Lower Minnesota River Dissolved Oxygen

Total Maximum Daily Load Implementation Plan

Regional Division

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Minnesota Pollution Control Agency

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Lower Minnesota River Dissolved Oxygen TMDL Implementation Plan

Executive Summary

Water quality in the Minnesota River Basin is at risk for several reasons:

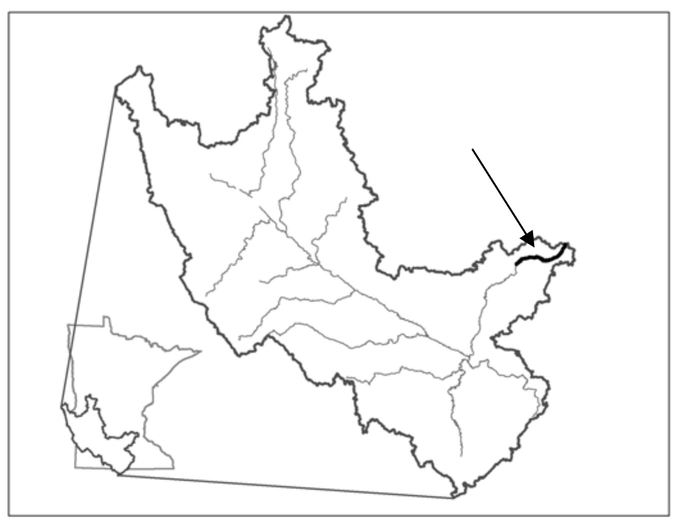
- Sediment – clouds the water, limits light on the bottom causing plants not to thrive, destroys fish and aquatic organism habitat and spawning beds and discourages recreational use of the water.
- Bacteria – indicates the presence of disease-causing organisms that can make people ill.
- Phosphorus – encourages algae growth; as algae dies and decays, it uses oxygen in the water resulting in lower dissolved oxygen levels.

This project – the *Lower Minnesota River Dissolved Oxygen TMDL Implementation Plan* – addresses only the phosphorus issue. Sediment is being addressed through a Minnesota River Turbidity TMDL now underway. TMDL projects to address bacteria are underway in the Blue Earth, Watonwan, Le Sueur, Yellow Medicine, and Chippewa River Watersheds.

When and Why Phosphorus is a Problem

The section of the river that is affected is the 22-mile stretch between Shakopee and the point where the Minnesota River joins the Mississippi River – called the "Lower Minnesota River." Phosphorus presents the biggest problem during *low flow conditions*, a situation that usually happens in the late summer when the rainfall is low and there isn't enough water in the river to flow normally. During low flow phosphorus builds up because of the water isn't flowing very fast. Phosphorus acts as a fertilizer – enabling the algae to grow at abnormal rates. When the algae die, the decay process uses the oxygen dissolved in the water that is needed by fish and other aquatic life.

Figure 1: Lower Minnesota River



The federal Clean Water Act requires states to study water bodies and find out the Total Maximum Daily Load (TMDL) – the amount of pollutants that can be discharged to a particular water body without hurting the water quality. In 2003-2004, the Minnesota Pollution Control Agency studied the low flow situation of the Minnesota River and worked with an advisory committee to develop a *TMDL Report* that identified phosphorus as a pollutant that must be reduced in order to restore and maintain water quality. The Report is followed by this *Implementation Plan* that describes the steps that must be taken to restore the water and the time frames for each step. This plan addresses the phosphorus level and the strategy to reduce it.

Sources of Phosphorus

When studying the phosphorus problem during low flow conditions, the Minnesota Pollution Control Agency (MPCA) discovered the phosphorus was coming primarily from these sources:

1. Wastewater treatment facilities that discharge continuously to the River;
2. Stormwater from urban areas;
3. Direct discharges of sewage from homes and unsewered communities; and
4. Runoff from agricultural cropland.

Phosphorus comes from multiple sources with complex interactions so there is not a simple method to reduce it. Rather, it will take multiple groups working together to solve the phosphorus loading in the Minnesota River.

Strategies to Reduce Phosphorus

The strategies to reduce phosphorus from each source are discussed below.

Wastewater Treatment Facilities

Forty of the 143 permitted municipal and industrial wastewater treatment facilities discharging to the Minnesota River Basin have the greatest impact. The goal is to reduce total phosphorus from these facilities by 35 percent by the year 2010. To reduce the total amount of phosphorus, the MPCA is implementing a new basin-wide phosphorus permit. Expecting all wastewater treatment facilities to make expensive upgrades may place undue financial burden on individuals in small communities whose phosphorus contribution may be small already. To get the most gain for the least cost, the basin–wide permit includes provisions that allow small communities to take advantage of large reductions by facilities who contribute large amounts of phosphorus. The result is that phosphorus will be reduced overall without undue financial burden on any one community.

Stormwater from urban areas

Communities, industries, construction sites and others needing a stormwater permit already will submit *Stormwater Pollution Prevention Plans* as part of permit requirements. Those located in the Minnesota River Basin will be required to address phosphorus reduction in their plans. Non-permitted communities will rely on education and voluntary measures to reduce phosphorus.

Sewage from failing septic systems and unsewered communities

This source includes septic systems that illegally discharge untreated or under-treated sewage that can find its way to a ditch, stream or other surface water. These may be individual septic systems or groups of systems – such as one of the 13 unsewered or under-sewered small communities in the basin. To reduce phosphorus from this source, failing systems must be located and fixed. Financial assistance and loans will be used to encourage and enable homeowners and small communities to do this.

Runoff from agricultural cropland

Agricultural cropland is also a source of phosphorus. During low-flow conditions, there is little rainfall and most rainwater soaks in rather than running off the land. So, although some reduction is possible, we cannot achieve large phosphorus reductions from this source. To reduce phosphorus from this source, utilizing crop residue and protecting open tile intakes – or equivalent practices – will be encouraged.

Timelines

Most activities will be implemented by 2015 except for urban stormwater retrofits (construction activities such as replacing pipes or adding ponds) which will be allowed 20 years to implement because of the complexity and cost to make these changes in areas that have already been developed.

Project Evaluation

As a part of the Implementation Plan, the MPCA and partners will keep track of changes and monitor effects. Parts of the study may be repeated around 2010 (when some of the reductions are in place) or during the next low flow period. (Low flow conditions generally happen about every 10 years.)

Conclusion

The Lower Minnesota River acts like a barometer – indicating the condition of the water flowing through it. Since many Minnesota River Basin streams and lakes show poor water quality, it is not surprising that the Lower Minnesota River reflects these problems. Meeting water quality standards in the Minnesota River Basin will require changes from all sectors of society – groups and individuals, urban and rural, government and private. Many groups are already working together at the city, county or watershed levels to improve water quality in the state's namesake river. Nearly every major watershed in the Minnesota River Basin has an active watershed project. It will take everyone, working together, to improve the water quality in the Minnesota River.

1. Introduction

This implementation plan applies to the Lower Minnesota River Dissolved Oxygen Total Maximum Daily Load (TMDL). The impaired reaches are in the lower 22 miles of the Minnesota River. The 22-mile segment includes four reaches:

- 07020012-501
- 07020012-505
- 07020012-506
- 07020012-532

The dissolved oxygen standard in this river segment is 5.0 mg/L as a daily average. In 1985 the MPCA conducted a Waste Load Allocation (WLA) study for the lower Minnesota River and determined that the lower 22 miles of the Minnesota River would not meet the dissolved oxygen standard during low flow conditions due to high levels of biochemical oxygen demand (BOD). Treatment upgrades of the Blue Lake and Seneca wastewater treatment facilities were required. The MPCA also determined that a significant part of the BOD came from the Minnesota River upstream of Shakopee. A goal was set to reduce BOD by 40 percent at Shakopee. Subsequent research showed that the main cause of the BOD was phosphorus from point and nonpoint sources. Phosphorus causes algae growth. Once the algae die, bacteria use the oxygen in the water to decompose the algae. The low oxygen problem occurs during low flow, drought conditions. Therefore, based on the TMDL study, the BOD goal will be achieved by reducing phosphorus.

The TMDL Report identified four sectors that impact phosphorus concentrations in the river: 1) continuously discharging wastewater treatment facilities discharging over 1,800 pounds of phosphorus per year; 2) urban stormwater; 3) direct discharges of sewage from individual residences or unsewered communities; and 4) runoff from agricultural cropland. Results of the TMDL study indicated that wastewater treatment facilities, urban stormwater, and direct discharges of sewage would be effective in reducing phosphorus. Agriculture, however, was not as effective in decreasing phosphorus due to the lack of runoff during low flow conditions. Agricultural practices that held more water on the land were selected as part of the TMDL process and cited as a way to reduce runoff during higher flow times, therefore increasing the amount of ground water recharge. During dry periods, this temporarily stored ground water seeps back into the river and increases the flow, ultimately helping reduce the low flow period.

The upstream boundary for the TMDL model was Lac Qui Parle Lake near Montevideo. The lake has a dampening effect on flow and parameter concentrations. Due to the dampening effect, the Upper Minnesota River and tributaries above Lac Qui Parle Lake (Pomme de Terre and Lac Qui Parle) were treated as a whole, while the area downstream of the lake was divided into watershed segments. Nearby monitoring stations (e.g. United States Geological Survey and Minnesota River Assessment Project stations) provided additional data.

The lower boundary was a United States Geological Survey (USGS) flow monitoring station at Jordan and the associated water quality monitoring stations from the Minnesota River Assessment Project (MRAP) and Metropolitan Council. The WLA Study established a boundary for upstream loading near Shakopee. However, Jordan was selected as the modeling endpoint because additional data were available for calibrating the model. There was not significant variability between the two data sets with regard to instream concentrations of key parameters. Therefore, the more robust data set at Jordan was used to check the performance of the model under various conditions.

1.1 A phased approach

Mitigating the impairment at this large scale (i.e. 12,000 square miles) is occurring in the three phases described below. The phases feature a management process that uses current and new information as it becomes available.

Phase I: A 1985 WLA Study established the basis for wastewater treatment facility BOD discharge limits for the facilities in the lower 22 miles of the Minnesota River and established a 40 percent BOD reduction goal upstream of Shakopee (MPCA, 1985). The upstream area was treated as one unit (i.e. not separated by watershed or BOD source). The EPA approved the 1985 WLA Study and the approved allocation became the basis for further study of the Minnesota River. Phase I was implemented at the end of the WLA Study.

Phase II: The Phase I portion of this project did not (and was not intended to) provide information on the sources of BOD upstream of Shakopee. Phase II provides: 1) an understanding of how the nutrient phosphorus creates BOD in this large river system; 2) a more comprehensive understanding of the loading contributions from upstream dischargers and area-wide nonpoint pollution sources; and 3) an understanding of how the loading and eutrophication cycles travel downstream to Shakopee. The TMDL Report was completed in 2004.

Phase III: This phase has two main objectives. The first is to develop a finer scale assessment at the major and minor watershed levels. This finer scale assessment will allow a more tailored best management practice (BMP) targeting strategy within the major watersheds. The second objective is to create a feedback loop as continued efforts to understand the river system provide new information. The new information gathered during other impairment studies (e.g. Minnesota River Turbidity TMDL and the downstream Lake Pepin TMDL) may add data and information. As a result, the Lower Minnesota River Dissolved Oxygen TMDL and this implementation plan may be modified based on new information in 2015. The Minnesota River Basin Phosphorus Permit may be adjusted in 2010, depending on the outcomes of TMDL studies.

1.2 Estimate of phosphorus sources

The TMDL Report identified four sectors for implementation (Table 1). The sectors are spread across much of the Basin. Table 2 shows an approximate number of sources in each sector.

Table 1: Estimate of primary sources of phosphorus during a low flow period.

Category	Percent of Phosphorus
Continuously discharging wastewater treatment facilities	65
Urban stormwater	16
Agriculture	14
Direct discharges of sewage	4

Table 2: Number of phosphorus sources.

Category	Number
Wastewater treatment facilities above 1,800 pound phosphorus threshold with phosphorus limits	11
Wastewater treatment facilities above 1,800 pound phosphorus threshold without phosphorus limits	29
Direct discharges of sewage that have surface discharges or transport waste to water without treatment (classified as Imminent Threats to Public Health)	approximately 20,000
Incorporated communities without proper wastewater treatment	15
Permitted MS4 communities	10
Communities below MS4 thresholds – approximately	>150
Acres of agricultural land	7 million

1.3 Two ways to solve the problem

During the stakeholder process, two methods were developed to solve the low dissolved oxygen problem. The first is to reduce phosphorus and the second is to increase flows during low-flow periods. Reducing phosphorus in the Minnesota River Basin above Shakopee will involve wastewater treatment facility upgrades, urban stormwater BMPs, and eliminating direct discharges of sewage. As a result, reduced phosphorus loading will produce less algae (resulting in less BOD) during low flow conditions in the lower 22 miles of the Minnesota River.

A less obvious way to reduce the impact of the low flow problem is to increase the base flow (ground water recharge) in the river during low flow conditions. One way to accomplish this is to redirect some of the surface runoff to the river by increasing the amount of water infiltrating into the soil. Water flowing through the soil will take more time to reach the river as it infiltrates via ground water seeps. During low flow conditions, ground water makes its way to the river, keeping the flow higher than it would otherwise be. Examples of effective practices include increasing buffers and wetlands, urban stormwater infiltration, increased use of perennial crops, and crop residue.

2. Estimate of load reductions

The overall goal is to reduce BOD by 40 percent in order to meet the dissolved oxygen standard during low flow conditions. Since much of the BOD is caused by phosphorus, the nutrient needs to be reduced. Continuously discharging wastewater treatment facilities need to achieve a cumulative 51 percent reduction in phosphorus; permitted Municipal Separate Storm Sewer System (MS4) communities a 30 percent reduction; nonpermitted communities a 20 percent reduction; and direct discharges of sewage a 90 percent reduction. Agricultural practices will increase flows at Jordan by 8 percent.

Continuously discharging wastewater treatment facilities will achieve the highest reductions because the problem occurs during low flow periods. However, it is also important to include agriculture and urban stormwater because:

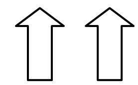
1. Storms occur during dry periods in a basin the size of the Minnesota River. It is important to provide protection for these events;

2. Phosphorus reduction during high flow periods will build a base for future work on pollutants such as turbidity; and

3. Increases in base flow reduces the duration of low flow periods.

Table 3 shows the allocations from the TMDL Report. As a result of the public process, the reduction goals were developed for each sector (Table 4).

Table 3: Summer low flow TMDL allocations by sector (in pounds per day).

Sector	Approximate phosphorus contribution from current loading during a low flow condition	Allocation needed to meet water quality goals	Impact on flow
Continuously discharging wastewater treatment facilities	807	416	--
Agriculture*	179	179**	
Urban stormwater	201	147	--
Direct discharges of sewage	50	6	--
Background	3	4	--
Total	**1,240**	**752**	

*Agriculture includes the conservation tillage, conventional tillage, grazed pasture, and manured land application categories.

**While some phosphorus reduction is possible in the agricultural land use category during low flow conditions, significant reductions were not projected from the modeling runs. Modeling results indicated a beneficial increase in base flow from selected agricultural practices.

Table 4: Estimate of load reductions by source.

Wastewater treatment facilities	
Continuously discharging wastewater treatment facilities discharging over 1,800 pounds of phosphorus per year with phosphorus limits or equivalent point-point trading	51 percent reduction in phosphorus when the 40 facilities are at 1 mg/L or equivalent (the 51 percent reduction is cumulative for the 40 facilities and not for each facility individually). 35 percent reduction by 2010.
Wastewater treatment facilities discharging less than 1,800 pounds of phosphorus per year	Facilities complete feasibility studies and implement phosphorus reductions where feasible.
Direct discharges of sewage	
Direct discharges of sewage that have surface discharges or transport waste to water without treatment (classified as Imminent Threats to Public Health)	90 percent reduction in direct discharges of sewage by 2015.
Incorporated communities without proper wastewater treatment	Communities have appropriate treatment in by 2015.
Urban stormwater	
Permitted entities (MS4, construction, industrial)	30 percent reduction in phosphorus by 2025.
Communities below permitted MS4 thresholds	20 percent reduction in phosphorus by 2025.
Agriculture	
Land with less than 3 percent slope	Protection of surface tile intakes will reduce the direct path that sediment and phosphorus have to the river. Removal of surface tile intakes can also be effective on land with slopes greater than three percent. Intakes protected by 2015.
Land with 3 percent slopes or greater	Crop residue (or equivalent agricultural practices) on 75 percent of cropland – crop residue (30 percent on a corn-soybean as a rotation average) holds soil in place and reduces overland runoff. Equivalent BMPs include terraces, alternative crops, etc. Crop residue in place by 2015.

2.1 Geographic targeting of implementation activities

Among many complex watershed and in-stream processes, proximity is perhaps the most straight-forward predictor of how phosphorus that leaves the mouth of a tributary will impact the lower Minnesota River. Table 5 shows “impact coefficients” at a number of discharge points within the modeled area (Tetra Tech, 2003). The coefficients are expressed as a percent of phosphorus lost before reaching Jordan. The greater the percentage, the more phosphorus that is assimilated near a given discharge point. Coefficients are shown for both the critical low-flow period (the focus of this implementation plan) and the 7-year simulation period. For example, during low flow periods, phosphorus that reaches the mouths of High Island Creek and the Rush River (66 percent assimilated) would have a greater impact than phosphorus from the Watonwan (98 percent assimilated) River. While the Middle Minnesota is not shown on this table, its impact coefficients would likely be in the range of those for High Island Creek, Rush River, and the Blue Earth River. It is important to note that the coefficients do not consider phosphorus loads or yields from the different watersheds, another important consideration in geographic prioritization.

Table 5: Phosphorus impact coefficients as percent loss to Jordan.

Watershed	Critical Low Flow Period (Aug.-Sept. 1988 Hydrology)*	Seven Year Simulation (1986-1992 Hydrology)*	Point of Discharge
Upper boundary	94%	17%	At Montevideo
Yellow Medicine River, Hawk Creek	92%	14%	At mouth
Lower Redwood	87%	13%	At mouth
Lower Cottonwood	77%	10%	At mouth
Blue Earth	75%	7%	At mouth
Upper Blue Earth	98%	23%	above Rapidan Reservoir
Rush R., High Island	66%	5%	At mouth
Watonwan	98%	23%	above confluence w/ Blue Earth
Lower Le Sueur	82%	6%	above confluence w/ Blue Earth
Upper Le Sueur	83%	7%	above Reach 600
Upper Redwood	92%	31%	above Reach 784
Upper Cottonwood	93%	18%	above Reach 750

*Although the hydrology data is from 1986-1992 (this is when the last low flow condition occurred), data from 1999-2000 was used for land use, including: Minnesota Ag Statistics (for animal livestock numbers), National Pollutant Discharge Elimination System discharge records (including flow and limits for phosphorus, BOD, TSS, and nitrogen), Conservation Reserve Program, Reinvest In Minnesota, Conservation Reserve Enhancement Program, and direct discharges of sewage.

3. Description of management measures to achieve load reductions

3.1 Wastewater treatment facilities

Implementation for the wastewater treatment facilities involves the continuously discharging wastewater treatment facilities discharging over 1,800 pounds of phosphorus per year. This is a cumulative reduction from the 40 facilities identified in the TMDL Report. The MPCA is also working with the pond permits to better understand how pond discharges impact the lower Minnesota River.

Phosphorus reductions from the sources described below will need to occur upstream of Shakopee. A general permit has been drafted for Minnesota River Basin wastewater treatment facilities that applies only to phosphorus. It is a “general” permit because it applies to all the facilities and it sets a limit for the combined amount of phosphorus discharged and individual reduction goals.

Phosphorus reductions for wastewater treatment facilities will be implemented over a 10-year period. The Minnesota River Basin General Phosphorus Phase I Permit spans the first five years of the TMDL implementation cycle. The permit targets an aggregate 35 percent reduction in phosphorus discharges. Operational changes and phosphorus removal techniques take time to implement; therefore, the 35 percent reduction will occur in stages over the life of the permit (2005-2010).

All wastewater dischargers downstream of the outlet of the Lac Qui Parle reservoir and upstream of Shakopee are listed in the General Phosphorus Permit. The permit covers four types of facilities in this geographic area: existing continuously discharging facilities; existing controlled discharge stabilization ponds; unsewered/undersewered communities; and new continuously discharging or stabilization pond facilities.

The following dischargers must apply for coverage under the General Phosphorus Permit: existing continuously discharging facilities with a design capacity to discharge more than 1,800 pounds of phosphorus per year; new or expanding facilities that must trade to offset their added contribution of phosphorus discharged to the Minnesota River; and unsewered/undersewered communities upgrading to secondary treatment that must trade to offset any increased growth-related phosphorus contribution to the Minnesota River.

All existing facilities have phosphorus-monitoring requirements under the General Phosphorus Permit. The permit does not relax any requirements of existing general or individual National Pollutant Discharge Elimination System (NPDES) permits. If requirements differ from one permit to the next, the more stringent requirements apply. The General Phosphorus Permit prohibits any net increase in the amount of phosphorus entering the Minnesota River.

Facilities with a design capacity of more than 1,800 pounds of phosphorus discharge per year (about 40) received an allocation based on reductions from their baseline discharge loading. Baselines were established for most facilities by using their May through September phosphorus concentrations in 1999 and 2000 discharges, or the earliest years available.

Other wastewater sources include smaller continuous discharge facilities, stabilization ponds and unsewered/undersewered communities. Phosphorus-related activities for these sources will be implemented through either individual or general NPDES permits. NPDES permits for these facilities are scheduled for reissuance toward the end of 2005. These sources did not receive phosphorus limits through the General Phosphorus Permit because they were not assigned an individual waste load allocation in the TMDL report. However, the permitting process does require that they conduct monitoring and develop Phosphorus Management Plans.

The phosphorus reductions for wastewater treatment facilities will be implemented over a 10-year period. The General Permit addresses the first five years (Phase I) of that 10-year period. Phase II of implementation will begin in 2010 when the current General Phosphorus Permit expires. Specific requirements of Phase II depend on the success of Phase I, the results of other TMDL studies affecting the Minnesota River (e.g. Minnesota River Turbidity and Lake Pepin TMDLs, and an update of the 1985 Waste Load Allocation Study) and potential changes in the scientific understanding of phosphorus transport within the Basin. The goal for the 10-year implementation period is to meet the allocation for phosphorus on all facilities discharging more than 1,800 pounds of phosphorus per year and to prevent a net increase in the amount of phosphorus discharged from small facilities in the Basin.

A. Implementation Targets

1. The permit targets an aggregate 35 percent reduction in phosphorus, discharged during May through September, from baseline loading within the Basin by 2010.

2. The 10-year allocation established by the TMDL for wastewater treatment facilities is based on a phosphorus discharge limit of 1 mg/L at a percentage of a facility's design flow (during low flow periods facilities tend to discharge less than design flows). This goal may change based on results from other ongoing TMDL efforts (e.g. Minnesota River Turbidity and Lake Pepin TMDLs, and an update of the 1985 WLA Study regarding BOD in the Minnesota River), further understanding of how phosphorus is transported in the Basin, or the results of the 35 percent reduction required by this permit.

3. Facilities under the 1,800-pound phosphorus threshold will develop and implement a phosphorus management plan (PMP). This PMP is meant to

encourage the facilities to reduce the amount of phosphorus discharged. The PMPs do not set phosphorus limits.

B. Milestones

1. The permit requires a 35 percent reduction in phosphorus by 2010. Because operational changes and prevention opportunities take time to put in place, the reduction of phosphorus occurs in the following stages:

   a. 15 percent reduction in 2008

   b. 25 percent reduction in 2009

   c. 35 percent reduction in 2010

2. Discharge Monitoring Report (DMR) – wastewater treatment facilities with phosphorus limits are required to submit monthly DMRs upon issuance of the permit. The DMR indicates the mass of phosphorus discharged during the calendar month.

3. Pre-season Implementation Plan – The plan is required by April 30 of 2006 through 2010 for facilities that will trade phosphorus credits during those years. The Pre-season Implementation Plan estimates phosphorus discharges for the upcoming calendar year. It also indicates any phosphorus trades that have been made for the upcoming calendar year.

4. Annual Compliance Report – This report indicates the wastewater treatment facility's compliance status for the calendar year. This information is collected from each facility and will be used to measure whether or not the phosphorus reductions required by the permit are occurring.

5. Phosphorus monitoring – Wastewater treatment facilities are required to monitor for phosphorus either 1 time or 2 times per week during the May-September phosphorus limit period. During other months of the year, these facilities are required to monitor at least 2 times per month.

6. Number of PMPs developed with and without feasibility study requirements. Some PMPs require a 30 and 50 percent feasibility study to determine what level of phosphorus reduction is feasible for a facility to reduce. This milestone is to determine how many are reducing phosphorus.

C. Costs

Of the 40 facilities discharging above the 1,800 pound phosphorus threshold, about 26 will need to construct additional wastewater treatment facilities, buy phosphorus credits from other facilities, or implement phosphorus management plans. If the entire 26 facilities construct to meet a 1 mg/L average phosphorus concentration, the estimated cost is $16,000,000. The range is estimated to be from $9,000,000 to $22,000,000. The estimate was based on the current infrastructure, ability to upgrade, and influent and effluent phosphorus concentrations. It was assumed that a facility would construct a biological phosphorus removal system if possible, and that approximately 10 of the 26 may choose that option with the remaining 16 constructing only the chemical addition option.

The large range of costs is dependent upon whether the facilities install only the chemical treatment equipment necessary to add chemical salts (such as alum or ferric chloride) to promote chemical coagulation and precipitation, or whether they construct biological phosphorus removal facilities with chemical treatment as a backup. The biological phosphorus removal facilities require a larger up front capitol investment, but the yearly operation and maintenance costs are lower than with only chemical treatment. Annual costs associated with chemical treatment include chemicals and increased biosolids storage and disposal. Most of the facilities would likely install chemical treatment as a backup even if biological treatment is the main phosphorus treatment technology, so this adds to the initial costs.

The other large unknown is whether additional biosolids storage would have to be constructed at a facility when phosphorus treatment is implemented. This is a site specific factor, which is also influenced by the ability of each facility to land apply the biosolids at different times of the year. Operation and maintenance costs were not included in the estimates above.

3.2 Agriculture

Since this particular TMDL implementation plan focuses on low flow conditions, agricultural practices exclusively targeting phosphorus reductions will have a limited impact because runoff is minimal. The TMDL Report did include agricultural practices as a way to reduce runoff during higher flow times, thereby increasing the amount of ground water recharge during dry periods. This temporarily stored ground water seeps back into the river and increases the flow during medium and low flow periods.

A. Implementation targets

1. Crop residue (or equivalent practices): 75 percent of row-cropland with slopes greater than three percent – Crop residue (30 percent on a corn-soybean as a rotation average) holds soil in place and reduces overland runoff. Equivalent BMPs include combinations of terraces, alternative crops, etc. as determined by comparison of cropping factors (c) and practice factors (p) in the Revised Universal Soil Loss Equation (RUSLE).

2. Surface tile intakes – On cropland with slopes less than three percent, 50 percent of surface tile intakes are targeted to be protected. This will reduce the direct path that sediment and phosphorus have to the river. Protection of

surface tile intakes can also be effective on land with slopes greater than three percent. Protection methods for surface tile intakes include installing perforated risers, rock inlets or grass buffers. This list is not intended to be comprehensive. Other practices not listed may be effective.

Protection of surface tile intakes is more effective in reducing phosphorus and TSS and less effective at reducing flows. The practice is used because crop residue is not as effective on flat land.

3. Manure application – State feedlot rules governing land application of manure specify nitrogen agronomic rates for manure crediting and manure application frequency will be reduced where soil phosphorus is elevated, especially near waters. Near waters, manure must be incorporated after application and generally will be applied over a greater number of acres to limit soil phosphorus build-up. This applies to any size feedlot. Incorporation maximizes benefits of manure, binding soil particles and reducing runoff and erosion.

   Compared with manure spills and feedlot runoff, land application of manure is the primary source of annual loading of feedlot-related nutrients to surface water (Environmental Quality Board, 2002). Although manure application is based on nitrogen agronomic rates, Minnesota Rules Ch. 7020 further limits manure applications based on phosphorus in certain locations.

   In addition to the phosphorus requirements near waters as noted above, a manure management plan is required in cases where feedlots exceed 300 animal units and where soil test phosphorus levels are extremely high. The manure management plan must describe how phosphorus will be managed to prevent pollution resulting from phosphorus transport.

   Approximately 30 percent of the state's 29,787 registered feedlots are in the Minnesota River Basin (Table 6) – Feedlots not registered are not included. These 8,772 feedlots contain over 2.2 million animal units. Five percent of the Basin's feedlots are larger than 1,000 animal units, yet these feedlots represent a disproportionately high percentage of manure that is land-applied.

Table 6: Feedlots located in the Minnesota River Basin.

Animal Units	Number of registered feedlots in Basin	Percent within Basin
<50	2,637	30%
50-100	1,854	21%
101-300	2,640	30%
301-999	1,200	14%
>1000	441	5%
Total feedlots registered in Minnesota River Basin	8,772	
Total feedlots registered in Minnesota	29,787	

4. Phosphorus crediting – On land where manure and commercial fertilizer are applied, 25 percent of the acres will use phosphorus agronomic rates, after manure crediting for phosphorus. Phosphorus agronomic applications are those determined by the University of Minnesota.

5. Native grasses or wetlands – An increase of native grass or wetland restorations will be pursued at a yet to be determined scale. Vegetation slows water, allows sediment to drop out and increases infiltration of water.

   Equivalent practices may be just as effective as those listed in the points below (Table 7). A University of Minnesota Extension Service publication titled Optimum Tillage Systems for Corn and Soybean Production and Water Quality Protection in South Central Minnesota – Minnesota River Basin provides guidance to farmers on tillage system selection (Randall and Vetsch, 2005).

Table 7: Examples of other practices to increase infiltration and reduce phosphorus.

Practice	NRCS Code
Conservation Cover	327
Conservation Crop Rotation	328
Contour Buffer Strips	332
Contour Farming	330
Cover and Green Manure Crop	340
Critical Area Planting	342
Cross Wind Ridges	589A
Cross Wind Stripcropping	589B
Cross Wind Trap Strips	589C
Dam, Multi-Purpose	402
Diversion	362
Fencing	382
Field Border	386
Filter Strip	393
Stream Habitat Management	395
Forage Harvest Management	511
Grade Stabilization Structure	410
Grassed Waterway	412
Herbaceous Wind Barrier	422A
Nutrient Management	590
Pasture and Hayland Planting	512
Planned Grazing System	556
Prescribed Grazing	528A
Residue Management, Mulch Till (formerly Conservation Tillage)	329B
Residue Management, No-till and Strip Till (formerly Conservation Tillage)	329A
Residue Management, Ridge Till (formerly Conservation Tillage)	329C
Residue Management, Seasonal (formerly Crop Residue Use)	344
Riparian Forest Buffer	391
Riparian Herbaceous Cover	390
Stream Channel Stabilization	584
Strip Cropping-Contour	585
Strip Cropping-Field	586
Structure for Water Control	587
Terrace	600
Use Exclusion	472

Waste Storage Facility	313
Waste Utilization	633
Water and Sediment Control Basin	638
Wetland Enhancement	659
Wetland Restoration	657
Windbreak/Shelterbelt Establishment	380
Windbreak/Shelterbelt Renovation	650
Wastewater & Feedlot Runoff Control	784

B. Milestones

1. Conduct Transect Tillage Survey on biennial schedule. The next survey will be completed in spring 2006. Estimate open tile intakes along with crop residue as part of Transect Tillage Survey.

    a. Acres over 3 percent slope achieving 30 percent residue cover (or equal BMPs):

        (i) 50 percent of acres protected by 2010

        (ii) 75 percent of acres protected by 2015

    b. Surface tile intakes protected (on lands less than 3 percent slope):

        (i) 30 percent protected by 2010

        (ii) 50 percent protected by 2015

2. Other practices tracked to determine progress toward achieving TMDL goals:

    a. Native grass acres

    b. Wetland restoration acres

    c. Alternative crops with equivalent RUSLE c and p factors as corn-soybean at 30 percent residue.

3. Develop tracking system for agricultural practices by 2008.

4. MPCA will pursue increases to the level of manure management plan review required of County Feedlot Officers (CFOs) in their annual work plans. Initially, the focus will be to ensure that producers are keeping the required records and maintaining required manure management plans. By 2010, the goal will be to include more in-depth analysis of soil test

phosphorus levels and manure application methods and frequencies that are documented in producer records and manure management plans.

C. Costs

1. Protection of open tile intakes – $9,130,000 to $17,600,000

    a. 7 million acres with 7-9 intakes/mi^2 ; $200 to $300/intake; 75 percent cost share; protect 50 percent of the intakes = $5,740,000 to $11,000,000

2. Local administration assumed to be 59 percent of land treatment cost. See Section 4 for details (BWSR, 2004). Adding 59 percent to costs above = $9,130,000 to $17,600,000.

3. Costs for other practices – to be tracked.

4. Options for funding:

    a. State and federal government - 319 TMDL funding, Clean Water Legacy (if funded), Conservation Security Program/farm bill, and BWSR challenge grants.

    b. Local government – provide funding for practices or matching other funding sources.

    c. Other – contributions from individuals or nonprofits.

3.3 Direct discharges of sewage

There are two main categories of non-compliant systems: 1) failing systems are considered to be failing to ground water; and 2) Imminent Threats to Public Health and Safety (ITPHS) are situations where there is sewage on the surface, piped to a ditch, stream, etc. Since phosphorus is transported by the ITPHS systems, phosphorus reduction efforts are targeted there.

Whether the sewage source is an individual residence or a small community, direct discharges of sewage are a problem. The model used in the TMDL study projected direct discharges of sewage as approximately 4 percent of the total phosphorus load under low flow conditions. The TMDL subsequently established a 90 percent compliance goal for the direct discharge category. While this source was not a major contributor to phosphorus loading, it is recognized as a significant human health impact and, therefore, must be eliminated.

Via the 2004 county ISTS reports, the MPCA estimates approximately 155,000 septic systems exist in counties that are in or part of the Minnesota River Basin. Of those, approximately 20,000 are in the ITPHS category (Table 8).[1] Discharges of

[1] ISTS reports submitted by counties in 2005.

improperly treated sewage range from 10 to 30 mg/L total phosphorus. Many counties have ordinances that vary in terms of point of sale inspections, field checking of new or replacement ISTS drainfields, and maintenance programs to ensure correction of these systems.

A. Implementation target

   1. 90 percent of directly discharging systems in compliance by 2015.

B. ITPHS Reduction Strategy

   1. All systems and small communities classified as Imminent Threats to Public Health and Safety are illegal under Minnesota rules. Individual sewage treatment systems are regulated by local governments in Minnesota, primarily counties, although cities and towns may also choose to regulate the systems. It is necessary to implement the compliance efforts at this level. As a part of the strategy, the MPCA recognizes the need to support or supplement the many and varied existing efforts that are underway to address the ITPHS problems.

      a. Estimate the number of system upgrades counties are able to permit per year and the years it would take for each county to have ITPHS compliance. Determine what counties need to speed up program as well as barriers to fixing ITPHS systems. Use information generated from three county pilot projects (Chisago, Cottonwood, and Fillmore) and watershed projects.

      b. Provide for financial mechanisms at the county or local government unit (LGU) level. Currently, several watershed-based low interest loan programs exist that cover all or parts of counties. Providing for whole-county low-interest loan coverage will help homeowners come into compliance with new systems or upgrades. Many of the watershed-based loans are also scheduled for sunset unless renewed, so establishing a self-sustaining program for the counties/LGUs will ensure a financial infrastructure to make fixes feasible.

         Grant programs for individual systems are not generally supported by LGUs due to their limitations. However, counties who choose to bond for ISTS upgrade monies or otherwise provide for a county/LGU-based financial platform could be given grants to buy down the cost of the loans to an acceptable rate for homeowners. Cottonwood County, for example, provides small incentive grants with funds from the MPCA's ISTS pilot project.

      c. Target existing monies more toward ITPHS systems. Currently, many of the existing CWP and Ag-BMP loan monies typically use between 10 percent and 50 percent of the loan monies to address the ITPHS systems; while the bulk goes toward upgrades of "failing" systems. Prioritizing the use of the ISTS monies to ITPHS systems should be maximized for each LGU but not to the extent that monies are left unused. Counties could also prioritize identification of ITPHS systems. Proposed 7077 Rule amendments will place a higher priority on ITPHS systems than on other ISTS failure types. The 7077 Rule is the Water Pollution Control Revolving Fund under Minnesota Statute 446A.07.

d. Encourage counties to require compliance inspections at the time of property transfers for counties/LGUs that do not currently require them. Property transfer requirements, while not specifically targeting ITPHS over failed systems, do help accelerate the rate of ITPHS compliance overall. The Minnesota River Board and Association of Minnesota Counties are considering assisting/leading in this effort. Lincoln County has been successful in upgrading systems at the time of property transfer. The county set a goal for 75 percent of the systems to be in compliance by 2010.

e. Enhance existing wastewater financial assistance programs for small unsewered communities. It will be important to engage the communities that have not moved forward due to funding limitations, and support or enhance the existing funding sources that are available (PFA-SRF; Small Cities Development-DTED; WIF; 319, etc.).

f. Encourage LGUs to conduct an ITPHS inventory. A comparison of the list of homestead tax parcels to a list of permitted systems could provide a starting point for the "missing" parcels, which could then be turned into a short list of possible ITPHS systems with further review. Currently, Cottonwood County is going through a state-funded ITPHS pilot project to identify and bring into compliance all ITPHS systems in the county. Lessons learned from their effort can be passed on to the other counties in the Basin. The Minnesota River Board has discussed requiring a 10-year plan for counties that could be tied to release of financial program monies.

g. Ensure provision for the maintenance of systems. Achieving compliance must be coupled with maintaining compliance to ensure future water quality.

h. Prioritization system for counties – use the scale below to prioritize work with counties. Priority is given to level 3 counties that are not moving toward compliance.

    (i) On schedule to achieve compliance in 10 years (Faribault Co.);

(ii) Working on projects to accelerate compliance:

(a) Are, or will be working on fecal coliform bacteria TMDL project (in which case a detailed implementation plan will be developed for the bacteria TMDL and therefore target ITPHS system problem);

(b) Point of sale inspections;

(c) Other

(iii) Are not included in the above.

C. Milestones

1. 40 percent of ITPHS systems in compliance by 2010.

2. Results of Cottonwood County pilot project.

3. Drawdown on low interest loan funds.

D. Costs

1. Approximately 20,000 discharges x 0.9 (90 percent compliance goal) x \$8,000 per system = \$144,000,000. Adding technical assistance, local administration. Local administration assumed to be 59 percent of land treatment cost. See Section 4 for details (BWSR, 2004). \$144,000,000 x 59 percent = \$84,960,000 + \$144,000,000 = \$228,960,000

2. Thirteen unsewered incorporated communities exist in the Basin. According to a review of alternative wastewater projects with soil-based disposal, the average capitol cost per home was \$15,900. If a range of \$13,000 to \$19,000 is used, the cost for the 13 communities would be \$11,830,000 to \$17,290,000 (assuming 70 households per community). Adding 59 percent for local administration and planning, the costs total \$18,809,000 to \$27,491,000. Costs will vary depending on the type of treatment system selected.

Figure 1 shows the status of point of sale requirements by county and fecal coliform bacteria TMDL Projects by watershed. The numbers of ITPHS systems were calculated by multiplying the number of ITPHS systems provided in the 2004 annual report by the percent of each county in the Basin (Table 8).

Figure 1: Status of point of sale requirements and fecal coliform bacteria TMDL projects in the Minnesota River Basin.

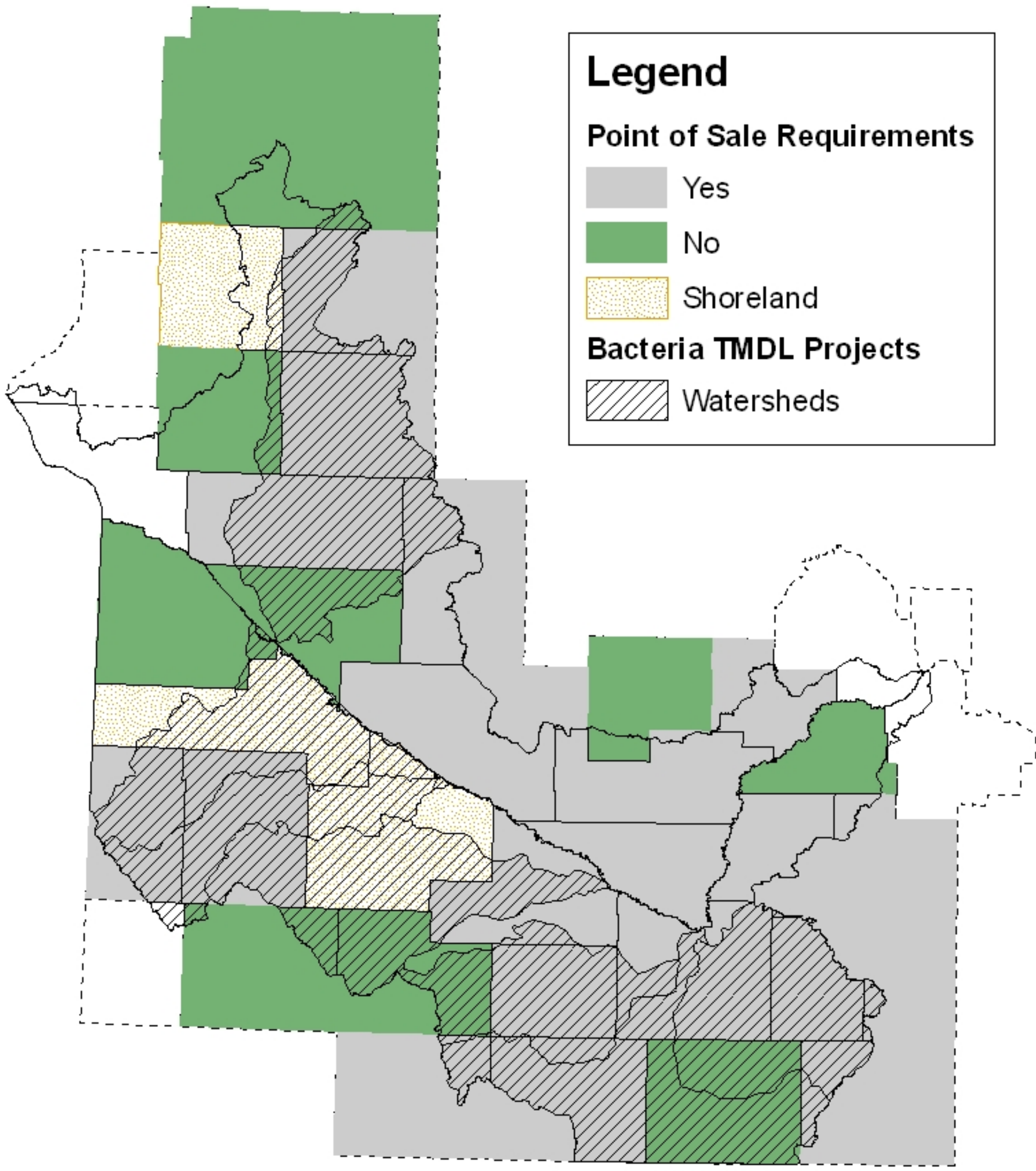


Table 8: Estimates of direct discharges of sewage in the Minnesota River Basin (provided by counties in 2004 annual report).

County	Number of residences	Percent failing systems	Number of failing systems	Percent ITPHS	Number of ITPHS	Percent of county in Basin	Number of ITPHS in Basin
Big Stone	1,200	30	360	10	120	81	97
Blue Earth	5,650	50	2,825	25	1,412	100	1,408
Brown	2,352	40	940	40	940	100	941
Carver	4,030	50	2,015	15	604	61	369
Chippewa	2,205	7	154	50	1,102	100	1,103
Cottonwood	1,648	19	313	44	725	75	541
Dakota	1,039	30	311	3	31	12	4
Douglas	10,000	60	6,000	10	1,000	45	446
Faribault	2,060	-	-	62	1,277	100	1,276
Freeborn	13,100	30	3,930	15	1,965	22	429
Grant	1,200	30	360	5	60	34	21
Hennepin	1,600	25	400	5	80	18	15
Jackson	3,250	65	2,112	70	2,275	13	298
Kandiyohi	6,372	40	2,548	10	637	47	299
Lac Qui Parle	1,632	-	-	40	652	100	653
Le Sueur	5,413	50	2,706	25	1,353	69	939
Lincoln	1,452	25	363	50	726	85	617
Lyon	2,050	50	1,025	5	102	97	99
Martin	4,500	40	1,800	28	1,260	76	964
Mcleod	6,050	60	3,630	30	1,815	13	234
Murray	1,799	5	89	60	1,079	16	171
Nicollet	2,532	20	506	40	1,012	100	1,013
Ottertail	23,000	50	11,500	15	3,450	11	375
Pipestone	1,570	20	314	60	942	06	52
Pope	2,963	20	592	10	296	86	254
Redwood	2,450	90	2,205	75	1,653	100	1,653
Renville	2,485	13	323	63	1,565	74	1,154
Rice	6,579	27	1,776	13	855	09	81
Scott	12,579	20	2,515	1	62	94	59
Sibley	4,020	15	603	50	2,010	97	1,954
Steele	2,994	40	1,197	10	299	08	25
Stevens	1,170	5	58	35	409	75	307
Swift	3,926	82	3,219	5	196	100	196
Traverse	844	20	168	5	42	06	2
Waseca	2,209	27	596	26	574	82	469
Watonwan	1,330	5	66	40	532	100	532
Yellow Medicine	1,800	-	-	45	810	100	810
					Total		19,860

3.4 Stormwater

Minnesota's stormwater program is in the process of designating additional municipalities that must meet the Municipal Separate Storm Sewer System (MS4) permitting requirements. No permitted MS4 communities currently exist upstream of Jordan. Stormwater rules require that designated communities submit Storm Water Pollution Prevention Programs, or Storm Water Pollution Prevention Plans in the case of industry and construction (SWPPPs). SWPPPs need to be consistent with TMDL allocation requirements and implementation plans. Language on this requirement is included in the MS4 permit and construction permit. Similar language will likely be included in the industrial permit, which is currently expired and will be revised after EPA releases its draft permit.

In the Lower Minnesota River Dissolved Oxygen TMDL Report, the stormwater sector represented approximately 16 percent of the phosphorus in the lower Minnesota River during low flow conditions. Land use data from the year 2000 was used and the TMDL Report assumed no BMPs in place. Previously installed and future BMPs will receive credit for reducing phosphorus. Consequently, the stormwater sector has already made some progress toward the phosphorus reductions identified in the TMDL report. Stormwater is divided into permitted and nonpermitted activities (Table 9).

Table 9: Permitted and nonpermitted stormwater activities.

Permitted activities	Nonpermitted activities
Permitted Municipal Separate Storm Sewer System (MS4) communities ~10 communities Construction Industrial	Nonpermitted communities under MS4 - >150 communities

A. Implementation targets

1. **Permitted activities: 30 percent reduction –** including ~10 permitted MS4 communities, permitted construction stormwater sites, and permitted industrial stormwater sites. Permitted MS4 communities in the Minnesota River Basin (upstream of Jordan) are designated by state rule (Table 10). The designated communities have up to 18 months following adoption of the rule to submit permit applications, SWPPPs, and meet other permit requirements. This is estimated to be in February 2007. Prior to this time, the 10 communities will be in the 20 percent reduction category.

Table 10: Communities designated to meet stormwater permitting requirements.

City	County	Population (2000)
Fairmont	Martin	10,889
Mankato	Blue Earth	32,427
Marshall	Lyon	12,735
Montevideo	Chippewa	5,346
New Ulm	Brown	13,594
North Mankato	Blue Earth	11,798
Redwood Falls	Redwood	5,459
St. Peter	Nicollet	9,747
Waseca*	Waseca	8,493
Willmar	Kandiyohi	18,351

*A small portion of the City of Waseca is in the Minnesota River Basin and would need to meet the phosphorus reduction requirement.

2. **Nonpermitted activities: 20 percent reduction**

    a. Communities under MS4 permitting requirements

3. Timeline for retrofits for already developed areas will be given 20 years. New construction will follow permit requirements.

4. Reduction targets assume no practices are currently in place.

B. Stormwater strategy for permitted activities

1. The Statewide Stormwater Manual, developed by the Stormwater Steering Committee and the MPCA, should be useful in identifying the practices to achieve the appropriate reductions. The manual will be completed by January 2006.

2. Permitted MS4s – Under the stormwater program, permitted MS4s are required to develop and implement a SWPPP. Six minimum control measures must be covered including: 1) Public education and outreach; 2) Public participation and involvement; 3) Illicit discharge, detection and elimination; 4) Construction site runoff control; 5) Post-construction site runoff control; and 6) Pollution prevention/good housekeeping. The permittee must identify best management practices (BMPs) and measurable goals associated with each minimum control measure. A report on the implementation of the SWPPP must be submitted each year.

a. By May 2006, the MPCA will provide guidance to communities on additional measures that need to be added to SWPPPs in order to achieve the necessary phosphorus reductions. Communities will prepare SWPPPs that include information to identify existing stormwater discharges and BMP phosphorus credits from present city management activities (street sweeping, sediment basins etc.). The permitted communities will also project future infrastructure changes to reduce phosphorus loading from areas of new development. The time period from 2006 to 2010 will be used for planning, so that the requirements can be included in the 2010 permit. If permitted communities are not ready to include the requirements in the 2010 permit, the requirements can be included in a future permit. Practices need to be adopted by 2025.

b. MPCA staff meet with permitted communities in Minnesota River Basin in 2006-2007 to work on various aspects of the SWPPPs and potential practices to use.

c. Prepare three to four brief case studies on successful efforts of Minnesota River communities. This may feature cooperative efforts, successful implementation of practices, etc. The purpose of the case studies is to demonstrate approaches to phosphorus reductions from communities. Case studies completed by 2010 if funding is available.

d. For permitted activities, the signature of the person responsible for overall permit compliance certifies that the SWPPPs are designed to achieve the goal of the appropriate phosphorus reductions. MPCA will provide the protocol to estimate the reductions.

e. A longer term strategy that may be considered by communities is to use low impact development and to set aside three to five percent of the land in a city for future BMPs, as necessary. This land may be in the floodplain or a riparian area, or may be otherwise sensitive. Property could be accessed as land becomes available. A better understanding of floodplain corridors, vulnerable landforms, and use of greenways will be encouraged.

3. <u>Construction and industry</u>

a. SWPPPs are compliant with stormwater requirements.

C. Stormwater strategy for nonpermitted activities

1. Public works staff identify stormwater discharges, areas contributing to stormwater discharges, and inventory existing structural and nonstructural stormwater BMPs (e.g. street sweeping, grassed swales, ponds. etc.).

2. Consider types of BMPs to reduce phosphorus.

3. Identify BMPs to be implemented and a timeline for each.

D. Milestones

1. MPCA staff meet with communities and provide guidance to communities on the additional measures that need to be added to SWPPPs – May 2006;

2. Permittees submit SWPPPs – 2007;

3. Permittees assess reduction needs, plan construction, draft ordinances, etc. – 2007-2010;

4. Permittees include new city administrative requirements (e.g. ordinances, staffing, etc.). SWPPPs also will include a description of plans and timelines for implementing BMP construction activities to retrofit already developed areas to achieve the phosphorus reduction requirements in second SWPPP, which will be completed in 2010. If 2010 SWPPP is not possible, then include in future SWPPP so activities are in place by 2025;

5. Case studies featuring stormwater reduction efforts of Minnesota River communities completed by 2010;

6. Stormwater sector adopts practices to achieve phosphorus reductions by 2025; and

7. Develop system to track BMPs in small towns (e.g. surveys, watershed initiatives, reporting, etc.).

E. Costs

According to demographic data from the 2000 census, there were 53,200 households in the ten permitted MS4 communities and 126,200 households in the smaller non-permitted MS4 communities. The estimated costs are aggregated among the permitted MS4 communities and among the nonpermitted communities. Cost estimates are not per community.

The costs were estimated using two methods. The first method used the Survey of Residential Annual Storm Water Utility Charges for Various Cities in the Metropolitan Area. The data were collected by Brian Voelker from the City of Cottage Grove. Actual costs will vary depending on the types of practices selected. For the permitted MS4 communities, a mean cost of $38.27 per household was used and for non-permitted MS4s, the twenty-fifth percentile cost of $24.58 per household was used.

1. Permitted MS4 cost – approximately $2 million per year or $40 million over 20 years.

2. Non-permitted MS4 cost – approximately $3 million per year or $60 million over 20 years.

The second method used a cost-benefit analysis from the National Pollutant Discharge Elimination System-Regulations for Revision of the Water Pollution Control Program Addressing Storm Water Discharges (Federal Register, 1999). Results from a survey of potential permitted MS4 communities nationwide estimated a cost of $9.16 per household per year.

1. Permitted MS4 cost – approximately $487,000 per year or $10 million over 20 years.

2. Non-permitted MS4 cost – approximately $1.2 million per year or $24 million over 20 years.

3.5 Projects underway to improve water quality

Local water quality improvement projects are integral to reducing nonpoint source phosphorus in the Minnesota River Basin. Work by watershed or county projects has been, and will continue to be an essential part of improving the Minnesota River. The Minnesota River is a priority in which citizens and government have invested significant amounts of time and money. According to the Minnesota River Basin Plan, as of September 2001, nearly $32 million had been spent on monitoring and research, Clean Water Partnership grants and loans, ISTS loans and other water quality improvement efforts since 1989. Approximately $311 million had been spent on wastewater treatment facility upgrades since 1981. Much of this money was matched locally. People have made a significant investment to clean up the river. The funding is paying off since improvements are beginning to be seen. Additional resources will be necessary to keep the momentum going.

Hawk Creek – The Hawk Creek Watershed Project received Phase I Clean Water Partnership (CWP) funding from the MPCA in 1999 and Phase II CWP funding in 2001. As part of a "Green Corridors" Project, areas within 350 feet of a stream are targeted for conservation practices. Other BMPs include blind tile inlets, ditch bank side inlets, and buffer strips. An estimated 103,000 tons of sediment and 160,000 pounds of phosphorus have been reduced. That's enough soil to fill 10,300 dump trucks and enough phosphorus to fertilize 4,000 acres of corn! The Hawk Creek Watershed Project received funding for conservation projects along a number of Minnesota River tributaries. A variety of conservation practices are eligible.

Yellow Medicine River – The Greater Yellow Medicine River Watershed Project was awarded Phase I CWP funding in 1997 and Phase II funding in 2001. BMP adoption is being accelerated via the Phase II funding and a 319 grant. A six year, 25 percent reduction goal has been set for nutrients. The installation of filter strips has been accelerated due to Conservation Reserve Enhancement Program (CREP) and incentive payments. Approximately 450 acres in 30 locations have filter strips with incentive payments of $100 per acre.

Other projects include more than 50 water and sediment control basins on 12 properties with erosion impacts in the watershed; water and sediment control basins planned for 11 properties with erosion impacts in the watershed; and work with landowners on nutrient management plans.

Chippewa River – The Lower Main Stem Chippewa River Subbasin Project was awarded with 319 TMDL implementation funding in the fall of 2002. The $170,000 grant will fund buffer strips (900 acres targeted), nutrient and residue management (30 landowners targeted), provide education and incentives for livestock exclusion from streams (4 landowners targeted), and replace 200 open tile intakes in the watershed. The project also has a significant information and education component.

Redwood and Cottonwood Rivers – The Redwood River watershed began its watershed work with funding from the MPCA in the early 1990s, with the Cottonwood River Watershed following by the end of the decade. From 1994 through 2000, 30,876 acres of CRP were established in the Redwood River Watershed and an additional 3,673 acres of permanent RIM easements. Over 160 landowners and operators established over 350 BMPs throughout the watershed. Redwood-Cottonwood Rivers Control Area staff estimated a 61,170-ton sediment reduction and a 69,528-pound phosphorus reduction (Redwood River Clean Water Project, 2001).

The Redwood River Watershed TMDL Compliance Project received 319 TMDL implementation funding in the fall of 2002. The project will provide cost share funding and technical assistance for terraces, rock inlets, grassed waterways, livestock waste management, riparian buffer strips, nutrient management, non-compliant septic systems, water and sediment control basins and provide education to urban officials on stormwater treatment and water storage.

Middle Minnesota River – much of this watershed borders both sides of the Minnesota River and therefore has several tributaries flowing to the Minnesota River. This poses challenges to managing the watershed. The Phase I and II CWPs are located in just two locations within the Middle Minnesota River Watershed – the Seven Mile Creek Watershed and the Little Cottonwood River Watershed.

The major emphasis in the Little Cottonwood River Watershed was placed on restoring the riparian corridors. The single most important tool to help with this effort was the CREP program. Two full-time staff worked with local conservation groups and landowners to secure over 2,300 acres or more than half the total acres in the county within the watershed. For areas outside the 100-year floodplain, marginal cropland acres were targeted for CRP wetland restorations and filter strips. To date, the project has secured about 1,900 acres through the CRP program. Similar programs are occurring in the Seven Mile Creek Watershed. Several demonstration projects are underway to address TMDLs. They include: milkhouse wastewater treatment systems, streambank erosion stabilization and fish habitat using soil bioengineering and natural stream channel design, on-farm nutrient management demonstrations utilizing global positioning and yield monitors, and using wetlands to store water and remove nitrogen and phosphorus from ag tile drainage systems. Low interest loan money has been used to upgrade approximately 50 non-complying septic systems. Goals include a 25 percent reduction in sediment, a 40 percent reduction in phosphorus and nitrates, and maintaining E. Coli bacteria levels below 200 col./100 ml.

Watonwan River – The Watonwan River watershed diagnostic study was part of a Phase I CWP project including the Blue Earth and Le Sueur River watersheds, which began in 1996. In 2000, Phase II grant and loan funding were awarded. The project's focus is on reductions in phosphorus, bacteria, nitrogen, and total suspended solids. Other elements include public awareness and education, agricultural BMPs, and management of the riparian corridor.

Blue Earth River – Lily and Center Creek, which are Blue Earth River subwatersheds, received Phase II CWP funding in 2001. A 40 percent sediment reduction goal was established. Areas will be targeted using GIS and BMPs established by working with existing programs.

The Blue Earth River Watershed also received funding via the Conservation Security Program.

Le Sueur River – The Lower Maple River, a subwatershed of the Le Sueur River, received Phase II CWP funding in 2002. It is one of the higher contributors of total suspended solids, total phosphorus, nitrate, and turbidity when compared to minimally impacted streams in the Western Corn Belt Plains Ecoregion. The 1,200 feet of land adjacent to the Maple River is a priority area. Additional target areas will be selected in at least two smaller county drainage subwatersheds. Reduction goals for sediment, phosphorus, nitrate, and fecal coliform bacteria have been established as 25 percent for each. Erosion control practices along with nutrient and residue management are high priorities on agricultural lands.

The Greater Blue Earth River Watershed has also received funding via the EPA Watershed Initiative to restore five wetlands, organize crop insurance for farmers, cost-share with landowners for installation of riparian buffers, organize educational awareness projects, and promote existing agricultural conservation programs. The Le Sueur and Blue Earth River Watersheds are among the highest loaders of phosphorus and sediment in the Minnesota River Basin, according to the State of the Minnesota River Report.

Lower Minnesota River – The Rush River CWP is in Phase I and the High Island Creek CWP is in Phase II. Both are southwest of the metro area. The High Island project has set phosphorus and sediment reduction goals of 30 percent at upland sites, 20 percent at the outlet, and a 10 percent nitrogen reduction goal. The project will target wetland restorations, gully structures, terraces, filter strips, buffer strips, and open tile intake alternatives.

Also active in the watershed is Friends of the Minnesota Valley. They have two coordinators hired to work with rural and urban issues in the watershed. Teams have been formed, priorities set, and projects identified.

4. Estimates of financial and technical assistance needed

The estimated costs for implementation of the Lower Minnesota River Dissolved Oxygen TMDL are in Table 11. The estimates do not suggest what is paid by public or private funding. Applications for funding will determine this.

In 2004, a group of organizations issued a report to estimate TMDL costs titled Methodology and Assumptions for TMDL Non-point Source Pollution Restoration Planning Estimates (BWSR, 2004). The report estimated what it would cost to implement a TMDL over ten years. Participants included BWSR, MDA, PCA, MASWCD, MAWD, NRCS and a number of local watershed districts and soil and water conservation districts.

Cost estimates for nonpoint activities included the following activities:

1. Land treatment/management practices, these cost estimates are based on the total construction costs of typical structural practices, and incentive payments for land management practices, and are based on current costs of practices reported to BWSR & MDA, as well as estimates from the USDA Natural Resources Conservation Service (NRCS), and Farm Services Agency (FSA).

2. Local Administration, cost related to administering program and grant funds. (13% of projected land treatment and management practices cost).

3. Technical & Engineering Assistance, cost necessary to provide engineering and/or technical assistance for planning, survey, design, & construction supervision of practices. (30% of projected land treatment and management practices cost).

4. Information and Education, cost associated with landowner outreach and education. (12% of projected land treatment and management practices cost).

5. Monitoring and Evaluation, post implementation monitoring and accomplishment reporting. (4% of projected land treatment and management practices cost).

When costs for local administration, technical assistance, information and education, and monitoring and evaluation are added, the total is 59 percent, which is then multiplied by the land treatment/management costs to build in these other items. Costs for direct discharges of sewage and agricultural practices were estimated this way.

Table 11: Costs to implement TMDL*

Sector	Description	Cost estimate
Wastewater treatment facilities	Cost to upgrade treatment plants	$9,000,000 to $22,000,000
Agriculture	Protection of open tile intakes	$9,130,000 to $17,600,000
Direct discharges of sewage – residential	Permitting direct discharges of sewage	$228,960,000
Direct discharges of sewage – unsewered incorporated communities	Permitting unsewered incorporated communities	$18,809,000 to $27,491,000
Stormwater	Practices to reduce phosphorus in stormwater (using the $9.16 per household estimate)	$33,000,000
FTEs**	3.7 FTEs per year through 2015 and 1.5 FTEs per year from 2016 through 2025	$5,000,000
Total		**$303,899,000 to $334,051,000**

*All costs are estimates and reflect total cost.

**FTEs for MPCA stormwater and wastewater treatment facility implementation include 4 FTEs per year in 2005, 2010, and 2015 and 3 per year from 2006 through 2009 and 2011 through 2014. Because stormwater is allowed an additional 10 years, 1.5 FTE per year is provided for 2016 through 2025. Tracking and evaluation is estimated as 0.1 FTE per year from 2005 through 2015 and 0.05 FTE per year from 2016 through 2025. FTEs for agriculture and direct discharges were added to land treatment costs earlier in plan. FTEs for wastewater treatment facility and community staff were not included. Total cost per FTE is $96,500.

5. Information and education to enhance public understanding

Basin management in the Minnesota River Basin provides a framework to set goals and develop strategies to improve the Minnesota River. Both phosphorus reduction and impaired waters are important components of basin management. Several organizations are involved in the overall Minnesota River effort.

Minnesota River Basin Data Center – this organization organizes Basin-wide events to promote research and implementation activities. Phosphorus has been an issue of interest. The Data Center works to simplify data access, works with other agencies to produce the State of the Minnesota River Report, and deals with research issues via an annual research forum.

Watershed projects – Nearly every major watershed in the Minnesota River Basin has a watershed project. Many of these have been formed by counties, watershed districts, and non-profits. Many have targeted practices and priority areas for phosphorus and sediment reduction efforts. Land use and water quality can best be assessed and integrated at the watershed scale. Over time, changes in land use and improvements in land management can be tied with water quality. Education is significant in all these projects. For example, in several watersheds canoe trips are organized so people can get out on the river and see how important the river is to recreation and identify problems. Many of these projects are listed in section 3.5.

Lower Minnesota River Dissolved Oxygen TMDL Advisory Committee – the purpose of this committee was to advise the MPCA on the methods to reduce phosphorus in the Minnesota River Basin. The information was used in drafting the TMDL Report. It was composed of people representing cities, industry, agriculture, SWCDs, non-profits, and environmental groups.

Minnesota River Board – This multi-county board of commissioners holds an annual conference and coordinates Minnesota River efforts. People attending meetings include watershed projects; local, federal, and state agencies; environmental groups, and citizens. The Board was instrumental in securing CREP funding for the Basin and will be considering other initiatives to improve the Minnesota River.

6. Project evaluation plan

The project evaluation plan will evaluate the progress of meeting the dissolved oxygen standard during low flow conditions in the lower Minnesota River. Evaluation begins once the allocations in a TMDL have been established and implementation is underway. This includes developing the systems to track the adoption of practices and monitoring changes in water quality.

Scientists often use trend analysis in studies to detect changes in water quality. Low flow is defined as a seven-day average flow with a ten-year return frequency. Since low flow conditions occur, on average, once every ten years, it may be decades until enough low flow data is generated for a statistically valid trend analysis. While low flow monitoring will be conducted, this evaluation plan involves tracking the pollution reduction practices adopted and correlating the changes in land use with water quality. Changes in land use practices include wastewater treatment facilities (i.e. effluent limits and permitted stormwater activities) and nonpoint sources (e.g. agriculture, stormwater, and direct discharges of sewage). Another complicating factor is the extensive spatial scale over which changes will occur (i.e. 12,000 square miles).

A challenge in identifying the changes is that programs are often implemented at the county level while water is monitored on a watershed basis. The two may not match up due to the multiple scales at which implementation is occurring and the hydrology of the area.

There are three options if the practices are not adopted or are not effective: 1) use multiple compliance tools for adoption; 2) adjust the treatment efficiencies of the practices; 3) change the adoption requirements for one or more of the four sectors; and 4) revise the allocations in the TMDL.

Although tailored to the Lower Minnesota River Dissolved Oxygen TMDL, this plan can also be used as a framework for other large scale TMDL projects in the Minnesota River Basin. The Minnesota River turbidity TMDL and fecal coliform bacteria projects will also have implementation activities. When possible, monitoring stations should be coordinated and used for as many projects as possible. Additionally, the monitoring stations identified as a part of this process should be considered for sentinel watersheds for the Northern Glaciated Plains, West Central Corn Belt Plains, and North Central Hardwood Forest ecoregions.

The Project Evaluation Plan begins at the small watershed scale (5,000 to 20,000-acre watersheds) and increases in size to the system (i.e. lower Minnesota River) scale. The adoption of practices, effectiveness of the practices, and local resource response will be tracked at the small scale and watershed scale. The response of the Minnesota River is at the system scale.

A. Small scale

1. Adoption of practices in the four sectors will be important to track. Tracking tools are listed in Table 12. Many are already in place.

Table 12:* *Tools to track the adoption of practices.

Sector	Baseline	Tracking tool
Wastewater treatment facilities	Discharge monitoring reports from 1999-2000	Delta – Individual facility Effluent limits – individual facility Trading agreements – individual facility Discharge Monitoring Reports by individual facility
Stormwater–permitted sites	Assumed no BMPs in TMDL Report	Permits, SWPPPs, annual reports
Stormwater – nonpermitted communities	Assumed no BMPs in TMDL Report	Method to gather information from non-permitted communities to be determined
Agriculture	eLINK data and crop residue survey results from late 1990s and early 2000s	eLINK CEAP (NRCS) Crop residue Other systems
Direct discharges of sewage	Annual reports from counties	Annual reports Inventories of direct discharges

2. Efficiency of practices – initially the literature will be used to estimate efficiency of practices. Data from other studies is needed to add to the knowledge base of the practices above. Information on phosphorus and runoff reductions will aid in precision in the future.

B. Watershed scale

Many of the practices above will be tracked individually. At some point the practices may be aggregated to a watershed level (minor or major watershed) and then correlated to water quality measurements. This will aid in determining the water quality response to the practices adopted upstream of a monitoring station.

1. Gathering water quality data at various scales will be important. Table 13 below shows many of the monitoring stations used to collect water quality

data on the Minnesota River and its tributaries. The stations to be used as a part of this plan will be selected by June 30, 2006 and included in an appendix to the implementation plan.

2. MPCA and partners develop goals for water monitoring stations by June 30, 2008. Providing these milestones for each station will establish meaningful goals for the Minnesota River and its tributaries upstream of Shakopee.

Table 13: Potential water monitoring stations to be used in collecting water quality data for effectiveness monitoring.

ID	Station	Name	Beginning year
104.00000	H26037001	Chippewa River @ U.S. Highway	1996
111.00000	H27043001	Redwood River At Russell, MN	1998
118.00000	H29015001	Cottonwood River @ Cr 2	1996
121.00000	H29062002	Cottonwood River Near Lamberton, MN	1996
135.00000	H33032001	Minnesota River At Henderson, MN	1996
136.00000	H33032002	Mill Creek @ Hwy 19 To Dirt Road	1996
93.00000	H24039001	Lac Qui Parle, W. Br. @ Hwy 212	1996
102.00000	H25087001	Yellow Medicine River Near Hanley Falls, MN	1996
103.00000	H25088001	Spring Creek Near Hanely Falls, MN	1996
105.00000	H26042001	Henschien Lake Outlet @ County Road 38 In Park	1992
106.00000	H26042002	Norway Lake Inlet (cd 29) @ Kandiyohi County Road 1	1992
107.00000	H26042003	North Branch County Ditch 29 @ County Road 1,	1996
108.00000	H26042004	Huse Creek @ 62 Nd Street Nw	1996
109.00000	H26047001	County Ditch 27 @ County Road 1	1992
110.00000	H27039001	Threemile Creek Near Green Valley, MN	1996
112.00000	H28012001	Minnesota River @ State Highway	1996
117.00000	H29011001	Sleepy Eye Creek Near Cobden, MN	1996
120.00000	H29022001	Cottonwood River Near Leavenworth, MN	1996
124.00000	H31021001	South Fork Watonwan River	1996

		Near Madelia, MN	
147.00000	H33095001	Rush River, South Branch @ Cr18	1996
149.00000	H33114001	Assumption Creek Near Shakopee, MN	1996
150.00000	H33121004	Eagle Creek, West Branch @ Boone Ave S	1996
123.00000	H30051001	Elm Creek Near Huntley, MN	2004
122.00000	H30028001	Center Creek Near Huntley, MN	2004
130.00000	H32002002	Iosco Creek @ 55th Street Bridge	2000
131.00000	H32002003	Unnamed Tributary To Iosco Creek Near Palmer, MN	2003
132.00000	H32072001	Maple River Near Rapidan, MN	2004
114.00000	H28063001	Sevenmile Creek At Hwy 169 Near North Star, MN	2004
115.00000	H28063002	Seven Mile Creek Site 1	2002
116.00000	H28066001	Seven Mile Creek Site 2	2002
96.00000	H25007001	Hawk Creek, CR116, 1.25 MI S of MN 40, 4.2 MI SW of Willmar	2002
97.00000	H25024001	Hawk Creek near Maynard, USGS 05314500	2003
98.00000	H25027001	Chetomba Ck, at unnamed Twp Rd, 5 Mi SE of Maynard	2003
99.00000	H25037001	Hawk Creek @ Cr52	2002
101.00000	H25053002	Beaver Creek Outlet	2002
143.00000	H33091001	High Island Creek Near Henderson, MN	2004
148.00000	H33096001	Rush River, SH-93 by Henderson (Site 1RP)	2003
144.00000	H33092001	Buffalo Creek Near Jessenland, MN	2004
141.00000	H33075001	High Island Creek Near Arlington, MN	2004

C. System Scale

The system scale includes multiple watersheds upstream of (and including) the lower 22 miles of the Minnesota River. This involves monitoring water quality and validating the HSPF model.

1. Monitoring dissolved oxygen and other parameters

a. Targets for lower Minnesota River at Shakopee

(i) 40 percent reduction in BOD_5 by 2015, which equates to a low flow (seven-day average flow with a ten-year return frequency) summer season average concentration of 3.7 mg/L;

(ii) Phosphorus concentration of 0.131 mg/L;

(iii) Chlorophyll-a concentration of 65 ug/L;

(iv) Algal species present (percent of blue green algae may drop quicker than other types); and

(v) Long-term increase in flows at Jordan by 8 percent (flows will use the seven-day average for the ten-year return frequency as calculated by the MPCA staff in the Environmental Analysis and Outcomes Division).

b. Monitoring plan for the Lower Minnesota River—There are several long-term and short-term monitoring programs in the lower Minnesota River, which should provide comprehensive coverage.

(i) The Metropolitan Council operates a long-term river-monitoring program in the Twin Cities Metropolitan Area, which includes five stations on the Lower Minnesota River at Jordan, Shakopee, Savage, Black Dog, and Fort Snelling. BOD_5, phosphorus, chlorophyll, and other variables are monitored twice per month at Jordan, Black Dog, and Fort Snelling. BOD_5 is also monitored twice per month at Shakopee. Dissolved oxygen is monitored weekly at all five stations and continuously at Fort Snelling. Phytoplankton samples are collected annually in the summer near Jordan and Fort Snelling. For more information, see http://www.metrocouncil.org/environment/RiversLakes/Rivers.

(ii) The U.S. Geological Survey operates continuous stream-flow gaging stations near Jordan and at Fort Snelling State Park. The Jordan station has been operating since 1935. The Fort Snelling station began operation in 2004 and will continue through at least March 2007 with the cooperation of the Lower Minnesota River Watershed District and Metropolitan Council.

(iii) The Metropolitan Council, with the assistance of local partners, operates a stream-monitoring program in the Metro Area. This program includes nine tributaries to the Lower Minnesota River. For more information, see http://www.metrocouncil.org/environment/RiversLakes/Streams. In addition, Carver County monitors Chaska and East Chaska Creeks, and the Riley-Purgatory-Bluff Creek Watershed District monitors Purgatory Creek.

(iv) During water years 2004, 2005, and 2006, the Metropolitan Council is intensifying its river, stream, and effluent monitoring programs to collect data needed to build an advanced water-quality model of the lower 40 miles of the Minnesota River, which is described below under model validation. Monitoring is planned at all flows and seasons but will be further intensified at summer low flows if they occur. A number of special field studies are planned including a comprehensive assessment of oxygen dynamics (reaeration, sediment oxygen demand, community production and respiration, and others) and research on nutrients and sediment. For more information, see http://www.metrocouncil.org/environment/Water/LMRM.

(v) The MPCA plans to conduct an intensive survey of water quality in the Lower Minnesota River in summer when river flows are low. The weeklong survey will consist of continuous monitoring at four locations using sonde-equipped buoys plus grab sampling at two locations each day. The study reach is from just upstream of the Blue Lake wastewater treatment facility discharge near mile 20.5 to approximately 0.5 miles upstream of the confluence with the Mississippi River. Field work will be triggered by a steady summer flow of less than 1,500 cubic feet per second at the USGS's continuous flow recording station on the Minnesota River near Jordan (River Mile 39.4). By using sonde-equipped buoys, a set of 24-hour monitoring data will be continuously recorded during the survey. The sondes record dissolved oxygen, pH, temperature and conductivity. Every day while the monitors are in place, the field crew will collect probe drift-correction data for the sondes, additional field measurements, and water samples for laboratory analyses (solids, chlorophyll, nutrients, and organic carbon).

(vi) Collect additional water samples upstream of Jordan to verify previous modeling results.

(vii) The Metropolitan Airports Commission (MAC) monitors stormwater discharges from the Minneapolis-St. Paul International Airport for three outfall locations. In addition, the MAC is required to monitor the Minnesota River at two locations during June through September when river flows near Jordan are less than 1,000 cubic feet per second. The two sites are located upstream and downstream of all airport outfalls at approximately river mile 4.0 (I-494 bridge) and between miles 0.1 and 0.4. Under these conditions, the MAC will conduct weekly monitoring of dissolved oxygen, five-day CBOD, temperature, pH, total ammonia-nitrogen and un-ionized ammonia-nitrogen at mid-depth and mid-channel at a point where most of the rivers flow is passing between 10:30 a.m. and 12:30 p.m. This period corresponds to the time of the daily average dissolved oxygen concentration.

(viii) Xcel Energy is conducting a research study to determine the impact of temperature on dissolved oxygen. Two of four coal-fired units were recently converted to gas, and operational changes may potentially increase the volume of heat released to the Minnesota River. The discharge permit requires a supplemental study pursuant to Section 316A of the Clean Water Act. Xcel Energy is required to study the thermal effects on the water quality and aquatic health of the Minnesota River through monitoring and modeling. A work plan was submitted to the MPCA in July 2003, monitoring will be conducted over three years (2004-2006), and a final report is due by May 1, 2007.

The primary concern is how Black Dog's cooling system affects the hydrodynamics and temperature of the river. Increasing the water's temperature has an adverse impact because warm water can hold less dissolved oxygen and it increases the decay rate of oxygen consuming substances. The Black Dog Generating Plant withdraws water from the Minnesota River near mile 8.8 for cooling condensers. After passing through the condenser chambers once, the water is discharged to Black Dog Lake, which serves as a cooling lake. The water then flows back to the Minnesota River at either end of the lake (miles 10.7 and 7.6). The withdrawal and discharge rates can represent a sizable portion of river flow.

The 316A demonstration will focus on biological monitoring of fish and invertebrates, but some dissolved oxygen monitoring is also included. Since fall 2003, dissolved oxygen and pH have been measured with a portable meter on a monthly basis at three locations:

- Minnesota River near the I35W bridge (river mile 11.5)
- Black Dog intake (river mile 8.8)
- Black Dog outfall near Cedar Ave (river mile 7.6)

Continuous dissolved oxygen monitoring on a semi-permanent basis is being considered at the two outfalls and river mile 11.5.

2. Model validation – periodically there will be a need to update the HSPF model with additional information and correct inadequate assumptions or errors.

   a. Update 1985 Waste Load Allocation—The 40-percent reduction goal for the TMDL was established by a waste load allocation study completed in

1985 (amended in 1987) by the MPCA using data from the 1970s and 1980 and a steady-state water-quality model (version of QUAL II). The Metropolitan Council is leading an effort to build an advanced water-quality model (CE-QUAL-W2) of the lower 40 miles of the Minnesota River using data from 1988-1991 (low-to-high flows) and 2004-2006 (see description above under monitoring). Major partners in this effort are the MPCA, MAC, Lower Minnesota River Watershed District, US Army Corps of Engineers, and USGS. This six-year project began in 2003 and will be completed in 2008, with a fully tested model ready by the end of 2007. The MPCA will use the Lower Minnesota River Model to update the waste load allocation study by 2010. For more information on the modeling project, see http://www.metrocouncil.org/environment/Water/LMRM.

b. Assumptions used in the 1985 Waste Load Allocation will be evaluated. This includes sediment oxygen demand loading rates, reaeration rates, algal growth rates, etc.

c. Projections of phosphorus discharged from wastewater treatment facilities – model projections in the Lower Minnesota River Dissolved Oxygen TMDL Report estimated a contribution of 49,200 pounds of phosphorus from continuously discharging wastewater treatment facilities over a sixty-one day period. Since 2003, wastewater treatment facilities have collected additional data. Updated estimates indicate approximately 72,000 pounds. Additional data will be collected as part of the general permit. This will be used in conjunction with future modeling runs to see if adjustments are warranted in the estimate of phosphorus that reaches Jordan, and therefore the lower Minnesota River.

d. Validate correlations used in modeling process – This includes phosphorus to BOD correlation and BOD modeled estimates compared to instream BOD monitoring results.

D. Criteria for achieving goals, revision of TMDL Report, or revision of implementation plan

1. Criteria to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining targets, or assuring continued attainment of water quality standards include:

a. Success of each sector in achieving allocation targets;

b. Results from future model runs. Additional phosphorus data will be included from wastewater treatment facilities. In previous model runs 18 facilities had phosphorus data;

c. Results of 1985 Waste Load Allocation update; and

d. Results of Lake Pepin and Minnesota River Turbidity TMDL projects.

2. Criteria for determining whether the TMDL Report or implementation plan need to be revised or new TMDLs need to be developed for waters in the watershed if reductions are not achieved include:

   a. Dissolved oxygen or BOD goals not met by 2015 or the first low flow period following 2015 (low flow is necessary since the dissolved oxygen problem normally occurs under low flow conditions);

   b. Update of 1985 Waste Load Allocation indicates BOD reductions need to change;

   c. One or more sectors do not meet adoption goals and modeling indicates the adoption goals are necessary to achieve TMDL goals; or

   d. HSPF model runs indicate changes are necessary in overall TMDL allocation or sector allocations (e.g. wastewater treatment facilities, agriculture, direct discharges of sewage, and stormwater).

7. References

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8. Glossary

BMP **Best Management Practice**
Examples: Grassed waterways, buffer strips, protected tile intakes.

BOD **Biochemical Oxygen Demand**
Amount of oxygen needed by organisms to consume organic material.

CWP **Clean Water Partnership**
Created in 1987, provides state funding for local water resource improvement programs.

EPA **U.S. Environmental Protection Agency**

HSPF **Hydrologic Simulation Program Fortran**
A computer model for analyzing water quality in watersheds.

ITPHS **Imminent Threats to Public Health and Safety**
A direct discharge of sewage at the surface.

LA **Load Allocation**
The portion of pollutant loading attributed to non-point sources or natural background sources over a wide area.

LGU **Local Government Unit**

MS4 **Municipal Separate Storm Sewer System**

Non-Point Source
Rain and snowmelt runoff from the rural landscape, farm fields and feedlots, urban storm water, individual sewage treatment systems.

NPDES **National Pollutant Discharge Elimination System**

NTU **Nephelometric Turbidity Unit**
A measure of turbidity. The degree to which light is scattered in water by suspended particles and soluble colored compounds.

PMP **Phosphorus Management Plan**

Point Source Municipal or industrial facility discharging treated wastewater to surface water or land at a distinct discharge point.

RFP **Request for Proposal**

SWPPP **Stormwater Pollution Prevention Plan**

A plan for a stormwater discharge that includes erosion prevention measures and sediment controls that, when implemented, will decrease soil erosion on a parcel of land and decrease off-site nonpoint pollution.

TMDL **Total Maximum Daily Load**
The sum of allocated loads of pollutants at a level that a water body can absorb and still meet applicable water quality standards.

TSS **Total Suspended Solids**

USGS **United States Geological Survey**

WLA **Waste Load Allocation**
The portion of pollutant loading allocated to existing or future point sources.