Schmidt, Pomerleau and Bass Lakes Nutrient TMDL
Implementation Plan

Wenck File #1240-76

Prepared for:

SHINGLE CREEK WATERSHED MANAGEMENT COMMISSION

MINNESOTA POLLUTION CONTROL AGENCY

October 2009

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1.0 Introduction

The Schmidt, Pomerleau, and Bass Lakes Nutrient Total Maximum Daily Load (TMDL) Implementation Plan addresses nutrient impairments in three lakes in the City of Plymouth, Hennepin County, Minnesota, in the Shingle Creek watershed, which is part of the Upper Mississippi River basin. The lakes were placed on the 2002 State of Minnesota's 303(d) list of impaired waters. Each was identified for impairment of aquatic recreation. Bass and Schmidt Lakes are highly used recreational water bodies with opportunities for fishing and swimming as well as providing habitat and aesthetic values, while Pomerleau has limited public access. Water quality does not meet State standards for nutrient concentrations and thus is not supportive of aquatic recreation.

The Shingle Creek Watershed Management Commission (SCWMC) has completed a Total Maximum Daily Load (TMDL) analysis for the Minnesota Pollution Control Agency (MPCA) to quantify the phosphorus reductions needed to meet State water quality standards for nutrients in Schmidt (27-0102), Pomerleau (27-0100), and Bass (27-0098) Lakes (see Figure 1) in accordance with Section 303(d) of the Clean Water Act. The TMDL and Implementation Plan were prepared in cooperation with the City of Plymouth and with review by Hennepin County, the City of Maple Grove, the Minnesota Department of Transportation (Mn/DOT), the Board of Water and Soil Resources, and the Department of Natural Resources.

The final step in the TMDL process is the development of an Implementation Plan that sets forth the activities that will be undertaken to reduce phosphorus loading to the three lakes. This Implementation Plan provides a brief overview of the TMDL findings; describes the principles guiding this Implementation Plan; discusses sequencing, timing, lead agencies and organizations, and other implementation general strategies; and describes the proposed implementation activities.

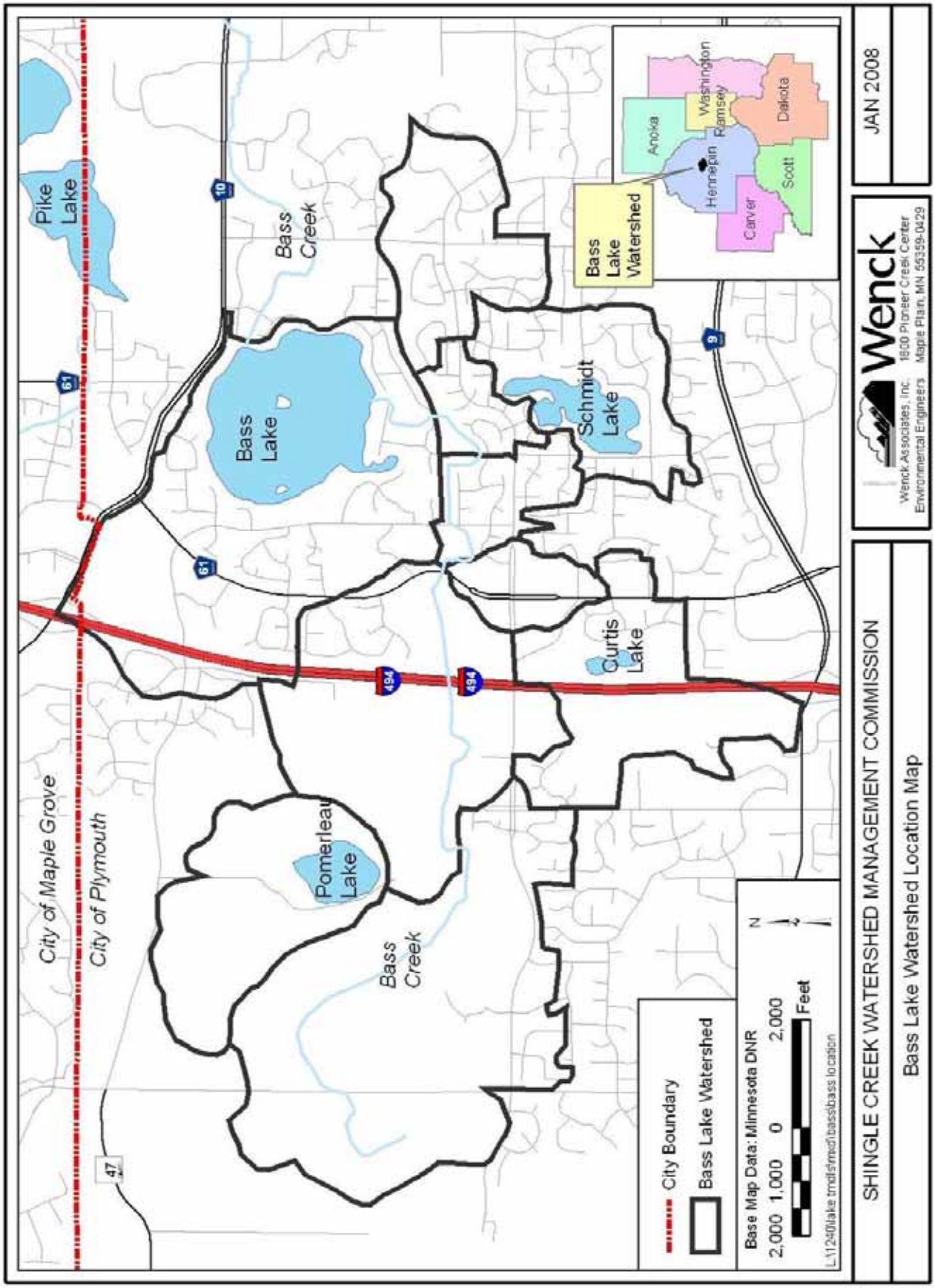

Figure 1. Schmidt, Pomerleau, and Bass Lakes location.

2.0 Schmidt, Pomerleau, and Bass Lakes TMDL Summary

The entire drainage area of these lakes is located within the city of Plymouth in the northwestern suburban Twin Cities metropolitan area, except for a fraction located in the city of Maple Grove (See Figure 1). The Pomerleau Lake and Schmidt Lake subwatersheds drain through the Bass Lake subwatershed to Bass Lake. Bass Lake outlets through Bass Creek to Shingle Creek, which outlets into the Mississippi River. he area is almost fully developed, with a 2000 Census population of about 20,000.

Bass Lake is approximately 175 acres in size with an average depth of 10 feet. Approximately 82% of the surface area is littoral (i.e., shallow enough to support emergent and submerged rooted aquatic plants) and therefore biological communities have a significant impact on the water quality in this shallow lake. Runoff from the watershed displaces the lake volume approximately twice per year which provides a significant and regular supply of nutrients to the lake.

Pomerleau Lake is approximately 30 acres in size with an average depth of 11 feet. Approximately 66% of the surface area is littoral and therefore biological communities have an impact on the water quality in this deep lake. Runoff from the watershed displaces the lake volume a little more than once per year.

Schmidt Lake is approximately 37 acres in size with an average depth of 5.5 feet. Approximately 92% of the surface area is littoral and therefore biological communities have a significant impact on the water quality in this shallow lake. Runoff from the watershed displaces the lake volume approximately twice per year which provides a significant and regular supply of nutrients to the lake.

2.1 CURRENT WATER QUALITY

Water quality is eutrophic and moderately degraded in all three lakes, with average Carlson's Trophic Status (TSI) of 64 for Pomerleau, 63 for Bass, and 61 for Schmidt. A TSI value of less than 57 is generally regarded as suitable water quality for swimming

The lakes are moderately impaired, and all experience late summer algal blooms of varying intensity. Bass Lake and Schmidt Lake are considered shallow lakes – that is, more than 80 percent of the lake area is littoral – while Pomerleau is considered a deep lake. The State of Minnesota has different water quality standards for shallow and deep lakes. Table 1 shows the current water quality in these lakes compared to the appropriate state standard. Water quality in the lakes varies annually based on precipitation, temperature, and other conditions.

Table 1. Water quality by lake, 1990-2007.

Lake	Summer Average		
	Total Phosphorus (µg/L)	**Chlorophyll-a (µg/L)**	**Secchi Depth (m)**
Schmidt Lake	54	20	1.6
Bass Lake	62	41	1.2
Shallow lake standard	***≤60***	***≤20***	***≥1.0***
Pomerleau Lake	74	28	1.5
Deep lake standard	***≤40***	***≤14***	***≥1.4***

Source: ***2009 Schmidt, Pomerleau, and Bass Lakes Nutrient TMDL Report.***

2.2 PHOSPHORUS LOAD SOURCES

Modeling data was used to develop a phosphorus budget for each of the lakes. The budget suggests that both internal and external phosphorus loads are significant factors in each of these lakes. The primary sources of external phosphorus are sediment and nutrients from stormwater runoff from the watershed conveyed to the lakes through storm sewers and channels. Internal loading can be a result of sediment anoxia where poorly bound phosphorus is released in a form readily available for phytoplankton production. Internal loading can also result from sediment resuspension from rough fish activity or prop wash from boat activity.

Phosphorus transported by stormwater represents one of the largest contributors of phosphorus to lakes. Impervious surfaces in the watershed improve the efficiency of water moving to streams and lakes resulting in increased transport of phosphorus into local water bodies. Phosphorus in stormwater is a result of transporting organic material such as leaves and grass clippings, fertilizers, and sediments to the water body. All of these materials contain phosphorus which can impair local water quality.

Curly-leaf pondweed can increase internal loading because it senesces and releases phosphorus during the summer growing season (late June to early July). The Bass Lake Improvement Association routinely contracts for aquatic plant chemical treatment to target curly-leaf pondweed, Eurasian water milfoil, and filamentous algae. A survey for Schmidt Lake conducted in 2004 found that about 66 percent of the lake bottom was colonized with submerged aquatic plants, with curly-leaf pondweed and coontail the dominant plants in the early summer. By late summer Eurasian water milfoil was more abundant, but at low to moderate density. Chemical treatments for curly-leaf pondweed have been applied in Schmidt Lake for several years. No aquatic vegetation data is available for Pomerleau Lake.

Common carp and other rough fish can also affect internal loading. Carp feeding and spawning re-suspends bottom sediments and nutrients. There are carp present in Bass Lake, and Minnesota Department of Natural Resources (DNR) fish survey data indicate that the carp are large and could significantly disturb the lake bottom sediments. Carp may be present in Schmidt and Pomerleau Lakes, but none were collected from either lake during the most recent fish survey. Black bullhead are present in large numbers in Schmidt Lake and could potentially disturb macrophyte beds and nutrient rich sediments. Residents have observed a reduction in bullhead population in recent years.

2.3 CONCLUSIONS

2.3.1 Schmidt Lake

The TMDL estimated that internal loading could potentially account for up to 50% of the overall load in Schmidt Lake. Internal load can be reduced through targeted aquatic plant and rough fish management. Only small external load reductions are required for the Schmidt Lake watershed and management needs to focus on in-lake activities such as rough fish and invasive species control. Internal load should be evaluated further to refine its role in lake phosphorus cycling.

2.3.2 Pomerleau Lake

Pomerleau Lake water quality is likely controlled by watershed runoff; however the lake does have the potential for internal loading. Presently, the internal load appears to be minimal. An imbalanced fishery is likely contributing to the algal blooms, which are often more severe than expected based on the total phosphorus concentrations. Restoration efforts should focus on the external loads and restoring a balanced fishery.

2.3.3 Bass Lake

Bass Lake has reasonably good water quality, yet experiences severe algal blooms. Although watershed controls will be necessary, the biggest need is in-lake controls including aquatic plant management and rough fish control. The lake demonstrates some internal loading; however it is difficult to determine its role in water quality. Consequently, restoration efforts should focus on controlling the external load while reestablishing the biological integrity of the lake.

2.4 REQUIRED PHOSPHORUS LOAD REDUCTIONS

Wasteload and load allocations to meet State water quality standards indicate that phosphorus load reductions of 9% in Schmidt, 67% in Pomerleau, and 33% in Bass Lakes would be required to consistently meet standards under average precipitation conditions. This Implementation Plan details the specific activities the stakeholders in the watershed plan to undertake to attain that reduction.

2.4.1 Allocations

Stormwater discharges are regulated under the National Pollution Discharge Elimination System (NPDES), and are considered wasteloads. Entities ("MS4s" - Municipal Separate Storm Sewer Systems) with permits to discharge stormwater to the lakes are shown in Table 2 below. Because there is not enough information available to assign loads for Bass Lake to individual permit holders, the Wasteload Allocations are combined in the TMDL and this Implementation Plan as Categorical Wasteload Allocations (WLA) assigned to all permitted dischargers in the contributing watershed. The City of Plymouth is the only permitted discharger for Pomerleau and Schmidt Lakes. There are no known industrial dischargers in the watershed. The pollutant load from construction stormwater is considered to be less than 1 percent of the TMDL and difficult to quantify. Consequently, the WLA includes pollutant loading from construction

stormwater sources. The Load Allocation includes atmospheric deposition and internal loading and is allocated in the same manner as the WLA.

Table 2. Wasteload allocation by NPDES permitted facility for each lake.

NPDES Permit Number	Pomerleau	Schmidt	Bass
MS400102-Maple Grove	N/A	N/A	Categorical WLA
MS400112-Plymouth	WLA	WLA	Categorical WLA
MS400138-Hennepin	N/A	N/A	Categorical WLA
MS400170-MnDOT	N/A	N/A	Categorical WLA

N/A = Not applicable – does not drain to lake.

Each permittee has committed to implement Best Management Practices (BMPs) to reduce nutrient loading to each lake. The MS4s cooperated in developing the TMDL and Implementation Plan and will continue to work together through the ongoing Commission Technical Advisory Committee (TAC) to identify and implement BMPs either individually or in collaboration. This collective approach allows for greater reductions for some permit holders with greater opportunity and less for those with greater constraints. Construction stormwater activities are considered in compliance with provisions of the TMDL if they obtain a Construction General Permit under the NPDES program and properly select, install, and maintain all BMPs required under the permit, or meet local construction stormwater requirements if they are more restrictive than requirements of the State General Permit.

2.4.2 Implementation Focus

The focus in implementation will be on reducing the annual phosphorus loads to the lakes through structural and nonstructural BMPs. Load allocations by source are provided in Table 3 and Table 4 for average precipitation conditions. However, lakes are uniquely dynamic systems. A dry year may result in increases in internal loading counteracting the effects of reduced flow and loading from the watershed. As a result, implementation will address not only load reductions from external sources in the watershed but internal loading where appropriate. The TMDLs established here are protective of the water quality standards for each of the lakes.

Table 3. TMDL total phosphorus allocations expressed as daily and annual loads.

Lake	Wasteload TP Allocation[1]		Load TP Allocation		Margin of Safety	Total Phosphorus TMDL	
	(kg/day)	(kg/yr)	(kg/day)	(kg/yr)		(kg/day)	(kg/yr)
Schmidt	0.12	42.0	0.02	9.0	Implicit	0.14	51.0
Pomerleau	0.07	23.2	0.02	7.8	Implicit	0.09	31.0
Bass	1.12	410.1	0.07	25.9	Implicit	1.19	436.0

[1]The wasteload allocation is allocated to NPDES-permitted facilities in accordance with Table 2.

Table 4. TMDL total phosphorus loads partitioned among the major sources.

Lake	Allocation	Source	Total Maximum Daily TP Load		Load Reduction (kg/yr)
			(kg/day)	(kg/yr)	
Schmidt Lake	Wasteload	Stormwater Load	0.12	42.0	4.6
	Load	Atmospheric Load	0.01	4.0	0
		Internal Load	0.01	5.0	0.5
		TOTAL LOAD	**0.14**	**51.0**	**5.1**
	9% load reduction required				
Pomerleau Lake	Wasteload	Stormwater Load	0.07	23.8	55.0
	Load	Atmospheric Load	0.01	3.2	0
		Internal Load	0.01	4.0	9.1
		TOTAL LOAD	**0.09**	**31.0**	**64.1**
	67% load reduction required				
Bass Lake	Wasteload	Stormwater Load	1.03	374.8	205.3
		Upstream Load	0.09	35.3	17.4
	Load	Atmospheric Load	0.06	20.9	0
		Internal Load	0.01	5.0	N/A
		TOTAL LOAD	**1.19**	**436.0**	**218.7**
	33% load reduction required				

3.0 Implementation Plan

3.1 TMDL AND IMPLEMENTATION PLAN PROCESS

The activities and BMPs identified in this Implementation Plan are the result of a series of Technical Advisory Committee (TAC) and stakeholder meetings led by the Shingle Creek Watershed Management Commission. The TAC included stakeholder representatives from local cities, Minnesota DNR, the Metropolitan Council, the United States Geological Survey (USGS) and the Minnesota Pollution Control Agency. All meetings were open to interested individuals and organizations. TAC meetings to review this and other lake TMDLs in the watershed were held on December 8, 2005, February 10, 2006, March 9, 2006, and June 27, 2007. The general TMDL approach and general results of TMDLs were presented to six City Councils in May and July 2006.

The preliminary results of the TMDL were presented to the City of Plymouth Environmental Quality Committee on March 8, 2006. This citizen commission invited lake association members and other interested parties to attend this meeting. The TMDL and the preliminary Implementation Plan were presented to the Environmental Quality Committee on June 11, 2008.

This Implementation Plan was distributed to stakeholders - cities, Hennepin County, Mn/DOT, the Board of Water and Soil Resources, and the Minnesota DNR - for review and posted on the SCWMC website *www.shinglecreek.org* for public review and comment. On November 13, 2008 the Shingle Creek Watershed Management Commission reviewed the draft Implementation Plan and all comments received and approved the Plan.

3.2 IMPLEMENTATION PLAN PRINCIPLES

Through the discussion of policies and practices, current activities, and ongoing research, the stakeholders developed principles to guide development and implementation of the load reduction plan. These principles, in no order, include:

1. Restore Biological Integrity

It is generally recognized that a healthy biological community in the lakes is essential to provide internal controls on water clarity, especially in the shallow lakes. To that end, the cities and agencies agree to work cooperatively to restore the biological communities in these lakes, including fish, plants, and zooplankton.

2. Control Internal Load

A significant portion of the phosphorus load is a result of internal loading and internal load must be addressed to successfully improve water quality in these lakes. Consequently, the cities and agencies agree to work cooperatively to reduce internal phosphorus loading in the lakes.

3. Retrofit BMPs in the Watershed As Opportunities Arise

Since the watershed to these lakes is almost fully developed, options to retrofit BMPs to reduce nutrient loading are limited. Each MS4 will include in their SWPPP the statement that "Water quality BMPs will be incorporated into public improvement projects unless it can be demonstrated why it is technically infeasible or not cost-effective to do so within the context of the current practice." Each MS4 further agrees to take advantage of opportunities such as redevelopment to add or upsize BMPs.

4. Require Pollutant Load Reduction and Volume Management for New Development

There is some developable land in the watershed draining to these lakes. The Shingle Creek Watershed Management Commission has in place rules and standards requiring treatment of stormwater runoff and a reduction in the volume of new runoff through infiltration or other forms of abstraction. Each stakeholder agrees to require new development to maximize treatment and minimize the volume of new stormwater runoff through application of Commission and local rules and ordinances as well as use of Low Impact Design principles.

5. Foster Stewardship

City staff, especially maintenance staff, will be provided opportunities for education and training to better understand how their areas of responsibility relate to the protection and improvement of water quality in the lakes.

6. Communicate with the Public

Public education will take a variety of forms, and will include both general and specialized information, targeted but not limited to:

- General public
- Elected and appointed officials
- Lakeshore residents
- Lake users
- Property owners and managers

3.3 IMPLEMENTATION PLAN

The stakeholders agree that implementation should be a joint effort, with the SCWMC taking responsibility for ongoing coordination, general education and monitoring activities and the NPDES permittees taking responsibility for BMP implementation. The Cities of Maple Grove and Plymouth, Hennepin County, and Mn/DOT will incorporate appropriate BMPs into their Storm Water Pollution Prevention Programs (SWPPP) and NPDES Minimum Control Measures. The stakeholders will annually report to the SCWMC their annual activities, and the SCWMC will summarize those activities into its own Water Quality Annual Report. This framework is illustrated in Figure 2 below.

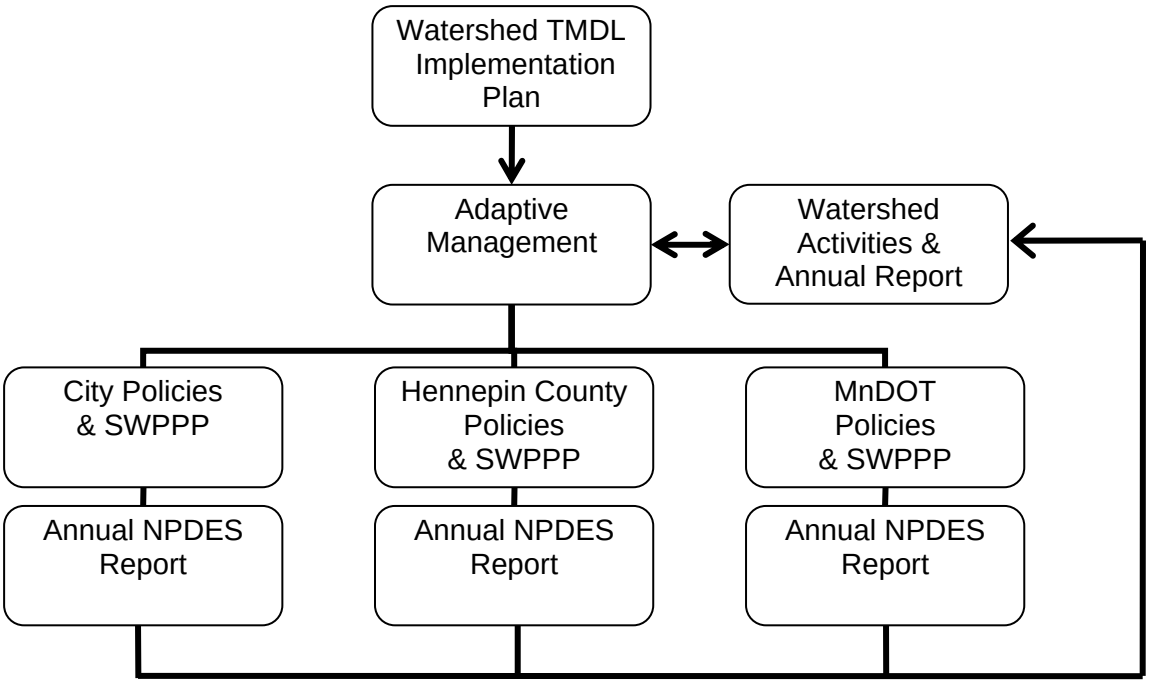

Figure 2. Implementation framework.

3.3.1 Implementation Approach

The impairments to these lakes developed over time as the watersheds draining to them urbanized. As the watershed developed, the native prairie and savanna was cleared and wetlands were ditched and filled to support farming. Over the past century the farms and remaining undeveloped land were converted to urban and suburban uses, increasing the volume of runoff and the amount of pollutants conveyed to the lakes. As a result of this land use and land cover change, the lakes slowly degraded. Just as this degradation took many years, improvement will take many years through ongoing retrofit of the watershed with BMPs as well as eventual redevelopment of existing land uses with lower-impact development and stormwater treatment.

The TMDL study and this Implementation Plan identified specific improvements to reduce external and internal phosphorus loading. These are "short term" projects that could be accomplished in the next 5-20 years. Both Bass and Schmidt Lakes are very close to meeting state water quality standards and may achieve those standards in the next 5-10 years, while Pomerleau Lake improvement may take longer. However, projects alone may not be sufficient to achieve or maintain water quality goals in these lakes. An essential "long-term" component of this Implementation Plan is to routinely retrofit BMPs in this fully developed watershed as redevelopment or construction activities provide opportunities.

As the road authorities cycle through their street and highway reconstruction programs, it is now routine to include treatment BMPs such as stormwater detention ponds and underground treatment devices where possible. These incremental reductions will over time add up to a significant external load reduction.

Another long-term type of external load reduction is redevelopment. Parts of the watershed draining to these lakes developed prior to the development of Shingle Creek Watershed

Commission rules and standards and subsequently there is currently little or no treatment of stormwater. As these areas redevelop over time, the new development will be required to abstract some stormwater and treat the balance of the runoff before discharging it to the lakes. Some cities use redevelopment as an opportunity to provide even more stormwater treatment by "upsizing" treatment BMPs above and beyond the minimum required by the rules or to create new regional treatment opportunities.

3.3.2 Implementation Strategies

The initial emphasis of implementation will be on controlling external loading, while gathering more information to refine a strategy for addressing internal loading and other in-lake management activities. The Shingle Creek Watershed Annual Water Quality Monitoring Report will be the mechanism by which the Commission will recommend to the MS4s which internal load management activities could be completed concurrently with external load reduction implementation. An important part of the Adaptive Management strategy of this Implementation Plan is restoring and maintaining biological integrity and associated impacts to water quality through management of the aquatic plant community, fishery, and macroinvertebrate and zooplankton assemblages. However, biological manipulation cannot provide all the internal load reduction that would be required. More detailed study is required to evaluate whether chemical treatment with alum, hydraulic drawdown, or other means of reducing internal phosphorus loading are feasible, and at what point in the Implementation cycle those "structural-type" activities would be most effective.

The following sections discuss the general BMP strategies that were identified in the TMDL process to reduce phosphorus load, restore ecological integrity, and meet state water quality goals for these lakes; the general sequence of implementation activities; and the stakeholders who would take the lead in implementing each activity. Where the responsible stakeholder is an MS4, this Plan expects that MS4 to identify more specific implementation activities and include those in their SWPPPs.

BMP strategies for each lake as identified in the TMDL are listed below and described in more detail in Sections 4 and 5 of this Plan.

<u>Strategies for All Lakes</u>

- Evaluate adequacy of existing rules, standards, and ordinances for runoff water quality treatment and volume management and revise if necessary
- Add BMPs as opportunities arise to decrease runoff from the watershed and increase stormwater treatment
- Monitor and maintain existing stormwater ponds and other BMPs to sustain removal effectiveness
- Increase infiltration and abstraction in the watershed
- Increase frequency of street sweeping in sensitive areas
- Conduct or update aquatic plant surveys and prepare management plans
- Encourage shoreline restoration to improve runoff filtration
- Measure actual internal load
- Monitor water quality in the lakes on an ongoing basis

Strategies for Schmidt Lake

- Update the aquatic plant survey and refine the aquatic plant management plan
    - Focus on invasive species control
- Conduct zooplankton and phytoplankton surveys
- Conduct an updated fish survey
- Consider rough fish removal if recommended by the fish survey
- Reduce external loads where possible
    - Small reductions would make a difference
    - Increase infiltration and filtration in the lakeshed
    - Encourage property owners to plant a native shoreline buffer

Strategies for Pomerleau Lake

- Focus on reducing external loads
    - Protect high-value wetlands in the lakeshed and minimize the potential for phosphorus export
    - Maximize stormwater loading controls on new development, encouraging low impact development
    - Retrofit engineering controls where possible
- Conduct an aquatic plant survey and prepare an aquatic plant management plan
- Conduct zooplankton and phytoplankton surveys
- Conduct an updated fish survey
- Internal load management
    - Biological management, biomanipulation most feasible
    - Partner with DNR to manage the fish community to promote pisciverous fish
    - Evaluate a possible aeration system identified by the DNR in its Pomerleau Lake management plan

Strategies for Bass Lake

- Focus on reducing external loads
    - Retrofit engineering controls where possible
    - Protect high-value wetlands and consider restoration of degraded wetlands
- Conduct zooplankton and phytoplankton surveys
- Consider rough fish removal
- Conduct an updated fish survey
- Partner with DNR to restore pisciverous and panfish balance
- Update the aquatic plant survey and aquatic plant management plan

3.3.3 Sequencing

Some of the above activities may be undertaken immediately, while others would be implemented as opportunities arise. In general implementation will proceed according to the following sequence of activities:

First Five Years

- Continue monitoring the lakes
- Continuously update the watershed SWMM and P8 models

- Evaluate rules, standards, and ordinances
- Evaluate ways to refine street sweeping practices to maximize pollutant removal
- Identify opportunities for BMP retrofit
- Measure actual internal loads
- Conduct or update aquatic vegetation, fish, phytoplankton, and zooplankton surveys
- Develop or update vegetation and fish management plans
- Implement BMP retrofits as opportunities arise
- Implement BMP and restoration demonstration projects as opportunities arise

Second Five Years and Subsequent Permit Cycles

- Continue monitoring the lakes
- Evaluate progress towards goals including what BMPs and activities were implemented and subsequent water quality improvement
- Amend this Implementation Plan as necessary based on progress
- Implement BMP retrofits as opportunities arise to continue to reduce external loading
- When sufficient external load controls are in place, prepare feasibility studies for internal load reduction strategies
- Implement internal load reduction BMPs

3.3.4 Stakeholder Responsibilities

The primary stakeholders in this Plan are the Shingle Creek Watershed Management Commission (SCWMC), the City of Plymouth, Hennepin County, and Mn/DOT. The City of Maple Grove has a very small amount of land in this watershed. In addition, property owners in the watershed have a role to play in implementing BMPs on their private properties. The Education program will provide both residential and non-residential property owners and managers with information on BMPs that would have the most impact on improving water quality. Table 5 shows which stakeholder will take the lead in implementing the various implementation activities identified in this Plan.

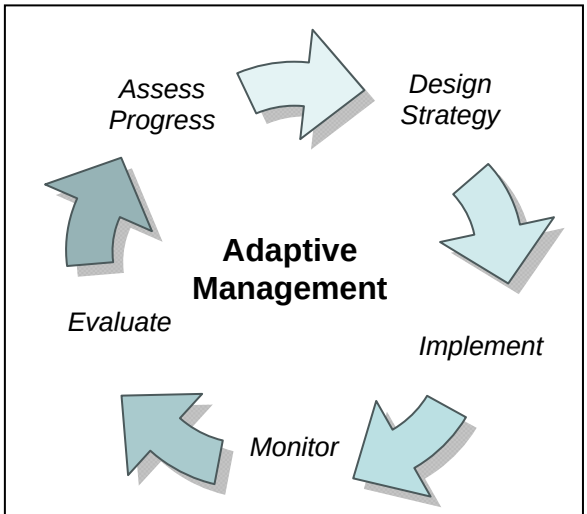

Figure 3. Adaptive management

3.4 ADAPTIVE MANAGEMENT

The load allocations in the TMDL represent aggressive nutrient reduction goals for Pomerleau Lake and more achievable goals for nutrient reductions in Bass and Schmidt Lakes. Implementation will be conducted using adaptive management principles. Adaptive management is an iterative approach of implementation, evaluation, and course correction (see Figure 3). It is appropriate here because it is difficult to predict the lake response to load reductions. Future conditions and technological advances may alter the specific course of actions detailed in this Plan. Continued lake water quality monitoring and course corrections responding to monitoring results offer the best opportunity for meeting the water quality goals established in the TMDL and this Implementation Plan.

Table 5. Implementation activity by stakeholder.

Actor	Stormwater	Internal Load	Aquatic Vegetation	Aquatic Life	Monitoring/ Reporting
SCWMC	• Evaluate watershed rules and standards • Evaluate volume management standards • Provide focused education and outreach • Solicit and fund Demonstration Projects • Prepare grant applications • Evaluate ways to refine street sweeping practices	• Measure internal loads • Prepare feasibility reports and make recommendations on internal load strategies in partnership with the City of Plymouth.	• Evaluate and make recommendations for curly-leaf pondweed management in all lakes • Identify potential shoreline restoration projects	• Evaluate and make recommendations for rough fish removal for Bass and Schmidt Lakes	• Continue CAMP citizen water quality monitoring • Conduct periodic in-depth lake monitoring • Monitor aquatic plants and plankton every five years or as determined in annual monitoring plan • Collect implementation data from stakeholders annually • Prepare annual report on monitoring and activities
Cities	• Provide focused education and outreach • Implement BMPs to reduce loads as opportunities arise • Conduct routine pond inspections for maintenance • Sweep streets at least twice annually	• Consider internal load reduction strategies and implement as opportunities arise	• Consider curly-leaf pondweed management and implement as opportunities arise • Consider shoreline restoration projects and implement as opportunities arise	• Consider rough fish removal in Bass and Schmidt Lakes and implement as opportunities arise	• Report implementation activities to SCWMC annually
Mn/DOT	• Sweep streets at least once annually • Implement BMPs to reduce loads as opportunities arise				• Report implementation activities on annual MS4 report
Hennepin County	• Sweep streets at least twice annually • Implement BMPs to reduce loads as opportunities arise				• Report implementation activities to SCWMC annually
Property Owners	• Implement BMPs to reduce loads as opportunities arise		• Implement curly-leaf pond weed management • Implement shoreline restoration projects		

4.0 Watershed Commission Activities

The SCWMC has agreed to take the lead on general coordination, education, and ongoing monitoring. The Commission will also collect MS4 annual NPDES reports and other information from the stakeholders and compile BMP activities undertaken by all parties. This information will be incorporated into the Commission's annual Water Quality Report. The following activities will be conducted by the SCWMC.

4.1 GENERAL COORDINATION

4.1.1 Coordination

One of the primary Commission roles in managing the watershed is serving as a coordinator of water resource policies and activities. The Commission will continue in that role in the implementation of this TMDL. General activities now undertaken by the Commission will be continued or expanded as the Commission moves from management planning to implementation coordination. These are activities that are included as part of the Commission's general administrative budget and no additional cost is expected from their implementation:

- Provide advice and assistance to member cities on their implementation activities;
- Research and disseminate information on changing BMP technology and practices;
- Collect annual implementation activity data;
- Recommend activities such as vegetation or fishery management, partnering with the DNR;
- Periodically update the Commission's Capital Improvement Program (CIP);
- Maintain the watershed SWMM and P8 models;
- Conduct public hearings on proposed projects; and
- Share the cost of qualifying improvement projects.

Estimated Cost: Ongoing activity
Funding Source: General operating budget, county levy for project share

4.1.2 Commission's Annual Water Quality Monitoring Report

An annual report on phosphorus load reduction activities is necessary under the adaptive management approach established in the TMDL. Each year the Commission will collect from the permittees in the watershed a listing of the activities undertaken in the previous year. This report will summarize those activities and provide the permittees assigned a categorical wasteload allocation the necessary information for their annual NPDES reports. The report will detail BMP implementation, associated load and volume reductions, and current monitoring data to evaluate activity effectiveness. At the end of each five year period this report will include an assessment of progress and identification of any revisions to the implementation plan. This report will be a part of the Commission's annual Water Quality Monitoring Report. The format and content of the Water Quality Monitoring Report is being revised to include reporting on the three stream TMDLs and 13 lake TMDLs in the watershed.

Estimated Cost: $10,000-12,000
Funding Source: General operating budget (currently budgeted at about $5,000)

4.1.3 Rules and Standards

In early 2008 the Commission directed its Technical Advisory Committee (TAC) to review and if necessary recommend revisions to the current rules to address the effectiveness of the regulatory program in meeting the TMDL requirements. The TAC reviewed the current pollutant removal performance standard and current infiltration requirement to determine if a more stringent rule was necessary. The TAC concluded that the current pollutant removal standard of 85% total suspended solids (TSS) and 60% phosphorus removal combined with the existing 0.5" infiltration standard were sufficiently stringent without being overly burdensome. The Commission will keep abreast of regulatory trends and consider future rules and standards revisions if so warranted.

Estimated Cost: $2,000
Funding Source: General operating budget for Management Plan (current budget is $3,000)

4.1.4 Establish Performance Standards

As a part of this and other TMDL Implementation Plans the cities, county, and Mn/DOT will be implementing various BMPs to reduce phosphorus load and stormwater volume. These stakeholders will report load reductions made by each BMP to the Commission, which will track progress toward meeting load reductions throughout the watershed. BMPs implemented since the TMDL baseline "current phosphorus budget" year (2001) will be tracked.

Stakeholders will have varying levels of information and data about these BMPs. In some cases estimating the load reduction will be part of the BMP design process. For example, load reductions for a new or enhanced pond can be calculated using standard modeling techniques. However, many other types of BMPs such as rain gardens, reforestation, reductions in impervious pavement, etc. have an impact that is more difficult and time-consuming to calculate. The Commission has directed its Technical Advisory Committee (TAC) to review literature, the State Stormwater Manual, and other guidance from Minnesota and other states to help provide guidance to the cities for estimating performance values for various BMPs. For example, a typical residential rain garden might be credited with reducing phosphorus by X kilograms per unit area annually. Or, an underground treatment device of Brand X would be assigned specific removal efficiencies. The MPCA is exploring establishing such standards, as are other watershed management organizations.

Estimated Cost: $3,000
Funding Source: General operating budget for Engineering Administration (current budget is $41,000)

4.2 EDUCATION

4.2.1 Public Education and Outreach

The Commission operates an ongoing education and outreach program that is managed by the standing Education and Public Outreach Committee (EPOC). The EPOC is a group comprised of city staff, Commissioners, and watershed resident volunteers that develops and implements educational materials and programming.

The Commission in fall 2007 undertook a professional opinion survey to better understand what people know and how public education and outreach can most effectively communicate how

individual property owners can impact water quality through the implementation of individual Best Management Practices in the watershed. The EPOC is preparing recommendations for the Commission for implementation in 2009 and beyond.

The Minnesota and Wisconsin Departments of Natural Resources, the University of Minnesota Extension Service, and University of Wisconsin Extension have prepared numerous fliers and brochures on various topics relating to lake management that can be made available to target audiences at city meetings, block club and National Night Out gatherings, and other opportunities, and on the Commission's and cities' web sites. The EPOC has also developed specialty brochures focused on groups such as apartment and small commercial building managers.

Estimated Cost: Ongoing activity
Funding Source: General operating budget for Education activities (current budget is $28,700)

4.2.2 Encourage Public Official and Staff Education

There is a need for city, county and state officials and staff to understand the TMDL process and the proposed implementation activities so that they can effectively make regulatory, budget and programming decisions and conduct daily business. Resources such as self-study lake management background information from Water on the Web ("Understanding Lake Ecology"), Project NEMO (Nonpoint Education for Municipal Officials), UW Extension ("Understanding Lake Data") and other sources would provide basic information about lake ecology to help staff, Councils and Commissions make informed decisions about lake management.

Estimated Cost: $500
Funding Source: General operating budget for Education activities (current budget is $28,700)

4.2.3 Presentations at Meetings

Awareness of lake management can be raised through periodic presentations at meetings of lake associations, homeownership associations, block clubs, garden clubs, service organizations, senior associations, advisory commissions, City Councils, or other groups as well as displays at events such as remodeling fairs and yard and garden events. "Discussion kits" including more detailed information about topics and questions and points for topic discussion could be made available to interested parties. The Commission's annual education budget assumes staff attendance at three presentations or events per year such as staffing booths at events.

Estimated Cost: $1,000
Funding Source: General operating budget for Education activities (current budget is $28,700)

4.2.4 Demonstration Projects

Property owners may be reluctant to adopt good lake management practices without examples they can evaluate and emulate. A few demonstration projects have been completed in the watershed through outside grants or from the Commission's Education and Implementation Grant program, including a shoreline restoration project in a park on Middle Twin Lake in Brooklyn Center and a shoreline restoration and a rain garden in a park on Ryan Lake in Minneapolis. The City of Plymouth has also completed demonstration projects including retrofitting rain gardens in the Schmidt Lake neighborhood. The Commission will encourage demonstration projects so property owners can see how a project or practice is implemented and how it looks. Examples might include

planting native plants; planting a rain garden; restoring a shoreline; managing turf using low-impact practices such as phosphorus-free fertilizer, reduced herbicides and pesticides, and proper mowing and watering techniques; and improving drainage practices with redirected downspouts and rain barrels. The estimated cost of this activity is highly variable. The Commission annually budgets $20,000 for grant matching and small projects. The Commission will evaluate appropriate activities and develop guidelines for funding demonstration projects from this budget.

Estimated Cost: Varies based on the type of activity
Funding Source: General operating budget for grant match/demonstration projects (current budget is $20,000)

4.2.5 Feasibility Studies

No specific internal load reduction projects have been identified. However, if any of the lakes still do not meet water quality standards after external sources have been reduced and biological controls put in place, then other types of internal load reduction strategies should be explored for feasibility. The Commission will lead the preparation of feasibility studies evaluating internal load management strategies such as chemical treatment or lake drawdown. These studies and resulting recommendations will be prepared in consultation with the Commission's Technical Advisory Committee (TAC).

Estimated Cost: $10,000 – 30,000 each
Funding Source: Member cities by cooperative agreement

4.3 ONGOING MONITORING

4.3.1 Water Quality Monitoring

The SCWMC will lead monitoring and tracking of the effectiveness of activities implemented to reduce nutrient loading in the watershed. This monitoring will continue to be detailed in the Commission's Annual Water Quality Monitoring Report. The Commission will continue to participate in the Metropolitan Council's Citizen Assisted Lake Monitoring Program (CAMP). Through this program, citizen volunteers monitor surface water quality and aesthetic conditions biweekly. Each year four to six lakes in the Shingle Creek watershed are monitored in this manner. This program is also a useful outreach tool for increasing awareness of water quality issues. The estimated cost of this monitoring is $6,500 annually, and is included in the Commission's existing Monitoring budget.

Estimated Cost: $6,500 annually
Funding Source: Monitoring budget for CAMP monitoring (current budget is $6,500)

The Commission will also periodically (every 4-5 years) conduct a more detailed analysis of water quality, collecting biweekly data on lake surface, water column, and bottom conditions. This data will provide a more detailed picture of lake response to BMP activities and will help determine necessary "course corrections" as part of the Adaptive Management philosophy guiding this Implementation Plan.

As described above, the Commission annually publishes a Water Quality Monitoring Report that compiles and interprets monitoring data from the lakes, streams, and wetlands in the watershed. The

monitoring data collected by the commission and other agencies will be analyzed to determine the linkage between BMP implementation and water quality and biotic integrity in Schmidt, Pomerleau and Bass Lakes, and to assess progress toward meeting the Total Maximum Daily Load and in-lake phosphorus concentration goals. This detailed monitoring is not part of the Commission's existing Monitoring budget. As the Commission completes its current cycle of management planning in 2010 with the Wetland Management Plan, that annual budget ($15,000) will be reallocated to more extensive lake monitoring.

Estimated Cost: $7,000 – 10,000 per lake
Funding Source: Reallocated operating budget for management plans (current budget is $15,000)

4.3.2 Other Monitoring

Some aquatic vegetation surveys have been completed for these lakes and should be updated every 4-5 years as part of the more detailed water quality assessment described above. Zooplankton sampling has not been conducted and should be periodically completed to assess overall biologic conditions. The estimated cost of this monitoring is $2,000-3,000 per lake. Neither type of monitoring is routinely part of the Commission's existing Monitoring budget. As the Commission completes its current cycle of management planning in 2010 with the Wetland Management Plan, that annual budget ($15,000) will be reallocated to more extensive lake monitoring.

Estimated Cost: $3,000-4,000 per lake
Funding Source: Reallocated operating budget for management plans (current budget is $15,000)

The Commission will work together with the DNR to determine the optimum strategy for monitoring the fish community.

Estimated Cost: To be determined
Funding Source: To be determined

The Commission will explore funding opportunities to research or pilot monitoring of BMP effectiveness.

Estimated Cost: To be determined
Funding Source: To be determined

4.3.3 Road Salt Reduction Data Analysis

Shingle Creek, to which these lakes ultimately drain, is an Impaired Water due to high concentrations of chloride. A TMDL approved by the EPA in 2007 identified road salt for ice control as the primary source of this chloride. Various BMPs to significantly reduce sodium chloride loading to Shingle Creek are identified in that TMDL's Implementation Plan. Phosphorus is often present in road salt as an additive or an impurity. Reducing the use of road salt to limit chloride loading may also reduce phosphorus loading. Some data is available to infer those potential reductions, but more analysis should be conducted to prepare a more accurate estimate of the total load reduction that may result from reducing road salt usage in the watershed.

Estimated Cost: $3,000 for data analysis
Funding Source: SCWMC general operating budget for monitoring (current budget is $37,000)

5.0 Stakeholder Activities

While the SCWMC will coordinate the implementation of the Schmidt, Pomerleau, and Bass Lakes TMDL, the Cities of Plymouth and Maple Grove, Hennepin County, and Mn/DOT as well as private property owners will ultimately implement the identified BMPs. Table 5 in Section 3 of this report shows the lead agencies for each of the stakeholder activities. Not all stakeholders will undertake all these activities. Those activities for which the stakeholders will take the lead will be incorporated into their NPDES Stormwater Pollution Prevention Programs (SWPPPs), and implementation actions will be reported annually.

Each stakeholder is in a unique position to implement BMPs. For example, street and highway reconstruction can provide opportunities to retrofit or enhance treatment, but some streets and highways may not require reconstruction for years or even decades. BMPs requiring new equipment or accessories are dependent upon the individual stakeholder's ongoing equipment replacement schedule. Other activities must be integrated into ongoing maintenance responsibilities as the budget allows.

The following are the general BMP implementation activities that will be most effective in restoring water quality in the lakes to state standards and an estimate of their cost. Refer to Section 3 of this report for information regarding sequencing and lead agencies.

5.1 REDUCE EXTERNAL LOAD

5.1.1 Retrofit BMPs to Add Stormwater Treatment in the Watershed

Additional treatment will be sought across the watershed as opportunities such as street reconstruction projects and development and redevelopment arise. Treatment options include but are not limited to:

- New and enhanced stormwater ponding;
- Infiltration basins and devices and other types of abstraction such as native vegetation or reforestation;
- In-line or off-line treatment manufactured devices; and
- Rain gardens and biofiltration.

For example, as part of the Schmidt Lake Management Plan, Plymouth has installed catch basin inserts at six locations to filter runoff and trap debris. Five sump manholes allow debris to settle out of the storm sewer flow, where it is mechanically removed by sewer vacuum. These small practices are effective in removing debris, leaf litter, and other potential pollutants.

Retrofit Best Management Practices might include detention ponds, native plantings, sump manholes, swirl separators, and trash collectors. These small practices are effective in removing debris, leaf litter, and other potential pollutants. Depending on the type of BMP, location, easement requirements, and other factors, costs can range from $5,000 for a sump manhole to $250,000 or more for a detention pond. The number of BMPs necessary to achieve the required phosphorus load reduction is unknown and is dependent on the types of opportunities that arise. Load removals might range from a fraction of a pound per year for plantings to 20-30 pounds per year for a detention pond treating a large subwatershed.

In addition, it may be possible to "upsize" water quality treatment BMPs for both development and redevelopment projects to increase treatment efficiency beyond the minimum required by the City and Commission to maximize the amount of load reduction achieved. The public cost of "upsizing" would be dependant on the specific BMPs, negotiations with developers, etc., but could range from $10,000-500,000 each. The incremental load removal might range from 1 pound to 10 pounds per year above the minimum required by development standards.

Estimated Cost: Varies by specific project
Funding Source: Cities, SCWMC through county levy, grant funds

5.1.2 Increase Infiltration in Watershed

Cities will work with developers to incorporate Low Impact Development principles into redevelopment as appropriate. Cities will incorporate infiltration and other abstraction strategies into city improvement projects where possible as opportunities arise. The cost of this strategy varies depending on the BMP, and may range from $500 for a single property owner installing an individual rain garden to retrofitting parks and open space with native vegetation rather than mowed turf at a cost of $10,000. Twin Cities Metro Area precipitation records indicate that 70-80 percent of annual runoff volume is conveyed from up to the first 1" of precipitation. A BMP that can abstract up to 1" of runoff could reduce nutrient load from that treated volume by 50-60 percent annually. Because these BMPs usually treat only a small area, the load reduction from an individual BMP is generally less than a few pounds annually. However, because of their small size multiple infiltration basins, for example, can be incorporated into a neighborhood street reconstruction project for a substantial load reduction. The Commission's Education and Outreach Committee regularly provides education and outreach information to member cities on these topics for publication in city newsletters, neighborhood and block club fliers, and the city's website.

Estimated Cost: Varies by specific project, City staff level of effort to be determined
Funding Source: Cities, Commission's education program

5.1.3 Shoreline Management and Restoration

Restore shoreline areas with native vegetation and lakescaping where opportunities present themselves. Shoreline restoration provides minimal pollutant load reduction but provides habitat, aesthetic, and shoreline stabilization benefits. Shoreline restoration can cost $30-50 per linear foot, depending on the width of the buffer installed. Residential property shoreline totals about 25,700 linear feet on Bass and Schmidt Lakes, with the balance of the shoreline made up of riparian wetlands. Ideally about 75 percent of the residential shoreline would be native vegetation, with about 25 percent available for lake access. Accomplishing this goal would require restoration of about 19,275 feet of shoreline. Education materials targeted to shoreline owners (for example, *www.bluethumb.org*), will be promoted to encourage voluntary shoreline restoration. Shoreline restoration provides minimal pollutant load reduction but provides habitat, aesthetic, and shoreline stabilization benefits.

Estimated Cost: $578,250 – $963,750
Funding Source: Private property owners, cities, grant funds

5.1.4 Street Sweeping

Newer street sweeping technologies are available that use high pressure to remove a greater percent of the small particles that can carry phosphorus to the lakes. Using these newer technologies can

help improve water quality. Studies conducted in the Lakes Nokomis and Hiawatha lakesheds in Minneapolis (Wenck Associates 1998) suggest that improved street sweeping technologies and increased street sweeping frequency could reduce phosphorus loads by 7 percent. The entire Schmidt Lake watershed is in Plymouth's Priority Sweeping program.

Estimated Cost: $100,000 to 200,000 per new sweeper
Funding Source: Cities

Increased and targeted street sweeping may be most effective in the direct watersheds to Bass and Pomerleau Lakes. Existing sweeping policies and practices and the experience in the Schmidt Lake watershed should be reviewed to determine how existing practices could be refined (for example frequency, timing) to improve efficiency and effectiveness as well as to identify where additional sweeping would provide the most water quality benefit.

Estimated Cost: $65-85 per mile of additional sweeping
Funding Source: Cities

5.2 REDUCE INTERNAL LOAD

5.2.1 Internal Load Reduction Projects

No specific internal load reduction projects have been identified. However, if any of the lakes still do not meet water quality standards after external sources have been reduced and biological controls are put in place, then other types of internal load reduction strategies should be explored for feasibility. The City of Plymouth would be responsible for implementing any agreed-upon internal load management project.

Estimated Cost: varies depending on strategy
Funding Source: Cities, SCWMC through county levy, grant funds

5.3 BIOLOGIC INTEGRITY MANAGEMENT

5.3.1 Aquatic Plant Management

The SCWMC recognizes the importance of a healthy biological community in meeting water clarity goals, especially in shallow lakes. Aquatic plant management is a key aspect in maintaining a healthy shallow lake. Studies of water quality following whole-lake aquatic vegetation management have shown mixed but promising results, although it is difficult to establish a numerical link or a specific load reduction. There is limited information available on the actual biomass of curlyleaf pondweed and other nuisance vegetation in these lakes. An aquatic vegetation management plan has been developed for Schmidt Lake. Aquatic vegetation surveys and management plans should be prepared for Bass and Pomerleau Lakes as well. As BMPs are implemented and water clarity improves, the aquatic vegetation community will change. Surveys should be updated periodically and vegetation management plans amended to take into account appropriate management activities for that changing community.

Estimated Cost: $3,000 for management plan and $4-5,000 per year/lake treated
Funding Source: Cities, lake associations

5.3.2 Rough Fish Management

Another factor affecting internal phosphorus release and plant establishment is the presence of carp and other rough fish. Common carp and rough fish have both direct and indirect effects on aquatic environments. Carp uproot aquatic macrophytes during feeding and spawning, re-suspending bottom sediments and nutrients into the water column. Carp excretions also contain high levels of nutrients. These effects are complex, and it is very difficult to assign a specific nutrient load reduction to rough fish management. The fish surveys on these lakes were conducted in the early 1990s and do not reflect the current standing crop of fish, so at this time even the extent of the problem is unknown. However, especially in shallow lakes it is not possible to control internal load without managing all three of these factors: 1) aquatic vegetation; 2) fish population; and 3) sediment release rates.

Rough fish controls include chemical treatment, removal and controlling access to spawning areas.

Estimated Cost: $25,000 to $50,000 per lake
Funding Source: Cities, lake associations, grant funds, DNR

Biannual removal will be required to effectively control carp populations. This action includes carp removal biannually. The Schmidt Lake Association has been active in restocking fish and may partner with Plymouth and the DNR to help restore a beneficial fish community.

Estimated Cost: $2,000 to $5,000 annually
Funding Source: Cities, lake associations

5.4 TRACKING AND REPORTING

Each stakeholder will integrate BMPs into their SWPPPs required by their NPDES General Permits for municipal stormwater discharges. Activities will be tracked and reported in their annual NPDES report. Each stakeholder will make a copy of the annual report available to the Commission, which will then incorporate that information into the Commission's annual Water Quality Monitoring Report. Additional MS4 staff time will be necessary to track and report on activities for this TMDL and Implementation Plan, however, it is difficult to estimate the magnitude of the additional level of effort.

Estimated Cost: City staff level of effort to be determined
Funding Source: Cities

Literature Cited

Wenck Associates Inc. 1998. Lakes Nokomis and Hiawatha Diagnostic Feasibility Study – Internal Phosphorus Load Estimates. Internal Technical Memorandum.

Wenck Associates, Inc. 2009. Draft Schmidt, Pomerleau and Bass Lakes Nutrient TMDL.