Sault Ste. Marie Area Watershed

Management Plan

October 10, 2007

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

Table of Contents

Acknowledgements

The Partnership

The concept of watershed management doesn't just end with managing the land. Management must also incorporate the people who have a *stake* in protecting water quality. The Sault Project *stakeholders* included a steering committee consisting of professionals from City government and administration, Lake Superior State University, Regional Planning, Sault Area and Soo Township Schools, Chippewa-Ottawa (Native American Tribes) Resource Authority, Chippewa County, as well as local citizens from the watershed project area. Steering Committee members volunteered water quality concerns and provided guidance into ways to address those concerns. The design of aquatic resource protection activities outlined in this plan were directed by input from these community representatives.

Chemical and biological assessment of surface waters was completed by Lake Superior State University faculty and students. City (Sault Ste. Marie) officials provided planning information, maps, and historical information as well as insight into residents' desired uses for the watershed. Michigan Department of Environmental Quality provided administrative guidance as well as information regarding local contamination sites. The Chippewa County Health Department was a wealth of information about septic system conditions as well as contamination sites throughout the city. Little Traverse Conservancy helped with technical information regarding land protection. Local citizens provided historical information as well as representation of public sentiment about water quality issues and improvement ideas.

The United States Environmental Protection Agency provided funding for this project through Section 604(b) of the Clean Water Act.

Project Partners

Steering Committee	Affiliation	Technical Advisor	Affiliation
Verna Lawrence	City Commission	Barb Keller	LSSU
Marylin Burton	City Commission	Dave Szlag	LSSU
Jeff Hagan	EUP Planning	Greg Zimmerman	LSSU
Gene Wicks	Sault High School	Ashley Moerke	LSSU
Diane & Carl Meyers	Sierra Club	Roger Greil	LSSU
Mike Ripley	CORA	Anthony Boseley	Chippewa Co.
Hank Lotoszinski	CEMCD	Dave Strickland	City Engineer
Terry Browning	Soo Township	Barb Lisiecki	City Planning
Rich Serfass	CEMCD	James Ellis	USGS
Anne Marie Askwith	Sault Resident	Dirk Heckman	Chippewa Co. Road Com.
Katie Bosket	Sault Resident	Michigan Department of Environmental Quality	
Pat Carr	CEMCD	Jim Lucas	MSU Extension
Dusty King	CEMCD	Dan Tadgerson	Sault Tribe/Chippewa

Technical advisors are a compilation of citizens and environmental professionals knowledgeable about the historical degradation of the area's natural resources. The Sault Ste. Marie Area Watershed Management Project is a partnership of local citizens and environmental professionals concerned over water quality in the Sault Ste. Marie area. This resulting watershed management plan is an assessment of current conditions and characteristics of water quality in the creeks and groundwater within the watershed of the city of Sault Ste. Marie. The assessment also takes into account historical and social perspectives that have helped shape water quality conditions.

List of Tables

List of Figures

List of Maps

List of Maps (Continued)

Abbreviations and Acronyms

CEMCD	Chippewa/East Mackinac Conservation District
City	City of Sault Ste. Marie (Municipal Department)
CCGOV	Chippewa County Government
SPSC	Sault Project Steering Committee
STCI	Sault Ste. Marie Tribe of Chippewa Indians
Little T	Little Traverse Conservancy
CCHD	Chippewa County Health Department
BPAC	Binational Public Advisory Council
LIAA	Land Information Access Association
Press	Sault Evening News, Voice, etc.
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
LSSU	Lake Superior State University
EUPRPDC	Eastern Upper Peninsula Regional Planning and Development Commission
NRCS	USDA Natural Resources Conservation Service
SAPS	Sault Area Public Schools
MSUE	Michigan State University Extension
CCRC	Chippewa Co. Road Commission
USGS	United States Geologic Survey
CCBA	Chippewa County Building Authority
CCR	Chippewa County Recycling
SOO	Soo Township Officials
CCO	Chippewa County Officials
MDOT	Michigan Department of Transportation
EPA	Environmental Protection Agency
ITC	Inter-Tribal Council
IJC	International Joint Commission
SCF	Sault Community Foundation
CCHD	Chippewa County Health Department
MSUE	Michigan State University Extension
MNFI	Michigan Natural Features Inventory
COC	Sault Ste. Marie Chamber of Commerce

Introduction

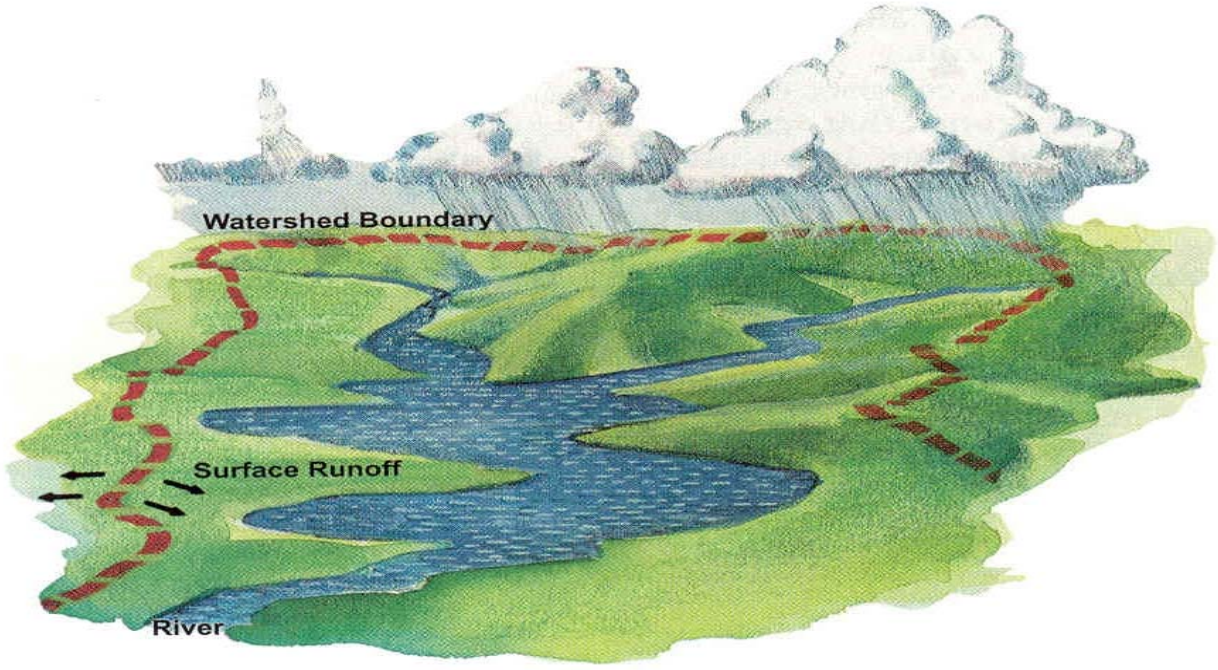
The city of Sault Ste. Marie has always been grounded in natural resources. Founded through the early fur trade, roots developed by the lumbering era, and now sustained in part by the shipping of minerals and other natural resource commodities through its locks, the Sault owes its infrastructure to the utilization of the area's natural resources. Unfortunately, this dependence upon natural resources has shown signs of degradation of our most important natural resource--clean water.

The Sault Ste. Marie Area Watershed Management Plan is a guide to help the Sault Ste. Marie community and other stakeholder, including local units of government, nonprofit organizations, and local residents protect water quality and aquatic resources in the Sault area watershed. Furthermore, similar communities facing similar concerns can use the guide to protect their aquatic resources.

Protecting Water Quality by Managing Watersheds

Imagine a typical landscape with hills, valleys, rivers, wetlands, as well as development like houses, parking lots, etc. that you find all across America. The characteristics of our water quality begin with our first experience with water as rainfall and/or snow falling to the landscape. Right away, that precipitation either percolates into the soil to recharge groundwater, or it evaporates, or it takes the path of least resistance downhill as runoff and collects at common low points, usually lakes, ponds, rivers, and wetlands. Each landscape can be delineated into watersheds based on the low point which creates the water body with the runoff water collected from all the land surrounding it. The water body is defined by these common low points. The watershed is all the land that drains to a common water body.

Figure I-1 Watershed



A watershed is an area of land that drains to a common body of water.

Precipitation carries pollutants[1] through the watershed to the water bodies. Therefore, water quality in lakes, streams, and underground is dependent upon pollution characteristics of the surrounding watershed from where these water bodies collect their supply. This is the rationale for managing water quality on a watershed scale. Almost every activity on the land has the potential to affect water quality. Watershed management is an attempt to eliminate sources of pollution on land by empowering local partners within the watershed regardless of private property boundaries or political boundaries to properly manage land use in order to protect the water quality in our lakes, ponds, rivers, and underground.

Almost every activity on the land has the potential to affect water quality.

The Partnership

The concept of watershed management doesn't just end with managing the land. Management must also incorporate the people who have a *stake* in protecting water quality. The Sault Project *stakeholders* included a steering committee consisting of professionals from City government and administration, Lake Superior State University, Regional Planning, Sault Area and Soo Township Schools, Chippewa-Ottawa (Native American Tribes) Resource Authority, Chippewa County, as well as local citizens from the watershed project area. Steering Committee members volunteered water quality concerns and provided guidance into ways to address those concerns. The design of aquatic resource protection activities outlined in this plan were directed by input from these community representatives.

Chemical and biological assessments of surface waters were completed by Lake Superior State University faculty and students. City (Sault Ste. Marie) officials provided planning information, maps, and historical information as well as insight into residents' desired uses for the watershed. Michigan Department of Environmental Quality provided administrative guidance as well as information regarding local contamination sites. The Chippewa County Health Department was a wealth of information about septic system conditions as well as contamination sites throughout the city. Little Traverse Conservancy helped with technical information regarding land protection. Local citizens provided historical information as well as representation of public sentiment about water quality issues and improvement ideas.

The United States Environmental Protection Agency provided funding for this project through Section 604 (b) of the Clean Water Act.

Technical advisors included a compilation of citizens and environmental professionals knowledgeable about the historical degradation of the area's natural resources,

The Sault Ste. Marie Area Watershed Management Project is a partnership of local citizens and environmental professionals concerned over water quality in the Sault Ste. Marie area. This resulting watershed management plan is an assessment of current conditions and characteristics of water quality in the creeks and groundwater within the watershed of the city of Sault Ste. Marie. The assessment also takes into account historical and social perspectives that have helped shape water quality conditions.

"The Gathering Place"

Sault Ste. Marie is the oldest city in Michigan, and the third-oldest city in the United States. It's history has been shaped by the wealth of adjacent aquatic resources. Over 2,000 years ago, Native Americans began to gather here for the wealth of fish and fur found along the rushing

[1] Non-point source pollution is water pollution caused by stromwater runoff, air deposition, groundwater infiltration and altered hydraulic flow. Sediment, fertilizer, bacteria, toxic chemicals, oils and other byproducts of poor land use degrade water resources. Roads, driveways, parking lots, farms, lawns and septic systems are common non-point sources. All are widespread throughout the watershed making non-point source pollution a cumulative problem that cannot be solved on a site-by-site basis (Harrison 2002).

waters of the wide, turbulent river that linked the Great Lakes of Superior and Huron. They called the area "Bahweting," or "The Gathering Place." The river below the rapids provided an abundance of fish for native peoples, as well as for several tribes from throughout the region, which migrated here during the peak fishing season. To this day, it remains a world-class spot for sport fishing.

Unfortunately, the water quality that attracted settlement has been degraded by the forces required to sustain that development. Hundreds of years ago the treacherous rapids and cascades that fell over 20 feet from the level of Lake Superior to the level of the lower lakes prohibited boat traffic and necessitated an overland portage (*now Portage Avenue)* from one lake to the other. With the coming of the industrial age and the discovery of copper and iron ore in western Lake Superior, it was necessary to construct the first "Lock" in the St. Marys in 1837 to enable ships to pass between Lake Superior and Lake Huron to transport ore to the industrial centers to the south. This historical time passage evolved the significance of the Sault from a "gathering place" based on natural features to a gathering place based on industrial importance.

Water quality attracted settlement and has been degraded by the forces required to sustain it.

The focus on sustaining this industrial importance has impacted the ecological landscape and the quality of aquatic resources in the watershed and St. Mary's River. Several developments have occupied the Sault area watershed and degraded the environmental quality and continue to pose a threat to the community's water quality.

Nonetheless, an appreciation for the area's natural resources is evident. Stakeholders are becoming aware of the value of *greenspace* in the city limits. City officials have developed plans for additional recreation opportunities centered around the area's natural features. Environmental professionals have teamed up to put natural resource protection at the forefront of work plans.

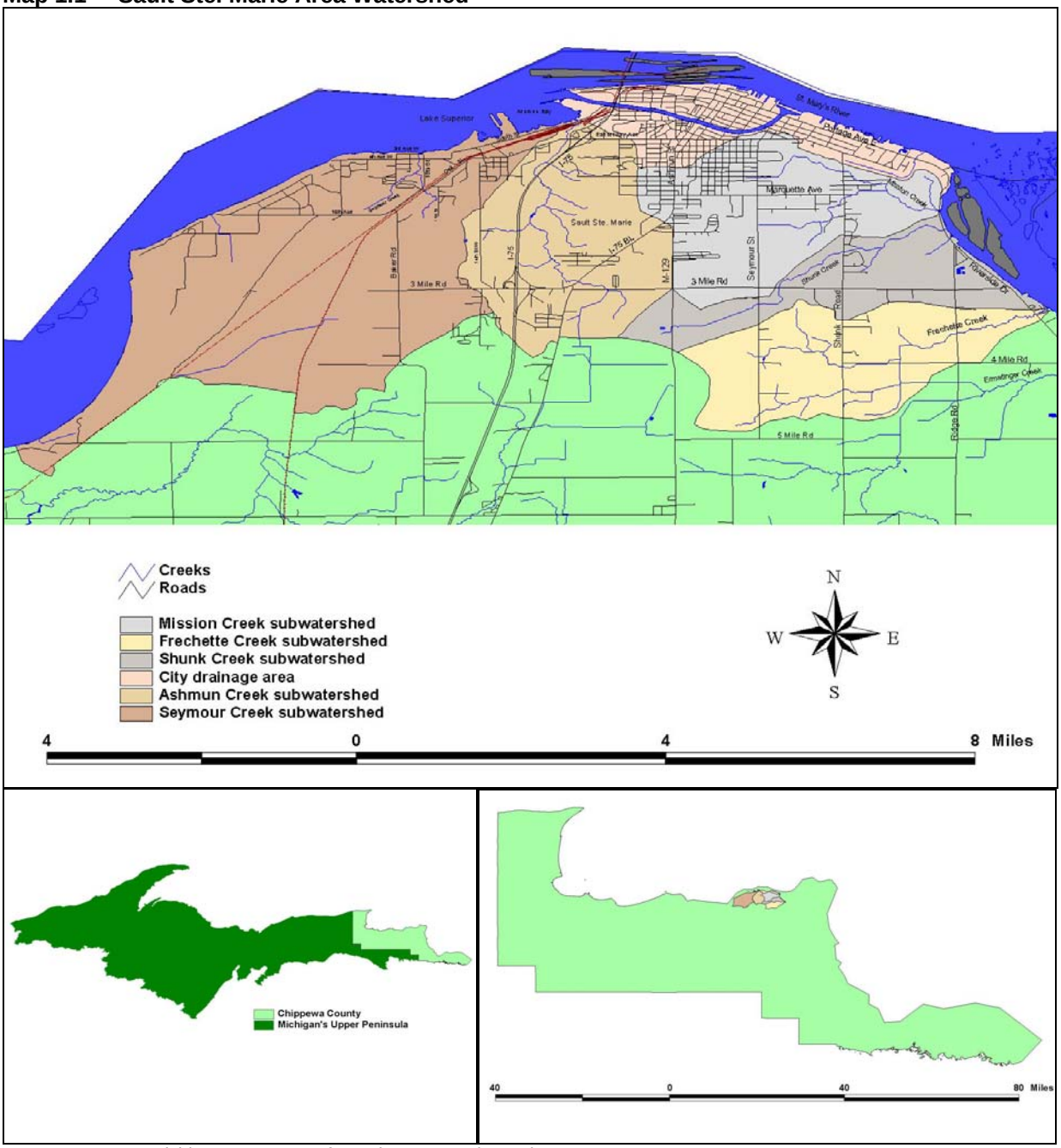
These examples of community participation are the impetus for the Sault Ste. Marie Area Watershed Management Project.

Chapter 1 Description of Watershed Characteristics

1.1 The Sault Ste. Marie Watershed

The Sault Ste. Marie Area Watershed Project (tracking code # 2004-0124) is located in northeastern Chippewa County in Michigan's Eastern Upper Peninsula. The watershed includes Frechette Creek, Seymour Creek, Ashmun Creek, Shunk Creek, and Mission Creek along with several city and county drains suspected of contributing non-point source pollution into the St. Mary's River.

Map 1.1 Sault Ste. Marie Area Watershed



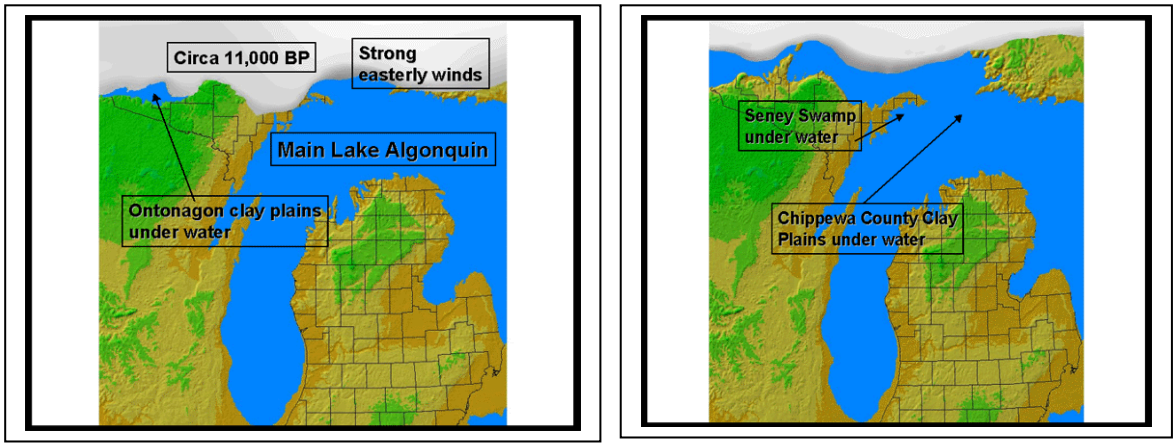
Source: MDNR, Michigan Resource Information System (MIRIS)
Adapted by the LCWC

1.2 Landscape Characteristics

Glacial History

The current landscape of the Sault Area watershed was influenced in part by glacial activity[1] roughly 11,000 years ago, when glacial Lake Algonquin inundated most of what is now Michigan's eastern and southern regions of the upper peninsula as well as the northern lower peninsula. Due to the sheer weight of the ice cap, these areas were isostatically depressed, and were lower than the outlets of the lake, what is now Chicago and Port Huron.

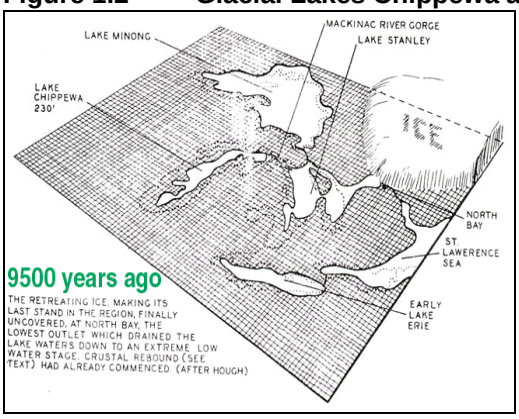
Figure 1.1 Glacial Lake Algonquin

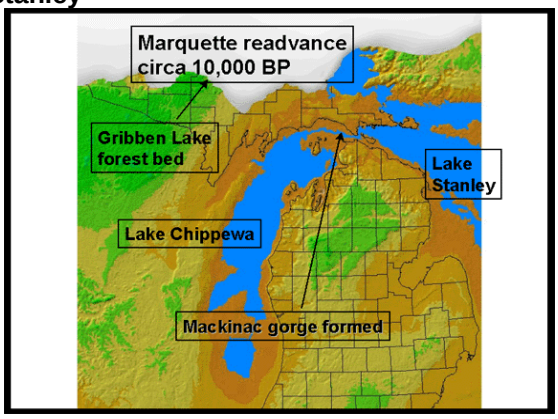


Glacial Lakes Chippewa and Stanley

The formation of Lake Chippewa (Michigan) and Stanley (Huron) followed Algonquin as the North Bay outlet in Canada was exposed (as the ice withdrew from it). This very low, isostatically-depressed outlet allowed the waters of glacial Lake Algonquin to drain rapidly out to the east, lowering the water levels over 300 feet in what is now the Lake Michigan-Huron basin. The "plug was pulled" about 10,000 years ago.

Figure 1.2 Glacial Lakes Chippewa and Stanley



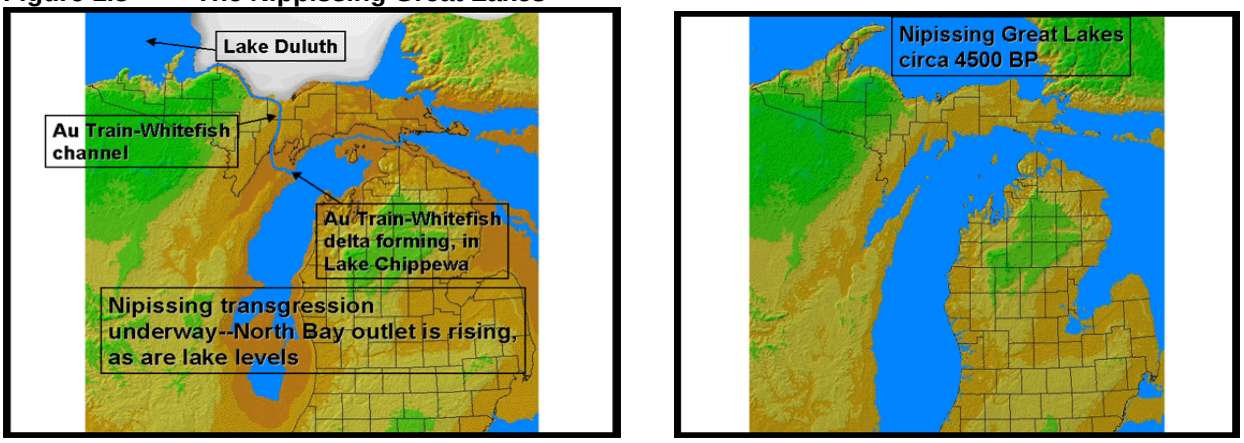


[1] Glacial narrative and pictures courtesy of http://www.geo.msu.edu/geo333/glaciallake_algonq.html

The Nippissing Great Lakes

With the glaciers gone from the region and glacial Lake Algonquin down to the *Chippewa-Stanley* level, the North outlet rose, due to isostatic rebound. Lake levels also rose--a period in time referred to as the *Nipissing Transgression*. Eventually, the lakes ascended to a level that was a few meters higher than current lake levels, and cut a conspicuous notch (beach ridge) into the landscape to mark this high water stand. The shoreline of this watermark can still be seen as the ridge that runs through Sault Ste. Marie and parallels the St. Mary's River (Drzyzga et.al 2002).

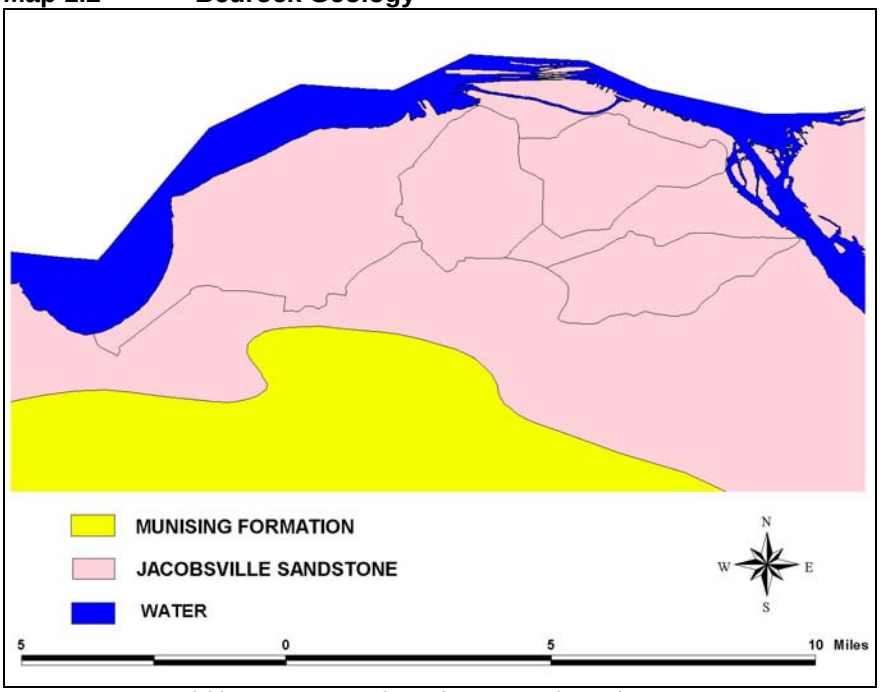
Figure 1.3 The Nippissing Great Lakes



Physiography

Glacial activity left a mantle of unconsolidated material approximately 10 to 12,000 years ago. These deposits vary from a few feet in thickness in the area near the rapids to over 200 feet at the far eastern end of the watershed (3 Mile Road/Riverside Drive intersection). These deposits are primarily clay, dominated by fine and silty-sandy loams and clay loams. These near-surface deposits all are underlain with a clay substratum. This glacial material sits on top of bedrock of the Cambrian era typically known as "red rock or sandstone".

Map 1.2 Bedrock Geology

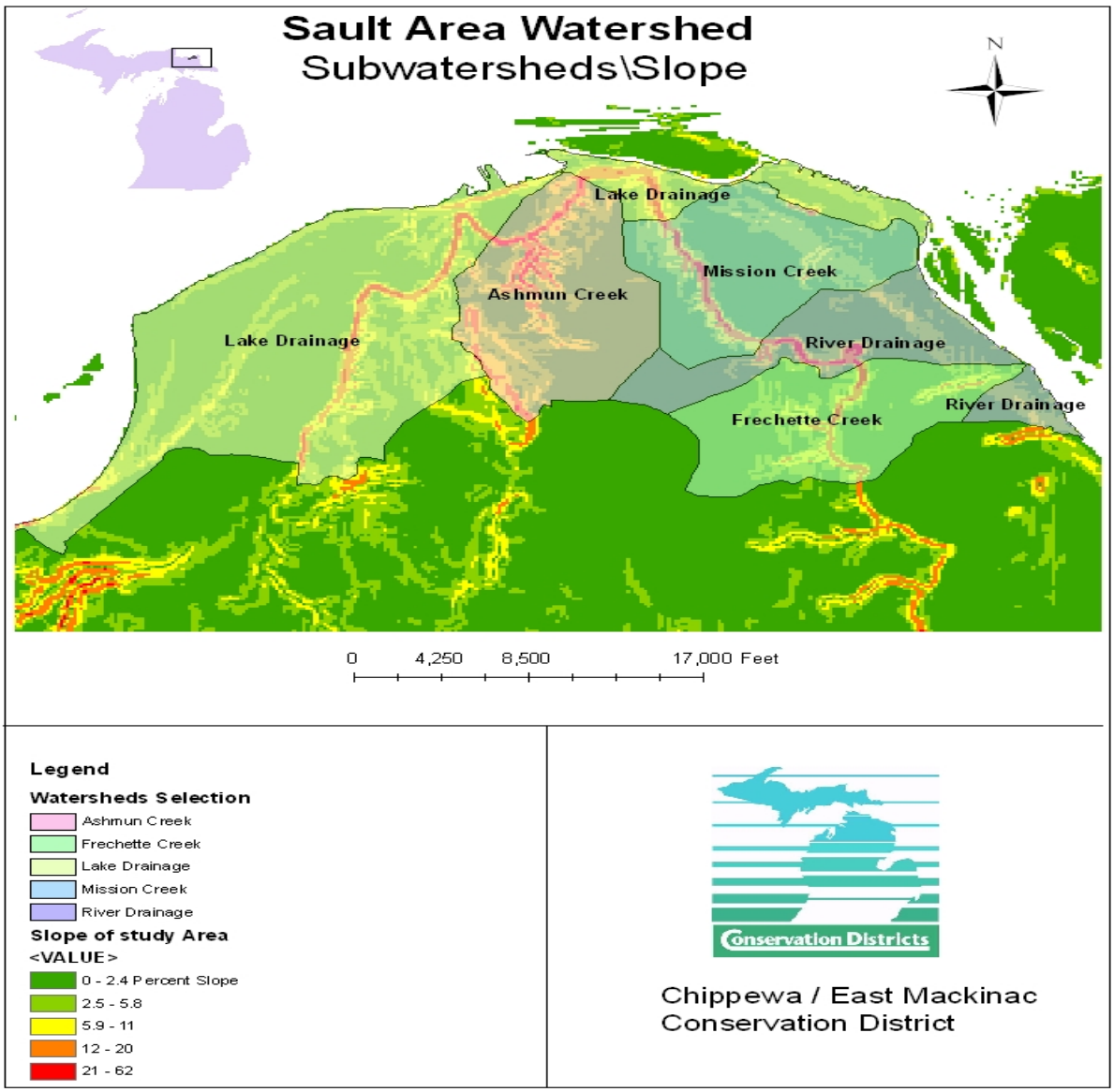


Source: MDNR, Michigan Resource Information System (MIRIS)

Topography

Surface characteristics of the watershed are characterized by several features, including headwater beginnings atop what is considered the Rudyard Clay Lake Plain. This area exhibits a generally flat to gently rolling landscape. Unfortunately, a few inches of elevation change, typical during development, can greatly alter drainage conditions (USGS 2005). The clay lake plain descends to the coastal lowlands where most of the watershed is located. This elevation change is roughly triangular in shape, with its southerly base located between 20th street and Seymour along 3 mile Road. To the north and into the heart of the City, the ridge narrows to a ½ mile point between Ashmun Street and the freeway just north of M-134. This upland plateau is approximately 100 feet higher than the City's lowlands. The highest elevation in the city is at Northern Sand and Gravel on 3 Mile Road. Other examples of the high plateau include Lake Superior State University's hill area at 700 feet, and the city airport at 722 feet on the northeast side of the runway. The lowlands of the city consistently lay at approximately 615 above sea level (USGS 2005).

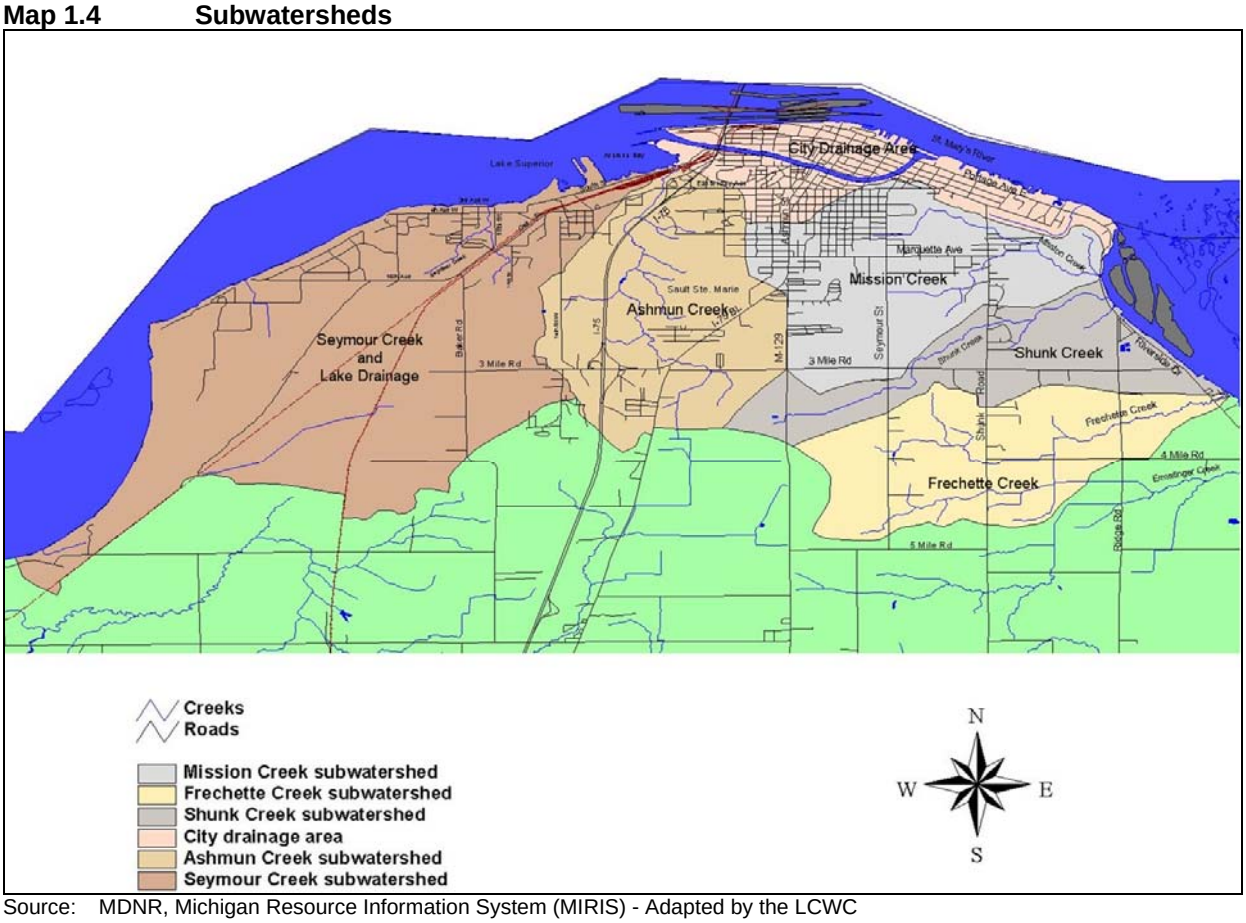
Map 1.3 Topography



Hydrology

Five streams course through the Sault area watershed and act as conduits for land-based pollutants from the city and surrounding landscape. They all originate from a geographic center of the watershed and empty into the St. Mary's River in and around the Sault city limits. They include Frechette Creek, Seymour Creek, Ashmun Creek, Mission Creek, and the intermittent Shunk Creek (River Drainage). The remaining acreage lacks a delineated drainage pattern except for the numerous storm drains and ditches and for mapping purposes, will be considered *Lake drainage*.

Map 1.4 Subwatersheds



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

Table 1.1 Watershed Acreage

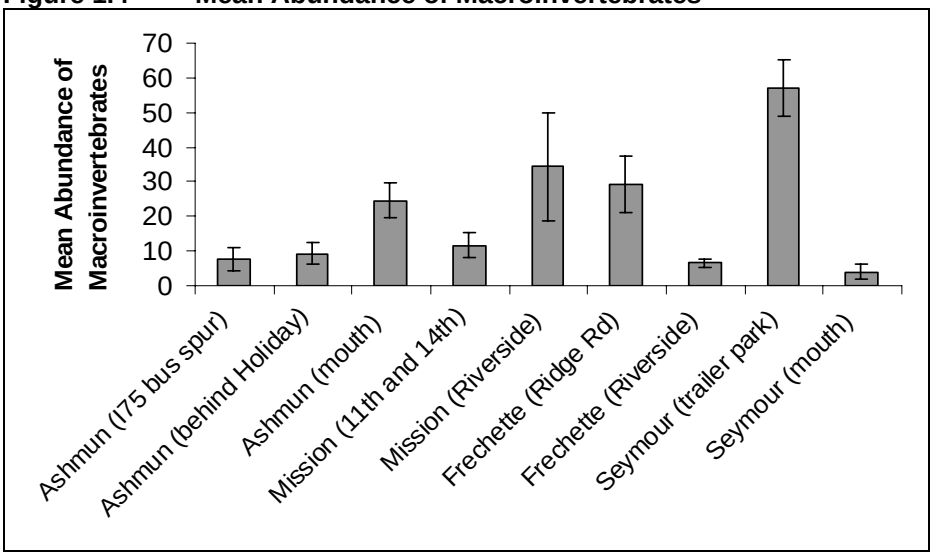
Subwatershed	Watershed Area (acres)
Ashmun Creek	2,558
Mission Creek	2,306
Seymour Creek and drainage area	877
Frechette Creek	2,149
Shunk Creek	1,517
Lake Drainage	5,221
Total Watershed Acreage	14,628

Several inherent characteristics of these creeks help illustrate local water quality. The creeks are turbid most of the year, flowing through mainly lacustrine clay soils that dominate the regional landscape. Since the clays are generally impervious, surface runoff reaches the creeks quickly and takes with it suspended clay particles. Base flow is supplied primarily by storm runoff (MDEQ 2005). Most of the headwater stream segments are intermittent during dry summer conditions due to the lack of groundwater input. The creeks (except for Shunk Creek, which had little to no flow throughout the planning project) average a discharge of 0.12 m^3 per second, and swell significantly during spring snowmelt and significant rain

events. In fact, signs of periodic high flows are evident with trash and woody debris interlaced among the riparian corridors. Michigan Department of Environmental Quality (MDEQ) survey of Ashmun Creek (2005) substantiated these indicators, indicating that Ashmun Creek exhibited reduced metric scores for flow stability and flashiness (2005). Lake Superior State University's (LSSU) assessment of area creeks flow characteristics were inconclusive due to infrequent rain events during the period window of data monitoring.

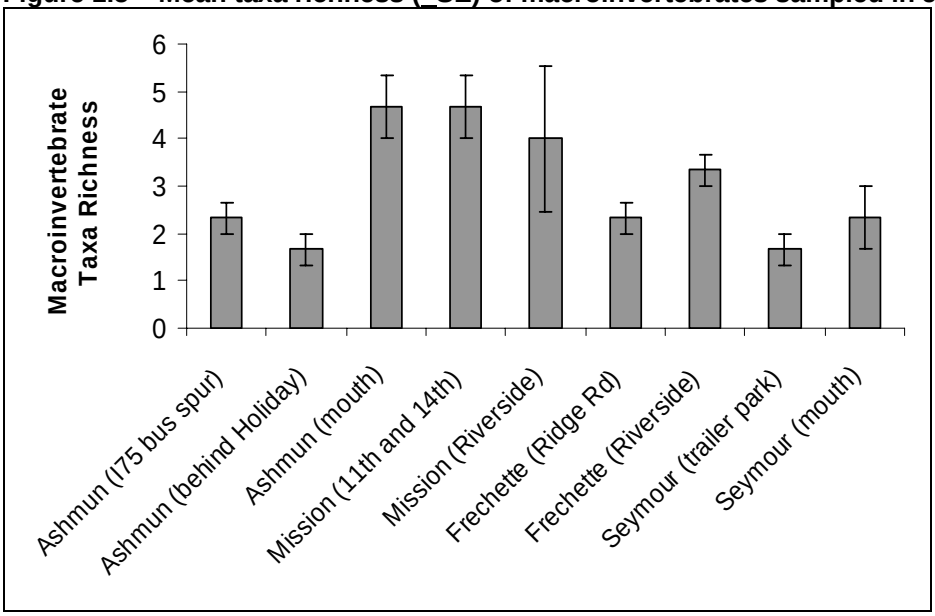
LSSU surveyed both macroinvertebrate and fish communities in order to characterize biotic life. Macroinvertebrates were sampled using a Hess sampler (n=3) at each site in July 2005. Macroinvertebrate communities at all four sites were dominated (>99%) by pollution-tolerant invertebrates, including Isopoda, Amphipoda, Chironomidae, and Corixidae. Only two sites, Seymour and Mission Creek, had any intolerant invertebrates (e.g. Ephemeroptera), but it was limited to 1 or 2 individuals.

Figure 1.4 Mean Abundance of Macroinvertebrates



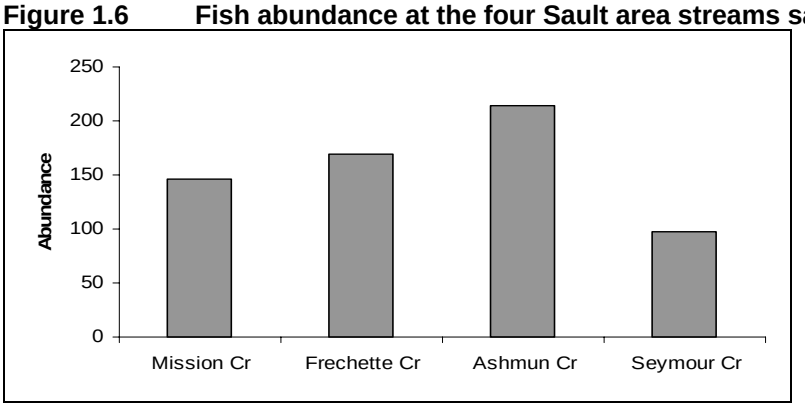
Mean abundance (±SE) of macroinvertebrates sampled in July 2005 (n=3).

Figure 1.5 Mean taxa richness (±SE) of macroinvertebrates sampled in July 2005 (n=3).



Fish at each site were sampled in July 2005 by triple-pass backpack electrofishing a 50-m block-netted reach. Fish communities at all four sites were dominated (>80%) by pollution-tolerant species, including White Suckers (Catostomus Commersoni), Creek Chubs (Semotilus atromaculatus), and Bluntnose Minnows (Pimephales notatus).

Figure 1.6 Fish abundance at the four Sault area streams sampled in July 2005.



Water Quality

In summer 2005, the four low-order streams in the Sault Sainte Marie area were surveyed for water quality, macroinvertebrates, and fish in collaboration with Lake Superior State University in order to develop a baseline characterization of water chemistry and biota of each creek. More detailed chemical analysis was performed during the fall of 2005 and spring of 2006 for additional parameters (see chapter 5 for summary report and appendix).

Water quality measurements were sampled in July 2005 using a Hydrolab. Stowaway temperature dataloggers were also employed to record hourly temperatures at each site.

Figure 1.7 Dissolved oxygen concentrations (mg/L) at the 4 streams sampled in the Sault Ste. Marie area in July 2005.

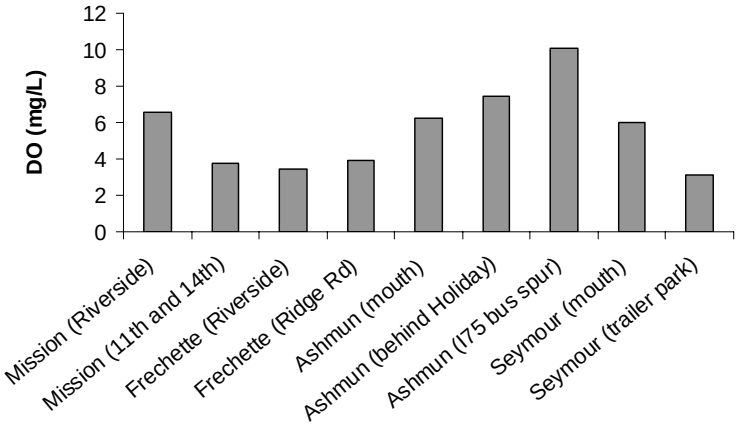


Figure 1.8 **pH levels at the 4 streams sampled in the Sault Sainte Marie area in July 2005.**

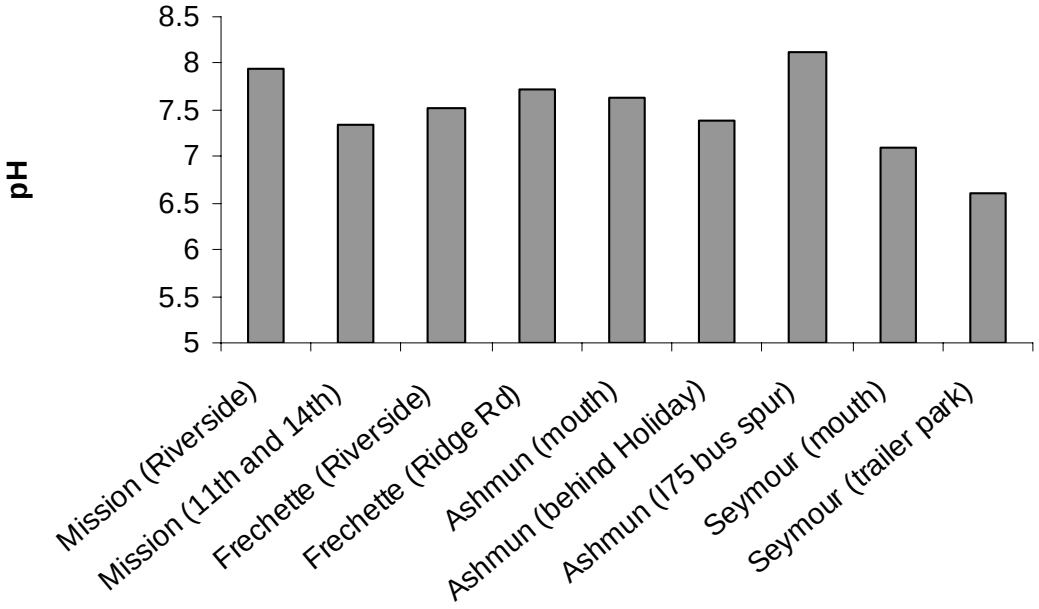
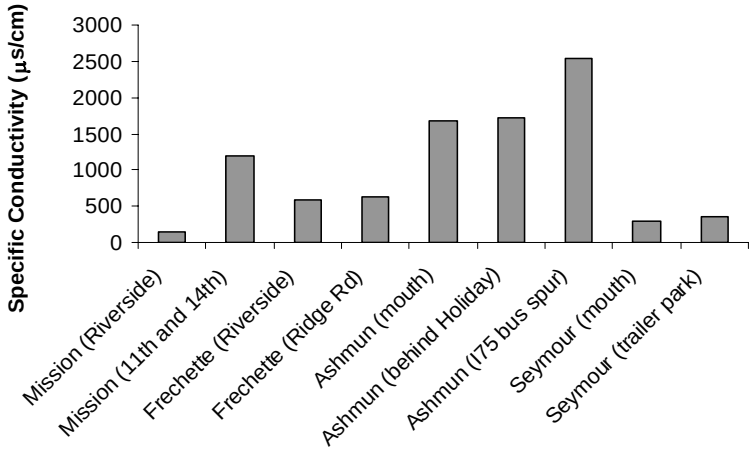


Figure 1.9 **Specific conductivity (μS/cm) at the 4 streams sampled in the Sault Ste. Marie area in July 2005.**



Water Temperature

Water temperature affects countless other components of water quality, including saturation constants of dissolved gases in water, metabolic rates of organisms, and a vast array of other factors that directly or indirectly affect life aquatic life. Since very little of the base flow of Sault area creeks comes from groundwater, the greatest source of heat in these waters is solar radiation. All creeks experience a daily temperature flux. As the following graphs illustrate, Sault area creeks also experience this flux, with variations up to at least a 8° change recording during August and September 2005. According to Hauer and Hill, range in daily temperatures of more than 5° is common (1996).

Figure 1.10 Hourly temperatures of Ashmun Creek from August-September 2005.

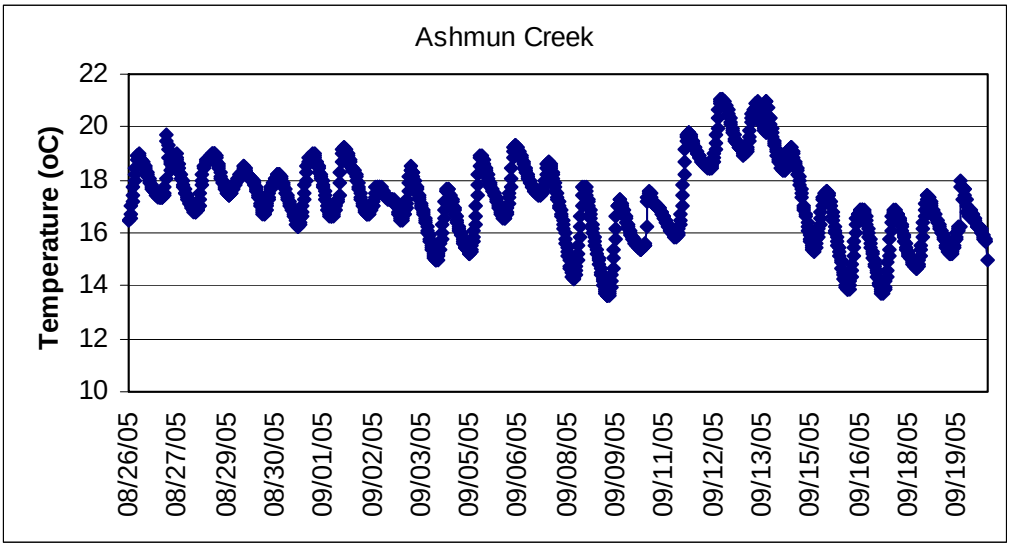


Figure 1.11 Hourly temperatures of Frechette Creek from August-September 2005.

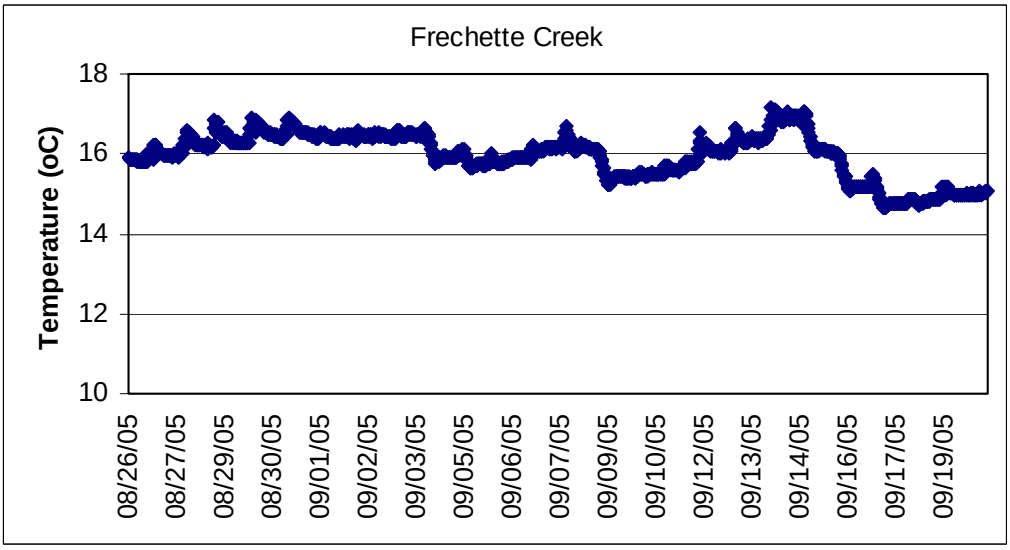


Figure 1.12 Hourly temperatures of Mission Creek from August-September 2005.

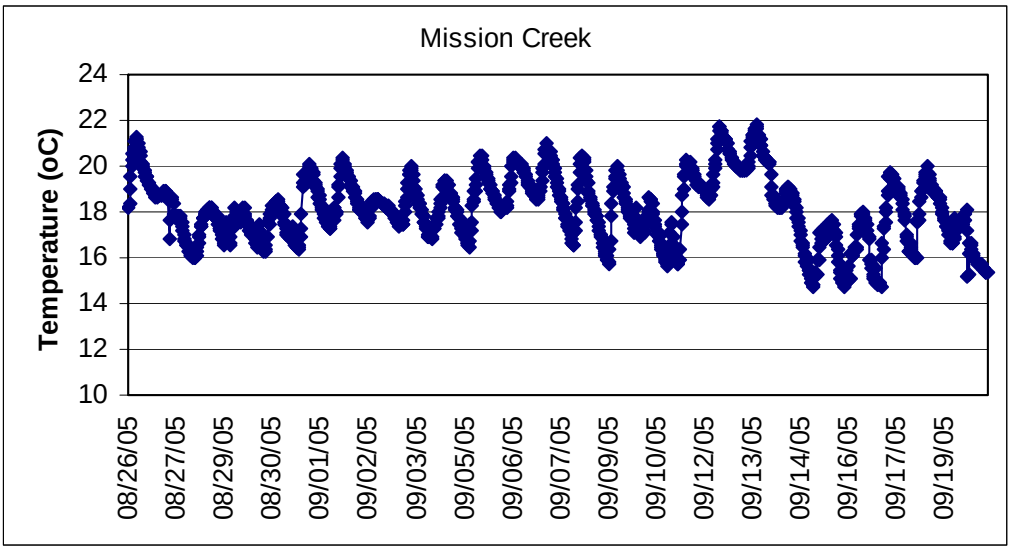
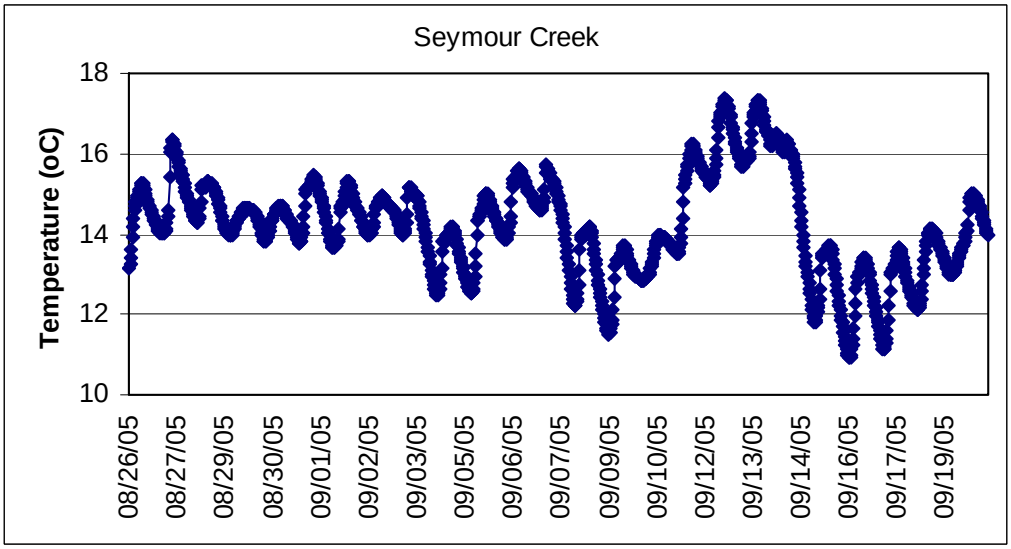


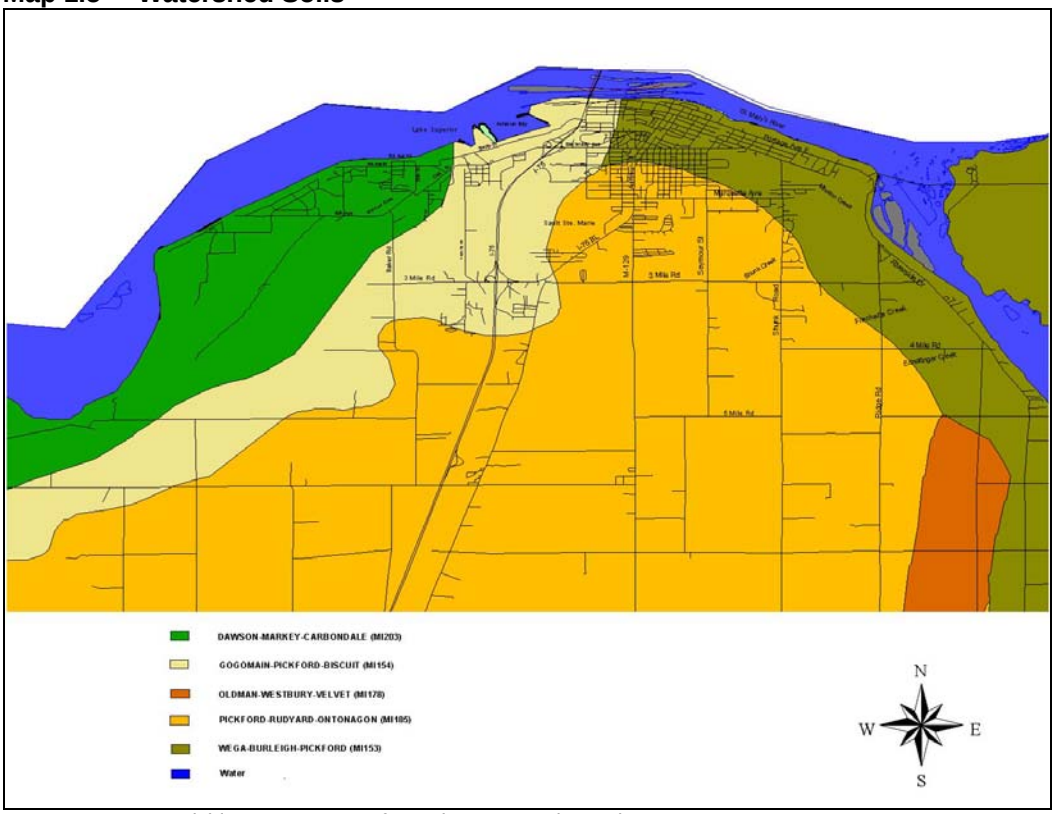
Figure 1.13 Hourly temperatures of Seymour Creek from August-September 2005.



Soils

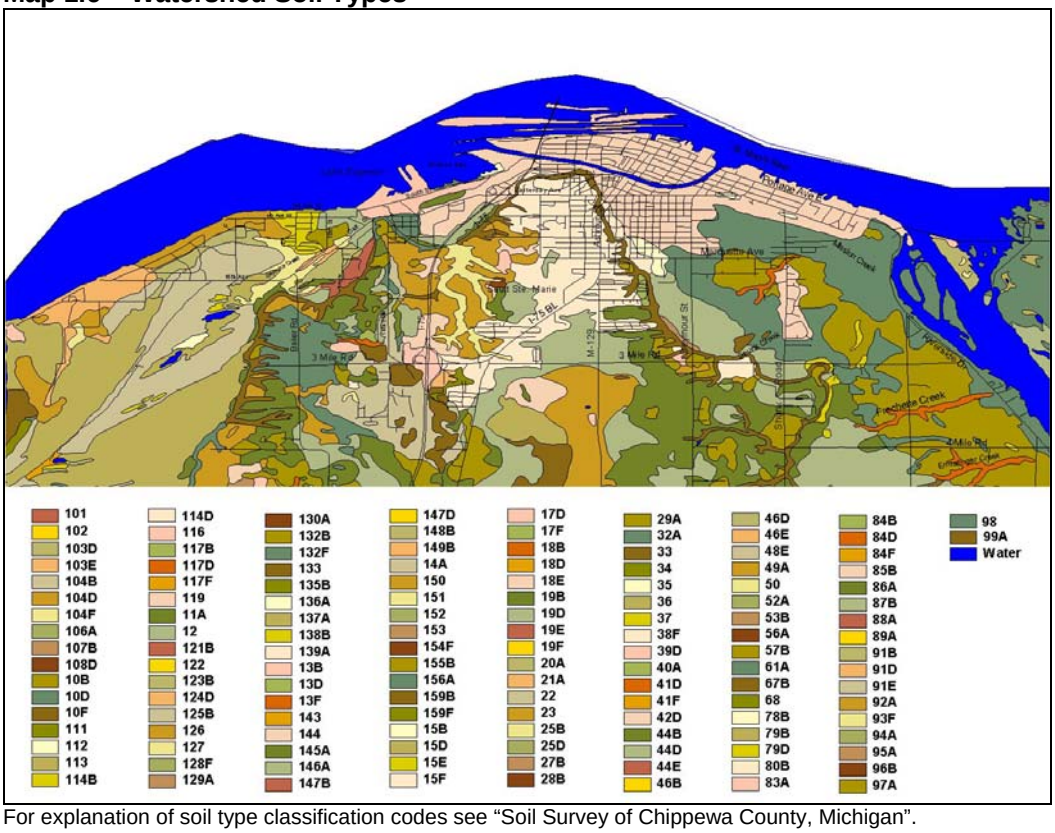
One of the most important components of the Sault Ste. Marie area watershed is its soil characteristics. Much of the watershed is considered wetland since hydric soils dominate the Sault area watershed. (1) *Pickford-Rudyard-Ontonagon, (2) Markey-Kinross-Croswell, (3) Ermatinger-Wega-Burleigh, and (4) Fibre-Allendale-Pickford* associations make up the majority of the watershed and all are considered poorly drained (USDA 1988) (See Map 1.5) These soils hinder infiltration rates and are frequently ponded, explaining the prevalence of wetlands in the watershed. The region's hydrology, consequently, is greatly influenced by this imperviousness, to the extent that even a few inches of elevation change, which typically occurs with the filling of wetlands for development, can adversely change flow rates, temperature, and basic water quality.

Map 1.5 Watershed Soils



Source: MDNR, Michigan Resource Information System (MIRIS)

Map 1.6 Watershed Soil Types



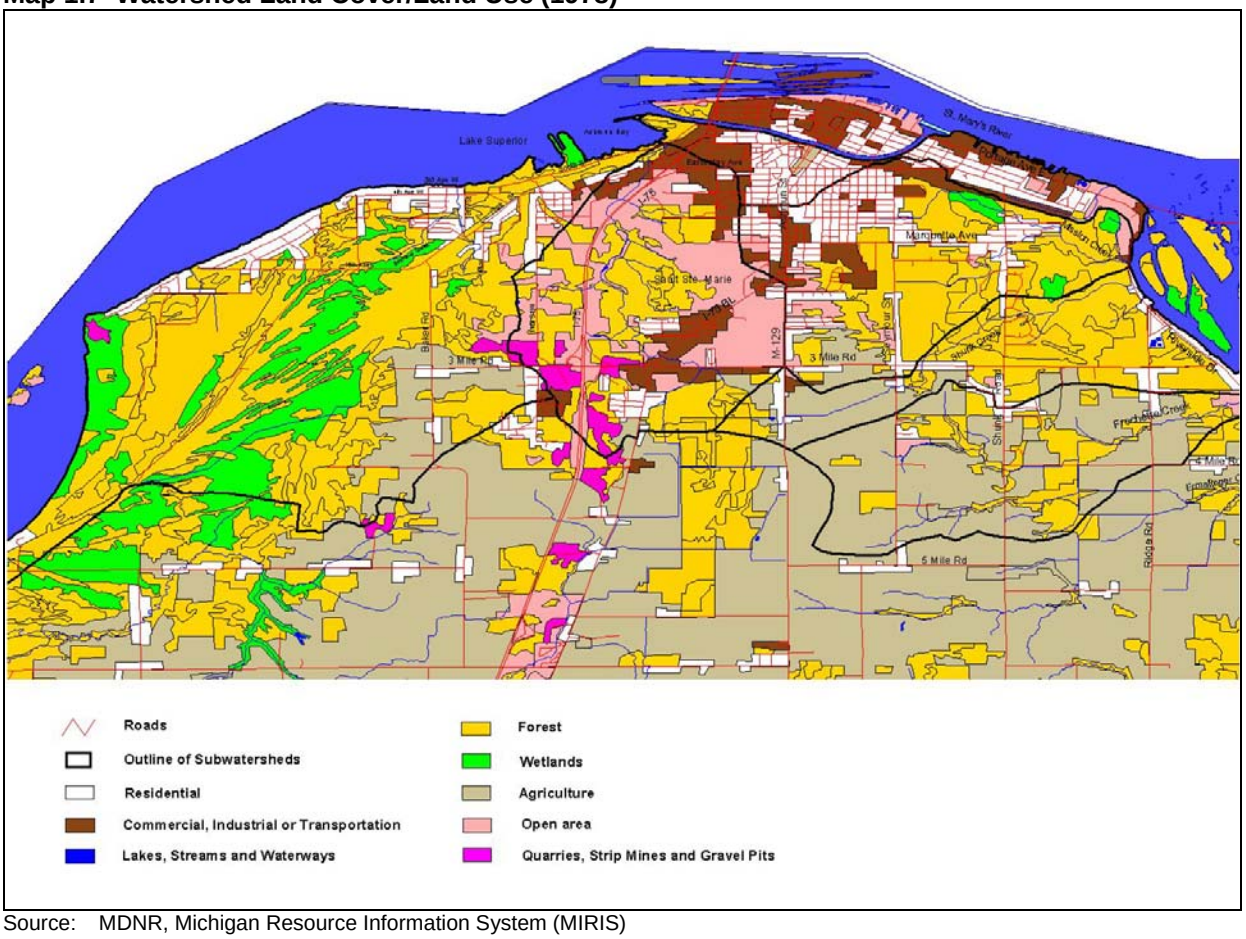
For explanation of soil type classification codes see “Soil Survey of Chippewa County, Michigan”. (USDA 1998)

Land Cover/Land Use

The Sault Area Watershed consists of approximately 15,000 acres dominated (60%) by the urban landscape (residential, commerce, and industry) of the contiguous city limits of Sault Ste. Marie. The remaining 39% of the watershed project area consists of 3,247 acres of small woodlots (21%), 2,525 (16%) acres wetlands, and 165 acres (1%) barren lands within the city limits and Soo Township. The remaining 1% of the watershed adjacent to the city limits is primarily agricultural.

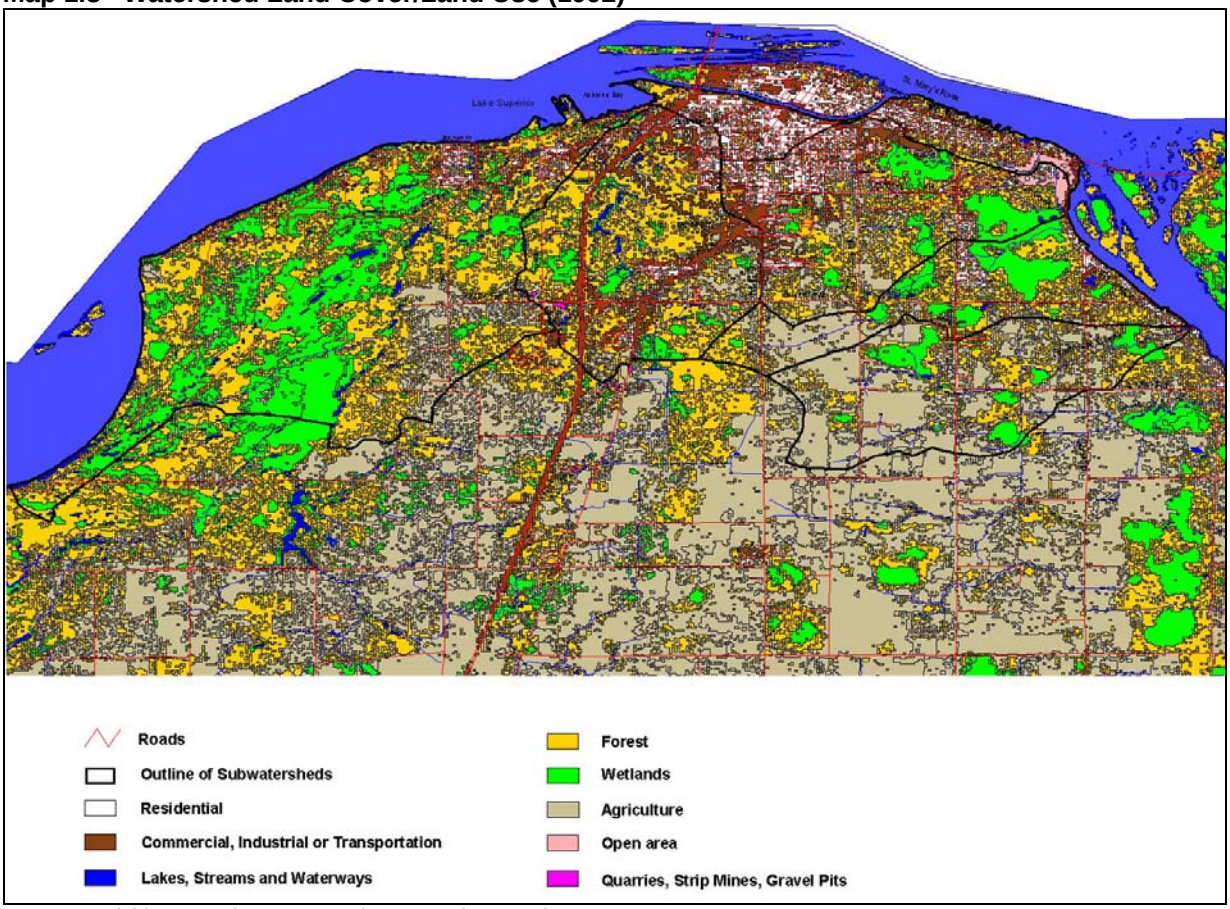
Developed land within the city is broken up into several factions. The largest land use in the city is low and medium density residential development at 1,460 acres. Transportation systems account for over 1,000 acres. Lake Superior State University and Sault Area Schools account for a significant acreage of developed land at 392 acres. Recreational parks in various forms use approximately 784 acres of the developed land in the watershed. Other public and semi-public land occupies 367 acres of developed land. Industry occupies 208 acres of lands, including 400 considered as commercial land (Gove 1995). In addition, there are over 4,600 scattered acres of the city limits considered vacant. The final acreage of the Sault area watershed are outlying areas of the city islands (136 acres), the Soo Locks (82 acres), and neighboring Soo Township (5,900 acres).

Map 1.7 Watershed Land Cover/Land Use (1978)



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

Map 1.8 Watershed Land Cover/Land Use (1992)



Source: Michigan Land Cover Data (USGS and USEPA)

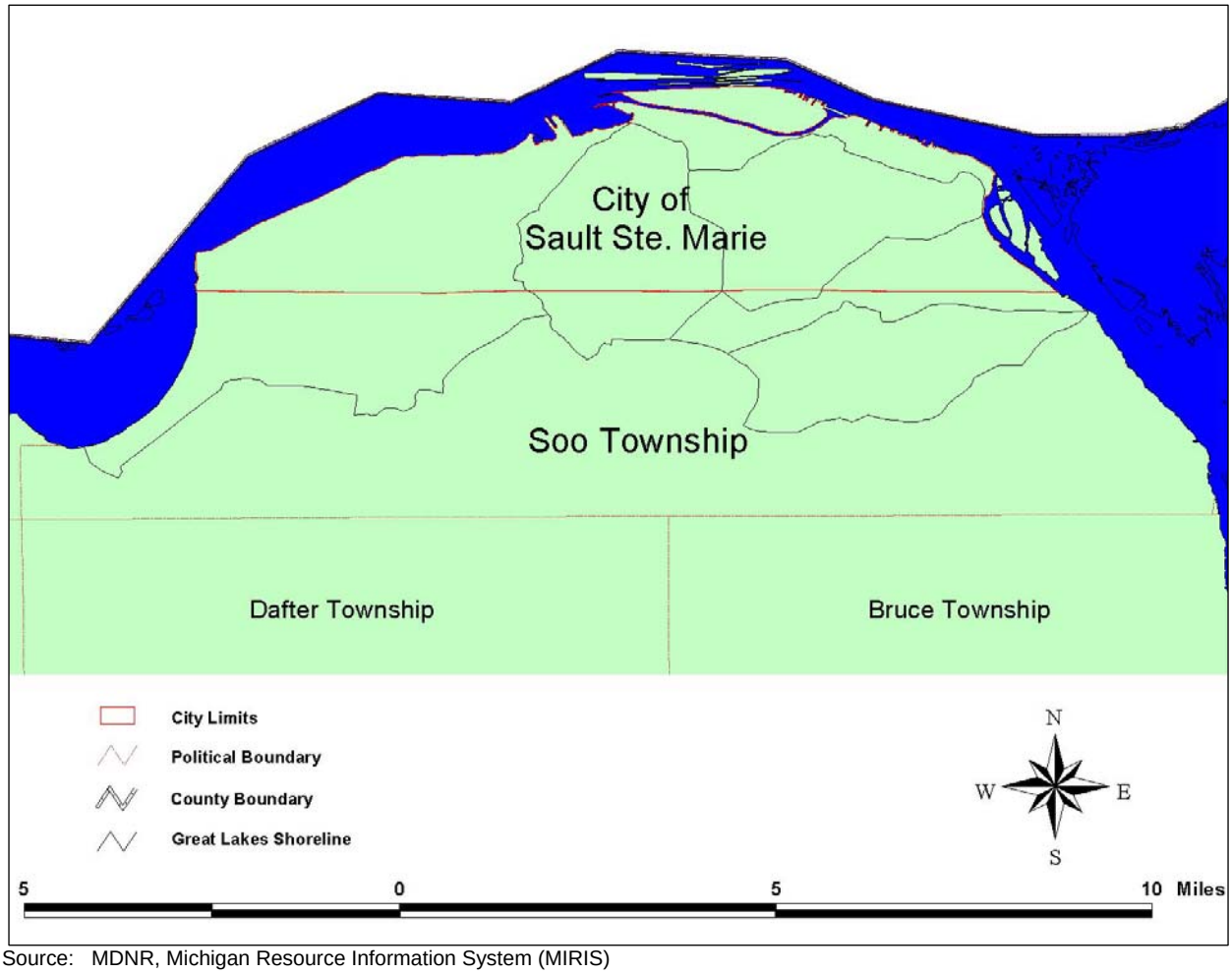
Climate

Climatic conditions, specifically precipitation rates, are coupled with the typical movements of the water cycle will help dictate water quality. As significant rainfall and snowmelt runoff land into receiving water bodies (creeks, rivers, lakes, and oceans), the water dissolves loose soil, toxics such as gas and oil, and builds in discharge that could affect the integrity of the water body's form and structure. According to the USDA, the area experiences an average of 114.7 inches of snowfall per year. Coupled with the relatively impervious clay soils in the area, spring thaw runoff results in significant discharge to area creeks, which can adversely affect water quality.

The Watershed Community

The Sault area watershed encompasses both the city limits of Sault Ste. Marie and the northern fringe of Soo Township. Despite being neighbors, population trends have been and continue to be quite different. Whereas the City population has fluctuated with both increases and decreases over the past 40 years, Soo Township has experience the greatest percentage increase in population of any municipality in Chippewa County since 1960, and this trend is expected to continue (EUPRPDC 2000).

Map 1.9 Local Jurisdictions



Source: MDNR, Michigan Resource Information System (MIRIS)

Table 1.2 Watershed Population Dynamics (Gove 1995)

Area	1960	1970	% Change 1960-1970	1980	% Change 1970-1980	1990	% Change 1980-1990	2000	% Change 1990-2000	% Change 1960-2000
Sault	18,722	15,136	-19.2	14,448	-4.5	14,689	1.7	16,542	12.6	-11.6
Soo Twp	1,617	1,775	9.8	2,163	21.9	2,165	0.1	~2622	21.1	62.2

Since the headwaters of each subwatershed in the project area begin in this rapidly growing district, it will be imperative to consider development's impact on water quality and plan for growth accordingly.

Chapter 2 Watershed Concerns

2.1 Designated Uses in the State of Michigan

The ultimate goal of the Sault Ste. Marie area watershed project is to restore and maintain water quality to the level that it meets the *Designated Uses* for water as set by the State of Michigan as set by the Michigan's Environmental Protection Act (P.A. 451 of 1994, Part 31, Chapter 1).

Table 2.1 Designated Uses for Surface Waters in the State of Michigan

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

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

If a body of water does not meet the water quality standards established for a specific designated use, then it is considered in non-attainment[1]. A bi-annually published listing of water bodies in Michigan that are in non-attainment can be found in Michigan Department of Environmental Quality's integrated report (MDEQ 2002). The St. Mary's River is on the list for water bodies requiring TMDL's (Category 5) (Combined Sewer Overflows, pathogens, FCA-PCB's, Fish Tissue-Mercury).

2.2 Water Quality Concerns

The Sault planning project began with the formal collection of water quality concerns (including the St. Mary's River[2]) from local technical advisors and stakeholders including representatives from Lake Superior State University, the Sault Ste. Marie Tribe of Chippewa Indians, Michigan State University Extension, USDA's Natural Resource Conservation Service, Chippewa/Ottawa Resource Authority, Sierra Club, and the Intertribal Council of Michigan. The group compiled perceived concerns and effects on the designated uses for water in the Sault Ste. Marie Area (Table 2.2.1). Afterward, in February 2005 the general public was invited to express their water quality concerns and provide direction for the project through participation in a steering committee. The group listed their concerns with CEMCD and that initiated the following inventory work. That meeting was followed by an initial steering committee meeting, where local citizens, state, federal and tribal personnel, regional planning agencies, local government officials, and representatives from local environmental groups met to further discuss details about water quality concerns and issues. The group also committed to working together to develop this watershed management plan. The following table lists the preliminary pollutant, source, and cause concerns

[1] The Sault Ste. Marie watershed project area is a subwatershed of the St. Mary's River, which is listed on MDEQ's Section 303 (d) Report list as impacted by mercury, PCB's (Polychlorinated biphenyls), and pathogens (Creal and Wuycheck 2002)

[2] The St. Mary River was identified in 1985 by the International Joint Commission (IJC) as one of 42 Areas of Concern (AOC) in the Great Lakes Basin. Areas of Concern were identified based on known impairments of beneficial water uses. The St. Mary's River was identified as an AOC as a result of problems associated with phosphorus, bacteria, heavy metals, trace organics, contaminated sediments, fish consumption advisories and impacted biota.

that set the stage for the watershed inventory, providing background direction for focused investigation.

Table 2.2 Watershed Concerns and Impacted Designated Uses

Watershed Concern	Threatened Designated Use
Hazardous waste from landfills, contamination sites, LUSTS, etc.	Public water supply (impaired), Aquatic life, Warm/coldwater fishery
Inadequately treated wastewater failing on-site septic systems (OSS)	Public water supply, partial and full body contact recreation
Soil erosion from construction sites, stream banks, and road embankments	Warm/coldwater fishery, Aquatic life
Degradation/loss of aquatic habitat	Warm/coldwater fishery, Aquatic life
Nutrient contamination from residential and golf course lawns	Warm/coldwater fishery, Aquatic life
Altered hydrology	Warm/coldwater fishery, Aquatic life
Polluted stormwater	Warm/cold water fishery, Aquatic life, Public water supply (Surface water intake)

Chapter 3 Watershed Inventory

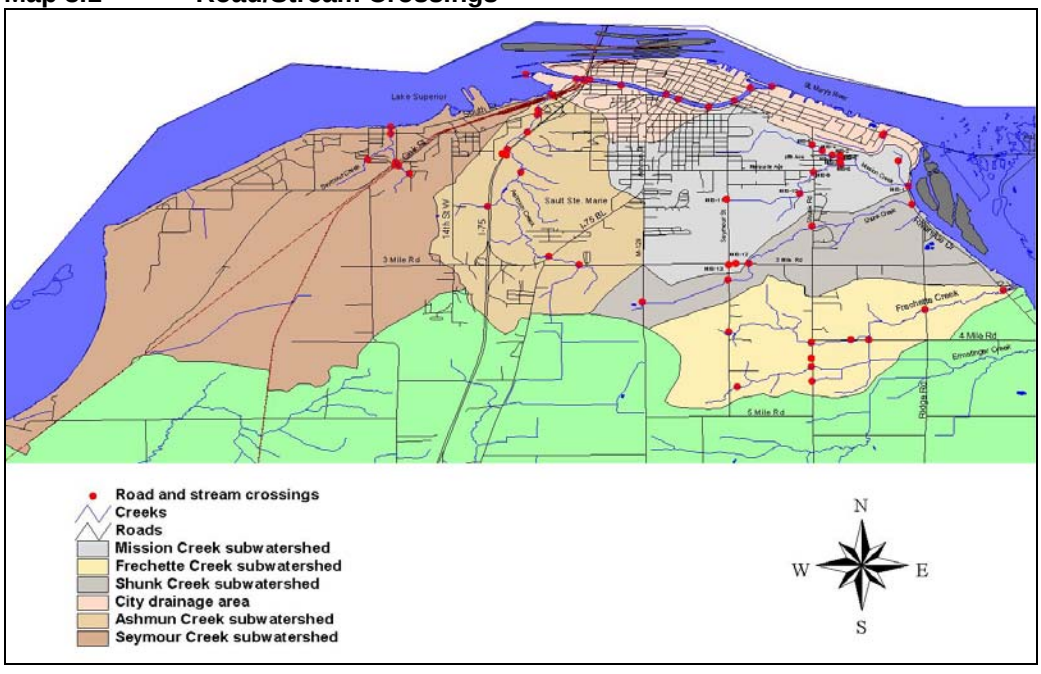
3.1 Inventory of the Watershed

Throughout the planning project (October 2004-October 2006), CEMCD staff pursued several avenues of inventory with local landowners, steering committee members, and LSSU faculty and students to investigate water quality concerns in the Sault Ste. Marie area watershed. CEMCD staff and local volunteers surveyed area streams from road/stream crossings and other access sites. LSSU performed chemical and biological assays, and local, state, and federal agencies provided information regarding contamination sites throughout the city of Sault Ste. Marie and Soo Township. Quarterly meetings and individual consultations were held with LSSU, Chippewa County Health Department, the Chippewa County Building Authority, and City officials to discuss current water quality conditions and potential protection strategies for water quality. The inventories are explained in greater detail in the following paragraphs. Information gleaned from these inventories provided the basis for the water quality problems described in the following chapters and the recommendations outlined in the Implementation Plan.

3.2 Stream Crossing Watershed Survey

Road/stream crossings are effective locations for assessing stream conditions, including both in-stream and riparian habitats as well as the crossing impact on stream health. Crossings are also great locations to access the stream for macroinvertebrate and chemical analyses. CEMCD staff utilized guidance from the MDEQ *Stream Crossing Watershed Survey Procedure (2000)* to survey the creeks from the 50 road/stream crossings throughout the watershed. The project manager and technician focused attention on streambank erosion conditions up and downstream, other pollutant threats, and road and culvert pollution characteristics. Using MDEQ's *Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual*, erosion severity was calculated and results used to prioritize sites, along with accompanying crossing characteristics potentially affecting natural hydrology[1].

Map 3.1 Road/Stream Crossings



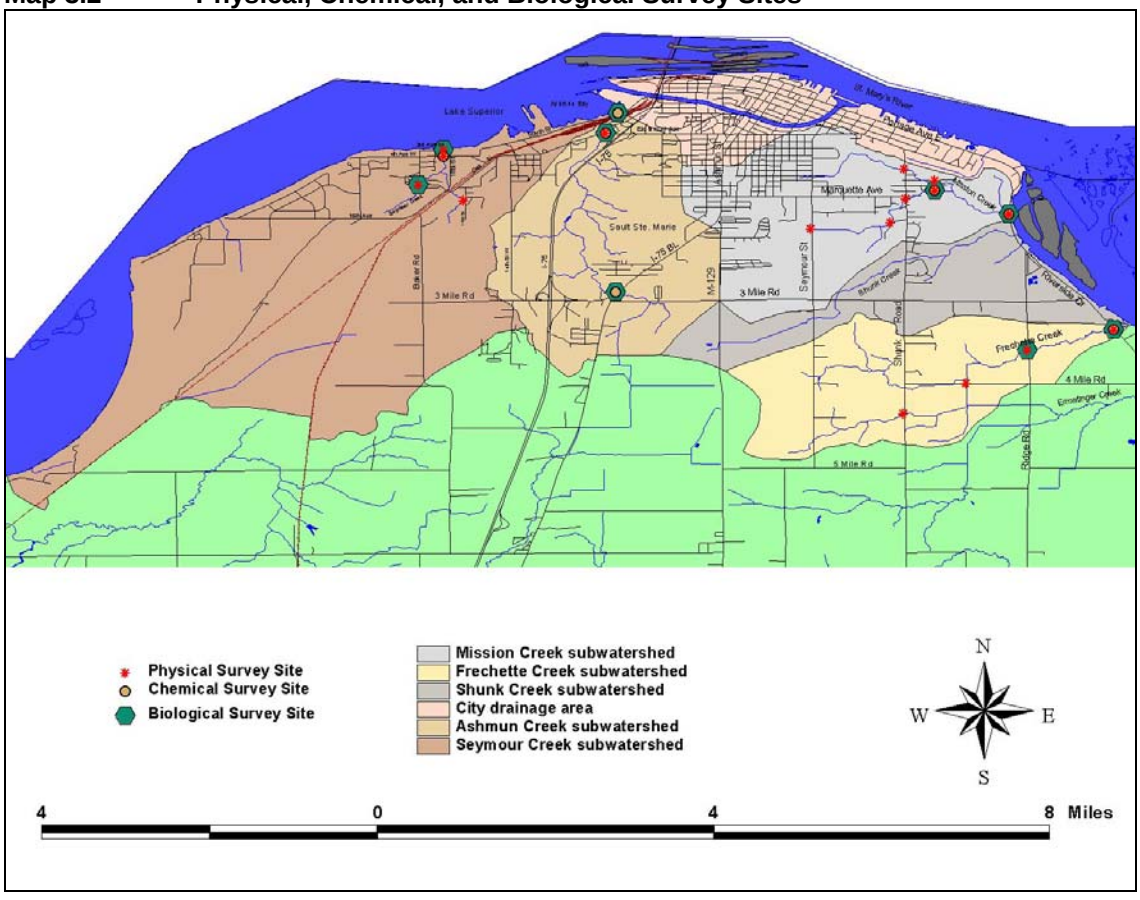
[1] Criteria for hydrology alteration included relationship between cross-sectional area of culvert and creek at bankful depth/width, angle of culvert confluence with upstream, and culvert perching.

3.3 Chemical Analysis

CEMCD partnered with Lake Superior State University (LSSU) faculty and students to survey chemical characteristics of area creeks to provide a snapshot or overview of the health of the sub watersheds located within Sault Ste. Marie area watershed, and their contribution of non-point pollution to the St. Mary's River (see appendix for quality assurance plan). The St. Mary's River was identified as an area of concern by the International Joint Commission as a result of problems associated with phosphorus, bacteria, heavy metals, trace organics, contaminated sediments, fish consumption advisories, and impacted biota. The St. Mary's is also listed in the state's integrated report as requiring a Total Maximum Daily Load by 2012 for pathogens (rule 100), CSO's, fish consumption advisory, PCB's, and Mercury-fish tissue). Survey design was based in part on detecting these pollutants except Mercury.

Sampling locations on Ashmun Creek were selected by LSSU faculty and MDEQ staff. Sites were based on accessibility, representation, and known water quality problems. Sample sites for Seymour, Mission, Shunk, and Frechette creeks were selected based on consultation with LSSU faculty using information provided through their consultation with MDEQ staff. Lake Superior State University's Environmental Analysis Laboratory assisted with inorganic chemistry analysis of the water and sediment samples. LSSU also assisted with habitat, macroinvertebrate, and bacteriological examination of the watershed[2].

Map 3.2 Physical, Chemical, and Biological Survey Sites



[2] Trimatrix Laboratories, Inc., a MDEQ certified laboratory was responsible for providing organic chemistry including PAH and PCB analysis of the submitted sediment samples as well as DOC analysis of submitted water quality samples. This lab was responsible for QA/QC and lab data reduction for these sample analyses.

3.4 Biological Analysis of Sault area Creeks

LSSU faculty and students assessed biological characteristics of the watershed streams, including macroinvertebrates, bacteria, and fish. All surveys followed procedure 51 for data acquisition[3]. Macroinvertebrates were sampled using a Hess sampler at each site. Fish at each site were sampled in July 2005 by triple-pass backpack electrofishing a 50-m block-netted reach. Total coliforms and *E. coli* were enumerated according to the Michigan single sampling event standard (geometric mean of triplicate samples < 300 *E. coli*/100mL).

3.5 Physical Conditions of Area Watersheds

Additional survey of water quality by project partners included assessment of in-stream aquatic habitat. Parameters included channel morphology, volumetric flow, water velocity, substrate quality, and riparian zone parameters[4]. CEMCD staff and trained volunteers began surveys at sites consistent with chemical and biological sampling and added sites to gain a appropriate representation of creek habitat (Map 3.2). In addition, volunteers walked along sections of creeks and documented critical erosion areas where in-stream and riparian habitats had been altered through human perturbations, including, but not limited to channelization and excavation.

The Sault planning partners used as models Lake Superior State University's evaluation of Ashmun Creek and Charlotte River (*Grant Name and tracking number*) and Michigan Department of Environmental Quality's 2005 assessment of Ashmun Creek in order to maintain consistency with data acquisition (MDEQ 2005).

3.6 Urban Stormwater Assessment

Stormwater is excess water that accumulates on the surface after the ground has become saturated from precipitation (rain, snow, or snowmelt) and begins to flow overland (TOMWC 2004). Stormwater runoff occurs naturally, but increases as a result of landscape development. As predevelopment vegetation is removed, the landscaped excavated and replaced by more impervious surfaces, runoff increases dramatically, carries surface pollutants to receiving water bodies, and alters the natural integrity of those receiving waters.

Since the Sault Ste. Marie area watershed includes both stormwater inputs from the city of Sault Ste. Marie and the adjacent, more rural Soo Township, CEMCD reviewed stormwater information from both the Sault Ste Marie Master Plan (1995), City stormwater management documents, and consultation with the City Engineer. Water testing was completed by LSSU at storm outlets into Ashmun Creek to gather a representative characterization of urban stormwater. Results were used with the stormwater predictive model *The Simple Method,* to estimate pollutant loads from urban stormwater[5]. Included in the Sault Ste. Marie watershed is over 6,000 acres of the more rural Soo Township. Within the township, approximately 1200 acres are considered urbanized, including small commercial areas (18 acres) and industrial (35) and the remaining urbanized acreage is low density residential (1113 acres). Stormwater runoff is directed into ditches that course into area creeks. Acreage of impervious surfaces like parking lots, streets, and rooftops are much lower at an estimated 10% of the watershed, but the area also suffers from the impermeability of clay soils. Since the township's projected growth is increasing, rural, and eventually urban stormwater in Soo Township will be a real threat to water quality in the Sault

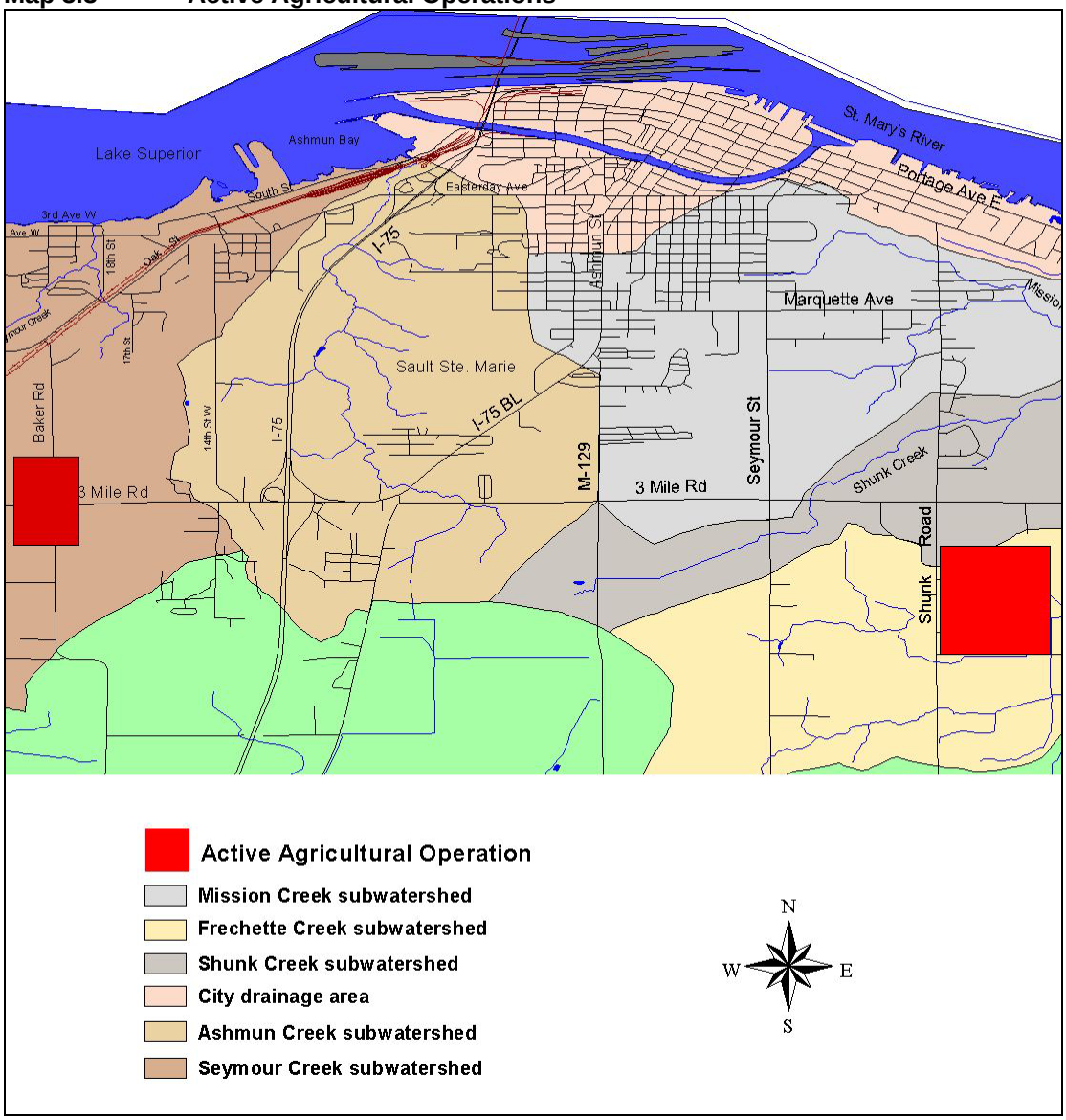
[3] Qualitative Biological and Habitat Survey Protocols for Wadeable Streams and rivers: MDEQ, (2002).
[4] following MI P51, section VII, AII Procedure for Performing Habitat Assessment in MI P51 (Qualitative Biological and Habitat Survey Protocols for Wadeable Streams and rivers: MDEQ, 2002).
[5] The Simple Method estimates pollutant loads for chemical constituents as a product of annual runoff volume and pollutant concentration, as: ***Load=0.226(unit conversion factor) x annual runoff (inches) x pollutant concentration (mg/l) x area (acres)***

area watershed. *The Simple Method* was also used to estimate at least the more urban area stormwater, and the creek surveys performed with LSSU will be used to characterize pollutants coming from the areas runoff.

3.7 Agriculture Inventory

Although the majority of the Sault Ste. Marie area watershed is urban, there exists 2,700 acres of agricultural operations within the headwater areas of the watershed. Only two operations continue with predominantly small hay and livestock farms, while the majority of the other agricultural acreage is in fallow pasture. The area is characteristic of Chippewa County's decline in active farmers and the increase in transfer of farmland into residential property or fallow fields. CEMCD staff worked with USDA's Natural Resource Conservation Service to assess resource concerns of the operations, including walking one operation with the landowner to view problems and discuss desired uses of the property.

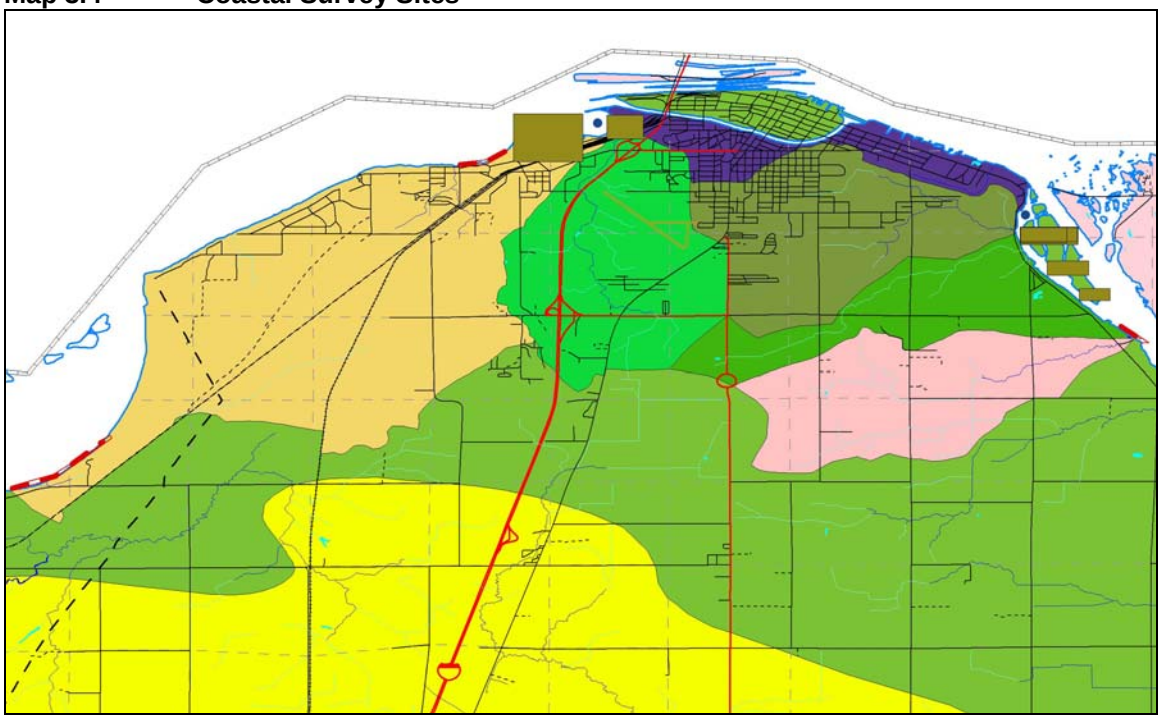
Map 3.3 Active Agricultural Operations



3.8 Coastal Areas

There are at least 25 miles of St. Mary's River coastline included in the Sault Ste.Marie area watershed. Project partner concerns centered around a few sites suffering from erosion problems, sites exhibiting natural features, and sites considered critical for low impact recreational desired uses, including the locally-known *high banks area* (5 mile road), Ashmun Bay, the Soo Locks south to the lower islands, and the mouth of Frechette Creek. Partners viewed these sites to assess current conditions of eroding banks and nearshore habitat. LSSU faculty and students also surveyed local coastal wetlands in the area to assess water quality, benthic macroinvertebrates, and ecological health of certain St. Mary's River coastal wetlands as part of the *Biotic Integrity and Habitat Assessment within the Sault Ste. Marie Area Watershed,* funded by the USEPA's Great Lakes National Project Office[6].

Map 3.4 Coastal Survey Sites



3.9 Identifying and Analyzing Projects, Programs, and Ordinances

Land use planning can be the most critical cause of pollution or the precursor to its prevention. Local and regional planning guidance and regulation is usually in the form of governmental master plans and zoning ordinances. Both have a great potential to affect water quality. Master Plans represent a governmental unit's vision for land use planning. Zoning ordinances represent the manifestations of that vision in the form of the regulations to realize that vision. Zoning

6 1. Use of multimetric indices of biotic integrity (IBIs) to assess the "health" of St. Mary,s River coastal marshes.

2. Habitat assessment of coastal marsh areas of the St. Mary,s River, including the mouths of Ashmun Creek and Mission Creek.

3. Bio-indices will be measured (biodiversity, population genetics, and reproductive health), at the selected St. Mary,s River coastal marshes with a particular emphasis on upper trophic level fish.

4. Environmental sampling and analysis at the selected St. Mary,s River coastal marshes with an emphasis on organic (total PAH and total PCB) and trace-metal contaminants in fish, sediment, and water samples.

5. Development of a GIS database to incorporate data generated by the project and to enhance evaluation and interpretation of his data.

ordinances primarily affect land development in a region and are related to site design and access. They are used to regulate permitted uses of the land (i.e. establishing lot sizes and setback requirements (from neighbors, roads, and water bodies). Overall, zoning ordinances are enacted to protect the use of a property and ensure the public's safety, health, and welfare. In terms of watershed management, zoning ordinances can help the community manage activities on the land to protect the water bodies into which they drain (U'ren 2005).

With help from the Eastern Upper Peninsula Regional Planning and Development Commission (EUPRPDC) and Sault Ste. Marie's Planning Department, CEMCD reviewed the master plans and zoning ordinances for the city of Sault Ste. Marie and Soo Township specifically looking for types of protection given to water quality and natural resources. Information for each jurisdiction regarding natural resources was pulled and summarized from available master plans and zoning ordinances. Both of the master plans reviewed contained general concerns over environmental protection.

Both zoning ordinances were reviewed to see if they included regulations for the following: district delineations and protections for environmental sensitive areas; special approval or permits for environmentally sensitive areas; special requirements for St. Mary's River shoreline; special requirements for wetland areas; special provisions to protect streams, surface water, or groundwater; soil erosion or stormwater provisions; sewer/water provisions; and open space regulations.

3.10 Inventory of Other Projects and Programs

Binational Public Advisory Council

BPAC as it is commonly recognized, is a citizen's group organized in 1988 made up of members from Canada and the United States with the specific goal of informing the St. Mary's River (AOC) Remedial Action Plan (RAP) Team about public views and opinion regarding management and delisting of the St. Mary's as an AOC, and to assist with water use goals, planning methodology, technical data, preferred remedial options, problem identification, plan recommendations, and plan adoption. BPAC is dedicated to ensuring that the river water quality and the ecosystem are improved and protected for all users of the river. BPAC operates an office at LSSU, where personnel facilitate the acquisition of data, documents, and materials for projects and seminars branching from environmental concerns. BPAC personnel strive toward community involvement in achieving a local volunteer base for water quality projects.

BPAC representatives participated in the Sault Planning Project mainly through public outreach activities. The project's purpose, potential success, and relevance to BPAC mission was mentioned at BPAC monthly meetings in order to illustrate common goals with the St. Mary's RAP. The project was included into an addition to the RAP document as a community project to address concerns over St. Mary's tributaries. During the planning project, CEMCD called on BPAC for information and volunteer support for obtaining water quality information and providing public outreach for water quality projects. The partnership utilized BPAC's Volunteer Citizen Scientists network established in the spring of 2004 for water quality sampling in the St. Marys River watershed. BPAC hosted the annual *Environmental Summit*[7] each fall during the project, in part highlighting the Sault Planning project to interested attendees. In fact, the *Sault Sustainability Coalition*[8], of which the Sault Planning Project and partners are cooperating

[7] BPAC's Environmental Summit is an annual event in which local, state, and federal environmental agencies display current water quality work and present research results. The Summit provides a forum for public outreach of work focused on improving and protecting the water quality of the St. Mary's River and adjacent region.

[8] The mission of the Sustainable Sault Coalition is to assist in the establishment of specific projects promoting economic, social, and educational development in the Sault Sainte Marie, Michigan area, while maintaining the integrity of the natural environment, cultural heritage, and unique lifestyle we enjoy here. The project is designed to act as a catalyst for existing organizations, to encourage actionby providing technical and logistical support thereby connecting Lake Superior State University students, faculty, and staff with existing community groups.

members, originated from the 2005 summit. BPAC also organized the Ashmun Creek Clean Up, which may be expanded with help from the Sault Ste. Marie Area Watershed Management Plan. The Sault project implementation plan will utilize BPAC as a volunteer resource for implementing the watershed management plan.

Soil Erosion and Sediment Control (Part 91 PA 451)

Watershed field inventories exposed CEMCD and project partners to inadequacies in Chippewa County's administration and enforcement of part 91, Soil Erosion and Sedimentation Control of the Natural Resources and Environmental Protection Act 1994 PA 451 as amended, which states, "*a landowner or designated agent who contracts for, allows or engages in an earth change in this state shall obtain a permit from the appropriate enforcing agency before commencing an earth change which disturbs 1 or more acres of land, or which is within 500 feet of the water's edge of a lake or stream*[9]*."*

The threat of area water quality degradation prompted the Chippewa/East Mackinac Conservation District to volunteer to take over administration of the SESC program from the Chippewa County Building Authority (CCBA). The District has qualified staff to administer the program and the pervading theme of the SESC program is consistent with the mission of the Conservation District and the Sault Ste. Marie area watershed project.

Sault Ste. Marie's CSO Control Program (*from Sault Ste. Marie Master Plan 1995*)

Sault Ste. Marie's wastewater treatment system currently serves a population of approximately 15,000 residents spread over 2,080 acres. Included in this system are approximately 70 miles of sanitary and combined sewers[10] with five sanitary pump stations and 10 active combined sewer overflows (CSO)[11]. The collection area also has 17 miles of separate storm sewers draining 490 acres. Inflow source removal is the primary goal of the City's CSO Control Program.

The existing collection system currently contains 10 active CSO structures, providing overflow relieve to combined sewer areas. The average annual number of overflows from these structures vary from 0 to 15, depending on tributary area wet weather flow rates.

The City of Sault Ste. Marie is implementing a program to separate its combined sewer system. As part of that program, new sanitary sewers are proposed and the existing combined sewers will become storm sewers. Although the capacity of these sewers to transport storm runoff is important, the absence of observed surface flooding problems indicates that deficiencies in the removal of stormwater are not critical. Because the combined sewers that will become the storm sewers are old, pipe failures or collapse due to service life factors are a concern. Rather than replace these old sewers, the City has elected to perform repair or replacement work on an as-needed basis. Large-scale replacement of the old pipe will not occur until major road improvements are initiated in 20 years.

Storm sewer systems are designed to collect and transport flow from large but infrequent storms. These large storms are described by their average return period. A common storm used for design is a 10-year storm. On average, a 10-year storm will be equaled or exceeded once every 10 years. Expressed differently, the 10-years storm has a 10 percent probability of occurring in

[9] Soil Erosion and Sedimentation Control Training Manual MDEQ 2004

[10] Sault's wastewater collection system consists of 49 miles of sanitary sewer, 20 miles of combined sewer.

[11] A combined sewer is a sewer that is designed to carry both sanitary sewage and storm water runoff. A discharge from a combined sewer system occurs in response to rainfall and/or snowmelt because the carrying capacity of the sewer system is exceeded. These discharges do not receive all treatment that is available and utilized under ordinary dry weather conditions (normally during dry weather conditions the wastewater is transported to a wastewater treatment facility where it receives appropriate treatment prior to discharge). Both the combined sewer overflow structure and the discharge from the structure are referred to as "CSOs".

any give year. Likewise, a 5-year storm has a 20 percent probability of occurring in any give year.

Over half of the outlet storm sewers could not pass the flow from a 10-year storm without surcharge. Several sub-area storm systems could not transport the runoff from a 1-year storm. Future development will have minimal effect on the existing sewer area storm flows. When the City next considers major stormwater improvements in 20 years, the improvement should be prioritized to first address the sub-areas with transport capacities less than the 1-year storm flow, and eventually review all sub-areas with capacities to handle less than 10-year storms.

Outlet culverts in the Mission Creek and Ashmun Creek sub-areas are adequately sized to transport existing and future 10-year and 100-year flows. Outlet culverts for smaller drains in the southeast corner of the City cannot transport 100-year flow from existing conditions or the 10-year flow from future conditions. These undersized culverts should be replaced during the next road construction project (Gove 1995).

National Pollutant Discharge Elimination System *(from MDEQ 2006)*

The NPDES permit process was initiated in 1972 by The Federal Water Pollution Control Act amendments to the Michigan Water Resources Commission Act (Act 245) of 1929. The purpose of the program is to control the discharge of pollutants into surface waters by imposing effluent limitations to protect the environment. Perhaps the most notable goal of the Act was the elimination of discharge of pollutants into navigable waters by 1985. This goal was not realized, but remains a principle for establishing permit requirements. The Act had an interim goal to achieve "water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water" by July 1, 1983. This is more commonly known as the "fishable, swimmable" goal.

The enactment of the 1972 amendments marked a distinct change in the philosophy of water pollution in the United States. The amendments maintained the water quality-based controls, but also included technology-based control strategies. The treatment technology-based discharge standards are promulgated by the U.S. Environmental Protection Agency (EPA) and are based on the category of the facility. Dischargers are placed in categories based on industrial processes or on the type of wastewaters generated. As treatment technology improves, these federal standards are expected to become more restrictive in order to progress toward the goal of zero discharge. As permits expire they must be reissued with limits reflecting the most recent treatment technology standards. The Act also contains four important principles:

1. The discharge of pollutants to navigable waters is not a right.

2. A discharge permit is required to use public resources for waste disposal and limits the amount of pollutants that may be discharged.

3. Wastewater must be treated with the best treatment technology economically achievable - regardless of the condition of the receiving water.

4. Effluent limits must be based on treatment technology performance, but more stringent limits may be imposed if the technology-based limits do not prevent violations of water quality standards in the receiving water.

An NPDES permit is valid for a maximum of five years. If the applicant continues to require NPDES permit coverage, it is necessary to reapply by April 1 of the year the permit will expire. This generally involves completing a new application form. This gives the appropriate authorities an opportunity to reevaluate operational and monitoring requirements and effluent limits.

Michigan has developed a strategy for scheduling permit reissuance known as the "5-Year Basin Plan." This is a timetable for reissuance of permits based on receiving water-bodies. A receiving water is the river, stream or lake that "receives" a particular discharge. It is ideal to simultaneously evaluate all permits allowing discharge to a particular receiving water or watershed. A complete cycle of reissuances occurs every 5 years, with approximately 20% of the permits being reissued each year. The "5-Year Basin Plan" was established with the objective of establishing the most efficient plan for water quality monitoring and permit reissuance. CEMCD assessed available information regarding NPDES permits in the Sault area watershed to assess point source pollutant concerns. Since no discharges were of concern, no management action was prescribed except for continuous monitoring of discharges and permit information.

Map 3.5 Five-Year Basin Cycle

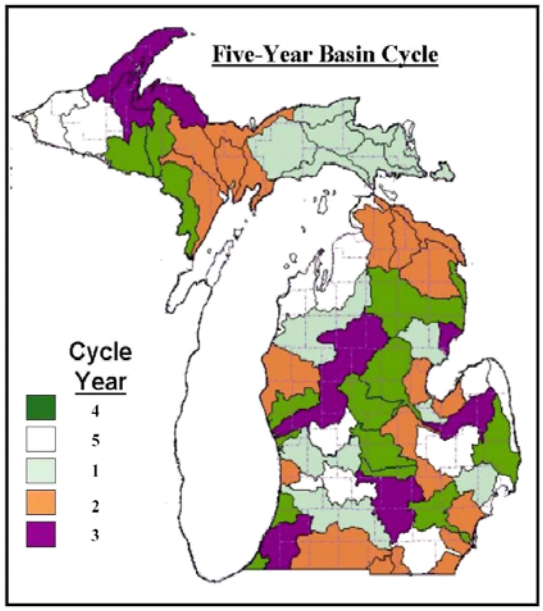


Table 3.1 NPDES Permitees in the Sault Ste. Marie Subwatershed. (Source: Michigan Department of Environmental Quality 2006)

Designated Permit Holder	Permit Type	Date Permit Expires	Receiving Waters
Key Plastics	Non Contact Cooling Water-Discharges of storm water (and specified non-storm water) from industrial activities to surface waters of the state located within a cycle-year 1 watershed.	4/1/2008	Ashmun Creek
Hoover Precision Products	Discharges of storm water (and specified non-storm water) from industrial activities to surface waters of the state located within a cycle-year 1 watershed.	4/1/2006	Ashmun Creek
Sault Municipal Airport	Discharges of storm water (and specified non-storm water) from industrial activities to surface waters of the state located within a cycle-year 1 watershed.	4/1/2006	Ashmun Creek
Mast Fab Co-Superior Fab Div	Discharges of storm water (and specified non-storm water) from industrial activities to surface waters of the state located within a cycle-year 1 watershed.	4/1/2006	
MCM Marine	Discharges of storm water (and specified non-storm water) from industrial activities to surface waters of the state located within a cycle-year 1 watershed.	4/1/2006	St. Mary's River
Union Carbide Disposal Site	Facilities which discharge storm water to surface waters of the state located within a cycle-year 1 watershed. Applicable discharges include storm water from secondary containment structures required by State or Federal law, from lands on Michigan's List of Sites of Environmental Contamination, or from other activities which may contribute pollutants to the storm water for which the Department determines monitoring is needed.	4/1/2006	Mission Creek
Sault Ste. Marie Wastewater treatment Plant		10/1/2005	St. Mary's River
Odenaange Tribal Housing Wastewater Treatment			Frechette Creek

Total Maximum Daily Load Program and the Sault Ste. Marie Area Watershed

A TMDL, or Total Maximum Daily Load, is a tool for implementing water quality standards and is based on the relationship between pollution sources and in-stream water quality conditions. The TMDL establishes the allowable loadings or other quantifiable parameters for a waterbody and thereby provides the basis to establish water quality-based controls. These controls should provide the pollution reduction necessary for a waterbody to meet water quality standards. Guided by the designated uses for water, the state monitors water quality every five years, and for those surface waters that do not or are not expected to meet the requirements with technology-based point source controls alone, Clean Water Act requires the state to develop additional water quality-based requirements, TMDL, to restore and protect water quality.

Section 303 (d) of the Clean Water Act provides that the State is to list waters for which technology-based limits alone do not ensure attainment of water quality standards. The current list denotes the St. Mary's River as scheduled for TMDL development on 2012 for pathogens, PCB, and Mercury. To determine if these pollutants were originating from the watershed, CEMCD and LSSU performed appropriate chemical analysis of the St. Mary's River tributaries coursing through Sault Ste. Marie along with a representative storm drain entering Ashmun Creek, one of the aforementioned St. Mary's River tributaries (see chapter 4 and appendix for detailed results).

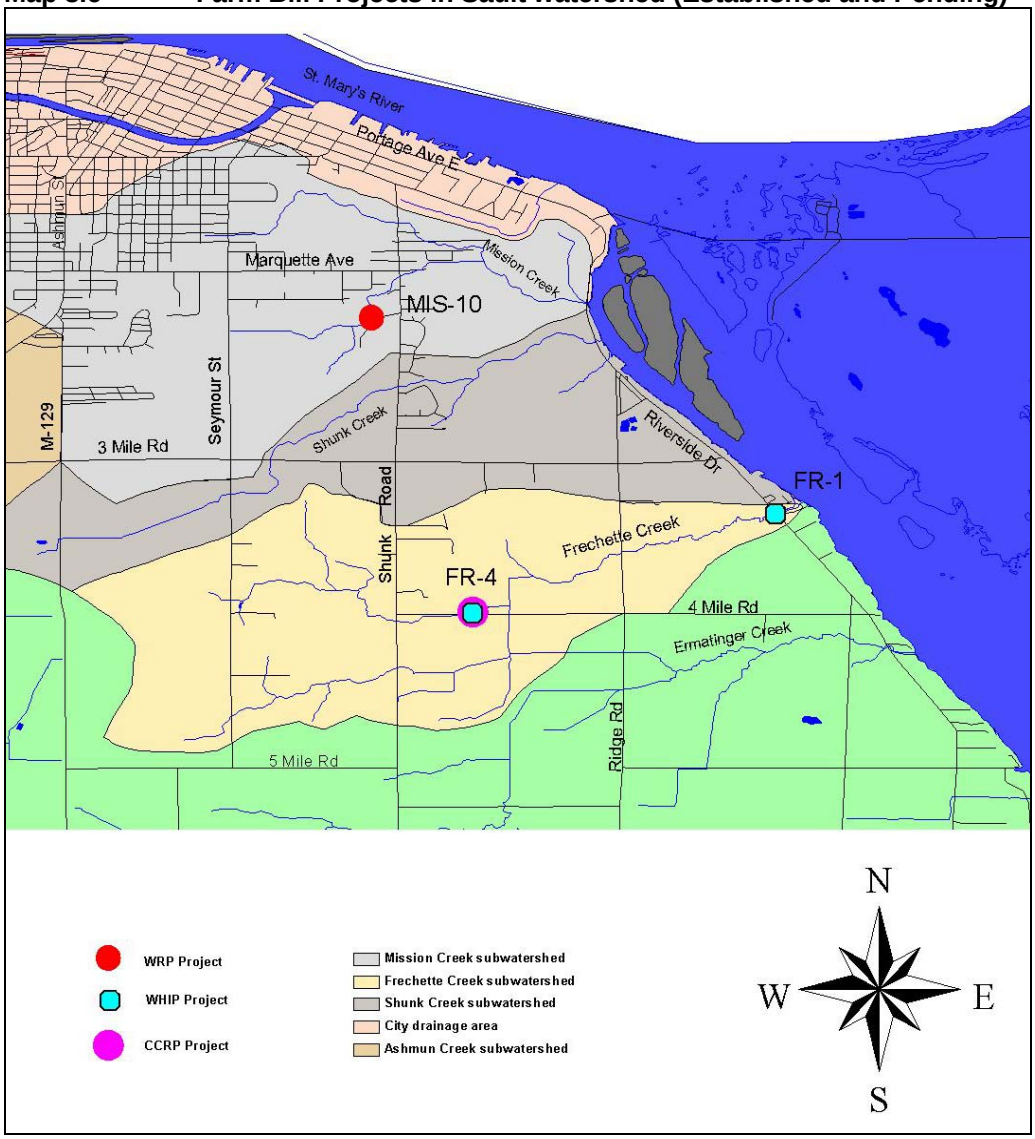
Natural Resource Conservation Service

The Farm Security and Rural Investment Act of 2002 (Farm Bill) represents the single most significant commitment of resources to implement conservation on private lands in the Nation's history. The legislation responds to a broad range of emerging natural resource challenges faced by farmers and ranchers and even more urban areas, including soil erosion, wetlands, and wildlife habitat. The U.S. Department of Agriculture's Natural Resource Conservation Service administers several Farm Bill programs in the watershed to protect wildlife habitat, wetlands, and riparian areas. The *Wildlife Habitat Incentives Program* is a voluntary program that encourages creation of high quality wildlife habitats that support wildlife population of national, state, tribal, and local significance. Through WHIP, NRCS provides technical and financial assistance to landowners and others to develop upland, wetland, riparian and aquatic habitat areas on their property. The Wetlands Reserve Program (WRP) is a voluntary program that provides technical and financial assistance to eligible landowners to address wetland, wildlife habitat, soil, waste, and related natural resource concerns on private lands in an environmentally beneficial and cost-effective manner. The program provides an opportunity for landowners to receive financial incentives to enhance wetlands in exchange for retiring marginal land from agriculture. The Conservation Reserve Program (CRP) encourages farmers to voluntarily plant permanent areas of grass and trees on land that needs protection from erosion. This vegetative cover also serves as a windbreak and improves water and soil quality. Creating more areas of vegetation is crucial to maintaining healthy wildlife populations because doing so provides a source of food and habitat (USDA 2001).

Table 3.2 Farm Bill Programs in the Sault Ste. Marie area watershed

Program	Resource Concern	Conservation Practice	Pollutant Addressed	Subwatershed
WHIP	Eroding Streambank	Rip Rap, Shrub Planting	Sediment Habitat Loss	Frechette
	Livestock in Waterway	Livestock exclusion fence	Sediment Nutrients	Frechette (Potential)
	Wind Erosion	Riparian Buffer Forest Land Buffer	Sediment Wind	Frechette (Potential)
CCRP	Loss of Habitat	Shallow Flooding	Loss of Habitat	Frechette
WRP	Loss of Habitat	Wetland Restoration	Loss of Habitat	Mission (Potential)

Map 3.6 Farm Bill Projects in Sault watershed (Established and Pending)



Chapter 4 Designated and Desired Uses

4.1 Condition of Designated Uses

Results from several methods of watershed inventory indicate that certain designated uses of water are either threatened or have been impacted by several contaminants. Underground aquifers, which historically provided drinking water to local residents has been continually contaminated with petroleum by leaking underground storage tanks. Municipal water has been extended to areas of contamination and the City's drinking supply intake moved to the St. Mary's River near Sherman Park (See map 4.1). In addition, the fishery and other aquatic life designated use are threatened due to hydrological alterations, habitat degradation, sediment, toxins, and nutrients from a variety of sources and causes. Pathogens also threaten full and partial body contact recreation, as well as the current new source for the areas' drinking water-the St. Mary's River. Despite these threats, water is currently meeting all of the designated uses, except for the groundwater public water supply. Details concerning sources and severity are outlined in the next chapter.

Table 4.1 Condition of Designated Uses

Designated Uses	***Condition of Designated Use***	**Pollutant** k=known s=suspected
Public Water Supply	Impaired (groundwater)	Pathogens (k) Toxins (k)
Warm/coldwater fishery	Threatened	Alteration of hydrology (k) Sediment (k) Toxins (k) Nutrients (k)
Other aquatic life	Threatened	Alteration of hydrology (k) Sediment (k) Toxins (k) Nutrients (k)
Full body contact recreation	Threatened	Pathogens (E.*coli) (s)*
Partial body contact recreation	Threatened	Pathogens (E.*coli) (s)*
Navigation	Designated Use being met	
Industrial Water Supply	Designated Use being met	
Agriculture	Designated Use being met	

4.2 Desired Uses

The desired uses for a watershed constitute the community's desired appearance of the watershed, including the integrity of the natural features and natural view-scapes. Desired uses might include a quality fishery to sustain a local economy or a natural park for low impact recreation. One obvious desired use that is shared by the Sault project partners is to maintain the designated uses for water in the project area. CEMCD hosted meetings and one-on-one consultations with the project steering committee, city officials, business owners, and landowners as well as consulting with historical City-conducted surveys to determine the following themes consistently surfaced as desired uses for the watershed:

Protect nature-based aesthetic areas in the Sault Ste. Marie area to enrich environmental livelihood of the community.

Many of the environmental characteristics that helped make this area a hub for early settlers have been compromised for the sake of industrial progress. With the boon of the industrial revolution long passed, the tide is turning for the appreciation of local environmental treasures. Activity has ensued to promote areas within the watershed as natural areas worthy of protection. A large tract in the Seymour Creek subwatershed has been preserved through a conservation easement with Little Traverse Conservancy. Lake Superior State University recently applied for an EPA *Watershed Initiative* grant to create an *Ashmun Creek Bioreserve* along sections of the undeveloped Ashmun Creek corridor. In addition, according to the Sault Master Plan (1995), action items related to protecting environmental areas and natural aesthetic qualities include:

- Preserve corridors of open space for purposes of aesthetics, maintenance of property values and maintenance of native flora and fauna. Connectivity of the corridors will be encouraged.

- Promote silt reduction from water-courses in the City through the encouragement of plant growth, stabilized embankments and the establishment of green spaces and buffer zones.

- Integrate walking on bike trails in conjunction with green spaces or open space corridors.

- Continue planting of native vegetation along main thoroughfares and near industrial operations.

- Encourage public and private investment in the improvement of the appearance of the community.

- Continue to support efforts of Beautification Committee, and expand efforts to include planting of native trees and shrubs in beautification efforts.

- Incorporate protection of replanting of vegetated areas as part of site plan standards for new commercial and industrial development.

Restore natural aesthetic qualities to areas degraded by trash, pollution, abandonment, and other urban influences.

- Remove visible trash and pollutants from area creeks, wetlands, and potential natural areas.

- Improve degraded properties for public recreational enjoyment, aesthetic qualities, and potential commercial utilization, including but not limited to the following areas:
    - Carbide Dock Property
    - I-500 Track area
    - Cannelton Property
    - Superior Sanitation Landfill

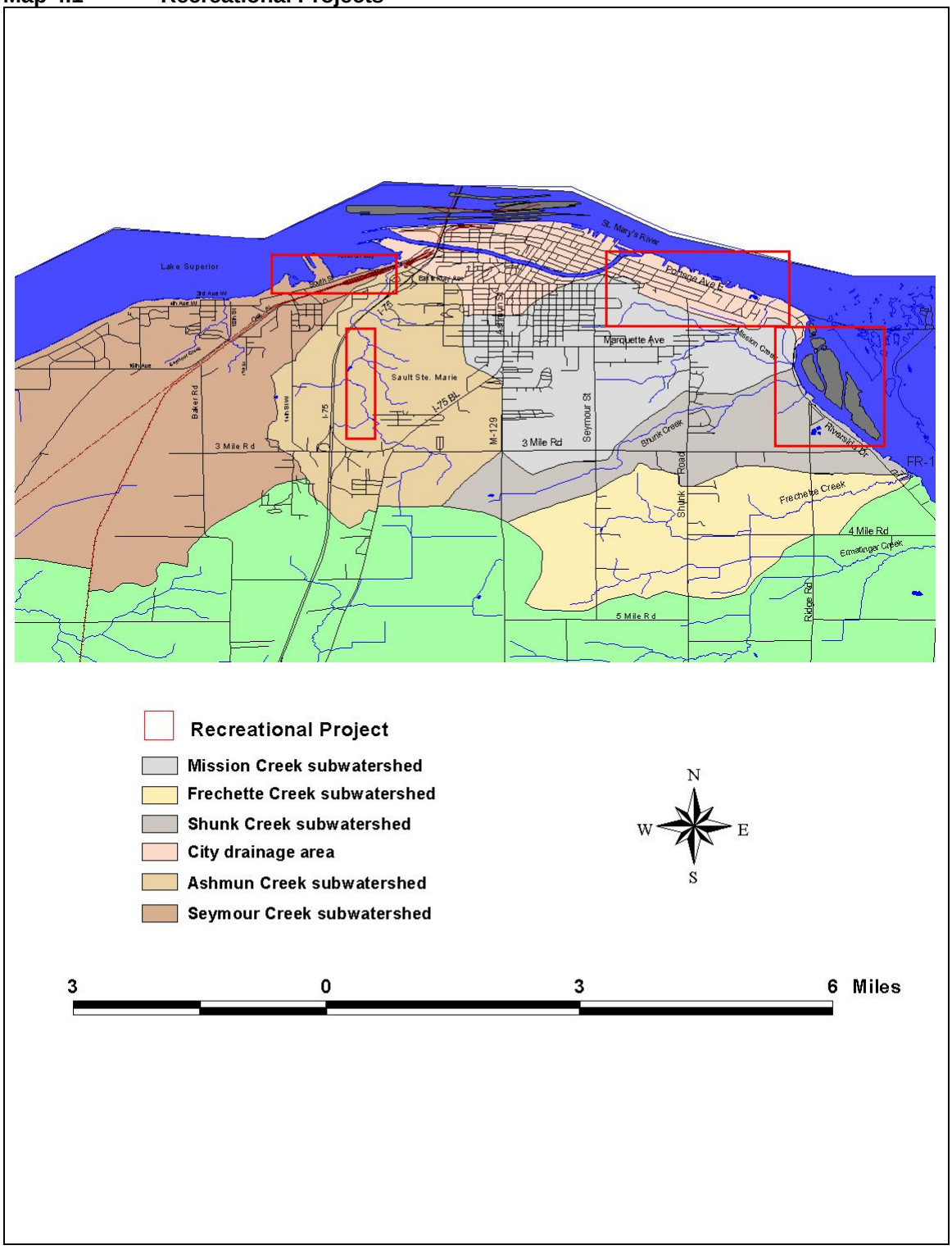
Provide opportunities for public enjoyment of natural resources within watershed.

The livelihood of the Sault Ste. Marie community depends upon quality natural resource based recreational opportunities. The Sault project partners will facilitate the establishment and/or improvement of recreational opportunities including but not limited to the following sites:

- St. Mary's River walkway
- Lower river islands park

- Ashmun Bay Park
- Ashmun Creek Bioreserve

Map 4.1 Recreational Projects



Chapter 5 Water Quality Threats

5.1 Pollutants, Sources and Causes

CEMCD staff, technical advisors, and the project steering committee reviewed project inventory results from the watershed *windshield* survey, road/stream crossing survey, water testing, and contamination site consultation with MDEQ to develop the list of pollutants, sources, and causes that will be the focus of this plan.

Table 5.1 Priority Problems (Pollutants), Sources, and Causes

Pollutants	Known or Suspected Sources	Known or Suspected Causes
Alteration of hydrology	1. Destruction (channelized) of natural stream (5800 linear feet) morphology/habitat (k)	1. 12 developments totaling 500 acres directly requiring channelization of adjacent water bodies
	2. Destruction/Alteration of at least 2500 acres of natural wetland complexes (k)	1. 90 housing units/year requiring fill and alteration of drainage (k)
	3. Accelerated/increased urban/rural stormwater runoff from 2 inches/year to 6 inches/year.	1. 17% imperviousness in Sault Ste. Marie & 10% imperviousness in Soo Township.
	4. Upstream ponding/impounding from 11 priority road/stream crossings (k)	1. 11 Inadequately sized and improperly designed road/stream crossing culverts
Pathogens (Bacteria)	1. Increased rate of Urban/Rural Stormwater runoff from 2.23"/year early settlement to 5.94"/year (Sault) and 4.16"/year (Soo) rates(s) (1500 colony forming units/ml urban stormwater (typical concentration))	1. Increase in imperviousness requiring accelerated stormwater conveyance. 2% early development increased to City's 17%; Soo Township's 10%.
	2. OSS wastewater from approximately 319 on-site septic systems (OSS) (10^8-10^{10} total coliform mg/L wastewater[12].)	1. 319 near shore homes remaining with OSS 2. Poorly sited and engineered OSS (33% of installation permits/year) (k)
	3. Wastewater from combined sewer overflow (CSO) discharges (s) -appx. 1/year(2001,2002,2003,2004) (10 million gallons 2001)	1. 10 active CSO's remaining in city 2. Lack of effective urban stormwater treatment infrastructure (retention areas, wetlands, unaltered riparian zones-potential overflow problem
	1. Wastewater discharge from Odenaang tribal development (k) -4million gallons/year	1. Development of 50 tribal residential sites along Frechette Creek requiring community waste treatment (secondary) system
Toxins (Trash)	1.Urban/Rural Stormwater (k) -Typical concentrations (11.1ug/l Cu, 50.7 Pb, 129 Zn[13])	1. Lack of stormwater treatment/filtration near hazardous material use (fuel stations, street drains, etc.) 2. Direct connection between urban stormwater and surface waters (k) 3. Lack of awareness of stormwater management
	2. 51 LUSTS, Part 201 sites, FUDS, etc. (k)	1. Inadequate management of hazardous wastes at 51 sites 2. Non compliance with appropriate legislation (3 sites) 3. Clean up action pending (27 sites)
	3. Residential/Commercial Fertilizer/Pesticide Use (s)	1. Lack of education/information (lawn/agriculture) 2. Destruction of riparian buffers
	4. Eight historical landfill sites (k)	1. Installation of 8 inappropriate landfills (k) 2. Lack of appropriate closure safeguards installed on 8 sites (k)
	5. 6 Creek dumping sites (k)	1. Historical apathy for area water bodies, wetlands, landscape (k)
Nutrients	1. 9 discharge sites of concentrated urban/rural stormwater (k)	1. Runoff drainage concerns at 9 developed areas requiring ditching/storm drains (k) 2. 9 site direct drainage connection between maintained lawns/agriculture operations and surface waters (k)

[12] Adapted from http://www.epa.gov/ORD/NRMRL/pubs/625r00008/html/625R00008chap3.htm
[13] Adapted from New York State Stormwater Management Design Manual (Appendix A, A-2)

Pollutants	Known or Suspected Sources	Known or Suspected Causes
	2.Urban/rural stormwater (s) -1790lbs phosphorus/year -10,803 lbs nitrogen/year	3. One possible leaking water or sewer main (Ash 10) (s) 4. Increased impervious surfaces (s) -see pathogens above
	3. Two golf courses and 13 suspected riparian residential sources of fertilizer/pesticide use (s)	1. Lack of and/or ineffective information/education regarding fertilizers/pesticide use(s) 2. Lack of riparian buffer along golf course waterbodies and at least 13 riparian residential sites (s)
	4. OSS wastewater from approximately 319 on-site septic systems (OSS) (26-75mg/L Nitrogen & 6-12 mg/L Phosphorus (typical residential wastewater[14].)	1. 319 nearshore homes remaining with OSS 2. Poorly sited and engineered OSS (33% of installation permits/year) (k)
	5. Wastewater discharge from Odenaang tribal development (k) -4million gallons/year	1. Development of 50 tribal residential sites along Frechette Creek requiring community waste treatment (secondary) system
Sediment	1. Urban/Rural Stormwater (247 tons)	1. Increased rate of Urban/Rural Stormwater runoff from 2.23"/year early settlement to 5.94"/year (Sault) and 4.16"/year (Soo) rates(s) 2. Increasing erodable soils due to urbanization 90 developments/year(k) 3. Decrease in effective sediment depositional wetlands near stormwater conveyances (2/3 pre-settlement wetlands filled)
	2. Developed areas/construction sites (90 developments/year)(k)	1. Lack of pre-construction site Soil erosion/sediment control planning (k) -20 SESC permits/year 2. Non-compliance with SESC regulations (k) ~20 SESC permits compared with ~90 building projects/year
	3. Nine Road/Stream Crossings (k)	1. Flooding of embankments at 9 inadequately sized road/stream crossing culverts 2. Unstable gravel road/shoulder surfaces at 9 sites
	4. Nine streambanks/2 miles of eroded shoreline (k)	1. 15 priority shoreline developments/9 riparian developments in which vegetation on/near shoreline/streambanks has been removed.

Sections 5.2 through 5.6 provide a description of each pollutant, its respective sources and causes, and critical areas of focus, exhibiting common causes.

5.2 Altered Hydrology – Pollutant Description

Altered hydrology as a pollutant refers to the negative change of natural hydrological processes, including natural stormwater runoff, infiltration rates, and evaporation rates. Water quality impacts include the magnitude and frequency of flood events, increased ratio of surface storm runoff as subwatershed base flow, increased stream flow velocities, and degradation of watershed geomorphology (structure and form)(MDEQ 1998). This change results in the degradation of water quality, including water chemistry, biota, and habitat. CEMCD and MDEQ (Biological Survey of Ashmun Creek in Chippewa County (MI/DEQ/WB-05/072)) assessed the physical habitat conditions of Sault Ste. Marie area watershed creeks at 14 sites following the Great Lakes And Environmental Assessment Section (GLEAS) Procedure 51 (MDEQ 2002) Eleven metrics were assessed at each site, where both upstream and downstream reaches were observed following procedure 51. The metrics are organized under three components: **Substrate and Instream Cover**, which generally describes stabile cover, including wood, rock, or organics, that are stabile within the stream along the banks and the bottom and provides habitat for aquatic wildlife. It also includes the existent sequence of pools, riffles, and runs that provide quality habitat. **Channel Morphology** constitutes the structural characteristics of the stream channels and their flow. The measure of water, its flow characteristics, sediment deposition, and the natural

[14] Adapted from http://www.epa.gov/ORD/NRMRL/pubs/625r00008/html/625R00008chap3.htm

directional winding (sinuosity) of the water body is also grouped here. **Riparian and Bank Structure** defines the stability of the streambanks and adjacent riparian area. Since the presence of rooted vegetation along a riparian corridor is integral to its erosion characteristics, this is also included in this group for analysis. Metrics within these categories were scored on the following scale.

Table 5.2 Metric Scores/Ratings

Metric (Glide/Pool)	**Scoring Range/Rating**			
Substrate and Instream Cover	***Excellent***	***Good***	***Marginal***	***Poor***
Epifaunal Substrate/Available Cover	16--20	11--15	6—10	0--5
Pool Substrate Characterization	16—20	11--15	6—10	0--5
Pool Variability	16—20	11--15	6—10	0--5
Channel Morphology				
Sediment Deposition	16—20	11--15	6—10	0--5
Flow status-Maintained Flow Volume	9—10	6--8	3—5	0--2
Flow status-Flashiness	9—10	6--8	3—5	0--2
Channel Alteration	16—20	11--15	6—10	0--5
Channel Sinuosity	16—20	11--15	6—10	0--5
Riparian and Bank Structure				
Bank Stability	16—20	11--15	6—10	0--5
Vegetative Protection	16—20	11--15	6—10	0--5
Riparian Vegetation Zone Width	16—20	11--15	6—10	0--5
Habitat Characterization	**Total Point Score (metrics 1—10)**			
Excellent	>154			
Good	105—154			
Marginal	56—104			
Poor	<56			

All of these metrics helped substantiate altered stream hydrology as a pollutant and help quantify the problem. For example, 75% of sites proved marginal in habitat metrics, almost 20% poor, and only one could be considered good. Over 80% of the sites exhibited poor pool variability, over 80% contained such low water levels as to garner a marginal or poor determination. Over half the sites exhibited characteristics of stream flashiness, including refuse lodged high along rooted vegetation along the streambank, and signs of elevated high water marks, including elevated scouring of streambanks with little to no rooted vegetation. Half of sites were marginal or less in terms of altered channel characteristics, including straightened reaches possibly created for landscape drainage. All streams suffer from lack of sinuosity, as many reaches have been directed along property perimeters and altered by ditching. Fortunately, almost half (48%) of sites have good riparian zone stability, with rooted vegetation holding soils stabile against the destructive spring snow melt flows.

Table 5.3 Metric Score Summary

Site ID	Substrate and Instream Cover (60 Total)	Channel Morphology (80 Total)	Riparian and Bank Structure (60 Total)	Habitat Characterization (Exc >154; Good 105-154; Marginal 56-104; Poor <56)
SE 1	14	55	34	103 Marginal
SE 2	16	49	24	89 Marginal
SE 3	19	35	26	80 Marginal
SE 8	19	48	46	113 Good
MIS 1	18	48	34	100 Marginal
MIS 2	7	32	48	87 Marginal
MIS 5	14	35	40	89 Marginal
MIS 8	9	30	32	71 Marginal
MIS 9	18	47	26	91 Marginal
MIS 10	0	11	24	35 Poor
MIS 11	0	25	26	51 Poor
FR 1	0	11	24	35 Poor
FR 2	10	39	36	85 Marginal
FR 3	7	32	44	83 Marginal
FR 5	15	46	32	93 Marginal
FR 7	14	55	34	103 Marginal

Fortunately, these metrics have provided guidance for the design of the implementation schedules located in following chapters of this plan. Implementation tasks are geared toward eliminating the causes of these alterations and decreasing the corresponding reference scores. Future evaluation of implementation success will utilize these scores as benchmarks for post project habitat assessment comparison.

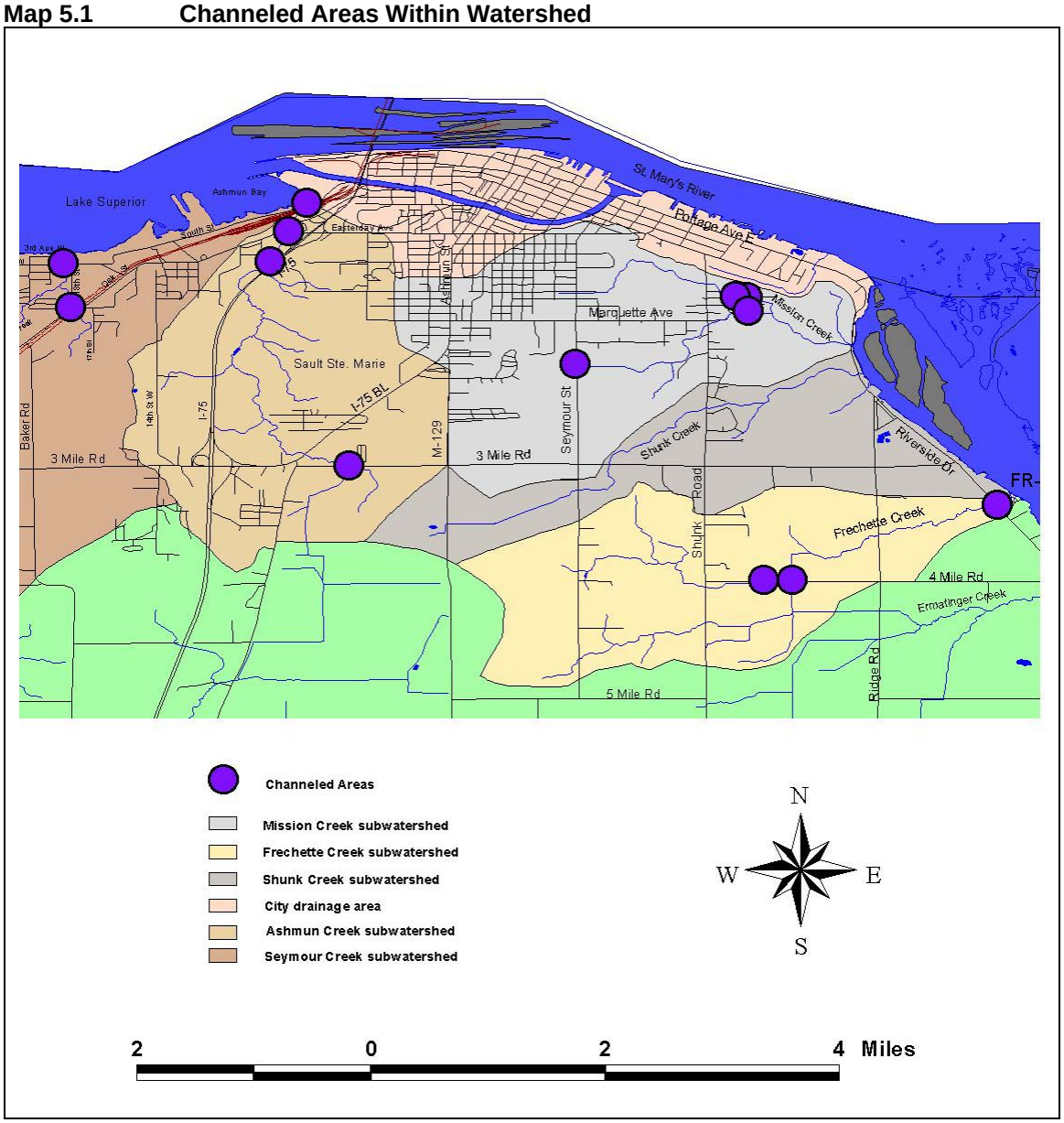
5.2.1 Altered Hydrology - Sources and Causes

5.2.1.a Loss of Wetlands, Riparian Habitat, and other Natural Features

Urban and rural development of the wetlands and other natural areas in the Sault Ste. Marie area watershed has impacted the area's natural hydrology. Considering past and current land use and the likely expanse of presettlement soils (USDA soil survey 1988), CEMCD estimates that approximately 2/3 of presettlement wetlands, or over 2500 acres, have been altered for urban development, eliminating wetlands for stormwater storage, filtration, and evaporation. In fact, according to the Sault Master Plan, development continues at a rate of 90 housing units/developments each year. Since much of the watershed soil is hydric, extensive fill is necessary for building. Filled wetlands mean increased impervious surfaces and accelerated stormwater runoff (USDA 1988). The area has increased imperviousness from 2% impervious surfaces consistent with the rural agricultural beginnings of the area to now over 17%[15]. This has increased annual rates of stormwater runoff from 2 inches/year to 6 inches/year[16]. This increased volume, especially during concentrated storms and spring runoff scours the streambed and banks, destroying stream habitat and eroding banks. The streams have taken on steep, bare banks with streambeds lacking any significant cover. This has contributed to creek flows that have gouged deep riparian ravines, scoured clay substrates and creek banks, eliminating in-stream habitat and geomorphological diversity.

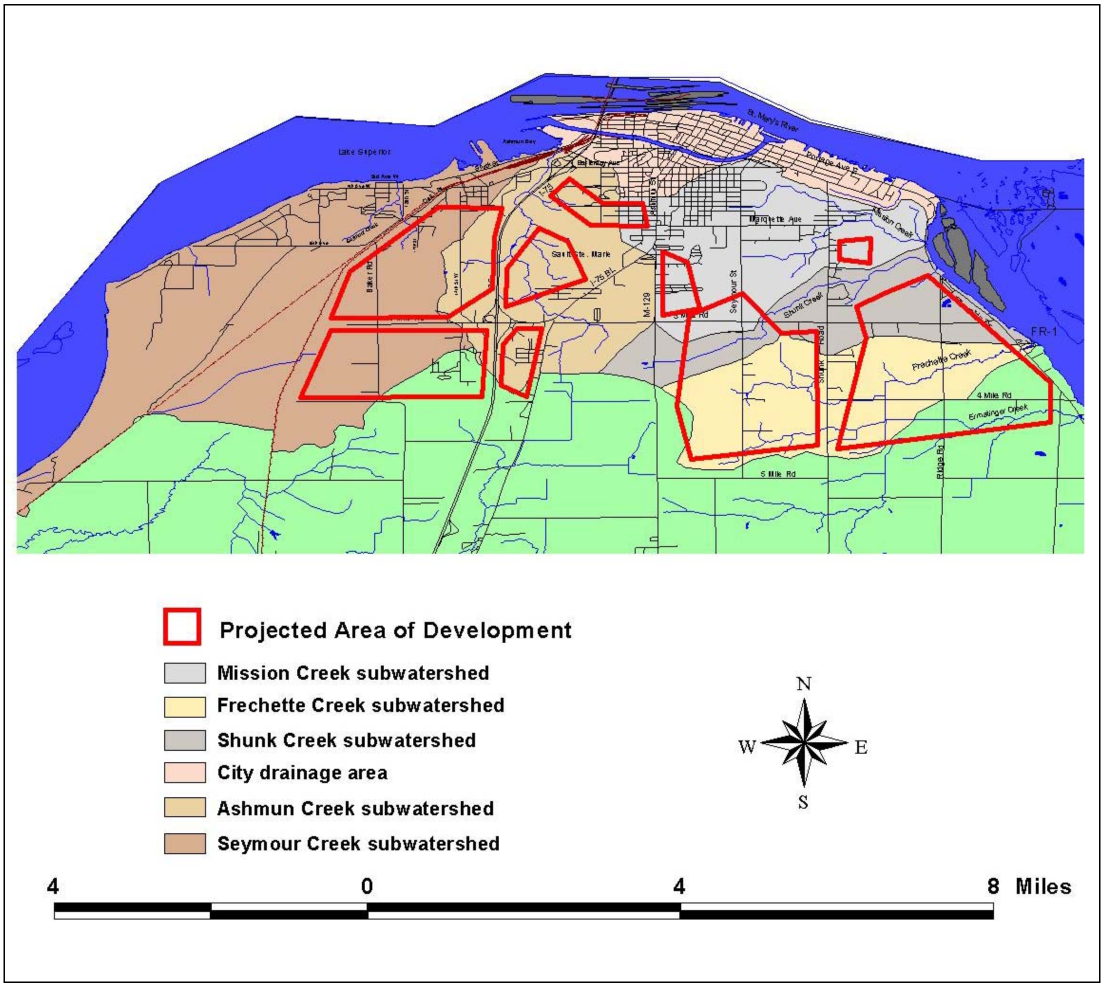
[15] Estimates based on modeling from New York State Stormwater Management Design Manual A-5
[16] Based on the *Simple Method* calculations impervious cover changes in the watershed from presettlement to present.

Map 5.1 Channeled Areas Within Watershed



Unfortunately, these conditions may continue, as headwater areas in Soo Township are developing quickly (2% early settlement imperviousness to current 10% level) and developable land exists along the riparian areas of the streams coursing through the Sault. Future development in the entire watershed area will undoubtedly require filling of remaining wetlands. The Sault planning project aims to protect land critical to water quality from the remaining 6,000 acres of wetlands, including small parcels of forested wetlands and barren wetlands that are not already impacted by development. The remaining areas of little riparian development and altered wetlands will be targeted for protection. Fortunately, stream reaches in these areas tend to be sinuous, with twisting courses that have floodplains to handle surplus water and stable banks to handle discharge energy (Map 5.3). These areas will be targeted for preservation through land protection strategies, regulation enforcement, and education.

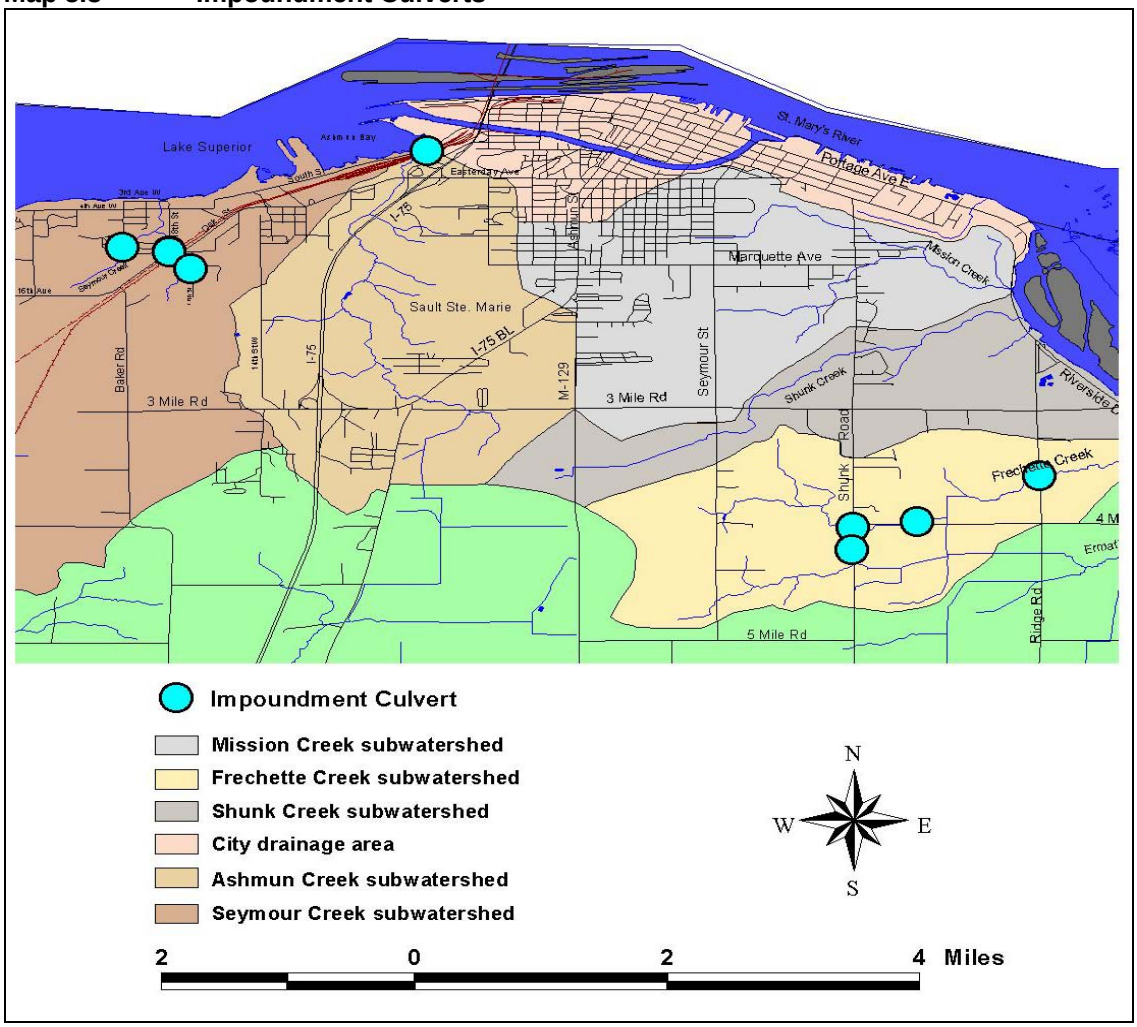
Map 5.2 Projected Areas of Development and Proposed Land Protection



5.2.1.b Road/Stream Crossings (Impoundments)

Impoundments, both natural and manmade, can alter hydrology. Several beaver dams, which are a natural occurrence, continue to exist in the Sault area watershed, despite continuous urbanization, and pose a threat to flooding of developed areas and erosive conditions where flood levels overtop established streambanks. Despite this concern, the Sault project is focused on man-made impoundment obstacles--specifically, road/stream crossings that contain undersized or misplaced culverts that plague natural flows, and their associated embankments where soils are not protected with rooted vegetation or other methods. Of the 50 road stream crossings that have been inventoried in the watershed, many are properly designed to facilitate the significant flood events characteristic of spring snow melt and significant rain events. Unfortunately, inventories have delineated at least eleven poorly designed crossings where embankment and adjacent streambank structural clues proved that peak flows are continuously impounded, causing erosive conditions (Map 5.4). For further documentation of existent problems, CEMCD consulted the preliminary Sault Ste. Marie Stormwater Master Plan for delineation of crossing problems (NcNamee et. Al 1994).

Map 5.3 Impoundment Culverts



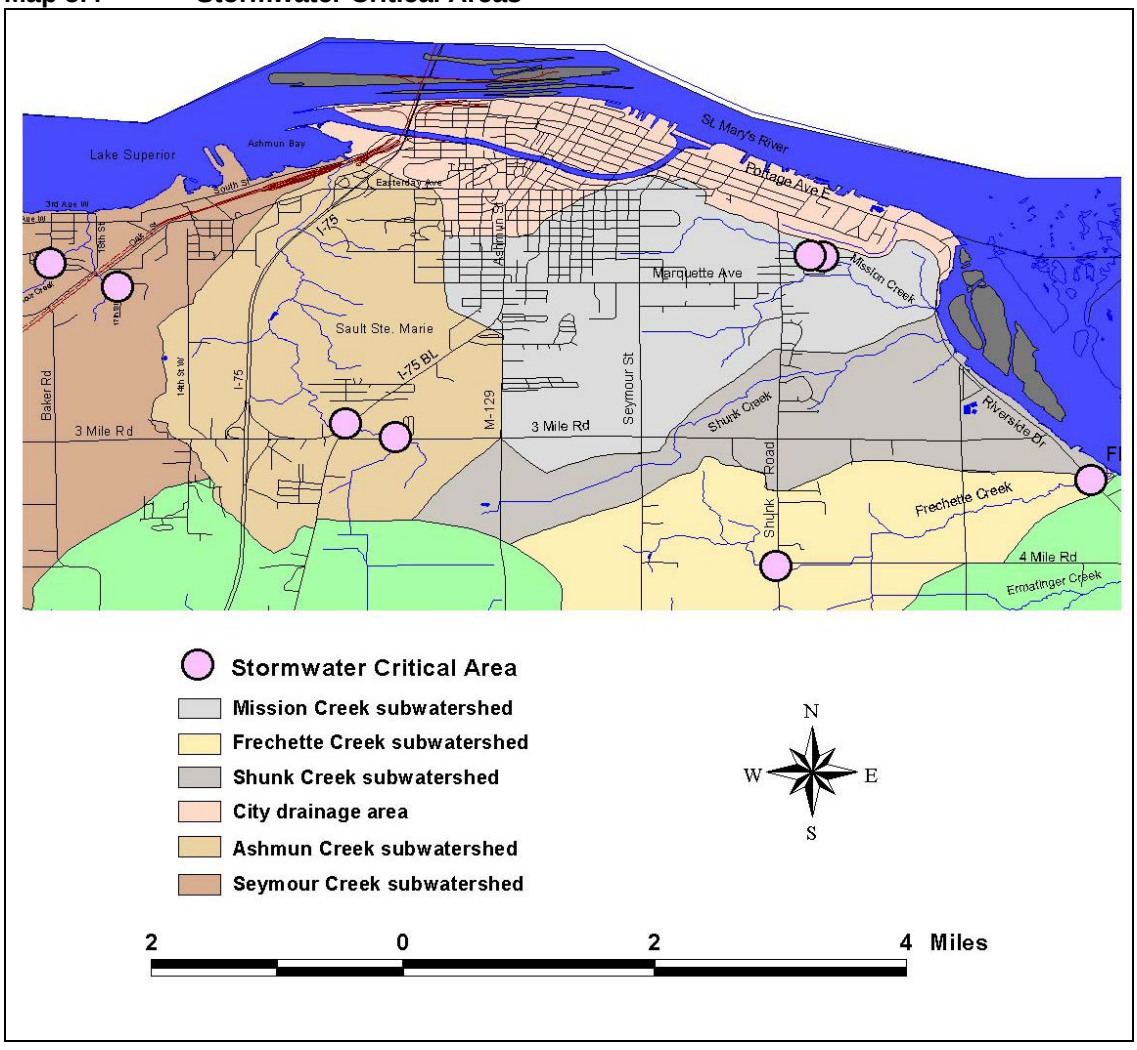
5.2.1.c Stormwater

Natural landscapes like forests, wetlands, and grasslands act as filters for runoff from melting snow and precipitation. Typical natural landscapes provide areas for infiltration into aquifers. Natural vegetation and topography provides structure to slow overland flow and disperse it as sheet flow across the landscape into receiving water bodies. This stable, consistent flow helps sustain year-round, consistent base flows for area creeks, protecting aquatic habitats. Poorly planned and coordinated urbanization typically means defoliating natural areas, filling of wetlands, and installation of vast nonporous urban landscapes like roads, bridges, parking lots, and buildings, which doesn't let runoff slowly percolate into the ground or run slowly as sheet flow overland[17]. To accelerate these problems sources, the effects of urbanization in the Sault has compelled the City of Sault Ste. Marie to install storm sewer systems and the more rural Soo

17 Research suggests that there is a threshold to the amount of impervious cover that can occur within a watershed at which the degradation of aquatic systems occurs. Findings reveal that stream degradation consistently occurs when impervious surface levels in a watershed reach between 10-20% (CWP 1994). Project partners estimate that the city's impervious surface level is at 17% (Schueler 1987). Combine that with the clay soil base, and impermeability is a significant problem in the Sault watershed.

Township[18] community to install ditches that quickly channel runoff away from developments like roads and other impervious surfaces like parking lots and groomed farm fields. As previously mentioned, both the Sault and Soo Township have increased the percentage of impervious surface in their midst from 2% during more rural agricultural beginnings to 17% (Sault) and 10% (Soo Township) of current land area. This has increased annual runoff rates from 2 inches/year to over 6 inches/year. This volume of runoff gathers speed through conveyances and empties into streams as large volumes of quickly flowing runoff that alters the natural hydrology of the streams, affecting water quality and aquatic habitat. In turn, this results in high stormwater flows and lower water depths during non-storm periods. Nine critical areas within the watershed have been delineated as serious stormwater conveyance areas requiring remediation to stabilize stormwater inputs into areas streams.

Map 5.4 Stormwater Critical Areas



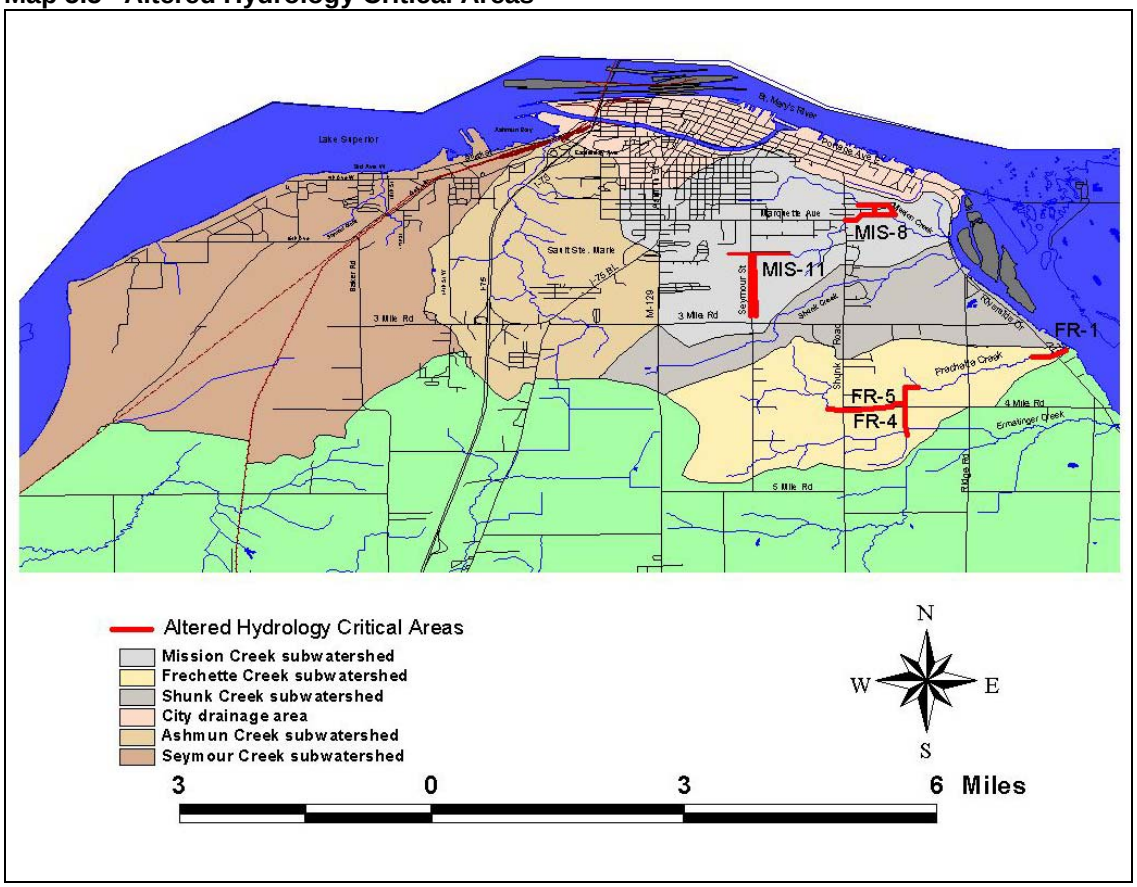
18 Included in the Sault Ste. Marie watershed is over 6,000 acres of the more rural Soo Township. Within the township, approximately 1200 acres are considered urbanized, including small commercial areas (18 acres) and industrial (35) and the remaining urbanized acreage is low density residential (1113 acres). Stormwater runoff is directed into ditches that course into area creeks. Acreage of impervious surfaces like parking lots, streets, and rooftops are much lower at an estimated 10% of the watershed, but the area also suffers from the impermeability of clay soils. Since the township's projected growth is increasing, rural, and eventually urban stormwater in Soo Township will be a real threat to water quality in the Sault area watershed.

Altered Hydrology Critical Areas

Focusing pollution remediation on areas suffering numerous maladies will result in the most benefit in restoring natural hydrology across the entire watershed. The most critical areas suffering from the most hydrological causes include:

- MIS-8 (habitat loss/channelization/development pressure/stormwater outfall)
- MIS-11 (habitat loss/channelization/development pressure),
- FR-1 (habitat loss/channelization/stormwater),
- FR-4 (channelization/development pressure/culverts), and
- FR-5 (development pressure/culverts/stormwater).

Map 5.5 Altered Hydrology Critical Areas



5.3 Pathogens (Bacteria) – Pollutant Description

Pathogens are microbes that cause disease. They include a few types of bacteria, viruses, protozoa, and other organisms. Some pathogens are often found in water, frequently as a result of fecal matter from sewage discharges, leaking septic tanks, and runoff from animal feedlots into bodies of water. Fecal coliforms, specifically Escherichia Coliform (E. coli), is a naturally occurring bacteria that lives in the digestive tract of warm blooded animals including humans, and as such, serve as an indicator of potential bacterial pathogen contamination. They are not generally regarded as disease causing agents, but they do indicate the possible presence of pathogens that do cause serious diseases like hepatitis A, salmonella, E. coli varieties, and even parasites like giardia. Any direct or unfiltered contact between fecal material and the stream is likely to elevate fecal coliform counts in the stream. Fecal coliform does not directly harm most aquatic life, and if the addition of fecal material is not continuous in a watershed, these bacteria rather quickly die off. However, leaky septic systems, and fecal material from animals all enter

watershed on a regular basis, especially after a rain. Therefore fecal coliform counts become a useful and relatively easy to measure indicator of stream health (Teel 1998). The presence of *E. coli* bacteria in surface water indicates pollution from sewage and wastewater and the potential for other pathogens to be present. There are a variety of sources that contribute bacteria and other pathogens to the surface water. These sources include illegal waste connections to storm sewers or roadside ditches, septic systems, combined and sanitary sewer overflows, storm (rain) runoff, wild domestic animal waste, and agriculture runoff.

The Michigan Public Health Code, P.A. 368 of 1978 sets standards that limit the levels of E. coli at beaches called Total Body Contact Standards. If the standards exceed the required limit, the beach location is posted closed to the public. The required limit is 300 colony forming units E.coli per 100 milliliters of sample, whereas the calculation of the sample is the daily geometric mean (cube root) of 3 or more samples taken during the same sampling event at representative locations within a defined sample area. Project partner assessment of area streams discovered consistent levels of coliform bacteria above these reporting limits. These levels in turn suggest a potential threat of pathogen contamination of surface waters.

Table 5.4 Coliform Bacteria Levels

Site	Date	Coliform	E.Coliform
Ashmun 1 (South Street)	5/2006	>2419.6	**674.5**
	7/2006	2164.8	**402.6**
	8/2006	>2419.6	**435**
Ashmun 2 (Behind Admiral Gas Station)	5/2006	1809	**433.6**
	7/2006	1028	224.8
	8/2006	>2419.6	**516.4**
Ashmun 3 (I-75 Spur (State Police Post))	5/2006	>2419.6	**921.4**
	7/2006	1561.1	**326.4**
	8/2006	>2419.6	174.3
Seymour 2 (4th Ave.)	10/2005	249.7	12.3
	5/2006	>2419.6	**921.4**
	7/2006	>2419.6	58.2
	8/2006	>2419.6	**380.4**
Mission 1 (Riverside Drive)	10/2005	1130.5	39.2
	5/2006	>2419.6	**664.4**
	7/2006	2265.6	53.5
	8/2006	>2419.6	**365.5**
Frechette Creek (Riverside Drive)	10/2005	935	82.6
	5/2006	>2419.6	**1511.7**
	7/2006	>2419.6	**460.6**
	8/2006	>2419.6	**478.2**

5.3.1 Pathogens – Sources and Causes

Using results from LSSU water chemistry analysis of area streams including stormdrains emptying into Ashmun Creek at ASH-10, CEMCD used *The Simple Method* to estimate bacteria loading in area stormwater. According to the model, billions of bacterial colonies enter our surface waters from the 6 inches of stormwater runoff from the City and 4 inches coming from Soo Township. According to *the Simple Method,* typical stormwater loads include approximately 1500 colony forming units per milliliter of stormwater. Due to decreasing amounts of filtering vegetation and wetlands, overland runoff reaches stormdrains and waterbodies untreated.

5.3.1.a Failing Onsite Septic Systems

According to USEPA bacteria and viral estimates of typical OSS wastewater, if typical household wastewater discharge is approximately 150 gallons per day and 1000 viral units per liter of wastewater, the threat of pathogens equals approximately 190 million viral units each day being

discharged into both ground and surface water from the approximately 319 OSS households in the Sault area watershed (USEPA).

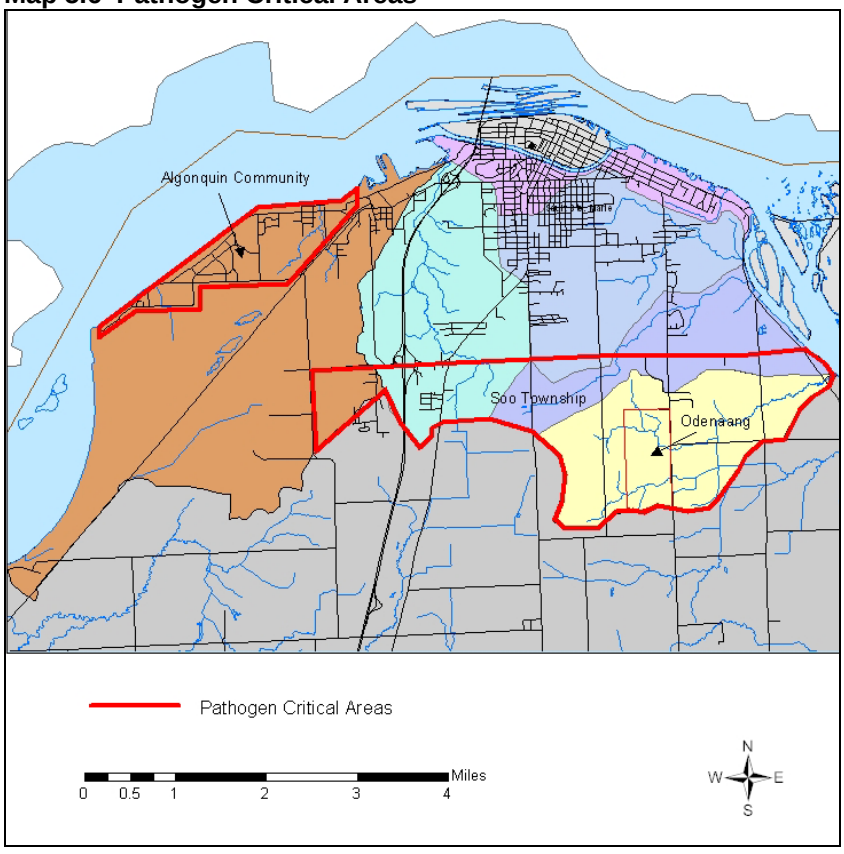
5.3.1.b Municipal Wastewater Management

Two concentrated wastewater operations exist in the watershed--the city's (Sault Ste. Marie) municipal system and the Sault Ste. Marie Tribe's (Chippewa) *Odenaang* housing development on the headwaters of Frechette Creek. Both operations are required to adhere to State discharge pollutant limits, but overflows and contingencies during treatment threaten appropriately treated discharges. With millions of gallons reaching surface waters each year from these two operations, it will be important to monitor water quality of these discharges regularly.

Pathogen Critical Areas

The city's (Sault Ste. Marie) municipal wastewater treatment system has eliminated most of the non point sources of fecal contamination of area waters in the project area. Nonetheless, there still remain areas in the watershed not serviced by the system, continuing to rely on onsite septic systems. These areas are critical areas for fecal contamination and will require aggressive attention to minimize pollution. They include the *Algonquin* community west of the city, much of Soo Township north of the city, and isolated homes within the city limits not serviced by the city. In addition, the *Odenaang* tribal development on the headwaters of Frechette Creek relies on a secondary treatment system for approximately 50 homes, with potential for 150.

Map 5.6 Pathogen Critical Areas



5.4 Toxins and Trash – Pollutant Description

Toxins in the Sault Ste. Marie area watershed include but are not limited to fuels, solvents, salts, and lawn care materials (pesticides, herbicides, fungicides, etc.).

5.4.1 Toxins and Trash - Sources and Causes

5.4.1.a Stormwater

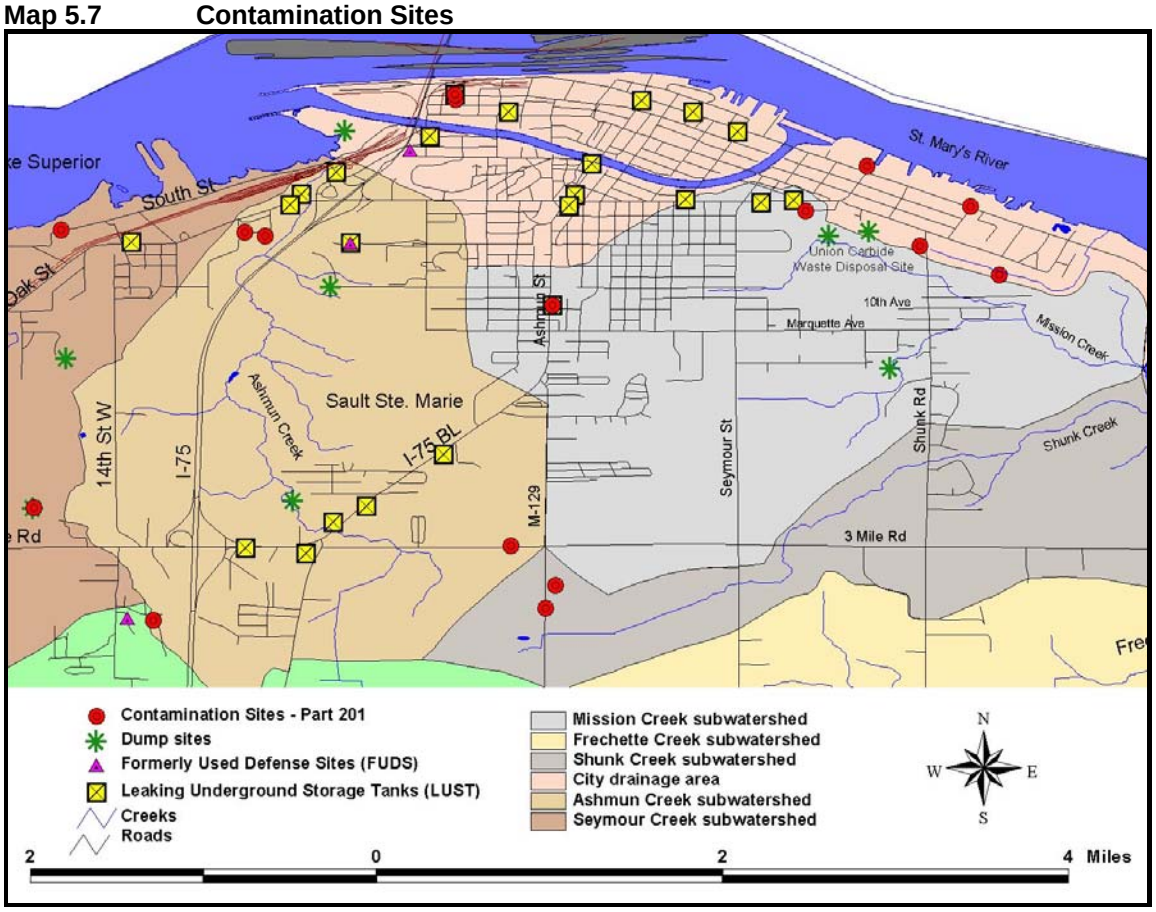
These toxic substances enter waterways from several different sources, especially through the 6 inches and 4 inches of stormwater runoff from the Sault and Soo Township, respectively. Toxins originate from such diffuse sources as leaking automobile radiators, landowners applying herbicides or pesticides to their lawns, or someone spilling gasoline while filling up their car. Every time it rains, these toxic pollutants are washed from the roads, parking lots, driveways, and lawns into the nearest storm drain or road ditch, eventually reaching the creeks of the watershed and the St. Mary's River. Hundreds of tons of road salt and sand are spread over area roadways during the winter. Spring rains wash the remnants into drains, ditches and directly into creeks. LSSU water quality analyses were completed in part to assess the significance of toxic pollution in area water bodies, and concentrations were used to compute stormwater source pollutant loads for toxins using *The Simple Method* (Schueler 1987)[19]. According to the model, yearly estimates of two representative metals in stormwater total 1617 lbs of zinc, and 428 lbs of copper reaching the St. Mary's River from the Sault area watershed (Schueler 1987).

5.4.1.b Contamination Sites

Another source of toxins that has plagued the watershed since its industrial beginnings is contaminated sites, including environmental remediation sites (part 201 of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended), leaking underground storage tanks (LUSTS-part 213), State-owned sites (Public Act 380, Section 20108c), a Superfund site (Comprehensive Response, Compensation and Liability Act of 1980), formerly used defense sites (FUDS), and closed landfills. CEMCD worked with MDEQ to document 51 contamination sites in the watershed. Unfortunately, estimates of pollutant load from these sources were inconclusive and variable due to lack of partner technology and information to quantify pollutants. During the implementation phase of the Sault project, CEMCD will work with the contamination site owners, MDEQ, and local government officials to pursue resources to remediate the sites.

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

Map 5.7 Contamination Sites



5.4.1.c Residential/Commercial Fertilizer Use

Traditionally, toxic chemicals including pesticides and herbicides have been associated with agricultural operations. In the case of the Sault watershed, though, it is believed that many "agri-chemicals" are used more intensively, and in greater quantity, in the urban and suburban setting such as lawns or golf courses. Quantification and management of these users is less certain than with the agriculture community, since scattered urban sources lack record keeping and regularly scheduled fertilizer and pesticide/herbicide use. The impact of the chemicals is also less clear, though the potential for environmental entry is high. In order to quantify existing pollutant loads from this source and, CEMCD considered LSSU chemical analysis of area streams and the estimates of phosphorus and nitrogen loading in urban and rural stormwater (see Nutrients 5.5).

5.4.1.d Landfills and Illicit Dumping of Trash

Sault Ste. Marie has been inundated with residential and commercial trash dump sites. Creek inventories discovered household trash at several locations throughout the watershed, especially near developed areas like parking lots, road/stream crossings, and behind residential developments. In addition, the Binational Public Advisory Council (BPAC) and LSSU hosted an Ashmun Creek cleanup during the planning project and removed at least 100 pounds of trash from each of three sites visited on Ashmun Creek. Conservative estimates total at least one ton of trash needs to be removed from each of the sub-watersheds' riparian zones. Old community landfills were reported at several locations (See Map 5.6). Inventory activity discovered evidence of buried trash at many of the sites. Unfortunately, all of the sites have been developed and

quantification and removal of the underground trash would provide fewer resource concern benefits than the cost.

Toxin Critical Areas

The most critical areas needing immediate attention to eliminate toxins, their sources and causes are the fuel stations with leaking underground fuel tanks scattered throughout the watershed. Liquid petroleum migrates easily through groundwater to surface water and volume of pollutant is relatively higher than other non point source pollutants, such as fertilizers and pesticides. CEMCD will facilitate implementation of LUST remediation plans with these stations, promote stormdrain BMP's, and provide information and education to appropriate station managers, all to minimize petroleum-based toxins migrating to area waters. (See map 5.5)

5.5 Nutrients – Pollutant Description

Nutrients are vital to plants and the whole cycle of life. Nature created a system of nutrient production and cycling that keeps these vital life ingredients flowing. Nitrogen is captured from the air and "fixed" or converted by certain bacteria to nitrates that are easily used by plants. This form of nitrogen becomes available to animals when the plant is eaten or to other plants when leaves die and decay. People have enhanced the nitrogen cycle by production of nitrogen fertilizers using high temperatures and pressures to convert the normally inert nitrogen gas to nitrates. These are given to plants in the form of inorganic fertilizers, often combined with two other major nutrients, potassium and phosphorus. Other nutrients are added as well, like calcium, magnesium, sulfur, selenium, copper, and boron, complimenting the impact of the major nutrients (Teel 1998).

The problem with nutrients, whether they are in inorganic form or organic form, like compost or manure, is that they leak, especially when used at rates that exceed the natural cycling ability of an ecosystem. Nitrates, nitrites, and ammonium compounds are highly soluble, dissolving readily in water and moving with water on or under the soil surface. Potassium moves easily too, but causes fewer problems than nitrogen. Phosphorus is generally thought to be immobile, but recent studies indicate that after phosphorus saturates the soil profile it too becomes mobile, even reaching water tables in some locations (Teel 1998).

Nutrient surpluses in aquatic systems cause a number of problems. Arguably chief among these is algae growth and subsequent decay. Nutrients, after all, are fertilizer, and fertilizer promotes rapid plant growth. Algae in streams respond no differently. Rapid growth also means an increase of organic materials in the water that also die and decay. The decay process uses oxygen at rates greater than the production by new algae or incorporation through flow over rocks. A decrease in oxygen threatens animal life in the stream, from the smallest mayfly to the largest trout or bass. Since some of these creatures consume algae, their demise leads to a greater accumulation of rotting organic material (Teel 1998).

5.5.1 Nutrients - Sources and Causes

5.5.1.a Residential and Commercial Fertilizer Use

The primary sources of nutrients in the watershed are residential and commercial fertilizer use (by residents, businesses, golf courses, and agricultural operations). Quantifying residential and commercial fertilizer use in the watershed as a source is difficult without extensive water sampling across the watershed. Therefore, CEMCD extrapolated local severity from research in other locations. Other watershed planners located studies that were completed for lawn fertilizers in Wisconsin, and results did indicate a large amount of phosphorus in the water stemming from fertilizer use despite limited precipitation runoff from residential lawns (U'ren 2005). For example, one study conducted in an urban area reported that lawns accounted for only 24% of runoff

volume, but contribute 56-70% of Phosphorus export (Waschbusch et al. 1999). Another study conducted on a lake with 70% of its shoreline developed with lawns mowed to the water's edge reported that lakeshore lawn drainage area provided just 4% of the water inflow to the lake, but comprised 51% of the total phosphorus input (Garn 2002). The same study measured total phosphorus concentrations in runoff for different fertilizer categories (no fertilizer, no-phosphorus fertilizer, and regular fertilizer) and found that total phosphorus concentrations in runoff from lawn sites with the no-phosphorus fertilizer applications were similar to that of unfertilized sites (Garn 2002). This indicates that no-phosphorus fertilizer use may be an effective, low-cost practice for reducing phosphorus in runoff. The Sault project will use these percentages in guiding action in reducing nutrient levels in area waters.

5.5.1.b Stormwater

Since Stormwater tends to concentrate nutrients from residential and commercial fertilizer use, the severity of this source was determined through LSSU chemical analysis of a representative storm drain and area streams, and extrapolating that data using *the Simple Method* model for computing stormwater pollutant loads. CEMCD determined that local stormwater is responsible for contributing 1790 lbs of phosphorus and 10,803 lbs of nitrogen each year to local water bodies. Project goals for reduction of those pollutants were based on that modeling.

5.5.1.c Failing Onsite Septic Systems

Another potential source of nutrient enrichment in the Sault Ste. Marie area watershed is from septic systems. Even though the majority of the Sault community is serviced by a municipal wastewater system that removes most of the nutrients from wastewater, the *Algonquin* community on the western region of the watershed, still relies upon on site septic systems (OSS) to treat wastewater from toilets, wash basins, bathtubs, washing machines, and other water-consumptive items, many of which can be a source of high pollutant loads. The city of Sault Ste. Marie at one time had resources to extend municipal wastewater treatment to the community, but locals declined the opportunity. The Sault watershed project will pursue locating resources to again offer that service to the community.

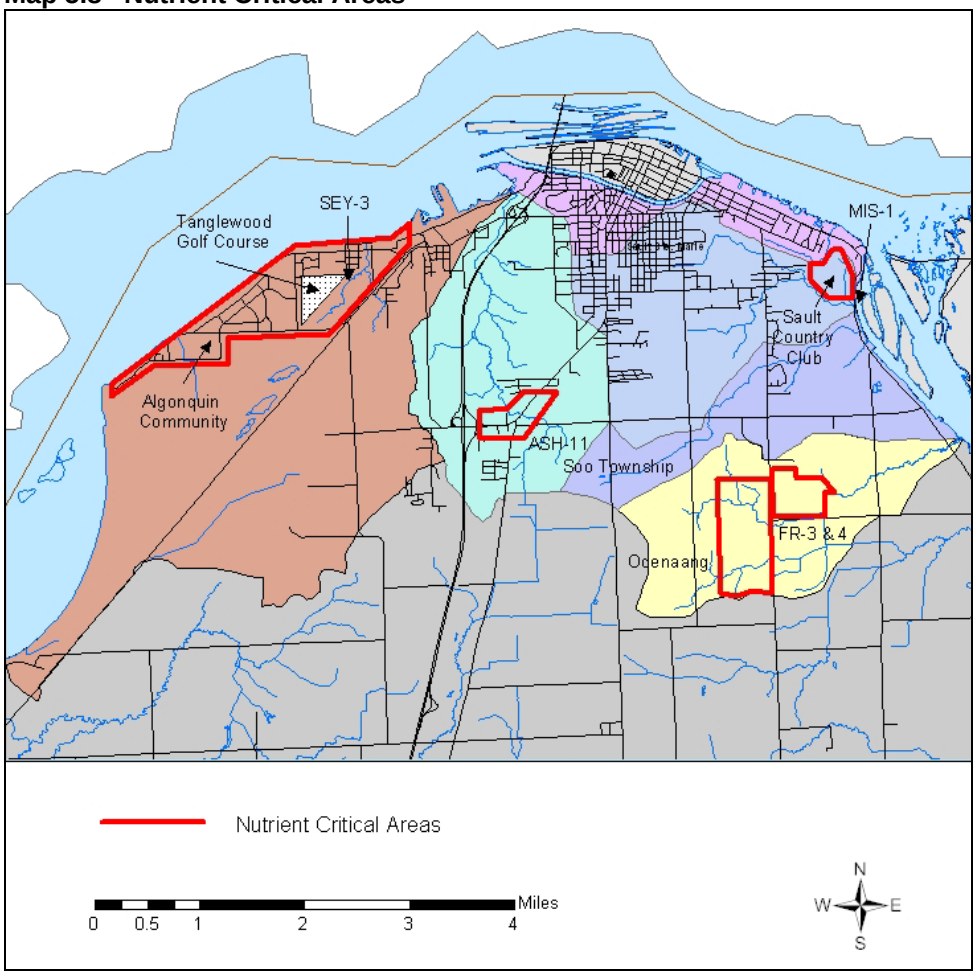
Failing septic systems from this area threaten water quality through discharge effluent with pollutant concentrations potentially exceeding established water quality standards. Failure can result from saturation of the drain field due to high water tables, overuse, improper design, and system breakage. Research indicates that failure rates for septic systems typically range between one and five percent each year (De Walle 1981) but can be much higher in some regions (Schueler and Holland 2000, Article 123). According to the Chippewa County Health Department, 33% of septic system installations permits each year are for replacement systems due to failures. There are numerous extenuating circumstances that affect that number, including overly wet years, abnormally high water tables, and/or old systems, etc.

The pollutant load discharged from onsite septic systems varies depending on the type of system used and the conditions at the site. The fact is, even a properly operating septic system can release more than 10 pounds of nitrogen per year to the groundwater for each person using it (Septic System Fact Sheet – www.stormwatercenter.net). The average pollutant removal effectiveness for a conventional septic system is as follows: total suspended solids 72%, biological oxygen demand 45%, total nitrogen 28%, and total phosphorus 57% (USEPA 1993). This shows that even properly operating conventional septic systems have relatively low nutrient removal capability, and can be a cause of eutrophication in lakes and coastal areas (U'ren 2005). Typical OSS pollutant load discharge contains 50mg/L nitrogen, 9mg/L, 100mg/L fats, oils, grease, .3mg/L volatile organic compounds, 100 million organisms(bacteria)/100ml of wastewater, and 1,000 to 10,000 infectious viral units/L (USEPA). Consequently, partner estimates of the real pollutant threat from OSS in the watershed is at least 36mg nitrogen and 4mg phosphorus per liter of wastewater per household per day.

Nutrient Critical Areas

Critical areas of focus for eliminating nutrient loading in the Sault Ste. Marie Area watershed were determined by selecting sites with multiple issues. Addressing these areas will result in the greatest water quality return. These sites include the *Algonquin Community* within the Seymour creek subwatershed (Sey 3) due to the sheer number of non point sources of pollution (OSS), the stormwater catchment area for two stormdrains emptying into Ashmun Creek at Ash 11 because of multiple pollutant problems, the agriculture operation adjacent Frechette Creek at FR 3 and 4 because of numerous pollutants from one management source, the *Odenaang* wastewater discharge into Frechette Creek due to the potential volume of pollutant, and the *Tanglewood* and *Sault Country Club* golf courses, located near Sey 3 and MIS 1, respectively. Here, numerous non point areas and pollutants can be eliminated by dealing with two groups. CEMCD will focus on information and education programs to facilitate improvement in on-site septic system management to Algonquin residents, and fertilizer concerns to the staff at Tanglewood. CEMCD will also work with the agriculture operation and the tribal housing operation (Odenaang) along Frechette Creek to reduce nutrient loading from raising livestock and managing concentrated wastewater. CEMCD will also work with the Sault Country Club along the banks of Mission Creek to eliminate nutrient loading from the management of their golf course. As with other pollutants, CEMCD will work with the City of Sault Ste. Marie to determine high pollutant (nutrients) loading from stormdrains at Ash 11.

Map 5.8 Nutrient Critical Areas



5.6 Sediment – Pollutant Description

Sediment is mobilized soil particles carried by water or air and re-deposited in another location. It is a product of erosion, both natural and human caused. **Natural** erosion is a slow process and can result from natural processes like earthquakes and violent storms (Teel 1998). **Human** activity has accelerated erosion and deposition of sediment. Agriculture, construction, or other activities, leave soil bare, unprotected by the roots, stems, leaves and litter of plants. Rain and wind loosen and break apart exposed soil particles, splashing them downhill. Runoff carries these particles to streams, rivers, and eventually to lakes and oceans (Teel 1998). Sediments destroy aquatic habitat when soil particles that are carried off the land enter surface waters and settle out. Many of the most productive bottom dwelling macroinvertebrates, such as mayflies, stoneflies, and caddis flies, live on rocks or cobble that water bubbles over, maximizing oxygen supply. When spaces between these rocks becomes filled with mud, it deprives the critters of habitat, which in turn leads to declines in fish populations dependent on these critters for food. A highly sediment-compromised stream has a clay-silt-sand lining that greatly restricts both variety and absolute numbers of animals, many of whom get their food by filtering the water, further reducing stream health in a cascade a problems (Teel 1998). In the Sault Ste. Marie area watershed, sediment impacts water quality mainly through **turbidity,** the cloudy, muddy condition that occurs when eroded soil is suspended in the water before settling out. Sault area soils are predominantly clay. When eroded, the soils reach the water bodies and remain in suspension for long periods of time, producing turbid surface waters. These turbid waters can stress or kill fish by clogging their gills and making it hard for them to see food sources (MDEQ 1998).

5.6.1 Sediment – Sources and Causes

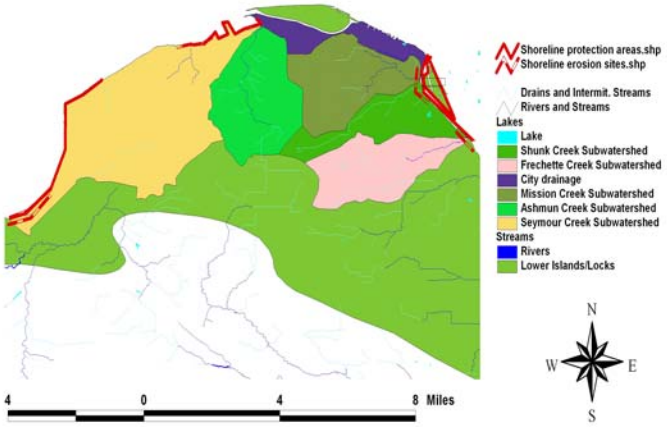
5.6.1.a Developed and Construction Areas

One source of erosion and sediment in the watershed includes construction and development sites. During the process of residential, commercial, or transportation development, sites require preparation, including excavation, leaving soil unprotected by natural cover. Sediment can leave the site during significant rain and wind events. The threat of sediment deposition increases when the projects are near surface waters. There is some protection against this threat. Part 91, Soil Erosion and Sedimentation Control of the Natural Resources and Environmental Protection Act 1994 PA 451 is a state statute that requires soil erosion protection measures on building sites of an acre or more and within 500 feet of a water body (SESC 2004). Unfortunately, project inventory discovered several non-compliant construction projects that were determined to be erosion and sediment threats close to water bodies and large enough to be regulated by the SESC statutes. CEMCD calculated typical soil loss per acre for these sites to quantify minimum erosion threats from representative construction sites and for design of remediation efforts. Using MDEQ's Soil Erosion and Sediment Control Training Manual*,* CEMCD estimated that from an acre of unprotected soil, representative of a typical building site footprint, 1 to 2 tons of soil could leave each site during typical building periods. That soil reaches stormdrains, ditches, and water bodies via stormwater, and impacts water quality. With approximately 90 development projects each year in the watershed (Gove 1995), there exists the potential for almost 100 tons of sediment to reach area water bodies from building sites.

5.6.1.b Eroding Shoreline

There are approximately 18 miles of St. Mary's River shoreline within the boundaries of the project area. Most of that 18 miles is significantly developed with either rip rap, steel abutments, or other stabilization techniques consistent with industry. In addition, along several residential developments, landowners have removed shoreline vegetation, thus subjecting even more shoreline to the erosive potential of the St. Mary's River. A long stretch of shoreline at the west end of the project area is suffering from extensive erosion by St. Mary's flow and wave action. Homes along the area locally known as *high banks,* have been moved away from the shoreline because of the severe erosion. The Sault planning project will stabilize approximately 2 miles of eroded and threatened shoreline, eliminate over 300 tons of sediment from reaching the St. Mary's each year from these areas, and permanently protect six miles of shoreline important to water quality and the desired uses of the watershed community.

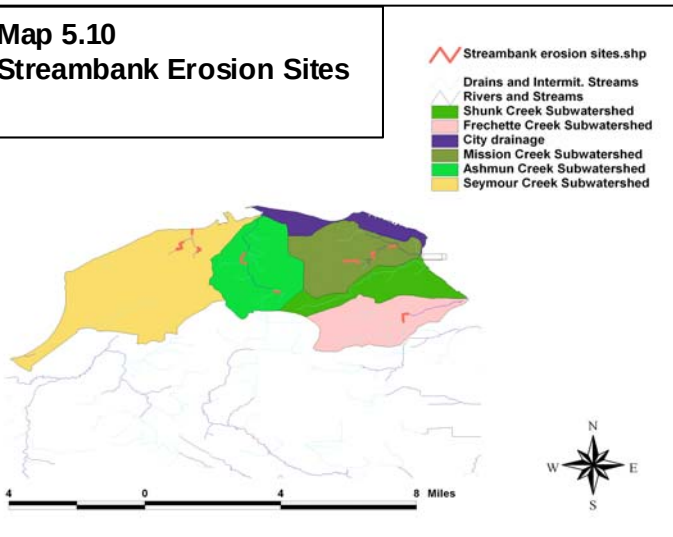
Map 5.9 Shoreline Critical Areas



5.6.1.c Eroding Streambanks

Several streambank erosion sites exist in the watershed. Each site is the result of poor land use practices that have compromised the riparian buffer that existed under natural conditions. Each site suffers from vegetation removal and development infrastructure, including roads, parking lots, and buildings close to the water's edge. CEMCD calculations estimate that nine sites are depositing approximately eight tons of sediment in area waters each year. The Sault project is committed to stabilizing these sites, and protecting the riparian zones to prevent further degradation of aquatic habitat.

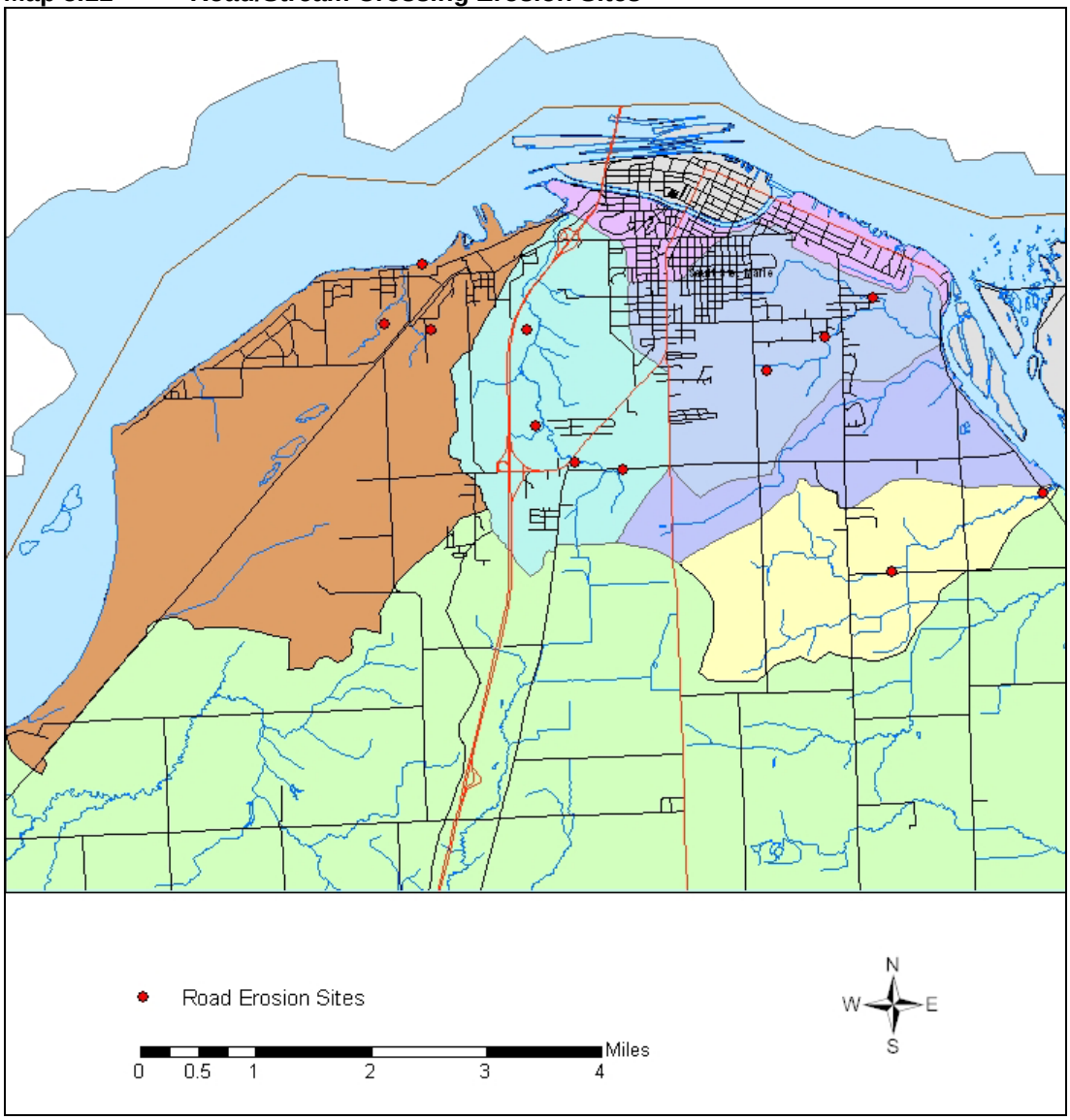
Map 5.10 Streambank Erosion Sites



5.6.1.d Road/Stream Crossings

Significant known sources of sediment include road/stream crossings. The watershed crossing inventory performed by CEMCD and local volunteers show that there are at least 50 road stream crossings in the Sault Ste. Marie area watershed, with at least nine sites contributing over 5 tons sediment each year to area waters. Several conditions exist at the crossings to contribute to erosion and sedimentation, most of all embankment erosion caused by flow impoundments due to small culverts. Upstream flows are impounded, water rises over bankful levels and the erosive forces draw sediments back into the water bodies when levels recede. Another source of sediment are the roads and trails adjacent the streams. At least two sites are contributing sediments due to the erosion problems on the road. One site in particular (the snowmobile trail near the I-500 snowmobile race track), is a trail made up entirely of highly erodable sand and it is located on a steep hill near Ashmun Creek. At least 2.5 tons per year of the sand is reaching the creek. This is exacerbated by added erosive activity during the summer months by ATV's and foot traffic.

Map 5.11 Road/Stream Crossing Erosion Sites



5.6.1.e Stormwater

According to the empirical stormwater pollutant load model *The Simple Method,* the most significant source of sediment in the watershed is urban stormwater (Schueler 1987). Stormwater sources include both the city of Sault stormwater collection system and the ditches and drains within the more rural Soo Township. Urban stormwater contains significant amounts of clay, sand, and silt dissolved from parking lots, roads, and residential establishments. More undeveloped areas contribute soils from dirt roads, gardens, agriculture operations, and any bare ground. Using the *Simple Method* for stormwater pollutant loads, CEMCD calculated sediment load coming from both urban and more rural stormwater. Urban stormwater contributes over 177 tons of sediment to area waters and rural stormwater accounts for almost 70 tons each year (Schueler 1987)

Sediment Critical Areas

Critical areas for sediment delivery to surface waters are illustrated in the maps above (5.6, 5.7, and 5.8) These areas comprise the most serious areas needing attention. CEMCD will also focus attention on building sites within 500' of area water bodies through their administration of part 91 of Public Act 451 (Soil Erosion and Sediment Control). Information and education is needed for prospective landowners and contractors working within the riparian and coastal corridors to reduce soil erosion and sedimentation to water.

5.7 The Priority Source and Cause: Stormwater and Land Use Planning

5.7.1 Stormwater

Project partners utilized several steering committee meetings to review inventory information, and stormwater surfaced as a common source of all of the pollutants identified. Therefore, the committee collectively voted stormwater as the highest priority source. Unfortunately, the Sault Ste. Marie watershed contains both urban and rural stormwater drainage systems that empty stormwater directly into the local creeks and the St. Mary's River without the filtering effects of presettlement landscapes. The imperviousness of the urban landscape along with accompanying clay soils has necessitated approximately 49 miles of sanitary and approximately 20 miles of combined sewers serving over 2,000 acres and another 17 miles of separated storm sewers draining 490 acres. According to the Sault Master Plan (1995), the existing collection system contains 10 active CSO structures, providing overflow relief to combined sewer areas. The annual number of overflows from these structures varies from 0 to 15, depending on tributary area wet weather flow rates. The city has a program to separate its combined sewer system. As part of that program, new sanitary sewers are proposed and existing combined sewers will become storm sewers.

Of course, the city of Sault Ste. Marie produces the greatest concentration of stormwater in the watershed due to the increased amount of impervious surfaces (17%) than in the headwater areas in Soo Township (10%). Urban land use research also suggests that there is a threshold to the amount of impervious cover that can occur within a watershed at which the degradation of aquatic systems occurs. Findings reveal that stream degradation consistently occurs when impervious surface levels in a watershed reach between 10-20% (CWP 1994). Unfortunately, Soo Township's growth is expected to increase, and with it impermeable cover.

Stormwater entering the St. Mary's River and its tributaries from storm drain outlets and ditches contributes a significant amount of pollution. When added up, inputs from all these small, single inputs of stormwater can result in a massive amount of pollution. Lacking actual water chemistry analysis of stormdrains, CEMCD estimated stormwater pollutant loads using *The Simple*

Method.[20] The following table lists representative nutrients, toxins, sediment, and pathogens estimated to be contained in the Sault Ste. Marie area watershed stormwater.

Table 5.5 Urban Stormwater Estimates

Urban Stormwater Estimates (Schueler 1987)		
	Sault	Soo Twp.
Direct Drainage Area (Acres)	9,000	6,000
Land Use (% of acreage)		
Vacant/undeveloped	62	81
Commercial/Industrial	17	1
Residential	21	18
Overall Impervious Cover (%)	17	10
Annual Pollutant Export (lbs)		
Phosphorus	1,242	548
Nitrogen	7,763	3,040
Sediment	355,357	138,114
Zinc	1,374	243

Considering these estimations, the project steering collectively voted stormwater as the highest priority source of all pollutants in the Sault Ste. Marie area watershed. The group determined that developing strategies to manage stormwater would result in the greatest potential pollution reduction cost/benefit. Therefore, many of the action items outlined in chapters 7 and 8 are at least indirectly targeted to treat stormwater and its detrimental effects on the area's water quality.

5.7.2 Master Plan, Zoning Ordinance, and Other Planning Documents Inventory

As mentioned earlier, Sault Project partners determined that the basic cause of all water quality degradation is land use management, planning, and regulation, without regard for water quality. This determination necessitated analysis of existing and planned land use documents to help develop recommendations to address this component of watershed management.

Following procedures based on similar management plan development[21], Sault Ste. Marie and Soo Township's master plans and zoning ordinances, along with a preliminary draft of Sault Ste. Marie's Stormwater Management Plan were reviewed to determine if land use regulations and/or suggestions existed for the following:

- Special districts for environmental sensitive areas
- Special approval or permits for environmentally sensitive areas
- Special requirements for shoreline
- Special requirements for wetland areas
- Special provisions to protect streams, surface water, or groundwater
- Soil erosion provisions

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

[21] the Northwest Michigan Council of Government's 2005 review of Grand Traverse Bay watershed political districts

- Stormwater provisions
- Sewer/water provisions
- Open space regulations

Results

Fortunately, both the Sault Ste. Marie and Soo Township Master Plans consider natural resource management as important to the sustainability of both communities' livelihood. Goals in the Sault Plan include continuing development "with minimum changes to the topography and natural features of the area." In addition, the City will safeguard the health and safety of area residents by maintaining a safe and clean environment. Potential actions toward this goal include 1) Working with the Michigan Department of Natural Resources to maintain an up-to-date status report of all sites of environmental contamination and leaking underground storage tanks in the area; 2) Where possible, preserve corridors of open space for purposes of aesthetics, maintenance of property values and maintenance of native flora and fauna. Connectivity of the corridors will be encouraged whenever possible; 3) Promote silt reduction from water courses in the City through the encouragement of plant growth, stabilized embankments and the establishment of green spaces and buffer zones; 4) Where possible, integrate walking on bike trails in conjunction with green spaces or open space corridors; 5) Establish a household hazardous waste program, and educate residents of proper disposal techniques and the hazards of the improper disposal of hazardous household items; 6) The City will continue to be an active player in getting contaminated sites cleaned up and put to a productive use. In terms of water, wastewater and stormwater, the plan set as an action item the implementation of a storm water detention ordinance that will require new developments to provide detention areas and to consider establishing a storm water utility fee to finance improvements. In terms of natural aesthetics, the city will continue planting of native vegetation along main thoroughfares and near industrial operations. The City will also continue to support efforts of the Beautification Committee, and expand efforts to include planting of native trees and shrubs in beautification efforts. Finally, the City Plan suggests incorporating protection of replanting of vegetated areas as part of site plan standards for new commercial and industrial development (Gove 1995)

The Soo Township Plan outlines key issues defined by past public surveys. They include the preservation of the quiet, rural nature of the township, adequate groundwater protection throughout the township, and the elimination of open storage of garbage (EUPRPDC 2000). The Plan documents several objectives to protect the environment, including encouraging development that doesn't impact the environment and unique rural character from encroachment, pollution. The plan specifically emphasizes protection of environmentally sensitive areas, including steep slopes, wetlands, and stream corridors. Language also mentions educating the public in regards to the Township's "strong reliance upon groundwater resource for potable water supplies and the potential detrimental effects of irresponsible land development and land use" (EUPRPDC 2000).

Soo Township Zoning Ordinances address certain environmental protection, but not to the degree as the Township's Master Plan. First mention of addressing the natural environment in land use planning is the development of a Forestry/Recreation district and a waterfront district, which aids in specific planning for these different land use types. Protection is limited, though. Setbacks from high water marks are 30 feet. Minimum lot sizes are 15,000 square feet. As a positive note, however, lot widths along the St. Mary's River must be a minimum of 500 feet. Unfortunately, observation suggests that the ordinance is not being enforced.

Sault Ste. Marie has not incorporated several of the aforementioned protective ideas into the zoning ordinances. Nonetheless, the city has improved site plan review language so that care is taken before construction commences on projects in the city to accommodate certain issues, especially stormwater drainage. In fact, the one successful regulation is the requirement for on-site stormwater detention for new developments within the city. Other than that, no comprehensive protection was afforded natural resources in the Sault Ste. Marie Ordinances.

For the most part, it is easy to see from the master plans that these communities have good intentions when it comes to protecting natural resources. The natural resources of this area are why some people choose to live in the Sault area. Unfortunately, Soo Townships and the Sault community may lack the initiative to draft and enact affective, and enforceable, zoning requirements. The validity of a zoning ordinance, particularly one that is more restrictive, is often challenged by developers and others. Local governments may have trouble obtaining information to back up their ordinances that will stand up in court (U'ren 2005).

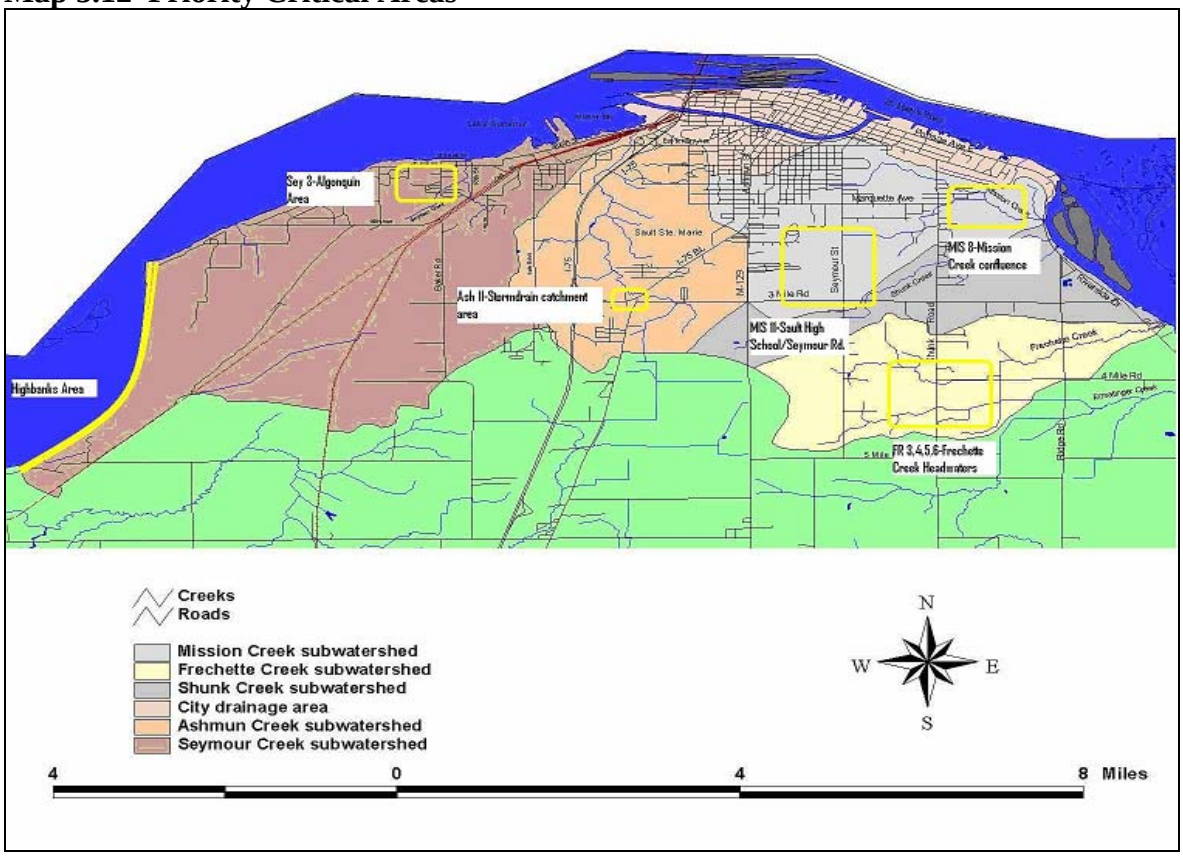
In conclusion, CEMCD assessment of both political regions suggests that existing ordinances are lacking in areas such as requiring significant setbacks from water features, establishing vegetative buffers along water bodies, hillside protection (in steep sloped areas), and protecting the quality of intermittent streams and stream sections, which are prevalent in Soo Township. It will be important that Soo Township, which is forecasted to experience high growth rates and/or high populations enacts and enforces zoning regulations that protect water quality and natural resources before these things become degraded. Zoning is a great opportunity for the Township to decide what kind of development and growth it wants in the area, as well as what kind of protection for water resources.

Sault Project Partners, consequently, have included goals, objectives, and tasks that include working with both the Soo Township and City officials to develop protective regulations for water quality and the area's natural resources. In the implementation phase, officials will be solicited to develop practical regulations and devise strategies for approving and implementing those strategies. In order to assist the Sault and Soo Township community, the Sault Project partners will utilize the MDEQ's *Filling the Gaps: Environmental Protection Options for Local Governments* that equips local officials with important information to consider when making local land use plans, adopting new environmentally focused regulations, or reviewing proposed development (Ardizone, Wyckoff, and MCMP 2003). An overview of Federal, State, and local roles in environmental protection is provided, as well as information regarding current environmental laws and regulations including wetlands, soil erosion, inland lakes and streams, natural rivers, floodplains, and more. The book also outlines regulatory options for better natural resources and environmental protection at the local level. A copy of this guidebook is available via the DEQ website: www.michigan.gov/deq. Assisting local governments in updating and enacting strong zoning ordinances to protect water quality and secure natural areas is extremely important in the Sault Ste. Marie area watershed and is a high priority for implementation efforts. Much can be done at the local level because City and Township planners and active community members know their land resources better than anyone. If appropriate, these local governments can enact more stringent or practical wetland and riparian development regulations than exists from either the State or Federal agencies (U'ren 2005).

Priority Critical Areas

CEMCD analyzed commonalities between aforementioned pollutant critical areas to direct future pollution reduction efforts toward the greatest pollutant reduction effect. These areas that shared multiple pollutants, sources, and causes are priority critical areas. The area of Sey 3 has sediment issues at or near the crossing, nutrient pollutants from the area golf course, and pathogen threats from the *Algonquin* area on site septic systems; The area of Ash 11 has sediment issues at or near the crossing as well as nutrient and bacteria contamination from the stormdrain; MIS 8 area hydrology has been significantly altered, sediment problems exist at or near the crossing, and the area golf course is suspect of nutrient loading to Mission Creek. Upstream at MIS 11, wetland filling, road construction, and channelization have severely altered natural hydrology, as a result, sedimentation is a problem; Finally, the headwaters of Frechette Creek is a critical area suffering from a combination of pollutants, from a wide range of sources, and causes, including nutrients and altered hydrology from agricultural operations, pathogens from wastewater discharge, and sediment from poorly designed road crossings. These areas will be the eventual critical areas of focus for the Sault area watershed project.

Map 5.12 Priority Critical Areas



Chapter 6 Project Goals

The overall mission for the Sault Ste. Marie area watershed management plan is to provide guidance for the implementation of actions that will reduce the negative impact that pollutants and environmental stressors have on the designated watershed uses of the Sault Ste Marie area watershed. The main goal is to have the water bodies within the Sault Ste. Marie area watershed support appropriate designated and desired uses while maintaining their distinctive environmental characteristics and aquatic biological communities.

Using suggestions obtained from steering committee meetings, partner communications with area stakeholders, and examples from other watershed management plans, the project steering committee developed six broad goals for the area watershed (Table 6.1). Working to attain these goals will ensure that threatened designated uses are maintained or improved.

Table 6.1 Project Goals

Impaired or Threatened Designated or Desired Use	Goal	Pollutant(s) Addressed
Warm/Coldwater Fishery Other Aquatic Life Desired Use: -Recreation -Natural aesthetics	1. Restore and protect aquatic and terrestrial ecosystems within the watershed, including the warm/coldwater fishery and other aquatic life	Alteration of Hydrology Sediment Nutrients Toxins
Public Water Supply Total/Partial Body Contact Recreation Desired Use: -Recreation	2. Protect and improve the quality of water resources within the Sault Ste. Marie watershed for drinking and recreational use	Alteration of Hydrology Sediment Nutrients Toxins Pathogens
Coldwater Fishery Other Aquatic Life Desired Use: -Natural aesthetics	3. Establish and promote land and water management practices that conserve and protect the natural resources of the watershed	Alteration of Hydrology Sediment Nutrients Toxins Pathogens
Warm/Coldwater Fishery Desired Use: -Recreation	4. Enhance the amount and quality of low impact, nature-based recreational opportunities	Alteration of Hydrology Sediment Nutrients Toxins Pathogens
Coldwater Fishery Other Aquatic Life Public Water Supply Total/Partial Body Contact Recreation Desired Use: All	5. Establish and promote educational programs that support stewardship and watershed management goals, activities, and programs	Alteration of Hydrology Sediment Nutrients Toxins Pathogens
Coldwater Fishery Other Aquatic Life Desired Use: All	6. Preserve the distinctive character and aesthetic qualities of natural ecosystems in the watershed	Alteration of Hydrology Sediment Nutrients Toxins

Objectives

The following project objectives (Table 6.2) outline how the Sault Project partners will reach the corresponding project goals.

Table 6.2 Goals and Objectives

Project Goals	Objectives
1. Restore and protect aquatic and terrestrial ecosystems within the watershed, including the warm/coldwater fishery and other aquatic life	**Restore and protect natural hydrology** -Restore and maintain natural riparian corridors, St. Mary's River shoreline, and instream aquatic habitat through protection strategies and/or enhancement projects on at least 1 priority wetland/natural area -Promote proper land use management to protect natural hydrologic flow across stable landscapes through addition of concept in SOO TWP/Sault Master Plan and at least 1 stormwater management protection ordinance -Promote and restore hydrology through restoration of at least 1 priority site degraded by channelization or other development -Repair hydrological alteration problem at least 1 road/stream crossing site **Reduce sediment impacts on aquatic ecosystems** -Promote the restoration and maintenance of stabile riparian/shoreline areas with at least 1 I/E project and/or 1 restoration BMP on a priority streambank and/or shoreline erosion site -Promote and oversee installation of at least 1 erosion and sediment control structure on a representative construction/development site -Promote proper stormwater management by facilitating the development of a drainage district program in the watershed -Restore and maintain at least one priority eroding road/stream crossing Reduce toxin impacts on aquatic ecosystems -Promote and install at least 1 toxin control structure, riparian buffer or other appropriate BMP near at least 1 storm drain or other appropriate location -Promote proper residential/commercial fertilizer/pesticide use through at least one public outreach campaign to the watershed community (brochure, advertisement, etc.) -Remove at least one priority contamination site from State site lists through the restoration and maintenance of the site for listed contaminants *(see appendix)*

	Reduce nutrient impacts on aquatic ecosystems -Promote proper residential/commercial fertilizer/pesticide use through at least one public outreach campaign to the watershed community (brochure, advertisement, etc.) -Promote and install at least one nutrient management BMP on one agricultural operation -Promote continuation of separation of combined sewer systems through pursuit of at least one funding resource for city officials -Distribute at least one OSS education and awareness strategy to priority community
2. Protect and improve the quality of water resources within the Sault Ste. Marie watershed	**Reduce the impact of hydrological alterations, sediments, nutrients, and toxins on surface and groundwater (see objectives above)** **Reduce the impact of pathogens on surface and groundwater.** -Promote the retrofitting of municipal sewer to all of watershed residents and businesses (~300 units) and the continued separation of CSO's -Create awareness of proper OSS management to protect water quality through at least 1 mailing or workshop each year **Reduce the impact of toxins on surface and groundwater** -Promote awareness of proper lawn maintenance through 1 education and informational mailing or workshop each year -Promote limited use of road salts and pursuit of alternative winter road deicers, sponsoring at least 1 deicer test each winter for project duration -Promote/facilitate status reviews for watershed contamination sites through consultation with each site owner (50) -Promote remediation of watershed contamination sites through at least 1 informational mailing to mailing to each landowner and general public as to site status and remediation information
3. Establish and promote land and water management practices that conserve and protect the natural resources of the watershed	**Reduce the impact of hydrological alterations, sediments, nutrients, and toxins on surface and groundwater (see objectives above)** Establish and promote land management practices that conserve natural resources and protect water quality -Promote and facilitate protection of at least 100' of riparian, 100' of shoreline, 1 acre of wetlands, and 1 biologically sensitive area property in 3 years

	-Promote low impact design of future impervious surface in the watershed through at least 1 demonstration project each year -Pursue low impact/"green" development planning to vacant areas appropriate for particular land use types and density by providing consultant to area planners -Limit fragmentation/development of remaining priority aquatic through at least 1 conservation easement and/or 1 riparian/shoreline/wetland protection ordinance
4. Enhance the amount and quality of low impact, nature-based recreational opportunities and support a sustainable local economy	**Restore and maintain warm/coldwater fishery** -Promote and facilitate habitat protection through at least 1 conservation easement -Promote and facilitate habitat restoration through at least 1 improvement project -Promote and facilitate the obtainment of good habitat (P51 metrics) in all subwatersheds **Protect water quality and access areas for public swimming** -Promote and facilitate water quality testing for bacteria with one grant application/year -Promote and facilitate development of at least 1 public swimming area -Promote completion of the Ashmun Bay Park, St. Mary's Walkway, and natural enhancements to other parks
5. Establish and promote educational programs that support stewardship and watershed management goals, activities, and programs	**Establish a successful public Information and Education (I/E) program throughout the Sault area watershed. (See I/E chapter)** **Educate public about the value of the watershed and St. Mary's River to the community and their responsibility to be stewards of the resource** -Promote and facilitate at least 1 I/E promotional activity and/or product each year **Provide continuous information to public about watershed facts, research, and protection project opportunities** -Promote and facilitate at least 1 I/E promotional activity and/or product each year **Involve the community in the implementation of the Sault implementation plan through meetings, workshops, data acquisition, etc.** -Promote and facilitate at least 1 project participation meeting, workshop, or data acquisition project each year
6. Preserve the distinctive character and aesthetic qualities of the watershed	**Support public and private needs while promoting economic sustainability and a sense of community.** -Continue with participation with *Sustainable Soo Coalition* include attendance/facilitation of

	annual Environmental Summit **Preserve existing settings of particular historical and/or cultural importance** -Promote and facilitate protection of at least 1 priority historical and/or cultural resource **Maintain the visual quality of desirable viewsheds while supporting landowner desires for property use, privacy, and security** -Promote and facilitate the protection of at least one priority “greenspace” property **Maintain open space, parks, greenways, and natural areas to allow for aesthetic enjoyment and to sustain the perception of the high quality of life that brings people to the area** -Promote and facilitate the protection of at least one priority “greenspace” property **Increase access to recreational lands and viewsheds through local land trusts** -Promote and facilitate at least 1 land trust protection/access project each year

Chapter 7 Implementation Tasks

7.1 Logistics of Implementation Plan

This chapter includes tasks that the Sault Project partners will facilitate in order to address the sources and causes that contribute pollutants to local water bodies and threaten and impair designated uses for water in the watershed. These implementation tasks (also known as Best Management Practices or BMPs) represent an integrative approach, covering more than one pollutant at times, to reduce existing sources of priority pollutants and prevent future contributions. It is intended that these BMPs be implemented in priority areas in the watershed (see Maps in Chapter 5). The project steering committee consulted references in Table 7.1 for BMP design as well as other local, state, and federal agencies, including other watershed management plans. The tasks were organized according to pollution sources and/or causes determined in the inventory process and designed to reduce multiple pollutants. In this way, partners may work on a specific source (i.e., urban stormwater or failing OSS) that may contribute more than one type of watershed pollutant and meet more than one watershed goal.

The categories are as follows:

1. Loss of Aquatic Habitat (Wetland/Riparian Zones/In-stream Habitat/Natural Features)
2. Developed Areas/Construction Sites
3. Road Stream Crossings
4. Urban/Rural Stormwater
5. Bank/Shoreline Erosion
6. Contamination Sites (LUSTS, FUDS, etc.)
7. Residential/Commercial Fertilizer/Pesticide Use
8. Failing On-site Septic Systems
9. Monitoring
10. Desired Uses

7.2 Summary of Best Management Practices

Best Management Practices (BMPs) are any structural, vegetative, or managerial practices used to protect and improve surface water and groundwater (DEQ 2001). It is important to note that no BMP can be used at every site, and no BMP can include so many specifications that all possible uses and all possible conditions are included. Each site must be evaluated, and specific BMPs can be selected which will perform under the site conditions. For BMPs to be effective, the correct method, installation, and maintenance need to be considered for each site. Addressing each of these factors will result in a conservation practice that can prevent or reduce non-point source pollution.

Structural BMPs are physical systems that are constructed for pollutant removal and/or reduction. This can include rip-rap along a streambank, rock check dams along a steep roadway or detention/retention basins, oil/grit separators, and porous asphalt for stormwater control.

Non-structural BMPs include managerial, educational, and vegetative practices designed to prevent or reduce pollutants from entering a watershed. These BMPs include buffers and filter strips, but also include education and public involvement programs, land use planning, natural resource protection, regulations, operation and maintenance or any other initiative that does not involve designing and building a physical structure (U'ren 2005).

Table 7.1 is based on a similar table in the Grand Traverse Bay Protection Plan, and lists potential systems of commonly used Best Management Practices (BMPs) that deal with various

types of pollutant sources, and their effectiveness[22]. The table lists the total percent removal of phosphorus, nitrogen, sediment (total suspended solids), and metals and bacteria for selected BMPs that are suggested in Chapter 7. Listing BMP effectiveness by percentage is a much more useful way of displaying the data rather than using specific values, which can be deceiving depending on the size of BMP implemented or installed. This is because specific values for pollutant removal depend on 1) the size of BMP implemented (feet of riparian buffer installed or acres of stormwater detention ponds), and 2) how much pollution was initially coming from the source. The BMP's listed here for each respective source or cause is a representation of the actual BMP listed in the implementation task. For example, to correct sedimentation from riparian construction and development, one Plan suggestion is to protect riparian zones through conservation easements, set back ordinances, and education. These activities obviously focus on either eliminating or limiting riparian development, which is synonymous with establishing riparian buffers. Thus the pollution reduction potential outlined here can be extrapolated for many other similar activities in the implementation plan (U'ren 2005).

Table 7.1 BMP Examples and Efficiency (by Source)

Major Source or Cause	Pollutant Addressed	BMP's	% Pollutant Removal[23]	Reference
Wetland/Riparian/In-stream Construction and Development	Alteration of Hydrology Sediment	Enforce SESC(Stabilize Site Soils)	80-90 Solids	-Part 91 PA 451 -Section 303 -Local Health Department Regs. --Guidebook of BMP's for Michigan Watersheds -Public I/E Strategy
		Riparian Buffers* (Promoted through regulation,easements, I/E)	Grass:39-88 Phos Forest:23-42 Phos Grass:17-87 N Forest:85 N Grass:63-89 Solids	
Road Stream Crossings	Alteration of Hydrology Sediment	Stabilize Embankment-Establish vegetation	40 P 20 N 84 Solids	-Guidebook of BMP's for Michigan Watersheds
Urban/Rural Stormwater	Alteration of Hydrology Sediment	See Riparian Buffers Above	See Above	-MDEQ Stormwater Management Guidebook - Guidebook of BMP's for Michigan Watersheds
		Protect/Construct Wetlands**	51 P,30 N 77 Solids 56 Metals 78 Bacteria	
		Grassed Filter Strips, Channels, Swales	37 P, 26 N 83 Solids 57 Metals	
Bank/Shoreline Erosion	Alteration of Hydrology Sediment	See Riparian Buffers Above	See Above	-Guidebook of BMP's for Michigan Watersheds
Contamination Sites (LUSTS, FUDS, etc.)	Toxins	Tank, Contaminated Soil Removal	100% Contaminants from Site	-MDEQ
Lawn/Agriculture Maintenance	Toxins Nutrients	See Riparian Buffers Above	See Above	-Guidebook of BMP's for Michigan Watersheds -Public I/E Strategy
		See Grassed Filter Strips, Channels, Swales Above	See Above	
Failing On-site Septic Systems	Toxins Nutrients Pathogens	Information and Education	N/A	-Public I/E Strategy

*Pollutant removal efficiencies will increase as buffer width increases. Grasses in this case mean native grasses and not regular lawn or turf grass.

** Wetlands are among the most effective stormwater practices in terms of pollutant removal, and also offer aesthetic value. While natural wetlands can sometimes be used to treat stormwater runoff that has been properly pretreated, stormwater wetlands are fundamentally different from natural wetland systems. Stormwater wetlands are designed specifically for the purpose of treating stormwater runoff, and typically have less biodiversity than natural wetlands both in terms of plant and animal life. There are several design variations of the stormwater wetland, each design differing in the relative amounts of shallow and deep water, and dry storage above the wetland.

[22] Effectiveness estimates gathered from The Center For Watershed Protection Website, (*www.stormwatercenter.net*)

[23] percent removal values are comparative numbers that state how much pollutant was removed compared to no BMP implementation at the site.

***Evidence for oil grit separators overwhelmingly suggests that oil-grit separators are a very poor stormwater practice and should probably be dropped as a treatment option unless these systems are designed off-line and with the same treatment volume of other stormwater practices.
Values obtained from Center for Watershed Protection's Stormwater Center website (www.stormwatercenter.net) and Practice of Watershed Protection Manual (Schueler and Holland 2000).

7.3 Description of Implementation Task Components

Partner Acronyms

City	City of Sault Ste. Marie
CCO	Chippewa County Officials
MDOT	Michigan Department of Transportation
SAPS	Sault Area Public Schools
MDEQ	Michigan Department of Environmental Quality
SPSC	Project Steering Committee
MDNR	Michigan Department of Natural Resources
EPA	Environmental Protection Agency
NRCS	Natural Resource Conservation Service
SOO	Soo Township Government
STCI	Sault Ste. Marie Tribe of Chippewa Indians
Little T	Little Traverse Conservancy
CCHD	Local Health Departments
ITC	Inter-Tribal Council
IJC	International Joint Commission
CCRC	Chippewa County Road Commission
SCF	Sault Community Foundation
USGS	United States Geological Survey
CCR	Chippewa County Recycling
MNFI	Michigan Natural Features Inventory
BPAC	Binational Public Advisory Council
MSUE	Michigan State University Extension Service
EUPRPDC	Eastern Upper Peninsula Regional Planning & Development Commission
COC	Sault Ste. Marie Chamber of Commerce

Other Organizations:

Local Realtors, Businesses, landowners

Responsible Partners

For each task, the partner best suited to help implement the task has been identified.

Timeline

Project partners will try to accomplish most tasks within 10 years. Completion of some tasks will be pursued in the first phase of implementation within a timeframe of 3 years. Tasks designed for continuous data acquisition and may require a long term commitment were given a timeframe of "ongoing."

Milestones

Milestones for specific tasks identify when respective tasks should be completed. They are meant to guide implementation priorities and measure progress.

Estimated Costs and Timeframe:
For costs associated with salaries, the proposed watershed manager rate of $25/hour was applied. For tasks to be completed by a specialized consultant, a rate of $50/hour was used.

Tasks that will be done yearly, or on site basis are noted as such ($X/yr or $X/site). Appendix **A** lists average rates for costs associated with purchasing materials for and installing standard BMPs. Further details are noted where applicable. Tasks that should be completed in the short term were given a timeframe of 3 years; long-term tasks were given a timeframe of 10 years; tasks that should be undertaken annually were given a timeframe of "ongoing." **Priority** corresponds with the timeframe. High priority tasks will be pursued first through funding and participation resources.

7.3 Recommended BMP's

1. Loss of Aquatic Habitat
Goals Addressed: 1,2,3,4,6

Task A: Develop local ordinances to ensure best management practices are utilized on private property along the water's edge including the retention or establishment of shoreline and riparian vegetative buffers, minimizing vegetation removal and mowing to the water's edge, and eliminating refuse dumping into or near the water. Adopt ordinances or establish policies that maintain these practices for the maintenance of public lands as well.
Estimate Cost: $15,000 for technical assistance per ordinance
Milestone/Timeline: Planning communication 2007, provide technical assistance for ordinance development 2007-2009; develop protective ordinance or site plan review regulation for City planner by 2010
Priority: High
Potential Project Partners: CEMCD, EUPRPDC, City, SOO

Task B: Work with Chippewa County Building Authority and Michigan Department of Environmental Quality, contractors, etc. to monitor and enforce regulations concerning near shore, riparian, and wetland areas.
Estimated Cost: $40,000 (SESC staff/year)
Milestone/Timeline: CEMCD took over administration of SESC enforcement during the planning phase. Administration of program will require monitoring activity of county and critical area developments. Task timeline will be ongoing. CEMCD will hold an annual information and education workshops with contractors and developers.
Priority: High
Potential Project Partners: CEMCD, CCBA, MDEQ

Task C: Install BMPs where needed to restore channelized stream sections to restore natural sinuosity and in-stream habitat variability.
Estimated Cost: $25,000/year
Milestone/Timeline: See BMP Summary following this section
Priority: High
Potential Project Partners: CEMCD, MDEQ, City, SOO, STCI, MDNR

Task D: Consult MDNR Fisheries staff to evaluate appropriate sites for in-stream habitat improvement projects such as lunker structures, island structures, half-log structures or log jams in conjunction with stream rehabilitation BMP's. Criteria to be assessed includes: woody debris, bank stability, riparian vegetation, in-stream cover, flow dynamics, and fish population structure.
Estimated Cost: $ Manager's Salary
Milestone/Timeline: Preliminary inventory completed; Consult MDNR 2007 to determine priority sites in preparation for implementation grant proposal. Engineer site design - 2008. Install priority sites by 2010.
Priority: High
Potential Project Partners: CEMCD, LSSU, MDNR, MDEQ

Task E: Install in-stream habitat improvements where appropriate, according to the inventory in Task D
Estimated Cost: $>10,000/year
Milestone/Timeline: Install habitat improvements on all priority sites by 2010.
Priority: High
Potential Project Partners: CEMCD, MDEQ, MDNR

Task F: Work with local land conservancies, local units of government and other partners with protection of lands that maintain or expand wildlife corridors, protect sensitive wildlife and fisheries habitats such as wetlands, riparian corridors, low impact recreation, etc., and protect habitat for threatened and endangered species. Where necessary assist with purchase of conservation easements, deed restrictions, and other strategies.
Estimated Cost: $5,500/year staffing; >$100,000, each priority property
Milestone/Timeline: Develop list of priority sites and contact landowners (maps) by 2008. Secure at least one priority property conservation easement by 2008.
Priority: High
Potential Project Partners: Little T, CEMCD, MDEQ, EUPRPDC, City, SOO

Task G: Create an endowment fund to assist the local land conservancies in purchasing conservation easements on key priority parcels within the Sault Ste. Marie area watershed. Parcels targeted for protection would contain sensitive physical and hydrologic features that are essential to preserving water quality (e.g. wetlands, water frontage, groundwater recharge, steep slopes, etc.).
Estimated Cost: $1,500,000 initial capital
Milestone/Timeline: Design fundraising strategy 2007. Establish fund for endowment donations by 2009.
Priority: High
Potential Project Partners: CEMCD, Little T, LSSU, Sault Community Foundation

Task H: Develop a Revolving Conservation Land Acquisition Fund for conservancies to purchase lands for conservation easement implementation and resale. This would be for critical properties that are on the market or in cases where landowners are unwilling to sell the conservation easement, but would rather sell the land outright. This would provide a mechanism to allow local land conservancies to purchase the land, restrict the land with a conservation easement prohibiting or severely limiting building/development, and then resell the land to "conservation buyers" at its restricted value. This would require funds to cover the cost of the conservation easement. (i.e. difference in value).
Estimated Cost: $1,500,000 initial capital
Milestone/Timeline: Design fundraising strategy 2007. Establish fund for endowment donations by 2008.
Priority: High
Potential Project Partners: CEMCD, LSSU, Sault Community Foundation, Little T

2. Developed Areas/Construction Sites
Goals Addressed: 1,2,3,5,6

Task A: Work with appropriate local and state agencies (i.e., County Drain Commissioner, MDEQ) to recommend BMP's for developers on construction sites and to ensure compliance with those BMP's. Potential systems of BMPs to require include: access roads, construction barriers, grading, staging, and proper scheduling for other BMPs including proper soil erosion control measures at construction sites.
Estimate Cost: $40,000/yr SESC staffing
Milestone/Timeline: CEMCD took over SESC administration during planning phase; develop recipe or guidebook of regionally based BMP suggestions for contractors by 2008 and hold annual trainings beginning in 2008.

Priority: High
Potential Project Partners: CEMCD, MDEQ, CCBA, contractors

Task B: Assist townships with zoning and master plans to develop ordinances that protect water quality and natural resources. Examples of topics to cover in the model ordinances include: mandatory building setbacks from bodies of water, minimizing development clearings by landowners, stormwater management, establishing riparian buffers along waterways, and protecting wetlands.
Estimated Cost: $20,000 planner salary
Milestone/Timeline: Develop riparian/shoreline ordinance for adoption by 2009 in both Soo Township and the City of Sault Ste Marie
Priority: High
Potential Project Partners: CEMCD, City, SOO, EUPRPDC, Little T

3. Road Stream Crossings
Goals Addressed: 1,3

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

1. Road Crossings
   a) Remove obstructions that restrict flow through the culvert
   b) Replace undersized (too small or too short) culverts
   c) Remove and replace perched or misaligned culverts to avoid erosion and provide for fish passage
   d) Install bottomless culverts and bridges where possible
   e) Replace culverts with a length that allows for > 3:1 slope on embankments
   f) Revegetate all disturbed or bare soils on embankments

2. Road Approaches
   a) Create diversion outlets and spillways to direct road runoff and stormwater away streams
   b) Pave or use other stabilization techniques for steep, sandy approaches where feasible
   c) Dig or maintain ditches where needed and construct check dams if required

3. Road Maintenance
   a) Encourage Road Commissions to look at the long-term savings of crossing improvements over cumulative maintenance costs

Estimated Milestone Cost:
Milestone/Timeline: See BMP Summary.
Priority: High
Potential Project Partners: CEMCD, City, SOO, CCRC

Task B: Reevaluate list of priority road stream crossings needing remediation work after initial implementation stage. Reevaluate any new data regarding road stream crossings, including erosion and impoundment characteristics, and completed improvement projects. Inventory any remaining road stream crossings that have not been surveyed and determine priority areas.
Estimated Cost: $ Manager's Salary
Milestone/Timeline: Reevaluate unaddressed crossings 2010
Priority: High
Potential Project Partners: CEMCD, City, SOO, CCRC

4. Urban/Rural Stormwater
Goals Addressed: 1,2,3,5

Task A: Conduct an assessment of stormwater and parcel ownership characteristics with City engineers to provide information for establishing drainage districts across city.
Estimated Cost: Manager's salary, equipment
Milestone/Timeline: Planning Partners completed a basic analysis of watershed during planning phase. Consult city planners and MDEQ to develop public comment process 2009. Develop and distribute public outreach concerning drainage districts 2009 to all riparian landowners in watershed project area.
Priority: High
Potential Project Partners: CEMCD, LSSU, USGS, MDEQ

Task B: Develop GIS map of combined and separated sewer/storm drains and outlets in Sault Ste. Marie (in collaboration with above task)
Estimated Cost: **$**50,000 consultant rate
Milestone/Timeline: Develop map by 2009 for use in soliciting riparian landowners.
Priority: High
Potential Project Partners: CEMCD, LSSU, LIAA, City, SOO

Task C: Work cooperatively with local units of government to update stormwater management plan and/or ordinances for the city and Soo Township using a variety of tools including mapping of existing storm sewers; identifying locations where retrofitting is needed; working with adjacent townships to manage joint stormwater; and ensure that emergency response plans exist for pollutant spills.
Estimated Cost: $10,000
Milestone/Timeline: Perform assessment of plan 2007-2008. Mapping 2008-2009. Develop stringent stormwater protective revisions to plan by 2010.
Priority: High
Potential Project Partners: CEMCD, LSSU, LIAA, City, SOO

Task D: Work with local governments, area businesses, and property owners to install the following stormwater BMPs at priority sites (Ash 10,11;MIS 7,11;FR1,7) (see BMP Summary).

1. Vegetative Filter Strips: Filter Strips/Aquatic Buffers, Wet Swales, Dry Swales, Grass Channels
2. Stormwater Filtering Systems: Bioretention and Surface, Perimeter, Organic, Underground, Pocket Sand Filters
3. Infiltration Practices: Infiltration Trench or Basin, Porous Pavement
4. Retention and Detention Ponds
5. Other Low Impact Design Elements: Rain/Roof Gardens, Native Plantings, Riparian Buffers

Estimated Cost: $15,000/year staff; >$1,000,000 (BMP costs)
Milestone/Timeline: Install all stormwater BMP's by 2010
Priority: High
Potential Project Partners: CEMCD, STCI, City, SOO, LIAA, LSSU, Little T, SAPS

Task E: Encourage the use of "low impact development" stormwater treatment techniques in SESC preconstruction site plans, where applicable.
(*Collaborate with Task 2A*)

5. Bank/Shoreline Erosion
Goals Addressed: 1,3,5,6

Task A: Work with municipalities and other government organizations to maintain or install riparian buffers on priority publicly owned riparian/shoreline property in the watershed.
Estimated Cost: $10,000/yr staff and materials
Milestone/Timeline: Install protective buffers on all priority parcels by 2009
Priority: High
Potential Project Partners: CEMCD, LSSU, City, SOO, NRCS

Task B: Identify and work with landowners along portions of the St. Mary's River defined as critical erosion areas (see chapter 5) to stabilize the shoreline using biotechnical and soft engineering techniques. (Work with and gain permission from private property owners.)
Estimated Cost: $ Manager's Salary
Milestone/Timeline: Gain commitment from priority area landowners in 2007. Apply for funding by 2008, and install practices by 2011.
Priority: High
Potential Project Partners: CEMCD, LSSU, NRCS

Task C: In areas that have already been inventoried, work with interested landowners to install riparian buffers in priority areas.
Estimated Cost: **>**$10,000/site for materials
Milestone/Timeline: Gain commitment from priority area landowners in 2007. Install practices by 2009.
Priority: High
Potential Project Partners: CEMCD, NRCS, landowners

Task D: Establish shoreline riparian buffer demonstration sites to show riparian landowners how to create buffers that are both aesthetic and effective.
Estimated Cost: $10,000/site
Milestone/Timeline: Gain commitment from priority area landowners in 2007. Install practices by 2008. Public Outreach 2009.
Priority: High
Potential Project Partners: CEMCD, NRCS, landowners

Task E: Update existing streambank and shoreline erosion surveys to determine sites where bank stabilization and restoration is needed and compile list of priority areas.
Estimated Cost: $10,000 salary
Milestone/Timeline: Reevaluate current site listing early in 2007 to determine aforementioned activity of Tasks 5 A-D. Update site review each year.
Priority: High
Potential Project Partners: CEMCD, NRCS, LSSU

Task F: Stabilize streambanks and shoreline at priority sites and use biotechnical methods where possible. Include costs and time for maintenance of stabilized sites.
Estimated Cost: ~$10,000/ea (varies depending on proposed BMPs)
Milestone/Timeline: Gain commitment from priority area landowners in 2007. Apply for funding by 2008, and install practices by 2011.
Priority: High
Potential Project Partners: CEMCD, NRCS, MDEQ, MDNR, City, SOO

6. Contamination Sites (LUSTS, FUDS, etc.)
Goals Addressed: 1,2,3,4,5

Task A: Work with area marinas (Valley Camp, Municipal) to install and promote BMPs (like spill response carts containing brooms, pads and absorbents; bilge sponges; emergency shut-off valves; and stormwater detention areas and buffer strips) that will reduce the amount of pollution coming from boat fuels, wastewater, erosion, and lack of riparian buffers.
Estimated Cost: $2,000/year (cost for staff time and BMPs for one marina)
Milestone/Timeline: Conduct inititial needs assessment 2007. All marinas outfitted with appropriate BMP's 2008.
Priority: Medium
Potential Project Partners: CEMCD, local businesses, City

Task B: Minimize stormwater contamination from vehicle fuel by installing and maintaining spill containment kits for gas and other fueling stations where necessary.
Estimated Cost: $5,000/station staff consultation and equipment
Milestone/Timeline: Conduct initial needs assessment 2007. All stations outfitted with appropriate BMP's 2008.
Priority: Medium
Potential Project Partners: CEMCD, business owners, MSUE

Task C: Work with area businesses and property owners to encourage proper maintenance and monitoring of underground fuel storage tanks and replace them when there is a risk of leakage from tank age, poor maintenance, or damage.
Estimated Cost: Manager's Salary for initial consultations, strategies
Milestone/Timeline: Consult DEQ for LUST update 2007. Contact business owners and perform needs assessment of LUSTs 2007-2008. De-list undeveloped LUST sites 2010.
Priority: High
Potential Project Partners: CEMCD, City, local businesses, MDEQ

Task D: Eliminate improperly capped abandoned wells to prevent contaminants from moving into and among groundwater aquifers via this route. Inventory existing abandoned wells through surveys, well logs, and landowner interviews and properly plug the abandoned wells.
Estimated Cost: $10,000 staff time for inventory; $750/well (capping wells)
Milestone/Timeline: Consult MSU extension for initial project planning 2007. Conduct inventory 2007. Develop site map 2007-8. Cap first abandoned well 2009.
Priority: Medium
Potential Project Partners: CEMCD, MSUE, CCHD

Task E: Conduct clean-up event(s) on each area stream and along St. Mary's River shoreline to remove tires, drums, various scrap metal, wooden pallets, bricks, ceramics and other debris.
Estimate Cost: $2,000 per subwatershed clean-up
Milestone/Timeline: Complete at least one stream/shoreline area cleanup/year
Priority: High
Potential Project Partners: CEMCD, LSSU, SAPS

7. Lawn/Agricultural Maintenance (Residential/Commercial Fertilizer/Pesticide Use
Goals Addressed: 1,2,3,5

Task A: Increase activity with Home*A*Syst, Lake*A*Syst, and Lawn*A*Syst programs in watershed and encourage residents to utilize them.
Estimated Cost: Manager's Salary
Milestone/Timeline: Contact at least 10% of watershed population by 2009
Priority: Medium
Potential Project Partners: MSUE, CEMCD

Task B: Update Conservation Plans, Resource Management Plans, or Progressive Plans for farms and develop plans for farms that do not currently have one. As appropriate, information should be included on: crop nutrient management, weed and pest management, grassed waterways, sod centers in orchard rows, conservation buffers, proper manure management, conservation tillage, fencing off stream access to livestock, installing watercourse crossings, planting cover crops, and crop rotation.
Estimated Cost: Manager's Salary
Milestone/Timeline: Complete updates to plans with all area farmers by 2009
Priority: High
Potential Project Partners: NRCS, CEMCD, MSUE

Task C: Work with agricultural producers that have an approved Conservation Plan to implement USDA-NRCS cost-share programs that provide cost incentives and/or rental payments to farmers who implement eligible conservation practices on their land. Examples of these types of programs include: Environmental Quality Incentives Program (EQIP), Conservation Security Program (CSP) and the Conservation Reserve Program (CRP).
Estimated Cost: Farm Bill
Milestone/Timeline: Begin implementation of farm bill activity 2009.
Priority: High
Potential Project Partners: NRCS, MSUE, CEMCD

8. Failing On-site Septic Systems
Goals Addressed: 2,3,5

Task A: Work with project partners to improve watershed area wastewater management effectiveness of onsite wastewater treatment systems (OSS) as well as the municipal wastewater management system following recommended activity from USEPA's CZARA 6217 *New Onsite Disposal Systems Management Measures* and *Operating Onsite Disposal Systems Management.*
Estimated Cost: Manager's Salary
Milestone/Timeline: Implement CZARA recommendations 2007 through 2009.
Priority: High
Potential Project Partners: CEMCD, CCHD

Task B: Work with CCHD to determine alternative OSS, and install demonstration properties. Task would be to monitor operation success and provide public and state agency outreach.
Estimated Cost: Manager's Salary; $15,000 installation
Milestone/Timeline: Develop, install, and begin monitoring at least one alternative OSS by 2008
Priority: High
Potential Project Partners: CEMCD, CCHD, MSUE, MDEQ

Task C: Work with City officials and Soo Township to pursue expanding municipal wastewater treatment for priority areas in watershed (*Algonquin region, Soo Township)*.
Estimated Cost: Manager's Salary
Milestone/Timeline: Complete feasibility study to include *Algonquin* and *Soo Township* communities by 2009
Priority: High
Potential Project Partners: CEMCD, City, SOO, CCHD

9. Monitoring
Goals Addressed: 3,5

Task A: Conduct inventories of aquatic habitat conditions (debris, substrate, channel form, riparian corridor, erosion, etc.), chemical, and biotic conditions throughout the watershed where needed to track trends in habitat condition.
Estimated Cost: $20,000/yr staff and monitoring equipment
Milestone/Timeline: Conduct *Procedure 51* habitat and biotic monitoring as well as chemical monitoring (following planning project QAPP) of all subwatersheds each year to track changes in water quality parameters.
Priority: High
Potential Project Partners: MDNR, CEMCD, LSSU, MDEQ

Task B: Assist CCHD with continued annual beach E. coli monitoring program for Sault area beaches.
Estimated Cost: $20,000/year CCHD costs (staffing/test kits)
Milestone/Timeline: Continue monitoring beaches at established schedules
Priority: High
Potential Project Partners: CEMCD, CCHD, LSSU

Task C: Work with local governments, LSSU, MDEQ, MDNR, and other stakeholders to ground-truth existing wetland maps, and perform natural features inventory throughout the watershed and put information into a GIS format.
Estimated Cost: $50,000 staff and GIS equipment
Milestone/Timeline: Survey area wetlands using existing maps and field confirmation. Create boundaries using GIS. 2007-2009.
Priority: High
Potential Project Partners: CEMCD, LSSU, LIAA, City, SOO, MDEQ, MDNR, MNFI

Task D: Work with Inter-Tribal Council to improve air quality monitoring stations to detect trends in air quality and distribute results to community.
Estimated Cost: $15,000 staffing
Milestone/Timeline: Consult ITC for available information and public outreach plan 2008. Distribute available information for public use 2008.
Priority: Medium
Potential Project Partners: CEMCD, LSSU, ITC

Task E: Create an on-line interactive water quality database to provide community with easy access to water quality research and reports in order to increase awareness of local conditions.
Estimated Cost: $10,000 to establish database
Milestone/Timeline: Establish database online by 2009
Priority: High
Potential Project Partners: CEMCD, LSSU, LIAA, City, SOO

Task F: Conduct follow up inventory of near-and offshore areas along St. Mary's River following LSSU Coastal Wetlands project (Werner) protocol. Include sediment analysis of near shore areas, aquatic vegetation, benthic invertebrates, and water chemistry.
Estimated Cost: $35,000/inventory (salary cost only)
Milestone/Timeline: Develop/Approve project QAPP 2008. Complete follow up inventory summer 2009.
Priority: High
Potential Project Partners: CEMCD, LSSU

Task G: Annually inventory creeks (by walking/visual assessment) that are threatened by development to document ongoing land use and water quality changes due to increasing development in the Sault Ste. Marie area. Creeks that should be inventoried include: Seymour, Ashmun, Mission, Shunk, and Frechette.
Estimated Cost: $12,500/year staff
Milestone/Timeline: Complete visual inventory of all creeks each summer, 2007, 2008, 2009
Priority: High
Potential Project Partners: CEMCD, LSSU

Task H: Annually evaluate monitoring results gathered from other groups conducting work in the watershed and assist with efforts when needed. (Update results in future water quality database – See Task E).
Estimated Cost: $2,500/yr
Milestone/Timeline: Establish data organization system by 2008. Establish database online by 2009. Input of data ongoing.
Priority: High
Potential Project Partners: CEMCD, LSSU, LIAA

Task I: Undertake further evaluation and monitoring of fisheries and other aquatic organisms in the St. Mary's River in collaboration with the St. Mary's Remedial Action Plan (AOC).
Estimate Cost: $100,000
Milestone/Timeline: Develop baseline criteria (fisheries and other aquatic organisms and habitat) for delisting as area of concern by 2013.
Priority: High
Potential Project Partners: CEMCD, LSSU, BPAC, IJC

Task J: Document the effectiveness of BMP implementation by taking photographs, completing site data sheets and gathering physical, chemical and/or biological site data. Work with partners to develop a standardized methodology implementation.
Estimated Cost: Manager's Salary
Milestone/Timeline: Baseline data, photographs taken during planning phase. Perform documentation during initial implementation phase 2007-2009 upon completion of approved BMP's.
Priority: High
Potential Project Partners: CEMCD, LSSU, SPSC

10. Desired Uses
Goals Addressed: 4,5,6

Task A: Work with local units of government to develop and promote local initiatives that preserve open space and sensitive/important natural areas.
Estimate Cost: Manager's salary
Milestone/Timeline: Design enforceable initiative or ordinance focused on natural areas prioritized by city officials, CEMCD, and participating partners.
Priority: High
Potential Project Partners: CEMCD, LSSU, City, SOO, EUPRPDC

Task B: Assist project partners with establishing planned recreational projects, including Ashmun Creek park, St. Mary's walkway, and the Lower Islands park.
Estimated Cost: $15,000/year staff
Milestone/Timeline: Develop needs assessment for current recreation projects 2007. Pursuit of funding ongoing.
Priority: High
Potential Project Partners: CEMCD, LSSU, City, SOO, EUPRPDC, MDNR

Table 7.2 Structural, Vegetative BMP Summary Table

Site ID	Pollutant Reduced (Tons/year)	BMP/Partner	Unit Cost	Cost	Timeline Start/Completion
SEY 1	.35 sediment eroding from river bank/yr	Stabilize 3rd Ave. Gully w/geotextile & rip rap	$5/ft^2 vegetated chute	$1000	Gully stabilized 7/2007
SEY 2	.14 sediment eroding from Seymour Creek bank/yr' Maintain >4mg/L DO Maintain peak temperature<18°c	-Install riparian buffer	$400/acre vegetation	$1000	Buffer installed 6/2008
SEY 3	1.02 sediment reaching stream at site from eroding embankments and streambanks. Lower average downstream flow velocity 50%. Maintain >4mg/L DO Maintain peak temperature<18°c	Replace cement with geotextile reinforced, vegetated riprap to stabilize d/s & u/s embankments and absorb flow. Install riparian buffer at upstream bend	$60 yd^3 stabilization w/ rip rap, geotextile fabric $400/acre vegetation $1000 excavation of cement	$3500	Embankment protection installed 8/2007 Buffer installed 5/2007
SEY 4	.7 sediment from road/shoulder and embankment reaching creek during rain events/snow melt	-Install roadside turnouts -Stabilize u/s embankment w/ geotextile, vegetative reinforced rip rap	$60 yd^3 stabilization w/ rip rap, geotextile fabric 2-$500/turnouts	$2000	Complete turnouts and embankment stabilization 9/2007
SEY 8	.7 sediment reaching creek from eroding u/s embankment; Eliminate seasonal bankful flood level events above Sey 8 culvert top.	-Stabilize u/s embankment -Improve upstream inlet capacity	-$60 yd^3 stabilization w/ rip rap, geotextile fabric -$50/ft culvert extend	$1000	Begin embankment stabilization and culvert improvement 7/2008 Complete construction 8/2008
ASH 1	>10 tons of cement riprap littering road/stream crossing embankments	-Protect Shoreline w/ Conservation Easement -Promote low impact recreation park Replace cement rip rap with smaller, geotextile and vegetation reinforced riprap	>$100,000/park development $60 yd^3 stabilization w/ rip rap, geotextile fabric	$110,000	Complete rip rap work 2007 Pursue park funding 2008
ASH 2	100' of natural streambank habitat has been destroyed to stabilize railroad crossing. Decrease average downstream discharge rates by 50%.	-Install natural stream bank structure/habitat to stabilize flow energy caused by cemented banks	$60 yd^3 stabilization w/ rip rap, geotextile fabric $25/foot installation of natural habitat	$10,000	Develop restoration plan w/railroad company 2007 Complete construction 2009
ASH 6	1.4 sediment reaching stream from eroding stream bank Maintain >4mg/L DO Maintain peak temperature<18°c	-Stabilize d/s bank with geotextile reinforced rip rap and vegetation	-$400/acre vegetation -$60 yd^3 stabilization w/ rip rap, geotextile	$2000	Complete streambank restoration 9/2007
ASH 7/8	.68 sediment reaching stream from eroding crossings	-Stabilize embankment drainage ditches along each snowmobile trail exit	-$34/yd3 aggregate/geotextile, installed	$2400	Complete r/s crossing 9/2007
ASH 10	Eliminate elevated levels of nutrients and	-Determine stormdrain	-Wet/Dry detention pond -Oil/Grit separator	$40,000/acre N/A	City planning/consult

Site ID	Pollutant Reduced (Tons/year)	BMP/Partner	Unit Cost	Cost	Timeline Start/Completion
	bacteria from stormwater discharge (30% N, 50% P, 70% bacteria) Maintain<300 colony forming units bacteria mg/L stormwater	discharge source. Redirect to wet/dry detention. Install treatment/filtration hardware	--Nutrient separator	N/A	2007 Installation 2008
ASH 11	Eliminate culvert breech flows (50% average flow reduction) during spring runoff period. Maintain<300 colony forming units bacteria mg/L stormwater Maintain minimum dissolved oxygen level (>4mg/L), reduce maximum instream water temperature to 18°C. Reduce nutrient (N=30%, P=50%) loads in stormwater and baseflow.	-Incorporate/enforce stormwater detention all new construction (Soo township) Construct wet/dry detention ponds near current larger developments(Soo Township)	-Dependent upon development	N/A $40,000/acre ponds	City planning/consultation 2007
ASH 12	3.4 sediment from trail surface reaching stream Maintain >4mg/L DO Maintain peak temperature<18°c Reduce nutrient (N=30%, P=50%) loads in stormwater and baseflow.	-Stabilize snowmobile surfaces (approaches) w/ gravel and geotextile -Install trail turnouts -Protect riparian zone w/ Conservation Easement -Promote recreation	-$34/yd^3 aggregate/geotextile, installed -$500/turnout >$100,000 for easement	$110,000	Construction complete 9/2007 Promotion complete 2007-2010 Easements obtained 2010
MIS 2	1,000 linear feet of original stream channel has been comprimised. Restore flow to natural stream channel. Reduce average discharge volume (50% measured during spring thaw periods) at MIS 2 Maintain >4mg/L DO Maintain peak temperature<18°c	Restore natural drainage by blocking channelized drain, redirecting flow into original channel	-$60/yd^3 stabilization w/ rip rap, geotextile fabric	$13,300	Planning w/ City complete 2007 Channel restored 2008
MIS 3	.44 tons sediment reaches stream when road floods during spring;	Replace culvert with larger bottomless and increase road fill: Stabilize embankments	-$60/yd^3 stabilization w/ rip rap, geotextile fabric -$5000 culvert	$5300	Evaluate site after channel restoration 2008 Construction complete 2009
MIS 4	.44 tons sediment reaches stream when road floods during spring Eliminate storm water breech at culvert	-Replace twin culverts w/ one larger culvert -Stabilize d/s & u/s embankments	-$60/yd^3 stabilization w/ rip rap, geotextile fabric -$5000 culvert	$5300	Evaluate site after channel restoration 2008 Construction complete 2009
MIS 6	.12 tons sediment	-Replace culvert w/	-$60/yd^3 stabilization w/	$5000	Planning w/ City

Site ID	Pollutant Reduced (Tons/year)	BMP/Partner	Unit Cost	Cost	Timeline Start/Completion
	reaches stream with rains and road flooding during spring Eliminate storm water breech at culvert >1000' of original stream dewatered due to channel diversion Restore baseflow at site to 100% of contributing flow u/s of diversion Maintain >4mg/L DO Maintain peak temperature<18°c	one larger and longer bottomless culvert to realign original channel -Stabilize d/s & u/s embankments -Restore original hydrology; block drain -Install buffer	rip rap, geotextile fabric -$15/ft culvert replacement -$25/foot stream habitat restoration		complete 2007 Channel restored 2008 Remaining construction activity complete by 2010
MIS 7	Eliminate 100% stormwater discharge at this site. Maintain >4mg/L DO Maintain peak temperature<18°c	Restore original hydrolgoy to mainstream. Block this drainage site.	-$60/yd riprap, geotextile fabric	$1000	Complete installation 2007
MIS 8	.3 sediment erodes each year from unprotected streambank along reach .5 ton garbage strewn throughout reach Maintain >4mg/L DO Maintain peak temperature<18°c	-Stabilize eroded streambanks w/ vegetation -Stabilize embankments -Remove trash	-$50/hr garbage removal -$25/foot installation fascines, and bioengineering	$5000	Planning w/ City complete 2007 Channel restored 2008 Remaining construction activity complete by 2010
MIS 9	.25 sediment eroding from streambank 1 ton of junk metal at site Maintain >4mg/L DO Maintain peak temperature<18°c	-Stabilize u/s eroding streambank -Remove junk	-$60/yd^3 stabilization w/ rip rap, geotextile fabric -$25/foot restoration -$50/hr clean up	$3500	Remove metal junk 2007 Stabilize streambank 2008
MIS 10	.55 sediment from eroding streambanks Maintain >4mg/L DO Maintain peak temperature<18°c	-Stabilize d/s eroding streambank -Install riparian buffer -Install/improve in-stream habitat	-$60/yd^3 stabilization w/ rip rap, geotextile fabric -$400/acre vegetation -$25/foot restoration	$5000	Stabilize streambank 2008 Install buffer/habitat 2009
MIS 11	1.4 tons sediment from eroding streambank upstream along Seymour road. >1000' of channelized streambanks Decrease peak seasonal discharge by 10% and increase baseflow by 10%. Maintain >4mg/L DO Maintain peak temperature<18°c Maintain<300 colony forming units bacteria mg/L stormwater	-Install riparian buffer -Protect remaining wetlands w/ conservation easement -Install flood plain culverts under Seymour Road -Increase streambank vegetation and instream debris to increase natural sinuosity and pool/riffle habitats. -Spread runoff from concentrating in power line ditch and west Seymour Rd. ditch into adjacent wetlands	-$400/acre vegetation -$25/linear ft. of stream restoration >$100,000 culvert insertion under Seymour Rd. >$100,000 wetland conservation easement -$60/yd^3 stabilization w/ rip rap, clay, aggregate, geotextile fabric	$240,000	Engineering complete 2008 Construction complete 2010

Site ID	Pollutant Reduced (Tons/year)	BMP/Partner	Unit Cost	Cost	Timeline Start/Completion
FR 1	2 tons sediment have eroded from 600' of stream bank; Riparian vegetation has been replaced with large concrete rip rap; Maintain >4mg/L DO Maintain peak temperature<18°c Decrease seasonal peak flows by 10% and increase baseflow by 10% Maintain<300 colony forming units bacteria mg/L stormwater	-Restore riparian buffer -Install/improve geotextile reinforced riprap at streambank toe. -Install storm water basins adjacent city property; check dams or other obstacles in approach ditches	-$400/acre vegetation -$25/linear ft. of stream restoration --$60/yd^3 stabilization w/ rip rap, geotextile fabric	$30,000	Complete rip rap by 2007 Restore buffer by 2008 Complete ditch work by 2008
FR 2	.13 sediment erodng from u/s and d/s embankments around culvert.	-Stabilize d/s & u/s embankments	-$60/yd^3 stabilization w/ rip rap, geotextile fabric	$1000	Installation complete 2008
FR 3	200' streambank channelized. Decrease seasonal peak flows by 10%, increase base flow by 10%. Maintain >4mg/L DO Maintain peak temperature<18°c	-Restore riparian habitat, including vegetation, woody debris structures, sinuosity u/s & d/s	$25/linear ft. stream restoration	$5000	Installation complete 2008
FR 5	.13 sediment eroding from u/s and d/s embankments around culvert.	-Stabilize d/s & u/s embankments	-$60/yd^3 stabilization w/ rip rap, geotextile fabric	$1000	Installation complete 2008
FR 7	.2 sediment eroding from u/s and d/s embankments around cultert and d/s streambanks Maintain >4mg/L DO Maintain peak temperature<18°c	-Stabilize d/s & u/s embankments -Stabilize d/s streambanks -Stabilize approach ditches	-$60/yd^3 stabilization w/ rip rap, geotextile fabric	$1500	Installation complete 2008
FR 8	.22 sediment eroding from new culvert embankment	-Stabilize d/s & u/s embankments	-$60/yd^3 stabilization w/ rip rap, geotextile fabric	$1000	Installation complete 2008
FR 9	.22 sediment eroding from new culvert embankment Maintain >4mg/L DO Maintain peak temperature<18°c	-Stabilize d/s & u/s embankments -Install riparian buffer	-$60/yd^3 stabilization w/ rip rap, geotextile fabric $400/acre vegetation	$5000	Embankments stabilized 2008 Riparian Buffer installed 2009
CAN 1	7 acres of shoreline habitat destroyed	-Protect shoreline w/ conservation easement -Redevelop nearshore upland area for low impact recreation	>$100,000 park development >$100,000 upland conservation easement $0 shoreline easement	>$200,000	Establish conservation easement language with City by 2009 Begin immediate pursuit of development funding

Site ID	Pollutant Reduced (Tons/year)	BMP/Partner	Unit Cost	Cost	Timeline Start/Completion
CAD 1	2 suspected waste storage pits exist on site	-Locate and remove existing toxins	>$100,000 soil tests, excavation,stabilization	$100,000	Locate specific toxin locations 2007: Remove by 2009
SSL 1	1 ton of sediment erodes from landfill face since construction Orange, oily leachate issuing from site	-Identify observed leachate -Improve clay layer -Install erosion control structures around landfill	$1,000 monitoring/chemical analysis $1.50 linear foot installed silt fence $400/acre vegetation	$2000	Analyze leachate 2007 Install erosion control measures 2008
CLA 1	-Facilitate DEQ compliance/clean up -Work with Landowner to develop a Water Quality Management Plan for site	Automotive based toxins on ground surface. Ditched path to surface water (Ashmun 10)	Project manager's salary	Project manager's salary	Establish water quality management/clean up plan by 2008
PET 1	-Conduct well water testing to determine potential pollutants	Potential fuel spills	$500 well test	$2500	Conduct a private well water and nearby surface water analysis by 2007 Develop site water quality management plan 2007
SPD 1	-Conduct well water testing to determine potential pollutants	Potential fuel spills	$500 well test	$2500	Conduct a private well water and nearby surface water analysis by 2007 Develop site water quality management plan 2007
UCC 1	-Facilitate successful regeneration of vegetation over site -Permanently protect adjacent wetland	>1million yds^3 toxic pollutants remain on site. Potential leaching may enter into wetland at headwaters of Mission Creek	$100,000 Conservation Easement Facilitate yearly planting of native vegetation to stabilize site	$100,000 $1000/yr	Develop conservation easement on property and adjacent properties Facilitate native vegetation planting each spring/fall
AMT 1	-Continue monitoring of test wells	Potential fuel spills	$500 well test Manager's Salary	$6000	Conduct well tests on 12 wells by 2007 Complete a site remediation plan with landowner by 2008
ALG 1	30% reduction of 190 million viral units/year per household (319)	Replace/improved OSS Extend municipal wastewater management	$10,000/household Unknown	$1,000,000 Unknown	2008-2015

Structural BMP Summary			
Road/Crossings sites	**# Sites Addressed**	**Total Pollutant Load Reduction**	**Total Cost**
	11	5.4 Tons sediment/Year	$145,000

Site ID	Pollutant Reduced (Tons/year)	BMP/Partner	Unit Cost	Cost	Timeline Start/Completion
Stream bank sites	14	9.4 Tons sediment/Year, 3,900 linear feet stream restored (10% reduction in seasonal peak flow volume;10% increase in base flow/year, maintain minimum dissolved oxygen level (>4mg/L), reduce maximum seasonal instream water temperature to 18°C. 7 acres shoreline buffer restored Reduce nutrient enriched stormwater from entering mainstream (N=30%, P=50%) Eliminate E. coli bacteria occurrence >300 colony forming units per each mg/L sample (geometric mean)	$430,300		
Contamination Sites	8	Undefined, 7 sites delisted 30% reduction of 190 million viral units/year per household (319)	$1,214,000		
Stormwater Sites	6	Restored Natural Hydrology 6 sites; 10% reduction in peak flow discharge volume; 10% increase in baseflow discharge volume Eliminate E.coli bacteria occurrence >300 colony forming units (geometric mean mg/L samples(3/site) Maintain minimum dissolved oxygen level (>4mg/L), reduce maximum instream water temperature to 18°C. Reduce nutrient (N=30%, P=50%) loads in stormwater and baseflow.	$352,500		

Chapter 8 Information and Education Strategy

According to Margaret Meade, "*A small group of thoughtful people could change the world. Indeed, it's the only thing that ever has."* Therein lies the remedy for water quality concerns in the Sault Ste. Marie watershed: the local community. Committed representatives of the community have participated in public meetings, one-on-one interviews, assessing local, state, and federal reports, as well as performing chemical, biological, and *windshield* surveys of the watershed to find that water quality problems are diverse and result from a long community history of ambivalence toward the area's aquatic resources. The purpose of this information and education (IE) strategy is to empower local representatives to improve awareness and appreciation of the local natural resources, especially aquatic resources, in every facet of the community. Only then, can the goals of this project be realized and sustained.

8.1 The Goal of the I/E Strategy

The goal of the IE strategy is to **establish education and information programs that promote the conservation, education, protection, restoration, and sustainability of aquatic resources within the Sault Ste. Marie area watershed.** Where the structural and vegetative BMPs mentioned in the previous chapter are pollution source fixes directly on land and require a small partnership to succeed, an effective I/E strategy involves applying knowledge and experience to several partners and involving the most people possible. Success isn't only a one-time construction project, but an ongoing movement and stewardship ethic adopted by the local community to protect water quality.

8.2 I/E Objectives

The objectives of this plan focus on building awareness, educating target audiences, and inspiring action. Five major objectives have been identified:[24]

- To raise community awareness and knowledge of the aquatic ecosystem of the Sault Area watershed and St. Mary's River, the interconnectedness of the system and the role that an individual's day-to-day activities play in protecting this ecosystem.

- To develop a set of consistent messages that can be used by partners in a variety of communications.

- To involve citizens, public agencies, civic groups and landowners in the implementation of the watershed protection plan.

- To inform stakeholders about the watershed, implementation activities and successes; and provide opportunities to participate.

- Motivate target audiences to adopt behaviors and implement practices that result in water quality improvements.

[24] These objectives were based on the 2005 *Grand Traverse Bay Protection Plan* objectives and adapted to the Sault Ste. Marie area watershed and community by the Sault Planning Project Steering Committee.

8.3 I/E Strategy Target Audiences

The Sault Ste. Marie community can be divided into the following general audiences so that specific I/E activities can be directed accordingly:

Households **–** The general public throughout the watershed.

Riparian Landowners – Due to their proximity to a specific water body, the education needs of riparian landowners are different.

Agricultural Landowners – There exist only two small livestock operations in the watershed and adjacent pasture lands.

Business and Industry – There is a fairly diverse mix of business and industry segments within the watershed. Traditional "smokestack" type industry is present in the sister city of Sault Ste. Marie, Ontario (Canada) across the St. Mary's River. Tourism, retail, and other service industries dominate the mix along with manufacturing and construction.

Tourists – Tourism is a significant industry in the Sault Ste. Marie areas. Approximately a third of Sault employment is in retail and related services, reflecting a strong tourist nature of the local economy. That tourism and related activity is perceived to center on viewing the Soo Locks and visiting the local gaming establishments. The Sault Project steering committee has recognized the need to establish low impact nature-based tourism opportunities.

Builders/Developers/Real Estate – This group consists of all involved in the process of developing land including carpenters, excavators, and those promoting land sales and development. It will be critical to increase awareness in this sector to low impact development techniques.

Education – Area educators and students, including K-12. Included in this category is Lake Superior State University.

Partner Organizations – The Sault Ste. Marie watershed region boasts a knowledgeable list of watershed partner groups with a broad range of expertise and important ongoing protection, restoration and education programs. Providing ongoing learning opportunities to watershed partner organizations regarding current research, BMPs, emerging issues and trends is important to keep implementation work moving forward.

Special Target Audiences - In addition to the above, certain user groups such as sportsman, environmental groups, or smaller audience segments may be targeted for specific issues.

Elected and Appointed Officials **–** Township, city, and county commissioners; planning commissions; zoning board of appeals; road commissioners; drain commissioners; etc.

Governmental Staff **–** Planners, engineers, zoning administrators, etc.

Table 8.1 Target Audience

Watershed Pollutant Sources	Target Audiences	Priority Target Audiences	Priority
Loss of wetlands and natural features (k)	All	Riparian homeowners with non-compliant well/septic systems	1
Stormwater	All	City Building Officials; Soo Township Planners	2
Channeled drains and stream sections	City officials Township officials	Riparian Landowners	3
Developed areas/construction sites	City officials Township officials	Contractors; Planners; Building officials	4
Contamination Sites	Contamination Site Landowners	Active site business owners	5
Streambank/Shoreline erosion/sedimentation	Riparian landowners	Sault Tribe; City Building Officials; *Highbanks* area shoreline owners	6
Road crossings	Chippewa County Road Commission; City Building Officials	Chippewa County Road Commission; City Building Officials	7
Residential/Commercial Fertilizer Use (s)	Homeowners; Businesses	*Sault Country Club* and *Tanglewood* Golf Course owners and greenskeepers	8
Failing septic systems	OSS Landowners	Algonquin region landowners; Soo Township residents	9
Desired Use			
Low impact recreation	All	All	N/A
Promote natural character, aesthetics	All	All	N/A

8.4 The Information and Education Plan

The I/E plan is organized to pollutant source similar to the action plan in the previous chapter. In the first phase of implementation, the Sault Project will focus on exposing stakeholders to the watershed management plan and its various findings and conclusions. Work to build awareness of basic watershed issues, pollutant sources and how individual behaviors impact the health of the watershed will also be completed. The IE Strategy tasks use a diverse set of methods and delivery mechanisms. Workshops, presentations, demonstration projects, brochures, public and media relations, web sites and other communications tools will be used for the different tasks and target audiences.

The categories are as follows:

1. Loss of Aquatic Habitat (Wetland/Riparian Zones/In-stream Habitat/Natural Features)
2. Developed Areas/Construction Sites
3. Road Stream Crossings
4. Urban/Rural Stormwater
5. Bank/Shoreline Erosion
6. Contamination Sites (LUSTS, FUDS, etc.)
7. Residential/Commercial Fertilizer/Pesticide Use
8. Failing On-site Septic Systems
9. Monitoring
10. Desired Uses

Organization Acronyms

CEMCD	Chippewa/East Mackinac Conservation District
City	City of Sault Ste. Marie (Municipal Department)
CCGOV	Chippewa County Government
SPSC	Sault Project Steering Committee
STCI	Sault Ste. Marie Tribe of Chippewa Indians
Little T	Little Traverse Conservancy
CCHD	Chippewa County Health Department
BPAC	Binational Public Advisory Council
LIAA	Land Information Access Association
Press	Sault Evening News, Voice, etc.
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
LSSU	Lake Superior State University
EUPRPDC	Eastern Upper Peninsula Regional Planning and Development Commission
NRCS	USDA Natural Resources Conservation Service
SAPS	Sault Area Public Schools
MSUE	Michigan State University Extension
CCRC	Chippewa Co. Road Commission
USGS	United States Geologic Survey
CCBA	Chippewa County Building Authority
CCR	Chippewa County Recycling
SOO	Soo Township Officials

Estimated Costs and Timeframe

For costs associated with salaries, an average watershed technician rate of $25/hour was applied. For tasks to be completed by a specialized consultant, a rate of $50/hour was used. Tasks that will be done on a yearly or site-by-site basis are noted as such ($X/yr or $X/site). Further details are noted where applicable. Tasks that should be completed in the short-term were given a timeframe of 3 years; long-term tasks were given a timeframe of 10 years; tasks that should be undertaken annually or continuously were given a timeframe of “ongoing.”

Task Milestones

Milestones in the IE plan are similar in design to those in the BMP implementation plan and identify when tasks should be completed. Milestones for the IE Strategy were harder to define because many of the tasks are ongoing. Additionally, the best way to conduct outreach activities is continually evolving and depends on the audience one is trying to reach. This is why many of the IE tasks are general and don’t include the specific message. Key milestones for the IE plan include conducting workshops for landowners on the benefits of riparian buffers, conducting workshops with local contractors, developers, and planners regarding erosion controls and aquatic habitat protection, and providing information in the protection plan to local government officials.

8.5 I/E Strategy Tasks

1. Loss of wetlands and natural features
Goals Addressed: 1,2,3,5,6

Task 1[25]: Initiate education efforts in Sault Ste Marie area watershed that promote the essential link between land use and water quality protection and improvement. This includes promoting the retention or establishment of shoreline vegetative buffers, the minimizing of vegetation removal and mowing to the water's edge, and dumping of garbage/hardware into the water.
Estimate Cost: $5,000/year staffing/materials
Milestone/Timeline: Ongoing. Produce and distribute one I/E product (public service announcement, brochure, presentation) addressing each priority source/each year (2007-2009).
Priority: High
Potential Project Partners: CEMCD, Press, LSSU, SAPS, CCHD

Task 2: Develop a realtor and developer educational program aimed at providing new homeowners with information regarding water quality and watershed issues at the point-of-sale.
Estimated Cost: $5,000/yr staffing/materials
Milestone/Timeline: Ongoing. Produce and distribute one I/E product (public service announcement, brochure, presentation) addressing each priority source/each year (2007-2009).
Priority: Medium
Potential Project Partners: CEMCD, Realtors, COC, CCHD

Task 3: Provide education to the general public and officials on the importance of maintaining diverse natural habitats and developing wildlife corridors on their property, including wetlands and other critical habitats. Develop a public awareness program to inform the public of ecologically sound riparian and coastal wetland land management practices.
Estimated Cost: $5,000 staffing/materials
Timeline: Ongoing. Produce and distribute one I/E product (public service announcement, brochure, presentation) addressing each priority source/each year (2007, 2008, 2009).
Priority: High
Potential Project Partners: CEMCD, NRCS

Task 4: Educate local governments, developers, contractors, and others through workshops and presentations, press releases, brochures, etc, regarding the ecological value of and consequences of developing potentially unregulated wetland areas and appropriate and successful methods of restoring troubled wetlands.
Estimated Cost: $5,000/yr staffing/materials
Milestone/Timeline: Ongoing Produce and distribute one I/E product (public service announcement, brochure, presentation) addressing each priority source/each year (2007-2009).
Priority: High
Potential Project Partners: CEMCD, NRCS, CCBA,
Target Audience: Local Governments, Builder/Developer/Realtor

Task 5: Educate and communicate to local shoreline (St. Mary's River) owners the current beach maintenance regulations, the value and proper care of emergent coastal wetlands, and the benefit of keeping these wetlands in a natural state. Disseminate existing brochures, mail letters, host public meetings, etc.
Estimated Cost: $5,000/year staffing/materials
Milestone/Timeline: Ongoing. Produce and distribute one I/E product (public service announcement, brochure, presentation) addressing each priority source/each year (2007-2009).
Priority: High
Potential Project Partners: CEMCD, MDEQ

[25] I/E tasks will be numbers rather than letters (Chapter 7) to help separate structural/vegetative BMPs from the more managerial I/E BMP's

Task 6: Provide priority area landowners education regarding voluntary conservation easements and other available land protection measures utilizing direct mail, publications, etc. Facilitate meetings/presentations with landowners already enjoying easement protections to promote to prospective candidates.
Estimated Cost: $5,000/yr staffing/materials
Milestone/Timeline: Ongoing. Produce and distribute one I/E product (public service announcement, brochure, presentation) to all priority area landowners within 2007.
Priority: High
Potential Project Partners: Little T, CEMCD, LSSU

Task 7: Produce an information packet for area realtors to provide basic information regarding environmental laws (wetlands) that might impact new homeowners. Packet will also include activities new landowners can do to improve natural habitat on their properties.
Estimated Cost: $2,000 staff/materials
Milestone/Timeline: Develop packet in 2007. Distribute packet by 2008
Priority: High
Potential Project Partners: CEMCD, CCHD, MDEQ

2. Developed Areas/Construction Sites
Goals Addressed: 1,2,3,5

Task 1: Host workshops, seminars, and site tours to educate developers and contractors on proper stormwater and sediment management at construction sites.
Estimated Cost: $5,000/year staff/materials
Milestone/Timeline: Host at least 1 workshop each year 2007, 2008, and 2009.
Priority: High
Potential Project Partners: CEMCD, CCHD, CCBA, contractors

Task 2: Recommend design, construction and maintenance of new and existing development in the watershed that utilizes Best Management Practices to protect water quality.
Estimated Cost: $50,000 SESC staff/materials
Milestone/Timeline: See Task 2.1. Acquire BMP technical resources applicable to regional development 2007-2008 (Literature, brochures, magazines, reports, training materials, etc.) Consult with appropriate partners on existing technology to facilitate improved site design for future developments 2008-2009. Establish minimum low impact design criteria for new development for use in City Planner/Engineer site review process 2009.
Priority: High
Potential Project Partners: CEMCD, CCBA, Contractors, City Planner

Task 3: Educate and inform local planning and zoning officials regarding up-to-date information on planning, zoning, and design innovations relating to the protection of water quality. Utilize MDEQ book titled “Filling the Gaps: Environmental Protection Options for Local Governments”. Information will assist in developing reasonable conditions/ordinance language regarding environmental protection (i.e., installing or providing riparian buffers and/or other BMPs on site).
Estimated Cost: $2,000 staff/materials
Milestone/Timeline: CEMCD will host “Filling the Gaps” informational workshop to watershed area planners, commissions, government officials 2008. Follow-up evaluation of adopted principles developed, distributed, and analyzed 2009.
Priority: High
Potential Project Partners: CEMCD, SOO, City, EUPRPDC

Task 4: Educate local governments, developers, contractors, and others regarding local hydrology, and importance to fisheries sustainability to protect it from over-development and inappropriate development activity.
Estimated Cost: $2,000 staff/materials
Milestone/Timeline: Develop informational outreach materials (packet, workshop, etc.) by 2008 and distribute/present to constituents by 2009 through workshops and/or development consultation. Host initial outreach activity by 2009.
Priority: High
Potential Project Partners: CEMCD, LSSU, MDEQ, EUPRPDC, City, SOO

3. Road Stream Crossings
Goals Addressed: 1,3,5

Task 1: Host workshops for County Road and Drain Commissions and City Building officials to provide education regarding possible BMPs to establish at road crossings to reduce the harmful effects of sedimentation, impoundments, and stormwater runoff.
Estimated Cost: $5,000 staff/materials
Milestone/Timeline: Develop and host 1st workshop by 2008.
Priority: Medium
Potential Project Partners: CEMCD, CCRC, CCBA, BMP vendors

4. Urban/Rural Stormwater
Goals Addressed: 1,3,4

Task 1: Develop comprehensive public education program regarding the management of stormwater including the following components: door hangtags, utility bill inserts, workshops, brochures, newspaper articles, PSAs, and print advertising.
Estimated Cost: Manager's Salary
Milestone/Timeline: Develop at least one example of each form of media in this task description and distribute by 2009.
Priority: High
Potential Project Partners: All partners

Task 2: Provide general stormwater education for local units of government and the general public that stresses the benefits of limiting impervious surfaces, reducing wetland destruction, and implementing stormwater BMPs and low-impact design practices to minimize stormwater flows. I/E component to work in conjunction with Chapter 7 task of improving Sault Stormwater Management Plan for eventual drainage districts
Estimated Cost: $5,000 staff/materials
Milestone/Timeline: Host initial I/E outreach activity with local governmental units 2008.
Priority: High
Potential Project Partners: CEMCD, LSSU, EUPRPDC, City, Soo

Task 3: Implement a watershed-wide storm drain stenciling event involving local schools, businesses, and other volunteers.
Estimated Cost: $1,500/year
Milestone/Timeline: Host initial stenciling event 2008.
Priority: Medium
Potential Project Partners: CEMCD, City, local businesses

5. Bank/Shoreline Erosion
Goals Addressed: 3,5,6

Task 1: Work with priority landowners to establish shoreline buffers for demonstration projects for public information; produce accompanying brochure for non-attending shoreline owners.
Estimated Cost: $20,000
Milestone/Timeline: Consult Landowners, 2007; Host installation workshop 2008
Priority: High
Potential Project Partners: CEMCD, MSUE, shoreline landowners, contractors

Task 2: Develop and distribute riparian and/or shoreline landowners' guidebooks.
Estimated Cost: $2,000 for print materials
Milestone/Timeline: Develop and distribute guidebook/brochure to all riparian/shoreline landowners by 2008
Priority: High
Potential Project Partners: CEMCD, MSUE, SOO

6. Contamination Sites (LUSTS, FUDS, etc.)
Goals Addressed: 2,3,5

Task 1: Develop and distribute I/E material to boaters and City marina operators regarding environmentally friendly boating and fueling practices including: avoiding illegal sewage and gray water discharges, fuel spills, engine maintenance, etc.
Estimated Cost: $5,000 staff/materials
Milestone/Timeline: Develop I/E materials and distribute to marinas by 2008
Priority: High
Potential Project Partners: CEMCD, City, SOO

Task 2: Work with MGSP to provide education regarding health risks to individuals and communities from improper disposal of hazardous wastes. Provide information regarding proper disposal of household hazardous waste and pharmaceuticals. Provide information on alternative products and methods and promote participation in household hazardous waste collection events.
Estimated Cost: MGSP staff/materials
Milestone/Timeline: Develop Materials 2007; Distribute materials 2008-2009
Priority: High
Potential Project Partners: CEMCD, City, CCR, MGSP

Task 3: Work with contamination site owners, City officials, MDEQ, and other stakeholders to determine appropriate remediation activities, and available funding resources for remediation of sites identified in this plan. Work with partners to apply for and manage funds for remediation projects.
Estimated Cost: See chapter 7
Milestone/Timeline: Develop at least one remediation plan for a priority site by 2009.
Potential Project Partners: CEMCD, City, MDEQ, site owners

7. Lawn/Agriculture Maintenance
Goals Addressed: 3,5

Task 1: Educate the public about environment-friendly lawn care, maintenance, and the application and use of fertilizers and pesticides, specifically, providing education materials (brochures, door hangers, pamphlets, etc.) and conduct landowner workshops regarding 1) the need for soil testing prior to fertilizer application, 2) the proper use of residential and commercial fertilizers with respect to the application amount, timing, frequency, location, method, and phosphorus content, 3) the appropriate use of pesticides, 4) Provide information to the public regarding environment-friendly lawn care contractors, where to buy low-phosphorous fertilizers, alternatives pest management practices and products, etc.

Estimated Cost: $2,000/year staff/materials
Milestone/Timeline: Host landowner workshop 2008. Produce and distribute one I/E product (public service announcement, brochure, presentation) addressing each priority source 2007.
Priority: High
Potential Project Partners: CEMCD, MSUE

Task 2: Develop promotions with landscaping and garden centers to provide educational brochures and workshops regarding native planting, "green landscaping," etc.
Estimated Cost: $2,000/year staff/materials
Milestone/Timeline: Contact vendors within 2007; develop/obtain educational brochures/workshops and begin distribution/presentations by spring 2008
Priority: Medium
Potential Project Partners: CEMCD, MSUE, local businesses

8. Failing On-site Septic Systems
Goals Addressed: 2,3,5

Task 1: Work with county health department to develop comprehensive public education program regarding septic systems. Program will include public workshops/meetings, along with other forms of media, including but not limited to door hangtags, utility bill inserts, workshops, brochures, newspaper articles, PSAs, radio and TV advertisement campaigns, radio talk shows, and print advertising.
Estimated Cost: $5,000/year
Milestone/Timeline: Initial consultation with CCHD 2007. Produce and distribute one I/E product (public service announcement, brochure, presentation) addressing each priority source 2008 and each following year 2009, 2010, etc.
Priority: High
Potential Project Partners: CEMCD, CCHD, MSUE, LSSU

Task 2: Work with City officials, MDEQ, and other stakeholders to determine feasibility and potential funding to provide municipal (Sault) wastewater service to outlying communities to protect water quality from failing OSS.
Estimated Cost: Project manager salary
Milestone/Timeline: Host initial focus meetings 2007.
Priority: Medium
Potential Project Partners: CEMCD, City, SOO, CCHD, MDEQ

9. Monitoring
Goals Addressed: 2,3,5,6

Task 1: Regularly inform the public through feature news articles, TV and Radio ads, public service announcements, print ads, etc. about project partner activities, study findings, successful example projects, and opportunities for involvement contribution in the Sault Ste. Marie area watershed.
Estimated Cost: $15,000/year staff/materials
Milestone/Timeline: Develop at least one form of I/E media each month during implementation phase.
Priority: High
Potential Project Partners: All

Task 2: Maintain and promote a comprehensive website containing information about the watershed along with activities, events, ways to get involved, plan documents, links to relevant organizations and resources, etc.
Estimated Cost: $7,500/year
Milestone/Timeline: Website online 2007.

Priority: High
Potential Project Partners: CEMCD, LIAA

Task 3: Assist Binational Public Advisory Council with hosting annual "Environmental Summit" for regional stakeholders to discuss and address priority issues impacting water quality, review implementation efforts and accomplishments, share resources, etc.
Estimated Cost: $5,000/year
Milestone/Timeline: Host summit each year, 2007, 2008, 2009
Priority: High
Potential Project Partners: CEMCD, BPAC, LSSU

Task 4: Establish educational signage and kiosks throughout the watershed at parks, demonstration projects, beaches, marinas, boat launches, etc.
Estimated Cost: $5,000 per kiosk
Milestone/Timeline: Develop and install at least one project relevant sign and/or kiosks at each of the sites mentioned in the task description by 2009.
Priority: Medium
Potential Project Partners: CEMCD, MSUE, City, SOO

Task 5: Develop an interactive water quality database incorporating past and current research, the management plan, and other information valuable to the local community, researchers, government, etc.
Estimated Cost: $10,000/year
Milestone/Timeline: Contract development of online tool 2007. Database developed and online by 2009
Priority: High
Potential Project Partners: CEMCD, LIAA

Task 6: Work with LSSU and City planners to develop public attitude survey (as well as follow up surveys) questions to determine and monitor the public's awareness regarding watershed and water quality issues. (Evaluation tool for I/E activity)
Estimated Cost: $15,000/survey
Timeline: DEQ approved QAPP, 2007. Implement survey 2008, assess results 2008, Follow up survey 2009.
Priority: High
Potential Project Partners: CEMCD, LSSU, City, SOO

Task 7: Provide key stakeholders with summary version of management plan and basic recommendations.
Estimated Cost: $2,500 printing, manager's salary
Milestone/Timeline: Public outreach of plan 2007-presentation to civic groups, City and County Commissions, environmental groups, etc.
Priority: High
Potential Project Partners: CEMCD, City, CCGOV

10. Desired Uses
Goals Addressed: 4,5,6

Task 1: Host annual guided and/or self-guided tours of natural areas.
Estimated Cost: $1,000/tour
Timeline: Host at least one public tour each year at priority area: 2007, 2008, 2009
Priority: High
Potential Project Partners: BPAC, LSSU, CEMCD

Task 2: Develop educational video about priority watershed issues, remediation projects, successes, etc. for use in promoting Sault project.
Estimated Cost: $15,000
Milestone/Timeline: Develop video 2008. Distribute with area presentations (Task 9.7).
Priority: Medium
Potential Project Partners: CEMCD, LSSU

Chapter 9 Evaluating Success[26]

Section 9.1 Qualitative Evaluation Techniques

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

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

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

These evaluation techniques will provide the project partners with a better perspective of the community's response to the project and the implementation plan's success of reaching water quality goals. This evaluation will also provide insight into which activities the partnership should discontinue, continue, or improve. Section 9.2 will describe quantification evaluation techniques.

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

Table 9.1.1 Qualitative Evaluation Techniques

Task or Objective	Evaluation Technique	Measurement/ Criteria for success	Pros and Cons	Implementation
(I/E) Public education or involvement in the project	Public survey (perform at beginning of implementation phase, midway through project, and at the 3-year mark)	Level of awareness; participation in project; before/after knowledge; opinions; attitudes (proof of behavior change)	Moderate costs. Instant feedback. Low response rate.	Pre and post surveys by mail, telephone, or focus group; attendance lists; suggestion box-feedback forms; determine progress on goals/objectives; initial survey 2008; mid-point 20010; and final review 2012

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

Task or Objective	Evaluation Technique	Measurement/ Criteria for success	Pros and Cons	Implementation
(I/E) Public meetings; workshops; education and involvement projects	Written evaluations	Level of awareness; participation in project; before/after knowledge; opinions; attitudes (proof of behavior change)	Good response rate. Low cost	Post-event participants will complete brief evaluations requesting what was learned, deficiencies in event, and suggestions for improvement. Evaluations done at event Continuous throughout project after events
(I/E) Education efforts, brochures, public outreach, public consultation	Surveys, phone calls. Maintain office hours. Document correspondence and complaint records	Level of awareness; participation in project; before/after knowledge; opinions; attitudes (proof of behavior change) Public concerns Location of problem areas	Subjective information from limited number of community	Answer phones, emails, and letters. Document correspondence Assess success from content Years 1-3
(I/E) Public involvement and education projects	Participation tracking	Number of people participating. Geographic distribution of participants. Amount of pollution removed. (Stream clean up, hazardous waste removal)	Low cost. Easy to track and understand	Attendance/informational sign up sheets Document pollution materials removed
(I/E) Information and education programs	Focus groups, Civic groups	Level of awareness; participation in project; before/after knowledge; opinions; attitudes (proof of behavior change)	Medium to high cost. Instant identification of motivators and barriers to behavior change	Select random sample population as participant. 6-8 people per group. Plan questions, facilitate. Record and transcribe discussion
Structural Improvements (Designated Uses)	Photographs, calculations, models, monitoring	Pollutant load, BMP' s installed, physical outcomes, before and after results Aesthetics	Photos are easy to do, moderate costs; calculations are relatively easy to implement, moderate costs	Photograph sites before and after BMP installation, measure erodable soils before and after installation, and design and implement

Task or Objective	Evaluation Technique	Measurement/ Criteria for success	Pros and Cons	Implementation
				computer and mathematical models; gather continuous physical, chemical, and biological data.
Identify riparian and aquatic improvements. Identify recreational and improvements/ opportunities. Aesthetics (Desired Uses)	Stream surveys Shoreline surveys	Habitat; flow; erosion; recreation potential; impacts	Current and first-hand information. Time-consuming. Relatively high cost	Identify parameters to evaluate. Record on standardized form using standardized protocol (GLEAS 51) Assess success; Continue implementation as data directs

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

9.2 Quantitative Evaluation Techniques

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

9.2.1 Water Quality Monitoring Design

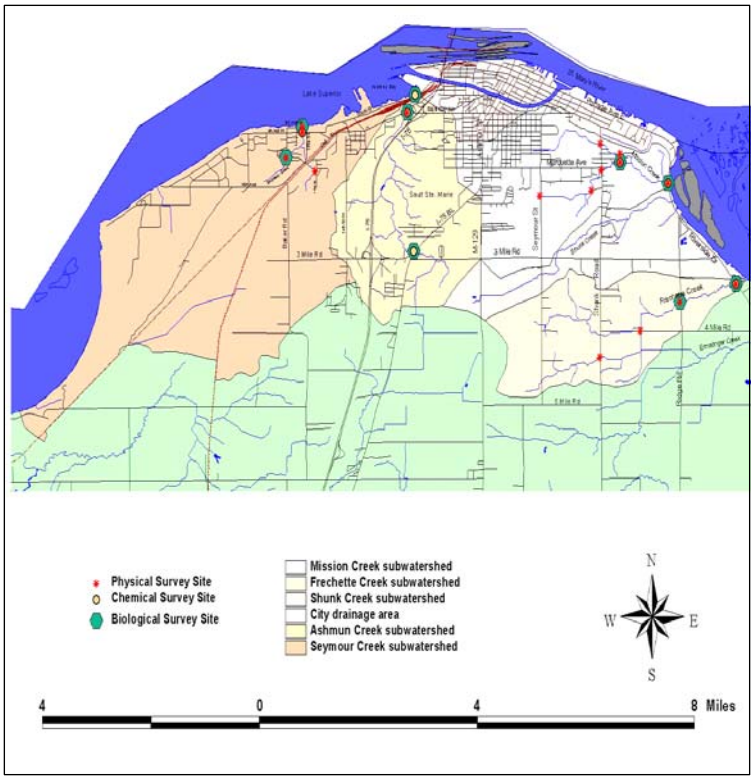
A significant goal of the project partners is to compile all the past information that went into this management plan and expand upon that information through a monitoring program that has significant survey locations, frequencies, including wet weather events, and appropriate parameters for assessment.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

Parameters

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

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

Map 9.1 Evaluation Survey Sites



The monitoring plan will employ local volunteers trained by MDEQ personnel or qualified Lake Superior State University faculty to measure dissolved oxygen (DO), biological oxygen demand (BOD), bacteria (E. coli), phosphorus (P) and its forms, nitrogen (N) and its forms, and conductivity at each creek site on Map 9.1 at least once each summer to screen for negative differences from target measures outlined below. Additional testing will be completed at added adjacent sites to target specific pollution sources if significant differences are discovered. The surveys will collaborate with MDEQ's five-year surveys (Ashmun Creek and St. Mary's River) and to evaluate any changes brought on by BMP installation. Additional components to be monitored, including *Rosgen's Bank Erosion Hazard Index*, *streambank erosion with erosion pins, and creek flashiness* will be selected with MDEQ consultation during QAPP development.

Establishing Targets

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

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

. . . for waters of the state designated for use for warm water fish and other aquatic life, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below a minimum of 4 milligrams per liter, or below 5 milligrams per liter as a daily average, at the design flow during the warm weather season in accordance with R 323.1090(3) and (4). At the design flows during other seasonal periods as provided in R 323.1090(4), a minimum of 5 milligrams per liter shall be maintained. At flows greater than the design flows, dissolved oxygen shall be higher than the respective minimum values specified in this subdivision.
(Michigan State Legislature. 1999)

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

Conductivity measures the amount of dissolved ions in the water column and is considered an indicator for the relative amount of suspended material in the stream. The scientifically established standard for conductivity in a healthy Michigan stream is 800 microSiemens (µS), which should be the goal for the creeks and St. Mary's River sites in the Sault area watershed. Levels higher than the standard indicate the presence of stormwater runoff generated suspended materials or possible nutrient inputs from failing on-site septic system. The Sault Watershed Project will employ local volunteers to measure conductivity in each creek as part of the monitoring schedule mentioned. Developed St. Marys River near the *Algonquin* area (Map 9.1) will also be measured as part of a comprehensive monitoring campaign to assess possible OSS failure.

The state requires that "nutrients shall be limited to the extent necessary to prevent stimulation of growths of aquatic rooted, attached, suspended, and floating plants, fungi or bacteria which are or may become injurious to the designated uses of the watersheds of the state" (MCSMP 2003). The Sault partners will utilize the concentration limit of 0.05 mg/L phosphorus that was designated for a reference TMDL (Middle Huron River Watershed) and persistent concentrations of unionized ammonia <0.02 µg/l (based on recommendations from the St. Mary's River Binational Public Advisory Council for the St. Mary's River Area of Concern Stage 2 Report) in order to prevent nuisance vegetation growth. Anions including nitrate and nitrite, and ortho-

phosphate will be analyzed by ion chromatography at LSSU. Total phosphorous will be run using persulfate digestion and the ascorbic acid method described in "Standard Methods for the Examination for Water and Wastewater" (AWWA).

Predominately clay soils throughout the watershed contribute to turbidity problems in surface waters. Sault partners will utilize total suspended solids measurement (TSS) to monitor soil erosion and sedimentation in surface waters. TSS for surface waters does not have a numerical standard set by the state. The State does require that "The addition of any dissolved solids shall not exceed concentrations which are or may become injurious to any designated use." To protect the designated uses of fisheries and wildlife habitat, as well as the desired recreation and aesthetic uses of the surface waters in the subwatershed, there are recommended targets established on a scientific basis. From an aesthetic standpoint, it is recommended that TSS less than 25 mg/L is "good", TSS 25-80 mg/L is "fair" and TSS greater than 80 mg/L is "poor". The TSS target, therefore will be to maintain TSS below 80 mg/L in dry weather conditions.

To determine sediment load, the level of embeddedness of the substrate (how much of the stream bottom is covered with fine silts) and the bottom deposition (what percentage of the bottom is covered with soft muck, indicating deposition of fine silts) could be used. These are measurements taken by the GLEAS protocol habitat assessment conducted by MDEQ every five years. Rating categories are from "poor" to "excellent". The target will be to increase the number of sites to improve the existing MDEQ and Sault Project databases and attain GLEAS 51 scores of at least "fair" at sites that are determined "poor," and improve "fair" sites to "good," and maintain "good" and "excellent" conditions at the remaining sites. The Sault project will employ local volunteers to continue evaluating MDEQ established sites (Ashmun Creek), and other sites developed through the planning phase, each year along with assessment of upstream and downstream areas where BMP's will be installed as part of the restoration of hydrology and elimination of erosion areas.

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

Numerical or fish community standards have not been set by the state. However, the Michigan Department of Environmental Quality has developed a system to estimate the health of the predicted fish communities through the GLEAS 51 (Great Lakes Environmental Assessment Section) sampling protocol. This method collects fish at various sites in the creek and based on whether or not certain expected fish species are present, as well as other habitat parameters, fish communities are assessed as poor, fair, good, or excellent. The target will be to maintain GLEAS 51 scores of "excellent" at sites where they are attained, "good" at sites where they are attained, improve "fair" sites to "good", and improve "poor" to "good" through the implementation of this plan. The GLEAS 51 protocol also identifies whether or not there are sensitive species present in the creek, which would indicate a healthy ecosystem. Certain species are especially useful for demonstrating improving conditions. These species tend to be sensitive to turbidity, prefer cleaner, cooler water. The project will employ LSSU *Aquatic Research Laboratory* students each summer to electroshock 300' creek sections upstream and downstream of sites being fitted with BMP improvements, once in 2008, prior to installations, and then each summer thereafter to monitor population assemblages and possible success of BMP's. One site possessing representative habitat will be selected for each creek not being fitted with BMP's to provide baseline population assemblages.

Similar to the assessment of fish communities, the state employs the GLEAS 51 protocol for assessing macro invertebrate communities on a five-year cycle in the State's watersheds. Sault

partners will utilize state sampling sites in the watershed (Ashmun Creek) along with other sites developed during the planning process, and perform macro invertebrate assessments using the GLEAS 51 procedures each year along with physical habitat health assessment. The monitoring target for macro invertebrate communities will be to increase the number of sites to improve the existing database and attain GLEAS 51 scores of at least "fair" at sites that are determined "poor," and improve "fair" sites to "good," and maintain "good" and "excellent" conditions at the remaining sites.

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

The state standard lists temperature standards only for point source discharges and mixing zones – not ambient water temperatures in surface water. Temperature studies will be conducted for the Sault area in order to determine the average daily temperatures and whether increased temperatures are a problem for tributary health. Data loggers will be installed in each creek and a control creek in Chippewa County to monitor areas with significant stormwater and other urban influences and compare to a relatively undeveloped subwatershed.

State standards do not exist for aesthetics or recreation potential. However, an area with high aesthetic qualities will add, in either a passive or active context, recreational opportunities for the public and a greater appreciation or awareness of the area's natural resources. Measuring aesthetics of an area is inherently a qualitative effort. However, progress toward attaining aesthetically pleasing places can be measured and evaluated effectively using a standard tool, such as a survey, at regular intervals in time. A public survey will be developed for the Sault community to assess awareness and perception of natural aesthetics concerns and measure perceptions and desires for water clarity, ambient odors, vegetative diversity, wildlife use, streambank erosion, debris, evidence of public use, and other parameters that indicate positive or negative aesthetic qualities. Volunteers and/or community field staff will most likely be utilized for this effort.

In order to measure project success in increasing and enhancing nature based recreational opportunities as well as perpetual land protection for water quality, project partners will measure and map areas with recreation and land protection potential not already delineated by project partners in the initial planning phase. The first component of this effort will be an initial assessment of recreational and land protection potential of the watershed to determine where opportunities and access and perpetual protection can be implemented or improved. The goal is to identify areas in the watershed, both along the riparian corridor and on the landscape that can be protected for water quality or provide passive or active recreation. Within the watershed, these areas will be linked where possible to provide linear corridors that connect, or greenways, for both people (hiking, biking trails) and wildlife. This activity will begin with mapping existing areas (with help from Little Traverse Conservancy and Michigan Natural Features Inventory and their current land protection maps) dedicated to recreation or preservation, and then completing a watershed exploration to record information including: evidence of current public use, potential for public access, linkages to other natural areas (greenways potential), ownership of property, vegetation types (forested, wetland area, in need of riparian cover, etc.), excessive woody debris, etc. This survey will include photographs of potential recreation areas which will assist the community and project partners in prioritizing new areas for preservation and recreation for the public, offering the public more opportunity for using and appreciating Sault area natural resources. Finally, these activities will lead to the identification of funding mechanisms for

purchase of land and conservation easements, as well as any necessary infrastructure (construction of trails, boardwalks, river front kayak access, etc.) that would support new or improved recreational opportunities. Details regarding responsible parties, monitoring standards, sampling sites, and frequency of monitoring for the qualitative and quantitative evaluation techniques will be defined in a MDEQ approved quality assurance project plan prior to monitoring activity (MCSSAG 2003).

Sault Ste. Marie Area Watershed Planning Project
Works Cited

AWWA.1995. Standard Methods for the Examination of Water and Wastewater. 19th ed. American Public Health Association, American Water Works Association and Water Environment Federation.

Anderson, S. 1992. Studies Begin on Kaneohe Bay's Toxin Problem. *Makai*, 14(2):1,3. University of Hawaii Sea Grant College Program.

Bascom, W. 1964. *Waves and Beaches - The Dynamics of the Ocean Surfaces.* Anchor Books, Doubleday and Company, Inc. New York.

Creal, W. and Wuycheck, J. 2002. Clean Water Act Section 303 List (Michigan). Michigan Department of Environmental Quality. Lansing, MI.

De Walle, F.B. 1981. "Failure Analysis of Large Septic Tank Systems." Journal of Environmental Engineering. American Society of Civil Engineers.

Drzyzga, S., Ashton S. & Schaetzl R. Michigan State University. Department of Geology. 2002 East Lansing, MI.

Environmental Protection Agency. 1993. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters Chapter 6: Management Measures for Hydromodification: Channelization and Channel Modification, Dams, and Steambank and Shoreline Erosion. EPA 840-B-92-002.

Eastern Upper Peninsula Regional Planning and Development Commission (EUPRPDC). 2000. Soo Township Master Plan. Sault Ste. Marie. MI.

Erickson, R.E., R.L. Linder, and K.W. Harmon. 1979. Stream Channelization (PL 83-566) Increased Wetland Losses in the Dakotas. *Wildlife Society Bulletin*, 7(2):71-78.

Garn, H. 2002. Effects of lawn fertilizer on nutrient concentration in runoff from lakeshore lawns, Lauderdale Lakes, Wisconsin. USGS Water-Resources Investigations Report 02-4130. 6 pp.

Gove Associates Inc. 1995. Sault Ste. Marie Master Plan. Kalamazoo, Michigan.

Hauer, F. Richard and Hill, W. 1996. "Temperature, Light, and Oxygen" Methods in Stream Ecology San Diego, CA.

Michigan Department of Environmental Quality (MDEQ). 1998. Guidebook of Best Management Practices for Michigan Watersheds. Lansing, MI.

Michigan Department of Environmental Quality (MDEQ). 2002. Great Lakes And Environmental Assessment Section Procedure #51. Surface Water Quality Division. Lansing, MI

Michigan Department of Environmental Quality (MDEQ). 2004. Soil Erosion and Sedimentation Control Training Manual. Lansing, MI.

Michigan Department of Environmental Quality (MDEQ). 2005. A Biological Survey of the Charlotte River, Ashmun Creek, and Wilmar Creek Watersheds in Chippewa County (MI/DEQ/WB-05/072). Marquette, MI.

Michigan Department of Environmental Quality. 2006. http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3713-10780--,00.html Lansing, MI.

Michigan Department of Environmental Quality. 2006. Conversation with Scott Schaeffer. Newberry, MI.

Mill Creek Subwatershed Stakeholder Advisory Group. 2003. Mill Creek Subwatershed Management Plan. Ann Arbor, MI.
Natural Resources Conservation Service. 2002. Farm Bill 2002-Wetlands Reserve Program. Washington, DC.

Natural Resources Conservation Service. 2004. Farm Bill 2002-Wildlife Habitat Incentives Program. Washington, DC.

Orlova and Popova. 1976. Original not available for examination. Cited in Brocksen et al., 1982.

Overmier, Gary. 2005. *Basin Program Unveils "Stop the Mudness" Campaign.* Keeping It On The Land. Ann Arbor, MI.

Schoof, R. 1980. Environmental Impacts of Channel Modification. Water Resources Bulletin, 16:697-701. In *Channelization of Streams and Rivers in Illinois: Procedural Review and Selected Case Studies*, ed. R.L. Mattingly and E.E. Herricks. Illinois Department of Energy and Natural Resources, Springfield, IL. INENR/re-WR-91/01. 1990.

Schueler, Thomas R., 1987. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. Washington Metropolitan Water Resources Planning Board, Washington D.C.

Schueler, Thomas R., Heather K. Holland. 2000. (Reprint 2002.) The Practice of Watershed Protection. Center for Watershed Protection: Ellicott City, MD.

Sherwood, C.R., D.A. Jay, R. Harvey, P. Hamilton, and C. Simenstad. 1990. Historical Changes in the Columbia River Estuary. *Progr. Oceanogr*., 25:299-352.

Teel, Wayne. S. 1998. Non-Point Source Pollution: Types, Sources and Impacts on Virginia Waters. James Madison University.

Tip of the Mitt Watershed Council (TOMC). 2004. Little Traverse Bay Watershed Protection Plan. Petoskey, MI.

U'ren, Sarah, 2005. Grand Traverse Bay Watershed Protection Plan. Traverse City, MI.

United States Environmental Protection Agency (USEPA). 1993. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. USEPA, Office of Water, Washington, D.C.

United States Department of Agriculture. 2001. Continuous Signup For High Priority Practices. Washington, DC.

U.S. Environmental Protection Agency. (USEPA). National Risk Management Research Lab. Chapter 3. URL:http://www.epa.gov/ORD/NRMRL/pubs/625r00008/html/625R00008chap3.htm

Waschbusch, R., W. Selbig, and R. Bannerman. 1999. Sources of phosphorus in stormwater and street dirt from two urban residential basins in Madison, Wisconsin, 1994-95. USGS Water-Resources Investigations Report 99-4021.

Appendix

Appendix A – Long Range Plan

Appendix B – Timeline

Appendix A
Sault Ste. Marie Area Watershed
Long Range Plan

SAULT STE. MARIE AREA WATERSHED – LONG RANGE PLAN	2007	2008	2009
Operating Expenses			
Manager	45,000	47,000	49,000
General Operations	6,000	6,000	6,000
Total Operating Expenses	51,000	53,000	55,000
Project Implementation Plan - Objectives and Tasks			
1. Loss of Aquatic Habitat (BMPs)			
Task A - Develop Ordinance/Regulation	5,000	5,000	5,000
Task B - SESC Administration	40000/SESC staff	40000/SESC staff	40000/SESC staff
Task C - Install Structural BMPs	25,000	25,000	25,000
Task D - Fisheries Habitat Evaluation	Manager's Salary	Manager's Salary	Manager's Salary
Task E - Fisheries Habitat Installation	10,000	10,000	10,000
Task F - Land Protection Strategy	5,500	5,500	100,000
Task G - Land Protection Endowment	500,000	500,000	500,000
Task H - Revolving Land Protection Fund	500,000	500,000	500,000
1. Loss of Aquatic Habitat (Information/Education (I/E))			
Task 1 - Land Use Education	5,000	5,000	5,000
Task 2 - Educate Realtors and Developers	5,000	5,000	5,000
Task 3 - Backyard Wildlife Education	5,000	5,000	5,000
Task 4 - Wetland Education Campaign	5,000	5,000	5,000
Task 5 - Shoreline Education	5,000	5,000	5,000
Task 6 - Land Protection Strategy Education	5,000	5,000	5,000
Task 7 - Develop Water Quality Information Packet	1,000	1,000	0
2. Developed Areas/Construction Sites (BMPs)			
Task A - Construction Site BMP Education	40000/SESC staff	40000/SESC staff	40000/SESC staff
Task B - Township/City Technical Assistance			20,000 planner
2. Developed Areas/Construction Sites (I/E)			
Task 1 - SESC Workshops	1,000	1,000	1,000
Task 2 - SESC Site Review	40000/SESC staff	40000/SESC staff	40000/SESC staff
Task 3 - Filling the Gap Workshop/Materials		2,000	
Task 4 - Fisheries Education			2,000
3. Road Stream Crossings (BMPs)			
Task A	50,000	50,000	50,000
Task B	Manager Salary	Manager Salary	Manager Salary
3. Road Stream Crossings (I/E)			
Task 1 - Road Commission TA	5,000	5,000	5,000
4. Urban/Rural Stormwater (BMPs)			
Task A - Drainage District Feasibility Research	Manager Salary	Manager Salary	Manager Salary

Task B - GIS Stormwater Infrastructure			50,000
Task C - Update City/TWP Stormwater Plan			10,000
Task D - Installation of Stormwater BMPs	15,000	15,000	15,000
Task E - SESC Stormwater Consultation	40000/SESC staff	40000/SESC staff	40000/SESC staff
4. Urban/Rural Stormwater (I/E)			
Task 1 - Public Stormwater Education	Manager Salary	Manager Salary	Manager Salary
Task 2 - Public Stormwater Education materials	5,000	5,000	5,000
Task 3 - Drain Stenciling	1,500	1,500	1,500
5. Bank/Shoreline Erosion (BMPs)			
Task A – Pursue Installation Public Shoreline BMPs	10,000 materials	10,000 materials	10,000 materials
Task B – Pursue Installation Private Shoreline BMPs	Manager Salary	Manager Salary	Manager Salary
Task C - Install BMP's (Established Sites)	10,000	10,000	10,000
Task D - Demonstration Sites	10,000	10,000	10,000
Task E – Update Streambank Inventory	Manager Salary	Manager Salary	Manager Salary
Task F – Install Streambank BMPs	10,000	10,000	10,000
5. Bank/Shoreline Erosion (I/E)			
Task 1 - Develop Demonstration Sites	Manager Salary	Manager Salary	
Task 2 - Shoreline/Riparian Area Guidebook		2,000	
6. Contamination Sites (LUSTS, FUDS, etc.) (BMP's)			
Task A - Install BMPs at Marinas	2,000	2,000	
Task B - Install BMPs at Fuel Stations	5,000	5,000	5,000
Task C - LUST Owner Consultation	Manager Salary	Manager Salary	Manager Salary
Task D – Pursue abandoned wells/cap	Managers salary+750 well	Managers salary+750 well	Managers salary+750 well
Task E – Stream Clean Up	2,000	2,000	2,000
6. Contamination Sites (LUSTS, FUDS, etc.)(I/E)			
Task 1 - Marina Info/Education-Boater's Workshops		5,000	
Task 2 – Hazardous Waste Education	Manager Salary	Manager Salary	Manager Salary
Task 3 – Contamination Site Consultation	Manager Salary	Manager Salary	Manager Salary
7. Residential/Commercial Fertilizer/Pesticide Use (BMPs)			
Task A - Home Asyst, Lake Asyst, etc.	Manager's Salary	Manager's Salary	Manager's Salary
Task B – Update NRCS Plans	Manager's Salary	Manager's Salary	Manager's Salary
Task C - Implement Farm Bill			Farm Bill
7. Residential/Commercial Fertilizer/Pesticide Use (I/E)			
Task 1 - Lawn Care Education/Information	2,000	2,000	2,000
Task 2 - Consultation with Landscapers	2,000	2,000	2,000
8. Failing On-site Septic Systems (BMPs)			
Task A – CZARA 6217 Recommendations	Manager's Salary	Manager's Salary	Manager's Salary
Task B - Consult CCHD for OSS Alternatives and Installation			15,000
Task C - Municipal Wastewater Expansion Feasibility	Manager's Salary	Manager's Salary	Manager's Salary
8. Failing On-site Septic Systems (I/E)			
Task 1 - Develop OSS I/E	2,000	2,000	2,000
Task 2 - Municipal Wastewater Expansion Feasibility	8C	8C	8C
9. Monitoring (BMPs)			

Task A – GLEAS 51	Manager's Salary	Manager's Salary	Manager's Salary
Task B - Beach Monitoring	20,000	20,000	20,000
Task C - GIS/Map Natural Features Inventory			50,000
Task D - Analyze Air Quality-ITC		Manager's Salary	
Task E - On line Database			10,000
Task F- Coastal Wetlands Inventory			35,000 LSSU Staff
Task G - Land Protection Endowment			
Task H - Riparian Land Use	Manager's Salary	Manager's Salary	Manager's Salary
Task I - Support Fisheries Monitoring	Manager's Salary	Manager's Salary	Manager's Salary
Task J - Evaluate BMPs	Manager's Salary	Manager's Salary	Manager's Salary
9. Monitoring (I/E)			
Task 1 - Implementation Plan Outreach	15,000	15,000	15,000
Task 2 - Host/Manage Website	7,500	7,500	7,500
Task 3 - BPAC Summit	5,000	5,000	5,000
Task 4 - Project Signage	5,000	5,000	5,000
Task 5 - On line database	9E	9E	9E
Task 6 - Develop and Distribute Social Survey		10,000	
Task 7 - Distribute Management Plan	2,500		
10. Desired Uses (BMPs)			
Task A - Open Space Initiative	Manager's Salary	Manager's Salary	Manager's Salary
Task B – Assist Low Impact Parks	Manager's Salary	Manager's Salary	Manager's Salary
10. Desired Uses (I/E)			
Task 1 - Host Natural Area Tours	1,000	1,000	1,000
Task 2 - Project Video		15,000	
Total Plan Expenses	**316000+SESC Staff**	**349500+SESC Staff**	**466000+SESC Staff**

Appendix B
Sault Ste. Marie Area Watershed
Timeline

SAULT AREA PROJECT TIMELINE	2007	2008	2009
Project Implementation Plan – Objectives and Tasks			
1. Loss of Aquatic Habitat (BMPs)			
Task A - Develop Ordinance/Regulation	Project Planned	Provide Technical Assistance	Ordinance Developed
Task B - SESC Administration	Ongoing	Ongoing	Ongoing
Task C - Install Structural BMPs	See BMP Summary Table		
Task D - Fisheries Habitat Evaluation	Consult MDNR	Engineer Sites	
Task E - Fisheries Habitat Installation			Install Sites
Task F - Land Protection Strategy	Provide Technical Assistance	Provide Technical Assistance	Secure Easement
Task G - Land Protection Endowment	Solicit Endowment Funding	Secure Endowment Funding	Secure Endowment Funding
Task H - Revolving Land Protection Fund	Solicit Funding	Establish Fund	Begin Distributing Loans
1. Loss of Aquatic Habitat (Information/Education (I/E))			
Task 1 - Land Use Education	Develop, Distribute I/E Media	Develop, Distribute I/E Media Example	Develop, Distribute I/E Media Example
Task 2 - Educate Realtors and Developers	Develop, Distribute I/E Media	Develop, Distribute I/E Media	Develop, Distribute I/E Media
Task 3 - Backyard Wildlife Education	Develop, Distribute I/E Media	Develop, Distribute I/E Media	Develop, Distribute I/E Media
Task 4 - Wetland Education Campaign	Develop, Distribute I/E Media	Develop, Distribute I/E Media	Develop, Distribute I/E Media
Task 5 - Shoreline Education	Develop, Distribute I/E Media	Develop, Distribute I/E Media	Develop, Distribute I/E Media
Task 6 - Land Protection Strategy Education	Develop, Distribute I/E Media	Develop, Distribute I/E Media	Develop, Distribute I/E Media
Task 7 - Develop Water Quality Information Packet	Develop Packet	Distribute Packet	Distribute Packet
2. Developed Areas/Construction Sites (BMPs)			
Task A - Construction Site BMP Education	Host Workshop	Host Workshop	Host Workshop
Task B - Township/City Technical Assistance	Provide Technical Assistance	Provide Technical Assistance	Develop Ordinance, Update Planning Documents
2. Developed Areas/Construction Sites (I/E)			
Task 1 - SESC Workshops	See 2A	See 2A	See 2A
Task 2 - SESC Site Review	Ongoing	Ongoing	Ongoing
Task 3 - Filling the Gap Workshop/Materials	Host Workshop	Host Workshop	Host Workshop
Task 4 - Fisheries Education	Develop, Distribute I/E Media	Develop, Distribute I/E Media	Develop, Distribute I/E Media

3. Road Stream Crossings (BMP's)			
Task A	See BMP Summary Table	See BMP Summary Tale	See BMP Summary Table
Task B	Host Workshop	Host Workshop	Host Workshop
3. Road Stream Crossings (I/E)			
Task 1 - Road Commission TA	Host Workshop	Host Workshop	Host Workshop
4. Urban/Rural Stormwater (BMPs)			
Task A - Drainage District Feasibility Research	City Officials Consultation	Develop GIS Parcel Map/Distribute Outreach	Public Comment, vote.
Task B - GIS Stormwater Infrastructure		Develop GIS Map of Stormwater Structure	
Task C - Update City/TWP Stormwater Plan	City Officials Consultation	Develop Recommendations	Complete Revisions to Plan
Task D - Installation of Stormwater BMPs	City Officials Consultation	Install 50% planned BMP's	Install 100% planned BMP's
Task E - SESC Stormwater Consultation	Ongoing	Ongoing	Ongoing
4. Urban/Rural Stormwater (I/E)			
Task 1 - Public Stormwater Education	Develop, Distribute I/E Media	Develop, Distribute I/E Media	Develop, Distribute I/E Media
Task 2 - Public Stormwater Education materials	City Officials Consultation	City Officials Consultation	City Officials Consultation
Task 3 - Drain Stenciling		Host Stenciling Event	Host Stenciling Event
5. Bank/Shoreline Erosion (BMPs)			
Task A - Pursue Installation Public Shoreline BMPs	Confirm Priority Parcels	Engineer Sites	Install BMPs
Task B - Pursue Installation Private Shoreline BMPs	Confirm Priority Parcels	Engineer Sites	Install BMPs
Task C - Install BMPs (Established Sites)	Confirm Landowners/Engineer	Install 50% planned BMPs	Install 100% planned BMPs
Task D - Demonstration Sites	Confirm Landowners/Engineer	Install Demonstration Site	Public Outreach
Task E - Update Streambank Inventory	Update Inventory	Monitor Changes	Monitor Changes
Task F - Install Streambank BMPs	Confirm Sites/Engineer	Install 50% planned BMP's	Install 100% planned BMPs
5. Bank/Shoreline Erosion (I/E)			
Task 1 - Develop Demonstration Sites	Consult Landoowners	Engineer/Install Sites	Evaluate Effectiveness
Task 2- Shoreline/Riparian Area Guidebook	Plan/Develop Book	Distribute Book	Distribute Book
6. Contamination Sites (LUSTS, FUDS, etc.) (BMPs)			
Task A - Install BMPs at Marinas	Consult Marinas/Plan Materials	Distribute/Install BMPs	Maintenance
Task B - Install BMPs at Fuel Stations	Consult Stations	Distribute/Install BMPs	Maintenance
Task C - LUST Owner Consultation	Consult MDEQ/Landowners	Implement Delist Criteria	Implement Delist Criteria
Task D - Pursue abandoned wells/cap	Develop Map/Plan	Pursue Funding	Cap Well

Task E - Stream Clean Up	Plan Clean up/Solicit Funding	Sponsor Creek Clean Up	Sponsor Creek Clean Up
6. Contamination Sites (LUSTS, FUDS, etc.) (I/E)			
Task 1 - Develop Marina Information/Education-Boater's Workshops	Develop Outreach Materials	Distribute Materials	Distribute Materials
Task 2 - Hazardous Waste Education	Develop Outreach Materials	Distribute Materials	Distribute Materials
Task 3 - Contamination Site Consultation	Consult Partners/Engineer	Consult Partners/Engineer	Assist Landowner Implement Plan
7. Residential/Commercial Fertilizer/Pesticide Use (BMPs)			
Task A - Home Asyst, Lake Asyst, etc.	Facilitate MSUE Activity Increase	Facilitate MSUE Activity Increase	Facilitate MSUE Activity Increase
Task B - Update NRCS Plans	Consult Farmers	Update Farmer's Plans	Update Farmer's Plans
Task C - Implement Farm Bill	Consult Farmers	Pursue Funding	Implement Plan
7. Residential/Commercial Fertilizer/Pesticide Use (I/E)			
Task 1 - Lawn Care Education/Information	Develop, Distribute I/E Media	Host Workshop	Develop, Distribute I/E Media
Task 2 - Consultation with Landscapers	Consult Vendors/Materials	Host Vendor Workshop	Monitor Activity
8. Failing On-site Septic Systems (BMPs)			
Task A - CZARA 6217 Recommendations	Consult OSS Landowners	Develop Landowner Plans	Evaluate Effectiveness
Task B - Consult CCHD for OSS Alternatives/Installation	CCHD Consultation/Research	Develop Test Home	Evaluate Effectiveness
Task C - Municipal Wastewater Expansion Feasibility	Consult City Officials	Develop Feasibility Study	Complete Feasibility Study
8. Failing On-site Septic Systems (I/E)			
Task 1 - Develop OSS I/E	CCHD Consultation/Research	Develop, Distribute I/E Media	Develop, Distribute I/E Media
Task 2 - Municipal Wastewater Expansion Feasibility	Consult City Officials	Develop Feasibility Study	Complete Feasibility Study
9. Monitoring (BMPs)			
Task A - GLEAS 51	Survey All Sites	Survey All Sites	Survey All Sites
Task B - Beach Monitoring	Survey All Sites	Survey All Sites	Survey All Sites
Task C - GIS/Map Natural Features Inventory	Partner Consultation/Planning	Perform Inventory	Complete Inventory/Map
Task D - Analyze Air Quality-ITC		Consult ITC/Distribute Information	Distribute Information
Task E - On line Database	Contractor Consultation	Develop Database	Complete Database
Task F- Coastal Wetlands Inventory	Approve Project QAPP	Survey All Sites	Complete Project
Task G - Monitor Riparian Land Use	Create Baseline Land Use Map	Monitor Changes	Monitor Changes
Task H - Compile/Organize Partner Data		Compile/Organize Data	Compile/Organize Data
Task I - Support Fisheries Monitoring	Consult Partners	Develop Fisheries Criteria	Develop Fisheries Criteria
Task J - Evaluate BMPs	Confirm Evaluation Strategy	Monitor BMPs	Monitor BMPs

9. Monitoring (I/E)			
Task 1 - Implementation Plan Outreach	Develop, Distribute I/E Media	Develop, Distribute I/E Media	Develop, Distribute I/E Media
Task 2 - Host/Manage Website	Develop Website	Host Website	Host Website
Task 3 - BPAC Summit	Host Workshop	Host Workshop	Host Workshop
Task 4 - Project Signage	Develop/Plan Project Signage	Install Signage	Install/Maintain Signage
Task 5 - On line database	9E	9E	9E
Task 6 - Develop and Distribute Social Survey	Develop Survey/Approve QAPP	Distribute Survey and Evaluate	Public Outreach
Task 7 - Distribute Management Plan	Print Plan/Presentations	Public Presentations	Public Presentations
10. Desired Uses (BMPs)			
Task A - Open Space Initiative	1A	1A	1A
Task B - Assist Low Impact Parks	Develop Needs Assessment	Solicit Funding	Solicit Funding
10. Desired Uses (I/E)			
Task 1 - Host Natural Area Tours	Host Tour	Host Tour	Host Tour
Task 2 - Project Video	Video Planning/Filming	Distribute/Show Video	Distribute/Show Video