Lower Grand River Watershed Management Plan

Prepared for

Grand Valley Metropolitan Council

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LOWER GRAND RIVER

WATERSHED MANAGEMENT PLAN

SEPTEMBER 2004
PROJECT NO. G02408

This pilot version of the Watershed Management Plan (WMP) was specifically designed for ongoing use by other watershed or subwatershed associations within the Lower Grand River Watershed (LGRW). Therefore subsequent versions are intended to be released as other watershed and subwatersheds within the LGRW use and provide feedback for improving this WMP and its various recommendations, maps, guidelines, and other tools.

FISHBECK, THOMPSON, CARR & HUBER, INC. **Engineers ● Scientists ● Architects**
1515 Arboretum Drive, SE, Grand Rapids, MI 49546 Telephone: 616-575-3824

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ACKNOWLEDGEMENT

The LGRW project was initiated and completed through the work of many individuals, representing the following organizations, who participated in the Grand River Forum and the various committees and subcommittees involved in this watershed planning effort. Their contributions to this effort resulted in a realistic document for present and future watershed stakeholders to use in managing their valuable resources.

Lower Grand River Steering Committee Members	
Ms. Abigail Matzke	Grand Valley State University (GVSU) - Annis Water Resource Institute (AWRI)
Mr. John Koches	GVSU - AWRI
Mr. Andy Bowman	Grand Valley Metropolitan Council (GVMC)
Mr. Don Stypula	GVMC
Mr. Brian Donovan	City of East Grand Rapids
Mr. Corky Overmyer	City of Grand Rapids
Mr. James Smalligan	Fishbeck, Thompson, Carr & Huber, Inc. (FTC&H)
Ms. E. Wendy Ogilvie	FTC&H
Mr. Jason Buck	FTC&H
Ms. Laurie Beth Nederveld	FTC&H
Ms. Erika Rosebrook	Kent County Administration
Ms. Janice Tompkins	Michigan Department of Environmental Quality (MDEQ)
Mr. Jim Beelen	Allendale Charter Township
Mr. Jim Holtvluwer	Georgetown Charter Township
Mr. Jim Oosting	Coldwater River Watershed Council
Mr. Karl Hausler	Michigan Department of Agriculture
Ms. Kristine Huizen	Frey Foundation
Mr. Paul Geerlings	Ottawa County Drain Commissioner
Mr. Scott Conners	City of Walker
Mr. Tom Doyle	Barry County Drain Commissioner

Lower Grand River Urban Subcommittee Members	
Mr. Aaron Bodbyl-Mast	Ottawa County Planning and Grants
Mr. Andy Bowman	GVMC
Ms. Angie Latvaitis	GVMC
Mr. Bradley Boomstra	Kent County Drain Commissioner's Office
Mr. Dan Czarnecki	City of Grand Haven
Mr. Doug Kadzban	City of East Grand Rapids
Mr. Frank Wash	Alpine Township
Ms. Janice Tompkins	MDEQ
Mr. Jim Beelen	Allendale Charter Township
Mr. Jim Beke	City of Kentwood
Mr. Jim McAllister	Kent County Road Commission
Mr. Jim Miedema	Jamestown Charter Township
Mr. John Koches	GVSU - AWRI
Mr. James Smalligan	FTC&H
Ms. E. Wendy Ogilvie	FTC&H
Ms. Laurie Beth Nederveld	FTC&H
Mr. Mark Rambo	City of Walker
Mr. Mike Chesher	City of Grandville
Mr. Russ Henckel	City of Wyoming

Lower Grand River Urban Subcommittee Members	
Mr. Ryan Teelander	Cannon Township
Mr. Shawn Wessell	West Michigan Environmental Action Council
Mr. Stephen Kepley	City of Kentwood

Lower Grand River Rural Subcommittee Members	
Mr. Aaron Bodbyl-Mast	Ottawa County Planning and Grants
Mr. Arleen Spalding	Morrison Lake Improvement Board
Mr. Doug Powless	Land Conservancy of West Michigan
Mr. Ed Hanenburg	River Ridge Farms, Inc.
Ms. Elizabeth Robins	Ionia County Conservation District
Mr. Fred Steketee	Thornapple River Watershed
Mr. Gregory Ransford	Robinson Township
Ms. Melissa Eldridge	Ionia Conservation District
Ms. Janice Tompkins	MDEQ
Mr. Jay Wright	Crockery Township
Ms. Mary Ledford	Wright Township
Mr. Myron Erickson	Wyoming Clean Water Plant
Mr. Reggie Brooks	Eaton Rapids Township
Mr. Rob Zbiciak	MDEQ
Mr. Tom Doyle	Barry County Drain Commissioner
Ms. Laurie Beth Nederveld	FTC&H
Ms. Abigail Matzke	GVSU - AWRI

Lower Grand River Watershed Technical Subcommittee Members	
Mr. Andy Bowman	GVMC
Mr. Bradley Boomstra	Kent County Drain Commissioner's Office
Mr. Bryan Jennings	Premarc
Mr. Doug Kadzban	City of East Grand Rapids
Mr. Eric Swanson	RMT, Inc.
Ms. Janice Tompkins	MDEQ
Mr. Jim McAllister	Kent County Road Commission
Mr. Jim Szejda	Ottawa County Health Department
Mr. John Koches	GVSU - AWRI
Mr. Rob Zbiciak	MDEQ
Mr. Russ Henckel	City of Wyoming
Mr. Ryan Teelander	Cannon Township
Mr. Scott Conners	City of Walker
Mr. Steve Van Hoeven	Ottawa County Road Commission
Mr. James Smalligan	FTC&H
Ms. E. Wendy Ogilvie	FTC&H
Ms. Laurie Beth Nederveld	FTC&H

Lower Grand River Watershed Visioning Subcommittee Members	
Mr. Andy Bowman	GVMC
Ms. Janice Tompkins	MDEQ
Ms. Amy Harrrington	Michigan Department of Natural Resources
Mr. Corky Overmyer	City of Grand Rapids
Ms. Jane Secord	Center for Environmental Study (CES)

Lower Grand River Watershed Information and Education Subcommittee Members	
Mr. Aaron Bodbyl-Mast	Ottawa County Planning and Grants
Ms. Abigail Matzke	GVSU - AWRI
Ms. Bonnie Shupe	Cannon Township
Mr. Dan Wolz	Wyoming Clean Water Plant
Mr. Dave Weinandy	Aquinas College

Lower Grand River Watershed Information and Education Subcommittee Members	
Ms. Elizabeth Robins	Ionia County Conservation District
Mr. Garrick Rochow	City of Holland
Mr. Geoffrey Habron	Michigan State University
Mr. Greg Rappleye	Ottawa County Administration
Ms. Jane Secord	CES
Ms. Janice Tompkins	MDEQ
Mr. Jeff Auch	Muskegon Conservation District
Ms. Kathy Evans	Muskegon Conservation District
Ms. Lori Larsen	CES
Ms. Melissa Eldridge	Ionia County Conservation District
Ms. Laurie Beth Nederveld	FTC&H
Ms. Patricia Pennell	West Michigan Environmental Action Council
Ms. Peggy Weick	Ottawa County Conservation District
Ms. Robin Woodbury	Premarc
Mr. Tom Williams	V3 Companies

EXECUTIVE SUMMARY

The Grand River's headwaters begin in southern Jackson County and flow northwest across 260 miles to its confluence with Lake Michigan, making it the longest river located entirely in Michigan. The Lower Grand River Watershed Management Plan (WMP) studies the portion of the Grand River Watershed (Watershed) below the Looking Glass River confluence, near the City of Portland. The Lower Grand River Watershed (LGRW) has a drainage area of 2,909 square miles and encompasses large portions of Ottawa, Muskegon, Kent, Montcalm, Ionia, Barry, and Eaton Counties. Counties with very small portions of the LGRW include: Newaygo, Allegan, and Mecosta Counties. The LGRW contains two urban areas: the Grand Rapids Metropolitan area and the Muskegon Metropolitan area, which includes the Grand Haven, Tri-cities areas. Three major tributaries flow into the Grand River: the Thornapple River, the Flat River, and the Rogue River. Most of the Watershed is covered by residences, urban centers, forests, and agriculture.

WATER QUALITY CONCERNS

Past studies of the LGRW suggest that water quality within the Watershed is impacted by pollutants, originating from past and present agricultural, industrial, private, and municipal activities. Both point and nonpoint sources (NPS) of pollution impact water quality within the Watershed. NPS pollution contributes sediment, nutrients (such as nitrogen and phosphorus), and bacterial pathogens [such as *Escherichia coli* (*E. coli*)] to surface water. Sediment becomes suspended in surface water due to stream bank erosion, runoff from agricultural fields, construction sites, and storm water runoff. Pathogens enter surface water from septic systems, concentrated wildlife, farm animals, and pets. In addition, lawn and agricultural fertilizers contribute nutrients to surface water.

The Michigan Department of Environmental Quality (MDEQ) has identified 36 waterbodies within the LGRW that require Total Maximum Daily Load (TMDL) studies. Pollutants of concerns in these waterbodies include: polychlorinated biphenyls (PCBs), mercury, sediment, nutrients, pathogens (*E. coli*), low dissolved oxygen, and untreated sewer discharges resulting in poor fish and macroinvertebrate communities and fish kills. MDEQ biological surveys have reported that the observed urbanization of the watershed, with increased impervious surfaces, is accelerating sedimentation and flow fluctuations from storm water runoff, which causes impairments to its streams. NPS pollution from agricultural sources was cited as a source of nutrients and possibly pathogens in the Watershed.

The LGRW Steering Committee determined the impacts watershed pollutants, and their sources, were having on the designated uses of the LGRW to determine what pollutants and water quality concerns should be addressed. Designated uses were considered impaired if measured state water quality standards were not being met.

Designated uses were considered threatened if water quality was declining or conditions in the Watershed indicated that water quality standards may not be met in the near future. The status of the designated uses in the Watershed is described below.

Designated Use	Status of Designated Use	Prioritized Pollutants and Impairments
Agriculture	Streams used as sources of clean water for livestock watering are impaired by pathogens.	**High**
		Pathogens (k)
	Excessive amounts of nutrients can affect herd health and cause algal blooms and nuisance vegetation.	**Low**
		Nutrients (k)
	Water supplies for irrigation are threatened by altered hydrology and reduced base flows.	**Low**
		Hydrologic flow (k)
Navigation	Conditions in the Watershed are being met for navigation.	None
Warm Water Fishery	Spawning habitats are impaired by sediment and altered hydrology.	**High**
		Sediment (k)
	Heavy metals and oils are impairing habitat and fish prey.	**Low**
		Chemicals (s)
Coldwater Fishery	Spawning habitats are impaired by sediment and altered hydrology.	**High**
		Sediment (k)
	Increased temperatures from storm water runoff impair the necessary cold water temperatures for fish.	**Medium**
		Temperature (k)
	Heavy metals and oils are impairing habitat and fish prey.	**Low**
		Chemicals (s)
Indigenous Aquatic Life and other Wildlife	Sediment is impairing fisheries and habitat that some terrestrial animals depend upon for feeding.	**High**
		Sediment (k)
	Fragmentation of habitat is impairing the conditions for wildlife to thrive.	**Medium**
		Loss of habitat (k)
	Nutrients are causing algal blooms and vegetative conditions that may alter water chemistry or make foraging for food difficult.	**Low**
		Nutrients (k)
	Invasive species are impairing the diversity and presence of native species.	**Medium**
		Invasive species (k)
Partial Body Contact Recreation	Recreational opportunities are impaired by pathogens.	**High**
		Pathogens (k)
	Nutrients are causing algal blooms and nuisance amounts of aquatic vegetation.	**Medium**
		Nutrients (k)
Total Body Contact Recreation	Recreational opportunities are impaired from May 1 to October 31 by pathogens.	**High**
		Pathogens (k)
	Nutrients are causing algal blooms and nuisance amounts of aquatic vegetation.	**Medium**
		Nutrients (k)
Public Water Supply	Surface water withdrawals for public water supply could be threatened.	Unknown
Industrial Water Supply	Surface water withdrawals for industrial water supply could be threatened.	**Low**
		Nutrients (k)
		Sediment (k)
		Hydrologic Flow (k)

(k) = known
(s) = suspected

GOALS AND OBJECTIVES

Many of the water quality concerns of the LGRW are reflected in the Lake Michigan Lakewide Management Plan (LaMP), including NPS pollution, high bacteria counts at beaches, fragmentation of wildlife habitats, and invasive species. The recommendations described in the LaMP were reviewed for their applicability to the LGRW goals. Goals for the existing WMPs already developed within the LGRW were also evaluated to recognize any unique conditions that needed to be addressed. The goals developed for the Upper Grand River Watershed were assessed to ensure that conflicting recommendations would not be made. The goals of the Watershed were determined after discussing the sources and causes of the impairments in the LGRW and coordinating with these other studies and reports. The goals are based on improving or restoring the designated uses of the Watershed and attaining compliance with established TMDLs:

- Maintain and improve water quality by promoting sound land management decisions.
- Assess relationships between water quality and storm water runoff by developing guidelines for storm water management to reduce impacts of urbanization.
- Preserve and restore, coldwater fisheries, and reintroduce indigenous game fish species where possible.
- Provide for flood protection, minimize risk of flooding, and assess necessity of flood control improvements.
- Ensure public safety in recreational opportunities in surface waters.
- Protect healthy habitats for native aquatic life and wildlife.

Desired uses of the Watershed reflect how the community wants to use the Watershed and what activities should be promoted within the Watershed. The ideas discussed by the Steering Committee, the Grand River Forum members, and local officials resulted in five categories: Recreational use, planning and development, wildlife habitat, educational opportunity, and water consumption.

RECOMMENDATIONS

The Steering Committee administered the development of goals and objectives for each impairment to the designated uses, and gave the directive to attain compliance with established TMDLs and develop recommendations for action. Best management practice (BMP) recommendations were based on the underlying cause of the source of the impairment. The recommendations include: structural and vegetative BMPs, management and policy BMPs, and informational and educational activities.

The Urban, Rural, and Technical Subcommittees identified what structural and vegetative BMPs could be used to reduce potential sources of pollutants from both urban and rural areas in the Watershed. The Subcommittees then developed a spreadsheet that listed the structural and vegetative BMPs, and their characteristics that are currently being used or considered to address the pollutants. The structural and vegetative BMPs were categorized into practices of pretreatment, detention/retention, vegetated treatment, infiltration, filtration, and agricultural. A similar spreadsheet was developed for managerial BMPs. The managerial BMPs were categorized into practices of agricultural, zoning ordinance/land use policies, recycling/composting, turf management, operations and maintenance, and municipal operations. The Information & Education (I&E) strategy was developed with assistance from the I&E Subcommittee and outlines the activities and products needed to successfully maintain and improve water quality. The strategy provides 1) an outline of the developmental process for the planning phase, 2) a brief overview of the public participation during the planning phase, 3) an outline of the planning phase I&E strategy, and 4) an I&E strategy for the implementation phase of the project.

EVALUATION

Evaluation of the Watershed project will be a two-phase process. The first phase evaluated the success of the planning process, divided into five areas of focus:

- Assessment and Characterization of the Watershed's Natural Resources and Water Quality Conditions
- I&E Strategy
- Creating a System of Regional Governance for the Watershed
- Reviewing and Recommending the Adoption of BMPs
- Management Process for the Project

The second phase of the evaluation will measure the success of the project following the implementation of the prioritized BMPs. The evaluation criteria were selected based on the pollutants identified as impairments to the designated uses. This evaluation will determine the level and rate of water quality improvements, which are achieved in areas of physical, chemical, and biological improvements.

THE GRAND VISION

The Lower Grand River WMP is a broad, reference-oriented document that builds upon and elevates existing water quality improvement efforts in the Watershed. The members of the Grand River Forum (Forum) recognized that the plan should take a holistic, ecosystem approach, and provide a vision and broad strategic plan for the entire Watershed under which to operate. The Vision Committee created the following Vision and Mission Statement for the Watershed:

Lower Grand River Watershed Vision: Connecting water with life: swimming, drinking, fishing, and enjoying all the waters of our Grand River Watershed.

Lower Grand River Watershed Mission Statement: "Discover and value all water resources and celebrate our shared water legacy throughout our entire Grand River Watershed community."

The Vision Committee worked with the Forum to develop guidelines and recommendations to follow to achieve the vision and mission. The Buck Creek and Sand Creek WMPs, completed during this project, provided the details on the recommendations for those watersheds to reach the overall goals and objectives of the Lower Grand River WMP. The remedies for the impaired urban areas of the Buck Creek Watershed will provide opportunities for other urban and urbanizing areas in the LGRW to evaluate management measures used, and determine which management measures would be best for their particular situation. The Sand Creek WMP will provide the Sand Creek Watershed Partners the details on how to implement recommendations to reach more immediate goals and objectives, for agricultural and rural developing areas, and the longer range visions of the Lower Grand River WMP. These WMP recommendations are expected to be extrapolated for use and adoption in other urban and rural areas of the LGRW experiencing similar problems, using the tools developed in the Lower Grand River WMP.

The watershed-based permit, under which the urbanized communities in the LGRW are conducting their National Pollution Discharge Elimination System (NPDES) Phase II storm water program, allows flexibility on how each community develops and implements a storm water management plan. The storm water management plans will be based on the Lower Grand River WMP recommendations, but each community will have its own implementation strategy.

The LGRW Steering Committee provided oversight and direction to the project and was responsible for developing the goals and objectives of the planning project. The Steering Committee met monthly since the project began and coordinated efforts to ensure that the project is representative of as many interests and concerns as possible in the Watershed. The Steering Committee will continue to meet after the project is completed, as an organization, group, or council, the structure of which is described in this document.

CHAPTER 1 - INTRODUCTION

1.1 PROJECT OVERVIEW

A Watershed Management Plan (WMP) considers many aspects of water usage and functions, and coordinates them into a comprehensive plan for managing the activities that govern how our natural resources are utilized or viewed. A WMP is developed to provide direction and prioritize how resources are used for the management, protection, or restoration of a watershed. A watershed approach is ideal for managing water resources since they cross jurisdictions and political boundaries. Often this fluid nature of water is overlooked or taken for granted. Water flows over the ground and picks up pollutants before reaching a lake, stream, wetland, or river. This same water is used for irrigation, swimming, aquatic life, and drinking. The Lower Grand River WMP takes into account the many needs that water resources must meet and composes a vision for the future.

This watershed project chose to focus on the portion of the Grand River Basin below the Looking Glass River confluence, near the City of Portland. This portion of the basin was referred to as the Lower Grand River Watershed (LGRW). Rather than following traditional guidelines for WMP development, the LGRW project produced a guidance document for creating WMPs for subwatersheds. The LGRW is intended to be used as a catalyst for developing other WMPs. One of the goals of this project is to develop a watershed organization that can serve as an umbrella for existing watershed management efforts or help establish future subwatershed groups. This WMP will be highly useful in the planning stage for future watershed projects.

A report to the U.S. Environmental Protection Agency (EPA) in 1995 discovered that certain barriers to successful watershed planning exist depending on the scale of the project. The report discovered that large watershed projects often had difficulty coordinating local governments and setting water quality goals for the diverse problems that face large geographic areas. Conversely, small watershed projects lacked the scope to address regional problems and sometimes worsened conditions in other areas. The report recommends a solution to this paradox by planning on both scales. Large scale or basin-wide planning is needed to establish regional goals and objectives and small units are needed at the implementation phase (Adler, 1995).

The LGRW project is using this approach to design and implement the WMP. At the large scale, the project has produced a mission statement and vision. Goals and objectives are broad and encompass the needs of the diverse stakeholder groups. Implementation of the WMP is expected on the subwatershed level, by those closest to the problem. Small watershed projects that result from this project will be able to use the tools and information in this WMP to design and implement cost-effective solutions to local water quality problems.

1.2 CULTURAL HISTORY

The Grand River Watershed, home to the mound-building Hopewell Indian Tribe and later to the European settlers, is a region rich in cultural history and natural resources. Native Americans and European settlers alike depended on the Grand River for food, transportation, and recreation. Diving deep into the Grand River's past, one will discover fascinating details of a land covered with thousands of feet of ice and, earlier, a warm inland sea.

Over 2,000 years ago, the Hopewell Indians, known for their large burial mounds, occupied the Grand River Valley. They dug mussels and traded with others as far away as South Carolina. The Hopewell Tribes were eventually replaced by the Mishkotink and later the Ottawa, who traded furs with the first European settlers in Michigan. These Native Americans called the river, "Owashtenong," meaning "long-flowing river."

In 1826, a trading post was established along the Grand River by a French trader named Louis Campau. The easiest way of communicating during this time was through the Grand River; chiefly by the use of Indian canoes called the bateaux, which are various small craft of the French traders, and the little flat-bottom skiffs which the people along the stream built for themselves. By 1836, a large number of new settlers had immigrated to the settlement. In 1838, the settlement was incorporated as a village and encompassed an area of approximately three-quarters of a mile. Steamboats traversed the Grand River from Grand Haven all the way to Lyons from the 1830s to the 1870s. The Grand River Times described the Grand River in 1837 as "one of the most important and delightful [rivers] to be found in the country" with "clear, silver-like water winding its way through a romantic valley."

Industrialization of the nineteenth century impacted the Grand River greatly. In 1889, Everette Fitch described the damaging effects on the Grand River. She wrote, "The channel was, as usual, covered with a green odiferous scum, mixed with oil from the gas works." The Grand River was greatly abused by waterpowered, river-dependant industries, large increases in population, stripping of the forests, and discharges of chemical and sewage wastes.

By the mid 1960s, the Grand River needed a massive cleanup effort. The Michigan Grand River Watershed Council, authorized by Governor Romney in 1966, spearheaded most of the river cleanup efforts. The council studied navigation, flood prevention, fish and wildlife, recreation, and water quality. Using funds from the 1968 Clean Water Bond, many municipal wastewater treatment plants were able to upgrade technologies and volunteers had supplies they needed to clean up trash and debris and plant trees along the river's banks.

By the end of the 1960s, water quality had improved to the point that recreationists were once again looking to the Grand River for waterskiing, boating, fishing, and swimming opportunities.

An ambitious project called the Grand River Salmon Plan began in 1977, and brought salmon and other sport fish all the way to the state capitol by constructing a series of fish ladders over the six dams that obstructed fish passage upstream of Grand Rapids. The project brought much attention and fanfare back to the Grand River. A fisheries study, performed by the Michigan Department of Natural Resources (MDNR) in 1978, reported that water quality in the Grand River was dramatically improved. The Rogue River, which had been a murky and virtually fishless river, was returned to a sparkling, clear, and cold river capable of supporting a trout population rivaling any other urban stream in Michigan. Many more successes were to follow in the Grand River Watershed.

In the 1990s, the City of Grand Rapids began a massive undertaking of removing combined sewers. The combined sewers delivered both sanitary and storm water to the City of Grand Rapid's waste water treatment plant. During periods of heavy rainfall, the sewers would overflow into the Grand River. Occasionally, this would result in bacteria counts that warranted beach closures downstream. Over the last five years, the City of Grand Rapids has removed 95% of the combined sewer overflows. Similar projects are taking place upstream in the Cities of Lansing and Jackson.

The LGRW project has revealed a glimpse of the region's past and compared it to existing conditions. At the turn of the twentieth century, the Grand Rapids Evening Press predicted that the Grand River would be more of a sewer than a river by 2005. Thankfully, the Grand River is far from this condition, and is today supporting excellent opportunities for recreation and wildlife. This WMP will show the many successes in the LGRW resulting in improved water quality.

1.3 PROJECT DESCRIPTION

1.3.1 GEOGRAPHIC SCOPE

The headwaters of the Grand River begin in southern Jackson County and flow northwest across 260 miles, making it the longest river located entirely in Michigan. The Lower Grand River WMP studies the portion of the LGRW below the Looking Glass River confluence, near the City of Portland. The LGRW covers approximately 2,909 square miles and large portions of Ottawa, Muskegon, Kent, Montcalm, Ionia, Barry, and Eaton counties. Counties with very small portions of the LGRW are Newaygo, Allegan, and Mecosta (Figure 1).

Lower Grand River Watershed Project

Information Services Center
Annis Water Resources Institute
Grand Valley State University

Map Prepared August, 2004

Lake Michigan

Muskegon County
Newaygo County
Oceana County
Mecosta County
Montcalm County
Ottawa County
Kent County
Allegan County
Barry County
Ionia County
Clinton County
Eaton County

Muskegon
North Muskegon
Roosevelt Park
Norton Shores
Whitehall
Montague
Fremont
White Cloud
Newaygo
Grant
Cedar Springs
Greenville
Carson City
Rockford
Belding
Ionia
Portland
Grand Haven
Ferrysburg
Coopersville
Grandville
Wyoming
Kentwood
Hudsonville
Zeeland
Holland
Saugatuck
Douglas
Fennville
Allegan
Otsego
Plainwell
Hastings
Charlotte
Eaton Rapids
Grand Ledge
Lansing

Grand River
Muskegon River
Rogue River
Thornapple River

Base Information
- Interstate/Highway
- Major Watercourses
- County Boundary
- Watershed Boundary
- City/Village
- Township

N

0 10 Miles

Data Source
Base Information: Framework V3B, Michigan Center for Geographic Information , Department of Information Technology, 2004.

Location

Lower Grand River Watershed

Figure 1

1.3.2 DEMOGRAPHICS

The Watershed's most populated region is in the Grand Rapids Metropolitan area. Figure 2 indicates areas of highest population density within the LGRW.

An Urban Cluster is a term used by the United States Census Bureau to describe areas of contiguous, densely settled areas that have population densities greater than 1,000 people per square mile and encompass a total population of at least 2,500 people, but fewer than 50,000 people. An Urban Area meets the same minimum population density requirements, but encompasses a total population of at least 50,000 people. The LGRW contains two Urban Areas: the Grand Rapids Metropolitan area and the Muskegon Metropolitan area, which includes the Grand Haven Tri-cities areas.

The LGRW has experienced significant economic growth in recent years. From 1985 to 1995, the number of jobs in the Grand Rapids metropolitan area increased 38.4%. This economic growth has been accompanied by an overall increase in population. Between 1990 and 2000, the population of Kent County increased by 14.6%, while Ottawa County's population increased by 26.9%. Many townships in the LGRW experienced population growth of more than 20%. This trend can have a negative impact on water quality for a number of reasons, which are discussed in Chapter 2. However, population losses were experienced in parts of the Grand Rapids metropolitan area and in the City of Grand Haven (*Ameregis Metropolitan Area Research Corporation*, 2003). The loss of urban populations is further explored in Chapter 2.

Barry County's population has been steadily increasing since 1930, after a 20-year period of decline due to urban migration. Between 1990 and 2000, the county's population increased by 13.4%. Irving, Rutland Charter, Thornapple, and Yankee Springs Townships, located in the northwest region of the county, experienced the highest rates of township growth (27.9% - 40.9%) due to the growth and out-migration of the Grand Rapids metropolitan area. Approximately two-thirds of Barry County's total population growth was due to natural population growth, while over one-third of the county's rate of population growth resulted from people moving into the county. In comparison, the average rate of in-migration for all Michigan counties over the same period was only 0.5%. According to the Community Profile Report prepared for the Barry County Planning Commission in November 2003, high rates of in-migration are attributed to the natural beauty of the area, the relatively strong economy, and local quality of life.

Lower Grand River Watershed Project

Information Services Center
Annis Water Resources Institute
Grand Valley State University

Map Prepared August, 2004

Mecosta County

Montcalm County

Muskegon County

Newaygo County

Lake Michigan

Ottawa County

Kent County

Allegan County

Barry County

Ionia County

Clinton County

Eaton County

Cedar Springs

Greenville

Belding

Coopersville

Grand Haven

Grand Rapids Metro Area

Lowell

Ionia

Portland

Lake Odessa

Middleville

Hastings

Potterville

Charlotte

Fish River

Rogue River

Grand River

Thornapple River

37 46 131 44 91 57 66 21 45 43 37

I-96

Base Information

- Interstate/Highway
- Major Watercourse
- County Boundary
- Watershed Boundary

Urban Areas

- Urban Area
- Urban Cluster

N

0 10 Miles

Data Source
Base Information and Urban Areas:
Framework V3B, Michigan Center for Geographic Information , Department of Information Technology, 2004.

Urban Areas

Lower Grand River Watershed

Figure 2

1.3.3 PROJECT HISTORY

In 1998, the communities in the greater Grand Rapids area began thinking about how they would comply with new storm water regulations that would take effect in March 2003. The NPDES Phase II Storm Water Regulations required all jurisdictions with designated urbanized areas to obtain a storm water discharge permit. These communities decided that regulatory compliance could be achieved most effectively and efficiently using a watershed-based approach.

The Grand Valley Metropolitan Council (GVMC) began to delineate a watershed boundary that would include all these communities in the greater Grand Rapids area. The GVMC also considered options for developing a WMP that would be large enough to cover all the jurisdictions.

After the 2000 census reports became available, the urbanized area was expanded to include the Grand Haven/Spring Lake area on the Lake Michigan shoreline. The addition of the shoreline communities in the urbanized area made it a necessity to include all of the Grand River between the City of Grand Rapids and the City of Grand Haven. At the same time, the GVMC was involved in the Rogue River Watershed project, Ionia County was forming a watershed planning committee, and the Thornapple River Watershed Council was contemplating applying for a grant to develop a WMP. Several subwatersheds in the LGRW were developing, or had already completed, WMPs. Considering all the existing efforts, the communities decided that a regional need existed for a comprehensive WMP to include all of these efforts.

The GVMC began to organize partnerships with local governments, environmental agencies, and non-government organizations to compose a Section 319 grant application for developing a WMP for the Lower Grand River. A letter was sent out to nearly 200 stakeholders asking for their support for a watershed project. An overwhelming number of letters were returned from stakeholders representing many diverse groups and interests across the entire LGRW. Many of the letters of support included promises of local match in the form of financial or in-kind contributions. A list of the communities that provided local match is included in Table 1. A Section 319 grant was awarded to the GVMC in July 2002, and funded the planning efforts through July 2004.

Table 1 - Local Matching Funds

Community	Match Committed
Ada Township	$2,580
Alpine Township	2,985
Byron Township	4,185
Cascade Charter Township	4,455
City of East Grand Rapids	2,850
Gaines Charter Township	5,265
Grand Rapids Charter Township	4,275
City of Grandville	4,590
City of Kentwood	12,195
Plainfield Charter Township	8,610
City of Walker	6,555
City of Wyoming	17,190
Kent County Administration	30,000
Georgetown Charter Township	12,090
City of Hudsonville	2,160
Ottawa County Administration	15,000
City of Grand Rapids	15,000
TOTAL	**$149,985**

1.3.4 PROJECT ORGANIZATION

The formation of a Steering Committee and five subcommittees organized stakeholders and solicited input from the entire LGRW. The LGRW Steering Committee is made up of 12 individuals that were nominated by the GVMC and personally invited to serve. Soon after the development of the Steering Committee, five subcommittees were developed to provide support to the project in their areas of expertise: Rural, Urban, Technical, Information & Education (I&E), and Sustainability. A summary of the roles and responsibilities for each subcommittee is provided in Appendix 1 - Subcommittee Responsibilities.

Urban and Rural Subcommittees were developed to help the project focus on the distinct land use characteristics and issues that occur in the LGRW. The main function of these two subcommittees was to identify systems of BMPs and to characterize the water quality concerns in urban and rural areas in the LGRW. These committees provided much of the content for Chapter 3 of this WMP.

The Technical Committee served as an advisory council to the other subcommittees, mainly reviewing systems of BMPs recommended by the Rural and Urban Subcommittees. The Technical Subcommittee participated in data collection and interpretation to aid in the completion of the WMP. This data was compiled into a database that provides detailed information about each subwatershed in the LGRW.

The I&E Subcommittee was responsible for soliciting participation for the LGRW planning process. Members of the I&E Subcommittee implemented public outreach activities to inform watershed residents about opportunities to participate in the LGRW project. Designing a strategy for public outreach and education was accomplished with input from the I&E Subcommittee.

Sustaining the LGRW project into the implementation phase and beyond was recognized as an essential goal early in the process. A Sustainability Subcommittee was created and was charged with the task of developing a strategy for creating a watershed organization that would evolve out of the project's Steering Committee. These Sustainability Subcommittee members realized that a project mission statement and vision were needed before any long-range planning could be successful. This new development changed the scope of the Sustainability Subcommittee responsibilities and resulted in a new committee that operated within and beyond the confines of the LGRW project. This new group was named the Vision Committee and the tasks of the Sustainability Subcommittee were assumed by the Steering Committee.

1.4 PUBLIC PARTICIPATION PROCESS

Grand River Forum (Forum) meetings, held quarterly throughout the LGRW project, offered the opportunity for public comment on the management of the LGRW project.

Over 100 watershed stakeholders from the LGRW attended these public meetings, which provided an opportunity for watershed residents, local decision makers, and watershed coordinators to share their concerns, offer solutions, and provide feedback regarding the management of the Lower Grand River. The greatest watershed concerns expressed by participants included impacts from development, bacteria levels, storm water management, sediment pollution, hydrology fluctuations, and wetland protection. Identified goals and desired uses of the LGRW included recreational use, desirable habitat, and educational opportunities. Participants also listed the following steps to reach these goals: smart growth techniques, enforcement of existing regulations, installation of buffer strips, and public education.

A future LGRW organization will emerge from the planning phase of this Section 319 project to oversee, guide, and recommend future watershed efforts and sustain the initiative that has been created. It will provide an opportunity for residents, local units of government, watershed coordinators, and other interested individuals to express their concerns and desires for the management of the LGRW.

Subcommittees of the LGRW project were formed to address the variety of issues in the LGRW. Members from the Forum volunteered to serve on the Urban, Rural, Technical, I&E, and Vision Subcommittees. Subcommittees were formed with specific responsibilities and tasks. By narrowing the focus of each subcommittee, more opportunities for public participation were possible. Subcommittees kept the group size small and participants were able to contribute in their area of expertise. A project website kept subcommittee members up-to-date and informed by providing information regarding upcoming meetings, meeting minutes, public outreach activities, related projects, and the WMP planning process.

Membership on the Urban and Technical Subcommittees saw strong support from communities within the Watershed that have been identified by the EPA as having urbanized areas requiring a National Pollution Discharge Elimination System (NPDES) storm water discharge permit. These communities are required by the EPA to develop a Storm Water Pollution Prevention Initiative (SWPPI) in accordance with NPDES Phase II Storm Water Regulations. These NPDES Phase II Communities participated in the LGRW project to develop a watershed-based strategy to pursue compliance with these regulations.

On June 3, 2004, members of the Forum, project subcommittees, and Steering Committee participated in a public workshop. The hands-on public workshop was hosted by the GVMC to familiarize participants with the interactive tools created during the LGRW project: Watershed Interactive Tool (WIT), Watershed Interactive Mapping (WIM), Watershed Assessment Matrix (WAM), and Watershed Action Plan (WAP). Approximately 35 participants generated feedback on draft versions of each interactive tool, which were presented at the workshop in two one-hour breakout sessions. Following the breakout sessions, an evaluation of the workshop materials was performed with the workshop attendees. Comment was also gathered during a public meeting led by project staff following the breakout sessions.

The public participation process will continue through the planning and implementation projects of subwatersheds in the LGRW.

1.5 GOALS AND OBJECTIVES OF THE PROJECT

This project was the result of the momentum stimulated by watershed projects and initiatives occurring within the LGRW. One goal for this project is to continue this momentum and help generate future watershed projects that would sustain success and yield water quality benefits. The WMP provides sustainable strategies to reduce nonpoint source (NPS) pollution. The goals of the WMP are based on improving or restoring the designated uses of the LGRW and attaining compliance with established Total Maximum Daily Loads (TMDLs.)

The EPA has emphasized the importance of small watershed projects for successful water quality improvements. However, numerous studies have shown that public outreach efforts and watershed organizations are more effective at a larger scale. Watershed organizations and environmental programs within the LGRW need a unified strategy for meeting common goals. A watershed organization for the entire LGRW could become an umbrella over these programs to coordinate activities, share information, and develop effective tools for improving water quality. An organization would also be able to help small watershed groups get the word out about watershed protection for their subwatersheds.

This WMP has initiated many events and has produced new and innovative products. This project has brought together numerous communities to discuss water quality, enabling them to recognize that they share many common problems. For the first time, documents about the Grand River have been compiled in a library that can be searched on the internet. Many of these outcomes were made possible through advances in communication technology that allow cooperation across a wide geographic area.

The value placed on this technology was reflected in the project goals and objectives to create online interactive watershed planning tools that communities or individuals can use to make informed decisions regarding water management. These tools will aid resource managers in selecting best management practices (BMPs), give planners information about water quality, and help students and citizens find data about their local watersheds.

1.6 WATERSHED MANAGEMENT PLAN CONTENT

This document is a unique WMP that is designed as a hands-on universal guide for watershed planning in the LGRW. Chapter 2 describes the overall physical description of the LGRW, highlighting some of the unique features of the Thornapple, Flat, and Rogue River Watersheds. Chapter 3 includes many of the tools created during this project, which eventually leads the reader into an action plan for improving water quality in their community or watershed. Chapter 4 is the I&E Strategy, with activities for basin-wide education, as well as local water quality awareness. Chapter 5 details the evaluation methods used for the planning phase of the project and for evaluating the effectiveness of the implementation strategies. Chapter 6 describes the framework for creating a watershed organization to lead the Grand River Watershed into the future.

CHAPTER 2 - PHYSICAL DESCRIPTION OF THE LOWER GRAND RIVER WATERSHED

2.0 TOPOGRAPHY AND CLIMATE

The topography within the Lower Grand River Watershed (LGRW) is influenced by glacial deposition of sediment and the effect of water deposition and drainage over time. Watershed topography is undulating and dissected by water courses with occasional small plains studded with bogs and small lakes.

Topography within the LGRW varies. The Flat River and Rogue River sub-basins contain rolling hills and highlands above deep valleys. The Thornapple River sub-basin has two topographically distinct areas. The upper area has less relief and more areas of flat and gently rolling topography with only a few lakes and is generally well drained. The lower area is more rugged and contains numerous lakes and large depressions. The Lower Grand River sub-basin ranges from fairly rugged topography in the entrenched main stream of the Grand River (in the Grand Rapids area) to a low, flat plains area along the lower reaches of the river toward Grand Haven. Many of the tributary streams in this area flow through steep, walled valleys where they join the entrenched valley of the Grand River. The streams are commonly 20 or more feet below the surrounding uplands (Grand River Basin Coordinating Committee, 1972).

The LGRW enjoys a moderate continental climate and annually experiences 155 frost-free growing days. It is located at a latitude approximately midway between the North Pole and the equator. Air masses originating from the Gulf of Mexico, northern Canada, and the north pacific influence day-to-day weather. The presence of Lake Michigan has a slight moderating effect on annual temperatures and results in increased snowfall near the coast. The mean January temperature in the LGRW is approximately 23° Fahrenheit; the mean July temperature is approximately 71° Fahrenheit. The average rainfall throughout the LGRW is approximately 32 inches. Annual snowfall ranges from 80 inches along Lake Michigan to 40 inches along the eastern edge of the watershed (Bieneman, 1999).

2.1 GEOLOGY AND SOILS

The bedrock formations of the LGRW consist primarily of shale, sandstone, limestone, and gypsum (MDNR, 1968). These formations formed from sediments that were deposited from 345 to 370 million years ago in seas, which occupied a depression known as the Michigan basin. Another sea occupied central Michigan from 135 to 181 million years ago and deposited red muds, gypsum, and fine sands. A remnant of this formation occurs in the central part of the LGRW.

The Pleistocene epoch began about one million years ago. Glaciers from Canada moved over the state, picking up fine soil, sand, gravel, and boulders and carrying them great distances before depositing them. At least four major glaciers advanced and retreated over Michigan during the Pleistocene epoch. The physiography of the LGRW owes its development to the last of these glaciers, the Wisconsin stage, which ended about 10,000 years ago.

As the last glacier retreated, the load of earthen materials incorporated in the ice was deposited, forming several types of glacial features (till plains, moraines, outwash, lake plains, and spillways). The thickness of the glacial drift overlying bedrock varies from 0 feet (in western Kent County) to more than 500 feet (at the northern end of the basin). Figure 3 - [Quaternary Geology] shows the surface geology within the LGRW.

The debris deposited by the glaciers forms the parent material for the soils throughout the LGRW. The almost infinite variety of combinations of mineral materials located in many conditions of topography and climate have resulted in a great number of soil types of varying fertility. Sandy and loamy soils are common throughout the basin. Soils in the LGRW fall into three soil orders: Alfisols, spodosols, and histosols. Spodosols are located in the northern portion of the sub-basin. Soils in this order form under coniferous and mixed forests and are usually acidic. The surface soil horizon is heavily leached and often has a grayish color. These soils characteristically have subsurface accumulation of iron, aluminum, and clay.

Alfisols are located south of the spodosols. These soils have a gray to brown surface horizon resulting from organic material deposited from deciduous trees. The underlying soil is leached and has a low pH. A layer of clay accumulation is present below the leached horizon.

Histosols are found in poorly drained areas throughout the sub-basin. These soils are composed primarily of organic matter and are known as peat or muck. They are found in scattered areas in swamps, along streams, and in old lake beds that have filled with organic material. They are waterlogged under normal conditions (Bieneman, 1999).

Lower Grand River Watershed Project

Information Services Center
Annis Water Resources Institute
Grand Valley State University

Map Prepared August, 2004

Mecosta County

Montcalm County

Muskegon County

Newaygo County

Lake Michigan

Ottawa County

Kent County

Ionia County

Clinton County

Allegan County

Barry County

Eaton County

Flat River

Grand River

Thornapple River

N

0 10 Miles

Base Information

- County Boundary
- Watershed Boundary
- Major Watercourses

1982 Quaternary Geology

- Coarse-textured glacial till
- Dune sand
- End moraines of coarse-textured till
- End moraines of fine-textured till
- End moraines of medium-textured till
- Fine-textured glacial till
- Glacial outwash sand and gravel and postglacial alluvium
- Lacustrine sand and gravel
- Medium-textured glacial till
- Water

Data Source
Base Information and Quaternary Geology: Framework V3B, Michigan Center for Geographic Information , Department of Information Technology, 2004.

Quaternary Geology

Lower Grand River Watershed

Figure 3

2.2 HYDROLOGY

The elevation of the Grand River at the eastern edge of the LGRW is 780 feet. The Grand River flows 260 miles west and drops 209 feet to its confluence with Lake Michigan at the City of Grand Haven. With a drainage area of 2,909 square miles, the LGRW encompasses significant portions of eight counties. The LGRW is characterized by poor natural drainage, resulting in numerous lakes, swamps, and artificial drains Figure 4 - [Hydrology].

The LGRW includes three major tributaries that flow into the Grand River: the Thornapple River, the Flat River, and the Rogue River. The Thornapple River flows 86 miles northward out of a drainage basin of 875 square miles. It enters the Grand River between the Cities of Lowell and Grand Rapids. The Flat River is 73 miles long and drains 500 square miles in the northeast portion of the LGRW, entering the Grand River after passing through the City of Lowell. The Rogue River is 50 miles long and drains 255 square miles in the northwest portion of the LGRW, entering the Grand River north of the City of Grand Rapids (Grand River Basin Coordinating Committee, 1972).

Steamboat operators and log driving companies dredged the river and constructed pilings for log sorting pens in the 1800s. The Army Corps of Engineers constructed numerous wing dams, river training walls, and other navigation channel structures in the late 1800s and early 1900s. The City of Grand Rapids built major floodwalls before World War I and obtained Works Progress Administration (WPA) funds to work on flood protection and river beautification during the 1930s. In addition, significant sections of the Grand River bed and adjacent floodplain have been filled within the City of Grand Rapids.

Significant alterations have been made to the Grand River and its tributaries since the 1800s. The first dam built across the Grand River, in Grand Rapids, was completed in 1849 and rebuilt in 1866. Today, 236 dams or impoundments are located in the Grand River Watershed to control water levels and/or to generate power. The dams are noted on Figure 5 **-** [Dams]. A complete list of dams and their locations can be found in Appendix 2 - [Dam Site Information]. The Sixth Street dam, in downtown Grand Rapids, was constructed in 1910 to control water levels. A pool-and-weir type fishway (the “fish ladder”) was constructed adjacent to the dam in 1975 to allow salmon to migrate upstream (Huggler, 1990). More “fish ladders” followed at the Lyons, Webber, Portland, Grand Ledge, and North Lansing dams. This project, called the Grand River Salmon Plan, allowed unrestricted fish passage from Lake Michigan to the City of Lansing.

An extensive system of county drains is located throughout the LGRW. Agricultural drains hasten storm water drainage from cultivated fields and other areas, reducing the frequency of flooding in these areas. However, rapidly flowing water is more likely to erode streambeds and carry sediment to the Grand River and its adjacent floodplain. Fields drained with tiles also create a hazard for surface water contamination from pesticides, fertilizer, and *E. coli*.

Lower Grand River Watershed Project

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Annis Water Resources Institute
Grand Valley State University

Map Prepared August, 2004

Mecosta County

Montcalm County

Muskegon County

Newaygo County

Lake Michigan

Ottawa County

Kent County

Ionia County

Clinton County

Allegan County

Barry County

Eaton County

Base Information

- River/Stream
- Lake/Pond
- County Boundary
- Watershed Boundary

N

0 10 Miles

Data Source
Base Information:
Framework V3B, Michigan Center for Geographic Information , Department of Information Technology, 2004.

Hydrology

Lower Grand River Watershed

Figure 4

Lower Grand River Watershed Project

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Annis Water Resources Institute
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Map Prepared August, 2004

Mecosta County

Montcalm County

Muskegon County

Newaygo County

Lake Michigan

Ottawa County

Kent County

Allegan County

Barry County

Ionia County

Clinton County

Eaton County

Base Information

- Interstate/Highway
- River/Stream
- County Boundary
- Watershed Boundary
- Dams

N

0 10 Miles

Data Source
Base Information:
Framework V3B, Michigan Center for Geographic Information , Department of Information Technology, 2004.
Dams:
Michigan Departement of Natural Resources, 2004

Dams

Lower Grand River Watershed

Figure 5

Macropores, large spaces that occur between soil particles that form through the soil, can allow surface-applied products to directly discharge into surface water streams and ponds via tile drains.

2.3 LAND USE

The LGRW was almost entirely covered with hardwood forest and mixed hardwood/conifer forest prior to 1830 Figure 6 - [Presettlement Vegetation]. Mixed hardwood/conifer forest was primarily located at the northern and western ends of the LGRW. Improved transportation led to a land boom in the 1830s, with the lumbering industry coming into prominence between 1840 and 1870. Deforested land was converted to farmland and farming became a predominant occupation around the turn of the 20th century.

The Grand River supported the development of the region by providing a means of conveying logs to sawmills located on the banks of the Grand River and powered by its flow. Steamboats ferried finished products between Grand Rapids and Grand Haven. In addition, gypsum, limestone, sand, and gravel were mined from the banks of the Grand River, and clams were harvested for commercial button production. Large-scale logging ceased in the 1920s, around the time of rapid industrialization in the LGRW. The City of Grand Rapids became a significant manufacturing center, discharging industrial and municipal wastes into the Grand River. Environmental legislation, initiated in the late 1960s, provided the impetus for cleanup of the Grand River and its tributaries.

Currently, most of the land not covered by residences, urban centers, and forests is cultivated. Primary agricultural products include fruit, dairy products, potatoes, poultry, and vegetables through truck gardening (cucumbers, onions, mint, and celery). Kent and Ottawa Counties are the most significant counties within the LGRW in terms of value of agricultural products. Ottawa County is the highest producing agricultural county in the State of Michigan (West Michigan Strategic Alliance, 2002). However, urbanization is impacting agricultural land, resulting in significant yearly loss of farmland to residential and commercial development.

As with most aging urban areas, populations in the Cities of Muskegon, Holland, and Grand Rapids are stagnant or shrinking and the suburbs surrounding these areas are growing very rapidly. The majority of the growth has been in agricultural areas. The result of this type of population growth has been an overall reduction in population density. As communities expand away from the urban centers, it tends to produce large lot residential areas, large shopping centers and new roads, parking lots, roof tops, and driveways that increase the LGRW's imperviousness. A study by the Brookings Institute in 2001 found that the greater Grand Rapids area's land use changed 46% while the change in population was only 27%. This produced a change in density of -13% (Orfield, 2002).

Lower Grand River Watershed Project

Information Services Center
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Map Prepared August, 2004

Mecosta County

Muskegon County

Newaygo County

Montcalm County

Lake Michigan

Clinton County

Ottawa County

Ionia County

Kent County

Allegan County

Eaton County

Barry County

Grand River

Rogue River

Flat River

Thornapple River

N

0 10 Miles

Base Information

- County Boundary
- Watershed Boundary
- Major Watercourses

Presettlement Vegetation

- Conifer Forest and Barrens (0.25%)
- Forested Wetlands (11.20%)
- Grassland (0.04%)
- Hardwood Forest and Savanna (63.99%)
- Lake/River (1.64%)
- Mixed Hardwood /Conifer Forest and Barrens (20.52%)
- Sand Dune (0.005%)
- Unforested Wetlands (2.37%)

Data Source
Base Information and Presettlement Vegetation: Framework V3B, Michigan Center for Geographic Information , Department of Information Technology, 2004.

Presettlement Vegetation

Lower Grand River Watershed

Figure 6

Figure 7 - [Land Use/Land Cover] shows current land use and land cover within the LGRW. The total area and percentage of each land use is as follows: Agricultural land (49.30%), barren (0.02%), forest land (23.23%), range land (11.76%), urban and built up (10.22%), water (1.97%), and wetlands (3.49%).

2.4 SEWER SERVICES AREAS

Municipal sewer services are available within the metropolitan areas located in the LGRW sub-basin. Outlying regions rely on individual septic systems. Historically, sanitary and storm water sewers were combined within the City of Grand Rapids. As a result, raw sewage overflowed into the Grand River during periods of heavy precipitation. The City of Grand Rapids has been separating the sewer lines since the 1990s and anticipates having all sewer lines separated by around 2020. Other cities in the LGRW have separate sewer systems that were built after the era of combined sewer systems. However, the Cities of Jackson and Lansing both have combined sewer overflow problems that are being addressed with sewer separation projects similar to the City of Grand Rapids.

Although sanitary sewers sometimes overflow and spill untreated wastewater into the Grand River and its tributaries, they do eliminate chronic pathogen and nutrient problems associated with failing septic systems. A number of tributaries in the LGRW have been placed on the state 303(d) list for non-attainment of state water quality standards for pathogens. This problem can be partially attributed to the high rate of septic system failure in a number of communities. Many more problems may exist in areas where the water is not tested for the presence of disease causing organisms.

2.5 SIGNIFICANT NATURAL FEATURES

Ecologically, the LGRW is located at the northern edge of the Carolinian biotic province (also known as the oak-hickory formation). The LGRW also contains a high percentage of species more typical of the Canadian biotic provinces, which constitute the lake forest formations of northern Michigan. A southern extension of northern coniferous forests was formerly present along the sandy shore of Lake Michigan, including most of Ottawa County and part of Kent County.

There are probably no remnants of virgin forest remaining in the LGRW, except in a few swamps. Woodlands today are restricted to lands that are difficult to till along watercourses, hilly land, and second-growth stands maintained between fields as a windbreak (Grand River Basin Coordinating Committee, 1972).

Lower Grand River Watershed Project

Information Services Center
Annis Water Resources Institute
Grand Valley State University

Map Prepared August, 2004

Mecosta County

Muskegon County

Newaygo County

Montcalm County

Clinton County

Ionia County

Kent County

Ottawa County

Allegan County

Barry County

Eaton County

Lake Michigan

Grand River

Thornapple River

N

0 10 Miles

Base Information

- County Boundary
- Watershed Boundary
- Major Watercourses

Land Use/Cover

- Agricultural Land (49.30%)
- Barren (0.02%)
- Forest Land (23.23%)
- Rangeland (11.76%)
- Urban and Built Up (10.22%)
- Water (1.97%)
- Wetlands (3.49%)

Data Sources
Base Information:
Framework V3B, Michigan Center for Geographic Information , Department of Information Technology, 2004.
Land Use/Land Cover:
Newaygo, Mecosta, Montcalm, Ionia, Clinton, Eaton, Barry, and Allegan Land Use: 1978 MIRIS
Muskegon Updated Land Use: GVSU-AWRI 1998
Ottawa and Kent Updated Land Use: GVSU-AWRI 1992.

Land Use/Land Cover

Lower Grand River Watershed

Figure 7

Figure 8 - [Regional Landscape Ecosystems] notes the Regional Landscape Ecosystems, located in the LGRW sub-basin (United States Geologic Service, 1998). The ecosystems are described below.

Table 2.3 - Regional Landscape Ecosystems

Ecosystem	Description
VI.2.1 Battle Creek Outwash Plain	Broad, flat, outwash plain containing numerous small lakes and wetlands and small ridges of ground moraine. Oak savanna, oak and oak-hickory forest, tallgrass prairie, hardwood swamp, wet prairie, and prairie fen. Most of the uplands and large areas of wetland have been converted to agriculture.
VI.2.2 Cassopolis Ice-Contact Ridges	Steep, narrow bands of ice-contact and end-moraine ridges. Oak and oak-hickory forest and bogs. Prairie fens are common along the margins of this ecosystem.
VI.3.1 Berrien Springs	Sandy loam, loam, and silt-loam end and ground moraine; beech-sugar maple or white oak forests; swamp hardwoods, tamarack, wetland shrubs, and bogs in kettle depressions. Most of the area is presently vineyard or orchard.
VI.3.2 Southern Lake Michigan Lake Plain	Glacial lake plain, sand dunes; beech-sugar maple forest, oak-hickory forest, oak savanna, white oak-white pine forest, open sand dune, coastal plain marsh. Rare plants are found on sand dunes and in wet prairies.
VI.3.3 Jamestown	Fine-textured end and ground moraine; beech-sugar maple forest. No rare plants identified. Most of land is cultivated.
VI.4.1 Lansing	Medium-textured ground moraine; beech-sugar maple forest and hardwood swamp. This broad till plain has rich, loamy soils that have been largely converted to agriculture.
VI.4.2 Greenville	Coarse-textured end and ground moraine; beech-sugar maple forests and white oak-white pine forests, conifer swamps and bogs. No rare plant communities identified.
VII.2.1 Cadillac	Steep, sandy end moraines; northern hardwood forest, white oak-red oak forest.
VII.3 Newaygo Outwash Plain	Outwash plain and sandy end moraines; white pine-white oak forest, jack pine barrens, dry sand prairie. Contains coastal plain marshes and dry sand prairies.

Michigan's Natural Rivers Program designates two of the LGRW's tributaries among its 14 natural rivers. The Rogue River, one of Michigan's southernmost trout streams, and the Flat River are in close proximity to the City of Grand Rapids. Several designated trout streams also exists within the LGRW. Figure 9 - [Designated Trout Streams] identifies these designated trout streams and their type (i.e. Type I, II, IV). These stream types indicate which category of fishing regulations, established by the Michigan Department of Natural Resources (MDNR), applies to that particular trout stream.

Michigan State University's Natural Features Inventory (NFI) maintains a database of known occurrences of endangered, threatened, and special concern plant and animal species throughout the State of Michigan.

Lower Grand River Watershed Project

Information Services Center
Annis Water Resources Institute
Grand Valley State University

Map Prepared August, 2004

Mecosta County

Montcalm County

Muskegon County

Newaygo County

Ottawa County

Kent County

Ionia County

Clinton County

Allegan County

Barry County

Eaton County

Lake Michigan

VII.2.1

VII.3

VI.4.2

VI.4.2

VI.3.2

VI.3.3

VI.4.1

VI.3.1

VI.2.1

VI.2.2

Fish River

Rogue River

Grand River

Thornapple River

N

0 10 Miles

Base Information

- County Boundary
- Watershed Boundary
- Major Watercourses

Regional Landscape Ecosystems

- VI.2.1 Battle Creek Outwash Plain
- VI.2.2 Cassopolis Ice-Contact Ridges
- VI.3.1 Berrien Springs
- VI.3.2 Southern Lake Michigan Lake Plain
- VI.3.3 Jamestown
- VI.4.1 Lansing
- VI.4.2 Greenville
- VII.2.1 Cadillac
- VII.3 Newaygo Outwash Plain

Data Source
Base Information and Regional Landscapes: Framework V3B, Michigan Center for Geographic Information , Department of Information Technology, 2004.

Regional Landscape Ecosystems

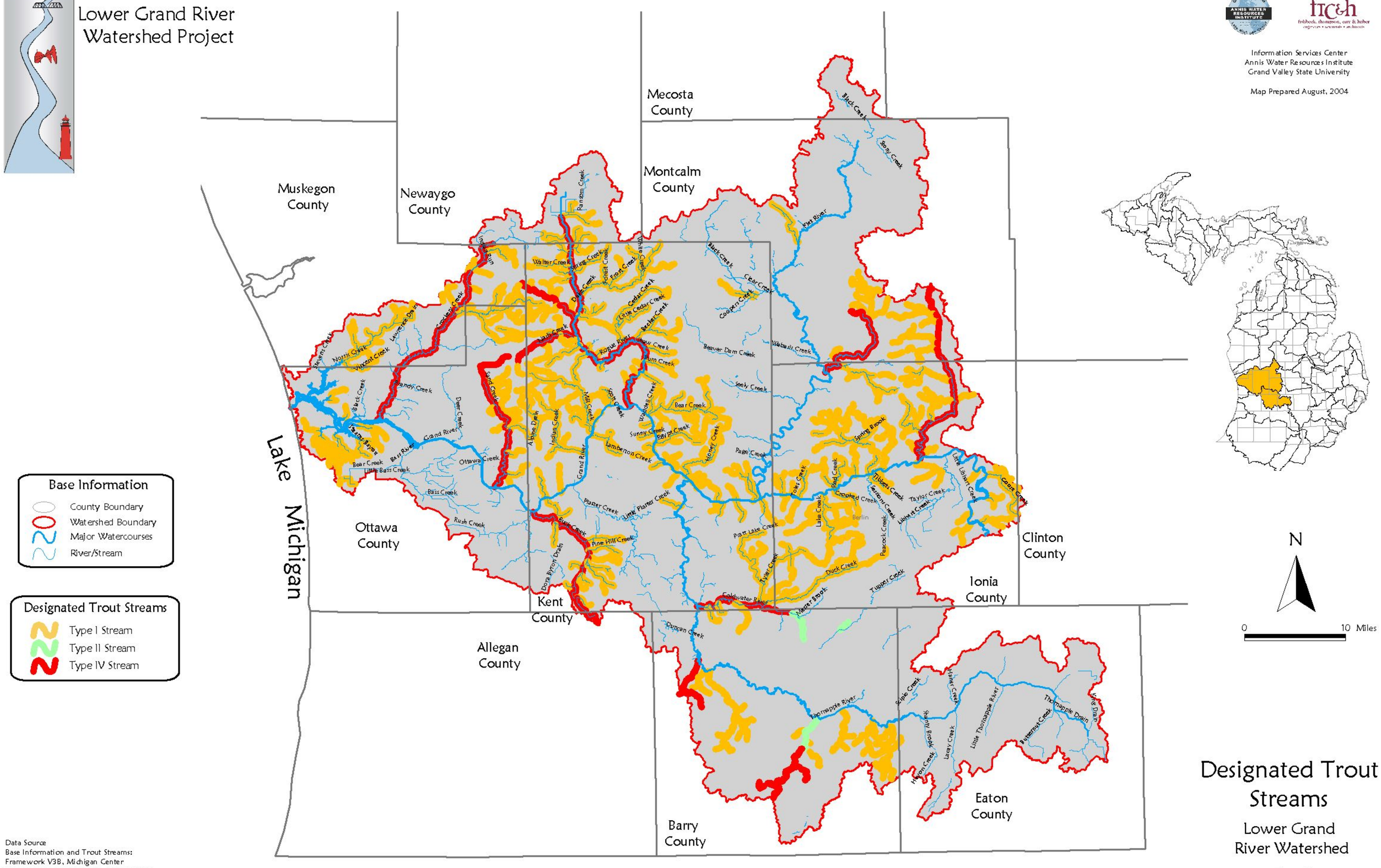
Lower Grand River Watershed

Figure 8

Lower Grand River Watershed Project

Information Services Center
Annis Water Resources Institute
Grand Valley State University

Map Prepared August, 2004



Base Information

- County Boundary
- Watershed Boundary
- Major Watercourses
- River/Stream

Designated Trout Streams

- Type I Stream
- Type II Stream
- Type IV Stream

N

0 10 Miles

Data Source
Base Information and Trout Streams:
Framework V3B, Michigan Center for Geographic Information , Department of Information Technology, 2004.

Designated Trout Streams

Lower Grand River Watershed

Figure 9

An endangered species is any species that is in danger of extinction throughout all or a significant part of its range. A threatened species is any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Both endangered and threatened species are protected under Michigan's Endangered Species Act (Part 365 of PA 451, 1994 Michigan Natural Resources and Environmental Protection Act).

Special concern species are not protected under the Endangered Species Act. These species are of concern due to declining or relict populations in the state. If these species continue to decline, they would be recommended for threatened or endangered status. It is important to maintain self-sustaining populations of special concern species in order to prevent them from becoming endangered or threatened species in the future.

The NFI database was reviewed for the LGRW. Endangered, threatened, or special concern species were noted in almost all of the 146 subwatersheds. Thirty-seven of the subwatersheds contained five or more different endangered, threatened, and special concern species. Twenty-nine of the subwatersheds contained 10 or more endangered, threatened, and special concern species. The locations of these subwatersheds are noted on Figure 10 - [Natural Features Inventory].

Seven endangered species have been observed in the LGRW. These species are the rarest of the listed species. The species and the subwatersheds in which they have been observed are listed below.

Table 2.4 - Endangered Species in the LGRW

Common Name	Scientific Name	Type	Subwatershed
King Rail	*Rallus elegans*	Bird	Thornapple-Coldwater Thornapple-Mud Creek Thornapple-Scipio Creek Thornapple-High Banks Creek Thornapple-Main Branch Thornapple Drain, Rogue River
Mermaid-weed	*Proserpinaca pectinata*	Plant	Grand River-Pottawatomie Bayou
Regal Frillary	*Speyeria idalia*	Insect	Flat River-Dickerson Creek
Three-staff Underwing	*Catocala amestris*	Insect	Thornapple River Tributary
Mitchell's Satyr	*Neonympha mitchellii mithchellii*	Insect	Thornapple River Tributary
Indiana Bat	*Myotis sodalis*	Mammal	Thornapple-Lacey Creek
Prairie Fringed Orchid	*Platanthera leucophaea*	Plant	Thornapple-Lacey Creek

The Michigan Sate University NFI notes a wide variety of habitats that supports the listed species. These include forests (mesic southern, mesic northern, dry mesic, and southern floodplain), prairie (dry sand, hillside, wet, and wet-mesic), wetlands (bog, southern swamp, emergent marsh, Great Lakes marsh, interdunal, hardwood-conifer swamp, prairie fen, and coastal plain marsh), Great Lakes barrens, and open dunes.

Lower Grand River Watershed Project

Information Services Center
Annis Water Resources Institute
Grand Valley State University

Map Prepared August, 2004

Mecosta County

Montcalm County

Muskegon County

Newaygo County

Lake Michigan

Ottawa County

Kent County

Ionia County

Clinton County

Allegan County

Barry County

Eaton County

Rogue River

Flat River

Grand River

Thornapple River

N

0 10 Miles

Base Information

- County Boundary
- Subbasin Boundary
- Watershed Boundary
- Major Watercourses

Natural Features

- 10 or More Listed Endangered, Threatened or Special Concern Species
- 5 To 9 Listed Endangered, Threatened or Special Concern Species
- 1 To 4 Listed Endangered, Threatened or Special Concern Species
- 0 Listed Endangered, Threatened or Special Concern Species

Data Source
Base Information:
Framework V3B, Michigan Center for Geographic Information , Department of Information Technology, 2004.
Natural Features Inventory:
Michigan Natural Features Inventory, Sept. 2004.

Natural Features Inventory

Lower Grand River Watershed

Figure 10

2.6 THORNAPPLE RIVER WATERSHED

At approximately 850 square miles in size, the Thornapple River Watershed (TRW) is the largest tributary to the Lower Grand River and the second largest in the entire Grand River Watershed. The Thornapple River flows 78 miles from its headwaters in Eaton Rapids Township to its confluence with the Grand River near the Village of Ada. Some portions of the Thornapple River have been channelized or dredged resulting in a loss of habitat for sport fish. However, several tributaries including Quaker Brook, Coldwater River, and High Bank Creek are coldwater streams.

The Thornapple River is moderately impaired by agricultural runoff, channel modification, and to some degree, wastewater treatment plant discharges. While these impairments are evident, the overall habitat and water quality has been rated as "good" by the Michigan Department of Environmental Quality (MDEQ). Tributaries and the main channel itself are recovering from historic dredging activities and provide excellent substrate for macroinvertebrates and fish spawning. Many of these tributaries provide great opportunities for fishing and wildlife viewing.

Public interest in the TRW has been active. The Thornapple River Watershed Council (TRWC) holds an annual river cleanup in cooperation with the canoe liveries that operate on the Thornapple River. The TRWC has recently received a grant from the Frey Foundation to develop more opportunities for public involvement and education.

2.7 FLAT RIVER WATERSHED

The Flat River Watershed (FRW) flows 70 miles from the southeast corner of Mecosta County, in the Six Lakes area, through Montcalm and Ionia Counties and enters the Grand River in the City of Lowell, in eastern Kent County. The FRW comprises 560 square miles of the LGRW of which 50% is agricultural. The Flat River is described as the most scenic river in the southern Lower Peninsula. The FRW is an excellent small-mouth bass fishery and has a historically rich past. Today, the Flat River is remembered for its contributions to the Native American and lumbering history. For these reasons, the MDNR included the Flat River for designation under the Natural Rivers Act of 1970.

The townships along the Flat River decided that local interests would be able to provide the most protection for the Flat River and its scenic values. Six of the nine townships along the segments of the Flat River that were designated Natural River areas, adopted ordinances that were approved by the MDNR. The other three townships are using the Natural River Plan that was drafted by the MDNR. The sections of the Flat River and its tributaries that are designated as a Natural River are protected by zoning overlay zones that control how development can impact the Flat River's water quality, habitat, and scenic views.

The Flat River offers a number of opportunities for public recreation. Along the Flat River's 70 miles of scenic natural beauty, visitors can find many acres of naturally vegetated wetlands and hardwood forests. There are five dams that must be portaged between the Six Lakes area and the mouth of the Flat River in the City of Lowell. Along the way, canoeists will see two of Michigan's four remaining wood covered bridges. Approximately 7% of the shoreline along the Flat River is owned by the MDNR as State Game Areas.

Currently, the Flat River does not have a Watershed Management Plan (WMP). However, the Flat River from its mouth to the confluence upstream to the Greenville Dam, needs to develop a Total Maximum Daily Load (TMDL) for Polychlorinated Biphenyls (PCBs) by the year 2010. Developing a TMDL for the Flat River will require a comprehensive analysis of its watershed and specific recommendations to remediate water quality and prevent future contamination.

2.8 ROGUE RIVER WATERSHED

The Rogue River Watershed encompasses 260 square miles mostly in Kent and Newaygo Counties. At one time it received discharges from agriculture, landfills, and industry, that turned the Rogue River into a virtually fishless habitat. Today, these discharges have been largely controlled, and the Rogue River has since returned to a top-class trout stream.

Water quality in the Rogue River is partially protected under the Natural Rivers Act of 1970. Approximately half of the Rogue River Watershed's 180 miles of streams are designated as a Natural River. This designation creates an overlay district around the designated stream segments where development must preserve water quality, wildlife and aquatic life habitat, and scenic views.

Prior to settlement, the Rogue River Watershed (RRW) was mostly covered in white pine forests. Today, the majority of the RRW is used for agricultural purposes. The lower portion of the RRW is mostly residential and urban. Residential development is the fastest expanding land use and threatens water quality with Nonpoint Source (NPS) pollution.

The majority of flow in the Rogue River comes from groundwater sources. This characteristic is what accounts for the cool/coldwater fisheries.

Stream flow in the Rogue River is extremely vulnerable to changes in land use and impervious surfaces. Increased development can also result in greater use of septic systems and large lot residential development.

A WMP was developed in 1999 through a Section 319 grant to the Annis Water Resource Institute (AWRI). The WMP identified sediment and thermal pollution as the highest priority pollutants. Many partnerships have formed to implement the WMP recommendations. Two other grants have aided in the repair of four road stream crossings and two sections of streambanks. In addition to implementing best management practices (BMPs), the Rogue River Watershed Council has been formed to preserve, protect, and enhance the Rogue River and its tributaries by upholding the WMP recommendations and the Natural Rivers plan. Much of the support for their efforts has been the result of an Information & Education (I&E) strategy that resulted in volunteer water quality monitoring programs, educational workshops, stream cleanups, and a watershed fair.

2.9 SUMMARY

The Grand River is indeed very appropriately named. As indicated above, the Grand River is more than just the longest river in the State of Michigan. It is also an area holding unique historical richness, vast natural resources for outdoor recreation, and diverse concerns for communities and water quality. No one plan can adequately provide a solution to manage the entire basin. However, it is at the basin-wide scale that a vision for the entire Grand River can be established. Meeting these goals will require additional planning and strategy development at the subwatershed scale.

While implementing WMPs at the subwatershed scale results in the most efficient strategy for watershed restoration, it is often very difficult to mobilize the necessary resources to initiate local planning efforts. The Lower Grand River WMP has developed a series of interactive planning tools to aid watershed managers at the subwatershed scale. Watershed managers are encouraged to use the companion guidebook and the interactive planning tools, to develop subwatershed management plans for the LGRW that share similar characteristics, strategies, and vision.

CHAPTER 3 - WATER QUALITY FINDINGS AND RECOMMENDATIONS

3.0 INTRODUCTION

This chapter identifies tools that communities and individuals can use to protect their water resources. The Watershed Assessment Matrix (WAM) is a tool that organizes water quality data and watershed characteristics into categories for each subwatershed. The process of using this Watershed Management Plan (WMP) and the information contained in the WAM can be facilitated by using the Watershed Action Plan (WAP), an interactive planning tool. The Watershed Interactive Mapping (WIM) tool can be used to access data from the WAM to create inquiries and to obtain characteristics about each subwatershed. Water resource managers should use the WAM, WIM, and the WAP when selecting best management practices (BMPs) or when creating ordinances and future land use plans. For more information about using these tools, see the Lower Grand River Watershed (LGRW) Planning Guidebook.

3.0.1 WATERSHED ASSESSMENT MATRIX

The LGRW has been divided into 136 unique subwatersheds. This division is based on hydrologic units developed by the United States Geological Survey (USGS). These subwatersheds are usually about 30 square miles, an excellent size for implementing subwatershed management plans. The WAM is a collection of the available data and resources for each subwatershed. The WAM is a spreadsheet organized by subwatershed and categories of data types. Users of the WAM will find information about the availability of water quality data, land use types, existing planning strategies, and groups of stakeholders for each subwatershed. The information contained in the WAM is linked to other interactive planning tools so that users can customize their use to the subwatershed of interest. The WAM can provide all the information one would need to start the process of writing a water resource related grant or find resources that would aid in developing a subwatershed management plan. When combined with the WIM (described below), an accurate picture of conditions in each subwatershed can be created. The WAM is available on CD in Appendix 3 and future updated versions can be accessed at http://www.gvsu.edu/wri/isc/lowgrand/wit/plan.htm.

3.0.2 WATERSHED INTERACTIVE MAP

The development of watershed management plans includes creating maps using current geographic data. Geographic Information System (GIS) software can be used to download up-to-date information about roads, streams, land use, soils, and government boundaries to create accurate maps showing the relationship between these mapping layers. By overlapping these mapping layers, a GIS map can show areas where farming is occurring in highly erodable soils, or where residential development is placed in areas with poor septic suitability.

A GIS software program is essential for developing a watershed management plan that meets today's expectations for accuracy and detail. An online GIS mapping tool, called the WIM, provides access to all the GIS information that is available for each subwatershed. This information can be displayed on any computer with an internet connection. Expensive GIS software programs are not needed to view and interact with this information. Users of the WIM can access data from the WAM to create inquiries about the availability of other resources and to obtain characteristics about each subwatershed. The WIM can be accessed at http://www.gvsu.edu/wri/isc/lowgrand/wit/mapping.htm.

3.0.3 WATERSHED ACTION PLAN

The purpose of a watershed management plan is to provide an action-oriented strategy for local governments and other stakeholders to meet water quality standards. In most cases, this goal is achieved using BMPs. BMPs can be structural, such as detention basins, vegetative, such as buffer strips, or managerial, such as zoning ordinances. The WAP is a tool that helps watershed managers prioritize water resource use, pollutants, and pollution sources to select the most appropriate system of BMPs. The WAP provides links to information about designated uses, hydrology, BMP characteristics, and land preservation techniques, then leads the user through the entire decision making process. The WAP is available on CD in Appendix 3 and future updated versions can be accessed at http://www.gvsu.edu/wri/isc/lowgrand/wit/plan.htm.

3.0.4 WATERSHED INTERACTIVE TOOL

The Watershed Interactive Tool (WIT) is an online web-based interactive tool for local decision makers, educators, students, and residents of the Lower Grand River Watershed (LGRW). This tool incorporates a variety of information to educate and inform users about the LGRW. Topics covered include watershed management, natural history, general watershed concepts, lesson plans for watershed education, government resources, and local water issues. The WIT also provides information to local units of government and non-profit organizations on how to write their own Nonpoint Source (NPS) Management Plan. Links are provided to all the major products of the LGRW project: the Lower Grand River, Sand Creek, and Buck Creek WMPs; the three additional interactive tools (WAM, WIM, WAP), and the online resource library.

The resource library is a useful tool to identify the various reports and documents written about areas of the LGRW that are housed at the Annis Water Resources Institute, Fishbeck, Thompson, Carr & Huber, Inc., and Grand Valley Metropolitan Council. The WIT can be accessed at http://www.gvsu.edu/wri/isc/lowgrand/wit/index.htm.

3.1 OVERVIEW OF WATER QUALITY FINDINGS AND RECOMMENDATIONS

Water quality indicators provide information on the "health" of aquatic resources. An overall condition of water resources is based on a variety of indicators that point to whether rivers, lakes, streams, wetlands, and coastal areas are "well" or "ailing" and whether activities on the surrounding lands that affect the waters are placing them at risk. Water quality indicators can help water quality management professionals make better decisions on strategies and priorities for environmental programs. Analyses of indicators can provide information on the condition and vulnerability of aquatic resources over time to help measure progress toward the goal that all watersheds be healthy and productive places.

A variety of water quality indicators are being used within the LGRW, but the most common and widely used are the following:

- Assessed rivers meeting designated uses established by the State of Michigan Water Quality Standards
- Fish and wildlife consumption advisories
- Ambient water quality data - from the Michigan Department of Environmental Quality (MDEQ) biological surveys

These indicators were used to assess the condition of subwatersheds in the LGRW and suggest that water quality within the LGRW is impacted by pollutants originating from past and present agricultural, industrial, private, and municipal activities. Both point source and NPS of pollution impact water quality within the watershed. Point source pollution originates from an easily identifiable source, such as an outfall pipe from an industrial or municipal wastewater treatment plant. NPS pollution originates from indistinguishable sources, such as runoff from lawns, agricultural areas, construction sites, and impervious surfaces, or leaking septic tanks and atmospheric deposition. NPS pollution contributes sediment, nutrients (such as nitrogen and phosphorus), and bacterial pathogens (such as *Escherichia coli* [*E. coli]*) to surface water. Sediment becomes suspended in surface water due to stream bank erosion, runoff from agricultural fields, construction sites, and storm water runoff. Pathogens enter surface water from septic systems, concentrated wildlife, farm animals, and pets. In addition, lawn and agricultural fertilizers contribute nutrients to surface water.

3.2 WATER QUALITY INVESTIGATIONS

3.2.1 TOTAL MAXIMUM DAILY LOAD STUDIES

Section 303(d) of the Federal Clean Water Act and the U.S. Environmental Protection Agency (EPA) Water Quality Planning and Management Regulations require states to develop total maximum daily loads (TMDLs) for water bodies that are not meeting water quality standards (WQS). The TMDL process establishes the allowable loadings of pollutants for a waterbody based on the relationship between pollution sources and in-stream water quality conditions. TMDLs provide a basis for determining the pollutant reductions necessary from both point source and NPS to restore and maintain the quality of water resources.

TMDLs are studied and developed by the MDEQ, publicly reviewed, modified as needed, and submitted to the EPA for final approval. Once approved, the state is required to implement the TMDLs so that the waterbody will meet water quality standards through addressing pollutant loads. The TMDL is implemented through existing programs, such as the National Pollutant Discharge Elimination System (NPDES) permits for point source discharges and NPS control programs, to achieve water quality standards.

When a waterbody is not meeting WQS, the MDEQ adds it to a list of waterbodies called the Section 303(d) non-attainment list. At that time, the MDEQ will identify the reason for non-attainment of WQS (e.g. pathogens, sediment, mercury), and will assign a deadline for developing a TMDL. The MDEQ has identified waterbodies within the LGRW that require TMDL studies. These waterbodies are noted in Table 3.1, as well as the corresponding pollutant that exceeds its acceptable load and the date when the TMDL must be developed and implemented. Pollutants of concerns in the LGRW include:

- Polychlorinated biphenyls (PCBs)
- Mercury
- Sediment
- Nutrients
- Pathogens (*E. coli*)
- Low dissolved oxygen
- Untreated sewer discharges
- Poor fish and macroinvertebrate communities (indicator of pollution)
- Fish kills (indicator of pollution)

Table 3.1 - Waterbodies Requiring TMDLs Within the Lower Grand Watershed

Watershed ID Number	Watershed	Pollutant	TMDL Development Date
14_100	Sand Creek	Poor fish community	2006
14_101	Grand River	Polychlorinated biphenyls	2009
14_102	Deer Creek	Poor fish community, pathogens, low dissolved oxygen, untreated sewer discharge, nutrients, fish kills	2011
14_103	Grand River	Polychlorinated biphenyls	2009
14_105	Bass River	Pathogens, poor fish community, poor macroinvertebrate community	2006
14_106	Grand River	Polychlorinated biphenyls	2009
14_109	Crockery Creek	Untreated sewer discharge, pathogens (Rio Grande)	2003
14_112	Grand River	Polychlorinated biphenyls	2009
14_116	Grand River	Polychlorinated biphenyls	2009
14_117	Grand River	Polychlorinated biphenyls, mercury	2009, 2011
14_56	Grand River	Polychlorinated biphenyls	2009
14_57	Grand River	Polychlorinated biphenyls	2009
14_59	Grand River	Polychlorinated biphenyls	2009
14_64	Grand River	Polychlorinated biphenyls	2009
14_71	Grand River	Polychlorinated biphenyls	2009
14_75	Grand River	Polychlorinated biphenyls	2009
14_77	Grand River	Polychlorinated biphenyls	2009
14_78	Lake Creek	Polychlorinated biphenyls	2010
14_79	Grand River	Polychlorinated biphenyls	2009
14_80	Grand River	Polychlorinated biphenyls	2009
14_81	Grand River	Polychlorinated biphenyls	2009
14_82	Grand River	Polychlorinated biphenyls	2009
14_84	Bear Creek	Poor fish community, sediment	2011, Complete
14_85	Grand River	Polychlorinated biphenyls	2009
14_86	Mill Creek	Poor fish community	2007
14_87	Grand River	Polychlorinated biphenyls	2009
14_89	Grand River	Polychlorinated biphenyls, Mercury, poor fish community (York Creek)	2010, 2011
14_90	Plaster Creek	Poor fish community, poor macroinvertebrate community, pathogens	2002
14_91	Plaster Creek	Poor fish community, poor macroinvertebrate community, pathogens	2002
14_92	Grand River	Polychlorinated biphenyls	2009
14_94	Buck Creek	Pathogens	2006
14_97	Grand River	Pathogens	2006
14_98	East Fork Creek	Poor fish community	2005
14_99	Sand Creek	Poor fish community	2006
14D_26	Little Thornapple River	Mercury	2011
14D_27	Coldwater River	Pathogens	2006
14D_31	Bear Creek / Tyler Creek	Poor fish community, poor macroinvertebrate community, pathogens	2006
14D_32	Coldwater River	Pathogens	2006
14E_10	Clear Creek	Mercury (Lincoln Lake)	2011
14E_12	Coopers Creek	Poor fish community, pathogens (Butternut Creek)	2006
14E_15	Wabasis Creek	Mercury	2011
14E_16	Flat River	Polychlorinated biphenyls	2010
14E_19	Unnamed Trib	Mercury	2011
14E_22	Flat River	Polychlorinated biphenyls	2010
14E_23	Flat River	Polychlorinated biphenyls	2010
14E_24	Flat River	Polychlorinated biphenyls	2010
14F_4	Duke Creek	Poor macroinvertebrate community	2006
14F_5	Duke Creek	Poor macroinvertebrate community	2006
14F_9	Stegman Creek	Poor macroinvertebrate community	2006

Currently, the MDEQ is conducting TMDL investigations on waterbodies that are impaired by *E. coli* and must have a TMDL developed by 2006. Five waterbodies in the Watershed are being investigated:

- Bass River - Grand River confluence upstream to 92nd Street
- Buck Creek - Grand River Confluence upstream to 68th Street
- Coldwater River - Morse Lake Avenue upstream to Brown Road
- Tyler/Bear Creek - Entire reach
- Grand River - Vicinity of Johnson Park

The detection of *E. coli* can predict the presence of other harmful microorganisms. Once *E. coli* and microorganisms are in a stream or lake, humans can become infected through ingestions, skin contact, or by consuming contaminated fish. Sampling results for these sites will be posted weekly from May 17, 2004, to October 31, 2004, on the MDEQ website at the following address: http://www.deq.state.mi.us/beach/public/default.asp?County=41.

The TMDL report will be completed in 2006, following a public comment period and a public meeting, and sent to the EPA for approval.

Three TMDL studies within the LGRW have been approved:

- One half mile of Rio Grande Creek, Muskegon and Ottawa Counties, which has elevated *E. coli* levels. Possible sources include illicit discharges, untreated sewage, and agricultural runoff.

- Approximately 12 miles of Plaster Creek, Kent County, which has elevated *E. coli* levels due to storm water runoff.

- Bear Creek, Kent County, which has elevated sediment loads.

3.2.2 MDEQ BIOLOGICAL SURVEYS

The MDEQ conducts biological surveys through its Surface Water Quality Assessment Survey program. The program operates on a five-year rotation. The survey includes characterizing the macroinvertebrate community and its habitat at selected sampling points and analyzing surface water samples obtained from these locations for water quality parameters. Availability of MDEQ biological surveys is listed in the WAM.

Many of the studies have reported that the observed urbanization of the watershed, with increased impervious surfaces, is accelerating sedimentation and flow fluctuations from storm water runoff, which causes impairments to the streams. Some of these sources have been addressed through grant funded projects on the Rogue River, Bear Creek, Crockery Creek, and York Creek. NPS pollution from agricultural sources has also been cited as a source of nutrients and possibly pathogens in the LGRW.

3.2.3 MDEQ WATERSHED SURVEY ASSESSMENT PROCEDURE

The Watershed Survey Assessment Procedure, performed by MDEQ field staff, surveys road/stream crossings within a watershed to quickly assess the health of the watershed. The procedure combines both qualitative and quantitative assessment of the waterbodies and provides a basis upon which to identify any potential sources of NPS pollution negatively affecting the watershed. The procedure is intended to be used as a quick screening tool to increase the amount of information available on the water quality of Michigan's rivers and the sources of pollutants to the rivers. The procedure was designed to provide standardized assessment and data recording that can be used by a variety of MDEQ staff and trained volunteers. Field staff evaluates the potential for NPS pollution during the procedure, which focuses on the severity of potential pollutant inputs, not pollutant impacts. As part of this procedure, field staff looks for a possible pollutant source, a potential pathway to the waterbody, and potential severity of the input.

In summary, the Watershed Survey Assessment Procedure was designed to address several general objectives:

- Increase the information available on the water quality of Michigan rivers and the sources of pollutants, for use by MDEQ staff and local watershed groups.
- Provide for consistent data collection and management statewide.
- Serve as a quick screening tool to identify issues and the need for more in depth investigations.
- Provide information for use in the MDEQ's Procedure 51 stream assessments to help determine the following: 1) where monitoring stations should be established, 2) how far upstream a station is representative, and 3) what pollutant sources are present for incorporation into the Procedure 51 assessment reports.

The Watershed Survey Assessment Procedure is one of several assessment procedures that will be used to meet the MDEQ's long-term goal to "improve the identification of NPS and impacts in Michigan watersheds to effectively target resources by 2011." (www.michigan.gov/deq)

As of May 2004, approximately 50% of the subwatersheds in the LGRW have had a watershed survey assessment completed. The status of the surveys for each subwatershed is included in the WAM.

3.2.4 LOCAL WATER QUALITY MONITORING PROGRAMS

In the late 1980s, a series of surface water contamination events in Kent County served to increase public interest in the quality of local rivers and streams. The municipal sewer system of the City of Grand Rapids frequently discharged sewage into the Grand River following heavy rains. Although the sewer system had originally been designed to function in this manner, a greater awareness was growing of the effects of environmental contamination from these combined sewer overflow (CSO) events. In 1988, according to the Kent County Health Department, the contamination of the Rogue River in northern Kent County from sewage overflows further heightened concern about local surface water quality.

In response, local governments began giving local surface water quality closer scrutiny, examining root causes and contaminates, and the role of existing infrastructure in contamination events. Such efforts, however, were hampered by the fact that there was very little data on the quality and cleanliness of water in Kent County rivers and streams. Because such data was necessary both to assess the impact of contamination events, as well as to develop solutions and prevention processes, the Kent County Board of Health, on September 9, 1988, adopted a resolution that called for the Kent County Health Department (KCHD) to develop a "...water quality surveillance and assessment procedure to be used in gathering information concerning the relative healthfulness of rivers and streams in Kent County."

The resulting surface water-monitoring program was initiated in 1989 and was charged with providing water quality information necessary for future decision-making. Initially, 11 Kent County rivers and streams were sampled at 14 locations. The funding for the program has been suspended for the 2003 to 2004 fiscal year, but could possibly resume in the future years. Annual reports were prepared summarizing sampling results.

The City of Grand Rapids has monitored 15 locations along the Grand River and its major tributaries in Kent and Ottawa Counties between 1985 and 2000. During the summer of 2000, the City of Grand Rapids initiated an investigation of its storm water collection system for illicit discharges. Inspectors diagnosed the presence and potential sources of illicit discharges at the time of dry-weather flows. During the storm water collection system inspection program, discharges were tested for temperature, dissolved oxygen, pH, nitrate, phosphate, fecal coliform, total suspended solids, chloride, and other parameters. Monitoring values were compared with established warning limits, which were derived from surface water samples collected monthly during the previous sixteen years.

The Ottawa County Environmental Health staff collects water samples from bodies of water throughout Ottawa County from Memorial Day through September. Samples are analyzed for various water quality parameters, including bacteria levels, to protect public health and to prevent the spread of disease. Beaches are closed if deemed unsafe to public health.

The Barry-Eaton District Health Department was awarded an inland lakes beach monitoring grant for its "BE in the SWIM: Barry-Eaton Surface Water Impact Monitoring" program in September 2003. This program involves the routine collection of water samples from May 1 through September 30, 2004, at specified public beaches within Barry and Eaton Counties to assess whether the *E. coli* levels allow for safe swimming. The MDEQ Water Laboratory in Lansing uses standard methods to perform the *E. coli* analyses. Results are available the afternoon following the date of collection and can be accessed by the public through the Michigan Public Beach and Waterway Information website at www.deq.state.mi.us/beach.

The Muskegon County Environmental Health program conducts seasonal, weekly sampling of water at local beaches as funding permits. Using state criteria, samples are statistically analyzed to determine if bacterial levels are safe for full body contact.

In May 2003, the MDEQ awarded grant funds to the Muskegon County Health Department, through the Federal Beaches Environmental Assessment and Coastal Health Act, for beach water monitoring. Currently, the Muskegon County Health Department, in partnership with the Annis Water Resources Institute (AWRI), is monitoring 12 beaches along Lake Michigan and an additional 14 inland lake beaches in Muskegon County for *E. coli* during the 2004 "high use" season. Beach water test results are available on their website.

The Annis Water Resources Institute is conducting total suspended solids (TSS) monitoring and flow monitoring of five watersheds within the LGRW between May and August 2004 to initiate the TMDL development process. These five watersheds include the Bass River, Sand Creek, Strawberry/Mill Creek, York Creek, and an unnamed tributary. These stream reaches are listed on the 2004 303(d) list as requiring a TMDL as they do not support the designated use for biota. The primary causes of stream degradation are related to excess TSS and extraordinary flashy flow regimes due to storm events.

The Ionia, Montcalm, and Newaygo County Health Departments do not currently have a surface water quality monitoring program. In the recent past, Montcalm County applied for grant funding to conduct monitoring of their bathing beaches, but was not awarded. They plan to apply again in the future to monitor several of their approximately 260 inland lakes.

3.2.5 NPDES STORM WATER DISCHARGE PERMITS

EPA establishes Effluent Limitations Guidelines (ELGs) to require a minimum level of process control and treatment for discharges to surface water. A list of NPDES permitted outfalls in the LGRW can be found in Appendix 4. Locations of permitted outfalls are illustrated in Figure 11 - [NPDES Locations]. The regulations for point sources have controlled direct discharges to the degree that point sources are no longer the largest source of pollutant discharges to surface water. However, national water quality monitoring programs have indicated that many waterbodies are being impaired by NPS pollution. To contend with this growing problem, the Clean Water Act was revised in 1987 to require NPDES permits for municipal storm water discharges. Phase I of the municipal storm water program targeted large cities with storm water systems serving populations over 100,000 people. Phase II of this program includes urbanized areas with 50,000 or more people with population densities greater than 1,000 people per square mile. Programs are being implemented in municipalities to remedy municipal storm water pollution.

Phase I Communities - Grand Rapids, Michigan Department of Transportation

The City of Grand Rapids and the Michigan Department of Transportation (MDOT) were required to obtain Phase I storm water permits in 1990. The City of Grand Rapids has created an effective storm water program, including a water sampling program and a well-received public education campaign. Radio ads, called "Water Spots", were created and aired on local radio stations in the Grand Rapids areas. The purpose of "Water Spots" is to raise public awareness of storm water issues. Over twenty different topics related to storm water control were addressed, including education about natural features that help control storm water, such as leaf litter and trees. “Water Spots” also educate the public about pollutants, such as salts, trash, oils, pet wastes, and fertilizer that can mix with storm water runoff to pollute nearby surface waters. “Water Spots” ads can be heard at the following website: http://www.grand-rapids.mi.us/index.pl?page_id=142.

MDOT was issued NPDES permits by the MDEQ for MDOT-operated storm water drainage systems in the Phase I communities of Ann Arbor, Flint, Grand Rapids, Sterling Heights, and Warren. The NPDES permits authorize MDOT to discharge from all of its existing Municipal Separate Storm Sewer System (MS4) outfalls that serve roadways in these communities to surface waters in the Clinton, Flint, Grand, and Huron River Watersheds.

These NPDES permits require MDOT to developed a storm water management plan (SWMP) to address storm water pollution control related to highway planning, design, construction, and maintenance activities in the five Phase I communities.

Lower Grand River Watershed Project

Information Services Center
Annis Water Resources Institute
Grand Valley State University

Map Prepared August, 2004

Mecosta County

Montcalm County

Muskegon County

Newaygo County

Ottawa County

Kent County

Allegan County

Barry County

Ionia County

Clinton County

Eaton County

Base Information

- Interstate/Highway
- River/Stream
- County Boundary
- Watershed Boundary
- NPDES Permitted Outfalls

N

0 10 Miles

Data Source
Base Information:
Framework V3B, Michigan Center for Geographic Information , Department of Information Technology, 2004.
NPDES Locations: U.S. Environmental Protection Agency, 2004.

National Pollutant Discharge Elimination System Locations

Lower Grand River Watershed

Figure 11

In addition, this SWMP identifies responsibilities within MDOT for implementing storm water management procedures and practices, as well as training, public education and participation, program evaluation, and reporting activities. MDOT's storm water program is described at the following website: http://www.mdot.state.mi.us/stormwater/stormwater.cfm.\

Phase II Communities

The communities in the LGRW required to obtain Phase II storm water discharge permits in March 2003 are listed in Table 3.2. Most of these communities have joined in a cooperative agreement to submit a joint watershed-based permit. The watershed-based permit allows greater flexibility for the communities since they can set their own goals and share resources to implement a regional strategy. These communities have recognized the importance of monitoring and reducing storm water runoff to the streams and drains in their communities and have initiated an Illicit Discharge Elimination Plan (IDEP) and a Public Education Plan (PEP) through the watershed-based Phase II permit program.

Table 3.2 - Phase II Communities in the Lower Grand River Watershed

Ada Township	Kent County
Algoma Township	Kent County
Alpine Township	Kent County
Byron Township	Kent County
Caledonia Charter Township	Kent County
Cannon Township	Kent County
Cascade Charter Township	Kent County
Courtland Township	Kent County
City of East Grand Rapids	Kent County
Gaines Charter Township	Kent County
Grand Rapids Charter Township	Kent County
City of Grandville	Kent County
City of Kentwood	Kent County
Plainfield Charter Township	Kent County
City of Rockford	Kent County
Sparta Village	Kent County
Sparta Township	Kent County
City of Walker	Kent County
City of Wyoming	Kent County
City of Ferrysburg	Muskegon County
Fruitport Charter Township	Muskegon County
City of Grand Haven	Muskegon County

Table 3.2 - Phase II Communities in Lower Grand River Watershed

Grand Haven Charter Township	Muskegon County
Robinson Township	Muskegon County
Spring Lake Village	Muskegon County
Spring Lake Township	Muskegon County
Allendale Charter Township	Ottawa County
Blendon Township	Ottawa County
Georgetown Charter Township	Ottawa County
City of Hudsonville	Ottawa County
Jamestown Charter Township	Ottawa County
Tallmadge Charter Township	Ottawa County
Wright Township	Ottawa County

Table 3.3 identifies the Phase I and Phase II communities located in each subwatershed of the LGRW.

Table 3.3 - Lower Grand River Watershed NPDES Phase I and Phase II Communities

Watershed ID Number	Major Watershed	Subwatershed	NPDES Phase I and Phase II Communities
14_100	Grand River	Sand Creek	City of Walker, Tallmadge Charter Township
14_101	Grand River	Grand River	Tallmadge Charter Township, City of Walker, Georgetown Charter Township
14_103	Grand River	Grand River	Allendale Charter Township, Georgetown Charter Township
14_104	Grand River	Bass Creek	Allendale Charter Township, Blendon Township, Georgetown Charter Township
14_105	Grand River	Bass River	Allendale Charter Township
14_113	Grand River	Pottawatomie Bayou	City of Grand Haven, Grand Haven Charter Township
14_114	Grand River	Norris Creek	Fruitport Charter Township
14_115	Grand River	Spring Lake	Village of Spring Lake, Spring Lake Township, Fruitport Charter Township, City of Ferrysburg
14_116	Grand River	Grand River	Grand Haven Charter Township, City of Grand Haven
14_117	Grand River	Grand River	City of Ferrysburg, City of Grand Haven
14_83	Grand River	Honey Creek	Ada Township
14_84	Grand River	Bear Creek	Cannon Township
14_85	Grand River	Grand River	Plainfield Charter Township, Grand Rapids Charter Township, City of Grand Rapids, Ada Township
14_86	Grand River	Mill Creek	Alpine Township
14_87	Grand River	Grand River	Plainfield Charter Township
14_88	Grand River	Indian Mill Creek	Alpine Township, City of Walker, City of Grand Rapids
14_89	Grand River	Grand River	City of Grand Rapids, Plainfield Charter Township, Alpine Township, Grand Rapids Charter Township, City of East Grand Rapids, City of Kentwood
14_90	Grand River	Plaster Creek	City of Kentwood, Cascade Charter Township, Gaines Charter Township
14_91	Grand River	Plaster Creek	Grand Rapids Charter Township, City of Grand Rapids, Ada Township, Cascade Charter Township, City of East Grand Rapids, City of Kentwood, City of Wyoming
14_92	Grand River	Grand River	City of East Grand Rapids, City of Grand Rapids
14_93	Grand River	Buck Creek	City of Wyoming, Byron Township, Gaines Charter Township

Table 3.3 - Lower Grand River Watershed NPDES Phase I and Phase II Communities

Watershed ID Number	Major Watershed	Subwatershed	NPDES Phase I and Phase II Communities
14_94	Grand River	Buck Creek	City of Grandville, City of Wyoming, City of Grand Rapids, Gaines Charter Township, Byron Township
14_95	Grand River	East Branch Rush Creek (Bliss Creek Drain)	Georgetown Charter Township, City of Grandville, Jamestown Charter Township, City of Wyoming, Byron Charter Township
14_97	Grand River	Grand River	City of Walker, City of Grand Rapids, Tallmadge Charter Township, City of Wyoming, City of Grandville
14_98	Grand River	East Fork Creek	Alpine Township, City of Walker, Wright Township, Tallmadge Charter Township
14_99	Grand River	Sand Creek	Wright Township
14D_35	Thornapple River	Thornapple River	Caledonia Charter Township
14D_36	Thornapple River	Thornapple River	Ada Township, Cascade Charter Township
14F_11	Rogue River	Rogue River	City of Rockford, Courtland Township, Cannon Township, Plainfield Charter Township
14F_12	Rogue River	Rogue River	Plainfield Charter Township
14F_6	Rogue River	Nash Creek	Sparta Village, Sparta Township
14F_7	Rogue River	Rogue River	Sparta Village, Sparta Township
14F_8	Rogue River	Rogue River	Sparta Village, Sparta Township
14F_9	Rogue River	Stegman Creek	Algoma Township
14L_1	Lake Michigan	Lake Drainage	City of Grand Haven

3.3 DESIGNATED AND DESIRED USES

3.3.1 DESIGNATED USES OF WATER BODIES

The primary measurement for water quality is whether the waterbody meets designated uses. The State of Michigan (State) has determined that all water bodies in the State shall be protected for the following designated uses:

- Agriculture
- Navigation
- Warm water or coldwater fishery
- Indigenous aquatic life and other wildlife
- Partial body contact recreation
- Total body contact recreation between May 1 and October 31
- Public water supply
- Industrial water supply

The goal of the State is to have all waterbodies meet all designated uses. A critical part of watershed management planning is the identification of which designated uses are being met, threatened, or impaired. A definition of each designated use is provided below.

Agriculture - Surface waters must be a consistent and safe source for irrigation and livestock watering. Irrigation is important in areas of the LGRW that have very well drained soils. Livestock producers in the LGRW rely on water that is free of pathogens that could pose health risks to the livestock.

Navigation - Reaches of waterways, that are large enough for canoes or kayaks, must maintain navigable conditions. Recreational users of the Grand River and its major tributaries should be able to enjoy a float trip without experiencing excessive log jams, low footbridges, and other obstructions that impede navigation.

Warmwater Fishery - A warm water fishery is generally considered to have summer temperatures between 60 and 70° Fahrenheit and is capable of supporting warm water species, such as largemouth and smallmouth bass, on a year-round basis. The Michigan Department of Natural Resources (MDNR) has stocked both many tributaries of the Grand River with varieties of fish for many years where sustainable conditions support the improvement to the fisheries.

Coldwater Fishery - A coldwater fishery is considered to have summer temperatures below 60°Fahrenheit and to be able to support natural or stocked populations of trout. The MDNR has stocked designated coldwater reaches of the Grand River tributaries to sustain and improve the fisheries. A healthy riparian habitat is essential to provide the needed shade to the streams to maintain lower temperatures.

Other Indigenous Aquatic Life and Wildlife - Aquatic plants and animals and other wildlife in the ecosystem should be considered in all management strategies. A stable and sustainable habitat supports populations of wildlife that indicate a healthy ecosystem.

Partial Body Contact Recreation - All waterbodies must meet water quality standards of less than 1,000 count/100 mg of *E. coli* for recreational uses of fishing and boating to be safe. The popularity of fishing and boating in the LGRW necessitates the prevention of *E. coli* from entering the waterbodies.

Total Body Contact Recreation - All waterbodies must meet water quality standards of less than 130 count/100 mg of *E. coli*, as a 30-day geometric mean, for areas to be safe for swimming from May 1 to October 31. Other impediments to total body contact recreation include nuisance aquatic vegetation and algae blooms from excessive nutrient loadings to the Watershed.

Public Water Supply at Point of Intake - Municipal water supplies must have safe and adequate amounts of surface water. Table 3.4 lists the community surface water supplies that exist in the LGRW. Groundwater and Lake Michigan are the primary sources of drinking water for the communities within the LGRW.

Table 3.4 - Surface Water Intakes for Public Water Supply

Community	County	Description	Population Served	Permit Number
Ada Township	Kent	Purchased Surface Water	4,866	MI0000012
Allendale Township	Ottawa	Purchased Surface Water	11,422	MI0000127
Spring Lake Township	Ottawa	Purchased Surface Water	9,000	MI0006235
Village of Spring Lake	Ottawa	Purchased Surface Water	3,040	MI0006230
City of Wyoming	Kent	Lake Michigan Intake	70,000	MI0007220
Byron/Gaines Townships	Kent	Purchased Surface Water	14,500	MI0001023
Crockery Township	Ottawa	Purchased Surface Water	927	MI0001664
City of East Grand Rapids	Kent	Purchased Surface Water	10,764	MI0001960
City of Ferrysburg	Ottawa	Purchased Surface Water	3,270	MI0002285
Fruitport Township	Muskegon	Purchased Surface Water	7,144	MI0002507
Georgetown Township	Ottawa	Purchased Surface Water	33,000	MI0002620
City of Grand Haven	Ottawa	Purchased Surface Water	12,245	MI0002750
Grand Haven Township	Ottawa	Purchased Surface Water	11,562	MI0002760
City of Grand Rapids	Kent	Lake Michigan Intake	200,000	MI0002790
City of Grandville	Kent	Purchased Surface Water	16,263	MI0002820
City of Hudsonville	Ottawa	Purchased Surface Water	7,160	MI0003290
Jamestown Township	Ottawa	Purchased Surface Water	545	MI0003474
City of Kentwood	Kent	Purchased Surface Water	27,500	MI0003620
Olive/Blendon Townships	Ottawa	Purchased Surface Water	375	MI0004989
Park Township	Ottawa	Purchased Surface Water	13,076	MI0005203
Polkton Township	Ottawa	Purchased Surface Water	80	MI0005427
Ada Township	Kent	Purchased Surface Water	4,866	MI0000012
Allendale Township	Ottawa	Purchased Surface Water	11,422	MI0000127

Industrial Water Supply - Industrial water supplies must have cool water with low turbidity. At least two surface water intakes for industrial water supplies are known to exist in the Watershed: Construction Aggregates on the Grand River and Johnston Boiler on Spring Lake.

Pollutants affect these designated uses in a variety of ways. Table 3.5 describes typical impacts of pollutants, and their sources, on designated uses. Each water quality concern can impair one or more designated use.

Table 3.5 - Pollutant Impacts on Designated Uses

Storm Water Pollutant	Sources	Related Impacts to Designated Uses								
		Agriculture (Drainage/Irrigation)	Industrial Water Supply	Public Water Supply	Navigation	Warmwater Fishery	Coldwater Fishery	Other Aquatic Life and Wildlife	Partial Body Contact Recreation	Total Body Contact Recreation (May 1 through October 31)
Sediment	Construction Sites, other disturbed and/or non-vegetated lands, eroding banks, road sanding, urban runoff	Restricts drainage, reduces storage capacity, clogs irrigation	Restricts intake pipes, reduces channel capacity	Restricts intake pipes	Restricts channels	Covers spawning areas, clogs fish gills, limits food supply, reduces light penetration, lowers dissolved oxygen levels	Covers spawning areas, clogs fish gills, limits food supply, reduces light penetration, lowers dissolved oxygen levels	Covers substrate, decreases food supply, diminishes species diversity, lowers dissolved oxygen levels	Unpleasant conditions, interferes with aesthetic enjoyment	Reduces water clarity
Nitrogen	Urban runoff, animal waste, fertilizers, failing septic systems	Elevated levels cause excessive algae and aquatic weed growth, leaches to underground water	Can cause algae blooms and clog inlets	Converts to nitrates and contaminates groundwater		Reduces dissolved oxygen	Reduces dissolved oxygen	Beds of algae block out sunlight to aquatic life	Eutrofication of lakes reduces recreation opportunities, excessive algae creates problems for boating	Eutrofication of lakes reduces recreation opportunities, excessive algae decreases swimming pleasure
Phosphorous		Elevated levels cause excessive algae and aquatic weed growth	Can cause algae blooms and clog inlets						Eutrofication of lakes reduces recreation opportunities, excessive algae creates problems for boating	Eutrofication of lakes reduces recreation opportunities, excessive algae decreases swimming pleasure
Organic Matter		Clogs inlets	Clogs inlets	Clogs infiltration	Debris causes obstructions in channel	Lowers dissolved oxygen levels	Lowers dissolved oxygen levels	Excessive amounts lower dissolved oxygen levels		

Table 3.5 - Pollutant Impacts on Designated Uses

Storm Water Pollutant	Sources	Related Impacts to Designated Uses								
		Agriculture (Drainage/Irrigation)	Industrial Water Supply	Public Water Supply	Navigation	Warmwater Fishery	Coldwater Fishery	Other Aquatic Life and Wildlife	Partial Body Contact Recreation	Total Body Contact Recreation (May 1 through October 31)
Metals (Copper, Lead, Cadmium and Zinc)	Industrial processes, normal wear of automobile brake lines and tires, automobile emissions, automobile fluid leaks, metal roofs			Contaminates drinking water supply		Bioaccumulation in aquatic species and through food chain	Direct toxic impact to freshwater aquatic life, bioaccumulation in aquatic species and through food chain	Direct toxic impact to freshwater aquatic life, bioaccumulation in aquatic species and through food chain	Acute and chronic degradation	Degrades appearance of water surfaces
Trash and Debris					Obstacles and nuisances					
Biological Oxygen Demand						Decreases readily available oxygen to aquatic organisms	Fish kills	Decreases readily available oxygen to aquatic organisms		
Pathogens (Bacteria)	Animal waste, urban runoff, failing septic systems			Human health risks via drinking water supplies		Threatens fish harvests, bacteria multiply faster in warmer water	Threatens fish harvests	Introduces diseases	Introduces bacteria or viruses causing human disease, closes beaches due to health hazard, causes unpleasant odors	Introduces bacteria or viruses causing human disease, closes beaches due to health hazard, causes unpleasant odors
Pesticides	Pesticides (herbicides, insecticides, fungicides, rodenticides, etc.), industrial processes	Leaches to groundwater				Accumulates in sediment, bioaccumulates in fish and passed up food chain	Accumulates in sediment, bioaccumulates in fish and passed up food chain	Acute die-offs		

Table 3.5 - Pollutant Impacts on Designated Uses

Storm Water Pollutant	Sources	Related Impacts to Designated Uses								
		Agriculture (Drainage/Irrigation)	Industrial Water Supply	Public Water Supply	Navigation	Warmwater Fishery	Coldwater Fishery	Other Aquatic Life and Wildlife	Partial Body Contact Recreation	Total Body Contact Recreation (May 1 through October 31)
Petroleum, Oil and Grease (Hydrocarbons)	Industrial processes, automobile wear, automobile emissions, automobile fluid leaks, waste oil					Bioaccumulation in aquatic species and through food chain	Bioaccumulation in aquatic species and through food chain	Bioaccumulation in aquatic species and through food chain		
Salts (chlorides)	Road salting and uncovered salt storage	Toxic to crops				Very soluble, toxic to freshwater organisms not able to withstand salty conditions	Very soluble, toxic to freshwater organisms not able to withstand salty conditions	Very soluble, toxic to freshwater organisms not able to withstand salty conditions		
Temperature						Elevated temperatures stress fish and aquatic insects	Changes species composition, fish kills	Elevated temperatures increase metabolic and reproductive rates throughout the food chain causing imbalance in ecosystem		
High Flow		Flooding				Flooding disrupts habitat	Flooding disrupts habitat	Reduces diversity	Creates dangerous conditions	Creates dangerous conditions
Low Flow		Limits supply for irrigation	Limits supply for intake	Limits supply for intake	Reduces passages	No base flow limits populations	No base flow limits populations	Reduces diversity	Alters access sites, reduces boating opportunities	Reduces opportunities for enjoyment

3.3.2 STATUS OF DESIGNATED USES

A task of the Steering Committee was to determine if the above designated uses are being met, impaired, or threatened within the LGRW. The Steering Committee used the worksheet, shown in Table 3.5, to determine the impacts that certain pollutants, and their sources, can have on the designated uses to get an idea of what pollutants and water quality concerns should be addressed. Designated uses are considered impaired if measured state water quality standards are not being met. These impaired waters require the development of a TMDL allocation or measurable milestones by which to evaluate improved water quality. Designated uses are considered threatened when water quality is declining or conditions in the watershed indicate that water quality standards may not be met in the near future. The status of the designated uses in the LGRW is described in Table 3.6.

Table 3.6 - Prioritization and Status of Designated Uses and Pollutants

Designated Use	Status of Designated Use	Prioritized Pollutants and Impairments
Agriculture	Streams used as sources of clean water for livestock watering are impaired by pathogens	**High**
		Pathogens (k)
	Excessive amounts of nutrients can affect herd health and cause algal blooms and nuisance vegetation	**Low**
		Nutrients (k)
	Water supplies for irrigation are threatened by altered hydrology and reduced base flows.	**Low**
		Hydrologic flow (k)
Navigation	Conditions in the watershed are being met for navigation	None
Warm water fishery	Spawning habitats are impaired by sediment and altered hydrology	**High**
		Sediment (k)
	Heavy metals and oils are impairing habitat and fish prey	**Low**
		Chemicals (s)
Coldwater fishery	Spawning habitats are impaired by sediment and altered hydrology	**High**
		Sediment (k)
	Increased temperatures from storm water runoff impair the necessary cold water temperatures for fish	**Medium**
		Temperature (k)
	Heavy metals and oils are impairing habitat and fish prey	**Low**
		Chemicals (s)
Indigenous aquatic life and other wildlife	Sediment is impairing fisheries and habitat that some terrestrial animals depend upon for feeding	**High**
		Sediment (k)
	Fragmentation of habitat is impairing the conditions for wildlife to thrive	**Medium**
		Loss of habitat (k)
	Nutrients are causing algal blooms and vegetative conditions that may alter water chemistry or make foraging for food difficult	**Low**
		Nutrients (k)
	Invasive species are impairing the diversity and presence of native species	**Medium**
		Invasive species (k)

Table 3.6 - Prioritization and Status of Designated Uses and Pollutants

Designated Use	Status of Designated Use	Prioritized Pollutants and Impairments
Partial body contact recreation	Recreational opportunities are impaired by pathogens	**High**
		Pathogens (k)
	Nutrients are causing algal blooms and nuisance amounts of aquatic vegetation	**Medium**
		Nutrients (k)
Total body contact recreation	Recreational opportunities are impaired from May 1 to October 31 by pathogens	**High**
		Pathogens (k)
	Nutrients are causing algal blooms and nuisance amounts of aquatic vegetation	**Medium**
		Nutrients (k)
Public Water supply	Surface water withdrawals for public water supply could be threatened	Unknown
Industrial water supply	Surface water withdrawals for industrial water supply could be threatened	**Low**
		Nutrients (k)
		Sediment (k)
		Hydrologic Flow (k)

(k) = known
(s) = suspected

3.3.3 PRIORITIZATION OF POLLUTANTS AND IMPAIRMENTS OF DESIGNATED USES

The LGRW Steering Committee prioritized the water quality problems affecting the designated uses in the LGRW by discussing the results of the past studies and evaluating the resources of the LGRW, according to the perceived value and the Steering Committee members' local knowledge of their importance. Table 3.6 lists the Steering Committee's prioritized ranking of the pollutants and impairments. Pathogens and sediment are considered the highest priority pollutants in the LGRW that are affecting the designated uses.

3.3.4 PRIORITIZATION OF POLLUTANT SOURCES AND CAUSES

Due the large size of the LGRW, pollutant sources were not prioritized for the entire LGRW. Consequently, pilot project areas were selected to represent the urban and rural issues of the area. These pilot projects generated two model WMPs: the Sand Creek and Buck Creek WMPs, which can serve as models on how to prioritize pollutant sources and causes for an urban and a rural/developing subwatershed in the LGRW. In addition, the WAP was developed for local governments and stakeholders to assist in the prioritization of pollutants, pollution sources, and pollution causes in order to select the most appropriate system of BMPs for subwatersheds in the LGRW. The WAP then provides the framework which allows communities to prioritize pollutant sources and causes on a subwatershed level.

3.4 WATER QUALITY GOALS AND OBJECTIVES

3.4.1 GOALS OF WATERSHED

The Lake Michigan Lakewide Management Plan (LaMP) identifies the Lake Michigan ecosystem as an outstanding natural resource of global significance, yet under stress and in need of special attention. The LaMP recommends the continued efforts to remediate damage from human impacts that are impairing the ecosystem. Many of the water quality concerns of the LGRW are reflected in the LaMP, including NPS pollution, high bacteria counts at beaches, fragmentation of wildlife habitats, and invasive species. The recommendations described in the LaMP were reviewed for their applicability to the LGRW goals. Goals for the existing watershed management plans already developed within the LGRW were also evaluated to recognize any unique conditions that need to be addressed. A summary of these plans is included in Table 3.7. The goals developed for the Upper Grand River Watershed were assessed for their compatibility to the other goals, to ensure that conflicting recommendations would not be made. The goals of the LGRW were determined after discussing the sources and causes of the impairments in the LGRW and coordinating with these other studies and reports. The goals are based on improving or restoring the designated uses of the LGRW and attaining compliance with established TMDLs.

Table 3.7 - Summary of Existing Management Plans, Goals, and Objectives

	Overall Water Quality Goal	General Goals	Sediment Pollutant Reduction Goal	Nutrients Pollutant Reduction Goal	Pathogen Goals	Hydrologic/ Hydraulic Goals	Temperature / Habitat Goals	Hydrocarbon/Other Toxins Goals	Education Goals
LaMP (EPA – GLNPO, 2002)	Restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem	Address pathogens, fragmentation and destruction of habitats, nuisance species, uncontrolled runoff, and erosion							
York Creek Watershed Management Plan (Alpine Township, 1994)	Improve water and habitat quality sufficiently to make feasible the reintroduction of indigenous game fish species by the year 2000		Reduce suspended solids concentrations by 50% by 1998			Reduce stream peak flows following rain events by 40% by mid-1997			
Bear Creek Stewardship Plan (Cannon Township, 1997)	Protect Bear Creek from environmental impacts associated with urbanization		Reduce the negative impact that sediment has on the cold water fishery						Demonstrate that protection of a watershed through education and improved land use management is less expensive than restoration of a degraded watershed health

Table 3.7 - Summary of Existing Management Plans, Goals, and Objectives

	Overall Water Quality Goal	General Goals	Sediment Pollutant Reduction Goal	Nutrients Pollutant Reduction Goal	Pathogen Goals	Hydrologic/ Hydraulic Goals	Temperature / Habitat Goals	Hydrocarbon/Other Toxins Goals	Education Goals
Rogue River Watershed Management Plan (AWRI-GVSU, 2003)	Maintain and improve water quality and environmental conditions by implementing BMPs and promoting sound land management decisions		Reduce the negative impact that sediment has on both the warm water fishery and the cold water fishery		Reduce the negative impact that microorganisms can have on human		Reduce the negative impacts temperature can have on aquatic organisms		
Crockery Creek Watershed Management Plan (NCD, 1996)	Restore use as a coldwater stream		Reduce severe sedimentation			Reduce extremes in flow fluctuations			
Sand Creek Watershed Management Plan (SCWP, 2003)	Restore or improve the cold water fishery, protect and improve the habitats of native aquatic life and wildlife improve and protect partial and total body contact recreational uses		Reduce sediment pollution	Reduce nutrient pollution	Reduce pathogen concentrations	Reduce harmful changes in hydrology	Reduce harmful invasive/exotic plant species. Reducing thermal pollution	Reduce hydrocarbon pollution reducing toxic substance pollution	Reduce trash pollution

Table 3.7 - Summary of Existing Management Plans, Goals, and Objectives

	Overall Water Quality Goal	General Goals	Sediment Pollutant Reduction Goal	Nutrients Pollutant Reduction Goal	Pathogen Goals	Hydrologic/ Hydraulic Goals	Temperature / Habitat Goals	Hydrocarbon/Other Toxins Goals	Education Goals
Hager Creek Watershed Management Plan (OCRPC, 2000)	Restore the designated uses of warm water fishery and other indigenous aquatic life and wildlife		Reduce the negative impact of sediment on fish and fish habitat, and aquatic life and wildlife						
Spring Lake Watershed Management Plan (Spring Lake – Lake Board, 2001)	Protect threatened designated uses and resort impaired designated uses of navigation, warm water fishery, indigenous aquatic wildlife, partial body contact recreation, and total body contact recreation.		Reduce sedimentation	Reduce nutrient loading	Reduce levels of *E. coli*			Reduce oil, grease, and heavy metal inputs	
Plaster Creek Watershed Management Plan (KCDC, 1992)	Assess relationship between water quality and storm water runoff	Establish water quality goals through development of WMP and implementation of urban BMPs							Increase public awareness of the impacts of NPS pollution

Table 3.7 - Summary of Existing Management Plans, Goals, and Objectives

	Overall Water Quality Goal	General Goals	Sediment Pollutant Reduction Goal	Nutrients Pollutant Reduction Goal	Pathogen Goals	Hydrologic/ Hydraulic Goals	Temperature / Habitat Goals	Hydrocarbon/Other Toxins Goals	Education Goals
Cole Drain Stormwater Management Plan (KCDC, 1998) **(Plaster Creek tributary)**	Are improvements for flooding problems still necessary on Cole Drain?					Construct overflow spillway for detention storage. Install single span structure at Mart Street when replacement is needed			
Little Plaster Creek Watershed Management Plan (KCDC, 1995) **(Plaster Creek tributary)**	Minimize risk of flooding damage and protect water resources					Drain improvements and construction of sediment basin			
Roys Creek Stormwater Management Plan (KCDC, 1998)	Are improvements for flooding problems still necessary on Roys Creek? Direction for ongoing storm water management					Maintain existing hydraulics of crossings. Increase storage capacity. Preserve floodplain areas and require on-site detention for future developments			

Table 3.7 - Summary of Existing Management Plans, Goals, and Objectives

	Overall Water Quality Goal	General Goals	Sediment Pollutant Reduction Goal	Nutrients Pollutant Reduction Goal	Pathogen Goals	Hydrologic/ Hydraulic Goals	Temperature / Habitat Goals	Hydrocarbon/Other Toxins Goals	Education Goals
Buck Creek Watershed Management Plan (GVMC, 2003)	Restore fisheries, safe recreation opportunities, and healthy habitat for wildlife		Reduce sediment through buffers, SESC, and agricultural practices	Reduce nutrients from trash and debris and other sources	Reduce *E. coli* inputs from septic systems and agricultural areas				
Flat River Natural River Plan (MDNR, October 1979)	Preserve, protect, and enhance the river environment in a natural state for the use and enjoyment of present and future generations	Maintain water quality consistent with the designated classification of the river and adhere to the concept of non-degradation of water quality					Prohibit development or activities which may damage the ecologic, aesthetic or historic values of the river and adjacent lands, or development is consistent with the natural environment and aesthetic qualities of the stream		Recreational uses are consistent with the natural environment and aesthetic qualities of the stream, and that a quality recreation experience is maintained
Coldwater River Watershed Management Plan (Coldwater River Watershed Council, 2003)	Improve and protect the water resources in the watershed for partial and total body recreation	Empower Watershed Council with tools to further these efforts and a process for evaluating the efforts	Install BMPs to reduce sediment		Install BMPs to reduce bacteria		Install BMPs to reduce unnaturally warm water entering the water bodies		Create I&E Strategy for specific audiences that will create awareness about good watershed stewardship behavior. Provide ordinances for local townships

Table 3.7 - Summary of Existing Management Plans, Goals, and Objectives

	Overall Water Quality Goal	General Goals	Sediment Pollutant Reduction Goal	Nutrients Pollutant Reduction Goal	Pathogen Goals	Hydrologic/ Hydraulic Goals	Temperature / Habitat Goals	Hydrocarbon/Other Toxins Goals	Education Goals
Schoolhouse Creek Watershed Study (Cascade Charter Township, 1997)	Projects for flood protection and protection of water quality		Dredge pond to reestablish capacity for sediment deposition, identify high risk soil erosion areas. Streambank stabilization measures			Require extended storm water detention for developments adjacent to natural water courses			
Huizenga Intercounty Drain Stormwater Management Plan (KCDC, 1995)	Address present and future concerns of storm water control					Conveyance improvements, regional detention in Wyoming, and onsite detention for new developments in Grandville. Implementation and enforcement of building restrictions within 100-year floodplain or within a regulated wetlands			

Table 3.7 - Summary of Existing Management Plans, Goals, and Objectives

	Overall Water Quality Goal	General Goals	Sediment Pollutant Reduction Goal	Nutrients Pollutant Reduction Goal	Pathogen Goals	Hydrologic/ Hydraulic Goals	Temperature / Habitat Goals	Hydrocarbon/Other Toxins Goals	Education Goals
Bliss Creek Intercounty Drain WMP (KCDC, 1994)	Structural improvements to reduce flooding		1)Channel restoration and sediment basins to improve water quality 2)Enforcement of SESC and restrictions on grading and removal of vegetation			Onsite storm water detention and update of 100-year floodplain maps			
Bliss Creek Intercounty Drainage District Phase II Evaluation (KCDC, 1997)	Projects to provide greater flood protection					Develop storm water management criteria for detention and floodplain protection - Mapping completed in 1995			

3.4.2 OVERALL WATER QUALITY GOALS

- Restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem by enhancing river environments in their natural states for present and future generations.
- Maintain and improve water quality by promoting sound land management decisions.
- Assess relationships between water quality and storm water runoff by developing guidelines for storm water management to reduce impacts of urbanization.
- Preserve, restore coldwater fisheries and reintroduce indigenous game fish species where possible.
- Provide for flood protection, minimize risk of flooding, and assess necessity of flood control improvements.
- Ensure public safety in recreational opportunities in surface waters.
- Protect healthy habitats for native aquatic life and wildlife.

3.4.3 OBJECTIVES OF WATERSHED

The objectives required to meet the goals are based on addressing the identified causes of the sources of NPS pollution in the LGRW. Pollutants were prioritized to help narrow the focus on the greatest impairment to each designated use. The pollutants were prioritized based on the degree of impairment and the feasibility of reducing the pollutant to desirable levels. Pollutants that were known (identified as “k”) were given a higher priority than pollutants that were suspected (identified as “s”). The pollutant prioritization is outlined in Table 3.8.

Table 3.8 - Goals and Objectives for Prioritized Pollutants

Pollutant Impairing Designated Use	Impaired Designated uses	Priority of Pollutant	Sources	Cause	Goal	Objectives
Pathogens (k)	Agriculture, water recreation, and public water supply	High	Septic Systems	Septic system failure due to poor soils or maintenance	Reduce *E. coli* inputs from septic systems	Increase proper maintenance and installation of septic systems
						Increase the use of sanitary sewers in high risk areas
			Livestock	Unrestricted livestock access	Reduce number of livestock in streams and increase quality of riparian buffers	Increase use of livestock fencing and filter strips
			Storm water runoff	Illegal connections to storm sewer system	Reduce number of illicit connections to storm sewers	Locate and remove or correct illicit connections to storm sewers
				Over or misapplication of manure or septic waste	Improve manure and septic waste management techniques	Increase use of agriculture incentive programs and comprehensive manure management plans
						Encourage stronger county and state regulatory oversight
			Sanitary sewers	Overflows or leaks from sanitary sewers due to rainfall or failures	Reduce number of overflows from combined sewers and locate and repair sewer leaks	Encourage municipalities to increasingly locate and repair sanitary sewers in areas with high levels of *E. coli*
			Animals	Pet waste in storm water runoff	Reduce amount of pet waste entering storm sewer systems	Increase the number of pet waste collection facilities and encourage their use with signage and educational media
				Concentrated wildlife in or around storm sewer system	Reduce concentrations of nuisance wildlife (i.e. geese, raccoons, etc) in and around storm sewer systems	Increase use of goose management practices and install BMPs that exclude wildlife from storm sewers

Table 3.8 - Goals and Objectives for Prioritized Pollutants

Pollutant Impairing Designated Use	Impaired Designated uses	Priority of Pollutant	Sources	Cause	Goal	Objectives
Sediment (k)	Warmwater and coldwater fisheries, aquatic life/wildlife, and public and industrial water supply	High	Streambank erosion	Lack of storm water management for stream protection	Stabilize stream flow	Increase development of storm water ordinances that require infiltration, low impact development techniques, rain gardens, and extended detention that addresses channel forming flows where appropriate
						Increase stream buffer and green space ordinances
						Develop wetland, green space, and flood plain protection programs
				Erosion from human or animal access	Reduce number of livestock in streams and increase quality of riparian buffers and access sites	Increase use of livestock fencing and filter strips
				Wave action from watercraft	Reduce streambank erosion from large and fast moving watercraft in sensitive areas	Work with the MDNR to establish no wake zones
			Agricultural erosion	Lack of conservation cover in agricultural soils	Minimize runoff from agricultural areas	Increase the use of appropriate agricultural BMPs, such as cover crops and reduced tillage practices, in agricultural areas near surface water
			Storm water runoff	Runoff from impervious surfaces that contains sediment	Minimize urban storm water runoff	Increase infiltration where possible and implement green space protection programs and stream buffer ordinances

Table 3.8 - Goals and Objectives for Prioritized Pollutants

Pollutant Impairing Designated Use	Impaired Designated uses	Priority of Pollutant	Sources	Cause	Goal	Objectives
						Increase development of storm water ordinances that require infiltration, low impact development techniques, rain gardens, and extended detention that address channel forming flows where appropriate
			Construction sites	Lack of soil erosion and sedimentation control measures	Reduce erosion and contain sediment on construction site	Improve soil erosion and sedimentation control measures and construction site inspection
Nutrients (k)	Agriculture, water recreation, aquatic life/wildlife, public water supply, and industrial supply	High	Septic Systems	Septic system failure due to poor soils or maintenance	Reduce nutrient loadings from failing or improperly maintained septic systems	Increase proper maintenance and installation of septic systems
						Increase the use of sanitary sewers in high risk areas
			Sanitary sewers	Discharge from waste water treatment plants	Reduce number of discharge exceedances from waste water treatment plants	Increase awareness of waste water treatment plant discharge reports
						Make continual efforts to separate combined sewers
			Livestock	Unrestricted livestock access	Reduce number of livestock in streams and increase quality of riparian buffers	Increase use of livestock fencing and filter strips
			Storm water runoff	Illegal connections to storm sewer system	Reduce number of illicit connections to storm sewers	Locate and remove or correct illicit connections to storm sewers
				Over or misapplication of manure or septic waste	Improve manure and septic waste management techniques	Increase use of agriculture incentive programs and comprehensive manure management plans

Table 3.8 - Goals and Objectives for Prioritized Pollutants

Pollutant Impairing Designated Use	Impaired Designated uses	Priority of Pollutant	Sources	Cause	Goal	Objectives
						Encourage stronger county and state regulatory oversight
				Illegal dumping of organic waste into storm sewers	Reduce amount of yard waste being dumped into drains and ditches	Create awareness of storm sewer systems and affects of yard waste in lakes and streams
						Implement ordinances that prohibit dumping of yard waste
Unstable hydrology (k)	Agriculture, aquatic life/wildlife, and industrial water supply	Medium	Impervious surfaces	Lack of storm water management for stream protection	Reduce amount of impervious surfaces and storm water runoff	Increase infiltration where possible
						Implement storm water management ordinance with stream protection
			Loss of flood storage	Wetland destruction and flood plain development	Protect wetlands and flood plains	Develop wetland and flood plain protection programs
Temperature (k)	Coldwater fishery and industrial water supply	Medium	Storm water runoff	Thermal heating of storm water from impervious surfaces or basins	Decrease amount of storm water runoff from urban areas and increase amount of infiltration	Increase infiltration where possible and implement green space protection programs
			Solar heating	Lack of riparian buffers along streams and ponds	Increase amount of riparian buffers in designated coldwater streams	Develop stream buffer and green space protection programs
Habitat fragmentation (k)	Aquatic life/wildlife	Medium	Invasive species	Landscaping with exotic and invasive species	Reduce spread and remove invasive species from sensitive habitats	Increase the use of native vegetation in landscaping
				Introduction from ballast water or watercraft transport	Reduce introduction of species from watercraft transport	Develop ordinance that prohibits transport or introduction of invasive and exotic species

Table 3.8 - Goals and Objectives for Prioritized Pollutants

Pollutant Impairing Designated Use	Impaired Designated uses	Priority of Pollutant	Sources	Cause	Goal	Objectives
			Development	Destruction of forest areas and wetlands	Reduce loss of forested and wetland areas	Participate in a natural features inventory
						Develop wetland and green space protection programs
Chemicals (s)	Warmwater and coldwater fisheries, aquatic life/wildlife, and public water supply	Low	Storm water runoff	Leaking automobile fluids on parking lots and streets	Reduce amount automotive fluids in storm water runoff	Increase amount and frequency of street sweeping
			Dumping	Illegal dumping of hazardous wastes into storm sewers	Reduce amount of automotive and hazardous waste being illegally dumped into storm drains	Implement ordinances that prohibit dumping of any substance other than clean water into storm drains
			Spills	Lack of spill protection measures in chemical storage or use areas	Eliminate spills from entering storm sewers, groundwater, and surface water	Develop emergency spill response plans and pollution prevention initiatives by municipalities and industry

3.4.4 DESIRED USES OF WATERSHED

Desired uses of the LGRW, those uses not directly related to water quality, were discussed by the Steering Committee, the Grand River Forum members, and local officials. These desired uses reflect how the community wants to use the LGRW and what activities should be promoted within the LGRW. The discussions resulted in five categories that described desired uses and tools to use in the watershed: recreational use, planning and development, wildlife habitat, educational opportunity, and water consumption. A summary of survey responses taken at a Grand River Forum meeting are presented below:

Question: What are your goals or desired uses for the Lower Grand River's water resources?

Boating	1
Fishing	4
Public Access	12
Recreation	34
Recreational Use	**51**

Conservation Easements	1
Continue Agriculture	3
Flood Control	4
Incentives for Good Planning	1
Industrial Use of Water	2
Irrigation	6
No Industrial Use	1
Purchase Development Rights	4
Residential Growth	1
Smart Growth	3
Wetland Protection	1
Storm water Drainage	11
Planning and Development	**38**

Aesthetics	4
Habitat	19
Preservation	7
Riparian Corridors	7
Stream Morphology	1
Wildlife Habitat	**38**

Celebrate Water	7
Education	11
Educational Opportunity	**18**

Recreation was the largest overall desired use, as people associate water with boating, fishing, and swimming. Planning and development emphasizes the need for smart growth to protect natural resources while maintaining economic viability. Healthy wildlife habitats allow for public viewing and experiences with terrestrial and aquatic wildlife. The Grand River also offers an educational and celebratory resource.

3.4.5 CRITICAL AREAS OF THE WATERSHED

Critical areas of the LGRW are those areas having specific NPS pollution concerns that need to be addressed with appropriate BMPs. The critical areas of the LGRW need to be defined in order to locate areas of high priority. This project also focused the selection of critical areas where projects would be the most feasible, based on other characteristics, such as local participation, interest in innovative storm water management practices, development pressures, and funding availability. The selected critical areas are described below.

The **riparian corridor** is critical to the protection of water quality by buffering the effects of land use activities. The recommendation of buffer zones, filter strips, and riparian protection will reduce sediment and nutrients from entering the streams. The importance of creating buffers adjacent to the stream for protection of water quality initiated the concept of a setback or buffer zone critical area in the LGRW. BMPs will be implemented within the corridor and also on agricultural fields adjacent to the corridor.

The amount of biomass in a **wetland** is capable of purifying outflows and storing water for a slower release rate to stream channels and aquifers. Restoring wetlands has a significant impact on improving fisheries, species diversity, and water quality in the watershed. BMPs for the protection and restoration of wetlands can be regulatory or non-regulatory techniques.

Residential areas have been identified as contributing nutrients to the streams. Visual observation of algal blooms and excess aquatic plant growth suggested that nutrients could be entering the waterways from storm water runoff carrying fertilizers or pet waste and from illegal dumping of yard waste. Failing septic systems in rural areas could also be contributing nutrients. The residential areas included in the critical areas of the LGRW included those areas zoned for residential or commercial development with the following characteristics: septic systems in high-risk soils/sensitive areas, served by storm sewers, and/or adjacent to lakes, streams, and rivers.

Agricultural areas in the LGRW are contributing sediment, nutrients, and potentially pathogens to the streams through rill and gully erosion, manure applications, and drain tile outlets. Bare plowed fields up to the water's edge also allow these pollutants into the streams. Farmers that provide their livestock unlimited access to the stream also contribute these pollutants. The agricultural critical area includes farms with row crops, livestock, and any other farm adjacent to a stream.

Rural areas in the LGRW are not served by the public sanitary sewer system. These areas that are located in unsuitable soils are included in the critical area for possible faulty or leaking septic systems. Failing or improperly installed systems could be adding nutrients and pathogens to lakes or streams.

Trash and debris that accumulates in the stream channel often alters the hydrology of the stream by diverting or blocking the natural flow of the stream. Stretches of the streams that have excessive trash blocking culverts or logjams that are either blocking flow or diverting flow and causing streambank erosion are considered part of this critical area.

Goals and objectives for each critical area are described in Table 3.9.

Table 3.9 - Critical Areas

Critical Area	Goal	Objectives	Pollutant Impairing Designated Use
Areas not served by sanitary sewers in unsuitable soils or near riparian areas	Reduce *E. coli* inputs and nutrient loadings from failing or improperly maintained septic	Increase proper maintenance and installation of septic systems	Pathogens (k), Nutrients (k)
Areas served by public water supplies but not sanitary sewers		Increase the use of sanitary sewers in high risk areas	Pathogens (k), Nutrients (k)
Agricultural areas with livestock	Reduce number of livestock in streams and increase quality of riparian buffers	Increase the use of livestock fencing and filter strips	Pathogens (k), Sediment (k), Nutrients (k)
Urbanized areas with municipal separate storm sewer systems	Reduce number of illicit connections to storm sewers	Locate and remove or correct illicit connections to storm sewers	Pathogens (k), Nutrients (k)
Agricultural areas with land application of manure fertilizer near riparian areas	Improve manure management techniques	Increase use of agriculture incentive programs and comprehensive manure management plans	Pathogens (k)
		Encourage stronger county and state regulatory oversight	
Watersheds with TMDLs for *E. coli* and/or nutrients	Reduce number of overflows from combined sewers and locate and repair sewer leaks	Encourage municipalities to continue to locate and repair sanitary sewers in areas with high levels of *E. coli*	Pathogens (k)
Parks and high density residential areas	Reduce amount of pet waste entering storm sewer systems	Increase the number of pet waste collection facilities and encourage their use with signage and educational media	Pathogens (k)

Table 3.9 - Critical Areas

Critical Area	Goal	Objectives	Pollutant Impairing Designated Use
Urban areas and parks with high populations of wildlife	Reduce concentrations of nuisance wildlife (i.e. geese, raccoons, etc) in and around storm sewer systems	Increase use of goose management practices and install BMPs that exclude wildlife from storm sewers	Pathogens (k)
Entire watershed	Stabilize stream flow	Increase development of storm water ordinances that require detention of runoff to protect streams	Sediment (k)
		Develop wetland, green space, and flood plain protection programs	Sediment (k)
		Increase stream buffer and green space ordinances	
Lakes and navigable waterways	Reduce streambank erosion from large and fast moving watercraft in sensitive areas	Work with MDNR to establish no wake zones	Sediment (k)
Agricultural riparian areas (1/8 mile from water's edge)	Minimize runoff from agricultural areas	Increase use of appropriate agricultural BMPs, such as cover crops and reduced tillage practices, in agricultural areas near surface water	Sediment (k)
Urban areas, near construction sites, and industrial impervious surfaces	Minimize urban storm water runoff and increase amount of infiltration	Increase amount and frequency of street sweeping	Sediment (k)
Land zoned for growth and development	Minimize urban storm water runoff	Increase infiltration where possible and implement green space protection programs and stream buffer ordinances	Sediment (k)
Watersheds with streams designated as coldwater fisheries	Minimize urban storm water runoff	Increase development of storm water ordinances that require infiltration, low impact development techniques, rain gardens, and extended detention that addresses channel forming flows where appropriate	Sediment (k)
Land zoned for growth and development	Reduce erosion and contain sediment on construction site	Improve soil erosion and sedimentation control measures and construction site inspection	Sediment (k)

Table 3.9 - Critical Areas

Critical Area	Goal	Objectives	Pollutant Impairing Designated Use
Residential areas served by sanitary sewers	Reduce number of discharge exceedances from waste water treatment plants	Increase awareness of waste water treatment plant discharge reports	Nutrients (k)
City of Grand Rapids		Encourage continual effort to separate combined sewers	Nutrients (k)
Agricultural riparian areas (1/8 mile from water's edge)	Improve manure management techniques	Increase use of agriculture incentive programs and comprehensive manure management plans	Nutrients (k)
		Encourage stronger county and state regulatory oversight	
Residential areas served by storm sewers or located in a riparian area (1/8 mile from water's edge)	Reduce amount of yard waste being dumped into drains and ditches	Create awareness of storm sewer systems and affects of yard waste in lakes and streams	Nutrients (k)
Entire watershed		Implement ordinances that prohibit dumping of yard waste	Nutrients (k)
Watersheds with streams designated as coldwater fisheries	Reduce amount of impervious surfaces and storm water runoff	Increase infiltration where possible	Unstable hydrology (k)
Entire watershed		Implement storm water management ordinance with stream protection	Unstable hydrology (k)
Stream channels and riparian areas (1/8 mile from water's edge)	Protect wetlands and flood plains	Develop wetland and flood plain protection programs	Unstable hydrology (k)
Watersheds with streams designated as coldwater fisheries	Decrease amount of storm water runoff from urban areas and increase amount of infiltration	Encourage infiltration where possible and implement green space protection programs	Temperature (k)
Watersheds with streams designated as coldwater fisheries	Increase amount of riparian buffers in designated coldwater streams	Develop stream buffer and green space protection programs	Temperature (k)
Entire watershed	Reduce spread and remove invasive species from sensitive habitats	Increase the use of native vegetation in landscaping	Habitat fragmentation (k)
Lakes and navigable waterways	Reduce introduction of species from watercraft transport	Develop ordinance that prohibits transport or introduction of invasive and exotic species	Habitat fragmentation (k)

Table 3.9 - Critical Areas

Critical Area	Goal	Objectives	Pollutant Impairing Designated Use
Entire watershed	Reduce loss of forested and wetland areas	Participate in a natural features inventory	Habitat fragmentation (k)
New developments in entire watershed		Develop wetland and green space protection programs	Habitat fragmentation (k)
Urban areas and commercial parking lots	Reduce amount automotive fluids in storm water runoff	Increase amount and frequency of street sweeping	Chemicals (s)
Entire watershed in areas served by storm sewers	Reduce amount of automotive and hazardous waste being illegally dumped into storm drains	Implement ordinances that prohibit dumping of any substance other than clean water into storm drains	Chemicals (s)
Entire watershed and industrial parks	Eliminate spills from entering storm sewers, groundwater, and surface water	Develop emergency spill response plans and pollution prevention initiatives by municipalities and industry	Chemicals (s)

(k) = known
(s) = suspected

3.4.6 CRITICAL SUBWATERSHEDS OF THE WATERSHED

While the previous section assessed areas of the LGRW that had a potential for water quality degradation, this analysis ranks subwatersheds based on their estimated water quality degradation from flow, sediment, and temperature pollution, which are high priority pollutants listed in the watershed plan. Five factors were used to make this assessment: 1) land use, 2) impervious area, 3) in-stream temperature fluctuation, 4) storm water runoff, and 5) population density. From the information available, these factors were believed to weight the sensitivity of these subwatersheds in terms of urban issues. The information below details how each of the subwatersheds were ranked based on these five factors and how a total ranking for each subwatershed was determined.

LAND USE RANKING

This ranking identifies subwatersheds with high percentages of urban and agricultural land. Data for this analysis came from the 1978 MIRIS Land Use/Cover data for Allegan, Barry, Clinton, Eaton, Ionia, Mecosta, Montcalm, and Newaygo Counties. For Kent and Ottawa Counties, updated 1992 Land Use/Cover data, collected by AWRI, was used. Updated 1998 Land Use/Cover data, collected by the AWRI, was used for Muskegon County.

Each subwatershed received a numerical rank based on the percentage of urban/agricultural land: 0-25% = 1, 26-50% = 2, 51-80% = 3, and 81-100% = 4. A score between 1 and 2 was classified as a slightly critical area, a score of 3 was classified as moderately critical, and a score of 4 was classified as severely critical.

IMPERVIOUS AREA RANKING

This ranking identifies subwatersheds with high percentages of impervious land. The total amount of impervious acreage for each subwatershed was calculated using an average percent impervious number for each land use (Table 3.10) (Halley et al., 1998). The acreage of impervious land in each subwatershed was then divided by the total acreage of land to achieve an impervious area percentage.

All subwatersheds received a numerical rank based upon the percentage of impervious land: 0-25% = 1, 26-50% = 2, 51-80% = 3, and 81-100% = 4. A score between 1 and 2 was classified as slightly critical, a score of 3 was classified as moderately critical, and a score of 4 was classified as severely critical. Subwatersheds received a score of 0 if information was not available.

Table 3.10 - Average Percent Imperviousness of Typical Land Uses

Description	Average % Impervious	Typical Land Uses
Residential (High Density)	65	Multi-Family Apartments, Condos, Trailer Parks
Residential (Med. Density)	30	Single Family, Lot Size ¼ to 1 acre
Residential (Low Density)	15	Single-Family, Lot Size 1 acre and Greater
Commercial	79	Strip Commercial, Shopping Centers
Industrial	79	Schools, Prisons, Treatment Plants, Light Industrial
Disturbed/Transitional	5	Gravel Parking, Quarries
Agricultural	5	Cultivated Land, Row Crops
Open Land	5	Parks, Golf Courses, Greenways
Meadow	5	Hay Fields, Tall Grass
Forest	5	Forest Litter, Woods/Grass combination, Tree Farms
Water	0	Water Bodies, Lakes, Ponds, Wetlands

IN-STREAM TEMPERATURE FLUCTUATION RANKING

This ranking used Valley Segment Ecological Classification (VSEC) data, developed through the Michigan Rivers Inventory (MRI), to determine the percentage of streams in each subwatershed with a high degree of in-stream temperature fluctuation. Researchers involved in the MRI determined temperature averages and fluctuations based on catchment hydrology and size, upstream lake and shading effects, latitude, impacts from upstream land cover patterns, presence of upstream lakes, and downstream temperature conditions (Seelbach et al., 1997). The length of cold or cool water streams, with either a moderate or high diurnal (daily) temperature fluctuation, based on the MRI, was calculated for each subwatershed and then divided by the total stream length to reach a total percentage.

Subwatersheds received a numerical rank based on the percentage of cold or cool water streams with a moderate to high in-stream temperature fluctuation: < 25% = 1, 25–50% = 2, 50.01–75% = 3, and > 75% = 4. A score between 1 and 2 was classified as slightly critical, a score of 3 was classified as moderately critical, and a score of 4 was classified as severely critical. Subwatersheds received a score of 0 if VSEC data was not available for the area.

STORMWATER RUNOFF RANKING

This ranking also used VSEC data to determine the percentage of streams in each subwatershed with the majority of their hydrological input coming from surface runoff. Researcher involved in the MRI determined discharge patterns by examining the composition of catchment topography, surficial geology, land cover, and neighboring stream segments (Seelbach et al., 1997).

The length of these type of streams was calculated for each subwatershed and then divided by the total stream length to achieve a total percentage. Subwatersheds received a numerical rank based on the percentage of runoff driven streams: < 25% = 1, 25–50% = 2, 50.01–75% = 3, > 75% = 4. A score between 1 and 2 was classified as slightly critical, a score of 3 was classified as moderately critical, and a score of 4 was classified as severely critical. Subwatersheds received a score of 0 if VSEC data was not available for the area.

POPULATION DENSITY RANKING

The population density for each subwatershed was determined using the 2000 Census. Subwatersheds received a numerical rank based on the population density: no information = 0, < 40 people/square mile = 1, 41–115 = 2, 116–299 = 3, and > 300 = 4. A score between 1 and 2 was classified as slightly critical, a score of 3 was classified as moderately critical, and a score of 4 was classified as severely critical.

TOTAL RANKING

The total ranking added the individual rankings from each of the five categories measured for the critical subwatershed analysis (Table 3.11). The subwatersheds receiving higher rankings are the critical subwatersheds most sensitive to changes within the LGRW. A total ranking between 8 and 12 was classified as slightly critical, a ranking of 13 to 14 was classified as moderately critical, and a ranking at or above 15 was classified as severely critical Figure 12 - [Critical Area Sensitivity Ranking]. Several subwatersheds were not able to be ranked and are listed as N/A in the total ranking. These subwatersheds were lacking information for one or more of the five factors.

Lower Grand River Watershed Project

Information Services Center
Annis Water Resources Institute
Grand Valley State University

Map Prepared August, 2004

Muskegon County
Newaygo County
Mecosta County
Montcalm County
Lake Michigan
Ottawa County
Kent County
Ionia County
Clinton County
Allegan County
Barry County
Eaton County

Base Information

- County Boundary
- Subbasin Boundary
- Watershed Boundary
- Major Watercourses

Total Ranking

- Insufficient Data
- Minor
- Moderate
- Severe

* Text labels (e.g. 14F 11) represent a subbasins watershed ID.

N

0 10 Miles

Critical Area Sensitivity Ranking

Lower Grand River Watershed

Figure 12

Data Source
Base Information:
Framework V3B, Michigan Center for Geographic Information , Department of Information Technology, 2004.
Critical Area Ranking:
GVSU-AWRI, 2004

Table 3.11 - Critical Area Ranking for Subwatersheds

Subwatershed	Sub ID	Stream Temperature Fluctuation Ranking	Stormwater Runoff Ranking	Land Use Ranking	Population Ranking	Impervious Ranking	Total Rank
Nash Creek, at Mouth	14F 6	4	4	4	4	2	18
Buck Creek, at Mouth	14 94	4	1	4	4	4	17
Flat River, Above Dickerson Creek	14E 16	4	4	3	4	2	17
Flat River, at Gage #04116500	14E 22	4	4	3	4	2	17
Flat River, at Mouth	14E 24	4	4	2	4	3	17
Grand River, at Gage #04119000	14 89	1	4	4	4	4	17
Grand River, at Plaster Creek	14 92	1	4	4	4	4	17
Little Thornapple River, at Jordan Lake Dam	14D 26	4	4	4	3	2	17
Plaster Creek, at Mouth	14 91	4	1	4	4	4	17
Thornapple Drain, at Mouth	14D 3	4	4	4	3	2	17
Crockery Creek, at Rio Grande Creek	14 109	4	4	3	3	2	16
Prairie Creek, at Mouth	14 70	4	4	3	3	2	16
Rogue River, at Stegman Creek	14F 10	4	4	2	4	2	16
Stegman Creek, at Mouth	14F 9	4	4	2	4	2	16
Thornapple River, Above Unnamed Tributary	14D 22	3	3	3	4	2	16
Buck Creek, at Sharps Creek	14 93	4	1	3	4	3	15
Coldwater River, Above Duck creek	14D 28	4	4	3	3	1	15
Coldwater River, at Messer Brook	14D 27	4	4	4	2	1	15

Table 3.11 - Critical Area Ranking for Subwatersheds

Subwatershed	Sub ID	Stream Temperature Fluctuation Ranking	Stormwater Runoff Ranking	Land Use Ranking	Population Ranking	Impervious Ranking	Total Rank
Duck Creek, at Mouth	14D 29	4	4	4	2	1	15
Duke Creek, Above Frost Creek	14F 4	4	4	2	3	2	15
East Fork, at Mouth	14 98	4	1	3	4	3	15
Goose Creek, at Mouth	14 58	4	4	4	2	1	15
Grand River, at Deer Creek	14 103	1	4	3	4	3	15
Grand River, at Mill Creek	14 87	1	4	3	4	3	15
Little Thornapple River, at Mouth	14D 4	4	4	4	2	1	15
Mill Creek, at Mouth	14 86	4	1	4	4	2	15
Mud Creek, Above Hagar Creek	14D 15	4	4	4	2	1	15
Plaster Creek, Above Little Plaster Creek	14 90	4	1	3	4	3	15
Quaker Brook, at Mouth	14D 13	4	4	3	3	1	15
Rush Creek, at Mouth	14 96	4	1	3	4	3	15
Thornapple River, Above Thornapple Lake	14D 14	4	4	3	3	1	15
Thornapple River, at Mouth	14D 36	1	4	3	4	3	15
Coldwater River, at Mouth	14D 32	4	4	2	3	1	14
Deer Creek, at Mouth	14 102	4	1	4	3	2	14
Duke Creek, at Mouth	14F 5	4	4	2	3	1	14
East Branch Creek, at Mouth	14 95	4	1	3	4	2	14
Flat River, at Coopers Creek	14E 13	4	4	2	3	1	14

Table 3.11 - Critical Area Ranking for Subwatersheds

Subwatershed	Sub ID	Stream Temperature Fluctuation Ranking	Stormwater Runoff Ranking	Land Use Ranking	Population Ranking	Impervious Ranking	Total Rank
Flat River, at Unnamed Tributary	14E 6	4	4	3	2	1	14
Grand River, at Bellemy Creek	14 75	1	4	3	4	2	14
Grand River, at Gage #04116000	14 71	1	4	3	4	2	14
Grand River, at Mouth	14 117	1	4	2	4	3	14
Grand River, at Sand Creek	14 101	1	4	2	4	3	14
Grand River, at US 31	14 116	1	4	2	4	3	14
Mud Creek, at Mouth	14D 16	4	4	3	2	1	14
Qauker Brook, at Gage #04117000	14D 12	4	4	3	2	1	14
Rogue River, at Gage #04118500	14F 11	1	4	2	4	3	14
Rogue River, at Nash Creek	14F 7	2	4	2	4	2	14
Sand Creek, at Mouth	14 100	4	1	3	4	2	14
Scipio Creek, at Mouth	14D 10	4	4	3	2	1	14
Shanty Creek, at Mouth	14D 9	4	4	3	2	1	14
Thornapple River, at Coldwater River	14D 33	4	4	2	3	1	14
Thornapple River, at Glass Creek	14D 24	4	4	2	3	1	14
Tributary to Fourth Lake, Above Fourth Lake	14E 1	4	4	3	2	1	14
Bear Creek, at Mouth	14 84	4	1	2	4	2	13
Crockery Creek, at Lawrence Drain	14 110	2	4	3	3	1	13
Crockery Creek, at Mouth	14 111	2	4	3	2	2	13

Table 3.11 - Critical Area Ranking for Subwatersheds

Subwatershed	Sub ID	Stream Temperature Fluctuation Ranking	Stormwater Runoff Ranking	Land Use Ranking	Population Ranking	Impervious Ranking	Total Rank
Flat River, at Unnamed Tributary	14E 7	4	4	2	2	1	13
Grand River, Above Maple River	14 59	1	4	3	3	2	13
Grand River, Above Rogue River	14 85	1	4	2	4	2	13
Grand River, Above Thornapple River	14 82	1	4	2	4	2	13
Grand River, at Bass River	14 06	1	4	3	3	2	13
Grand River, at Toles Creek	14 79	1	4	3	3	2	13
Grand River, at Unnamed Tributary	14 81	1	4	2	4	2	13
Grand River, at Webber Dam	14 57	1	4	4	3	1	13
Lake Creek, at Mouth	14 78	1	4	3	3	2	13
Rogue River, Above Cedar Creek	14F 8	1	4	2	4	2	13
Rogue River, Above Duke Creek	14F 3	3	4	2	3	1	13
Rogue River, at Hickory Creek	14F 2	4	4	2	2	1	13
Thornapple River, at Unnamed Tributary	14D 35	1	4	2	4	2	13
Townline Creek, at Mouth	14E 3	1	4	3	3	2	13
Alder Creek Drain, at Mouth	14E 8	3	3	2	3	1	12
Bear (Tyler) Creek, at Mouth	14D 31	1	4	4	2	1	12
Beaver Dam Creek, at Mouth	14E 14	1	4	3	3	1	12
Bellemy Creek, Above Spring Brook	14 73	1	4	4	2	1	12
Bellemy Creek, at Mouth	14 74	1	4	3	3	1	12

Table 3.11 - Critical Area Ranking for Subwatersheds

Subwatershed	Sub ID	Stream Temperature Fluctuation Ranking	Stormwater Runoff Ranking	Land Use Ranking	Population Ranking	Impervious Ranking	Total Rank
Crockery Creek, Above N Br Crockery Creek	14 108	1	4	3	3	1	12
Dickerson Creek, at Mouth	14E 20	3	4	2	2	1	12
Dickerson Creek, at Unnamed Tributary	14E 18	1	4	3	3	1	12
Flat River, at Fallasburg Dam	14E 23	2	4	3	2	1	12
Glass Creek, at Mouth	14D 23	1	4	2	4	1	12
Libhart Creek, Above Taylor Drain	14 60	1	4	4	2	1	12
Norris Creek, Above Willow Hill Creek	14 114	1	4	2	3	2	12
Prairie Creek, Above Bacon Creek	14 65	1	4	4	2	1	12
Sessions Creek, at Mouth	14 72	1	4	4	2	1	12
Unnamed Tributary, at Mouth	14E 19	3	3	2	3	1	12
Black Creek, Above Clear Creek	14E 9	1	4	3	2	1	11
Black Creek, at Mouth	14E 2	1	4	3	2	1	11
Coopers Creek, at Mouth	14E 12	1	4	2	3	1	11
Dickerson Creek	14E 17	1	4	3	2	1	11
Grand River, Above Flat River	14 80	1	4	2	3	1	11
Grand River, Above Prairie Creek	14 64	1	4	2	3	1	11
Grand River, at Crockery Creek	14 112	1	4	2	3	1	11
Grand River, at Crooked Creek	14 77	1	4	3	2	1	11
Honey Creek, at Mouth	14 83	4	1	2	3	1	11

Table 3.11 - Critical Area Ranking for Subwatersheds

Subwatershed	Sub ID	Stream Temperature Fluctuation Ranking	Stormwater Runoff Ranking	Land Use Ranking	Population Ranking	Impervious Ranking	Total Rank
Lacey Creek, at Mouth	14D 7	1	4	3	2	1	11
Libhart Creek, at Mouth	14 63	1	4	3	2	1	11
N Br Crockery Creek, at Mouth	14 107	1	4	3	2	1	11
Prairie Creek, Above Ross and Branch Drain	14 67	1	4	3	2	1	11
Prairie Creek, at Unnamed Tributary	14 69	1	4	3	2	1	11
Seely Creek, at Mouth	14E 21	1	4	2	3	1	11
Spring Lake, at Outlet	14 115	1	1	2	4	3	11
Wabasis Creek, at Mouth	14E 15	1	4	2	3	1	11
Pratt Lake Creek, at Mouth	14D 30	1	1	3	3	2	10
Bass River, at Mouth	14 105	1	1	3	3	1	9
High Bank Creek, at Mouth	14D 17	1	1	3	3	1	9
Cedar Creek, at Mouth	14D 19	1	1	2	3	1	8
Bacon Creek, at Mouth	14 66	0	0	3	3	1	N/A
Bass Creek, Above Little Bass Creek	14 104	0	0	4	2	2	N/A
Butternut Creek, at Mouth	14D 2	0	0	3	4	3	N/A
Cedar Creek, Above Kellie Creek	14D 18	0	0	2	3	1	N/A
Clear Creek, at Lincoln Lake Outlet	14E 10	0	0	3	3	1	N/A
Duncan Creek, at Mouth	14D 25	0	0	4	3	1	N/A
Fall Creek, at Mouth	14D 21	0	0	2	3	1	N/A

Table 3.11 - Critical Area Ranking for Subwatersheds

Subwatershed	Sub ID	Stream Temperature Fluctuation Ranking	Stormwater Runoff Ranking	Land Use Ranking	Population Ranking	Impervious Ranking	Total Rank
Grand River, at Portland Municipal Dam	14 56	0	0	4	4	2	N/A
Indian Mill Creek, at Mouth	14 88	0	0	3	4	3	N/A
Little Libhart Creek, at Mouth	14 62	0	0	4	2	1	N/A
Pottawattomie Bayou, at Outlet	14 113	0	0	2	4	3	N/A
Red Creek, at Mouth	14 76	0	0	3	3	1	N/A
Rogue River, at Ransom Lake Outlet	14F 1	0	0	2	3	1	N/A
Taylor Drain, at Mouth	14 61	0	0	4	3	2	N/A
Thornapple River, at Butternut Creek	14D 1	0	0	3	3	1	N/A
Thornapple River, at Darken and Boyer Drain	14D 6	0	0	4	2	1	N/A
Thornapple River, at Gage #04117500	14D 20	0	0	2	3	1	N/A
Thornapple River, at Gage #04118000	14D 34	0	0	2	4	1	N/A
Thornapple River, at Lacey Creek	14D 8	0	0	4	2	1	N/A
Thornapple River, at Mill Pond Dam	14D 11	0	0	3	3	2	N/A
Unnamed Tributary, at Mouth	14E 5	0	0	3	2	1	N/A
Unnamed Tributary, at Mouth	14 68	0	0	3	3	1	N/A

3.5 PROPOSED IMPLEMENTATION ACTIVITIES

3.5.1 BEST MANAGEMENT PRACTICES

The MDEQ provides a list of BMPs that have been evaluated based on their effectiveness for addressing pollutants.

The list includes a description of the BMP, the pollutant controlled, impacts, applications, relationship to other BMPs, construction specifications, and maintenance requirements. The list of practices and the link to the website for each practice is listed in Table 3.12.

Table 3.12 -Michigan Department of Environmental Quality Best Management Practice Links

Best Management Practices	BMP Links (must be connected to the internet)
MDEQ NPS BMP INDEX	http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3714-13186--,00.html
Access Road	http://www.deq.state.mi.us/documents/deq-swq-nps-ar.pdf
Buffer/Filter Strip	http://www.deq.state.mi.us/documents/deq-swq-nps-bfs.pdf
Catch Basins	http://www.deq.state.mi.us/documents/deq-swq-nps-cab.pdf
Critical Area Stabilization	http://www.deq.state.mi.us/documents/deq-swq-nps-cas.pdf
Community Car Washes	http://www.deq.state.mi.us/documents/deq-swq-nps-car.pdf
Check Dam	http://www.deq.state.mi.us/documents/deq-swq-nps-cd.pdf
Construction Barrier	http://www.deq.state.mi.us/documents/deq-swq-nps-cob.pdf
Constructed Wetlands	http://www.deq.state.mi.us/documents/deq-swq-nps-conw.pdf
Dust Control	http://www.deq.state.mi.us/documents/deq-swq-nps-dc.pdf
Diversions	http://www.deq.state.mi.us/documents/deq-swq-nps-div.pdf
Dune/Sand Stabilization	http://www.deq.state.mi.us/documents/deq-swq-nps-dss.pdf
Dewatering	http://www.deq.state.mi.us/documents/deq-swq-nps-dw.pdf
Extended Detention Basin	http://www.deq.state.mi.us/documents/deq-swq-nps-edb.pdf
Equipment Maintenance and Storage Area	http://www.deq.state.mi.us/documents/deq-swq-nps-ems.pdf
Filters	http://www.deq.state.mi.us/documents/deq-swq-nps-fil.pdf
Fertilizer Management	http://www.deq.state.mi.us/documents/deq-swq-nps-fm.pdf
Grading Practices	http://www.deq.state.mi.us/documents/deq-swq-nps-gp.pdf
Grade Stabilization Structures	http://www.deq.state.mi.us/documents/deq-swq-nps-gss.pdf
Grassed Waterways	http://www.deq.state.mi.us/documents/deq-swq-nps-gw.pdf
Household Hazardous Waste Disposal	http://www.deq.state.mi.us/documents/deq-swq-nps-hhhw.pdf
Infiltration Basin	http://www.deq.state.mi.us/documents/deq-swq-nps-ib.pdf
Infiltration Trench	http://www.deq.state.mi.us/documents/deq-swq-nps-it.pdf
Land Clearing	http://www.deq.state.mi.us/documents/deq-swq-nps-lc.pdf
Lawn Maintenance	http://www.deq.state.mi.us/documents/deq-swq-nps-lm.pdf
Modular Pavement	http://www.deq.state.mi.us/documents/deq-swq-nps-mp.pdf
Mulching	http://www.deq.state.mi.us/documents/deq-swq-nps-mul.pdf
Organic Debris Disposal	http://www.deq.state.mi.us/documents/deq-swq-nps-odd.pdf
Oil Grit Separators	http://www.deq.state.mi.us/documents/deq-swq-nps-ogs.pdf
Porous Asphalt Pavement	http://www.deq.state.mi.us/documents/deq-swq-nps-pap.pdf
Pond Construction and Management	http://www.deq.state.mi.us/documents/deq-swq-nps-pcm.pdf
Parking Lot Storage	http://www.deq.state.mi.us/documents/deq-swq-nps-pls.pdf
Pesticide Management	http://www.deq.state.mi.us/documents/deq-swq-nps-pm.pdf
Pond Sealing and Lining	http://www.deq.state.mi.us/documents/deq-swq-nps-ps.pdf
Riprap	http://www.deq.state.mi.us/documents/deq-swq-nps-rip.pdf
Roof Top Storage	http://www.deq.state.mi.us/documents/deq-swq-nps-rts.pdf
Sediment Basin	http://www.deq.state.mi.us/documents/deq-swq-nps-sb.pdf
Stream Bank Stabilization	http://www.deq.state.mi.us/documents/deq-swq-nps-sbs.pdf
Storm Water Conveyance Channel	http://www.deq.state.mi.us/documents/deq-swq-nps-scc.pdf
Subsurface Drain	http://www.deq.state.mi.us/documents/deq-swq-nps-sd.pdf
Seeding	http://www.deq.state.mi.us/documents/deq-swq-nps-see.pdf
Soil Management	http://www.deq.state.mi.us/documents/deq-swq-nps-sm.pdf
Stabilized Outlet	http://www.deq.state.mi.us/documents/deq-swq-nps-so.pdf
Sodding	http://www.deq.state.mi.us/documents/deq-swq-nps-sod.pdf
Spoil Piles	http://www.deq.state.mi.us/documents/deq-swq-nps-sp.pdf
Staging and Scheduling	http://www.deq.state.mi.us/documents/deq-swq-nps-ss.pdf
Slope/Shoreline Stabilization	http://www.deq.state.mi.us/documents/deq-swq-nps-sss.pdf
Street Sweeping	http://www.deq.state.mi.us/documents/deq-swq-nps-sw.pdf
Tree Protection	http://www.deq.state.mi.us/documents/deq-swq-nps-tp.pdf
Water Course Crossing	http://www.deq.state.mi.us/documents/deq-swq-nps-wac.pdf
Wet Detention Basin	http://www.deq.state.mi.us/documents/deq-swq-nps-wdb.pdf
Wet Land Crossing	http://www.deq.state.mi.us/documents/deq-swq-nps-wec.pdf
Winter Road Maintenance	http://www.deq.state.mi.us/documents/deq-swq-nps-wrm.pdf

The Urban, Rural, and Technical Subcommittees used the MDEQ BMP list to identify what structural and vegetative BMPs could be used to reduce potential sources of pollutants from both urban and rural areas in the LGRW. The subcommittees then developed a spreadsheet that listed the structural and vegetative BMPs and their characteristics that are currently being used or considered to address the pollutants. The structural and vegetative BMPs were categorized into practices of pretreatment, detention/retention, vegetated treatment, infiltration, filtration, and agricultural (Table 3.13).

Table 3.13 - Structural and Vegetative Best Management Practices

Best Management Practice	Description	Pollutant Addressed	Pollutant Removal Efficiency	Potential Sources of Pollutants	Additional BMPs to Complete Treatment Train	Expected Life Span	Maintenance Requirements	Training Requirements	Applicability to Site	Environmental Concerns	Hydrologic Effects to Consider	Installation Costs	Operation and Maintenance Costs	Special Considerations	Communities Using BMP	MDEQ/NRCS Link
Pretreatment (e.g., sediment traps, drainage channels, water quality inlets)																
Catch basin inlet devices	Devices that are inserted into the storm drain inlets to filter or absorb sediment, pollutants, and sometimes oil and grease. The capture of hydrocarbons can be enhanced with the use of absorbents.	Solids, sediments	Moderate to high; 70% of total suspended solids (5); <20% of total phosphorous. Assume same as Hydrodynamic Separators.	Storm water runoff	Catch basin cleaning program	2 - 5 years	High; Remove and dispose of sediment, trash and debris, and change filters as needed (approximately every 6 months)	Low/moderate	Needs less than 5 acres of drainage area	Proper disposal of sediment		$50 - 1,500 (5)	$300/Catch Basin/year (5)	Useful for retrofit	MDOT	
Permanent Sediment Basin (including forebays)	Man-made depression in the ground where runoff water is collected and stored to allow suspended solids to settle out. May have inlet and outlet structures to regulate flow.	Sediments, solids	Moderate to high; 50% of Total Suspended Solids(4); <20% of Total Phosphorous (4)	Storm water runoff	Detention/Infiltration	50+ years	Moderate; Remove and dispose of sediment, trash and debris, and repair erosion.	Low	Use for large drainage areas (≥ 1 acre), at storm sewer outfalls, may be included with detention pond, and to collect overland flow.			Low; Capital Cost: $0.60/cft of storage volume excluding land purchase. (1)	7% of capital cost/year. (1)	Not always aesthetically pleasing	Wyoming	http://www.deq.state.mi.us/documents/deq-swq-nps-sb.pdf
Combination curb with water spreader and vegetated swale	Curb with cut outs. Storm water is directed off the street at the cut out areas (not spillways).	Sediments, water volumes	High; 80% of total suspended solids. 50% of total phosphorous.	Storm water runoff	Vegetated swale, detention pond	30+ years (6)	Moderate; Remove and dispose of sediment, trash and debris, and repair erosion.	Low			Capacity must be equal to swale or channel	Moderate	Low	Need to stabilize cut out sections behind curb to prohibit soil erosion. Requires a vegetated swale behind the curb. Street sweeping.		
Check dams, Grade control structures (NRCS practice 410)	Stones, sandbags, or gravel generally used to stabilize grades in natural or artificial channels by carrying runoff from one grade to another. Designed to prevent banks from slumping, reduce runoff velocity, and prevent channel erosion from an excessive grade.	Sediment and attached pollutants, hydrologic flow	High (classic gully erosion) (12) Moderate (streambank erosion) (12) Low (runoff/ flooding) (12)	Streambank erosion, soil erosion, storm water runoff	Buffer/filter strips, grassed waterway, diversion, critical area planting	20+ years	Low. Periodic inspections. Repair/replace failing structures. Address any vegetation and erosion plems.	Moderate. Design and installation should be done by a registered professional engineer	Widely applicable to erosive areas with an excessive grade. Place in drainage channel.	Concentrated flows may cause erosion downstream - discharge point should be investigated.	Cause backwater effect; slows down water velocities; capacity equal to channel	Low to moderate. $4,650/structure or $800/vegeted chute (9) - EQIP, WHIP	Low. $60 structure (9)	Use native grasses when planting filter strip. Easements or permits may need to be obtained.	GVSU; Barry, Ionia, Ottawa County Road Commissions	http://www.deq.state.mi.us/documents/deq-swq-nps-cd.pdf
Hydrodynamic Separator Units (Continuous Deflective Separation (CDS) Units, Stormceptors, Vortechnics, Downstream Defender)	Precast, flow-through, underground units that capture sediments, debris, and oils (in some units). The capture of oils can be enhanced with the use of absorbents. (CDS, Vortechs, Downstream Defender, Stormceptor)	Sediment, solids	Effective; 60% TSS Removal (1); <20% of total phosphorous (4)	Storm sewer system	Street sweeping, stream protection practices	50+	Moderate; Remove and dispose of sediment, trash and debris	Minimum	Use for small drainage areas (≤ 1 acre) with high pollutant loads, in line with storm sewer system, and to collect overland flow	Proper disposal of sediment	Catches first flush. High flows by-pass unit through pipe system	High. $15,000 per acre of impervious (2); 6,000/cfs capacity	$500 practice (2); $1,000/year (3)	Placed upstream of storm sewer discharge. Unit is below grade. Need to allow access for cleaning the chambers.	East Grand Rapids	http://www.deq.state.mi.us/documents/deq-swq-nps-ogs.pdf

Table 3.13 - Structural and Vegetative Best Management Practices

Best Management Practice	Description	Pollutant Addressed	Pollutant Removal Efficiency	Potential Sources of Pollutants	Additional BMPs to Complete Treatment Train	Expected Life Span	Maintenance Requirements	Training Requirements	Applicability to Site	Environmental Concerns	Hydrologic Effects to Consider	Installation Costs	Operation and Maintenance Costs	Special Considerations	Communities Using BMP	MDEQ/NRCS Link
Detention/Retention (e.g., extended detention basin)																
Ponded Type Detention Basin (wet pond)	Small, man-made basin to maintain a permanent pool of water with emergent wetland vegetation around the bank. Designed to capture and remove particulate matter, nonsoluble metals, organic matter and nutrients through settling. It generally has inlet and outlet structures to regulate flow.	Sediment; nutrients; hydrologic flow	Moderate; 80% of total suspended solids (4) 50% of total phosphorous (4). Of the detention/ retention basins, this practice may be the most effective in removing pollutants.	Storm water runoff	Sediment forebay or other form of pretreatment, riprap, sediment basin, filter	50+ years (1,6)	Low; remove and dispose of sediment, trash and debris; repair erosion; and plant replacement vegetation as needed.	Low; design and installation should be done by a professional	Use for large drainage areas (≥ 10 acre), at storm sewer outfalls, and to collect overland flow. Ponds generally will not work in soils with high infiltration rates.	Possible downstream warming; low bacteria removal; West Nile Virus (aerator can remove threat of West Nile Virus)	Provides full control of peak discharges for large design storms.	Low to moderate; $1/cft of storage volume, excluding land purchase (1)	5% of capital cost/year. (1)	Need available land area, can include sediment forebay, requires more planning, maintenance and land to construct.	East Grand Rapids, Ottawa County Road Commission (OCRC), Housing developments in Barry County, Industrial areas of Wright Township	http://www.deq.state.mi.us/documents/deq-swq-nps-wdb.pdf
Dry Detention Basin	Small, man-made basin designed to capture and remove particulate matter. It generally has inlet and outlet structures to regulate flow, but is dry for most of the year.	Sediment; hydrologic flow	Moderate; 80% of total suspended solids (4) 50% of total phosphorous (4)	Storm water runoff	Sediment forebay or other form of pretreatment	50+ years	Low; remove and dispose of sediment, trash and debris; repair erosion.	Minimum	Needs land that will allow inlet at a higher elevation than outlet	Low bacteria and nutrient removal. If vegetation is not maintained, erosion and resuspension will occur.	Reduced peak flows and no standing water	Low to moderate	Low to moderate	Basin grading very important to prevent pools of standing water.	MDOT, Ottawa County Drain Commission (OCDC)	
Extended Detention Basin	Extended detention basins are designed to receive and detain storm water runoff for a prolonged period of time, typically up to 48 hours. Benefits include: receives and detains storm water runoff, minimizes downstream erosion, reduces flooding, and provides enhanced pollutant removal.	Sediment and attached pollutants, nonsoluble metals, nutrients, hydrologic flow	Moderate to high	Storm water runoff	Riprap, grassed waterways, sediment basins		Moderate to high	Mow buffer/filter strip, remove debris and inspect basin regularly during wet weather, and remove sediment from basin every 5-10 years.	Depends on infiltration rates and soil permeability	Can significantly warm the water in the marsh area over a short period of time	Designed to receive and detain storm water runoff for a prolonged period of time. Outlet device regulates the flow from the basin.			Determine site location of BMP through a hydrologic analysis. Designed as either single stage or two-stage. Need spill response plan.	Housing developments in Barry County	http://www.deq.state.mi.us/documents/deq-swq-nps-edb.pdf
Parking lot storage	Storage of storm water on parking lots is used primarily to reduce the peak discharge of storm water from the surrounding area during moderate storms. Will reduce peak runoff from small sites and provide some flood storage. This helps reduce stream bank erosion and flooding.	Sediment and attached pollutants, hydrologic flow		Storm water runoff, soil erosion	Grassed waterway, porous or modular pavement, infiltration trench, buffer/filter strip, street sweeping		Low to moderate - sweep and clear debris from the parking lot after storms. Regularly inspect and clean the release drain.	Design and installation should be done by a professional	This BMP will work best in areas that do not have a steep slope. Parking lot slope should be 1% or less.	Because detention time is small, only some large solids will settle. Solids must be removed often to prevent resuspension.	Reduces peak runoff from small sites, provides some flood storage, and reduces flooding.			A spill response plan must be developed. BMP is most effective when used with other BMPs that allow for infiltration or sediment trapping.	City of Grand Rapids	http://www.deq.state.mi.us/documents/deq-swq-nps-pls.pdf
Water and Sediment Control Basin (638)	An earth embankment or a combination ridge and channel generally constructed across the slope and minor watercourses to form a sediment trap and water detention basin. Improves water quality by trapping sediment on uplands and reducing gully erosion. Grass cover may provide wildlife habitat. Dissolved substances, such as nitrates, may be removed from discharge to downstream areas because of the increased infiltration.	Sediment and attached pollutants, nutrients, hydrologic flow	High (gully erosion) (12) Moderate (runoff/ flooding) (12) Low (streambank erosion) (12)	Soil erosion, agricultural runoff	Nutrient management, terraces, grassed waterways, contouring, conservation cropping system, conservation tillage, and crop residue management	10 years (9)	Reseed and fertilize as needed. Check basins after large storm events and make necessary repairs.	USDA Natural Resources Conservation Service (NRCS) available for assistance	Widely applicable.	Over application of fertilizer possible.	Traps storm water runoff and prevents it from reaching lowlands. Moderate decrease in runoff/flooding. Slight increase in excess subsurface water. (12)	$2,100 - 3,150/basin (11)	5% of original cost per unit (11)	Basin must be large enough to control the runoff from a 10-year storm without overtopping.	City of Grand Rapids, Southwest Michigan	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/638.pdf

Table 3.13 - Structural and Vegetative Best Management Practices

Best Management Practice	Description	Pollutant Addressed	Pollutant Removal Efficiency	Potential Sources of Pollutants	Additional BMPs to Complete Treatment Train	Expected Life Span	Maintenance Requirements	Training Requirements	Applicability to Site	Environmental Concerns	Hydrologic Effects to Consider	Installation Costs	Operation and Maintenance Costs	Special Considerations	Communities Using BMP	MDEQ/NRCS Link
Regional Detention	Large, man-made basin designed to capture and remove particulate matter. It generally has inlet and outlet structures to regulate flow from large drainage areas.	Sediment; nutrients; hydrologic flow	Moderate	Storm water runoff	Sediment forebay or other form of pretreatment	50+ years	Low; remove and dispose of sediment, trash and debris; repair erosion.	Minimum	Use for large drainage areas (≥ 1 acre), at storm sewer outfalls, and to collect overland flow.	Possible downstream warming; low bacteria removal; West Nile Virus	Reduced peak flows, storage	Moderate	Low to Moderate	Need available land area, can include sediment forebay.	OCDC, KCDC, City of Wyoming	
Vegetated Treatment (e.g., constructed wetland, grassed swale)																
Constructed Wetland	Excavated basin with irregular perimeters and undulating bottom contours into which wetland vegetation is placed to enhance pollutant removal from storm water runoff.	Sediment, nutrients, bacteria	Moderate to high depending on season; 80% of total suspended solids (4) 50% of total phosphorous (4)	Storm water runoff	Sediment forebay or other form of pretreatment	50+ years (1)	High; remove and dispose of sediment, trash and debris; repair erosion.	Moderate to High	Significant land use requirement; needs appropriate soils, slope, and hydrology	Potential for nutrient release in winter months	Slows flow and reduces peak flow	Moderate to High; $500 - $1000 excluding purchase of land (3)	2% of capital cost/year (1)	2% of drainage area needs to be wetland for efficient pollutant removal. Harvesting may be necessary if plants are taking up large amounts of toxics. Needs supplement water to maintain water level.	Ottawa County Road Commission	http://www.deq.state.mi.us/documents/deq-swq-nps-conw.pdf
Restored Wetland (NRCS practice 657)	Rehabilitation of a drained or degraded wetland where hydrology and the vegetative community are returned to their natural condition to the extent practicable. Provides natural pollution control by removing pollutants, filtering and collecting sediment, reducing both soil erosion and downstream flooding, and recharging groundwater supplies.	Sediment and attached pollutants, nutrients, hydrologic flow, bacteria, chemicals	Moderate to high (depending on season); 80% of total suspended solids from sheet, rill, wind, or ephemeral gully erosion (4) 50% of total phosphorous (4).	Storm water runoff, soil erosion	Sediment forebay or other form of pretreatment. In agricultural areas cattle exclusion fencing, buffer/filter strip, grassed waterway	50+ years (1)	High; remove and dispose of sediment, trash and debris, and repair eroded areas.	Moderate to High Design and installation should be done by a professional	Site must have previously been a wetland	Can increase water temperature. Potential for nutrient release in winter months	Stores storm water and may reduce downstream runoff and flooding. Slows flow and reduces peak flow.	Low: $200 cost to landowner if wildlife organization involved. Break tile and build berm. $2,350/acre (scwmp)	3% of original cost (11)	Many wetlands release water slowly into the ground which recharges groundwater supplies. One acre of wetland can store up to 1.5 million gallons of floodwater (enough to fill 30 Olympic size swimming pools) (EPA, 2002)	Barry County, Ionia State Park Recreational Area	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/657.pdf
Rain Gardens and other "Landscaping for Water Quality" techniques	Small, vegetated depressions used to promote infiltration and evapo-transpiration of storm water runoff. A rain garden combines shrubs, grasses, and flowering perennials in depressions that allow water to pool for only a few days after a rain. Landscaping for water quality involves planting native gardens in place of turf grass using native grasses, sedges, and wildflowers. Protects water quality, captures rainwater, reduces flooding, eases soil erosion, increases infiltration, and requires less fertilizer and water to thrive.	Sediment and attached pollutants, nutrients, thermal pollution, solids, chemicals, oils, salt, hydrologic flow	High; 75% - 90% of total suspended solids. (3) (8) 75% of total phosphorous. (8)	Storm water runoff, fertilizers	Mulching	Assume 25 years, based on rain gardens installed in the early 1990s in Prince George County, MD which are still functioning. Depends on plant types and owner maintenance .	Low to Medium; remove and dispose of sediment, trash, and debris, repair erosion, re-vegetate, and weed, water, and mulch, annually. Soil replacement and additional preparation are sometimes needed for success. A mulch of shredded hardwood is an integral part of the rain garden to keep the soil moist and ready to soak up rain, and low maintenance.	Moderate, initial work to establish plant community. Aesthetic maintenance after initial establishment of rain garden. Center for Environmental Study, Master Gardeners Program, West Michigan Environmental Action Council available for assistance.	Site specific, depends on soils. Use for drainage areas ≤ 5 acres (8), at storm sewer outfalls, and to collect overland flow. Highly suitable for residential areas, not on steep slopes	Introduction of exotic/invasive plant species possible. Landowner may treat vegetation with herbicides or pesticides which could be carried via runoff to surface waters.	Will reduce the velocity of storm water runoff and increase infiltration	$1,075 - $12,355/ rain garden (dependent on surrounding land use)	Low. Assume $100/year; similar to yearly landscaping maintenance	Use native plant species. Soils adequate for infiltration are required. Cold climates may reduce evapotranspiration and infiltrative capacity. Practice not suitable for slopes greater than 20% (1). Pretreatment (sediment basin) needed in high sediment load areas. Not used in wellhead protection areas.	City of Grand Rapids, City of Holland, City of Grand Rapids, Kalamazoo Public Schools	

Table 3.13 - Structural and Vegetative Best Management Practices

Best Management Practice	Description	Pollutant Addressed	Pollutant Removal Efficiency	Potential Sources of Pollutants	Additional BMPs to Complete Treatment Train	Expected Life Span	Maintenance Requirements	Training Requirements	Applicability to Site	Environmental Concerns	Hydrologic Effects to Consider	Installation Costs	Operation and Maintenance Costs	Special Considerations	Communities Using BMP	MDEQ/NRCS Link
Vegetated Buffers or Filter Strips (NRCS Practice 393)	A buffer/filter strip is a vegetated area adjacent to a water body. The buffer/filter area may be natural, undeveloped land where the existing vegetation is left intact, or it may be land planted with vegetation. Practice protects water bodies from pollutants such as sediment, nutrients and organic matter, prevents erosion, provides shade, leaf litter, and woody debris. Buffer/filter strips often provide several benefits to wildlife, such as travel corridors, nesting sites and food sources.	Sediment and attached pollutants, nutrients, thermal pollution	High to Moderate (streambank erosion) (12) Insignificant (runoff/ flooding) (12)	Runoff from parking lots, roof tops, and outflow from ponds, soil erosion, agricultural runoff	Conservation tillage in agricultural areas	10-20 years (9)	Low. Perform periodic inspections to identify concentrated flows and to verify that vegetative cover is maintaining its effectiveness. Address stream bank erosion if identified. Damaged areas should be repaired.	Low. NRCS available for assistance	Widely applicable		Will reduce the velocity of storm water runoff and increase infiltration.	Low. $350/acre (10). $250/ herbaceous acre (11) – Conservation Reserve Program (CRP), Environmental Quality Management Program (EQIP)	Low. $10/acre (9)	Several researchers have measured >90% reductions in sediment and nitrate concentrations; buffer/filter strips do a reasonably good job of removing phosphorus attached to sediment, but are relatively ineffective in removing dissolved phosphorus (Gilliam, 1994).	Typical in counties of the LGRW.	http://www.deq.state.mi.us/documents/deq-swq-nps-bfs.pdf ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/393.pdf
Forested or Wooded Riparian Buffer (NRCS practice 390)	Forested or wooded areas adjacent to stream	Sediment and attached pollutants, nutrients, thermal pollution	High (sheet, rill, wind, streambank, soil mass movement, road bank/ construction erosion; organics, fertilizers, pesticides, runoff/ flooding) (12)	Runoff from parking lots, roof tops, and outflow from ponds, soil erosion, storm water runoff	Filter strip	15 years (9)	Low. Perform periodic inspections to identify concentrated flows and to verify that vegetative cover is maintaining its effectiveness. Address stream bank erosion if identified. Damaged areas should be repaired.	Moderate to High. NRCS/Michigan Department of Agriculture (MDA) available for assistance	Widely applicable	Poor or lack of maintenance may cause increased erosion if trees fall into stream	Trees in the floodplain may catch debris and impede flow.	Low. $475/forrested acre (11) - CRP, EQIP	1% of original cost (11)	Keep south and west sides of streams wooded to provide shade. Several researchers have measured >90% reductions in sediment and nitrate concentrations; buffer/filter strips do a reasonably good job of removing phosphorus attached to sediment, but are relatively ineffective in removing dissolved phosphorus (Gilliam, 1994).	Ottawa County Parks, typical in counties of the LGRW (e.g. Barry County)	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/390.pdf
Two-stage channel design	A practical procedure that can be used to correctly size the stream channel and minimum bench widths for stable, effective discharge in agricultural drainage ditches. The bench of a two-stage ditch acts as a floodplain within the ditch to dissipate energy, reduces the erosive potential of high flow volumes, and reduces the shear stress on the bank toe. Two-stage ditches will have improved conveyance capacity, will be more self sustaining, will create and maintain better habitat, and will improve water quality.	Sediment, hydrologic flow		Agricultural runoff	Filter/buffer strips		May require less maintenance then conventional ditches.	The Nature Conservancy has information available for assistance.	Widely applicable.		Two-stage ditches have improved conveyance capacity compared to conventional ditches and enhance drainage	In comparison to conventional ditches, additional costs are related to increased width and more initial earthwork.	May result in less annual Operation & Maintenance (O&M) costs then conventional ditches.	Evidence and theory both suggest that ditches prone to filling with accumulated sediment may require less frequent "dipping out" if constructed in a two-stage form.		

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Infiltration (e.g., infiltration basin)																
Infiltration Trench	An excavated trench (3 - 12 feet deep), backfilled with stone aggregate, and lined with filter fabric. Infiltration trenches remove fine sediment and the pollutants associated with them.	Nutrients, sediment, metals, hydrologic flow (soluble pollutants - dependent on holding time)	High; 100% of total suspended solids (4); 60% of total phosphorous.	Storm water runoff	Sediment basin, buffer/filter strips, oil/grit separators	Short; 10 years or less (1)	Low to Moderate - Annual; Remove and dispose of sediment, trash and debris. Eroding or barren areas must be re-vegetated.	Moderate. Design and installation should be done by a professional	Site specific; depends on soils. Soil infiltration rates must be greater than 0.52 inches per hour, with clay content less than 30%.	If storm water runoff contains high amounts of soluble contaminants, groundwater contamination can occur.	Provides full control of peak discharges for small sites, provides groundwater recharge, may augment base stream flow, and allow infiltration.	Moderate; average $8/cubic feet of storage (1)	9% of capital cost (1)	Avoid areas with potential hazardous material contamination. Soils with high infiltration rates required. Cold climates may hinder infiltrative capacity, fines will clog pore space in soil, and practice is not suitable for steep slopes. Use as part of a "treatment train," where soluble organic substances, oils, and coarse sediment are removed prior to storm water entering the trench. A very high failure rate occurs with infiltration trenches if they are not maintained.	MDOT, Ottawa and Barry Counties	http://www.deq.state.mi.us/documents/deq-swq-nps-it.pdf
Infiltration Pond	Water impoundment over permeable soils which receives storm water runoff and contains it until it infiltrates the soils.	Nutrients, sediment, metals	High	Storm water runoff	Sediment forebay or other form of pretreatment	25+ years	Annual	Moderate	Site specific depends on soils	Potential to contaminate groundwater	May recharge groundwater	Moderate	Moderate	Avoid areas with potential hazardous material contamination	MDOT	http://www.deq.state.mi.us/documents/deq-swq-nps-ib.pdf
Porous or Modular Pavement	Permeable asphalt or interlocking paving blocks providing infiltration. When the brick or concrete is laid on a permeable base, water will be allowed to infiltrate. Benefits include: removal of fine particulates and soluble pollutants; attenuation of peak flows; reduction in the volume of runoff; reduction in soil erosion; and groundwater recharge.	Nutrients, sediment, metals, hydrologic flow	High; 95% TSS removal rate (2)	Storm water runoff	Vacuum sweeping, subsurface drains, extended detention basin, infiltration basin.	10+ years	Moderate; Bi annual sweeping required. Periodically inspect, especially after large storms. If severe clogging occurs, may have to replace filtering material.	Low. Design and installation should be done by a professional	This practice should only be used on sites with soils which are well or moderately well drained. Must use special materials for high traffic areas	Potential risk to groundwater due to oils, greases, and other substances that may leak onto the pavement and leach into the ground.	Provides soil infiltration, attenuation of peak flows, reduction in the volume of runoff leaving the site and entering storm sewers, and groundwater recharge.	Moderate	Low to Moderate	Pretreatment of storm water is recommended where oil and grease or other potential groundwater contaminants are expected. Avoid areas with potential hazardous material contamination	MDOT, East Grand Rapids - Reed's Lake boat launch	http://www.deq.state.mi.us/documents/deq-swq-nps-pap.pdf

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Filtration (e.g., sand filters)																
Vegetated Swale or Bio-filtration	A broad, shallow channel consisting of dense vegetation and designed to accommodate concentrated flows without erosion.	Sediment	High; 75% - 80% of total suspended solids (2)(4); 50% of total phosphorous (4)	Storm water runoff	Native vegetation	20-50 years	Moderate; remove and dispose of sediment, trash and debris, and repair erosion.	Moderate	Highly applicable to residential areas, not suited to steep slopes	Potential to contaminate groundwater	Slows flow	Low; $0.50/square foot of swale (7)	$0.03/square foot/year. (7)	Does not require a large land area. Should not be used in steep areas or well head areas. Soils adequate for infiltration required to discourage ponding on slopes less than 2%.	MDOT	
Sand Filters	Area designed to hold and treat the first half inch of runoff discharging from an adjacent impervious area.	Sediment, bacteria, nutrients, metals	Moderate; 83% TSS removal rate (2)	Storm water runoff		Yet to be determined	Moderate to High depending on amount of sediment	Moderate	Suitable for individual developments; requires less land and can be placed underground.	Will not filter soluble nutrients and toxics		Low to moderate	5% of initial construction costs (1)	BMP performance is still experimental		
Agricultural BMPs																
Cattle Exclusion (NRCS practices: Use Exclusion (472), Fence (382))	Fencing to exclude cattle from waterbodies and protect streambanks. Fencing prevents cattle from trampling banks, destroying vegetation, depositing waste in the stream, and stirring up sediment in the streambed.	Sediment and attached pollutants, nutrients, pathogens	Moderate to High (12)	Livestock access, animal manure	Buffer/filter strip, alternative water sources for livestock, planned grazing system, stream crossing and livestock access	10 years (use exclusion) (15) 20 years (fence) (9)	Repair fence as needed. Remove off-stream watering systems in the winter, if needed.	NRCS available for assistance	Widely applicable	Increased grazing in confined areas may reduce vegetative cover	Fencing in floodplain may catch debris and restrict flow	$1.90/ft of fence (9) - EQIP (use exclusion) Wildlife Habitat Incentive Program (WHIP) (fence)	$0.05/ft of fence (9)	Additional BMPs (e.g. Buffer/Filter Strips) are needed to prevent animal waste runoff from entering the stream.	Typical in counties of the LGRW (e.g. Barry County)	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/472.pdf ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/382.pdf
Agricultural Waste Storage Facility (313)	A waste storage impoundment that protects water bodies from manure runoff by storing manure until conditions are appropriate for field application. Several options exist including an earthen storage pond, above or below ground tank, pit underneath a confinement facility, or a sheltered concrete slab area. Allows for field application when conditions are right. Field application cuts fertilizer costs and reduces nutrient losses.	Nutrients, pathogens	Moderate (organics (12), fertilizers (12), and polluted storm water runoff)	Animal manure	Cattle exclusion fencing, roof runoff management, diversion, Comprehensive Nutrient Management Plan (CNMP)	15 years (15)	Inspect storage structures for leaks or seepage periodically and make necessary repairs. Repair any damaged fences immediately. Empty storage structure twice a year.	NRCS available for assistance	Widely applicable	Leaks or seepage of the structure could add nutrients and bacteria to downstream water bodies via runoff. However, if building is according to specifications this would not occur.		Approximately $10,000 - 250,000 (14) - (12) - EQIP	$250 - 1,000 maximum (14)	Storage period should be 6 months unless winter applied risk index is completed	Typical in counties of the LGRW (e.g. Barry County, Ottawa County)	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/313.pdf

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Alternative Water Sources (Watering Facility (614), Water Well (642))	A readily available source of clean drinking water for cattle located away from water bodies. Reduces the direct deposition of cattle waste into water bodies by changing animal behavior through providing alternate drinking water.	Sediment and attached pollutants, nutrients, pathogens		Livestock access, animal manure	Cattle exclusion fencing, buffer/filter strip, planned grazing system, stream crossing and livestock access	10 years / watering facility (15) 20 years / water well (15)	Watering facility: check for materials in the trough which may restrict the inflow or outflow system; check for leaks and repair immediately; check the automatic water level device to insure proper operation. Water well: create a maintenance plan including a log of identified problems, corrective actions taken, etc.	NRCS available for assistance	Widely applicable	Depending on the structure, it may not protect watercourse if contiguous with it	Diversion of water	$1,050 / water facility (11) - EQIP	2% original cost (watering facility) (11) 1% original cost (water well) (11)	Areas adjacent to source that will be trampled by livestock should be graveled, paved, or otherwise treated to provide firm footing and reduce erosion.	Typical in counties of the LGRW (e.g. Barry County, Ottawa County)	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/614.pdf ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/642.pdf
Cover Crop (340)	A crop of close-growing, grasses, legumes, or small grain grown primarily for seasonal protection and soil improvement. It usually is grown for 1 year or less, except where there is permanent cover as in orchards. Temporarily protects ground from wind / water erosion, adds organic matter to the soil, recycles or holds nutrients, improves soil tilth, reduces weed competition, retained soil moisture by acting as a mulch, and fixes atmospheric nitrogen (legumes).	Sediment and attached pollutants, nutrients, chemicals (pesticide), hydrologic flow, chloride (salt)	High (sheet, rill, wind, gully irrigation induced erosion, runoff/ flooding) (12) Moderate (salts, organics, fertilizers, pesticides) (12)	Soil erosion, agricultural runoff	Pest management, nutrient management, conservation crop rotation, crop residue management	1 year (9)	Plant cover crop annually, kill cover crop in the spring, restrict grazing if necessary	NRCS available for assistance	Widely applicable. Consider soil type, slopes, etc.	Requires pest management (IPM) to ensure that pesticide use is appropriate	Significant decrease in runoff/ flooding, moderate reduction in excess subsurface water	$30/acre (9) - EQIP	$0/acre (9)	Can be used for livestock feed or left alone to build soil organic matter.	Organic farmers of the LGRW	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/340.pdf
Windbreak/Shelterbelt Establishment (380)	Rows of trees and shrubs that protect areas from wind and provide food and cover for wildlife. Reduces wind erosion, conserves energy, provides food and cover for wildlife, and beautifies a farmstead.	Sediment and attached pollutants	High (wind erosion only) (12)	Soil erosion	Cattle exclusion fencing	15 years (9)	Control competing vegetation, inspect regularly	NRCS available for assistance	Widely applicable	Over application of herbicides or pesticides possible	Will reduce storm water runoff and increase infiltration	$150 - 1,000 seedlings (13) - EQIP, WHIP	10% of original cost (11)	Consider if the mature windbreak will cast a shadow over the driveway or nearby road, prolonging icy conditions.	Muck farmers in Barry, Kent, Ottawa, and Allegan Counties	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/380.pdf
Conservation Cover (327)	Establishing and maintaining perennial vegetative cover to protect soil and water resource on land retired from agricultural production. Reduces erosion and increases soil tilth due to perennial cover establishment of species adapted to site. Improves water quality when nutrients and sediments are retained on the field. Reduces weed sources. Wildlife food, cover, and water needs will be met.	Sediment and attached pollutants, hydrologic flow, nutrients	High (sheet, rill, wind, gully erosion; runoff/ flooding) Moderate (streambank erosion) (12)	Soil erosion, agricultural runoff	Upland wildlife habitat management, wildlife food plot, tree/shrub establishment	10 years (15)	If necessary, mow during the establishment period to reduce competition from annual weeds. Annual mowing of the conservation cover stand for general weed control is not recommended. Control noxious weeds.	NRCS available for assistance	Widely applicable	Over application of herbicides or pesticides possible	Significant decrease in runoff/ flooding, moderate reduction in excess subsurface water	$260 - 460/acre (9) - CRP, EQIP	$35/acre (9)	Use of fertilizers, pesticides and other chemicals should not compromise the intended purpose. Maintenance practices and activities should not disturb cover during the primary nesting period for grassland species in each state.	Typical in counties of the LGRW (e.g. Barry and Ionia County)	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/327.pdf

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Pasture and Hayland Planting (512)	Planting grass and legumes to reduce soil erosion and improve production in a low-producing pasture, hayfield, or eroding crop field. Reduces soil erosion by wind and/or water, extends length of the grazing season, provides cover and habitat for wildlife, protects water quality by filtering runoff and increasing filtration, and adds organic matter to the soil	Sediment and attached pollutants, nutrients, chemicals (pesticides), hydrologic flow	High (sheet, rill, wind ephemeral gully, irrigation inducted erosion; fertilizers, pesticides, runoff/ flooding) (12)	Soil erosion, agricultural runoff	Nutrient management, pest management, prescribed grazing	10 years (9)	Mow weeds, apply fertilizer and herbicide as needed	NRCS available for assistance	Widely applicable. Consider soil type	Over application of herbicides or pesticides possible	Significant decrease in runoff/ flooding and excess subsurface water	$75/acre (11) - EQIP, CRP	5% of original cost per unit (11)	Do not mix warm and cool season grasses in the same pasture. Choose species that will help reduce the use of pesticides and herbicides.	Typical in counties of the LGRW	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/512.pdf
Critical Area Planting (342)	Establishing permanent vegetation on sites that have or are expected to have high erosion rates, and on sites that have physical, chemical or biological conditions that prevent the establishment of vegetation with normal practices. Stabilizes areas with existing or expected high rates of soil erosion by water and wind. Restores degraded sites that cannot be stabilized through normal methods.	Sediment and attached pollutants, salts	High (sheet, rill, wind, gully, streambank, soil mass movement, road bank/construction erosion) (12) Moderate (salts) (12)	Soil erosion, agricultural runoff	Diversions, riprap, grade stabilization structures, filter/buffer strips, subsurface drains, grassed waterways, nutrient management	10 years (9)	Periodic burning (if needed), prohibit grazing until year 2, prevent overgrazing, inspect after severe storms	NRCS available for assistance	Widely applicable. Consider soil type, slopes, etc. Apply on any area which is difficult to stabilize.	Use of non-native or invasive species is not recommended. Use by recreational users may degrade area.	Will reduce the velocity of storm water runoff and increase infiltration.	$460 - $815/acre (2001 and 2004) EQIP, WHIP, WRP	1 % of original cost per unit (11)	Use native plants with low long term maintenance requirements. Soil tests should be done to determine the nutrient and pH content of the soil.	Typical in counties of the LGRW (e.g. Ottawa County)	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/342.pdf
Grassed Waterway (412)	The establishment and shaping of grass in a natural drainage way to prevent gullies from forming. Vegetation filters runoff and provides cover for wildlife.	Sediment and attached pollutants, hydrologic flow	High (ephemeral gully erosion) (12) Low (reduction in classic gully erosion, runoff/ flooding) (12)	Soil erosion, agricultural runoff	Grade stabilization structure	10 years (9)	Yearly re-grading, reseeding, and inspection of subsurface drain and related outfall may be needed. Fertilize as needed and mow periodically.	Design and installation should be done by a professional. NRCS available for assistance.	Widely applicable	Better conveyance enhances storm water runoff velocities and possible contamination to surface waters	Drainage way directs runoff to an outlet	$800/acre (without tile) (9) $4,500/acre (with tile) (9) CRP, EQIP	$105/acre (9)	A nurse crop, temporary cover or mulching may be necessary until permanent cover is established. Avoid planting end rows along the waterway.	Typical in counties of the LGRW	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/412.pdf
Diversion (362)	Earthen embankment that directs runoff water from a specific area. Reduces soil erosion on lowlands. Vegetation filters runoff water and provides cover. Allows better crop growth on bottomland soils.	Sediment, nutrients, chemicals (pesticide), hydrologic flow	High (ephemeral gully erosion, runoff/ flooding) (12) Moderate (classic gully, soil mass movement, road bank/construction erosion) (12) Low (sheet, rill, streambank erosion, organics, fertilizers, pesticides) (12)	Soil erosion, agricultural runoff	Sediment basin or stabilized outlet, buffer/filter strip, nutrient management	10 years (9)	Clear outlet of debris, maintain vegetative cover on ridge, ridge repair, fertilize as needed	Design and installation should be done by a professional	Widely applicable. Do not build in high sediment producing areas unless other conservation measures are installed.	Over application of fertilizer possible	Catches storm water runoff and prevents it from reaching lowlands, reducing runoff velocity and increasing infiltration	$5.00/ft (9) - EQIP	$0.26/ft (9)	Important as Soil Erosion and Sediment Control (SESC) in developing sites. Each diversion must have an outlet.	?	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/362.pdf

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Other BMPs																
Abandoned Well Closures (Well decommissioning (351))	Well decommissioning seals an abandoned well. Abandoned wells are wells which are no longer in use or are in such disrepair that groundwater can no longer be obtained from them. Benefits include: a) Reduces the risk of groundwater contamination, b) Eliminates the risk of injury, c) Avoids liability under the Michigan Polluter Pay Law	Sediment and attached pollutants, chemicals, nutrients, chloride (salt), pathogens, hydrocarbons	High (13)	Agricultural runoff, hazardous waste spills	Stand alone practice	20 years (9)		High: professional required. A drilled, deep bedrock and artesian well should be closed by a licensed well driller. Farm*A*Syst available for assistance.	Widely applicable.	Groundwater contamination may already be present.	Will prevent surface water from reaching the groundwater supply via the abandoned well.	$50 - $500/closure - Michigan groundwater stewardship program, MDA, EQIP	Low (14)	Filling a well with rocks/gravel will not reduce the groundwater contamination risk. Technical assistance is required to properly close an abandoned well.	Spring Lake Village, Ionia and Barry County	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/351.pdf
Streambank and Shoreline Protection (580)	Treatment(s) used to stabilize and protect banks of streams or constructed channels, and shorelines of lakes, reservoirs, or estuaries, such as bioengineering, rip rap, geotextile materials, and vegetative techniques.	Sediment and attached pollutants	High (streambank erosion, soil mass movement) (12)	Soil erosion	Livestock exclusion, prescribed grazing, buffer/filter strips, diversions, or additional sediment control measures.	20 years (9)	Site inspections conducted to ensure the stream bank structures are staying in place within the first few months of installation and following storm events.	Consult the MDEQ (Water Division or Land Division), local Conservation District, NRCS, or other agencies or consultants.	Widely applicable: site-specific practices will depend on soil type, slope of the bank, river gradient, flow, and uses of the watercourse.		Maintains the capacity of the stream channel.	EQIP: 50% cost share (15)	10% of original cost (11)	Since each reach of a watercourse is unique, stream bank protection techniques must be selected on a site-by-site basis; the specifications for each technique differ. Utilize vegetative species that are native and/or compatible with local ecosystems.	Barry County Drain Commission	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/580.pdf
Dam Removal	Releases made from dams commonly cause a decrease in summer temperatures and an increase in winter temperatures downstream. Dam removal benefits fish by: (a) removing obstructions to upstream and downstream migration; (b) restoring natural riverine habitat; (c) restoring natural seasonal flow variations; (d) eliminating siltation of spawning and feeding habitat above the dam; (e) allowing debris, small rocks and nutrients to pass below the dam, creating healthy habitat; (f) eliminating unnatural temperature variations below the dam; and (g) removing turbines that kill fish.	Thermal pollution		Dam	Will depend on the effects of dam removal. Streambank stabilization may be necessary.	Permanent		Design and removal should be done by a professional	Widely applicable to unsafe dams and dams that no longer serve a purpose.	Recent studies show removal of small dams can have limited negative environmental impacts while restoring stream functions. Negative impacts include elevated sediment loads in addition to transformed channel morphology and hydrology. Dam removal may also wreak havoc on already highly disturbed ecosystems. Reservoirs that store high levels of contaminants may release them following dam removal, creating a contaminant plume.	Dam removal will restore natural stream flow and natural seasonal flow variations.	A number of studies (River Alliance of Wisconsin 2003, American Rivers 2003) have found removal costs to be up to 1/3 to 1/5 the cost of repair, especially when the benefits of the dam are minor. Funding sources include: private or community foundation funding, environmental grants, and state or federal assistance programs.	None	Many aging dams are no longer economically practical or cost effective to operate. Similarly, dam operation and maintenance costs tend to increase as a dam ages. These increased costs, combined with the potentially lower revenue, allow for removal to become the most cost effective alternative for the dam owner.	Stronach Dam, on the Pine River, Manistee County Big Rapids dam on Muskegon River, Mecosta County	

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Stabilized Outlets	Outlets are areas which receive discharge water. Stabilized outlets are outlets which reduce the velocity of discharge water to non-erosive velocities. Stabilized outlets help reduce erosion in the area where water is released. Some outlets may also provide treatment of various types of pollutants. Types of outlets include: conveyance outlets (grassed waterway, stone filters, stormwater conveyance channel); water storage outlets (sediment basin, infiltration basin, detention/retention basin, oil/grit separators, Wet ponds and wetlands); conduits; and outlet protection.	Sediment and attached pollutants, hydrologic flow	Dependent on type of outlet used.	Storm water runoff, streambank erosion	Riprap, if needed	Dependent on type of outlet used.	Requires regular maintenance.	Stabilized outlets should be designed by a registered professional engineer.	Widely applicable.	If outlets are not maintained, excessive sediment may be introduced to surface waters downstream.	Stabilized outlets will reduce the velocity of discharge water to non-erosive levels.	Dependent on type of outlet used.	Dependent on type of outlet used.	If the outlet is a county or intercounty drain, permission to discharge must be obtained from the	Drain commissioner or drain board. The actual structure may require a MDNR permit if the outlet is in a watercourse or if wetlands are impacted.	http://www.deq.state.mi.us/documents/deq-swq-nps-so.pdf
Emergency Spill Kit	Kit materials capture oil, gasoline, and diesel spills on water.	Hydrocarbons		Boat spill					Applicable to lakes							
Pond Construction and Management (378)	A water impoundment made by constructing an embankment or by excavating a pit or dugout. Excavated ponds are made for conditions which require a small supply of water such as a golf course hazard. Embankment ponds hold larger volumes of water. Ponds can be used for storm water management and to attract wildlife. Properly designed and maintained embankment ponds provide a safe, reliable means of water supply, and may become the settling area for sediment and contaminants in the drainage area. If water quantity is more critical than quality, runoff can be used to maintain higher pond levels of an excavated pond.	Sediment and attached pollutants, chemicals, nutrients, flooding	Low (gully erosion, streambank erosion, flooding) None (sheet and rill erosion) N/A (chemicals, nutrients)	Storm water runoff	Slope/Shoreline Stabilization, Seeding, Mulching, Sodding, Pond Sealing or Lining	20 years (2004)	Moderate to High	Design and installation should be done by a professional	Depends on soil suitability. Build ponds in areas where the water supply is adequate for the intended use.	Purple loosestrife (Lythrum salicaria) is an undesirable, exotic perennial which often becomes established in disturbed sites.	Ponds can be used for storm water management.		1% of original cost per unit (2001)	For excavated ponds, consider drainage characteristics, including depth to the water table. For embankment ponds, consider upstream drainage characteristics and how the pond will affect downstream flows, temperatures, etc.	City of Grand Rapids, Barry and Ionia Counties	
Composting Facility (317)	A facility for the biological stabilization of waste organic material. The purposed is to treat waste organic material biologically by producing a humus-like material that can be recycled as a soil amendment and fertilizer substitute or otherwise utilized in compliance with all laws, rules, and regulations. Keeps organic debris out of surface waters and away from floodplains, which helps prevent the depletion of oxygen in surface waters.	Nutrients, low dissolved oxygen (DO)		Upland source (yard trimmings and kitchen waste)	N/A	15 years / composting facility (2004)	Composting requires proper aeration, watering and mixing in order to result in a useable end product. Product can be sold, delivered, and applied.	Design and installation should be done by a professional	Widely applicable to dense residential or riparian sites. Soils, topography and climate will all affect the types of composting options available.	Waste needs to be composted and correctly applied as fertilizer. Runoff from compost application may contaminate surface waters.	N/A	$37,000/ composting facility (2004)	Annual Maintenance $370/ year composting facility (2004)	As of March 27, 1993, yard waste collected or generated in Michigan on public property is banned from land fills and incinerators.	Green Rock Landscape Supply, Rockford Phoenix Resources, Alto Eagle Ottawa Leather Company, Grand Haven	

Table 3.13 - Structural and Vegetative Best Management Practices

Best Management Practice	Description	Pollutant Addressed	Pollutant Removal Efficiency	Potential Sources of Pollutants	Additional BMPs to Complete Treatment Train	Expected Life Span	Maintenance Requirements	Training Requirements	Applicability to Site	Environmental Concerns	Hydrologic Effects to Consider	Installation Costs	Operation and Maintenance Costs	Special Considerations	Communities Using BMP	MDEQ/NRCS Link
Mulching (484)	The process of placing a uniform layer of straw, wood fiber, wood chips or other acceptable materials over a seeded or landscaped area. Helps keep soil particles and their associated attached chemicals (e.g. phosphorus and pesticides) from entering surface waters. Will suppress weed growth and provide a moist area for vegetative growth.	Sediment and attached pollutants	Low to Moderate	Soil erosion	Seeding, soil management, fertilizer management, grading practices, diversions (if needed).	1 year (2004)	Low: inspect mulched areas following storm events to ensure mulch has stayed in place.	Low	Widely applicable	None known.	Seeded area will eventually reduce the velocity and increase infiltration of storm water runoff.	$3.00/acre (2001)	Annual maintenance 100% of original cost per unit (2001)	Mulch should be applied immediately after seeding has occurred. Anchoring of the mulch should be done immediately after the mulch is applied.	City of Grand Rapids, Barry County Drain Commission	
Riprap	A permanent cover of rock used to stabilize stream banks, provide in-stream channel stability, and provide a stabilized outlet below concentrated flows. The use of riprap protects stream banks and discharge channels from higher erosive flow velocities and decreases sediment input to a watercourse.	Sediment and attached pollutants	High	Soil erosion, agricultural runoff	Filters. (Riprap is often used in making stabilized outlets, in stream bank stabilization, etc.)	10 + years (SV)	Low: Periodically inspect underlying fabric, adjust and add riprap as needed.	Low: consult technical resources	Widely applicable: riprap is most often used in stream banks, on slopes, and at outlets.	Potential to cause additional erosion downstream.	Reduces down cutting and lateral cutting of erosive flow velocities. Typically not a significant velocity reducer.	$70/square yard (2003b) Including geotextile		MDEQ permit may be required if placed in waters of the state. Explore downstream impacts.	Road Commissions	

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3. Michigan Department of Environmental Quality. Guidebook of Best Management Practices for Michigan.1996.
4. Environmental Protection Agency (EPA). National Pollutant Removal Performance Database. June 2000.
5. Personal Communication with Hydro-Compliance Management, Inc. staff. 2004.
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8. Rain Gardens of West Michigan. Beautiful Solutions for Water Pollution. [Online] 2003. Available at http://www.raingardens.org/Index.php.
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10. USDA - Natural Resources Conservation Service. Michigan Area 3 Component Data. June 2003.
11. USDA - Natural Resources Conservation Service. Sample County Practice and Maintenance Costs. 2001.
12. USDA - Natural Resources Conservation Service. Conservation Practice Physical Effect Worksheet[s]. 2004.
13. Personal Communication with Technical Committee of the Lower Grand River Watershed Project. 2004.
14. Personal Communication with District Conservationist of the NRCS Grand Rapids Service Center. 2004.
15. USDA - Natural Resources Conservation Service. FY04 Michigan EQIP Statewide Eligible Practice List, Land Management Practices (Incentive Payments). 2004.

A similar spreadsheet was developed for managerial BMPs using the MDEQ BMP list, the MDOT list of BMPs, the MDEQ Agricultural BMP manual, and the MDEQ Wetland Protection Guide. The managerial BMPs were categorized into practices of agricultural, zoning ordinance/land use policies, recycling/composting, turf management, operations and maintenance, and municipal operations (Table 3.14).

Table 3.14 - Managerial Best Management Practices

Best Managerial Practices	Description	Benefit	Pollutant Addressed	Potential Sources of Pollutants	Environmental Impacts and Special Concerns	Comparative Costs	Communities Using BMP	MDEQ/NRCS Link
Agricultural								
Crop Residue Management (329A-C, 344), includes no till, mulch till, ridge till, and seasonal	Leaving last year's crop residue on the surface before and during planting operations, providing soil cover at a critical time of the year. The residue is left on the surface by reducing tillage operations and turning the soil less. Pieces of crop residue shield soil particles from rain and wind until plants can produce a protective canopy.	Ground cover prevents soil erosion and protects water quality. Residue improves soil tilth and adds organic matter to the soil as it decomposes. Fewer trips and less tillage reduce soil compaction.	Sediment and attached pollutants	Agricultural runoff, soil erosion	Consider if crop will produce enough residue. Planning for residue cover should begin at harvest. Time, energy, and labor savings are possible with fewer tillage trips. Equipment for specialized tillage techniques needed. Additional chemical treatments may be necessary to control pests. Assistance available from USDA office or Conservation District. No local government controls in place. Crop reside reduces the velocity of storm water runoff and improves infiltration	$28-36/acre (includes no-till and strip till, ridge till) (11). Maintenance costs are 100% of original cost (11). Environmental Quality Incentive Program (EQIP) (for mulch till, ridge till, and seasonal residue management). Equipment rental or purchase $40+ per acre. Consider costs for pest control.	Typical in Counties of the Lower Grand River Basin (e.g. Kent County)	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/329a.pdf ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/329b.pdf ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/329c.pdf ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/344.pdf
Conservation Crop Rotation (328)	A sequence of crops designed to provide adequate organic residue for maintenance or improvement of soil tilth and fertility. Other BMPs to use include nutrient and pest management, buffer/filter strips, cover crops	Reduces sheet, rill, and wind erosion Maintains or improve soil organic matter content Manages the balance of plant nutrients Improves water use efficiency Manages saline seeps Manages plant pests (weeds, insects, and diseases) Provides food and cover for wildlife Reduces fertilizer needs and may reduce pesticide needs	Sediment and attached pollutants	Soil erosion, agricultural runoff	Rotations that include grains, such as corn, or meadow provide better erosion control. Where excess plant nutrients or soil contaminants are a concern, utilizing deep rooted crops or cover crops in the rotation can help recover or remove the nutrient or contaminant from the soil profile. Over application of fertilizer or pesticide is possible. Plants will reduce the velocity of storm water runoff and increase infiltration.	$4.00/acre (11) - EQIP	Typical in Counties of the Lower Grand River Basin (e.g. Kent County)	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/328.pdf
Planned Grazing System	Pasture is divided into two or more pastures or paddocks with fencing. Cattle are moved from paddock to paddock based on forage availability and livestock nutrition needs. Other BMPs to use include alternative water source, cattle exclusions, nutrient management, and soil testing	Improves vegetative cover, reduces erosion, and improves water quality by reducing sediment and nutrient runoff. Rotating also evenly distributes manure and nutrient resources.	Sediment and attached pollutants, nutrients, pathogens	Soil erosion, agricultural runoff	Keep fencing secure. Apply fertilizer and nutrients according to soil tests, mow or hay paddocks if needed and update rotation schedule if needed. Practice is widely applicable. Consider adequacy of the mix of grass and legumes to meet livestock needs. Sediment and nutrient runoff is not eliminated just reduced. This practice will increase harvest efficiently and help ensure adequate forage throughout the grazing season.	EQIP can fund establishment. $25/acre for maintenance (14)	Typical in Counties of the Lower Grand River Basin (e.g. Kent County)	
Irrigation Water Management (449)	Determining and controlling the rate, amount, and timing of irrigation water in a planned and efficient manner. Other BMPs to use include nutrient management, pest management, crop residue management, soil conservation measures	Management of the irrigation system should provide the control needed to minimize losses of water and discharge of sediment and sediment-attached and dissolved substances, such as plant nutrients and herbicides.	Sediment and attached pollutants, nutrients, hydrologic flow	Agricultural runoff	Poor management may allow the loss of dissolved substances from the irrigation system to surface or groundwater. There is an insignificant reduction in runoff/flooding and slight reduction in excess subsurface water. Consider the effects irrigation water has on wetlands, water related wildlife habitats, riparian areas, cultural resources, and recreation opportunities.	EQIP can fund establishment.	Typical in Counties of the Lower Grand River Basin (e.g. Kent County)	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/449.pdf
Contour Strip Cropping (585)	Crop rotation and contouring combined in equal-width strips of corn or soybeans planted on the contour and alternated with strips of oats, grass, or legumes. Other BMPs to use include field border, fertilizer management, grassed waterways.	Meadow slows runoff, increases infiltration, traps sediment and provides surface cover. Ridges formed by contoured rows slow water flow which reduces erosion. May reduce fertilizer costs.	Sediment and attached pollutants, hydrologic flow	Agricultural runoff, soil erosion	Keep strip widths consistent from year to year. Make adjustments in rotation schedule if needed. Over application of fertilizer possible, if used. Will reduce the velocity of storm water runoff and increase infiltration. Strip cropping is not as effective if crop strips become too wide, especially on steep slopes.	$10/acre (9) - EQIP	Typical in Counties of the Lower Grand River Basin (e.g. Kent County)	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/585.pdf

Table 3.14 - Managerial Best Management Practices

Best Managerial Practices	Description	Benefit	Pollutant Addressed	Potential Sources of Pollutants	Environmental Impacts and Special Concerns	Comparative Costs	Communities Using BMP	MDEQ/NRCS Link
Contour Farming (330)	Hillsides are cultivated and planted in rows along the hillside contour, not up and down the hill. Crop row ridges on the contour create hundreds of small berms. Other BMPs to use include field border, grassed waterways, and terraces or strip cropping if needed.	Reduces sheet and rill erosion and transport of sediment and other water-borne contaminants. Ridges built by tilling and planting on the contour, slow water flow and increase infiltration, which reduces erosion by as much as 50% from up and down hill farming.	Sediment and attached pollutants, hydrologic flow	Agricultural runoff, soil erosion	To avoid having to lay out new contour lines every year, establish a narrow permanent strip of grass along each key contour line. All tillage and planting operations should be performed parallel to the key contour line. Contour farming will reduce the velocity of storm water runoff, increase infiltration, moderately decrease runoff/ flooding, and slightly increase excess subsurface water. Contouring is less effective in preventing soil erosion on steeper or longer slopes.	$10/acre (9)	Typical in Counties of the Lower Grand River Basin (e.g. Kent County)	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/330.pdf
Pest Management (595)	Crops are scouted to determine type of pests and the stage of development. The potential damage of the pest is then weighed against the cost of control. Finally, if pest control is economical, all alternatives are evaluated based on cost, results, and environmental impact. Precaution is taken to keep any chemicals from leaving the field by leaching, runoff, or drift. Other BMPs include buffer/filter strips, crop rotation, and erosion control measures.	Treatments tailored for specific pests on identified areas of a field prevent over-treatment of pests. Using fewer chemicals improves water quality.	Chemicals (Pesticide)	Agricultural runoff	Continual scouting to best identify pests and control methods. Keep records to track costs and chemical application. Calibrate spray equipment. Consider which soils on farm are likely to leach pesticides. Consider pest control alternatives.	100% of cost/unit (11) - EQIP		ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/595.pdf
Nutrient Management (590) CNMP	Crop nutrient needs are determined after a soil test, setting realistic yield goals, and taking credit for contributions from previous years' crops and manure applications, crop nutrient needs are determined. Nutrients are then applied at the proper time by the proper application method. Nutrient sources include animal manure, sludge, and commercial fertilizers. Other BMPs include manure testing, soil testing, soil conservation measures, waste management system, waste storage facility, and waste utilization.	This practice properly budgets and supplies nutrients for plant production. It also reduces the potential for nutrients to infiltrate into water supplies by preventing over application. Correct manure and sludge application on all fields can improve soil tilth and organic matter. It is very applicable on Concentrated Animal Feeding Operations (CAFOs).	Nutrients	Agricultural runoff, over application of fertilizers.	Maintenance requirements: - Perform a periodic plan review to determine necessary adjustments - Protect nutrient storage facilities from weather and accidental leakage/spillage - Calibrate application equipment and document application rates - Spread wastes away from waterbodies on an adequate land base and incorporate ASAP - Analyze manure and other organic waste for nutrient content before field application and determine appropriate application rate - Test soils once every three years according to Extension recommendations - Establish a winter cover crop if nitrogen leaching is possible due to poor crop yield * Consider the Michigan Agriculture Environmental Assurance Program (MAEAP). The CNMP must be developed by a trained technical person (service provided by NRCS or Conservation District). Consider potential groundwater contamination - proximity to waterbodies critical.	$5/acre (9) - EQIP (Costs associated with waste water collection, soil testing, integrated crop management are low but have a high start up.)	Typical in Counties of the Lower Grand River Basin (e.g. Kent County)	ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/590.pdf

Table 3.14 - Managerial Best Management Practices

Best Managerial Practices	Description	Benefit	Pollutant Addressed	Potential Sources of Pollutants	Environmental Impacts and Special Concerns	Comparative Costs	Communities Using BMP	MDEQ/NRCS Link
Organic Farming Practices	Organic farming differs from other farming systems in a number of ways. It favors renewable resources and recycling, returning to the soil the nutrients found in waste products. Where livestock is concerned, meat and poultry production is regulated with particular concern for animal welfare and by using natural foodstuffs. Organic farming respects the environment's own systems for controlling pests and disease in crops and livestock. Organic farmers use a range of techniques that help sustain ecosystems and reduce pollution. Other BMPs include filter/buffer strips, crop rotation, organic manuring, composting, limited chemical intervention, conservation of wildlife and natural habitats, management of livestock, recycling of organic materials.	Organic farming conserves biodiversity, provides a wide range of habitats, saves energy, improves soil fertility, and protects groundwater and surface waters from nitrates, phosphates, and pesticides. Organic food is grown without using any synthetic pesticides, herbicides, insecticides, fungicides, fertilizers, or hormones.	Nutrients, chemicals (pesticides)	Agricultural runoff	Organic farming methods are usually more labor intensive than conventional farming, so the cost of organic farming will usually be more.	EQIP funds supporting practices such as cover crops, conservation crop rotation, nutrient management, pest management.	Roseland Organic Farms, Cassopolis, MI FOGG Organic Farmers and Market, Leslie, MI	
Soil Testing of Cropland	For proper management, a soil test for available nutrients should be made every 3-5 years. Use Integrated Crop Management (ICM)	Testing will help prevent over application of nutrients from fertilizers, manures and other sources.	Nutrients	Agricultural runoff.	Soil should be tested to determine nutrient levels. Care should be taken to not add nutrients already present in adequate levels. Soil testing should be undertaken by lab or local Michigan State University Extension (MSUE) office. Proper collection of a soil sample is important. Accuracy of analysis depends on the collection of a representative soil sample.	Costs associated with Integrated Crop Management (ICM). Typically a yearly expense. Low cost technique of monitoring soil. EQIP	Prevalent on agricultural land in rural communities. Typical in counties of the Lower Grand River Basin.	
Agriculture Incentive Programs	Farm Bill programs that offer a rental payment to landowners that agree to take environmentally sensitive areas out of production. Continuous sign-ups for these programs are available to riparian and wetland areas. Rental rates are set by county boards.	Creates incentive for landowners to conserve riparian buffers, wetlands, and wildlife habitats.	Sediment, nutrients, hydrologic flow, pathogens, chemicals (pesticides)	Agricultural runoff	Property enrolled in Farm Bill programs are not protected in perpetuity. Fertilizer cannot be applied to areas under contract. In some cases, land values or crop yields may discourage landowners to use these incentive programs.	In some counties soil rental rates can be very high.		http://www.nrcs.usda.gov/programs
Zoning Ordinances/Land Use Policies								
Stronger County and State Regulatory Oversight of Over Application and Misapplication of Septage	Stronger regulatory oversight can ensure that septage is applied correctly and limited to those areas where it is appropriate. Septic system alternatives should be encouraged where such alternatives prove economical and technically sufficient in order to protect public health and the environment.	Stronger regulatory oversight will reduce the over application and misapplication of septage and help prevent nutrients and *E.coli* from entering waterbodies.	Nutrients, *E. coli*	Agricultural runoff	If existing and future regulations are not enforced, they will be useless in preventing over application and misapplication of septage			
Development/Enforcement of Storm Water Ordinance	An ordinance can provide for the regulation and control of storm water runoff; provide for storm water permits and the procedures and standards for the issuance; provide regulations for the inspection, sampling and monitoring of storm water and other discharges; establish performance and design standards for storm water management in specified zones of the township/municipality; and provide penalties for the violations of the ordinance.	Storm water runoff rates and volumes are controlled in order to protect floodways. Controls soil erosion and sedimentation; minimizes deterioration of existing watercourses, culverts, bridges, etc.; and encourages groundwater recharge.	Sediment and attached pollutants, hydrologic flow	Storm water runoff	Establishing storm water management control will minimize storm water runoff rates and volumes from identified new land development and encourage groundwater recharge. Proposed Model Storm Water Ordinance for Kent County recommends the following release rates: 0.05 cfs/acre for a 2-year storm event for Zone A; 0.13 cfs/acre per Kent County Drain Commission rules for Zone B	$8,000/ordinance development (Grand Valley Community Survey)	Algoma, Cannon, and Courtland Townships of Kent County	
Development/Enforcement of Stream Buffer Ordinance	Ordinance protects a given area of buffer adjacent to stream systems. Protected buffers can provide numerous environmental protection and resource management benefits.	Moderate to high. Reduces the risk of sediment and contaminants entering the stream. Provides long term solution to water quality concerns.	Sediment and attached pollutants, nutrients, thermal pollution	Storm water runoff from impervious surfaces (e.g. parking lots and roof tops) and outflow from ponds.	Lack of maintenance can increase erosion if trees fall into streams. At a minimum, keep south and west sides of streams wooded to provide shade. Trees in floodway can impede flow.	$8,000/ordinance development (Grand Valley Community Survey)	Cannon Township	

Table 3.14 - Managerial Best Management Practices

Best Managerial Practices	Description	Benefit	Pollutant Addressed	Potential Sources of Pollutants	Environmental Impacts and Special Concerns	Comparative Costs	Communities Using BMP	MDEQ/NRCS Link
Development/Enforcement of Wetland Ordinance	Ordinance promotes a policy to avoid or minimize damage to wetlands and coordinate the planning and zoning process with federal and state wetland programs.	Wetland benefits are preserved. Wetlands provide natural pollution control by removing pollutants, filtering and collecting sediment, reducing both soil erosion and downstream flooding, and recharging groundwater supplies.	Sediment and attached pollutants, hydrologic flow, nutrients, pathogens, chemicals (pesticides), salts	Storm water runoff	Part 303, section 324.30307 authorizes local units of government to adopt and administer their own wetland regulations that address wetlands not protected by the state, provided they are at least as restrictive as state regulations. The DEQ must be notified if a community adopts a wetland ordinance, but it has no review or approval authority.	$8,000/ordinance development (Grand Valley Community Survey)	Salem Township	
Green Space Protection Ordinance	Ordinance preserves environmentally sensitive and open areas. Can also use filter strips and tree planting to enhance protection.	High if properly executed. Provides protection of natural pollutant removal methods.	Thermal pollution, sediment, nutrients, hydrologic flow	Construction zones, developed parcels, agricultural land		$3/sq. ft. Land acquisition and management costs depend on site. Affected property may double as park/open space usage with related costs.	Ottawa County Parks and Recreation Commission, Land Conservancy of West Michigan	
Low Impact Design Practices	Land use planning to incorporate practices onsite. Examples include: bioretention, dry wells, filter strips, vegetated buffers, grass swales, rain barrels, cisterns, infiltration trenches. Involves careful site planning to reduce the impact to water resources by eliminating impervious surfaces and protecting infiltration areas.	Numerous water quality benefits. Long term solution to concerns.	Thermal pollution, solids, sediments, nutrients, metals	Rainfall, runoff, solar, fertilizers				http://www.lid-stormwater.net/
Illicit Discharge Ordinance (MDOT)	Program to seek out and prohibit illicit discharges and connections to municipal separate storm sewers	High if properly executed. Eliminate hazardous and harmful discharges	Hazardous wastes	Industrial, residential, commercial		$2/ac (assuming 1 system monitored every 5 sq. miles). Maintenance program. $0.83/acre/year, $50/ac/yr (with TV inspection)	Phase II communities, MDOT	
Pet Waste Disposal Ordinance	Ordinance to require pet owners to clean up after their pets. Can be enhanced by installing signs and pet waste collection facilities in high traffic areas	Moderate	Nutrients, bacteria	Animals, dogs or other household pets				
Development/Enforcement of Septic System Ordinance	Ordinance abates water pollution caused by failing onsite sewage disposal systems, minimizes infiltration of seepage from systems into the storm water drainage system, and establishes penalties for its violation.	Ordinance can be used to enforce regular maintenance of disposal systems, which will minimize threats to public health and combat the degradation of surface and subsurface waters.	Bacteria	Septic systems	Lack of ordinance enforcement (regular inspection) can introduce pollution into groundwater reserves.	$8,000/ordinance development (Grand Valley Community Survey)	Wayne County	
Development/Enforcement of Yard and Kitchen Waste Ordinance	Ordinance prohibits the disposal of yard and kitchen waste on streambanks and outlines acceptable disposal methods, such as composting or disposal at a permitted disposal facility.	Proper disposal of yard and kitchen waste ensures that nutrients from these materials are not released into surface and groundwater supplies.	Nutrients	Upland source (yard/kitchen waste)	If yard and kitchen waste are composted on landowner's premises, nutrient runoff should not reach nearby surface water bodies.	$8,000/ordinance development (Grand Valley Community Survey)		
Development/Enforcement of Watercraft Control Ordinance	Ordinance prohibits the operator of a recreational watercraft to exceed a "slow - no wake" speed when within x feet of the shoreline.	Enforcing "no wake" zones will reduce streambank erosion.	Sediment and attached pollutants	Recreational watercraft	Issues concerning trespass, disorderly conduct, or damage caused to private property by the wake of vessels are not valid safety considerations for establishing a local ordinance.	$8,000/ordinance development (Grand Valley Community Survey)	City of Detroit (Detroit and Rouge River)	
Public Access Ordinance	Ordinance controls access to a designated waterbody by limiting hours of access, number of users, etc.	By controlling public access to a waterbody, sediment pollution is reduced.	Sediment and attached pollutants	Public access, boat wakes	Consider using porous/ modular pavement at boat launches locations.	$8,000/ordinance development (Grand Valley Community Survey)		
Development/Enforcement of Fertilizer Ordinance	Ordinance prohibits the use of fertilizers containing more than 1% by weight of anhydric phosphoric acid.	Moderate; other sources of phosphorus may be present in the watershed.	Phosphorus	Fertilizers	Sources of low phosphorus fertilizers are few.	$8,000/ordinance development (Grand Valley Community Survey)	East Grand Rapids	
RECYCLING/COMPOSTING								
Household Hazardous Waste Management	Proper buying, using, storing and disposal of Hazardous materials such as automotive waste, household cleaners and paint.	Moderate: eliminates disincentives and discourages illegal dumping of products into storm sewers and onto the ground	Hazardous wastes	Residents: Used oil, paints, cleaning products, etc.	Proper credentials needed for management. Typically consultant based.	Recycling station expenses.		http://www.deq.state.mi.us/documents/deq-swq-nps-hhhw.pdf

Table 3.14 - Managerial Best Management Practices

Best Managerial Practices	Description	Benefit	Pollutant Addressed	Potential Sources of Pollutants	Environmental Impacts and Special Concerns	Comparative Costs	Communities Using BMP	MDEQ/NRCS Link
Composting	Converting plant debris, grass, leaves, pruned branches, etc. to compost. Use with lawn maintenance, pesticide and fertilizer management, and diversions (if needed)	Keeping organic debris out of surface waters and away from floodplains. Will help prevent the depletion of oxygen in surface waters. Widely applicable to dense residential or riparian sites.	Nutrients, chemicals, and pesticides, low dissolved oxygen, trash and debris	neighborhoods, agricultural areas, yard, and kitchen waste	Compost piles placed near floodplains will contribute to the depletion of oxygen in surface waters. Composting requires proper aeration, watering, and mixing in order to result in a useable end-product. Soils, topography and climate will all affect the types of composting options available.	Recycling vs. garbage hauler costs. Establishment of large scale facility $190,000, land dependant. $70,000 annual maintenance.	Larger facilities are generally operated by private business. Ex: in Sec 36, Zeeland Township, Ottawa County	
Yard Waste Collection and Disposal Program	Municipalities collect yard waste for compost.	Widely applicable to dense residential or riparian sites	Nutrients and organic sediment, trash and debris	Yard waste and leaf litter	Waste needs to be composted and correctly applied as fertilizer. Need large collection facility for compost operations.	Low	Cascade Township, City of Wyoming, City of Kentwood, City of Grand Rapids, Byron Township, Ada Township, City of Coopersville, Georgetown Twp	
Recycling Program (MDOT)	Collection of recyclable materials either by curb-side pick up or at drop off centers	Reduction in potential clogging and harmful discharge	Trash, used construction material reuse	Highways, travelers, vehicle debris	Some materials may require more energy to collect and recycle than using new products. However, recycling programs do build awareness	$200,000/year. $1.15/person/yr.		
Used Oil Recycling Program (MDOT)	Central collection facilities that allow residents to drop off used motor oil. Can be operated by local governments or businesses that recycle oil.	Reduces risk of surface water and groundwater contamination	Used oil and other transportation fluids reuse, hydrocarbons, metals, nutrients	Vehicle maintenance facilities. Vehicles or other equipment requiring lubrication.	Oil may easily become contaminated during collection making it a hazardous waste.	$79 - $179 recovery charge. Administrative costs to organize. Minimal personnel cost to collect and temporarily store oil. Opportunity to be paid by private business for waste material	MDOT, OCRC	
Turf Management								
Pesticide Management for Turf Grass and Ornamentals	Use of all available strategies (resistant turf, cultural controls, biological controls, mechanical controls and pesticides) to manage pests so that an acceptable yield and quality can be achieved economically with the least disruption to the environment. Used with lawn maintenance, fertilizer management, and soil management.	Moderate to High	Harmful chemicals, pesticides, insecticides	Landscaping, storm water runoff	Must have proper training and credentials to commercially apply pesticides and manage turf.	Pesticide management should reduce application rates and related costs.	Public parks, administrative offices thru out region. Typically private contractor based.	http://www.deq.state.mi.us/documents/deq-swq-nps-pm.pdf
Lawn Maintenance	Includes mowing, irrigating, pesticide and fertilizer management, soil management and the disposal of organic debris such as lawn clippings and leaves.		Phosphorus, nutrients, and sediments	Landscaping, storm water runoff	Consider minimizing lawn with more native species	Lawn alternatives may reduce mowing but still require regular maintenance of weed control and pest management.		http://www.deq.state.mi.us/documents/deq-swq-nps-lm.pdf
Fertilizer Management	Includes the proper selection, use, application, storage and disposal of fertilizers. Used with pesticide management, lawn maintenance, and nutrient management	Moderate	Nutrients	Landscaping, storm water runoff	Consider consulting professional, such as Michigan State University Extension (MSUE)	Material cost reduction may conflict with traditional aesthetic values. Fertilizer management should reduce chemical costs but may impact maintenance and watering.		http://www.deq.state.mi.us/documents/deq-swq-nps-fm.pdf
Soil Testing of Lawns and Gardens			Nutrients	Lawn and garden fertilizer	Testing should be done at qualified lab	Typically yearly testing required, contact local MSUE office. Test results may result in operations and maintenance costs. Low cost tool in management of lawns and gardens. $9.50 per test.	Typically associated with private property or public administration sites.	
Operations and Maintenance								
Operation and Maintenance Programs			Sediment, hydrocarbons, metals, nutrients	Erosion of road footprint and related infrastructure, leaking equipment, etc.		Labor intensive. Equipment required.	MDOT, OCRC and other Public Works Departments	
BMP Inspection and Maintenance Plan for Roads (MDOT)		A regular inspection and maintenance program will maintain the effectiveness and structural integrity of the BMPs.	Sediment, hydrocarbons, metals, nutrients, etc.	Road related sediments/pollutants	Materials needed for emergency structural repairs may not be easily obtainable and may require stockpiling (MDOT). Should be designed and implemented by trained professional.	$150-$9,000 depending on the BMP. Specialized BMP installation involves planning, design, construction and maintenance costs.	MDOT, Drain Commission's and other Public Works Departments	
Material Management Plan (MDOT)	Identified hazardous and non-hazardous materials in the facility. Assures that all containers have labels. Identifies hazardous chemicals that require special handling, storage, and disposal.		Chemicals and other potentially hazardous materials.	Varies depending on type of material usage at specific facilities. Oil, salt, degreasers, solvents, antifreeze, etc. Industrial sites where chemicals are used.	Extensive training typically required to prepare and administer plan.	Plan preparation and updates. Inspections mandated. Plan development typically needs consultant or knowledgeable employee. Operation typically employee dependant.	MDOT, Public Works Departments	

Table 3.14 - Managerial Best Management Practices

Best Managerial Practices	Description	Benefit	Pollutant Addressed	Potential Sources of Pollutants	Environmental Impacts and Special Concerns	Comparative Costs	Communities Using BMP	MDEQ/NRCS Link
Clean and Maintain Storm Drain Channels (MDOT)		Prevent erosion in channels. Improve capacity by removing sediment. Remove debris toxic to wildlife.	Sediment, trash, woody debris	Development, natural erosion, vehicle remnants, road winter safety operations.	Should be implemented by trained professional.	$21/acre/year, $45-60 per acre (rural). Channels are less expense to construct and easier to maintain than enclosed systems.	MDOT, Public Works Departments, Road and Drain Commission's	
Clean and Maintain Storm Inlets and Catch Basins (MDOT)	Catch basins are periodically inspected and cleaned out using a vacuum truck.	Moderate; reduces pollutant slugs during the first flush, prevents downstream clogging, and restores sediment trapping capacity of the catch basin.	Solids, sediments, metals, oils	Storm water runoff, automobiles	Requires continual maintenance every 1 - 3 years. General fund, KCRC road maintenance budget - $250,000	Moderate to High; Total annual cost per catch basin = ($8/catch basin) + ($40/catch basin) = $48/catch basin. (Grand Rapids (GR) BMP Study). $21/acre/year maintenance.	City of Grand Rapids, East Grand Rapids, Kent County Road Commission (KCRC) contracts out to Plummer's Environmental, MDOT	
Annual Road/Stream Crossing Inspections	Inspections of stream crossings for evidence of erosion, debris, etc.	Moderate	Sediment	Erosion of streambank		Moderate; regular inspection can prevent major expenditures for potential major points of erosion	Coopersville, OCRC, KCRC	
Municipal Operations								
Snow and Ice Control Operations	Removal of snow and ice from roadways, utilizing plows, salt, and sand.		Salts	Snow melt runoff	Moderate, all KCRC equipment operators are trained. Training of road maintenance crew required.	KCRC winter maintenance budget - $3.5 million. Maintenance costs $1,000/lane/mile, dependant on severity of winter.	KCRC maintains State trunk lines for MDOT, primary, local and gravel roads within Kent County. Subdivisions and Platted areas contracted out.	
Calibrated Salt Delivery		Low	Salts	Over application of salt	Calibration does not guarantee efficient application of road salt. Annual training and calibration necessary.	Low upfront cost. Long term equipment maintenance vs. reduced salt. Equipment costs $1,500 per truck, minimal additional cost.	Wyoming, KCRC, OCRC	
Pre-wet Road Salt Application		High if also used with environmentally friendly alternatives to salt	Salts	Road salt		Low to Moderate; $25/lane/mile, equipment maintenance costs - $5,000 per truck.	East Grand Rapids, OCRC	
Snow Removal Storage on Grassy Areas		Low	Sediment, metals, hydrocarbons, salt	Snow melt runoff	Snow storage may damage vegetation and possibly cause soil erosion. Piled snow melts at a slower rate. Need Right of Way (ROW) for snow removal. Need large grassed area adjacent to buildings and parking areas and properly spaced from waterbody.	Dependant on amount of trucking, distance to site, etc. Cleanup after melt	City of Grandville, City of Grand Haven, City of Holland	
Minimizing Effects from Road Deicing (MDOT)			Salts & chemicals	Maintaining agency, Snow melt runoff, spring rains		Varies	MDOT	
Street Sweeping	The use of specialized equipment to remove litter, loose gravel, soil, vehicle debris and pollutants, dust, de-icing chemicals, and industrial debris from road surfaces. There are generally 2 types of sweepers: mechanical broom street sweepers and vacuum-type street sweepers.	Moderate; 60% TSS removal rate. Reduction in potential clogging of storm drains. Some oil and grease control (MDOT). When done regularly, can remove 50 - 90% of street pollutants (1), makes road surfaces less slippery in light rains, improves aesthetics by removing litter, and controls pollutants.	Sediment, metals, hydrocarbons	Atmosphere, construction, vehicles	Sweeping may wash sediments into catch basins if wash is not vacuumed. Disposal of collected materials must be handled by the governing agency (MDEQ, Public Health, Transportation). Sweeping schedules and timing critical - sweep after snow melt and before spring rains. Vehicle maintenance required.	KCRC Road maintenance budget - $300,000/yr. Ottawa County: Mechanical - $119.40/curb mile. Vacuum Assisted - $87.95/curb mile (GR BMP Study)	City of Grand Rapids, City of East Grand Rapids, Cascade Township, City of Wyoming, City of Kentwood, Gerald R. Ford International Airport - Mostly contracted out to Semisweet by KCRC, MDOT	http://www.deq.state.mi.us/documents/deq-swq-nps-sw.pdf
Emergency Spill Response and Prevention Plan	Plans detail emergency procedures to respond to a release of hazardous materials. Also plans that describe procedures for proper handling and storage of chemical materials.	Low to High, depending on preparedness. Can be highly effective at reducing the risk of surface and ground water contamination	Hazardous wastes	Equipment, poor training, accidents, Industrial, commercial, residential, and transportation related spills, chemical storage areas	Speed and containment are critical. Requires a well-planned and clearly defined plan, updated regularly. May require training, protective gear, containment and retrieval knowledge. Equipment must be readily available. (MDOT)	Management plan preparation with upgrades. Cost of simulations. In public sector, typically subcontracted to private contractor	Ottawa County, MDOT, Kent County, local municipalities	
SESC Plans	Plans that specifies the actions that will be taken on a construction site to minimize erosion and sedimentation	High if properly executed. Reduce erosion and sedimentation during construction project. Increased removal using Floc Logs through construction.	Sediment	Unvegetated areas, land development	State training, SESC and/or certified operator.	Act 91 mandated, ongoing local administrative costs. Fee based to landowner option.	Commonly used by many communities.	
Dust Control (MDEQ)	Using measures such as watering, fencing, mulching and vegetation to prevent soil and attached pollutants from leaving a site and/or entering nearby waterways.	High if properly executed.	Sediment	Lack of vegetation typically associated with dirt or gravel roads	Salt and other potential pollutants are used in the dust control mixture. Rural, urbanizing, and transportation sites subject to wind erosion. Air pollution issue if neglected.	$100 to $500 per treatment. Employee administrative expense. Maintenance of water truck (minimal) - Roads 50-55 cents/gal, 1,500 gal/mile for a single pass		http://www.deq.state.mi.us/documents/deq-swq-nps-dc.pdf

Table 3.14 - Managerial Best Management Practices

Best Managerial Practices	Description	Benefit	Pollutant Addressed	Potential Sources of Pollutants	Environmental Impacts and Special Concerns	Comparative Costs	Communities Using BMP	MDEQ/NRCS Link
Urban Forestry	Management of woods and trees in an urban setting.	Moderate to high. Increases greenspace, reduces storm water runoff and thermal pollution. Long term solution to concerns.	Thermal pollution, solids, sediments	Rainfall, Solar	Woody debris and detritus may require annual maintenance. May eliminate original line of sight			
Other								
Invasive Plant Species Management	Invasive plant species are controlled using appropriate and effective removal methods for particular species.	Population and spread of invasive plant species is reduced or eliminated.	Invasive plant species	Accidental/purposeful introduction, natural dispersion	Invasive alien plants thrive in disturbed sites. Native plant communities fragmented by human disturbance are most vulnerable to invasion, but the most invasive species can infest even intact ecosystems. Invasive alien plants are free of natural controls such as insects and diseases that keep them in balance in their native habitats. Invasive species can also significantly reduce forest regeneration.		Grand Rapids Audubon Society (garlic mustard)	
Woody Debris Management								
Goose Management								
Information and Education								
Public Education Program (MDOT)		Can reduce improper disposal of hazardous waste	Potentially all			$200,000/year	METRO Council, Grand Rapids City, MACC	
Grounds Maintenance Training		Moderate	Nutrients and organic sediment	Leaf litter, grass clippings, fertilizer, and pesticides		Low	Cascade Township, City of Grandville, City of Grand Rapids	
Employee Training (MDOT)		Low cost and easy to implement storm water management BMPs	Potentially all				MDOT	
Storm Drain Stenciling	Painting Storm Drain Inlets with "No Dumping" signs and symbols.	Moderate; Educates the general public that the storm drain discharges into a natural waterbody. Can tie into hazardous waste collection, yard waste collection	Hazardous waste and nutrients	Household hazardous waste, motor oil, pet waste and yard waste	Volunteers need to take care with paint around storm drains. Permanent castings or decals may be more effective. Public education campaign is also needed for effective reduction in illegal dumping. Short term effectiveness.	$0.45/inch - Mylar stencils $5-$6 each - ceramic tiles $100 or more - metal stencils	East Grand Rapids, MDOT, Spring Lake Board	

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3. Michigan Department of Environmental Quality. Guidebook of Best Management Practices for Michigan.1996.
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12. USDA - Natural Resources Conservation Service. Conservation Practice Physical Effect Worksheet[s]. 2004.
13. Personal Communication with Technical Committee of the Lower Grand River Watershed Project. 2004.
14. Personal Communication with District Conservationist of the NRCS Grand Rapids Service Center. 2004.
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A list of preservation and conservation methods was developed in conjunction with the West Michigan Land Conservancy, local planning agencies, and the MDEQ. The methods are regulatory and non-regulatory techniques that can help protect pristine areas or create conservation easements to reserve lands from development. The list is described in Table 3.15.

Table 3.15 - Land Protection Methods for Improving Water Quality

Regulatory Land Protection Technique
1. Natural Resource Preservation Ordinances Development and other land altering activities cause many negative impacts to water quality. Increased soil erosion, loss of natural habitat, and increased storm water runoff are typical examples of negative impacts directly or indirectly related to development activities. Local ordinances that protect and maintain natural vegetation and habitats such as woodlots and wetlands are effective strategies to maintain existing vegetative cover and keep the negative impacts from development to a minimum. Natural resource preservation ordinances are generally not effective tools to improve water quality, but rather tools used to maintain existing water quality within a watershed.
2. Eminent Domain A tool used by government agencies to obtain land that is needed for the "public good", but is unavailable for purchase. Generally, eminent domain is used for development projects such as road or drain construction, but it has also been used to obtain natural lands for parks and wildlife refuges. Government agencies are usually hesitant to use eminent domain, and prefer to deal with willing sellers. When land is sold by a willing seller at or below market value for permanent conservation, it is referred to as a "Bargain Sale."
3. Designing Development to Protect Wetlands Part 303 of the Michigan Natural Resources and Environmental Protection Act (P.A. 451 of 1994) protects all wetlands that are contiguous to one of the Great Lakes, an inland lake or stream, or a pond that is greater than 1 acre in size. Non-contiguous wetlands greater than 5 acres in size are also protected in counties that have a population of more than 100,000. Because of regulatory barriers, time constraints, and the high costs of mitigating wetland impacts, developers should avoid directly impacting state regulated wetlands whenever possible. Developers should also take steps to minimize any secondary impacts to wetlands. Wetlands and other natural features are amenities that can be incorporated into developments and bring premium sale prices for the lots that adjoin or surround them.
4. Cluster Development/Open Space Preservation Cluster development theory proposes developing a smaller area of land at a higher density, so that the remaining undeveloped land can be preserved as open space. Cluster development is a win-win situation. The developer still constructs the same number of units desired, while incurring smaller infrastructure costs for utilities and roads. The natural features within the undeveloped open space are preserved in perpetuity and continue to maintain water quality and provide wildlife habitat. Open spaces can also be protected by increasing lot widths and requiring development setbacks.
5. Purchase of Development Rights (PDR) The landowner voluntarily sells the development rights of the property to a land conservancy, township, or state, gaining compensation for not developing the land. The landowner maintains full ownership of the land for agricultural uses and the land can be sold or transferred, but can never be used for non-farm development. Most programs allow the landowner to buy back development rights. One fundamental concern with PDR programs is obtaining funding sources to purchase the rights (Langworthy et al., 2003).

Table 3.15 - Land Protection Methods for Improving Water Quality

Regulatory Land Protection Technique
6. Transfer of Development Rights (TDR) Transfer of development rights is another voluntary preservation option that compensates landowners for not developing their land by allowing the development rights to be transferred to a development district. For TDR to work properly, two districts need to be established: a preservation or "sending" area, where no development will occur; and a "receiving" area that allows higher development density above the community's zoning guidelines. The TDR then becomes a tool to redirect growth from one area of the community to another. Compensation benefits for the landowner include reduced tax assessments and the right to buy, sell, or transfer the property (Langworthy et al., 2003).
7. Farmland Preservation Techniques Several regulations can be implemented through zoning techniques in order to preserve land for agricultural use. These provisions do not, by themselves, preserve farming in any community. Rather, these techniques are intended to permit larger blocks of land to be set aside for farm use. The following techniques include: exclusive use zoning, sliding scale zoning, quarter/quarter zoning, and agricultural buffers. **Exclusive use zoning** can be used to protect productive farms, avoid conflicting land uses, maintain a viable agricultural economic base, and maintain open space/rural character. It is most appropriate where there is limited pressure for residential development and there are existing large areas of prime or unique agricultural resources. New non-farm residences are often strictly regulated in the Exclusive Use District, and require approvals through a Special Land Use permitting process. Site development standards within the district could include a maximum lot area for non-farm, residential use and a large minimum lot area for a farm dwelling unit. Other provisions may include a maximum lot to depth ratio of 1:3 and large minimum lot widths and setbacks. **Sliding scale zoning** limits the number of times that a parent parcel (a parcel existing on the date of ordinance adoption) can be split, based on its size. The larger the parcel the more splits that may occur, up to a predetermined number. A larger minimum parcel size is also established. Unlike exclusive use zoning, slide scale zoning allows some non-farm residential development without a special land use permit or other reviews. It can be useful in agricultural areas where significant development pressure and land speculation exist. It is most effective in areas where a wide range of parcel sizes exist and non-farm residential development has already begun to occur. **Quarter/quarter zoning** is a density-based zoning technique, which is most appropriate in rural areas with large farming operations, moderate growth pressures, and where average parcel sizes generally exceed 40 acres. "Quarter/quarter zoning" refers to a quarter of a quarter section of land (40 acres) where a limited number of non-farm homes are allowed. The non-farm splits are usually regulated by minimum and maximum sizes, e.g. no less than 1 acre and not greater than 2 acres. **Agricultural buffers** are open space buffers between active agricultural areas and other uses, such as residential development, can help reduce land use conflicts, particularly where residential and agricultural conflicts are occurring with greater frequency. The use of buffers can also be used to protect waterbodies from fertilizers and pesticides. The buffer should be described in the property deed to alert potential buyers of the need to honor the no-disturb area.
Non-Regulatory Land Protection Techniques
1. Land Donations Land donations are a legal mechanism whereby a landowner donates property to another entity. Often the landowner receives positive tax benefits from a land donation. Obtaining donations of land is a very effective method to protect natural resources for the long term. Donations are obtained at no cost and can be a significant part of an overall land protection strategy. However, there are often costs associated with ownership, such as taxes and land management, which must be taken into consideration. Ideally, the most environmentally sensitive and valuable properties would be the highest priority for obtaining

Table 3.15 - Land Protection Methods for Improving Water Quality

through donations.
Non-Regulatory Land Protection Techniques
2. Conservation Easements Conservation easements are a legal mechanism whereby a landowner either sells or donates certain property rights to another entity, such as a local land conservancy. The individual still owns the land but has either sold or donated the right to develop the land. The land conservancy holds the easement and has the right to enforce it. Often the landowner receives positive tax considerations from granting an easement. Purchasing or obtaining conservation easements is a very effective method to protect natural resources for the long term. Conservation easements can be obtained at less cost than purchases and therefore can generally be a significant part of an overall land protection strategy. Ideally, the most environmentally sensitive and valuable properties would be the highest priority for obtaining through conservation easements.
3. Deed Restrictions and Covenants Deed restrictions and covenants are legal mechanisms to limit or prevent certain activities from occurring on a specific parcel of property. They are similar in nature to a conservation easement, but are not as effective. Deed restrictions and covenants are more easily removed or altered than conservation easements.
4. Purchase of Land Purchasing land to preserve its natural characteristics is the best method to protect natural resources for the long term. However, purchases are usually very costly and generally can only provide a small part of an overall land protection strategy. There are also costs associated with ownership, such as taxes and land management expenses, which must be taken into consideration. The most environmentally sensitive and valuable properties would be the highest priority for purchase.
5. Tax Incentives There are often favorable tax incentives to landowners who donate land to a government agency or non-profit organization. There are additional tax incentives to landowners who donate or sell conservation easements to such organizations.
6. Private Landowner Subsidies Numerous governmental programs are available that encourage landowners to improve the environmental health of their land. Programs exist to restore wetlands, reestablish native prairies, retire farmland and correct an array of environmental problems. These programs will generally pay most, if not all, of the expenses necessary to achieve the environmental improvements. Some programs will also pay the landowner to participate in the program. This compensation may be in the form of an annual rental payment on retired farmland for a period of 10 to 15 years, or a one-time payment to purchase a 30-year or perpetual conservation easement.

3.5.2 ACTION PLAN FOR MEETING GOALS AND OBJECTIVES

The purpose of a watershed management plan is to provide an action-oriented strategy for local governments and other stakeholders to meet water quality standards. In most cases, this goal is achieved using BMPs. BMPs can be structural, such as porous pavement; vegetative, such as rain gardens; or managerial, such as zoning ordinances. Selecting the appropriate BMP to meet water quality needs can be difficult because BMPs are often site specific and the information about BMP effectiveness is not always available.

The LGRW project has produced an interactive tool called the WAP to aid local governments, watershed residents, environmental groups, and other interested stakeholders in the LGRW.

The WAP will assist in the development of an action plan to meet their watersheds' goals and objectives while staying within the same goals and objectives set for the LGRW.

A detailed explanation of how to use the WAP is discussed in the companion document, *The Lower Grand River Watershed Planning Guidebook*. The WAP provides links to information contained in the WAM, and also information about designated uses, hydrology, mapping, BMP systems, BMP characteristics, and land preservation techniques. The WIM and the educational WIT can also be accessed to assist in the entire decision making process.

3.5.3 IMPLEMENTATION SCHEDULES

The implementation of BMPs is required to address NPS pollution and improve water quality. A system of BMPs includes not only structural, vegetative, and managerial BMPs, but also community outreach/education and land use planning. BMPs address the physical sources of water quality impairments and are therefore an important part of the overall NPS pollution reduction strategy.

The implementation of BMPs requires the coordination of landowners, agencies, organizations, and other partners. Once the BMPs are selected, through using the WAP, appropriate technical assistance, estimated costs, and possible financial assistance can be determined. These details that are available in the WAP will support the assessment of both the benefits and the costs of the actions identified for a particular watershed.

The implementation schedule, represented in Table 3.16 is categorized into long-term goals, intermediate goals and objectives, and short term objectives.

Table 3.16 - Implementation Schedule

Long-Term Goals 10 to 20 Years
Restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem by enhancing river environments in their natural states for present and future generations
Maintain and improve water quality by promoting sound land management decisions
Assess relationship between water quality and storm water runoff by developing guidelines for storm water management to reduce impacts of urbanization
Preserve, restore coldwater fisheries and reintroduce indigenous game fish species where possible
Provide for flood protection, minimize risk of flooding, and assess necessity of flood control improvements

Table 3.16 - Implementation Schedule

Long-Term Goals 10 to 20 Years	
Ensure public safety in recreational opportunities in surface waters	
Protect healthy habitats for native aquatic life and wildlife	
Intermediate Goals and Objectives 5 to 10 years	**Short-term Objectives 1 to 5 years**
Reduce *E. coli* inputs from septic systems	Increase proper maintenance and installation of septic systems Increase the use of sanitary sewers in high risk areas
Reduce number of livestock in streams and increase quality of riparian buffers	Increase use of livestock fencing and filter strips
Reduce number of illicit connections to storm sewers	Locate and remove or correct illicit connections to storm sewers
Improve manure management techniques	Increase use of agriculture incentive programs and comprehensive manure management plans Encourage stronger county and state regulatory oversight
Reduce number of overflows from combined sewers and locate and repair sewer leaks	Encourage municipalities to increasingly locate and repair sanitary sewers in areas with high levels of *E. coli*.
Reduce amount of pet waste entering storm sewer systems	Increase the number of pet waste collection facilities and encourage their use with signage and educational media
Reduce concentrations of nuisance wildlife (i.e. geese, raccoons, etc) in and around storm sewer systems	Increase use of goose management practices and install BMPs that exclude wildlife from storm sewers
Stabilize stream flow	Increase development of storm water ordinances that require infiltration, low impact development techniques, rain gardens, and extended detention that addresses channel forming flows where appropriate Increase the number of stream buffer and green space ordinances Develop wetland, green space, and flood plain protection programs

Table 3.16 - Implementation Schedule

Intermediate Goals and Objectives 5 to 10 years	Short-term Objectives 1 to 5 years
Reduce streambank erosion from large and fast moving watercraft in sensitive areas	Work with MDNR to establish no wake zones
Minimize runoff from agricultural areas	Increase the use of appropriate agricultural BMPs, such as cover crops and reduced tillage practices, in agricultural areas near surface water
Minimize urban storm water runoff and increase amount of infiltration	Increase infiltration where possible and implement green space protection programs and stream buffer ordinances Increase development of storm water ordinances that require infiltration, low impact development techniques, rain gardens, and extended detention that addresses channel forming flows where appropriate
Reduce erosion and contain sediment on construction site	Improve soil erosion and sedimentation control measures and construction site inspection
Reduce nutrient loadings from failing or improperly maintained septic systems	Increase proper maintenance and installation of septic systems Increase the use of sanitary sewers in high risk areas
Reduce number of discharge exceedances from waste water treatment plants	Increase awareness of waste water treatment plant discharge reports Make continual effort to separate combined sewers
Reduce amount of yard waste being dumped into drains and ditches	Create awareness of storm sewer systems and affects of yard waste in lakes and streams Implement ordinances that prohibit dumping of yard waste
Reduce amount of impervious surfaces and storm water runoff	Increase infiltration where possible Implement storm water management ordinance with stream protection
Protect wetlands and flood plains	Develop wetland and flood plain protection programs
Increase amount of riparian buffers in designated coldwater streams	Develop stream buffer and green space protection programs
Reduce spread and remove invasive species from sensitive habitats	Increase the use of native vegetation in landscaping

Table 3.16 - Implementation Schedule

Intermediate Goals and Objectives 5 to 10 years	Short-term Objectives 1 to 5 years
Reduce introduction of species from watercraft transport	Develop ordinance that prohibits transport or introduction of invasive and exotic species
Reduce loss of forested and wetland areas	Participate in a natural features inventory Develop wetland and green space protection programs
Reduce amount automotive fluids in storm water runoff	Increase amount and frequency of street sweeping
Reduce amount of automotive and hazardous waste being illegally dumped into storm drains	Implement ordinances that prohibit dumping of any substance other than clean water into storm drains
Eliminate spills from entering storm sewers, groundwater, and surface water	Develop emergency spill response plans and pollution prevention initiatives by municipalities and industry

3.5.4 TECHNICAL AND FINANCIAL ASSISTANCE

Technical and financial assistance is needed to successfully implement portions of WMPs. Financial assistance from grant programs often overshadows the importance of technical experts, who are necessary in the development of a WMP. These experts may have an awareness of other funding opportunities or information resources. The agencies and organizations listed in Section 3.5.5 should be invited to participate in the development of a WMP.

3.5.5 POTENTIAL PROJECT PARTNERS

FEDERAL AGENCIES

The **United States Department of Agriculture (USDA) National Resources Conservation Services (NRCS)** provides the technical expertise to implement agricultural BMPs that are eligible under the Farm Bill. The **USDA Farm Service Agency (FSA)** administers the financial aspects of the Farm Bill programs. The programs offer federal cost-share opportunities and coordinate the funding with state and local programs to maximize the benefits. Full listings and descriptions of the programs are available at: www.mi.nrcs.usda.gov.

STATE AGENCIES AND ORGANIZATIONS

The **Michigan Department of Environmental Quality (MDEQ)** administers programs and enforces laws that protect public health and promotes the appropriate use of, limit the adverse effects on, and restore the quality of the environment. As stewards of Michigan's environmental heritage, the MDEQ works on behalf of the people of the Great Lakes State for an improved quality of life and a sustainable future, protecting and enhancing Michigan's environment and public health. Technical and financial assistance through grants provided by the MDEQ will guide the project implementation activities to create the most efficient systems of improvements for the LGRW.

The **Michigan Department of Natural Resources (MDNR)** is committed to the conservation, protection, management, use, and enjoyment of the State's natural resources for current and future generations. The MDNR will assist the implementation of a WMP by encouraging citizen participation and partnerships in developing new ways of addressing environmental issues. Watersheds with designated trout streams should contact MDNR for assistance and access to fisheries research.

The **Michigan Department of Agriculture (MDA)** is perhaps the most versatile department of state government. There services include consumer protection, licensing, business development, and other tasks that would not normally be considered as part of agriculture. The MDA provides environmental assistance to farmers through the MAEAP. In addition to the voluntary MAEAP, MDA employees are available for assisting farmers and concerned citizens with stewardship activities relating to wildlife, forestry, groundwater, and pollution prevention.

REGIONAL AGENCIES AND ORGANIZATIONS

The **Grand Valley Metropolitan Council (GVMC)** is an alliance of governmental units in the Grand Rapids metropolitan area that plans for the growth and development, improves the quality of the communities' life, and coordinates governmental services. GVMC has served as the grantee for this watershed planning process and will continue to be a leader in environmental issues for West Michigan watersheds. Partnerships with community foundations and other financial resources create possible sustainable mechanisms for future improvements throughout the LGRW.

COUNTY AGENCIES AND DEPARTMENTS

County Drain Commissioners (CDCs) maintain and improve county drains and provide assistance in the implementation of BMPs along waterways. Many projects are financed through drain assessments within the drainage districts.

County Health Departments (CHDs) conduct water quality sampling and analysis to detect water quality impairments. CHDs also conduct household hazardous waste collection days and provide information about septic system maintenance and proper disposal of other household wastes. CHDs administer programs to monitor surface water, groundwater, and drinking water quality. Warning signs are posted on waters which are not safe for human contact. Groundwater programs provide technical assistance in the design, construction, and abandonment of wells and septic systems. Well water programs evaluate drinking water quality through laboratory analysis to detect chemical and/or bacteriological contamination. A water supply evaluation consists of a review of well construction, location, and water quality. Water samples for bacteriological and partial chemical analysis are collected and analyzed by county laboratories.

County Road Commissions (CRCs) are responsible for the construction, maintenance, and improvements of all county roads and highways. The CRCs will assist in the implementation of the BMPs by assisting with the evaluation of roadside erosion sites and serving as the contracting organization for constructing BMPs on the county road rights-of-way.

County Conservation Districts (CCDs) are local units of state government established to carry out programs for conservation promoting the wise use of natural resources for current and future generations. CCDs are organized by local people to address local natural resource concerns, governed by a board of elected volunteers. The board of directors makes all decisions regarding the district's programs and activities. The directors hire qualified staff to conduct and carry out the programs and activities that provide technical assistance, information, and education to properly manage natural resources. The CCDs may assist the implementation of WMPs through educational programs and providing technical assistance for agricultural improvements.

LOCAL GROUPS AND ORGANIZATIONS

The Greater Grand Rapids Home Builders Association can promote incorporating innovative designs and construction practices into their projects to help promote low impact development and smart growth techniques.

Local Governments (cities, villages, and townships) are instrumental in the planning and development within the LGRW. Land use issues are a predominant concern in this area, and the cooperation of the local governments is essential for consistent and comprehensive land use planning.

UNIVERSITIES

The Annis Water Resources Institute (AWRI) of Grand Valley State University (GVSU) is a multidisciplinary research organization that has been in existence since 1986, and has been involved in many watershed projects. In addition to the LGRW project, the AWRI is currently involved in the LGRW through two implementation projects in the Rogue River Watershed, an information & education (I&E) program and a physical improvements project. The goal of the I&E program is to increase community involvement in watershed protection activities through awareness, education, and action. The AWRI has worked with watershed residents, local decision-makers, and environmentally based organizations to provide educational workshops, biological monitoring events, stream cleanups, and watershed fairs to encourage appropriate land use activities. In addition to I&E activities, the AWRI has led the physical improvements project with assistance from several partners to improve road stream crossings, stabilize stream banks, and establish vegetation along sections of the Rogue River.

Michigan State University Extension (MSUE) utilizes the resources of MSU and works on community outreach, especially with agriculture and the homeowner. MSUE offers a wide variety of technical assistance and employs individuals with high levels of expertise in their area of concentration to meet specific needs of producers and homeowners. MSUE is involved with research to better the services and technology that is available. Demonstration plots and training workshops involve the landowners in the implementation of practices they can adopt to address resource concerns.

Aquinas College, a liberal arts college located on the eastern edge of Grand Rapids, offers an Environmental Science major designed to provide students with a full knowledge of how ecosystems function. The Sustainable Business degree, the only undergraduate program of its kind in Michigan, presents a non-traditional strategy for business that eliminates waste and toxic materials, maximizes efficiencies, encourages an increase in corporate profitability, and eliminates negative environmental impacts. Aquinas College offers students the opportunity to participate in the Aquinas Chapter of Tri-Beta, Lambda Alpha (Tri-Beta), the national honor society for the biological sciences. The current Tri-Beta membership of Aquinas College participates annually in the Adopt-A-Stream Program facilitated by the West Michigan Environmental Action Council (WMEAC). Through assistance from WMEAC, students volunteer their time to pick up trash and debris from streambanks of Coldbrook Creek. Students also perform macroinvertebrate studies in order to determine general water quality.

NONPROFIT ORGANIZATIONS

The **Center for Environmental Study (CES)** uses scientific information and a shared sense of community at all levels to create environmental awareness and involvement. Selecting projects on the basis of need, resources, and appropriateness to its overall vision, the CES will act as a facilitator and catalyst, creatively using partnerships to expand its reach and effectiveness. CES has developed a Statewide Storm Water Education Campaign that will be integrated into the LGRW Project to create clear and consistent messages to the entire watershed.

CES has also partnered with the City of Grand Rapids to produce and air many radio ads called "Water Spots" as part of their NPDES Phase I Storm Water Discharge Permit.

Ducks Unlimited conserves, restores, and manages wetlands and associated habitats for North America's waterfowl. Ducks Unlimited is very active in the Grand River Watershed. They have identified several acquisition and habitat restoration projects during the first three years of their Grand River Watershed Program: a component of the Great Lakes Ecosystem Initiative. They also received a $1 million grant from National Animal Welfare Advisory Committee (NAWAC) to conserve 2,000 wetland acres in the Grand River Watershed. The grant will be combined with $3.7 million in matching funds from eight conservation partners.

Isaak Walton League of America works to "protect and use sustainably America's rich resources to ensure a high quality of life for all people, now and in the future".

They are dedicated to protecting soil, air, woods, waters, and wildlife. The Dwight Lydell Chapter currently holds membership in the Rogue River Watershed Council and was involved in the organization and planning of the Rogue River Celebration, a watershed fair for kids.

Land Conservancy of West Michigan is dedicated to "the protection of the dunes, forests, wetlands, and fields" in central West Michigan. Through their efforts in working directly with landowners and local communities they have established and currently maintain six nature preserves in Kent, Ottawa, and Oceana Counties.

The Nature Conservancy has been involved in the preservation of plants, animals and natural communities since 1951. They have worked with communities, businesses, and residents to protect more than 117 million acres around the world. The West Michigan Program Office has been active in the LGRW through the Rogue River Watershed I&E Program.

Schrems West Michigan Trout Unlimited Chapter is committed to the conservation, protection, and restoration of coldwater fisheries. They have been involved with the Pere Marquette, Rogue, Muskegon, Au Sable, and Coldwater Rivers. Chapter activities include river clean-ups, stream monitoring, streambank stabilization, fish shocking, invertebrate studies, and fly-fishing clinics.

Timberland Resource Conservation and Development (RC&D) Area Council was established in 1990. The purpose of the RC&D program is to encourage and improve the capability of volunteer, local elected, and civic leaders to plan and carry out projects for natural resource conservation and community development. RC&D provides a framework for people to work together to plan and carry out activities that will make their area and the region, a better place to live. Such activities lead to sustainable communities, prudent land use, and the sound management and conservation of natural resources. Since 2003, Timberland RC&D has been involved with the Sand Creek Watershed Partners, which works to conserve, protect, and restore the Sand Creek Watershed.

The West Michigan Environmental Action Council (WMEAC) is a non-profit environmental advocacy and education organization committed to citizen empowerment. Members are men, women, young people, retirees, families, professionals and students, hunters and anglers, sportsmen, executives, and homemakers with one thing in common: a desire to make a difference for the environment and their children's future. Their Adopt-A-Stream program involves volunteers of all ages in cleaning up, monitoring, and restoring streams throughout Kent County and surrounding areas. WMEAC, in partnership with the City of Grand Rapids, Michigan, has also started a community storm water education effort focused in the City of Grand Rapids and surrounding suburban communities. Stream Search is a program that partners WMEAC with the MDEQ in checking the health of Kent County streams and rivers. Teams of citizen scientists perform biological and habitat assessments.

CHAPTER 4 - INFORMATION AND EDUCATION STRATEGY

4.0 INTRODUCTION

An Information and Education (I&E) strategy is needed to help motivate the Lower Grand River Watershed's (LGRW) stakeholders, residents, and decision-makers to take the actions necessary to protect the water quality and environmental conditions in the watershed. This I&E strategy will serve as a working document that outlines the major steps and actions needed to successfully maintain and improve water quality and environmental conditions in the LGRW. There are two major sections of the strategy. The first section outlines the I&E strategy used during the planning phase, while the second section recommends an I&E strategy for implementation.

4.1 INFORMING AND INVOLVING THE PUBLIC DURING PLANNING

During the planning phase, public input was needed to ensure a comprehensive watershed management plan and I&E strategy for use during the implementation phase. Involving stakeholders during planning would ensure a more effective implementation phase.

4.1.1 I&E SUBCOMMITTEE

The I&E Subcommittee was formed early in the project in December 2002. Its membership was made up of local decision-makers and environmental outreach organizations. The I&E Subcommittee met monthly to focus on the development of information and educational tools, and their dissemination throughout the watershed. The goals and objectives of the I&E Subcommittee are listed below.

Goal 1: The I&E Subcommittee will involve all users of the watershed to assist in the creation of a successful and innovative information and education strategy.

Objectives to meet Goal 1:

- Assist in the identification of target audiences in the watershed.
- Develop appropriate messages to be disseminated throughout the watershed, and incorporate input from other subcommittees.
- Review various media forms, formats, and styles to make the most effective strategy.

Goal 2: The I&E Subcommittee will participate in the development of a Decision Support System (DSS) to delineate the urban and rural subwatersheds and the critical areas in the watershed.

Objectives to meet Goal 2:

- Review and interpret existing and new data, such as inventory findings, land use data, and impairments collected in the watershed.
- Review the DSS.

Goal 3: The I&E Subcommittee will participate in the preparation of the evaluation of the watershed management planning process and the measurable goals that will be used to assess water quality improvements in the watershed.

Objectives to meet Goal 3:

- Create and implement evaluation tools such as surveys, focus groups, monitoring, and computer modeling.
- Use tools to evaluate the success of the planning project and the effectiveness of water quality improvement measures.

4.1.2 I&E STRATEGY FOR THE PLANNING PHASE

A number of products/activities were slated for development during the planning phase of this project. The original work plan called for the development of one brochure, three newsletters, an I&E strategy for implementation, and a DSS, which emerged into a watershed-based interactive tool. Modifications to the work plan were made to include additional products and activities including a project website, a watershed handout, three board displays, two targeted training workshops, a project fact sheet, and an I&E guidebook. To keep organized, an I&E strategy was developed by the I&E Subcommittee and project staff.

The strategy was created to coordinate the development, review, distribution, and evaluation of each I&E product and activity. The I&E Subcommittee decided that all I&E efforts would be developed with this theme in mind: "It is vital that we be stewards of the LGRW because it has been of key importance to our past and will be valuable to our future."

A worksheet was developed for each I&E product and activity, and included the following items to be discussed and agreed upon by the I&E Subcommittee:

1. Product Name
2. Purpose
3. Theme
4. Target Audience
5. Learning Objective
6. Behavioral Objective
7. Emotional Objective
8. Distribution
9. Completion Date
10. Copies Budgeted
11. Product Evaluation (i.e. quantitative, external qualitative, and internal qualitative)
12. Level of Success

A review process also was discussed and established (Table 4.1). The review process involved the Grand Valley Metropolitan Council (GVMC), Fishbeck, Thompson, Carr & Huber, Inc. (FTC&H), the Annis Water Resources Institute (AWRI), the Michigan Department of Environmental Quality (MDEQ) representative, and the I&E Subcommittee. Step four of this six step process called for target audience members to review the product using a feedback form based on the product's objectives.

Table 4.1 - Review Process for I&E Products

Step One	First draft	Reviewed internally by AWRI
Step Two	Second draft	Draft sent to I&E Subcommittee members via e-mail for initial review of content and grammar
		Reviewed as a committee at the next I&E Subcommittee meeting
Step Three	Third draft	Reviewed internally by FTC&H, GVMC, and AWRI
Step Four	Fourth draft	Review of product by target audience members via a feedback form relating to product's objectives
Step Five	Fifth draft	Sent to I&E Subcommittee via e-mail for final comments
		Sent to Ms. Janice Tompkins for review required by MDEQ
Step Six	Final Draft	Sent to printer or internet

4.1.3 DELIVERABLES DURING THE PLANNING PHASE

The following I&E efforts were completed throughout the two-year planning phase: seven printed information tools, a project website, three board displays, two workshops, an I&E strategy, and a watershed-based interactive tool.

The brochure was completed at the onset of the project. It provided information on the LGRW Project, the Grand Forum (Forum) and project subcommittees, and ways to become involved in the project. It was disseminated through various project partners and members of the Forum. An additional general informational handout was also developed and distributed with the brochure to assist in the explanation of watershed and land use terminology.

Only two newsletters, rather than the three called for in the original work plan, were developed as it became obvious that other products were needed and would have more value. Additional products included a project website, www.gvsu.edu/wri/isc/lowgrand, which provided project information, meeting schedules and minutes, online copies of I&E materials and watershed maps, a list of project partners, and ongoing watershed activities. A fact sheet and board display also were created and used at the Growing Communities Conference held in June 2003. Two additional board displays also were created and displayed at the State of the Lake 2003 Conference, a meeting with the MDEQ in May 2004, and a public workshop held in June 2004.

In addition to the several printed materials and board displays, a watershed-based interactive tool, the Watershed Interactive Tool (WIT), was created for local decision makers, educators, students, and residents of the LGRW. This tool incorporates the following information regarding the LGRW: watershed management, natural history, interactive mapping, and general watershed concepts; also included are lesson plans for watershed education, government resources, and local water issues. The WIT also provides information to local units of government and non-profit entities on how to write their own nonpoint source (NPS) management plan. Two targeted training workshops were held for teachers during the second project year to solicit feedback regarding this tool.

Also, an I&E guidebook was created to assist units of government in the LGRW with their local outreach efforts. The guidebook provides the tools needed to develop and implement an effective outreach campaign. In addition to the creation of a strategy for individual watershed communities, an I&E strategy for the entire LGRW will be discussed in this document. It will provide the necessary steps to assist project staff in implementing an effective outreach campaign to motivate residents and decision-makers to take actions necessary to protect the water quality and environmental conditions in the watershed.

4.1.4 PUBLIC PARTICIPATION PROCESS

Members of the Forum and the I&E Subcommittee offered feedback on how to meet the goals and objectives developed for the I&E Subcommittee in addition to providing feedback on I&E products and activities. The Forum and I&E Subcommittee were open to the general public. Members of the Forum and Subcommittee included local, regional, and state governmental agencies, environmental activists, and watershed groups. Members discussed and offered suggestions on the content of I&E efforts throughout the project. Members also had a role in determining the vision, mission, and set of core values developed in a visioning process, in which the efforts of the I&E Subcommittee were based.

The public also had an opportunity to provide feedback on project products. The public provided their reaction to the content of the watershed newsletters and were asked to remark on the newsletter's success. At the two targeted training workshops, participants were asked to comment on the success of the workshop and the I&E products covered during the training session.

4.2 INFORMING AND INVOLVING THE PUBLIC DURING IMPLEMENTATION

With the completion of the planning phase, an I&E strategy for the implementation phase is necessary to help reach the goals developed for the LGRW. Well-defined steps will be needed to guide an effective I&E campaign. Tetra Tech, Inc., under contract with the U.S. Environmental Protection Agency (EPA), has developed *Getting In Step: A Guide for Conducting Watershed Outreach Campaigns.* The purpose of this publication is to provide the tools necessary to develop and implement an effective outreach campaign. The guide will be used to provide the framework for implementing an effective I&E strategy for the LGRW. The guide defines six discrete steps, which will be followed in this I&E strategy. The six steps are as follows:

1. Define the driving forces, goals, and objectives
2. Identify and analyze the target audience
3. Create the message
4. Package the message
5. Distribute the message
6. Evaluate the outreach campaign

4.2.1 DRIVING FORCES, GOALS, AND OBJECTIVES

Identification of driving forces, goals, and objectives will help determine the scope of the campaign and focus efforts on a purpose.

DRIVING FORCES

There are several driving forces that have prompted the creation of a Watershed Management Plan (WMP) for the LGRW. Because of increasing urban development, threats of combined sewer overflows (CSOs), and both past and current water pollution, the public has felt a need to protect and restore this resource. The GVMC, the AWRI of Grand Valley State University (GVSU), and FTC&H became interested in initiating this project to address watershed concerns by creating a WMP for the LGRW. The project was supported and promoted by numerous communities who pledged to attend meetings and provide available resource information. Many of these communities had been identified by the EPA as having urbanized areas requiring a National Pollutant Discharge Elimination System (NPDES) storm water discharge permit. These communities saw the opportunity to use the Lower Grand River WMP as a guide to understanding water quality concerns in their community and developing their Storm Water Pollution Prevention Initiative (SWPPI) in accordance with NPDES Phase II Storm Water Regulations.

PROJECT GOALS

Through the LGRW project's visioning process, a vision, mission, overall project goal, and set of core values were developed. These must be kept in mind when undertaking all I&E tasks in the future.

LGRW Vision Statement: *Swimming, drinking, fishing, and enjoying our Grand River Watershed: Connecting water with life.*

LGRW Overall Mission Statement: *Discover and restore all water resources and celebrate our shared water legacy throughout our entire Grand River Watershed community.*

LGRW Overall Project Goal: *To continue the momentum of Section 319 planning project and help provide support to generate future watershed projects that would sustain success and have greater water quality benefits.*

LGRW Core Values:

- LGRW activities are diverse, inclusive, and collaborative
- LGRW efforts are sustainable and of high quality
- LGRW images and messages create a widely shared sense of legacy and heritage
- LGRW methods and products are holistic and employ a systems approach
- LGRW organization and program evaluate progress and reward success

I&E GOALS

The I&E strategy will help fulfill the vision and mission of the Lower Grand River project. I&E efforts will achieve the watershed management goal by increasing the involvement of the community in watershed protection activities through the steps of awareness, education, and action. It is also the goal of this strategy to coordinate with the ongoing efforts of Phase II communities to implement their Public Education Plans (PEPs), and to coordinate with the Statewide Storm Water I&E Campaign developed by the Center for Environmental Study (CES).

I&E STRATEGY OBJECTIVES

To reach the I&E goals, four major objectives must be met. These objectives will move the audience through the phases of outreach: Awareness, education, and action. The messages and formats used to achieve these outcomes will vary with each audience. Under each objective, specific tasks and products will be developed to address how the objective will be achieved. The objectives are as follows:

- *Objective 1* (Awareness): Make the target audience aware that they live in a watershed with unique resources and that their day-to-day activities affect the quality of those resources.

- *Objective 2* (Education): Educate target audiences on the link between urban development/rural practices and water quality impacts. Highlight what actions can be taken to reduce impacts.

- *Objective 3* (Action): Motivate the audience to adopt and implement practices that will result in water quality improvements.

- *Objective 4* (Action): Incorporate watershed protection activities into land-use planning and land management decisions.

I&E STRATEGIC COMPONENTS

Listed below are eight strategic components for public awareness developed by the Forum and project partners during the planning phase of the LGRW project. According to these components, public awareness must:

- Be relevant and tied directly to general public interests and should be on a very personal, interactive level. (To as great a degree as possible, attach "water connectedness" to daily personal work, play, and living of real people.)

- Involve LGRW activities into existing, well-attended, locally appreciated (cherished) events. Use this as a chance to establish both a local visibility and connection between the watershed and the general public. Where active subwatershed groups exist, help these groups to establish activities which are consistent with LGRW goals and objectives.

- Be responsive to a generational imperative. (Awareness must occur over a broader spectrum of population segments recognizing real differences between generations.)

- Establish a series of events or programs, which physically connect people to water, i.e. raft race, bridge walk, watershed festivals, movie previews, etc. ("Connection" should evoke all the senses including memories.)

- Develop and support ongoing interactive educational institutions, e.g. mobile water workshops, water center or museum, and the AWRI research vessels.

- Ensure that the information base is made accessible and understandable over a wide range of learning styles and a wide range of ages.

- Establish the effective development of a LGRW image tying water to home, heritage, and health. (Must have consistency in messaging.)

- Design campaigns for continual interactions with image/message, particularly emphasizing the place of LGRW in our own prominent world feature (Great Lakes) and connecting one's own sub-basins through the LGRW to that globally significant feature.

4.2.2 TARGET AUDIENCES AND MESSAGES

Target audiences were identified by the I&E Subcommittee and project staff. Characteristics of each audience were sought out and summarized. For each of the audiences, general messages were developed. One of the first steps in the implementation phase should be to conduct focus groups of each audience throughout the watershed to fine tune characterization and messages.

SPECIFIC TARGET AUDIENCES

Based on the I&E goals for the LGRW, key target audiences were identified. Although the overall audience for the I&E strategy is extremely broad, there are two major categories of audiences: 1) users of the resource and 2) local decision-makers (elected officials, planners). Each category is further broken down to include the following groups:

Category 1

- Agricultural Community
- Residents of Rural Pilot Project Area
- Residents of Urban Pilot Project Areas
- Business Owners
- Builders/Developers
- Environmental/Recreational Groups
- Schools (K-College)
- Homeowners/Riparian and Corridor Landowners/Others
- Watershed Management Members/Forum/Others

Category 2

- Municipal Leaders
- Municipal Employees

TARGET AUDIENCE CHARACTERISTICS

To be effective, the LGRW project must evaluate the target audiences who will receive the information about watershed issues. Their level of understanding of watershed management, range of values and concerns, and level of enthusiasm for watershed activities are expected to differ across the diverse groups that make up the community. Understanding these differences is critical to targeting appropriate audiences, developing effective messages and means of participation, and motivating audiences to become involved in the watershed management process.

For each key audience, project staff members researched audience characteristics. This information will be critical for developing and distributing effective messages on watershed issues. It is recommended that information be collected continuously throughout the process to refine the I&E strategy. Appendix 5 includes a summary of 1) makeup of the audience, 2) how they receive information on environmental issues, 3) existing level of knowledge on watershed issues, and 4) communication tools used to reach their constituents. Appendix 6 includes contact information for each of the target audiences as well as potential project partners.

MESSAGES

Effective, vivid messages will be needed to motivate stakeholders to take actions necessary to protect the water quality and environmental conditions in the LGRW. Messages are designed to raise general awareness, educate, or motivate action. Messages for the LGRW have been crafted based on the established goals and objectives for the LGRW and the I&E strategy. These messages can be used to raise awareness, educate audiences, and create calls for action. Messages should be repeated frequently to make an impact on the audience.

Each audience will respond differently to the information presented. It is critical that messages be tailored to meet the needs of each audience. The members of each audience must understand specifically how the information presented affects them. Several broad messages have been developed for various audiences based on the information available. These messages should be validated and modified as more information becomes available during the outreach campaign. The key messages, which have been created thus far, are as follows:

- *The Lower Grand River Watershed is a unique resource in which everyone can enjoy and take pride.* This message emphasizes the value of this resource making the audience feel proud and protective.

- *Take part in shaping your future.* If the audience feels vested in the project, it has a higher likelihood of success.

- *Protecting your watershed also protects your pocketbook.* It is important to emphasize the connection between a healthy watershed and economic savings. Information that can be collected and presented includes: 1) revenue generated from recreational users, 2) cost/benefit ratio of BMPs, 3) property values along the river, and 4) cost comparisons between prevention and repair.

- *We've got the tools to help you get the job done*. As audiences move from awareness to education, they need to be informed of available resources to help implement changes.

4.2.3 PACKAGE THE MESSAGE

The format of each message was determined based on the information collected on target audiences. Certain formats are effective for an area as large as the Grand River Basin and many of these formats will be helpful to groups working in smaller watersheds as well. Several formats have been identified and crafted into many I&E products and activities that are explained below.

GENERAL SUMMARY OF THE LOWER GRAND RIVER WMP

A general summary of the Lower Grand River WMP will provide a synopsis of watershed concerns and recommendations for watershed stakeholders and key target audiences. Stakeholders would receive an easy-to-read update on accomplishments, outcomes, and recommendations of the planning phase. The summary could be distributed at various events and should be developed very early on during implementation to establish a connection between the planning and implementation phases.

SUB-BASIN WORKSHOPS REGARDING I&E STRATEGY DEVELOPMENT

Providing workshops for LGRW communities regarding local I&E strategy development would help to create and implement local outreach campaigns that incorporate LGRW goals and objectives.

WORKSHOPS ON INTERACTIVE WATERSHED MANAGEMENT TOOLS

Through the LGRW project, four interactive watershed management tools were generated to help watershed stakeholders in their efforts toward improving water quality. During the planning phase, a workshop was held in June 2004 to train individuals on the products developed; however, more workshops are needed. Workshops will train individuals on how to use the tools and also solicit feedback for their improvement.

MEETINGS TO ASSIST WITH IMPLEMENTATION OF LOCAL PEPS

A PEP was developed by FTC&H for participating Phase II communities in accordance with NPDES Phase II Storm Water Regulations. Coordinating Phase II community efforts, regarding local outreach campaigns, with the I&E strategy of the LGRW project will combine resources and create a stronger I&E campaign. Meetings with Phase II communities can be planned to discuss coordinating efforts, sharing resources, etc. It should be noted that the PEP identifies behaviors residents can adopt to improve water quality. In addition, the PEP:

- Identifies target audiences for pollution sources related to storm water
- Catalogs existing environmental educational programs in the Greater Grand Rapids Area
- Identifies needs for additional educational programs to meet PEP objectives
- Lists funding sources available for implementing PEP activities
- Raises awareness about existing programs

WORKSHOPS TO ASSIST WITH COORDINATION OF STATEWIDE STORM WATER EDUCATION CAMPAIGN

The LGRW covers an immense area; therefore, it makes sense to coordinate with the Statewide Storm Water I&E Campaign. The product of the Statewide Storm Water I&E Campaign, an I&E tool kit, was developed by the Grand Rapids based CES. The tool kit includes electronic files of brochures, fact sheets, posters, flyers, print ads, activity ideas, radio/TV public service advertisements, etc. These materials can be promoted in a series of workshops for local decision-makers in the LGRW.

WATERSHED EDUCATION CENTER

A watershed education center would provide a central location for watershed resources such as books, studies, teaching tools, maps, and electronic resources. The center could also collect historical and current pictures and become the community's cultural connection to the watershed. It would be the "go to" place for watershed awareness and education. Potentially this center could be its own entity or part of the LGRW project. The center could require transportation such as a mobile classroom or a built/renovated structure to house materials. The City of Wyoming's Clean Water Plant is currently interested in spearheading this effort.

WATERSHED FESTIVAL (WATER WEEK)

A watershed festival, coordinated with other large events in the watershed (e.g. art festivals, River Run, conventions), will draw a large audience. This activity would draw attention to water quality issues in the watershed and raise awareness regarding human effects on water quality. Millennium Park offers an ideal location and provides public access to water bodies, parking, and plenty of space for activities.

4.2.4 DISTRIBUTE THE MESSAGE

After the message has been packaged in the desired format, it can be distributed. Messages can be delivered by mail, phone, door-to-door, e-mail, presentations, workshops, meetings, local events, etc. Who will deliver the message depends on the target audience to be reached. Methods of distribution for each message are noted in the section “Implementation I&E Strategy Outline” on page 123.

4.2.5 EVALUATING THE OUTREACH CAMPAIGN

Evaluation provides a feedback mechanism for ongoing improvement of an outreach effort. Feedback generated during the early stages of implementation should be used immediately in making preliminary determinations about the program’s effectiveness. Continually adapting elements of the outreach effort as new information is received ensures that ineffective components are adjusted or scrapped, while pieces of the program that are working are supported and enhanced. Methods of evaluation for each proposed I&E effort are provided in section “Implementation I&E strategy Outline” on page 123. In the section below, the use of focus groups and pre-post surveys are discussed. These methods of evaluation will be used to develop and assess the effectiveness of messages and their delivery methods as well as the overall impact of I&E efforts during the implementation phase.

EVALUATION FOR EFFECTIVE MESSAGES AND DELIVERY METHODS

In an effort to develop appropriate and effective media messages and formats for those living within the LGRW, it is essential that baseline data be gathered about the population in this region. What is required are primary data that can reveal information about predictable behavioral and attitudinal tendencies of this population, which in turn can help fashion specific media messaging. It is surmised that LGRW target audiences represent 11 population groups (specific target audiences are listed on Page 114 in two categories).

FOCUS GROUP METHODOLOGY

It is proposed that focus groups be conducted with representatives of the defined 11 population groups. A focus group is a discussion session in which individuals (who are pertinent to the issue at hand) are in attendance to speak with one another about a set of related issues or problems: In this case, water quality, the LGRW, individual and collective responsibilities toward the region and water quality, and other collateral matters.

The principal value of a focus session is that it permits and promotes communication dynamics and the articulation of subjective dimensions of behavior (i.e. attitudes) that are at the root of human perception (what we can and are willing to acknowledge) and human action (what we can and are willing to do).

COST OF FOCUS GROUPS

The Complete Approach: The most complete, accurate, and efficient approach in this situation is to: 1) conduct a telephone survey to screen for, and invite, potential focus group participants, and 2) conduct one focus group for each of the 11 population groups previously identified.

It is estimated that a screening telephone survey, using a random digit dialing technique, would involve contacting 500+ individuals. The survey questionnaire would offer an efficient and unbiased approach to focus group participant selection. Estimated cost for this portion of the project is $4,800 +/- 15%.

The cost of moderating, taping, and summarizing (in writing) each focus group is $850, assuming a commitment to a package of 11 focus sessions (total = $9,350), which includes a final report and recommendations.

Total cost, including the telephone screening survey and 11 focus sessions is around $14,000.

The Reduced Approach: A trimmed-back approach would forego the screening survey and would, instead, rely upon referrals. This is an acceptable alternative, though it is substantially biased. Cost is estimated to be $1,500 +/- 10% for secretarial/clerical support. Furthermore, in lieu of conducting 11 focus sessions, there would be only four sessions: three focus groups would cover Category 1 and one focus group would cover Category 2. In this situation, assuming a commitment to four focus groups, the per session cost is $1,000 for a total of $4,000. This includes the cost of moderating, taping, summarizing, as well as a final report and recommendations.

In an effort to reduce the number of focus groups, and yet cover the range of the population in the basin, each focus group would necessarily contain members of two or more population groups. While the interspersing of focus group participants can work, it is far better from a research perspective to conduct a focus session for each (of the 11) population groups. It is believed that each population group is likely to have a unique contribution to the dialogue. Population groups are considerably more likely to speak freely when they can speak with other individuals with shared identities.

EVALUATION OF THE IMPACTS OF I&E EFFORTS DURING THE IMPLEMENTATION PHASE

Pre/post surveys will be used to assess the overall impact of I&E efforts during the implementation phase.

PRE/POST PUBLIC SURVEYS

Pretest: Once focus groups have been conducted, and before the public has been exposed to media messages, it is critical to survey the public in this region as to its general grasp of the array of issues. These include issues such as awareness of water quality, beliefs about water quality, personal practices regarding water quality, watershed principles, media usage, awareness of environmental agencies and organizations, public perception of credible sources vis-à-vis water quality issues, demographics, etc.

To survey the public, a random-based telephone survey can be conducted within the region. The total cost of data collection for the pretest phase of the survey is $10,000 +/- 10%, which includes an analysis of the data and a final report.

Posttest: It is strongly recommended that there be two posttest periods to test for changes in the public that can be directly attributed to the impact of media messages. The first period would be at the end of a six-month media campaign. The second period would be one year after the first posttest. The two posttests are essential to this project in that they confirm the changes, if any, have occurred. Both periods of post testing are desirable. The first posttest provides measures of immediate changes (that might not be lasting), whereas the second posttest provides measures of mature changes. The cost of each posttest is estimated at $8,000 +/- 10%, for a total of $16,000 +/- 10%. A cost summary is available on Table 4.2.

Finally, it should be underscored that it is unnecessary to have a separate evaluation, or posttest, of the focus groups. Essentially, the focus groups provide the necessary background for the development of media messages, and the area-wide surveys (pretest and posttests) offer the validation of the impact of these messages.

TABLE 4.2 - Estimated Costs for Focus Groups and Surveys

Proposed Activity	Estimated Cost Range
Screening telephone survey (Focus group selection) -or- Focus group referrals	$4,800 +/- 15% $1,500 +/- 10%
11 Focus groups -or- 4 Focus Groups	$9,350 $4,000
Pretest telephone survey -and- 2 Posttests	$10,000 +/- 10% $16,000 +/- 10%

Timeframe: The following timeframe is an estimation and may require adjustment depending upon further demands and requirements.

TABLE 4.3 - Schedule for Focus Groups and Surveys

Task	Length of Time Required
Focus Group Selection (Survey screening or referral)	6 to 8 weeks
Focus Group Moderation (4 or 11 focus sessions)	6 to 8 weeks
Analysis/Final Report	6 to 8 weeks
Development of Media Messages and Pretest Survey	8 to 12 weeks
Public Exposure to Media Messages	24 weeks
First Posttest (At the end of the first year/after 6 months of media messages)	6 to 8 weeks
Second Posttest (At the end of the second year of media messages)	6 to 8 weeks

4.2.6 IMPLEMENTATION I&E STRATEGY OUTLINE

An action implementation plan is needed to proceed with an outreach campaign. Table 4.4 outlines target audiences, messages, delivery mechanisms, and potential methods for evaluation. Table 4.5 outlines potential partners, milestones, timelines, and estimated costs. The staff hour cost for each task is based on one full time project manager. Time spent by project partners on I&E activities were not included in the estimated costs.

TABLE 4.4 - Summary of Delivery Mechanisms, Messages, Potential Evaluation, and Target Audiences

Pollutant	Source/Cause	Objective	Target Audience	Messages	Delivery Mechanism	Potential Evaluation
Pathogens Sediment Nutrients Unstable Hydrology Temperature Habitat Fragmentation Chemicals	Sources/causes identified in Lower Grand River WMP	Awareness	Selected as pollutants are determined for area	Conduct focus groups of each audience throughout the watershed to fine tune characterization and messages. Example Message: *Take part in shaping your future.*	Focus groups to develop specific messages and target audience characterization	Complete with 1 pre-test and 2 posttests
Pathogens Sediment Nutrients Unstable Hydrology Temperature Habitat Fragmentation Chemicals	Sources/causes identified in Lower Grand River WMP	Awareness	Applies to all audiences	Conduct focus groups of each audience throughout the watershed to fine tune characterization and messages. Example Message: *The Lower Grand River Watershed is a unique resource in which everyone can enjoy and take pride in.*	General summary of LGRW management plan	Tear-off evaluation postcard included in summary
Storm Water and Associated Pollutants	Unmanaged storm water	Education and Action	Selected as pollutants determined	Conduct focus groups of each audience throughout the watershed to fine tune characterization and messages. Example Messages: *1) Protecting your watershed also protects your pocketbook.* *2) We've got the tools to help you get the job done.*	Sub-basin workshops regarding I&E strategy development	Exit surveys will provide an evaluation of workshop's success

TABLE 4.4 - Summary of Delivery Mechanisms, Messages, Potential Evaluation, and Target Audiences

Pollutant	Source/Cause	Objective	Target Audience	Messages	Delivery Mechanism	Potential Evaluation
Storm Water and Associated Pollutants	Unmanaged storm water	Education	Selected as pollutants determined	Conduct focus groups of each audience throughout the watershed to fine tune characterization and messages. Example Message: *We've got the tools to help you get the job done.*	Workshops on interactive watershed management tools	1) Exit surveys to evaluate workshop's success 2) Follow-up phone surveys to evaluate use
Storm Water and Associated Pollutants	Unmanaged storm water	Action	Municipal Leaders	Conduct focus groups of each audience throughout the watershed to fine tune characterization and messages. Example Messages: 1) *Protecting our watershed also protects your pocketbook.* 2) *We've got the tools to help you get the job done.*	Meetings to assist with implementation of local PEPs	1) Exit surveys to evaluate meeting's success 2) Follow-up phone surveys to evaluate effectiveness
Storm Water and Associated Pollutants	Unmanaged storm water	Action	Municipal Leaders	Conduct focus groups of each audience throughout the watershed to fine tune characterization and messages. Example Messages: 1) *Protecting our watershed also protects your pocketbook.* 2) *We've got the tools to help you get the job done.*	Workshops to assist with coordination of statewide storm water education campaign	1) Exit surveys to evaluate workshop's success 2) Follow-up phone surveys to evaluate effectiveness

TABLE 4.4 - Summary of Delivery Mechanisms, Messages, Potential Evaluation, and Target Audiences

Pollutant	Source/Cause	Objective	Target Audience	Messages	Delivery Mechanism	Potential Evaluation
Storm Water and Associated Pollutants	Unmanaged storm water	Education	Students, Educators, General Public	Conduct focus groups of each audience throughout the watershed to fine tune characterization and messages. Example Messages: 1) *The Lower Grand River watershed is a unique resource in which everyone can enjoy and take pride in.* 2) *Take part in shaping your future.*	Watershed Education Center (WEC)	Survey of participants to evaluate WEC
Storm Water and Associated Pollutants	Unmanaged storm water	Awareness and Education	Students, Educators, General Public	Conduct focus groups of each audience throughout the watershed to fine tune characterization and messages. Example Messages: 1) *The Lower Grand River watershed is a unique resource in which everyone can enjoy and take pride in.* 2) *Take part in shaping your future.*	Watershed Festival (Water Week)	Pre/post survey of participants to evaluate festival

TABLE 4.5 - Schedule and Estimated Costs

Delivery Mechanism	Tasks	Potential Partners	Milestones	Timeline	Estimated Costs
Focus groups to develop specific messages and target audience characterization	Organize groups, conduct meetings, analyze results, disseminate results, and evaluation of findings	Grand Valley State University Communication Department, AWRI, Tetra Tech, FTC&H, CES	Focus Group selection (survey screening or referral) Focus group moderation (4 or 11 focus sessions) Analysis/final report Development of media messages and pretest survey Public exposure to media messages First Posttest (at the end of the first year/after 6 months of media messages) Second Posttest (at the end of the second year of media messages)	4 to 6 weeks 2 to 6 weeks 2 to 3 weeks 8 to 12 weeks 24 weeks 3 to 4 weeks 3 to 4 weeks	Range depending on factors chosen. $16,300 to $24,950
General summary of Lower Grand River WMP	Organize project staff and resources to develop, disseminate, and evaluate summary	Current planning phase partners	Fill out worksheet to outline theme, objectives, evaluation methods, and dissemination methods. Develop Summary Disseminate Summary Conduct Evaluation	First Quarter, First Year Second to Third Quarter, First Year Second to Third Quarter, First Year Third Quarter, First Year	Costs driven by number of hours to develop and disseminate summary, number of pages in summary, number of colors used, format of printed version, and number actually printed.

TABLE 4.5 - Schedule and Estimated Costs

Delivery Mechanism	Tasks	Potential Partners	Milestones	Timeline	Estimated Costs
Sub-basin Workshops Regarding I&E Strategy Development	Organize project staff and partners to develop content and agenda for workshops and to coordinate locations to generate interest from local watershed groups Must also evaluate workshops individually	Environmental education groups and government agencies such as: NRCS, MDEQ, conservation districts, nature centers, museums, WMEAC, CES, AWRI	Organize partners Develop content and agenda, secure locations Organize invitations/promotions/ RSVPs Conduct workshops Conduct evaluation	First quarter, First year Second to third quarter, first year Second to third quarter, first year Third to fourth quarter, first year Third to fourth quarter, first year	$100 to $150/workshop + 24 staff hours
Workshops on Interactive Watershed Management Tools	Organize project staff and partners to develop content and agenda for workshops and to coordinate locations to generate interest from local watershed groups	Project Staff from Planning Phase of Project (Grand Valley Metro Council, AWRI, GVSU, FTC&H, MDEQ)	Organize and train staff with products/tools Develop content and agenda, secure locations Develop invitations/promotions/ RSVPs Conduct workshops Conduct evaluation	Third quarter, first year Third quarter, first year Fourth quarter, first year to first quarter, second year Fourth quarter, first year First quarter second year	$100 to 150/workshop + 24 staff hours

TABLE 4.5 - Schedule and Estimated Costs

Delivery Mechanism	Tasks	Potential Partners	Milestones	Timeline	Estimated Costs
Meetings to assist with implementation of local PEPs	Incorporate needs of PEPs into focus groups to develop messages and combine resources for promotion of activities	Phase II communities, GVSU, AWRI, FTC&H, CES, WMEAC	Organize partners Develop content and agenda, secure locations Organize invitations/promotions/ RSVPs Conduct meetings Conduct evaluation	To be determined	$50/meeting + 16 staff hours
Workshops to assist with coordination of Statewide Storm Water Education Campaign	Assist LGRW communities to incorporate materials from statewide storm water campaign into their I&E strategies	CES, Phase II communities	Identify interested communities Conduct workshops to assist CES in incorporating statewide information and education information into community I&E strategies Conduct evaluation	To be determined	$100 to $150/workshop + 24 staff hours
Watershed Education Center	Locate and provide appropriate educational material for use in mobile “center”	Wyoming clean water plant, Phase II communities	Locate information Obtain/purchase copies of information Find appropriate location to display information Conduct evaluation	To be determined	To be determined
Watershed Festival (Water Week)	Coordinate festival activities and volunteers	Phase II communities, GVSU, AWRI, FTC&H, CES, WMEAC	Determine festival activities/layout Find volunteers to staff festival Get materials and donations Hold festival Conduct evaluation	First year second to fourth quarter	$800 to $2,000/festival

CHAPTER 5 - METHODS OF PROJECT EVALUATION

Evaluation of the Lower Grand River Watershed (LGRW) project is a two-phase process. The first phase has evaluated the success of the planning process and the second phase will outline the methods and strategies for evaluating the implementation of the watershed management plan.

The desire for success can sometimes create a bias for project partners and managers; therefore, the evaluation of this project was contracted to a third-party consultant. This allowed the project partners to openly share their thoughts about the experience, not to assign blame, but to learn from these experiences and to identify creative solutions. The evaluation process not only provided the project partners the opportunity to identify areas for improvement, but also the opportunity to collectively acknowledge and celebrate successes. Future subwatershed projects are highly encouraged to study this evaluation to avoid identified weaknesses and build on successful strategies.

The second phase of project evaluation will occur during the implementation of the watershed management plan. The evaluation tools that are identified will be used to measure the success of the project as it relates to water quality, public participation, and the success of project outcomes.

5.1 EVALUATION OF THE PLANNING PROCESS

The planning process of the LGRW project began on July 1, 2002. The evaluation of the planning process was subcontracted to Tetra Tech, Inc. to complete an objective assessment of the success in meeting the goals and objectives of the project. The third-party evaluation used a process developed by the W.K. Kellogg Foundation to assess the success of this project. This evaluation process used stakeholder involvement to generate information about the project and examine the context of the project, how it was implemented, and what outcomes resulted.

Tetra Tech, Inc. organized an evaluation team made up from representatives from the Steering Committee and each of the five subcommittees. The tasks of the evaluation process were to:

- Develop evaluation questions with the evaluation team
- Develop the evaluation approach and tools
- Collect and analyze data
- Prepare draft and final evaluation summary

The evaluation team met in March 2003 to develop a list of questions regarding the information the Evaluation Team wanted to collect and the appropriate tools to collect this information. The evaluation team developed a list of questions that were designed to capture information about the following focus areas:

- Assessment and characterization of the watershed's natural resources and water quality conditions
- Information and Education Strategy
- Creating a system of regional governance for the LGRW
- Reviewing and recommending the adoption of Best Management Practices (BMPs)
- The management process for the project including the timeliness and manner of implementation of various project elements, strategies, and activities

Team members conducted a brainstorming activity during the first meeting to identify potential evaluation questions in each of the five project focus areas. The questions addressed issues related to goals and objectives, organizational arrangements, processes, and outputs. Many of the evaluation questions had the same type of evaluation tool options listed. This was not intended to indicate that a separate evaluation activity should be used for each question. The intent was to identify those questions that could use the same type of evaluation tool and then use one activity to maximize the type of information generated.

The evaluation tools selected by the evaluation team were content analysis, focus groups, interviews, and surveys. Throughout the project's second year, Tetra Tech, Inc. used these tools to ask project staff, partners, and stakeholders the questions developed by the Evaluation Team. A description of each evaluation tool and how it was used is provided below.

5.1.1 CONTENT ANALYSIS

Review and analysis of project-related documentation allows for a comparison of the intent of the project with the reality of the project. Tetra Tech, Inc. reviewed and analyzed the following project documents and products generated through the LGRW project:

- Project work plan
- Project schedule
- Quarterly reports
- Subcommittee goals and objectives
- Grand River Forum (Forum) evaluations
- Interactive tool evaluation forms
- Project brochure
- Watershed handout
- Grand River Beacon newsletters
- Project website
- Online resource library
- Committee meeting minutes
- Proposed project area maps

During the content analysis, the Tetra Tech, Inc. project evaluator reviewed and analyzed material to identify information regarding the context, implementation, and outcomes of the project. In some cases, the project evaluator compared information contained in documents to identify successes and challenges. In addition, the project evaluator compared information compiled through the content analysis to information collected using other evaluation tools such as focus group results and survey responses.

5.1.2 FOCUS GROUP

Focus groups generate a range of opinions on a topic and foster discussion. Evaluation team members met on July 30, 2003, in a focus group session, to discuss the challenges and successes of the LGRW project. The project evaluator served as the facilitator and asked participants to provide feedback on a series of questions derived from the potential evaluation questions developed during the evaluation team meeting held in March 2003. The questions addressed issues related to goals and objectives, organizational arrangements, processes, and outputs of the project.

5.1.3 INTERVIEWS

The project evaluator used interviews as an evaluation tool to obtain in-depth details on the workings of the project and the project partners. Phone interviews, administered by the project evaluator, took place with the MDEQ Project Administrator and project grantees and covered the same range of issues as discussed in the evaluation team focus group meeting on July 30, 2003. The project evaluator also contacted representatives from Phase II communities that provided matching funds and contributed time and resources to the project. Evaluation questions presented to representatives addressed Phase II storm water permitting needs, benefits and value of participation, and the perceived assistance provided by the completion of the Watershed Management Plan.

In order to obtain input regarding the potential impact of the LGRW project on subwatershed groups in the LGRW, the project evaluator also contacted a representative from each of the six active subwatershed groups. Active subwatershed groups in the LGRW include groups in the Coldwater River Watershed, the Bear Creek Watershed, the Rogue River Watershed, the Thornapple River Watershed, the York Creek Watershed, and the Sand Creek Watershed. The evaluation questions presented to these subwatershed groups addressed each group's familiarity and level of participation with the project, their understanding of the purpose and function of the LGRW organization, and the perceived value of such an organization.

5.1.4 SURVEYS

To ensure that the evaluation captured the broader perspective of subcommittee participants, the evaluation team members facilitated evaluation activities within their respective subcommittees. Although initially intended to function as a focus group, subcommittee members requested additional time to consider the evaluation questions and prepare their responses. As a result, many subcommittee members answered the evaluation questions in a survey format by taking home the evaluation questions and submitting their answers to the project evaluator individually. Evaluation questions provided to subcommittee members addressed subcommittee goals and objectives, communication among subcommittees, level of participation, subcommittee functions and structure, project schedules and budgets, and overall lessons learned.

Feedback on the subcommittee focus group questions helped to formulate focus group questions for the Steering Committee. Evaluation questions provided to members of the Steering Committee addressed committee goals and objectives, communication with subcommittees, challenges, missing areas of expertise, committee functions and structure, level of participation, overall lessons learned, and future tasks.

Surveys were also provided to members of the Forum in order to evaluate the seven Forum meetings that took place over the course of the project. Evaluation questions presented to the Forum members, addressed level of participation, size and diversity of forum, meeting logistics, usefulness of meetings, and perceived value of feedback given to project staff.

5.2 EVALUATION FINDINGS

Following the evaluation team meetings, the project evaluator was prepared to use the evaluation tools to collect information that would answer the questions posed by the evaluation team. Using the W.K. Kellogg Foundation evaluation approach, the project evaluator assessed the project in three categories: context, implementation, and outcomes.

5.2.1 CONTEXT

Findings in this evaluation category address the structure and function of the project partners, as well as how the project functions within the community.

Successes related to project context are as follows:

- Adapting project structure based on needs of the group by dividing the responsibilities of the Sustainability Subcommittee between the Steering Committee and the Visioning Subcommittee;
- Coordinating a watershed organization discussion panel to learn from existing watershed organizations in the LGRW and the State of Michigan to inform the watershed organization development process;
- Creating the Forum as a mechanism specifically intended to generate stakeholder participation and involvement;
- Identifying and fulfilling the need for the primary grantee to take a more significant leadership role among project partners;
- Generating momentum among a core group of watershed stakeholders to sustain efforts of the planning phase through to the implementation phase.

Challenges related to project context are as follows:

- Creating a project structure that may have hampered communication among subcommittees, particularly for individuals that did not participate on more than one committee;
- Creating the perception of a Grand Rapids/Kent County focused project and a watershed stakeholder group with limited diversity;
- Defining a watershed vision and goals at the end of the project rather than the beginning;
- Initiating subcommittee activities without providing members the opportunity to contribute to the development of subcommittee goals and processes.

5.2.2 PROJECT IMPLEMENTATION

Findings in this evaluation category address task implementation, the performance of project staff and partners, and the evolution of the project over time. Project implementation also takes into account project outputs (i.e., project deliverables required under the work plan) and deadlines.

Successes related to project implementation are as follows:

- Ensuring constant progress toward achieving work plan tasks through the use of dedicated project staff;
- Resolving facilitation issues within the information & education (I&E) Subcommittee based on input from subcommittee members;
- Completing work plan requirements;
- Developing watershed vision and goals;
- Developing the Watershed Interactive Tool and related resources using stakeholder feedback throughout the development process;
- Creating strategic plan for creation of an appropriate watershed organization;
- Implementing additional tasks beyond work plan requirements;
- Providing a forum for information exchange among watershed stakeholders participating on subcommittees;
- Identifying and creating formalized product development processes as necessary.

Challenges related to project implementation are as follows:

- Fluctuating participation trends among Steering Committee, subcommittees, and the Forum;
- Developing I&E products with limited evaluation to assess effectiveness;
- Focusing on two specific pilot project areas that may have resulted in diminished participation from stakeholders with interests outside of the pilot project areas;
- Limiting Forum meetings to a specific time and location that does not allow a wide array of watershed stakeholders to participate.

5.2.3 PROJECT OUTCOMES

Project outcomes focus on the impact that the LGRW planning project has had in the short-, medium-, and long-term.

Successes related to project outcomes are as follows:

- Obtaining stakeholder approval on the Watershed Interactive Tool and related resources;
- Obtaining positive feedback from participating Phase II communities on the usefulness of project products to fulfilling their Phase II storm water permitting requirements;
- Developing two MDEQ-approved watershed management plans for Sand Creek and Buck Creek watersheds;
- Acknowledging long-term project evaluation needs;
- Developing long-term project evaluation mechanisms.

Challenges related to project outcomes are as follows:

- Assessing future impact of products on watershed and storm water management efforts;
- Assessing increased awareness of watershed management issues as a result of I&E efforts;
- Assessing effectiveness of strategy to create a permanent watershed organization through the use of an interim watershed council comprised of Steering Committee members;
- Assessing effectiveness of the Lower Grand River Watershed Management Plan (WMP) in achieving water quality improvements during the implementation phase.

Additional assessment of these three project categories can be found in the final project evaluation (Appendix 7).

5.3 EVALUATION OF PROJECT IMPLEMENTATION

The second phase of the evaluation will measure the success of the project and improvements to water quality after the WMP's recommendations are implemented. To evaluate water quality, evaluation criteria were selected based on the pollutants identified as impairments to the designated uses. Quantitative and qualitative measurements are used in this evaluation to determine the level and rate of water quality improvements, focusing on areas of physical, chemical, and biological improvements. The measurements that will be used to evaluate water quality are outlined in Table 5.1.

Qualitative evaluation is an assessment process that measures how well something was done. Qualitative measurements that are recommended can be used to measure the success of stakeholder participation and community involvement in improving the quality of life in the LGRW. For example, the number of individuals attending training sessions and receiving a certificate could be a measure of the program's success. These types of measurements are considered interim measures of success, those that mark milestones rather than environmental improvements.

Quantitative evaluation is an assessment process that measures how much of something was done or changed. Quantitative measurements are further defined by categories of indirect indicators and direct indicators. Indirect indicators are those that measure practices and activities that could indicate water quality improvements, but do not actually measure water quality. For example, estimating the pollutant reduction that a practice will achieve is stating that a certain amount of that pollutant will be prevented from entering the stream, but not necessarily improving water quality. Direct environmental indicators measure water quality through scientific investigation. Sediment load reduction could be measured by secchi disks and nutrient load reductions could be measured through chemical analysis of the water. Macroinvertebrate surveys are also direct indicators of water quality since some insects are very sensitive to changes in a stream's health.

Table 5.1 - Evaluation Techniques for Implementation

Impairment	Evaluation Technique	Units of Measurement	Measurable Goals	Partners in Evaluation
Sediment	Pollution reduction calculations	Tons of sediment prevented from entering the waterways	Prevent 10,000 tons/year of sediment from entering waterways	Michigan Department of Environmental Quality (MDEQ), Natural Resources Conservation Service (NRCS), Consultants
	Implementation of BMPs	Number and location of BMPs implemented	Implement BMPs on all identified sites according to implementation schedule	Municipal and county departments of public works (DPWs)
	Photographs of BMPs installed	Before and after photographs	Portfolio of photographs with supporting documentation	Municipalities, MDEQ
	Benefit to cost comparisons	Pollutant load reduction compared to cost of BMP implemented	Economic impact of pollutant load reduced outweighs cost of BMP implementation	Municipalities, contractors, consultants
	Macroinvertebrate surveys	Water quality assessment	Increased ranking of water quality	West Michigan Environmental Action Council (WMEAC), Grand Valley State University (GVSU), MDEQ
	MDEQ biological surveys	Fish, habitat, and physical properties of water	Increased rating of fish, habitat, and physical properties	MDEQ

Table 5.1 - Evaluation Techniques for Implementation

Impairment	Evaluation Technique	Units of Measurement	Measurable Goals	Partners in Evaluation
Pathogens	Pet waste collection bags	Number of pet waste collection bag sites in parks	Document increase of use of pet waste collection bags	County, and municipal park departments, pet stores, humane society
	Water quality monitoring	Pathogen counts per 100 ml	Meet water quality standards of 1,000 count *E.coli*/100 ml for partial body contact recreation and 130 count/100 ml in areas for total body contact recreation	County health departments, MDEQ
	Elimination of sources	Number and location of sources identified	Eliminate all identified sources of *E. coli*	Municipalities, county health departments, agricultural producers
	Benefit to cost comparisons	Reduced health risks compared to cost of BMP implemented	Economic impact of reduced health risks outweigh cost of BMP implementation	Municipalities, contractors, consultants
Nutrients	Pollution reduction calculations	Pounds of nutrients prevented from entering waterways	Prevent 5,000 pounds/year of phosphorous and 10,000 pounds of nitrogen from entering waterway	MDEQ, NRCS, consultants
	Implementation of BMPs	Number and location of BMPs implemented	Implement BMPs on all identified sites according to implementation schedule	DPWs, county departments
	Photographs of BMPs installed	Before and after photographs	Portfolio of photographs with supporting documentation	Municipalities, MDEQ
	Benefit to cost comparisons	Pollutant load reduction compared to cost of BMP implemented	Economic impact of pollutant load reduced outweighs cost of BMP implementation	Municipalities, contractors, consultants
	MDEQ biological surveys	Fish, habitat, and physical properties of water	Increased rating of fish, habitat, and physical properties	MDEQ
	Macroinvertebrate surveys	Water quality assessment	Increased ranking of water quality	WMEAC, GVSU, MDEQ

Table 5.1 - Evaluation Techniques for Implementation

Impairment	Evaluation Technique	Units of Measurement	Measurable Goals	Partners in Evaluation
Trash/Debris	Stream cleanups	Number of volunteers at event	Increase number of volunteers at stream cleanup events every year	WMEAC, youth groups, church groups, business, community service programs
	Trash and debris removal	Pound of trash and debris removed from waterways	Increase in number of areas selected for trash removal and inspection. Assessment of log jam removal according to woody debris management principles	DPWs, youth groups, community service programs. Drain commissioners, municipalities, MDNR, MDEQ, consultants
Temperature	MDEQ biological surveys	Fish, habitat, and physical properties of water	Increased rating of fish, habitat, and physical properties	MDEQ
	Volunteer stream monitoring	Average high summer water temperatures	Maintain temperatures that meet Michigan Department of Natural Resources (MDNR) criteria for coldwater streams	MDNR, WMEAC, conservation organizations
	Riparian buffer analysis	Number of miles of riparian buffers	Increased use of riparian buffer protection and restoration	Drain commissioners, conservation districts, conservation organizations
	Impervious surface calculations	Amount of impervious cover by subwatershed	Changing development rules to limit amounts of impervious cover in developments	DPWs, planning agencies, Grand Valley Metropolitan Council (GVMC)
Unstable Hydrology	Hydrologic analysis	Peak flow	No increase in storm water runoff from new development	Drain commissioners, planning agencies, GVMC
	Storm water ordinance adoption	Number of communities with a storm water ordinance	All communities in the LGRW have adopted a storm water ordinance	Drain commissioners, planning agencies, GVMC

Table 5.1 - Evaluation Techniques for Implementation

Impairment	Evaluation Technique	Units of Measurement	Measurable Goals	Partners in Evaluation
Invasive Species	Volunteer habitat restoration	Number of volunteers at event	Increase number of volunteers at restoration events every year	WMEAC, land conservancies, conservation districts
	MDEQ biological surveys	Habitat quality	Increased rating of habitat	MDEQ
Fragmentation of Habitat	Aerial photography	Acres of protected wetlands	No net loss of wetlands in the LGRW	MDEQ, NRCS, land conservancies, drain commissioners, GVMC
	Michigan natural features inventory	Number of rare species and status of threatened or endangered species	Increase frequency of rare species	Michigan State University
	MDEQ biological surveys	Habitat quality	Increased rating of habitat	MDEQ
Other Urban Contaminants	MDEQ biological surveys	Fish, habitat, and physical properties of water	Increase in number of fishers using the stream and the number of fish caught	MDEQ
	Hydrologic analysis	Hydrographs of peak flows	Reduction of peak flows by limiting impervious cover, minimizing channelization of streams, and restoration of wetlands and storage areas	MDEQ, consultants
	Impervious cover calculations	Percentage of impervious cover in the LGRW	Changing development rules to limit amount of impervious cover in the LGRW	GVSU, Regional Geographic Information System (REGIS), MDEQ, consultants

5.4 EVALUATION OF PROJECT OUTCOMES

The second phase of the evaluation will measure not only water quality improvements but the success of project outcomes during and after implementation. Table 5.2 provides specific recommendations for evaluating the implementation of the Lower Grand River WMP and its associated products developed through the LGRW project. Recommendations offer evaluation measures identified as administrative, social, or environmental indicators. Additional evaluation activities, which relate to the Forum meetings, Phase II communities, and subwatershed groups, can be considered during the implementation phase to assess the effectiveness of the project in the long-term. These additional evaluation recommendations are listed below:

5.4.1 GRAND RIVER FORUM FOLLOW-UP EVALUATION RECOMMENDATIONS

The evaluation of Forum participants on June 3, 2004, was limited to those individuals attending on that particular day, resulting in answers that do not reflect input from other individuals who have attended one or more meetings over the course of the two-year project.

The project evaluator recommends conducting a follow-up evaluation activity with other Forum participants that can also serve as a tool for planning stakeholder meetings during the implementation phase. A brief list of questions should be developed that attempts to discern the cause for changes in participation and their relationship to factors such as meeting logistics (e.g. day, time, location) and agenda/meeting format (e.g. presentation-oriented rather than activity-oriented). For additional information on survey details, see the final project evaluation in Appendix 5.

5.4.2 PHASE II COMMUNITY FOLLOW-UP EVALUATION RECOMMENDATIONS

Two respondents alluded to the need for evaluating the benefits related to the contribution of matching funds and participation in the LGRW project over time. Their responses highlight the need for future evaluation activities during the implementation phase to further assess the success of the project. The project evaluator recommends conducting a brief follow-up survey with the communities that contributed matching funds to the LGRW project during the period of time communities should be implementing measures to comply with their storm water permitting requirements. See the final project evaluation in Appendix 5.

Another consideration for a follow-up evaluation is to measure the change in community participation from the planning phase to the implementation phase. This will be particularly interesting if project partners use different recruitment strategies to encourage continued participation and to generate new participation. In addition to measuring the change in participation, the project evaluator also recommends conducting a pre-project evaluation with contributing communities as an initial activity. Information collected in the pre-project survey can help gauge project effectiveness, as well as assist with project planning (e.g. where and when to schedule meetings) to promote continuous participation.

5.4.3 SUBWATERSHED GROUP FOLLOW-UP EVALUATION RECOMMENDATIONS

As the organization evolving from the LGRW project begins to take shape, the project evaluator recommends conducting a brief follow-up survey with representatives from subwatershed groups to determine if there is a change in perception or attitude toward the umbrella organization and the potential affect on local organizations. The current evaluation focused on obtaining input from individuals that participate in the LGRW project as well as a subwatershed organization or group. To ensure that the evaluation assesses the perceptions of a wider stakeholder group, the project evaluator recommends surveying subwatershed organization members that do not actively participate in the LGRW management efforts to gauge perceptions of those active at the local level that may or may not have buy-in to the larger-scale watershed approach.

5.5 SUMMARY

The evaluation of the Watershed project is a two-phase approach, as described previously. The first phase of the project evaluation was performed by a third-party evaluator and measured the successes and challenges of the project. The second phase of the project evaluation will be conducted by those implementing the WMP and will measure the success of the project during and after implementation. It is hoped that subwatershed management projects will use the evaluation tools outlined in this WMP to overcome similar obstacles through lessons learned and repeat any successes during this planning phase. Most importantly, the evaluation process has provided insights that will aid in the establishment of a sustainable watershed organization to support watershed management in the LGRW.

Table 5.2 - Implementation Phase Evaluation Recommendations: Potential Indicators

Project Element	Evaluation Indicators		
	Administrative	Social	Environmental
Tools			
Watershed Interactive Tool (WIT)	Number of hits on the web site per month Number of people attending WIT demo/trainings	Number of classrooms integrating educational materials into curriculum Number of watershed stakeholders that are 1) aware of what the WIT is and the resources available on the WIT; and 2) can describe how they have applied information from the WIT Number of users that obtain a high score on a watershed quiz available on the WIT web page Number of users developing watershed action plans using WIT information Number of users assisting subwatershed activities using WIT information Number of implemented watershed projects that used WIT in project development	Improved riparian conditions Improved instream habitat Water quality improvements
Watershed Interactive Mapping (WIM)	Number of hits on the web site Number of people attending WIM trainings	Number of plans incorporating WIM maps Number of implemented protection/restoration projects and plans incorporating WIM maps	Improved riparian conditions Improved instream habitat Water quality improvements
Watershed Action Plan (WAP)	Number of hits on the web site Number of people attending WAP trainings	Number of developed/implemented watershed action plans Number of plans maintained in an active status (i.e., reviewed, updated regularly)	Improved riparian conditions Improved instream habitat Water quality improvements

Table 5.2 - Implementation Phase Evaluation Recommendations: Potential Indicators

Project Element	Evaluation Indicators		
	Administrative	Social	Environmental
Watershed Assessment Matrix	Number of subwatersheds in assessment matrix with updated assessment information Number of updates made to the matrix with new assessment information	Number of people contributing to watershed assessment information contained in matrix Number of implemented watershed projects recorded in assessment matrix	Improved riparian conditions Improved instream habitat Water quality improvements
Management Plans			
Lower Grand River WMP	Plan developed Plan maintained in active status (i.e., reviewed, updated regularly) Funding level associated with planning and projects Number of subwatershed management plans developed using information and resources generated through the planning project Number of Phase II storm water management plans developed using information and resources generated through the planning project	Number of partners involved in the planning phase continuing into implementation phase Number of new participants recruited for the implementation phase by partners involved in the planning phase Number of plan-linked projects underway Media coverage of plan-linked projects and partners	Improved riparian conditions Improved instream habitat Water quality improvements
Buck Creek WMP	Plan developed Plan maintained in active status (i.e., reviewed, updated regularly) Funding level associated with planning and projects	Number of partners involved in planning Number of plan-linked projects underway Media coverage of plan-linked projects and partners Plan implementation	Improved riparian conditions Improved instream habitat Water quality improvements

Table 5.2 - Implementation Phase Evaluation Recommendations: Potential Indicators

Project Element	Evaluation Indicators		
	Administrative	Social	Environmental
Sand Creek WMP	Plan developed Plan maintained in active status (i.e., reviewed, updated regularly) Funding level associated with planning and projects	Number of partners involved in planning Number of plan-linked projects underway Media coverage of plan-linked projects and partners Plan implementation	Improved riparian conditions Improved instream habitat Water quality improvements
Organizational and Strategic Elements			
Watershed Vision	Vision statement created and adopted Number of projects and plans citing watershed vision	Number of partners involved in visioning, planning/management Number of stakeholders aware of watershed vision Number of stakeholders that cite change in behavior due to desire to achieve the watershed vision (or related aspect)	Improved riparian conditions Improved instream habitat Water quality improvements

Table 5.2 - Implementation Phase Evaluation Recommendations: Potential Indicators

Project Element	Evaluation Indicators		
	Administrative	Social	Environmental
Organizational and Strategic Elements			
Organizational Structure	Number of staff and partners involved in planning/management Creation of permanent watershed organizational structure that fulfills watershed strategic elements Number of projects reviewed and funded by the interim/permanent watershed organization Number of participants at watershed organization meetings	Perceptions of existing subwatershed groups of permanent organizational structure Number of watershed stakeholder categories represented in organization versus total number of watershed stakeholder categories (diversity indicator) Number of successfully implemented projects funded by the interim/permanent watershed organization Number of subwatersheds seeking technical assistance from interim/permanent watershed organization to establish subwatershed group Changes in awareness of the existence of a Lower Grand River Watershed organization among watershed stakeholders on an annual basis Changes in participation trends of the permanent watershed organization	Changes in riparian conditions, instream habitat, and water quality conditions in subwatersheds with subwatershed organizations supported by the interim/permanent watershed organization

CHAPTER 6 - THE GRAND VISION

6.1 INTRODUCTION

The Lower Grand River Watershed Management Plan (WMP) is a broad, reference-oriented document that builds upon and elevates existing water quality improvement efforts in the watershed. The members of the Grand River Forum (Forum) recognized that the plan should take a holistic, ecosystem approach and provide a vision and broad strategic plan for the entire watershed under which to operate, with guidelines and recommendations to follow to achieve that vision. The Buck Creek and Sand Creek WMPs, completed during this project, provided the details on the recommendations for those watersheds to reach the overall goals and objectives of the Lower Grand River WMP. The remedies for the impaired urban areas of the Buck Creek Watershed will provide opportunities for other urban and urbanizing areas in the Lower Grand River Watershed (LGRW) to evaluate management measures used and determine which management measures would be best for their particular situation. The Sand Creek WMP will provide the Sand Creek Watershed Partners the details on how to implement recommendations to reach more immediate goals and objectives for agricultural and rural developing areas and the longer range visions of the Lower Grand River WMP. These WMP recommendations are expected to be extrapolated for use and adoption in other urban and rural areas of the LGRW experiencing similar problems, using the tools developed in the Lower Grand River WMP.

The watershed-based permit, under which the urbanized communities in the LGRW applied for their National Pollutant Discharge Elimination System (NPDES) Phase II storm water permit, allows flexibility on how each community develops and implements a storm water management plan. All of the storm water management plans will be based on the Lower Grand River WMP recommendations, but each community will have its own implementation strategy.

The LGRW Steering Committee (Steering Committee) provided oversight and direction to the project and was responsible for developing the goals and objectives of the planning project. The Steering Committee has met monthly since the project began and has coordinated efforts to ensure that the project is representative of as many interests and concerns as possible in the LGRW. The Steering Committee will continue to meet after the project is completed as an organization, group, or council, the structure of which is described in this chapter.

6.2 A STRATEGIC BEGINNING

To ensure that the goals and objectives and other important products of the Lower Grand River WMP have been aligned with a broad commonly held vision of what the stakeholders in the LGRW desire for the future, a Vision Committee was formed and charged with developing key elements of a strategic plan including a vision, mission, core values, and other components that would be necessary to place the Lower Grand River WMP initiative in a much larger context of long-term success over the entire watershed.

The Vision Committee provided a means for stakeholders to develop a common vision and to offer their expertise in sketching out the major accomplishments that would be necessary to someday meet that vision. The Forum represented stakeholders from the watershed and through a visioning process provided the following elements of a strategic plan:

LGRW Vision: Connecting water with life: swimming, drinking, fishing, and enjoying all the waters of our Grand River Watershed.

LGRW Mission Statement: "Discover and value all water resources and celebrate our shared water legacy throughout our entire Grand River Watershed community."

LGRW Core Values:

- Activities will be diverse, inclusive and collaborative
- Efforts are sustainable and high quality
- Images and messages create a widely shared sense of legacy and heritage
- Methods and products are holistic and employ a systems approach
- The organization and program offers incentives, evaluates progress, and rewards success

LGRW Strategic Components: In addition to establishing an overall watershed vision, mission and core values, the Vision Committee conducted a series of focus sessions with key members of the Forum and established the following strategic goals or broad accomplishments that would be necessary to meet the LGRW vision. These strategic goals were more fully thought out by the Forum and Vision Committee and a more complete matrix of strategic needs was developed as shown in Table 6.1.

With a larger strategic framework in place, the Vision Committee and Steering Committee determined that to ensure effective continuation of the Lower Grand River WMP, the following immediate action steps would be necessary:

1. Develop a provisional organization, from the existing Steering Committee, and build a future and formal watershed organization, and establish a staff relationship building function.

2. Continue the Steering Committee until Grand Valley Metropolitan Council (GVMC), with assistance from project partners, establishes the provisional organization.

Table 6.1 - Lower Grand River Vision Outline

Strategic Component		Strategic Needs:						
Public Awareness Must:		**Partnerships**	**Communications**	**Technology**	**Infrastructure**	**Financing**	**Skills**	**Evaluation**
No. 1	Be relevant and tied directly to general public interests. Should be on a very personal, interactive level. To as great a degree as possible, attach "water connectedness" to daily personal work, play and living, of real people. Ideas: Watershed Weatherperson	Annis Water Resources Institute, Center for Environmental Study, West Michigan Environmental Action Council, Michigan Department of Environmental Quality, Marketing professionals, Convention Bureau, Tourism Industry	TV, cinema, radio, newspaper, fliers, world-wide web, Johnny Ads. Must cover wide range of media types.	Internet, gimmicks, billboards	Communications hub, (no suggestions) with running water.	Small grants to lead to larger grants. Find financing with profit-based as well.	Coordination, public awareness staff, grant writing, quality assurance project plan writing, public relations w/environmental specialties.	Number of water interactive promotions; confirmation by surveys, focus groups.
No. 2	Involve LGRW activities directly into existing, well attended, locally appreciated (cherished) events. Use this as a chance to establish both a local visibility and connection between watershed and general public. Where there are sub-basins, help them establish the activity with help from LGRW.	Waste Disposers, Environmental Restoration Co., movie theaters, recyclers, media "brokers", convention bureau, and sub-basin groups.	Watershed tours, TV/Radio public service announcements; Kits for sub-basins to create events.	Calendars and bulletin boards. Be part of local government wide area network (WAN)	Portable booths, pertinent equipment.	Local contributors, ticket sales, package deals with Convention Bureau.	Event coordinator, presenters, speakers and educators.	Number of fairs and venues involved; number of local sub-basins involved.

Table 6.1 - Lower Grand River Vision Outline

Strategic Component		Strategic Needs:						
Public Awareness Must:		Partnerships	Communications	Technology	Infrastructure	Financing	Skills	Evaluation
No. 3	Be responsive to a generational imperative. Awareness must occur over a broader spectrum of population segments recognizing real differences between generations, (i.e. younger folks tend to watch their media, older folks tend to read or listen to their media).	Media outlets, Schools, American Association for Retired Persons (AARP), Professional Societies, Grand Rapids Symphony, Arts Council, Bear Creek Players, Sustainable Business Forum, Children's Museum	Youth music stations, classical stations, entertainment newsletters, bookstore promotions, children's materials	Learning links, interactive computer games, distributed CDs, newsletters, brochures		Private contributions	Arts coordinator w/environmental or water specialties, focus sessions	Test for age segments being "hit"
No. 4	Establish series of events or programs which physically connect people to water, i.e. raft race, bridge walk, watershed festivals, movie previews, etc. "Connection" should evoke all the senses including memories.	Sub-basin Watershed Councils, West Michigan Environmental Action Council, Izaak Walton League, Intermediate School Districts, teacher groups, variety based upon event	Create event "Packages", IMAX experience	Same as #1 above	Same as #1 above	Event receipts, same as #1 above	Fishing and recreation expertise, monitoring, event planning	Number of events developed, number of persons attending
No. 5	Develop ongoing interactive educational institutions, i.e., mobile water workshops, water center or museum, the Grand Valley State University Annis Water Resources Institute research vessels.	Educational Institutions, Public Museums, Children's Museums	Watershed management curriculum, extensive advertising of tours	Wireless data technology, closed circuit broadcasting	Dependent upon choices; could be bus, building, etc.	Large grants and capital drive for acquisition/ construction; partnerships for operating costs	Dependent upon choices; could be drivers, operators, maintenance staff, presenters. Consider staffing with partnerships. Also: writing and computer skills and project management	Number attending and number aware of choice

Table 6.1 - Lower Grand River Vision Outline

Strategic Component		Strategic Needs:						
Public Awareness Must:		Partnerships	Communications	Technology	Infrastructure	Financing	Skills	Evaluation
No. 6	Ensure that the information base is made accessible and understandable over a wide range learning styles (i.e., visual, kinetic, musical, etc.), and a wide range of ages.	Watershed interactive tools developers, current data keepers, Intermediate School Districts, specific "style" institutions (i.e., drawing, music, dance, etc.)	same as #3 above	Interactive tiers of data delivery, same as #3 above	Sub-basin WAN, same as #1 above	Selling data, same as #1 above	Focus work to test populations for styles, data developers w/public relations specialties, strategic presentations	Amount of variety in style offerings, number of "hits" per style offerings
No. 7	Establish effective LGRW image development tying water to home, heritage, health. Must have consistency in messaging.	Primarily organizational, media brokers, ad/marketing companies	Image established in all choices	Image established in all choices	Image established in all choices	Organizational, private funding	Marketing/advertising, graphic designers, writers	Number aware of organization, number aware of vision/mission
No. 8	Design campaigns for continual interactions with image/message, particularly emphasizing the place of the LGRW in our own prominent world feature (Great Lakes) and connecting the sub-basins through the LGRW to that globally significant feature.	Community media center, public libraries, Great Lakes Federation, sub-basin watershed councils, sustainable business forum, West Michigan Strategic Alliance	Create campaign and advertising "packages" for sub-basins	All forms of distribution	Kiosk communications	Large grants, special drive for campaign costs	Advertising, selling, media relations, project management	Frequency of showings, number aware of campaign

Table 6.1 - Lower Grand River Vision Outline

Strategic Component		Strategic Needs:						
Data Management Must:		Partnerships	Communications	Technology	Infrastructure	Financing	Skills	Evaluation
No. 1	Ensure that output is rendered in relevant and engaging formats covering a wide range of age groups and user types.	West Michigan Environmental Action Council, Annis Water Resources Institute, Michigan State University Extension, Michigan Water Environment Federation, Local news	Press, internet, radio, television	Network and data storage	LGRW Data website, Watershed Education Center	Foundations	Communication of technical information in simple terms	Who is using the data and for what purposes?
No. 2	Test output for credibility with persons or institutions routinely found credible and reliable by the general public, (i.e., clergy, teachers, local officials, others).	Grand Valley State University, West Michigan Environmental Action Council, Center for Environmental Study, Health Departments	Church, school, public meetings, television, press			Foundations	Highly connected individuals	Are officials or media increasing interest or coverage?
No. 3	Be holistically evaluated for an improved acquisition, storage, analysis and delivery system. Such a system should be designed to allow for better flow of data into the correct database locations, to adequately and safely store it, appropriately analyze	Environmental Protection Agency, Michigan Department of Environmental Quality, Lake Michigan Monitoring Coordination Council	Conferences, internet, training workshops	Network and data storage	Locally housed network	Environmental Protection Agency, Michigan Department of Environmental Quality	Internet savvy	Third party evaluation
No. 4	Introduce high quality, "state of the art" data collection and delivery based on clearly supported procedures and the information needs of the general public and other significant watershed data users.	Michigan Department of Environmental Quality, Conservation Districts, Michigan Water Environment Federation, consultants	Conferences, internet, training workshops	Laboratory approved by Michigan Department of Environmental Quality		Environmental Protection Agency, Michigan Department of Environmental Quality	Routine sampling with approved methods	Number of hits to Quality Assurance Project Plan website
No. 5	Provide the necessary support and documentation for those users relying LGRW data to promote the vision, mission, and goals of the organization.	Grand River Forum, non-government organizations, Grand Valley Metro Council, local news	Grand River Forum, presentations		LGRW data website	Foundations, Environmental Protection Agency	Communication of technical information in simple terms	Number of requests for data retrieval

Table 6.1 - Lower Grand River Vision Outline

Strategic Component		Strategic Needs:						
Data Management Must:		Partnerships	Communications	Technology	Infrastructure	Financing	Skills	Evaluation
No. 6	Establish appropriate methods to allow for watershed-wide prioritization of initiatives and projects.	Lake Michigan Monitoring Coordination Council, Environmental Protection Agency, Michigan Department of Environmental Quality, Great Lakes Commission	Conferences, Grand River Forum			Michigan Department of Environmental Quality, Great Lakes Commission	Big picture thinkers	Number of requests to speak at conferences
No. 7	Establish tiers or levels of data and various levels of Quality Assurance/Quality Control which is appropriately related to the purposes and needs of the complete spectrum of potential users.	Michigan Department of Environmental Quality, Lake Michigan Monitoring Coordination Council, West Michigan Environmental Action Council, Grand River Forum	Conferences, internet, training workshops	Webpage with approved Quality Assurance Project Plan		Michigan Department of Environmental Quality	Science or engineering background	Number of hits to Quality Assurance Project Plan website
No. 8	Provide simple answers to simple questions. The watershed organization will be the providers of data and will compare data to standards without "spinning" numbers or extrapolations. (For example, "water is safe for swimming and fish consumption" is adequate data for the general public)	West Michigan Environmental Action Council, local news, Center for Environmental Study, Health Departments	Television, radio, internet			Environmental Protection Agency, Michigan Department of Environmental Quality, Foundations, Great Lakes Commission	Communication of technical information in simple terms	Are officials or media increasing interest or coverage?

Table 6.1 - Lower Grand River Vision Outline

Strategic Component		Strategic Needs:						
Organization Must:		Partnerships	Communications	Technology	Infrastructure	Financing	Skills	Evaluation
No. 1	Be efficiently staffed. The work of a LGRW organization must be well known and highly regarded, independent of staff numbers and services offered.	Functional organizational partnering with: Universities, well established environmental groups, West Michigan Strategic Alliance, regional planning entities.	Wide variety of methods over all age groups	Direct linkage to those served with information	Office or locations with functional partner. Also, consider no office via circuit riding and/or related to "watershed bus"	Broad and diverse sources, partnership contributions where possible	Paid staff, not dependent on individual, public relations skills, information technology skills, "consultants", advocacy, funding coordinator	Qualitative assessments, number of key persons recognizing
No. 2	Include a wide range of membership types. This should involve sub-basin representation, local and county governmental officials, other government agency representatives, nonprofit organizations, private businesses, riparian, lake and other water-based associations, and dedicated individuals.	Numerous, well connected, diverse, sub-basin groups.	Rotating meeting scheme; widely acceptable representational structure; virtual meeting linkages	Flexible and consistent meeting scheduling, WAN	Mobile workshop	Membership fees	Same as #1 above, and meeting administration	Diversity in membership, survey satisfaction with effective representation
No. 3	Be the custodian of the vision, mission and strategic direction established for the LGRW. This should include routinely conducting reviews of vision, mission and direction as well as taking steps to reassure the watershed community that apparent independent activities throughout the watershed are being directed to those ends.	Developing "founders", consultants, consider special part of organization.	Ongoing interaction with key players such as sub-basin watershed councils, municipalities, drain commissioner and other agencies	Two-way data communications; need for continual monitoring of activity	N/A	N/A	Same as #1 above, and strategic planning	Ongoing member and partner surveying; create qualitative checklist against vision-mission

Table 6.1 - Lower Grand River Vision Outline

Strategic Component		Strategic Needs:						
Organization Must:		Partnerships	Communications	Technology	Infrastructure	Financing	Skills	Evaluation
No. 4	Be acknowledged as the "go to" place for water issues by coordinating, convening, lobbying, catalyzing and facilitating. A highly credible manner and image must be maintained.	All water issue groups including West Michigan Environmental Action Council, Great Lakes Federation, Wastewater groups, storm water groups, recreations groups, resource groups, others.	Established location for organizational contact, (i.e., phone number, website links, etc.)	Best available technologies as applied to data provisions and image development	Broadest connections with widest range of users	Fees for products and services	Same as #1 above, and interpersonal, political and facilitating	Number of successful contacts, follow-up interviews to ensure effective answers and solutions
No. 5	Provide the types and degrees of service that are really desired and be seen and understood as doing that. This includes being an acknowledged source of information and direction on water issues. Most importantly must involve environmental community, public/private business sectors and local governments.	Similar to #1 above, add municipalities and private sector.	See #1 above; well advertised relevant services offered	See # 1 above, include whatever is necessary for specific services offered	See #1 above, plus equipment equipment/ storage for support specific services offered	See #1 above	Same as #1 above	Customer service orientation, number of calls, number of solutions
No. 6	Institute the celebration, heritage and legacy aspects of the mission within both the watershed and our entire Great Lakes region through continual scanning, inventorying, evaluations, reporting and recognitions.	Local governments, civic institutions and universities, Intermediate School Districts and school districts, Great Lake Federation, West Michigan Strategic Alliance.	Widespread two-way connections and networking	WANs, LANs, lists, list serves, bulletin boards, newsletters, minutes, etc.	All forms of communications	Organizational	Same as #1 above	Number of inputs routinely reviewed, number of occurrences qualifying as celebration, heritage, legacy
No. 7	Be a well known organization whose "role" is distinctive and widely understood.	Local, state, national organizations, professional/local societies.	Domain and website, consistent use of image developed	Servers and ample high speed connections	Housing for local servers and connections	Organizational	Same as #1 above	Focus groups testing organizational awareness

6.3 THE FIRST STEP: A WATERSHED ORGANIZATION

A first step to be taken in our Grand Vision is the establishment of a watershed organization. Michigan is home to a number of watershed organizations that have successfully leveraged community support to continue efforts to cleanup and beautify their rivers, lakes, and streams. Some of these watershed organizations are found within the LGRW. The Rogue River Watershed Council and the Coldwater River Watershed Council are examples of watershed organizations that are operating individually within the LGRW. A desire of the LGRW stakeholders is that 1) all subwatersheds of the LGRW have complete watershed management plans and 2) a watershed organization is created and sustained to implement the Lower Grand River WMP's recommendations.

6.3.1 LOWER GRAND RIVER WATERSHED ORGANIZATION

A watershed organization can take many forms. Each type of organizational structure has advantages that vary from tax-exempt status to the ability to assess taxes to implement water quality improvements. To aid the Steering Committee in selecting an organizational structure for the LGRW, a watershed organization discussion panel was cosponsored with the Rogue River Watershed Council. The panel had representatives from the Muskegon River Watershed Assembly, Friends of the Rouge, Clinton River Watershed Council, and the Pere Marquette Watershed Council. These watershed organizations are all 501(c)(3) non-profit organizations; however, their background, funding sources, and operational strategies are very diverse. The LGRW Steering Committee would like to take the best ideas from past examples and blend them to form a watershed organization that is effective and high profile with diverse funding sources.

The idea to form a watershed organization in the LGRW was envisioned very early in the planning process by the Forum and the Vision Subcommittee. The existing watershed organizations and environmental groups have started local initiatives and desire to maintain this status without being absorbed by a larger organization. The LGRW would fulfill this desire by serving as an umbrella under which these local groups would operate.

Existing watershed organizations would play a large role in fulfilling the goals of the LGRW Organization. A board of stakeholders would include representatives from local government units, existing watershed organizations, environmental organizations, and business leaders (particularly those recognized throughout West Michigan for their attention to environmental issues). The task of the LGRW Organization would be to identify priorities within the Grand River Watershed and to facilitate projects that address high priority concerns.

The role of the LGRW Organization would be as a capacity builder to facilitate the formation of subwatershed groups that would be capable of creating watershed management plans and grassroots level opportunities for local governments and citizens to take ownership of their projects.

The assistance given to the Rogue River Watershed Council will provide an example of how subwatershed groups would operate under the umbrella of the LGRW Organization. Watershed projects initiated by the LGRW project will receive assistance with watershed management planning and the formation of a watershed advisory committee.

The initiative behind the LGRW is municipally driven. Municipally driven projects tend to have greater stability for funding, as long as the watershed organization provides a service to local governments. However, stability and government services alone will not meet the LGRW mission of engaging the public to value water as a resource. A grassroots component involving the public and local governments is needed in the other watersheds within the LGRW to capture the core values outlined in the LGRW Mission Statement.

Creating a grassroots watershed organization in small watersheds can be difficult. Holding meetings, mailing correspondence, setting up 501(c)(3) tax-exempt status, and organizing stakeholders may be tasks too large to overcome by small grassroots efforts without grant monies or a government interest. However, a larger organization that would encompass the entire LGRW could provide technical assistance, effective watershed-wide awareness programs, and seed money for new watershed organizations and grassroots efforts. Once subwatershed organizations are established, the LGRW Organization would serve as a facilitator until the group is capable of sustainable independence.

While the LGRW Organization would provide basin-wide oversight, implement regional or watershed-wide initiatives, and prioritize water quality concerns, the subwatershed organizations would manage operations within the subwatershed, implement the watershed management plan, and serve as a liaison between local stakeholders and the LGRW Organization. For example, local government needs for storm water management identified by a subwatershed organization could be fulfilled through technical support offered by the LGRW Organization. These services could include water quality data stored in a central database, GIS mapping, integrating or linking volunteer programs, or grant administration.

The Vision Committee and Steering Committee examined and discussed the myriad and monumental tasks that must be accomplished as outlined in Table 6.1. Realizing the need for more than a simple watershed council start-up, in hopes that it will mature into an effective, widely understood, and accepted organization, the LGRW project has concluded that much more strategic planning and implementation will be required to someday meet the Grand Vision. Therefore, the creation of a provisional or temporary organization was proposed.

This provisional organization is to be set up as an agency within the Grand Valley Metropolitan Council with two specific charges: 1) To plan and implement measures necessary to establish an appropriate watershed organization for the LGRW and 2) To maintain marginal watershed council functions as needed while this work is being done.

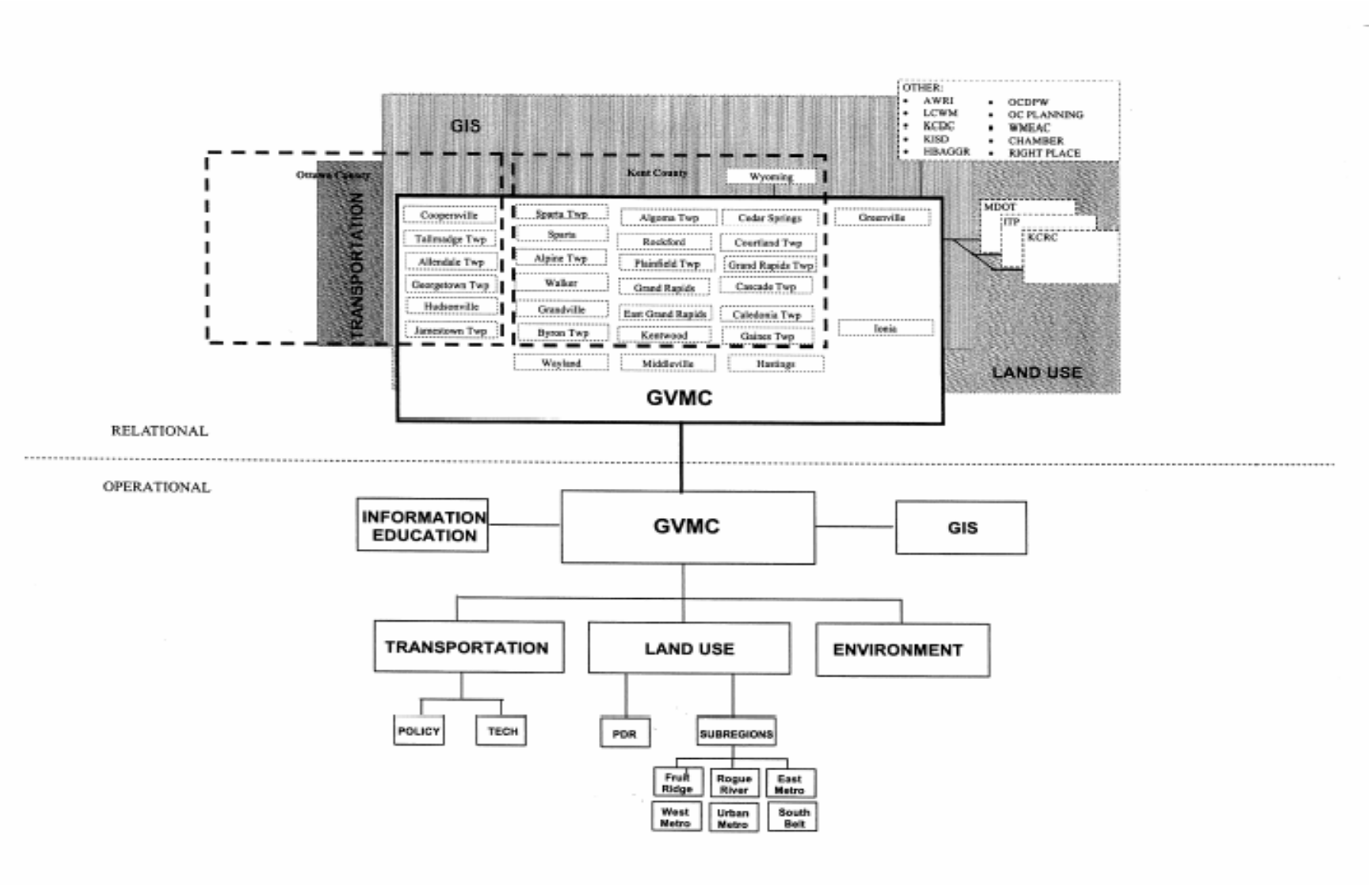
The Steering Committee would persist to work on planning and implementation and the Forum would continue to fulfill basic council functions within the temporary Grand Valley Metropolitan Council (GVMC) agency. The provisional organization will require immediate funding, primarily to establish meeting resources and a leadership position filled by someone with both organization startup skills and a demonstrated passion for the vision. The Vision Committee has also concluded that the provisional organization must work out a specific strategy to evolve into, or independently establish, a permanent organization which:

- Is based on the widest possible funding base both institutionally and geographically.
- Judiciously meets as many key components of the Vision Committees strategy outline as possible.
- Is based upon business plan projecting details of success for at least 5 years.
- Emphasizes organizational identity and broad awareness.
- Establishes the compelling case (like REGIS) to join and willingly fund the organization.
- Outlines details for transition from the provisional organization to the permanent organization.

Chart 6.1 illustrates the organizational structure for GVMC which will be used to facilitate how such a group will be adopted at GVMC. A provisional organization should:

- Be established as soon as possible and function for no more than 3 years.
- Immediately establish connections to nationally renown leaders in the field of environmental or watershed management.
- Include both on ongoing steering or leadership committee as well as an assembly of leaders from throughout the LGRW.
- Immediately develop additional information to meet strategic needs outlined in this plan including watershed asset inventories, a recognizable organizational identity, and a 5-year business plan.
- Conduct quarterly or semi-annual meetings of the assembly of watershed leaders at which time there can be pertinent presentations or speakers as well as sub-basin reports on local needs and unique watershed activities.
- Establish partnerships, membership or other functional links with key funding institutions, environmentally active associations and agencies, visionary watershed leaders both from the general public and the private sector.
- Hire motivated staff who can assist in both administrative and assembly side of the interim organization. Establish methods for evaluating and prioritizing watershed projects upon request.

Chart 6.1 - Grand Valley Metropolitan Council Organizational Structure



6.4 LONG TERM SUSTAINABILITY

The GVMC has received funds from the Urban Cooperation Board to form a provisional organization. This organization will be formed from the existing Steering Committee, which will solicit membership from potential partners who have shown an interest in the project. A set of prioritization criteria, established during the project, will guide the organization in selecting future projects to address nonpoint source (NPS) pollution in the LGRW. On these watershed projects, the organization hopes to coordinate with the Upper Grand River Watershed Council, NPDES storm water permitted communities, local agencies and interest groups, and other watershed projects.

6.4.1 PRIORITIZATION CRITERIA FOR THE LOWER GRAND RIVER WATERSHED

The Steering Committee of the LGRW project developed a prioritization process to be used on an interim basis by the Steering Committee and provisional organization. This process integrates ecological information with other social and economic factors to prioritize subwatershed implementation projects within the LGRW. The following criteria should be considered when evaluating implementation projects:

- Project meets vision, mission, and strategic components for the LGRW as outlined in this chapter and in Table 6.1.
- Project is consistent with long and short term goals and objectives of the LGRW (Table 3.16).
- Project has local support including local government agencies, elected officials, community groups, businesses, schools, youth organizations, and environmental organizations.
- Project is within defined critical area of the LGRW (Section 3.4.5)
- Project has Total Maximum Daily Load or other documented water quality concerns.
- Project has watershed-wide applications and regional land use planning initiatives.
- Project would provide information to further enhance and expand knowledge and database.
- Project demonstrates sustainability.

6.4.2 UPPER GRAND RIVER WATERSHED COUNCIL

The Upper Grand River Watershed (UGRW) project was nearing completion at the onset of the LGRW planning phase. The Upper Grand River Watershed Steering Committee was striving toward similar goals to create a watershed organizational structure within the confines of existing programs, organizations, and agencies. Similar to the LGRW project, the UGRW council found that most existing efforts were doing excellent work without centralized leadership. However, these groups were limited by a geographic scope that did not include the entire Upper Grand River Watershed. This led the project consultants to recommend forming an organization that would encompass the entire Upper Grand River Watershed to provide continuity through and beyond the watershed planning phase. The ultimate goal for the resulting organization would be to coordinate with the LGRW project and expand the geographic scope to include the entire Grand River Basin.

6.4.3 NPDES STORM WATER PERMITTED COMMUNITIES

Portions of many communities within the LGRW have been identified by the U.S. Environmental Protection Agency (EPA) as having urbanized areas requiring a NPDES storm water discharge permit. These communities are required by the EPA to develop a Storm Water Pollution Prevention Initiative (SWPPI) in accordance with NPDES Phase I and Phase II Storm Water Regulations. These communities have worked together to develop a watershed-based strategy to pursue compliance with these regulations.

A WMP serves as a guide for communities to understand water quality concerns and voluntary actions needed to meet the water quality goals. The NPDES Storm Water Regulations creates an opportunity for communities to implement recommendations of the WMP as compliance standards in their SWPPI.

The SWPPI component of the NPDES Phase II Storm Water Regulations require each jurisdiction to identify significant sources of storm water pollution and to develop an action oriented strategy to address each pollutant. The SWPPI will be designed to reduce the discharge of pollutants to the maximum extent practicable and will be consistent with the goals and objectives set forth in this WMP. Once submitted to the Michigan Department of Environmental Quality (MDEQ), the SWPPI will be used to evaluate each community's actions toward mitigating impairments caused by storm water pollution. Maintaining local control of this task would offer the communities within the subwatershed greater flexibility in determining what commitments will be included in their SWPPI.

6.4.4 LOCAL AGENCIES AND INTEREST GROUPS

County administrations have provided support through local match and in-kind services during the planning phase of this watershed project. Institutionalizing the WMP's recommendations could be accomplished by the county administrations through the Planning Commissions, Departments of Public Works, and Departments of Parks and Recreation.

The county drain commissioners have jurisdictions over many waterways in the LGRW. Stream reaches and tributaries designated as county drains are placed into drainage districts. Residents living in the drainage districts are assessed for improvements to the waterways that improve storm water drainage and reduce flooding. Recommendations in this WMP could be implemented through a special assessment from water quality improvements in the drainage district.

Some road stream crossings were identified in the NPS pollution inventory and past studies as sources of flooding and erosion problems. Road crossing improvements in the LGRW could be completed by the county road commissions in accordance with recommendations in this WMP.

The United States Dairy Association (USDA) Farm Services Agency (FSA) and Natural Resources Conservation Service (NRCS) provide technical and financial assistance to landowners to address resource concerns of soil, water, air, plants, and animals. The agencies offer cost-share opportunities through many federal programs and coordinate with state and local programs to maximize benefits. http://www.mi.nrcs.usda.gov/

A number of groups were already taking an active interest in water quality protection prior to initiation of the Lower Grand River WMP. Numerous groups and individuals participate in the West Michigan Environmental Action Council's Stream Search and Adopt-A-Stream programs. Volunteer stream clean-ups and water quality monitoring occur in many areas of the watershed. Communities focus their festivals and fairs around their water resources, and host storm drain stenciling programs to educate students about their water systems.

Scores of groups have a vested interest in the sustainability and success of the Lower Grand River WMP. These groups will be included in the LGRW Organization. Assistance will be made available to volunteer groups to continue and enhance monitoring and clean-up efforts. Cities and townships are interested in the success of this project to improve their community's water resources in parks and open space and to protect their infrastructure from erosion and flooding.

6.4.5 COORDINATION WITH OTHER WATERSHED PROJECTS

The LGRW project coordinated with ongoing projects of subwatersheds within the LGRW. The LGRW project reviewed the goals and objectives of all existing WMPs in the LGRW for inclusion in this plan, as described in Table 3.7. The LGRW project worked with the Sand Creek Watershed Partners to pursue funding opportunities to implement recommendations in the Sand Creek WMP, resulting in a State of Michigan's Clean Michigan Initiative (CMI) grant application. The LGRW project collaborated with the Coldwater River Watershed Council to submit a grant proposal for Section 319 funding to address *E. coli* issues in the watershed. The LGRW organized a panel discussion with the Rogue River Watershed Council, at which directors of other watershed groups across the state shared their successes and lessons learned. Members of several subwatershed groups participated in various subcommittees of the LGRW project by attending meetings and providing input on the products and goals of the project.

6.5 CONCLUSION

The support shown by watershed groups, environmental organizations, local units of governments, and watershed stakeholders will continue to be needed for the success of the LGRW provisional organization and future watershed projects. Several proposals for subwatershed projects have been developed and two have been accepted to improve water quality in the LGRW: the Sand Creek Watershed project and the Buck Creek, Plaster Creek, and Coldwater River Watersheds *E.* coli study. The provisional organization will over see these projects and assist in the implementation of the recommendations of the Lower Grand River WMP to improve water quality and work toward achieving the vision of the LGRW: "Connecting water with life: swimming, drinking, fishing, and enjoying all the waters of our Grand River Watershed."

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APPENDIX 1 - SUBCOMMITTEE RESPONSIBILITIES

RESPONSIBILITIES OF SUBCOMMITTEES		STEERING COMMITTEE (GVMC)	URBAN SUBCOMMITTEE (FTCH)	RURAL SUBCOMMITTEE (AWRI)	TECHNICAL SUBCOMMITTEE (FTCH)	INFORMATION AND EDUCATION SUBCOMMITTEE (AWRI)	SUSTAINABILITY SUBCOMMITTEE (GVMC, FTCH, AWRI)
TASK 1:	**IDENTIFY STAKEHOLDERS, FORM COMMITTEES, AND FACILITATE MEETINGS**						
A.	Develop Steering Committee and Facilitate Meetings	■					
TASK 2:	**IDENTIFY CHARACTER OF WATERSHED**						
A.	Conduct Inventory of Existing and Past Studies to Identify Gaps in Information		■	■			
B.	Create Decision Support System				■		
C.	Prioritize Problem Sites, Sources, and Causes		■	■			
D.	Establish Pilot Project Areas	■					
E.	Determine Designated, Threatened, and Desired Uses and Critical Areas of Watershed	■	■	■	■		
F.	Develop Initial Water Quality Summary	■			■		
TASK 3:	**DEVELOP INFORMATION & EDUCATION STRATEGY**						
A.	Determine Goals and Objectives					■	
B.	Create and Distribute Printed Material - Brochures (B), Inserts (I)					■	
C.	Conduct Public Meetings					■	
D.	Create Interactive Watershed Management Tool for Pilot Project Areas					■	
TASK 4:	**SET WATERSHED PROJECT GOALS AND OBJECTIVES**						
A.	Determine Goals of Watershed Project	■					
B.	Determine Objectives of Watershed Project	■					
TASK 5:	**IDENTIFY SYSTEMS OF BEST MANAGEMENT PRACTICES**						
A.	Delineate Urban and Rural Subwatersheds				■		
B.	Identify Needed Best Management Practices (BMPs) in Urban Subwatersheds		■				
C.	Identify Needed Best Management Practices (BMPs) in Rural Subwatersheds			■			
D.	Set up prioritization process for areas outside of pilot project areas	■			■		
TASK 6:	**INTEGRATE EXISTING WATER RESOURCE PROGRAMS AND ORGANIZATIONS**						
A.	Identify Existing Programs	■					■
B.	Work with Local Agencies on Water Quality Issues	■					■
TASK 7:	**PROGRESS REPORTING**						
A.	Submit Quarterly Reports	■					
B.	Submit MDEQ Factsheet Summary	■					
C.	Submit Draft and Final Report and Release of Claims Statement	■					
TASK 8:	**WRITE AND ASSEMBLE WATERSHED MANAGEMENT PLAN**						
A.	Assemble Draft Watershed Management Plan		■	■	■		
B.	Finalize Watershed Management Plan	■			■		
TASK 9:	**DEVELOP EVALUATION PROCESS**						
A.	Establish Evaluation Team					■	
B.	Create and Implement Evaluation Criteria and Tools					■	
C.	Communicate Results from Evaluation Process					■	
D.	Prepare Draft and Final Evaluation Summary					■	
TASK 10:	**DEVELOP SUSTAINABILITY FOR WATERSHED MANAGEMENT PLAN**						
A.	Define Steering Committee Members' Roles and Responsibilities						■
B.	Coordinate Local Programs						■
C.	Create Resource Library						■

APPENDIX 2 - DAM SITE INFORMATION

DAM NAME	COUNTY	RIVER	POND	WATERSHED CODE	LATITUDE	LONGITUDE
Cannonville Dam	Montcalm	Tributary to Flat River		14E	43.36389	-85.26667
Algonquin Lake Dam	Barry	Kurtz Creek	Algonquin Lake	14D	42.67500	-85.35000
Cedar Creek Dam	Barry	Cedar Creek		14D	42.52167	-85.32667
Nashville Dam	Barry	Thornapple River	Mill Pond	14D	42.60833	-85.09167
Elsie Dam	Clinton	Maple River		14C	43.08967	-84.40594
Mix Dam	Eaton	Grand River		14	42.83333	-84.65500
Wilson Dam	Eaton	Grand River		14	42.64667	-84.65167
Lake Le-Ann South Dam	Hillsdale	Grand River	South Lake Le-Ann (#1)	14	42.06500	-84.43333
Lake Le-Ann North Dam	Hillsdale	Grand River	North Lake Le-Ann (#2)	14	42.07000	-84.43333
Bowen Mill Dam	Barry	Gun River	Barlow Lake	14D	42.65833	-85.51667
Moores Park Dam	Ingham	Grand River		14	42.71667	-84.55833
Williamston Dam	Ingham	Red Cedar River		14A	42.69000	-84.29333
Hubbardston Dam	Ionia	Fish Creek		14C	43.09000	-84.84667
Humany Dam	Ionia	Tributary to Dickerson Creek		14	43.11280	-85.16910
Cannon Creek Dam	Ionia	Cannon Creek	Cannon Pond	14C	43.08556	-85.22861
Portland Municipal Dam	Ionia	Grand River	Portland Pond	14	42.88833	-84.93667
Smyrna Milling Company Dam	Ionia	Seely Creek	Tebbles Pond	14E	43.06000	-85.25000
Sterner Dam	Ionia	Prairie Creek		14	43.02000	-85.02833
Grand Ledge Dam	Eaton	Grand River		14	42.76333	-84.76333
Michigan Center Dam	Jackson	Grand River	Center Lake	14	42.22900	-84.32740
Leoni Dam	Jackson	Leoni Creek	Leoni Mill Pond	14	42.24500	-84.27167
Liberty Dam	Jackson	Grand River	Liberty Mill Pond	14	42.10000	-84.40000
Minard Mill Dam	Jackson	Sandstone Creek		14	42.34000	-84.55000
Waterloo Dam	Jackson	Portage River	Mill Pond	14	42.35500	-84.14000
Portage Creek Trout Pond Dam	Jackson	Portage Creek		14	42.30667	-84.21667
Webber Dam	Ionia	Grand River		14	42.95667	-84.90333
County Farm Dam	Montcalm	Dickerson Creek		14E	43.19500	-85.16000
Sackett Ranch Dam	Montcalm	Tributary to Fish Creek		14E	43.33167	-85.02167
Winnewanna Dam	Washtenaw	Portage Creek	Winnewanna Impoundment	14	42.35000	-84.11667
Root Dam	Ottawa	Sand Creek	Tall Dam	14	42.99000	-85.83167
Milli-Ander Pond Dam	Gratiot	Collier Creek	Milli-Ander Pond	14C	43.13972	-84.56278
Good Point Flooding Dam	Montcalm	Tributary to Dickerson Creek		14E	43.14361	-85.11000
Lake Manitou Dam	Shiawassee	Tributary to Spring Brook	Manitou Lake	14C	42.92833	-84.20167
Scenic Lake Dam	Shiawassee	Tributary-Looking Glass River	Scenic Lake	14B	42.85833	-84.32833
North Branch Cedar Creek Dam	Barry	North Branch Cedar Creek		14D	42.58667	-85.28667
Eastbrook Lake Level Control Structure	Kent	Whiskey Creek	Eastbrook Lake	14	42.91780	-85.58020
Little Rainbow Lake Dam	Gratiot	Tributary to Pine Creek	Little Rainbow Lake	14C	43.15000	-84.69667
Grass Lake Level Control Structure	Kent	Barkley Creek		14F	43.08833	-85.52167
Stanton Lake Dam	Montcalm	County Drain #112	Stanton Lake	14E	43.29806	-85.16306
Topski Dam	Barry	Cedar Creek		14D	42.53333	-85.30000
Cummings Lake Dam	Shiawassee	Springbrook Creek	Cummings Lake	14C	42.91667	-84.19000
Belding Dam	Ionia	Flat River		14E	43.09833	-85.23667
Greenville Dam	Montcalm	Flat River		14E	43.18333	-85.25833
Ada Dam	Kent	Thornapple River	Ada Impoundment	14	42.95000	-85.49167
Cascade Dam	Kent	Thornapple River	Cascade Impoundment	14D	42.91167	-85.50000
LaBarge Dam	Kent	Thornapple River		14D	42.80833	-85.48667
Whites Bridge Dam	Ionia	Flat River		14E	43.02000	-85.29167

APPENDIX 2 - DAM SITE INFORMATION

DAM NAME	COUNTY	RIVER	POND	WATERSHED CODE	LATITUDE	LONGITUDE
Fallasburg Dam	Kent	Flat River		14E	42.97000	-85.33333
Grand Rapids West Side Dam	Kent	Grand River		14	42.98000	-85.67500
Lyons Dam	Ionia	Grand River		14	42.98000	-84.95333
Smithville Dam	Eaton	Grand River		14	42.50000	-84.63333
North Lansing Dam	Ingham	Grand River		14	42.75000	-84.55000
Weippert Dam	Ionia	Sebewa Creek	Mill Pond	14	42.81500	-84.95833
Irving Hydro Dam	Barry	Thornapple River		14D	42.69000	-85.41833
Middleville Dam	Barry	Thornapple River		14D	42.71167	-85.46500
King Milling Company Dam	Kent	Flat River		14E	42.92667	-85.34667
Wabasis Lake Level Control Structure	Kent	Wabasis Creek	Big & Little Wabasis Lakes & Millpond	14E	43.17500	-85.35833
Rockford Dam	Kent	Rogue River		14F	43.12051	-85.56187
Muskegon Waste Water Lagoons	Muskegon	Black and Mosquito Creeks		14L	43.25000	-86.04167
Rainbow Lake Dam	Gratiot	Pine Creek	Rainbow Lake	14C	43.12333	-84.69833
Lake Geneva Dam	Clinton	Tributary-Looking Glass River	Lake Geneva	14B	42.83333	-84.58333
Lake Victoria Dam	Clinton	Alder Creek	Lake Victoria	14C	42.92414	-84.37790
Thunder Hole Dam	Clinton	Tributary to Maple River		14C	43.10593	-84.74279
Lake Of The Hills Dam	Ingham	Lake Lansing Outlet	Lake of the Hills	14A	42.78333	-84.38333
Mirror Lake Dam	Jackson	Grand River	Mirror Lake	14	42.08333	-84.41833
Ranney Lake Dam	Ionia	Unnamed Tributary to Flat R	Wallin Lake	14E	43.11667	-85.24167
Westdale Family Dam	Kent	Tributary to Honey Creek		14	42.97000	-85.47000
Sadilek Dam	Gratiot	Tributary to Pine River		14C	43.15000	-84.70000
North Branch Rush Creek Retention Basin Dam	Ottawa	North Branch Rush Creek		14	42.89167	-85.76667
Sleepy Hollow Dam	Clinton	Little Maple River	Maple River W/S Dam #1	14C	42.94667	-84.41833
Putney Dam	Jackson	Mill Creek	Putney Mill Pond	14	42.08833	-84.42500
Kenowa Lake Level Control Structure	Ottawa	Huizeinga Dr. trib to Rush Cr	Kenowa Lake	14F	42.89690	-85.78380
Dills Dam	Eaton	Tributary to Thornapple River	Dills Pond	14D	42.67821	-84.79379
Portage Lake Dam	Jackson	Tributary to Portage River	Portage Lake	14	42.35833	-84.25667
Mason Wildlife Dam	Ingham	Mud Creek		14A	42.55000	-84.38333
Secluded Lake Dam	Kent	Tributary to Grand River		14	43.07500	-85.56000
Hunter Lake Level Control Structure	Montcalm	Tributary to Flat River	Hunter Lake	14E	43.29667	-85.26333
Sessions Creek Dam	Ionia	Sessions Creek	Sessions Lake	14	42.94533	-85.12610
Jackson Prison Dam	Jackson	Tributary to Grand River	Jackson Prison Walleye Rearing Pond	14	42.29722	-84.39778
Rush Creek Detention Basin Dam #2	Ottawa	Deweerd Drain		14	42.85194	-85.84861
Honey Creek Dam	Kent	Honey Creek		14	42.97389	-85.48417
Falconcrest Industrial Park Detention	Kent	Plaster Creek		14	42.87361	-85.55000
Cross Creek Condos Detention Dam	Kent	Tributary to Plaster Creek		14	42.89861	-85.61389
Pond 4 Dam	Ionia	Tributary to Sessions Creek		14	42.93778	-85.13444
Rose Lake Dam	Clinton	tributary to Vermilion Creek	Rose Lake	14B	42.79167	-84.37694
Rose Lake Flooding Dam	Shiawassee	Tributary to Vermillion Creek	Rose Lake Flooding	14B	42.81389	-84.35000
York Creek Detention Dam	Kent	Tributary toYork Creek		14	43.04306	-85.68194
Sam Dix Dam	Kent	Tributary to Armstrong Creek	Sam Dix Pond	14	43.07083	-85.48889
Myers-Henderson Detention Pond	Eaton	Miller Creek		14	42.74500	-84.69028
Swan Lake	Montcalm			14C	43.26889	-84.91222
Dean Lake Level Control Structure	Kent			14F		
Ziegenfuss Lake Level Control Structure	Kent			14E	43.17444	-85.33500
Silver Lake Level Control Structure	Kent			14E	43.09333	-85.49528
Pine Lake Level Control Structure	Kent			14E	43.21667	-85.46556

APPENDIX 2 - DAM SITE INFORMATION

DAM NAME	COUNTY	RIVER	POND	WATERSHED CODE	LATITUDE	LONGITUDE
Myers Lake Level Control Structure	Kent			14E	43.13417	-85.49222
Rushmore Lake Level Control Structure	Ottawa			14	42.89306	-85.80167
Crystal Springs Lake Level Control Structure	Ottawa			14	42.90333	-85.80306
Duncan Lake Creek Dam	Barry	Duncan Creek		14D	42.74667	-85.51000
Hastings Hatchery Dam	Barry	West Creek		14D	42.64617	-85.30515
Hubbell Dam	Barry	Tributary to Glass Creek	Hubbell's Lake	14D	42.63000	-85.37500
Little Twin Lake Dam	Barry	Little Twin Lake		14D	42.67167	-85.29333
Morgan Dam	Barry	Highbank Creek		14D	42.62167	-85.17167
Schutz Dam	Barry			14D	42.65833	-85.48833
Smith Pond Dam	Barry	Tributary to Glass Creek		14D	42.61000	-85.37333
Wargess Dam	Barry			14D	42.58167	-85.23333
Albion Dam	Barry	Tributary to Glass Creek		14D	42.65278	-85.40278
Alward Lake Dam	Clinton	Alward Lake Outlet		14C	42.89500	-84.56833
Charlotte City Dam	Eaton	Battle Creek		14D	42.55000	-84.83000
Hall Dam	Eaton	Tributary to Spring Brook	Hall Pond	14	42.47167	-84.67000
Johnson's Dam	Eaton	Tributary to Thornapple River	Johnson Pond	14D	42.65124	-84.83435
Lacey Lake Dam	Eaton	Lacey Creek	Lacey Lake	14D	42.53333	-84.97000
Sanitation Dam	Eaton	Grand River		14	42.51667	-84.65000
Van Aken Dam	Eaton	Tributary to Grand River	Van Aken Pond	14	42.55833	-84.61667
Wilmore Dam	Eaton	Little Thornapple River	Wilmore Pond	14D	42.63500	-84.88833
WonsterDam	Eaton	Tributary to Sebewa Creek		14	42.75833	-84.94000
Hawkins Dam	Ingham	E Br Columbia Creek		14	42.53167	-84.53500
Lowry Dam	Ingham	Willow Creek		14	42.50167	-84.59500
VFW Dam	Ingham	Puffenberger Drain		14	42.47167	-84.59833
Baldwin Flooding Dam	Jackson	Trist Creek		14	42.32818	-84.17688
Michigan Center Pike Marsh Dam	Jackson	Tributary to Center Lake		14	42.21500	-84.29833
Petterson Dam	Jackson	Trist Creek		14	42.31333	-84.16167
Schroen Dam	Jackson	Tributary to Willow Creek		14	42.21333	-84.19333
Mud Lake Dam	Jackson	Mud Lake Outlet	Mud and Sugarloaf Lakes	14	42.35000	-84.13333
Moon Lake Dam	Shiawassee	Tributary to Vermillion Creek	Moon Lake	14B	42.81194	-84.33472
Augustine Dam	Kent	Tributary to Bear Creek		14	43.06167	-85.47167
Beautification Dam	Kent	Wadell Creek		14	43.05500	-85.53000
Chou-Cannon Dam	Kent	Bear Creek		14	43.05167	-85.54000
Grand River Beautification Dams	Kent	Grand River		14	43.96333	-85.67500
Hanson Dam	Kent	Indian Lake Feeder	Creets Lake	14F	43.19833	-85.65833
Honey Creek Dam	Kent	Honey Creek		14	42.96500	-85.47833
Laraway Creek Detention Basin Dam	Kent	Laraway Creek		14	42.91500	-85.63833
Squaw Lake Dam	Kent	Squaw Lake Drain		14F	43.19833	-85.68167
Wittenbach Dam	Kent	Tributary to Flat River		14	43.01500	-85.35167
Townwood Dam	Kent	Tributary to Buck Creek		14	45.91833	-86.94500
Whitneyville Dam	Kent	Whitneyville Creek		14D	42.86875	-85.45873
Cameron Dam	Livingston	Trib to Middle Cedar River		14A	42.57167	-84.05000
Cornell's Dam	Livingston	Spring to Mid Cedar River		14A	42.55000	-84.05000
Kreeger Dam	Livingston	Tributary to Cedar Creek		14A	42.69167	-84.07167
Long Lake Pike Rearing Pond Dam	Barry	Tributary to Long Lake		14D	42.55833	-85.36667
Parmalee Road Dam	Barry	Cain Creek		14D	42.75333	-85.36333
Enness Dam	Montcalm	Tributary to Flat River		14E	43.33000	-85.14833

APPENDIX 2 - DAM SITE INFORMATION

DAM NAME	COUNTY	RIVER	POND	WATERSHED CODE	LATITUDE	LONGITUDE
Manoka Lake Dam	Montcalm	Tributary to Flat River	Manoka Lake	14E	43.16667	-85.26333
Wellman Dam	Montcalm	Tributary to Fish Creek		14C	43.28000	-85.04500
Holton Dam	Jackson	Grand River		14	42.24500	-84.39667
Perrington Dam	Gratiot	Pine Creek		14C	43.16667	-84.67500
Shook Dam	Gratiot	Tributary to Pine Creek		14C	43.16667	-84.67167
Muskrat Farm Flooding	Barry	Tributary to Cain Creek		14D	42.74690	-85.36760
No Name	Muskegon	Tributary to Norris Creek		14	43.13833	-86.13167
Patterson Park Dam	Muskegon	Rio Grand Creek		14	43.14833	-85.95000
Harwell Lake Dam	Newaygo	Costen Drain	Harwell Lake	14F	43.32167	-85.66667
Little Black Lake Dam	Muskegon	Little Black Creek	Little Black Lake	14L	43.12583	-86.25278
Hasting Point Rd Fish Pond Dam	Barry	Tributary to Hall Lake Outlet	Hasting Point Road Fish Pond	14D	42.62500	-85.48500
Jordan Lake Dam	Barry	Little Thornapple River	Jordan Lake	14D	42.76000	-85.14833
Podunk Lake Dam	Barry	Podunk Creek	Podunk Lake	14D	42.61167	-85.35333
Wall Lake Dam	Barry	Wall Lake Outlet	Wall Lake	14D	42.52131	-85.37251
Long Lake Dam	Ionia	Ravels Creek		14	43.10833	-85.12667
Morrison Lake Level Control Structure	Ionia	Lake Creek	Morrison Lake	14D	42.86944	-85.20417
Lake Lansing Dam	Ingham	Lake Lansing Outlet	Lake Lansing	14A	42.76167	-84.41000
Cranberry Lake Level Control Structure	Jackson	Cranberry Lake Outlet	Cranberry Lake	14	42.17833	-84.34167
Gilletts Lake Level Control Structure	Jackson	Tributary to Brill Lake	Gillette Lake	14	42.26333	-84.32000
Big Brower Lake Level Control Structure	Kent	Big Brower Lake Outlet	Big Brower Lake	14F	43.12682	-85.48256
Big Crooked Lake Level Control Structure	Kent	Tributary to Big Crooked Lake	Big Crooked Lake	14E	44.06604	-85.38720
Clear Lake Level Control Structure	Kent	Tributary to Spring Creek	Clear Lake	14F	43.25571	-85.67496
Echo Lake Level Control Structure	Kent	Trib to Little Plaster Creek	Echo Lake	14	42.95844	-82.56668
Five Lakes Level Control Structure	Kent	Tributary to Coopers Creek	Horseshoe,Woodbeck,Banks,Thomas,1/2M	14E	43.21837	-85.33383
Lincoln Lake Level Control Structure	Kent	Clear Creek	Lincoln Lake	14E	43.23470	-85.35402
Little Pine Island Lake Level Control Structure	Kent	Tributary to Rogue River	Little Pine Lake	14	43.09333	-85.65000
Sand Lake Level Control Structure	Kent	Duck Creek	Sand Lake	14F	43.28667	-85.53167
Cedar Lake Level Control Structure	Livingston	Tributary to Red Cedar River	Cedar Lake	14A	42.53167	-83.98333
Crystal Lake Level Control Structure	Montcalm	Crystal Lake Outlet	Crystal Lake	14C	43.26500	-84.94333
Duck Lake Level Control Structure	Montcalm	Tributary to Fish Creek	Duck Lake	14C	43.26500	-84.88333
Pearl Lake Level Control Structure	Montcalm	Prairie Creek	Pearl Lake	14E	43.20833	-85.07667
Crockery Lake Level Control Structure	Ottawa	Trib to N Br Crockery Creek	Crockery Lake	14	43.16570	-85.86180
Sleepy Hollow Country Club Dam	Clinton	Ferdon Creek		14C	43.07500	-84.59167
Lenhert Dam	Clinton	Bad Creek		14C	42.88333	-84.63333
Whitaker Dam	Clinton	Little Maple Stream		14C	42.95667	-84.46667
Slamka Dam	Clinton	Little Maple Stream		14C	42.95667	-84.46667
Markman Dam	Clinton	Trib to Little Maple Stream		14C	42.95667	-84.46667
Simmon Dam	Clinton	Stoney Creek		14C	42.97167	-84.77167
Spitzley Dam	Clinton	Stoney Creek		14C	42.97167	-84.79167
Simmon Dam	Clinton	Stoney Creek		14C	42.97167	-84.75000
Ryon Dam	Clinton	Tributary Looking Glass River		14B	42.82000	-84.75000
Phillips Dam	Clinton	Cox Drain		14C	43.09833	-84.68333
Schlarf Dam #1	Clinton	Maple River		14C	43.11667	-84.60667
Schlarf Dam #2	Clinton	Maple River		14C	43.11667	-84.60667
Jousma Dam	Kent	Tributary to Grand River		14	42.95500	-85.45833
Twork Dam	Eaton	Tributary to Gruesbeck Drain		14	42.56500	-84.69333
Sutter Dam	Ottawa	Tributary to Sand Creek		14	42.96000	-85.85000

APPENDIX 2 - DAM SITE INFORMATION

DAM NAME	COUNTY	RIVER	POND	WATERSHED CODE	LATITUDE	LONGITUDE
Aginaw Lake Dam	Shiawassee	Rowley Creek	Aginaw Lake	14B	42.83000	-84.05167
Hecht Dam	Barry	Tributary to Messer Creek		14D	42.76000	-85.24500
Robinson Dam	Barry	Tributary to Thornapple River	Robinson Pond	14D	42.70417	-85.41667
Ferris Dam	Ionia	Toles Creek		14	42.95667	-85.25500
No Name	Ionia	Tributary to Grand River		14	42.95333	-85.29167
Walma Dam	Ionia	Tributary to Toles Creek		14	42.93833	-85.25333
Spark Foundation County Park Dam	Jackson	Tributary to McCain Drain		14	42.22167	-84.44333
McCaul Dam	Kent	Tributary to Honey Creek		14	42.97000	-85.47167
Reith Dam	Kent	Lee Creek		14E	42.97333	-85.38000
Rooker Dam	Kent	Tributary to Grand River		14	42.95333	-85.51167
Sarniak Dam	Kent	Tributary to Page Creek		14E	42.99500	-85.35833
Lords Lake	Jackson	Sandstone Creek		14	42.35278	-84.54194
Haas Dam	Eaton	Tributary to Thornapple River	Haas Pond	14D	42.54111	-84.70389
Hoffman Dam	Ottawa	Tributary to Lloyd Bayou		14	43.07000	-86.15833
Motman Dam	Ottawa	Tributary to Grand River		14	42.97500	-85.85333
Trib To Bruce Bayou Dam	Ottawa	Tributary to Bruce Bayou		14	43.06000	-86.13167
Trib To Dermo Bayou Dam	Ottawa	Tributary to Dermo Bayou		14	43.05000	-86.14333
VanSlooten Dam	Ottawa	Tributary to Bass River		14	42.98667	-86.03500
Geeck Road Dam	Shiawassee	Tributary to Hovey Drain		14C	42.90333	-84.04500
Blythefield Memorial Gardens Pond #1	Kent	Tributary to Grand River		14	43.08667	-85.56000
Blythefield Memorial Gardens Pond #2	Kent	Tributary to Grand River		14	43.08500	-85.56000
Prairie Dam	Ionia	Prairie Creek	Prairie Creek	14	42.98500	-85.02500
Deer Creek USGS Control	Ingham	Deer Creek		14A	42.60833	-84.32167
Sloan Creek USGS Control	Ingham	Sloan Creek		14A	42.67500	-84.36500
Red Cedar USGS Control	Ingham	Red Cedar River		14A	42.72833	-84.47833
Hunters Hollow Hunt Club Dam	Ingham	Mud Creek	Lake Elwynn	14A	42.51500	-84.37167
Hulsebos Dam	Eaton	Tributary to Shanty Brook		14D	42.57333	-85.02167
Miel Dam	Montcalm	Townline Creek		14E	43.45167	-85.16333
Pleasant Lake Level Control Structure	Jackson	Pleasant Lake Drain	Pleasant Lake	14	42.39167	-84.35333
Johnson Estate Dam	Kent	Huizenga Drain		14	42.88667	-85.75667
Gratiot-Saginaw Impoundment 15 Dam	Gratiot	Tributary to Maple River		14C	42.22500	-84.44167
County Line Flooding Dam	Montcalm	Tributary to Flat River	County Line Flooding	14E	43.12000	-85.23667
Deadwood Pond Dam	Barry	Tributary to Glass Creek		14D	42.63028	-85.39139
Dansville State Game Area #18 Dam	Ingham	Tributary to Batteese Creek		14A	42.52333	-84.33167
Stoker Dam	Jackson	Tributary to Portage Lake		14	42.31333	-84.21333
Greens Flooding Dam	Montcalm	Tributary to Dickerson Creek	Greens Flooding	14E	43.13333	-85.12250
Snaky Run Flooding Dam	Montcalm	Tributary to Dickinson Creek		14E	43.14306	-85.18194
Comstock Park Fish Rearing Pond Dam	Kent	Tributary to Mill Creek	Comstock Park Walleye Pond	14	43.03778	-85.67222
Hartwell Road Dam	Ionia	Tributary to Grand River	Hartwell Road Pond	14	42.94778	-85.15389
Jordan Lake Road Dam	Ionia	Tributary to Sessions Creek	Jordan Lake	14	42.95000	-85.13333
Pond 1 Dam	Ionia	Tributary to Sessions Creek		14	42.93528	-85.12944
Pond 2 Dam	Ionia	Tributary to Sessions Creek		14	42.93528	-85.12944
Pond 3 Dam	Ionia	Tributary to Sessions Creek		14	42.93861	-85.13167
Gratiot-Saginaw Impoundment 21 Dam	Gratiot	Tributary to Maple River		14C	43.19167	-84.41250
Six Lakes Cooling Pond Dam	Montcalm	Tributary to Flat River	Six Lakes Cooling Pond	14E	43.43833	-85.13722
Briggs Road Dam	Montcalm	Tacoma Lake Outlet		14E	43.32056	-85.25444
Pickerel Lake Dam	Kent	Tributary to Bear Creek	Big and Little Pickerel Lakes	14		

APPENDIX 2 - DAM SITE INFORMATION

DAM NAME	COUNTY	RIVER	POND	WATERSHED CODE	LATITUDE	LONGITUDE
Buttermilk Creek Detention Dam	Ottawa	Buttermilk Creek		14		

Appendix 3 – Watershed Assessment Matrix (WAM) and Watershed Action Plan (WAP)

Watershed Assessment Matrix (266 KB)

http://www.gvsu.edu/wri/isc/lowgrand/wit/plan/matrix.xls

Watershed Assessment Plan (4.45 MB)

http://www.gvsu.edu/wri/isc/lowgrand/wit/plan/wap.xls

APPENDIX 4 - NPDES PERMITTED OUTFALLS

PERMIT NO.	NAME	FLOW	FACILITY TYPE	OWNERSHIP	ISSUED	EXPIRES	STATUS	STORM	PERMITTEE NAME	COUNTY
MIG580058	Mulliken WWSL	25.00	N-INDSW	Public	10/21/2003	4/1/2009	Issued (not yet in ef		Village of Mulliken	Eaton
MIG580058	Mulliken WWSL	25.00	N-INDSW	Public	10/21/2003	4/1/2009	Issued (not yet in ef		Village of Mulliken	Eaton
MI0020745	Portland WWTP	0.50	N-INDSW	Public	2/12/2003	10/1/2007	In Effect		City of Portland	Ionia
MI0020851	Belding WWTP	3.30	N-INDSW	Public	11/8/1999	10/1/2004	In Effect		City of Belding	Ionia
MI0021041	Ionia WWTP	4.00	N-INDSW	Public	12/15/2000	10/1/2005	In Effect		City of Ionia	Ionia
MIG570213	Grand Ridge Homeowners Assoc	0.04	N-INDSW	Private	8/29/2001	4/1/2005	In Effect		Grand Ridge Homeowners Association	Ionia
MIG580130	Saranac WWSL	90.00	N-INDSW	Public	1/18/2000	4/1/2004	In Effect		Village of Saranac	Ionia
MIG580130	Saranac WWSL	90.00	N-INDSW	Public	1/18/2000	4/1/2004	In Effect		Village of Saranac	Ionia
MIG580138	MDNR-Ionia RA WWSL	2.50	N-INDSW	Federal/State	9/12/2000	4/1/2004	In Effect		Michigan Department of Natural Resources	Ionia
MIG580138	MDNR-Ionia RA WWSL	2.50	N-INDSW	Federal/State	9/12/2000	4/1/2004	In Effect		Michigan Department of Natural Resources	Ionia
MI0043109	Clarksville Morrison Lake WWTP	62.00	N-INDSW	Public	9/15/2000	10/1/2005	In Effect		Clarksville-Morrison Lake Sewer Authority	Ionia
MIG580364	Orleans Twp WWSL	19.70	N-INDSW	Public	10/17/2000	4/1/2004	In Effect		Orleans Township	Ionia
MIG580364	Orleans Twp WWSL	19.70	N-INDSW	Public	10/17/2000	4/1/2004	In Effect		Orleans Township	Ionia
MI0023311	Kent City WWTP	62.00	N-INDSW	Public	6/19/2000	10/1/2004	In Effect		Village of Kent City	Kent
MIG580128	Casnovia WWSL	10.78	N-INDSW	Public	1/14/2000	4/1/2004	In Effect		Village of Casnovia	Kent
MI0020311	Lowell WWTP	1.42	N-INDSW	Public	2/18/2000	10/1/2004	In Effect		City of Lowell	Kent
MI0023027	Grandville WWTP	4.40	N-INDSW	Public	8/13/2001	10/1/2005	In Effect		City of Grandville	Kent
MI0024392	Wyoming WWTP	19.00	N-INDSW	Public	7/25/2001	10/1/2005	In Effect		City of Wyoming	Kent
MI0026069	Grand Rapids WWTP	59.40	N-INDSW	Public	7/31/2001	10/1/2005	In Effect		City of Grand Rapids	Kent
MI0020478	Sparta WWTP	0.80	N-INDSW	Public	6/9/2000	10/1/2004	In Effect		Village of Sparta	Kent
MI0056723	Eastbrook Condo-Algoma	0.05	N-INDSW	Private	6/20/2002	10/1/2005	In Effect		Eastbrook Builders	Kent
MI0020397	Greenville WWTP	1.50	N-INDSW	Public	6/26/2000	10/1/2004	In Effect		City of Greenville	Montcalm
MIG580129	Sheridan WWSL	43.40	N-INDSW	Public	11/21/2003	4/1/2009	Issued (not yet in ef		Village of Sheridan	Montcalm
MIG580129	Sheridan WWSL	43.40	N-INDSW	Public	11/21/2003	4/1/2009	Issued (not yet in ef		Village of Sheridan	Montcalm
MIG580126	Ravenna WWSL	66.00	N-INDSW	Public	10/21/2003	4/1/2009	Issued (not yet in ef		Village of Ravenna	Muskegon
MIG580126	Ravenna WWSL	66.00	N-INDSW	Public	10/21/2003	4/1/2009	Issued (not yet in ef		Village of Ravenna	Muskegon
MI0056936	Beacon Woods MHP	0.12	N-INDSW	Private	9/11/2002	10/1/2005	In Effect		Delphin Properties LLC	Ottawa
MIG580135	Crockery MHP	12.00	N-INDSW	Private	6/15/1999	4/1/2004	In Effect		Crockery Mobile Home Park	Ottawa
MIG580135	Crockery MHP	12.00	N-INDSW	Private	6/15/1999	4/1/2004	In Effect		Crockery Mobile Home Park	Ottawa
MIG580295	Ottawa CRC-Chester Twp WWSL	8.76	N-INDSW	Public	6/3/1999	4/1/2004	In Effect		Ottawa County Road Commission	Ottawa
MI0021245	Grand Haven-Spring Lake WWTP	6.67	N-INDSW	Public	3/8/2001	10/1/2005	In Effect		Grand Haven-Spring Lake Sewer Authority	Ottawa
MI0022730	Coopersville WWTP	0.90	N-INDSW	Public	2/28/2001	10/1/2005	In Effect		City of Coopersville	Ottawa
MIG570126	Allendale Twp WWTP	2.40	N-INDSW	Public	1/31/2001	4/1/2005	In Effect		Allendale Charter Township	Ottawa
MIG570127	Metron of Lamont WWTP	0.01	N-INDSW	Private	2/1/2001	4/1/2005	In Effect		Metron of Lamont	Ottawa
MIG570128	River Haven MHP WWTP	0.12	N-INDSW	Private	1/24/2001	4/1/2005	In Effect		River Haven Operating Company LLC	Ottawa
MIG580134	Indian Trails Childrens Camp	0.84	N-INDSW	Private	11/5/2003	4/1/2009	Issued (not yet in ef		Indian Trails Childrens Camp	Ottawa
MIG580134	Indian Trails Childrens Camp	0.84	N-INDSW	Private	11/5/2003	4/1/2009	Issued (not yet in ef		Indian Trails Childrens Camp	Ottawa
MIG580136	Wright Twp-Ottawa Co WWSL	25.00	N-INDSW	Public	6/3/1999	4/1/2004	In Effect		Wright Township	Ottawa
MIG580104	Thornapple Twp-Duncan Lk WWSL	10.95	N-INDSW	Public	1/25/2000	4/1/2004	In Effect		Thornapple Township	Barry
MIG580104	Thornapple Twp-Duncan Lk WWSL	10.95	N-INDSW	Public	1/25/2000	4/1/2004	In Effect		Thornapple Township	Barry
MI0020079	Nashville WWTP	0.40	N-INDSW	Public	7/23/1999	10/1/2004	In Effect		Village of Nashville	Barry
MI0020575	Hastings WWTP	2.00	N-INDSW	Public	12/22/1999	10/1/2004	In Effect		City of Hastings	Barry
MI0024198	Sunfield WWSL	30.00	N-INDSW	Public	4/13/2000	10/1/2004	In Effect		Village of Sunfield	Eaton
MI0020508	Potterville WWTP	165.00	N-INDSW	Public	10/28/1999	10/1/2004	In Effect		City of Potterville	Eaton
MI0024261	Vermontville WWTP	36.00	N-INDSW	Public	12/29/1999	10/1/2004	In Effect		Village of Vermontville	Eaton
MI0042978	Lakewood WW Auth WWTP	274.00	N-INDSW	Public	1/26/2000	10/1/2004	In Effect		Lakewood Wastewater Authority	Ionia
MI0055697	Bowne Twp WWTP	0.17	N-INDSW	Public	12/15/2000	10/1/2005	In Effect		Bowne Township	Kent
MIG960011	Village of Middleville WWTP	-99.00	N-INDSW	Public	8/10/2001	4/1/2005	In Effect		Village of Middleville	Barry
MIG960003	Cedar Springs WWTP	-99.00	N-INDSW	Public	10/9/2000	4/1/2005	In Effect		City of Cedar Springs	Kent
MIG960005	Caledonia WWTP	-99.00	N-INDSW	Public	10/10/2000	4/1/2005	In Effect		Village of Caledonia	Kent
MIG080988	MDEQ-STD-Bobs	0.29	STAND	Federal/State	1/10/2001	4/1/2005	In Effect		Michigan Department of Environmental Quality	Eaton
MIG080064	Lakewood PS-Clarksville	0.01	STAND	Public	1/16/2001	4/1/2005	In Effect		Lakewood Public Schools	Ionia

APPENDIX 4 - NPDES PERMITTED OUTFALLS

PERMIT NO.	NAME	FLOW	FACILITY TYPE	OWNERSHIP	ISSUED	EXPIRES	STATUS	STORM	PERMITTEE NAME	COUNTY
MI0052213	Pitsch Sanitary Landfill	0.14	STAND	Private	9/8/1999	10/1/2004	In Effect		Pitsch Sanitary Landfill, Incorporated	Ionia
MI0002763	TBG Inc-Extruded Metals	0.58	STAND	Private	10/29/1999	10/1/2004	In Effect	Y	TBG Incorporated	Ionia
MIG250439	Indian Summer Inc	0.09	STAND	Private	4/23/2003	4/1/2008	In Effect		Indian Summer	Ionia
MIG250465	Nakano Foods Inc	0.86	STAND	Private	5/7/2003	4/1/2008	In Effect		Nakano Foods Incorporated	Ionia
MI0041637	Lacks Ind-Saranac	0.15	STAND	Private	1/29/2001	10/1/2005	In Effect		Lacks Enterprises, Incorporated	Ionia
MI0048712	Ingersoll-Rand	0.29	STAND	Private	10/13/2000	10/1/2005	In Effect		Ingersoll-Rand Company	Ionia
MI0053546	MDC-Mich Reform Power Plant	0.03	STAND	Federal/State	7/13/2000	10/1/2005	In Effect	Y	Michigan Department of Corrections	Ionia
MIG080635	Crystal Flash LP-Saranac	0.14	STAND	Private	10/11/2000	4/1/2005	In Effect		Crystal Flash Limited Partnership	Ionia
MIG080879	Emro Marketing Co-Burlingame	0.07	STAND	Private	2/1/2001	4/1/2005	In Effect		Speedway SuperAmerica	Kent
MIG250162	De Jager Construction Inc	0.06	STAND	Private	2/18/2003	4/1/2008	In Effect		De Jager Construction Inc.	Kent
MIG250409	Center Mfg Inc-84th	0.12	STAND	Private	2/27/2003	4/1/2008	In Effect		Center Manufacturing Incorporated	Kent
MIG250456	Center Mfg Inc-Piedmont	0.13	STAND	Private	2/18/2003	4/1/2008	In Effect		Center Manufacturing Inc.	Kent
MIG081031	WESCO-Cedar Springs	0.11	STAND	Private	6/16/2003	4/1/2005	In Effect		Weaver's Inc.	Kent
MIG080044	Westside Beer Distributing	0.14	STAND	Private	2/12/2001	4/1/2005	In Effect		Westside Beer Distributing	Kent
MIG250440	Spectrum-GR-Plymouth	0.04	STAND	Private	2/18/2003	4/1/2008	In Effect		Spectrum Industries Inc.	Kent
MI0043877	GM-NAO-Grand Rapids	0.84	STAND	Private	4/6/2001	10/1/2005	In Effect	Y	General Motors Corporation	Kent
MIG670277	ANR Pipeline Co-Walker	0.10	STAND	Private	2/18/2003	4/1/2008	In Effect		ANR Pipeline Company	Kent
MI0055573	Root-Lowell Mfg Co	0.20	STAND	Private	11/12/1998	10/1/2003	In Effect	Y	Root-Lowell Manufacturing Company	Kent
MI0048828	Oxy-USA Inc	1.30	STAND	Private	4/2/2003	10/1/2005	In Effect		Miller Springs Remediation Management, Inc.	Kent
MIG080130	MSI #649-Kentwood	0.00	STAND	Private	2/12/2001	4/1/2005	In Effect		Bulk Petroleum Corporation	Kent
MIG080878	Bulk Petroleum-Northland Dr	0.04	STAND	Private	1/22/2001	4/1/2005	In Effect		Bulk Petroleum Corporation	Kent
MIG080884	Amoco Oil Co-Grand Rapids#9758	0.04	STAND	Private	1/24/2001	4/1/2005	In Effect		Amoco Oil Company	Kent
MIG080892	J&H Oil Co-Cherry St	0.04	STAND	Private	2/12/2001	4/1/2005	In Effect		J&H Oil Company	Kent
MIG250153	Welcome Home for the Blind	0.05	STAND	Private	3/26/2003	4/1/2008	In Effect		Welcome Home For The Blind	Kent
MI0043150	Steelcase Inc-Grand Rapids	0.20	STAND	Private	7/25/2000	10/1/2005	In Effect	Y	Steelcase Incorporated	Kent
MIG080640	Speedway SuperAmerica-Kentwood	0.04	STAND	Private	2/12/2001	4/1/2005	In Effect		Speedway SuperAmerica LLC	Kent
MIG250169	Betz Foundry Inc	0.01	STAND	Private	2/27/2003	4/1/2008	In Effect		Betz Foundry, Inc.	Kent
MIG080083	Meijer #11-Grand Rapids	0.03	STAND	Private	2/12/2001	4/1/2005	In Effect		Meijer #11	Kent
MIG250271	Yamaha Musical Products	0.11	STAND	Private	1/24/2003	4/1/2008	In Effect		Yamaha Corporation of America, Inc.	Kent
MIG080992	Oxy USA Inc-Sparta	0.04	STAND	Private	1/22/2001	4/1/2005	In Effect		Glenn Springs Holdings, Incorporated	Kent
MIG250402	Sparta Foundry Inc	0.02	STAND	Private	2/7/2003	4/1/2008	In Effect		Sparta Foundry Incorporated	Kent
MI0001236	Delphi Automotive Systems LLC	3.50	STAND	Private	7/13/2001	10/1/2005	In Effect	Y	Delphi Automotive Systems LLC	Kent
MI0043061	Steelcase Inc-Kentwood	-99.00	STAND	Private	7/25/2000	10/1/2005	In Effect	Y	Steelcase Incorporated	Kent
MIG080036	Thrifty Petroleum-Wyoming	0.14	STAND	Private	2/12/2001	4/1/2005	In Effect		Byron Petroleum	Kent
MIG080115	Bulk Petroleum-Wyoming	0.01	STAND	Private	2/1/2001	4/1/2005	In Effect		Bulk Petroleum Corporation	Kent
MIG080172	J & H Oil Co-Wyoming	0.14	STAND	Private	10/25/2000	4/1/2005	In Effect		J & H Oil Company	Kent
MIG250151	Keebler Co	0.70	STAND	Private	2/27/2003	4/1/2008	In Effect		Keebler Company	Kent
MIG250152	Blackmer-A Dover Resources Co	0.13	STAND	Private	12/26/2002	4/1/2008	In Effect		Blackmer	Kent
MIG080886	Equilon Enterprises-Gr Rapids	0.03	STAND	Private	2/1/2001	4/1/2005	In Effect		Equilon Enterprises, LLC	Kent
MIG250159	Sojourners Trans Living	0.02	STAND	Private	3/27/2003	4/1/2008	In Effect		Hope Network Rehabilitation Services	Kent
MIG080212	Amoco Oil Co-Wyoming #5213	0.02	STAND	Private	1/16/2001	4/1/2005	In Effect		Amoco Oil Company	Kent
MIU990002	Organic Chemicals-SF Site		STAND	Private	3/2/1995	0	In Effect		Organic Chemicals, Incorporated Steering Committee	Kent
MIG250375	Carmelite Monastery	0.00	STAND	Private	2/18/2003	4/1/2008	In Effect		Discalced Carmelite Nuns	Kent
MIG250423	R L Adams Plastics-Burlingame	0.18	STAND	Private	3/11/2003	4/1/2008	In Effect		R. L. Adams Plastics, Inc.	Kent
MIG080422	Budget Rent-A-Car Systems	0.01	STAND	Private	1/31/2001	4/1/2005	In Effect		Budget Rent-A-Car Systems	Kent
MIG250156	Clarion Tech Inc-Caledonia	0.00	STAND	Private	2/27/2003	4/1/2008	In Effect		Clarion Technologies, Inc.	Kent
MIU990004	ChemCentral-Grand Rapids SF		STAND	Public	7/9/1994	0	In Effect		ChemCentral/Grand Rapids Corporation	Kent
MI0037486	Kent Co DPW-Plainfield Twp LF	0.25	STAND	Public	5/26/2000	10/1/2004	In Effect	Y	Kent County Department of Public Works	Kent
MIG080895	Weaver Oil Co-Sand Lake	0.04	STAND	Private	1/24/2001	4/1/2005	In Effect		Weaver Oil Company	Kent
MIG080985	Bulk Petroleum-Grand Rapids	0.01	STAND	Private	2/1/2001	4/1/2005	In Effect		Bulk Petroleum Corporation	Kent
MIG081003	Dale Baker-Service Building	0.01	STAND	Private	8/9/2000	4/1/2005	In Effect		Dale Baker Motor Mall	Kent
MI0002135	Frigidaire Home Products	0.55	STAND	Private	11/30/1999	10/1/2004	In Effect	Y	White Consolidated Industries	Montcalm

APPENDIX 4 - NPDES PERMITTED OUTFALLS

PERMIT NO.	NAME	FLOW	FACILITY TYPE	OWNERSHIP	ISSUED	EXPIRES	STATUS	STORM	PERMITTEE NAME	COUNTY
MI0002836	Federal Mogul Corp-Greenville	1.34	STAND	Private	8/4/2000	10/1/2004	In Effect	Y	Federal Mogul Corporation	Montcalm
MI0003662	Michcon-W C Taggart Sta	21.00	STAND	Private	7/31/2000	10/1/2004	In Effect		Michigan Consolidated Gas Company	Montcalm
MIG250438	Tower Automotive-Greenville	0.20	STAND	Private	9/24/2003	4/1/2008	In Effect		Tower Automotive	Montcalm
MIG250157	Rogers Printing Inc	0.14	STAND	Private	3/25/2003	4/1/2008	In Effect		Rogers Printing, Incorporated	Muskegon
MIG250463	Metal Technologies-Ravenna	0.20	STAND	Private	3/28/2003	4/1/2008	In Effect		Metal Technologies, Incorporated	Muskegon
MIG080042	Weaver Oil Co-Grant	0.09	STAND	Private	1/31/2001	4/1/2005	In Effect		Weaver Oil Company	Newaygo
MIG081005	Citgo Corp-Ferrysburg	0.05	STAND	Private	9/14/2000	4/1/2005	In Effect		Citgo Petroleum Corporation	Ottawa
MIG670176	Citgo Corp-Ferrysburg	1.00	STAND	Private	3/25/2003	4/1/2008	In Effect		Citgo Petroleum Corporation	Ottawa
MIG640225	MDOT-Jamestown Water Main	0.03	STAND	Federal/State	10/8/2002	4/1/2005	In Effect		Michigan Department of Transportation	Ottawa
MIG250154	Solar of Mich-Coopersville	0.18	STAND	Private	3/28/2003	4/1/2008	In Effect		Solar of Michigan, Inc.	Ottawa
MI0000728	Grand Haven BL&P-J B Sims	67.18	STAND	Public	2/26/2001	10/1/2005	In Effect	Y	City of Grand Haven	Ottawa
MI0050253	Eagle Ottawa Leather Co	1.50	STAND	Private	8/31/2000	10/1/2005	In Effect	Y	Albert Trostel & Sons Company	Ottawa
MI0052353	Challenge Machinery Co	0.07	STAND	Private	11/30/2000	10/1/2005	In Effect	Y	The Challenge Machinery Company	Ottawa
MI0054399	Harbourfront-Grand Haven	0.47	STAND	Private	6/23/2000	10/1/2005	In Effect		Harbourfront Place, LLC	Ottawa
MIG080223	Reiss Remediation Co	0.06	STAND	Private	1/24/2001	4/1/2005	In Effect		Reiss Remediation Company	Ottawa
MIG081008	Tri City Oil Co-Spring Lake	0.09	STAND	Private	12/7/2000	4/1/2005	In Effect		Tri City Oil Company, Inc.	Ottawa
MIG250164	Grand Haven BL&P	10.00	STAND	Public	1/24/2003	4/1/2008	In Effect		City of Grand Haven	Ottawa
MIG490126	Construction Aggregates Corp	1.00	STAND	Private	4/19/1996	10/1/2000	In Effect		Construction Aggregates Corporation	Ottawa
MIG670179	Shell Oil ProductsFerrysburg	0.74	STAND	Private	2/18/2003	4/1/2008	In Effect		Equilon Enterprises LLC	Ottawa
MI0053597	MDEQ-ERD-Rozema Waste Garage	0.10	STAND	Federal/State	11/20/2000	10/1/2005	In Effect		Michigan Department of Environmental Quality	Ottawa
MIG080076	Jerrys Citgo-Grand Haven	0.07	STAND	Private	1/22/2001	4/1/2005	In Effect		Tri City Oil Company	Ottawa
MI0004022	Johnston Boiler Co	0.10	STAND	Private	11/21/2000	10/1/2005	In Effect		Johnston Boiler Company	Ottawa
MIG250166	JSJ Corp-GHSP-North	0.07	STAND	Private	3/11/2003	4/1/2008	In Effect		JSJ Corporation	Ottawa
MIG250379	Holland Plastics Corp-Gr Haven	0.18	STAND	Private	3/28/2003	4/1/2008	In Effect		Holland Plastics Corporation	Ottawa
MIG440009	River Ridge Farms-CAFO		STAND	Private	8/27/2003	12/31/2007	In Effect		River Ridge Farms, Inc.	Ottawa
MIG440010	River Ridge Dairy-CAFO		STAND	Private	9/3/2003	12/31/2007	In Effect		River Ridge Dairy Company, Inc.	Ottawa
MI0003646	Bliss Clearing Niagara	0.12	STAND	Private	1/27/2000	10/1/2004	In Effect		Bliss Clearing Niagara, Inc.	Barry
MI0004405	Bradford-White Corp	0.09	STAND	Private	8/11/2003	10/1/2007	In Effect	Y	Bradford-White Corporation	Barry
MI0050199	Hastings Sanitary Service	0.14	STAND	Private	8/27/1999	10/1/2004	In Effect	Y	City Environmental Services Landfill, Inc. of Hasting	Barry
MI0002771	Owens-Brockway Glass Container	1.17	STAND	Private	4/13/2000	10/1/2004	In Effect	Y	Owens-Brockway Glass Container, Incorporated	Eaton
MIG080987	Lakewood Schools-Sunfield	0.00	STAND	Public	1/10/2001	4/1/2005	In Effect		Lakewood Public Schools	Eaton
MI0043893	C & M Produce Ltd-Miller Farm	0.25	STAND	Private	10/27/1999	10/1/2004	In Effect		C & M Produce LTD	Eaton
MI0055735	Gerald R Ford Intl Airport-GR	-99.00	STAND	Public	9/28/2000	10/1/2004	In Effect	Y	Gerald R. Ford International Airport	Kent
MIG440008	Freeport Dairy-CAFO		STAND	Private	8/27/2003	12/31/2007	In Effect		Freeport Dairy LLC	Kent
MIG960008	Cedarfield Development	-99.00	STAND	Private	4/4/2001	4/1/2005	In Effect		Cedarfield Inc.	Kent

Target Audience Profile

Target Audience: Agricultural Community

1. What is the makeup of the target audience (answer if appropriate) ?
   a. Average Age N/A
   b. Gender N/A
   c. Place of Residents (home or apartment, any unique characteristics) Homes in watershed
   d. Level of Education: N/A
   e. Level of Income: refer to following table
   f. Other pertinent facts: Major crops for Kent and Ottawa County are corn, oats, and soybeans

2. How do they communicate with each other? Michigan State University Extension, Farm Bureau, Natural Resource Conservation District, Natural Resource Conservation Service, Internet, 4-H fairs

3. How do they receive information on environmental issues? Mass Media, local publications, small group discussions.

4. Of what other community organizations are they members? Places of Worship, sporting clubs

5. What are their major environmental concerns: Flooding, water storage, dredging of drains (sedimentation)

Target Audience Profile

Target Audience: Agricultural Community, Extra Information

Agricultural Census Information for Kent County, Michigan			
	1997	1992	1987
Farms (number)	1,136	1,190	1,368
Land in farms (acres)	186,453	190,706	203,842
Land in farms - average size of farm (acres)	164	160	149
Land in farms - median size of farm (acres)	63	(N)	(N)
Estimated market value of land and buildings@1: average per farm (dollars)	453,387	301,712	202,820
Estimated market value of land and buildings@1: average per acre (dollars)	2,686	1,832	1,274
Estimated market value of all machinery/equipment@1:aver per farm (dollars)	74,189	59,263	42,890
Farms by size: 1 to 9 acres	97	97	126
Farms by size: 10 to 49 acres	383	347	430
Farms by size: 50 to 179 acres	399	470	489
Farms by size: 180 to 499 acres	178	196	234
Farms by size: 500 to 999 acres	45	52	62
Farms by size: 1,000 acres or more	34	28	27
Total cropland (farms)	1,043	1,113	1,268
Total cropland (acres)	149,898	154,552	163,275
Total cropland, harvested cropland (farms)	934	1,046	1,175
Total cropland, harvested cropland (acres)	127,476	119,403	121,233
Irrigated land (farms)	128	164	144
Irrigated land (acres)	6,120	9,030	7,445
Market value of agricultural products sold ($1,000)	121,041	105,990	82,983
Market value of agricultural products sold, average per farm (dollars)	106,550	89,067	60,660
Market value of ag prod sold-crops,incl nursery and greenhouse crops ($1,000)	91,987	73,688	50,383
Market value of ag products sold - livestock, poultry, and their products ($1,000)	29,054	32,302	32,600
Farms by value of sales: Less than $2,500	309	325	397
Farms by value of sales: $2,500 to $4,999	152	139	163
Farms by value of sales: $5,000 to $9,999	127	157	196
Farms by value of sales: $10,000 to $24,999	158	161	188
Farms by value of sales: $25,000 to $49,999	87	99	105
Farms by value of sales: $50,000 to $99,999	89	96	108
Farms by value of sales: $100,000 or more	214	213	211
Total farm production expenses@1 ($1,000)	93,300	88,084	66,289
Total farm production expenses@1, average per farm (dollars)	82,131	74,082	48,421
Net cash return from agricultural sales for the farm unit (see text)@1 (farms)	1,136	1,189	1,369
Net cash return from agricultural sales for the farm unit (see text)@1 ($1,000)	27,844	19,863	16,075

Net cash return from ag sales for fm unit (see text)@1, average per farm (dollars)	24,510	16,705	11,742
Operators by principal occupation: Farming	487	536	625
Operators by principal occupation: Other	649	654	743
Operators by days worked off farm: Any	667	701	809
Operators by days worked off farm: 200 days or more	501	531	610
Livestock and poultry: Cattle and calves inventory (farms)	356	431	531
Livestock and poultry: Cattle and calves inventory (number)	27,633	32,184	34,672
Beef cows (farms)	189	184	227
Beef cows (number)	2,769	2,327	3,286
Milk cows (farms)	93	148	173
Milk cows (number)	9,097	11,218	12,343
Cattle and calves sold (farms)	336	391	519
Cattle and calves sold (number)	11,272	13,420	17,002
Hogs and pigs inventory (farms)	52	88	108
Hogs and pigs inventory (number)	7,949	14,203	17,065
Hogs and pigs sold (farms)	49	89	112
Hogs and pigs sold (number)	14,364	26,356	27,198
Sheep and lambs inventory (farms)	27	27	37
Sheep and lambs inventory (number)	523	1,282	949
Layers and pullets 13 weeks old and older inventory (see text) (farms)	32	45	62
Layers and pullets 13 weeks old and older inventory (see text) (number)	976	(D)	2,795
Broilers and other meat-type chickens sold (farms)	5	11	10
Broilers and other meat-type chickens sold (number)	283	782	880
Corn for grain or seed (farms)	373	404	596
Corn for grain or seed (acres)	42,188	39,798	39,847
Corn for grain or seed (bushels)	4,550,863	3,271,022	3,684,369
Wheat for grain (farms)	155	206	205
Wheat for grain (acres)	6,918	7,744	5,565
Wheat for grain (bushels)	361,368	318,398	243,064
Soybeans for beans (farms)	123	85	38
Soybeans for beans (acres)	14,120	5,743	2,520
Soybeans for beans (bushels)	526,560	163,833	91,803
Dry edible beans, excluding dry limas (farms)	17	18	9
Dry edible beans, excluding dry limas (acres)	2,876	2,243	1,346
Dry edible beans, excluding dry limas (hundredweight)	50,270	32,961	19,108
Hay-alfalfa,other tame,small grain,wild,grass silage,green chop,etc(see txt)(farms)	553	634	757
Hay-alfalfa,other tame,small grain,wild,grass silage,green chop,etc(see txt)(acres)	30,713	34,196	39,950
Hay-alfal,oth tame,small grain,wild,grass silage,green chop,etc(see txt)(tons,dry)	78,350	89,707	109,579
Vegetables harvested for sale (see text) (farms)	80	114	118
Vegetables harvested for sale (see text) (acres)	3,747	4,507	4,311
Land in orchards (farms)	184	236	257
Land in orchards (acres)	15,143	16,988	16,332

(D) Withheld to avoid disclosing data for individual farms.
(N) Not available.

Agricultural 2000 Census Information for Ottawa County, Michigan			
	1997	1992	1987
Farms (number)	1,292	1,367	1,471
Land in farms (acres)	170,627	176,305	177,894
Land in farms - average size of farm (acres)	132	129	121
Land in farms - median size of farm (acres)	51	(N)	(N)
Estimated market value of land and buildings@1: average per farm (dollars)	395,504	268,234	207,266
Estimated market value of land and buildings@1: average per acre (dollars)	3,066	2,026	1,754
Estimated market value of all machinery/equipment@1:aver per farm (dollars)	78,117	61,705	52,554
Farms by size: 1 to 9 acres	149	142	156
Farms by size: 10 to 49 acres	476	457	479
Farms by size: 50 to 179 acres	426	493	541
Farms by size: 180 to 499 acres	171	213	242
Farms by size: 500 to 999 acres	48	50	43
Farms by size: 1,000 acres or more	22	12	10
Total cropland (farms)	1,199	1,287	1,380
Total cropland (acres)	140,978	146,319	146,152
Total cropland, harvested cropland (farms)	1,096	1,220	1,305
Total cropland, harvested cropland (acres)	119,789	112,242	112,721
Irrigated land (farms)	323	297	296
Irrigated land (acres)	14,811	13,659	10,537
Market value of agricultural products sold ($1,000)	299,985	232,853	182,959
Market value of agricultural products sold, average per farm (dollars)	232,187	170,339	124,378
Market value of ag prod sold-crops,incl nursery and greenhouse crops ($1,000)	160,066	108,015	78,706
Market value of ag products sold - livestock, poultry, and their products ($1,000)	139,919	124,838	104,253
Farms by value of sales: Less than $2,500	252	251	309
Farms by value of sales: $2,500 to $4,999	140	132	164
Farms by value of sales: $5,000 to $9,999	150	180	205
Farms by value of sales: $10,000 to $24,999	177	170	204
Farms by value of sales: $25,000 to $49,999	117	123	131
Farms by value of sales: $50,000 to $99,999	118	155	136
Farms by value of sales: $100,000 or more	338	356	322
Total farm production expenses@1 ($1,000)	243,970	196,812	152,637
Total farm production expenses@1, average per farm (dollars)	188,685	143,868	103,694
Net cash return from agricultural sales for the farm unit (see text)@1 (farms)	1,293	1,368	1,472
Net cash return from agricultural sales for the farm unit (see text)@1 ($1,000)	56,728	33,087	30,571
Net cash return from ag sales for fm unit (see text)@1, average per farm (dollars)	43,873	24,187	20,768
Operators by principal occupation: Farming	658	724	742
Operators by principal occupation: Other	634	643	729
Operators by days worked off farm: Any	713	782	852

Operators by days worked off farm: 200 days or more	506	552	623
Livestock and poultry: Cattle and calves inventory (farms)	451	545	607
Livestock and poultry: Cattle and calves inventory (number)	36,159	41,580	40,843
Beef cows (farms)	184	196	211
Beef cows (number)	2,421	3,644	2,266
Milk cows (farms)	137	184	205
Milk cows (number)	13,177	13,470	12,517
Cattle and calves sold (farms)	429	517	584
Cattle and calves sold (number)	46,743	23,626	40,069
Hogs and pigs inventory (farms)	96	177	176
Hogs and pigs inventory (number)	69,018	89,434	90,617
Hogs and pigs sold (farms)	97	181	193
Hogs and pigs sold (number)	162,430	168,499	168,880
Sheep and lambs inventory (farms)	35	32	23
Sheep and lambs inventory (number)	713	938	462
Layers and pullets 13 weeks old and older inventory (see text) (farms)	46	50	69
Layers and pullets 13 weeks old and older inventory (see text) (number)	2,336,067	983,741	2,392,286
Broilers and other meat-type chickens sold (farms)	20	18	21
Broilers and other meat-type chickens sold (number)	9,166	3,032	369,297
Corn for grain or seed (farms)	410	525	683
Corn for grain or seed (acres)	42,224	42,362	42,328
Corn for grain or seed (bushels)	4,862,900	3,724,693	4,055,681
Wheat for grain (farms)	199	206	109
Wheat for grain (acres)	6,118	4,863	2,011
Wheat for grain (bushels)	318,173	206,383	82,869
Soybeans for beans (farms)	132	34	33
Soybeans for beans (acres)	9,232	1,289	1,148
Soybeans for beans (bushels)	369,525	36,483	38,364
Dry edible beans, excluding dry limas (farms)	2	0	0
Dry edible beans, excluding dry limas (acres)	(D)	0	0
Dry edible beans, excluding dry limas (hundredweight)	(D)	0	0
Hay-alfalfa,other tame,small grain,wild,grass silage,green chop,etc(see txt)(farms)	535	628	745
Hay-alfalfa,other tame,small grain,wild,grass silage,green chop,etc(see txt)(acres)	29,015	29,723	33,541
Hay-alfal,oth tame,small grain,wild,grass silage,green chop,etc(see txt)(tons,dry)	71,942	76,358	84,903
Vegetables harvested for sale (see text) (farms)	103	126	152
Vegetables harvested for sale (see text) (acres)	3,362	3,752	4,475
Land in orchards (farms)	65	95	101
Land in orchards (acres)	6,170	6,985	6,804

(D) Withheld to avoid disclosing data for individual farms.
(N) Not available.
Data From: “Census of Agriculture: 1987, 1992, 1997.” GovStats. Oregon State University Libraries. Updated: Feburaury 28, 2002. Retrieved: November 23, 2003. <http://govinfo.kerr.orst.edu/php/agri/show2.php>

Target Audience: Rural Pilot Project Areas

1. What is the makeup of the target audience?
   b. Average Age Varied Families
   c. Gender M & F
   d. Place of Residents (home or apartment, any unique characteristics) 66.86% owner occupied 33.13% renter occupied
   e. Level of Education: 85.94% High School Ed or higher (25yrs and older)
   f. Level of Income: median family income $56, 471
   g. Other pertinent facts: 38.38% of families have children under 18

3. How do they communicate with each other? Grand Rapids Press, Grand Rapids Times, Grand Rapids Business Update, Paper, On-The-Town Magazine, Community Voice, Ottawa Press, West Michigan Christian Newspaper, Associated Press, Michigan Outdoor News, Catholic Connector, The Holland Sentinel. West Michigan Today, Alive, Mlive, Bullentein Boards, Church newsletters, Restaurants

4. How do they receive information on environmental issues? Mass Media and possibly through organizations active in the area.

5. Of what other community organizations are they members? Timberland Resource Conservation & Development Area Council, Marne American Legion, Girl Scouts of Michigan Trails, Boy Scouts of America, UAW-United Automobile, Aerospace & Agricultural Implement Workers of America, Rotary Club of Grand Rapids, Kent County Conservation League, Kent County Farm Bureau, Marne Conservation Club, Grand Rapids Lions Club, Optimist Club of Grand Rapids, West Walker Sportsman's Club, Blandford Nature Center, Land Conservancy of West Michigan, West Michigan Alive, The Nature Conservancy, Sand Creek Group, Friends of the Musketawa Trail

6. What are their major environmental concerns: Residents are concerned about flooding (which is caused by extreme changes in hydrologic flow and worsens due to lack of storage) and sedimentation (which is caused by agricultural uses and lack of BMPs).

Target Audience: Rural Pilot Project Areas, Extra Information

Rural Pilot Project Area

General Demographic Profile
Using Demographic Profile 1 (DP-1) Profile of Genera Characteristics:2000
DP-2 Profile of Selected Social Characteristics: 2000
DP-3 Profile of Selected Economic Characteristics: 200
Geoghraphic Comparison Table-Population Housing (GCT-PHI) Population, Housing, Area, and Density: 2000

Using the United States Census Bureau, American FactFinder, www.factfinder.census.gov

Information was collected from above sources for the following Minor Civil Divisions (MCD): Alpine Township, Kent County; Chester Township, Ottawa County; Tallmadge Township, Ottawa County; City of Walker, Kent County; Wright Township, Ottawa County.

- Total Population: 48,300-for whole townships (15,484 when clipped to watershed boundaries)
- Female Population: 24, 157
- Male Population: 24,143
- Average Water Area/square mile/MCD: 0.262
- Total Water Area/square mile: 1.31
- Average Population Density/square mile of land use/ MCD: 325.26
- Average Housing Unit Density/square mile of land use/MCD: 130.72
- Number of Owner Occupied Housing Units: 12,296
- Number of Renter Occupied Housing Units: 6,093
- Median Household Income/MCD: $48,771.00
- Median Family Income/MCD: $56, 471.00
- Average % of Families with Children under 18/MCD: 38.38%
- Average % Have high school education or up/MCD: 85.94%
- Average % have BA or higher/MCD: 16.21%
- Average % have only high school: 37.34%

Target Audience Profile

Target Audience: Urban Pilot Project Areas

1. What is the makeup of the target audience?
   h. Average Age Varied Families
   i. Gender M & F
   j. Place of Residents (home or apartment, any unique characteristics) Population : 474,296 ; Owner Occupied Housing Units: 118,816; Renter Occupied Housing Units: 59,173
   k. Level of Education: 87.67% have high school education or higher
   l. Level of Income: median family income $60,619.00
   - Other pertinent facts: 39.05% of families have children under 18

7. How do they communicate with each other? Grand Rapids Press, Grand Rapids Times, Grand Rapids Business Update, Paper, On-The-Town Magazine, Community Voice, Ottawa Press, West Michigan Christian Newspaper, Associated Press, Michigan Outdoor News, Catholic Connector, The Holland Sentinel. West Michigan Today, Alive, Mlive, Bullentein Boards, Church newsletters, Restaurants

8. How do they receive information on environmental issues? Mass Media and possibly through organizations active in the area.

9. Of what other community organizations are they members? Timberland Resource Conservation & Development Area Council, American Legion, Girl Scouts of Michigan Trails, Boy Scouts of America, UAW-United Automobile, Aerospace & Agricultural Implement Workers of America, Rotary Club of Grand Rapids, Kent County Conservation League, Kent County Farm Bureau, Marne Conservation Club, Land Conservancy of West Michigan, West Michigan Alive, The Nature Conservancy, Issac Walton League, Trout Unlimited, Ducks Unlimited

10. What are their major environmental concerns:

Urban Pilot Project Area

General Demographic Profile

Using Demographic Profile 1 (DP-1) Profile of Genera Characteristics:2000
DP-2 Profile of Selected Social Characteristics: 2000
DP-3 Profile of Selected Economic Characteristics: 200
Geoghraphic Comparison Table-Population Housing (GCT-PHI) Population, Housing, Area, and Density: 2000

Using the United States Census Bureau, American FactFinder,
www.factfinder.census.gov

Information was collected from above sources for the following Minor Civil Divisions (MCD): Alpine Township, Kent County; Byron, Kent County; Dorr, East Grand Rapids, Kent County; Gaines, Kent County; City of Grand Rapids, Kent County; Grand Rapids Charter, Kent County; City of Grandville, Kent County; City of Kentwood, Kent County; Leighton, Allegan; Plainfield, Kent County; Tallmadge, Ottawa County; City of Walker, Kent County; City of Wyoming, Kent County;

- Total Population: 474,296
- Female Population: 241,560
- Male Population: 232,736
- Average Water Area/square mile/MCD: 0.33
- Total Water Area/square mile: 4.67
- Average Population Density/square mile of land use/ MCD: 1,419
- Average Housing Unit Density/square mile of land use/MCD: 553
- Number of Owner Occupied Housing Units: 118,816
- Number of Renter Occupied Housing Units: 59,173
- Median Household Income/MCD: $52,630.21
- Median Family Income/MCD: $60,619.00
- Average % of Families with Children under 18/MCD: 39.05%
- Average % Have high school education or up/MCD: 87.67%
- Average % have BA or higher/MCD: 25.84%
- Average % have only high school: 30.30%

Target Audience Profile

Target Audience: Business Owners

1. What is the makeup of the target audience (answer if appropriate)?
   a. Average Age: Adult
   b. Gender M/F
   c. Place of Residents (home or apartment, any unique characteristics)
      Most residing in Grand River Watershed
   d. Level of Education: Varied
   e. Level of Income: Varied
   f. Other pertinent facts: Special categories for contact are waste disposal, industrial usages, water treatment, environmental clean up agencies.

2. How do they communicate with each other? Trade newsletters, magazines, conferences, day to day business operations, select organizations (West Michigan Water Environmental Association, Home Builders Association, Health Departments)

3. How do they receive information on environmental issues? Regulations on industrial processes and waste disposal, as well as through mass media.

4. Of what other community organizations are they members?

5. What are their major environmental concerns: Sustainable business practices.

Target Audience Profile

Target Audience: Builders and Developers

1. What is the makeup of the target audience (answer if appropriate) ?
   a. Average Age N/A
   b. Gender Majority is Male
   c. Place of Residents (home or apartment, any unique characteristics) Focused on Ottawa and Kent County, not townships
   d. Level of Education: Specialized on building tasks, not overly scientific technical information.
   e. Level of Income: varies by number of projects and size of company
   f. Other pertinent facts: Group does better with hands on items that can be used at work site rather than with products or meetings that take them away from projects.

2. How do they communicate with each other? Newsletters, workshops, educational programs supplied by Home Builders Association

3. How do they receive information on environmental issues? Regulations governing construction activities, classes required to obtain permits, newsletters, and mass media.

4. Of what other community organizations are they members? Home Builders Association

5. What are their major environmental concerns: Depends on builder, a lot of emphasis is put on erosion and sediment controls, will want environmental practices that help to sell homes, atheistically, practically, and financially.

Information from Home Builders Association, phone interview with Mr. Chris Hall, November 24, 2003

Target Audience Profile

Target Audience: Environmental/Recreational Groups

1. What is the makeup of the target audience (answer if appropriate)?
   a. Average Age Varied
   b. Gender M/F
   c. Place of Residents (home or apartment, any unique characteristics)
      Primarily in Ottawa County
   d. Level of Education: Varied
   e. Level of Income: Varied
   f. Other pertinent facts: Have been active in other watershed efforts during planning phase of project.

2. How do they communicate with each other? Primarily through meetings and specific group publications/paper updates.

3. How do they receive information on environmental issues? Mass media, and through other environmental publications, possibly nation wide publications.

4. Of what other community organizations are they members? Places of Worship, schools, some government venues.

5. What are their major environmental concerns: Remains particular to group. Some interest in making land available to the public through development of parks (Lions Club)

Target Audience: Schools K-College

1. What is the makeup of the target audience (answer if appropriate)?
   a. Average Age 4-22
   b. Gender M/F
   c. Place of Residents (home or apartment, any unique characteristics)
      Primarily in Ottawa County
   d. Level of Education: Varied
   e. Level of Income: Varied/Majority existing on parents income or small part time employment
   g. Other pertinent facts: Grand Valley State University students have been active in other watershed efforts during planning phase of project.

2. How do they communicate with each other? Through school activities, clubs, extracurricular events, classroom activities and lessons, social groups.

3. How do they receive information on environmental issues? Mass media, lessons, social groups, extracurricular events, organizations like Regional Math and Science Institute, Globe Project, Project WET, etc

4. Of what other community organizations are they members? Places of Worship, clubs, teams, 4-H.

5. What are their major environmental concerns: Interest in world around them, understanding what is happening in their environment, what they can do to help, how are they affecting the environment.

Target Audience Profile

Target Audience: Homeowners

1. What is the makeup of the target audience (answer if appropriate) ?
   b. Average Age_____
   c. Gender M/F
   d. Place of Residents (home or apartment, any unique characteristics) 12,296 homeowner occupied housing units.
   e. Level of Education: 85% high school education or higher
   f. Level of Income: median family income $56,471
   g. Other pertinent facts: can get possible riparian homeowner listing from Ottawa County.

2. How do they communicate with each other? Through mass media, Advance is the local newspaper, attending children's' school events, church events, one on one

3. How do they receive information on environmental issues? Flyers, newspaper, radio, television, home improvement stores.

4. Of what other community organizations are they members? Environmental groups, Places of Worship, schools, local units of government.

5. What are their major environmental concerns: Flooding, having water safe for contact, having environment safe for family, protecting home investment

Data from same source as rural residents.

Target Audience Profile

Target Audience: Watershed Management Members

1. What is the makeup of the target audience (answer if appropriate)?
   h. Average Age 21 and up
   i. Gender M/F
   j. Place of Residents (home or apartment, any unique characteristics) Reside in watershed and surrounding watersheds
   k. Level of Education: high school plus some
   l. Level of Income: varied
   m. Other pertinent facts: have been working together for last couple of years, have existing networks for information dissemination, looking to become non-profit entity

2. How do they communicate with each other? Meetings, email, phone calls

3. How do they receive information on environmental issues? Researchers, professors, state resources, presentations, flyers, regulations, meetings, articles, tours, workshops.

4. Of what other community organizations are they members? Local units of government, some ties to Boy Scouts, local clubs, Places of Worship.

5. What are their major environmental concerns? Flooding needs to be reduced, stream to be a resource, farming is to be sustained.

Target Audience Profile

Target Audience: Locally Elected Bodies

1. What is the makeup of the target audience (answer if appropriate)?
   a. Average Age 30+
   b. Gender M/F
   c. Place of Residents (home or apartment, any unique characteristics) Generally residing in watershed or close to watershed, many living in own homes
   d. Level of Education: High school and up
   e. Level of Income: varied
   f. Other pertinent facts: Have townships of Alpine, Chester, Tallmadge, and Wright, and City of Walker involved, along with Ottawa County Commissioners

2. How do they communicate with each other? Board meetings, planning meetings, day to day operations. Also, often being friends and neighbors of the same community, there are ample opportunities to communicate at local venues such as church and school functions as well as local socially oriented businesses such as restaurants or entertainment spots.

3. How do they receive information on environmental issues? Since many locally elected officials have "day jobs" it depends on their other associations. Many are involved in occupations where they may receive information on such issues from sources slanted to a point of view, depending upon the occupation. Also, information on a specific issue upon which they are deliberating may well be supplied by applicants or professionals hired to inform them on specific aspects of such an issue as part of the legislative or administrative review. Information may also be found in publications associated with membership organizations such as those cited below.

4. Of what other community organizations are they members? Grand Valley Metro Council, Michigan Township Association, Michigan Municipal League, Michigan Association of Counties, local chapters of some of these organizations as well as national counterparts organizations, though these are not as active. There may also be memberships associated with smaller geographical levels such as neighborhood associations, business associations and other special purpose organizations such as watershed groups or multi-jurisdictional discussion groups. Other important groups are based more on profession such as Michigan Local Government Managers Association, and ICMA.

5. What are their major environmental concerns? Accomplishing the decisions of their constituents, to implement cost effective measures, meet regulated standards for stormwater. To ensure appropriate levels of development and redevelopment occurs without causing health and safety concerns for local residents, businesses and other constituents. Getting their jobs done on a daily basis without doing great and obvious harm to major environmental assets.

Information is from Andy Bowman, Grand Valley Metro Council, on November 26, 2003.

Target Audience Profile

Target Audience: Municipal Employees

1. What is the makeup of the target audience (answer if appropriate)?
   a. Average Age Varied
   b. Gender M/F
   c. Place of Residents (home or apartment, any unique characteristics)
      In Grand River Watershed
   d. Level of Education: Varied
   e. Level of Income: Varied
   f. Other pertinent facts: Pay special attention to departments that deal with streets and highways, water transport, water supply at both the County and City level.

2. How do they communicate with each other? Staff meetings, telephone, email, training seminars, day to day operations, websites.

3. How do they receive information on environmental issues? Regulations, policies, mass media, and through training.

4. Of what other community organizations are they members? Varies

5. What are their major environmental concerns: Safe workplace, cost effective control measures, within mandated levels for pollutants.

Appendix 6: Contact Information for Potential Target Audiences

Libraries	Name	Address 1	Address 2	Zip	Phone	Fax	Email/Website
Allendale	Allendale Township Library	6178 Library Lane	Allendale	49401	616-895-4178		
Belding	Belding City Public Library	302 East Main Street	Belding	48809	616-794-1450		
Byron Center	Bryon Township Library-KDL	2456 84th Southwest	Byron Center	49315	616-878-1665		
Caledonia	Caledonia Township Library	240 Emmons Street Southeast	Caledonia	49316	616-647-3840		
Cascade	KDL Kent District Library	2870 Jack Smith Avenue Southeast	Grand Rapids	49546	616-647-3850		
Cedar Springs	Cedar Springs City Library	43 West Cherry	Cedar Springs	49319	616-696-1910		
Charlotte	Charlotte Community Library	226 South Bostwick Street	Charlotte	48813	517-543-8859		
Comstock Park	Alpine Township Library	5255 Alpine Avenue Northwest	Comstock Park	49321	616-647-3810		
	Comstock Park BR Library	3943 West River Drive Northeast	Comstock Park	49321	616-784-5575		
Coopersville	Northeast Ottawa District Library	333 Ottawa Street	Coopersville	49404	616-837-6809		
Dorr	Dorr Township Library	1804 Sunset Drive	Dorr	49323	616-681-9678		
	Salem Township Library	3007 142nd	Dorr	49323	616-896-8170		
East Grand Rapids	KDL Kent District Library	746 Lakeside Drive Southeast	Grand Rapids	49506	616-949-1740		
Fruitport	Fruitport District Library	47 Park Street	Fruitport	49415	231-865-3461		
Gaines Township	KDL Kent District Library	421 68th Street Southwest	Grand Rapids	49548	616-647-3870		
Grand Haven	Grand Haven Library	407 Columbus Avenue	Grand Haven	49417	616-842-5560		
	Loutit District Library	407 Columbus Avenue	Grand Haven	49417	616-842-5560		
Grand Rapids	Grand Rapids Public Library	111 Library Street Northeast	Grand Rapids	49503	616-988-5400		
	Grandville Avenue Neighborhood Library	1260 Grandville Avenue Southwest	Grand Rapids	49503	616-475-1150		
	Ottawa Hills Branch- Grand Rapids Library	1150 Giddings Avenue Southeast	Grand Rapids	49506	616-988-5412		
	Van Belkum Library Branch- Grand Rapids Library	1563 Plainfield Avenue Northeast	Grand Rapids	49505	616-988-5410		
	West Leonard Branch- Grand Rapids Library	1017 Leonard Street Northwest	Grand Rapids	49504	616-988-5416		
	Creston Branch- Grand Rapids Library	1563 Plainfield Avenue Northeast	Grand Rapids	49505	616-988-5410		
	Creston Branch- Grand Rapids Library	1431 Plainfield Avenue Northeast	Grand Rapids	49505	616-988-5410		
	Madison Sqaure Branch- Grand Rapids Library	1201 Madison Avenue Southeast	Grand Rapids	49507	616-988-5411		
	Seymore Branch- Grand Rapids Library	2350 Eastern Avenue Southeast	Grand Rapids	49507	616-988-5413		
	West Side Branch- Grand Rapids Library	713 Bridge Street Northwest	Grand Rapids	49504	616-988-5414		
	Yankee Clipper Branch- Grand Rapids Library	2025 Leonard Street Northeast	Grand Rapids	49505	616-988-5415		
Grandville	Grandville Public Library	4055 Maple Street Southwest	Grandville	49418	616-530-4995		
Grant	Grant Public Library	51 North Front Street	Grant	49327	231-834-5713		
Greenville	Flat River Community Library	200 West Judd Street	Greenville	48838	616-754-6359		
Hastings	Hastings Public Library	121 South Church Street	Hastings	49058	269-945-4263		
Hudsonville	Hudsonville City Library	3338 Van Buren Street	Hudsonville	49426	616-669-1255		
	Jamestown Library	2445 Riley Street	Hudsonville	49426	616-896-9798		
Ionia	Hall-Fowler Memorial Library	126 East Main Street	Ionia	48846	616-527-3680		
Kentwood	KDL Kent District Library	4700 Kalamazoo Avenue Southeast	Grand Rapids	49508	616-647-3910		
Lowell	Lowell Public Library	200 North Monroe Street	Lowell	49331	616-897-9596		
Newaygo	Croton Public Library	6464 Croton Hardy Drive	Newaygo	49337	231-652-7411		
	Newaygo Carniegie Library	44 State Road	Newaygo	49337	231-652-6723		
Plainfield	KDL Kent District Library	2650 5 Mile Road NE	Grand Rapids	49525	616-361-0611		
Portland	Portland City Library	259 Kent Street	Portland	48875	517-647-6981		
Potterville	Potterville-Benton Township District Library	150 Library Lane	Potterville	48876	517-645-2989		
Rockford	Krause Memorial Library	140 East Bridge Street	Rockford	49341	616-866-2352		
Stanton	White Pine Library	106 East Walnut Street	Stanton	48888	989-831-4327		
Walker	KDL Kent District Library	4293 Remembrance Road Northwest	Grand Rapids	49544	616-791-6844		
White Cloud	White Cloud Community Library	1038 East Wilcox Avenue	White Cloud	49349	231-689-6631		
Wyoming	KDL Kent District Library	3350 Michael Avenue Southwest	Wyoming	49509	616-530-3181		

Lower Grand River Watershed
Developing a Watershed Management Plan

Final Project Evaluation

July 29, 2004
Evaluation Team Review Draft

Tetra Tech
10306 Eaton Place
Suite 340
Fairfax, VA 22030

Executive Summary

Partners in the Lower Grand River Watershed are collaborating in the development of a watershed management plan using a Section 319 grant from the Michigan Department of Environmental Quality (MDEQ) Surface Water Quality Division. This is an ambitious undertaking due to the size of the Lower Grand River Watershed – an area approximately 3,020 square miles that encompasses ten counties in western Michigan. It is a unique project that will establish sustainable organizational and informational infrastructure to support comprehensive watershed management in the Lower Grand River Watershed and, in the future, the entire Grand River Watershed.

The Lower Grand River Watershed Management Planning Project (the Project) was a two-year project that began in July 2002, conducted by three primary project partners Grand Valley Metro Council (GVMC), Grand Valley State University's Annis Water Resources Institute (AWRI), and Fishbeck, Thompson, Carr & Huber, Inc. (FTC&H), with support from numerous watershed stakeholders. Through the Project, partners set out to accomplish ten tasks that would support existing and future watershed management efforts at the local level by developing a unique regional watershed management plan that provides techniques and tools for stakeholders in subwatersheds to use in conducting planning efforts at the local level. Products of the project include the Lower Grand River Watershed Management Plan, two subwatershed management plans, and a series of computer-based planning tools and electronic resources. In addition, partners and participating stakeholders generated a vision for the Lower Grand River Watershed and strategic elements necessary for creating a sustainable watershed organization.

An important component of the Project is a comprehensive project-level evaluation that serves as the vehicle for identifying, documenting, and distributing beneficial lessons learned. The project evaluation process involved several project partners and stakeholders who volunteered to participate on the Evaluation Team. To lead the evaluation process and facilitate the efforts of the Evaluation Team, AWRI hired Tetra Tech, Inc., a consulting firm experienced in developing, implementing and evaluating watershed management projects, to serve as the Project Evaluator. Together the Project Evaluator and the Evaluation Team identified a series of evaluation questions and evaluation tools to identify the successes and challenges associated with the Project.

The Evaluation Team and Project Evaluator continued to conduct evaluation activities during the final year of the Project. Final evaluation activities focused on addressing issues that were too premature to address during the first year of the Project, such as the quality and usefulness of products, and aspects of the Project that could not be addressed in the Mid-Project Evaluation due to time constraints. As a result, the final evaluation activities have focused on efforts of the Visioning Subcommittee and the Steering Committee, follow-up on implementation issues such as development of a watershed vision and goals, and final products. Findings of the Mid-Project Evaluation coupled with the findings from the final project evaluation activities have highlighted significant successes and challenges in each of the three evaluation categories. Overall project conclusions in each of the three evaluation categories are as follows:

Project Context

Findings in this evaluation category address the structure and function of the project partners, as well as how the project functions within the community.

Successes related to project context are as follows:

- Adapting project structure based on needs of the group by dividing the responsibilities of the Sustainability Subcommittee between the Steering Committee and the Visioning Subcommittee;
- Coordinating a watershed organization discussion panel to learn from existing watershed organizations in the Lower Grand River Watershed and the State of Michigan to inform the watershed organization development process;
- Creating the Grand River Forum as a mechanism specifically intended to generate stakeholder participation and involvement;
- Identifying and fulfilling the need for the primary grantee to take a more significant leadership role among project partners;
- Generating momentum among a core group of watershed stakeholders to sustain efforts of the planning phase through to the implementation phase.

Challenges related to project context are as follows:

- Creating a project structure that may have hampered communication among subcommittees, particularly for individuals that did not participate on more than one committee;
- Creating the perception of a Grand Rapids/Kent County focused project and a watershed stakeholder group with limited diversity;
- Defining a watershed vision and goals at the end of the project rather than the beginning;
- Initiating subcommittee activities without providing members the opportunity to contribute to the development of subcommittee goals and processes.

Project Implementation

Findings in this evaluation category address task implementation, the performance of project staff and partners, and the evolution of the project over time. Project implementation also takes into account project outputs (i.e., project deliverables required under the work plan) and deadlines.

Successes related to project implementation are as follows:

- Ensuring constant progress toward achieving work plan tasks through the use of dedicated project staff;
- Resolving facilitation issues within the I&E Subcommittee based on input from subcommittee members;
- Completing work plan requirements;
- Developing watershed vision and goals;
- Developing the Watershed Interactive Tool and related resources using stakeholder feedback throughout the development process;
- Creating strategic plan for creation of an appropriate watershed organization;

- Implementing additional tasks beyond work plan requirements;
- Providing a forum for information exchange among watershed stakeholders participating on subcommittees;
- Identifying and creating formalized product development processes as necessary.

Challenges related to project implementation are as follows:

- Fluctuating participation trends among Steering Committee, subcommittees, and the Grand River Forum;
- Developing I&E products with limited evaluation to assess effectiveness;
- Focusing on two specific pilot project areas that may have resulted in diminished participation from stakeholders with interests outside of the pilot project areas;
- Limiting Grand River Forum meetings to a specific time and location that does not allow a wide array of watershed stakeholders to participate.

Project Outcomes

Project outcomes focus on the impact that the Lower Grand River Watershed Planning Project has had in the short-, medium-, and long-term.

Successes related to project outcomes are as follows:

- Obtaining stakeholder approval on the Watershed Interactive Tool and related resources;
- Obtaining positive feedback from participating Phase II communities on the usefulness of Project products to fulfilling their Phase II storm water permitting requirements;
- Developing two MDEQ-approved watershed management plans for Sand Creek and Buck Creek watersheds;
- Acknowledging long-term project evaluation needs;
- Developing long-term project evaluation mechanisms.

Challenges related to project outcomes are as follows:

- Assessing future impact of products on watershed and storm water management efforts;
- Assessing increased awareness of watershed management issues as a result of I&E efforts;
- Assessing effectiveness of strategy to create a permanent watershed organization through the use of an interim watershed council comprised of Steering Committee members;
- Assessing effectiveness of the Lower Grand River Watershed Management Plan in achieving water quality improvements during the implementation phase.

SECTION ONE: INTRODUCTION

The Lower Grand River Watershed Management Planning Project (the Project) focuses on a portion of the larger Grand River Watershed in western Michigan. Draining approximately 3,020 square miles, the Lower Grand River Watershed encompasses ten counties and draws together a significant number of partners. The geographic scope of the Lower Grand River Watershed sets the stage for a complex watershed management planning process that requires the participation of numerous stakeholders representing multiple stakeholder interests. Three watershed stakeholders collaborated to develop and obtain funding to conduct the Project, a two-year effort initiated in July 2002 with Section 319 grant funding from Michigan Department of Environmental Quality (MDEQ). Grand Valley Metro Council (GVMC) served as the lead grantee, bringing on Grand Valley State University's Annis Water Resources Institute (AWRI) and Fishbeck, Thompson, Carr & Huber, Inc. (FTC&H) as co-grantees. Table 1.1 describes the roles and responsibilities of the three collaborating project partners and MDEQ in conducting the Project.

Table 1.1 Roles and Responsibilities of Lower Grand River Watershed Management Planning Project Partners

Partner	Role(s)	Responsibility
Michigan Department of Environmental Quality (MDEQ)	Project Administrator	Ensure grantee spends grant funds according to workplan; Review products and quarterly reports; Participate on various subcommittees
Grand Valley Metro Council (GVMC)	Primary Grantee	Leading efforts of the Steering Committee and the Visioning Subcommittee (formerly the Sustainability Subcommittee)
Annis Water Resources Institute (AWRI)	Sub-grantee	Leading efforts of the Rural Subcommittee and the Information & Education Subcommittee
Fishbeck, Thompson, Carr & Huber, Inc. (FTC&H)	Sub-grantee	Leading efforts of the Urban Subcommittee and the Technical Subcommittee

One of the ten project tasks is a comprehensive project evaluation intended to capture the successes and challenges of the Project. AWRI hired Tetra Tech, Inc. to serve as the Project Evaluator, tasked with developing and implementing the project evaluation process as a neutral third-party experienced in watershed management planning and implementation. The Project Evaluator worked with project partners to assemble a group of watershed stakeholders participating in the Project through various subcommittees. The volunteer group of participants, referred to as the Evaluation Team, assisted the Project Evaluator in identifying appropriate evaluation questions and tools.

Like the Project, the project evaluation process spanned the two-year timeframe to allow partners and participating stakeholders the opportunity to provide continuous feedback on a variety aspects of the Project, including project context, implementation, and outcomes. The project evaluation process began in March 2003, requiring the Project Evaluator to assemble the Evaluation Team and conduct initial evaluation process development as the first year of the project drew to a close. Therefore, evaluation activities intended to focus only on the initial year of the Project actually took place during the second year of the Project. The Mid-Project Evaluation Report, completed in May 2004, addressed activities that took place from July 2002 to June 2003, as well as activities that took place during a portion of the second year. The initial year of the project focused on assembling

the organizational structure of the Project, comprised of a Steering Committee, five subcommittees, and the stakeholder group referred to as the Grand River Forum, as well as establishing processes for implementing the tasks of the Project. As a result, the Mid-Project Evaluation Report examined the organizational structures, project processes, participation trends, and progress toward achieving work plan requirements.

After completion of the Mid-Project Evaluation Report, the Project Evaluator and Evaluation Team focused on evaluating aspects of the project that took shape during the second year and were feasible to evaluate in the near-term. Aspects examined during the final project evaluation activities include the following:

- Efforts of the Steering Committee related to development of a sustainable watershed organization;
- Efforts of the Visioning Subcommittee to create a watershed vision;
- Perceptions of specific watershed stakeholders affected by the Project, including participants in the Grand River Forum, communities contributing matching funds due to storm water management issues, and sub-watershed organizations and projects;
- Perceptions related to final products, such as watershed management plans, computer-based tools and resources, strategic elements of the organizational structure, information and education (I&E) materials.

> "Success of this grant process should not be measured by the progress reached to date, but by what happens to the Lower Grand process post-grant."
> – Participant in the Lower Grand River Watershed Planning Project Evaluation Process

In addition to conducting evaluation activities, the Project Evaluator also identified long-term evaluation needs that will allow project partners to continue assessing the effectiveness of the Project beyond this cycle of grant funding. An important element of the project evaluation process is determining how to measure the long-term outcomes or impacts of the Project. Many of the outcomes of the Project will have a direct affect on implementation activities during the next phase of management efforts in the Lower Grand River Watershed.

The Mid-Project Evaluation Report contains detailed information on the Project and the evaluation process. The remainder of this report focuses on the evaluation activities, findings, and recommendations related to the second year of the Project. In addition, this report provides overall project conclusions and recommendations for evaluating project outcomes over the long-term – beyond this grant cycle and into the implementation phase. Section Two of this report presents findings related to final evaluation activities, including overall project conclusions and recommendations. Section Three of this report focuses on long-term evaluation considerations to assist project partners with follow-up

evaluation activities for the Project and evaluation mechanisms for evaluating implementation efforts.

SECTION TWO: EVALUATION FINDINGS

This section presents the information obtained through evaluation activities focused on aspects of the project not addressed in the Mid-Project Evaluation Report. Evaluation findings fall into the following categories: 1) project context; 2) project implementation; and 3) project outcomes.

Project Context

Findings in this category address the structure and function of project partners, as well as how the project functions within the community. The Mid-Project Evaluation Report focused on the structure and function of project partners. Evaluation activities for the final project evaluation focused on the function of the Lower Grand River Watershed Planning Project in the community. Stakeholders from communities within the watershed participated in the project through the Grand River Forum meetings. In addition, the Lower Grand River Watershed Planning Project has reached out to the community by providing an incentive for municipalities subject to Phase II National Pollutant Discharge Elimination System (NPDES) municipal separate storm sewer system (MS4) permitting requirements to participate in watershed management planning activities. Several watershed groups are active at the local level in the Lower Grand River Watershed; these subwatershed groups are an important part of the community affected by the Lower Grand River Watershed Planning Project. Feedback generated through evaluations of Grand River Forum participants, Phase II municipalities, and subwatershed organization representatives is presented below.

Grand River Forum Evaluations

The Grand River Forum provided watershed stakeholders with the opportunity to become informed and involved in the Lower Grand River Watershed Planning Project. Grand River Forum meetings began in October 2002 and continued throughout the two-year project on a quarterly-basis. A total of seven Grand River Forum meetings took place over the course of the project. According to the meeting minutes available on the project web site, most Grand River Forum meetings employed a presentation format to provide participants with an update of activities related to the Lower Grand River Watershed Planning Project. However, a few meetings did provide opportunities for participants to become more actively involved. The second quarterly meeting provided participants with an opportunity to work in break-out sessions to address pilot project area selection. The sixth quarterly Grand River Forum meeting contained an interactive component during which participants brainstormed the needs of a successful watershed organization to aid in the development of a watershed strategic plan. The final Grand River Forum meeting also used an interactive format that provided participants with the opportunity to test the Watershed Interactive Tool and associated project products such as the Watershed Assessment Matrix and the Watershed Interactive Mapping tool.

Evaluations of Grand River Forum participants occurred at four of the seven meetings held during the course of the project. Initial evaluations, referred to as exit surveys,

focused on meeting logistics such as time, location, day of the week, meeting format, and room set-up. Exit survey summaries for meetings held on October 17, 2002, February 20, 2003, and March 15, 2004 indicate that a majority of participants responding to the exit survey were pleased with meeting logistics. The lowest score received related to room set-up during the October 17, 2002 meeting. Some written comments contained in the exits survey summaries reflect comments related to the focus of meetings (e.g., "[meetings should be] more progressively focused") and ways to increase participation (e.g., "send reminder email messages the Friday before a meeting").

Exits surveys also asked participants for suggestions for future meetings, organizations that project staff should encourage to participate, and programs that may collaborate with the Lower Grand River Watershed Planning Project. The exit survey for the March 15, 2004 meeting asked for feedback related to the Watershed Interactive Tool. Early feedback captured in the exit survey summary indicates positive feedback for the concept and function of the Watershed Interactive Tool; participants provided suggestions for promoting the tool and recommendations for changing the acronym.

In addition to the three exit surveys, project staff asked Grand River Forum participants to complete a final evaluation form. Project staff distributed the final evaluation form during the June 3, 2004 Grand River Forum meeting and sent the form via email to past Grand River Forum participants who did not attend the June meeting. The purpose of the final evaluation form was to determine how the level of participation in the Grand River Forum meetings has changed during the two-year project and to assess the usefulness of the Grand River Forum.

The evaluation form was distributed to approximately 31 participants at the June 3, 2004 meeting and approximately 83 individuals on an email distribution list; some overlap did exist between the meeting participants and the individuals contained on the email distribution list. Of the 31 participants attending the June 3, 2004 meeting, a total of 15 participants submitted evaluation forms. Of the approximately 83 individuals on the email distribution list, one individual completed and mailed an evaluation form to the Project Evaluator. Information from the 16 completed evaluation forms on participation and usefulness of the Grand River Forum meetings is summarized below.

The June 3, 2004 Grand River Forum meeting generated involvement from individuals who had never before participated in a Lower Grand River Watershed event. Nearly forty percent of the evaluations (6 of 16) reflect input from first-time participants. While the input of new participants is helpful and encouraged, the responses on some of the evaluations contain comments that reflect input relevant only to the June 3, 2004 Grand River Forum meeting. Responses provided by participants that have attended more than one meeting may reflect more accurately the trends of the Grand River Forum meetings. Therefore, it is helpful to interpret responses with an understanding of who – first-time participants or frequent participants – provided the response.

Questions and Findings

1) What prompted you to participate in the Grand River Forums?

The open-ended question resulted in a variety of factors, with most respondents listing more than just one. Factors listed by respondents fell into the following categories:

- Connection to job (4)
- Watershed management interests (3)
- Connection to regulatory issues (e.g., NPDES regulations) (3)
- Interest in the Grand River (3)
- Collecting information (3)
- Community or sub-watershed interest (2)
- Participation on other aspect of Lower Grand River Watershed project (1)
- Opportunity to network (1).

2) How many Grand River Forums have you participated in over the past 2 years?

According to both the evaluation forms, as well as the sign-up sheet, the June 3, 2004 meeting had several first-time participants. Six respondents indicated that they had not attended any of the Grand River Forum meetings prior to the June 2004 meeting. One respondent indicated that he attended only the first Grand River Forum meeting on October 17, 2002. Nine respondents indicated that they attended three or more of the six Grand River Forum meetings. Project staff attribute the number of first-time participants to the unique nature of the June 2004 meeting (i.e., workshop to demonstrate the Watershed Interactive Tool) and the number of personal invitations and reminder email messages and phone calls made by project staff. According to AWRI, the sign-up sheet for the June 3, 2004 meeting contained 31 names; 14 of the 31 attendees had never before attended a Lower Grand River Watershed event.

3) If you have not participated in all of the meetings, what factors would have increased your participation?

Of the 16 total respondents, only 10 individuals answered the question on factors affecting participation. Five of the responses related to multiple time demands and scheduling conflicts. Other responses included involvement in other watershed activities in other communities; lack of advanced notice; personal reasons; and hosting the meeting closer to home.

4) Do you feel the size of the group was adequate? Yes/No. Please explain.

Thirteen respondents answered yes. Explanations provided included:

- Size felt good, but seemed as if a lot of people were missing
- Proper size for sharing the computers (comment specific to June 3rd meeting)
- Not too big or small. Representatives/participants changed somewhat, but yet there seemed to be a core group providing continuity.

- We needed a diverse and interested group.
- Smaller groups can be more productive.
- Somewhat small but adequate. Could benefit from more diverse group of individuals.

Two respondents answered no. Explanations provided included:

- I wish we had more participation.
- There are interested people who did not participate at all. No business sector participation. Not enough people.

One respondent did not provide an answer.

5) Do you feel the composition of the group was representative of the watershed community? Yes/No. Please explain.

Eight respondents answered yes. Four of the respondents answering yes had not attended a Grand River Forum meeting prior to the June 2004 meeting. Six respondents are from within the watershed. One respondent represents the Upper Grand River Watershed. One affiliation is unknown. Explanations included:

- There appeared to be a broad mix in backgrounds.
- Seemed like a diverse group with several local agencies represented as well as MDEQ.
- But most in attendance were old die hards.
- It appeared to bring together a good diverse group.

Five respondents answered no. Three of the respondents answering no stated they had attended all Grand River Forum meetings and two had attended at least three meetings. All respondents represent communities and organizations within the watershed. Explanations included:

- Lacking Native Americans, business/industry, citizens at large, students, educators.
- I think we need new "members" or "players."
- Not completely. No representation of African American or Hispanic communities.
- Composition seemed more Grand Rapids/Kent County/Ottawa County with lesser participation from other interest groups.
- Needed more diversity.

Three respondents stated that it was difficult to discern the composition of the group at the June 2004 Grand River Forum meeting. Two of the respondents had not attended any prior Grand River Forum meetings, one of which represented a county located outside of the watershed. One respondent attended the first Grand River Forum meeting in October 2002 and represented a community located within the watershed.

6) Do you feel the meetings were held to optimize participation from the attendees? Yes/No. Please explain.

Eight respondents answered yes. Four respondents had never attended a Grand River Forum meeting prior to June 2004. Four respondents attended one or more meetings. Explanations included:

- It is a great start and it will be a major task to keep the ball rolling.
- Smaller groups/subcommittees were nice for those of us with a fear of speaking in large groups.

Two respondents answered no. One respondent attended all the Grand River Forum meetings and the other respondent had not attended any prior to the June 2004 meeting. Explanations included:

- A large amount of information to take in, difficult to process and formulate questions or input in short time period.
- Timing and location of meetings excluded many who would have participated.

Six respondents did not provide an answer. Despite the lack of a "Yes/No" answer, two of the respondents did provide written explanations:

- Unfortunately you will never be able to adjust meetings to everyone's schedule. You might consider more than one date for Forum.
- I feel the intent of Forum leaders was to foster participation and that results were mixed.

7) Do you feel your input was incorporated into the watershed management planning process? Yes/No. Please explain.

Nine respondents answered yes. Six respondents attended one or more Grand River Forum meetings, and the remaining two respondents had not attended any Grand River Forum meetings prior to June 2004. Explanations provided by respondents included:

- My actual input was limited due to my experience and knowledge.
- Our participation in the Sand Creek watershed was evident at this presentation.
- Absolutely.
- Enjoying participating on the sub-committee/committee level.

One respondent answered no and did not provide an explanation.

Six respondents did not provide a "Yes/No" answer to the question. Three respondents attended more than one Grand River Forum meetings, and the other three respondents had not attended a Grand River Forum meeting prior to June 2004. Two respondents provided the following written explanations:

- I feel that the skills and information I had to share did not connect/were not effective in this project. They are very effective in mine.
- I am newly involved in this program and am just learning about the project.

8) What do you think were the most useful aspects of the Grand River Forums?

Eleven respondents provided answers. Of those who answered, four had not attended a Grand River Forum meeting prior to June 2004. Respondents identified the following aspects as the most useful:

- Interaction with others interested in watershed initiatives; innovative ideas
- Keeping everyone connected and working toward implementation; working together to create a useable plan
- Brainstorming
- Bringing people together; break-out workshops
- Forums useful to educate and keep connected to outside, but the actual committees formed are the real pay-off in benefits to watershed activity
- Increasing awareness of the watershed we all live in
- Seeing where we are going and what we are doing
- The hands-on training was great for me.
- All aspects useful
- Access to, and information about, resources available to educate oneself about matters of community importance and the environment as they relate to the Grand River Watershed.
- Producing the watershed mapping and information tools; evaluation is something that has not been [pushed] for, and is essential. It is great that this will be used! Environmental education tools can help produce quality communication and products.

9) What do you think could have made the Grand River Forums more useful?

Eight respondents provided comments on how to make the Grand River Forums more useful. Four respondents had not attended Grand River Forum meetings prior to June 2004. Respondents provided the following input:

- Shorter presentations in the middle
- I have just started attending watershed meetings
- Although a great deal of work and resources are required, continued work in all directions needs to continue.
- More participation by affected communities.
- Parallel establishment of a watershed organization to maintain continued focus, attend to improvements and regulatory issues. Leadership after the grant and consultant assistance? Too many questionnaires – too much to write and not enough time to complete.
- Bring in people besides agencies and organizations. Time and location of meetings excluded many people. Better public awareness – we were preaching to the choir.
- Try to get more involvement – maybe more times in different locations.
- Getting people to come to the meetings – both the Forums and the committee meetings.

10) Would you like to be involved in future watershed protection efforts?

Nine respondents stated yes. Six evaluation forms did not contain an answer and one respondent answered no. Additional written comments included:

- Evaluate why so many people stopped coming – call them, ask them.
- Want to know more about the Steering and Visioning Committee – what's next? 1) Watershed organization – what is it, when? 2) Public awareness – has to be, how do we do that? We've known that public awareness is important for a long time, but it is generally the same core group of participants at watershed-type meetings. 3) Data management will become the responsibility of the organization.

Conclusions

The influx of new participants at the last Grand River Forum meeting is important to note, since increasing participation at Grand River Forum meetings appears to be important to both project staff and regular Forum attendees. According to AWRI, approximately 45 percent of attendees at the June 3, 2004 meeting were first-time participants. Increased participation beyond the usual core group of participants may be the result of the personal invitations made by the Project Administrator, as well as the reminder phone calls and email messages from project staff. When asked what motivated participation, first-time participants provided responses related to information collection and sharing. It is likely that this type of meeting – an interactive workshop providing participants with the opportunity to test new tools – sparked the interest of stakeholders because the agenda focused on interactive sessions as opposed to presentations focused on project updates. Although the last Grand River Forum meeting attracted new participants, respondents do not feel that the Forum meetings attract a representative group of stakeholders. Responses to Question Five about the composition of the Grand River Forum participants illustrates that those individuals in regular attendance of Forum meetings felt that the group was not diverse and did not fully represent stakeholders in the watershed.

Sustaining participation is also a concern for project staff and regular Forum attendees. The most cited reason for participating in the Grand River Forums was "connection to job." Despite the connection to jobs, respondents indicated that conflicts in schedule have the most significant affect on their personal participation – a factor that is often difficult to overcome because the people who participate the most are often the "old die hards" within the communities of the Lower Grand River Watershed that likely have multiple commitments. Some respondents stated that the timing and location of the meetings might adversely affect the growth and diversity of the overall group. The six Grand River Forum meetings took place at the Grand Valley State University Eberhard Center in Grand Rapids on a weekday from 9:00 or 9:30 am to 11:00 am or 12:00 pm. The June 3, 2004 meeting also took place in Grand Rapids, but took place from 1:00 pm to 5:00 pm. Although the standard location and time of the Grand River Forum meetings may provide reliability and assist some individuals with planning, these logistical factors may actually limit the type of stakeholders that are able to attend (e.g., excludes

stakeholders that must work during the day) and their geographic representation (e.g., promotes a Grand Rapids/Kent County focus).

Recommendations

Based on the increase in new participants and their responses regarding motivating factors, project staff should consider focusing future Grand River Forum meetings (or any meeting that seeks broad stakeholder involvement) on an innovative and interactive activity, such as training on a particular tool or a skill that will benefit stakeholders while promoting watershed management. In addition, project staff should consider exploring ways to continue personalizing invitations to attend meetings. For example, consider creating a membership team that is comprised of volunteers willing to send personalized email messages or make phone calls to remind and invite stakeholders within the watershed. Since a membership team could not contact every stakeholder, the team could identify and focus their efforts on a particular sub-set (i.e., teachers, business representatives, ethnic groups, etc.) for each meeting.

By scheduling meetings at multiple times in multiple locations on a particular day and/or during the course of a particular week, stakeholders within the watershed would have the opportunity to select a time and location that works best with their schedule. If successful, this approach will improve the diversity, size, and sustainability of the Grand River Forum participants.

Phase II Municipality Evaluations

Many communities participated in the Lower Grand River Watershed Management Planning Project because project partners approached communities and demonstrated how planning activities could assist them in meeting their NPDES Phase II MS4 permitting requirements. Sixteen communities subject to Phase II requirements in the Lower Grand River Watershed participated in the project by providing matching funds and encouraging municipal staff to participate on a subcommittee.

Questions and Findings

The Project Evaluator contacted representatives from the sixteen Phase II communities via telephone and email with four specific questions related to the impact the Lower Grand River Watershed Planning Project has had on Phase II storm water permitting related activities. Of the sixteen communities contacted, representatives from eight provided the Project Evaluator with responses via telephone or email. The questions and a summary of responses are provided below.

1) How does the Lower Grand River Watershed Management Plan, as well as other project products (e.g., Watershed Information Tool) address your community's Phase II storm water permitting needs?

Respondents provided mixed responses regarding the ways in which products from the Lower Grand River Watershed Planning Project will address storm water permitting needs, with the majority stating that one or more of the project's tools will prove helpful. Six of the eight respondents identified aspects of the project will prove

beneficial, including the urban best management practices (BMPs), the Buck Creek Watershed Management Plan, the Tool book, and the Lower Grand River Watershed Management Plan. One respondent stated that the Lower Grand River Watershed Management Plan and related products provide a regionally-consistent and approved message that the environment is important and the community is taking the initiative to be environmentally savvy. Two respondents commented that the project helped communities to meet permitting requirements more efficiently due to the group approach and the use of a consultant and Grand Valley Metro Council.

One respondent stated that storm water problems do not exist in his community and as a result, the various tools and plans will not be useful to his community. Another respondent stated that the products will partially address storm water permitting needs by providing a base for developing a jurisdictional SWPPI.

2) How has participating on the Lower Grand River Watershed Planning Project been beneficial to your community? If you do not feel that this project has been beneficial to your community, please state why.

A majority of respondents felt that participating on the Lower Grand River Watershed Planning Project has been beneficial to their community. Benefits listed by seven of the eight respondents included:

- Saved time and resources
- Promoted information and idea sharing among communities in the watershed
- Provided access to technical experts and exposure to diverse points of view
- Increased understanding of water quality issues, strategies for managing development, watershed management concepts
- Resulted in working knowledge of the benefits associated with storm water management that can be incorporated into daily practices and conveyed to community residents
- Prepared communities for the storm water permit application process and provided regulatory information necessary to remain in compliance.

Only one respondent stated that he had minimal participation in the project because he felt that it wasn't necessary given the lack of water quality problems in his community and that, if not for the link to regulatory requirements, his community would not have contributed or participated in the project at all.

3) What aspect of the Lower Grand River Watershed Planning Project will assist your community in managing storm water, as well as other water resources, more effectively?

A majority of respondents identified aspects of the project that will assist the community in effectively managing storm water and water resources. Three respondents listed the public education program as an aspect of the Lower Grand River Watershed Planning Project that, once implemented, will assist their community. One respondent stated that the project will assist his community because it promotes taking a holistic approach to ensure that upstream and downstream communities are making

efforts to improve water quality. Other respondents stated that the municipal operations component of the project, activities related to inspecting, locating, and identifying storm sewer system outfalls, and the BMP worksheets will assist their communities in effectively managing storm water and water resources. According to another respondent, knowing the hydrology and soil types of the sub-watershed provided information necessary to establish storm water management criteria to minimize flooding and erosion. One of eight respondents stated that no aspect of the project will assist his community because a recent assessment of storm water outfalls indicated that the community does not have a storm water problem.

4) Was the contribution of matching funds to the Lower Grand River Watershed Planning Project a worthwhile investment for your community? Why or why not?

Six of the eight respondents stated that contribution of matching funds to the Lower Grand River Watershed Planning Project was a worthwhile investment due to the opportunity to share costs with other communities. Respondents acknowledged that undertaking a similar project alone would have cost considerably more. One of the six respondents added that although it appears beneficial now, it would be necessary to look at the benefit relative to the cost over time.

One of the two remaining respondents stated that the value of contributing matching funds is unknown at this time. The only respondent to state that the contribution of matching funds was not a worthwhile investment explained that his community contributed because it was difficult to say no and that there was a desire to help out other participating communities affected by the Phase II storm water permitting requirements.

Conclusions

Many of the communities that contributed matching funds to the Lower Grand River Watershed Planning Project appear to have made this monetary commitment based on the project's connection to Phase II storm water permitting requirements. The majority of Phase II communities participating in the evaluation felt they gained much more from the project than assistance with their Phase II storm water permitting requirements. A few responses revealed the importance of moving from the project's planning phase to the implementation phase, particularly in terms of public education, although many respondents cited tools and products resulting from the planning phase that they can use immediately. Respondents placed a great deal of emphasis on the benefits of working as a consortium of communities, indicating that communities would support this type of group approach during the implementation phase.

Answers from a majority of respondents indicated an understanding of the difference between the Lower Grand River Watershed Planning Project and the simultaneous – but separate – Phase II storm water permitting project lead by FTC&H. The mid-project evaluation captured a concern by some project staff that communities did not have a clear understanding of each project (e.g., the fact that they were separate but related). The respondent who did not participate much on the Lower Grand River Watershed Planning

Project appeared to be the only respondent who initially provided answers specific to Phase II storm water permitting requirements, indicating that 1) he, and possibly other in his community, did not completely understand the difference between the two projects and 2) the connection to the Phase II storm water permitting requirements may have detracted from some communities' perception that the Lower Grand River Watershed Planning Project had value. Although assistance with regulatory requirements provided an incentive for some communities to participate, the connection to unpopular regulatory requirements may have also provided a disincentive for other communities to participate – particularly those that do not feel they should have to comply with regulations perceived as unnecessary or unfair.

Job title of the individuals participating in the evaluation potentially affected the survey responses. Although respondents were not asked to specify their job title, some respondents did indicate if they were departmental staff or if they were a local elected official. One respondent commented that a person's job title is likely to affect his or her perspective toward participation on watershed management projects. For example, a director of a public works department may look favorably on participation in a watershed management project because it results in tools that will ultimately benefit the effectiveness of department staff. However, a township supervisor may not have a positive attitude toward participating on a watershed management project because it results in diverting resources from other community priorities.

Recommendations

When seeking participation from a community – or any watershed stakeholder – it is important to understand their priorities, attitudes, and perceptions and identify ways to tailor recruitment strategies accordingly. For example, communities that hold a negative attitude toward the Phase II storm water permitting requirements and do not feel that they should have to conduct any activities related to meeting the requirements may not have felt motivated to participate in the Lower Grand River Watershed Planning Project because the link to the Phase II storm water permitting requirements were over-emphasized during recruitment activities.

Future implementation efforts should identify ways to involve more than staff-level representatives from local communities. While department staff will ultimately have implementation responsibilities, the success of implementation is likely to depend on the support of elected and appointed local officials that influence budget decisions for the community. One suggestion for obtaining broader support for implementation activities is to enlist the support from community representatives active during the planning phase that are willing to conduct peer-to-peer outreach and education among other communities. Ideally, a supportive township supervisor can share the benefits experienced by his or her community with other township supervisors, providing the perspective that other individuals in the same position can relate to.

Sub-Watershed Organization Evaluations

Until the advent of the Lower Grand River Watershed Planning Project, the Lower Grand River Watershed has primarily seen watershed activity at a smaller sub-watershed level.

Sub-watersheds in the Lower Grand River Watershed that have existing groups or activities, or have been the focus of past watershed projects, include the Coldwater River Watershed, the Bear Creek Watershed, the Rogue River Watershed, the Thornapple River Watershed, the York Creek Watershed, and the Sand Creek Watershed.

Questions and Findings

The Project Evaluator contacted a representative from each of the six sub-watershed organizations and projects via telephone and email for input regarding the potential impact of the Lower Grand River Watershed Planning Project on their respective sub-watershed. The three evaluation questions and a summary of responses from the six sub-watershed organization representatives are presented below.

1) How are you familiar with the Lower Grand River Watershed Project? In what capacity have you participated in the Lower Grand River Watershed project?

All respondents stated that they were very familiar with the Lower Grand River Watershed Project and involved to varying degrees. Half of the respondents stated that they are involved on the Visioning Subcommittee, the group responsible for crafting the vision and goals for the Lower Grand River Watershed. Two respondents stated that they are involved on the Steering Committee, the group responsible for considering options for developing a sustainable watershed organization. Three respondents mentioned attending Grand River Forum meetings. Two respondents participated on the Rural Subcommittee, one participated on the Urban Subcommittee, and one mentioned involvement with the I&E Subcommittee. Two respondents mentioned that their participation in the Project has recently decreased. One respondent mentioned that the sub-watershed group's board members were also generally aware of the Lower Grand River Watershed Planning Project.

2) What is your understanding of the purpose and function of a Lower Grand River Watershed group that has the potential to evolve from the Lower Grand River Watershed project?

Most respondents had limited knowledge of what the Lower Grand River Watershed group's purpose and function will be, although they could clearly articulate what they ***hoped*** the purpose and function would be. One respondent stated that the group formed as a result of this project should have real authority pursuant to a statute, that it should include representatives from the general population and all counties without having too large a membership. Two respondents described their vision of the group that would evolve from the project as an umbrella organization in the watershed with the sub-watershed groups taking action. The survey revealed that concerns related to the purpose and function of the evolving organization do exist; one respondent expressed a concern that the group will be primarily a Kent County or Grand Rapids or metro initiative and another stated that the geographic size of the watershed might create coordination challenges – but has the potential to make water quality and land use connections.

3) In what ways do you think that a Lower Grand River Watershed organization could help or hinder the activities of your sub-watershed group?

Two of the six respondents stated that their respective sub-watershed groups are either no longer active or have limited activity and did not specify how the Lower Grand River Watershed organization might affect efforts at the sub-watershed level. The remaining four respondents stated that the organization evolving from the Lower Grand River Watershed Planning Project could help their sub-watershed groups in a variety of ways. One respondent stated that a Lower Grand River Watershed organization could provide professional assistance to sub-watershed organizations in developing specific watershed management plans and implementing these plans, including assistance in seeking grants. This respondent added that it would be very important for the individual sub-watershed organizations to retain the ability to set their own agenda. Another respondent actively involved in both the Visioning and Steering Committee activities listed very specific ways that a Lower Grand River Watershed organization could help activities of sub-watershed groups. The list included giving citizens the big-picture by generating a link to the Great Lakes, pooling resources for activities, creating relationships with local government, obtaining assistance in land use planning, and setting priorities in the watershed to ensure more effective use of funding.

Conclusions

Representatives from sub-watershed groups participated on the Steering Committee and Visioning Subcommittee, the groups responsible for defining and crafting the umbrella organization that will evolve from the Lower Grand River Watershed Planning Project. Given their participation, it is likely that representatives shared the concerns and priorities of their sub-watershed groups during the organizational structure discussions. Responses from sub-watershed group representatives indicate that they are uncertain about the structure and function of the organization evolving from the Lower Grand River Watershed Planning Project. However, sub-watershed representatives appear to be optimistic that this organization will come to fruition. Although one respondent emphasized the importance for sub-watershed organizations to remain in control of their own priorities, responses do not indicate that local organizations feel threatened by or a sense of competition with an umbrella organization that focuses on coordinating watershed activities at a more regional level.

Recommendations

The umbrella watershed organization evolving out of the Lower Grand River Watershed Planning Project will take shape with the assistance of Steering Committee members who volunteer to remain involved. It is important that representatives from sub-watershed groups continue to play a role in the development of the watershed organization, given their organizations will be affected by the structure and functions performed by the umbrella watershed organization that evolves. Not all sub-watershed groups had representation on the Steering Committee; therefore, it is important that project staff maintain constant communication with sub-watershed groups about progress toward developing the umbrella watershed organization. Constant communication, that

incorporates a feedback mechanism, will ensure sub-watershed groups feel connected to the process and support the final outcome.

Findings from the final project evaluation activities illustrate that key stakeholder groups in the watershed have positive attitudes toward the Lower Grand River Watershed Planning Project as it draws to a close. Those who participated in the evaluation process perceive the Project to have benefited the watershed communities and appear supportive of future efforts related to implementation. A summary of conclusions related to project context issues over the course of the two-year project is available at the end of this Section. Section Three provides recommendations for follow-up evaluation activities that will assess project context issues over the long-term.

Project Implementation

This category focuses on task implementation, the performance of project staff and partners, and the evolution of the project over time. Project implementation also takes into account project outputs (i.e., project deliverables required under the work plan) and deadlines. The Mid-Project Evaluation Report focused on project implementation at the subcommittee and committee level, providing an analysis of the factors that affected participation and the ability to accomplish respective tasks. In addition, the Mid-Project Evaluation Report provided a brief analysis of the processes used to complete work plan requirements and the status of product development.

Evaluation activities for the final project evaluation focused on project implementation issues that the Project Evaluator could not analyze until the project neared completion. Project implementation issues addressed in the final project evaluation include Visioning Subcommittee activities and products, Steering Committee activities related to defining an organizational structure for a Lower Grand River Watershed group, and insights related to the quality of final project products (e.g., watershed management plans, tools, information and education materials).

Project Implementation at the Subcommittee and Committee Level

The Mid-Project Evaluation examined facilitation, participation, and processes to complete tasks for the Steering Committee and each of the five Subcommittees: Technical, Urban, Rural, Information and Education (I&E), and Sustainability. As discussed in the Mid-Project Evaluation, the Sustainability Subcommittee evolved into the Visioning Subcommittee in May 2003. The Steering Committee took on the responsibilities of the Sustainability Subcommittee related to defining an organizational structure and the Visioning Subcommittee focused on developing a vision and mission for the Lower Grand River Watershed. The final project evaluation focuses on the progress of the Steering Committee and the Visioning Subcommittee toward developing a vision and identifying an organizational structure.

Steering Committee

During the second year of the Project, the Steering Committee focused its efforts on identifying an appropriate organizational structure for the Lower Grand River Watershed. The Steering Committee recognized that several types of watershed organizations exist in

the Lower Grand River Watershed, as well as in the State of Michigan. To draw upon the experiences of existing watershed organizations, the Steering Committee co-sponsored a watershed organization discussion panel with the help of the Rogue River Watershed Council, a sub-watershed group located in the Lower Grand River Watershed.

Section 6 of the draft Lower Grand River Watershed Management Plan articulates the purpose and functions of a watershed organization for the Lower Grand River Watershed as envisioned by the Steering Committee, the Visioning Subcommittee and the Grand River Forum. According to the draft Lower Grand River Watershed Management Plan, the purpose of the new watershed organization "would be to identify priorities within the Grand River Watershed and to facilitate projects that address high priority concerns." The organization would serve as an umbrella that would encompass the entire Lower Grand River Watershed, providing basin-wide oversight and building capacity for the formation of sub-watershed groups that would create and implement watershed management plans at the sub-watershed level. The umbrella organization would not absorb sub-watershed organizations.

The Project Evaluator asked GVMC to provide information about the current status of the Lower Grand River Watershed organization to include in the final project evaluation. GVMC provided a copy of the May 2004 memorandum to the Steering Committee that outlines key points about the organizational structure. According to the memorandum, the Visioning Subcommittee proposed the creation of a provisional organization within GVMC intended to 1) plan and implement measures necessary to establish an appropriate watershed organization for the Lower Grand and 2) maintain marginal watershed council functions as needed while work to develop the watershed organization is ongoing. According to GVMC's correspondence with the Project Evaluator, the interim watershed council housed at GVMC capitalizes on the current momentum generated through the Project. GVMC offered an extension to any members of the Steering Committee, as well as additional watershed stakeholders, to remain as a functioning group to help create a primary bridge to an interim watershed council. In addition to formulating a strategy for developing an interim and permanent watershed organization, the Steering Committee also developed a prioritization process for use by the interim watershed organization when evaluating implementation projects.

Visioning Subcommittee

As described in the Mid-Project Evaluation Report, the Visioning Subcommittee was formed out of the Sustainability Committee. According to the draft Lower Grand River Watershed Management Plan, the Vision Subcommittee was "charged with developing key elements of a strategic plan including a vision, mission, core values, and other components that would be necessary to place the Lower Grand River Watershed Management Plan initiative in a much larger context of long-term success over the entire watershed." To develop the key elements of a strategic plan, GVMC and MDEQ planned and facilitated a focus group process with members of the Grand River Forum.

The Project Evaluator asked GVMC to provide a description of the process used to develop the elements of the strategic plan. According to GVMC, the focus groups

involved selected experts from the Grand River Forum in three vision-strategy components: public awareness, data management, and organization. Each focus group session addressed 10 to 20 questions aimed at what would need to happen to move the Lower Grand River Watershed toward the vision and mission adopted by the Visioning Subcommittee. Answers captured during the focus group sessions became the elements for initial strategies and the Visioning Subcommittee further determined "Strategic Needs" for the identified elements in several categories such as Partnerships, Communications, Technology, Infrastructure, Financing, Skills, and Evaluation.

The work of the Visioning Subcommittee has resulted in a vision, mission statement, core values, and strategic components for the Lower Grand River Watershed crafted through the stakeholder-based focus group process and reflected in the draft Lower Grand River Watershed Management Plan. In addition, the Visioning Subcommittee has significantly contributed to the characteristics of the interim and permanent watershed organizations as articulated in the draft Lower Grand River Watershed Management Plan.

Project Implementation at the Overall Project-Level

The Mid-Project Evaluation Report identifies three issues related to overall project implementation: 1) defining the vision and setting goals; 2) sustaining participation; and 3) fulfilling workplan requirements. For the final project evaluation, the Project Evaluator considered each issue and provided new information where available.

Defining the Vision and Setting Goals

Defining the vision and setting goals later in the project caused some frustrations among Subcommittee members and had the potential to impede activities of some Subcommittees, such as the I&E Subcommittee, that was in the process of finalizing their respective tasks without the benefit of a watershed vision or goal. As previously discussed, the Visioning Subcommittee was able to articulate a vision, mission statement, core values and strategic components during the last quarter of the project. Although the vision and related elements were not available to Subcommittees throughout the planning process, project staff were able to integrate the vision and related elements into the draft Lower Grand River Watershed Management Plan as the planning phase draws to a close. Specifically, the I&E Strategy developed by the I&E Subcommittee states that all I&E tasks conducted during the implementation phase will reflect the vision and mission developed for the Lower Grand River Watershed.

Sustaining Participation

The Mid-Project Evaluation Report highlights participation trends for the Steering Committee and each of the Subcommittees. Meetings for most of the Subcommittees ended in mid- to late-April 2004. The last meeting for the I&E Subcommittee took place in May 2004. Given the limited number of meetings that took place between the Mid-Project Evaluation Report and the final evaluation activities, the Project Evaluator determined that additional analysis into participation trends beyond the Mid-Project Evaluation would not provide new insights.

Fulfilling Workplan Requirements

Through evaluation activities for the Mid-Project Evaluation Report, the Project Evaluator examined the processes used to develop work products and the status of work plan tasks compared to the work plan schedule. Products listed under each work plan task are nearly complete, according to the Quarterly Report -Y2Q3 and recent meeting minutes available on the Lower Grand River Watershed Project web site. As mentioned in the Mid-Project Evaluation Report, the I&E Subcommittee determined that completing the third newsletter specified in the work plan, the first two having been completed, would not benefit the project; instead, the I&E Subcommittee identified and produced other outreach products (e.g., the project web site) that would add value. Other tasks not completed as of the Mid-Project Evaluation Report have since been completed or will be complete when the project officially ends. Per recent conversations with project staff, AWRI has submitted an amendment to the original contract requesting a two month extension to enhance the Lower Grand River Watershed Management Plan and components of the Watershed Information Tool based on recent input from the Grand River Forum meeting.

Counting the number of completed tasks and products required under the work plan is one way to measure project progress; however, simply counting the number of completed products does not provide information to gauge product quality and usefulness. Feedback from target audiences is a more meaningful type of information to determine if a product is – or will be – effective. Primary products of the Lower Grand River Watershed Planning Project include watershed management plans, tools, and I&E materials (planning phase). As discussed in the Mid-Project Evaluation Report, I&E products developed through the Project incorporated limited evaluation mechanisms to generate feedback from the target audience. However, the I&E Strategy for the implementation phase does place a stronger emphasis on product evaluation. Evaluation activities for the final project evaluation examined recent feedback on tools and watershed management plans.

Lower Grand River Watershed Workshop

The June 3, 2004 Grand River Forum meeting provided participants with an opportunity to test components of the Watershed Interactive Tool through a hands-on workshop. The workshop took place at Grand Valley State University's Pew Campus in Grand Rapids. In addition to testing the Watershed Interactive Tool, the workshop provided participants with the opportunity to provide feedback on the features and functions of the tools using tailored evaluation forms. Approximately 36 individuals registered for the workshop and nearly all attended, although the sign-in sheet reflects 31 participants. Nearly half of the participants completed evaluation forms for three tools: the Watershed Interactive Tool, the Watershed Action Plan, the Watershed Assessment Matrix, and the Watershed Interactive Mapping. A summary of the evaluation questions and associated findings for each tool is presented below.

Questions and Findings

Project staff developed and distributed three evaluation forms to evaluate each tool demonstrated during the June 3, 2004 Grand River Forum meeting.

Watershed Interactive Tool (WIT)

The evaluation form for the WIT shows the links to the nine components of the WIT on the left-hand side of the form, providing space for participants to make written comments in the center column and rank components of the WIT according to usefulness in the right-hand column. A total of 17 participants submitted evaluation forms for the WIT. Comments were generally editorial in nature, identifying changes to web addresses or corrections in spelling. Other comments indicated support for a particular component of the WIT. Some participants provided feedback on the format and function of the WIT and specific components. Overall, comments were positive in nature. In terms of ranking components of the WIT according to usefulness, participants did not consistently rank using the instructions on the evaluation form; only five participants submitted evaluation forms with WIT components correctly and consistently ranked. Of the five evaluation forms with components correctly ranked, three forms had the Watershed Interactive Mapping component ranked as the most useful and two forms had the Water Science Education K-12 component ranked as the second most useful and the Nonpoint Source Pollutants component as the third most useful.

Watershed Interactive Mapping (WIM)

The evaluation form developed to obtain feedback on the WIM asked participants nine questions related to ease of finding on the WIT, data usefulness, functions, training and future use. A total of 16 participants submitted the WIM evaluation form. All respondents felt that finding the WIM page on the WIT was not difficult, with over 60 percent of respondents indicating it was easy. Respondents identified several data layers as most useful, including hydrology, percent imperviousness, basins, sub-basins and density. Five respondents stated that all or most data layers were useful. Over 40 percent of respondents stated that the step-by-step handout helped in navigating the WIM and that they would like to be notified of additional training for this tool. Respondents provided additional written comments either indicating support for the WIM or providing suggestions to improve functions for future users.

Watershed Action Plan (WAP)/Watershed Assessment Matrix (WAM)

The evaluation form developed to obtain feedback on the WAP and the WAM asked participants eight questions related to the most useful component of the tool, organization, future training, and ease of use. A total of 16 participants submitted the WAP/WAM evaluation form. Respondents identified the drop-down menus (7), pop-up explanations (5), and printable summary sheets (4) as the most useful tools available on the WAP. Over 80 percent of respondents made a statement that the WAP is organized in a manner that would be conducive to developing watershed management plans in other communities. All respondents indicated that the WAP was a relatively simple tool, with over half of the respondents indicating that it is an easy tool to use. Half of the respondents stated that using a computer-based hands-on approach was the most useful aspect of the session focusing on the WAP and theWAM. Nearly 70 percent of respondents stated that they would be interested in future training sessions for the WAP and the WAM, particularly for other staff or if developers add new features. Written

comments from respondents focused on recommendations for improving the functionality and indicated support for the WAP and the WAM.

Conclusions

Participants at the June 3, 2004 Grand River Forum meeting that evaluated the workshop provided positive feedback about the format and functionality of the WIT, the WIM, and the WAP, with minor suggestions to improve the tools. Respondents also indicated that using the tools in a hands-on workshop setting was helpful. Participants provided additional comments specifically related to the workshop on the Grand River Forum evaluation forms intended to obtain feedback on all seven meetings; feedback also supported the use of a hands-on training approach. Participant feedback indicates that, after making corrections and adjustments, the tools developed through the Lower Grand River Watershed Planning Project are easy to use and provide useful information. Project staff should address modifications that are appropriate and feasible based on participant input. Some participants stated that they may have additional feedback after taking the time to further experiment with the tools; therefore, project staff should prepare another evaluation mechanism to solicit additional feedback from workshop participants after a short period of time.

Recommendations

Obtaining input during the planning and development phase is essential to ensure that the target audience finds each tool easy-to-use and effective. An indicator of success is not completion of each tool, but evidence that the target audience is using each tool to make informed decisions that will benefit the health of the Lower Grand River Watershed. Therefore, project staff will need to continually evaluate factors related to tool application during the implementation phase. The Project Evaluator recommends that project staff develop evaluation mechanisms to assess the following factors: 1) marketing to raise awareness and promote the widespread use of each tool; 2) training to increase self-efficacy that will promote widespread use of each tool; 3) frequency of use and applications of each tool by categories of user groups; and 4) effectiveness of each tool in achieving progress toward watershed goals. Section Three provides specific recommendations for further evaluating each tool during the implementation phase.

Watershed Management Plans

The Lower Grand River Watershed Planning Project will produce a total of three watershed management plans: 1) the Sand Creek Watershed Management Plan that represents agricultural and developing rural areas; 2) the Buck Creek Watershed Management Plan that represents urban and urbanizing areas; and 3) the Lower Grand River Watershed Management Plan that provides a vision and a broad strategic plan for the entire watershed. Evaluation of the watershed management plans centers on two factors: 1) participation and buy-in from watershed stakeholders who will eventually implement the actions contained in the plan and 2) formal review and approval from Michigan Department of Environmental Quality to ensure plans meet required criteria. Both factors are key in generating a watershed management plan that is eligible for state and federal funding and has a high probability for implementation at the local level.

The watershed management plans for Sand Creek and Buck Creek were not part of the original work plan, but evolved from the process of identifying and selecting pilot project areas as specified in the work plan. The Sand Creek Watershed Partners, an existing sub-watershed group, and the Rural Subcommittee developed the Sand Creek Watershed Management Plan, therefore ensuring that the final product had local input before project staff submitted the final product to Michigan Department of Environmental Quality for review and approval. The Urban Subcommittee and individual communities in the Lower Grand River Watershed provided input on the Buck Creek Watershed Management Plan before going to Michigan Department of Environmental Quality for review and approval. After project staff addressed minor comments, Michigan Department of Environmental Quality approved both watershed management plans in January 2004.

The Lower Grand River Watershed Management Plan serves as a broad, reference-oriented document for other sub-watersheds and communities to use when conducting local watershed management and storm water planning activities. Unlike the watershed management plans for Buck Creek and Sand Creek, the Lower Grand River Watershed Management Plan will provide tools and techniques rather than specific implementation recommendations to address water quality concerns. Watershed stakeholders have had an opportunity to provide input and feedback on the Lower Grand River Watershed Management Plan concept by participating on any one of the Subcommittees or in the Grand River Forum meetings. The Project Administrator representing the Michigan Department of Environmental Quality has also been involved throughout the development of the Lower Grand River Watershed Management Plan. This level of involvement should ensure that the final product has stakeholder and agency support. Once the Lower Grand River Watershed Management Plan has been completed, project staff will submit the product to Michigan Department of Environmental Quality for review and approval. The interview conducted with Grand Valley Metro Council reflected in the Mid-Project Evaluation Report indicated potential concern about the final approval process because the Lower Grand River Watershed Management Plan is unlike any other watershed management plan and may not appear to meet the standard criteria. An approvable watershed management plan for the Lower Grand River Watershed would indicate a successful planning process.

Project Outcomes

Project outcomes focus on the impact that the Lower Grand River Watershed Planning Project has had in the short-, medium-, and long-term. Project outcomes should relate to project goals. According to the draft Lower Grand Watershed Management Plan, "this project was the result of the momentum stimulated by watershed projects and initiatives occurring within the LGRW. One goal for this project is to continue this momentum and help provide support to generate future watershed projects that would sustain success and have greater water quality benefits."

At the end of the Mid-Project Evaluation Report, the Project evaluator listed several project outcomes that would help to define the impact of the Lower Grand River Watershed Planning Project in the short-, medium- and long-term. In a very narrow

sense, outcomes from the Lower Grand River Watershed Planning Project can focus solely on the development of products and tools required in the work plan (administrative impacts). However, in a very holistic sense, outcomes from the Lower Grand River Watershed Planning Project should focus on generating local watershed projects and initiatives (social impacts) that will produce water quality benefits (environmental impacts). Over time, the Lower Grand River Watershed Planning Project should lead to implementation activities that improve conditions in the watershed.

Based on the culmination of project evaluation activities, the Project Evaluator has modified the list of project outcomes contained in the Mid-Project Evaluation Report. The list has been expanded to include immediate project outcomes, as well as short-, medium-, and long-term outcomes. Immediate project outcomes represent tangible results from the Lower Grand River Watershed Planning Project that may not have a measurable impact now, but are intended to have a measurable impact on awareness, behavior, and water quality in the long-term. Short-term project outcomes represent anticipated results of the Lower Grand River Watershed Planning Project that are likely to occur within the next year. Medium-term project outcomes represent anticipated results that are likely to occur within the next two to five years. Long-term outcomes represent anticipated results that are likely to occur five years and beyond.

Immediate Project Outcomes

- Approved Buck Creek and Sand Creek watershed management plans, including I&E Strategies
- Submitted final Lower Grand River Watershed Management Plan, including I&E Strategy, for Michigan Department of Environmental Quality review
- Promoting local watershed and storm water management planning and implementation through functional web-based tools (i.e., Decision Support System)
- Created Grand Vision to help Lower Grand River Watershed move into implementation phase
- Developed strategy for creating a sustainable organizational structure that capitalizes on existing momentum
- Increased awareness of the Lower Grand River Watershed Planning Project and watershed issues among project participants
- Generated core group of supporters willing to move from the planning phase to the implementation phase

Anticipated Short-Term Project Outcomes (within next twelve months)

- Obtain approval on the Lower Grand River Watershed Management Plan, including I&E strategy, from Michigan Department of Environmental Quality
- Initiate implementation of approved Buck Creek and Sand Creek Watershed Management Plans
- Initiate implementation of Lower Grand River Watershed Management Plan, including I&E strategy
- Develop watershed and storm water management plans using web-based tools and resources

- Continue to develop organizational structure with support from Steering Committee volunteers

Anticipated Medium-Term Project Outcomes (one to five years)

- Continue to implement approved Buck Creek and Sand Creek Watershed Management Plans
- Continue to develop and implement watershed and storm water management plans using web-based tools and resources
- Establish sustainable Lower Grand River Watershed organization
- Increase watershed awareness among target audiences linked to I&E material development and distribution
- Increase participation in local watershed events in connection with Lower Grand River Watershed efforts
- Coordinate collection and management of Lower Grand River Watershed data and information

Anticipated Long-Term Project Outcomes (five years and beyond)

- Modify targeted behaviors of specific target audiences to reduce nonpoint source pollution in the Lower Grand River Watershed
- Increase the number of local watershed projects and organizations supported by the Lower Grand River Watershed organization
- Improve water quality within the Lower Grand River Watershed
- Achieve the vision for the Lower Grand River Watershed

Any project outcomes beyond those in the immediate category will realistically transcend the planning phase and enter into the implementation phase. Therefore, implementation related activities – and the success of those activities – are indicators for ongoing evaluation of the planning phase. In other words, the successes and challenges experienced during the implementation phase may provide useful information about the effectiveness of the watershed management plans and tools on which implementation is based.

Overall Project Conclusions

The Lower Grand River Watershed Planning Project has demonstrated successes and challenges during the two-year project timeframe, as reflected in the Mid-Project Evaluation Report and the findings of final project evaluation activities described earlier in this Section. The Project Evaluator has reviewed conclusions contained in the Mid-Project Evaluation Report and findings of the final project evaluation activities to identify the most significant project successes and challenges in each of the three evaluation categories. The overall project conclusions in each of the three evaluation categories are presented below.

Project Context

Findings in this evaluation category address the structure and function of the project partners, as well as how the project functions within the community.

Successes related to project context are as follows:

- Adapting project structure based on needs of the group by dividing the responsibilities of the Sustainability Subcommittee between the Steering Committee and the Visioning Subcommittee;
- Coordinating a watershed organization discussion panel to learn from existing watershed organizations in the Lower Grand River Watershed and the State of Michigan to inform the watershed organization development process;
- Creating the Grand River Forum as a mechanism specifically intended to generate stakeholder participation and involvement;
- Identifying and fulfilling the need for the primary grantee to take a more significant leadership role among project partners;
- Generating momentum among a core group of watershed stakeholders to sustain efforts of the planning phase through to the implementation phase.

Challenges related to project context are as follows:

- Creating a project structure that may have hampered communication among subcommittees, particularly for individuals that did not participate on more than one committee;
- Creating the perception of a Grand Rapids/Kent County focused project and a watershed stakeholder group with limited diversity;
- Defining a watershed vision and goals at the end of the project rather than the beginning;
- Initiating subcommittee activities without providing members the opportunity to contribute to the development of subcommittee goals and processes.

Project Implementation

Findings in this evaluation category address task implementation, the performance of project staff and partners, and the evolution of the project over time. Project implementation also takes into account project outputs (i.e., project deliverables required under the work plan) and deadlines.

Successes related to project implementation are as follows:

- Ensuring constant progress toward achieving work plan tasks through the use of dedicated project staff;
- Resolving facilitation issues within the I&E Subcommittee based on input from subcommittee members;
- Completing work plan requirements;
- Developing watershed vision and goals;
- Developing the Watershed Interactive Tool and related resources using stakeholder feedback throughout the development process;
- Creating strategic plan for creation of an appropriate watershed organization; Implementing additional tasks beyond work plan requirements;
- Providing forum for information exchange among watershed stakeholders participating on subcommittees;
- Identifying and creating formalized product development processes as necessary.

Challenges related to project implementation are as follows:

- Fluctuating participation trends among Steering Committee, subcommittees, and the Grand River Forum;
- Developing I&E products with limited evaluation to assess effectiveness;
- Focusing on two specific pilot project areas that may have resulted in diminished participation from stakeholders with interests outside of the pilot project areas;
- Limiting Grand River Forum meetings to a specific time and location that does not allow a wide array of watershed stakeholders to participate.

Project Outcomes

Project outcomes focus on the impact that the Lower Grand River Watershed Planning Project has had in the short-, medium-, and long-term.

Successes related to project outcomes are as follows:

- Obtaining stakeholder approval on the Watershed Interactive Tool and related resources;
- Obtaining positive feedback from participating Phase II communities on the usefulness of Project products to fulfilling their Phase II storm water permitting requirements;
- Developing two MDEQ-approved watershed management plans for Sand Creek and Buck Creek watersheds;
- Acknowledging long-term project evaluation needs;
- Developing long-term project evaluation mechanisms.

Challenges related to project outcomes are as follows:

- Assessing future impact of products on watershed and storm water management efforts;
- Assessing increased awareness of watershed management issues as a result of I&E efforts;
- Assessing effectiveness of strategy to create a permanent watershed organization through the use of an interim watershed council comprised of Steering Committee members;
- Assessing effectiveness of watershed management plans in achieving water quality improvements during the implementation phase.

SECTION THREE: CONSIDERATIONS FOR LONG-TERM PROJECT EVALUATION DURING THE IMPLEMENTATION PHASE

This section addresses recommendations for developing evaluation mechanisms that will help to track short-, medium-, and long-term project outcomes from the planning phase, as well as evaluate efforts conducted during the implementation phase. As discussed in the previous section, project staff cannot measure many of the project outcomes at this point in time because outcomes are linked to various stages of implementation. Thinking about evaluation before the implementation phase begins will allow project staff to develop evaluation mechanisms that track both project outcomes related to planning and

implementation efforts simultaneously. The remainder of this section provides recommendations related to developing an evaluation process to track implementation project success for any watershed project, and provides specific recommendations for evaluating implementation of the Lower Grand River Watershed Management Plan and associated products developed through the Lower Grand River Watershed Management Planning Project.

Recommended Evaluation Process for Implementation

The Lower Grand River Watershed Management Plan is unique in that it does not provide a list of implementation activities to conduct throughout the watershed; instead, the Lower Grand River Watershed Management Plan and related resources (e.g., Watershed Interactive Tool) serve as resources for stakeholders that want to develop and implement watershed management plans at the local level. Therefore, successful implementation of the Lower Grand River Watershed Management Plan is related to the successful development of sub-watershed management plans.

Watershed management plans developed for implementation at the local-level using the Lower Grand Watershed Management Plan and related products (e.g., the Watershed Interactive Tool) should include a strategy for evaluation. An evaluation strategy should be tailored to the specific goals of the sub-watershed management plan, or other implementation project, while providing the necessary information to track improvements in the overall Lower Grand River Watershed. Like watershed management, evaluation is an iterative process that requires stakeholder involvement at the outset. Evaluation strategies should include goal identification, indicator selection, evaluation tool identification and selection, evaluation information collection and analysis, and project augmentation.

Rather than organizing evaluation efforts according to context, implementation, and outcomes, the Project Evaluator recommends organizing the evaluation process for the implementation phase around three types of indicators: 1) administrative; 2) social; and 3) environmental. Administrative indicators and some social indicators will address issues related to project context and project implementation. Other social indicators and environmental indicators will address project outcomes. The Project Evaluator suggests that project staff and watershed stakeholders consider developing a common suite of indicators that all sub-watershed groups can track that will help measure successes at the larger Lower Grand River Watershed scale.

Evaluating Implementation of the Lower Grand River Watershed Management Plan

Evaluation is usually thought of as an activity conducted at the end of a project. However, the effectiveness of an evaluation is dependent on a well thought-out evaluation strategy at the beginning of a project. By considering evaluation mechanisms to assess the long-term impacts of this project, project staff and watershed stakeholders in the Lower Grand River Watershed are actually planning evaluation activities for the implementation activities. Many of the long-term project outcomes are related to the successful use of the products developed through the Lower Grand River Watershed

Planning Project. Provided below are recommendations and ideas for evaluating the products beyond the end of the current grant and into the implementation phase. Recommendations focus on the Watershed Interactive Tool and related resources, watershed management plans, and the Lower Grand River Watershed organization. Table 3.1 below presents ideas for administrative, social, and environmental indicators that project staff and watershed stakeholders can consider using to measure the long-term project outcomes.

Watershed Interactive Tool and Related Resources

To date, the web sites for the tools developed through the Lower Grand River Watershed Planning Project (e.g., WIT, WIM, WAP) do not include any evaluation mechanisms. The Project Evaluator suggests selecting indicator(s) from Table 3.1 below, or developing alternate indicators, to evaluate the tools. After selecting appropriate indicators, staff should identify associated mechanisms for collecting information to support each indicator. Indicators and evaluation mechanisms will vary, depending on how the project staff and stakeholders articulate the goals associated with the tools. For example, if the goal of the WIT is to increase awareness on watershed issues, the indicator for evaluating effectiveness might be a user's level of awareness before and after using the WIT. The evaluation mechanism for measuring a user's level of awareness could be a quiz that a user takes before and after using the WIT. If the goal of the WIT is to change behavior of a particular target audience, project staff should select indicators and evaluation mechanisms that measure behaviors before and after using the WIT.

The Project Evaluator recommends developing a quiz to serve as one possible evaluation mechanism on the main WIT web site. The quiz is a low-cost evaluation mechanism that will reach WIT users as they access tools. In addition, a quiz can assist project staff in collecting a wide range of information in a short period of time, such as users' knowledge of watershed facts before and after using the WIT (e.g., nonpoint source pollutants, history of the watershed, Lower Grand 319 Project), users' current behaviors and anticipated use of the information obtained through the WIT, and users' characteristics (age, affiliation, sub-watershed of interest, how they heard about the WIT). Project staff may have to overcome the challenge associated with encouraging users to take a voluntary quiz and should consider providing an incentive (e.g., free giveaway that has the LGRW logo or name).

In addition to the quiz, the Project Evaluator also recommends developing a page specifically intended to generate feedback on the WIT. The feedback web page could explain the importance of obtaining input from users and provide a feedback mechanism (e.g., email comment box that goes to a central email in-box or a brief survey) to determine what users like and don't like, as well as recommendations for improving the WIT.

Watershed Management Plans

Section 5 of the draft Lower Grand River Watershed Management Plan addresses evaluation with a focus on quantitative measurements to assess water quality

improvements achieved through implementation efforts. The quantitative measurements relate to pollutants identified as impairments to designated uses within the Lower Grand River Watershed and serve as environmental indicators for assessing the effectiveness implementation activities. Given the link to water quality conditions and water quality standards, the quantitative measurements highlighted in Section 5 of the draft Lower Grand Watershed Management Plan are the most desirable way to determine if implementation activities are meeting water quality goals and watershed management goals. However, other types of indicators can also prove useful in assessing the effectiveness of the watershed management planning and implementation process over the long-term. Table 3.1 below lists potential administrative and social indicators, as well as additional environmental indicators, the project staff can consider in tracking long-term effectiveness of watershed management plans.

Organizational and Strategic Elements

Evaluating the effectiveness of the interim and permanent watershed organizational structure, as well as the strategic elements related to the watershed vision, evolving from the Lower Grand River Watershed Management Planning Project will require assessing all three types of indicators. Given the purpose and mission of the umbrella watershed organization will be to promote and sustain watershed management activities at the local level, measuring success of the organization will most likely rely on measuring the success of the sub-watershed organizations that seek financial and technical support under that umbrella. Table 3.1 provides potential indicators in all three categories that project staff can consider when determining how to evaluate success of the watershed vision and the interim/permanent watershed organization. Techniques for evaluating the organizational structure and the strategic elements could include administrative tracking procedures (e.g., sign-up sheets for meetings, maintaining a comprehensive participants database to track participation trends), surveys to assess perceptions and attitudes over time, as well as organizational reporting that will occur if a formal non-profit watershed organization is established.

Additional Evaluation Recommendations

The final project evaluation activities highlighted other evaluation activities that project staff can consider during the implementation phase to assess the effectiveness of the Project in the long-term. Evaluation activities relate to the Grand River Forum meetings, Phase II communities, and sub-watershed groups.

Grand River Forum Follow-Up Evaluation Recommendations

The evaluation of Grand River Forum participants on June 3, 2004 was limited to those individuals attending on that particular day, resulting in answers that do not reflect input from other individuals who have attended one or more meetings over the course of the two-year project. As one respondent stated at the end of the evaluation form, it is important to understand why other participants stopped attending meetings. The Project Evaluator recommends conducting a follow-up evaluation activity with other Grand River Forum participants that can also serve as a tool for planning stakeholder meetings during the implementation phase. The evaluation activity should involve generating a spreadsheet of all past Grand River Forum participants using old sign-up sheets. For

each participant, track the number of meetings attended and identify participants that show a decline in participation over time (e.g, attended initial two meetings and didn't attend remaining five or attended any four meetings except the last three). Project staff should develop a brief list of questions that attempt to discern the causes for changes in participation and their relationship to factors such as meeting logistics (e.g., day, time, location) and agenda/meeting format (e.g., presentation-oriented rather than activity-oriented). The questions should also assess how individuals hear about meetings, how far in advance they need to schedule meetings, and what factors help to make a meeting a priority. In addition, all future meetings should have a sign-up sheet and a thorough (but succinct) evaluation form that asks questions about factors affecting participation and perceptions of participants toward meeting and/or project progress.

Phase II Community Follow-Up Evaluation Recommendations
Two respondents alluded to the need for evaluating the benefits related to the contribution of matching funds and participation in the Lower Grand River Watershed Planning Project over time. Their responses highlight the need for future evaluation activities during the implementation phase to further assess the success of the project. It is likely that communities contributing matching funds to the project will continue to measure success of this project by numerous factors, including the ability to use tools generated by the project to comply with storm water permit requirements. The Project Evaluator recommends conducting a brief follow-up survey with the communities that contributed matching funds to the Lower Grand River Watershed Planning Project during the period of time communities should be implementing measures to comply with their storm water permitting requirements. Questions used in the survey should focus on the degree to which communities used tools and products resulting from the project to meet their storm water permitting requirements and assess if the tools and products adequately met their needs. Future evaluation efforts should request job title information to determine if there is a connection to individuals' perspectives toward watershed management.

Another consideration for a follow-up evaluation is to measure the change in community participation from the planning phase to the implementation phase. This will be particularly interesting if project partners use different recruitment strategies to encourage continued participation and to generate new participation. In addition to measuring the change in participation (e.g., number of communities contributing funds during the planning phase compared to number of communities contributing funds during the implementation phase), the Project Evaluator also recommends conducting a pre-project evaluation with contributing communities as an initial activity. The pre-project survey can assess information such as 1) initial level of awareness, attitudes and perceptions related to watershed management; 2) project expectations; 3) factors that will promote or hinder continuous participation; and 4) geographic areas of concern. Information collected in the pre-project survey can help gauge project effectiveness, as well as assist with project planning (e.g., where and when to schedule meetings) to promote continuous participation. Phase II communities were a primary target audience of urban BMP related tools; therefore, long-term evaluation activities should attempt to track the use of the Watershed Information Tool and other resources by this particular target audience.

Sub-Watershed Group Follow-Up Evaluation Recommendations

As the organization evolving from the Lower Grand River Watershed Planning Project begins to take shape, the Project Evaluator recommends conducting a brief follow-up survey with representatives from sub-watershed groups to determine if there is a change in perception or attitude toward the umbrella organization and the potential affect on local organizations. The current evaluation focused on obtaining input from individuals that participate in the Lower Grand River Watershed Planning Project as well as a sub-watershed organization or group. To ensure that the evaluation assesses the perceptions of a wider stakeholder group, the Project Evaluator recommends surveying sub-watershed organization members that do not actively participate in the Lower Grand River Watershed management efforts (i.e., the planning project, ongoing organizational development activities or future implementation-phase activities) to gauge perceptions of those active at the local level that may or may not have buy-in to the larger-scale watershed approach.

Table 3.1 Implementation Phase Evaluation Recommendations: Potential Indicators

Project Element	Evaluation Indicators		
	Administrative	**Social**	**Environmental**
Tools			
Watershed Interactive Tool (WIT)	Number of hits on the web site per month Number of people attending WIT demo/trainings	Number of classrooms integrating educational materials into curriculum Number of watershed stakeholders that are 1) aware of what the WIT is and the resources available on the WIT; and 2) can describe how they have applied information from the WIT Number of users that obtain a high score on a watershed quiz available on the WIT web page Number of users developing watershed action plans using WIT information Number of users assisting sub-watershed activities using WIT information Number of implemented watershed projects that used WIT in project development	Improved riparian conditions Improved instream habitat Water quality improvements
Watershed Interactive Mapping (WIM)	Number of hits on the web site Number of people attending WIM trainings	Number of plans incorporating WIM maps Number of implemented protection/restoration projects and plans incorporating WIM maps	Improved riparian conditions Improved instream habitat Water quality improvements
Watershed Action Plan (WAP)	Number of hits on the web site Number of people attending WAP trainings	Number of developed/implemented watershed action plans Number of plans maintained in an active status (i.e., reviewed, updated regularly)	Improved riparian conditions Improved instream habitat Water quality improvements

Project Element	Evaluation Indicators		
	Administrative	**Social**	**Environmental**
Watershed Assessment Matrix	Number of subwatersheds in assessment matrix with updated assessment information Number of updates made to the matrix with new assessment information	Number of people contributing to watershed assessment information contained in matrix Number of implemented watershed projects recorded in assessment matrix	Improved riparian conditions Improved instream habitat Water quality improvements
Management Plans			
Lower Grand River Watershed Management Plan	Plan developed Plan maintained in active status (i.e., reviewed, updated regularly) Funding level associated with planning and projects Number of subwatershed management plans developed using information and resources generated through the planning project Number of Phase II storm water management plans developed using information and resources generated through the planning project	Number of partners involved in the planning phase continuing into implementation phase Number of new participants recruited for the implementation phase by partners involved in the planning phase Number of plan-linked projects underway Media coverage of plan-linked projects and partners	Improved riparian conditions Improved instream habitat Water quality improvements
Buck Creek Watershed Management Plan	Plan developed Plan maintained in active status (i.e., reviewed, updated regularly) Funding level associated with planning and projects	Number of partners involved in planning Number of plan-linked projects underway Media coverage of plan-linked projects and partners Plan implementation	Improved riparian conditions Improved instream habitat Water quality improvements

Project Element	Evaluation Indicators		
	Administrative	**Social**	**Environmental**
Sand Creek Watershed Management Plan	Plan developed Plan maintained in active status (i.e., reviewed, updated regularly) Funding level associated with planning and projects	Number of partners involved in planning Number of plan-linked projects underway Media coverage of plan-linked projects and partners Plan implementation	Improved riparian conditions Improved instream habitat Water quality improvements
Organizational and Strategic Elements			
Watershed Vision	Vision statement created and adopted Number of projects and plans citing watershed vision	Number of partners involved in visioning, planning/management Number of stakeholders aware of watershed vision Number of stakeholders that cite change in behavior due to desire to achieve the watershed vision (or related aspect)	Improved riparian conditions Improved instream habitat Water quality improvements
Organizational Structure	Number of staff and partners involved in planning/management Creation of permanent watershed organizational structure that fulfills watershed strategic elements Number of projects reviewed and funded by the interim/permanent watershed organization Number of participants at watershed organization meetings	Perceptions of existing subwatershed groups of permanent organizational structure Number of watershed stakeholder categories represented in organization versus total number of watershed stakeholder categories (diversity indicator) Number of successfully implemented projects funded by the interim/permanent watershed organization Number of subwatersheds seeking technical assistance from interim/permanent watershed organization to establish subwatershed group	Changes in riparian conditions, instream habitat, and water quality conditions in subwatersheds with subwatershed organizations supported by the interim/permanent watershed organization

Project Element	Evaluation Indicators		
	Administrative	Social	Environmental
		Changes in awareness of the existence of a Lower Grand River Watershed organization among watershed stakeholders on an annual basis Changes in participation trends of the permanent watershed organization	