit heavy snowfall along the shoreline. Once the snow begins to melt the water may be absorbed by the ground, or may enter the lakes and streams of the watershed, eventually returning to the lake as runoff.

## Land Uses

### *Past*

Originally the homeland of the Chippewa Indians, the watershed became popular with French fur traders in the 1600's. In 1844 the first settlers moved into the area. The population grew slowly over the next thirty years, but tripled within ten years following the construction of a sawmill in the 1870's. Lumbering made a tremendous impact on the landscape, and by the early 1900's the vast northern Michigan forests had been logged off.

Commercial fishing began to flourish in both counties around the same time as the lumbering boom, and Connable Fish Market bought up large quantities of fish to pack and ship as far away as Philadelphia. Farming and manufacturing also gained importance at this time.

The Inland Water Route was a major factor in the development of the watershed area. The waterway connects many of the lakes and streams in northern Michigan and was a vital component of the area's transportation system before the days of railroads. From Pickerel Lake in Emmet County, the waterway runs through Pickerel Channel to Crooked Lake and continues via Crooked River to Burt Lake in Cheboygan County. The waterway also connects Douglas Lake to Burt Lake by way of the Maple River. From Burt Lake, the waterway courses through the Indian River to enter Mullett Lake. Leaving Mullett Lake at the north end, the waterway continues down the Cheboygan River and through the city of Cheboygan to eventually discharge into Lake Huron.

### *Present*

Soils, topography and surface water in large part determine the present land uses for the watershed. Only about 4.7 per cent of the watershed is being used for residential, commercial, industrial, or institutional purposes. Over a quarter of all housing in Emmet County is seasonal/recreational, and this fraction continues to grow. Agriculture is an important land use in the western portion of the watershed with nearly 17 per cent of Emmet County in farmlands. The eastern portion of the watershed is less heavily farmed, and only 6.3 per cent of land in Cheboygan County is designated agricultural. Surface water covers roughly 6.5 per cent of the watershed area, and another 4.2 per cent is comprised of wetlands. Nearly two-thirds of the watershed area is forested

### *Future*

Suburbanization of rural acreage continues, with renewable resource lands such as farms and forests becoming increasingly fragmented under current land division practices. The number of seasonal and vacation homes will grow dramatically, with especially heavy development along lake and river shorelines. Throughout the watershed, but particularly in Emmet County, many seasonal homes are being converted to year round housing. Both counties represented in the watershed have or are developing plans to assist in the management of future land use within the watershed.

## Recreation

The two counties of the Cheboygan River-Lower Black River watershed offer a wide variety of recreational opportunities with over 100 boat-water access sites; 9 campgrounds; many hiking trails; several public parks, picnic areas and playgrounds; over 30 public fishing access sites, marinas and harbors; numerous soccer and softball fields; tennis, volleyball, shuffleboard, racket ball and basketball courts; 2 indoor ice rinks (both in Cheboygan), 2 bowling alleys (one in each county) and 31 golf courses, 15 of which lie in Emmet County.



Large portions of the watershed are available for hunting, fishing, snow-shoeing, cross-country skiing, and swimming, and Emmet County is famous for its ski slopes. The Cheboygan County Historical Museum and the Little Traverse Historical Society offer locals and visitors a glimpse into the area's past. Year round indoor entertainment is available at the Cheboygan Opera House, Victories Casino in Petoskey, and local theaters in both counties.

Recreational properties owned by Cheboygan County are barrier-free, with the exception of the Boy Scout Camp. The camp is presently used only as a picnic area. If plans for re-development of the site are implemented, handicap accessibility will be an integral part of the project. Any future recreational projects will include compliance with handicap accessibility standards.

According to the Emmet County Comprehensive Recreation Plan, there are buildings included in the county's park system that are not now barrier free. However, these structures came with the larger resource environmental properties, and were not constructed by Emmet County. As improvements are made, barrier free design features will be incorporated, as some already have.

The recreation plan also further states that it is Emmet County's intent to assess physical barriers to handicapped persons who may wish to enjoy county park properties, and to take measures to mitigate existing barriers. New construction will incorporate barrier free design and meet applicable code standards.

## Governmental Units

The Cheboygan River-Lower Black River Watershed covers portions of two northern Michigan counties; Cheboygan and Emmet. A nine-member Board of Commissioners oversees Cheboygan County, with support from various departments, including the County Administrator and County Clerk/Register. The county also has a Planning Commission, a Zoning Commission and a Road Commission. The population center of the watershed is the city of Cheboygan, which is governed by a Mayor, a Mayor Pro Tem, a City Manager, various departments and a seven-member City Council. Cheboygan has its own Planning Commission.

Emmet County is managed by a seven-member Board of Commissioners and several departments, including County Clerk, Road Commission, Drain Commission, and Planning and Zoning Administration. The population center for Emmet County, the city of Petoskey, lies outside the watershed boundary. Petoskey is governed by a Mayor, a City Manager and four Council Members. Each council member oversees one of the city's four wards. The city government includes a Department of Finance, Administration Department, a Department of Public Works, and a Department of Public safety.

The watershed area ranges over five townships in Cheboygan County and over another five in Emmet County. Each township in both counties has a governing body, which includes a township supervisor, a clerk, a treasurer, and an assessor, with the exceptions of Grant and Munro Townships in Cheboygan County, which do not have an assessor position. None of the townships in the watershed have their own zoning laws, but are zoned through their respective counties.

## Agencies and Organizations

The following agencies and local organizations are involved with environmental programs and concerns within the watershed:

### ***Michigan Department of Environmental Quality***

*Mission Statement:* The mission of the Michigan Department of Environmental Quality (DEQ) is to drive improvements in environmental quality for the protection of public health and natural resources to benefit current and future generations. This will be accomplished through effective administration of agency programs, providing for the use of innovative strategies, while helping to foster a strong and sustainable economy.

### ***Huron Pines Resource Conservation & Development Area Council***

Huron Pines RC&D Council is a non-profit, non-governmental organization serving the eleven county region of Northeast Michigan. Its goals are:

- 1.) Sponsor collaboration in the sustainability of renewable natural resources through orderly development and accepted conservation practices.
- 2.) Foster citizen appreciation through education of the need for healthy ecosystems as critical to the area's long-term social and economic stability.
- 3.) Improve the quality of life and economic conditions in our service area by helping to nurture land, water, mineral, and living resources as the enduring basis for desirable communities, first-rate tourism, and thriving industry.

### ***Tip of the Mitt Watershed Council***

The Tip of the Mitt Watershed Council, founded in 1979, is celebrating its 20th year as the lead organization for water resources protection in Antrim, Charlevoix, Cheboygan, and Emmet Counties. A coalition of citizens, lake associations, businesses, and resorters, the Watershed Council works to maintain the environmental integrity and economic and aesthetic values of lakes, streams, wetlands, and ground water.

### ***US Department of Agriculture***

*Mission:* Enhance the quality of life for the American people by supporting production of agriculture:

- ❖ Ensuring a safe, affordable, nutritious, and accessible food supply
- ❖ caring for agricultural, forest, and range lands
- ❖ supporting sound development of rural communities
- ❖ providing economic opportunities for farm and rural residents

- ❖ expanding global markets for agricultural and forest products and services
- ❖ working to reduce hunger in America and throughout the world.

### **Natural Resource Conservation Service**

*Mission Statement:* The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

### **Conservation Districts**

Michigan's Conservation Districts are "unique" local units of State Government, that utilize state, federal and private sector resources to solve today's conservation problems. The guiding philosophy of all Conservation Districts is that decisions on conservation issues should be made at the *local level*, by *local people*, with technical assistance provided by government.

### **Northeast Michigan Council of Government**

*Mission Statement:* NEMCOG is committed to facilitating the development of intergovernmental cooperation and coordination within the eight-county region of Northeast Michigan. The agency is also committed to providing for a controlled growth policy; to preserve and improve the environment, to pursue greater efficiency and responsiveness of local units of government, and to improve the ecological, social, and economic well being of citizens within the region.

### **District Health Department #4**

*Mission Statement:*

"It shall be the responsibility of this board to continually and diligently endeavor to prevent disease, prolong life, and promote the public health through organized programs including prevention and control of environmental health hazards; prevention and control of disease; prevention and control of health problems of particularly vulnerable population groups; development of health care facilities and health service delivery systems; and regulations of health care facilities and health service delivery systems to the extent provided by law"

### **Michigan State University Extension**

*Mission*

"Michigan State University Extension (MSUE) helps people improve their lives through an educational process that applies knowledge to critical issues, needs and opportunities."

Since its beginning, Michigan Extension has focused on bringing knowledge-based educational programs to the people of the state to improve their lives and communities. Today, county-based staff members, in concert with on-campus faculty members, serve every county with programming focused on agriculture and natural resources; children, youth and families; and community and economic development.

### **US Fish and Wildlife Service**

"The U.S. Fish and Wildlife Service's mission is, working with others, to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people."

### **Little Traverse Conservancy**

The Conservancy is a broad coalition of individuals, families, and businesses who agree that the acquisition and protection of natural land is important if we are to retain the quality of life which makes northern Michigan so attractive. The Little Traverse Conservancy is supported entirely by people who willingly donate their time, talent, and financial support to protect irreplaceable natural land.

### **Petoskey Regional Audubon Society**

#### **Mission Statement:**

Michigan Audubon Society is a nonprofit organization that promotes the awareness, understanding, enjoyment, and stewardship of the environment and natural resources of the upper Great Lakes region by educating the public, supporting ecological research, maintaining sanctuaries, and by taking part in appropriate advocacy to protect the environment, with emphasis on birds and their habitats.

### **Science and Environmental Education-North**

#### **Mission Statement:**

SEE-North's mission is to foster people's connections with the plants, animals, and habitats of northern Michigan; to deepen their knowledge of the natural world; and to inspire in people of all ages a sense of responsibility for their place in nature.

### **Douglas Lake Stewards**

The Douglas Lake Stewards are a group of volunteers that meet for about a half a day every two weeks from May-October . Environmental efforts are concentrated on or near Douglas Lake and the University of Michigan Biological Station lands. The stewards work closely with Biological Station staff when involved in projects located on U. of M. property.

### **Douglas Lake Association**

### **Long Lake Association**

### **Twin Lakes Association**

## **Demographics**

The watershed area has a permanent population of approximately 11,832, clustered mainly in Benton and Inverness townships. This figure reflects a 28.9% increase since 1990 (see **Table 1**). Nearly all of the townships within the watershed have been growing at a significant rate, particularly Aloha Township in Cheboygan County (47.2% since 1990) and Maple River Township in Emmet County (65.8% since 1990). The only township within the watershed to show a decrease in population during this time period was Center Township in Emmet County (-3.5%). Another population increase of at least 10% is expected for the watershed by the year 2010. According to the U. S. Department of Commerce, 20% of the population in Canada and the U. S. live within 500 miles of Emmet and Cheboygan Counties, making the area an attractive vacation destination for a great number of people. The main population center for the watershed is the city of Cheboygan, but the resort town of Petoskey in Emmet County draws vacationers to the area from a large portion of the Midwest. Although Petoskey lies outside the watershed boundaries, this seasonal influx of roughly 20,000 visitors has a strong impact on the watershed.

| <b>Table 1: Watershed Population by Township<br/>Cheboygan and Emmet Counties (1990-2000)</b> |                            |                            |                           |                     |                            |                            |                           |
|---|----------------------------|----------------------------|---------------------------|---------------------|----------------------------|----------------------------|---------------------------|
| <b>Cheboygan County</b>   |                            |                            |                           | <b>Emmet County</b> |                            |                            |                           |
| <b>Township</b>   | <b>1990<br/>Population</b> | <b>2000<br/>Population</b> | <b>Percent<br/>Change</b> | <b>Township</b>     | <b>1990<br/>Population</b> | <b>2000<br/>Population</b> | <b>Percent<br/>Change</b> |
| Aloha   | 707                        | 1041                       | 47.2%                     | Carp Lake           | 597                        | 807                        | 35.2%                     |
| Benton  | 2388                       | 3080                       | 29.0%                     | Center              | 517                        | 499                        | -3.5%                     |
| Grant   | 686                        | 947                        | 38.0%                     | Maple               | 743                        | 1232                       | 65.8%                     |

|  |             |      |                |          |               |      |       |
|--|-------------|------|----------------|----------|---------------|------|-------|
|  |             |      |                | River    |               |      |       |
| Inverness                              | 1952        | 2278 | 16.7%          | McKinley | 1080          | 1269 | 17.5% |
| Munro                                  | 512         | 679  | 32.6%          |          |               |      |       |
| TOTAL                                  | 6245        | 8025 | 28.5%          | TOTAL    | 2937          | 3807 | 29.6% |
| <b>Population Totals For Watershed</b> |             |      |                |          |               |      |       |
| <b>1990</b>                            | <b>2000</b> |      | <b>Percent</b> |          | <b>Change</b> |      |       |
| 9182                                   | 11,832      |      | 28.9%          |          |               |      |       |

Source: U.S. Census Bureau

Cheboygan County has experienced a 28.5% population growth over the last ten years, and a 20% increase in all *housing units* (physical residential living structures, both occupied and unoccupied). The number of seasonal homes, however, has dropped by 8.7%, reflecting the fact that fewer vacation homes are presently being built while those already in existence are being converted to year-round residences (**Tables 1 and 2**). The number of *households* (occupied housing units) in Cheboygan County that lie within the watershed boundaries has been increasing at an even greater rate than in the county as a whole. Between the years 1990 and 2000 the number of households in the watershed has jumped by 39.1% compared to a 32.1% increase experienced over the entire county.

| <b>Table 2: Watershed Housing Units by Township<br/>Cheboygan and Emmet Counties (1990-2000)</b> |             |             |             |                       |                       |       |
|--|-------------|-------------|-------------|-----------------------|-----------------------|-------|
| <b>Cheboygan County</b>  |             |             |             |                       |                       |       |
| <b>Township</b>  | <b>1990</b> |             | <b>2000</b> |                       | <b>Percent Change</b> |       |
|  | Seasonal/   | Total       | Seasonal/   | Total                 | Seasonal/             | Total |
| Aloha  | 220         | 535         | 206         | 670                   | -6.4%                 | 25.2% |
| Benton   | 349         | 1272        | 312         | 1627                  | -10.6%                | 27.9% |
| Grant  | 409         | 714         | 347         | 817                   | -15.2%                | 14.4% |
| Inverness  | 229         | 1037        | 221         | 1226                  | -3.5%                 | 18.2% |
| Munro  | 363         | 591         | 347         | 650                   | -4.4%                 | 10.0% |
| TOTAL  | 1570        | 4149        | 1433        | 4990                  | -8.7%                 | 20%   |
| <b>Emmet County</b>  |             |             |             |                       |                       |       |
| Carp Lake  | 377         | 681         | 354         | 728                   | -6.1%                 | 6.9%  |
| Center   | 70          | 223         | 86          | 301                   | 22.9%                 | 35.0% |
| Maple<br>River   | 72          | 354         | 72          | 533                   | 0.0%                  | 50.6% |
| McKinley   | 38          | 479         | 63          | 572                   | 11.0%                 | 19.4% |
| TOTAL  | 557         | 1737        | 575         | 2134                  | 3.2%                  | 22.9% |
| <b>WATERSHED HOUSING TOTALS</b>  |             |             |             |                       |                       |       |
| <b>1990</b>  |             | <b>2000</b> |             | <b>Percent Change</b> |                       |       |
| Seasonal   | Total       | Seasonal    | Total       | Seasonal              | Total                 |       |
| 2127   | 5886        | 2008        | 7124        | 5.6%                  | 21.0%                 |       |

Source: U.S. Census Bureau

Emmet County's population is growing at a slightly faster rate than Cheboygan County--29.6% over the last ten years (**Table 1**). Housing in Emmet County has been keeping pace with its population growth, showing a 22.9% increase in housing. This figure includes a 3.2% growth in seasonal homes, reflecting the resort nature of the surrounding area. Emmet County's increase is highlighted by the significant decrease of seasonal homes seen in Cheboygan County (**Table 2**).

While the population, number of housing units and number of households in the watershed have all been on the increase, household size has decreased from 2.58 persons per household in 1990 to 2.43 persons per household in 2000. As shown in **Table 3**, these figures represent a 5.8% drop in household size. This tendency toward smaller household size is seen through out the country and reflects the changing lifestyles in the United States. The watershed area may be even more strongly affected by this trend as its seasonal residents reach retirement age and settle in the area on a permanent basis.

| <b>Table 3: Watershed Households<br/>1990-2000</b> |                         |             |                           |                              |             |                           |
|--|-------------------------|-------------|---------------------------|------------------------------|-------------|---------------------------|
| <b>Within Cheboygan County</b>                     |                         |             |                           |                              |             |                           |
| <b>Townships<br/>In<br/>Watershed</b>              | <b>Total Households</b> |             |                           | <b>Persons per Household</b> |             |                           |
|  | <b>1990</b>             | <b>2000</b> | <b>Percent<br/>Change</b> | <b>1990</b>                  | <b>2000</b> | <b>Percent<br/>Change</b> |
| Aloha  | 278                     | 423         | 52.2%                     | 2.54                         | 2.45        | -3.7%                     |
| Benton   | 877                     | 1248        | 42.3%                     | 2.71                         | 2.44        | -9.9%                     |
| Grant  | 275                     | 428         | 55.6%                     | 2.49                         | 2.21        | -11.4%                    |
| Inverness  | 738                     | 914         | 23.8%                     | 2.64                         | 2.49        | -5.9%                     |
| Munro  | 193                     | 270         | 39.9%                     | 2.65                         | 2.47        | -6.9%                     |
| Total  | 2361                    | 3283        | 39.1%                     | 2.60                         | 2.41        | -7.3%                     |
| Total for<br>County                                | 8201                    | 10835       | 32.1%                     | 2.58                         | 2.41        | -6.6%                     |
| <b>Within Emmet County</b>                         |                         |             |                           |                              |             |                           |
| Carp Lake  | 239                     | 339         | 41.8%                     | 2.50                         | 2.38        | -4.7%                     |
| Center   | 127                     | 192         | 51.2%                     | 2.90                         | 2.55        | -12.0%                    |
| Maple River  | 267                     | 434         | 62.5%                     | 2.78                         | 2.84        | 2.1%                      |
| McKinley   | 388                     | 459         | 18.3%                     | 2.76                         | 2.76        | 0.0%                      |
| Total  | 1021                    | 1424        | 39.5%                     | 2.74                         | 2.63        | 4.0%                      |
| Total for<br>County                                | 9516                    | 12577       | 32.2%                     | 2.58                         | 2.44        | -5.5%                     |
| Watershed<br>Total                                 | 17717                   | 23413       | 32.1%                     | 2.58                         | 2.43        | -5.8%                     |

Source: U. S. Census Bureau

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## Chapter Two: Water Quality

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### Introduction

The Cheboygan River/Lower Black River Watershed contains over 5000 acres of surface water in its lakes, in addition to hundreds of miles of rivers, streams and tributaries. The quality of these important waterbodies becomes increasingly at risk as development of natural areas continues and forested lands are converted to commercial and residential parcels. As these and other land use changes continue to take place, the associated pollution impacts to lakes, streams and rivers increase. During periods of high runoff (rainstorms, snowmelts, etc.) contaminants such as fertilizers, sediments, nutrients, oil, grease, road salt and toxic chemicals are flushed from streets, parking lots, yards and agricultural lands. The pollutant laden water can either move overland to the nearest lake, stream or wetland or percolate through the soil into the groundwater. Storm sewers and drains, which increase with development, provide an even more direct route for runoff to reach the water resources. At present, the Cheboygan River/Lower Black River Watershed has a *Good to Excellent* water quality rating, but with the ever-increasing demands development puts on our water resources, great care will need to be taken to ensure continued high water quality.

### Designated Uses of the Cheboygan River and Lower Black River

Part 31 (formerly known as the Water Resources Commission Act) of the Natural Resources and Environmental Protection Act, P.A. 451 of 1994, as amended requires all waters of the State of Michigan to be of the quality to meet seven designated uses:

- 1.) Agriculture
- 2.) Industrial water supply
- 3.) Public water supply at the point of intake
- 4.) Navigation
- 5.) Warm or cold water fisheries
- 6.) Other indigenous aquatic life and wildlife
- 7.) Partial or total body contact recreation

At the present time, none of the designated uses for the Cheboygan River/Lower Black River Watershed are impaired. As the population within the watershed continues to grow, however, the impact of human activities on the quality of water will become increasingly noticeable. Residential and commercial development, along with increased recreational activities will stress watershed critical areas, threatening some designated uses and degrading their status to "impaired".

**Table 4** Lists the status of the seven Designated Uses and shows the causes and sources of threats to those uses.

| <b>Table 4: STATUS OF DESIGNATED USES</b> |                  |                    |   |
|---|------------------|--------------------|---|
| <b>Designated Use</b>                     | <b>Impaired?</b> | <b>Threatened?</b> | <b>Cause or Source of Threat</b>  |
| Agriculture                               | No               | No                 |   |
| Industrial                                | No               | No                 |   |
| Public Water Supply                       | No               | Yes                | Failing septic systems; Livestock access to streams; Groundwater contamination                                    |
| Navigation                                | No               | Yes                | Sedimentation   |
| Warm or Cold Water Fisheries              | No               | Yes                | Impact of dam; Sedimentation from construction/development sites; Nutrients from lawn care/ agriculture practices |
| Indigenous Aquatic Life/ Wildlife         | No               | Yes                | Development/ construction along shorelines; Invasive species; Nutrients from lawn care/ agriculture practices     |
| Partial/Total Body Contact                | No               | Yes                | Failing septic systems  |

### **Desired Uses**

Desired uses are those uses not required by law, but which the community has deemed important to the watershed. A list of desired uses for the Cheboygan River/Lower Black River Watershed was developed by the steering committee at the initial steering committee meeting, with input from the technical committee and concerned community members. The Desired Uses for the watershed are listed below:

- Protection of critical areas
- Preservation of open space
- Zoning for conversion of lawns, shorelines to greenbelts
- Enactment of stormwater controls
- Management of water for irrigation (no water usage regulations at present)
- Floodplain protection
- Gauges for Cheboygan dam

### **Initial Water Quality Summary**

Both the Cheboygan River and the Lower Black River have good to excellent water quality and meet the requirements for all seven designated uses. These river systems are actively used for agriculture; navigation; industrial water supply; warm-water fishing; total body contact recreation; and provide habitat for indigenous aquatic life.

### **Known and Suspected Pollutants**

Evidence of several pollutants has been noted in various parts of the watershed. Some of these pollutants, along with their known or suspected causes are:

- ♦ *Nutrients*—agricultural runoff, livestock access to streams, waterfowl, lawn maintenance practices, inadequate or failing septic systems, manure
- ♦ *Toxics*—Contaminated sites
- ♦ *Petroleum products, chlorides, vehicular contaminants, bacteria, pesticides*—abandoned wells, underground storage tanks, boats, housing, dams, undersized culverts
- ♦ *Sediments*—road/stream crossings, streambank erosion, development activities, stormwater runoff, recreational uses, inadequate or poorly maintained culverts
- ♦ *Biological (invasive species)*—recreation boats

Below, **Table 5** shows known (k) or suspected (s) pollutants in the watershed area, along with the known or suspected source and/or cause of each pollutant.

| <b>Table 5: Pollutants, Causes and Sources</b> |                                     |   |
|--|-------------------------------------|---|
| <b>KNOWN OR SUSPECTED POLLUTANTS</b>           | <b>SOURCE OF POLLUTANT</b>          | <b>CAUSE</b>  |
| <b>Sediments (k)</b>                           | Streambanks (k)                     | Livestock access (k)<br>Human access (k)<br>Flow Fluctuations (s)                                       |
|  | Road-stream crossings (s)           | Undersized or deteriorating culverts (s)  |
|  | Agricultural activities (k)         | Uncontrolled livestock access (k)   |
|  | Development sites (s)               | Inadequate erosion control (s)<br>Loss of greenbelt (k)<br>Construction activities (s)                  |
|  | Stormwater runoff (k)               | Impervious surfaces (k)<br>Inadequate drains (k)  |
| <b>Nutrients (s)</b>                           | Inadequate wastewater treatment (s) | Improperly sited, designed, or maintained septic systems (s)<br>Combined sewer overflows (s)            |
|  | Leaves/grass clippings (s)          | Residential lawns (s)   |
|  | Fertilizers (k)                     | Residential lawns (s)<br>Agricultural operations (s)  |
|  | Animal manure (k)                   | Uncontrolled livestock access (k)<br>Waterfowl (k)  |
| <b>Oils, grease and metals (s)</b>             | Stormwater runoff (k)               | Improper oil disposal (s)<br>Impervious surfaces such as parking lots (s)                               |
| <b>Pesticides</b>                              | Residential lawns (s)               | Improper use/overuse (s)  |
|  | Agricultural operations (s)         | Improper use/overuse (s)  |
| <b>Toxics</b>                                  | Contamination sites                 | Leaking underground storage tanks<br>Improper disposal of hazardous household wastes<br>Abandoned wells |

## Water Quality Threats or Impairments

Many factors can contribute to the degradation of water quality. A list of factors that are impacting water quality and future uses for the watershed was developed by the steering committee for the Cheboygan River/Lower Black River Watershed. Steering committee members expressed concern over several potential threats to the stability and health of the watershed. Threats cited include: conflict between recreational and industrial water uses; sediments and contaminants introduced to lakes and streams by stormwater runoff; increased development of lake and river shorelines; loss of wetlands and wildlife habitat due to development and other human impacts; inadequate or poorly maintained septic systems and agricultural runoff that contribute bacteria and nutrients to the water system; increased sedimentation from shoreline erosion and erosion at road/stream crossings; and impairment of recreation and aquatic/wildlife habitat with the introduction and spread of invasive species. **Table 6** is a compilation of the water quality concerns expressed by the steering committee, and the relationship of each concern to the affected designated use.

| <b>Table 6: Threats to Water Quality</b> |   |
|--|---|
| <b>Water Quality Threats</b>             | <b>Threatened Designated Use</b>  |
| Recreation/river use conflicts           | Total/Partial body contact, Aquatic life/ wildlife, Cold/Warm water fisheries                     |
| Stormwater runoff                        | Cold/Warm water fisheries, Public water supply, Aquatic life/wildlife                             |
| Shoreline development                    | Public water supply, Aquatic life/wildlife, Navigation  |
| Loss of wetlands                         | Aquatic life/wildlife, Public water supply  |
| Loss of habitat                          | Aquatic life/wildlife, Cold/Warm water fisheries  |
| Erosion                                  | Navigation, Cold/Warm water fisheries, Aquatic life/wildlife                                      |
| Septic/sewer system impacts              | Public water supply, Cold/Warm water fisheries, Aquatic life/wildlife, Total/Partial body contact |
| Invasive species                         | Cold/Warm water fisheries, Aquatic life/wildlife, Total body contact                              |

## Initial Goals for the Cheboygan River/Lower Black River Watershed

Watershed goals outline the anticipated future state of the watershed. After reviewing the pollutants found to be threatening the watershed and discussing the watershed concerns expressed by the steering committee, a list of initial goals was drafted. The purpose of the list of goals is to guide the restoration and protection of the designated and desired uses for the watershed and is based on those uses found to be threatened or impaired. **Table 7** shows each threatened use, and the goal developed to alleviate or eliminate the threat.

| <b>Table 7: Initial Watershed Goals</b> |   |
|---|---|
| <b>Public Water Supply</b>              | Prevent industrial, bacterial, chemical and organic pollution from entering the lakes and rivers of the watershed   |
|   | Prevent Increase in stormwater flows  |
|   | Provide for long-term protection of the watershed through the adoption and enforcement of local land use policies and conservation practices.   |
| <b>Navigation</b>                       | Enhance recreational access sites to prevent degradation of water quality.  |
|   | Protect lake and river shorelines to control erosion  |
| <b>Warm or Cold Water Fisheries</b>     | Prevent increase in stormwater flows  |
|   | Improve and protect the water quality for the preservation of warm and cold water fisheries in the watershed by reducing the amount of sediment entering the system.                  |
|   | Prevent industrial, bacterial, chemical and organic pollution from entering the lakes and rivers of the watershed   |
|   | Protect lake and river shorelines to control erosion  |
| <b>Habitat</b>                          | Restore aquatic habitat in portions of the watershed where impairment is suspected  |
|   | Implement BMP's during all forest treatment activities in the critical area of the Watershed to protect water quality.  |
|   | Provide for long-term protection of the watershed through the adoption and enforcement of local land use policies and conservation practices.   |
|   | Ensure high water quality and provide for the protection of aquatic and terrestrial wildlife by reducing the amounts of nutrients, sediments and toxic pollutants entering the river. |
|   | Prevent industrial, bacterial, chemical and organic pollution from entering the lakes and rivers of the watershed   |
|   | Prevent industrial, bacterial, chemical and organic pollution from entering the lakes and rivers of the watershed   |
| <b>Partial/Total Body Contact</b>       | Enhance recreational access sites to prevent degradation of water quality.  |
|   | Prevent industrial, bacterial, chemical and organic pollution from entering the lakes and rivers of the watershed   |

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## CHAPTER THREE: WATERSHED CRITICAL AREA

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### Critical Area Determination

#### *Methodology*

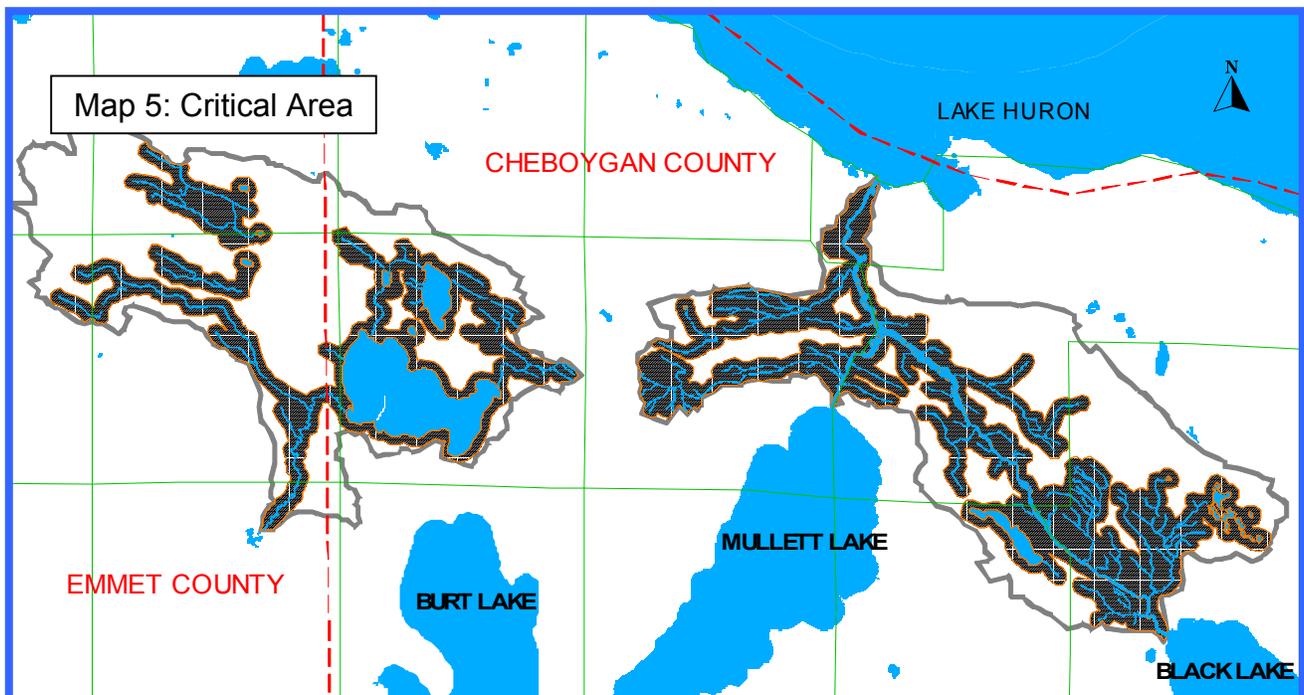
The critical area for the Cheboygan River-Lower Black River Watershed was determined using Tip of the Mitt Watershed Council's priority area criteria. Criteria used to determine the priority area are as follows:

1. Areas within 1000 feet of the Cheboygan River and the Lower Black River.
2. Designated tributaries, including intermittent drainages.
3. Inland lakes within the watershed.
4. Contiguous wetlands.
5. Urban areas which drain to surface waters.
6. Contiguous steep slopes, defined as 10% slope or greater.
7. Areas of groundwater recharge.

The initial map was presented at the April 30, 2002 meeting. The critical area will be continuously adjusted according to the inventory results.

#### *Defined Critical Area*

The total area for the Cheboygan River/Lower Black River Watershed is 124 square miles. The total critical area is 52.8 square miles (33,798 acres). Most of the efforts of the watershed plan were directed toward protecting and restoring designated and desired uses within the critical area. The shaded portions of **Map 5** indicate the critical area of the watershed.



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## Chapter Four: Cheboygan River/Lower Black River Nonpoint Source Inventory

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### Introduction

Nonpoint source pollution can find its way into a water system through various means. When streambanks and shorelines erode, sediments are deposited into lakes and rivers. Sediments and other pollutants can be washed into streams at road/stream crossings. Agricultural and residential areas contribute fertilizers and pesticides, and storm drains provide an even more direct route for pollutants to enter waterways during a storm event. Several inventories, including streambank, road/stream crossing, agriculture and storm drains were conducted during spring through autumn of 2002 to gather information regarding the state of the watershed. Materials used in the assessment of the watershed included topographic maps, MIRIS land use maps, plat books, aerial photographs, watershed maps, and county road maps. Water quality data and zoning ordinances were also used to supplement the spatial data. The field inventories were conducted by car, boat, canoe and/or by walking the watershed. The resulting data sets were used to determine which pollutants are threatening or impairing the watershed's designated and desired uses.

### Streambank Erosion Inventory

#### *METHODOLOGY*

An inventory of streambank erosion sites was conducted in summer 2002 and concluded in spring 2003. The streambanks were inventoried using a variety methods, including topographical maps, soils studies, and where navigable, various watercraft were used. Each erosion site was given an identification number, the condition of the site was documented, and photographs were taken of the streambank. Information collected at each site included length and slope of the eroded embankment, soil type and amount of vegetation present, the condition of the bank, and the extent and causes of the erosion (**Appendix A** is a sample data collection form; **Appendix B** is the severity scoring sheet used to determine site rank). Using this data, best management practices were then determined for each site inventoried. In order to identify the most critical erosion sites, a ranking system that evaluates the collected data was used, and each erosion site was determined to be either a *Minor*, *Moderate*, or *Severe* environmental concern. Evaluation of the streambanks in the watershed is critical in determining not only which sites need immediate attention, but also in identifying sites that may pose potential sedimentation problems in the future.

For maps and more detailed information on erosion sites, see the Support Document One: *Streambank Erosion Inventory and Road/Stream Crossing Inventory*.

## RESULTS

A total of nineteen sites displaying significant amounts of streambank erosion were located within the watershed. Eight of the sites show minor amounts of erosion, ten have moderate erosion, and one site was considered severe. The minor sites were located on the Cheboygan River, the Maple River, and the Lower Black River. The Cheboygan, Maple and Lower Black Rivers along with Myers Creek and Owens Creek all had sites of moderate erosion. The only site determined to be severely eroded was located on the Cheboygan River. The causes of erosion varied from site to site. A few of the erosion sites were naturally occurring from a bend in the river, wildlife access or bank seepage. The erosion at many of the sites, however, was the result of human activities. Sites where livestock had access to streams, and fishing and boat-launch sites in particular often showed moderate to severe signs of erosion. **Table 8** is a brief summary of the streambank inventory.



| <b>Table 8: SUMMARY OF STREAMBANK INVENTORY</b> |             |                   |            |
|---|-------------|-------------------|------------|
| Site ID   | Township    | Stream            | Site Score |
| <b>Minor Sites</b>                              |             |                   |            |
| S001  | Inverness   | Cheboygan River   | 21         |
| S008  | Benton      | Cheboygan River   | 27         |
| S011  | Maple River | Maple River       | 22         |
| S012  | Maple River | Maple River       | 25         |
| S015  | Maple River | Maple River       | 29         |
| S017  | Benton      | Lower Black River | 20         |
| S018  | Benton      | Lower Black River | 26         |
| S019  | Benton      | Lower Black River | 29         |
| <b>Total Minor Sites</b>                        | <b>8</b>    |                   |            |
| <b>Moderate Sites</b>                           |             |                   |            |
| S002  | Benton      | Cheboygan River   | 31         |
| S003  | Benton      | Cheboygan River   | 32         |
| S004  | Benton      | Cheboygan River   | 33         |
| S005  | Benton      | Cheboygan River   | 36         |
| S007  | Inverness   | Myers Creek       | 36         |
| S009  | Grant       | Owens Creek       | 31         |
| S010  | Maple River | Maple River       | 32         |
| S013  | Maple River | Maple River       | 33         |
| S014  | Maple River | Maple River       | 33         |
| S016  | Benton      | Lower Black       | 33         |
| <b>Total Moderate Sites</b>                     | <b>10</b>   |                   |            |
| <b>Severe Sites</b>                             |             |                   |            |
| S006  | Inverness   | Cheboygan River   | 38         |
| <b>Total Severe Sites</b>                       | <b>1</b>    |                   |            |
| <b>Watershed Total</b>                          | <b>19</b>   |                   |            |

## Shoreline Inventory

A shoreline survey to identify locations of Cladophora growth and other shoreline features was conducted on Long Lake, Douglas Lake, Munro Lake and Twin Lakes by the Tip of the Mitt Watershed Council in July 2002.

Cladophora is a branched, filamentous green algae that occurs naturally in small amounts in Northern Michigan Lakes. Its occurrence is governed by specific environmental requirements for temperature, substrate, nutrients, and other factors. It is found most commonly in the wave splash zone and shallow shoreline areas of lakes, and can also be found in streams. It grows best on stable substrates such as rocks and logs. Artificial substrates such as concrete or wood seawalls are also suitable. The preferred water temperature is 50 to 70 degrees Fahrenheit. This means that late May to early July, and September and October are the best times for its growth in Northern Michigan lakes.

The nutrient requirements for Cladophora to achieve large, dense growths are greater than the nutrient availability in lakes with high water quality, such as Douglas Lake. Therefore, the presence of Cladophora can indicate locations where relatively high concentrations of nutrients, particularly phosphorus, are entering a lake (it has less usefulness as an indicator of nutrient pollution in streams). Sources of these nutrients can be due to natural conditions, including springs, streams, and artesian wells that are naturally high in nutrients due to the geologic strata they encounter; as well as wetland seepages which may discharge nutrients at certain times of the year. However, past experience has shown that the majority of Cladophora growths can be traced to cultural sources such as lawn fertilization, malfunctioning septic systems, poor agricultural practices, soil erosion, and wetland destruction. These nutrients can contribute to an overall decline in lake water quality. Additionally, malfunctioning septic systems pose a potential health risk due to bacterial and viral contamination.

A Cladophora survey can be a valuable lake management tool. Coupled with follow-up on-site visits and questionnaires, controllable sources of nutrients to the lake can be identified. Subsequently, a reduction in nutrient loading and other forms of pollution can often be achieved by working with homeowners to solve problems. These solutions are often simple and low cost, such as regular septic system maintenance, proper lawn care practices, and preservation or establishment of a greenbelt along the shoreline. Prevention of problem situations can also be achieved through the publicity and education associated with the survey.

The 2002 project is the first systematic lake-wide survey conducted on Munro Lake, Long Lake, or Twin Lakes, and the first on Douglas Lake since 1988. Periodic repetition of shoreline algal surveys are important for identifying chronic problem sites as well as recent occurrences. They are also valuable for determining long term trends of near shore nutrient inputs associated with land use changes, and for assessing the success of remedial actions.

## METHODOLOGY

The shoreline was surveyed to develop a database of property parcel features and their description as viewed from the water. Property features include developed platted lots, undeveloped (vacant) lots, large undeveloped parcels, parks, preserves, public access sites, and county road endings. However, it was not possible to identify every distinct parcel in this manner.

For the purpose of this survey, *developed* means the presence of buildings or other significant permanent structures. Included are roadways, boat launching sites, and recreational properties (such as parks with pavilions and parking lots). Properties with only mowed or cleared areas, seasonal structures (such as docks or travel trailers), or unpaved pathways were not considered developed. Additionally, relatively large parcels which may have development in an area far from the water's edge were not considered developed. The length and area of developed versus undeveloped shoreline was not calculated.

The database field containing the property description contains a sometimes cryptic descriptive phrase up to 50 characters long. For example, *1stsmGry, wh tr, blk sh, rb chm, dck* means that the property has a small one-story gray house with white trim, black shutters, a red brick chimney, and a deck. There is a key to the abbreviations included at the end of the database. Database fields were created for names of property owners and shoreline address of properties, however, few entries were made. This information can be gathered and added at a later time.

The shoreline was also closely inspected for Cladophora growths by traveling in a small boat as close to the shoreline as possible (usually within 20 feet). The Cladophora growths observed were described by estimating the length (feet) of shoreline covered and the density or amount of available substrate that was utilized. Categories and densities are as follows:

|                              |                    |
|------------------------------|--------------------|
| Very Light (VL) .....        | up to 25% coverage |
| Light (L) .....              | 25-49% coverage    |
| Light to Moderate (LM) ..... | 50-59% coverage    |
| Moderate (M).....            | 60-74% coverage    |
| Heavy (H) .....              | 75-99% coverage    |
| Very Heavy (VH) .....        | 100% coverage      |

For example, if Cladophora covered half the rocks along a 25 foot length of shoreline, it would be described Mx25.

Although the size of the growth on an individual basis is important in helping to interpret the cause of the growth and the severity of the problem, growth features of Cladophora are greatly influenced by such factors as current patterns, shoreline topography, size and distribution of substrate, and the amount of wave action the shoreline is subject to. Therefore, the description has limited value when making year-to-year comparisons at a

single location or estimating the relative amount of shoreline nutrient input. Rather, the presence or absence of any significant growth at a single site over several years is the most valuable comparison. It can reveal the existence of chronic nutrient loading problems, and help interpret the cause of the problems and assess the effectiveness of any remedial actions. Comparisons of the total number of algal growths can reveal trends in nutrient input due to changing land use.

Many species of filamentous green algae are commonly found growing in the near shore regions of lakes. Positive identification of these species usually requires the aid of a microscope. However, Cladophora usually has an appearance and texture that is quite distinct to a trained surveyor, and these were the sole criteria upon which identification was based.

Other species of filamentous green algae can respond to an external nutrient source in much the same way as Cladophora, although their value as an indicator species is not thought to be as reliable. When other species occurred in especially noticeable, large, dense growths, they were recorded on the survey maps and described the same as those of Cladophora.

Among other things, the distribution and size of each Cladophora growth is dependant on the amount of suitable substrate present. The extent of suitable substrate should therefore be taken into account when interpreting the occurrence of individual growths, and assessing the overall distribution of Cladophora along a particular stretch of shoreline. The type of substrate present in front of each property was recorded during the survey. Substrates were broadly grouped into five categories: rocks, rock-sand mixture, sand, muck-sand mixture, and muck.

The preservation or establishment of a shoreline greenbelt (also known as a vegetated buffer strip) is considered one of the most important shoreline management techniques. A greenbelt is a strip of diverse vegetation, either naturally growing or planted, along the shoreline of a lake or stream. It usually consists of a mixture of trees, shrubs, ground cover, and wildflowers. Greenbelts minimize polluted runoff, reduce the need for lawn maintenance (including pesticide and fertilizer applications), remove nutrients from septic systems and other sources, strengthen shoreline soils and help prevent erosion, are attractive, offer privacy and dampen sound, attract wildlife, can help save energy, discourage congregations of waterfowl, and may increase property values. Mowed turf grass usually stands in stark contrast to a diverse, well-functioning greenbelt.

Information on the presence or absence of a shoreline greenbelt was also compiled during this survey. The presence and characteristics of a shoreline greenbelt was described using an index with three basic categories:

**2.5-3.0 Excellent.** Very little disturbance of the natural vegetation outside the “footprint” of the house, especially along the shoreline (including emergent rushes and other aquatic vegetation). These properties have the appearance of a cottage tucked into the woods, and are often difficult to observe from the water during the growing season. This is the best category, one that property owners

should strive to attain to ensure maximum water quality protection and biodiversity.

**2.0-2.49 Good.** Although significant areas of natural vegetation remain, large areas have also been converted to lawn or other uses, especially along the shoreline. Properties in this category are generally doing a good job of managing their shoreline with respect to water quality protection, but there is room for improvement.

**1.0-1.99 Poor.** The shoreline has mostly been converted to an urban setting, with little natural or woody vegetation remaining along the shore. These properties are most likely contributing nutrients from surface runoff and could use improvement.

The presence or absence of accelerated shoreline erosion and its relative severity (slight, moderate, or severe) can be ascertained by the following clues:

- An area of bare soil on a steep, high shoreline bank,
- Leaning or downed trees, or trees with exposed roots,
- Undercut banks,
- Rapid rate of recession (often based on personal knowledge),
- Slumping hunks of sod,
- Excessive deposits of sediments, and,
- Muddy water during wavy times.

Additional information about the nature of the erosion, such as height and length of bank, whether it occurs at the toe or the top of the bank, type of soils, rate of recession, obvious causes, etc. may be added during future surveys. The Shoreline Inventory Database which contains a database report with the sequential listing of properties (as well as all the other information described) can be found in *Support Document Two: Stormwater Outfall Inventory, Agriculture Inventory, and Shoreline Inventory Database*.

## RESULTS

**Douglas Lake:** The survey identified approximately 341 property parcels. These included several large parcels, especially the University of Michigan Biological Station (UMBS), which contains approximately 48% of the Douglas Lake shoreline. The UMBS parcel included a large portion of shoreline on the eastern half of the lake as well as the area around Maple Bay and a small parcel of land in the northwest corner in Marl Bay. The properties on Pell's Island were also included in the survey. Also included were three road endings, one of which provides the opportunity for the launching of trailerable boats. Of the total property parcels recorded and excluding the undeveloped parcels of the UMBS, approximately 306 (or 90%) were developed.

Habitat generally considered suitable for *Cladophora* growth was present at 147 properties (48%). Noticeable growths of *Cladophora* or other filamentous green algae

were found in 54 locations (slightly more than one-third of the properties). Numbers of each type of Cladophora growth are as follows:

|                         |    |
|-------------------------|----|
| Very Light .....        | 17 |
| Light .....             | 21 |
| Light to Moderate ..... | 3  |
| Moderate .....          | 10 |
| Moderate to Heavy ..... | 3  |
| Heavy .....             | 6  |

Most of the Cladophora growths were associated with developed shoreline properties. Although some of the algae growths are undoubtedly associated with septic system leachate or other factors associated with development and human activities, most of the growths are in the very light or light category and few severe water pollution problems were evident along the Douglas Lake shoreline. However, the cumulative impact of many slight problems can be significant.

The shorelines of approximately 8.5% of developed properties were in the excellent greenbelt category, while 4% were in the good category. Most developed properties (87.5%) were in the poor category.

Accelerated erosion in the form of undercut banks, exposed tree roots, or other obvious indications was present at 108 sites throughout the survey area (or about 31% ). Accelerated erosion is mostly due to woody vegetation removal, and so was predominantly associated with developed properties with extensive lawns. The relative severity of the erosion was not determined.

Support Document Two contains a database report with the sequential listing of properties (as well as all the other information described), beginning at the public boat launch at the end of Bryant Road, and traveling clockwise around the entire perimeter of the lake. The Pell's Island properties are included at the end of the survey. Those properties were surveyed beginning in the southwest corner of the island and traveling in a clockwise direction.

**Long Lake:** The survey identified approximately 179 property parcels. These included several large parcels such as Camp Walden and Pines Resort. Also included were three road endings that provide an opportunity for the launching of trailerable boats. Of the total property parcels, approximately 152 (or 85%) were developed.

Habitat generally considered suitable for Cladophora growth was present at 135 properties (89%). Noticeable growths of Cladophora or other filamentous green algae were found in 49 locations (about one-third of the properties). Numbers of each type of Cladophora growth are as follows:

|                         |    |
|-------------------------|----|
| Very Light .....        | 12 |
| Light .....             | 19 |
| Light to Moderate ..... | 7  |
| Moderate .....          | 16 |
| Moderate to Heavy ..... | 2  |
| Heavy .....             | 3  |

Most of the Cladophora growths were associated with developed shoreline properties. Although some of the algae growths are undoubtedly associated with septic system leachate or other factors associated with development and human activities, most of the growths are in the light to moderate category with few severe water pollution problems evident along the shoreline of Long Lake. However, the cumulative impact of many slight problems can be significant.

The shorelines of approximately 4.5% of properties were in the excellent greenbelt category, while 7% were in the good category. Most properties (88.5%) were in the poor category.

Accelerated erosion in the form of undercut banks, exposed tree roots, or other obvious indications was present at 48 sites throughout the survey area (or about 24% ). Accelerated erosion is mostly due to woody vegetation removal, and so was predominantly associated with developed properties with extensive lawns. The relative severity of the erosion was not determined.

Support Document Two contains a database report with the sequential listing of properties (as well as all the other information described) beginning at the public boat launch on Manning Road, and traveling counter-clockwise around the entire perimeter of the lake.

**Munro Lake:** The survey identified approximately 111 property parcels. These included several large parcels such as the Mackinac State Forest in the northwest area of the lake. Also included was one road ending at Brandau Road and one public boat launch that provide an opportunity for the launching of trailerable boats. Of the total property parcels, approximately 89 (or 80%) were developed.

Habitat generally considered suitable for Cladophora growth was present at 56 properties (50%). Noticeable growths of Cladophora or other filamentous green algae were found in 16 locations (about 29% of those properties). Numbers of each type of Cladophora growth are as follows:

|                         |    |
|-------------------------|----|
| Very Light .....        | 0  |
| Light .....             | 4  |
| Light to Moderate ..... | 0  |
| Moderate .....          | 11 |
| Moderate to Heavy ..... | 2  |
| Heavy .....             | 1  |

Most of the Cladophora growths were associated with developed shoreline properties. Although some of the algae growths are undoubtedly associated with septic system leachate or other factors associated with development and human activities, most of the growths are in the moderate category with very few severe water pollution problems evident along the shoreline of Munro Lake. However, the cumulative impact of many slight problems can be significant. The fact that more than 70% of the properties with suitable substrate for Cladophora growth did not have any algae present was a great indication that the lake had very little pollution.

The shorelines of approximately 1% of properties were in the excellent greenbelt category, while 10% were in the good category. Most properties (89%) were in the poor category.

Accelerated erosion in the form of undercut banks, exposed tree roots, or other obvious indications was present at 41 sites throughout the survey area (or about 38% ). Accelerated erosion is mostly due to woody vegetation removal, and so was predominantly associated with developed properties with extensive lawns. The relative severity of the erosion was not determined.

Support Document Two contains a database report with the sequential listing of properties (as well as all the other information described) beginning at the Brandau Road end, and traveling clockwise around the entire perimeter of the lake.

**Twin Lakes:** The survey identified approximately 144 property parcels. These included several large parcels such as the Mackinaw State Forest in the southwest area of the lake. Also included was one road ending at Page Road that provides an opportunity for the launching of trailerable boats.. Of the total property parcels, approximately 115 (or 78%) were developed.

Habitat generally considered suitable for Cladophora growth was present at 10 properties (7%). Noticeable growths of Cladophora were not found in any locations. There was a plume of filamentous algae off-shore of an undeveloped area. The algal growth could have been a result of the predominant winds coming across the lake to this bay.

The shorelines of approximately 43% of properties were in the excellent greenbelt category, while 20% were in the good category. Thirty-seven percent were in the poor category.

Accelerated erosion in the form of undercut banks, exposed tree roots, or other obvious indications was present at 22 sites throughout the survey area (or about 15% ). Accelerated erosion is mostly due to woody vegetation removal, and so was predominantly associated with developed properties with extensive lawns. The relative severity of the erosion was not determined.

Support Document Two contains a database report with the sequential listing of properties (as well as all the other information described) beginning at the Page Road end, and traveling clockwise around the entire perimeter of the lake. All basins of Twin Lakes are in this survey with the exception of the basin east of Krouse Road.

### **Road/Stream Crossing Inventory**

A road/stream crossing site exists wherever a road or street and a stream intersect. Road/stream crossings can be major contributors of sediments and other pollutants to the water system. Dirt and gravel from shoulders of the roads, or from unpaved roads, can be washed into a stream. The resulting build up of sediments in the stream is called *sedimentation*. Although sediments entering waterbodies is a natural process, excess amounts can wreak havoc on the aquatic environment. Some detrimental effects of sedimentation are:

- ◆ Destruction of aquatic habitat and the extermination of aquatic wildlife
- ◆ Negative impacts on birds and mammals dependent on the aquatic environment
- ◆ Restriction of plant productivity due to reduction of sunlight penetration
- ◆ Warming of waters, which can lead to destruction of coldwater fisheries
- ◆ Release of nutrients into the water system, causing the stimulation of algae growth
- ◆ Introduction into the water body of harmful pesticides, toxic metals and bacteria which may adhere to the grains of sediment
- ◆ Disruption of the fish life cycle by affecting their ability to feed, spawn, and inhibiting gill function.
- ◆ Reduction of width and depth of the stream channel, and the potential increase in flooding events

The amount of sedimentation experienced by a waterbody depends on several factors, such as the length and slope of the approaches, steepness of the embankment, whether or not the road is paved, the amount of vegetative cover along shoulders and ditches at the site, and the runoff path. These factors need to be taken into consideration in the development of any plan proposed to reduce the rate of sedimentation at road/stream crossings.

### **METHODOLOGY**

The road/ stream crossing inventory was conducted in the spring and summer months of 2002 by Northeast Michigan Council of Government (NEMCOG) staff. Using topographical and county road maps, possible road/stream crossings were located and each site was visited. At each site photographs were taken of upstream, downstream, and left and right approaches. Physical



condition and measurements of the culvert, the roadway, the length and slope of

approach, road width and surface type, stream depth and current, amounts and causes of erosion, and extent of vegetation were recorded. Using the data collected, each site was assigned a ranking of minor, moderate or severe based on the point system found on the severity ranking sheet. A site with a score between 0-15 ranks *Minor*, 16-29 is considered *Moderate*, and a score of 30 or more indicates a *Severe* site. Best Management Practices (BMPs) were determined according to the needs of each site. Sample inventory sheets and ranking sheets are included in **Appendices C** and **D**, respectively.

## **RESULTS**

A total of 194 road/stream crossing sites were inventoried for the Cheboygan River/Lower Black River Watershed (See **Map 6**). The sites were ranked as *Minor*, *Moderate* or *Severe* contributors of sediments to the river system. Nineteen sites were ranked *Minor*, all of which were located in Cheboygan County. Of the 159 *Moderate* sites inventoried, 124 were located in Cheboygan County and 35 were found in Emmet County. Sixteen of the watershed's road/stream crossings ranked *Severe*. Twelve of the severe sites were found in Cheboygan County, mainly in Inverness and Munro Townships. Of the four severe sites found in Emmet County, two were found in McKinley Township, one in Carp Lake Township, and one in Center Township. **Table 9** summarizes the road/stream crossing inventory by site, rank and estimated cost for individual sites, township, county, and for the entire watershed.

**MAP 6: Road/Stream Crossings**

**Table 9: ROAD/STREAM CROSSING INVENTORY SUMMARY WITH COST ESTIMATIONS**

| Aloha Township, Cheboygan County     |    |  | Total     |
|--------------------------------------|----|--|-----------|
| MINOR                                | 1  | 109A (\$4,770)   | \$4,770   |
| MODERATE                             | 6  | 075A; 078A; 079A(\$15,900); 080A(\$4,375); 081A(\$1,855); 108A(\$11,660)   | \$33,790  |
| TOTAL                                | 7  |  | \$38,560  |
| Benton Township, Cheboygan County    |    |  | Total     |
| MINOR                                | 8  | 049B; 050B; 062B(\$2,120); 067B; 083B(\$7,950);179B; 189B;191B   | \$10,070  |
| MODERATE                             | 37 | 047B(\$1,060) 048B; 051B(\$2,120); 058B(\$10,070); 061B(\$9,010); 063B; 064B; 065B(\$106); 066B; 068B; 069B; 070B(\$12,500); 071B(\$5,965); 072B(\$4,134); 073B(\$5,883); 076B(\$19,875); 077A(\$2,120); 082B(\$2,120); 084B(\$7,950); 085B(\$5,300); 086B(\$11,925); 087B; 088B(\$3,392); 089B(\$5,300); 090B(\$4,664) 091B(\$5,406); 092B(\$6,095); 093B; 094B; 095B; 096B(\$300); 097B(\$7,950) 098B(\$9,540); 099B(\$300); 100B(\$2,650); 107B; 190B   | \$145,735 |
| SEVERE                               | 1  | 074B(\$13,038)   | \$13,038  |
| TOTAL                                | 46 |  | \$168,843 |
| Grant Township, Cheboygan County     |    |  | Total     |
| MINOR                                | 4  | 101G; 114G(\$7,950); 117G; 121G;   | \$7,950   |
| MODERATE                             | 27 | 102G; 103G(\$10,600); 104G(\$7,950); 105G(\$7,950); 106G(\$7950); 110G(\$5,300) 111G(\$5,300); 112G; 113G(\$4,770); 115G(\$530); 116G(\$530); 118G(\$5,936) 119G; 120G; 122G(\$9,540); 123G(\$4770); 124G(\$4,982); 125G(\$4,770); 126G(\$4,770); 127G(\$4,770); 128G(\$7,950); 129G(6,625); 130G(\$11,660); 131G(\$2,650); 132G(\$4,770); 133G(\$5,300); 134G(\$7,950);   | \$81,818  |
| TOTAL                                | 31 |  | \$89,768  |
| Inverness Township, Cheboygan County |    |  | Total     |
| MINOR                                | 6  | 007I; 009I; 017I(\$1,060); 025I(\$1,060); 029I(\$1,590); 054I  | \$3,710   |
| MODERATE                             | 42 | 001I(\$11,766); 002I(\$7,922); 003I(13,780); 004I(\$9,160); 006I(\$6,495); 008I(\$11,130); 010I(\$530); 011I(\$9,010); 012I(\$1,060); 013I(\$7950); 014I(\$8374) 015I(\$8,374); 016I(\$7,950); 018I(\$6,784); 019I(\$1,060); 020I(\$1,060); 021I(\$1,060); 022I(\$1,060); 023I(\$1,060); 024I(\$1,060); 026I; 027I; 028I; 030I(\$3,922); 031I(\$9,116); 035I(\$4,240); 036I(\$6,360); 037I(\$3,710); 038I(\$2,650); 039I(\$15,900); 040I(\$15,264); 041I(\$6,360); 042I(\$1060); 043I(\$9,752); 052I(\$7,950); 053I(\$1,590); 055I; 056I(\$6,572); 057I(\$11,130); 059I(\$4,028); 060I | \$227,309 |
| SEVERE                               | 6  | 032I(\$4,134); 033I(\$6,890); 034I(\$3,392); 044I(\$5,300); 045I(\$8,800); 046I(\$7,950)   | \$36,466  |
| TOTAL                                | 54 |  | \$267,485 |
| Munro Township, Cheboygan County     |    |  | Total     |
| MODERATE                             | 12 | 135M; 136M(\$3,180); 140M(\$4,640); 142M; 143M(\$7,950); 144M(\$4,770); 145M(\$7,685); 146M(\$13,250); 147M(\$7,950); 149M(\$3,816); 192M(\$6,625); 193M   | \$59,866  |
| SEVERE                               | 5  | 032I(\$4,134); 033I(\$6,890); 034I(\$3,392); 044I(\$5,300); 045I(\$8,800); 046I(\$7,950)   | \$36,466  |
| TOTAL                                | 17 |  | \$96,332  |
| Bliss Township, Emmet County         |    |  | Total     |
| MODERATE                             | 1  | 162BL  | \$0       |
| TOTAL                                | 1  |  | \$0       |
| Carp Lake Township, Emmet County     |    |  | Total     |
| MODERATE                             | 16 | 157CL; 158CL; 159CL; 175CL; 176CL(\$300); 177CL; 178CL(\$800); 180CL(\$4,929); 181CL(\$4,929); 183CL(\$9,540); 184CL(\$7,9500; 185CL(\$9,350); 186CL; 187CL; 188CL(\$18,500); 194CL(\$2,120)   | \$58,418  |
| SEVERE                               | 1  | 182CL  | \$13,250  |
| TOTAL                                | 17 |  | \$71,688  |

| <b>Table 9: Road/Stream Crossing Inventory Summary, Continued</b> |            |  |                  |
|---|------------|--|------------------|
| <b>Center Township, Emmet County</b>                              |            |  | <b>Total</b>     |
| <b>SEVERE</b>   | 1          | 161C(\$8,480)  | \$8,480          |
| <b>TOTAL</b>  | 1          |  | \$8,480          |
| <b>Maple River Township, Emmet County</b>                         |            |  | <b>Total</b>     |
| <b>MODERATE</b>   | 1          | 160MR  | \$0              |
| <b>TOTAL</b>  | 1          |  | \$0              |
| <b>McKinley Township, Emmet County</b>                            |            |  | <b>Total</b>     |
| <b>MODERATE</b>   | 16         | 150MK; 151MK; 152MK; 153MK; 154MK(\$18,550); 155MK; 156MK(\$17,225); 163MK; 164MK(\$4,240); 165MK(\$3,445); 166MK(\$15,900); 168MK(\$6,943); 169MK(\$7,950); 170MK(\$5,618); 172MK(\$7,950); 173MK(\$7,950); 174MK(\$7,950); | \$103,721        |
| <b>SEVERE</b>   | 2          | 167MK(\$10,000); 171MK(\$21,200)   | \$31,200         |
| <b>TOTAL</b>  | 18         |  | \$134,921        |
| <b>WATERSHED TOTALS</b>   |            |  |                  |
| <b>MINOR</b>  | 19         | Cheboygan County   | \$91,745         |
|   | 0          | Emmet County   | \$0              |
|   | 19         | Total Watershed  | \$91,745         |
| <b>MODERATE</b>   | 124        | Cheboygan County   | \$462,780        |
|   | 35         | Emmet County   | \$162,139        |
|   | 159        | Total Watershed  | \$624,919        |
| <b>SEVERE</b>   | 12         | Cheboygan County   | \$91,745         |
|   | 4          | Emmet County   | \$52,930         |
|   | 16         | Total Watershed  | \$144,675        |
| <b>TOTAL SITES</b>  | <b>194</b> |  | <b>\$796,094</b> |

Detailed site descriptions, and maps of road/stream crossing sites by township can be found in Support Document One: *Streambank Erosion Inventory and Road/Stream Crossing Inventory*

### **Agriculture Inventory**

The welfare of fish and wildlife depends on the availability of habitat. Habitat consists of food, shelter, and water, which is essential to survival of all current species. Public concern grows for conservation as observations of the decline of fish and wildlife of the Cheboygan River watershed are noticed. A decline in water quality, habitat and other ecological factors threaten the region's fish and wildlife populations. Problems such as these can be attributed partially to the direct consequences of extensive land use by farmers for agricultural purposes. Public desires to protect the lands from extensive farming have been expressed through legislature, such as the Clean Water Act, the Endangered Species Act and the Farm Bill.

Pollution can only occur when the presence of a pollutant exists. The threat of a pollutant is determined by three factors: availability, detachment, and transport. A water pollution hazard occurs when a pollutant is available, becomes detached from a source and transports into a watershed where it becomes a problem. A designated use of a river or stream, such as habitat, boating or fishing is threatened by the presence of one or more pollutants.

Sediment is the most significant source of pollution in a watershed. Wind and water flowing across the land allows sediment to detach and provides transportation of sediment into a watershed, causing a loss of topsoil to the farmer and adding excess sediment to a lake, stream, or river. The loss of topsoil is usually countered by the addition of nutrients into the soil, leading to an excess of nutrients that disturb the natural balance of an ecosystem around a watershed as the nutrients collect in the water.

Animal manure also contributes to an excess of nutrients that is easily transported by water and concentrated into lakes and streams, disturbing the sensitive ecosystem of fish and wildlife while at the same time creating the loss of valuable habitat. Excesses of nutrients can affect the quality of drinking water, aquatic habitat, and recreational quality of watercourses.



Nonpoint source pollution is a serious issue, and one easily brought under control with proper management of our land and resources. The use of BMPs is cost effective in the long run and benefits all wildlife as well as humans. Farmers can produce better yields while humans and wildlife enjoy the quality of a well-maintained watershed. Potentially the state could collect more fees from hunting and fishing licenses, and land values for property owners could increase. A healthy

fish and wildlife population can result from the understanding and correction of current and potential nonpoint source pollution.

### **METHODOLOGY**

The Agricultural Inventory was conducted by the Cheboygan County Conservation District (CCCD) and the US Department of Agriculture-Natural Resource Conservation Service (USDA-NRCS). Agricultural sites were identified using a variety of maps, including aerial photos and plat maps. Utilizing the skills of USDA-NRCS personnel, high priority agricultural sites were identified. Field Inventories were conducted by roadside observations. Each agricultural site was evaluated on an Agricultural Inventory Field Data Form, shown in *Appendix C*. The sites were also photographed and a combined form with photos, field data, BMPs, and estimated costs are available in a separate document, Support Document Two: *Agricultural Inventory and Stormwater Inventory*. A map of agricultural sites inventoried was developed and is also included with this document.

### **RESULTS**

Two counties, Cheboygan and Emmet, were surveyed for agricultural causes of nonpoint source pollution in the Cheboygan River/Lower Black River Watershed. For the purpose of this inventory, the watershed was divided into three sub-watersheds: Black River; Cheboygan River; and Douglas Lake. For each sub-watershed, the location and any associated nonpoint source pollution problems were documented for

agricultural producers in the watershed. See **Table 10** below for a summary of the inventory by sub-watershed.

| <b>Table 10: Agricultural Sites by Sub-Watershed</b> |                    |              |                 |               |                   |
|--|--------------------|--------------|-----------------|---------------|-------------------|
| <b>Sub-Watershed</b>                                 | <b>Total Sites</b> | <b>Minor</b> | <b>Moderate</b> | <b>Severe</b> | <b>Total Cost</b> |
| Black River  | 53                 | 25 (47%)     | 25 (47%)        | 3 (6%)        | \$1,689,800       |
| Cheboygan River                                      | 50                 | 34 (68%)     | 13 (26%)        | 3 (6%)        | \$494,400         |
| Douglas Lake   | 74                 | 52 (70%)     | 21 (28%)        | 1 (1%)        | \$645,200         |
| Total Watershed                                      | 177                | 111 (63%)    | 59 (33%)        | 7 (4%)        | \$2,829,400       |

**Table 11** lists agricultural sites by township and severity ranking, and includes cost estimations for each township. For a more detailed list of agricultural sites and cost estimations see the Agricultural Inventory Table in **Appendix E**. A total of 177 agricultural sites were identified and inventoried in fall 2002 through spring 2003.

| <b>Table 11: SUMMARY OF AGRICULTURAL INVENTORY AND ESTIMATED COSTS</b> |                 |                        |                    |
|--|-----------------|------------------------|--------------------|
| <b>Total Sites Inventoried:</b>  | <b>177</b>      | <b>Total Cost:</b>     | <b>\$2,829,400</b> |
| <b>MINOR SITES</b>   | <b>Township</b> | <b>Number of Sites</b> | <b>Cost</b>        |
| <b>Cheboygan County</b>  | Aloha           | 1                      | \$1,500            |
|  | Benton          | 14                     | \$537,800          |
|  | Grant           | 13                     | \$17,400           |
|  | Inverness       | 32                     | \$65,200           |
|  | Munro           | 16                     | \$16,000           |
| <b>Emmet County</b>  | Bliss           | 7                      | \$7,000            |
|  | Carp Lake       | 10                     | \$10,000           |
|  | Center          | 5                      | \$5,000            |
|  | Maple River     | 4                      | \$4,000            |
|  | McKinley        | 10                     | \$10,000           |
| <b>Cheboygan Totals</b>  |                 | <b>75</b>              | <b>\$637,900</b>   |
| <b>Emmet Totals</b>  |                 | <b>36</b>              | <b>\$36,000</b>    |
| <b>Total Minor Sites Inventoried</b>                                   |                 | <b>111</b>             | <b>\$673,900</b>   |
| <b>MODERATE SITES</b>  | <b>Township</b> | <b>Number of Sites</b> | <b>Cost</b>        |
| <b>Cheboygan County</b>  | Benton          | 13                     | \$165,000          |
|  | Grant           | 13                     | \$287,300          |
|  | Inverness       | 12                     | \$177,000          |
|  | Munro           | 9                      | \$99,200           |
| <b>Table 11: Summary Of Agricultural Inventory, Continued</b>          |                 |                        |                    |
| <b>Emmet County</b>  | Bliss           | 2                      | \$24,000           |
|  | Carp Lake       | 7                      | \$84,000           |
|  | Center          | 1                      | \$12,000           |
|  | McKinley        | 2                      | \$24,000           |
| <b>Cheboygan Totals</b>  |                 | <b>47</b>              | <b>\$728,500</b>   |
| <b>Emmet Totals</b>  |                 | <b>12</b>              | <b>\$144,000</b>   |
| <b>Total Moderate Sites Inventoried</b>                                |                 | <b>59</b>              | <b>\$872,500</b>   |
| <b>SEVERE SITES</b>  | <b>Township</b> | <b>Number of Sites</b> | <b>Cost</b>        |
| <b>Cheboygan County</b>  | Benton          | 2                      | \$470,000          |
|  | Grant           | 2                      | \$350,000          |
|  | Inverness       | 2                      | \$113,000          |
|  | Munro           | 1                      | \$350,000          |
| <b>Cheboygan Totals</b>  |                 | <b>7</b>               | <b>\$1,283,000</b> |
| <b>Emmet Totals</b>  |                 | <b>0</b>               | <b>\$0</b>         |
| <b>Total Severe Sites Inventoried</b>                                  |                 | <b>7</b>               | <b>\$1,283,000</b> |

## Stormwater Inventory

All substances that find their way onto impervious surfaces (streets, roofs, sidewalks, etc.) are likely to be washed into nearby waterbodies by rainfall or snowmelt, especially when streets are curbed, guttered, and drained by roadside ditches or underground pipes. Phosphorus and sediment are two of the most serious pollutants, but storm sewers also contribute many other pollutants such as oil, salt, bacteria, trash, and other potentially toxic substances. Direct discharge of these pollutants to a water body can create very serious (and expensive) problems. Runoff from storm events, runoff at base flow (the normal discharge/flow at the stream during particular times of the year) and the spill potential within such a system all pose challenges for water resource management.

Increased development creates more impermeable surfaces, thus leading to more runoff. Theoretically, any type of development on a site will increase the amount of runoff, as well as its velocity and pollutant concentration. A small development on a large tract of land will generally result in an insignificant increase in runoff, unless it is adjacent to a water body or linked by a storm sewer.

Management of stormwater has become an important aspect of water resource protection. Basically, the goal is to preserve or restore pre-development hydrologic characteristics through a variety of techniques – including minimizing impervious surfaces, preserving open or green space, detention of runoff, infiltration trenches, water quality treatment basins, and “Low Impact Design Techniques”.

As part of the Lower Cheboygan Watershed Project, staff from Tip of the Mitt Watershed Council and Huron Pines Resource Conservation & Development Council (Huron Pines RC&D) conducted an assessment of the storm sewer impacts from the single large urban area located on the Cheboygan River – the City of Cheboygan. The findings are summarized in **Table 12:**

| <b>TABLE 12: CITY OF CHEBOYGAN STORM SEWER SUMMARY</b> |             |
|--|-------------|
| Area of city (acres)                                   | 4428        |
| Area of city draining to river via storm sewers        | 1087        |
| Percent of city draining to river via storm sewers     | 25%         |
| Number of stormwater outfalls inventoried              | 46          |
| Drains managed as part of the city system              | 29          |
| Drains from commercial development                     | 17*         |
| Land use within the city’s direct discharge zone       |             |
| Undeveloped or open land                               | 16%         |
| Commercial/industrial                                  | 26%         |
| Residential  | 58%         |
| Estimated pollution contributions from storm sewers**  |             |
| Phosphorus   | 900 lb.     |
| Sediment   | 549,413 lb. |

\*This is the actual number inventoried. It is likely there are several more.

\*\*Annual storm events only – not base flow

## **METHODOLOGY**

To better understand the potential impacts of stormwater on the Lower Cheboygan River, an inventory and assessment of the storm sewer system in the City of Cheboygan was conducted in the Fall of 2002, with follow-up research conducted in the Winter of 2003. The assessment consisted of identifying the land uses (e.g., commercial/industrial, residential, undeveloped/open land) within the City boundaries, reviewing maps of the City storm sewer system, delineating drainage areas, identifying locations of stormwater outfalls, and estimating pollutant loading using models developed in nationwide studies. Water sampling and testing were not conducted during this inventory assessment. Estimated runoff volume was calculated using a simple method.

The City also has stormwater runoff that enters Cemetery Creek, Little Black River, and Smith's Creek (all within City limits), although these runoff amounts are much smaller in scale than the discharges to the Cheboygan, and all are outside of the Lower Cheboygan Watershed and beyond the scope of this report. A map of the discharge area directly to the Cheboygan River is provided in Support Document Two: *Agricultural Inventory and Stormwater Inventory*.

## **RESULTS**

Water quality studies conducted by the Watershed Council have documented that the pollution and water quality impacts of storm sewer effluent from other Northern Michigan communities is similar to the predictive model.

Results of the studies indicate that there are 46 stormwater outfalls discharging directly to the Cheboygan River. Twenty-nine of these are part of the City's storm sewer system. Seventeen outfalls were identified as commercial/industrial, indicating that the stormwater from the commercial development along the waterfront (which is not part of the City's system) drains to the Cheboygan River. The seventeen identified privately-owned outfalls typically drained parking areas adjacent to the Cheboygan River. It is likely that there are more of these outfalls than were discovered through the inventory process.

All 46 of these outfalls and their respective estimated drainage areas are shown on **Map B** in Support Document Two: *Agricultural Inventory and Stormwater Inventory*. **Table 13** below, shows the approximate amount of acreage for each drainage zone, the size of outfall pipe, annual runoff, percent imperviousness, type of land-use, and annual pounds of phosphorous and sediment. As the estimates reveal in **Table 13**, a large amount of pollution is presently occurring due to the combined effects of stormwater and storm sewers draining into the lower Cheboygan River.

**TABLE 13: WATERSHED STORMWATER OUTFALL DATA**

| Site # | Drainage Area (acres) | Size of Outfall (inches) | Type of Land Use           | % Impervious | Estimated Runoff Volume Gal/Year | Estimated Annual Lbs. of Phosphorus | Estimated Annual Lbs. of Sediment |
|--------|-----------------------|--------------------------|----------------------------|--------------|----------------------------------|-------------------------------------|-----------------------------------|
| 5      | 31                    | 24                       | Residential/<br>Commercial | 50           | 10,106,000                       | 39                                  | 10,962                            |
| 6      | 5                     | 12                       | Residential                | 90           | 1,141,000                        | 4                                   | 1,238                             |
| 7-12   | 6                     | 5-12                     | Commercial/<br>Residential | 90           | 3,912,000                        | 15                                  | 42,432                            |
| 13     | 5                     | 24                       | Residential                | 30           | 1,141,000                        | 4                                   | 1,238                             |
| 14     | 6                     | 12                       | Residential                | 30           | 1,369,200                        | 5                                   | 1,485                             |
| 15     | 17                    | 18                       | Commercial/<br>Industrial  | 90           | 11,084,000                       | 42.5                                | 120,224                           |
| 16     | 15                    | 36                       | Commercial/<br>Industrial  | 90           | 9,780,000                        | 37.5                                | 10,608                            |
| 17     | 130                   | 36                       | Residential                | 30           | 29,666,000                       | 114                                 | 32,178                            |
| 18     | 30                    | 28                       | Residential                | 30           | 6,846,000                        | 26                                  | 74,256                            |
| 19-20  | 9                     | 12, 18                   | Commercial/<br>Industrial  | 90           | 5,868,000                        | 22.5                                | 63,648                            |
| 21-22  | 18                    | 6, 12                    | Commercial/<br>Industrial  | 90           | 11,736,000                       | 45                                  | 12,730                            |
| 23     | 7                     | 18                       | Residential                | 30           | 1,597,400                        | 6                                   | 1,733                             |
| 24     | 6                     | 12                       | Residential                | 30           | 1,369,200                        | 5                                   | 1,485                             |
| 25     | 22                    | 36                       | Commercial/<br>Industrial  | 90           | 1,434,400                        | 55                                  | 15,558                            |
| 26-29  | .3                    | 8                        | Commercial/<br>Industrial  | 90           | 195,600                          | .8                                  | 212                               |
| 30     | 12                    | 48                       | Commercial/<br>Residential | 50           | 4,694,400                        | 18                                  | 5,092                             |
| 31     | 10                    | 24                       | Residential                | 30           | 2,282,000                        | 9                                   | 24,752                            |
| 32     | 3                     | 18                       | Commercial/<br>Industrial  | 90           | 1,956,000                        | 75                                  | 4,243                             |
| 33     | 2                     | 18                       | Commercial/<br>Industrial  | 90           | 1,304,000                        | 5                                   | 1,414                             |
| 34     | .5                    | 12                       | Open                       | 10           | 48,900                           | .2                                  | 58                                |
| 35     | 48                    | 36                       | Residential                | 30           | 10,953,600                       | 42                                  | 11,881                            |
| 36     | 34                    | 8                        | Residential/<br>Commercial | 50           | 13,300,800                       | 51                                  | 14,427                            |
| 37-38  | 1                     | 12, 8                    | Commercial                 | 90           | 652,000                          | 2.5                                 | 707                               |
| 39     | 99                    | 36                       | Residential                | 30           | 22,591,800                       | 87                                  | 24,504                            |
| 40     | 3                     | 15                       | Commercial                 | 90           | 1,956,000                        | 7.5                                 | 2,122                             |
| 41     | 35                    | 36                       | Residential/<br>Commercial | 50           | 13,692,000                       | 53                                  | 14,851                            |
| 42     | 39                    | 21                       | Residential                | 30           | 8,899,800                        | 34                                  | 9,653                             |

**Table 13: Outfall Data, Continued**

| Site # | Drainage Area (acres) | Size of Outfall (inches) | Type of Land Use      | % Impervious | Estimated Runoff Volume Gal/Year | Estimated Annual Lbs. of Phosphorus | Estimated Annual Lbs. of Sediment |
|--------|-----------------------|--------------------------|-----------------------|--------------|----------------------------------|-------------------------------------|-----------------------------------|
| 43     | 1                     | 12                       | Residential           | 30           | 228,200                          | .9                                  | 248                               |
| 44     | 71                    | 48                       | Residential           | 30           | 16,202,200                       | 62                                  | 17,574                            |
| 45     | 19                    | 21                       | Residential           | 30           | 4,335,800                        | 17                                  | 4,703                             |
| 46     | 1                     | 15                       | Residential           | 30           | 228,200                          | .9                                  | 248                               |
| 47     | 11                    | 15                       | Commercial            | 30           | 2,510,200                        | 10                                  | 2,723                             |
| 48     | 5                     | 18                       | Commercial/Industrial | 90           | 3,260,000                        | 13                                  | 3,536                             |
| 49     | 56                    | 42                       | Residential           | 30           | 12,779,200                       | 49                                  | 13,861                            |
| 50     | 4                     | 21                       | Commercial/Industrial | 90           | 2,608,000                        | 10                                  | 2,829                             |

## Land Use Inventory

### METHODOLOGY

Michigan Resource Information System (MIRIS) land cover/use data for the portion of the Cheboygan River/Lower Black River lying in Cheboygan County was compiled by the Michigan Department of Natural Resources (MDNR) in the early 1980's using 1978 aerial photographs. In 1998 this computerized land cover/use information was updated using 1987 and 1992 aerial photography, and extensive field inspections. The land use data for the portion of the watershed lying in Emmet County was compiled using the original 1978 land use data from the MDNR and updating it with the 1998 Digital Ortho Photo Quads from the Center for Geographic Information. A land use map was then created for the watershed by merging data from both counties. The MIRIS land classification system was used for the update. Urban/built-up categories were mapped to greater detail than during the 1978 land cover/use inventory, which had a minimum type size of 2.5 to 5 acres. The smaller type size provides a better representation of various urban built-up categories. **Map 7** is a color coded thematic map of the 1998 Existing Land Use Inventory for the Cheboygan River/Lower Black Watershed.

In addition to the general watershed land use inventory, an inventory of three six-section blocks was conducted in summer 2003. Two six-section blocks were surveyed for land use changes in Cheboygan County. One of the blocks consisted of primarily *Residential land* in Inverness Township, the other of primarily *Agricultural land* in Grant Township. A six-section block representing *Forest land* was surveyed in McKinley Township, Emmet County. The information gathered indicates trends in general land use changes for the watershed, and will be discussed in the appropriate land use categories below.

## LAND USE MAP 7

## RESULTS

One of the features that attracts people to northern Michigan is the rural character of the area. Data from a 1998 update of the 1978 MIRIS land cover/use inventory shows that 49.6 percent of the Watershed's 94,131 total acreage was forested, with another 17.4 percent in agriculture, 16.51 percent open land, 3.69 percent wetlands and 6.6 percent water (see **Table 14**). Just over six percent of the watershed's land was used for urban-type purposes in 1998 which included commercial, industrial, institutional/recreational and residential uses.

### Land Use Categories

#### Residential

According to the MIRIS Land Cover/Use update, 4.5 percent or 4235.99 acres of the watershed's total land area was used for residential purposes. For the most part, residential development found in the watershed consists of single-family dwellings, however, single family duplexes, multi-family residential, condominiums, mobile homes and mobile home parks are also included in this category. Residential uses are concentrated in the City of Cheboygan. Many of the lakes, for example, Twin Lakes, Munro Lake, Long Lake and Douglas Lake, as well as the major rivers have high concentrations of residential development, both along the lake shores and in subdivisions adjacent to the lakes. In addition to new dwellings being built on waterfront property, many of the once seasonal and weekend developments have undergone a transition to year-round residences. Residential development is also occurring along county roads throughout the watershed as larger parcels are split into ten-acre and smaller parcels.

The 2003 land use update conducted over sections 7,8,9,16,17,18, in heavily residential Benton and Inverness Townships shows a 2.25% increase of residences in that six-section area. This increase coincides with a 1.62% decrease in the land use category *Open land*, as well as smaller losses in *Lowland* and *Agriculture* land use types. (See **Maps 8** and **9**.) This increase in residential land is a trend that can be seen not only in the Cheboygan River/Lower Black River Watershed, but throughout the state.

**MAPS 8 & 9 Benton/Inverness Residential Sections**

## Commercial

Commercial land uses include primary/central business districts, shopping center/malls, and secondary/neighborhood business districts, including commercial strip development. The 1998 land use inventory identified 469 acres (0.5%) in commercial use. Commercial facilities are found primarily in the City of Cheboygan and south out of the city limits, along M-27. A smaller commercial service center exists in the urbanized community of Levering, and limited services and can be found in other outlying sections of the watershed.

## Industrial

In addition to industrial and extractive development, this land use category includes transportation, oil and gas, communication and utility facilities. Development falling under this category made up only 0.6 percent of the total watershed land area. These land uses cover approximately 568 acres of the watershed. Much of the industrial development is located near the main community centers.

## Institutional/Recreational

Land devoted specifically for institutional and recreational purposes amounted to approximately 0.57 percent, or about 540 acres of the watershed. Land uses included in this category are public parks and campgrounds, golf courses, schools, churches and public buildings.

| <b>Land Use Category</b>   | <b>Acres</b>    | <b>Percent of Watershed</b> |
|----------------------------|-----------------|-----------------------------|
| Residential                | 4235.99         | 4.50%                       |
| Commercial                 | 469.29          | 0.50%                       |
| Industrial                 | 567.56          | 0.60%                       |
| Institutional/Recreational | 539.91          | 0.57%                       |
| Agriculture                | 16394.34        | 17.42%                      |
| Open Lands                 | 15540.34        | 16.51%                      |
| Upland Forest              | 32741.72        | 34.78%                      |
| Lowland Forest             | 13970.49        | 14.84%                      |
| Wetland                    | 3475.1          | 3.69%                       |
| Water                      | 6191.97         | 6.58%                       |
| Beach/Dune                 | 3.94            | 0.00%                       |
| <b>Watershed Total</b>     | <b>94131.11</b> | <b>100%</b>                 |

Source: 1998 update of 1978 MIRIS Land Cover/Use Inventory by Wade-Trim

## Agricultural Lands

With some 16,394 acres classified as farm land, agriculture is the watershed's the second largest land use category. Although the bulk of agricultural land is found in the eastern portion of the watershed, in Cheboygan County's Inverness, Benton, and Grant

Townships, large sections of farm land can also be found in the western portion, primarily in Munro Township, Cheboygan County and Carp Lake Township of Emmet County. It is interesting, but not surprising, to note that much of the agricultural property is found along or very near the area's major rivers and lakes. Predominate agricultural land uses are pastures, hayland and growing crops such as beans, oats, and barley. A small amount of land is used for livestock such as cattle, milk cows and hogs.

A six-section area (sections 4,5,6,7,8, and 9) in Grant Township, Cheboygan County was updated in 2003, and the results were compared to the 1998 land use update for the same six sections. Despite a slight increase in lands used for residential purposes, agricultural lands experienced a less than one percent change in land use. In this predominantly agricultural area, open-land saw a larger land use change (down slightly over one percent, coinciding with a 1.4 percent increase in residential) than did agriculture. **Maps 10** and **11** below show the slight changes in land use experienced here over the past five years.

**Table 15** shows changes in residential, forest, and agricultural land uses for three six-section blocks between 1998 and 2003. From these sample sections, it is possible to determine a slow but steady change from agricultural and forested lands to increased residential uses in the watershed.

**Table 15: Land Use Changes 1998-2003**

| Location of Sections | Acres Residential |        |           | Acres Agriculture |        |           | Acres Forested |         |           |
|----------------------|-------------------|--------|-----------|-------------------|--------|-----------|----------------|---------|-----------|
|                      | 1998              | 2003   | % Change  | 1998              | 2003   | % Change  | 1998           | 2003    | % Change  |
|                      | Acres             |        |           | Acres             |        |           | Acres          |         |           |
| Benton/Inverness     | 378.58            | 452.67 | (+) 2.25% | 748.98            | 730.34 | (-) 0.57% | 599.52         | 597.31  | (-) 0.07% |
| Grant                | 178.78            | 229.55 | (+) 1.43% | 380.16            | 371.17 | (-) 0.26% | 327.4          | 326.84  | (-) 0.01% |
| McKinley             | 121.62            | 165.61 | (+) 1.17% | 604.43            | 588.0  | (-) 0.43% | 2007.2         | 1992.22 | (-) 0.39% |

**MAPS 10 & 11 Grant Township Ag Sections**

## Open-Lands

Open-land is defined as areas supporting early stage of plant succession consisting of plant communities characterized by grasses or shrubs. Open-land makes up nearly 17 percent of the watershed's land area. One type of opening was created by turn of the century logging operations and subsequent wildfires. Other Open-land areas consist of abandoned or idle farm land. A majority of these areas are located within the active agriculture band mentioned above, with the largest portions of this land type found around the City of Cheboygan, Inverness and Benton Townships. Typical grass species are quack grass, Kentucky bluegrass, upland and lowland sedges, reed canary grass and clovers. Typical shrub species include blackberry and raspberry briars, dogwood, willow, sumac and tag alder.

## Upland Forests

Upland forests make up 32,741 acres or 34.8 percent of the watershed's surface area. The following species predominate areas classified as upland forests: sugar and red maple, elm, beech, yellow birch, cherry, basswood, white ash, all aspen types, white, red, jack and scotch pines and any managed Christmas Tree plantations. Other upland conifers include white or black spruce, balsam, or Douglas fir, along with areas covered by larch and hemlock.

## Lowland Forests

The county's land use inventory shows that 13,970 acres or 14.8 percent of the watershed's surface area consists of lowland forests. Lowland forests are defined as those containing ash, elm and soft maple, along with cottonwood, balm-of-Gilead. Lowland conifers, such as cedar, tamarack, black and white spruce and balsam fir stands are also included.

The upland and lowland forests combine to encompass 46,712 acres or 49.6 percent of the watershed's total surface area. Forests, therefore, constitute the largest single land use category for the Cheboygan River/Lower Black River Watershed. Large tracts of forested land can be found throughout the watershed, with especially high concentrations in McKinley Township, Emmet County, and Benton and Grant Townships, Cheboygan County. Of the total forests, 70 percent are upland forests, while 30 percent are lowland forests.

McKinley Township has nearly 7000 acres of upland forests, plus over 3000 acres of lowland forest. Land use for a six-section block (sections 3, 4, 5, 8, 9, and 10) within McKinley Township was updated in 2003, and compared to the 1998 land use patterns for those same six sections (see **Maps 12 and 13**). During the five years between land use updates, the six sections lost less than one percent of it's forests due to changing land uses. This despite a 1.7 percent increase of residential uses for the area. Other land use types, such as agriculture, open-lands, and wetlands also experienced slight decreases over the five year period.

**Maps 12 & 13 McKinley Forested Sections**

## Wetlands

As can be noted from **Table 14**, 3475.1 acres or about 3.7 percent of the Watershed's land area was identified as non-forested wetlands. Wetlands are those areas between terrestrial and aquatic systems where the water table is at, near, or above the land surface for a significant part of most years. The hydrologic regime is such that it permits the formation of hydric soils or it supports the growth of hydrophytic vegetation. Examples of wetlands include marshes, mudflats, wooded swamps and floating vegetation situated on the shallow margins of bays, lakes, rivers, ponds, streams. These wetland categories include of shrub wetlands, fresh-water marshes, wet meadows, open bogs, emergent wetlands and aquatic bed wetlands.

In some situations, lands classified as lowland forests are treated as wetlands. Combining the land use types of wetlands and lowland forests, for Cheboygan County, reveals that 17,446 acres or 18.53 percent of the surface area could be considered to be wetland types.

It is important to note that existing land use statistics used in this report are based on Michigan Resource Information System (MIRIS) data. Forested and wetland information contained in the MIRIS data was not verified by field inspection when the data was compiled. Thus, areas shown as wetlands on the MIRIS system may not actually meet State and Federal criteria for legally regulated wetlands. However, the information is still valuable for general land use planning decisions.

## Beaches/Dunes

Only 3.94 acres of the county's surface area is classified as beaches. Beaches include all sloping accumulations of exposed sand and gravel along shorelines and sand dunes.

## Surface Water

The Cheboygan River/Lower Black River Watershed is home to four significant inland lakes; Munro, Long, Douglas and Twin Lakes and several major rivers. In fact surface water makes up nearly 7 percent of the watershed's land use types (about 6192 acres). The combination of wetland types (including lowland forests) and surface water makes up over one third of the watershed's surface area. Therefore, protecting the water and wetland resources should be a major priority in land use planning.

## Septic System Inventory

The health of a watershed can be influenced by the state of the septic and sewer systems within its boundaries. When a septic system malfunctions or overflows, bacteria and nutrients are released and may contaminate the lakes, streams or groundwater of the watershed. Poorly installed or improperly sited systems, and older systems that were installed prior to the adoption of current zoning ordinances are potential contributors of this type of non-point pollution. Another potential problem for the watershed is seasonal homes that are converted for year round use without updating and expanding existing systems. The increased load may cause a septic system failure and as a result, contaminate area wells and waterbodies.

### *METHODOLOGY*

An inventory of septic systems within the Cheboygan River/Lower Black River Watershed was conducted by NEMCOG in the spring of 2003. Information on septic systems was compiled using data obtained from various sources such as the Emmet County Health Department, the Cheboygan County Health Department, U.S. Bureau of Census, The Environmental Protection Agency, and the Department of Environmental Quality. By comparing data from these various sources and **Map 4: Septic System Constraints**, it was possible to discern generally which areas have the oldest systems, which are being heavily developed and areas that are most susceptible to septic problems and therefore least suitable for increased development.

### *RESULTS*

Nearly the entire watershed is under severe constraints for septic systems. The cause for severity varies from section to section, and even from parcel to parcel. In the western portion of the watershed, particularly in Carp Lake and McKinley Townships, constraints are due mainly to large areas covered by hydric soils. Hydric soils are saturated for most of the year, and when soils are too wet, oxygen is not available for organisms that break down waste. Septic systems constructed in hydric soils therefore may not operate properly during wet seasons, resulting in groundwater contamination.

Hydric soils and areas of wetness also impact the effectiveness of septic systems in the eastern half of the watershed. In addition, much of this area is covered by sandy soils, which are poor filtering agents. These soils are mainly located in Grant and Benton Townships on Mackinaw State Forest land where development isn't an issue. Several severe septic system constraints exist in Inverness Township. Along with areas of sandy soils, the Township has several sections adjacent to the Cheboygan River where severe constraints are due to wetness ( see **Map 4**). These sections have seen steady development over the last thirty years. In addition, **Table 16** Shows that the Township has a substantial number of homes that were built prior to 1970, before current zoning ordinances were in place. Continued development combined with a large number of older systems create a potential risk to the future health of the watershed.

Munro Township in Cheboygan County is another area that bears watching. This Township also has a large number of septic systems that were installed prior to 1970. While development has been light in much of the Township, some areas such as Section 9 adjacent to Munro Lake, and Sections 17 and 18 adjacent to Douglas Lake have seen substantial growth. Here again, the combination of older systems, heavy development, hydric soils and poor filter material create a potential problem for the watershed.

| <b>TABLE 16: SEPTIC SYSTEM INVENTORY</b> |                             |                            |                              |
|--|-----------------------------|----------------------------|------------------------------|
| <b>TOWNSHIP</b>                          | <b>TOTAL SEPTIC SYSTEMS</b> | <b>INSTALLED 1970-2003</b> | <b>INSTALLED BEFORE 1970</b> |
| ALOHA                                    | 434                         | 336                        | 98                           |
| BENTON                                   | 1461                        | 634                        | 827                          |
| GRANT                                    | 838                         | 388                        | 450                          |
| INVERNESS                                | 1215                        | 678                        | 537                          |
| MUNRO                                    | 637                         | 217                        | 420                          |
| CARP LAKE                                | 711                         | 516                        | 195                          |
| McKINLEY                                 | 490                         | 567                        | 77                           |

Nearly all of the lands designated residential or agricultural for the watershed lie within areas of severe septic constraints due to hydric, wet, or poor filtering soils, as can be seen when **Map 4: Septic Constraints** is compared to **Map 3: Land Use**. If the trend of expanding residential areas continues as more and more agricultural lands are parceled out for development, increased potential for contamination to the water supply is inevitable. Septic system and soil constraints will need to be considered carefully in any future development in these areas and great care will need to be taken to ensure the continued health of the Cheboygan River/Lower Black River Watershed.

### **Area of Contamination**

There is a direct link between surface water and ground water contamination. For the Cheboygan River/Lower Black River Watershed, as well as virtually all of northeast Michigan, ground water is the only source of drinking water. It is therefore imperative that groundwater be protected from contamination. It is far less costly to use contamination preventative measures than it is to restore a contaminated ground water site to a potable state. Along with pollutants carried into the water system via stormwater drains, road/stream crossings and residential and agricultural runoff, contamination from abandoned wells, leaking underground storage tanks and other industrial sources may also find its way into ground water.

### **METHODOLOGY**

In order to determine the presence and extent of chemical contaminants in the watershed, DEQ and EPA documents were reviewed to identify Leaking Underground Storage Tanks (LUST) and other sites of contamination.

## *RESULTS*

According to the Michigan Department of Environmental Quality (MiDEQ), there are fourteen leaking underground storage tanks in the Cheboygan River/Lower Black River Watershed; sixteen in Cheboygan County and three in Emmet County. The contaminants found at these sites are most often gasoline and diesel fuel. Other contaminated sites are monitored by the DEQ's Environmental Response Division (ERD). As of November 2003, ERD lists thirteen sites of contamination in the watershed, eleven in Cheboygan County and two in Emmet County. Contaminants found at these sites include Barium, Zinc, Lead, PCE, Naphthalene, Chrysene, Acenaphthene, Fluorene, Chlorine, Benzene, Cyanide, Petroleum, Diesel Fuel, and Gasoline.

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## Chapter Five: Priority Pollutants and Their Sources and Causes

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Relying on insight gained from the various watershed inventories, steering committee members prioritized the pollutants, sources and causes affecting the watershed. Using the nominal group process, members were given three votes to cast for the pollutant thought to be the most detrimental to the watershed. The same process was then performed for the sources and causes of the pollutants, with steering committee members selecting three of each.

### Priority Pollutants

As indicated on **Table 17**, nutrients and sediments were ranked the top two pollutants of concern. Pesticides, heavy metals, oils and grease, were also identified as pollutants of concern for the watershed.

| Pollutant                      | Ranking |
|--------------------------------|---------|
| Organics (nutrients, bacteria) | 1       |
| Sediments                      | 2       |
| Pesticides                     | 3       |
| Oils, Grease and Metals        | 4       |
| Toxic Substances               | 5       |

### Designated Use Pollutants

The waters of the State of Michigan are required by Part 31 of the Natural Resources and Environmental Protection Act, P.A. 451 as amended, to maintain quality sufficient to meet seven designated uses. The designated uses the watershed's lakes and rivers must support are agriculture, industrial water supply, public water supply, navigation (where applicable), warm and cold water fisheries, wildlife and aquatic habitat, and total or partial body contact.

The following designated uses were determined by the steering committee to be adversely affected by one or more of the pollutants stated above. Organic materials (such as nutrients and bacteria) and sediments are the priority pollutants to control for protecting the coldwater fisheries, total/partial body contact, aquatic life, navigation and public water supply. Heavy metals/oils/grease and pesticides were also identified as threatening the designated uses. **Table 18** shows the relationship between the pollutants and their impact on each designated use.

| <b>Designated Use</b>            | <b>Pollutant</b>  |
|----------------------------------|---|
| Warm and Cold Water<br>Fisheries | Organics (nutrients, bacteria)<br>Sediments<br>Heavy Metals/Oils/Grease |
| Indigenous Aquatic &<br>Wildlife | Sediment<br>Heavy Metals/Oils/Grease<br>Pesticides                      |
| Navigation                       | Sediment  |
| Public Water Supply              | Organics (nutrients, bacteria)<br>Bacteria<br>Heavy Metals/Oils/Grease  |
| Total/Partial Body Contact       | Organics (nutrients, bacteria)  |

### Sources of Pollution

The main sources of pollution, as identified by the steering committee and based on the results of the nonpoint pollution inventories, were road/stream crossings, stormwater runoff, and fertilizers. Other sources of pollution include streambanks, agricultural activities, development sites, residential lawns, and contamination sites. These pollution sources were then ranked by the steering committee using the process described previously, with a ranking of one being the highest concern. **Table 19** lists these sources by rank and type of pollutant.

| <b>Pollutant</b>               | <b>Rank</b> | <b>Source</b>           | <b>Rank</b> |
|--------------------------------|-------------|-------------------------|-------------|
| Organics (nutrients, bacteria) | 1           | Fertilizers             | 1           |
|                                |             | Wastewater              | 2           |
|                                |             | Residential Lawns       | 3           |
|                                |             | Agricultural Activities | 3           |
| Sediments                      | 2           | Road/Stream Crossings   | 1           |
|                                |             | Stormwater runoff       | 2           |
|                                |             | Land Development        | 3           |
|                                |             | Streambanks             | 4           |
|                                |             | Agricultural Activities | 4           |
| Pesticides                     | 3           | Residential Lawns       | 1           |
|                                |             | Agricultural Operations | 2           |
| Oils, Grease and Metals        | 4           | Stormwater runoff       | 1           |
| Toxic Materials                | 5           | Contamination Sites     | 1           |

## Causes of Pollution

In order to correct existing nonpoint source pollution and prevent future pollution problems from occurring, sources and causes for each pollutant were identified, and steering committee members were asked to select the causes of pollution they felt were most detrimental to the watershed. Causes of pollution in the Cheboygan River/Lower Black River Watershed are ranked in **Table 20** below, with a ranking of number one indicating the highest priority cause of pollution.

| <b>Table 20: Pollutant Causes</b>                       |             |   |
|---|-------------|---|
| <b>Cause of Pollution</b>                               | <b>Rank</b> | <b>Pollutant Source</b>   |
| Undersized/deteriorating culverts                       | 1           | Road/stream crossings   |
| Impervious surfaces (such as parking lots or rooftops)  | 2           | Stormwater runoff   |
| Improper/overuse of fertilizers                         | 3           | Residential lawns; agricultural operations  |
| Loss of Greenbelt                                       | 4           | Land development  |
| Improper/overuse of pesticides                          | 4           | Residential lawns; agricultural operations  |
| Uncontrolled livestock access                           | 5           | Agricultural operations   |
| Inadequate erosion control                              | 5           | Streambanks; road/stream crossings; development sites; access sites; residential lawns; agricultural operations |
| Improperly sited, designed or maintained septic systems | 6           | Residential sites   |
| Improper disposal of hazardous household wastes         | 6           | Contamination sites; stormwater runoff  |
| Animal manure   | 6           | Agricultural operations; waterfowl; stormwater runoff   |
| Leaves, grass clippings                                 | 7           | Residential lawns   |
| Construction activities                                 | 8           | Development sites   |
| Improper oil disposal                                   |             | Stormwater runoff   |

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## **Chapter Six: Watershed Zoning and Ordinances**

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### Overview

Watershed management requires the use of many different techniques in order to be effective. Tools include educational outreach programs, voluntary land protection incentives for property owners of critical habitat areas, on-the-ground implementation of Best Management Practices to restore nonpoint source pollution sites, research & monitoring, and incorporating conservation-friendly design standards into new developments. Land use planning and zoning, at the local level, is another important tool for watershed protection. In addition to the direct benefits for aquatic resources, planning and zoning are tools used for ensuring the conservation of wildlife habitat, providing for sustainable development, protecting property values and maintaining community character.

A sound planning and zoning program requires that a community not only “buy-in” to the idea, but dedicate the trained personnel and funding make the program work; effective planning and zoning thus takes commitment and resources.

In the state of Michigan, planning and zoning are implemented at the township, municipal, or county level. The enabling legislation for land use planning can be found within four state acts:

Public Act 285 of 1931 -- Municipal Planning Act  
Public Act 168 Of 1959 -- Township Planning Act  
Public Act 282 of 1945 -- County Planning Act  
Public Act 281 of 1945 --Regional Planning Act

Following adoption of a master plan, the local unit of government creates a zoning ordinance. The zoning ordinance must be based on the goals set forth in the master plan.

The state has three legislative zoning acts that enable local units of government to control land uses through regulation of activities on the land:

Public Act 184 of 1943 -- the Township Rural Zoning Act  
Public Act 183 of 1943 -- the County Zoning Act  
Public Act 207 of 1921 -- the City and Village Zoning Act

In addition to planning & zoning, there are state regulations that are intended to help conserve natural resources. Relevant state laws for water resource protection include (this is only a brief summary, please see the respective law or contact MDEQ for more information):

Act 451, Part 91, Soil Erosion Control and Sedimentation Act  
(for earth changes within 500 feet of the shoreline)

Act 451, Part 303, Wetland Protection  
(covers the dredging, draining, or filling of regulated wetlands; however, non-contiguous wetlands in rural counties are generally not regulated wetlands)

Act 451, Part 301, Inland Lakes & Streams Act  
(covers work conducted below the ordinary high water mark)

Public Act 368 (1978), Aquatic Nuisance Control

For some of the issues related to watershed management, agencies (beyond the local unit of government) have a regulatory role. In the case of soil erosion & sedimentation, the Michigan Department of Environmental Quality (MDEQ) has jurisdiction; they have an agreement with counties to enforce the program at the local level (thus counties have a Soil Erosion Officer). With regard to regulation of wetlands, MDEQ also has jurisdiction (authorized through the federal Clean Water Act). Questions regarding wetlands and the permitting process should be directed to MDEQ's Land & Water Management Division. Regulations for septic systems are handled through the District Health Department. In all three of the areas listed above, a local community may adopt their own programs for managing the resource (standards adopted cannot be weaker than what the state would otherwise use). Such a decision to adopt a local ordinance may lead to more work for the local unit of government and a greater expenditure of fiscal resources; it may also create an opportunity to better achieve the goals laid out in community's comprehensive master plan.

In any event, a local unit of government should develop a comprehensive land use plan (based on public input) that allows them to plan for the future while maintaining what is important to the community. The plan becomes the basis for the zoning ordinance. Attention should be paid to whether the standards in the zoning ordinance actually achieve the goals set forth in the comprehensive master plan; oftentimes they do not. Once local government units have "good" land use policies in place, there is still work that needs to be done -- the governing body must keep their policies up-to-date and make decisions regarding infrastructure and zoning in accordance with their plan.

Oftentimes, volunteers on local zoning boards are pressured to make a decision on a site-specific issue without considering the whole system. Zoning standards and decisions must be made with the comprehensive master plan in mind; it can be extremely difficult to step back from a particular issue and consider the big picture, but that is exactly what trained planning commission officials must do. In addition, zoning regulations need to be enforced and followed up. Without enforcement, the majority that make the effort to follow land use regulations are, in effect, penalized, as they have went to greater effort and expense than those not following regulations. Such systems will eventually break down for local units of government -- either most everyone will eventually give up on trying to follow the rules or the court system will not hold up the regulations.

This following review of local land use regulations in the watersheds of the Lower Cheboygan River and Douglas Lake was prepared by Huron Pines Resource Conservation & Development Area Council in December 2003. This review is not intended evaluate the history of planning and zoning within the watershed, nor is intended to be the sole basis for determining the effectiveness of policies regarding water resource management. It may provide insight into how effective local unit of government are at protecting aquatic resources and help to identify some of the glaring weaknesses within current zoning ordinances.

## Summary of Local Planning & Zoning Efforts

Townships located in a county with zoning have the option of having the county handle the entire planning and zoning program or administering their own. (In rare cases,

neither a county nor township may have a zoning ordinance, these areas are considered “unzoned”). Within the Lower Cheboygan/Douglas Lake watersheds, the townships are covered under county zoning, while the City of Cheboygan administers its own program. Below is a list of local government units within the watershed and the adoption date of their master plans and zoning ordinances. (In those instances where major revisions appear to have been made, the “revised” plan/ordinance date is used, rather than the “adopted” date.)

| <b>Table 21: Planning and Zoning Jurisdictional Units<br/>Within the Cheboygan River/Lower Black River Watershed</b> |   |  |
|--|---|--|
| <b>Government Unit</b>   | <b>Zoning Ordinance<br/>Last Date of Revision<br/>or Adoption</b> | <b>Comprehensive<br/>Master Plan<br/>Last Date of Revision<br/>or Adoption</b> |
| <b>Cheboygan County</b><br>(Benton, Grant, Aloha, Inverness,<br>Beaugrand, Hebron, and Munro townships)              | 1983  | 2002   |
| <b>City of Cheboygan</b>   | 2001  | 1988*  |
| <b>Emmet County</b><br>(Carp Lake, McKinley, Maple River, Center,<br>and Bliss townships)                            | 2001  | 1997   |

\*The City is currently updating their master plan.

To determine, in part, the efficacy of regulatory coverage for aquatic resources within the Cheboygan River/Lower Black River Watershed, local zoning ordinances were reviewed to evaluate what, if any, “environmental provisions” were in place that may have an impact on water resources. The ordinances were specifically reviewed for the following:

- Vegetative Buffer Zones (Greenbelts): With regard to minimizing the impact of residential development along the waterfront, ensuring that vegetation is left along the shoreline is generally considered one of the most important actions that can be taken. Vegetative buffers help to filter nutrients, reduce erosion, and provide natural habitat. Although much research has been done through the years to verify the effectiveness of vegetative buffers, there are several practical difficulties with having a “greenbelt ordinance.” It can be difficult to enforce, many local officials and residents are unaware of what an effective greenbelt consists of, historic patterns of development have already degraded many areas (and these may be “grandfathered” in), zoning language is often poorly worded for proper enforcement, and citizens are often unaware that there is an ordinance in place. Even with the negatives, however, maintaining a greenbelt is essential to protecting water resources – even a 25 foot greenbelt can be effective. A mowed lawn to the water’s edge is not a greenbelt.

- Setbacks of structures along the waterfront are important for reducing the amount of impervious surface near the water, helping to ensure that a greenbelt can be maintained, and reducing the potential for serious resource problems. A structure that is setback only 30 or 40 feet is more likely to be associated with negative impacts to water resources than a structure 75 or 100 feet away from the water's edge. Unfortunately, many local units of government that do have an effective setback for homes will make many exceptions for large decks and boathouses. Such exemptions defeat the intent of the setback, as impervious surface cover will still be present near the water's edge. Furthermore, while many local units of government may have a greenbelt requirement of 50 or 75 feet width, they allow the structure setback to be less than the greenbelt restriction. Such a scenario significantly reduces the effectiveness of the greenbelt requirement. In addition, during the construction period, a structure being built less than 50 feet from the water will have a construction site that runs right down to the water. This leads to the unavoidable problem of the destruction of the greenbelt during construction. Maintaining the natural greenbelt in the first place is much easier than restoring a greenbelt. Setback requirements should be regarded as a key element for water resource protection.
- Minimum Lot Width for waterfront parcels is important for waterbodies because it ultimately determines the number of homes that will be built on the water. Developed shorelines with less than a 100-ft minimum lot width often experience water resource problems. Generally, the smaller the lot width around a lake, the more homes, greater wastewater treatment needs, increased user conflicts, fertilizer inputs, stormwater runoff, increased erosion, and loss of native vegetation, as well as an increase in the amount of impervious cover in the critical near-shore areas of surface water.
- Open space preservation is used for communities to protect their rural character, as well as maintain prime recreational, farm or forest land. Unfortunately, most zoning ordinances, if implemented correctly, are not written in such a way to accomplish those goals. Many local units of government that have open space guidelines in this watershed typically state something to the effect of, "At least 40% of the total gross project shall be left as open space." Some only require 25%, which is not a way to accomplish their community goals.

An improvement to the open space section of their ordinances would be to require the developer to increase the amount of open space to 50 or 60% and also make sure that some of the set aside acreage is from the developable portion of the site. Steep slopes, surface water, wetlands, etc., should be excluded from this calculation; otherwise only the most undesirable areas will be set aside as open space. Ordinance language should be something such as, "A minimum of 60% of the parent parcel's gross acreage shall be set aside as permanently protected open space. This area shall include at least half of the parcel's buildable land area."

There are incentive programs that local communities can adopt to encourage open space preservation, such as allowing higher development densities on the remaining land in a development or through setting up a Purchase of Development Rights (PDR) program.

- Septic Systems are under the jurisdiction of the District Health Department. Typically, only severe problems are addressed, departments are understaffed, and there are poor records of septic systems. Some local units of government have begun to initiate their own programs for inspections, maintenance, or replacement requirements. Generally, such a program is being run as a “Point of Sale” program, whereby inspections of septic systems are required at the time of property transfer. System upgrades are then required for those that are not working properly.
- Wetland Protection is handled through the state Department of Environmental Quality. For rural northern Michigan, the law does not apply to isolated wetlands. Some communities have addressed this oversight by adopting their own wetland regulatory program, which is authorized through the state wetland act. Only those ordinances that have standards *in addition to those at the state level* are noted.
- Stormwater Management is recognized as critical for keeping oils, greases, organic debris, and trash from running directly into a waterbody. While stormwater control measures are often taken during construction, the post-construction runoff of stormwater is a problem that is often overlooked. Proper management would require that new developments handle their own stormwater on-site (or at least do not increase the amount of runoff that would otherwise occur at the undeveloped site), rather than move the stormwater off their site as quickly as possible (which has been the historic practice).
- Lot Coverage/Impervious Cover is, on a watershed-wide level, an important indicator for overall watershed health. (Studies have been conducted that show water quality declines once 10% of the land area in a watershed is covered by impervious surfaces and that serious problems occur once more than 25% of the land area is covered.) Communities that recognize this fact sometimes attempt to address this problem on a parcel by parcel level by placing a maximum on the amount of land that can be covered by impervious cover. While well intended, these standards typically state that the buildings can only occupy a certain percentage of land, but fail to address roads, driveways, decks, patios, and walkways, which are all a part of the impervious cover issue.

Table 22 is a general summary of “environmental provisions” by local government unit.

| <b>Table 22: Summary Of Environmental Provisions</b> |  |   |  |
|--|--|---|--|
| <b>Water Quality Regulations</b>                     | <b>Local Government Unit</b>   |   |  |
|  | <b>Cheboygan County</b>  | <b>City of Cheboygan</b>  | <b>Emmet County</b>  |
| <b>Vegetative Buffer Zones (greenbelts)</b>          | Buffer strips must be at least 40 ft in width along water. (Lake & Stream Protection District.)                      | Not addressed   | <i>Recommended</i> (35 ft) for waterfront properties.                |
| <b>Waterfront Setbacks</b>                           | 40 ft  | 20ft (but this can be used for parking)                               | 60 ft setback for homes & 25 ft for decks/patios                     |
| <b>Minimum Lot Width for Riparian Parcels</b>        | 100 ft for Lake & Stream Protection District   | Not addressed   | 100 ft   |
| <b>Impervious Cover</b>                              | Not addressed  | 35% maximum, although this does not apply to waterfront district.     | Yes, a maximum 30% of each lot can be covered by impervious surface. |
| <b>Open Space</b>                                    | Preservation of open space is encouraged through a PUD density bonus   | Yes   | Addressed within Planned Unit Development section of ordinance.      |
| <b>Septic Systems</b>                                | Must be at least 100 ft from the water's edge, but 150 ft back from the River Protection District on the Upper Black | Not applicable  | No special restrictions, ordinance references health code.           |
| <b>Wetland Protection</b>                            | Not addressed  | Not addressed   | Not addressed  |
| <b>Stormwater Management</b>                         | Yes  | The county stormwater program is administered within the city limits. | Yes  |

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## Chapter Seven: Goals, Objectives and Recommendations

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### Goals and Objectives

At the December 5, 2002 meeting of the Cheboygan River/Lower Black River Watershed Initiative steering committee a discussion of possible goals for the watershed was held, and a list of watershed goals was drafted. The goals are intended to enhance, improve, and protect the quality of the watershed, and to ensure the waters meet all seven of the state mandated designated uses and the desired uses proposed by the community.

On March 5, 2003 this list of goals was posted and reviewed by committee members. A few last minute changes were made to the list before voting took place.

A simple voting method was used. Each committee member present was given four "sticky dots". Members were asked to attach the dots to the goals on the posted list that they felt were most important. Votes were tallied, and only goals that received votes were included in the final list. Goals were prioritized according to the number of votes each received. The following table shows the results of this voting process.

| GOAL  | VOTES RECEIVED | PRIORITY NUMBER |
|---|----------------|-----------------|
| Reduce the amount of stormwater runoff to the Cheboygan River.  | 9              | #1              |
| Provide for the protection of the watershed through adoption and enforcement of Land Use policies and conservation practices. | 9              | #1              |
| Reduce the amounts of nutrients entering rivers and lakes of the watershed.   | 8              | #2              |
| Provide for the long term protection of the watershed by addressing Land Use issues.  | 8              | #2              |
| Involve and educate the public on actions they can take to reduce nonpoint source pollution.                                  | 5              | #3              |
| Reduce the amount of erosion and sedimentation within the watershed.  | 4              | #4              |
| Restore aquatic habitat in the watershed where impairment is suspected.   | 1              | #5              |

The steering committee also selected the following mission statement for the watershed at the March 5 meeting:

*"The mission of the Cheboygan River/Lower Black River Watershed Initiative is to Ensure high water quality and provide the protection of wildlife by reducing amounts of nutrients, sediments, and toxic pollutants entering the River system."*

**Table 24: Watershed Goals And Objectives**

|   |
|---|
| <b>GOAL:</b> Reduce the amount of stormwater runoff to the Cheboygan River.   |
| <b>Objectives:</b>  |
| Implement stormwater BMPs for drains discharging directly to the Cheboygan River.   |
| Ensure new development does not increase amount of stormwater runoff to the Cheboygan River.  |
| <b>GOAL:</b> Provide for the protection of the watershed through adoption/enforcement of land use policies and conservation practices.  |
| <b>Objectives:</b>  |
| Improve local land use planning and zoning standards.   |
| Develop model ordinances and language for adoption into existing master plans and zoning that ordinances should address proper stormwater management, set back provisions, greenbelts, site plan review requirements and other water quality protection measures. |
| Permanently protect identified sensitive areas through conservation easements, purchase of development rights, and land purchases.  |
| Develop a mechanism for improved enforcement of "no wake" laws.   |
| Sponsor workshops and training sessions to increase local enforcement of regulations.   |
| <b>GOAL:</b> Reduce the amounts of nutrients entering rivers and lakes of the watershed.  |
| <b>Objectives</b>   |
| Install corrective measures to reduce runoff at agricultural sites of concern.  |
| Reestablish greenbelts/conservation buffers at identified sites in critical areas.  |
| Promote the use of structural (retention basins) and nonstructural measures (stormwater ordinances) for water resource protection.  |
| Implement a Drain Stenciling Program and involve the public in the stenciling process.  |
| Reduce, treat, and/or eliminate existing stormwater-associated pollution entering the watershed.  |
| Conduct water quality testing to establish a baseline assessment of the conditions of the watershed.  |
| Develop and implement stormwater BMPs for identified stormwater drains and drainage ditches   |
| <b>GOAL:</b> Provide for the long-term protection of the watershed by addressing Land Use issues.   |
| <b>Objectives</b>   |
| Protect areas that are significant to aquatic resources through a voluntary land protection program.  |
| <b>GOAL:</b> Involve and educate the public on actions they can take to reduce nonpoint source pollution.   |
| <b>Objectives</b>   |
| Provide more information to the public regarding watershed management.  |
| Expand media coverage of the planning process to encourage more public and local agency participation.  |
| Develop and implement a school education program; including a water-sampling program.   |
| Conduct tours of a model stormwater site and hold workshops for developers, contractors, local governments and their personnel.   |
| Develop water quality information packets for distribution to waterfront property owners.   |
| Develop a wetland protection program focusing on citizen involvement and long term protection efforts.  |
| Develop educational tools for the citizens of the watershed to reduce sediment, nutrient and pesticide contributions from lawn care and wastewater practices, and initiate a landowner education program.   |
| <b>GOAL:</b> Reduce the amount of erosion and sedimentation within the watershed.   |
| <b>Objectives</b>   |
| Implement BMPs at road/stream crossing problem sites.   |
| Implement BMPs at streambank erosion problem sites.   |
| Host soil erosion workshop for local excavators, developers, etc.   |
| Implement BMPs at shoreline erosion problem sites.  |
| Work with ag. producers to reduce streambank erosion caused by livestock.   |
| Implement BMPs at recreational access sites.  |
| Restore riparian vegetation in watershed critical areas.  |
| <b>GOAL:</b> Restore aquatic habitat in the watershed where impairment is suspected.  |
| <b>Objectives</b>   |
| Increase amount of woody debris at suitable sites.  |
| Conduct yearly river/lake cleanups.   |

## Recommendations

Even though the Cheboygan River/Lower Black River Watershed currently exhibits high water quality, both remedial and proactive measures are necessary to provide for the protection and enhancement of the river system.

Re-mediation of identified areas of degradation should include streambank erosion control, road/stream crossing upgrades, stormwater controls and installation of BMP's at agriculture areas of concern.

In order to provide for the long-term protection of the Cheboygan River/Lower Black River system, proactive measures need to be implemented. A proactive approach to watershed management includes such measures as information and education programs, land use controls, zoning ordinances, septic maintenance programs and establishment of greenbelts.

Based on inventory results, the Cheboygan River/Lower Black River Watershed steering committee developed the following strategies for reduction of nonpoint sources of pollutants in the river system. The recommendations utilize a combination of both reactive and proactive measures. Each recommendation integrates Best Management Practices (BMPs), information and education strategies, partnerships and intergovernmental coordination. Each task targets a specific objective of the plan. Responsible parties, appropriate BMPs, milestones, a timeline, estimated costs and evaluation methods are outlined below.

Order of implementation of the recommendations will be based on steering committee input, and in many cases the order will be determined by available funds. Considering sediment and nutrients ranked as the highest pollutants of concern, strategies aimed at reducing these nonpoint pollutants will be given higher priority. When installing structural BMP's, the sites ranked most severe will be considered first. **Table 25** indicates the cost of implementation for each inventory, as well as the total for the entire implementation project.

| <b>Table 25: Costs of Project Implementation</b> |                    |
|--|--------------------|
| Streambank Protection Projects                   | \$56,000           |
| Road/stream Crossing Treatments                  | \$148,000          |
| Agricultural Treatments                          | \$1,270,000        |
| Shoreline Protection Projects                    | \$17,500           |
| Stormwater Treatment Projects                    | \$2,538,000        |
| General Education Projects                       | \$136,000          |
| <b>Total Costs of Implementation</b>             | <b>\$4,165,500</b> |

### ***Streambank Protection Recommendations***

Erosion of streambanks and lake shores can result in sedimentation of lakes and rivers. This can lead to a degradation of water quality and to the impairment of designated uses, particularly uses for wildlife/aquatic habitat and navigation, within the watershed. Streambank erosion can occur in several ways such as foot traffic by humans and

wildlife, boat and canoe access, loss of vegetation to anchor streambanks, among others. **Table 26** below lists streambank protection recommendations for the Cheboygan River/Lower Black River Watershed.

| <b>Table 26: Streambank Protection Recommendations</b> |   |  |
|--|---|--|
|  | <b>Recommendation</b>   | <b>Timeline</b>  |
| <b>Objective One</b>                                   | Stabilize priority streambank erosion sites through the installation of corrective measures.  |  |
| Task 1   | Implement structural BMP's to reduce the amount of sediment from entering the river.  |  |
| Milestones   | Develop site plans, obtain proper permits and landowner permission for 9 sites recommended for treatment (sites: S001;S003; S004;S005; S010; S012; S014; S015; & S016;) Secure funding and organize materials Organize work crew and install BMP's at each of the 9 sites | <ul style="list-style-type: none"> <li>♦ 5 yrs.</li> <li>♦ 1-2yrs.</li> <li>♦ 10 yrs.</li> </ul> |
| BMP's  | Tree revetment, brush placement, re-vegetation, stairways, fencing, bank sloping  |  |
| Responsible Parties                                    | Huron Pines RC&D Council, Tip of the Mitt Watershed Council Conservation Districts, NEMCOG  |  |
| <b>Estimated Cost</b>                                  | <b>\$58,000 (9 sites)</b>   |  |
| Evaluation   | Take before and after photographs and document number of sites completed  |  |
| <b>Objective Two</b>                                   | Improve existing access sites by creating canoe launch pads, steps etc.   |  |
| Task 1   | Develop site plans, obtain proper permits and landowner permission for improvement to/ construction of access structures and stairways at sites S014 and S015   | ♦ 2-5 yrs.   |
| Milestones   | Secure funding and organize materials Organize work crew and implement BMP's for 1 site per year  | <ul style="list-style-type: none"> <li>♦ 2-5 yrs.</li> <li>♦ 3-4 yrs.</li> </ul>                 |
| BMP's  | Provide parking, create launch pads, steps, walkway   |  |
| Responsible Parties                                    | Huron Pines RC&D Council, Tip of the Mitt Watershed Council, Conservation Districts, NEMCOG   |  |
| <b>Estimated Cost</b>                                  | <b>\$6,000/site (4 sites \$24,000)</b>  |  |
| Evaluation   | Before and after photographs; document number of sites completed  | ♦ 3-9 yrs.   |
| <b>Total Streambank Protection Cost: \$56,000</b>      |   |  |

### **Road/Stream Crossing Recommendations**

Sediments, including dirt and gravel from shoulders of the roads (especially unpaved roads) can be deposited into the river system wherever a road and stream intersect. Sedimentation of streams is a natural process. Excessive amounts of sediments can, however, negatively impact several of the designated uses for the watershed, such as aquatic wildlife and habitat (including the watershed's cold water fisheries), birds and mammals dependent on an aquatic environment and aquatic plant life. Sedimentation can also, by reducing the width and depth of the stream channel, restrict navigation and promote an increase in flooding of the stream. **Table 27** details the recommended actions needed to reduce the effects of the sedimentation process in the watershed.

**Table 27: Road/Stream Crossing Recommendations**

| <b>Recommendation</b>                             |  | <b>Timeline</b>                    |
|---|--|------------------------------------|
| <b>Objective One</b>                              | Reduce the amount of sediment by establishing a road/stream crossing improvement program designed to correct identified problems   |                                    |
| Task 1  | Stabilize erosion at road/stream crossings   |                                    |
| Milestones  | Develop site plans, obtain proper permits and landowner permission for priority sites<br>Secure funding and organize materials<br>Organize work crew and implement BMP's at the selected site  | ♦ 2 yrs.<br>♦ 2 yrs.<br>♦ 2-5 yrs. |
| BMP's   | Replace culverts, reduce grade of approaches, pave approaches, pave curb and gutter, re-vegetation, erosion control structures at 11 sites recommended for treatment: 031I; 034I; 045I; 137M; 139M; 141M; 145M; 148M; 156MK; 161C; 171MK |                                    |
| Responsible Parties                               | Huron Pines RC&D, Cheboygan and Emmet County Road Commissions, NEMCOG, County Drain Commissions  |                                    |
| <i>Estimated Cost</i>                             | <i>\$123,000 (11 sites)</i>  |                                    |
| Evaluation  | Before and after photographs; document number of sites completed   | ♦ 5 yrs.                           |
| <b>Objective Two</b>                              | Provide local road commissions with BMP information regarding road/stream crossings  |                                    |
| Task 1  | Obtain or develop informational materials describing road/stream crossing treatment alternatives to be used by road commissions  |                                    |
| Milestones  | Organize workshop materials and plan seminar<br>Host seminar for road commissions  | ♦ 1 yr.<br>♦ 2 yrs.                |
| BMP's   | Informational brochures and workshop sessions  |                                    |
| Responsible Parties                               | Huron Pines RC&D, NEMCOG, Cheboygan and Emmet County Road Commissions  |                                    |
| Anticipated Products                              | Program agenda and educational brochures provided to workshop participants   |                                    |
| <i>Estimated Cost</i>                             | <i>\$1,600 (2 seminars)</i>  |                                    |
| Evaluation  | Develop evaluation forms, request participants of the workshops evaluate materials and impact of program   | ♦ 2 yrs.                           |
| <b>Total Road/Stream Crossing Cost: \$148,000</b> |  |                                    |

### **Agricultural Recommendations**

The agricultural community is a vital component of the Cheboygan River/Lower Black River Watershed. The crops and livestock produced locally benefit the economy of the area, and provide a rural atmosphere many visitors and permanent residents alike find aesthetically pleasing. Unfortunately, like many other watershed components, the agricultural industry can contribute significant amounts of pollution to the watershed. Sediments, nutrients, and bacteria natural by-products of farming activities. Best Management Practices such as exclusion fencing to keep livestock out of streams, adequate manure storage facilities, proper livestock crossings, nutrient management and buffers along streambanks can significantly lower the amounts of pollution entering the water system. In many cases, funding to correct these problems may be available

in the form of grants from various agencies and programs working within the watershed.

Actions recommended to reduce the negative impacts of agriculture on the watershed while promoting environmentally sound uses for agricultural lands are listed in **Table 28** below.

| <b>TABLE 28: AGRICULTURE RECOMMENDATIONS</b> |  |  |
|--|--|--|
|  | <b>Recommendation</b>  | <b>Timeline</b>  |
| <b>Objective One</b>                         | Restrict livestock access to the rivers and streams  |  |
| Task 1                                       | Develop site plans, provide alternate means for watering livestock and create proper stream crossings  |  |
| Milestones                                   | Create site plans for 11 sites recommended for treatment: A003; A017; A018; A028; A030; A043; A061; A062; A067; A076; A082; & A128;<br>Obtain proper permits and landowner permission<br>Secure funding and organize materials<br>Organize work crew and install BMP's | <ul style="list-style-type: none"> <li>◆ 1-2 yrs.</li> <li>◆ 1-2 yrs.</li> <li>◆ 2-3 yrs.</li> <li>◆ 2-5 yrs.</li> </ul> |
| BMP's  | Fencing, stream crossings, watering devices, buffers   |  |
| Responsible Parties                          | NRCS, NEMCOG, Cheboygan and Emmett County Conservation Districts, Huron Pines RC&D Council   |  |
| <b>Estimated Cost</b>                        | <b>\$700,000 (11 sites)</b>  |  |
| Evaluation                                   | Before and after photographs; document number of sites completed   | ◆ 3-5 yrs.   |
| Timeline                                     | 2 to 5 years   |  |
| <b>Objective Two</b>                         | Install corrective measures to reduce runoff at agricultural sites of concern.   |  |
| Task 1                                       | Develop plans; install devices to reduce runoff.   |  |
| Milestones                                   | Select sites and develop plans for identified areas of concern<br>Obtain proper permits and landowner permission<br>Secure funding and organize materials<br>Organize work crew and install BMP's  | <ul style="list-style-type: none"> <li>◆ 1 yr.</li> <li>◆ 1 yr.</li> <li>◆ 1-2 yrs.</li> <li>◆ 2-5 yrs.</li> </ul>       |
| BMP's  | Planting, nutrient management, fencing, filter strips, livestock exclusion, waste storage/utilization  |  |
| Responsible Parties                          | NRCS, Cheboygan and Emmet County Conservation Districts, NEMCOG  |  |
| Timeline                                     | 5 years  |  |
| <b>Estimated Cost</b>                        | <b>\$570,000 (11 sites)</b>  |  |
| Evaluation                                   | Before and after photographs; document number of sites completed   |  |
| <b>Total Agriculture Costs: \$1,270,000</b>  |  |  |

### **Shoreline Protection-Riparian Landowner Recommendations**

A shoreline inventory of the lakes within the Cheboygan River/Lower Black River Watershed was conducted in summer 2002 to determine the presence, extent and potential habitat of cladophora, a type of algae that occurs naturally in small amounts in northern Michigan waters. Cladophora proliferates in the presence of excessive nutrients and can be used as an indicator species for a decline in water quality.

The full value of a shoreline survey is only achieved when the information is used to educate lakefront property owners about preserving water quality, and to help them rectify any problem situations. A follow-up effort of this nature has occurred on several other lakes where the

Watershed Council has conducted shoreline surveys. **Table 29** lists follow-up actions recommended for Douglas Lake, Long Lake, Munro Lake and Twin Lakes.

| <b>TABLE 29: SHORELINE PROTECTION-RIPARIAN LANDOWNER RECOMMENDATIONS</b> |  |                         |
|--|--|-------------------------|
|  | <b>Recommendation</b>  | <b>Timeline</b>         |
| <b>Objective One</b>   | Educate public on identification of Cladophora growths, what they indicate   |                         |
| <b>Task 1</b>  | Send a <u>general</u> summary of the survey results to all shoreline residents, along with a packet of informational brochures to provide information about practical, feasible, effective actions to protect water quality. Keep the specific results of the survey confidential--in other words, do not publish a list of sites where Cladophora growths were found. |                         |
| Milestones   | Develop and assemble educational packet (septic maintenance, maintaining greenbelts, proper fertilizer application, etc.) to distribute to riparian landowners<br>Help landowners design a site plan to protect their shoreline  | ♦ 1 yr.<br>♦ 3 yrs.     |
| BMPs   | Produce and distribute educational material, site planning assistance  |                         |
| Responsible Parties  | NEMCOG, Huron Pines RC&D Council, Tip of the Mitt Watershed Council,   |                         |
| Anticipated Products   | Educational packet for riparian landowners   |                         |
| Evaluation Method  | Survey landowners to determine presence or extent of Cladophora growth   | ♦ 5 yrs.                |
| <i>Estimated Cost</i>  | <i>\$500-\$2500 (Approximately \$5 to \$25 per household, depending on complexity and type of materials distributed.)</i>  |                         |
| <b>Objective Two</b>   | Inform those owners of properties with Cladophora growths of the specific results for their property   |                         |
| <b>Task 1</b>  | Ask riparian landowners to fill out a questionnaire in an attempt to interpret cause of the growth, offer individualized recommendations for water quality protection.   |                         |
| Milestones   | Following the questionnaire survey, perform site visits coupled with ground water testing in an effort to gain more insight to the nature of the findings. (keep all information regarding names, specific locations, and findings confidential to encourage property owner participation in this project)   | ♦ 2-5 yrs.              |
| <b>Task 2</b>  | Repeat the survey periodically (every five years or so), coupled with the follow-up mailings in order to promote water quality awareness and good management practices in an ongoing basis.  |                         |
| Milestones   | During each subsequent survey, add more information about shoreline features to the database. The database will greatly facilitate future surveys, resulting in a reduction of staff hours needed for repeating the survey; information can be utilized for other water resource management applications.  | ♦ Ongoing               |
| BMPs   | Educational materials, questionnaires  |                         |
| Responsible Parties  | Huron Pines RC&D Council, NEMCOG, Tip of the Mitt Watershed Council  |                         |
| Anticipated Products   | Improved documentation of Cladophora sites, including causes, extent and location; shoreline database  |                         |
| Evaluation Method  | Survey of landowners, recheck of Cladophora sites  | 3-5 yrs.                |
| <i>Estimated Cost</i>  | <i>\$3,500-\$8,000</i>   |                         |
| <b>Objective Three</b>   | Add information to database to facilitate identifying the locations of Cladophora growths during repeat shoreline surveys and in making property owner contacts.   |                         |
| <b>Task 1</b>  | Compile more accurate parcel and ownership information for the shoreline database from either the Cheboygan County Equalization Department, or based on the knowledge of Association members or shoreline residents.   |                         |
| Milestones   | Encourage lake associations in shoreline monitoring activities<br>Compile and manage water resource information  | ♦ Ongoing<br>♦ 2-5 yrs. |

|   |  |             |
|---|--|-------------|
| BMPs  | Shoreline surveys  |             |
| Responsible Parties                               | Tip of the Mitt Watershed Council, NEMCOG, lake association volunteers   |             |
| <b>Table 29: Shoreline Protection, continued</b>  |  |             |
| Anticipated Products                              | Improved shoreline database for use in managing and monitoring the lake shores of the watershed<br>Water resource information clearing house to be shared by various agencies and the public |             |
| Evaluation Method                                 | Keep track of number of times database is accessed by agencies, and water resource information is accessed by agencies, lake associations and other organizations                            | ♦ 5-10 yrs. |
| <i>Estimated Cost</i>                             | <i>\$3,000</i>   |             |
| <b>Task 2</b>                                     | Create good quality maps showing property parcels, Cladophora locations, and other resource information by linking the shoreline database to a Geographic Information System                 |             |
| Milestones  | Expand database to include other shoreline features such as public access sites, shoreline erosion, wetlands, aquatic plants and type of bottom substrate.                                   | ♦ On-going  |
| BMPs  | Education, informational materials   |             |
| Responsible Parties                               | Huron Pines RC & D Council, NEMCOG, Tip of the Mitt Watershed Council  |             |
| Anticipated Products                              | Large body of information and maps useful in monitoring and protecting the shorelines of the watershed   |             |
| Evaluation Method                                 | Survey agencies using information and materials to evaluate quality and quantity of information available  | 10 yrs.     |
| <i>Estimated Cost:</i>                            | <i>\$4,000</i>   |             |
| <b>Total Shoreline Protection Costs: \$17,500</b> |  |             |

### **Stormwater Recommendations**

The ultimate goal of the Lower Cheboygan River Watershed Project is to prevent or at least reduce pollution. All of the recommended techniques to correct runoff problems will help achieve and enhance water quality of the Lower Cheboygan River Watershed, as well as the community.

There are currently at least 46 outfalls (within the Cheboygan City limits) discharging directly to the river, and additional sites are added each year. With few exceptions, these drainage zones have no treatment. The stormwater simply flows from city streets, rooftops, parking lots, etc., carrying with it oil, grease, trash, and sediment that is sent directly to the Cheboygan River. While this archaic practice has historically occurred and continues even today, *discharging stormwater directly from pavement to surface water is no longer recognized as an acceptable technique*. Stormwater policies currently employed by Cheboygan County that may prevent these harmful practices do not apply to the City. It is vital that an ordinance specifically addressing stormwater runoff problems should be drafted and adopted by the City of Cheboygan. Many forward-thinking municipalities in Michigan have already done this.

In addition to addressing the City's stormwater problem "at the end of the pipe," the City of Cheboygan should work to promote the concept and implementation of low-impact design techniques among private property owners. This approach, using relatively simple BMPs like rain gardens and directing water to grassed swale areas, has been shown to reduce both pollutants and the quantity of runoff. Such a long-term approach makes implementing **Task 3** below much easier, and there are less water and pollutants to be dealt with. (In one large city neighborhood in Seattle, runoff was reduced by 98% through an intensive use of low impact design BMPs.) A nearby Michigan community – Grayling – has already received funding in order to implement this approach to stormwater management.

Future development within the City should incorporate stormwater control measures. While this can be accomplished, in part, through the ordinance mentioned below (**Task 1**), it also requires well-thought-out planning by the City. On the future land use map for the City of Cheboygan, commercial business expansion is planned along Lincoln Avenue, east of the Cheboygan River. Intensive new development in this area will add a burden to the existing stormwater system, and thus should be handled on site, rather than added to the existing system. This is true of other future areas of expansion as well. In addition, within the City limits, there exist a number of parcels that can currently be considered “open land” (or otherwise undeveloped). Many of these will likely be developed in coming years. While encouraging intensive development within the City (rather than contributing to sprawl) is a good approach, the impacts of any development on the stormwater system and the River should be considered. Areas that once filtered pollutants and slowed runoff may, in the future, actually contribute to the problem if development is done poorly. Also, the City should incorporate conservation design in new residential and commercial areas (including existing properties), above and beyond what current regulations require (avoid curb and gutter).

Listed below in **Table 30** are some recommended actions the City of Cheboygan could take to reduce the stormwater impacts to the Cheboygan River.

| <b>Table 30: Stormwater Recommendations</b> |  |  |
|---|--|--|
|   | <b>Recommendation</b>  | <b>Timeline</b>  |
| <b>Objective One</b>                        | Promote the use of structural (retention/detention basins) and nonstructural measures (stormwater ordinances) for water resource protection  |  |
| <b>Task 1</b>                               | Work with City to facilitate immediate adoption of a post-construction stormwater runoff control ordinance in order to prevent the direct discharge of stormwater to surface water.  |  |
| Milestones                                  | The City is in the process of revising its stormwater policies<br>Coordinate planning efforts with Cheboygan County and townships surrounding the City of Cheboygan.   | <ul style="list-style-type: none"> <li>◆ 1-2 yrs.</li> <li>◆ 2-5 yrs.</li> </ul>   |
| BMPs  | Educational materials  |  |
| Responsible Parties                         | Huron Pines RC& D Council, Tip of the Mitt Watershed Council, NEMCOG   |  |
| Anticipated Products                        | Model stormwater ordinance   |  |
| Evaluation Method                           | The adoption of the stormwater ordinance, monitor outfalls for contaminants.   | ◆ 2-5 yrs.   |
| <i>Estimated Cost</i>                       | <i>\$2,000</i>   |  |
| <b>Task 2</b>                               | Retrofit existing storm drains from private businesses so they no longer discharge directly to the river   |  |
| Milestones                                  | Encourage riparian businesses to install grassy filter strips between pavement and water, rain barrels to reduce rooftop runoff, and infiltration trenches at storm drain sites<br>Educate riparian property owners and business people of the extent of the problem, and the relatively easy solutions<br>Develop model stormwater site within watershed<br>Conduct tours of model stormwater site for riparian business owners | <ul style="list-style-type: none"> <li>◆ 1-5 yrs.</li> <li>◆ 1-2 yrs.</li> <li>◆ 2-5 yrs.</li> <li>◆ 2-5 yrs.</li> </ul> |
| BMPs  | Detention/retention areas, filter strips, educational materials  |  |
| Responsible Parties                         | NEMCOG, Huron Pines RC&D Council, Tip of the Mitt Watershed Council  |  |
| Anticipated Products                        | Educational packet for riparian landowners and businesses, model stormwater site   |  |
| Evaluation Method                           | Before and after photos, document number of sites completed  | ◆ 2-5 yrs.   |
| <i>Estimated Cost</i>                       | <i>\$60,000 (17 sites)</i>   |  |

**Table 30: Stormwater Recommendations, continued**

|                       |   |  |
|-----------------------|---|--|
| <b>Task 3</b>         | Retrofitting of the existing City stormwater system may be the most difficult task in reducing the City's contribution of runoff to the river. At least 29 drainage zones have been identified; these carry pollutants from commercial, residential, and light industrial sections of the City and discharge directly to the River. Treatment options for stormwater runoff from the City should be developed on a zone-by-zone basis.                          |  |
| Milestones            | Develop plan and timetable for retrofit<br>Pursue funding for implementation at stormwater drainage zones<br>Complete retrofit on 2-3 sites per year  | <ul style="list-style-type: none"> <li>◆ 1 yr.</li> <li>◆ 1-10 yrs.</li> <li>◆ 2-15 yrs.</li> </ul>  |
| BMPs                  | Infiltration basins, constructed wetlands, detention ponds, and mechanical removal of pollutants (oil & grit separator)   |  |
| Responsible Parties   | City of Cheboygan, Huron Pines RC&D Council, Cheboygan Drain Commission, NEMCOG   |  |
| Evaluation Method     | Document number of sites completed  | ◆ 2-15 yrs.  |
| <i>Estimated Cost</i> | <i>\$2,500,000 (While this project is large in scope, it is likely that cost-share funding from the state or the federal government would be available in the coming years to help implement these types of solutions, as well as those listed in Task 4 below.)</i>  |  |
| <b>Task 4</b>         | Educate citizens on the importance of stormwater management and non point source pollution and promote the concept/ implementation of low-impact design techniques among private property owners.   |  |
| Milestones            | Mail information to each household in the City limits of Cheboygan, including brochures about non-point source pollution, urban property BMP's, and a map of the City's drainage system.<br>Give presentations where appropriate (e.g., school-aged children, garden clubs, and business owners).<br>Promote a "drain stenciling" day in the City of Cheboygan to increase awareness that storm drains are a direct route for pollutants to enter surface water | <ul style="list-style-type: none"> <li>◆ 1-3 yrs.</li> <li>◆ 1-3 yrs.</li> <li>◆ 1-3 yrs.</li> </ul> |
| BMPs                  | Rain gardens; redirecting water to grassed swale areas  |  |
| Responsible Parties   | Huron Pines RC&D Council, NEMCOG, Tip of the Mitt Watershed Council   |  |
| Anticipated Products  | Brochures, maps, materials for presentations  |  |
| Evaluation Method     | Send questionnaire to households, classrooms to gauge interest generated by educational programs  | ◆ 3-4 yrs.   |
| <i>Estimated Cost</i> | <i>\$15,000</i>   |  |
| <b>Task 5</b>         | Develop emergency response plans and communicate with responders for pollutant spills on City streets. Use the updated sewer maps.  |  |
| Milestones            | Develop plans and system for reporting/responding to pollution spills<br>Coordinate system with key agencies, departments in City<br>Educate City officials, business owners, and waste/chemical transports on response procedures  | <ul style="list-style-type: none"> <li>◆ 2-5 yrs.</li> <li>◆ 2-5 yrs.</li> </ul>                     |
| BMPs                  | Educational materials   |  |
| Responsible Parties   | City of Cheboygan, Huron Pines RC&D, Tip of the Mitt and NEMCOG   |  |
| Anticipated Products  | Emergency response plan   |  |
| Evaluation Method     | Conduct simulated emergency response events   | ◆ 2-5 yrs.   |
| <i>Estimated Cost</i> | <i>\$15,000</i>   |  |

**Total Stormwater Recommendations Cost: \$2,538,000**

## General Education Recommendations

Education is the key to a successful watershed management program. The overall goal of the information and education component of the watershed plan is to provide educational information to local officials, shoreline residents, contractors and developers, school children and the general public, enabling them to make decisions that will enhance the protection of the Cheboygan River/Lower Black River Watershed. Informed citizens can greatly affect the outcome of a watershed protection program. **Table 31** indicates projects recommended to increase the public's knowledge and understanding of the watershed and its many components.

| <b>Table 31: General Education Recommendations</b> |   |  |
|--|---|--|
|  | <b>Recommendation</b>   | <b>Timeline</b>  |
| <b>Objective One</b>                               | Develop and assemble an educational packet that covers such topics as septic maintenance, developing and maintaining greenbelts, and proper fertilization application.  |  |
| <b>Task 1</b>                                      | Distribute educational packets to riparian landowners and to Realtors for new riparian property owners.   |  |
| Milestones   | <ul style="list-style-type: none"> <li>◆ Create logo unique to the Cheboygan River/Lower Black River Watershed Initiative</li> <li>◆ Develop and assemble educational packet (septic maintenance, maintaining greenbelts, proper fertilizer application, etc.) to distribute to riparian landowners</li> <li>◆ Help landowners design a site plan to protect their shoreline</li> </ul> | <ul style="list-style-type: none"> <li>◆ 1 yr.</li> <li>◆ 3 yrs.</li> <li>◆ Ongoing</li> </ul> |
| BMPs   | Produce and distribute educational material, site planning assistance   |  |
| Responsible Parties                                | NEMCOG, Cheboygan and Emmet County Conservation Districts, Huron Pines RC&D Council, Tip of the Mitt Watershed Council, USDA-NRCS, MSUE   |  |
| Anticipated Products                               | Educational packet including watershed logo, brochures, pencil, note cards, stickers  |  |
| Evaluation Method                                  | Document volume of educational materials distributed; conduct survey of landowners on effectiveness of educational materials  | ◆ 2-10 yrs.  |
| <i>Estimated Cost</i>                              | <i>\$15,000</i>   |  |
| <b>Objective Two</b>                               | Encourage county road commissions to explore alternatives in road maintenance at road/stream crossings. (Also addressed in Table 27: Road/stream Crossing Recommendations, Objective Two)   |  |
| <b>Task 1</b>                                      | Create model road/stream crossing site in cooperation with county road commissions  |  |
| Milestones   | Meet with road commissions to select model site and plan for implementation of site design  |  |
| BMPs   | Educational materials   |  |
| Responsible Parties                                | NEMCOG, Huron Pines RC&D Council, Tip of the Mitt Watershed Council,  |  |
| Anticipated Products                               | Brochure that includes BMPs, road/stream crossing facts, and effects of sediments and road chemicals on the designated uses of the waterways; short PowerPoint presentation depicting "before & after" pictures of sites in other watersheds that used the road maintenance alternatives, model road/stream crossing site   |  |
| Evaluation Method                                  | Follow up with erosion control officer  | 2-10 years   |
| <i>Estimated Cost</i>                              | <i>\$30,000</i>   |  |
| <b>Objective Three</b>                             | Develop brochures and/or information packets that explain the importance of controlling livestock access, establishing fencing, and creating proper stream crossings. Include available funding sources. Distribute information at fairs, trade shows, and agriculture related events.  |  |
| <b>Task 1</b>                                      | Develop brochures and/or information packets that explain the importance of controlling livestock access, establishing fencing, and creating proper stream crossings.   |  |
| Milestones   | Provide educational materials to agricultural community   | 2-5 yrs.   |

**Table 31: General Education Recommendations, continued**

|                       |   |   |
|-----------------------|---|---|
| BMPs                  | Educational materials   |   |
| Responsible Parties   | NEMCOG, Cheboygan and Emmet County Conservation Districts, Huron Pines RC&D Council, Tip of the Mitt Watershed Council, USDA-NRCS, MSUE   |   |
| Anticipated Products  | Educational packet including the importance of controlling livestock access, establishing fencing, and creating proper stream crossings. Include a list of potential funding sources available.   |   |
| Evaluation Method     | Survey agricultural community to assess effectiveness of educational materials  | 2-5 yrs.  |
| <i>Estimated Cost</i> | <i>\$10,000</i>   |   |
| <b>Objective Four</b> | Promote responsible use of access sites   |   |
| <b>Task 1</b>         | Develop signage for use at water access sites   |   |
| Milestones            | <ul style="list-style-type: none"> <li>◆ Post signs at water access sites and provide information to canoe liveries and ORV parking areas to encourage anglers, canoe groups, ORV and motor boat users to protect the rivers by using stairs when available, by staying on designated trails, and by reducing wake speeds.</li> <li>◆ Develop informational pamphlets that encourage responsible use at access sites, distribute to canoe liveries and boat/ORV dealerships, rentals and parking areas</li> </ul> | <ul style="list-style-type: none"> <li>◆ 2-5 yrs.</li> <li>◆ 2-5 yrs.</li> </ul>                                      |
| BMPs                  | Signage, educational materials  |   |
| Responsible Parties   | NEMCOG, Cheboygan and Emmet County Conservation Districts, Huron Pines RC&D Council, Tip of the Mitt Watershed Council, USDA-NRCS, MSUE   |   |
| Anticipated Products  | Signs, informational pamphlets  |   |
| Evaluation Method     | Survey access sites for increase/decrease in erosion  |   |
| <i>Estimated Cost</i> | <i>\$30,000</i>   |   |
| <b>Objective Five</b> | Educate the public on stormwater impacts through a drain stenciling program, informative seminars for local officials, brochures for the public, and a tour of a model stormwater site.   |   |
| <b>Task 1</b>         | Implement a drain stenciling program in the watershed   |   |
| Milestones            | <ul style="list-style-type: none"> <li>◆ Develop a brochure explaining stormwater impacts on the watershed and the purpose of drain stenciling.</li> <li>◆ Hold seminars in both counties of the watershed to educate local officials on the importance of stormwater management</li> <li>◆ Conduct a tour for local officials and interested community members of a model stormwater site</li> <li>◆ Hold work bees for stenciling storm drains in the watershed; encourage community participation</li> </ul>   | <ul style="list-style-type: none"> <li>◆ 1 yr.</li> <li>◆ 2-5 yrs.</li> <li>◆ 2-5 yrs.</li> <li>◆ 2-5 yrs.</li> </ul> |
| BMPs                  | Educational materials, drain stenciling, seminars   |   |
| Responsible Parties   | NEMCOG, Cheboygan and Emmet County Conservation Districts, Huron Pines RC&D Council, Tip of the Mitt Watershed Council, USDA-NRCS, MSUE   |   |
| Anticipated Products  | Stormwater brochure, stenciled stormwater drains  |   |
| Evaluation Method     | Interview city officials/community members to gauge increase of awareness stormwater impacts, BMPs, and compliance  | 2-5 yrs.  |
| <i>Estimated Cost</i> | <i>\$20,000</i>   |   |
| <b>Objective Six</b>  | Develop and implement school programs concerning water quality education.   |   |
| <b>Task 1</b>         | Implement a water testing/monitoring program in area schools  |   |
| Milestones            | <ul style="list-style-type: none"> <li>◆ Make SEE-North's water quality testing kits available for classrooms</li> <li>◆ Establish interactive database to which students can enter classroom data</li> <li>◆ Facilitate participation by students in conference at U. of M. Biological Station**</li> </ul>  | <ul style="list-style-type: none"> <li>◆ 1-2 yrs.</li> <li>◆ 2-5 yrs.</li> <li>◆ 1-2 yrs.</li> </ul>                  |
| BMPs                  | Educational materials, hands-on activities  |   |
| Responsible Parties   | SEE-North, NEMCOG, Tip of the Mitt Watershed Council  |   |
| Anticipated Products  | Interactive water quality database  |   |

| <b>Table 31: General Education Recommendations, continued</b> |  |   |
|---|--|---|
| Evaluation  | Conduct short survey of teachers whose classrooms participated in demonstration to rate overall educational effectiveness of information, materials, presentation and activities, monitor results of water testing   | 2-5 yrs                                     |
| <i>Estimated Cost</i>   | <i>\$6,000</i>   | .   |
| <b>Task 2</b>   | Conduct a water resource curriculum review   |   |
| Milestones  | Review and compile existing instructional materials for elementary and secondary students that focus on water resources<br>With input from teachers, modify selected materials in ways that make these more locally relevant<br>Compile an on-line resource library for teachers on SEE-North's website for teachers; establish an on-line learning community of people involved in water resources<br>Develop a lesson study project* | ♦ 1 yr.<br>♦ 1 yr.<br>♦ 2-5 yrs.<br>♦ 1 yr. |
| BMPs  | Educational materials  |   |
| Responsible Parties   | SEE-North, NEMCOG, Tip of the Mitt Watershed Council   |   |
| Anticipated Products  | "Clearing house" of instructional materials, on-line resource library, lesson plans  |   |
| Evaluation  | Questionnaires distributed to teachers and students  | 2-5 yrs.                                    |
| <i>Estimated Cost</i>   | <i>\$25,000</i>  |   |
| <b>Total Cost of Education Recommendations: \$136,000</b>     |  |   |

\*Teachers from similar grade levels who wish to use the same instructional materials related to water resources can participate in a lesson study. These teachers meet several times and 'dissect' a particular lesson about water resources. One teacher volunteers to teach the lesson while other participants observe that teacher's class. Then the group meets again to share impressions from the observation and revise the lesson. Another teacher then volunteers to teach the lesson and other teachers in the group observe. The group then meets a second time to discuss the classroom observation and revise the lesson a second time. Lesson study is a powerful form of professional development for teachers, and is one of the professional development strategies used in Japan's educational system.

\*\* The conference focuses on interpreting the data and reflecting on the role of inquiry in learning. Students are also introduced to potential careers in water resources and tour a higher education facility that is actively engaged in aquatic research and water resource management. Elementary students may explore water resources through pond studies, stream studies or in-class freshwater aquaria.

### *Information/Education Strategies*

Education is the critical component in a successful watershed management program. The primary function of the Information and Education Strategy for the watershed plan is to provide educational information to local officials, shoreline residents, contractors and developers, school children and the general public. Learning about the watershed that is so fundamental to the sustainability of the region's economy and way of life will enable citizens to make decisions that will enhance and protect the waters of the Cheboygan River/Lower Black River Watershed.

**Table 32** lists the information and education strategies based on the goals and objectives stated earlier. Based on the sources of pollution, each educational strategy will be directed towards a specific target audience.

| <b>Table 32: Information and Education Strategies</b> |  |
|---|--|
| <b>Pollutant</b>                                      | <b>Organics (Nutrients/Bacteria)</b>   |
| Source  | Wastewater/ residential septic systems/lawns   |
| Target Audience                                       | Homeowners, riparian businesses  |
| Message   | Properly maintain septic systems to prevent degradation of water quality; discourage improper/over application of fertilizers on lawns; encourage soil tests and the use of low/no phosphate fertilizers |
| Delivery Mechanism                                    | Create an educational water quality kit for homeowners including brochures for septic system maintenance, environmentally friendly lawn care   |
| Source  | Agricultural lands   |
| Target Audience                                       | Agricultural operations; landowners  |
| Message   | Unrestricted livestock access to surface water threatens the health of the watershed   |
| Delivery Mechanism                                    | Brochures, work with NRCS, provide information at fair, trade-shows and local events   |
| <b>Pollutant</b>                                      | <b>Sediments</b>   |
| Source  | Road/stream crossings  |
| Target Audience                                       | Road Commissions   |
| Message   | Explore alternatives to road maintenance at road/stream crossings  |
| Delivery Mechanism                                    | Seminars for County Road Commissions   |
| Source  | Streambank erosion   |
| Target Audience                                       | Riparian Landowners, developers, construction companies  |
| Message   | Encourage landowners to leave a conservation buffer, provide attractive landscaping for natural vegetation, inform developers, construction companies of importance of greenbelts                        |
| Delivery Mechanism                                    | Information material distributed to Real Estate agencies, area businesses, riparian landowners   |
| Source  | Uncontrolled livestock access to streams   |
| Target Audience                                       | Landowners, agricultural operations  |
| Message   | Control livestock access, establish fencing, create proper stream crossings, information on alternate funding sources  |
| Delivery Mechanism                                    | Brochures, work with NRCS, provide information at fairs, trade-shows and local events  |
| Source  | Lake and stream access sites   |
| Target Audience                                       | Fishing enthusiasts, kayak/canoe/tube rentals and sales, ORV users, boat owners  |
| Message   | Protect river by using designated access sites and stairs when provided, staying on designated trails, and reducing wake speeds  |
| Delivery Mechanism                                    | Post signs at access points, provide information to canoe liveries, sporting goods stores and at ORV parking   |
| <b>Pollutant</b>                                      | <b>Pesticides</b>  |
| Source  | Residential lawns; agricultural operations   |
| Target Audience                                       | Landowners, agriculture managers   |
| Message   | Encourage proper application of pesticides to protect aquatic/wildlife habitats; and promote a healthy watershed   |
| Delivery Mechanism                                    | Brochures, work with various agencies such as lake associations, NRCS; provide information at fairs, trade-shows and events  |
| <b>Pollutant</b>                                      | <b>Oils, Grease, Metals and Other Toxic Substances</b>   |
| Source  | Stormwater runoff  |
| Target Audience                                       | County Drain Commission; riparian businesses; riparian landowners  |
| Message   | Provide surface runoff control to reduce and filter harmful substances from entering the river via stormwater runoff   |
| Delivery Mechanism                                    | Drain stenciling; informative seminars for local officials; brochures covering such topics as hazardous household wastes and where stormwater goes; tours of model stormwater site                       |

## **Planning & Zoning Recommendations**

In general, all three local government units do an effective job of making their zoning ordinances readily available to the general public and have kept their standards up-to-date. Several relatively minor improvements could be made by all three government units in order to improve water quality.

### **Cheboygan County**

Most of the land area within this watershed is in Cheboygan County. The Cheboygan County Planning Commission was created in 1969. (The City of Cheboygan, while located within the county, maintains its own planning and zoning authority, authorized through Public Act 207 of 1921 and Public Act 285 of 1931.) The county's first Planning Commission was established in 1969; the first county zoning ordinance was also adopted at this time. Cheboygan County has recently updated their comprehensive master plan, which includes numerous recommendations that would help to protect water resources; the county should implement these within the new zoning ordinance. Most of the land in this county that is part of the Lower Cheboygan Watershed is zoned Agriculture/Forestry. There are an abundance of water resources in Cheboygan County and intense growth pressure; effectively administering the zoning program is perhaps more than a full-time job. As noted in their newly updated master plan, "Any new development along or near the waterfront will require a greater standard of review to maintain or improve the quality of the County's water resources," (p. B-7).

The County does currently have a Lake & Stream Overlay Protection District, although "protection" is perhaps a poor use of the term. The zoning district does allow uses (with a special use permit) that one would not commonly associate with resource protection, such as retail stores, hotels, and subdivision development. Within this district (a 500 ft zone parallel to the shoreline's ordinary high water mark), the county does have special regulations for septic systems, vegetative buffer zones, structure design standards, agricultural & silvicultural activities, and erosion control.

To better improve the zoning ordinance, areas where commercial development is located along the waterfront should be rezoned to better reflect the fact they are not in a "protection" district. Other lands along the waterfront in the protection district should not be turned into commercial use (change the allowed uses section of the Lake & Stream Protection District). This recommendation has also been made by the County itself, and is within the County Master Plan (page C-2).

According to Section 10.5 of the current zoning ordinance, "Native trees, shrubs, and vegetation *should* be maintained and enhanced along the banks of rivers, streams, ponds and lakes in this district (the Lake & Stream Protection District)." If maintaining aquatic buffers is the goal, the language should be changed to reflect that this is a requirement, not a recommendation. In the following section, the ordinance does note that, "The vegetation strip *shall* be maintained for a distance of 40 feet inland measured horizontally from the ordinary high water mark..." Fortunately, the ordinance also specifies that a lawn is not an acceptable natural vegetation strip. In addition, the ordinance requires that applicants for permits for new waterfront development shall be required to submit their plans for the establishment/maintenance of a natural vegetation strip.

Within the L&S Protection District (Article 10, section 4.8), where existing structures on both sides of a property are within 200 ft of a new building and said structures do not meet waterfront setback standards, the required setback need not be greater than the average setback on the adjoining developed lots.

In addition, the ordinance states that the zoning administrator should annually publicize through local media the desirability and need for the establishment of waterfront natural vegetation strips on existing properties. This would seem to be a key element in getting voluntary compliance from property owners in establishing/maintaining greenbelts.

There is a special natural river designation (implemented by the County, not the State's Natural Rivers Program) for the Upper Black (not within this watershed but potentially impacting it) -- with 100 ft buffer strips along mainstream and 75 ft for tributaries. The Lower Cheboygan Watershed currently has a lot of commercial growth directed toward the waterfront; more attention should be paid to protecting water resources so they remain a source of appeal. The majority of the Lower Black River is zoned agriculture/forestry.

Finally, the County itself would seem to function more efficiently if one board handled planning & zoning (currently there is both a planning commission and zoning commission). The Zoning Board of Appeals would still remain, but the combining of the planning and zoning boards would make both economic and philosophic sense – perhaps better demonstrating the close connection between land use planning and the implementation of the plan, thus resulting in policies and standards that are consistently followed. The County does have their own Planner and should continue to utilize this professional.

#### **City of Cheboygan:**

While the City makes up a small area of the watershed geographically, it can have a significant impact on the Cheboygan River by virtue of the fact that the river runs through the heart of the city and is surrounded by intensive commercial, industrial, and residential development.

Some of the “environmental provisions” that are looked at as part of this study may not be as applicable for the city (for example, one should expect to have higher density development within a city), but there are some areas where improvement could be made. One of the most notable is with regard to stormwater management.

Within the City of Cheboygan, much of the land area is currently designated as single family residential. However, within the portion of the city currently discharging directly to the Cheboygan River via the storm sewer system, intensive commercial, waterfront/marina, and light industrial comprise much of the land area. In addition, future expansion of any of these districts is very likely to increase the amount of stormwater runoff to the Cheboygan River unless a stormwater management program is put in place.

The waterfront district includes a broad range of uses and allows for parking right along the waterfront. Currently, stormwater runoff from this area is directed into drains and discharged directly into the Cheboygan River. Redevelopment of some of the waterfront, with more emphasis on parks and open space and less on parking lots adjacent to the river, would benefit the river (and likely the whole community).

In addition to retrofitting the existing stormwater system to incorporate BMPs, future development should no longer be allowed to discharge stormwater directly to the river (as been the practice). This problem may now be addressed, as the County is administering the stormwater control program within the City.

The city does publish their zoning regulations on their internet site, which helps to educate the public, makes the documents readily accessible, and should make amending the ordinance easier/cheaper to do. The City is also currently working to update their land use plan.

### **Emmet County:**

A small part of the watershed is located in Emmet County. Overall, Emmet does have standards within their planning & zoning program that are good from a resource management standpoint. Emmet County does publish their zoning regulations on their internet site, which helps to educate the public, make the documents readily accessible, and should make amending the ordinance easier/cheaper to do. They also have a County Planner and Assistant Planner to help guide the commission and serve the public. Recently the county has also adopted a stormwater management ordinance.

An area of improvement is with regard to vegetative buffer strips (Section 2209), which is as it is currently written, is weak. The language reads, "It is suggested that a minimum shoreline greenbelt of 35 ft be maintained." The ordinance also includes a setback of 60ft for structures along the waterfront; this standard should remain (or be increased) as the county amends their ordinance to improve the greenbelt section.

### **Evaluating Success**

In order to determine the overall effectiveness of the watershed management plan, an evaluation process is essential. Listed below are the evaluation methods for the Cheboygan River/Lower Black River Watershed Initiative, as recommended in the DEQ Handbook: *Developing a Watershed Management Plan for Water Quality*.

- ◆ Physical water quality monitoring
- ◆ Chemical water quality monitoring
- ◆ Biological life measurements
- ◆ Photographic or visual evidence, before and after photos
- ◆ Documentation of site BMPs installed
- ◆ Pollutant loading measurements
- ◆ Stakeholder surveys, evaluate knowledge or change in behavior
- ◆ Focus groups, to determine effectiveness of project activities

Detailed evaluation methods for each task are outlined above in the Recommendations section. Several different evaluation methods were incorporated into the plan to accommodate the variety of strategies recommended for implementation. In order to document the installation of BMP's, before and after photos will be taken at road/stream crossings, streambank restoration sites, newly installed greenbelts and livestock crossings. Focus groups, interviews and surveys will be used when changing viewpoints and management strategies needed to be documented and structural BMP's were not recommended. A timeline for the completion of the evaluations is included in each recommendation table.

To ensure success in the implementation phase, evaluation of the measures being installed will be conducted annually by the steering committee. This will allow for continued monitoring by the steering committee of the overall progress of the project.

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## **Chapter Eight: Final Water Quality Summary**

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The Cheboygan River/Lower Black River Watershed currently has five designated uses that are threatened:

- Warm and Cold Water Fisheries
- Aquatic Life and Wildlife
- Recreation Total/Partial Body Contact
- Navigation
- Public Water Supply

*Project Goal:* The mission of the Cheboygan River/Lower Black River Watershed Initiative is to ensure high water quality and provide for the protection of wildlife by reducing amounts of nutrients, sediments, and toxic pollutants entering the River system.

### *Warm and Cold Water Fisheries*

The Cheboygan River/Lower Black River Watershed includes a few coldwater trout streams. However increased sediment, nutrients, bacteria, oil/grease, and heavy metals, have threatened this use. Nutrients and bacteria, were identified as having the most harmful effect on coldwater fisheries. Wastewater, residential lawns and agricultural activities were deemed the most significant sources of nutrients and bacteria.

Sediments were ranked the second most serious pollutant challenging the health of the of the watershed's coldwater fisheries. An over abundance of sediments in rivers and streams may block fish gills, destroy essential spawning habitat and reduce the amount of light available for healthy plant growth. Road/stream crossings and stormwater runoff are identified as being the most significant sources of sediment, however land development, streambank erosion and agricultural activities were also found to contribute significant amounts of sediment to the river system. Heavy metals, oil and grease are also considered a threat to the high quality coldwater fisheries .

Stormwater runoff was identified as the most serious source of pollution in the warm water fisheries of the watershed. Stormwater runoff contributes a wide variety of pollutants to the lakes and streams of the watershed, including sediments, pesticides, oil, grease, heavy metals and toxic substances. The leading causes of pollution in stormwater runoff are impervious surfaces such as rooftops and parking lots. Nutrients and bacteria were also identified as detrimental to the warm water fisheries.

### *Indigenous Aquatic and Wildlife*

Sediment, heavy metals, oils and grease, and pesticides are currently threatening aquatic life and habitat. Sediment affects aquatic life in the same way it affects coldwater fisheries; by clogging gills and decreasing spawning habitats. Heavy metals/organic compounds such as oil, grease and other toxic substances and

pesticides can affect the life cycles of aquatic species by decreasing immunity and reproductive viability and, in high enough concentrations, cause death.

Sources of sediment include road/stream crossings, streambank erosion, stormwater runoff, agricultural operations, land development practices and lake and river access sites. Sources of heavy metals/organic compounds include stormwater runoff, sites of environmental contamination and road/stream crossings. Common pollutants such as vehicle fluids (antifreeze, oil, grease, gas), pesticides, fertilizers, cleaners, paint products and bleaches can be carried directly to the river via storm drains.

### *Recreation Total/Partial Body Contact*

Recreation was identified as threatened by increased bacteria in the Cheboygan River/Lower Black River Watershed. High levels of bacteria can make swimming, canoeing, fishing and other activities, where individuals come in contact with the water, harmful. Although this has not been documented in the watershed in recent years, preventive measures need to be established to protect this designated use. The sources for bacteria include septic systems, livestock management practices and stormwater discharge.

Improperly sited, designed, or maintained septic systems along the waterbodies can allow bacteria to enter lakes and rivers. Increased riparian development requires additional septic systems to be constructed. Also, many seasonal homes are being converted into year-round residences and the size or condition of the septic system may not be adequate to serve the increased use. Proper septic maintenance is imperative to reducing the amount of bacteria entering the river system.

Livestock management practices, including the storage and application of manure, are significant sources of bacteria. Excessive manure application, runoff from manure piles and unrestricted livestock access, are all causes of increased bacteria entering the watershed.

### *Navigation*

An increased rate of sedimentation is currently threatening navigation in areas of the Cheboygan/Lower Black River Watershed. Known sources of sediment include road/stream crossings, streambank erosion, agricultural practices and stormwater runoff. Other sources include land development practices and lake and river access sites.

Sedimentation at road/stream crossings is often a result of short culverts, steep embankments, sand and gravel surfaces and inadequate diversion outlet. Public access sites located at road stream crossings need to have adequate measures in place in order to prevent erosion from occurring.

Streambank erosion may be caused by foot traffic, lack of vegetation along the bank and natural hydrologic conditions. Unrestricted livestock access to the river can also lead to bank destabilization and sediment delivery to the river. Inadequate stormwater

management can lead to the discharge of sediments into the river system. Oftentimes attached to sediment are other harmful pollutants including heavy metals, toxic substances and pesticides, which threaten other designated uses.

### *Public Water Supply*

The Environmental Protection Agency (EPA) is a federal agency that works closely with other federal agencies, state and local governments, and Indian tribes to develop and enforce regulations under existing environmental laws. The Department of Environmental Quality (DEQ) has primary enforcement authority in Michigan for the Federal Safe Drinking Water Act under the Michigan Safe Drinking Water Act. The DEQ has regulatory oversight for all public water supplies, including approximately 1,500 community and 11,000 non-community water supplies. The program also regulates drinking water well drilling for approximately 25,000 new domestic wells drilled each year. Michigan has over 1.12 million households served by private wells, more than any other state. In addition to its regulatory activities, the DEQ investigates drinking water well contamination, and oversees remedial activities at sites of groundwater contamination affecting drinking water wells.

Information concerning water systems in Michigan is maintained by the Michigan DEQ, and can be found on the EPA's *Safe Drinking Water Information Site*. The records at this site go back to 1993. For violations prior to 1993, interested parties may contact the operators of the water system in question, contact the State of Michigan, or file a Freedom of Information Act (FOIA) request.

### *Drinking Water Quality in the Cheboygan River/Lower Black River Watershed*

The EPA sorts drinking water wells into four classes:

1. PRIVATE WELLS

If drinking water comes from a private well, the owner is responsible for the water's safety. EPA rules do not apply to private wells, but recommends that well owners have their water tested annually. To get a list of certified commercial laboratories that test drinking water contact the State Certification Officer at:

Department of Environmental Quality  
3423 N. Martin Luther King B  
P.O. Box 30195  
Lansing, MI 48909  
(517) 335-8812

2. COMMUNITY WATER SYSTEMS

Community water systems serve the same people year-round, such as in homes or businesses. There are two community water systems active in the Cheboygan River/Lower Black River Watershed at this time, one of which is maintained by the City of Cheboygan, the other by a cabin/trailer park operation. The source of both wells is groundwater, with the City well serving a population of 5,295 and the park serving a population of 44. Neither well has had a significant violation in the last ten years.

3. NON-TRANSIENT WATER SYSTEMS

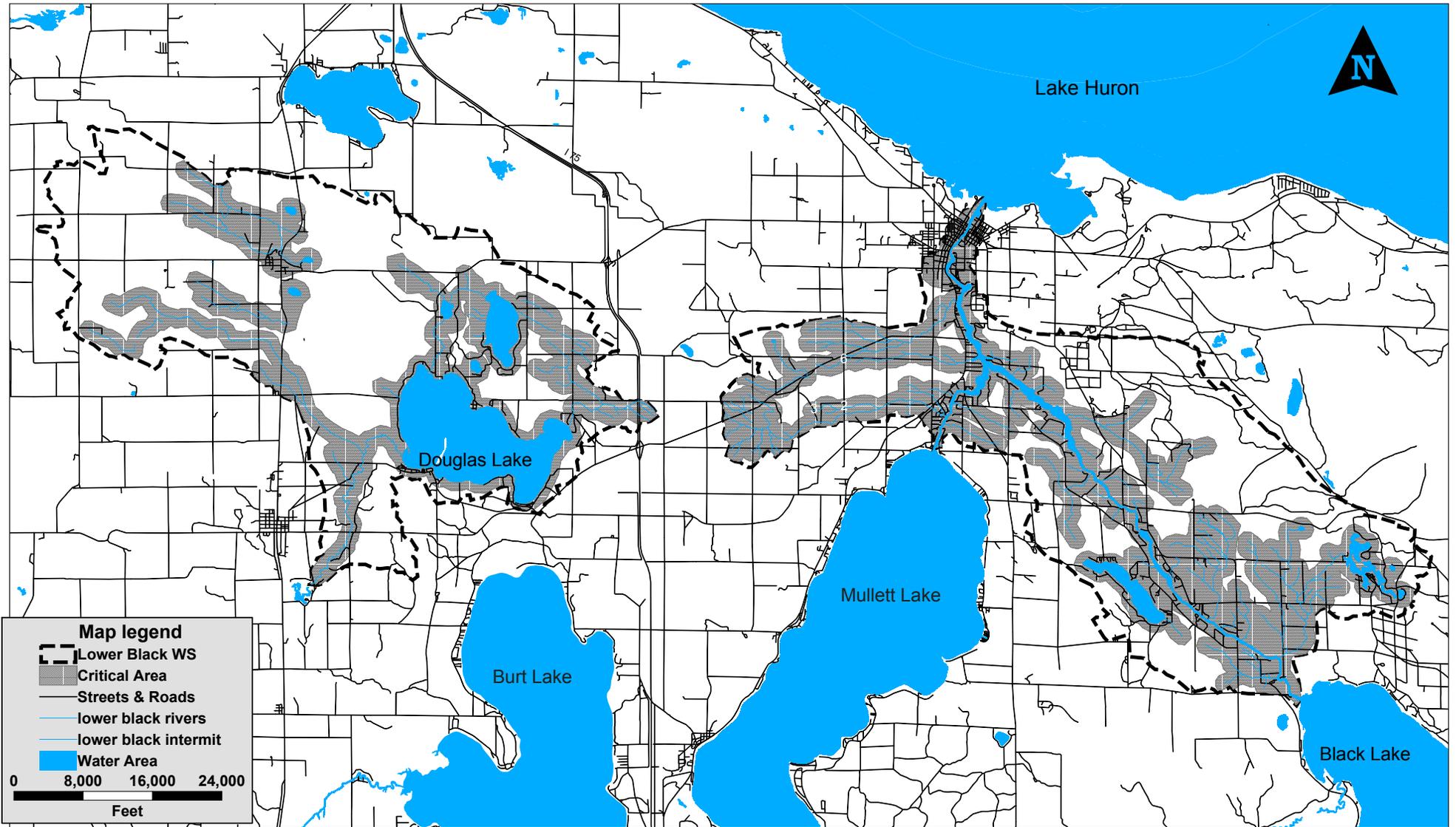
Non-transient water systems serve the same people, but not year-round (for example, schools that have their own water system). There are two such water systems located in the watershed, a rural elementary school and a large car dealership. Groundwater supplies both wells, serving a population of 266 at the school and 50 at the dealership. Neither well has had a significant violation in the last ten years.

4. TRANSIENT NON-COMMUNITY WATER SYSTEMS

Transient non-community water systems are systems that do not consistently serve the same people. Rest stops, campgrounds, gas stations, motels and convenience type stores not hooked into the City's water supply would be included in this category. Most of the wells in the watershed that are not considered private wells fall into this group. Over fifty such wells are found in the watershed with the vast majority located in Cheboygan County. Ground water supplies all of these wells, and the population served by each ranges from 25 to 150. Ten of these water systems (all located in Cheboygan County) were cited within the last ten years for violation of the *maximum contamination level* (MCL) allowed (one system was cited three times during this period). In all cases, the contaminant was *coliform*. Not a health threat in itself; coliform is a bacteria produced by the waste of both plants and animals. It is used to indicate whether other potentially harmful bacteria may be present in drinking water. In most cases, compliance to the Safe Drinking Water Act was achieved in a timely manner; eventually all of these systems achieved compliance.

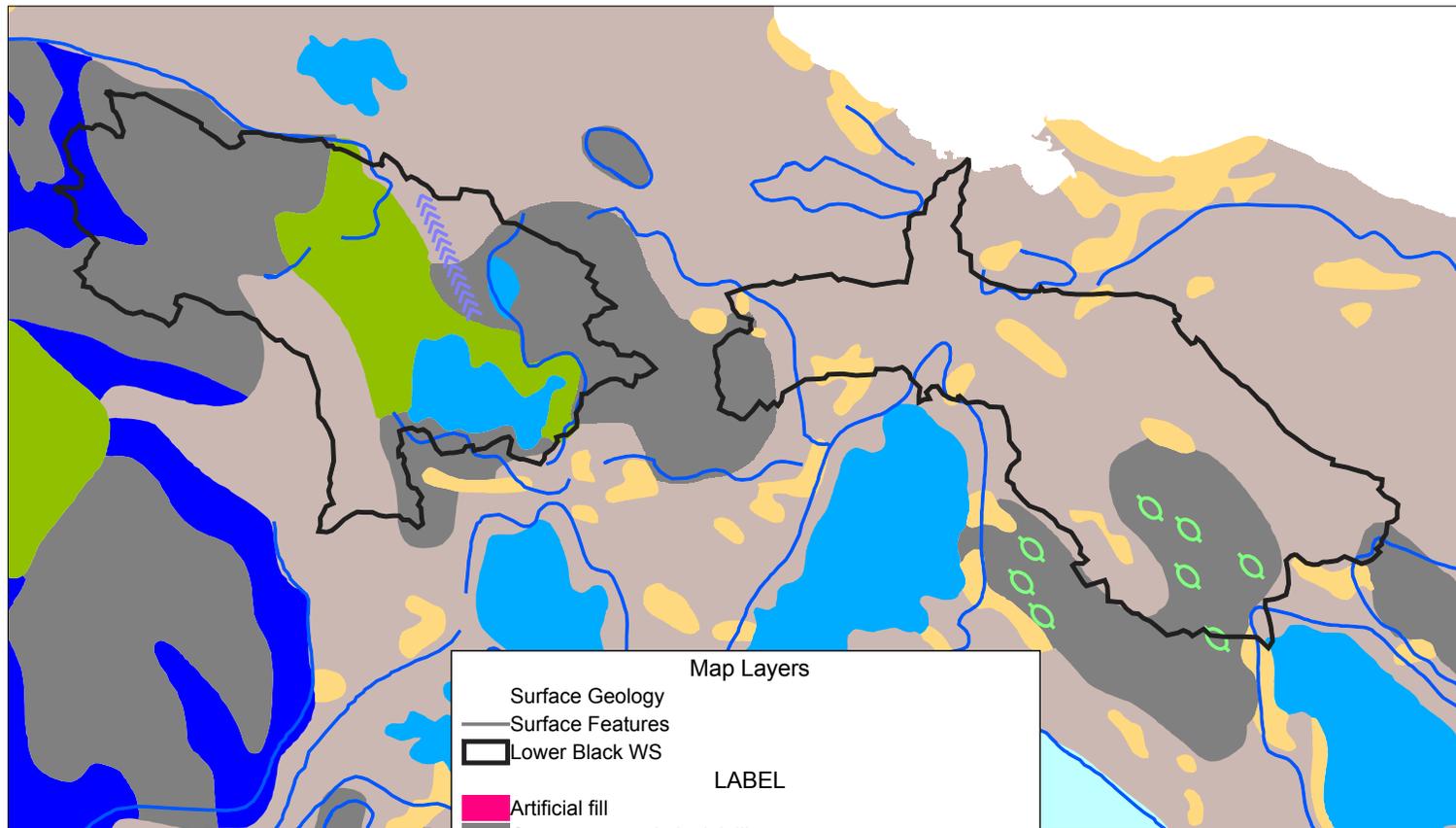
# Cheboygan River/Lower Black River WATERSHED BOUNDARY

Map 1



# CHEBOYGAN RIVER/LOWER BLACK RIVER WATERSHED

## GEOLOGY



**Map Layers**

- Surface Geology
- Surface Features
- Lower Black WS

**LABEL**

- Artificial fill
- Coarse-textured glacial till
- Dune sand
- End moraines of coarse-textured till
- End moraines of fine-textured till
- End moraines of medium-textured till
- Exposed bedrock surfaces
- Fine-textured glacial till
- Glacial outwash sand and gravel and postglacial alluvium
- Ice-contact outwash sand and gravel
- Lacustrine clay and silt
- Lacustrine sand and gravel
- Medium-textured glacial till
- Peat and muck
- Postglacial alluvium
- Thin to discontinuous glacial till over bedrock
- Water

**FEATURES**

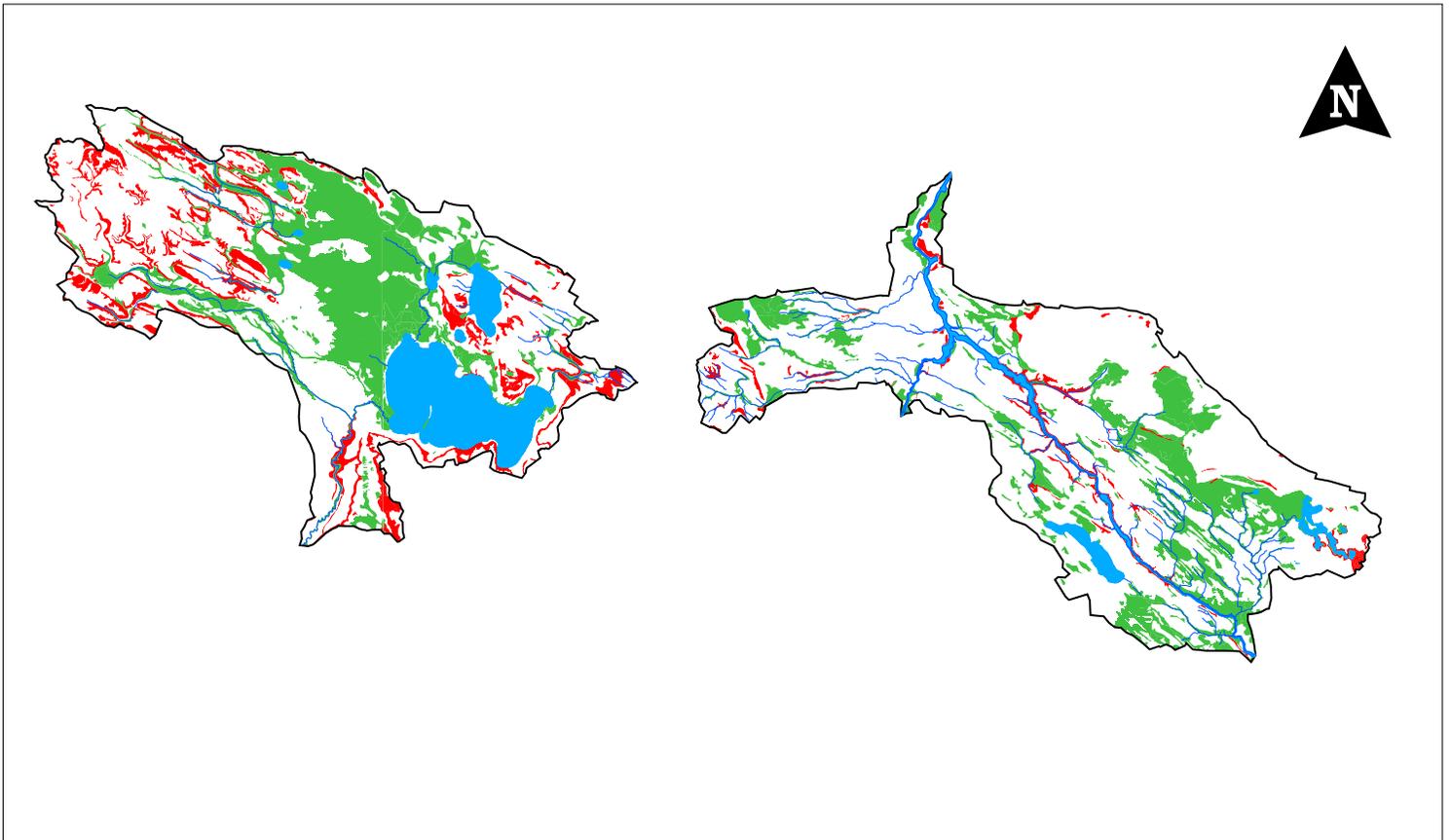
- DRUMLINS
- ESKERS
- SHORELINE
- SINKHOLES
- STRIATIONS/GROOVES

0 10,000 20,000 30,000  
Feet



# CHEBOYGAN RIVER/LOWER BLACK RIVER WATERSHED

## SOIL CONSTRAINTS



**SOIL CONSTRAINTS**  
Map Layers

- Lower Black WS
- Lower Black Lakes
- Streams

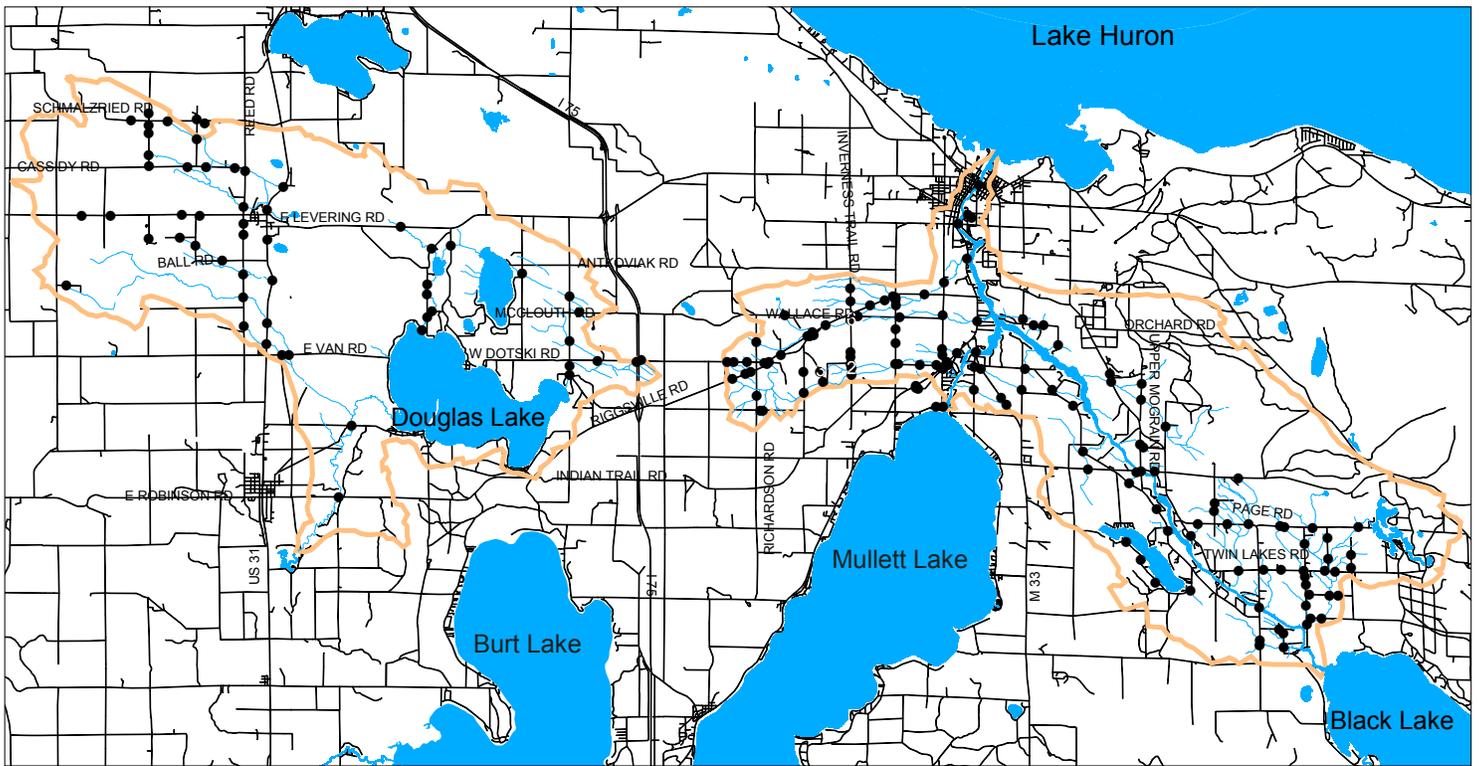
**HYDRIC-STEEP SLOPES**

- Hydric
- Slopes 12%-50%
- Water

0 10,000 20,000 30,000  
Feet



### Cheboygan River/Lower Black River Watershed ROAD/STREAM CROSSINGS



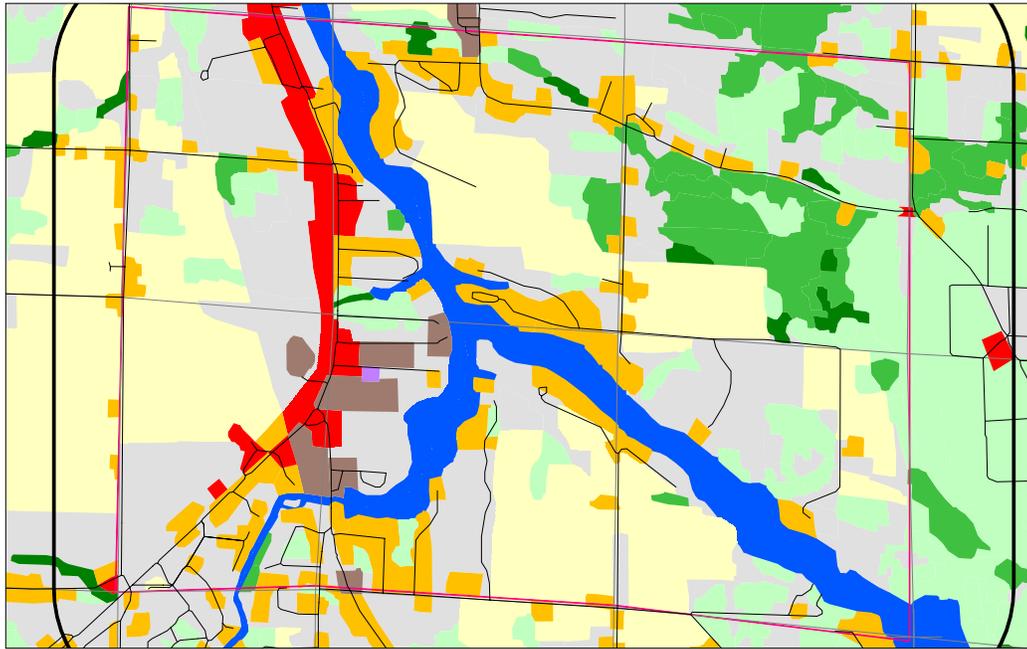
**Map legend**

- Streets & Roads
- Lower Black WS
- lower black rivers
- lower black intermit
- Water Area
- Road Stream Crossing

0 10,000 20,000 30,000  
Feet

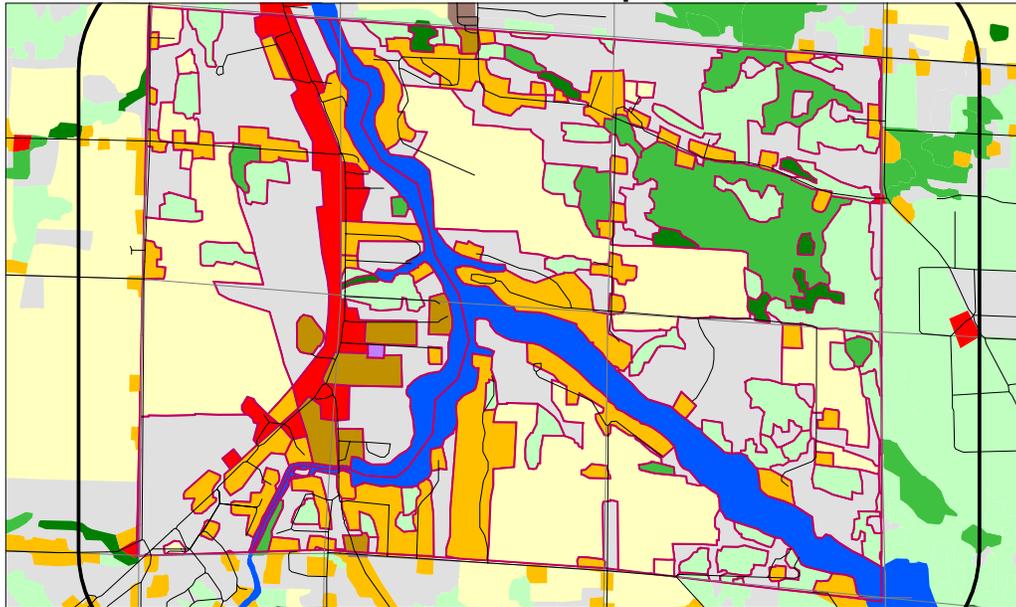


# 1998 Residential Land Use Benton/Inverness Township Sections



Map 8

## 2003 Land Use Update



Map 9

### Map Layers

INVERN98

BENTON98

— Section Lines

— Streets

### LEVEL10

01 (231)

02 (13)

03 (10)

04 (17)

05 (89)

06 (303)

07 (423)

08 (163)

09 (173)

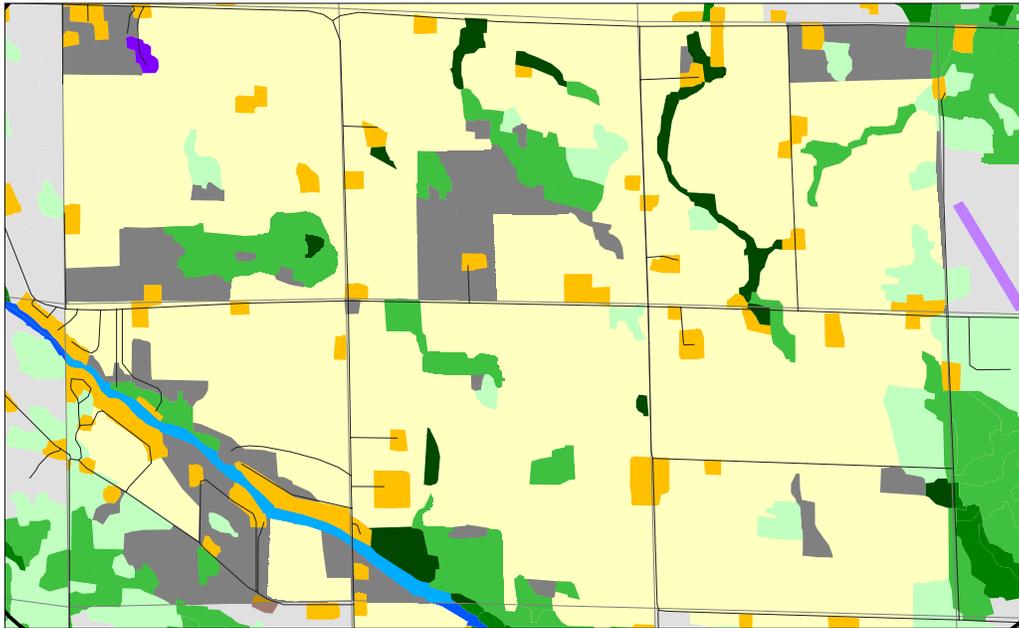
10 (6)

0 1,200 2,400 3,600

Feet

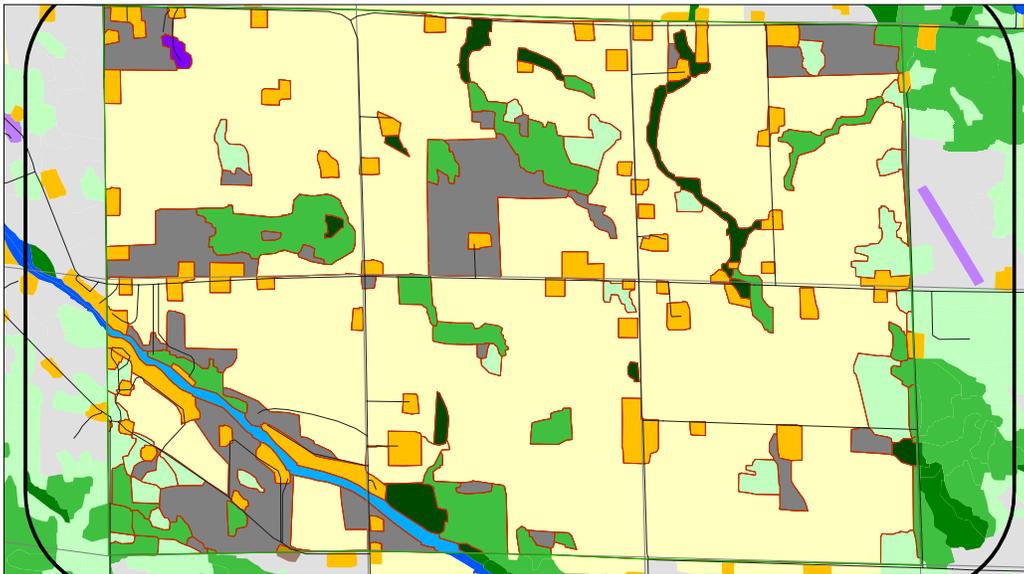


# 1998 Agricultural Land Use Grant Township Sections



Map 10

## 2003 Land Use Update



Map 11

### Map Layers

ALOHA98

Grant\_Update

Section Lines

Streets

LEVEL10

01 (103)

02 (1)

03 (7)

04 (4)

05 (24)

06 (157)

07 (488)

08 (202)

09 (71)

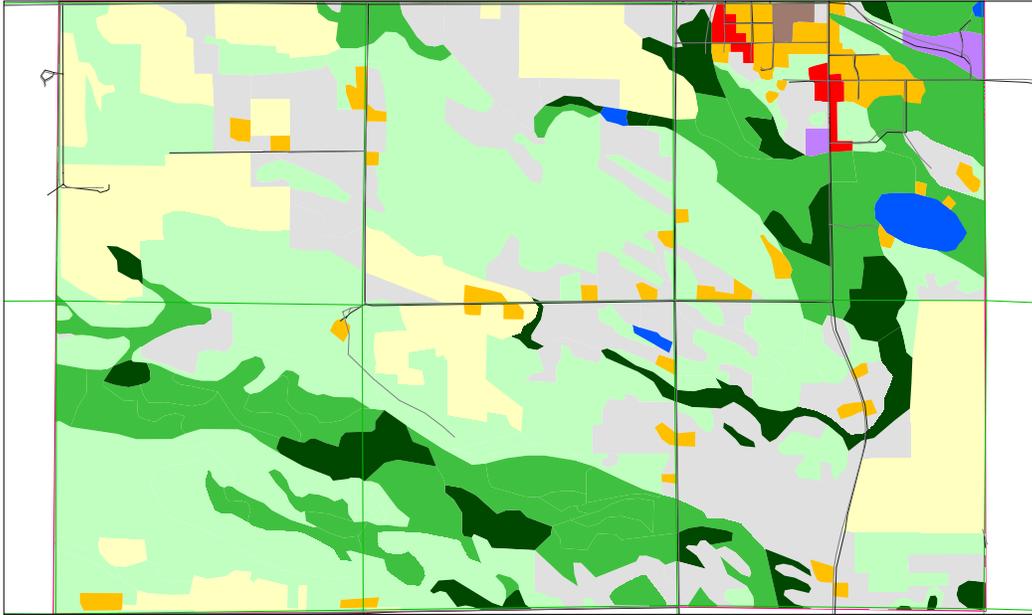
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Feet

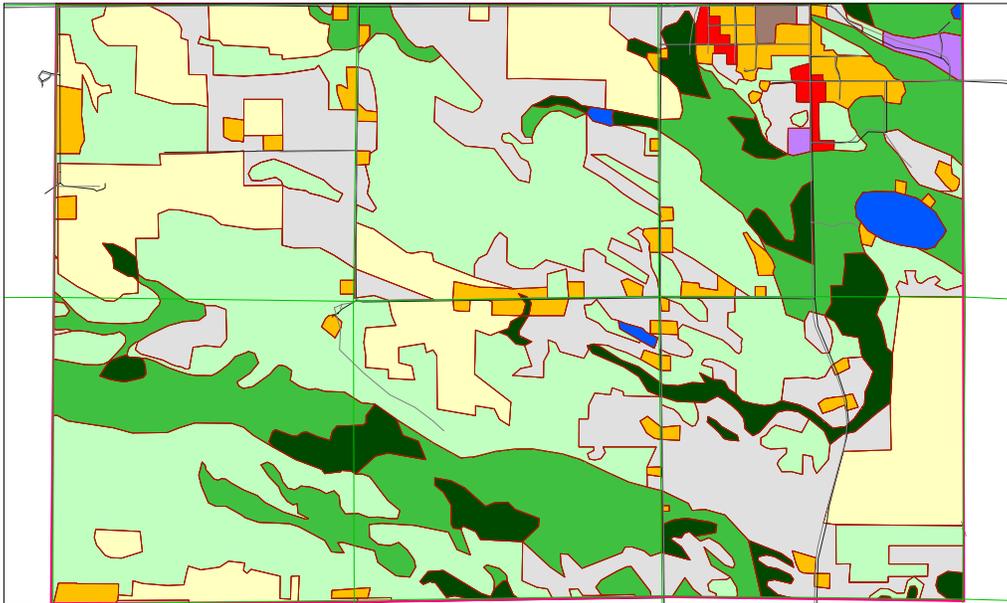


# 1998 Forest Land Use McKinley Township Sections



Map 12

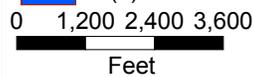
## 2003 Land Use Update



Map 13

### Map Layers

-  Emmet\_Update
  -  Streets
  -  allroads\_047v2a
  -  sections
- LEVEL 10**
-  01 (31)
  -  02 (2)
  -  03 (2)
  -  04 (1)
  -  05 (13)
  -  06 (44)
  -  07 (56)
  -  08 (36)
  -  09 (22)
  -  10 (4)



APPENDIX A

Streambank Erosion Inventory

Site Number: \_\_\_\_\_  
County: \_\_\_\_\_  
Photo Numbers: \_\_\_\_\_

Date: \_\_\_\_\_  
Map Sheet Number \_\_\_\_\_  
Personnel: \_\_\_\_\_

LOCATION

Township Name: \_\_\_\_\_ Township Number: \_\_\_\_\_ Range \_\_\_\_\_ Section \_\_\_\_\_

GPS Coordinates \_\_\_\_\_ N \_\_\_\_\_ W

Owners: FEDERAL COUNTY STATE PRIVATE \_\_\_\_\_

Landmarks, Features: \_\_\_\_\_

SITE INFORMATION

BANK--While looking downstream:                      RIGHT                      LEFT

Is there access to the site for equipment?:            YES                      NO

If no, distance to nearest road (estimate): \_\_\_\_\_

CONDITION OF BANK (Circle)

- A. TOE IS UNDERCUTTING
- B. TOE IS STABLE, UPPER BANK ERODING
- C. TOE AND UPPER BANK ERODING
- D. PERCENT OF VEGETATIVE COVER ON BANK:    0-10%    10-50%    50-100%
- E. OTHER (Describe): \_\_\_\_\_
- F. PROBLEM TREND:                      INCREASING                      DECREASING

APPARENT CAUSE OF EROSION (Circle any applicable)

- A. LAND USE (MOWING, CLEARCUTTING, DEVELOPMENT)
- B. FOOT TRAFFIC, BOAT ACCESS, FISHING SITE
- C. PEAKING (THUNDER BAY POWER)
- D. SURFACE WATER ENTERING
- E. BEND OR OBSTRUCTION IN RIVER
- F. WILDLIFE USE
- G. WAVE ACTION
- H. BANK SEEPAGE
- I. OTHER: \_\_\_\_\_

**Streambank Erosion Inventory, continued**AMOUNT OF EROSION AND SLOPE RATIO

A. SIDESLOPE OF BANK (Circle one):

Vertical      1:1      2:1      3:1      4:1      or Flatter

B. LENGTH OF ERODED BANK: \_\_\_\_\_

C. AVERAGE HEIGHT OF ERODED BANK: \_\_\_\_\_

RIVER CONDITIONS

A. APPROXIMATE WIDTH OF RIVER: \_\_\_\_\_

B. DEPTH OF RIE: \_\_\_\_\_ AT \_\_\_\_\_ FROM THE BANK

C. CURRENT:      SLOW      MODERATE      FAST

SOIL TEXTURE

SAND    CLAY    LOAM    GRAVEL    STRATIFIED      SAND OVER CLAY

OTHER \_\_\_\_\_

SEVERITY OF SITE:    MINOR      MODERATE      SEVERE

TYPE OF RECOMMENDED TREATMENT (Circle all that apply):

A. ROCK RIP-RAP

B. BIOLOGS/TREE REVETMENTS

C. TREE REVETMENT

D. BANK SLOPING

E. STAIRWAYS

F. BANK SEEDING OR PLANTING

G. BRUSH PLACEMENT

H. FENCING

I. OTHER \_\_\_\_\_

DRAWING OF SITE, COMMENTS

## APPENDIX B

**Cheboygan River/Lower Black River Watershed  
Streambank Erosion Severity Index**

| <b>Condition of bank</b>       | <b>Points</b> | <b>Soil type or texture</b>                    | <b>Points</b> |
|--------------------------------|---------------|--|---------------|
| Toe and upper bank eroding     | 5             | Sand   | 3             |
| Toe undercutting               | 3             | Gravel   | 2             |
| Toe stable, upper bank eroding | 1             | Stratified<br>Clay, loam                       | 2<br>1        |
| <b>Problem trend</b>           |               | <b>Vegetative cover on bank slope</b>          |               |
| Increasing                     | 5             | 0-10%  | 5             |
| Decreasing or stable           | 1             | 10-50%<br>40-100%                              | 3<br>1        |
| <b>Side-slope of bank</b>      |               | <b>Apparent cause of erosion</b>               |               |
| Vertical, 1:1                  | 5             | Light access traffic                           | 1             |
| 2:1, 3:1                       | 2             | Obstruction in river                           | 1             |
| 4:1 or flatter                 | 1             | Bank seepage                                   | 1             |
|                                |               | Gullying by side channels                      | 1             |
|                                |               | Bend in river                                  | 2             |
|                                |               | Wave action (impoundments)                     | 2             |
|                                |               | Road-stream crossing;<br>grade/shoulder runoff | 3             |
|                                |               | Moderate access traffic                        | 3             |
|                                |               | Heavy access (foot, horse, etc.)<br>traffic    | 5             |
| <b>Length of eroded bank</b>   |               | <b>Mean height of eroded bank</b>              |               |
| More than 50 ft.               | 5             | More than 20 ft                                | 7             |
| 20 to 50 ft.                   | 3             | 10 to 20 ft                                    | 5             |
| Less than 20 ft.               | 1             | 5 to 10 ft                                     | 3             |
|                                |               | less than 5 ft                                 | 1             |
| <b>Depth of river</b>          |               | <b>Current</b>                                 |               |
| 3 ft or over                   | 2             | Fast   | 2             |
| Less than 3 ft                 | 1             | Slow   | 1             |
| <b>Total Points for Site</b>   |               |  |               |

Accumulative points indicate extent of erosion, i. e., the site rating, as follows:

More than 36-----Severe  
30 to 36-----Moderate  
Less than 30-----Minor



**CONDITIONS AND TREATMENT**

Erosion Conditions:

- \_\_\_\_\_ Streambank Erosion Adjacent to Crossing
- \_\_\_\_\_ Embankment Erosion
- \_\_\_\_\_ Culvert Outlet Erosion
- \_\_\_\_\_ Pool Formation at Culvert Outlet
- \_\_\_\_\_ Shoulder/Ditch Erosion
- \_\_\_\_\_ Sand/Soil Over Crossing
- \_\_\_\_\_ Other \_\_\_\_\_

Recommended Treatment:

- \_\_\_\_\_ Pavement
- \_\_\_\_\_ Pave Curb & Gutter
- \_\_\_\_\_ Erosion Control Structures ( )
- \_\_\_\_\_ Sediment Basins ( )
- \_\_\_\_\_ Extend Culvert ( )
- \_\_\_\_\_ Diversion Outlets ( )
- \_\_\_\_\_ Increase Fill
- \_\_\_\_\_ Replace Culverts ( )
- \_\_\_\_\_ Other \_\_\_\_\_

Extent:

\_\_\_\_\_ Minor \_\_\_\_\_ Moderate \_\_\_\_\_ Severe

Reason for Recommendation: \_\_\_\_\_

Cause:

\_\_\_\_\_  
\_\_\_\_\_

**PHOTOS**

Film Numbers: \_\_\_\_\_

**SITE SKETCH**

## APPENDIX D

**Severity Scoring Worksheet**  
 Road/Stream Crossing Inventory  
 Cheboygan River/ Lower Black River Watershed

**Site I. D.** \_\_\_\_\_

| Factors Contributing to Severity        | Points   | Site Score |
|---|--|------------|
| ROAD SURFACE                            | Paved: 0 pt<br>Gravel: 3 pt<br>Sand and Gravel: 6 pt<br>Sand: 9 pt   |            |
| LENGTH OF APPROACHES                    | 0-40 ft: 1 pt<br>41-1000 ft (0.008-0.189 mi.): 3 pt<br>1001-2000 ft (0.19-0.379 mi.): 5 pt<br>> 2000 ft (>0.379 mi.): 7 pt |            |
| SLOPE OF APPROACHES                     | 0 %: 0 pt<br>1-5%: 3 pt<br>6-10 %: 6 pt<br>>10 %: 9 pt   |            |
| VEGETATIVE COVER OF SHOULDERS & DITCHES | Heavy: 1 pt<br>Partial: 3 pt<br>None: 5 pt   |            |
| WIDTH OF ROAD, SHOULDERS & DITCHES      | < 15 ft: 0 pt<br>16-20 ft: 1 pt<br>> 20 ft: 2 pt   |            |
| EMBANKMENT SLOPE                        | Bridges: 0 pt<br>>2:1 slope: 1 pt<br>1:5-2:1 slope: 3 pt<br>Vertical or 1;1 slope: 5pt                                     |            |
| STREAM DEPTH                            | 0-2 ft: 1 pt<br>>2 ft: 2 pt  |            |
| STREAM CURRENT                          | Slow: 1 pt<br>Moderate: 2 pt<br>Fast: 3 pt   |            |
| EXTENT OF EROSION                       | Minor: 1 pt<br>Moderate: 3 pt<br>Severe: 5 pt  |            |
| <b>TOTAL</b>                            | <b>0-15      Minor</b><br><b>16-29      Moderate</b><br><b>&gt; 30      Severe</b>   |            |

**Appendix E**  
**Agriculture Inventory Table**

| <b>CHEBOYGAN COUNTY</b>  |             |                          |             |                          |             |                           |             |                          |             |
|--------------------------|-------------|--------------------------|-------------|--------------------------|-------------|---------------------------|-------------|--------------------------|-------------|
| <b>MINOR SITES</b>       |             |                          |             |                          |             |                           |             |                          |             |
| <b>ALOHA TOWNSHIP</b>    |             | <b>BENTON TOWNSHIP</b>   |             | <b>GRANT TOWNSHIP</b>    |             | <b>INVERNESS TOWNSHIP</b> |             | <b>MUNRO TOWNSHIP</b>    |             |
| Site ID                  | Cost        | Site ID                  | Cost        | Site ID                  | Cost        | Site ID                   | Cost        | Site ID                  | Cost        |
| 34                       | \$ 1,500    | 2                        | \$ 500      | 32                       | \$ 1,500    | 46                        | \$ 1,500    | 103                      | \$ 1,000    |
|                          |             | 4                        | 200,000     | 37                       | 1,500       | 47                        | 2,000       | 104                      | 1,000       |
|                          |             | 6                        | 12,000      | 39                       | 1,500       | 48                        | 800         | 105                      | 1,000       |
|                          |             | 7                        | 12,000      | 41                       | 1,200       | 50                        | 1,500       | 106                      | 1,000       |
|                          |             | 8                        | 1,500       | 42                       | 1,500       | 51                        | 1,500       | 107                      | 1,000       |
|                          |             | 9                        | 250,000     | 44                       | 1,500       | 52                        | 1,500       | 108                      | 1,000       |
|                          |             | 11                       | 2,000       | 56                       | 1,500       | 54                        | 800         | 109                      | 1,000       |
|                          |             | 12                       | 20,000      | 57                       | 1,500       | 55                        | 6,000       | 110                      | 1,000       |
|                          |             | 14                       | 25,000      | 59                       | 1,500       | 58                        | 1,200       | 112                      | 1,000       |
|                          |             | 16                       | 1,200       | 60                       | 1,500       | 70                        | 25,000      | 114                      | 1,000       |
|                          |             | 19                       | 1,200       | 63                       | 1,500       | 72                        | 1,200       | 121                      | 1,000       |
|                          |             | 21                       | 1,200       | 65                       | 1,200       | 73                        | 1,000       | 122                      | 1,000       |
|                          |             | 25                       | 1,200       |                          |             | 75                        | 1,200       | 123                      | 1,000       |
|                          |             | 29                       | 10,000      |                          |             | 77                        | 1,000       | 124                      | 1,000       |
|                          |             |                          |             |                          |             | 78                        | 1,000       | 125                      | 1,000       |
|                          |             |                          |             |                          |             | 80                        | 1,000       | 126                      | 1,000       |
|                          |             |                          |             |                          |             | 81                        | 1,200       |                          |             |
|                          |             |                          |             |                          |             | 83                        | 1,200       |                          |             |
|                          |             |                          |             |                          |             | 84                        | 1,200       |                          |             |
|                          |             |                          |             |                          |             | 85                        | 1,200       |                          |             |
|                          |             |                          |             |                          |             | 86                        | 1,000       |                          |             |
|                          |             |                          |             |                          |             | 91                        | 1,200       |                          |             |
|                          |             |                          |             |                          |             | 93                        | 1,000       |                          |             |
|                          |             |                          |             |                          |             | 94                        | 1,000       |                          |             |
|                          |             |                          |             |                          |             | 95                        | 1,000       |                          |             |
|                          |             |                          |             |                          |             | 96                        | 1,000       |                          |             |
|                          |             |                          |             |                          |             | 97                        | 1,000       |                          |             |
|                          |             |                          |             |                          |             | 98                        | 1,000       |                          |             |
|                          |             |                          |             |                          |             | 99                        | 1,000       |                          |             |
|                          |             |                          |             |                          |             | 101                       | 1,000       |                          |             |
|                          |             |                          |             |                          |             | 102                       | 1,000       |                          |             |
|                          |             |                          |             |                          |             | 119                       | 1,000       |                          |             |
| <b>Total Minor Sites</b> | <b>Cost</b> | <b>Total Minor Sites</b> | <b>Cost</b> | <b>Total Minor Sites</b> | <b>Cost</b> | <b>Total Minor Sites</b>  | <b>Cost</b> | <b>Total Minor Sites</b> | <b>Cost</b> |
| 1                        | \$ 1,500    | 14                       | \$537,800   | 12                       | \$17,400    | 32                        | \$65,200    | 16                       | \$16,000    |

## Agriculture Inventory Table, Continued

| MODERATE SITES              |             |                             |             |                             |             |                             |             |                             |             |
|-----------------------------|-------------|-----------------------------|-------------|-----------------------------|-------------|-----------------------------|-------------|-----------------------------|-------------|
| ALOHA TOWNSHIP              |             | BENTON TOWNSHIP             |             | GRANT TOWNSHIP              |             | INVERNESS TOWNSHIP          |             | MUNRO TOWNSHIP              |             |
|                             |             | 1                           | \$20,000    | 31                          | \$ 15,000   | 45                          | \$ 6,000    | 111                         | \$15,000    |
|                             |             | 5                           | 50,000      | 33                          | 20,000      | 49                          | 16,000      | 113                         | 1,200       |
|                             |             | 10                          | 15,000      | 35                          | 25,000      | 53                          | 25,000      | 115                         | 12,000      |
|                             |             | 13                          | 20,000      | 36                          | 15,000      | 71                          | 23,000      | 116                         | 2,000       |
|                             |             | 15                          | 6,000       | 38                          | 14,000      | 74                          | 12,000      | 117                         | 12,000      |
|                             |             | 17                          | 6,000       | 40                          | 125,800     | 79                          | 12,000      | 118                         | 21,000      |
|                             |             | 20                          | 29,000      | 43                          | 12,000      | 87                          | 9,000       | 120                         | 12,000      |
|                             |             | 22                          | 1,000       | 62                          | 9,000       | 88                          | 12,000      | 127                         | 12,000      |
|                             |             | 23                          | 1,000       | 64                          | 15,000      | 89                          | 8,000       | 129                         | 12,000      |
|                             |             | 24                          | 1,000       | 66                          | 1,500       | 90                          | 20,000      |                             |             |
|                             |             | 26                          | 4,000       | 67                          | 12,000      | 92                          | 20,000      |                             |             |
|                             |             | 27                          | 8,000       | 68                          | 15,000      | 100                         | 14,000      |                             |             |
|                             |             | 28                          | 4,000       | 69                          | 8,000       |                             |             |                             |             |
| <b>Total Moderate Sites</b> | <b>Cost</b> |
| 0                           | \$0         | 13                          | \$165,000   | 13                          | \$287,300   | 12                          | \$177,000   | 9                           | \$99,200    |
| SEVERE SITES                |             |                             |             |                             |             |                             |             |                             |             |
| ALOHA TOWNSHIP              |             | BENTON TOWNSHIP             |             | GRANT TOWNSHIP              |             | INVERNESS TOWNSHIP          |             | MUNRO TOWNSHIP              |             |
|                             |             | 3                           | \$350,000   | 30                          | \$180,000   | 76                          | 90,000      | 128                         | \$350,000   |
|                             |             | 18                          | 120,000     | 61                          | 170,000     | 82                          | 23,000      |                             |             |
| <b>Total Severe Sites</b>   | <b>Cost</b> |
| 0                           | \$0         | 2                           | \$470,000   | 2                           | \$350,000   | 2                           | \$113,000   | 1                           | \$350,000   |

## EMMET COUNTY

## MINOR SITES

| BLISS TOWNSHIP           |             | CARP LAKE TOWNSHIP       |             | CENTER TOWNSHIP          |             | MAPLE RIVER TOWNSHIP     |             | MC KINLEY TOWNSHIP       |             |
|--------------------------|-------------|--------------------------|-------------|--------------------------|-------------|--------------------------|-------------|--------------------------|-------------|
| Site ID                  | Cost        |
| 142                      | \$1,000     | 161                      | \$1,000     | 151                      | \$1,000     | 157                      | \$1,000     | 131                      | \$1,000     |
| 143                      | 1,000       | 164                      | 1,000       | 152                      | 1,000       | 158                      | 1,000       | 132                      | 1,000       |
| 144                      | 1,000       | 165                      | 1,000       | 153                      | 1,000       | 159                      | 1,000       | 133                      | 1,000       |
| 145                      | 1,000       | 166                      | 1,000       | 154                      | 1,000       | 160                      | 1,000       | 134                      | 1,000       |
| 146                      | 1,000       | 167                      | 1,000       | 156                      | 1,000       |                          |             | 135                      | 1,000       |
| 149                      | 1,000       | 168                      | 1,000       |                          |             |                          |             | 136                      | 1,000       |
| 150                      | 1,000       | 169                      | 1,000       |                          |             |                          |             | 137                      | 1,000       |
|                          |             | 172                      | 1,000       |                          |             |                          |             | 138                      | 1,000       |
|                          |             | 174                      | 1,000       |                          |             |                          |             | 139                      | 1,000       |
|                          |             | 175                      | 1,000       |                          |             |                          |             | 141                      | 1,000       |
| <b>Total Minor Sites</b> | <b>Cost</b> |
| 7                        | \$7,000     | 10                       | \$10,000    | 5                        | \$5,000     | 4                        | \$4,000     | 10                       | \$10,000    |

**Agriculture Inventory Table, Continued**

| <b>MODERATE SITES</b>                        |             |                             |             |                             |             |                             |             |                             |             |
|--|-------------|-----------------------------|-------------|-----------------------------|-------------|-----------------------------|-------------|-----------------------------|-------------|
| <b>BLISS TOWNSHIP</b>                        |             | <b>CARP LAKE TOWNSHIP</b>   |             | <b>CENTER TOWNSHIP</b>      |             | <b>MAPLE RIVER TOWNSHIP</b> |             | <b>MC KINLEY TOWNSHIP</b>   |             |
| 147  | \$12,000    | 162                         | \$12,000    | 155                         | \$ 12,000   |                             |             | 130                         | \$12,000    |
| 148  | 12,000      | 163                         | 12,000      |                             |             |                             |             | 140                         | 12,000      |
|  |             | 170                         | 12,000      |                             |             |                             |             |                             |             |
|  |             | 171                         | 12,000      |                             |             |                             |             |                             |             |
|  |             | 173                         | 12,000      |                             |             |                             |             |                             |             |
|  |             | 176                         | 12,000      |                             |             |                             |             |                             |             |
|  |             | 177                         | 12,000      |                             |             |                             |             |                             |             |
| <b>Total Moderate Sites</b>                  | <b>Cost</b> | <b>Total Moderate Sites</b> | <b>Cost</b> | <b>Total Moderate Sites</b> | <b>Cost</b> | <b>Total Moderate Sites</b> | <b>Cost</b> | <b>Total Moderate Sites</b> | <b>Cost</b> |
| 2  | \$24,000    |                             |             | 1                           | \$12,000    | 0                           | \$0         | 2                           | \$24,000    |
| <b>NO SEVERE SITES FOUND IN EMMET COUNTY</b> |             |                             |             |                             |             |                             |             |                             |             |