Water Quality Improvement (Implementation) Plan for the Kalamazoo River Watershed and Lake Allegan through a Phosphorus Total Maximum Daily Load (TMDL) Process

Developed by:

The Kalamazoo River/Lake Allegan

TMDL Implementation Committee

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This Kalamazoo River/Lake Allegan TMDL Implementation Plan represents a multi-year effort by numerous organizations, municipalities, industries, agencies, institutions and citizens of the watershed to develop a water quality strategy addressing issues related to phosphorus inputs to the river. The plan was collectively developed by participants contributing thousands of hours of time and energy to ensure that strategic elements reflect the social, political and scientific feasibility of accomplishing community-established and USEPA-approved water quality goals.

Several participants of this overall process contributed significantly to the writing of this document. These individuals and affiliations include:

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This Implementation Plan was drafted with the intention to provide a flexible basis to obtain phosphorus reduction goals by 2012. This is in anticipation that Lake Allegan water quality goals for improved clarity, nuisance algal bloom elimination, dissolved oxygen criteria compliance and a balanced fishery can be achieved by 2015 (assuming a projected three-year system response to target load reductions). The implementation strategy also includes what the watershed community believes are the necessary milestones, incentives and enforcement mechanisms to achieve these water quality improvements required by the Clean Water Act.

To date, the development of this plan has been an engaging and successful process whereby several planning and implementation milestones were achieved during the formulation of this plan. The watershed cooperation and desire to meet these Kalamazoo River/Lake Allegan goals have been and will continue to be sustaining aspects of these long-term efforts to improve and protect this natural resource.

SECTION 1.0

OVERVIEW OF THE TMDL PROCESS

The Kalamazoo River Watershed drains 2,020 square miles of land in Allegan, Van Buren, Kalamazoo, Calhoun, Barry, Eaton, Hillsdale and Jackson counties in Southwest Lower Michigan. Over the years the Kalamazoo River and selected streams, lakes and wetlands flowing to it have experienced water quality problems. Because of a variety of pollution reduction programs, policies and efforts some of these water quality problems have been eliminated or greatly reduced. However, serious water impairments and threats still exist.

One of the water quality problems in the Kalamazoo River Watershed is nutrient enrichment of Lake Allegan. Lake Allegan is an impoundment in the lower reaches of the Kalamazoo River, created by the installation of the Caulkins Dam and located approximately twenty-one river miles upstream of Lake Michigan. Symptoms of the problems in Lake Allegan include algal blooms, low oxygen levels, poor water clarity, and a fish community heavily dominated by carp resulting in an unbalanced fishery. Most of the water and pollutants flowing through the River and its tributaries eventually reach Lake Allegan.

Although a variety of factors can affect these types of water quality problems, previous studies have found that phosphorus is the primary cause of eutrophication, or nutrient enrichment, in Lake Allegan. As such, this impoundment is on Michigan's 303(d) list of impaired waters. The State of Michigan is therefore mandated by the federal Clean Water Act to develop a Total Maximum Daily Load (TMDL) for Lake Allegan and its watershed.

The TMDL process has three primary elements: 1) setting new water quality improvement goals; 2) defining current contributors to the problems and necessary reduction goals for such sources, and; 3) developing and implementing a specific written plan to meet new goals. The first two steps of this process have been completed; this document represents the third required element of the TMDL: the Implementation (Improvement) Plan.

The Michigan Department of Environmental Quality (MDEQ) received a Sec. 104(b)(3) grant from the U. S. Environmental Protection Agency (USEPA) in July 1998 to develop a phosphorus-based TMDL for Lake Allegan. Initial development of the TMDL consisted of identifying sources of phosphorus in the watershed, load estimates to the lake and determining the lake's natural capacity to assimilate phosphorus. Extensive sampling was conducted beginning in 1998, on Lake Allegan and its tributaries, as part of the TMDL development process.

The TMDL for Lake Allegan sets phosphorus reduction targets for two broad categories of sources: point sources and non-point sources. Significant point sources consist of 38 industrial and municipal facilities that currently have federal National Pollution Discharge Elimination System permits (NPDES permits are issued by MDEQ) to discharge to the Kalamazoo River and its tributaries. These include wastewater and contact cooling water (30) and non-contact cooling water (8) discharges. Non-point sources are essentially all other contributions of phosphorus reaching the river and Lake Allegan via less defined pathways such as runoff, infiltration or internal recycling. Non-point sources can

include: residential and urban areas, roadways, farms, golf courses and construction activities as well as sediment resuspension. These also include naturally occurring levels of phosphorus in soils of forests, grasslands and wetlands.

Development of the TMDL also included the determination of a collective wasteload allocation for point sources and load allocation for non-point sources. These were used in determining the amount of phosphorus reductions necessary to meet the goals of the TMDL. Proposed water quality goals for Lake Allegan include: improved water clarity, reduced chlorophyll *a* (a measure of the amount of algae in the water and an indicator of eutrophication levels), a more balanced fish community, improved dissolved oxygen levels, and the absence of nuisance blue-green algae blooms. These goals will aid in the deterrence of taste and odor problems as well as fish kills.

A summary of the Kalamazoo River/Lake Allegan TMDL development, capacity determination, allocations and water quality goals are provided with this Implementation Plan. Details can be found in companion documents, *Loading Assessment of Phosphorus Inputs to Lake Allegan, 1998* (Heaton, 1999) and *Total Maximum Daily Load (TMDL) for Phosphorus in Lake Allegan* (Heaton, 2000).

An 80-mile stretch of the Kalamazoo River (including Lake Allegan) and Portage Creek (Kalamazoo County) are also contaminated with PCBs; a suspected carcinogenic material found in paper-making wastes discharged to the river during the 1950's through the early 1970's. As such, the Kalamazoo River and impacted areas are also designated as a "Superfund" site. The TMDL process will not address PCB remediation. However, there is some potential overlap of solutions, and as both processes move towards resolution, overlapping opportunities for mutual improvements will be examined.

In the Kalamazoo River/Lake Allegan TMDL process, MDEQ has been joined by a number of watershed partners to assist with the establishment of the TMDL goals and allocations, as well as develop the associated reduction plan (this document). This committee consists of representatives and individuals from regulated point sources, environmental groups, local government, agriculture, universities and the private sector. This group is by no means entirely representative of all watershed perspectives. This is an open and on-going process, and anyone is welcome to participate as the TMDL affects all citizens (stakeholders) living within the Kalamazoo River/Lake Allegan watershed.

Although the federal TMDL mandate requires that Lake Allegan be the focal point of phosphorus reductions efforts, it also creates the opportunity for improving water quality throughout the watershed. Implementing the proposed reductions will simultaneously reduce other pollutants as well, including sediment, oil, metals, salt, nitrogen, bacteria, and other pollutants that contribute to water quality degradation. The framework and resources provided by this TMDL process can help communities throughout the Kalamazoo River Watershed achieve their water quality goals.

The Michigan Department of Environmental Quality (MDEQ) is charged with ensuring that TMDLs are developed and implemented. A TMDL permanently establishes the amount of a particular substance or pollutant that a water body can assimilate and still remain healthy, and allocates (restricts) the amount of that pollutant from all sources. It also allows for periodic updates to ensure that goals are or can be met with the publicly adopted, EPA-approved Implementation Plan.

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 storm water 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 in Table 1.

Table 1. Existing Conditions and Water Quality Goals for Lake Allegan.

Water Quality Indicators	Existing Conditions	TMDL Goal
Total phosphorus	96 *u*g/L	60 *u*g/L
Chlorophyll *a*	67 *u*g/L	30 *u*g/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 in Table 2.

Table 2. Kalamazoo River/Lake Allegan Loading Allocations and Margin of Safety for the Early and Late Growing Seasons. (All values in pounds of Total Phosphorus per month.)

	April - June		July - September	
	Goal	***1998***	***Goal***	***1998***
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.

This document represents the final step of the TMDL approval process, i.e., the development and compilation of the "road map" or Implementation Plan that will: a) serve the entire Kalamazoo River/Lake Allegan Watershed; b) provide 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, we know that real 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 storm water and other non-point contributors have also been implemented through Phase II, CMI and 319 projects further reducing phosphorus loads within the watershed. Highlights of these activities are provided in this plan.

1.1 Public Participation

Over the past three years, a broad range of watershed-wide participants have actively engaged in dialogue with the state of Michigan, the USEPA and each other to: establish water quality improvement goals, identify sources of phosphorus in the watershed and set reduction goals for point sources and non-point sources of phosphorus flowing into the Kalamazoo River.

From its inception, the Kalamazoo River Watershed/Lake Allegan TMDL effort has been a community-based project. During this time, landowners, industry, government, community organizations and citizens from all facets of community life have participated in the strategy development of the TMDL Implementation Plan. An Implementation Committee began meeting in early 2000 and has provided leadership for point and non-point source stakeholders in planning phosphorus reductions in the watershed. Currently, no one existing organization has been found to be suitable to provide the sought-after watershed-wide coordination for this planning effort. However, the plan provides a framework for forward, positive progress and success, while efforts continue to resolve this gap. Over 75 meetings with the public have been held to date that have included public education, TMDL capacity and allocation development and Implementation Plan compilation. Attachment A

documents the history of these meetings and provides a partial listing of participants in the multi-year process.

An active Kalamazoo River/Lake Allegan TMDL Implementation Committee has developed strategies to reduce phosphorus from a variety of sources. Documented in detail later in this plan, these sources include:

- Point Source Dischargers
- Non-point Sources
  - Municipal Storm Water
  - Industrial Storm Water
  - Land Use/Development
  - Greenhouse Activities
  - Agricultural Activities
  - Construction Activities
  - Transportation Activities
  - Turf Grass /Alternative Landscape Management
  - On-site Sewage Disposal Systems
- In-lake/Instream Processes
- Sub-basin Watershed Management Efforts

The Implementation Committee has also set up a framework for convening stakeholders, gathering new data, tracking and regularly reporting on progress, and a variety of other tasks

The Implementation Plan will serve to engage and educate watershed stakeholders as to the sources, solutions and requirements of meeting these new water quality goals. The plan will ultimately evaluate, protect, and improve natural areas and resources; and build healthy, sustainable communities. The future of all Kalamazoo River/Lake Allegan watershed communities is at stake in this process; for all future growth can be directly equated to new burdens on an already overtaxed environment; an environment that must now instead make strides towards reducing such burdens to achieve new goals, and sustain them once they are met.

Information in this plan and objectives of the various ongoing efforts already underway related to the TMDL process have been shared with the public in draft and final form. Drafts of the Implementation Plan and or various sections were posted on the http://www.kalamazooriver.net web page for public review and comment since March 2002. The final document will be maintained on-line for continued public viewing as well as to announce any changes or updates, meeting plans and other relevant communications.

1.2 The "Cooperative Agreement"

An Environmental Council of States (ECOS)/EPA Agreement to Pursue Regulatory Innovation was developed to: improve environmental protection in the United States; improve USEPA/State environmental management practices, and; provide timely decision-making on good ideas. This agreement, and U.S. EPA approval of the TMDL has opened the door for a more flexible approach than is normally allowed under TMDLs. The "innovative approach" was well received by USEPA after a meeting with USEPA and the TMDL stakeholders. The USEPA was very impressed with the effort and

local leadership exhibited by the stakeholders. As a result, a revolutionary Cooperative Agreement to meet the Total Maximum Daily Load (TMDL) for phosphorus has been developed by watershed stakeholders and approved by USEPA. There are now 33 signatories (primarily point source dischargers, and the State of Michigan) that have approved the agreement. As individual NPDES permits are modified or reissued to establish the aggregate and individual permitted phosphorus discharges, the agreement has been incorporated into them as an enforceable requirement of the permit. Permits will also include schedules to achieve the necessary additional reductions.

Signatories to the Agreement acknowledge the role of phosphorus as a pollutant in the watershed, recognize its many sources and agree to a significant voluntary reduction program to meet stated and approved TMDL allocations and goals. They have also pledged to assist in preparation of non-point source reduction plans, and to "facilitate such reduction (of phosphorus) by providing assistance, resources, and the coordination of local efforts".

The agreement is between the Michigan Department of Environmental Quality (MDEQ), Surface Water Quality Division (SWQD) and other signatories, representing both point source (PS) and non-point source (NPS) stakeholders (e.g., municipalities) in the Kalamazoo River/Lake Allegan watershed. The primary purpose of the agreement is to create the process to cooperatively reduce phosphorus loading in the Kalamazoo River/Lake Allegan watershed to meet the goals of the Total Maximum Daily Load.

All partners have acknowledged the importance of the Kalamazoo River/Lake Allegan watershed as a contributor of valuable water resources for the residents, aquatic life, and wildlife in the watershed. These same partners have committed themselves to achieving water quality improvement goals. A copy of the Cooperative Agreement and signatories is included in Attachment B.

1.3 The Kalamazoo River/Lake Allegan Setting

Lake Allegan, a 1,587-acre impoundment situated approximately twenty-one river miles from Lake Michigan in the lower portion of the 2,020 square mile Kalamazoo River watershed. The Reach File Location number is 4050003-9-0009. The Section 303(d) list identification number is 083005G.

The Michigan Department of Environmental Quality, Land and Water Management Division has developed subwatershed boundaries. Figure 1 illustrates the subwatersheds draining to Lake Allegan in relation to the overall Kalamazoo River watershed. Each subbasin is color-coded according to the generalized MDEQ scheme. Subwatersheds within these subbasins are numbered in Figures 4-8 and correspond to those subwatershed designations (or "codes") in Table 3.

The topography of the Kalamazoo River watershed, derived from the USGS Digital Elevation Models (K&A, 2001), is displayed in Figure 2 in relation to urban areas. The region is characterized by gently rolling surfaces resulting from glacial moraines. Elevations range from approximately 600 feet above sea level to just over 1,260 feet. The highest elevations are observed in the eastern portions of the watershed. The Kalamazoo River floodplain is visible as a wide band of lower elevations surrounding the Kalamazoo River in Figure 2.

Based on land cover data generated from 1999 satellite imagery, the 1,550 square miles (992,884 acres) of the Kalamazoo River watershed draining to Lake Allegan is comprised of 40.8% forest and

rural open areas, 44.8% agriculture, 3.1% residential, 1.1% commercial and industrial, 3.6% transportation, and 6.6% open water and wetlands (K&A, 2001). Table 3 summarizes these land cover types by subwatershed. The urban centers of Kalamazoo and Portage, Battle Creek, Otsego and Plainwell, Marshall, and Albion are evident as large clusters of residential, commercial, and industrial land cover Figure 3. The remainder of the watershed is a patchwork of agriculture, forests/open areas, open water and wetlands.

Figures 4, 5, 6, 7 and 8 illustrate the percent distribution of land cover types by subwatershed. Figure 4 shows that agricultural lands are typically more prevalent in the eastern, upstream portions of the watershed. Subwatersheds 6 (Lampson Run Drain), 17 (North Branch of Rice Creek), 20 (Kalamazoo River), 22 (Kalamazoo River), 27 (Hogle and Miller Drain), and 29 (Big Creek) exhibit the highest percentage of agricultural lands. A very limited amount of agricultural land use is noted in subwatersheds 41 (Battle Creek) and 62 (Portage Creek), which overlap the municipalities of Battle Creek and Portage, respectively.

Forested and open areas by subwatershed are displayed in Figure 5. Areas with a greater percentage of these land covers tend to be found in the central and western portions of the Kalamazoo River watershed. Subwatershed 52 (Kalamazoo River), located just west of Battle Creek, exhibits the highest percentage of forested and open land, at 63%. The remainder of the subwatershed primarily falls within 30% and 60% open and forested areas. Those subwatersheds having the least forested/open land cover also tend to have the highest percentage of land cover in agriculture (refer to Figure 4.)

Wetlands and open water by subwatershed are depicted in Figure 6. The majority of the subwatersheds in the Kalamazoo River watershed range between 1% and 10% open water and wetland areas. Subwatershed 68, the Gun River subwatershed, exhibits nearly 24% water and wetland areas. Gun Lake contributes a large portion of the open water in this relatively small subwatershed. Those subwatersheds with a significant number of inland lakes tend to most influence this land cover distribution scheme.

Figure 7 displays the percent of urbanized land cover by subwatershed. Urban areas include larger percentages of residential, commercial, industrial, and transportation land covers. The subwatersheds overlapping Kalamazoo, Portage, and Battle Creek exhibit the highest percentages of the aforementioned land cover types. Subwatersheds overlapping Charlotte, Otsego, and Plainwell also have notably higher urban land covers relative to other subwatersheds.

Figure 8 displays the percent impervious surface cover by subwatershed. The subwatersheds that demonstrate the highest percentages of urban land covers in Figure 7 also demonstrate the highest percentages of impervious surfaces; e.g., Subwatersheds 62 (Portage Creek), 63 (Portage Creek), and 41 (Battle Creek). (For additional details see http://www.kalamazooriver.net/tmdl/docs/docs.htm; K&A, 2001.)

Major tributaries discharging to Lake Allegan are the Kalamazoo River and Dumont Creek. Several small perennial and ephemeral streams also discharge directly to this lake. Six dams (Trowbridge, Plainwell, Otsego, Otsego City, Allegan City, and Lake Allegan) were originally constructed on the stretch of river from Plainwell to Allegan (three have been partially removed - Trowbridge, Otsego, and Plainwell). Lake Allegan was created in 1936 as a result of the Caulkins Dam, built on the Kalamazoo River as a means of providing hydroelectric power.

Lake Allegan (Figure 9) has a volume of 17,200 acre-feet, and a mean hydraulic retention time of 7 days. In 1972, depths in the lake ranged from 3 to 20 feet, with a mean depth of 10 feet (USEPA, 1975). Maximum depths measured in 1998 were 20.5 feet (Heaton, 1999). Natural areas of upland forest dominate the shoreline of Lake Allegan. Much of the immediate surrounding land is designated as the Allegan State Game Area. Currently, residential areas comprise a small, but expanding, portion of the lake's shoreline.

1.4 Historic Kalamazoo River Water Quality Conditions

The noted local historian, Willis Dunbar, has noted that the Kalamazoo River was directly responsible for the patterns of settlement and development in the Kalamazoo River watershed (Dunbar, 1969). In a personal communication (June, 2002), Dr. John Cooley, a contemporary Kalamazoo author, offered several of the following historical vignettes into the history of the Kalamazoo River. Access to a plentiful and readily accessible clean water supply encouraged the growth of a large paper industry in the river valley. In 1847 the Kalamazoo Gazette boasted: "Capitalists who would embark on a profitable enterprise would do well to establish a mill in this village." The Kalamazoo Paper Company started producing paper on Portage Creek in 1867. In 1894 game warden O'Burne reported to the Gazette that thousands of fish were dead and dying in the Portage Creek and the river. "From two to three tons were killed, almost every kind of carp, some weighing nearly ten pounds." He noticed that there was a substance in the water that ate through the membrane between the gills and body, causing them to bleed to death. Later one of the mills apologized for an error, which emitted a bleaching vat directly into the creek.

By 1915 Kalamazoo declared itself the undisputed world paper-making capitol: the Paper City. As this industry expanded, so too did pollution from multiple aspects of papermaking. Portions of the Kalamazoo River developed a history of severe water quality degradation. The river began to struggle with occasional spills and the steady flow of excessive, untreated, paper-waste residuals being discharged to the river. The once-prized sport fishery would soon deteriorate and almost vanish completely. By 1945 water testing found no dissolved oxygen remaining in the river.

Citizens along the river complained of smelling hydrogen sulphide. They would watch the river burp and bubble from the decaying sludge deposits on the bottom. In the 1940's it was reported that the river's fumes would blister paint on boats and nearby houses. Through the 1940s, 1950s, and 1960s, extremely poor water quality existed in the Kalamazoo River. There were many fish kills during this period.

Conditions were so poor at times that the river ran multicolored and was considered a "dead, odiferous sewer" (WRC, September 1951). One of the most severe cases of degradation appears to have occurred on a tributary to Lake Allegan. In 1953, four acres of dying carp in Dumont Creek appeared as a photograph in Life Magazine (Life Magazine, October 1953). Fish in the Kalamazoo River were forced to move into tributaries due to oxygen depletion in the river water caused by organic wastes discharged to the river from paper mills.

Conditions most noticeably began to improve after the passage of the Clean Water Act, in 1972. Industry and municipal wastewater plants were mandated to make significant alterations to both their

equipment and their operations. However, by this time, much of the damage that would impact long-term considerations had already been done.

In 1982, the Kalamazoo River was listed as a Site of Environmental Contamination by Michigan; in 1983, an Area of Concern (AOC) by the International Joint Commission, and in 1990 a Superfund Site by the United States Environmental Protection Agency (USEPA). In 1984, a study was conducted by the Michigan Department of Natural Resources (MDNR) to determine the loadings of nutrients to the Kalamazoo River (Suppnick and Creal, 1986). As a result of the study, phosphorus limitations were recommended for the City of Kalamazoo Water Reclamation Plant (WRP).

In 1986, the WRP upgraded its facility and implemented advanced (tertiary) waste treatment and better phosphorus removal. Biological surveys conducted in 1988, 1989, and 1994 showed a dramatic improvement in the biological communities (fish and aquatic insects), as well as absence of the nuisance growths of algae that were present prior to the phosphorus reductions (Oemke, 1988; Heaton, 1990 and 1997). The dramatic improvements were a direct result of the reductions in phosphorus made in the watershed in the late 1980s, continuing thru the 1990s. With the recent demise of many paper making facilities in this watershed and the elimination of their discharges, expectations are for continued improvement in water quality conditions, perhaps more rapidly than may have otherwise been anticipated.

1.5 Phosphorus as the Pollutant of Concern

Like many other elements, phosphorus, is necessary to sustain all living organisms. Problems are typically created only when phosphorus is present at elevated levels in our lakes and streams, as is the case for Lake Allegan. High phosphorus levels in Lake Allegan have resulted in undesirable growths of algae. Undesirable algae blooms have caused high dissolved oxygen levels in the daytime when plants are releasing oxygen during photosynthesis, and likely low dissolved oxygen levels at night when no photosynthesis is occurring, but plant respiration is high. This increase in plant growth and lower dissolved oxygen has caused a shift in the fish and invertebrate communities in Lake Allegan to species that can tolerate these more stressful conditions. Dominant fish species in Lake Allegan now include carp and channel catfish. The increased plant growth, especially of algae, has also dramatically lowered the transparency of the water column. Average secchi depth in Lake Allegan is approximately two feet. These conditions have caused a violation of Rule 60(2) of the Michigan Water Quality Standards (WQS) which states …"nutrients shall be limited to the extent necessary to prevent stimulation of growths of aquatic rooted, attached, suspended, and floating plants, fungi or bacteria, which are or may become injurious to the designated uses of the waters of the state."

Section 305(b) of the 1972 Federal Clean Water Act (CWA) requires the MDEQ to biennially develop and submit to the USEPA a list of waterbodies that do not attain Michigan WQS. Section 303(d) of the CWA requires the submittal of a list of water quality limited or threatened waters needing established pollutant TMDLs. The MDEQ received a 104(b)(3) grant from the USEPA in July 1998 to develop a phosphorus TMDL for Lake Allegan. Lake Allegan was identified as an impaired waterbody not meeting WQS due to nutrient enrichment in the 1996 and 1998 305(b) reports (Kosek, 1997 and Wuycheck, 1998) and included on the 1996 and 1998 303(d) TMDL lists. In a department memorandum (March 1999) the MDNR, Fisheries Division, stated its support of the development of a phosphorus TMDL for Lake Allegan. Both the MDEQ and MDNR believe that improving water quality in Lake Allegan will lead to an improvement of the fishery.

1.6 Rationale for Addressing Phosphorus Loading

Total phosphorus has been shown to be the limiting nutrient for plant growth in Lake Allegan (USEPA, 1975). Water quality impairments have been directly attributed to phosphorus flowing into the river from a broad range of sources including wastewater and industrial discharges ("point sources") as well as "non-point" sources such as rainfall runoff from residential and urban areas, roadways, agricultural activities, golf courses and various types of construction activities. As an element with higher concentrations in some things than others, phosphorus can also enter waterbodies from stream bank erosion, waterfowl and even naturalized areas such as forests and wetlands.

Historically, reductions of total phosphorus in the Kalamazoo River upstream of Lake Allegan have resulted in a shift of the aquatic community from a nuisance condition to a more diverse and desirable aquatic community. Therefore, controlling the amount of total phosphorus in Lake Allegan should also result in the improvement of Lake Allegan water quality.

1.7 Water Quality Improvement Goals

Consistent with Rule 100 of Michigan's Water Quality Standards (WQS), Lake Allegan is protected for a warmwater fishery, other indigenous aquatic life and wildlife, agriculture, navigation, industrial water supply, partial body contact recreation, and total body contact recreation (Heaton, 1999). Many of these designated uses are currently not being met due to excessive phosphorus loads resulting in both nuisance and degraded water quality conditions (eutrophic conditions) in Lake Allegan.

To assess water quality improvement and phosphorus load reduction needs, the MDEQ began a study of the Kalamazoo River/Lake Allegan Watershed in 1997. Phosphorus loads from all major tributaries and all major permitted industrial and municipal discharges (point sources) were estimated for 1998; data collection in the River and the Lake has been ongoing since 1997.

The Kalamazoo River/Lake Allegan phosphorus TMDL was derived using 1998 ambient water quality and discharge monitoring data as the baseline. 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.

In developing the Lake Allegan total phosphorus goal, consideration was given to the available literature regarding total phosphorus in lakes and their responses, goals established for other lakes in Michigan, Water Quality Standards, and site-specific characteristics of the Kalamazoo River watershed. The total phosphorus goals typically set for lakes in northern Michigan have been in the range of 8 to 10 *u*g/l for less productive *oligotrophic lakes*. Goals of 20 to 30 *u*g/l have been set for more productive lakes classified as eutrophic, which are typically found in southern Michigan.

Perhaps the most predominant factor is the site-specific characteristics of the Kalamazoo River watershed. A review of the Kalamazoo River watershed indicates that it is in a fertile area of the state, with background total phosphorus levels somewhat higher than levels found in other areas of the state (Lundgren, 1994).

As part of the process in evaluating site-specific characteristics, an analysis of the conditions in Morrow Lake, an impoundment on the Kalamazoo River upstream of the city of Kalamazoo, was

conducted by the MDEQ. Morrow Lake and Lake Allegan share similar land use characteristics with the majority of land use being agriculture and forestlands. Morrow Lake is also of similar size (1,000 acres) and average depth (5-10 foot depth) as Lake Allegan, and appears to have a well-balanced fish community (Bohr and Liston, 1987; MDNR, 1984; and MDNR, 1999) and desirable water quality characteristics. These characteristics of Morrow Lake include no reported algae blooms with corresponding low chlorophyll *a* concentrations, transparency of over three feet and a balanced non-carp dominated fish community. These attributes of Morrow Lake serve as the basis for the proposed goals for Lake Allegan.

In 1999, the following characteristics were observed in Morrow Lake: average secchi depth was 3.5 feet (with a range of 2.5 to 5.5 feet), average chlorophyll *a* levels measured 23 *u*g/l (with a range of 8 to 75 *u*g/l) and the carp/catfish community represented 39 percent (by number). In 1984 and 1985, the percentage of carp in Morrow Lake was less than five percent. A different sampling scheme and effort may account for the higher percentages of carp reported in 1999 than in 1984 and 1985.

To achieve these desired attributes, a total phosphorus goal for Lake Allegan was determined through a three-part evaluation of Morrow Lake total phosphorus levels. First, an evaluation of the data available for the intensive monitoring period (April to September 1998) was completed. There were no total phosphorus data measurements directly collected on Morrow Lake in 1998. Therefore, the analysis for 1998 was done using a monitoring station on the Kalamazoo River in Comstock, 1.4 miles downstream of the Morrow Lake outlet. Given the geographic closeness of this station to the outlet of Morrow Lake, the station at Comstock was used as representative of the outlet for Morrow Lake. The average total phosphorus concentration at Comstock in 1998 was 66 *u*g/l. However, in July 1998, the Battle Creek Wastewater Treatment Plant (WWTP) was exceeding its permitted total phosphorus limit, which resulted in higher than normal total phosphorus concentrations in July. Removing this month as an outlier resulted in an average total phosphorus concentration at Comstock of 64 *u*g/l. Data from 1999 has shown that a ten percent increase in total phosphorus occurs from Morrow Lake to the Comstock station. Taking this increase into consideration results in an adjusted average total phosphorus concentration for Morrow Lake of 58 *u*g/l for 1998.

Based on these site-specific characteristics, the conditions in Morrow Lake were used as the basis to establish the specific desired attributes for Lake Allegan. These were presented in Table 1 as part of the TMDL goals.

1.8 Total Phosphorus Loading to the Kalamazoo River/Lake Allegan Watershed

There are 77 individual National Pollutant Discharge Elimination System (NPDES) permitted point source discharges within the Kalamazoo River/Lake Allegan watershed; 26 with individual limits for phosphorus. Non-point sources of nutrient input from urban sources include, but are not limited to, industrial storm water runoff from impervious and semi-impervious surfaces as a result of urban development, commercial and residential areas, transportation and construction activities, and septic systems throughout the watershed. Non-point sources of nutrient input from agricultural activities include runoff from barnyard areas, manure holding areas, and cropland.

Water quality data were collected from Lake Allegan in 1994, 1996, 1997, 1998, and 1999 by the MDEQ to gain a better understanding of the monthly and seasonal variability of the limnological processes controlling the eutrophication of the lake. Extensive sampling was conducted in 1998.

Heaton (1999) provides a detailed presentation and analysis of the sampling results and loading estimates. Plant growth in southern Michigan occurs during the spring and summer months of May to September. Due to the short retention time of seven days in Lake Allegan and allowing for time of passage and cycling of total phosphorus through the system, it was determined that the critical period for total phosphorus load to Lake Allegan is from April to September. Therefore, a seasonal approach was used in the development of the TMDL, with April to June being the spring season and July to September being the summer season.

The actual 1998 point source loads for facilities upstream of Lake Allegan were determined from monitoring reported to the MDEQ. The monthly contribution of phosphorus from point source discharges with authorization to discharge phosphorus was determined from questionnaires submitted by the facilities. The facilities were asked to complete a form that reported the average daily and monthly loads of total phosphorus from each of their outfalls. Each facility's NPDES permit specifies the frequency of monitoring flow and phosphorus concentration. The facilities are required to submit Discharge Monitoring Report (DMRs) forms to the MDEQ on a monthly basis. For those facilities where the forms were not submitted, Surface Water Quality Division staff computed the point source loads of phosphorus from the facility DMR form. Several non-contact cooling water discharges (NCCW) in the Kalamazoo River basin (excluding Calhoun) use potable water containing phosphate additives to reduce levels of copper and lead in the discharge. Point source estimates of phosphorus loads for NCCW were made based on an average phosphorus concentration of 0.7 mg/l and the average flows of the discharges.

The total phosphorus load to Lake Allegan measured in 1998 was 147,887 pounds for April to September. Total phosphorus loading to Lake Allegan in 1998 from non-point sources for the six-month period was estimated at 96,224 pounds. Total phosphorus loading from 37 point sources in the Lake Allegan watershed totaled 51,663 pounds. The 1998 non-point source loads were calculated by subtracting the point source load from the total load (Heaton, 2000). Loads presented in Table 4 were used to develop the TMDL load allocations at the M-89 inlet to Lake Allegan.

Table 4. MDEQ Estimated Phosphorus Loads to Lake Allegan in the Baseline Year 1998 (Heaton, 2000).

Month	Normalized* 1998 Total Load	Actual** 1998 Point Source Loads	Normalized 1998 Non-point Source Loads
April	28,500	7,427	21,073
May	25,544	8,565	16,979
June	21,690	9,159	12,531
July	17,763	9,222	8,541
August	16,306	8,303	8,003
September	16,110	8,987	7,123
Total Load (upstream M-89)	**125,913**	**51,663**	**74,250**

Definitions of normalized and actual loads:

* "normalized" loads are loads that were determined by using average flows for the historical period of record (1931 to 1997) rater than the actual flows measured in 1998.

** "actual" loads are those that were calculated using water quality data and flows measured in the field in 1998.

1.9 Non-point Source Loads to the Kalamazoo River/Lake Allegan Watershed

A preliminary non-point source (NPS) modeling effort of the Kalamazoo River watershed was conducted using data corresponding to a 1998-1999 river monitoring period to estimate NPS loads of phosphorus from recognized/delineated subwatersheds draining to Lake Allegan (K&A, 2001). Monitoring data were collected by the Michigan Department of Environmental Quality, Surface Water Quality Division (MDEQ) for preparation of a Total Maximum Daily Load (TMDL) for phosphorus in the Kalamazoo River and Lake Allegan. An independent modeling assessment was therefore undertaken to better define the spatial and temporal origin of non-point source phosphorus loads for the TMDL Load Allocation. Modeling targeted compilation and utilization of a consistent and updated set of relevant watershed attributes and climatic variables.

Non-point source modeling in this application used a combination of empirical tools, remotely sensed data and a geographic information system database. The approach integrated: a) high resolution land cover data for the watershed; b) 1:250,000 digital elevation models, and; c) interpolated rainfall data from existing weather stations to produce a consistent spatial data set for the entire watershed.

Seasonal and annual phosphorus loads were calculated for each subwatershed using event-mean concentrations, land cover relationships and precipitation data. Tributary monitoring data collected in 1998-1999 for selected subwatersheds were used to adjust NPS loading model coefficients to match monitored load estimates to Lake Allegan.

This non-point source modeling effort served as an initial step to compile the critically needed, up-to-date watershed feature database to compute phosphorus loadings for drainage areas of the Kalamazoo River watershed. Presently, there are no other rapid assessment means to undertake this effort with an entire or consistent land use data set corresponding to the 1998-1999 monitoring period upon which the TMDL is based. All other sources of information must be derived from a patchwork of 1970's through mid to late 1990's land cover information. These current efforts serve as a template for future loading analyses and tracking of NPS watershed improvements. The entire modeling report can be viewed at http://www.kalamazooriver.net/tmdl/docs/docs.htm.

The distribution of land cover throughout the watershed, and the corresponding non-point source phosphorus loads derived from this effort, provided important insight into the most significant contributors of phosphorus to the river. Analyses indicated that nearly one-half of the non-point phosphorus load appears attributable to urban related land covers that comprise only 8% of the total land use in the watershed above Lake Allegan. Although agriculture covers slightly less than half of the land surfaces in this same drainage, only about one-third of the non-point source phosphorus load may originate from agriculture. Non-point source phosphorus loading predictions for each subwatershed contributing to Lake Allegan are presented in Table 5.

Figure 10 summarizes land cover and loading information from Table 5. It offers yet another illustration of how these modeling results will provide a focus for developing long-range strategic non-point source reduction plans. It can also be noted that forests, open areas and water/wetlands cover almost one-half of the land area in the watershed while representing only about 20% of the phosphorus load. Although this ratio of land cover to load reflects a relatively small contributing proportion of the overall load, the 20% can be viewed as the "natural background" contribution associated with relatively undisturbed conditions.

1.10 TMDL Loading Capacity

To assess the current levels of phosphorus entering Lake Allegan from the Kalamazoo River, the MDEQ conducted a detailed analysis of sampling data (Heaton, 1999). A comparison of the Lake Allegan average total phosphorus levels to the inlet concentrations at M-89 indicated that there was a decrease in total phosphorus concentrations of approximately 20 percent. Data indicated that the lake functions as a total phosphorus sink due to the slowed water velocities as the Kalamazoo River enters Lake Allegan, resulting in the settling of nutrients and other suspended solids. Therefore, a 20 percent increase in the goal for Lake Allegan of 60 *u*g/l equates to a concentration goal of 72 *u*g/l at M-89. The incoming goal of 72 *u*g/l was translated into monthly average inlet load goals by multiplying the inlet concentration goal of 72 *u*g/l by the historical monthly average flows at the inlet. These monthly loads were then aggregated into two seasons: spring (April, May, and June) and summer (July, August, and September).

The monthly average inlet load goals were therefore calculated to be 18,400 pounds per month for the April through June season, and 10,700 pounds per month for the July through September season at the M-89 inlet location. The inlet goal load varies from the total load in Lake Allegan as a result of inputs from the immediate drainage and atmosphere. Adding the additional allocation for immediate drainage and atmospheric input results in a total load in Lake Allegan of 18,600 pounds for April through June and 10,838 pounds for July through September. The in-lake goal of 60 *u*g/l will be met with the additional allocation for the immediate drainage and atmospheric input (Heaton, 2000).

1.11 Wasteload Allocation (Point Source Discharges)

The 1998 point source load upstream of Lake Allegan resulted in a six-month average total phosphorus load from point sources of 8,700 pounds per month. The Wasteload Allocation (WLA) set for the April to June season was set at the 1998 expected load of 8,700 pounds per month for point sources upstream of Lake Allegan. The WLA for the July to September period was set at a load of 6,700 pounds per month for point source discharges upstream of Lake Allegan (see Load Allocation discussion below). This resulted in a 23 percent reduction in total phosphorus from the expected point source discharges for this period. It is during this season that point source load reductions are most important, since during this time, point source loading dominated the total load going to Lake Allegan.

1.12 Load Allocation (Non-point Source Discharges)

Development of the Load Allocation (LA) included inputs from precipitation, the immediate drainage surrounding Lake Allegan and Dumont Creek, and non-point source loads from upstream of the M-89 inlet (Heaton, 1999). The LA for the April to June period was determined by subtracting the expected point source WLA (8,700 pounds) and the margin of safety (MOS) of 100 pounds (see MOS

discussion below) from the inlet goal (18,400 pounds). This resulted in a LA for non-point sources upstream of M-89 of 9,600 pounds per month, for a 43 percent reduction from current normalized non-point source loads during the April to June period.

Reductions from applications of best management practices target a 50 percent lowering (3,950 pounds per month) of average, current, non-point source loads (7,900 pounds) for the July through September season. Using the LA of 3,950 pounds per month for non-point sources upstream of M-89, an MOS of 50 pounds, and the inlet goal of 10,700 pounds per month, the WLA for point sources was then determined to be 6,700 pounds per month.

Additional allocations were made for the immediate drainage of Lake Allegan, atmospheric sources (precipitation), and Dumont Creek. For the immediate drainage and Dumont Creek, a 50 percent reduction was assumed for the six-month period. For atmospheric sources, no reasonable reductions were anticipated; therefore, this load was left at 42 pounds/month. The monthly average seasonal LA for Lake Allegan totaled 9,800 pounds per month for the period April to June and 4,088 pounds per month from July to September. Heaton, 2000 served as the source for much of the information used in this section.

As approximately 20% of the non-point source load is considered "natural background" based on modeling evaluations (K&A, 2001), it can be noted that there will be few opportunities or techniques to reduce non-point source contributions from these background sources. Protection, preservation and/or conservation development practices will therefore be promoted as an integral element of the long-term TMDL Implementation Plan in these areas. Moreover, the inability or impracticality of reducing loads from these sources shifts the burden of additional reductions onto the manageable sources (urban and agriculture). This situation will, in effect, require a substantially greater percentage of reduction from these other areas than implied from the broader 43-50% reduction goal in the TMDL Load Allocation. This will have important ramifications in the overall long-range strategies to future non-point source reductions.

1.13 Margin of Safety

A "Margin of Safety" (MOS) is also required as part of the TMDL process to account for the uncertainties in the WLA and LA calculations (Heaton, 2000). The MOS developed for this TMDL is lower than typically derived because of the low uncertainty involved in estimating the point source and non-point source loads to the lake. An extensive amount of information was collected on ambient loadings of total phosphorus entering the lake from the watershed. In addition, point source loadings were intensely investigated so that accurate point source loadings and allocations could be developed. Therefore, an explicit Margin Of Safety of 100 pounds per month is allocated for the early season from April through June, since loads are greater in the spring season to account for the higher peak flow periods. An explicit MOS of 50 pounds per month is allocated for the summer season, since loads are lower in July to September.

SECTION 2.0

TMDL IMPLEMENTATION PLAN

2.1 Overview

Over the past three years, a broad range of watershed-wide participants have actively engaged in dialogue with the state of Michigan, the U.S.EPA and each other to: establish water quality improvement goals, identify sources of phosphorus in the watershed and set reduction goals for point sources and non-point sources of phosphorus flowing into the Kalamazoo River. This implementation plan is the first step in the TMDL process to formally integrate coordinated efforts to achieve Kalamazoo River/Lake Allegan water quality goals. This plan represents the collective thoughts, desires and varying interests of active stakeholders in this watershed. Current and future efforts to disseminate this information will ensure that the stakeholder base continues to expand, allowing for broader participation, new innovations and assurances that goals can ultimately be met. The Plan provides a framework upon which to build consensus and new ideas. It will also serve as the basis to formally administer, track and update TMDL progress, needs and reassessments.

The USEPA has identified several required elements that must be included in Implementation Plans in order to be approvable under current guidance and Clean Water Act regulations. The following provides a summary of these required elements:

- *Implementation actions/management measures:* these describe actions and/or management measures necessary to implement phosphorus reductions including a description of effectiveness.

- *Time line:* defines the milestones of the implementation activities including a schedule for revising point source permits to be consistent with the TMDL. The schedule also includes when best management practices and/or controls will be implemented.

- *Reasonable assurance:* reasonable assurance that the implementation activities will occur. Reasonable assurance means a high degree of confidence that reductions will be implemented by Federal, State or local authorities and/or through voluntary action.

- *Legal or regulatory controls:* a description of the legal authorities under which implementation will occur.

- *Time required to attain water quality standards*: an estimate of the time required to achieve water quality goals specific to the various sources of phosphorus to the river.

- *Monitoring plan:* a monitoring plan designed to determine the effectiveness of the implementation actions and the help determine whether reduction goals are met. The monitoring plan is intended to describe whether allocations are sufficient to attain water quality standards and how to determine whether implementation actions, including interim milestones, are occurring as planned. The monitoring approach must also contain

a methodology for assessing the effectiveness of best management practices and the control of actions for non-point sources.

- *Milestones for attaining water quality standards:* a description of milestones that will be used to measure progress in attaining water quality standards. The monitoring plan must contain incremental, measurable milestones consistent with the specific implementation action and the time frames for implementing those actions.

- *TMDL revision procedures:* a description of when the TMDL will be revised if specific milestones for implementing actions or interim milestones for attaining water quality standards are not met.

- *Tracking Implementation:* To achieve water quality goals, the plan will include a time line for implementation of identified management actions. Especially in the case of non-point source controls, the specific management actions will be distributed in various locations in the watershed. Tracking of the implementation of management actions over time will provide valuable information.

- *Public Participation:* Public participation is a requirement of the TMDL process and is vital to a TMDL's success. It will be vital to the successful completion and adoption of the Implementation Plan and ultimately for achieving water quality goals.

This Kalamazoo River/Lake Allegan Implementation Plan addresses each of these requirements as noted in the remainder of this document.

2.2 Process/Progress to Date

Significant progress on implementation of TMDL activities has occurred to date. This section provides a summary of efforts related to: Implementation Plan preparation, Wasteload Allocation, Load Allocation, tracking and monitoring. Additional details are provided in Section 3.0 of this plan as related to detailed implementation elements for point and non-point source reduction efforts.

2.2.1 Public Involvement, Committees and Subcommittees

A significant number of meetings, all open to the public, have been held as part of this Implementation Plan process (see Attachment A). Additionally, the public has been able to stay informed to all facets of the planning process through information routinely posted and updated at http://kalamazooriver.net. The Implementation Committee itself consistently strove to involve individuals having a diversity of size and representative backgrounds and affiliations, including both point and non-point source contributors of phosphorus. Representation from local units of government, state agencies, public and private sectors, business and non-profit entities all came together to address the task of developing this Implementation Plan for the Kalamazoo River Watershed.

The Implementation Committee is composed of two primary subcommittees, the Point Source Group and the various non-point source groups. Representation in each has been diverse with consistently at high levels of participation. As indicated by the Plan Strategies in Section 3.0, non-point participation was solicited and received for nine categories. As such, there are an additional set of

subcommittees that have formed and continue to serve the interests of these various non-point source groups. Brief descriptions of these committees and subcommittees follow.

2.2.2 Point Sources

Signatories of the Kalamazoo River/Lake Allegan Watershed Cooperative Agreement for the Reduction of Phosphorus Loading (known as "Cooperative Agreement"), have already submitted their first report to the MDEQ. The required six elements of the agreement were addressed in the report. There are over 30 signatories to the Agreement including the Michigan Department of Environmental Quality (MDEQ).

The first annual report submitted by the Point Source Committee to the MDEQ in March of 2002 outlined activities conducted by group. Most point source participants have been meeting and actively involved in the development and implementation of a phosphorus reduction strategy for the watershed since 1998. There has been and continues to be a tremendous level of commitment and effort put forth to ensure successful achievement of improvements to the Kalamazoo River/Lake Allegan watershed.

The following provides a brief summary of activities conducted in 2001 related to the requirements specified in the Cooperative Agreement.

- Twelve meetings were held in 2001 and were attended by various Point Source (PS) dischargers. The initial meeting on January 24, 2001 included representatives from the U.S. Environmental Protection Agency (USEPA), (both Headquarters and Region V personnel) which provided the opportunity to clarify issues and concerns regarding the Cooperative Agreement. This meeting assisted in generating the Cooperative Agreement as soon as feasible and to incorporate appropriate language referencing the Cooperative Agreement in the various National Pollutant Discharge Elimination System (NPDES) permits for the Point Source (PS) signatories.
- The PS Group has devised a general organizational structure to assist in carrying out the work that will be specified in the Implementation Plan.
- Summaries of the point source phosphorus effluent data and control methods were completed.
- Results were compiled for total phosphorus discharged over the six-month period as specified in the Cooperative Agreement for 2000 and 2001
- A website has been developed and is currently being used to begin the data handling and tracking process for both PS and NPS dischargers to the Kalamazoo River/Lake Allegan watershed. This website (http://www.kalamazooriver.net) provides a wide variety of information on the watershed was provided by Kieser & Associates as in-kind services. One of the goals of the website is to achieve a means of collecting and summarizing phosphorus discharge data that is readily accessible to Cooperative Agreement signatories and any other interested parties. The site includes summaries of any locally derived watershed monitoring data, including trend data, as implementation proceeds. Efforts will continue toward finding stable funding for this valuable website.

2.2.3 Non-point source reduction efforts

One of the benefits to bringing together the diversity of interested participants from non-point sources was the access to existing information sources provided during these interactions. Many participants, especially those not very familiar with water quality efforts in the community at-large, were

quite surprised to learn not only of how many activities are ongoing, but who is doing them and what types of results are being generated. Attachment C provides a tabular presentation of most non-point source projects taking place within the watershed including significant activities associated with Phase II Storm Water Regulations.

2.2.4 Website development for public access

A website, http://www.kalamazooriver.net developed and maintained by Kieser & Associates, allows for public access to many local activities related to the Kalamazoo River, including the phosphorus TMDL. By design of this project, the Implementation Plan and supporting documents are posted to the site for availability to all who may have interest in them. In so doing, anyone can "participate" in the process without necessarily having to attend meetings. Updates to the Plan can be made easily and effectively communicated to all interested parties without having to reprint and distribute massive quantities of more traditional paper documents. The anticipated results of this website approach include:

- a more convenient and effective method of access
- participation of a more widespread group throughout the watershed
- elimination of reproduction costs for hard copies

2.3 Implementation Actions/Management Measures

Figure 11 provides a graphical perspective of the Implementation Framework created for this Plan. Three primary areas are represented with corresponding task-related activities germane to each area illustrated below. Reduction Implementation efforts are directed toward addressing load and waste load allocations for both point and non-point sources. Coordination, Communication and Tracking comprises the "administrative" aspect of the Plan, in addition to outreach and educational efforts. Monitoring, Research and Surveys components will be addressed by MDEQ and other designated stakeholders as detailed in the plan.

2.4 Timeline

As presented below, time line elements to achieve the improvement goals for Lake Allegan are divided into point source and non-point source categories. Fundamentally, point source reduction goals (the waste load allocation) will be achieved by 2006. Non-point source reduction strategies will be fully implemented by 2009 with the resultant load reduction (load allocation) achieved by 2012.

For point source elements, the permitting cycle, (with its already scheduled and routine elements as dictated by the MDEQ's promulgated permitting authority), represents the means of addressing milestones and compliance issues. Additionally, Cooperative Agreement elements are similarly linked to the permit cycle for clarity and ease of understanding the approach used. It is anticipated that point source accomplishments will be evaluated in 2004 such that if the waste load allocations are achieved prior to 2006, point sources and the MDEQ will evaluate the utility and need to request an extension of the Cooperative Agreement's flexibility in holding existing permit levels till the expiration date in 2010.

Since non-point sources are not regulated to the extent of point sources, and as there are few compliance schedules between or amongst the various sources to incorporate into time lines, a different approach was developed. Given the tracking/GIS database that MSUE is developing, successful results (reductions of phosphorus) due to implementation of BMPs (process milestones) associated with ongoing watershed efforts (refer to Attachment C) and their efficacy will be examined in 2003. By 2004, it is anticipated that tracking tools will identify that a 10% non-point source loading reduction has been achieved. At this time, the effectiveness of non-point reduction strategies and practices will also be assessed to identify successes that can serve as the basis for further reductions and full non-point source strategy implementation through the period of 2005-2009. The 2009 milestone is then expected to achieve the remaining 40% non-point source phosphorus load reduction to Lake Allegan by 2012.

Point Sources

- *Permitting Cycle Milestones:*

MDEQ Bioassessment	2004
NPDES Permit Applications Due	April 2005
NPDES Permits Issued by MDEQ (during Basin Year)	October 2005-September 2006

- *Cooperative Agreement Milestones:*

Annual Point Source TMDL Reports	March 1, 2003-2006
Assess Cooperative Agreement Success/Petition to Extend	October 2004
Update & Compete Cooperative Agreement Review	2006
Achieve & Maintain Wasteload Allocation	2003-2006

Non-Point Sources

- *Process Milestones:*

GIS Database System Development	2002
GIS Database System Functional	2003
Analysis of Data for Determining NPS P Reductions	2003*
Review & Evaluate Reduction Effort Efficiency	October 2004

- *Reduction Milestones:*

10% NPS Load Reduction to Lake Allegan	2005**
Remaining 40% Reduction Strategies Implemented	2005-2009
Meet NPS Phosphorus Load Allocation Reduction Goals	2012

* By February 2003, other contributing areas for non-point source reductions will have been identified and analyzed by the NPS reduction initiative groups. These qualitative targets, that will reaffirm the 10% reduction, will have to be determined early in the year.

** Current activities that are providing watershed-wide reductions, (such as Storm Water Regulations, Conservation Management Programs, CAFO permits, watershed management planning projects, etc.), serve to support the initial 10% reduction in phosphorus by 2005.

2.5 Reasonable assurances

Reasonable assurances will be achieved in the wasteload and load allocations via the following mechanisms.

2.5.1 Point Sources

NPDES permits will play a major role in assuring implementation of the total phosphorus TMDL for Lake Allegan. Nutrient controls will be executed through the use of NPDES permits and the Cooperative Agreement.

In the Cooperative Agreement, point source dischargers committed to develop a Point Source Reduction Implementation Plan. All point source dischargers accounted for under the Cooperative Agreement are targeted for a collective 23 percent reduction from 1998 loads during the July through September season. A number of point source dischargers have made reductions of total phosphorus since 1998 in anticipation of the TMDL. Periodic reporting to the MDEQ and tracking of reductions are integral to their commitment under the agreement.

Under the agreement, point source dischargers also agreed to facilitate non-point source reductions by providing assistance, resources, and coordination of local efforts, and assist in the development of non-point source reduction strategies in this Implementation Plan. Point source dischargers in the watershed have also provided financial assistance to: 1) develop a non-point source loading model; 2) initiate monitoring in the Kalamazoo River watershed; 3) initiate efforts to address municipal storm water discharges in their communities; and 4) provide financial assistance for water quality monitoring in the Gun River as part of a watershed management planning project. Point sources have also voluntarily participated in the use and refinement of the web-based point source tracking system.

2.5.2 Non-point Sources

Non-point source reduction strategies have been formulated for a range of identified sources in the watershed that encompass contributing practices associated with: residential lawn fertilizers, septic systems, livestock operations, row cropping activities, construction, commercial, transportation, and industrial activities. Many of these sources are being addressed through existing programs, such as the Portage-Arcadia Creeks, Rice Creek, the Battle Creek River and the Gun River Watershed Management Planning Projects, MS4 Voluntary storm water permits, a City of Portage regional storm water treatment facility and the 2002 Farm Bill and associated subsidy programs. Other existing programs identify the substantial impetus already underway in the watershed to address a range of non-point loads.

An integral part of the non-point source reduction strategies is the watershed planning and management of targeted sub-basins with significant non-point source total phosphorus loading. Federal funding (Section 319 and 604(b) grants) and state funding (Clean Michigan Initiative grants) are being used to implement efforts within targeted sub-basins. This particular approach is one of the specific

strategies identified in this implementation plan that will facilitate the implementation of other non-point source strategies in critical sub-basin areas.

2.5.3 Water Quality (Phosphorus) Trading

Water quality trading has been identified in NPDES permits as one means, used in combination with technology-based treatment and individual load requirements, to meet the wasteload allocation. Trading was successfully demonstrated in pre-TMDL conditions in the Kalamazoo River watershed via a demonstration project funded in part by the U.S. EPA (Kieser, 2000). This project was instrumental in providing information vital to the design of a statewide water quality trading program. The project demonstrated and evaluated the environmental and economic implications of watershed-based nutrient (total phosphorus) trading between point and non-point sources. It also provided an incentive for implementing voluntary non-point source reductions. Thus, the reductions envisioned under this TMDL may be achieved, in part, by trading under the pending Water Quality Trading rules in Michigan.

Trading under the TMDL has not yet been fully defined, rather a framework for implementation is identified here in order to best-utilize and adapt this tool for achieving reduction goals as point and non-point source implementation efforts formalize. The following trading elements serve as placeholders for implementation within the TMDL.

- Point Source to Point Source Trading will be conducted at a 1.1:1 trading ratio
- Point to Non-point Source Trading will be conducted at a 2:1 trading ratio from 2002-2006 with the non-point source baseline established for existing conditions per MDEQ draft trading rules. The 2:1 trading ratio will also apply from 2006-2012 with non-point source baseline established at 50% of the existing conditions consistent with the TMDL load allocation.
- Non-point source to non-point source trading will be conducted at a 2:1 trading ratio with baseline phase-in conditions similar to Point/Non-point source trading timelines above.
- Banking of phosphorus reduction credits will be permissible in accordance with state of Michigan Draft Water Quality Trading rules.

2.5.4 Technical Support

Technical assistance will be provided on an annual basis to the operating Point Source Committee and the Implementation Committee for the Kalamazoo River/Lake Allegan Phosphorus TMDL by K&A through MDEQ and Point Source funding. Assistance will be provided in the following two areas:

<u>Technical assistance including:</u>

- Water quality data entry (MDEQ/other results into usable form as is currently available on website).
- Water quality data review and compilation for use by committees for review/decision making.
- Data analysis; updated loading computations and monthly assessments provided in a “user-friendly” format.
- Water Quality Trading coordination and assistance.
- Examination of In-lake/Instream issues.

- Reporting assistance, necessary meetings and coordination activities.

Website Maintenance including:

- Ongoing web maintenance (most activity likely to occur in Spring/Summer months)
- Point Source tracking system - new programming and updates

Non-point source technical assistance will be provided to the Implementation Committee by MSUE through March 2004. This will include:

- Coordination between non-point source reduction strategy committees
- Facilitation of Implementation Committee efforts
- Tracking of non-point source phosphorus reductions
- Addressing sustainability issues and needs
- Developing general educational information as well as for agriculture

To assure progress towards Lake Allegan water quality goals, MDEQ will conduct on-going water quality monitoring through 2006. These efforts are detailed in other sections of this Implementation Plan. Other agencies such as conservation districts and the NRCS have also dedicated technical assistance to the TMDL.

2.5.5 TMDL Leadership Structure

A watershed-wide TMDL leadership structure for the Implementation Committee is illustrated in Figure 12. This identifies the organizational structure agreed upon by stakeholders. The current TMDL Implementation Committee structure will formalize Point Source and Non-point Source Groups. Representatives of the point sources and non-point sources will work with a representative of the MDEQ to organize a September 2002 organizational meeting for the Implementation Committee. At that time, three co-chairs (representing point sources, non-point sources and a non-governmental organization) will be elected as officers/co-directors of the Committee. Membership to the Implementation Committee will be open to anyone living/working within the watershed having an interest in achieving watershed improvements. It is anticipated that this committee and its structure will ultimately formalize into a more permanent structure or organization. This is addressed further in the Section 2.13 Program Sustainability.

Representation on the Implementation Committee largely consists of members of the Point Source Group and the non-point source groups. Meetings will be held periodically to exchange information and track progress of the TMDL using data and evaluations derived from technical assistance provided to the point and non-point source groups, the MDEQ and participants of the Implementation Committee.

Point source participation in the TMDL process has been sustained at a high level with over 30 NPDES signatories to the Cooperative Agreement. The three largest dischargers are leading the point source group to the river. These include designated representatives from the City of Kalamazoo, City of Battle Creek and Menasha Corporation. Three subcommittees have formed addressing data collection and monthly tracking of point sources discharges, financing technical assistance and point source

participation which will communicate with Cooperative Agreement signatories to ensure their active participation. Tracking via the website, water quality trading and technical assistance will be used as tools for point sources to achieve waste load allocation goals.

The non-point sources consist of stakeholders from widely divergent, real and potential contributors of phosphorus loading to the river. The range of non-point source contributions is addressed by the various strategy groups that are convening to implement individual strategies (see Section 3.0) and providing input and feedback to the Implementation Committee. MSUE is addressing the technical facilitation, logistics and a non-point tracking system to be available for use in this TMDL component. A GIS-based tracking system will be used to assist in determining where and how much loading is coming from a participating non-point source.

Non-point source coordinators have not yet been determined but are expected to come from among those representatives that have been meeting with each category-specific non-point source groups. Other non-point source reductions strategies associated with in-lake/instream processes and Sub-basin Management efforts will also provide input to the non-point sources. Delivery and implementation of the non-point source phosphorus reduction strategies outlined in this Plan are largely based upon the premise that the most effective and beneficial focus for watershed planning and management often takes place at the sub-basin planning and management level.

Watershed Management and sub-basin planning require iterative and integrated processes of decision-making with regard to how lands and waters within a watershed can and should be used and/or modified. Such processes provide opportunities for stakeholders to balance diverse goals and uses for physical and biological resources at the local level while considering how their cumulative actions may affect long-term sustainability of the larger resource. Establishing linkages between Sub-basin Management activities and non-point source groups provides a more effective means of communication between those parties most likely to have impact upon or be impacted by such management plans.

2.6 Legal or Regulatory Controls

Point sources are regulated under the Clean Water Act via NPDES permitting mechanisms with the state of Michigan having the promulgated authority from U.S. EPA to administer this permitting program. The Cooperative Agreement, now signed by over 30 point sources and the state of Michigan, binds these signatories to relevant participation in collectively achieving the waste load allocation as well as maintaining an active role in non-point source reduction activities.

Although many non-point sources are not typically bound by existing regulatory requirements, municipalities falling under Phase II Storm Water Regulations, industrial storm water permits and large-scale animal feeding operations fall under the jurisdiction of the Clean Water Act. Many other existing non-point sources fall outside the purview of these regulations that stipulate narrative or numeric discharge limits. Michigan's Drain Code can be used to address existing sources to designated county drains leading to the Kalamazoo River while Michigan's Soil Erosion and Sedimentation Control Act addresses contributions from construction and new development activities. Ordinances and zoning provide local levels of control. The TMDL serves as the guide for revisions to existing ordinances and the basis for new ordinances to further address phosphorus loading. The TMDL's non-point source implementation strategies have been intentionally developed to address other sources of phosphorus where no federal, state or local ordinances are in place to do so.

2.7 Time Required to Attain Water Quality Standards

Point sources have established within the Cooperative Agreement that 2006 will be the time by which compliance with their waste load allocation will be achieved. Non-point sources will implement targeted reduction strategies by 2009 with resultant phosphorus load reductions being achieved by 2012. The Implementation Committee has currently projected a three-year response time for the Lake Allegan system to recover after reaching the desired load reductions in 2012. Thus, the actual time stipulated by this Implementation Plan to attain water quality standards will be 2012 plus three years, or 2015.

2.8 Monitoring Plan

This monitoring plan has been prepared by the MDEQ and has received authorization for funding for a five-year period.

Kalamazoo River

River monitoring, at a minimum, will include collecting monthly (April to September) grab samples at six locations on the Kalamazoo River as resources allow. The locations on the Kalamazoo River are listed below:

Kalamazoo River in Galesburg, Michigan (35th Street)
Kalamazoo River in Comstock, Michigan (River Road)
Kalamazoo River in Allegan, Michigan (M-222)
Kalamazoo River in Allegan, Michigan (M-89) - Inlet to Lake Allegan
Kalamazoo River in Allegan County (M-89/M-40)
Kalamazoo River in Allegan County (Allegan Dam Road) – Outlet to Lake Allegan

Samples collected from the Kalamazoo River will be analyzed for total phosphorus, ortho-phosphorus, nitrites, nitrates, ammonia, suspended solids, chlorophyll *a*, and total dissolved solids.

Lake Allegan

Lake monitoring will include monthly (April to September) samples collected in Morrow Lake and Lake Allegan. Three locations and five locations will be sampled in Morrow Lake and Lake Allegan, respectively, for total phosphorus, ortho-phosphorus, nitrites, nitrates, ammonia, suspended solids, and total dissolved solids at three depths (surface, middle, bottom) where possible.

Vertical profiles in Morrow Lake and Lake Allegan will also be taken for dissolved oxygen, temperature, conductivity, pH and chlorophyll *a* at two-foot increments in addition to the water quality parameters listed above. Lake transparency will be collected using a Secchi disk from the surface of each of the lakes at each location.

The fish community in Lake Allegan will also be sampled, at a minimum, during the rotating basin monitoring years in 2004 and 2009 to assess changes in the fish assemblage.

The point source loading to Lake Allegan will be checked through the periodic review of facility discharge monitoring reports.

2.9 Milestones for Attaining Water Quality Standards

Section 2.4 previously identified the overall timeframe for implementation of this plan. Milestones will be used to measure progress in attaining water quality goals. Section 3.0 of this plan provides details of individual reduction strategies, each with their own incremental milestones consistent with the specific implementation actions from this wide spectrum of contributors. All of these, however, fall under the broader milestones derived from the implementation schedule in Section 2.4. These include:

MDEQ river and lake monitoring	Annual (through 2006)
Analysis of monitoring and tracking data	Annual
Point Source reporting	Annual
Analysis of existing non-point reduction program successes	2003
Evaluation of non-point source reduction effort efficiency	October 2004
MDEQ's Bioassessment of Lake Allegan and Morrow Pond	2004
Point source assessment of Cooperative Agreement Success	October 2004
NPDES Permit Re-issuance based on the bioassessment and successes	October 2006
10% non-point source reduction to Lake Allegan	2005
Remaining 40% non-point source reduction strategy implementation	2009

The NPDES permitting cycle combined with annual monitoring associated with the TMDL, the 2004 intensive MDEQ bioassessment of the system, and the interim assessments of non-point reductions and program actions, provide the primary mechanisms to assess the progress of reductions as well as system responses since the baseline year of 1998 used for TMDL development.

2.10 TMDL Revision Procedures

Through the NPDES permitting cycle and the assessment of non-point source reduction efforts, revisions in the TMDL will first be considered in 2006. This is the expiration date of the applicable sections of the Cooperative Agreement whereby individual discharge limits can be set via new NPDES permit limits through the waste load allocation. By this milestone, a wealth of monitoring data, research on in-lake/instream conditions, quantified reductions through non-point tracking, water quality trading and point source reductions, will also be available. Thus, this is the first logical milestone where revisions to the allocation and/or Implementation Plan will be considered.

The 2006 milestone assessment will also examine the suitability of identified water quality goals based on assessments of conditions in Lake Allegan . The assessment will also consider data from the upstream Morrow Pond used to set relevant goals in Lake Allegan.

If sufficient progress towards achieving currently established Lake Allegan improvement goals is being made by 2006 based on monitoring data, and reduction efforts have achieved designated milestones, the next scheduled TMDL revision will occur in 2012, three years following the implementation of all non-point reduction strategies.

Milestone assessments will be led by the Implementation Committee (or other established TMDL lead organization that emerges during implementation). The MDEQ will provide monitoring data and interpretation of sampling results, as well as clear indications as the adequacy and need for NPDES permit revisions. A TMDL assessment report will be completed by the Implementation Committee and submitted to EPA by October 2006 in these regards.

If other significant activities or events occur in the watershed or Lake Allegan that do not necessarily fall under this Implementation Plan or current U.S.EPA TMDL policies, the Implementation Committee may choose to re-examine TMDL revisions at dates earlier than those established here. One example of such a situation is the potential for significant modification to river and Lake Allegan sediments impacted by PCBs under yet-to-be-determined Superfund remedial strategies. Such activities, which are not a part of this Implementation Plan, may significantly alter achievable water quality goals or reduction strategies and thus, require a re-examination of the TMDL. Other TMDLs slated for the Kalamazoo River associated with mercury and identified tributary impairments will be integrated into the phosphorus TMDL as appropriate.

2.11 Tracking Implementation

2.11.1 Point Source Tracking System

Point sources are operating under a unique cooperative agreement approved by U.S.EPA whereby no new individual permit limits are required for the wasteload allocation. Point sources voluntarily achieve the collective target allocation by individual end-of-pipe controls or water quality (nutrient) trading. A web-based point source tracking system facilitates real-time public access to point source loadings and allows those under the agreement to adjust loadings to meet the monthly or seasonal wasteload allocation. The system relies on the voluntary participation of point source dischargers through the timely submission of effluent monitoring data to http://www.kalamazooriver.net. This tracking system also serves as a possible precursor to a trading registry. Trading is by rule rather than a permit-by-permit basis. A trading framework was established previously in the Kalamazoo River through a U.S.EPA and WERF-funded trading demonstration project (Kieser, 2000) that also served to provide input to statewide trading rules development.

The tracking system is publicly accessible whereby anyone can access point source loading data summaries. Individual point source information is only available to the individual facilities to ensure that only they have access to their laboratory results and flow data used to compute loads. The following provides a synopsis of the type of information and user-friendly elements of this system.

- A registration page requests that a username, password, e-mail address, name, phone number, and the number of facility be provided before data entry. A pull down menu for the facility is also available. There can only be one user per facility. Once the registration form is completed, registration is complete. One is then prompted to enter the outfall ID (such as 001A), and permitted phosphorus loading for each outfall.
- Registration information will be sent to the administrator of the site for verification by the administrator as a valid user. The administrator confirms the registration via email.
- The data tracking program home page is where all the point source monthly totals are displayed. The totals are generated each time a user submits any data, so the monthly "total" is simply the total that the user has entered, and may not be the total for the entire month. If a discharger has

not registered, their outfall ID will be "None Registered." At the top of every page is a row of useful buttons to ease the navigation through this program.

- By default, the current month and the previous two months are displayed. Using the form at the bottom of the table and selecting the desired months wanted (for display) can change this display. The total for each month is tallied in the bottom row of the chart.
- To enter data (or register to use the program), one must click on the "login" button at the top of the page. Once this is done, you will be taken to the login page. If the user is not registered, they can apply for a username and password. Once logged onto the system, the outfall and month are chosen for data entry.

There are two ways of entering data. The first is by using the multi-day average form. To use this form, one selects a day to start data entry. By entering average daily flow and average concentrations, the program will compute the average for every day in the selected time period, and redisplay the current page, with the new data entered. The monthly total on the home page will also be updated.

The second way to enter data is to manually enter each day with an individual flow and concentration. The program will enter the new data and redisplay the current page, with the new data entered. The total for the month on the home page will also be updated. There is also a box for comments, although these are not viewed by anyone but the user and are meant to be a helpful aid for tracking data entry specifics.

2.11.2 Non-point Source GIS Tracking and Monitoring Plan

The TMDL Implementation Plan requires the design, development, implementation, and maintenance of a system to monitor the progress of phosphorus reduction activities in achieving water quality goals. This system needs to allow for the storage, retrieval, and consolidation of data for tracking, reporting, and modeling important watershed parameters and activities. The database will be spatial in structure to allow for the incorporation of that data into geographical representations for reporting, analysis, and education. Attachment D includes additional details of the proposed framework.

Michigan State University Extension has received funding to develop and maintain a tracking and reporting system. On behalf of the Implementation Committee, Kellogg Biological Station (KBS) Land and Water Program and MSU Department of Agricultural Engineering will develop this GIS-based system to track phosphorus reduction activity, information and events in the watershed for both point and non-point sources. The specific scope of the system, and parameters to be tracked and monitored is being determined in cooperation with the Implementation Committee.

Deliverables include an ongoing planning and coordination tool in the form of a 'living' web-based Geographic Information System (GIS). ArcView GIS and ArcView Internet Map server software packages will be used to record, track, and display water quality data and phosphorus reduction related activities, opportunities, photos, etc. across the watershed. This system will allow users to navigate through the watershed via an online map, choose areas of interest, and retrieve pertinent information. The map will contain numerous layers of information such as administrative boundaries, streets, highways, streams, lakes, land use, topography, soils, tract information, and spatially referenced information on phosphorus reduction activities and monitoring data. The map will be linked to pop-up windows with text and graphics that provide detailed information about the activities in each area, along with water quality summaries, photos and links to ongoing watershed projects. As an information

clearinghouse providing overall coordination in the watershed, KBS Land and Water Program will be in position to make ongoing and proactive planning recommendations to the Committee and its new partners.

2.13 Public Involvement

Public involvement has been a hallmark of this TMDL since before its inception in the fall of 1998. The Lake Allegan/Kalamazoo Watershed TMDL project has seen consistent participation and input from many community-based sectors. Landowners, industry, municipalities, governmental agencies, community environmental organizations and citizens from all walks of life have participated in development of the TMDL Implementation Plan. Allowing any individual to express a point of view through careful facilitation has lead to diverse groups of point and non-point source representatives communicating directly with each other and the establishment of cohesive and committed working groups.

The process of building trust has been key to this success and as such, continuity in facilitation of these groups is seen as critical - a key asset in convening and expanding stakeholder involvement and in developing new stakeholder initiatives. Such active public involvement and interaction must continue to ensure long-term implementation success.

The TMDL Implementation Committee, its successor and all partners must continue to provide an open public process, which includes regular convening and facilitation of stakeholders. Public accessibility to specific data and general information, provided through the current website and other means, should continue as a key means of communication to a wide range of stakeholders. Public involvement is essential to the successful protection and restoration of our water resources. Watershed management works best when local citizens, businesses, governmental groups and community organizations step up to lead the effort.

A comprehensive public involvement strategy will continue to play a pivotal role in the implementation of the TMDL strategies. This will be the ongoing responsibility of the Implementation Committee. Attention to group process and community building will influence the success of the TMDL Implementation Plan, and the goals of protection and restoration for this vital community resource. Elements of such a strategy include:

- Identification of targeted stakeholders
- Establishment of regular meetings
- Description of methods to seek public participation
- Consideration of special events/programs
- Communication of meeting minutes and other information
- Accessible reports and products forthcoming from stakeholder groups, including the Implementation Committee and its subcommittees.

There are numerous educational efforts being developed and promoted within many of the Watershed Management Plans and Phase II Storm Water communities inside the overall Kalamazoo River Watershed that will also be used for public involvement efforts in the larger watershed efforts. To duplicate or reinvent these good works would be wasteful and fiscally irresponsible. Another positive

benefit is the ability to recognize, promote and support the sound efforts of numerous stakeholders for their actions and activities within the watershed. Peer recognition can also be a significant intangible motivator for many.

In an effort to increase visibility, provide a better understanding of issues, gain support for the Project and encourage additional citizens to get actively involved, a "source to mouth expedition" has been recommended, to be conducted early in the implementation phases of the TMDL. This public float trip would invite elected and appointed community leaders, general citizenry, educators, students, industry, environmental and business representatives to discover (or rediscover) this great resource running through their "backyards", and join in discussion concerning its future.

The trip would generate observations and discussion of physical features, history and cultural development, aesthetics, recreational opportunities, vegetation and wetland alteration, floodplain occupations, wildlife habitat and observable impacts from point and non-point sources. Qualified resource leaders from state, federal and local agencies, colleges and universities, non-profit organizations and industry could help to identify and assess natural, cultural and recreational resources, suspected problem areas and possible solutions. Those choosing not to actually float on the water could visit with the others at parks and access points along the way.

2.13 Program Sustainability

Prior to its inception in the fall of 1998, the Lake Allegan/Kalamazoo River Watershed TMDL effort had been addressed by stakeholders in the watershed and continues to be a community-driven project. During this time, landowners, industry, government (local, state and federal), community organizations and citizens from all facets of the watershed have participated in the development of this TMDL Implementation Plan.

Project sustainability has been considered from the beginning. The process of implementing the TMDL in this watershed will continue to be an iterative one where goals, strategies, partners and progress will be regularly revisited. As such, there is a need for a watershed-wide organization, network or system that can provide facilitation, coordination, communication and tracking of phosphorus reduction activities across the watershed. Currently, no such entity exists.

The overriding precept of this plan includes reliance upon partnering local and regional stakeholder efforts as the keystone of watershed restoration. Strong emphasis is placed on voluntary changes in the activities we conduct and the way we manage our lands and waters. One major challenge will be to continue to identify, nurture and support, groups with on-going activities having watershed-based impacts, as well as those organization(s) capable of sustaining momentum gained over recent years. The task of coordinating all who are willing to help provide the necessary leadership for the future will not be an easy one.

Such leadership could entail overall coordination and communication of phosphorus reduction activities, including the convening and facilitation of stakeholders into a viable group. Public involvement is essential to the successful protection and restoration of our water resources. Watershed management works best when local citizens, businesses, multiple levels of government and community organizations lead the effort. Attention to group process and community building can positively influence the outcomes of these efforts. Within the structure there needs to be at least one entity that can

either serve as or identify a fiscal agent capable of seeking, accepting and administering grants, donations and other funding to help implement phosphorus reductions activities. The group does not necessarily need to do the actual work.

Several local organizations will be evaluated for consideration of their capabilities to provide, nurture and support the desired services for a watershed-wide TMDL group. There are numerous and varied successful watershed models within Michigan, and around the United States, that might help characterize a desirable situation. In addition, there are several regional, small watershed-planning projects authorized, organized and funded under Section 319 of the federal Clean Water Act. Such projects establish and utilize important community stakeholder networks, which can be critical to the educational components of an overall TMDL program. Land use guidelines and Best Management Practices (BMPs) for a wide list of activities are stressed in these projects. Such broad partnerships are also excellent candidates to provide support and coordination for a sustainable way of life into the future.

In the interim, the TMDL Implementation Committee has agreed to continue meeting on an at-least quarterly basis to provide such watershed wide leadership and coordination. The leadership established within the Point Source Group may serve as a role model for a similar development for local leadership to also direct the Implementation Committee. Three participants representing two major municipalities and a conservation district are currently coordinating the next Implementation Committee meetings to initiate this plan. The MDEQ, MSUE, Kieser & Associates and others will provide technical support to this group through various funding sources. At some point in the future, it is expected that consideration will be given to establishing a new entity, or empowering an exiting entity (or entities), which will provide the desired fiscal, leadership and coordination capabilities necessary to perpetuate a truly sustainable programmatic approach.

2.14 In-lake/Instream Additional Sampling

In-lake/instream sources of phosphorus (internal phosphorus loadings) have the potential to directly affect our ability to attain water quality goals. Scientific evidence (Robertson et al., 2000; Søndergaard et al., 1999; Soranno et al., 1997; Van der Molen and Boers, 1994; NRC, 1992; Jeppesen et al., 1991; and Marsden, 1989; etc.) has shown that due to internal loading, measures introduced to reduce external (point and non-point sources) phosphorus loading to lakes or reservoirs do not always lead to a decrease in lake water phosphorus concentrations, particularly in eutrophic lakes. The reason is the internal loading of phosphorus released from accumulated phosphorus in sediments from historic loads. Internal loading is a natural process existing in almost all lakes to various degrees. However, it manifests itself most significantly in eutrophic lakes where the sediment phosphorus levels are high and conditions favoring phosphorus release from sediment are present. Internal loading was not considered in developing the Lake Allegan/ Kalamazoo River TMDL, although concerns were raised and the need acknowledged for additional monitoring to determine "if phosphorus release from sediments plays a significant part in the recycling of phosphorus in Lake Allegan" (Heaton, 1999). In fact, data analysis conducted for Lake Allegan points to the possibility of this internal loading in Lake Allegan (see Attachment E)

The implication of continued internal phosphorus loading in the lake for the TMDL management plan can be three-fold. First and foremost, internal loading, along with streambank erosion and sediment resuspension, has the potential to delay the achievement of a desired phosphorus level in the water

column after point and non-point sources are reduced. Second, internal phosphorus loading in Lake Allegan could mean that load allocations might need to be re-examined with the consideration of the amount that internal loading contributes to the total load. Third, if internal loading is significant compared to external loading, in-lake treatment such as sediment dredging and rough fish eradication, and in-stream erosion controls such as bank stabilization could be more cost-effective in reaching the TMDL goals than introducing deeper cuts to external sources. This can have important economic implications because marginal costs of further reducing phosphorus discharges from external sources are rising rapidly after decades of efforts in curbing these discharges.

In-lake/instream processes considered in this category may include:

- Streambank erosion due to poor management activities (e.g., loss of natural vegetation cover and livestock access)
- In-stream sediment resuspension (scouring)
- In-lake phosphorus release from sediments under low dissolved oxygen conditions
- Lake sediment resuspension introduced by water movements
- Lake sediment resuspension introduced by recreational activities
- In-lake biological processes including carp excretion and bioturbation (sediment disturbances)
- Changes in hydrology (dam operations)

There are existing data gaps in understanding the in-lake/instream processes in this TMDL. Important questions include:

- Where is erosion occurring?
- How does phosphorus cycle within the river and Lake Allegan?
- What is the magnitude of internal phosphorus loading in Lake Allegan?
- How much do carp activities affect phosphorus (bioturbation, fecal deposition)?

To fill these information data gaps, additional sampling and monitoring are being examined for implementation (through yet to be determined funding sources) that include the following elements.

- *For characterizing internal phosphorus loading in the lake:*
  - *Water chemistry and flow data.* A mass balance for phosphorus in Lake Allegan is the most direct way to derive the internal loading rate. To obtain the phosphorus mass balance, water samples would be taken at least twice a month from the lake inlet (Kalamazoo River at M-89 in Allegan), the outlet (Lake Allegan Dam Road in Allegan County), and mouths of the tributaries (e.g., Dumont Creek) to the lake.
  - *Lake biota survey*. The overall phosphorus loading rate may not reflect localized strong internal loadings caused by biological activities such as carp disturbance or phytoplankton migration. These localized internal loadings can cause severe water quality problems and contribute to overall water quality problems. In addition, lake biota management, such as rough fish eradication, has proved exceptionally effective in improving lake water quality (e.g., Robertson et al., 2000). Therefore, fish survey and phytoplankton sampling would be conducted to understand the general relationship between water quality and lake biota.

- *Sediment phosphorus characterization*. Sediment characterization is the most direct measure of sediment phosphorus accumulation and release. Surface sediment sampling (for particulate phosphorus and soluble phosphorus) would be conducted throughout the year and depending on the results, sediment coring may or may not be necessary.

- *For Assessing streambank erosion contributions:*

  - To assess the magnitude of bank erosion and its impact on phosphorus sources and internal loading in-stream, a broader watershed-wide assessment of contributing streambank erosion sites is needed. This can be partially initiated through current and future 319 subwatershed projects, MDEQ stream crossing erosion inventories, and even future proposed river tours.

- *For understanding the impact of in-lake/instream processes on the TMDL implementation plan:*

  - A calibrated and verified water quality model, coupled with a biological model, (both using historic and new data), may be helpful to assess whether targeted reductions via point source waste load allocations and non-point source load allocations will bring about the expected changes in Lake Allegan.

2.15 Education/Outreach

Each individual phosphorus reduction strategy outlined in this plan has an information/education component. Many of those have identified and described their targeted stakeholders, the desired messages and recommended delivery mechanisms. However, there is also an important and critical need for a watershed-wide, and TMDL issue-wide, educational program.

The KBS Land and Water Program through Michigan State University Extension (MSUE) has received funding (until March 31, 2004) to serve as a clearinghouse for phosphorus reduction activity, information and events in the watershed on behalf of the Implementation Committee. The program will communicate the benefits of phosphorus reduction, advertise related activities and educational opportunities and highlight progress towards the TMDL to a variety of audiences and partners. In addition, the web site http://www.kalamazooriver.net, contains background material on the watershed and TMDL program, the planning effort and related material.

Additional planned activities include an ongoing phosphorus reduction communication campaign incorporating brochures, fact sheets, workshops and media releases. In addition, newsletter columns and one-page, two-sided newsletter inserts will be developed for regular distribution into existing regional newsletters. These efforts will be watershed wide with particular focus on the top contributing sub-basins.

Ongoing education efforts by organizations such as the Michigan Department of Environmental Quality, U.S. Environmental Protection Agency, Western Michigan University GEM Regional Center, Michigan Groundwater Stewardship Program, Kalamazoo Nature Center, Conservation Districts, County Extension offices and others, will be strengthened for the future. The many Phase II Storm

Water communities within the watershed are already playing an important educational role, and other partners in education will include area Math and Science Centers, and the Science Coordinators of the Intermediate School Districts.

A number of planning projects in smaller subwatersheds, authorized and funded under the federal Clean Water Act, are important community organizations critical to the educational components of an overall TMDL program. As part of that effort, they will stress land use guidelines and Best Management Practices (BMPs) for a wide list of activities. Projects currently are underway in the Gun River, Rice Creek, Battle Creek River and Portage/Arcadia Creek watersheds, and more are anticipated. Several other educational efforts associated with Phase II Storm Water Regulations and conservation district initiatives are also ongoing.

SECTION 3.0

IMPLEMENTATION STRATEGIES

The Implementation Committee adopted a consistent set of reduction strategies and guidelines for each recognized contributor of phosphorus to this system. This established a level playing field and accountability amongst all watershed stakeholders affected by the Lake Allegan/Kalamazoo River Watershed TMDL. The general categorical contributors include:

- Point sources
- Non-point sources
- In-lake/Instream processes
- Sub-basing Planning

For the non-point sources, several subcategories exist. These were introduced previously in Section 1.1 and appeared in Figure 11. For all of these sources, the following framework elements have been identified. By specifying complete responses to each of these categories, all stakeholders can recognize their contribution and commitment to the overall process of improving conditions in Lake Allegan as required by the Clean Water Act. Understanding the importance of these various elements will also result in 'buy-in' and support by each group. Information will additionally be used to educate those not familiar with the TMDL process and related requirements as well as strengthen alliances amongst the various groups and leverage additional support and funding.

Implementation Plan Elements addressed by all Stakeholder Groups include:

1. Identification of stakeholders.
2. Applicable regulations and requirements related to water quality.
3. Specific goals and objectives related to phosphorus loading reductions (qualitative and quantitative).
4. Actions/recommendations for achieving phosphorus reductions.
5. Resources available to achieve reductions (funding).
6. Tools to achieve reductions (programs).
7. Assessment of costs to best achieve reductions (cost-benefit analysis).
8. Identification of data gaps.
9. Accountability structure (who will ensure participation by all parties—a recognized body, group or agency).
10. Reporting (documentation of progress, disseminating new information) on a routine basis and established communications procedures (website, mailings, meetings).
11. Establishing timeline/target dates.
12. Tracking qualitative and quantitative results achieved.
13. Monitoring (actual sampling by any groups or participants; identifying related needs).
14. Contingency plans for implementing alternatives if established plans do not achieve reductions (goals).
15. Process for updating the overall strategy and revising as needed to achieve objectives and timelines.

Information pertaining to each point and non-point source reduction strategy/category is presented in a generally consistent manner that includes the following:

- General Description of stakeholder category
- A table of Implementation Plan strategies for each of the 15 elements noted above
- Reduction program highlights (including public participation, accomplishments to date, timeline)

A cross-cut analysis of overlapping elements between categories is provided after the presentation of all strategies.

3.1 Point Source Plan

Primary stakeholders consist of thirty-one dischargers, representing all municipal and industrial waste water treatment plants, lagoons and cooling water sources in the watershed. All were contacted to participate in formulation of this strategy. Approximately three-quarters of all dischargers were active participants who consistently met at meetings, which were very insightful and productive. Most representatives had the advantage of knowing each other professionally. Establishment of partnerships and other collaborations will be accomplished through Cooperative Agreements and potentially, water quality trading. The task of establishing working collaborations has already begun. Table 6 demonstrates the scope of considerations that went into the issues discussed.

Regulatory oversight for point source (PS) dischargers is provided through NPDES permits, the EPA-approved TMDL allocation and Cooperative Agreement. NPDES permits are tracked monthly through Discharge Monitoring Reports (DMRs) and the Point Source Tracking System established in 2000 to provide near real-time tracking of daily and weekly discharges. The other two elements listed have now been completed as well.

Goals established by the point sources include:

- At a minimum, from April to June, discharge levels are to be maintained at 1998 levels
- Between July and September, a 23% reduction of 1998 levels will be reached
- Reductions will be tracked monthly throughout the year (web-based system now active)

These plans are to be revisited as needed and all goals will be tracked for meeting or exceeding monthly and seasonal goals.

Ongoing efforts include MDEQ compliance and enforcement as appropriate to specific situations. Some facilities have already achieved reductions from the 1998 levels, as can be observed at the website tracking location. This consistent reporting and posting of results to a publicly available website allows all participants and others interested in tracking this approach to receive data on a more current timetable that otherwise possible. Participation by 100% of all point sources will be a significant milestone when reached.

Among the recommendations put forward by the Point Source committee, the following are offered as most instrumental in helping to achieve the goals of the plan.

- Implement additional treatment processes
- Consider use of end-of-pipe chemical additions
- Implement an alternative discharge schedule for lagoons (March-October)
- Expand pretreatment requirements
- Pursue alternative uses and handling procedures for cooling water (i.e., recycling/reuse, groundwater discharge, cooling towers)

Approaches for funding of resources ranged from:

- Increased rates to those receiving service
- Taxes or fee structure for new developments/connections
- Grants for innovative technologies and/or research
- Trading approaches between PS and NPS(s) or PS to PS
- Reduce energy used by more efficient equipment and processes
- Revenue neutralization (reduce or eliminate costs) for waste handling (marketable compost, land application, etc.)

Several point sources are currently investigating some of these approaches. As the Implementation Plan moves forward, and experiences (both positive and negative) are shared, there is the expectation for additional point sources to adopt approaches deemed pertinent to their specific situation.

A number of MDEQ programs (see accompanying table) and approaches were cited among the identified program resources. The Water Environment Federation (WEF) and its constituent units are a considerable source of reliable technical information, obtainable from local, state and national (website) constituents of this body. Other program resources include readily available information and equipment from multiple segments of the private sector, trading programs (viewed as a new and viable resource), and the aforementioned grants and demonstration project funds.

Optimization of costs will continue to play a persuasive role in all approaches, whether publicly or privately owned. Feasibility and pilot studies will assist in determining what equipment, management techniques and operational procedures can yield the lowest cost per pound for treatment alternatives. Again, the role of trading, especially between point source and non-point sources, in providing lower costs per pound for operations is seen as a key, especially when viewed from the perspective of capital costs anticipated for growth under a TMDL cap. Several of the conservation approaches listed above (as alternate funding sources) can play a significant role in optimizing current costs too.

Among data gaps identified in the current process are:

- Timing of monthly loading submittals
- Obtaining monthly submittals from all identified point sources
- Monthly NPDES phosphorus sampling requirements
- Necessary permittee and user costs to implement controls
- Future growth needs and the WLA

Throughout the ensuing process, data gaps will be identified and included within the documentation that will accompany the Implementation Plan.

To ensure that an accountability structure is in place for the TMDL process, point sources have already established a Point Source Group and a leadership strategy for an Implementation Committee. Discussions have culminated into a more formal organization with a fee structure to fund technical assistance. Alterations to the current structure will be finalized in 2003. Reporting will be accomplished by the monthly on-line entry into a database; annual reporting per the Cooperative Agreement and any interim reports that may be prepared.

The timeline for these activities is somewhat flexible as numerous considerations will need to be addressed in order to accommodate critical waste load allocation deliberations including new growth and new discharges. Some of these adaptations will also be necessary only if non-point sources are unsuccessful in achieving reductions. Others will be instituted along with routine updates of equipment and procedures. If nothing else, improvements are anticipated to be ongoing throughout the point sources as the Implementation Plan moves forward. A web-based framework has been drafted for one database for the TMDL process. The current web tracking database should continue as a source of monthly information. A key feature is the reliance upon individuals to voluntarily provide this information by entering data into the appropriate database. Standardized procedures allow for a more reliable data set.

Monitoring to ensure efficacy of the process set forth in this Implementation Plan can be accomplished through:

- NPDES reports (available if requested)
- MDEQ compliance and enforcement monitoring
- Ensuring that all river/lake monitoring data (MDEQ & other) follow suitable QA/QC procedures and is posted to web site to keep database current
- Determining a mechanism to ensure sound database management and accessibility
- Determining a mechanism for reliable data analysis

Recognizing that a contingency plan is in order, participants determined three scenarios:

- A short-term response (needed if monthly or seasonal goals are not met) would include an increased treatment level at the largest WWPTs to lower phosphorus output
- A 5-year plan consideration if goals are not met included the approach above as well as increased on-site treatment and water quality trading versus expansion of the WWTP system and evaluation of state-of-the-art phosphorus reduction options
- Long-range contingency plans would address new growth, incorporation of water quality trading incentives and markets, new discharges to the watershed, not meeting water quality improvements with or without either the described point source goals or the described non-point source goals

Updating is anticipated to be an ongoing activity through the efforts of the TMDL committees and associations that have been established and reviews of prepared reports (monthly, annually and within the 5-year cycle).

3.2 Non-point Source Plans

3.2.1 Municipal Storm Water

All Phase II communities in the watershed are stakeholders for Municipal Storm Water issues. The existing Federal Clean Water Act gave rise to storm water concerns addressed within Phase I and Phase II timetables. By March 2003, all regulated communities in urban areas must have submitted an application for permit coverage. Prior to that date, eligible entities can submit for a voluntary permit and coverage that will carry over past May 2003. Simply stated, the broadest goal for this element is for all communities that must be regulated as well as those that choose voluntary permit coverage, to have effective storm water programs (see Table 7).

To date, the following communities are the only ones in the State outside of the Rouge River watershed to have already received voluntary permit coverage and have begun implementing Phase II programs (this says something about the commitment in the Kalamazoo River watershed to improve water quality):

- City of Battle Creek
- Calhoun County Community Development
- City of Springfield
- City of Portage
- Western Michigan University

Additional ongoing efforts toward development of permit applications, municipal storm water programs and consistent educational efforts are the focus of the Kalamazoo Area Storm Water Working Group, which includes cities, townships and county entities, as well as Battle Creek area townships and the City of Allegan. This group and those participating stakeholders in this TMDL element endorse the following recommendations to effectively reduce phosphorus through municipal storm water programs. They will encourage:

- the watershed approach to implement municipal storm water management
- targeting of phosphorus reductions in municipal programs
- communities that are not automatically regulated to participate in the municipal storm water program

Such efforts are ongoing now and more will follow with implementation. Among the specific initiatives discussed are:

- Tracking those communities with regulated storm water
- Public education efforts to promote, publicize and facilitate watershed education and phosphorus reductions
- Searching for and removing illicit discharge connections watershed -wide
- Tracking pre- and post-monitoring removal of illicit discharges where possible
- Altering management practices such as augmenting street sweeping practices and conducting clean-outs of catch basins

- Improving criteria for managing storm water using bioretention and infiltration at sites of new development
- Promoting BMPs and structural mechanisms to improve storm water for retrofitting existing systems

A key opportunity for cost optimization was recognized by seeking to share resources across governmental jurisdictions whenever possible. The case of the watershed logo (see Attachment F) is such an example. Various watershed groups have determined that adoption of one logo would produce sizeable cost reductions for all who use this design. Costs for generic sign "blanks" and other paraphernalia can be minimized while simultaneously allowing for additional printing per sign for specific locations/purposes.

Accountability for this regulatory National Pollution Discharge Elimination System program will lie with the Michigan Department of Environmental Quality (MDEQ), serving as administrator in Michigan. Reporting will be to MDEQ on an annual basis with copies provided to the Implementation Committee and communicated to the general public at the annual TMDL meeting. Michigan State University is developing a tracking system for phosphorus reduction estimates in the watershed that should be available during 2003.

Monitoring is expected to be accomplished through multiple entities. Some communities will monitor their own storm water programs, while other efforts will be the result of state activities. A contingency effort in this plan is to designate for coverage, those communities not automatically designated under Phase II. If necessary the timing for such action will be highly dependant upon the success or failure of multiple reduction strategies, included in this Implementation Plan, by both point and non-point sources.

3.2.2 Industrial Storm Water

Federal Clean Water Act industrial storm water regulations require National Pollution Discharge Elimination System (NPDES) permit coverage for all regulated industrial sites having point source discharges. Stakeholders include the Michigan Department of Environmental Quality (MDEQ), regulated industries and local units of government. As established by the stakeholders in this project (see Table 8), the following goals were set forth:

- Permit coverage must be obtained for all facilities that should have such coverage
- Full permit compliance must be achieved by each facility having a permit, especially including full implementation and maintenance of storm water pollution prevention measures

During this process it was further determined that:

- The State has already implemented many regulations now in effect
- Most of the point sources have NPDES industrial storm water permits in place
- Many of the permitted sites have developed Storm Water Pollution Prevention Plans (SWPPPs) that are now in effect
- Some compliance activities are ongoing at this time

Recommendations included:

- A need for better compliance on the part of industrial permittees
- More regular compliance inspections by MDEQ of all permitted facilities in the watershed
- MDEQ enforcement of non-compliant sites
- Ongoing rapid identification of all non-permitted facilities that need permits that commenced in 2001

The latter element points to a data gap that requires rapid attention. Program resources available include MDEQ staff, local units of government, professional associations, environmental groups and private citizens. Cost optimization can be enhanced not only by adequate staffing levels within MDEQ, but also through sharing of reliable information and successful techniques among generators.

While the permit system provides its own built-in accountability structure, additional reporting will be available through the on-going MDEQ compliance tracking/reporting and regular MDEQ updates to the TMDL process itself. Additional elements for Industrial Storm Water will be determined and agreed to as the project continues to move forward.

3.2.3 Land Use and Development

As noted in the context of this Implementation Plan, the TMDL in essence provides a "cap", or limit, on the amount of phosphorus that will be allowed to enter the river and eventually, Lake Allegan. As such, this restriction can also be viewed as a cap on growth within the watershed. Traditionally, population growth, expanding communities and business development have resulted in greater wastewater contributions to our treatment plants (and thus to receiving waters), new industrial permitted discharges and often, greater runoff from more impervious urban areas. As municipal (local government) stakeholders, business professionals, planners and conservationists there is a need for appropriate land use and development tools to reduce and offset new phosphorus loads while addressing the political and social reality that growth will occur.

Conservation development (a variant of 'Smart Growth' and other concepts related to low impact development), in conjunction with incentives such as trading, can provide tools to address these competing issues (phosphorus reductions and growth). Conservation development and integrated planning that acknowledges new limits on runoff imposed by the TMDL can provide excellent means to stimulate thought and movement towards addressing the real issues of growth and environmental sustainability. These can be viewed both in the context of specific TMDL requirements, and as a means to adopt new planning approaches that meet community needs and challenges while incorporating fundamental economic realities. Strategies are now being examined through grant funded projects to integrate market-based incentives, such as nutrient (water quality) trading, into the process of land use and development.

Two meetings were held with: a subgroup of the Kalamazoo River TMDL committee, local stakeholders interested in this approach, and representatives of CH2M Hill. Funding from the Joyce Foundation allowed this group to:

- Discuss the conservation development approach
- Examine how this concept might serve to enhance our local planning processes

- Identify what steps might be taken to integrate this and other concepts in conjunction with TMDL implementation and planning needs
- Discuss what tools will need to be developed for use in the local planning process to promote development that addresses TMDL needs

As a result of these meetings, the approach described here was determined to be a desirable tool for watershed communities, incorporated into the initial Implementation Plan as a concept to be examined but not mandated. These efforts will also identify opportunities to move conservation development concepts forward, with additional meetings planned for follow-up with interested stakeholders.

Participants agreed that planning tools and techniques currently employed by watershed communities do not link land uses, or changes in land uses to phosphorus loadings. Therefore, no easy way exists to evaluate the net phosphorus load from, for example, a new subdivision, or a facility expansion or a retrofit. There also is no easy way to compare the net phosphorus impact of two alternative site proposals. On a broader scale, there also is no easy way to estimate the cumulative impacts of multiple land use changes on net phosphorus loads. This is an important planning capability, necessary to help manage the TMDL as well as current and future land use planning decisions. Thus, Table 9 outlines the current TMDL implementation strategy to address future development and growth in these regards.

These findings are supported by another ongoing, locally developed and driven project. "Convening Our Community," is being lead by Dr. Kiran Cunnigham and Dr. Hannah McKinney of Kalamazoo College. This project seeks out county-wide input and opinion on multiple topics including smart land use and growth issues within Kalamazoo County. Maps of both existing and proposed land use for each City, Township and Village in the county were gathered, digitized and integrated into a set of GIS formatted maps. Multiple, separate meetings were held with participation from a wide diversity of stakeholders (elected officials, appointed officials, teens and elderly) as a part of this concept. Identification of what participants believe to be geographic areas worthy of preservation, unique character or distinction were located and mapped. One goal seeks to have a more unified, county-wide land-use mapping program to allow all to see what and where the community is creating our greatest impacts (both positive and negative).

Local site plan review processes do not include an analysis of phosphorus loading impacts. With respect to what may be necessary under TMDL implementation, in terms of changing current practices, there is a gap in that outside of site plan review there is no sense of a mandate that something will change. Municipalities in the Kalamazoo basin have no such tools as those described above. Meeting discussions revealed that the workgroup was not sure how they would begin to implement TMDL goals relating to existing and new land uses without these kinds of capabilities.

It was therefore agreed that the best way to illustrate how a conservation credit market could be developed and implemented would be through a series of retrospective and live case studies. Such retrospective studies would pull information relating to several already completed land use projects and evaluate how the proposed suite of tools available for these demonstrations could have helped evaluate the plans and lead to a better result (i.e., lower net phosphorus impact). The actual case studies will interject these planning tools and credit concepts into one or more currently proposed projects that are at an early enough stage where such a demonstration could be successful and meaningful. Several

candidates were mentioned, including a brownfield site and a park expansion. It is believed that sufficient data are available (e.g., event mean concentrations) to customize the models for application in the Kalamazoo Basin, but that analysis would have to be confined to where we have both land use and water quality data. These studies are proposed to be conducted within the 2002-2004 period and should serve to bolster data and recommendations for the TMDL Implementation Plan.

3.2.4 Greenhouses

Kalamazoo County is home to the largest bedding plant industry in the United States. Many of these growers have banned together to form the Kalamazoo Valley Plant Growers Association. The bulk of these members have their operations within a small area of Comstock Township, not far from the Kalamazoo River. In an effort to provide greater outreach to such growers, MSUE has developed a new program. Greenhouse*A*Syst, modeled after the successful Farm*A*Syst and Home*A*Syst programs, is being piloted during 2002 within Kalamazoo County because of the density of growers located here. The program consists of a voluntary, confidential inventory of facilities and operations, undertaken at the operator's request. Problem areas are identified and discussed, and recommendations and implementation plans are proved at the end of the audit.

Among the stakeholders included in this Plan Element are the operators, related associations, MSUE District Horticultural Agents, groundwater programs, County Drain Commissioners, Conservation Districts, NRCS/RC&Ds, and local municipal officials. Regulations affecting this industrial sector range from the Clean Water Act at the federal level, to the Michigan Natural Resources and Environmental Protection Act (NREPA, PA 451), the Michigan Drain Code, this TMDL and local zoning ordinances and municipal statutes.

The primary goal, as with other NPS categories, is to help achieve a 50% reduction in phosphorus load to the Kalamazoo River and Lake Allegan. Table 10 identifies implementation strategies. Improvements in pesticide and fertilizer management, irrigation water management, water testing, employee training, building and site management and control of soil movement will all play roles in achieving reductions of phosphorus. Preliminary efforts with inventories are expected to commence in the fall of 2002. Acknowledgement of Phase II storm water outreach efforts will also contribute to better site management.

As private business owners, cost optimization will be a critical element to the incorporation of any proposed changes to operations and management. Exploration of potential research opportunities, identification of key data gaps, outside funding sources for assistance, cost sharing through member associations and a determination of potential individual savings/revenue enhancements will play important roles in gaining participants and moving this program forward. Reporting the results of these activities, for other growers and for public understanding, will be a significant milestone for this approach.

Projections are for the Greenhouse*A*Syst Program to be offered in all counties within the watershed by the summer of 2004. Tracking and monitoring will accompany efforts brought on line to evaluate efficacy. Should targeted approaches not yield the desired results, contingency plans include the potential for direct regulation of greenhouse operations via Michigan PA 451, Phase II Storm Water Regulations and/or industrial storm water provisions as "significant contributors". MDEQ compliance

and enforcement efforts can be used to address discharges contributing to violations of water quality standards. Consistent updating should occur through the proposed Implementation Committee structure.

3.2.5 Agriculture

Three stakeholder meetings were conducted, each within a different geographic area of the Watershed (a 2001-2002 milestone), to both obtain information from and provide information to agricultural and interested participants regarding phosphorus and water quality issues. (Summaries of these meetings are included in Attachment G. A diversity of participants are involved in the agricultural sector, including agricultural producers of crops and livestock, governmental and nongovernmental agencies, suppliers, educational institutions, multiple associations, consultants, drain commissioners, planning and zoning bodies, State and Federal elected officials, local officials, and non-agricultural landowners. It is fortunate to have representation from many of these sectors in this Implementation Plan effort. Continuing as targeted objectives will be the dissemination of information on current problems and the means to address those problems to achieve increased water quality within the watershed. Various aspects of these efforts are detailed in Table 11 as the implementation elements for agriculture.

Most regulatory elements are directed toward combined animal feeding operations (CAFOs) and direct discharge operational components. The federal Clean Water Act and Michigan's 1994 P.A. 451, as amended address impacts of discharges on surface water quality. Existing guidelines and programs include Generally Accepted Agricultural and Management Practices (GAAMPs) and the Michigan Agriculture Environmental Assurance Program (MAEAP). Efforts will remain ongoing in lobbying for a watershed designation under the Conservation Reserve Enhancement Program (CREP).

The primary goal for agricultural participants is instituting efforts to help reach the 50% reduction in phosphorus delivery by continuing improvements in:

- Nutrient management
- Soil erosion controls
- Manure and fertilizer storage and handling methods
- Knowledge of existing sources and contributions

Reductions already begun and expected to continue include: lessening of phosphorus (P) content in feed supplies and fertilizers, obtaining a better knowledge of P background levels and contributing sources/conditions, GIS-based soils mapping, testing to determine P content and, techniques for the differential application of fertilizers based on such mapping.

On-going efforts include: MAEAP education and implementation, RTF complaint resolution actions, manure management, groundwater and surface water risk assessment work, watershed management planning programs, MDEQ compliance and enforcement efforts, NRCS actions and local Conservation District plans, programs and activities. All of the foregoing contribute to continuing implementation of more effective BMPs and alterations to former practices that result in reduced phosphorus contributions to water sources in the watershed.

Recommendations for the Implementation Plan stemming from group interactions include:

- Target and install more BMPs through the Natural Resources Conservation Service network
- Assure that all CAFOs in the watershed are covered by the MAEP program or the CAFO permitting process
- Develop case studies of farms that successfully manage P for education programs
- Create new education and certification initiatives and cooperatively work with other similar educational efforts in the watershed (see meeting summaries later in this section)
- Continue existing educational programs such as MAEAP, MGSP and others
- Explore water quality trading opportunities as a means of achieving phosphorus reductions

Funding and program resources are expected to include what have become traditional sources in addition to the new Farm Bill sources and those established through water quality trading. Cost optimization should always be a priority for any technique or program used for P reductions. Recipients of funds, as with any business, are encouraged to share a portion of costs involved and seek to insure fiscal responsibility for all efforts.

Primary data gaps include the ability to readily quantify or estimate phosphorus loading reductions with various BMPs or other management measures (when most protocols focus on sediment loss estimates), and the ability to track a broad range of improvements being implemented across the watershed. Tools now being developed by MSUE will begin to address these needs. Water quality trading using estimation protocols relying on NRCS and MDEQ load estimation procedures and a pending electronic registry, will provide another means to address both data gaps for those agricultural participants pursuing the option to generate phosphorus reduction credits.

Accountability for implementation options and related P reductions will be shared between key agency players such as the Michigan Department of Agriculture, MDEQ, MSUE and NRCS. The Implementation Committee will also serve as part of the accountability structure created as part of this plan. Continued "buy-in" by participants is a key element of accountability.

Since most programs involving agricultural interests have some level of reporting requirements, reporting will become an on-going aspect of the Implementation Plan throughout its duration. Coupled with periodic meetings of the agricultural subcommittee and the Implementation Committee, ample opportunity exists for transfer of important information from one level to another and ultimately, to be made publicly available to any interested participant. Achieving implementation strategy goals by 2009 will remain the focus for accountability efforts.

Tracking will be important through the 2002-2006 period. Activities such as CAFO regulated farms, discharge violations, RTF resolutions, loss of farmland acreage, amount of land placed in conservation reserve, acres under MMSP and CNMP, implementation of new BMPs installed, trading efforts made, number of credits generated and marketed and the kinds of interactions between agencies will all be tracked and monitored wherever possible.

While contingency plans will contain a degree of reliance upon additional education and incentives to direct agricultural interests towards greater reductions in phosphorus delivery, there is recognition that a stronger motivational element may also be required. Toward that end, the

Implementation Committee will consider such options as livestock operations of 300-1,000 animal units will be designated for CAFO permit coverage.

Embedded within the considerations provided above is an on-going updating strategy by virtue of periodic meetings and reporting efforts. The Implementation Committee is willing to augment the Implementation Plan whenever needed on the basis of consistent information brought before it that suggests the need for such revision.

3.2.6 Transportation

Representatives of three County Road Commissions are among those meeting in 2002 to discuss Transportation Management considerations and their relationship to phosphorus loading in the Kalamazoo River/Lake Allegan watershed. Contributions from roadways, especially stream crossings, are varied as a result of their locations in proximity to the Kalamazoo River and its tributaries as well as the differing physical (paved vs. unpaved) condition of many roads in the watershed. Kalamazoo and Calhoun counties have some of the highest percentages of paved roads in the State of Michigan, while Allegan County has over 800 miles of unpaved roads. Tributaries and lakes are the typical water bodies receiving most of the runoff contributions from roadways. Participants expressed a desire to be better able to understand (with use of a simple procedure) the magnitude of phosphorus contributions from their areas of responsibility as an assisting guide for prioritization of bridge and road repairs, rebuilds and routine maintenance. More detail on specific elements considered can be found in Table 12.

It is acknowledged that increased costs and dwindling Federal and State financial assistance for road repairs and maintenance present real obstacles for addressing long-term concerns not just associated with transportation responsibilities, but also a TMDL. If adequate demonstration can be presented for concern with phosphorus loading from a particular site, prioritization will factor in this information and elevate that site as a work priority. With Phase II Storm Water Regulations coming into play in March 2003, Road Commission staff will pay closer attention to drainage from roadways and bridges.

Goals established as a result of these meetings include the following:

- Sediment and storm water reductions will be increased from transportation infrastructure to flowing waters (recognizing the phosphorus linkage)
- Improve techniques to reduce sediment on roads stemming from sites of less than one acre (BMPs)
- Increase the use of enforcement officers when warranted to achieve appropriate result
- Raise standards for Road Commission employees, contractors and others in "leadership positions" - DO IT RIGHT the first time and every time
- Where possible, improve public interface and how people are treated
- Develop effective procedures for maintenance and retrofit of older designs
- Provide technical training session(s) for commissioners

Many on-going efforts came to the fore of these discussions. Among the programs now taking place are:

- Routine operations and maintenance
- Participation in existing watershed management plans
- Upstream scouring of bridges, (all now being riprapped in Calhoun County)
- Gun River watershed study, Calhoun County Community Development, City of Portage & other projects have completed or are now inventorying all road crossings
- Drain Commissioners and Townships often prepare list of all road crossings in some counties
- Three bridge replacements funded & scheduled in Allegan Co.
- Albion College preparing Rice Creek 319 Project inventory of road crossings
- Battle Creek River Watershed project (Charlotte to Kalamazoo River) targeted to start June 1, 2002
- Continued MDEQ compliance and enforcement
- In Kalamazoo County, all curbed streets swept 2x/year; all catch basins done at least once per 3 years (some hot spots done 3x/year); Calhoun County is similar but they have their own Vactor truck

Among the recommendations made, this sub-committee offered suggestions that ranged from operations and maintenance approaches to physical considerations of BMPs to involving a wider array of municipal participants. The following points reinforce these concerns:

- Increase permit consolidation efforts for "one-stop shopping"
- Verify that Road Commissions use BMP Manuals from MDOT or MDEQ or other
- All superintendents will be trained uniformly and provided with consistent materials
- Develop watershed-wide techniques for design/retrofits/operations and maintenance to be selectively applied by Road Commissions
- Armor only those areas not lending themselves to "softer" techniques
- Improve information management systems
- Identify critical road crossing areas for erosion, nutrient and sediment loading
- Appropriate focus must filter from top to bottom (from office to ditch)
- Develop small field guide (10-20 pages) for road crews (diagrams & pictures)
- Blading and grading training (how the road is shaped) as keys to unpaved road maintenance
- Educate employees that shoulder work should not fill the direct discharge ditches along roads
- Gravel as needed on bladed shoulders to prevent water from sitting on edge and destroying asphalt
- Involve three major cities in Allegan Co. above Allegan Dam including Otsego, Plainwell and Allegan

Discussions on approaches for funding road and bridge improvements demonstrated many of the difficulties that confront improvements in these areas. Decreased funding from state and federal sources, a growing inability of many less well-populated townships to afford their required financial match (thereby delaying or canceling the project), increases in traffic volume and increases in the identified deterioration of bridge structures all present major challenges to how we will treat our transportation infrastructure. CMI funds seem to no longer be a reliable source of funds for Townships.

Existing sources of funds for road crossing work are limited. This will open the door to nutrient trading opportunities as one mechanism to help achieve future needs.

One benefit to planning reductions from roads and bridges is that long-term planned approaches are an already available resource. Both MDOT and Road Commissions must prepare 5, 10, and 25-year plans for their work and expectations. While flexible, these still provide a significant tool for identifying sites of concern and building in appropriate techniques to address them.

Data gaps are a serious impediment to more rapid improvements within this sector. Key issues are:

- Lack of a relatively simple method for consistent quantification of P loads from specific conditions
- No existing complete inventory of crossings within the Kalamazoo River watershed
- No available publicly accessible information base (on-line) to include mapping of crossings and site data

Accountability is handled through a variety of mechanisms within the watershed. APA inspectors have a role in ensuring compliance with existing good standards of practice. Phase II Storm Water Regulations will drive many of the medium to larger size communities to specific actions that will simultaneously impact phosphorus reductions. Many of the Kalamazoo River crossings are controlled by MDOT in areas of less-dense population (Allegan County). Cooperation with County Drain Commissioners is another element used to achieve desired ends, especially since Road Commissions are responsible for outfalls associated with their roads. In a rather unique approach, as part of the approval process in Allegan County, any storm water from a platted development becomes a County Drain. The county is then responsible for maintenance and can assess the property owners along the drain for any needed funds. A proposed Calhoun County ordinance is targeting similar issues.

Tracking systems within each county now exist on paper only. All participants expressed a desire for an eventual electronic tracking system. This would also facilitate another identified shortcoming - the lack of a publicly accessible on-line database. It was noted in discussions that tracking in urban zones would be one of the major Phase II activities in those communities so identified. Where not already in effect, coordination of efforts between Drain Commissioners and Road Commissioners is seen as a paramount step in achieving similar goals and objectives identified in both offices.

Existing monitoring efforts were identified as: MDEQ Stream Crossing Watershed Surveys that average 30% of crossings in a county once every 5 years. These surveys are used to assist MDEQ in following their Procedure 51 stream surveys in the following year for the same waterway. Each Road Commission representative expressed that individual activities of their respective offices are currently monitored as well. Efforts of the designated County Soil Erosion Agents can be considered another existing monitoring capability. As previously mentioned, a publicly accessible on-line database would be a welcome addition for all in terms of public participation and monitoring in cooperation with the KCD.

Private sector participants in the TMDL have recently been developed concepts in proposal form that will build upon these specific needs. This proposal has already by submitted to the Great Lakes Commission. Within the context of the TMDL, this effort will focus on quantification and tracking in conjunction with an existing Clean Michigan Initiative (CMI) grant whereby the three road commissions identified above are already participating in Kalamazoo River erosion site restorations. Soil phosphorus sampling and soil losses will be tracked to verify a standardized phosphorus load estimation protocol. A key focus of this proposed project is to enhance database capabilities by providing user-friendly, on-line tools for erosion, sediment and phosphorus load estimation that can be used in the Kalamazoo River watershed. This approach will provide a mechanism to calculate real reductions of sediment and phosphorus loads within the Kalamazoo River watershed related to TMDL Implementation Plan needs, Phase II storm water regulations, Michigan Soil Erosion and Sedimentation Control Act (Part 91) issues, watershed management planning projects and DOT erosion loss sites if funded.

Continued cooperation beyond these near-term proposed efforts is expected between the Road Commissions. All participants to date acknowledge the benefit of shared information and have expressed a desire for continued dialogue. If not through the efforts of the Implementation Committee, it is expected that those involved in transportation issues will continue to interact into the future.

3.2.7 Construction

Contributions of phosphorus from construction sites are limited to activities on sites that are within direct surface runoff capability to a tributary of or the Kalamazoo River itself and those sites from which materials may directly/indirectly be transported to storm sewers. That being said, there was recognition on the part of all participants that good site management practices on any site, regardless of location should be pursued. Data from the U. S. EPA's National Urban Runoff Program (NURP) illustrate that Total Suspended Solids (TSS) and Total Phosphorus (TP) are significantly higher within the construction category at 6,000 tons TSS and 80 lbs TP/acre-year versus Commercial, the next highest contributor, at 1,000 tons TSS and 1.5 lbs TP/acre-year.

Table 13 provides Plan Element details stemming from multiple meetings that included representatives from three counties and participants from the Associated Home Builders and Contractors of Greater Kalamazoo, Construction Storm Water Operators, a Drain Commissioner, city and designated administrators for Soil Erosion and Sedimentation Control permits (Part 91, Michigan PA 451), MDEQ personnel, the City of Kalamazoo, the Forum for Greater Kalamazoo and those providing administrative participation and coordination for the project. Participants have agreed to continue meeting and have arranged to begin educational meetings for members of building, construction and development associations. A repetitive theme throughout the proceedings was that builders and developers want to do the right things, are used to being inspected and want consistency regarding methodology or soil erosion control techniques in knowing what needs to be done and the preferred methods of doing them.

In the course of discussions it was agreed that impact to a larger range of stakeholders should be noted when federal Phase II storm water regulations regarding construction activities change in March 2003, to include coverage for parcels of one acre or greater rather than the current five-acre minimum. The target market must be the person managing the construction site. Significantly, one-third of all residential construction permits are issued to the homeowner. Experience has repeatedly demonstrated

that homeowners are less likely to know what their responsibilities and liabilities are that come with this permit. A recommendation that would greatly improve this situation is for all permits to include the guidelines for adherence to the permit and responsibilities of the permit holder to remain in compliance. A very useful Guide for Environmental Permit Coordination in Kalamazoo County can be downloaded from http://www.theforum.org/kcd/soileros.htm. Also Kalamazoo County has recently adopted a Soil Erosion and Sediment Control Ordinance and Rules of the Kalamazoo County Drain Commissioner for Storm Water Management, both of which are available from the office of the County Drain Commissioner.

Participants in these meetings set the following goals for the implementation Plan:

- Promote site designs with less potential for run-off to water bodies (i.e., less total clearing of sites, effective use of BMPs)
- Encourage more effective site plan review processes (i.e., new City of Kalamazoo process)
- Increase use of knowledgeable certified storm water inspectors as part of construction crews; ensure correct procedures are followed
- Encourage State to rescind Certifications of Storm Water Operators for not following requirements
- Ensure that every property owner understands the "why", "how to" and his/her responsibility for each site
- Practice staged development and site stabilization with minimal grading
- More planning prior to actual soil disturbance
- Select and maintain appropriate BMPs suitable for erosion and sediment control on a specific site

A number of the above efforts are taking place within new developments and within the attitudes of the industry itself. The National Homebuilders Association is in the process of developing "Green Building" guidelines for builders to follow and building and construction trade periodicals continue to feature more articles addressing soil and sedimentation-related concerns.

Specific recommendations coming from these stakeholders include:

- Make Certifications for Storm Water activities meaningful (take away privilege if not meeting requirements)
- Site access drive first for truck clean-off procedures; bring in aggregate (base materials) for driveways & to help eliminate mud tracking onto roads (most applicable for large projects)
- Educate subcontractors to care about what they do and how it impacts a project site
- Expressed a desire to have permit consolidation for building, driveway, soil erosion, etc.
- Preconstruction planning directed to minimize soil erosion & sedimentation
- Develop positive incentives for stakeholders to incorporate desired approaches
- Coordinate all Part 91 agents in watershed for consistency, communication and coordination (uniform regulation & enforcement)
- Sites should be inspected early and not when well into the job
- Reviewing specifications with permit holder as part of the permit issuance process would help
- Continue education and professional development opportunities within member associations
- Provide rationale for P reductions and role of construction sites as phosphorus generators for contractor buy-in

Funding was envisioned as coming from grant-funded demonstration projects, increased fees (if appropriate) related to the work required and potential penalties assessed and collected from violators of permits. Cost optimization could be stressed by passing penalty fees or additional clean-up costs on to the responsible contractor if it is not the same permit holder. Details included with bidding specifications for a job site would assist in cost optimization as would maintain storm water on site whenever possible and keeping as much vegetation on site during development rather than clear-cutting.

An issue repeated during construction meetings related to subcontractors not being aware of the results of their actions on the project and the site in terms of impacts. Recommendations include:

- Documentation kept by responsible agencies for number and type of permits issued
- On-site reports prepared and maintained by Certified Storm Water Operators
- Logged number of enforcement actions
- Database of reductions in phosphorus loading for various situations
- Locations where work was performed and discharge areas

All indications are that participants in the Construction Plan Element intend to continue to work at refining approaches seeking more efficient and effective methods or improving on-site work and streamlining the permit and inspection processes.

3.2.8 Turf Grass and Alternative Landscaping

The role of turf grass as a contributory non-point source of phosphorus has been well documented for many years and gave rise to the Michigan State University (MSU) Turf Grass Environmental Stewardship Program and the Kalamazoo Nature Center's programmatic efforts with corporations and golf courses. Table 14a and the two supplemental strategies (Tables 14b and 14c) provide more detailed insight into the approaches deemed important by participants in this planning group. One strategy addresses the promotion of appropriate phosphorus application to turf grass, while the other provides insights for the expansion of alternative landscape materials. One result of these efforts was the Super Soils Day event, held in April 2002, in cooperation with many volunteers and several retailers in three counties. Individual homeowners were able to bring in a soil sample from their yards and have it analyzed for nutrients and pH with recommendations made for any needed adjustments. All retailers involved continue to stock low and no-phosphorus fertilizers and refer customers to those as appropriate.

Several meetings were held to contribute information to Table 14, and develop the two strategies. Periodic postings of drafts to the TMDL website were made allowing for exposure to and contributions from other interested parties. The core group of planning participants included representatives from the Kalamazoo Conservation District (KCD), Michigan State University Extension (MSUE), the City of Battle Creek, Kalamazoo Environmental Council, Kieser & Associates (K&A), the Kalamazoo Nature Center (KNC) and the Michigan Department of Environmental Quality (MDEQ). The approach initially taken was to develop agreeable goals and then flush out what seemed most feasible to accompany them. Goals include:

- Track implementation of BMPs and related reductions quarterly throughout each year
- Develop on-the-ground demonstration examples for tracking and viewing

- Actively promote the expanded use of alternative landscape materials/techniques
- Promote the appropriate application of phosphorus in all turf grass applications
- Document of successful residential reductions of phosphorus
- Document of collective reductions in a subwatershed where possible
- Create of an accountability structure and consequences for unsuccessful attempts

Stakeholders include a wide range of willing "providers" and "users". It may be possible to encourage tracking of:

- Lawn reduction (sizes) by the planting of native species
- Changes in practices at large sites (commercial, institutional)
- Buffer strips planted near water bodies
- Commercial tracking by retailers in customer preference shift from normal to low phosphorus detergents, etc.
- Group program/project results

Existing regulatory structure can be found at federal, state, county and local levels that includes a broad spectrum of approaches. There are numerous ongoing efforts that, in one way or another, contribute to these categories. They range from grant-funded efforts to efforts funded in part by municipalities and the private sector.

Many of the details discussed as options and alternatives made their way into the accompanying strategies. Structuring funding sources was recognized as important, with a need for innovation in approach. Considerations included but were not limited to:

- Surcharge for high phosphorus fertilizers
- Internal savings recouped from lower material and maintenance costs
- Grants for innovative technologies or for research
- Ecomarket approaches (trading)
- Municipal matches
- Grants for site improvements via larger scale alternative landscaping
- County Drain assessments

Identified data gaps were among the most critical concerns expressed. Elements included:

- How do we know when those periods of most significant loading are taking place?
- What "background" or "baseline" documentation exists for contributions of phosphorus from turf within particular reaches of this or other comparable waterbodies?
- What phosphorus sampling requirements (locations, frequency) will be required if any?
- What are the costs to implement controls to reach 50% reductions in these categories?
- What might future growth needs look like if these techniques are successfully implemented?
- Is there any tracking of successful techniques already implemented locally?
- Given the 5-year window, how will we account for the difficulties establishing positive impacts of alternative landscapes when they require a minimum 3-5 years for effective establishment?

Attention was paid to concerns for reporting, timelines and tracking. Monitoring, database analysis, maintenance and accessibility along with QA/QC are likely to be addressed early in the process by the implementation group conceived by participants. Contingency plans tended to center on more restrictive regulation or an attempt to develop other possible reduction approaches if data suggest that current attempts are not making improvements. Both a five-year and longer range considerations addressing new growth will be considered as the overall process continues to move forward.

3.2.9 Septic Systems and On-Site Wastewater Treatment Systems

Representatives of three County Health offices were among those contacted to meet and discuss the Septic Systems and On-Site Wastewater Plan Element. Contributions from septic systems are not believed to be a wide-spread cause of high phosphorus loading to the Kalamazoo River. Tributaries and lakes are the typical water bodies most harmed from such activities. Though the number of participants who met was small in number, the meetings conducted were very insightful and productive. Table 15 demonstrates the depth of thought and consideration that went into the issues discussed.

It was acknowledged that the increasing spread of sewer lines to outlying locations from a centralized water reclamation plant is not always the best approach for wastewater treatment. Construction costs, energy use, repairs and expensive upgrades to infrastructure are all viewed as downsides to what many view as a desirable trend. The best approach to preventing problems from on-site septic systems is to maintain them properly, with adequate frequency. Pumping every two to three years is believed to be reasonable and appropriate under most conditions. Since sizing of systems is now prescriptive, (number of bedrooms, number of people, age of inhabitants, frequency of laundry, dishwasher present, etc.) installations may vary from house to house within the same geographical location.

Outcomes of significance, which were revealed in the course of these discussions and deemed worthy of separate notation, follow below.

- There is no state-wide educational component addressing these issues
- Michigan is the only state where each county is responsible for their own on-site wastewater code for residential and duplex housing
- An effort to legislate a uniform state-wide code (SB 107) was recently defeated
- MDEQ sets minimum program requirements for every county in the state
- Each Health Department must submit an annual report to the MDEQ
- Performance based sanitary codes are the preferred direction professionals would like to move in, but they expressed it will take years (10 years in Wisconsin) to accomplish this
- There are no such residential performance standards in Michigan now, only commercial
- Septic installers are licensed in Kalamazoo County (about 90 licensed with 15 doing most of the work); most counties do not require licensing
- The owner of a system is the key target for information and education efforts
- Historical paper files in Kalamazoo County go back to the late 50's
- Allegan, Barry, Eaton and Kalamazoo Counties have the same data systems; viewed as a good beginning
- Kalamazoo County provides an information-filled file folder (MSUE, Managing Your Septic System, WQ-39) with each permit, but, if the builder pulls the permit, the folder may never reach

the homeowner
- Revisions to County Health Codes occur at different times and are often not the same from county to county.
- Allegan County is running out of suitable soils for on-site systems
- Codes are typically driven from within, not from without
- A tracking system for installation and replacement of septic systems is now in place
- All regulated Phase II communities will need to do monitoring for impacts from septic systems to surface waters; an opportunity to share funds and data
- The Clean Water Act includes septic discharges as pollution violations if waters are negatively impacted

Of the many goals listed, stemming from sub-committee deliberations, what follow were deemed as key to this Plan Element:

- Move incrementally to performance based sanitary codes
- Explore benefits of licensing septic installers throughout watershed
- Develop a consistent tracking system for pumping of septic systems and proper handling of septage
- Develop an active and effective watershed-wide educational component
- Track & record types of systems that fail and why, with uniformity for all watershed counties
- Seek to develop incentives "carrots" for more frequent maintenance
- Establish consistent watershed-wide inspection requirements and protocols for alternative systems (i.e., minimum once every-other-year mandatory inspections)

Among the recommendations put forward by this sub-committee, the following are offered as most instrumental in helping to move the process of more effective on-site wastewater treatment forward:

- Move to performance based sanitary codes in watershed
- Recognize optional residential treatment processes for single family, including low to no water systems
- Provide information on systems suitable for cluster developments
- Establish demonstrations of wetlands treatment (small discharges) where suitable
- Coordinate educational efforts within the watershed to stakeholders
- Greater Kalamazoo Association of Realtors can pass info. on to property owners; public education in Home magazine; sponsor education sessions, etc.
- Verify that haulers are licensed.
- Track maintenance, frequency of pumping; create incentives (subsidy) for good maintenance (pump annually for three years and fourth time is free)
- Service providers could develop & market inspection/maintenance programs (same as HVAC firms and others do now)
- Increase phosphorus uptake by installation of shallower systems (within upper 24" of soil)
- Consider charging better performing systems lower permit fees
- Consider annual inspection requirement for alternative systems not well understood
- Move toward the elimination of land application for septage

Approaches for funding of resources ranged from increased permit costs based on performance/merit to surcharges for disposal of waste at water reclamation plants. Many information resources were identified, including materials available at: County Health offices, Cooperative Extension, MDEQ, the National Sanitation Foundation and the EPA website. A most unique approach toward cost optimization, the concept of septic service providers (installers and septic pumpers) developing and marketing an inspection and maintenance program bears further exploration. Other service providers such as power companies and heating, ventilation and air conditioning firms offer similar services. Such a program would help optimize the costs to owners for systems operation by maintaining them in good repair and working order and reduce the need for early and expensive system replacement.

Owners themselves offer one of the biggest challenges in their lack of knowledge as to how and why their systems operate and what they can do to keep them operating well. Getting information to owners is a key component in the success of on-site systems. Lack of good information for approved on-site treatment alternatives reaching potential users poses another gap in promoting and implementing these techniques. A number of opportunities, listed under data gaps, demonstrate the types of desired record keeping that could positively influence the use of alternative systems.

Ensuring that prospective homeowners are provided accurate documentation on the status of an existing septic system is an accountability approach in which realtors can play a significant role. Providing potential homeowners with documentation related to the age and history of a septic system should be part of the disclosure package for any residence.

Reporting and record keeping that will account for the annual volume of septage received at a wastewater treatment plant, the frequency of service for a particular system and the number of septic systems per year replaced by sewer systems are valuable elements in structuring accountability and tracking. In the end, monitoring of reported discharges, locations of failed systems, and actual analyses showing elevated phosphorus levels in sampled water due to septic failures will be the true measure of determining quantitatively their impact on water quality.

3.3 In-lake/Instream Sources

Implementation elements considered under this source category can be found in Table 16. Specifically, stakeholders under this non-point source category include both point and non-point sources because in-lake/instream (internal) phosphorus sources have historically originated from both. Internal loading has the potential to affect the magnitude and distribution of load reductions among point and non-point sources. Among all the stakeholders, Lake Allegan and Kalamazoo River riparian land owners will be the ones most affected by these in-lake/instream processes because phosphorus recycling in the lake and loss of streambank to erosion directly threaten their property values and living quality.

The Superfund process related to PCB contamination in the river, state or local inland lakes and stream ordinances, may provide regulations related to implementing potential in-lake/instream source reductions, along with other subwatershed management plans.

Under the TMDL, in-lake/instream loads are considered non-point sources. To date, there has been no allocation of this potential load given that non-point source loads were computed for one allocation immediately above Lake Allegan (i.e., M-89). However, consistent with the TMDL load

allocation, a target reduction goal has been arbitrarily set at 50%. Although future monitoring data will provide information on the causes and magnitude of internal loading, Table 16 highlights the implementation efforts associated with in-lake/instream processes that are being pursued by private sector participants in the TMDL through separate funding in conjunction with other existing efforts, the Implementation Committee and other watershed stakeholders.

On-going efforts to address the in-lake/instream processes include streambank erosion assessments under watershed management projects in the watershed, and a three county (Calhoun, Kalamazoo, and Allegan) Clean Michigan Initiative (CMI) project that is already underway to plan, design and implement streambank erosion control measures at sites on the Kalamazoo River and its tributaries. Approaches to estimate sediment and phosphorus losses from streambank sites in the watershed are included in the CMI project. Internal phosphorus loading in Lake Allegan will also be evaluated in the context of TMDL implementation strategies using existing studies and proposed sampling data with new funding (see Section 2.14). The role of carp in internal loading will also be assessed.

Specific approaches to identify and reduce the phosphorus input to the Kalamazoo River and Lake Allegan as a result of in-lake/instream processes include:

- Streambank erosion control measures, such as bank stabilization and native vegetation planting, for erosion sites contributing significant amount of phosphorus to the river and the lake
- Establishing stream buffers to prevent overland runoff from eroding streambanks
- In-lake treatment such as carp removal
- Modeling/monitoring to continue the evaluation of the impact of these processes on achieving the TMDL goals.

Funding sources that can be pursued to support on-going and future efforts to reduce internal phosphorus loadings include the Superfund Potential Responsible Parties (PRPs) for river/lake sediment remediation (removal) of sediment bound phosphorus. Partnerships with environmental organizations such as land conservancies, Ducks Unlimited, and Trout Unlimited can also be pursued for additional funding or participation to protect critical habitat areas threatened by in-stream erosion and lake internal loading. In addition, funding proposals have been drafted to secure funds for additional sampling and research on in-lake/instream processes in Lake Allegan and the Kalamazoo River. Another potential funding source for reductions is water quality trading under the TMDL. Streambank erosion control measures have proved very effective in reducing phosphorus loss to the river and thus generate substantial amount of trading credits (Kieser, 2000).

Contingency plans will include a re-examination of non-point source load allocations once new data and knowledge of in-lake/instream processes become available. If it is deemed that these processes are significant enough to warrant changes in non-point source load allocations or even point source waste load allocations, program options will be identified to specifically recommend the needs and considerations during Implementation Committee reviews that are already established as milestones (see Section 2.10). Management alternatives and additional control measures will be evaluated to achieve water quality goals.

Updating strategies focus on the assessment of the impact of in-lake/instream processes on the implementation plan after two years of monitoring and evaluation. New plans will be recommended in

the third year and improvement strategies will be considered for implementation in years four and five. An overall reassessment of the goals and the implementation plan will be conducted at the end of year five.

3.4 Sub-basin Planning

The sub-basin planning strategy suggests that the most effective and beneficial focus for watershed planning and management takes place at this level. This is also true for delivery and implementation of some of the phosphorus reduction strategies outlined in other parts of this Plan. Table 17 outlines the implementation elements of this strategy.

Watershed Management and sub-basin planning are iterative processes of integrated decision-making regarding uses and modifications of lands and waters within a watershed. Such processes provide an opportunity for stakeholders to balance diverse goals and uses for physical and biological resources, while considering how their cumulative actions may affect long-term sustainability of these resources.

Stakeholders typically have goals and values that vary with their relative location in a sub-watershed and uses of local land and water resources. Watershed management provides a framework for integrated decision-making, where we strive to:

- assess the nature and status of the watershed ecosystem
- define short-term and long-term goals for the system
- determine objectives and actions needed to achieve selected goals
- assess both benefits and costs of each action
- implement desired actions
- evaluate the effects of actions and progress toward goals, and
- re-evaluate goals and objectives as part of an iterative process

A number of small watershed (sub-basin) planning projects authorized and funded under the federal Clean Water Act are already underway within the Kalamazoo River Watershed. These federal Clean Water Act efforts are associated with the Four Townships Water Resources Project, and the Gun River, Rice Creek, Portage/Arcadia Creek, Davis Creek and Battle Creek River watershed management projects. They represent critical components of an overall non-point pollution program, which likely will stress land use guidelines and Best Management Practices (BMPs) for a wide list of activities. Additionally, these broad partnerships provide sustained, interactive and multi-disciplinary support and coordination for continued improvements into the future.

Existing sub-basin planning and management efforts will be supported and encouraged by the TMDL Implementation Committee. Additional community support and organization, including funding under sections 319 and/or 604(b) of the Federal Clean Water Act, should be sought for the following priority sub-watersheds:

- Lake Allegan immediate drainage area
- Schnable Brook
- Minges Brook/Harper Creek

- Comstock Creek
- Spring Valley Creek
- Pine Creek

A Lake Allegan sub-basin effort will be initiated in 2002, with projections for one other sub-basin study to be started every other year. The TMDL Implementation Committee will facilitate such studies by helping to build stakeholder support using a variety of currently available tools.

While sub-basin planning and management can take advantage of available state and federal funds, it must not rely on them. Municipalities and other interested parties need to identify and utilize, local initiatives, existing institutional programs and organizations that can participate to help provide and leverage funding. The TMDL Point Source Cooperative Agreement could be one such opportunity for leveraged funding. It should be the goal of all sub-basin planning and management efforts to become locally sustainable within 2 - 5 years.

3.5 Cross-Cut Analysis of Reduction Strategies

To ensure that future efforts to reduce phosphorus in the Kalamazoo River/Lake Allegan watershed are not redundant, but synergistic in their strategies and funding opportunities, Table 18 provides a cross-cut analysis of overlapping elements. This analysis stems from both described actions in the body of this Implementation Plan and the specific elements as offered by participants (documented in Tables 6-17) for each source category. Each of the source categories (and their corresponding table numbers in this plan) are used in Table 18. The numbers appearing the body of the table correspond to the source category in the left column.

Excluded from Table 18 are several of the 15 required reduction plan elements. These elements, and the rationale used for excluding them, are as follows:

- Phosphorus reduction is the primary goal for both the waste load allocation (point sources) and load reduction (non-point sources)
- Consistent cost optimization should apply to all
- Accountability strategies ultimately fall to the Implementation Committee, MDEQ and USEPA
- Reporting requirements are pertinent to all source categories
- Timelines as presented will not change; to include them would be redundant
- It is assumed that tracking will also be required of all efforts
- Monitoring has already been acknowledged as being necessary for cross-cut analysis and comparison of activities for efficacy and cost-effectiveness
- Updating strategies for the Implementation Plan will be directed through the Implementation Committee

Within Table 18, several elements, notably Land Use, In-lake/In-stream and Sub-basin Planning are shown to pertain to all Reduction Plan Elements. The number of a specific table has been listed under the particular Plan element where the discussions and/or participants have indicated a relationship of some type. In many cases, the subtleties and nuances of these relationships may not be apparent from the listing within the Table 18. Referral to specific elements found within the Source Category Tables should resolve most questions with regard to relationships. The broad approach used for this analysis is

intentional, given the nature of the many successful interactions among participants from different disciplines and sectors and their willingness to learn more from each other and seek mutually beneficial opportunities.

This table is intended for use by participants representing various source categories to communicate and coordinate with others to optimize their mutual efforts in achieving reduction goals. As these communications proceed, it is anticipated that programs will reach a broader audience and encourage additional participation, innovation and interest in achieving the Kalamazoo River/Lake Allegan improvement goals identified in this plan.

SECTION 4.0

REFERENCES

Bohr, J. and C. Liston. 1987. *A Survey of the Fish and Benthic Communities of Morrow Lake on the Kalamazoo River, Michigan, 1985 And 1986.* Report to STS Consultants, Ltd., 33 pp.

Dunbar, W. F. 1969. *Kalamazoo and How it Grow and Grow*. Western Michigan University. 242 pp.

Heaton, S. 1990. *Biological Survey of the Kalamazoo River Between Kalamazoo and Allegan, August, 1989*. MDNR, Surface Water Quality Division, Report No. MI/DNR/SWQ-90/032.

Heaton, S. 1997. *A biological Survey of the Kalamazoo River Watershed, Allegan and Kalamazoo Counties, July-August, 1994*. MDEQ, Surface Water Quality Division, Report No. MI/DEQ/SWQ-94/109.

Heaton, S. 1999. *Loading Assessments of Phosphorus Inputs to Lake Allegan, 1998.* Michigan Department of Environmental Quality, Surface Water Quality Division, November 1999. Report No. MI/DEQ/SWQ-99/125.

Heaton, S. 2001. *Total Maximum Daily Load (TMDL) for Total Phosphorus in Lake Allegan.* Michigan Department of Environmental Quality, Surface Water Quality Division, March 23, 2001.

Jeppesen, E., P. Kristensen, J. P. Jensen, M. Søndergaard, E. Mortensen and T. Lauridsen. 1991. Recovery Resilience Following a Reduction in External Phosphorus Loading of Shallow, Eutrophic Danish Lakes: Duration, Regulating factors and Methods for Overcoming Resilience. *Me. Ist. Ital. Idrobiol*. 48:127-148.

Kieser, M. 2000. *Phosphorus Credit Trading in the Kalamazoo River Basin: Forging Nontraditional Partnerships.* Water Environment Research Foundation. Final report of Project 97-IRM-5c.

Kieser & Associates (K&A). 2001. *Non-point Source Modeling of Phosphorus Loads in the Kalamazoo River/Lake Allegan Watershed for a Total Maximum Daily Load.* Prepared for the Kalamazoo Conservation District and submitted to Surface Water Quality Division, MDEQ, Kalamazoo District Office.

Kosek, S. 1997. *Water Quality and Pollution Control in Michigan, 1996 Report.* Michigan 305(b) Report: Volume 14. MDEQ Report No. MI/DEQ/SWQ-97/040.

Lundgren, R. 1994. *Reference Site Monitoring Report, 1992-1993*. MDNR, Surface Water Quality Division. Report No. MI/DNR/SWQ-94/048.

Marsden, M. W. 1989. Lake Restoration by Reducing External Phosphorus Loading: the Influence of Sediment Phosphorus Release. *Freshwater Biol*. 21:139-162.

Michigan Department of Natural Resources (MDNR). 1984. Morrow Pond Fish Survey, 1984. Unpublished data.

Michigan Department of Natural Resources (MDNR). 1999. Morrow Pond Fish Survey, 1999. Unpublished data.

Oemke, M.P. 1988. Biological survey of the Kalamazoo River between Comstock and Plainwell, July 1988. Report No. MI/DNR/SWQ-88/088.

Robertson, D. M., G. L. Goddard, D. R. Helsel, and K. L. MacKinnon. 2000. Rehabilitation of Delavan Lake, Wisconsin. *Lake and Reservoir Management.* 16:155-176.

Suppnick, J. and W. Creal. 1986. *Physical, Chemical, and Biological Monitoring Results from the Kalamazoo River, Comstock to Plainwell, 1984*. MDNR, Surface Water Quality Division, Report No. 04990.

Søndergaard, M., J. P. Jensen, and E. Jeppesen. 1999. Internal Phosphorus Loading in Shallow Danish Lakes. *Hydrobiologia*. 408/409:145-152.

Soranno, P. A., S. R. Carpenter, and R. C. Lathrop. 1997. Internal Phosphorus Loading in Lake Mendota. *Can. J. Fish. Aquat. Sci*. 54:1883-1893.

USEPA. 1975. *Report on Lake Allegan, Allegan County Michigan*. EPA Region V, Working Paper Series No. 182. EPA National Eutrophication Studies. 1975. Report on Lake Allegan, Allegan County Michigan. EPA Region V, Working Paper Series No. 182. EPA National Eutrophication Studies.

Van der Molen, D. T. and P. C. N. Boers. 1994. Influence of Internal Loading on Phosphorus Concentration in Shallow Lakes before and after Reduction of the External Loading. *Hydrobiologia.* 275/276:479-492.

WRC. 1951. *Minutes from the Michigan Water Resource Commission*, September 1951.

Wuycheck, J. 1998. *Water Quality and Pollution Control in Michigan*. Michigan 305(b) Report, MDEQ, Surface Water Quality Division, Report No. MI/DEQ/SWQ-98/030.