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

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.

Table 8: SUMMARY OF STREAMBANK INVENTORY

Site ID	Township	Stream	Site Score
Minor Sites			
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
Total Minor Sites	**8**		
Moderate Sites			
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
Total Moderate Sites	**10**		
Severe Sites			
S006	Inverness	Cheboygan River	38
Total Severe Sites	**1**		
Watershed Total	**19**		

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($7,9500);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

Table 9: Road/Stream Crossing Inventory Summary, Continued			
Center Township, Emmet County		**Total**	
SEVERE	1	161C($8,480)	$8,480
TOTAL	1		$8,480
Maple River Township, Emmet County		**Total**	
MODERATE	1	160MR	$0
TOTAL	1		$0
McKinley Township, Emmet County		**Total**	
MODERATE	16	150MK; 151MK; 152MK; 153MK; 154MK($18,550); 155MK; 156MK($17,225); 163MK; 164MK($4,240); 165MK($3,445); 166MK($15900); 168MK($6,943); 169MK($7,950); 170MK($5,618); 172MK($7,950); 173MK($7,950); 174MK($7,950);	$103,721
SEVERE	2	167MK($10,000); 171MK($21,200	$31,200
TOTAL	18		$134,921
WATERSHED TOTALS			
MINOR	19	Cheboygan County	$91,745
	0	Emmet County	$0
	19	Total Watershed	$91,745
MODERATE	124	Cheboygan County	$462,780
	35	Emmet County	$162,139
	159	Total Watershed	$624,919
SEVERE	12	Cheboygan County	$91,745
	4	Emmet County	$52,930
	16	Total Watershed	$144,675
TOTAL SITES	194		$796,094

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.

Table 10: Agricultural Sites by Sub-Watershed								
Sub-Watershed	**Total Sites**	**Minor**		**Moderate**		**Severe**		**Total Cost**
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.

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

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:**

TABLE 12: CITY OF CHEBOYGAN STORM SEWER SUMMARY	
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/ 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/ 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/ Industrial	90	11,084,000	42.5	120,224
16	15	36	Commercial/ 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/ Industrial	90	5,868,000	22.5	63,648
21-22	18	6, 12	Commercial/ 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/ Industrial	90	1,434,400	55	15,558
26-29	.3	8	Commercial/ Industrial	90	195,600	.8	212
30	12	48	Commercial/ Residential	50	4,694,400	18	5,092
31	10	24	Residential	30	2,282,000	9	24,752
32	3	18	Commercial/ Industrial	90	1,956,000	75	4,243
33	2	18	Commercial/ 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/ 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/ 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.

Table 14: Watershed Land Use

Land Use Category	Acres	Percent of Watershed
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%
Watershed Total	**94131.11**	**100%**

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.

TABLE 16: SEPTIC SYSTEM INVENTORY			
TOWNSHIP	**TOTALSEPTIC SYSTEMS**	**INSTALLED 1970-2003**	**INSTALLED BEFORE 1970**
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.