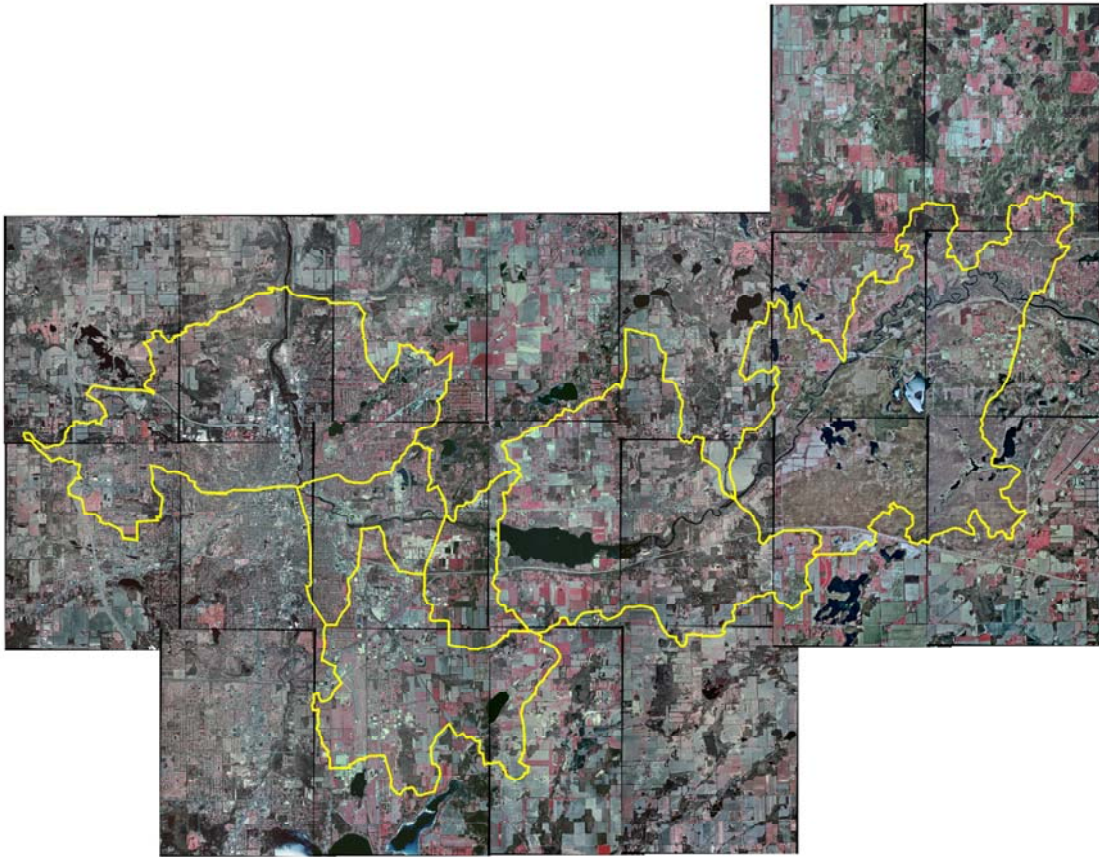


# **Kalamazoo River Mainstem 3 Corridor Watershed Management Plan**



*Prepared by:*

**The Kalamazoo River Mainstem 3 Corridor Steering Committee**

*On Behalf of:*

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# Table of Contents

<b>Table of Contents .....</b>	<b>i</b>
<b>Glossary of Acronyms and Abbreviations.....</b>	<b>iii</b>
<b>Chapter 1 – Executive Summary.....</b>	<b>E-1</b>
<b>Chapter 2 – Introduction.....</b>	<b>2-1</b>
2.1 The Kalamazoo River Watershed Mainstem 3 Corridor .....	2-1
2.2 Purpose of the Mainstem 3 Corridor Watershed Management Plan..	2-2
2.3 The Kalamazoo River Stormwater Work Group .....	2-2
2.4 The Mainstem 3 Corridor Steering Committee .....	2-2
2.5 The NPDES Phase II Watershed Management Planning Process .....	2-3
2.6 Coordination with the Kalamazoo River Phosphorus TMDL .....	2-4
2.7 Coordination with the Kalamazoo River RAP.....	2-4
2.8 Coordination with the MDNR Kalamazoo River Fisheries Assessment.....	2-4
2.9 Formation of a Future Kalamazoo River Watershed Organization ...	2-5
<b>Chapter 3 - Watershed Assessment.....</b>	<b>3-1</b>
3.1 General Watershed Characteristics – The Kalamazoo River Watershed .....	3-1
3.1.1 Hydrology of the Middle Segment .....	3-2
3.1.2 Channel Cross Section of the Middle Segment .....	3-3
3.1.3 Dams and Barriers in the Middle Segment.....	3-3
3.2 Land Use and Population .....	3-4
3.3 Imperviousness in the Landscape .....	3-4
3.4 Soil Characteristics .....	3-4
3.5 Sewer and Septic Areas .....	3-4
3.6 Pollutant Loads .....	3-5
3.7 River Quality Indicators.....	3-5
3.8 Mainstem 3 Corridor Subwatershed Features.....	3-7
3.8.1 17-52; 4050003 040100; Kalamazoo River at Gull Creek .	3-7
3.8.2 17-53; 4050003 040110; Kalamazoo River at Morrow Lake Dam.....	3-8
3.8.3 17-55; 4050003 040130; Kalamazoo River at USGS Gage #04106000.....	3-8
3.8.4 17-56; 4050003 050010; Davis Creek at Mouth.....	3-8
3.8.5 17-63; 4050003 050080; Kalamazoo River at Portage Creek.....	3-12
3.8.6 17-65; 4050003 050100; Kalamazoo River at Spring Brook.....	3-12
3.9 Example MS4 Demonstration Projects in the Kalamazoo River Watershed M3C Area .....	3-13

3.10 Identify Knowledge Gaps Eligible for Incorporation as Goals and Objectives.....	3-16
<b>Chapter 4 - Goals, Objectives, Actions .....</b>	<b>4-1</b>
4.1 Long-Term Goals (>5 years; longer than one permit cycle).....	4-1
4.1.1 Michigan Designated Uses .....	4-1
4.1.2 Desired Uses .....	4-2
4.1.3 Load Reduction Goals.....	4-2
4.1.4 Attaining Compliance with TMDL Goals .....	4-4
4.2 Short-Term Measurable Objectives (< 5 years; within current permit cycle).....	4-4
4.3 Actions to Achieve Long-Term Goals & Short-Term Measurable Objectives .....	4-5
4.4 Commitments and Dates – For Each Permittee to Implement the Actions .....	4-10
4.5 Assessment of Costs and Benefits of Actions.....	4-12
4.6 Methods of Evaluating Progress .....	4-12
<b>Chapter 5 - The Public Participation Process .....</b>	<b>5-1</b>
<b>Chapter 6 – Next Steps .....</b>	<b>6-1</b>
<b>References.....</b>	<b>R-1</b>
<b>Figures</b>	
<b>Tables</b>	
<b>Appendices.....</b>	<b>.....</b>
Appendix A – Analysis Methodology .....	A-1
Appendix B – Example of Steering Committee Derived Ways to Measure Progress, from the Portage & Arcadia Watershed Management Plan .....	B-1
Appendix C – Watershed Management Plan Objections.....	C-1

## **Glossary of Acronyms and Abbreviations**

AOC	Area Of Concern
BMP	Best Management Practice
CMI	Clean Michigan Initiative
COC	Certificate of Coverage
GAAMP	Generally Accepted Agricultural Management Practices
IDEP	Illicit Discharge Elimination Plan
LEED	Leadership in Energy and Environmental Design
LID	Low-Impact Development
M3C	Mainstem 3 Corridor
MDEQ	Michigan Department of Environmental Quality
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
PDR	Purchase Development Rights
PEP	Public Education Plan
PPP	Public Participation Plan
SC	Steering Committee
SESC	Soil Erosion Sediment Control
SWPPI	Storm Water Pollution Prevention Initiative
SWWG	Storm Water Work Group
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WMP	Watershed Management Plan

## Chapter 1 – Executive Summary

A Watershed Management Plan (WMP) has been prepared on behalf of eleven Municipal Separate Storm Sewer System (MS4) permit holders in the Mainstem 3 Corridor (M3C) of the Kalamazoo River Watershed. These MS4 permit holders are part of a larger group constituting the Stormwater Work Group (SWWG) that has been actively coordinating stormwater planning interests since the late 1990s. Permittees have collectively led these planning efforts as a Steering Committee directing the preparation of this plan by the consultants, Kieser & Associates, LLC (K&A) and Environmental Consulting & Technology, Inc. (ECT).

Prior to the completion of this watershed management plan, the SWWG expended considerable energy addressing requirements of their Certificates of Coverage (COCs) including development of the following:

- Illicit Discharge Elimination Plan (IDEP)
- Public Education Plan (PEP)
- Public Participation Plan (PPP)

This Watershed Management Plan represents a culmination of these efforts to date and addresses Michigan Department of Environmental Quality (MDEQ) National Pollutant Discharge Elimination System (NPDES) Wastewater Discharge General Permit minimum requirements for a WMP. Permittees will be required to use this WMP to develop or revise a Stormwater Pollution Prevention Initiative (SWPPI) that specifies the permittee's detailed commitments under the WMP. This plan has relied heavily upon the compilation of existing materials available for watershed planning for the Kalamazoo River and surrounding subwatershed plans. The Steering Committee was asked to verify, add, and delete information as it applied to the Mainstem 3 Corridor watershed. Similarly, information was retrieved from existing planning materials or was suggested by K&A and ECT based on typical programs and controls that are effective and affordable to formulate this plan.

As many areas surrounding the project area already fell under other existing watershed management plans or ongoing planning efforts, the M3C area crossed multiple jurisdictions and included watershed permittees that were already working together on required aspects of watershed based NPDES Permits. Additionally, these same permittees fell within a portion of the larger Kalamazoo River watershed which is subject to a phosphorus Total Maximum Daily Load (TMDL) and a Remedial Action Plan (RAP). Elements of existing efforts were used in the development of this Watershed Management Plan.

The broader value of this plan, beyond simply a permit requirement, can now be realized given the broad array of existing information and new goals set forth in this plan. This should be viewed as an important watershed milestone. Prior to this WMP, stormwater runoff impacts and a lack of management strategies for urban and rural streams crossing multiple jurisdictions often posed significant challenges to water quality protection and restoration. Varying socio-economic, political, infrastructure, policy and equity issues all typically serve to dilute efforts focusing on water quality. Thus, these efforts have met a unique challenge in the Mainstem 3 Corridor; that is, developing an approvable, cost-effective yet flexible plan with a common purpose.

This WMP provides the community with a plan to implement desired goals for water quality improvements and protection, as well as a consistent venue to communicate, adapt and revise the overall plan as new information is obtained and actions are completed. The plan serves as a template for jurisdictions to adopt short-term and long-term goals that accommodate existing infrastructure and established community visions. The plan also allows for growing areas to enact new policies and practices that better address water quality protection.

One of the most fundamental aspects of this planning process was a focus to collectively identify long-term goals, short-term objectives and related actions to improve water quality while incorporating stakeholders needs and expressed desires in a flexible framework. Both long-term goals (to be completed in greater than five years; longer than one permit cycle), and short-term measurable objectives (undertaken within the next five years; within current permit cycle) have been identified by permittees through the Steering Committee process. Specific actions to achieve the goals and objectives have also been charted and all MS4 permittees (with the exception of Comstock Township, Oshtemo Township, Kalamazoo Township, and the Kalamazoo County Drain Commission) have identified commitments towards these actions.

The following long-term goals and short-term objectives were established by the Steering Committee:

Goal 1. Increase the public's understanding about their role in protecting the watershed through public education and outreach.

- Develop and/or promote existing and future public education and outreach programs
- Support local/regional water protection/improvement activities
- Evaluate the effectiveness of education programs

Goal 2. Appropriately manage flow regimes and reduce pollutant loadings, emphasizing nutrients, sediment and erosion control.

- Review and enhance administrative management strategies that minimize negative impacts of development on water resources
- Improve enforcement of ordinances, regulations or policies
- Implement BMPs/management controls for improved water quality and flow
- Reduce the impact of municipal, commercial and industrial services Operations & Maintenance
- Continue actions to eliminate illicit discharges
- Reduce inputs of snow removal related materials and meltwater runoff volume
- Restore areas affected by hazardous materials
- Maintain and introduce flow control practices for direct discharges

Goal 3. Minimize impacts to drinking water supplies, natural features, unique/critical habitats, community amenities, and native species.

- Protect public water supply, groundwater
- Support preservation and protective practices

- Protect sensitive or unique natural features
- Protect and increase native species
- Promote recycling and hazardous material collection and proper disposal

Goal 4. Promote and encourage passive outdoor recreational opportunities with suitable public access.

- Support efforts to establish recreational areas

Goal 5. Support the formation of a community-based mechanism to implement and sustain the Mainstem 3 Corridor Watershed Management Plan.

- Continue to participate as a M3C Steering Committee Member
- Evaluate and consider creative financing programs to support future watershed management plan implementation projects
- Collaborate with groups involved in the TMDL Implementation Committee, the PAC, and other water quality and watershed regional groups within the Kalamazoo River Watershed
- Investigate the development or expansion of community-based water quality monitoring programs

This planning process, driven by Steering Committee input, will now be more broadly discussed with key watershed stakeholders as defined in the Public Participation Plan (PPP). Over the first several months of 2006, Steering Committee members will lead a series of public meetings to disseminate the plan and solicit public input. The primary basis of communications will be maintained through an Internet website ([www.kalamazooriver.net/Corridor3](http://www.kalamazooriver.net/Corridor3)) dedicated solely to this project and future related efforts throughout the Kalamazoo River Watershed ([www.kalamazooriver.net](http://www.kalamazooriver.net)).

## Chapter 2 – Introduction

A Watershed Management Plan (WMP) has been prepared for a portion of the Kalamazoo River Watershed referred to herein as the Mainstem 3 Corridor (M3C) Watershed. This plan has been prepared on behalf of eleven Municipal Separate Storm Sewer System (MS4) permit holders. This WMP meets requirements for a Watershed Management Plan described in MIG619000 for the National Pollutant Discharge Elimination System (NPDES) Phase II Stormwater Permitting Program.

### 2.1 The Kalamazoo River Watershed Mainstem 3 Corridor

Draining about 66,155 acres (103.4 square miles), the Mainstem 3 Corridor is located in Southwest Lower Michigan and can be found within the larger Kalamazoo River Watershed between the City of Battle Creek and the City of Kalamazoo (Figure 1). The Mainstem 3 Corridor contains six subwatersheds as defined by the Michigan Department of Environmental Quality (MDEQ) for the purpose of Watershed Management Plan Development consistent with the NPDES Phase II Stormwater Permitting Program (Figure 2). Urban core areas are clearly recognizable along the Kalamazoo River corridor, while a predominantly rural/agricultural mix of land uses dominate headwater areas away from the immediate river corridor between upper and lower reaches of the project area (Figure 3).

The watershed is comprised of hydraulic unit codes (HUC) including:

- 4050003 040100 17-52 Kalamazoo River at Gull Creek
- 4050003 040110 17-53 Kalamazoo River at Morrow Lake Dam
- 4050003 040130 17-55 Kalamazoo River at USGS Gage #04106000
- 4050003 050080 17-63 Kalamazoo River at Portage Creek
- 4050003 050010 17-56 Davis Creek at Mouth

The sixth area, Kalamazoo River at Spring Brook drainage, consists of HUC 4050003 50100 17-65, except for the Arcadia Creek drainage. The Arcadia Creek Drainage is currently covered by a WMP for Portage & Arcadia Creeks ([www.kalamazooriver.net/pa319new](http://www.kalamazooriver.net/pa319new)).

The Kalamazoo River Mainstem 3 Corridor and representative subwatershed areas lie amongst ten independent jurisdictions with 12 NPDES permit holders (covered under General Permit No. MIG619000) actively participating in watershed management planning (Figure 2). These jurisdictions and participants included:

	<u>Participants</u>	<u>Certificate of Coverage</u>
1.	Kalamazoo County	MIG610335
2.	Kalamazoo County Drain Commission	
3.	Kalamazoo County Road Commission	MIG610249
4.	City of Kalamazoo	MIG610336
5.	City of Portage	MIG610051
6.	City of Galesburg	MIG610327
7.	City of Parchment	MIG610331

8.	Comstock Township	MIG610328
9.	Cooper Township	MIG610324
10.	Kalamazoo Township*	MIG610323
11.	Oshtemo Township	MIG610332
12.	Pavilion Township	MIG610322

\*not actively participating

## 2.2 Purpose of the Mainstem 3 Corridor Watershed Management Plan

The NPDES Phase II Stormwater Permitting Program requires that a WMP be developed to serve as a guide for permitted MS4s. This WMP covers the Mainstem 3 Corridor and will be subject to periodic updates dictated by the terms of the NPDES permit program.

## 2.3 The Kalamazoo River Stormwater Work Group

Members of the Kalamazoo Stormwater Work Group (SWWG), which includes representatives of regulated bodies and other stakeholders in Kalamazoo County, coordinate their efforts to make it easier and less expensive to comply with federal regulations and to enhance protection of the watershed and groundwater resources. Using a cooperative approach, regulated bodies work jointly on planning, permit preparation and submission.

## 2.4 The Mainstem 3 Corridor Steering Committee

The eleven active participants listed in Section 2.1 (MS4 permit holders) functioned as the Steering Committee for this planning effort. These 11 participants were also part of the larger SWWG that had already expended considerable energy addressing requirements of their Certificates of Coverage (COC) including development, submission, and revision of some of the following:

- Illicit Discharge Elimination Plans (IDEPs);
- Public Education Plans (PEPs); and,
- a joint Public Participation Plan (PPP).

This Watershed Management Plan:

- Builds on existing products of the SWWG;
- Utilizes available material and existing organizational contacts that make up a mosaic of similar local efforts (watershed management plans and a phosphorus TMDL for areas surrounding the Mainstem 3 Corridor); and,
- Serves the SWWG in their required development of Storm Water Pollution Prevention Initiatives (SWPPIs) following completion of the WMP.

## 2.5 The NPDES Phase II Watershed Management Planning Process

In Chapter 1, “MDEQ Guidance for Watershed Management Planning: For The Purpose of Writing Storm Water Pollution Prevention Initiatives” of the document “MDEQ Guidance for Storm Water Pollution Prevention Initiatives (SWPPI)” (MDEQ 2005 pp. 1-2), the following overview of selected topics is provided.

*The basics of a Watershed Management Plan (WMP) are reviewed for the purpose of writing a Storm Water Pollution Prevention Initiative (SWPPI) under the Watershed Municipal Separate Storm Sewer System (MS4) Permit. Pages 9 and 10 of the Permit (MIG619000) lay out specific WMP requirements and also reference the guidance that gives details for developing a WMP.*

*The main purpose of the WMP is to identify implementation actions needed to protect and restore designated uses and resolve water quality and quantity concerns.*

*Specific components of the WMP needed to produce an approvable SWPPI include:*

- 1. Assessment of the watershed ecosystem*
- 2. Long-term goals*
- 3. Short-term measurable objectives*
- 4. Actions to achieve long-term goals*
- 5. Actions to achieve short-term measurable objectives*
- 6. Commitments and dates - for each permittee – to implement the actions*
- 7. Assessment of costs and benefits of actions (not a cost/benefit analysis).*
- 8. Methods of evaluating progress*

*The WMP shall also address Total Maximum Daily Loads (TMDL) established for a parameter within the watershed that may be affected by storm water. Setting goals and objectives is a main focus of the WMP. Both long-term goals and short-term measurable objectives are required. Actions must be identified to achieve the goals and objectives. Generally, a long-term goal is a broad target that could take multiple permit cycles to achieve. A short-term measurable objective defines a more specific target toward achieving the long-term goal. Short-term objectives should include a target that can be achieved within 5 years. Note that objectives must always be measurable. All uses of the term objective refer to measurable objectives.*

*Actions may vary for each permittee, as long as they work toward achieving common objectives. However, if an objective is not applicable throughout the entire watershed, then only communities for which the objective applies will need to commit to actions to address that objective.*

This guidance has driven the format and contents of this WMP.

## 2.6 Coordination with the Kalamazoo River Phosphorus TMDL

Localized water quality issues in the mainstem of the Kalamazoo River have historically determined water quality based effluent limitations for point source dischargers within this reach of the Kalamazoo River. Lake Allegan, a 1,587-acre impoundment situated approximately thirty-five river miles downstream of the City, has long been noted, however, as having impaired uses with water quality standards violations due to hypereutrophic conditions associated with excessive phosphorus loadings. To fulfill the requirements set forth in the federal Clean Water Act, a TMDL has been developed that focuses on seasonal (April-September) phosphorus limits. To achieve target water quality goals in Lake Allegan, a 43% reduction in non-point source phosphorus loads has been targeted with an approximate 23% reduction for point sources. Such reduction goals will be a primary consideration and driver for WMP recommendations for policy and practices in the Mainstem 3 Corridor. The specific requirements of the TMDL make it important for M3C entities to track and report phosphorus reductions.

## 2.7 Coordination with the Kalamazoo River RAP

The Kalamazoo River Remedial Action Plan (RAP) summarizes the Kalamazoo Area of Concern (AOC) designation (KRPAC, 1998 p. 6).

*Areas of Concern (AOC) are specific geographic areas having degraded environmental quality because of the presence of contaminants and the impairment of the waters, fish and wildlife, habitat, or aesthetic values of the resource. These sites were officially recognized by the governments of Canada and the United States in 1987 in an amendment to the 1978 Great Lakes Water Quality Agreement.*

*The Kalamazoo River Area of Concern includes the lower portion of the watershed from Morrow Dam in Kalamazoo County near Galesburg to the mouth of the River in Allegan County at Saugatuck. The Kalamazoo River was identified as an AOC because of the presence of polychlorinated biphenyls (PCBs), discharged primarily from historical deinking operations at local paper mills. Several sources of PCB contamination have been identified along the Kalamazoo River and Portage Creek. The upstream sources of PCBs are collectively referred to as the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund site. The area is listed as a site of environmental contamination and was officially included on the Superfund National Priorities List in August 1990.*

## 2.8 Coordination with the MDNR Kalamazoo River Fisheries Assessment

The Michigan Department of Natural Resources (MDNR) Fisheries Assessment for the Kalamazoo River was finalized in 2005 (Wesley, 2005). This document describes the characteristics of the river and its biological communities. The assessment provides a reference for citizens and agency personnel. It is used by the agency to identify fisheries management opportunities and solve fishery related problems. Useful background information about the Kalamazoo River has been summarized in the document and several recommendations for Kalamazoo River management apply in the Mainstem 3 Corridor.

## 2.9 Formation of a Future Kalamazoo River Watershed Organization

Michigan State University Extension (MSUE) has facilitated the Kalamazoo River TMDL Steering Committee in recent years with grant monies supporting overall coordination. Recently, during 2005, the coordinators and Steering Committee have reached out to entities across the watershed to help define future Kalamazoo River Watershed coordination and leadership across a broad array of watershed issues. Several stormwater permit holders already participate on local and regional Watershed Planning project committees and workgroups for these efforts and participation will likely need to increase to address issues of sustainability and coordination that occurs across traditional jurisdictional boundaries.

## Chapter 3 - Watershed Assessment

In Section 3.1, general watershed characteristics are listed as described in the Kalamazoo River RAP (KRPAC, 1998) as well as from the MDNR Fisheries Assessment (Wesley, 2005). In Sections 3.1.1 to 3.1.3, additional general descriptions are listed from the MDNR Kalamazoo River Fisheries Assessment. In Sections 3.2 to 3.8 the results of the analysis portion of the WMP effort are described. For a summary of the methodology used in Sections 3.2 to 3.8 see Attachment A.

### 3.1 General Watershed Characteristics - The Kalamazoo River Watershed

The Kalamazoo River RAP describes the Kalamazoo River Watershed general characteristics (KRPAC, 1998 pp. 9,17).

*Geography: The Kalamazoo River watershed is located in the southwest portion of Michigan's Lower Peninsula and drains about 2,020 square miles from 10 counties: Allegan, Barry, Calhoun, Eaton, Hillsdale, Jackson, Kalamazoo, Kent, Ottawa, and Van Buren. The watershed is about 162 miles long and varies in width from 11 to 29 miles.*

*The Kalamazoo River watershed is contained entirely within the Michigan/Indiana Till Plains Ecoregion. Ecoregions are defined using a combination of factors including land use, land surface form, native vegetation and soils. Characteristics of this region include irregular plains (mix of relatively level lands and rolling hills and valleys); potential natural vegetation of oak, hickory, beech, and maple; land use of cropland with pasture, woodland, and forest; and gray-brown podzolic soils.*

*There are about 2,450 lakes and ponds totaling 37,500 acres scattered across the watershed, ranging in size from Gun Lake (Allegan/Barry Counties) at 2,611 acres to numerous small ponds. There are 52 lakes or impoundments of 100 acres or more in size.*

*Demographics: Approximately 400,000 people live in the watershed, with most concentrated in the metropolitan areas of Kalamazoo and Battle Creek. There are 21 cities and villages, located on the River or a tributary, and all or part of 76 townships in the watershed. Other population centers (1990 census figures in parentheses), in addition to Kalamazoo (80,277) and Battle Creek (53,540), include Portage (41,042), Albion (10,066), Marshall (6,891), Plainwell (4,057), Otsego (3,937), and Allegan (4,547).*

*Land Use: There are 2,020 square miles of land in the Kalamazoo River watershed, approximately 1.3 million acres, currently used in the following ways:*

<i>Cropland and Pasture 57%</i>	<i>Forest Land 21%</i>	<i>Urban Areas 8%</i>
<i>Wetlands 3%</i>	<i>Open Water 2%</i>	<i>Other Uses 9%</i>

*Ninety-six percent of the land in the Kalamazoo River watershed is privately owned. The remaining 55,000 acres are publicly owned. Major public areas include*

*Allegan State Game Area (48,000 acres), Fort Custer Recreation Area (3,000 acres), and about one-fifth of the Yankee Spring Recreation Area (1,000 acres).*

The MDNR Kalamazoo River Fisheries Assessment describes the Kalamazoo River Watershed general characteristics (Wesley, 2005 p. 17).

*The Kalamazoo River watershed is predominately outwash plains with many small end- and ground-moraine ridges. Land is gently to moderately sloping with sandy loam and loam soils. Drainage conditions are mostly moderately well-drained with variable areas from poorly to excessively well-drained. Moderately well to well-drained portions of the outwash are used for agriculture, but poorly drained outwash deposits remain as swamp or marsh. For specific soil associations and distributions, review county soil survey maps that are available from soil and water conservation districts. In this assessment, soils have been lumped into three groups based on composition of sand, loam, or clay: Group A (sandy, loamy sand, or sandy loam), Group B (silt loam or loam), and Group C (clay loam, silty clay loam, sandy clay, silty clay, or clay).*

*The Kalamazoo River watershed is comprised of 52% (677,161 acres) Group A and 34% (441,732 acres) Group B soils. The remaining 14% (180,405 acres) is Group C soils and less than 1% is characterized as water, where soil surveys were not conducted due to existence of large lakes (i.e., Gull and Gun lakes).*

### 3.1.1 Hydrology of the Middle Segment

The MDNR Kalamazoo River Fisheries Assessment organized information based on standardized, statewide River Segment Classifications defined by the MDNR. The M3C resides entirely within the MDNR classified “Middle” Segment of the Kalamazoo River Watershed. The Fisheries Assessment describes general characteristics of the middle segment (Wesley, 2005 p.12).

*This segment begins at the confluence of the Battle Creek River in the City of Battle Creek and proceeds 50 miles downstream through Kalamazoo and Plainwell to just beyond Otsego. The river becomes larger as it picks up the drainage from Wabascon, Augusta, and Portage creeks and Battle Creek and Gun rivers. The river channel is sporadically confined as it meanders between moraine features in some sections and meanders freely in broad valleys through other sections within this segment. Groundwater inflows increase in this segment, which buffers the rate of stream temperature warming.*

*The Kalamazoo River at the Battle Creek gauge has the highest standardized 5% exceedence value compared to the rest of the mainstem. With a value of 2.8, it is still considered to be stable compared to other southern Michigan streams. The slight increase may be due to the confluence of the Battle Creek (which experiences more flashy flows) just upstream from the gauge location.*

### 3.1.2 Channel Cross Section of the Middle Segment

The Fisheries Assessment describes the channel cross section of the Middle Segment (Wesley, 2005 p.23).

*The river meanders as it flows within moraine features and broad valleys. It becomes larger as it picks up drainage from the Battle Creek River and several smaller tributaries. Width nearly triples between Battle Creek (68 ft) and Plainwell (202 ft). Depth averages 2-4 ft. Width is significantly narrow through the constructed channel portion of Battle Creek and below Morrow Dam in Comstock. The channel becomes significantly wide near Galesburg as the river enters Morrow Impoundment. Habitat rates as good to excellent through most of the middle mainstem segment. Cobble and gravel are very common averaging 50% of the substrate composition. Sand and silt comprise 10 to 20% of the substrate and becomes more prevalent near impounded areas. Below Morrow Pond in Comstock, the Kalamazoo River has a complex channel with excellent hydraulic diversity. Overhanging brush, woody structure, pools, and riffles are all common with some boulders present.*

### 3.1.3 Dams and Barriers in the Middle Segment

The Fisheries Assessment describes the dams and barriers of the Middle Segment (Wesley, 2005 p.27).

*This segment has 75 recorded dams with 7 on the mainstem. Morrow Dam near Kalamazoo and Bellevue Dam on Battle Creek are the only operating hydroelectric dams in the middle mainstem segment. The Morrow and Bellevue projects operate under an exempt FERC license, meaning that they do not have an official operating license, but still are under the control of FERC. The remaining dams are for recreation and consist of old mill dams and lake-level controls. The Brook Lodge Dam on Ransom Creek and the Monarch Paper Mill on Portage Creek are used for water supply. Eight dams are listed as high hazard types including Morrow, Plainwell, and Otsego dams on the mainstem. Dams severely fragment the middle segment of the Kalamazoo River basin and prevent free movement of fish between the mainstem and tributaries.*

*The Morrow Dam, which is owned by STS Hydropower, is still under FERC control although it does not possess an operating license with FERC. Under FERC review, STS Hydropower must also follow the recommendations of the United States Fish and Wildlife Service (USFWS) and MDNR. Some key issues with this facility are run-of-river flow, entrainment and impingement, and public access. Currently, the project is creating drastic flow fluctuations below the dam, although the facility has remained in compliance with their impoundment elevation requirements. The problem occurs when a turbine comes on or off line during low flow conditions. This event can instantly change the flow below the dam by 20% or more, but the impoundment level will remain nearly constant. This problem can be fixed by changing the requirements of run-of-river flow for the project to mean instantaneous outflow must equal instantaneous inflow rather than trying to maintain a certain impoundment level. Variable speed turbines will also*

*help the project meet the run-of-river flow requirement. A fish entrainment study using tailwater netting estimated 45,987 fish passing the facility consisting of 21 species, ranging in size from 1.8 to 32.4 inches, in 6.5 months of sampling (Bohr and Liston 1987). This is a significant loss of fish for one area of the Kalamazoo River. These losses need to be reduced with the installation of protection devices. Tailwater angler access is also a problem at the Morrow Project. Signs warn anglers and other river users of trespassing. STS Hydropower only allows canoe portaging around the dam and specifically says “No Fishing”. Although the project has provided excellent access to the impoundment via parks and public boat launches, their cooperation is needed to provide tailwater angler access with a parking area.*

### 3.2 Land Use and Population

Figure 2 details land use that was mapped from thematic satellite data obtained from 1997 satellite imagery (K&A, 2001). Table 1 summarizes land use by subwatershed. Population was summarized in Table 2 for several jurisdictions.

### 3.3 Imperviousness in the landscape

Impervious surface cover was mapped across the M3C watershed (Figure 4). Table 3 summarizes imperviousness in the M3C subwatersheds.

### 3.4 Soil Characteristics

The Fisheries Assessment describes the soil characteristics of the Middle Segment (Wesley, 2005 p.18).

*Soils in the middle segment are mainly characterized by Group A soils but with a mixture of Group B. The upper part of this segment has medium to coarse end moraines with outwash sands. The middle part of the segment consists of broad outwash sands. The lower section of the middle segment contains a band of ice-contact and end moraine ridges that stretches through Kalamazoo into Barry County, creating ridges that rise abruptly from outwash sands. Infiltration and groundwater flow rates are high.*

Soils in the M3C watershed were mapped (Figure 5). Soils types are described in Table 4.

### 3.5 Sewer and Septic Areas

The City of Kalamazoo tracks sewerage coverage areas and provided Figure 6 detailing the layout of sewerage areas serviced by the Kalamazoo Water Reclamation Plant as of 2003. It is assumed that areas outside of the coverage area are serviced by other municipalities or utilize septic systems or some other form of on-site wastewater management.

### 3.6 Pollutant Loads for Phosphorus

Pollutant loads in each subwatershed were calculated using non-point source modeling information from the Kalamazoo River TMDL (K&A, 2001). Phosphorus loads by subwatershed are listed in Table 5a. Calculated pollutant loading may be used as a baseline for tracking future load reductions.

### 3.7 River Quality Indicators

The following information regarding water quality impairment within the Mainstem 3 Corridor Watershed was compiled from reports by the MDEQ and the Kalamazoo County Human Services Department. Channelization, direct discharges of urban stormwater, removal of riparian cover, contamination from abandoned industrial (brownfield) sites, and development encroachment on streambanks are prominent concerns in the M3C. These contribute to flashy hydraulics creating erosive conditions and significant loss of instream habitat. Urban sprawl, sedimentation from agriculture and construction, septic systems along lake shorelines and low water are often major issues of concern in the more rural upper watershed reaches. The Kalamazoo River section downstream of Morrow Dam has been identified as an Area of Concern because of PCB contamination. From the 1950s to the mid-1970s, paper mills located along the Kalamazoo River discharged PCB-contaminated waste products either directly into the river or in landfills on the river banks. River sediments, paper company landfills and groundwater are still heavily contaminated by PCBs (Kalamazoo River Watershed PAC, 1998). Mercury is one of the most prevalent contaminants in Michigan waters; a health advisory regarding fish consumption is in place for all of Michigan inland lakes. Efforts are being made to reduce mercury pollution by eliminating mercury products (such as thermometers), ensuring proper disposal and improving emissions from power plants. These conditions illustrate the general need for restoration in urbanized areas and protection in headwater areas. Pollutants and their sources are listed in table 5b.

*Coldwater Streams:* Of particular interest in these areas of the Mainstem 3 Corridor is the existence of coldwater streams. The Kalamazoo River watershed experiences heavy groundwater inputs to streams in these areas (Wesley, 2005). Coldwater contributing areas are unique and especially sensitive to small disturbances and often warrant the maximum possible protection near and within the riparian areas.

*Designated Use Attainment Status:* The Total Maximum Daily Load (TMDL) process is a mandate of the federal Clean Water Act for all water bodies with water quality impairments. Its objective is to identify impaired waterbodies and the pollutants causing the impairment, and to establish a plan for restoring those waterbodies. A TMDL is essentially the amount of a particular substance or pollutant that a water body can assimilate and still remain healthy, and an allocation of that amount to the pollutant sources. MDEQ is charged with ensuring that TMDLs are developed and implemented. This section discusses non-attainment applicable to the M3C corridor.

The entire Kalamazoo River is on the 2004 Water Quality Standard (WQS) nonattainment list for water bodies requiring TMDLs for WQS exceedances for PCBs. TMDL development is scheduled for 2006. In addition, one mile of the Kalamazoo River (G Ave. bridge east of

Augusta) is also listed for exceedances for mercury, with a TMDL planned for 2011. TMDL development is scheduled in 2006 for Davis Creek (from its confluence with the Kalamazoo River to Cork Street) to remedy nuisance oil product pollution. The Kalamazoo River was scheduled for surface water quality monitoring by MDEQ in 2004, while both Davis Creek and the Kalamazoo River were scheduled for assessment to support TMDL development in 2005 (Wolf and Wuycheck 2004).

*Biological Conditions:* The MDEQ Water Bureau conducted biological surveys of the entire Kalamazoo River in the summer of 2004 (Cooper et al 2005, Walterhouse 2005). Four sampling stations were located within the Mainstem 3 Corridor Watershed, two in Davis Creek and two at the Battle Creek WWTP. At Davis Creek, macroinvertebrates communities were rated at the lower end of acceptable. Few macroinvertebrates were present, and those present were tolerant of impaired water quality. Sediment analysis at the Cork Street station showed that levels of metals were elevated but did not exceed water quality standards. Oil pollution in the sediments was also noted and could be partially responsible for Davis Creek's impairment. These results were similar to those of previous surveys (Walterhouse 2001). At the Battle Creek sampling stations, macroinvertebrate communities were rated as acceptable while overall habitat was scored as good because of an appropriate riparian corridor.

The fishery in the middle segment of the Kalamazoo River (corresponding approximately to the Mainstem 3 Corridor Watershed) was previously surveyed by the MDNR in 1982, while Morrow Pond was surveyed in 1999. Overall, species diversity ranged from 10 to 27. Blue Gill and common carp were the most abundant species in Morrow Pond. The invertebrate community rated from acceptable to excellent. Habitat ratings were good to excellent. Twelve species of special concern, two endangered and one threatened species were found in the middle segment of the Kalamazoo River (Wesley, 2005).

*Bacterial Contamination:* Kalamazoo County Human Services Department has been monitoring surface water quality since 2001 at sites throughout the Kalamazoo River Watershed. Two sites, Davis Creek and Eagle Creek, are located within the Mainstem 3 Corridor Watershed. In 2001-2003, half of the water samples from Davis Creek contained more than 300 E. coli bacteria colonies per 100 ml of water; samples from the East Kilgore Rd crossing had lower dissolved oxygen values, higher temperature and conductivity readings than other downstream sites. In 2003-2004, 10 water samples from Davis Creek exceeded 300 E. coli colonies. During both sampling periods, Eagle Creek had very low bacteria count, cooler water temperature and high dissolved oxygen. Eagle Creek is considered one of the highest quality streams in Kalamazoo County (Kalamazoo County Human Services Department 2003, 2004).

*Water Quality:* Annual water quality sampling occurs in a the Kalamazoo River in association with the phosphorus TMDL effort. Annual summaries of point and non-point source sampling results are available from MDEQ reports and are periodically reproduced and analyzed at [www.kalamazooriver.net/tmdl/krdata/index.htm](http://www.kalamazooriver.net/tmdl/krdata/index.htm) when MDEQ makes the data publicly available. In recent years, locations sampled during April - September included: 1) four sites along the length of the river in the TMDL area; 2) a surface sample from a site in Morrow Pond; and 4) samples at five sites in Lake Allegan at the surface as well as at other depths. Parameters measured at all sites include the following:

- Nitrite
- Nitrate plus Nitrite
- Ammonia
- Kjeldahl Nitrogen
- Ortho Phosphorus
- Total Phosphorus
- Total Suspended Solids

Additional parameters measured in the lakes include the following:

- Chlorophyll a
- Depth
- Temperature
- Dissolved Oxygen
- Conductivity
- pH

See [www.kalamazooriver.net/tmdl/krdata/index.htm](http://www.kalamazooriver.net/tmdl/krdata/index.htm) for more full details.

### 3.8 Mainstem 3 Corridor Subwatershed Features

The Mainstem 3 Corridor contains 6 subwatersheds. The amount of information available for each subwatershed varies greatly. The following sections detail subwatershed features.

#### 3.8.1 17-52; 4050003 040100; Kalamazoo River at Gull Creek

Subwatershed 17-52 totals 19,537 acres and falls within Ross, Charleston and Bedford Townships and the cities of Springfield and Battle Creek. Land cover types and areas within this subwatershed are broken down as follows: Water/Wetland – 2,227 acres; Forest/Open – 12,362 acres; Agriculture – 4,036 acres; Residential – 323 acres; Commercial – 117 acres; Transportation – 355 acres; and Barren/Urban Open – 117 acres. Impervious surfaces in this subwatershed area were determined to cover only 3.1% of the land area. Soil types found in this subwatershed area are predominantly MI045 (Oshtemo-Kalamazoo-Houghton) with the northeast section possessing MI046 soils (Oakville-Covert-Adrian). Annual phosphorus loads from this subwatershed were estimated at 3,128 lb/yr.

The following designated recreation/natural/open areas are located within Subwatershed 17-52: Fort Custer State Recreation Area, Veteran's National Cemetery, and Custer Reserve Forces Training Site. Also within this watershed are the following water bodies: Whitman Lake, Eagle Lake, Lawler Lake, Whitford Lake, Pond Lily Lake, Pool Drain and Goff Drain.

### 3.8.2 17-53; 4050003 040110; Kalamazoo River at Morrow Lake Dam

Subwatershed 17-53 is 15,243 acres in size and falls within Charleston and Comstock Townships and the City of Galesburg. Land cover types and areas within this subwatershed are broken down as follows: Water/Wetland – 1,514; Forest/Open – 6,485; Agriculture – 5,901; Residential – 548; Commercial – 207; Transportation – 468; and Barren/Urban Open – 121. Impervious surfaces in this subwatershed area were determined to cover only 4% of the land area. Soil types found in this subwatershed area are predominantly MI045 (Oshtemo-Kalamazoo-Houghton) with the smaller sections of MI047 soils (Schoolcraft-Kalamazoo-Elston). Annual phosphorus loads from this area were estimated at 3,354 lb/yr.

There are no designated recreation/natural/open areas within this drainage area. The three water bodies within this boundary are Morrow Lake, East Corporation Drain and Wait & Van Buren Drain.

### 3.8.3 17-55; 4050003 040130; Kalamazoo River at USGS Gage #04106000

Subwatershed 17-55 totals 2,807 acres and is located in Comstock Township. Land cover types and areas within this subwatershed are broken down as follows: Water/Wetland – 149; Forest/Open – 1,109; Agriculture – 966; Residential – 231; Commercial – 83; Transportation – 149; and Barren/Urban Open – 120. Impervious surfaces in this subwatershed area were determined to cover 13.1% of the land area. Soil types found in this subwatershed area are a combination of MI045 (Oshtemo-Kalamazoo-Houghton) and MI047 soils (Schoolcraft-Kalamazoo-Elston). Annual phosphorus loads from this area were estimated at 783 lb/yr.

There are no designated recreation/natural/open areas within this subwatershed. In addition, there are no lakes in this drainage area, although the following drains are included within the boundaries: Pease Drain, East Branch Carmen Drain, Cramer Drain and Comstock Road Drain.

### 3.8.4 17-56; 4050003 050010; Davis Creek at Mouth

Subwatershed 17-56 encompasses 9,294 acres and falls with Pavilion, Comstock and Kalamazoo Townships and the cities of Kalamazoo and Portage. Land cover types and areas within this subwatershed are broken down as follows: Water/Wetland – 259; Forest/Open – 2,820; Agriculture – 3,556; Residential – 1,014; Commercial – 579; Transportation – 655; and Barren/Urban Open – 412. Impervious surfaces in this subwatershed area were determined to cover 19.6% of the land area. Soil types found in this subwatershed area are predominantly MI047 (Schoolcraft-Kalamazoo-Elston) with a small portion containing MI045 soils (Oshtemo-Kalamazoo-Houghton). Annual phosphorus loads from this area were estimated at 3,294 lb/yr.

Detailed descriptions of this subwatershed are provided in the Davis Creek Watershed Management Plan produced by The Forum for Kalamazoo County, August 1996 (<http://www.theforum.org>).

*General. Davis Creek, also sometimes referred to in whole or in part as Allen Creek or the Olmsted-Davis Drain, is a highly modified, predominately urban drainage corridor in the urban and urbanizing core of Kalamazoo County. Recent water quality tests and biological assessments have shown that the creek is stressed from development and land use impacts associated with continued urbanization of the watershed. The creek suffers from the following known types of pollution:*

- *Suspended Solids and Sediments- The creek contains high concentrations of muck, dirt, sand and other grit which are washed in from roads, streambanks, bare urban lots and agricultural fields. Suspended sediment makes it difficult for fish to breath and feed, while sediment which settles and blankets the creek bottom reduces breeding habitat and overall food availability. Often other pollutants find their way to the creek by attaching to eroding soil. Sediments can also cause a stream to become wide and shallow which increases flooding problems.*
- *Bacteria- Fecal coliform bacteria have been found in unhealthy amounts in the creek waters. Fecal coliform bacterial are associated with human and animal waste and probably come from septic tank leakage, runoff from manure-fertilized fields, or pet wastes. These bacteria can cause a variety of diseases in both human and animals.*
- *Chemicals- Water samples have shown that Davis Creek contains high levels of phosphate and nitrogen compounds, both of which are found in most lawn fertilizers. These chemicals can cause unnaturally large growth of algae which in turn depletes the water of its oxygen, making it difficult for healthy plants and aquatic animals to survive.*
- *Trash- The creek contains a great deal of garbage in the form of glass bottles, tires, metal drums, plastic, styrofoam and cans. This not only makes the creek unpleasant to look at, but is also dangerous to fish and other aquatic animals which come in contact with it.*

*Location. Davis Creek originates at East Lake in Pavilion Township of Kalamazoo County, Michigan. The creek and its watershed are located entirely in Kalamazoo County. The creek joins the Kalamazoo River at a point upstream of the City of Kalamazoo. As a hydrologic component of the Kalamazoo River basin, the creek eventually drains to Lake Michigan at Saugatuck, Michigan in Allegan County. Davis Creek flows northwest from its origin at East Lake, through agricultural areas of Pavilion Township, and into the City of Portage at the Lexington-Green neighborhood. The creek then flows north through a densely populated mobile home park, and into eastern parts of the City of Kalamazoo and Kalamazoo Township. During its northerly flow, the creek roughly parallels Sprinkle Road at a distance of 1/4 to 1/2 mile to the west. This northerly run takes the creek behind Wings Stadium, east of the Cork Street Landfill and under the County Fairgrounds. Davis Creek joins with the Kalamazoo River north of the Fairgrounds, and adjacent to properties of the Georgia-Pacific Corporation.*

*Topography. Davis Creek is located in the Southern Michigan Northern Indiana Till Plains (SMNITP) ecoregion of Kalamazoo County, Michigan. The watershed is*

*relatively flat in the upper half of the watershed, where outwash plains are the dominant topographic feature. The outwash plain contains a ponded area, known as East Lake, which is generally recognized as the source of Davis Creek. The topography of the lower half consists of irregular rolling till plains.*

*Soils. The soils of the watershed reflect the strong glacial influences. Contrasting soil types are commonly found in any one general location due to the erratic nature of the glacial ice movement. Many of the soils are loamy in the upper part and are mostly medium to moderately coarse textured. A variety of generally stratified soils are associated with the outwash plain, and almost all have a high percentage of sand and gravel in the underlying material. The till plains are unstratified and contain more clay than in other areas.*

*Soil Sedimentation. Sediment is a product of soil erosion. Sediment accumulates in ditches, drainage channels, wetlands, creek bottoms and reservoirs. Sedimentation and associated cloudy water ("turbidity") degrades fish habitat, obstructs surface drainage, and fills and widens stream channels. The US Department of Agriculture, Soil Conservation Service, has estimated that sediment yields for Kalamazoo County vary between 50 and 200 tons per square mile per year.<sup>2</sup> This estimate implies that the sediment loading to Davis Creek is 325 to 1,300 tons annually. If one uses a typical six cubic-yard road commission dump truck for reference, then Davis Creek receives anywhere from 36 to 140 truck loads of sediment per year.*

*Hydrogeology. Almost all soils throughout the county have a high percentage of underlying sand and gravel material. The Davis Creek watershed till and glacial outwash deposits contain sand and gravel deposits which constitute an upper, unconfined aquifer underlying Davis Creek. A secondary lower aquifer of similar composition has also been identified before bedrock is encountered at a depth ranging from 200-300 feet.*

*Hydrology. Annual precipitation in Kalamazoo County averages approximately 32-35 inches, with a growing season of about five months (from May 9 through October 9). Winter snow fall averages about 55 inches per season. The heaviest recorded 24-hour rainfall was 5.2 inches at Kalamazoo on May 11/12, 1914. The Davis Creek watershed includes approximately 9,250 acres. The 1976 Olmsted-Davis Drainage Basin Study of the Kalamazoo County Drain Commission identified fourteen (14) sub-basin areas. Several hydrologic subbasins are predominately defined by underground storm sewer systems. These systems have slightly altered the natural topographic limits of the watershed within the urban sections of the watershed. This document presents the watershed boundaries identified in the Drain Commission study. The creek has a total length of approximately 6 miles and a total fall of approximately 100 feet from East Lake to the Kalamazoo River. With some exceptions, most notably those areas in which the stream has been confined and straightened, the stream grade fluctuates between 0.27% and 0.38%, and generally averages 0.34%. Among the exceptions, the grade is as low as 0.06% at the beginning of the creek as it leaves East Lake, and as high as 0.64% between Cork Street and Miller Road.*

*Ground water inflows influence creek temperatures. Historically, Davis Creek was known as a trout stream and cold water fishery. In the late 1940's it was stocked with trout by the Michigan Department of Natural Resources. The inventory of Davis Creek, undertaken during this planning project, revealed that large portions of the Davis Creek corridor have been modified by man. This activity has typically consisted of dredging and straightening. It is assumed these changes were made to (1) improve drainage of lands within the watershed, (2) to control seasonal flooding, and (3) to claim additional land for other uses by removing the natural creek meander and reducing the width of the natural drainage corridor. Figure 3 highlights sections of the stream corridor which are believed to be significantly modified from their natural, pre-development state.*

*Special Resources. Six Municipal Type I public water supply wells are located within the Davis Creek Watershed. Other special resources, while not unique, include wetlands, marsh areas, natural and man-made drainage systems, flood plain area, stream corridor greenways and habitat areas. No threatened or endangered species or other unique resources have been identified within the Davis creek watershed. Nor have any unique cultural or historic resource been identified.*

*Special Concerns. Kalamazoo County relies heavily upon groundwater resources as its principal source of water for public and private water supply systems. This includes public and private drinking water systems, industrial uses, irrigation of agricultural lands and livestock watering. Therefore a special concern for all citizens are wellhead protection programs designed to insure the long-term protection and viability of this precious resource. Other special concerns include the need to appropriately manage those land features which are critical for minimizing the cumulative environment impacts associated with an urbanizing watershed. Critical environmental lands are those lands which possess unique features which provide important community watershed functions. These unique features (due to either their unique character or unique location) include lands which provide important storm water detention, drainage, flood plain, greenway, habitat, groundwater infiltration or wetlands functions. These critical areas are discussed in greater detail under section II, part 4, Watershed Critical Areas.*

*Davis Creek Natural Features Inventory (<http://www.theforum.org/nfi>). A Natural Features Inventory of the Davis Creek Watershed in Kalamazoo County, Michigan was conducted in 1999 by KIESER & ASSOCIATES (K&A, 2000). Field investigations were undertaken to inventory the flora, fauna, and biological communities of the watershed. Current land cover data were generated to allow for large as well as small-scale analysis of the study area. Current land cover data were compared to presettlement vegetation to identify the changes which have taken place over the past 150 years. In addition, supplemental species presence data and spatial data were gathered from many diverse information sources.*

Over 250 species of flora and fauna were documented via field visits, with emphasis being placed on terrestrial communities. Many of the species documented are common to highly disturbed sites. However, three “listed” plants have recently been documented within the watershed; Rosinweed (*Silphium integrifolium*) and Cut-leaved Water Parsnip (*Berula erecta*), both listed as Threatened in Michigan, as well as Prairie False Indigo (*Baptisia lactea*), listed as

Special Concern by the State of Michigan. In addition, records of eleven listed birds exist, including the Prairie Warbler (*Dendroica dominica*), the Northern Goshawk (*Accipiter gentilis*), the Least Bittern (*Ixobrychus exilis*) and the Red-shouldered Hawk (*Buteo lineatus*), all Threatened in Michigan. Though few examples of natural biological communities exist within the watershed, the wetlands surrounding East Lake appear to have undergone relatively minimal disturbances. A Tamarack Bog is located at the southern end of the lake, providing valuable wildlife habitat.

Natural features information in this report is also provided by political jurisdiction. Discussion includes presence of species of interest, level of disturbance, and degree of habitat fragmentation. This type of information is imperative for effective community and conservation planning.

As part of this project, a web-based Natural Features Guide was produced in order to improve public access to the information gathered and serve as an educational tool to spur interest in these important features that surround the stakeholders within this watershed community. This guide is currently housed at The Forum of Greater Kalamazoo's website, at <http://www.theforum.org/nfi>.

#### 3.8.5 17-63; 4050003 050080; Kalamazoo River at Portage Creek

Subwatershed 17-63 is 3,817 acres in size with areas falling within Comstock and Kalamazoo Townships, as well as the City of Kalamazoo. Land cover types and areas within this subwatershed are broken down as follows: Water/Wetland – 224; Forest/Open – 1,311; Agriculture – 429; Residential – 795; Commercial – 541; Transportation – 273; and Barren/Urban Open – 245. Impervious surfaces in this subwatershed area were determined to cover 34.2% of the land area. Soil types found in this subwatershed area are predominantly MI045 (Oshtemo-Kalamazoo-Houghton) with a small area of MI047 soils (Schoolcraft-Kalamazoo-Elston) in the southwest portion. Annual phosphorus loads from this area were estimated at 1,789 lb/yr.

The two designated recreation/natural/open areas within this boundary are Sutherland Park and Hayes Park. The drains within this subwatershed are Early Drain, Lincoln Drain, Scholten Drain and Lake Street Drain. There are no lakes within this drainage area.

#### 3.8.6 17-65; 4050003 050100; Kalamazoo River at Spring Brook

Subwatershed 17-65 encompasses 15,346 acres, which fall within Cooper, Oshtemo and Kalamazoo Townships and the cities of Parchment and Kalamazoo. Land cover types and areas within this subwatershed are broken down as follows: Water/Wetland – 594; Forest/Open – 6,920; Agriculture – 3,172; Residential – 2,461; Commercial – 967; Transportation – 821; and Barren/Urban Open – 411. Impervious surfaces in this subwatershed area were determined to cover 21.1% of the land area. Soil types found in this subwatershed area are a combination of MI045 (Oshtemo-Kalamazoo-Houghton) and MI047 soils (Schoolcraft-Kalamazoo-Elston). Annual phosphorus loads from this area were estimated at 5,196 lb/yr.

Within this subwatershed are the following recreation/natural/open areas: Spring Valley Park, Kindleberger Park, Versluis Park, Dickinson Field, Harrison Park and Farrel Park. This subwatershed also contains the following water bodies: Stearns Lake, Averill Lake, Lesterhouse Drain, Wiersma Drain, West Drain, Zantman Drain and North Drain. Further details on the North Drain are provided below.

Detailed information about the North Drain is available in the “North Limits Drain Preliminary Water Quality and Stormwater Analysis” (K&A, 2002; [www.kalamazooriver.net/Corridor3](http://www.kalamazooriver.net/Corridor3)).

*The North Limits Drain watershed encompasses 1,996 acres with 852 acres falling within the City of Kalamazoo’s corporate boundary and the remaining 1,144 acres located in Kalamazoo Township. The North Limits Drain discharges to the Kalamazoo River just north of the City of Kalamazoo Water Reclamation Plant (WRP). The watershed is divided into three subwatersheds: Upper, Middle and Lower for purposes of this report. The three subwatershed areas were selected to represent three very different sections of the larger North Limits Drain watershed to facilitate discussions of potential management practices appropriate for each area.*

*Based on 1997 LANDSAT 5 satellite data, the Upper Subwatershed (1,041.6 acres) is predominantly forested land cover (36%) and open land (31%), with the remaining area consisting of: residential (14%); transportation (6%); barren land (5%); wetland (2%); commercial (2%); shrubland (1.5%); agriculture (1.5%); and water (<1%). The Middle Subwatershed (251.5 acres) is also dominated by open land (31%) and forest (27%), with the remaining area consisting of: residential (11%); commercial (10%); barren land (9%); transportation (6%); shrubland (2%); water (2%); and wetland (2%). The Lower Subwatershed (702.3 acres), located furthest east, has a greater percentage of residential and commercial land cover. While 39% is forested, residential areas comprise 21% of the total area and commercial areas account for 25% of the land cover. The remaining Lower Subwatershed land cover consists of: open land (8%); transportation (4.5%); barren land (1.5%); water (0.7%); wetland (0.3%); and shrubland (0.03%).*

### 3.9 Example MS4 Demonstration Projects in the Kalamazoo River M3C Area

There are several demonstration projects in areas around the M3C. The following list includes several different BMP types. More information is available at [www.kalamazooriver.net](http://www.kalamazooriver.net), [www.kalamazooriver.net/pa319new](http://www.kalamazooriver.net/pa319new), and on various municipal websites.

#### In-line Detention:

- City of Portage Consolidated Drain Project
- City of Portage STEP Project
- City of Kalamazoo Woods Lake Stormwater Treatment System

Low Impact Development/Riparian Corridor:

- Western Michigan University Business Technology & Research Park
- Western Michigan University, Various Future Projects
- City of Portage Buffer Project

Stormwater Pretreatment:

- Numerous Stormwater City of Kalamazoo Treatment Devices Pretreat Runoff Prior to Surface Water Discharge

On-site Stormwater Handling:

- Portage & Arcadia Creeks Neighborhood Downspout Disconnect Project
- Maple Street Magnet School Rain Garden

Stream/Pond Restoration and Stormwater Enhancement:

- Western Michigan University Goldsworth Valley Pond
- Kalamazoo River Streambank Restoration Associated with the Water Quality Trading Demonstration Project
- Axtell Creek Native Plantings
- Performance Paper Stream Restoration

Road/Stream Crossings:

- Kalamazoo County Road Stream Crossing Loading Quantification Procedures

Future Projects:

- Portage Creek - Milham Park Restoration
- Arcadia Creek - Kalamazoo Christian Schools Restoration

There are several recently completed or ongoing efforts at different watershed scales related to the M3C. The following table lists several ongoing efforts and include various examples of BMPs.

<b>Planning Documents</b>	<b>Scale</b>	<b>Organization/Author or Technical Consultant</b>
Portage and Arcadia Creek Watershed Management Plan and Transition and Implementation Projects (ongoing)	Portage and Arcadia Creeks, Kalamazoo and Portage	The Forum of Greater Kalamazoo and Steering Committee/Kieser & Associates
St. Joseph River Watershed Management Plan (ongoing)	St. Joseph River, Michigan and Indiana	Friends of the St. Joseph River/Kieser & Associates
Simulation of the Ground-Water-Flow System in the Kalamazoo County Area, Michigan (2004)	Kalamazoo County	United States Geological Survey Scientific Investigation Report 2004-5054

Wellhead and Groundwater Protection Programs	City of Kalamazoo wellhead areas, City of Portage	City of Kalamazoo, City of Portage
City of Portage Watershed Management Plan	City of Portage	Portage/FTC&H
Kalamazoo County Drain Maps	Kalamazoo County	Kalamazoo County Drain Commissioner
IDEPs, PPPs, PEPs	MS4s	(Various authors)
Kalamazoo River Assessment (2005)	Kalamazoo River Watershed	Michigan Department of Natural Resources
Non-point Source Modeling of Phosphorus Loads in the Kalamazoo River/Lake Allegan Watershed for a Total Maximum Daily Load (2001)	Kalamazoo River Watershed with primary focus upstream of Lake Allegan	Kalamazoo Conservation District/Kieser & Associates
Capstone Report to Stakeholders; Kalamazoo River/Lake Allegan Phosphorus TMDL (2005)	Kalamazoo River Watershed upstream of Lake Allegan	Michigan State University Extension
Western Michigan University Voluntary Stormwater Permit	Western Michigan University Properties	Western Michigan University/Kieser & Associates
The Kalamazoo River: Beauty and the Beast; Remedial Action Plan	Kalamazoo River Watershed	Kalamazoo River Public Advisory Council
Water Quality Improvement (Implementation) Plan for the Kalamazoo River Watershed and Lake Allegan through a Phosphorus Total Maximum Daily Load (TMDL) Process (2002)	Kalamazoo River Watershed upstream of Lake Allegan	TMDL Implementation Committee/Kieser & Associates
Surface Water Monitoring Annual Reports (2002-2004)	Kalamazoo County surface waters	Kalamazoo County Human Services Department
Phosphorus Credit Trading in the Kalamazoo River Basin: Forging Nontraditional Partnerships (2000)	Kalamazoo River Watershed	The Forum of Greater Kalamazoo/Kieser & Associates
Stormwater Thermal Enrichment in Urban Watersheds (2004)	Portage Creek near Portage, Michigan	Kieser & Associates
Natural Features Inventory of the Davis Creek Watershed, Kalamazoo, Michigan (2000)	Davis Creek, Kalamazoo	Davis Creek 319 Steering Committee/Kieser & Associates
Davis Creek Stormwater Drainage Feasibility Study	Davis Creek, Kalamazoo	Davis Creek 319 Steering Committee/Kieser & Associates

North Limits Drain Preliminary Water Quality and Stormwater Analysis	North Drain, Kalamazoo	City of Kalamazoo/Kieser & Associates
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### 3.10 Identify Knowledge Gaps Eligible for Incorporation as Goals and Objectives

Knowledge gaps identified by participants or the public that are eligible for incorporation as Goals and Objectives will be incorporated into future WMP revisions.

## Chapter 4 - Goals, Objectives, Actions

Setting goals, objectives and actions is a main focus of the WMP. Both long-term goals and short-term measurable objectives are required. Actions must be identified to achieve the goals and objectives.

### 4.1 Long-Term Goals (>5 years; longer than one permit cycle)

Long-term goals encompass both the protection and restoration of designated uses of the receiving waters, and attaining compliance with any stormwater-affected TMDL. A TMDL is specific for each water body, if established. Generally, a long-term goal is a broad target that could take multiple permit cycles to achieve. The following long-term goals were established by the Steering Committee:

- **Goal 1. Increase the public’s understanding about their role in protecting the watershed through public education and outreach.**
- **Goal 2. Appropriately manage flow regimes and reduce pollutant loadings, emphasizing nutrients, sediment and erosion control.**
- **Goal 3. Minimize impacts to drinking water supplies, natural features, unique/critical habitats, community amenities, and native species.**
- **Goal 4. Promote and encourage passive outdoor recreational opportunities with suitable public access.**
- **Goal 5. Support the formation of a community-based mechanism to implement and sustain the Mainstem 3 Corridor Watershed Management Plan.**

#### 4.1.1 Michigan Designated Uses

Designated Uses are recognized uses of Waters of the State established by state and federal water quality programs as defined by Part 4, Part 31 of PA 451, 1994, revised 4/2/99. All Waters of the State are to be designated and protected for all of the uses listed below. However, some uses are not met at all, some are met for only part of a watercourse and some do not apply. Threatened uses are defined as the types of activities that may impact a water body currently meeting a designated use such that it will not meet water quality standards in the future. Impaired uses are defined as verified and perceived concerns resulting in a designated use not being met. The designated uses are:

- Agriculture
- Industrial water supply
- Public water supply at the point of intake
- Navigation
- Warmwater fishery
- Other indigenous aquatic life and wildlife
- Partial body contact, recreation
- Total body contact, recreation between May 1 and October 31

Note: Certain water bodies are also protected as a coldwater fishery.

Table 6 relates Michigan designated uses to the actions presented below.

The forthcoming Kalamazoo River Watershed Management Plan will provide detailed information on which designated uses are being met, which are threatened and which are not being met.

#### 4.1.2 Desired Uses

The Portage & Arcadia Creeks Steering Committee also developed additional “desired uses” (those additional uses they would like to protect or improve) for subwatersheds to the West and South of the M3C. It is reasonable to assume that lengthy Steering Committee and public input from M3C stakeholders would produce similar “desired uses”. Therefore, desired uses for the nearby subwatersheds were applied to the M3C planning effort and it is expected that future public involvement and outreach activities will result in the refinement of these. The additional desired uses are:

- Native vegetation/naturalization
- Unique habitats/riparian buffers
- Aesthetic and community amenity
- Flood control (capacity)
- Flood capability (transport)
- Flood prevention/control of storm water
- Permitted discharge compliance
- Public water supply, groundwater
- Public access and education

#### 4.1.3 Load Reduction Goals

In the Kalamazoo River/Lake Allegan watershed, industrial and municipal point source (wastewater and cooling water) discharges account for approximately 35% of the total load of phosphorus to the river from April through September. The remaining 65% is from stormwater runoff from roads, parking lots, lawns, farms, industry, and commercial activities; from stream bank erosion; from poorly functioning septic systems; from livestock, pets and wildlife; and from improper (illicit) connections of sanitary discharges to storm sewers. Water quality goals indicative of a more well-balanced and healthy lake ecosystem have been developed for Lake Allegan and are contrasted with existing conditions as presented below.

#### **Existing Conditions and Water Quality Goals for Lake Allegan.**

<u>Water Quality Indicators</u>	<u>Existing Conditions</u>	<u>TMDL Goal</u>
Total phosphorus	96 ug/L	60 ug/L
Chlorophyll a	67 ug/L	30 ug/L
Dissolved oxygen	3.1 mg/L	5 mg/L
Water clarity	30 inches	42 inches
Carp as % of fish community	~87%	<30%

The Kalamazoo River/Lake Allegan phosphorus TMDL was derived using 1998 ambient water quality and discharge monitoring data as a baseline. This was for an intensive set of MDEQ monitoring information unlike previously collected data sets that were more generalized in scope and not specifically focused on phosphorus throughout the Kalamazoo River watershed and Lake Allegan (see Heaton, 2000). All increases and decreases in phosphorus loadings to the watershed will be tracked in relationship to 1998 levels. Changes in the water quality indicators will also be based on comparisons to their status from April through September 1998. Water quality monitoring will continue once a month from April through September. A TMDL requires that there be three elements:

- *Waste Load Allocation: loads from industrial and municipal point sources,*
- *Load Allocation: loads from all other sources, and*
- *Margin of Safety*

Because the symptoms and effects of nutrient enrichment primarily manifest themselves in the summer, the TMDL for Lake Allegan is seasonal (April through September). Thus, the Kalamazoo River/Lake Allegan Phosphorus TMDL allocations have been determined as shown below.

**Early and Late Growing Seasons. (All values in pounds of Total Phosphorus per month.)**

	<u>April – June</u>		<u>July - September</u>	
	<u>Goal</u>	<u>1998</u>	<u>Goal</u>	<u>1998</u>
Waste Load Allocation	8,700	8,700	6,700	8,700
Load Allocation	9,800	17,218	4,088	8,135
Margin of Safety	100		50	
Total	18,600	25,918	10,838	16,835

These allocations require a 23% reduction in phosphorus loads from municipal and industrial point sources throughout the watershed in the later half of the summer (July through September). Most ambitiously, up to a 50% reduction in phosphorus loadings from non-point sources is the target from April through September. The TMDL Implementation Plan document represents the final step of the TMDL approval process, i.e., the development and compilation of the “road map” that: a) serves the entire Kalamazoo River/Lake Allegan Watershed; b) provides the written document that represents the consensus of all participants and their desires, and; c) reflects the varying interests of all stakeholders in this watershed.

Because of the large size of the watershed, and the diffuse nature of phosphorus sources, significant improvements in the water quality of Lake Allegan will not likely be measurable for at least several years. However, through data already obtained as part of this process, reductions have been made in phosphorus loads to the river below the 1998 levels through numerous efforts of the point sources within the watershed. Multiple activities related to stormwater and other non-point contributors have also been implemented through Phase II, CMI and 319 projects further reducing phosphorus loads within the watershed.

#### 4.1.4 Attaining Compliance with TMDL Goals

Permittees should strive to use available techniques to estimate site-specific phosphorus loading reductions associated with nonpoint source reduction efforts. Generally, permittees should seek to maximize the phosphorus reductions they can achieve when evaluating BMP implementation.

- Calculate:* MDEQ guidelines exist in the Pollutants Controlled Manual [http://www.michigan.gov/deq/0,1607,7-135-3313\\_3682\\_3714---,00.html](http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3714---,00.html) and the Michigan Trading Rules: <http://www.state.mi.us/orr/emi/arcrules.asp?type=Numeric&id=1999&subID=1999-036+EQ&subCat=Admincode> for individuals to calculate the expected phosphorus reductions associated with land management practice changes or BMP implementation. Stormwater BMP efficiencies are available from various sources and can be used to estimate reductions in phosphorus expected with BMP implementation.
- Share:* Non point source reductions should be reported to MSUE at [www.kbs.msu.edu/kzoonps](http://www.kbs.msu.edu/kzoonps)
- Report:* Phosphorus reductions should be reported in Annual Reports and SWPPIs.
- Model:* Long-term modeling can be undertaken, typically by specialists or contractors, to periodically determine loading estimates based on land cover and land use for comparison over several years.

Simple modeling associated with this WMP effort provided subwatershed phosphorus loading based on subwatershed landuse/landcover and subwatershed area.

#### 4.2 Short-Term Measurable Objectives (< 5 years; within current permit cycle)

A short-term measurable objective defines a more specific target toward achieving the long-term goal. Short-term objectives include a target that can be achieved within 5 years. Objectives must always be measurable. Objectives identified and refined by the Steering Committee include the following:

- ***Objective 1-A. Develop and/or promote existing and future public education and outreach programs.***
- ***Objective 1-B. Support local/regional water protection/improvement activities.***
- ***Objective 2-A. Review and enhance administrative management strategies that minimize negative impacts of development on water resources.***
- ***Objective 2-B. Implement BMPs/management controls for improved water quality and flow.***
- ***Objective 2-C. Continue actions to eliminate illicit discharges.***
- ***Objective 3-A. Protect public water supply, groundwater.***

- *Objective 3-B. Protect sensitive or unique natural features.*
- *Objective 3-C. Protect and increase native species.*
- *Objective 4-A. Support efforts to establish recreational areas.*
- *Objective 5-A. Continue to participate as a M3C Steering Committee Member.*

#### 4.3 Actions to Achieve Long-Term Goals & Short-Term Measurable Objectives

Goals, objectives, and actions specified in this WMP may be watershed-wide or they may specify an individual water body such as a tributary or a lake within the watershed. Actions may vary for each permittee, as long as they work toward achieving common objectives. However, if an objective is not applicable throughout the entire watershed, then only communities for which the objective applies will need to commit to actions to address that objective. Steering Committee Members identified actions numbered and underlined below in this section. Generalized text and select examples are provided to explain each action. Table 6 contains a summary for all Actions. Some Actions serve to achieve several different Objectives and Goals.

#### **Goal 1. Increase the public’s understanding about their role in protecting the watershed through public education and outreach.**

##### *Objective 1-A. Develop and/or promote existing and future public education and outreach programs.*

##### Action 1. Continue implementation of the MS4 Public Education Plan and Public Participation Plan

Continued and new public education initiatives may include but not limited to: newsletter articles, tip cards, citizen guidebooks, Cable TV talk shows, public radio shows, advertising the Kalamazoo River website address in written pieces, continuing to place educational displays at public places such as events, libraries and city/township halls, developing interpretive signage in public parks, signs at road/tributary crossings and watershed boundaries to create visual awareness.

##### *Objective 1-B. Support local/regional water protection/improvement activities.*

##### Action 2. Promote periodic surface cleanups and water quality/habitat improvement projects.

Participants will promote river cleanups or organizations sponsoring these types of efforts using available outreach strategies, including media outlets. These river cleanup events may occur on an annual basis and may be hosted by one representative or a coordinated through a number of organizations. River Cleanups are designed to help educate residents about the importance of water resources while at the same time conducting effective woody debris management techniques or trash pick-up. Participants should also consider promoting adopt-a-stream or adopt-a-drain type programs.

Continued and new river cleanup efforts/initiatives should be promoted in a variety of ways, such as: community newsletter articles, flyers, citizen guidebooks, Cable TV presentations, public radio shows, on the watershed webpage ([www.kalamazooriver.net](http://www.kalamazooriver.net), [www.kalamazooriver.net/Corridor3](http://www.kalamazooriver.net/Corridor3)), advertising the events in written pieces, and placing educational displays at public places such as libraries and city/township halls.

**Goal 2. Appropriately manage flow regimes and reduce pollutant loadings, emphasizing nutrients, sediment and erosion control.**

***Objective 2-A. Review and enhance administrative management strategies that minimize negative impacts of development on water resources.***

Action 3. Evaluate, develop or improve stormwater management and natural features setback ordinances, regulations or policies.

Increases in impervious surface area and loss of natural features that slow and filter pollutants, result in degradation of water resources by increased amounts of pollutants coming from non-point sources. To mitigate these impacts, many communities have developed and adopted ordinances, regulations, or policies that control both the quantity and quality of stormwater that is permitted to leave a developed site.

Stormwater management and natural features setback ordinances, regulations or policies outline specific requirements for the use of best management practices to minimize the flow and water quality impacts associated with development. An example of a specific requirement is to modify parking ordinance standards to minimize impervious surfaces and maximize green space. Parking lots contribute a significant amount of impervious surface in commercial areas. Oversight and implementation of stormwater standards is often complicated by overlapping jurisdictions and conflicting goals and priorities. Where there are overlapping jurisdictions within individual communities, especially between townships, it is imperative that township and county agencies work cooperatively to understand the goals and unique issues specific to each agency. This should result in the successful implementation of stormwater management strategies.

Action 4. Support or improve soil erosion prevention programs.

Most communities rely on counties for soil erosion sediment control (SESC) regulation, inspection and enforcement. Counties, and communities, that have jurisdiction over SESC regulation and inspection either already have or are revising or developing new SESC ordinances to control soil erosion, especially from construction sites. These ordinances should limit the soil exposed during development or redevelopment, limit the rate at which water is transported across the exposed land, and allow for on-site capture of the sediment prior to discharging water from the site.

***Objective 2-B. Implement BMPs/management controls for improved water quality and flow.***

Action 5. Develop and maintain stormwater asset inventory programs.

Participants will keep a stormwater asset inventory of facilities owned and operated by the jurisdiction. The inventory will need to update with any new information generated during the IDEP, construction or maintenance operations. The inventory should include all stormwater assets and not exclusively BMPs.

Action 6. Maintain BMPs and maintenance programs.

BMPs owned by MS4 jurisdictions need to be inventoried. Operational guidelines and/or maintenance policies should be set up to require short-term and long-term maintenance for these facilities. Without regular inspections and maintenance, these systems will not provide effective pollutant reduction.

Action 7. Document, promote and maintain a spill response program.

Review and update jurisdictions maintenance facilities Spill Response Plan and employee education.

Educate and promote to the general public, spill response hotline available to this area; MDEQ Pollution Emergency Alerting System (PEAS) program, County Emergency Management, and Fire/Police operations. Suggestions to promote include community newsletters, websites and at public buildings.

Action 8. Inventory and stabilize eroding streambanks where appropriate.

Participants will strive to identify lengths of stream bank that are in need of stabilization. Various means to identify sites can be implemented such as inventorying local creeks, drains and rivers, site plan reviews, construction project inspection, periodic crossing inspections. Inventories will include the identification and prioritization of sites. Recommendations of potential methods of improvement, such as control/reduce upstream flow, vegetative and structural stabilization methods to improve riparian terrestrial and aquatic habitat, will be made with the aid of people with appropriate knowledge. It is important to note that many of these surface water features are located on private property and it may not always be feasible to conduct these types of projects if the property owner does not grant permission. Similar inventories currently exist ([www.kalamazooriver.net](http://www.kalamazooriver.net)) or are ongoing (e.g. Kalamazoo County Road Commission). When possible, quantification of soil and phosphorus losses from soils to streams should be undertaken (see: [www.kalamazooriver.net](http://www.kalamazooriver.net), stream bank quantification protocol).

Action 9. Promote and educate for the implementation of BMPs by landowners, contractors and municipalities.

Promote the implementation of stormwater BMPs through educational programs directed at landowners, contractors, governmental jurisdictions and through the development of additional stormwater ordinances. Public groups that can be targeted include lake/stream associations, Kalamazoo Home Builders Association, DPW operations, site plan review committees.

Action 10. Support farmland preservation and encourage agricultural BMPs.

Many communities within the M3C Watershed have active farming operations. The watershed group can work with the Michigan Department of Agriculture and the Kalamazoo Conservation District to identify GAAMPs (generally accepted agricultural management practices) other suitable BMPs, and appropriate dissemination mechanisms.

Communities with active farming and/or livestock operations can work with Natural Resources Conservation Service (NRCS) and Michigan Department of Agriculture (MDA) to understand generally accepted agricultural management practices (GAAMPs) and how the community can assist in water quality efforts. Results and lessons learned from other organizations and groups in other watersheds can be used to move forward.

Linkages to the agricultural community are particularly important as they relate to phosphorus reduction associated with the phosphorus TMDL. Commitments to this and other Actions can be pursued from partnering organizations, especially agricultural organizations, in future Watershed Management Plan updates.

Action 11. Support/encourage riparian buffers and no-mow zones encouraging native species.

Communities should consider cooperative and collaborative efforts to research available and/or develop a model Natural Features Setback ordinance that protects the vegetated buffer along watercourses and wetlands. Protecting the riparian corridor in this manner will help prevent streambank erosion as well as filter sediments carried in stormwater runoff.

Action 12. Implement BMPs during reconstruction or maintenance activities at road/stream crossings.

It is important that the local jurisdictions work cooperatively to implement road maintenance techniques that reduce soil erosion and sedimentation impacts on the water resources. Opportunities that may be evaluated include quickly vegetating roadside ditches to slow and filter stormwater runoff, removing accumulated sediment from roadside ditches, and only grading ditches during dry weather.

Grading of road surfaces is very important in the overall maintenance of the public roadway system. Some maintenance methods may be considered that will not only meet the goals of keeping the roadway smooth for travelers, but will also minimize sediment loads to the nearby waterways. For example, grading during dry weather and not prior to a rain event, compacting areas, where feasible, after grading and stockpiling materials away from streams, wetlands and other natural features areas will minimize the amount of sediment entering the nearby watercourses.

Sediment inputs at road crossings are a particular concern in the Kalamazoo River watershed. Areas needing attention should be identified in periodic physical inventories. These sites should be reviewed for opportunities to improve maintenance practices.

Action 13. Inspect and correct, as needed, storm sewer and culvert locations for blockage, erosion, structural deficiencies/failures.

During ongoing maintenance activities, participants will identify, document and prioritize storm sewers and culvert areas in public right-of-way for need of maintenance. Maintenance may include removing blockages and/or correcting erosion problems. Procedures will be established to conduct these types of maintenance activities.

***Objective 2-C. Continue actions to eliminate illicit discharges.***

**Action 14. Implement IDEP.**

Participants will continue to implement their respective Illicit Discharge Elimination Plans (IDEPs). One component of these plans is the elimination of illicit connections/discharges once they are identified.

**Goal 3. Minimize impacts to drinking water supplies, natural features, unique/critical habitats, community amenities, and native species.**

***Objective 3-A. Protect public water supply, groundwater.***

**Action 15. Develop/maintain/enforce wellhead protection plans and other groundwater protection programs.**

Where applicable, the watershed group and individual representatives will develop, implement or continue wellhead protection programs/plans through the site development review process in order to protect groundwater.

**Action 16. Support cooperative hydrologic groundwater monitoring programs and studies (e.g., USGS).**

Where applicable and possible, the watershed group and individual representatives will support partner agency groundwater and surface water monitoring programs and studies as necessary through attendance at meetings, cost-sharing, and in-kind services.

***Objective 3-B. Protect sensitive or unique natural features.***

**Action 17. Encourage and promote natural features/resources inventories.**

Communities, especially those within the rural fringe, will consider, encourage, conduct or review local and county natural features inventories and assessments to assess areas of priority for preservation and/or restoration. As parcels of land are identified for preservation or protection, methods of securing protection will be explored. Communities should work with area land trusts and conservancies to identify key areas and work toward funding for purchase of easements or property. Communities should also investigate opportunities for Purchase of Development Rights (PDR) programs offered by the state.

***Objective 3-C. Protect and increase native species.***

Action 18. Encourage restoration and rehabilitation projects using native species and invasive species removal/control.

Where possible, participants will promote removal of invasive species and planting of native species. These projects can be promoted in numerous ways, such as community newsletters, citizen guidebooks, local cable TV, public radio broadcasts, on the Kalamazoo River watershed webpage ([www.kalamazooriver.net](http://www.kalamazooriver.net), [www.kalamazooriver.net/Corridor3](http://www.kalamazooriver.net/Corridor3)), and through the placement of educational displays at public places such as libraries and city/township halls and events.

**Goal 4. Promote and encourage passive outdoor recreational opportunities with suitable public access.**

***Objective 4-A. Support efforts to establish recreational areas.***

Action 19. Identify existing and potential public recreational areas in the M3C watershed and participate in regional public pedestrian and river trailway planning.

Communities should use existing sources (community/USGS/GIS-based maps) to identify and locate existing and potential public recreational areas in the M3C watershed. If not developed individually by local jurisdictions, pedestrian and river trailway planning is done at a county wide level (Kalamazoo Area Transportation Study, Kalamazoo Parks Department and Friends of the Kalamazoo River Trailway), warranted by the project scale and inter-jurisdictional nature.

**Goal 5. Support the formation of a community-based mechanism to implement and sustain the Mainstem 3 Corridor Watershed Management Plan.**

***Objective 5-A. Continue to participate as a M3C Steering Committee Member.***

Action 20. Participate in SWWG meetings and other water resources-related meetings.

The Kalamazoo River and its tributaries flow through many communities on their way to Lake Michigan. Promoting information sharing and collaborative efforts between these diverse communities via the watershed groups could reap both economic and ecological benefits. Individual subwatershed groups should keep informed of the activities of the other subwatershed groups via Kalamazoo Watershed organizations, which can serve as liaison for sharing information and resources for the implementation of the M3C WMP.

**4.4 Commitments and Dates – For Each Permittee to Implement the Actions**

Steering Committee Members expressed commitments to the Actions listed in Section 4.3 by completing columns in Table 6. Individual Steering Committee Members, representing their

respective community's ongoing programs, abilities and budgetary limitations, expressed the following categorical Commitments to Actions based on the current budget and staffing levels:

- O = Ongoing/current
- S = Short-term within 5 years; within current permit cycle
- L = Long-term after 5 years; spanning more than one permit cycle
- WL = Wish list
- CS = County standards applied
- NA = Not applicable

Using the Commitment categories, each community was able to express their interpretation of individual actions and whether or not they were considered to be short or long-term. Commitments to Actions will be important for permittees to use as a guide and reference for developing or updating their SWPPIs for the M3C. Permittees must interact with the MDEQ to ensure that information assembled in the WMP is used in the SWPPIs and amended as appropriate in future document revisions determined by the permit requirements and/or participant and MDEQ agreement.

MDEQ guidance describes Commitments to Actions as follows (MDEQ, 2005):

*Commitments in the WMP are broad. A commitment to implement a specific action does not need to include details in the WMP other than a general timeframe for implementation. If more details are needed to implement the action, they can be included in the SWPPI.*

*There is no limit to the number of activities that may be added to the WMP wish list, as long as the WMP also includes a reasonable number of activities with commitments to accomplish the goals and measurable objectives.*

*If it's determined during SWPPI development that the permittee can't meet a commitment made in the WMP, changes can be made and identified in the submitted SWPPI. The permittee will need to provide adequate justification to the MDEQ for dropping a commitment or replacing an activity to accomplish the goal or measurable objective listed in the WMP.*

*The WMP must be reviewed and revised (if necessary) according to the date specified in the COC. Procedures for revising the WMP shall be identified in the WMP. Example reasons to revise the WMP may include, but are not limited to:*

- *If only short-term objectives were identified*
- *If additional watershed concerns are discovered*
- *If different objectives are needed*
- *If evaluation of the WMP shows that modifications are needed to achieve goals and objectives*

#### 4.5 Assessment of Costs and Benefits of Actions

Generalized costs and benefits were drafted, discussed, updated and included in Table 5. Cost ranges were generally described, where appropriate, as minimal to high cost. Definitive cost ranges were estimated by the project team and adjusted based on Steering Committee feedback for certain Actions (e.g., streambank rehabilitation per foot). Steering Committee Members were asked to consider available costs and benefits in order to make realistic commitments to Actions.

#### 4.6 Methods of Evaluating Progress

Methods of evaluating Progress refer to tracking watershed scale indicators expected to improve over time as Actions taken by all participants improve water quality. MDEQ guidance states that methods for evaluation of progress may include chemical or biological indicators, flow measurements, erosion indices, and public surveys.

The following actions (also listed in Table 6) are examples of ways to document ongoing individual efforts:

- Inventory stormwater assets, BMPs and maintenance programs (action 5 and 6).
- Inventory and stabilize eroding streambanks where appropriate (action 8).
- Natural features/resources inventories (action 17).

Additional Evaluation Methods for individual Actions may be developed and used by permittees as long as they are documented and justified in the SWPPI. Additional evaluation methods can be added to the WMP in subsequent revisions.

Sources of ongoing monitoring data were reviewed in preparing the WMP including:

- Kalamazoo County Surface Water Quality Monitoring Program
- MDEQ 303(d) and 305(b) lists and associated rotational monitoring of Michigan Watersheds

Additional or future sources of information include:

- Monitoring efforts associated with the TMDL involving the TMDL Leadership Committee, currently fostered by grant-supported efforts of Michigan State University Extension.
- Monitoring efforts associated with a Targeted Watershed Grant involving the Gun Lake Tribe.
- Ongoing USGS flow monitoring at gauging stations.

The M3C Steering Committee is not currently in a position to generate and develop support mechanisms for a new and unique monitoring program. However, participants expressed interest in further exploring existing programs and data sources in order to identify programs they could support in order to evaluate progress.

Minimally, M3C Steering Committee members will update and refine available data with each WMP update or revision using standard sources including:

- Kalamazoo County Surface Water Quality Monitoring Program: Kalamazoo County monitors E. coli as well as water temperature, dissolved oxygen, pH, conductivity and turbidity.
- MDEQ 303 and 305 lists and associated rotational monitoring of Michigan Watersheds
- Ongoing USGS flow monitoring at gauging stations
- TMDL monitoring programs: MDEQ monitors several parameters (total phosphorus, chlorophyll a, dissolved oxygen and water clarity, carp percentage) during the TMDL season (April to September).

The Portage and Arcadia Creeks Steering Committee conducted a similar exercise during the course of their WMP planning process to better understand and prioritize ways to track progress during the implementation of the WMP. Outcomes can be reviewed in Appendix B. These may be considered by the Steering Committee through the PP process.

## Chapter 5 - The Public Participation Process

The M3C Steering Committee shared announcements of M3C WMP development with the larger SWWG and with Stakeholders identified in the PPP during the planning process. The SC chairperson requested that SC members announce the project website resource to stakeholders and invite participation and feedback.

The Steering Committee discussed the timing of public rollout/feedback meetings and decided that public meetings would follow submission of the WMP by the December 31, 2005 deadline.

From its inception, the development of WMP sections were made publicly available at the website [www.kalamazooriver.net/Corridor3](http://www.kalamazooriver.net/Corridor3) as they were developed. Steering Committee members were informed of website and document updates that could be shared with Stakeholders identified in the PPP.

The Steering Committee identified the following schedule for the outreach, compilation of feedback and additions/revisions to the WMP:

- The Steering Committee assembled a schedule for conducting public outreach (e.g., public meetings) following the December 31, 2005 submittal.
- Meetings will be conducted and feedback will be compiled:
  - A public meeting was held on October 26, 2006.
  - There was no public comment.
- The Steering Committee will decide how to maintain the project website and how to use visits to the website by the public.

## **Chapter 6 – Next Steps**

During the Kalamazoo River Mainstem 3 Corridor (M3C) Watershed Management Planning (WMP) Process, the Steering Committee (SC) decided to finalize “operational guidelines” that will formalize future M3C SC interactions. Operational Guidelines will establish M3C SC procedures for arranging meetings, voting and providing the leadership necessary for the group to maintain the WMP and perform future WMP update and revisions.

The next steps for the M3C SC generally include the following steps that will be detailed after the December 31, 2005 WMP submission:

- Continue reporting M3C activities to the larger Storm Water Work Group.
- Update the WMP following public rollout and feedback period.
- Maintain the website and consider using it as a tracking device.
- Consider cooperation and partnering with existing watershed groups and/or inviting additional Commitments to Actions from other watershed organizations.
- Consider updates of the WMP to make it CMI and 319 approvable.
- Implement the use of quantification protocols with new BMPs and report progress in annual reports, in SWPPIs and to the TMDL Implementation Committee.

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<http://www.theforum.org/>

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[www.kalamazooriver.net/Corridor3](http://www.kalamazooriver.net/Corridor3)

[www.kalamazooriver.net/pa319new](http://www.kalamazooriver.net/pa319new)

# **Kalamazoo River Mainstem 3 Corridor Watershed Management Plan**

## **Tables**

**Table 1. Kalamazoo River Mainstem 3 Corridor  
Land Cover Areas by Subwatershed**

Subwatershed HUC Code	Land Cover Type (acres)							Total (acres)
	Water/Wetland	Forest/Open	Agriculture	Residential	Commercial	Transportation	Barren/Urban Open	
<b>17 52</b>	2,227	12,362	4,036	323	117	355	117	<b>19,537</b>
<b>17 53</b>	1,514	6,485	5,901	548	207	468	121	<b>15,243</b>
<b>17 63</b>	224	1,311	429	795	541	273	245	<b>3,817</b>
<b>17 55</b>	149	1,109	966	231	83	149	120	<b>2,807</b>
<b>17 56</b>	259	2,820	3,556	1,014	579	655	412	<b>9,294</b>
<b>17 65</b>	594	6,920	3,172	2,461	967	821	411	<b>15,346</b>

**Table 2. Population 2000 Census**

Battle Creek	53,364
Bedford twp	9,517
Charleston twp	1,781
Comstock twp	13,851
Cooper twp	8,754
Galesburg City	1,988
Kalamazoo twp	21,675
Kalamazoo City	77,145
Oshtemo twp	17,003
Parchment City	1,936
Pavilion twp	5,829
Portage City	44,897
Richland twp	893
Ross twp	4,148

**Table 3. Imperviousness in Kalamazoo River Mainstem 3 Corridor Subwatersheds**

<b>Subwatershed ID</b>	<b>Area (square meters)</b>	<b>Mean Percentage Imperviousness</b>	<b>Standard Deviation of Imperviousness</b>
17 52	79,207,700	3.1	11.8
17 53	61,829,300	4.0	13.1
17 63	15,355,200	34.2	29.6
17 55	11,354,900	13.1	23.6
17 56	37,735,500	19.6	29.1
17 65	62,185,200	21.1	25.8

**Table 4. Soils within the Kalamazoo River Mainstem 3 Corridor Watershed**

<b>MUID</b>	<b>Name</b>	<b>Texture</b>	<b>Soil group</b>	<b>Class</b>
MI045	OSHTEMO-KALAMAZOO-HOUGHTON (MI045)	L/CL/S/SR	A	Haplic Glossudalfs, fine loamy, mixed
MI046	OAKVILLE-COVERT-ADRIAN (MI046)	FS/S	A	Haplic Glossudalfs, fine, mixed, messic
MI047	SCHOOLCRAFT-KALAMAZOO-ELSTON (MI047)	L/CL	A	Typic hapludalfs, loamy-skeletal, mixed

Texture codes:

L, loam - S, sand - FS, fine sand - SR, stratified

**Table 5a. Kalamazoo River Mainstem 3 Corridor  
Annual Phosphorus Load (pounds) by Subwatershed**

Subwatershed HUC Code	Land Cover Type (acres)							Total (lb/yr)
	Water/Wetland	Forest/Open	Agriculture	Residential	Commercial	Transportation	Barren/Urban Open	
<b>17 52</b>	673	752	826	210	133	527	7	<b>3,128</b>
<b>17 53</b>	458	394	1,207	356	236	696	7	<b>3,354</b>
<b>17 63</b>	68	80	88	516	617	406	15	<b>1,789</b>
<b>17 55</b>	45	67	198	150	95	221	7	<b>783</b>
<b>17 56</b>	78	172	727	658	661	974	25	<b>3,294</b>
<b>17 65</b>	180	421	649	1,598	1,103	1,220	25	<b>5,196</b>

**Table 5b. Kalamazoo River Mainstem 3 Corridor  
Pollutants and pollutant sources**

<b>Pollutants</b>	<b>Pollutant sources</b>	<b>Causes</b>
<b>Oil, grease, metals (mercury)</b>	Storm water run-off, atmospheric deposition	Vehicular tires, fuels, lubricants, chemicals washed off roads, brownfield sites, coal-fired power plant emissions
<b>Hydrocarbons</b>	Storm water run-off, groundwater	Vehicular tires, fuels, lubricants, chemicals washed off roads, brownfield sites, underground storage tank leaks.
<b>Nutrients</b>	Fertilizers, organic compounds, septic systems	Fertilizer overuse, improper use, leaching in runoff, improper disposal
<b>Sediments</b>	Storm water run-off, erosion	Storm water transport, flooding & erosion due to lack of or inadequate buffers, streambank erosion, runoff from roads and bare earth (e.g. construction sites).
<b>Bacteria</b>	Fecal materials, refuse, illegal dumping	Illicit discharges, waterfowl, pets, littering
<b>PCBs</b>	streambank erosion, groundwater contamination	Historical wastewater discharges and landfill waste from paper mills

**Table 6. Action Matrix**

Actions	Goals & Objectives Addressed	Pollutants Addressed	Uses Addressed	Estimated Cost	Evaluation Method Examples
<b>Action 1. Continue implementation of the MS4 Public Education Plan and Public Participation Plan.</b>	1-A	All	Water supply; recreation; fisheries, aquatic life and wildlife; navigation	Costs vary depending on type of activity.	Number of events; number of participants; pre-/post- results can be used to evaluate learning.
<b>Action 2. Promote periodic surface water cleanups and water quality/habitat improvement projects.</b>	1-B	All	Water supply; recreation; fisheries, aquatic life and wildlife; navigation	Costs vary depending on type of activity. Costs can be minimal if conducted by volunteers.	Number of promotional items distributed; volume of trash removed; number of volunteers; number of habitat improvements installed.
<b>Action 3. Evaluate, develop or improve stormwater management and natural features setback ordinances, regulations or policies.</b>	2-A	All	Water supply; recreation; fisheries, aquatic life and wildlife; navigation	Using existing templates tailor to individual community needs. \$2,000 to \$12,000 depending on level of details.	Updated or completed ordinances, regulations, policies.
<b>Action 4. Support or improve soil erosion prevention programs.</b>	2-A	Hydrology Sediment	Water supply; recreation; fisheries, aquatic life and wildlife; navigation	\$2,000 to \$10,000 cost to review/update/prepare ordinance/ programs.	Counties and communities implementing support programs.
<b>Action 5. Develop and maintain stormwater asset inventory programs.</b>	2-B	All	Water supply; recreation; fisheries, aquatic life and wildlife	Variable cost.	Completed inventory; GIS mapping.
<b>Action 6. Maintain BMPs and maintenance programs.</b>	2-B	Hydrology Sediment Nutrients	Recreation; fisheries, aquatic life and wildlife; navigation	Variable cost.	Completed inventory.
<b>Action 7. Document, promote and maintain a spill response program.</b>	2-B	All	Recreation; fisheries, aquatic life and wildlife; navigation	Variable cost.	Program documentation; related response activities.
<b>Action 8. Inventory and stabilize eroding streambanks where appropriate.</b>	2-B	Hydrology Sediment Nutrients	Recreation; fisheries, aquatic life and wildlife; navigation	Bioengineering costs range from \$20 to \$120 per lineal foot. Additional stream surveys at \$3,000 per stream mile.	Document lineal footage of streambank stabilized.
<b>Action 9. Promote and educate for the implementation of BMPs by landowners, contractors and municipalities.</b>	2-B	All	Recreation; fisheries, aquatic life and wildlife; navigation	Variable cost. In-kind.	Distribution of materials; site inspection visits; programs presented; number of attendees.
<b>Action 10. Support farmland preservation and encourage agricultural BMPs.</b>	2-B	All, Phosphorus	Recreation; fisheries, aquatic life and wildlife; navigation	Variable cost.	Participation in TMDL; number of referrals to MSUE, Conservation Districts or other agricultural organizations.
<b>Action 11. Support/encourage riparian buffers and no mow zones encouraging native species.</b>	2-B	Hydrology Sediment Nutrients	Recreation; fisheries, aquatic life and wildlife; navigation	May be incorporated into landscape or stormwater ordinance. Costs may include mailings to riparian land owners (\$500 to \$1,000), workshops etc.	Community implements BMP guidelines into site plan review process and other areas as feasible; number of activities; monitoring of riparian areas.
<b>Action 12. Implement BMPs during reconstruction or maintenance activities at road/stream crossings.</b>	2-B	Hydrology Sediment Nutrients	Recreation; fisheries, aquatic life and wildlife; navigation	Bioengineering costs range from \$20 to \$120 per lineal foot. Road crossings may require structural improvements at higher costs.	Road crossings ranked through existing surveys.
<b>Action 13. Inspect and correct, as needed, storm sewer and culvert locations for blockage, erosion, and failures.</b>	2-B	Hydrology Sediment Nutrients	Water supply; recreation; fisheries, aquatic life and wildlife	Community staff at \$60/hour; equipment costs range from \$80 to \$150/hour	Number of sites restored, monitoring results.

**Table 6. Action Matrix**

Actions	Goals & Objectives Addressed	Pollutants Addressed	Uses Addressed	Estimated Cost	Evaluation Method Examples
<b>Action 14. Implement IDEP.</b>	2-C	All	Water supply; recreation; fisheries, aquatic life and wildlife	Correction varies dramatically depending on nature of problem. Communities should coordinate efforts with counties and /or may wish to contract with counties.	Number of site reviews and dry weather screenings; number of illicit discharges removed.
<b>Action 15. Develop/maintain/enforce wellhead protection plans and other groundwater protection programs.</b>	3-A	Hydrology Nutrients Bacteria	Water supply	Variable cost.	Compliance with protection programs.
<b>Action 16. Support cooperative hydrologic groundwater monitoring programs and studies (e.g., USGS).</b>	3-A	Hydrology Nutrients Bacteria	Water supply	Cost associated with supporting current groundwater programs by providing comment/input.	Communities pass resolution and/or incorporate support for groundwater programs into local plans.
<b>Action 17. Encourage and promote natural features/resources inventories.</b>	3-B	Hydrology Sediment Nutrients	Water supply; recreation; fisheries, aquatic life and wildlife; navigation	\$15,000-\$50,000 per community depending on size and whether field surveys are utilized.	Acreage inventoried.
<b>Action 18. Encourage restoration and rehabilitation projects using native species and invasive species removals/control</b>	3-C	Hydrology Sediment Nutrients	Recreation; fisheries, aquatic life and wildlife	Vary depending on type and size of project. Costs may be incorporated into the streambank stabilization activities.	Sites are identified and prioritized; number of sites restored; monitoring results.
<b>Action 19. Identify existing and potential public recreational areas in the M3C watershed and participate in regional public pedestrian and river trailway planning.</b>	4-A	All	Recreation; fisheries, aquatic life and wildlife	Cost associated with time to identify parcels and incorporate on overall subshed map (\$10,000-\$20,000); property acquisition costs.	Communities/counties incorporate into local plans; funding opportunities identified and procured for property acquisition.
<b>Action 20. Participate in SWWG meetings and other water resources-related meetings.</b>	5-A	All	Water supply; recreation; fisheries, aquatic life and wildlife; navigation	Minimal. Costs can be shared by participating entities.	Documentation of efforts.

\* The term "evaluate" means to look at options.

"All" means Hydrology, Nutrients (including phosphorus), Heavy Metals, Oil & Grease, and Bacteria.

**Table 7. Summary of Ongoing and Proposed Actions**

Key:

O = Ongoing / current, S = Short-term within 5 years; within current permit, L = Planned after 5 years; spanning more than one permit cycle, WL = Wish list, CS = County standards applied, NA = Not applicable

Action	Comstock Township	Cooper Township	City of Galesburg	City of Kalamazoo	Oshtemo Township	City of Parchment	Pavillion Township	City of Portage	Kalamazoo County	Kalamazoo County Drain Commissioner	Kalamazoo County Road Commission
Action 1. Continue implementation of the MS4 Public Education Plan and Public Participation Plan.	O	O	WL	O	O	O	O	O	O	O	O
Action 2. Promote periodic surface water cleanups and water quality/habitat improvement projects.	O	L	WL	O	NA	WL	S	O	S	WL	WL
Action 3. Evaluate, develop or improve stormwater management and natural features setback ordinances, regulations or policies.	O	L	O	L	O	O	S	O	S	NA	S
Action 4. Support or improve soil erosion prevention programs.	CS	CS	CS	O	CS	CS	CS	O	O	NA	O
Action 5. Develop and maintain stormwater asset inventory programs.	NA	NA	O	O	L	L	NA	L	WL	L	O
Action 6. Maintain BMPs and maintenance programs.	S	L	O	L	L	O	NA	WL	L	O	O
Action 7. Document, promote and maintain a spill response program.	O	O	O	S	O	O	O	O	S	O	S
Action 8. Inventory and stabilize eroding streambanks where appropriate.	WL	WL	WL	WL	NA	O	WL	WL	S	WL	WL
Action 9. Promote and educate for the implementation of BMPs by landowners, contractors and municipalities.	O	O	O	L	O	O	O	NA	NA	O	O
Action 10. Support farmland preservation and encourage agricultural BMPs.	L	L	NA	O	WL	NA	O	NA	NA	NA	NA
Action 11. Support/encourage riparian buffers and no mow zones encouraging native species.	O	L	WL	L	WL	WL	O	WL	NA	WL	WL
Action 12. Implement BMPs during reconstruction or maintenance activities at road/stream crossings.	NA	NA	NA	WL	NA	NA	NA	NA	NA	WL	O
Action 13. Inspect and correct, as needed, storm sewer and culvert locations for blockage, erosion, and failures.	NA	NA	O	WL	NA	O	NA	S	O	O	O
Action 14. Implement IDEP.	O	O	O	O	O	O	O	O	O	O	O
Action 15. Develop/maintain/enforce wellhead protection plans and other groundwater protection programs.	CS	NA	WL	O	O	O	NA	O	O	NA	NA
Action 16. Support cooperative hydrologic groundwater monitoring programs and studies (e.g., USGS).	O	L	WL	O	L	O	L	O	S	O	L

**Table 7. Summary of Ongoing and Proposed Actions**

**Key:**

O = Ongoing / current, S = Short-term within 5 years; within current permit, L = Planned after 5 years; spanning more than one permit cycle, WL = Wish list, CS = County standards applied, NA = Not applicable

Action	Comstock Township	Cooper Township	City of Galesburg	City of Kalamazoo	Oshtemo Township	City of Parchment	Pavilion Township	City of Portage	Kalamazoo County	Kalamazoo County Drain Commissioner	Kalamazoo County Road Commission
Action 17. Encourage and promote natural features/resources inventories.	WL	WL	WL	WL	WL	NA	O	L	L	NA	NA
Action 18. Encourage restoration and rehabilitation projects using native species and invasive species removals/control	WL	WL	WL	O	WL	O	O	O	L	WL	WL
Action 19. Identify existing and potential public recreational areas in the M3C watershed and participate in regional public pedestrian and river trailway planning.	WL	WL	WL	O	WL	WL	WL	WL	O	NA	O
Action 20. Participate in SWWG meetings and other water resources-related meetings.	O	O	O	O	O	O	O	O	O	O	O

\* The term "evaluate" means to look at options.

# **Kalamazoo River Mainstem 3 Corridor Watershed Management Plan**

## **Figures**

**Figure 1. Kalamazoo River Mainstem 3 Corridor Watershed**



**Figure 2a. Kalamazoo River Mainstem 3 Corridor Watershed and Subwatersheds**

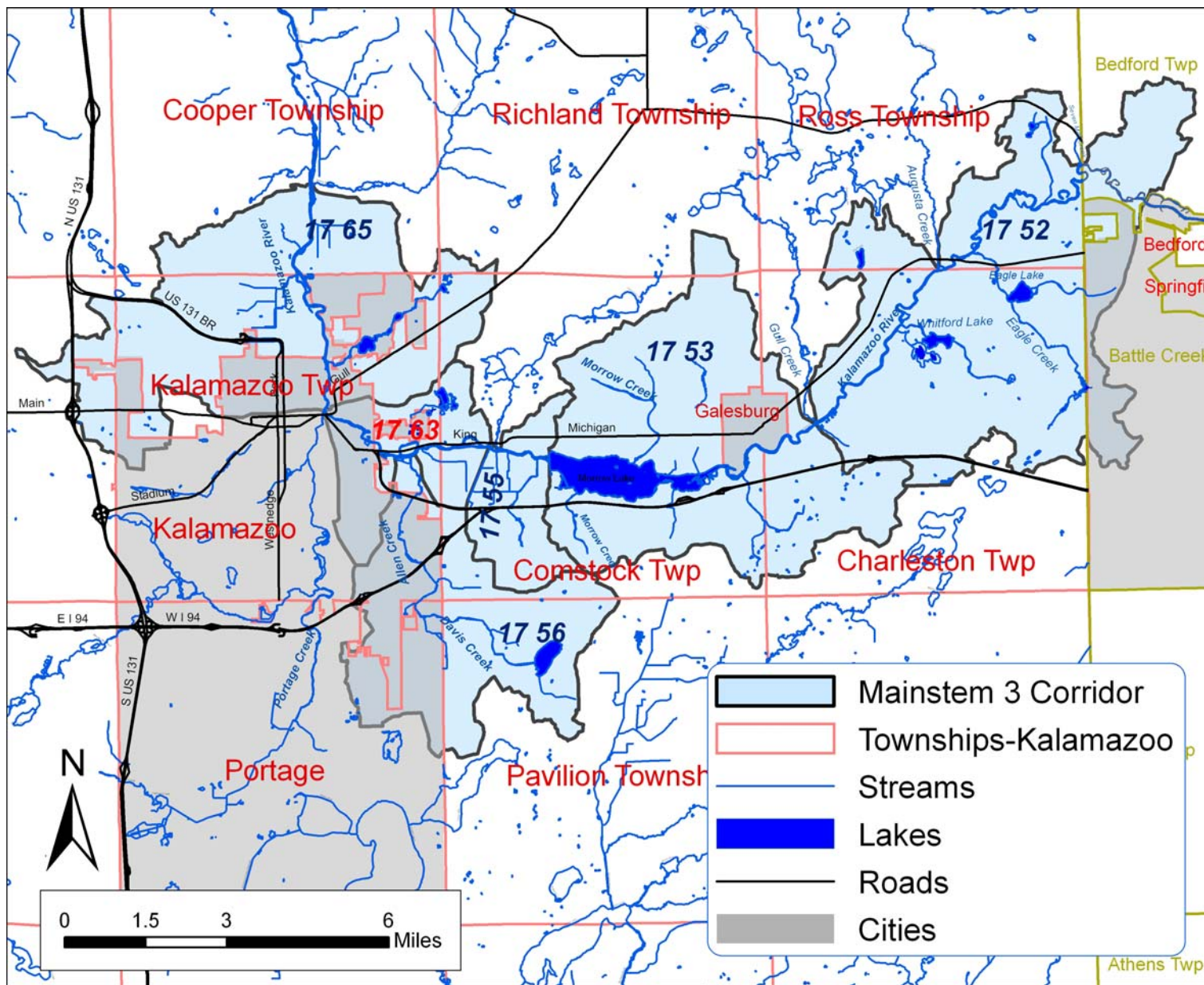
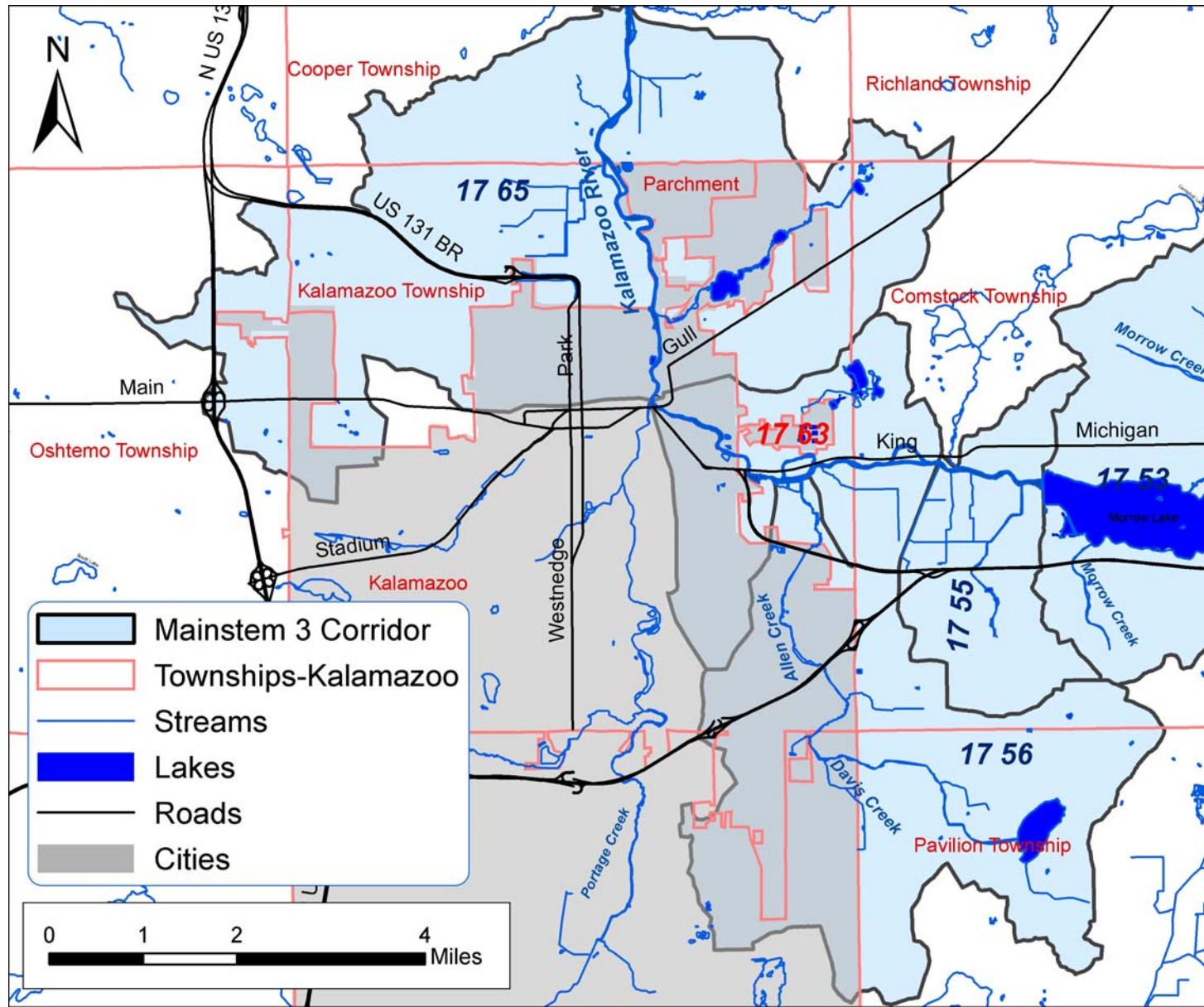
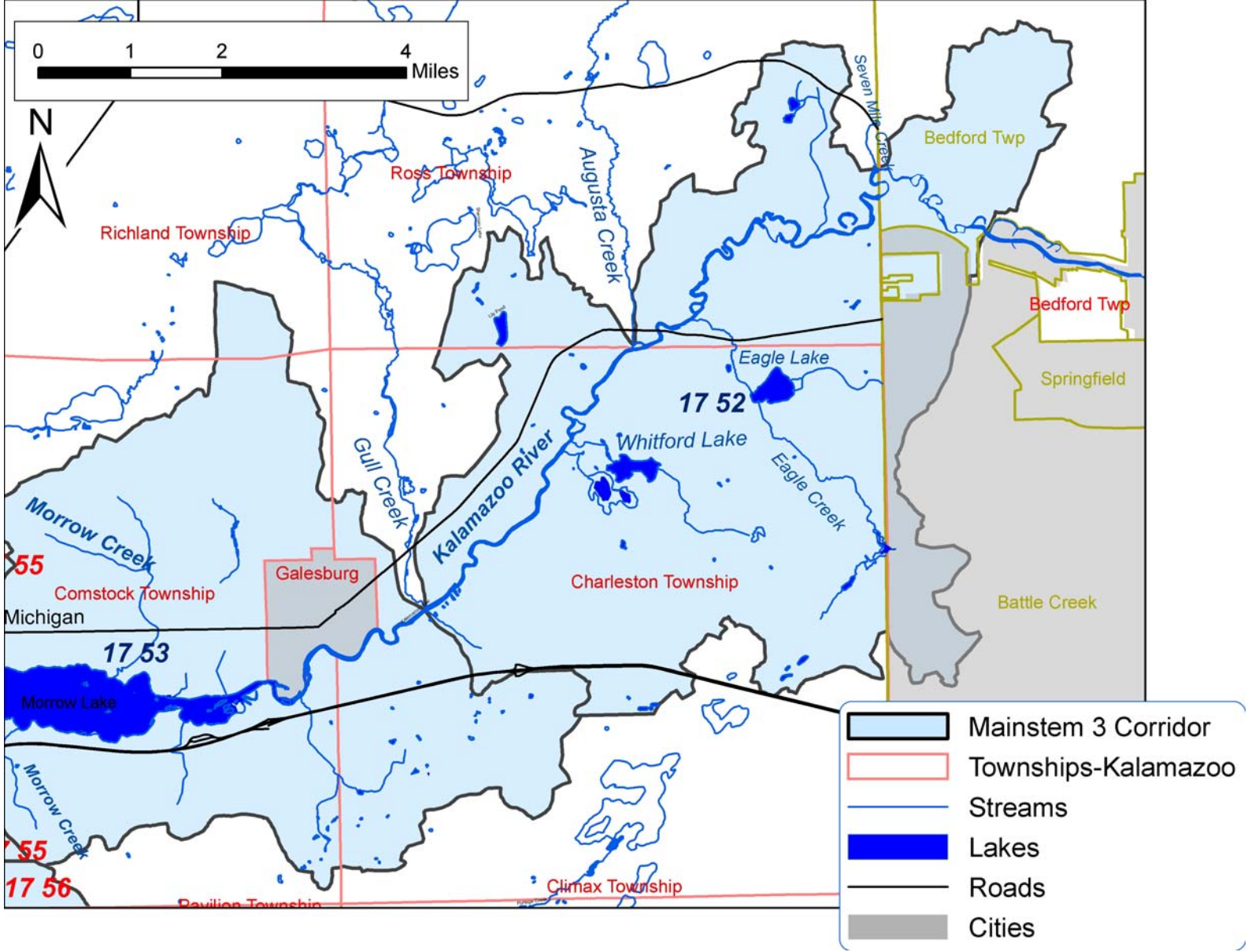


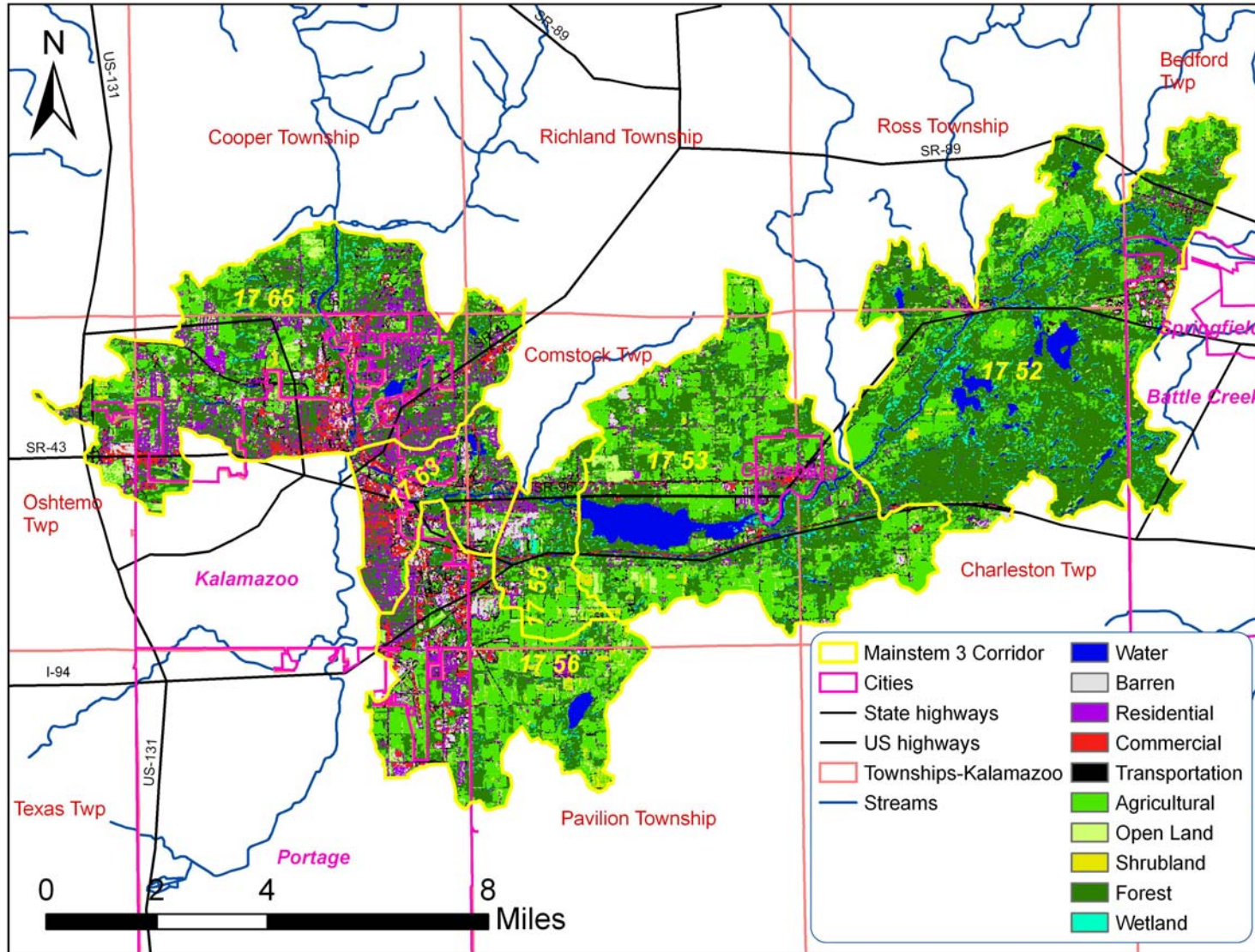
Figure 2b. Kalamazoo River Mainstem 3 Corridor Watershed – Western Sections



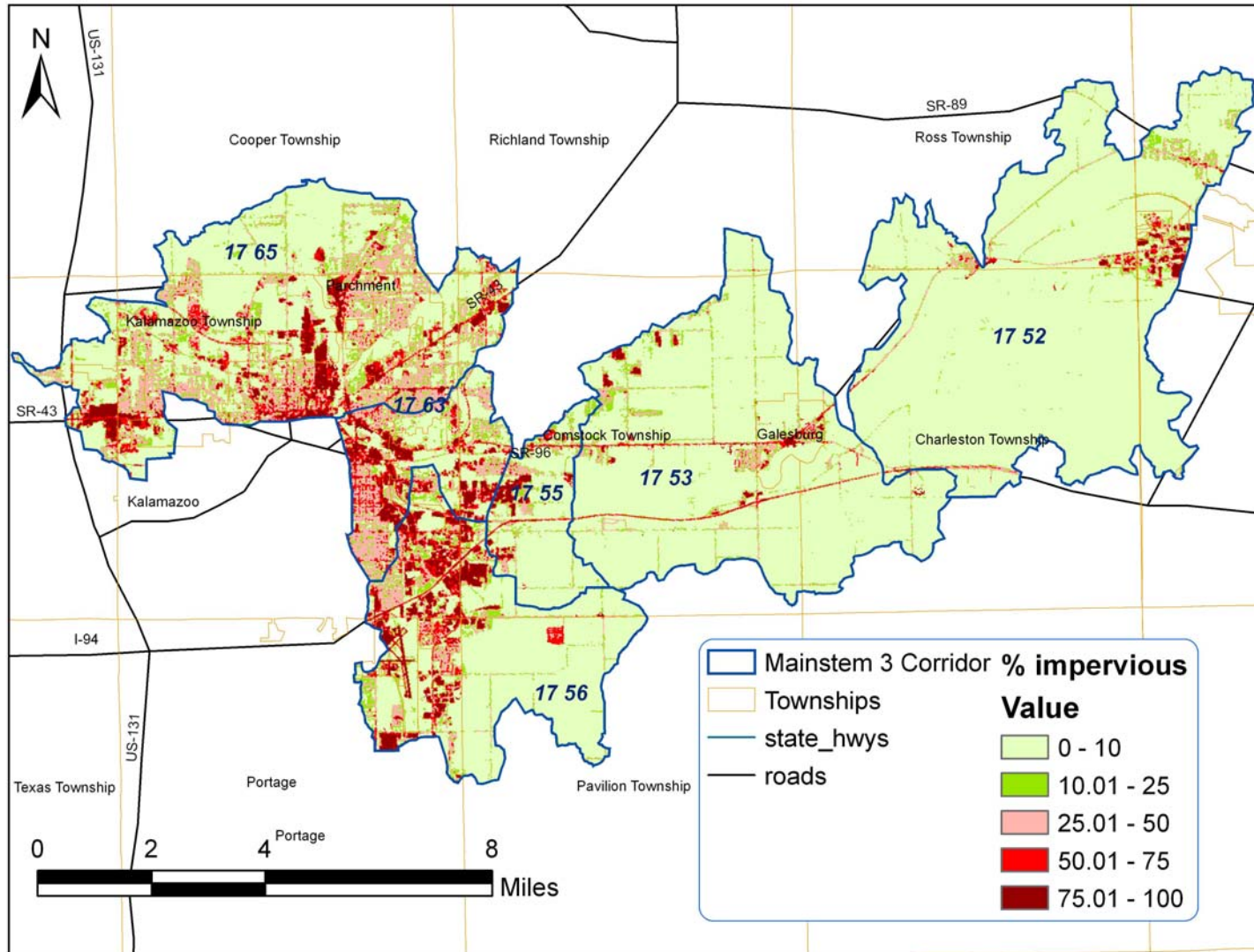
**Figure 2c. Kalamazoo River Mainstem 3 Corridor Watershed – Eastern Sections**



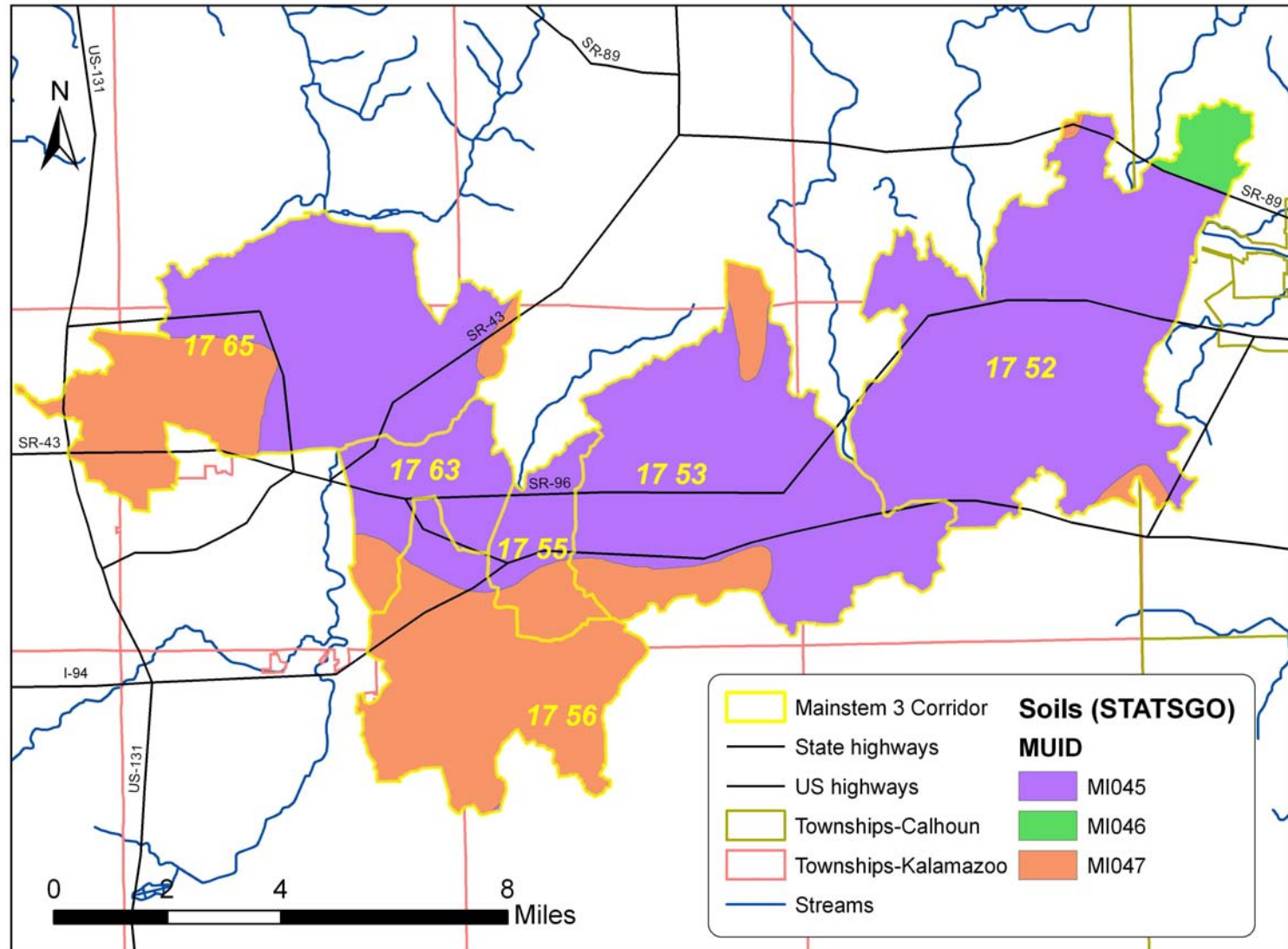
**Figure 3. Kalamazoo River Mainstem 3 Corridor Land Use/Land Cover**



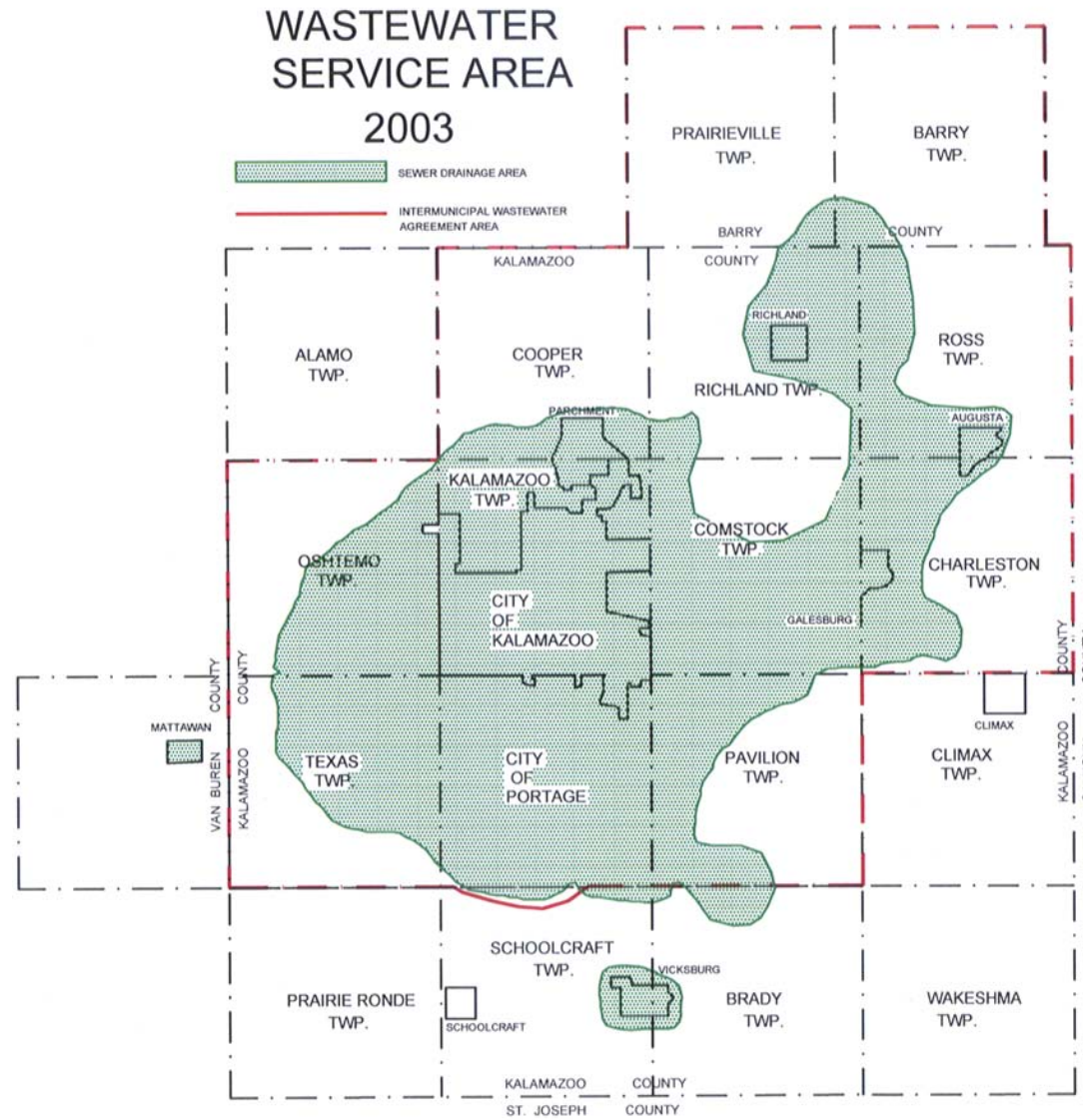
**Figure 4. Kalamazoo River Mainstem 3 Corridor Imperviousness**



**Figure 5. Kalamazoo River Mainstem 3 Corridor Soils**



**Figure 6. Kalamazoo River Mainstem 3 Corridor City of Kalamazoo Wastewater Service Area**



# **Kalamazoo River Mainstem 3 Corridor Watershed Management Plan**

## **Appendix A - Analysis Methodology**

## **Appendix A – Analysis Methodology**

### ***General Project GIS Methodology***

The landuse information used in the proposal was derived directly from Kalamazoo River watershed non-point source modeling report produced by K&A in 2001. These data were based on 1997 satellite imagery. K&A has also downloaded the latest available landuse (2001 IFMAP Lower Peninsula Land Cover) for mapping purposes from the Michigan Center for Geographic Information (MCGI at <http://www.mcgi.state.mi.us/mgdl/>), representing the most comprehensive, compiled version of land use data available for the area.

The subwatershed delineation for Corridor 3 Main Stem was based on State of Michigan's delineation (1997) except for subwatershed No. 1765 excluding Arcadia Creek. For the Portage-Arcadia Creek 319 project, Kieser & Associates in 2002 delineated the Arcadia Creek drainage, which is located mostly near or within the City of Kalamazoo, by taking into consideration both of the elevation and stormwater drain information. As such, this delineation truly reflects the direction of the water flow in the drainage and is more accurate than State of Michigan's elevation-based delineation, which is not field-checked. The exclusion of the Arcadia Creek portion of subwatershed No. 1765 was then done by clipping out the Arcadia Creek drainage delineated by Kieser & Associates.

### ***Additional Data Layers Methodology***

Base map layers (e.g. county and township boundaries, transportation and hydrography networks) were downloaded from the Michigan Center for Geographic Information. These were used to produce a variety of maps to spatially reference the Kalamazoo River Mainstem 3 Corridor watershed within its broader political and geographical context. The following data layers were clipped to the watershed boundaries and used to provide additional information to project participants:

- National Land Cover Dataset 2001-Impervious Surface layer - downloaded from the USGS Eros Data Center (<http://seamless.usgs.gov/>).
- Soil data from the State Soil Geographic (STATSGO) database, downloaded from MCGI.

Demographic data, from the 2000 U.S. Census (<http://www.census.gov/main/www/cen2000.html>), was compiled for every township and city within the watershed boundaries.

### ***Stormwater Pollutant Loading Methodology***

Using the identified land cover types and areas from the satellite data and geographic information system (GIS) software, common pollutant load estimation techniques were applied to each subshed to determine annual phosphorus pollutant loads from each area. The loading estimation technique is based on that used by the State of Michigan Draft Part 30-Water Quality Trading Rules (MDEQ, 2002).

Pollutant loads of total phosphorus from stormwater runoff were calculated for each Mainstem 3 Corridor Subshed using the Event Mean Concentration (EMC) method. As a note, EMCs are estimated concentrations of non-point source pollution determined by the U.S. Environmental Protection Agency (USEPA) Nationwide Urban Runoff Program (NURP). While these EMC values do not correspond to water quality criteria, they do represent average pollutant concentrations observed in areas of similar land cover during wet weather events. With this method, stormwater pollutant loads are also based on pollutant loading factors that vary by land use type and percent imperviousness (MDEQ, 2002). Loads can be computed using Equations 1 and 2 as follows.

$$M_L = EMC_L * R_L * K \quad \text{Eq. 1}$$

Where:

- $M_L$  = Loading factor from land use L (pounds/acre/year)
- $EMC_L$  = Event mean concentration of runoff from land use L (mg/L)
- $R_L$  = Total average annual surface runoff from land use L computed from Eq. 2
- $K$  = Unit conversion factor of 0.2266

Runoff Equation:

$$R_L = [ C_P + ( C_I - C_P ) DCIA_f * IMP_L ] * A_L * I \quad \text{Eq. 2}$$

Where:

- $R_L$  = Total average annual surface runoff from land use L (acre-inches/year)
- $C_P$  = Pervious area runoff coefficient (0.20)
- $C_I$  = Impervious area runoff coefficient (0.95)
- $DCIA_f$  = Fraction of impervious area that is directly contributing (0.50)
- $IMP_L$  = Fractional imperviousness of land use L
- $A_L$  = Area of land use L (acre)
- $I$  = Long term average annual precipitation (inches/year)

Equation 1 shows that the loading factor ( $M_L$ ) for land use  $L$  is the product of the event mean concentration for land use  $L$ , the annual runoff for land use  $L$ , and a unit conversion factor. The runoff calculation in Equation 2 provides the  $R_L$  value used in Equation 1 through the product of the annual rainfall depth [34.83 inches for the Kalamazoo area from Michigan State University climatology data (MSU, 2004)] and the percent imperviousness of land use  $L$ , with the tuning coefficients  $C_P$  and  $C_I$ . The loading factor,  $M_L$ , is multiplied by the area of land use  $L$  to obtain a total annual loading for that land use. Loads for each land use within the subsheds were then totaled.

**Kalamazoo River Mainstem 3 Corridor  
Watershed Management Plan**

**Appendix B – Example of Steering Committee Derived Ways  
to Measure Progress, from the Portage & Arcadia Creeks  
Watershed Management Plan**

**Portage and Arcadia Creeks Watershed Transition/Implementation  
Project Tracking Code: 2003-0028**

**Options for Developing Milestones and Tracking Progress**

**Milestones for Assessing Progress**

The Portage & Arcadia Creeks Watershed Management Plan defines specific BMPs for all stream stretches to protect or improve water quality. Watershed-wide objectives in the list below were presented to the Steering Committee. Priority milestones were selected with accompanying values and timelines. The prioritized milestones are listed in the Watershed Management Plan update text. Example milestones considered by the Steering Committee are listed below. These were separated into distinct categories. Kieser & Associates assessed the quantitative aspects of prioritized milestones in relation to existing or assumed levels necessary to achieve improvements where possible. Bold items were prioritized.

<b>Milestone</b>	<b>Quantity</b>	<b>How is it Measured?</b>	<b>Who Can Measure It?</b>
<b>Structural/Vegetative BMPs/Source Reduction</b>			
<b>Phosphorus reduction</b>	Pounds as related to TMDL (43% reduction of 2002 baseline load)	Grab samples upstream and downstream of BMP, mouth of creeks with Auto-sampler	Entity with ISCO and/or flow meter
		Estimations based on BMP efficiency, Modeling, published BMP efficiencies, lateral recession rate (streambanks)	Entity with GIS capabilities or training of lateral recession rate
<b>Sediment reduction</b>	Tons, sediment reduction which comes from BMPs targeting 43% TP reduction	Same as above	Same as above
Improvement of other in-stream parameters (flashiness, temperature)	Reduce average temperature by 2 degrees C in certain reaches, reduce temperature spikes by 10%, reduce peak flow spikes by 10%	Gauging Station, monitoring equipment, would require pre-implementation temperature monitoring, can use existing ISCO data for pre-implementation flow monitoring	Entity with ISCO and/or flow meter
In-stream goals using the Index of Biological Indicators	Increase in IBI score	Rapid Bioassessment Protocol, Macroinvertebrate collection with kick nets or rock baskets	Volunteers, MI Dept. of Environmental Quality

Portage and Arcadia Creeks EXAMPLE

Floodplain (new available flood storage, upland infiltration)	Acre-feet of runoff intercepted, acres of new wetlands, number of rain barrels	Participation in neighborhood rain barrel program, modeling of rain garden capture, city tracking via website of restoration projects	Municipalities, neighborhoods, storm sewer drainage unit groups
Number of BMPs completed	Acres of infiltration, number of projects, acre-feet of runoff captured	Online tracking integrated into city websites	Steering Committee, Municipalities
<b>Number of catch basin and inline treatment systems</b>	Acres of runoff captured, number of units, mass of sediment removed from units	Site plan review, required reporting by property owners	Municipalities
<b>Reduction of effective imperviousness/runoff volumes in storm sewer areas</b>	Same as above for floodplain metric	Modeling, GIS Mapping	WMP Tracking System
<b>Number of rain barrels/rain gardens installed</b>	Same as above for floodplain and BMP metrics	Track enrollment in rain garden/barrel program	Residents, neighborhood associations, Nature Center
<b>Decrease in waterfowl populations</b>	Number of birds	Waterfowl counts at specific stations	Volunteers
<b>Habitat/Preservation</b>			
Preservation of open space	Acres of preserved land		Kalamazoo Conservation District, municipalities
Habitat improvement	Length of buffers restored, area of wetlands restored, number of volunteer-hours spent planting native vegetation	Online tracking integrated into city websites, Natural features inventory updated, tracking by group leading efforts	Subwatershed committees, WildOnes, volunteer groups, Nature Center
Elimination of exotic species	Acres restored, number of volunteer-hours spent removing exotics	Same as above for habitat improvement	Subwatershed committees, WildOnes, volunteer groups, Nature Center
<b>Education/Policy</b>			
<b>Newsletter articles, press releases, public service announcements</b>	Number of articles, number of media outlets broadcasting messages	Sustained and consistent publications, track requests for logo/information/slogans	MS4s, neighborhood associations
<b>Workshops</b>	Number of events, number of participants	Sustained program theme, track requests for program slides/logo/slogans	Kalamazoo Nature Center, Steering Committee

Portage and Arcadia Creeks EXAMPLE

<b>New signage and storm drain stenciling</b>	Number of signs	Group account with signage company for all watershed signs, established layout and bulk discount	Steering Committee
<b>New ordinance adoption</b>	Number of ordinances, number of ordinance enforcement actions, number of illicit connections removed (due to IDEP ordinance)	Online ordinance information	MS4s, MI Township Association, MI Municipal League
<b>Establishment of municipal budget items for implementation efforts</b>	Dollars committed		MS4s
<b>School curriculum</b>	Number of schools, number of students		Education Subcommittee, MS4s
<b>Student involvement in watershed work</b>	Number of students, number of student leaders trained		WMU, Education Subcommittee
<b>Monitoring/Public Participation</b>			
<b>New volunteers</b>	Number trained, number of volunteer hours logged	Enrollment in MSU-E program, work of Clean Water Corps, Americorps Program	Volunteer monitoring program
Adoption of creeks	Number of schools, stream miles adopted	Identify adopted streams with signage, like highways	Education subcommittee, public school systems
Use of “You Make the Difference” logo on other organizations’ materials	Number of requests for logo	Request links to publications using logo, requirement to report usage when requested	Education subcommittee, City of Battle Creek
New organizations joining efforts	Number of groups	Track meeting attendance, request for watershed information	Steering Committee
Project website usage	Number of visits	Track monthly web statistics	Webmaster

**New Metrics to Monitor Change**

BMPs and education programs are expected to result in improvements in surface water quality. Metrics to determine whether improvements are realized are needed to assess progress toward goals. The following list identifies potential in-stream metrics. These were considered in terms of whether a volunteer monitoring effort could be implemented and sustained. Items in bold were prioritized. They will be refined as the Volunteer Monitoring Program is developed.

<b>Metric</b>	<b>How is it Measured?</b>	<b>Can Volunteers Measure it?</b>
<b>Stream macroinvertebrate community composition</b>	Kick Netting, Rock Baskets	Yes
Periphyton community composition	Rapid Bioassessment Protocol	Can collect samples, need to send to lab for analysis
Fish community composition	Electroshocking, Gill Netting	No, likely MI Dept. of Natural Resources Fisheries Division
<b>Sediment accumulation</b>	Visual observation at fixed station, quantity of sediment dredged from impoundments	Yes for visual observation, no for dredging
<b>Pool/riffle habitat</b>	Physical Characterization Data Sheet, Rapid Bioassessment Protocols	Yes
<b>Riparian habitat/buffers</b>	Rapid Bioassessment Protocol	Yes
Baseflow stream temperatures	Data Loggers	No
Baseflows/rainfall	Gauging Station, ISCO Auto Sampler	Maybe
<b>Litter accumulation</b>	Periodic counts at fixed station, annual Clean Sweep measurements	Yes
<b>Turbidity</b>	Turbidity tube, horizontal measurements	Yes
Wet weather peak flows	Gauging station, ISCO Auto Sampler	No

**Methods for Tracking Progress**

Implementation projects must be communicated to the public in order to build momentum for further watershed improvements. The following list suggests avenues for sharing data and watershed success stories, and possibly, for quantifying progress toward goals. These items are being considered by the Steering Committee.

<b>Method/Tool</b>	<b>What's Tracked</b>	<b>Example</b>
City of Kalamazoo storm water catch basin treatment system tracking	Number of stormwater treatment systems installed as required by site plan review at redevelopment sites. Can pollutant reduction quantification be added based on design of equipment by manufacturer?	
City of Kalamazoo and City of Portage online mapping programs	Parcel information, floodplains, aerial photographs, storm sewer assets. Can new BMPs be added as map layer?	<a href="http://www.ci.kalamazoo.mi.us/onlinegis/Viewer.htm">http://www.ci.kalamazoo.mi.us/onlinegis/Viewer.htm</a> <a href="http://www.portagemi.com/living/gis_mapping.asp?bhcp=1">http://www.portagemi.com/living/gis_mapping.asp?bhcp=1</a>
Project website	Community groups submit project and group information	<a href="http://www.kalamazooriver.net/pa319new/groups.htm">http://www.kalamazooriver.net/pa319new/groups.htm</a>
Voluntary monitoring water quality data entry	Water quality, macroinvertebrate, habitat scores	<a href="http://www.fotsjr.org/wqm/wqm.htm">http://www.fotsjr.org/wqm/wqm.htm</a>
Road-stream crossing and streambank erosion quantification tool	Erosion from streambanks, sediment loading is quantified	<a href="http://www.kalamazooriver.net/tmdl/nps_opps/rsc.htm">http://www.kalamazooriver.net/tmdl/nps_opps/rsc.htm</a>
Rain barrel program, Neighborhood tracking	Number of homes in program, area of roof disconnection	
USEPA National Directory of Volunteer Monitoring Programs	Volunteer monitoring group information, contacts	<a href="http://yosemite.epa.gov/water/volmon.nsf/Home?readform">http://yosemite.epa.gov/water/volmon.nsf/Home?readform</a>
BMP Pollutant Reduction Calculator	Pollutant load reductions from various BMPs	<a href="http://www.in.gov/idem/water/planbr/wsm/loadreduction.html">http://www.in.gov/idem/water/planbr/wsm/loadreduction.html</a>

**Kalamazoo River Mainstem 3 Corridor  
Watershed Management Plan**

**Appendix C – Watershed Management Plan Objections**

## **Appendix C - Objections**

Significant components of the Watershed Management Plan (WMP) which do not have complete agreement of the participants shall be detailed in this appendix to the WMP and will include a description of the WMP component, identification of participants who disagreed with the component, reasons for disagreement (if provided), and suggested alternatives (if provided).

April 20, 2006



Chris Bauer  
Kalamazoo District Office  
Field Operations Division  
Water Bureau  
7953 Adobe Road  
Kalamazoo, MI 49009-5026

RE: Kalamazoo River Mainstem 3 Corridor Watershed Plan

Dear Ms. Bauer:

While the Charter Township of Comstock has filled out its enclosed M3C Commitments to Actions, it is doing so under protest. As I have indicated in prior correspondence with the MDEQ, it is the belief of the Township that since it neither owns nor operates a "municipal separate storm sewer system" as defined at 40 CFR 122.26, it should not be subject to the requirement of obtaining a Phase II Urban Water Discharge Permit and the various requirements stemming from such a permit, including the enclosed submission and the commitments set forth therein. It is further the belief of the Township that any statutory interpretation or administrative rule to the contrary is in conflict with the so-called Headlee Amendment (Article IV, Section 29 of the Michigan Constitution) and invalid. Comstock Charter Township's position in this matter is identical to that expressed in letters from legal counsel for Kalamazoo Charter Township to your office dated November 16, 2004, February 10, 2005, April 4, 2005, and July 25, 2005, which are herein incorporated by reference.

Comstock Charter Township reserves the right to terminate its commitments to the actions identified herein and to seek legal redress with respect to this matter.

Sincerely,

A handwritten signature in black ink, appearing to read "Timothy J. Hudson".

Timothy J. Hudson, Supervisor  
Charter Township of Comstock