

Final Report

GRANT NO. 03-025

Funding period June 2003 to May 2005

**Pollution Prevention for Industrial Wastewater Dischargers
in the Upper Mississippi River Basin
Using City-wide Inventories**

Submitted to:
The McKnight Foundation

Submitted by:
Minnesota Technical Assistance Program (MnTAP)
University of Minnesota
200 Oak Street, SE, Suite 350
Minneapolis, MN 55455-2008

July 30, 2005

External report for distribution: Company names are included in this document only when the companies have agreed to have their information shared by MnTAP. Any appendices with company names have been removed to abide by MnTAP's Confidentiality Statement.

EXECUTIVE SUMMARY

This two-year project, funded jointly by The McKnight Foundation, the U.S. Environmental Protection Agency (EPA), and the Minnesota Pollution Control Agency (MPCA), focused on the use of pollution prevention strategies in phosphorus management plans (PMPs) and technical assistance to reduce loading of phosphorus and other pollutants from industrial sources in the Upper Mississippi River Basin. Partnering organizations included city publicly owned treatment works (POTWs), the Minnesota Wastewater Operators Association (MWOA), and the MPCA.

Implementing MPCA's phosphorus management strategy in Minnesota to minimize nutrient input to lakes and streams requires POTWs to prepare a PMP and/or meet a one part per million (ppm) wastewater effluent standard. PMPs place a high priority on reducing phosphorus from industrial sources by implementing pollution prevention measures.

The Minnesota Technical Assistance Program (MnTAP) conducted outreach to over 100 POTWs and 100 industries through presentations and newsletters. Technical assistance included 120 phone calls with POTWs and 61 with industries, 36 site visits to POTWs and 51 site visits to industry, facilitating five pollution prevention teams, and sponsoring three student interns in companies. This level of technical assistance resulted in 35,152 pounds of phosphorus reduced, 4.5 million pounds of biological oxygen demand (BOD) and total suspended solids (TSS) reduced, 37 million gallons of water conserved, and \$348,000 in cost savings to companies.

Companies benefit from pollution prevention because greater efficiencies minimize the loss of raw materials and result in reduced wastewater surcharges. Cities benefit from pollution prevention because less wastewater loading means less need for chemical treatment and reduced operating costs.

Three key factors were critical to the success of this project: regulatory drivers, relationships with POTWs, and implementation of pollution prevention practices. Phosphorus management plans and phosphorus limits were the regulatory drivers that caused POTWs to seek out MnTAP resources and assistance. Through the PMP process, relationships developed between MnTAP and POTWs through which MnTAP could promote pollution prevention and reach business clients. POTWs recognized the value of pollution prevention practices for their wastewater treatment plants and their industrial users, encouraging industry to use pollution prevention in order to meet current and future phosphorus reduction goals.

INTRODUCTION AND BACKGROUND

This two-year project, funded jointly by The McKnight Foundation, the U.S. EPA, and MPCA, focused on the use of pollution prevention strategies in PMPs and technical assistance to reduce loading of phosphorus and other pollutants from industrial sources in the Upper Mississippi River Basin. Partnering organizations included city POTWs, the MWOA, and the MPCA.

The Upper Mississippi River Basin covers approximately 20,100 square miles (12,864,000 acres) of Minnesota. The basin stretches from the headwaters of the Mississippi River at Lake Itasca to Lock and Dam Number 2 near Hastings (see Appendix 1 map). The basin drains 15 of the 80 major watersheds in Minnesota.¹ Approximately 240 cities and townships are in this basin, and roughly 100 of these have POTWs with industrial users that are significant phosphorus contributors. Because some cities have no industrial users and/or were served by another city's POTW, 62 POTWs became the audience for this grant along with their industrial users.

MPCA's phosphorus management strategy relies on a variety of approaches to reduce phosphorus including education and outreach, regional watershed basin management, and POTW permit-related initiatives based on phosphorus levels and local conditions. Permit-related initiatives include:

- Phosphorus limits—usually a 1 mg/L (or 1 ppm) phosphorus discharge standard stated in the National Pollutant Discharge Elimination System (NPDES) permit.
- Phosphorus management plans (PMPs)—a tool to assess phosphorus contributions and lay out a plan for phosphorus reduction, either through pollution prevention and/or phosphorus removal at the wastewater treatment plant.
- General phosphorus permit—a basin-wide general permit for phosphorus effluent from wastewater treatment facilities that discharge to the Minnesota River Basin.
- Nutrient trading—allows new and expanding sources of phosphorus to be established while insuring no net increase of phosphorus in the basin.
- Total maximum daily load (TMDL)—the maximum amount of a particular pollutant that a river can carry and still meet water quality standards.

Phosphorus is a concern in this basin and statewide because it provides the essential nutrient for stimulating excess algae growth, which can speed up the aging process of lakes and streams. As algae decomposes it uses up available oxygen in the water, sometimes threatening the survival of fish and other aquatic organisms.

Both point and nonpoint sources contribute phosphorus loading to rivers and streams, but point sources become a larger relative contributor during low rainfall periods. During high rainfall periods, the majority of phosphorus loading comes from nonpoint sources, primarily runoff from agricultural lands. During high flow periods, the MPCA monitoring data has documented that approximately 10 percent of total phosphorus comes from point sources. But during low flow or low rainfall conditions, point sources contribute as much as 64 percent of total phosphorus to the river basin. These point sources include wastewater treatment plants and industrial dischargers.

¹ Upper Mississippi River Basin Information Document, MPCA, 2003

Primary industrial point source contributions of phosphorus include:

- Cleaning operations, including sanitizing and janitorial cleaning in manufacturing or service businesses
- Food processing operations, including dairy, meat processing, vegetable processing, and rendering
- Phosphatizing operations from metal preparation in metal painting shops

Historically, industrial pretreatment programs have focused on end-of-pipe solutions to control the discharge of wastewater pollutants. However, pollution prevention—reducing or eliminating wastes or pollutants at the source—is given highest priority in the environmental management hierarchy. In addition to achieving source reduction, pollution prevention incorporates practices that reduce the use of raw materials, water, and energy.

This two year project, partnering with operators of wastewater treatment plants, focused on reducing phosphorus and other industrial pollutant discharges to the Upper Mississippi River to minimize water impacts locally and downstream.

PROJECT ACTIVITIES AND RESULTS

The overall objective of this project was to use pollution prevention strategies to reduce loading of phosphorus and other pollutants from industrial sources in the Upper Mississippi River Basin. MnTAP partnered with cities, the MPCA, and the MWOA to conduct outreach, provide assistance, gather data and share information.

Achieving results in this project involved identifying priority cities and their significant industrial users, conducting outreach within the overall basin, assisting cities with PMP development and implementation, conducting technical assistance with industries, documenting results, and sharing new information.

Identifying Priority Communities

MnTAP began the project in 2003 by obtaining input from MPCA staff on the top communities of concern in the Upper Mississippi River Basin based on the following criteria:

- High industrial loading to the POTW
- The city must develop a PMP or meet a 1 mg/L phosphorus limit
- The city discharges to an impaired water body
- MPCA is working to set a TMDL for the receiving water body

MPCA identified these cities as priority communities:

Buffalo	Long Prairie
Carlos	Sauk Centre
Hutchinson	St. Cloud
Litchfield	

Outreach to these seven priority communities and about 100 other cities in the Upper Mississippi River Basin was conducted to inform them that phosphorus is an issue in the river or to reinforce that message, introduce them to MnTAP, offer assistance for PMP development, and promote MnTAP services and pollution prevention approaches for their industrial users. This outreach included a variety of mechanisms including:

- Introductory letters about MnTAP and its pollution prevention services
- Presentations through MWOA, Rural Water Association, or MPCA-sponsored events (Appendix 2)
- Developed and disseminated (statewide to 584 POTWs) three issues of the *MnTAP Extra, Wastewater, a wastewater treatment resource about pollution prevention* newsletters with stories relevant to POTW needs including new pollution prevention technologies, case studies, and regulatory updates (Appendix 3).

Calls to the POTWs led MnTAP to identify 62 POTWs that had interest in and/or potential for phosphorus reduction (Appendix 4).

Identifying Priority Industrial Facilities

Working with a city on phosphorus reduction involved first developing a city-wide inventory of the businesses in town that may be contributing phosphorus to the wastewater treatment plant. These businesses were then ranked from high to low based on available monitoring data, their size and operations, and their potential to be a phosphorus contributor. MnTAP helped develop inventories for 70 percent of the 62 POTWs that had interest in and/or potential for phosphorus reduction. Some POTWs had developed inventories prior to MnTAP's contact. Business inventories were useful for determining monitoring needs, were a key step in the PMP process, and helped identify where to focus MnTAP services. Some cities had no significant industrial discharge sources. Their only industrial sources of phosphorus were from car or truck washes, restaurants and schools.

Developing Pollutant Reduction Plans for Cities

Statewide approximately 130 POTWs are required to develop a PMP and submit it to the MPCA, with approximately 25 of these in the Upper Mississippi River Basin. Approximately 20 PMPs in total have been developed and submitted, with 12 of these in the Upper Mississippi River Basin.

PMPs are useful for setting goals to work toward a phosphorus effluent level of 1 ppm from the wastewater treatment plant. Some plants must already meet a 1 ppm limit and it is anticipated that most will need to meet a 1 ppm limit over the next five to ten years.

In 2003, MnTAP and MPCA worked together to develop the Phosphorus Management Plan (PMP) Development Resource Packet. This resource packet contains a PMP template designed to encourage uniformity for PMP submissions required by some NPDES permits. The packet also includes sample PMPs and resources for industrial sector, promoting pollution prevention practices.

The PMP process was used with cities as a pollutant reduction plan and involved five steps:

- Compile POTW phosphorus monitoring data
- Evaluate reduction potential at the wastewater treatment plant
- Set goals for wastewater treatment plant influent and effluent phosphorus including an analysis of patterns and trends
- List businesses providing phosphorus monitoring data and those that might be contributing phosphorus (city-wide inventory)
- Develop an implementation plan, including a list of strategies for phosphorus reduction from residential, industrial and other sources, and removal at the wastewater treatment plant, with a timeline for implementation

MnTAP assisted 34 cities in the Upper Mississippi River Basin with PMP development during the course of this grant. Although some POTWs were not required to submit PMPs, they had phosphorus limits that made it useful to go through the PMP process. PMPs provide a useful basis for determining where MnTAP can assist industry with phosphorus reduction.

Conduct Technical Assistance and General Assessments

MnTAP provided pollution prevention assistance to industry using a variety of services including site visits, pollution prevention teams, and student interns. A summary of project activities and goals is shown in Table 1. See Appendix 3 for a breakdown of assistance provided.

Table 1. Summary of Project Activities

	Outreach Contacts	Phone Contacts	Site Visits	Student Intern Projects
Project Goals	POTWs: 100 Industrial facilities: 100	POTWs: 50 Industrial facilities: 100	POTWs: 30 Industrial facilities: 80	Industrial facilities: 2
Project Results 2003-2005	POTWs: 100 Industrial facilities: 100	POTWs: 120 Industrial facilities: 67	POTWs: 36 Industrial facilities: 51 Industrial pollution prevention teams started: 3 with 4 companies, 2 teams continuing from before	Industrial facilities: 3

Phone contact. Initial contact with POTWs and industries is generally by phone to follow up on an outreach effort, provide assistance, or set up a site visit. MnTAP set a goal to contact at least 50 POTWs and 100 industries. Over the course of the two-year project, MnTAP contacted about 100 POTWs, including all those listed in Appendix 3. MnTAP responded to 120 calls from POTWs (many of them calling two to three times) and 67 calls with industries. Contact with POTWs usually involved answering questions on PMPs, helping identify phosphorus sources, or discussing pollution prevention strategies for businesses. Contact with industries involved

discussing the source of phosphorus and means to reduce it, often setting up a site visit to investigate further.

Site visits. MnTAP conducted 36 site visits (some multiple) with POTWs and 51 site visits with industries during the grant period. Site visits with POTWs were useful to review wastewater treatment plant data, review the PMP steps and begin to fill in the template, and prioritize the list of businesses contributing phosphorus. Sometimes POTW site visits were built around site visits to industry when MnTAP and the wastewater treatment plant operator would meet jointly with the industry, and many times also with one of its chemical suppliers. Together the group identified specific phosphorus-generating operations in the plant, conducted a plant walk through, and discussed strategies and timelines for phosphorus reduction.

In food processing companies, where pollution prevention opportunities were somewhat apparent and companies were committed, MnTAP staff worked with the company to facilitate a pollution prevention team. Pollution prevention teams are comprised of a cross-section of workers from the company. For one to two years a MnTAP staff does multiple site visits to facilitate the teams working on reduction of phosphorus, BOD, TSS, water, and energy, with outcomes geared toward cost reductions.

Two teams were already in place at the start of this grant. An additional three teams at four companies were initiated in the Upper Mississippi River Basin over the past two years:

- Dairy
- Food manufacturer
- Food manufacturers, joint team between two companies

Student intern projects. Site visits often identify pollution prevention opportunities for student intern work. Student projects are an excellent way to help companies achieve pollution prevention because MnTAP provides a student to the company to work on a defined pollution prevention project for three months. The student can measure before and after impacts at the company, help the company implement pollution prevention practices, and gain valuable experience in an industrial setting. Students working on wastewater/water reduction projects were placed in three companies as part of this project:

- Blandin Paper, Grand Rapids (2004): Recovered clay and fiber material from the wastewater stream for reuse, lowering TSS.
- Hutchinson Technology, Inc., Hutchinson (2004): Reduced water use and improved rinse water cleanliness.
- U.S. Distilled Products, Princeton (2005): Reduce wastewater, packaging, and product losses.

MnTAP staff maintains contact with the intern company for at least two years to document reductions and cost savings and to provide additional assistance, if needed.

Documented Results

MnTAP was able to document reductions and cost savings as a result of the outreach, phone contacts, site visits, pollution prevention teams, and student intern projects. Data documenting company reductions and cost savings came from three sources: student intern project data,

company data, and monitoring data collected from cities. MnTAP collected and recorded this data into its contact management system. Table 2 contains the overall project results. See Appendix 5 for a breakdown of the quantified impacts at specific industries.

Table 2. Reductions at Industries

Reduction	Project Goals	Project Results 2003-2005
Phosphorus	50,000 pounds	35,152 pounds
BOD/TSS	3 million pounds	4.5 million pounds
Water	60 million gallons	37 million gallons
Cost savings	\$2 million	\$348,000

With student intern projects, the interns are able to spend more time with their one company to document baseline information and to document actual and potential impact. Table 3 shows the break out of intern project results from the reductions at industries in Table 2. The interns quantify the impact of each of their recommendations so MnTAP can know which recommendations will have the greatest impact on a company's waste and greatest savings.

Table 3. Reductions from Intern Projects

Company	Projected Annual Reduction	Projected Annual Savings	Current Annual Waste or Emission Reduction	Current Annual Savings
Blandin Paper, Grand Rapids	7,448,300 gal water 192,385 lb wastewater pollutants (TSS)	\$68,200	9,036,800 gal water 1,249,620 lb waste-water pollutants (TSS)	\$178,500
Hutchinson Technology, Inc., Hutchinson	490,000 gal water	\$44,000	230,000 gal water 800 gal chemical 540 hours labor	\$31,000
U.S. Distilled Products, Princeton*	—	—	—	—

* Intern project will end August 2005.

DISCUSSION OF PROJECT OUTCOMES

Regulatory drivers. This project was a good example of regulatory drivers providing an incentive for pollution prevention. Phosphorus limits or PMP requirements in NPDES permits provided POTWs an incentive to work with MnTAP and use the PMP Development Resource Packet. All of the POTWs that MnTAP contacted were aware of phosphorus water quality issues and their need to take action to reduce phosphorus effluent. Because of water quality concerns, MPCA has been working on POTW permit-related initiatives in the Lower Mississippi River and Minnesota River Basins for several years. When MnTAP was doing outreach to these basins we also included the Upper Mississippi River Basin POTWs in mailing of the *MnTAP Wastewater Extra*. They were also present at events where MnTAP presentations on phosphorus reduction. As a result, the POTWs in the Upper Mississippi River Basin had a knowledge base and have

been anticipating similar pressures for their area. This helped MnTAP exceed its goals for phone contact and site visits with POTWs as they were informed and ready to take action in many cases.

However, MnTAP's industry goal for telephone contacts fell short about 30 percent. Several factors contributed to this. In some cases, the POTW worked with MnTAP on its city inventory and PMP then met with the industries themselves to discuss phosphorus reduction. MnTAP prepared information packets with phosphorus reduction resources for several independent POTWs site visits. This was true for Monticello which worked with its main industry to reduce phosphorus by 3,172 pounds and TSS by 20,280 pounds.

While the POTWs were aware of phosphorus issues, many of the POTWs were not yet facing direct regulatory pressure so they had not yet turned to their industrial dischargers to reduce phosphorus. As a result, their businesses were less aware of phosphorus issues.

Community size. MnTAP provided assistance to cities ranging in size from 396 to 62,850 people. Many of the communities in the Upper Mississippi River Basin are small. Nearly 70 percent of the communities MnTAP had direct contact with had less than 5,000 people; 40 percent had less than 2,000 people. The smaller cities had car washes, restaurants and schools, but no significant point sources of phosphorus. The smaller cities had no resources for industrial monitoring of phosphorus and could not determine what portion of their phosphorus loads was attributable to any one industry. For cities with only one major phosphorus discharger, the POTW may know that pollution prevention will not be enough to get them below the limit.

POTWs that have a single major industry are careful to maintain a congenial relationship with that company, as the local economy depends on that company. Some cities are so sensitive to that relationship that they require the POTW to receive city council approval in order to visit the company or bring them outside resources. Some POTWs find building in phosphorus removal capacity and charging for influent is the simplest solution for their situation.

Priority communities. Six of the priority-community POTWs were given assistance in developing a city inventory. St. Cloud had already done its own inventory and visited each of its industrial phosphorus dischargers. Of the seven cities, five received PMP assistance and only three had companies that received technical assistance. MnTAP's impact and activity in the priority cities was no greater than in the other cities in the basin. However, the time spent identifying priority communities was helpful in building support from MPCA for the project and for pollution prevention as a phosphorus management strategy.

Transferable Knowledge

This project and previous POTW outreach and assistance efforts support three key points:

- Pollution prevention is a viable strategy for reducing industrial sources of phosphorus.
- PMPs are an effective tool to incorporate pollution prevention for phosphorus reduction.
- Relationships built with POTWs will benefit pollution prevention in the future.

Pollution prevention is a viable strategy for reducing industrial sources of phosphorus. As with any pollutant, if phosphorus can be reduced at the source, there are significant efficiencies and cost savings. Pollution prevention practices help industry use raw materials more efficiently, send less pollutant loading to the wastewater treatment plant, and save money due to less product loss and POTW surcharges. For POTWs, pollution prevention means less chemical needed to remove phosphorus or other pollutants, and this may help with meeting a phosphorus standard without the need to install expensive equipment. Thus, POTWs and industry view the use of pollution prevention strategies as a win-win approach.

POTWs understood the value of pollution prevention early on as a win-win approach and were a critical link to the businesses. They knew that reductions by their industrial users translated into not having to deal with those wastes at the wastewater treatment plant and would save both the city and the industry money. This makes good economic sense because the industries remain competitive, continue to be a good employer, and the city maintains its economic base.

Pollution prevention measures are effective for sources of incoming phosphorus but will not necessarily reduce effluent phosphorus levels to 1 ppm. Some wastewater treatment plants will need to eventually upgrade their plants for phosphorus removal using enhanced biological or chemical means.

PMPs are an effective tool to incorporate pollution prevention into phosphorus reduction strategies. One of the tools that has been particularly useful in having the POTWs use pollution prevention strategies is PMPs. PMPs are required for many cities in the Upper Mississippi River Basin, and can help cities meet a future 1 ppm limit. The key steps of a PMP include understanding where phosphorus is coming from and identifying and implementing strategies to reduce phosphorus. These strategies include pollution prevention for both industrial and residential sources. MnTAP can then assist companies with phosphorus reduction through site visits, teams, or interns.

Relationships built with POTWs will benefit pollution prevention in the future. POTWs have been a good partner for MnTAP to work with on phosphorus reduction for several reasons. Wastewater treatment operators understand the benefit of pollution prevention because each day they have to deal with what comes through their plant. Less phosphorus entering the plant means less chemical used to remove it. POTWs generally have good working relationships with their industrial dischargers that may help in voluntary reduction of a pollutant. If voluntary reductions do not work, they can use pretreatment agreements or surcharges as incentives to reduce. Finally, POTWs have been a good source of before and after industrial monitoring data for measuring phosphorus reduction.

Incorporating New Knowledge into MnTAP

MnTAP has benefited from four years of McKnight Foundation funding working with phosphorus reduction in three basins:

- Upper Mississippi River
- Lower Mississippi River
- Minnesota River

Having worked in all three of these river basins over four years has shown how much easier it is to get a group's attention if they are already aware of the issues and your message. As previously mentioned, the POTWs in the Upper Mississippi River Basin were receptive to contact from MnTAP because they had a strong base knowledge of issues and a familiarity with MnTAP because our past outreach activity to the other basins spilled over to them.

This work has helped MnTAP establish relationships with POTWs and industrial users in those areas, introduce them to the benefits of pollution prevention, and assist in implementation of pollution prevention practices. Work with these cities and industries will continue on an as needed basis. POTWs from southern Minnesota (previous grant) still call MnTAP for assistance. The resources developed through this project continue to be useful tools for their future phosphorus reduction efforts.

PMP work is ongoing and many cities have PMP deadlines in 2006 and 2007. MnTAP has MPCA funding through June 2006 for PMP pollution prevention support. The recent merger of OEA with MPCA will hopefully place greater emphasis on MPCA integrating pollution prevention approaches into its day-to-day work.

Mid-Course Corrections

This project followed its originally proposed tasks and schedule—no mid-course corrections were needed. Based on previous work in the Lower Mississippi and Minnesota River Basins, we anticipated participating in a number of partner meetings in which the city and MnTAP meet with key industrial contributors to discuss the POTWs phosphorus issues and how the phosphorus effluent limits were going to impact the industries. However, the POTWs in the Upper Mississippi River Basin did not feel these meetings were necessary. In many cases, the POTWs only had one major industrial contributor and a one-on-one site visit was determined to be most effective.

The majority of the first year of the project was spent conducting outreach to and working with POTWs, with some industrial contacts. The second year involved ongoing contact with POTWs but focused on work with industrial dischargers including site visits, teams, and student interns. The PMP process worked well as a way to review the need to reduce phosphorus, conduct an inventory of the businesses in town, and develop and implement phosphorus reduction strategies that included pollution prevention measures.

Benefits to Cities and Industries

Besides protecting the environment and conserving natural resources, companies have many financial incentives to implement pollution prevention programs, including cost savings related to raw materials, lost product, water, energy, and waste treatment and disposal. Implementing pollution prevention practices can also reduce a company's environmental liability and improve its public image.

Industry is not the only beneficiary of pollution prevention programs; POTWs also benefit from:

- Reduced influent loadings of phosphorus; BOD; TSS; fats, oils and greases (FOG); and heavy metals.
- Reduced influent water (hydraulic) loading, avoiding the need to invest in additional sewer and treatment capacity.
- Improved biosolids quality through reduced loading of heavy metals.
- Reduced chemical, energy, and sludge management costs.
- Reduced water demand, which increases the life of existing water supplies and avoids further investments in water supply and treatment infrastructure.

In addition to reducing pollutants to Minnesota rivers and lakes, this work greatly benefits Minnesota municipalities and industries, helping them improve efficiency, reduce waste, and save money. Using pollution prevention practices makes good sense and is a proven strategy for reducing pollution and saving money for businesses and municipalities.

SUMMARY

Overall, project results met expectations by using pollution prevention strategies to reduce phosphorus loading from industrial sources in the Upper Mississippi River Basin. Activity goals were largely met, in terms of outreach and assistance to POTWs and industries. Outcomes included reduction of 35,152 pounds of phosphorus, 4.5 million pounds of BOD and TSS, conservation of 37 million gallons of water, and \$348,000 in cost savings to companies.

Critical to the success of this project were three key factors: regulatory drivers, relationships with POTWs, and pollution prevention practices. Phosphorus limits and the need to develop phosphorus management plans served as the regulatory drivers that encouraged POTWs to seek out MnTAP resources and assistance. Through the PMP process, relationships developed between MnTAP and POTWs, in which MnTAP could promote pollution prevention and reach business clients. POTWs recognized the value of pollution prevention for their wastewater treatment plants and their industrial users, and encouraged them to use pollution prevention to meet current and future phosphorus reduction goals.

Appendix 2. Significant Outreach and Assistance Events

Month/Year	Significant Events (number attending seminar or presentation)
July 2003	Initial letter sent out to POTWs
July 24, 2003	Booth at annual meeting of MWOA, Moorhead (100)
August 11, 2003	Brainerd MPCA staff meeting (20)
October 15, 2003	MPCA Pond Troubleshooting Workshop, Willmar (50)
November 12, 2003	MWOA Southwest Section, St. James (30)
December 9, 2003	MWOA Central Section, St. Cloud (150)
January 2004	Intern outreach letters
February 2004	Dairy team starts
February 24, 2004	MPCA Innovative Approaches Conference, St. Cloud (180)
February 25, 2004	MWOA Southwest Section, Kasson (60)
February 26, 2004	Minnesota Air, Water, & Waste Conference, Bloomington (20)
March 3, 2004	Rural Water Conference, St. Cloud (150)
March 11, 2004	Booth at MPCA Annual Operations Conference, St. Paul (200)
May 20, 2004	LeSueur Watershed Meeting, Waseca (30)
May – August 2004	Hutchinson Technology, Inc. intern, Hutchinson
May – August, 2004	Blandin Paper intern, Grand Rapids
August 5, 2004	Annual MWOA booth, Duluth (110)
September 2004	Food manufacturers joint team starts
October 13, 2004	MWOA Southwest Section, Lake City (50)
January 2005	Intern outreach letters
March 18, 2005	MPCA Wastewater Annual, St. Paul (200)
May 2005	Food manufacturer team starts
May 4, 2005	Southeast/Southwest Sections Joint MWOA seminar, New Ulm (70)
June 14, 2005	MWOA Central Section, Cokato (20)
July 27-28, 2005	Annual MWOA Meeting, Marshall (100)

cm/word/McK final 03-025