Lower Mississippi River Basin
Fecal Coliform Implementation Plan
February 2007

REVISED REGIONAL TOTAL MAXIMUM DAILY LOAD

Fecal Coliform Bacteria Impairments In the Lower Mississippi River Basin Of Southeast Minnesota

IMPLEMENTATION PLAN

September 2007

By:
Cannon River Watershed Partnership
And
Minnesota Pollution Control Agency

wq-iw9-02c

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1.0 Introduction

This Revised Regional Total Maximum Daily Load Study of Fecal Coliform Bacteria Impairments in the Lower Mississippi River Baisn of Southeast Minnesota Implementation Plan has been prepared by the Cannon River Watershed Partnership (CRWP) and the Minnesota Pollution Control Agency (MPCA) with input from stakeholders in the Lower Mississippi River Basin (referred to hereafter as the Basin). Input for this document was gathered in the following manner:

1. A survey was sent out via the Basin Alliance for Lower Mississippi in Minnesota (BALMM) member list serve, paper copies were mailed to 110 stakeholders in the Basin such as feedlot officers, water planners, and a variety of county, city and state staff.
2. A press release was sent to many local papers and published in the Waseca County News (January 9, 2007).
3. A meeting was held in Rochester on January 24, 2007 to gather input from these stakeholders and any interested parties.
4. A draft of the document was sent out to these stakeholders for review and comment prior to submittal to the MPCA.
5. CRWP and MPCA staff worked together to develop the degree of impairment and source reduction information.

Information from the original *Regional Total Maximum Daily Load Study of Fecal Coliform Bacteria Impairments in the Lower Mississippi River Baisn of Southeast Minnesota Implementation Plan* (October 15, 2003) the original *Regional Total Maximum Daily Load Study of Fecal Coliform Bacteria in the Lower Mississippi River Basin in Minnesota* (November, 2002) and the *Revised Regional TMDL of Fecal Coliform Bacteria Impairments in the Lower Mississippi River Basin in Minnesota* (April, 2006) were incorporated into this document.

1.1 Why the TMDL and implementation plan have been revised

In 2002, a report titled *Regional Total Maximum Daily Load Study of Fecal Coliform Bacteria Impairments in the Lower Mississippi River Basin in Minnesota* was submitted by the MPCA to the U.S. Environmental Protection Agency (EPA). The purpose of the study and report submittal was to meet requirements of the federal Clean Water Act (CWA) for 20 stream and river reaches in the Lower Mississippi and Cedar river Basins that had been listed as impaired for swimming use due to fecal coliform levels that violated Minnesota water quality standards. The study described the magnitude of the problem and provided direction for improving water quality at the listed reaches as well as in many other streams and rivers that had not been formally assessed but are believed to exhibit similar water quality conditions. The report was approved by the EPA in November 2002, although the approval was challenged by the Minnesota Center for Environmental Advocacy (MCEA).

In June of 2005, ruling on the legal challenge from the MCEA, the United States District Court for Minnesota remanded the total maximum daily load (TMDL) report to the EPA for revision "in accordance with the requirements of the CWA and the regulations set forth thereunder". Specifics of the order included the following:

- The revised TMDL shall be established at a level necessary to implement the applicable water quality standards for each reach impaired with fecal coliform contamination.
- The revised TMDL shall contain a margin of safety that accounts for lack of knowledge concerning the relationship between effluent limitations and water quality.
- The revised TMDL shall properly account for straight pipe septic systems in the wasteload allocation of the TMDL.

Revision of the TMDL also included the addition of 19 new impaired reaches bringing the total to 39 reaches. Municipal separate storm sewer systems (MS4's) and confined animal feeding operations (CAFO's) were also included in the wasteload allocation portion of the TMDL.

In order to meet the provisions of the court order, the approach taken in the revised TMDL was somewhat different than that in the original. In particular, fecal coliform loading capacities were calculated for each individual impaired reach, and those capacities were allocated among point sources (wasteload allocation), nonpoint sources (load allocation), and a margin of safety. A loading capacity (i.e. TMDL) is the product of streamflow at each impaired reach and the monthly fecal coliform water quality standard. Five flow zones, ranging from low flow to high flow are utilized, so that the entire range of conditions were accounted for in the TMDL. The loading capacity and allocation vary by impaired reach, and by flow zone for a given reach.

The revised TMDL was approved by the EPA in April 2006. It is the policy of the MPCA that an implementation plan will be created within a year of the approval of a TMDL. This implementation plan will provide a guide for projects and activities in the Basin that need to take place in order to reduce fecal coliform in the waters.

1.2 Summary of this plan

This implementation plan has been developed to guide the source-reduction activities that are needed to meet the TMDL requirements. Projects and activities listed in this document are by no means the only ones that should be considered valid or effective in the reduction of fecal coliform, rather the items listed in this document should serve as suggestions for possible source reduction projects and activities. As noted in the South Branch Yellow Medicine River Fecal Coliform TMDL Implementation Plan (2005), the extent of implementation required to comply with the TMDL is unknown at this point. Initially, implementation should focus on BMPs that will clearly lead to load reductions. Follow-up monitoring will be necessary to quantify impacts of these implementation efforts. Thus, adaptive approaches may be appropriate, to allow for changes in strategy as research is completed, new data become available and management practices are installed and monitored.

This plan contains a review of projects and activities that have taken place since the original TMDL and implementation plan were put in place four years ago and list the many new projects that are to be funded in 2007 with funds from the Clean Water Legacy Act enacted by the Minnesota Legislature in 2006. The degree of impairment of the reaches and source reduction required per reach have been estimated by comparison with other reaches in the Basin. The pollutant source categories are reviewed, and reduction strategies and critical areas are discussed. A section on monitoring summarizes some existing work and gives suggestions for additional work needed. The document concludes with a discussion of coordination of activities and the concept of a small watershed scale approach.

1.3 Sources of fecal coliform bacteria (Revised TMDL, April 2006)
Certain types of bacteria pose a potential health risk to those who come into contact with surface water. These bacteria come from a variety of sources, including agricultural runoff, inadequately treated domestic sewage, and wildlife. Some of these bacteria may cause disease. Other potential pathogens (disease-causing agents) from theses sources include viruses, protozoa, and worms.

The limitations of available monitoring tools make it difficult to determine whether bacterial contamination in a water body is from human or animal sources. It is, however, possible to determine whether the bacteria originated in the intestinal tract of a mammal. These kinds of bacteria are called fecal coliforms. If fecal coliform bacteria levels exceed state water quality standards, it's an indication that fecal matter is entering the stream in quantities that pose a potential threat to public health.

There are many types of fecal coliform bacteria, and not all of them cause disease in humans, but where there are coliform bacteria there may be pathogens of concern. Thus, widespread violation of the fecal coliform standard in the Lower Mississippi River Basin indicates serious pollution and a possible health *concern*, but it doesn't necessarily mean there is an immediate health *threat* in any particular area.

The relationship between land use and fecal coliform concentrations found in streams is complex, involving both pollutant transport and rate of survival in different types of aquatic environments. Intensive sampling at several of the sites listed above in southeastern Minnesota shows a strongly positive correlation between stream flow, precipitation, and fecal coliform bacteria concentrations. In the Vermillion River watershed, storm-event samples often showed concentrations in the thousands of organisms per 100 milliliters, far above non-storm-event samples. A study of the Straight River watershed divided sources into continuous (failing individual sewage treatment systems, unsewered communities, industrial and institutional sources, wastewater treatment facilities) and weather-driven (feedlot runoff, manured fields, urban stormwater categories). The study hypothesized that when precipitation and stream flows are high, the influence of continuous sources is overshadowed by weather-driven sources, which generate extremely high fecal coliform concentrations. However, during drought, low-flow conditions continuous sources can generate high concentrations of fecal coliform, the study indicated. Besides precipitation and flow, factors such as temperature, livestock management practices, wildlife activity, fecal deposit age, and channel and bank storage also affect bacterial concentrations in runoff (Baxter-Potter and Gilliland, 1988).

Several studies have found a strong correlation between livestock grazing and fecal coliform levels in streams running through pastures. Several samples taken in the Grindstone River in the St. Croix River Basin, downstream of cattle observed to be in the stream, were found to contain a geometric mean of 11,000 organisms/100 ml, with individual samples ranging as high as 110,000/100 ml. However, carefully managed grazing can be beneficial to stream water quality. A study of southeastern Minnesota streams by Sovell, et. al., found that fecal coliform, as well as turbidity, were consistently higher at continuously grazed sites than at rotationally grazed sites where cattle exposure to the stream corridor was greatly reduced. This study and several others indicate that sediment-embededness, turbidity, and fecal coliform concentrations are positively related. Fine sediment particles in the streambed can serve as a substrate harboring fecal coliform bacteria. “Extended survival of fecal bacteria in sediment can obscure the source and extent of fecal contamination in agricultural settings,” (Howell et. al., 1996).

Finally, fecal coliform survival appears to be shortened through exposure to sunlight. This is purported to be the reason why, at several sampling sites downstream of reservoirs, fecal coliform concentrations were markedly lower than at monitoring sites upstream of the reservoirs. This has been demonstrated at Lake Byllesby on the Cannon River and the Silver Creek Reservoir on the South Branch of the Zumbro River in Rochester.

1.4 Definition of the problem (LMRB Fecal Implementation Plan, 2003)
The Lower Mississippi River Basin in southeastern Minnesota is endowed with a rich variety of landscapes, as exemplified in Figure 1, and land uses. Landscapes range from the hills and bluffs of the Driftless Area ecoregion close to the Mississippi River, where land use remains relatively varied and cold-water streams frequently support trout, to the prairie landscape on the western side of the Basin which is dominated by row-crop agriculture and hog production. The entire 7,266 square mile region is drained by a network of 11,556 miles of rivers and streams. These streams differ significantly in size, condition of the aquatic environment, and economic uses of the water resource. The Mississippi River with its riverine backwaters and navigation system defines one extreme. On the other extreme are 736 miles of trout water in 102 small, cold-water streams. In-between are main stem warm water tributaries such as the Root, Zumbro and Cannon Rivers.

Figure 1 – Fishing a Zumbro River Tributary.

The recreational potential offered by the region’s rivers and streams is high, but limited by various forms of aquatic and terrestrial habitat degradation. Fishing, boating, and hiking in and along the region’s streams are very popular. In 1998, a Minnesota Department of Natural Resources (DNR) creel survey estimated total mean angling pressure to be 617 hours per acre for the region’s trout streams. By contrast, annual angling pressure on Minnesota lakes rarely exceeds 100 hours/acre. Total estimated angling pressure in southeastern Minnesota is 500,000 hours. The Minnesota DNR manages six streams in the Basin as designated canoe routes. This totals nearly 300 stream miles for canoeing (Figure 2). Nine DNR trails ranging from three to 48 miles have been established on abandoned railroad grades for hiking, biking, and in-line skating. Hundreds of miles of additional trails are planned for the future. These trails frequently run parallel to streams, and have helped to stimulate interest in tubing in the Root, Zumbro and Cannon Rivers. Maintenance of high water quality in streams adjacent to the trails is integral to the quality of outdoor experience valued by the thousands of people who use the trails.

Figure 2– Canoeing on the Cannon River.

The recreational use of streams and rivers is limited, however, by various kinds of environmental degradation. Water quality monitoring over several decades has shown widespread exceedances of state and federal water quality standards throughout the Basin for turbidity and fecal coliform bacteria, along with increasing concentrations of nitrate nitrogen. Nitrate concentrations exceeding drinking water standards are found in shallow aquifers. Intensive land use, including significant artificial drainage, coupled with extreme weather, has led to increased flooding and stream bank erosion. The sources of these problems number in the thousands and are widely distributed over the rural and urban landscape. Sources pertinent to fecal coliform, a problem which directly affects recreational suitability of the areas streams, include failing residential septic systems, unprotected feedlots or manured fields, and pet waste that enters surface water through urban stormwater runoff.

The widespread problem of fecal coliform impairment is caused by thousands of ubiquitous pollutant sources spread across the Basin – feedlots, manured fields, wildlife, and failing septic systems, to name the main ones -- rather than by a few large, discrete sources. Pollution can be reduced and prevented by ensuring that these individual sources are brought into conformance with state rules and local ordinances as well as Best Management Practices for land use.

1.5 Description of land use and bacteria sources

The Lower Mississippi River Basin, which includes the Cedar River Basin for planning purposes, is located in southeastern Minnesota. It includes all or part of 17 counties and has 12 major watersheds covering about 7,266 square miles (4,650,100 acres). Land use is diverse (Table 1). On the western side, lands are primarily cultivated, while the eastern landscapes are dominated by steep forested hill slopes. About two-thirds of the land in the Basin is under cultivation, while about 13 percent is forested. Roughly 17 percent of the land use is open or pasture lands. Major agricultural crops include corn, soybeans, and hay. Animal production includes dairy and beef cattle, hogs, sheep and lambs. Seventy seven percent of the population is urban and 23 percent is rural. Major population centers include the southern metropolitan area of Dakota County, in addition to Northfield, Faribault, Owatonna, Rochester, Albert Lea, Austin, Red Wing, and Winona. These and other urban areas are experiencing rapid population growth and commercial development. Substantial variation among impaired reach watersheds is apparent. The percent of cultivated land, for example, ranges from less than 50 percent to over 90 percent. Urban and rural developed land comprises between 10 percent and over 30 percent of the South Zumbro and Vermillion watersheds, respectively, but only a few percent of the rest of the watersheds.

1.6 Summary of data (From the Revised TMDL)

The Revised TMDL document (April 2006) provides the information used to develop TMDLs for 39 impaired stream reaches on Minnesota's 2004 303(d) list that lie within the Lower Mississippi River Basin and the Cedar River Basin within Minnesota. These reaches were listed as impaired for failure to meet their swimming designated beneficial uses due to excessive fecal coliform concentrations. Figure 3 provides a map showing this information. A summary of the data (taken from the Revised TMDL, April 2006) is presented in Table 2.

Table 1 - Land Use/Land Cover for Lower Mississippi Basin Impaired Reach Watersheds (from Revised TMDL, Table 2.1)

Impaired Reach (indentation indicates subwatershed) Cult. = Cultivated	Drainage Area (mi^2)	Land Use/Land Cover Percentage					
		Cult.	Grass	Forest	Water/ Wetland	Residential, Urban, Industrial	Other
Cannon River; Pine Cr to Belle Cr	1,386	70	10	12	4	4	
(Prairie Creek; Headwaters to Cannon R (Lk Byllesby))	80	76	10	11	<1	3	
(Unnamed Creek; Headwaters to Prairie Cr)	17	84	11	3	<1	2	
(Unnamed Tributary to Prairie Creek; Unnamed Cr to Unnamed Cr)	13	84	11	3	<1	2	
(Chub Creek; Headwaters to Cannon R)	64	48	31	15	2	4	
Cannon River; Northfield Dam to Lk Byllesby inlet	957	72	10	8	5	5	
Straight River; Rush Cr to Cannon R	461	80	7	6	2	5	
(Rush Creek; Headwaters to Straight R)	22	89	3	6	<1	2	
(Crane Creek; Headwaters (Watkins Lk) to Straight R)	106	81	7	4	4	4	
Straight River; Maple Cr to Crane Cr	252	82	7	5	1	5	
(Maple Creek; Headwaters to Straight R)	38	77	11	5	<1	7	
Straight River; Turtle Cr to Owatonna Dam	204	83	7	5	1	4	
(Turtle Creek; Headwaters to Straight R)	44	82	9	6	1	2	
Straight River; CD #25 to Turtle Cr	135	87	6	4	1	2	
Root River; Thompson Cr to Mississippi R	1,660	60	15	22	<1	3	
(Robinson Creek; Headwaters to N Br Root R)	17	92	5	2	<1	2	
(Money Creek; End of trout stream portion to Root R)	77	36	18	44	<1	2	
Root River, South Branch; Canfield Cr to Willow Cr	143	76	9	13	<1	2	
Root River, South Branch; Headwaters to Class 1B,2A,3B	61	84	8	6	<1	2	
Whitewater River, Middle Fork; trout stream portion	54	69	18	10	<1	2	
Whitewater River, South Fork; trout stream portion above N Fk Whitewater R	93	64	16	15	<1	5	
(Whitewater River, South Fork; Headwaters to trout stream portion)	55	67	18	8	<1	7	
Whitewater River, North Fk; Unnamed Cr to Mid Fk Whitewater R	104	70	17	9	<1	3	
(Logan Branch; End trout stream portion to North Fk Whitewater R)	17	68	23	7	<1	2	
(Whitewater River, North Fork; Unnamed Cr to Unnamed Cr (below Class 7))	20	76	12	10	<1	2	
Garvin Brook; Class 1B,2A,3B portion	49	46	14	37	<1	3	
Stockton Valley Creek; Trout stream portion to Garvin Br	20	48	15	34	<1	2	

Table 1 Continued- Land Use/Land Cover for Lower Mississippi Basin Impaired Reach Watersheds (from Revised TMDL, Table 2.1)

Impaired Reach	Drainage Area (mi^2)	Land Use/Land Cover Percentage					
		Cult.	Grass	Forest	Water/ Wetland	Residential, Urban, Industrial	Other
Zumbro River; West Indian Creek to Mississippi River	1,488	67	12	11	<1	5	4
Zumbro River; Cold Cr to West Indian Cr	1,401	67	13	9	<1	6	5
Zumbro River, South Fk; Cascade Cr to Zumbro Lk	349	57	20	8	<1	13	2
Zumbro River, South Fork; Silver Lk Dam to Cascade Cr	260	62	20	7	<1	10	
Zumbro River, South Fork; Bear Cr to Oakwood Dam	239	62	20	8	<1	9	
Zumbro River, South Fork; Salem Cr to Bear Cr	157	68	18	7	<1	6	
Salem Creek; Lower 15 miles (Class 2C portion) to South Fk Zumbro R	62	80	12	5	<1	3	
Cedar River; Rose Cr to Woodbury Cr	544	87	5	4	1	4	
Cedar River; Roberts Cr to Upper Austin Dam	185	89	4	4	<1	3	
Shell Rock River; Albert Lea Lk to Goose Cr	195	76	9	5	4	5	
Vermillion River; S Br Vermillion R to the Hastings Dam	273	52	9	8	4	26	
Vermillion River; Below trout stream portion to South Br Vermillion R	142	43	9	7	9	32	

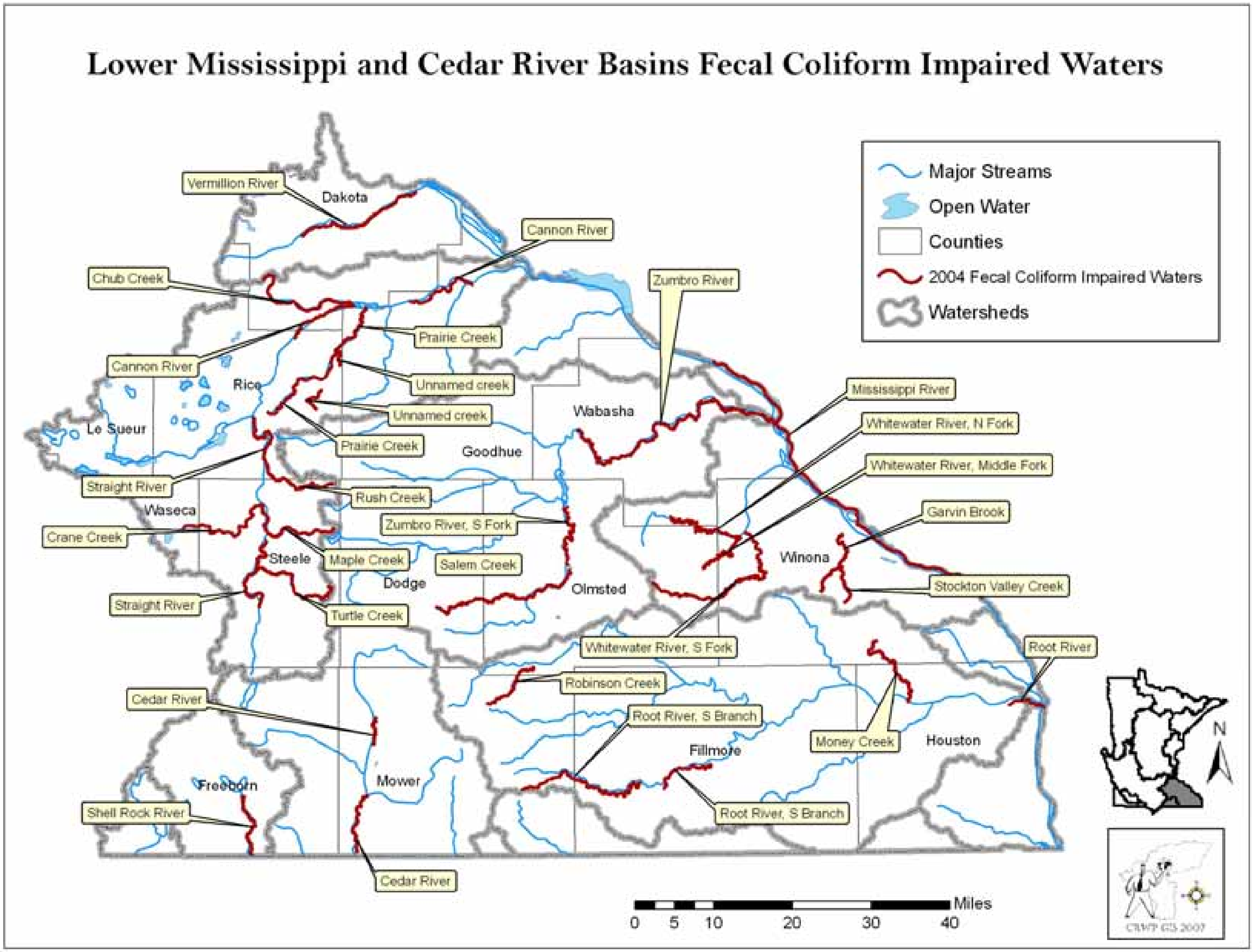


Figure 3 – Lower Mississippi and Cedar River Basins Fecal Coliform Impaired Waters.

Table 2 - Lower Mississippi Basin Impaired Reach Descriptions and Assessment Summaries (from Revised TMDL, Table 1.1)

Impaired Reach	Year Listed	Assessment Unit ID	Reach Length (miles)	Monitoring Stations Used in Assessment	Obs.	# months with ≥ 5 obs.	# months exceeding geometric mean of 200 orgs./100ml	Years of Data
Vermillion River; S Br Vermillion R to the Hastings Dam	96	07040001-506	11.51	Vermillion River 2.7 (MetC), 05346000	322	8	6	85-95
Vermillion River; Below trout stream portion to South Br Vermillion R	94	07040001-507	8.96	S000-896 (VR-32.5), 05345000	84	8	3	83-93
Cannon River; Pine Cr to Belle Cr	94	07040002-502	11.29	S000-003 (CA-13)	73	8	2	83-93
Straight River; Maple Cr to Crane Cr	94	07040002-503	5.43	S000-047 (ST-18)	44	7	6	88-93
Prairie Creek; Headwaters to Cannon R (Lk Byllesby)	94	07040002-504	26.02	S001-186 (PRA-0.5), S001-197 (PRA-1.5), S001-198 (PRA-2.6)	38	2	2	89-93
Rush Creek; Headwaters to Straight R	02	07040002-505	12.41	S000-502	23	3	3	99-00
Cannon River; Northfield Dam to Lk Byllesby inlet	04	07040002-509	10.21	S001-280 (MS318), S001-582	17	0	na	98,01,02
Unnamed Creek; Headwaters to Prairie Cr	02	07040002-512	2.72	S001-240	20	3	3	97-98

Impaired Reach	**Year Listed**	**Assessment Unit ID**	**Reach Length (miles)**	**Monitoring Stations Used in Assessment**	**Obs.**	**# months with ≥ 5 obs.**	**# months exceeding geometric mean of 200 orgs./100ml**	**Years of Data**
Unnamed Tributary to Prairie Creek; Unnamed Cr to Unnamed Cr	02	07040002-513	4.69	S001-246	15	3	3	1998
Straight River; Rush Cr to Cannon R	02	07040002-515	12.68	S003-627	24	4	2	99-00
Impaired Reach	Year Listed	Assessment Unit ID	Reach Length (miles)	Monitoring Stations Used in Assessment	Obs.	# months with ≥ 5 obs.	# months exceeding geometric mean of 200 orgs./100ml	Years of Data
Crane Creek; Headwaters (Watkins Lk) to Straight R	02	07040002-516	15.47	S003-009	26	5	4	99-00
Straight River; CD #25 to Turtle Cr	02	07040002-517	10.45	S001-343	24	4	2	99-00
Turtle Creek; Headwaters to Straight R	02	07040002-518	16.5	S003-628	24	4	4	99-00
Maple Creek; Headwaters to Straight R	02	07040002-519	11.73	S003-011	27	5	4	99-00
Chub Creek; Headwaters to Cannon R	04	07040002-528	19.51	S001-666 (CHB23), S001-670 (CHB3), S001-668 (CHB47), S001-669 (CHBRD)	132	5	5	99-00
Straight River; Turtle Cr to Owatonna Dam	04	07040002-535	7.4	S003-015	11	0	na	00-02
Whitewater River, South Fork; Headwaters to trout stream portion	94	07040003-505	20.37	S000-288 (WWR-26)	74	8	6	83-93

Impaired Reach	**Year Listed**	**Assessment Unit ID**	**Reach Length (miles)**	**Monitoring Stations Used in Assessment**	**Obs.**	**# months with ≥ 5 obs.**	**# months exceeding geometric mean of 200 orgs./100ml**	**Years of Data**
Whitewater River, South Fork; trout stream portion above N Fk Whitewater R	02	07040003-512	11.24	**SWR**: not yet in STORET, from GJohnson spreadsheet	56	3	3	00-02
Whitewater River, Middle Fork; trout stream portion	02	07040003-514	12.1	**MWR**: not yet in STORET, from GJohnson spreadsheet	53	3	3	00-02
Garvin Brook; Class 1B,2A,3B portion	94	07040003-542	13.99	S000-828 (GB-4.5)	74	8	6	83-93
Impaired Reach	Year Listed	Assessment Unit ID	Reach Length (miles)	Monitoring Stations Used in Assessment	Obs.	# months with ≥ 5 obs.	# months exceeding geometric mean of 200 orgs./100ml	Years of Data
Logan Branch; End trout stream portion to North Fk Whitewater R	02	07040003-536	10.1	**LOG**: not yet in STORET, from GJohnson spreadsheet	53	3	3	00-02
Whitewater River, North Fork; Unnamed Cr to Unnamed Cr (below Class 7)	02	07040003-553	7.65	**CSP**: not yet in STORET, from GJohnson spreadsheet	53	3	3	00-02
Whitewater River, North Fk; Unnamed Cr to Mid Fk Whitewater R	96	07040003-554	10.49	05376000	30	2	1	85-93
Stockton Valley Creek; Trout stream portion to Garvin Br	02	07040003-559	6.38	**SVC**: not yet in STORET, from GJohnson spreadsheet	55	3	3	00-02

Impaired Reach	Year Listed	Assessment Unit ID	Reach Length (miles)	Monitoring Stations Used in Assessment	Obs.	# months with ≥ 5 obs.	# months exceeding geometric mean of 200 orgs./100ml	Years of Data
Zumbro River; West Indian Cr to Mississippi R	04	07040004-501	23.43	S000-816	10	2	2	2002
Zumbro River; Cold Cr to West Indian Cr	04	07040004-502	23.4	S000-818, S000-819, S001-905	29	2	2	2002
Salem Creek; Lower 15 miles (Class 2C portion) to South Fk Zumbro R	94	07040004-503	17.28	S001-191 (SAL-7.2), S001-206 (SAL-9.1), S001-207 (SAL-9.9)	35	3	3	89-93
Zumbro River, South Fk; Cascade Cr to Zumbro Lk	94	07040004-507	12.42	S000-268 (ZSF-5.7)	74	8	3	83-93
Zumbro River, South Fork; Silver Lk Dam to Cascade Cr	04	07040004-533	0.19	S000-334	18	3	3	2001
Impaired Reach	Year Listed	Assessment Unit ID	Reach Length (miles)	Monitoring Stations Used in Assessment	Obs.	# months with ≥ 5 obs.	# months exceeding geometric mean of 200 orgs./100ml	Years of Data
Zumbro River, South Fork; Bear Cr to Oakwood Dam	04	07040004-535	0.53	S002-032	18	3	3	2001
Zumbro River, South Fork; Salem Cr to Bear Cr	04	07040004-536	8.67	S002-033	18	3	3	2001
Root River; Thompson Cr to Mississippi R	94	07040008-501	5.73	S000-065 (RT-3)	73	8	6	83-93
Robinson Creek; Headwaters to N Br Root R	94	07040008-503	10.35	S001-138 (ROB-0.03), S001-189 (ROB-0.15), S001-190 (ROB-0.4)	53	8	5	87-93

Impaired Reach	Year Listed	Assessment Unit ID	Reach Length (miles)	Monitoring Stations Used in Assessment	Obs.	# months with ≥ 5 obs.	# months exceeding geometric mean of 200 orgs./100ml	Years of Data
Money Creek; End of trout stream portion to Root R	04	07040008-521	16.89	S001-820 (Zephyr), S003-623 (SS-3)	10	0	na	2002
Root River, South Branch; Canfield Cr to Willow Cr	04	07040008-555	11.37	S001-320	18	0	na	99-02
Root River, South Branch; Headwaters to Class 1B,2A,3B	04	07040008-586	25.22	S001-318, S001-539, S001-945	32	3	3	99-01
Cedar River; Rose Cr to Woodbury Cr	98	07080201-501	10.25	S000-136 (CD-10)	62	8	4	86-94
Cedar River; Roberts Cr to Upper Austin Dam	98	07080201-502	4.84	S000-137 (CD-24)	63	8	4	86-94
Shell Rock River; Albert Lea Lk to Goose Cr	94	07080202-501	11.83	S000-084 (SR-1.2)	75	8	8	83-93

2.0 Update of activities since the original implementation plan

2.1 Grant funded project summaries

The original Fecal Coliform Implementation Plan for the Basin (October, 2003) provided management measures for achieving fecal coliform bacteria reduction from nine types of pollutant sources. These activities were undertaken as the initial steps towards achieving the goal of a 65% source reduction by 2012 as proposed in the 2003 Implementation Plan. Grant funding through Section 319 Grants, Clean Water Partnership Grants, the Public Facilities Authority, United States Department of Agriculture, and the recently funded Clean Water Legacy Act in Minnesota have made possible multiple projects throughout the Basin. Loans and cost-share programs are also a source of funding. A summary of projects is provided in Table 3.

2.2 Other activities

In addition to grant funded projects, a variety of actions have taken place through the work of city, county, state, and federal staff, as well as joint powers boards, local watershed organizations, agricultural producers and concerned citizens. The following are examples of such activities:

Feedlots

- Feedlot improvements to reduce runoff from sites.
- Enrollment in the MPCA's Open Lot Agreement
- On-going state and local feedlot program activities including permitting, inspections, education and enforcement.

Manure Management

- Work with livestock producers to update nutrient management/manure management plans
- Development of mini manure management plans and other tools/educational materials.

ISTS

- Work to educate homeowners about non-conforming septic systems and the operation of maintenance of their septic system.
- Promote low interest loans to homeowners through county-wide loan program for new onsite septic systems.
- Implementing a point of sale program for (ISTS). A compliance inspection is required when a property is sold and if a system is non-compliant it must be upgraded within 10 months.
- Enact County ordinances governing spreading of septage on agricultural land (Olmsted, Mower, Dodge, Dakota, Rice)
- Update list of small-communities with inadequate sewage treatment and creation of a map showing the location of these communities in relation to impaired waters.

Stormwater

- Street Sweeping
- Regional Stormwater ponds
- Enact illicit discharge ordinances
- Locate and eliminate sources of Inflow and Infiltration (I&I) to sanitary sewers to eliminate the need to bypass the sanitary sewer during heavy rainfall
- Public education especially regarding pet waste
- Eliminate Goose Feeding Stations

Conservation Practices

- Install buffers along waterways
- No-till and strip till practices to maintain cover on the land and reduce erosion
- Cover crops (rye and others)

Table 3 – Grant/Loan Funded Projects Related to Fecal Coliform Reduction in the Lower Mississippi River Basin – 2002 – 2009 (in chronological order)

Project Title	Funding Source	Project Sponsor	Grant Amount	Total Project Cost	Timeframe	Major Activities	Status
Targeted Feedlot Runoff reduction Project (Feedlot I)	319 Grant	Southeast Minnesota Water Resources Board (SEMWRB)	$586,080	$586,080	Oct 2001 – Aug 2005	Inform all livestock producers about new feedlot rules; achieve 90% signup of Open Lot Agreement by eligible producers in priority areas	See results tables in Feedlot section.
Targeted Residential Wastewater Treatment Acceleration Project (Wastewater I)	319 Grant	SEMWRB	$530,000	$530,000	2002-2006	Project to address the impact of human sources of bacteria through a combination of education , tech assistance and financial assistance to owners failing ISTS; 11 counties	16 small communities that have made progress toward solving their wastewater solutions although nothing is yet in the ground because the small community wastewater process takes from 3 to 7 years. Additionally the following educational activities were conducted: -47 Homeowner Education classes - 20 newsletter and newspaper articles - 20 Small Community Wastewater Process trainings - 3 Basin-wide staff workshops/tours - ISTS Staff Training (train the trainer) in Operation and Maintenance – 5 counties -Development of the Do-it-Yourself Septic System Evaluation

Project Title	Funding Source	Project Sponsor	Grant Amount	Total Project Cost	Timeframe	Major Activities	Status
City of Rochester Water Quality Protection Project	City of Rochester sales tax	City of Rochester	$22.5 million	$60 million	2001-	Cost-share connection of unsewered areas to community sewer and upgrading the trunk sewer lines	90% complete
Karst Campaign	USDA	U of M Extension	NA	NA	2002 -	Development of ag BMPs guidelines to attain TMDL requirements, specific to Karst area	Karst guidelines developed.
Accelerated Adoption of Rotational Grazing (Grazing Management for Trout Stream Improvement)	319 Grant	BWSR – Howard Moechnig	$139,000	NA	2002-	Fillmore, Houston, Wabasha, Winona	NA
Salem Creek Bacteria Reduction Project	319 Grant	Dodge County	$103,000	$212,000	2002-2005	Monitoring and technical assistance for feedlot improvements.	The project conducted stream monitoring for bacteria at 5 locations in the Salem Creek Watershed for 3 years (2002,03 and 04). The project also provided technical assistance and cost share for a total of 4 feedlot improvements (2 larger + 2 smaller projects).
Straight River Fecal Coliform Reduction Project	319 Grant	Cannon River Watershed Partnership (CRWP)	$256,750	$513,500	2003 - 2007	CRP conservation buffers, open lot feedlot agreements, surface water monitoring, manure management plans	100% sign up of feedlots into Open Lot Agreement in Steele Co. Approximately 1800 acres of buffers installed. 80 manure management plans developed. Cost-share underway for tillage and manure management equipment. Monitoring on Straight River at 7 sites.

Project Title	Funding Source	Project Sponsor	Grant Amount	Total Project Cost	Timeframe	Major Activities	Status
Improved Livestock Management in Sensitive Riparian Areas	319 Grant	Minnesota Department of Agriculture (MDA)	$185,000	$370,000	2003 - 2007	Monitoring overland flow of runoff from agriculture systems at f our sites. Monitoring at field edge as well as using rainfall simulations. Monitoring for fecal coliform, sediment, and nutrients. Cost share with farmers to install innovative managed grazing systems in riparian areas. Five demonstration sites. Field days to show the demonstration sites and an education document being developed discussing environmentally sound and economically beneficial grazing practices for grazing in riparian areas.	In-process.
South Branch Root River Watershed Fecal Coliform Bacteria Reduction Project	319 Grant Clean Water Partnership Loan	Fillmore County & SWCD, Mower County & SWCD, MN DNR, MPCA, MDA, MN Land Trust	$299,420 (grant) $300,000 (loans)	$728,910	2003-2008	Goal to reduce bacteria levels in the South Branch and its tributaries by 20%, reduce turbidity levels in the South Branch and its tributaries by 10%. Loans for ISTS upgrades	Implementation is in progress with cost-share and incentives for BMPs
Evaluating Feedlot Runoff Pollution and Ways to Reduce Impacts	319 Grant	University of Minnesota – SPA	$90,000	$180,000	2003 -	NA	NA
Reduction of Fecal Coliform Bacteria from Human Sources (Wastewater II)	319 Grant	Southeast Minnesota Water Resources Board (SEMWRB)	$154,000	$308,000	Oct 2002 – Sept 2007	Cost share assessment and engineering for unsewered communities. Provide improved ISTS data-management for counties. Partners 11 SE MN Counties	15 communities have applied for and been awarded funding.

Project Title	Funding Source	Project Sponsor	Grant Amount	Total Project Cost	Timeframe	Major Activities	Status
Whitewater Watershed "Paired Watershed" Monitoring Project 2004-2006	319 Grant	U of M – John Nieber MPCA	$98,500	$150,500	July 2004 – Dec 2006	1.Monitoring the quantity and quality of water running off two small watersheds that are tributaries to the Whitewater River Basin. 2. Identification of source waters for runoff using stable isotopes, flow temperature and selected ions; conducted with detailed sampling interior to the watersheds. 3. Modeling the growing season surface and subsurface flow of the two watersheds using the GSSHA (Gridded Surface Subsurface Hydrologic Analysis model).	Project completed, although the watersheds will continue to be monitored.
Jefferson German Phase II C	Clean Water Partnership	LeSueur County Environmental Services	$55,000	$105,950	2004-2008	Includes upgrading septic systems, correcting three feedlot issues, nutrient management, soil grid sampling, manure sampling and installing Ag and shoreland BMPs.	73 Septic Systems were brought into compliance with this Phase
Lake Volney Phase II B	Clean Water Partnership	LeSueur County Environmental Services	$125,000	$424,883	2004-2006	Septic upgrades, buffer installation, nutrient and manure management.	20 Septic Systems were upgraded during this project. Buffer strips were installed, a nutrient trial was completed, and soil grid sampling and manure sampling have been done. Future projects include a wetland restoration, buffer strip and five open intakes that will be replaced with blind inlets.

Project Title	Funding Source	Project Sponsor	Grant Amount	Total Project Cost	Timeframe	Major Activities	Status
Fillmore County Septic System Pilot Inventory Project	MPCA Three-County ISTS Pilot Program	Fillmore County & SWCD, SE MN Wastewater Initiative	$240,000	$240,000	2004-2009	Goals – inventory all IPHT septic systems in the county by July 1, 2008, bring all IPHT systems into compliance by May 1, 2009.	The inventory has been completed in 22 of 24 townships with 540 IPHT systems identified, 159 of those have been brought into compliance
Steele County Septic System Loan Program	319 Grant CWP Loan	Steele County Environmental Services and Planning & Zoning – Scott Golberg	$66,000 (grant) $500,000 (loan)	$566,000	2004-2007	Septic System Loan Program	Approximately $500,000 has been loaned out to 47 applicants for replacement septic systems. The county is planning to apply for continuation funding in 2007.
Designing Feedlot Improvements in Targeted Areas Under the Open Lot Agreement (Feedlot II)	319 Grant	SEMWRB	$300,000	$600,000	2004 - 2008	Hire technicians to design simple, low-cost runoff reduction solutions; assistance available to producers who have signed the Open Lot Agreement	See results table in Feedlot section.
On Farm Manure Management Demonstrations	319 Grant	University of Minnesota – WRC	$279,600	$564,386	2004 - 2008	On-farm manure rate trials Field days Extension publications	Two years of trials completed with third started. Four field days completed, including two in SE MN. Draft prepared of publication on BMPs for managing pathogens in manure.
Cost Share Incentives For Small Feedlot Fixes	319 Grant	Hiawatha Valley RC&D Association	$242,000	$484,000	2004 -2008	NA	NA
Targeted Feedlot Open Lot Implementation Engineering Assistance	319 Grant	SE Soil & Water Conservation District Technical Support Joint Powers Board	$300,000	$600,000	2004 - 2008	Provide resources to assist 8 counties in maximizing producer participation in the OLA	NA

Project Title	Funding Source	Project Sponsor	Grant Amount	Total Project Cost	Timeframe	Major Activities	Status
Chester Sewer Project	Rural Development MNTED City of Rochester Olmsted County Marion Township	Olmsted County	$1.5 million (grants) $500,000 (loan)	$2 million	2005-2006	Connected 103 residences and 5 businesses wit obsolete septic systems to a community sewer.	100% complete
Nutrient Management Planning in the South Fork of the Root River	BWSR Challenge Grant	Fillmore SWCD	$25,000	$50,000	2005-2007	Provide holistic nutrient management in the South Fork Root River for better management of fertilizers including manure through the development of GIS software for more efficient nutrient use, and by providing cost-share for feedlot fixes.	In progress with completion slated for June 2007.
Cannon River Wastewater Project (Building Local Capacity for Community Solutions to Wastewater Problems) (WWIII)	TMDL Implementation	Cannon River Watershed Partnership	$300,000	$300,000	2005-2008	Project to address the impact of human sources of bacteria through a combination of education , tech assistance and financial assistance to owners of failing ISTS and small communities with inadequate sewage treatment; 13 counties	In progress. Two community facilitators are currently assisting 14 communities. Grant ends Dec 2008. Will be looking for a more permanent funding source to continue providing facilitation assistance to small communities with inadequate sewage treatment.
South Branch Whitewater River Watershed Bacterial Reduction	319 Grant ISTS Loans	Whitewater Joint Powers Board, Winona County is Loan Sponsor for ISTS Upgrades	$174,660 (grant) $150,000 Loans	$388,700	2006-2008	Developing listing of residences in the watershed that have suspect septic systems. Compile and distribute bacteria pollution fact sheets and newspaper articles. Work with local municipalities on storm water planning. GIS aerial photos to access potential riparian/shoreland issues. Goal is 15 failing ISTS brought into compliance by Sept 30, 2008.	This project has completed 90% of the planned one-on-one setback mapping and education with South Branch livestock producers. Other education and outreach efforts are continuing. 80% complete

Project Title	Funding Source	Project Sponsor	Grant Amount	Total Project Cost	Timeframe	Major Activities	Status
Dakota County Septic Inspection and Upgrade Initiative	319 Grant	Dakota County (Tom Berry)	$160,500	$316,500	2006 - 2008	Goal is to ID and upgrade all failing septic systems first on the mainstems of the Vermillion River and Chub Creek (Phase I), then on other shoreland areas (Phase II), and finally all ISTS systems in the Vermillion and Chub Creek watersheds (Phase III).	Phase I completed in 2006.
Roberds Lake Assessment	DNR Conservation Partners Grant	Cannon River Watershed Partnership – Rice Co. P& Z	$10,000	$21,600	2006 -2007	Paper inventory and ranking of septic systems on 893 parcels. GIS mapping of feedlots, septic systems, land use, soils, and wetlands to determine pollutant sources in the watershed.	Septic inventory complete.
Silver Lake Shoreline Buffer TMDL Project	Public Facilities Administration	City of Rochester	$275,000	$550,000	2006-2007	Native vegetation will be planted to create a buffer that will filter storm water runoff to reduce fecal coliform loading to the lake (~1,000 resident birds and migratory Canada Goose population ~ 40,000)	Design plans and specifications are complete and have been submitted to MPCA for certification. Installation will begin in the Spring/Summer 2007.
Into the Home Stretch : Achieving Feedlot Runoff Control to Reduce Bacteria TMDL to Impaired Waters of the Lower Mississippi in Minnesota (Feedlot III)	319 Grant	SWMWRB	$300,000	$600,000	2007 - 2010	Technical assistance for designa dn producer cost-share for OLA signers	Starts in 2007

Project Title	Funding Source	Project Sponsor	Grant Amount	Total Project Cost	Timeframe	Major Activities	Status
EQIP cost share in Whitewater Watershed	NRCS	Whitewater Joint Powers Board	NA	$150,000	Jan 2007 – Oct 2008.	Some of the $150,000 in cost share will go toward practices that reduce fecal bacteria contamination either directly or indirectly.	Sign-up period underway
Technical Service Providers (TSP) Training Initiative	Clean Water Legacy appropriation to MDA to improve technical assistance capacity	MDA contract with U of M – Jim Anderson, Les Everett, Barb Weisman	$250,000 ($210,000 MDA, $40,000 BWSR)	This is not a grant, so the value of in-kind resources to be expended for this project is not calculated	2007-2009	Coordinate and expand nutrient management and conservation planning training options for private and public sector.	March 2007 courses to be announced soon. Website to be established by June 2007. Additional courses to be added in 2008 and 2009.
Rice County ISTS ordinance upgrade	Natural Resource Block Grant (BWSR)	Rice County	$9,885		2007	Update Rice county ordinance to follow new ISTS state statutes.	
Rice County Septic System Loan Program	USDA/Ag-BMP Revolving Loan	Rice County Environmental Services and Planning & Zoning	$104,665		2000-2007	Septic System Loan Program	19 Voluntary Agreements signed in Veseli to replace systems that are currently connected to a community field tile.
Rice County Septic System Loan Program	Small Cities Individual Septic Loan Fund	Rice County Environmental Services and Planning & Zoning			Ongoing	Septic System Loan Program to assist with replacement systems.	Assisted 6 homeowners in system replacement in 2006
Upper Cannon Assessment Project	Clean Water Partnership	LeSueur Co Environmental Services	$184,588	$445,257	2007-2009	Will monitor water quality in the Upper Cannon River Watershed – one of parameters will be E. coli on previously unassessed reaches of the Cannon River	Starts in 2007
Olmsted County Septic System Pilot Inventory Project	MPCA	Olmsted County	$120,000	$138,955	2007-2009	Inventory parcels with potential to surface discharge wastes and provide a $500 cash incentive to correct the problem for 240 households	Begins in 2007

Project Title	Funding Source	Project Sponsor	Grant Amount	Total Project Cost	Timeframe	Major Activities	Status
Mapping and Quantification of Priority Agricultural Lands TMDLs	Clean Water Legacyappropriation to MDA for research	MDA contract with U of M (Dave Mulla, Barb Weisman)	$20,000	n/a – this is not a grant, so the value of in-kind resources to be expended for this project is not calculated	2007-2009	Use existing GIS data to map and quantify priority agricultural lands relative to TMDL Implementation.	Maps and data for at least two watersheds (LeSueur and Wild Rice) are to be completed by Dec 2007. The Cannon is third in line if funds allow.
Cannon River Watershed Lake and Stream Assessment	Clean Water Legacy – Surface Water Assessment Grant	CRWP	$103,884	$162,582	2007 -2009	Assessment of some of the streams in the Cannon River Watershed for E. coli.	Begins in March 2007.
Developing a DNA marker system for Bacteria from Cattle, Swine and Poultry Manure and Beginning to Evaluate Bacteria Fate and Transport in a Rural Setting Background	MDA – Impaired Waters Research Funds	University of Minnesota – Michael Sadowsky and Jim Anderson MDA – Paul Burns	NA	$300,000	2007-2009	This effort will: *Identify DNAs that are specific for e.coli originating from domesticated cattle, swine and poultry. *Perform limited field studies to help identify actual sources and fate of e.coli in selected watersheds that have fecal coliform impairments. *Strive to identify some best management practices for manure management to limit bacteria loadings into surface waters.	Starts in 2007.
NA	Clean Water Legacy Grant	Dakota County SWCD	$80,000 Cost Share	NA	2007-2009	Cost share for filter strips and nutrient management incentives to landowners in Dakota County	Starts in 2007.
CWL Root River Grazing Management Initiative	Clean Water Legacy Grant - BWSR	Root River Watershed District	$110,000	210,000	2007-2009	Technical assistance funds will provide one staff person to assist in developing grazing management plans.	Starting in 2007.
Medford Public School Rain Garden Project	Clean Water Legacy Grant - BWSR	Steele County	$306,060	$311,060	2007-2009	Construct large rain gardens to treat storm water runoff .	Starting in 2007.

Project Title	Funding Source	Project Sponsor	Grant Amount	Total Project Cost	Timeframe	Major Activities	Status
Apple Valley Sunset Pond Storm Water Project	Clean Water Legacy Grant - BWSR	City of Apple Valley	$70,000	$140,000	2007-2009	Construct a water holding pond to treat storm water before it enters Alimagnet Lake and eventually the Vermillion River.	Starting in 2007.
Apple Valley EVR P-13 Storm Water Project	Clean Water Legacy Grant - BWSR	City of Apple Valley	$63,500	$127,115	2007-2009	Provide technical assistance to construct a water holding pond to treat storm water before it enters Long and Farquar Lakes and eventually the Vermillion River.	Starting in 2007.
Winona County CWL AgBMP Technical Assistance	Clean Water Legacy Grant - BWSR	Winona County SWCD	$2,000	$2,000	2007-2009	Provide technical assistance to develop 10 ISTS plans funded by the AgBMP loan program.	Starting in 2007.
Shell Rock WD Fecal Coliform Reduction Project.	Clean Water Legacy Grant - BWSR	Shell Rock River WD	$20,500	$50,000	2007-2009	Provide technical assistance for the development of nutrient management plans.	Starting in 2007.
SE SWCD Tech Support JPB 2006 CWL Fecal Coliform Reduction Project	Clean Water Legacy – BWSR	SE SWCD Technical Support JPB	$350,000	$480,000	2007-2009	Technical assistance funds will provide two staff persons to develop nutrient management plans. Cost share available to landowners to implement open lot agreement low cost feedlot fixes.	Starting in 2007.
Whitewater Bacteria Reduction Project	Clean Water Legacy Grant - BWSR	Whitewater JPB	$ 21,700	$84,700	2007-2009	Provide cost share for low cost feedlot fixes. Develop manure management plans.	Starting in 2007.

Project Title	Funding Source	Project Sponsor	Grant Amount	Total Project Cost	Timeframe	Major Activities	Status
Open Lot Agreement Technical Assistance Project (Feedlot II Supplemental Funds	319 Grant	SEMWRB	$97,000	$194,002	May 2006-June 2008	Funds to supplement efforts in 8 counties (Dodge, Fillmore, Goodhue, Houston, Olmsted, Rice, Wabasha, Winona) fund SWCD and county to hire part-time agriculturalists, tech info to producers.	Eight project completed as of 12/31/06.
Dakota County Soil and Water Conservation District Rural Land Incentive Program	Clean Water Legacy Grant - BWSR	Dakota County SWCD	$80,000	$160,000	2007-2009	To work with rural landowners to develop nutrient and conservation management plans for water quality improvements and to offer a filter strip incentive program.	Starting in 2007.

3.0 Degree of impairment and strength of data

There exists a wide range of fecal coliform levels throughout the Basin. Ideally, sufficient data would exist to calculate current actual fecal coliform loads to compare directly to the TMDLs, which would allow for load reduction projections. However, the amount of data required for load calculations is much greater than that required for simple impairment assessment. (Revised TMDL, 2006) The geometric means for fecal coliform from the impairment assessment are not flow weighted. Some sites have many storm event samples while others do not. The data are sufficient to document an impairment, but not enough, for example, to say one reach needs a 55% reduction while another needs a 75 % reduction in fecal coliform organisms. Table 4 provides a comparison of the impaired reaches to each other and shows the strength of the available data.

The less than, similar to, and greater than determinations were made using information provided in Table 2 , (Lower Mississippi Basin Impairment Reach Descriptions and Assessment Summaries) in section 1.6 of this report. The value for the number of months exceeding the geometric mean of 200 orgs./100 ml was divided by the number of months with ≥ 5 observations. This number was then converted to a percent which was then categorized as follows: 0 – 40% = less than, 41-69% = similar to, and 70-100% = greater than. This method was chosen to more equitably compare the results. For example, reach A may have had 3 months where the standard was exceeded but that was out of a total of 8 months where there were ≥ 5 observations, while Reach B had 3 months where the standard was exceeded out of a total of 3 months where there were ≥ 5 observations. Using this method Reach B would be considered to have a greater degree of impairment than reach A as 100 % of reach B's months with ≥ 5 observations exceeded the standard whereas reach A only had 38%.

In addition to the degree of impairment, it is important to look at the strength, or robustness, of the data used to make that determination. The method used to do this was to rank the data in two steps. First, the reaches were sorted based on the number of observations. The reaches were ranked from lowest to highest with a value of 1 being assigned to the reach with the least number of observations and increasing numerically. Reaches with the same number of observations were given the same ranking value. Step two was then to sort the reaches based on the # of months with ≥ 5 observations. Again, the reaches with the lowest number were given a value of 1 with values increasing. Reaches with the same # of months with ≥ 5 observations were given the same ranking value. The last step was to add the scores for each reach for the two steps to arrive at a total ranking value. The strength of data ranking values were then divided into three categories: 0-10 = low, 11-22 = medium, and 23-34 = high. For example, Rush Creek, Headwaters to Straight River, received a score of 7 with regard to the number of observations and a score of 3 with regard to # of months with ≥ 5 observations resulting in a strength of data value of 10, or low. Results from this exercise are also included in Table 4. Assigned in these ways, values for degree of impairment and strength of data indicate areas where more data collection would be of value.

This data are also presented as a map in Figure 4.

Table 4. Summary of Fecal Coliform Impairments and Strength of Data (Degree of Impairment Key: ⇓ =0-40% less than; ⇔ = 41-69%; ⇑ = 70-100%)

Watershed	Impaired Stream Reaches	AUID	Degree of Impairment Relative to all Monitored Streams and Rivers in Basin	Strength of Data
Vermillion River	Vermillion River, South Branch Vermillion River to Hastings Dam	07040001-506	⇑	High
	Vermillion River, Below trout stream portion to South Branch Vermillion River	07040001-507	⇓	High
Cannon River	Cannon River, Pine Creek to Belle Creek	07040002-502	⇓	High
	Straight River, Maple Creek to Crane Creek	07040002-503	⇑	Medium
	Prairie Creek, Headwaters to Cannon River	07040002-504	⇑	Medium
	Rush Creek; Headwaters to Straight R	07040002-505	⇑	Low
	Cannon River; Northfield Dam to Lk Byllesby inlet	07040002-509	⇓	Low
	Unnamed Creek; Headwaters to Prairie Cr	07040002-512	⇑	Low
	Unnamed Tributary to Prairie Creek; Unnamed Cr to Unnamed Cr	07040002-513	⇑	Low
	Straight River; Rush Cr to Cannon R	07040002-515	⇔	Medium
	Crane Creek; Headwaters (Watkins Lk) to Straight R	07040002-516	⇑	Medium
	Straight River; CD #25 to Turtle Cr	07040002-517	⇔	Medium
	Turtle Creek; Headwaters to Straight R	07040002-518	⇑	Medium
	Maple Creek; Headwaters to Straight R	07040002-519	⇑	Medium
	Chub Creek; Headwaters to Cannon R	07040002-528	⇑	High
	Straight River; Turtle Cr to Owatonna Dam	07040002-535	⇓	Low
Whitewater River	Whitewater River, South Fork; Headwaters to trout stream portion	07040003-505	⇑	High
	Whitewater River, South Fork; trout stream portion above N Fk Whitewater R	07040003-512	⇑	Medium

Watershed	Impaired Stream Reaches	AUID	Degree of Impairment Relative to all Monitored Streams and Rivers in Basin	Strength of Data
Whitewater River (cont.)	Whitewater River, Middle Fork; trout stream portion	07040003-514	⇑	Medium
	Garvin Brook; Class 1B, 2A, 3B portion	07040003-542	⇑	High
	Logan Branch; End trout stream portion to North Fk Whitewater R	07040003-536	⇑	Medium
	Whitewater River, North Fork; Unnamed Cr to Unnamed Cr (below Class 7)	07040003-553	⇑	Medium
	Whitewater River, North Fk; Unnamed Cr to Mid Fk Whitewater R	07040003-554	⇔	Medium
	Stockton Valley Creek; Trout stream portion to Garvin Br	07040003-559	⇑	Medium
Zumbro River	Zumbro River; West Indian Cr to Mississippi R	07040004-501	⇑	Low
	Zumbro River; Cold Cr to West Indian Cr	07040004-502	⇑	Medium
	Salem Creek; Lower 15 miles (Class 2c portion) to South Fk Zumbro R	07040004-503	⇑	Medium
	Zumbro River, South Fk; Cascade Cr to Zumbro Lk	07040004-507	⇓	High
	Zumbro River, South Fork;Silver Lk Dam to Cascade Cr	07040004-533	⇑	Low
	Zumbro River, South Fork; Bear Cr to Oakwood Dam	07040004-535	⇑	Low
	Zumbro River, South Fork; Salem Cr to Bear Cr	07040004-536	⇑	Low
Root River	Root River; Thompson Cr to Mississippi R	07040008-501	⇑	High
	Robinson Creek; Headwaters to N Br Root R	07040008-503	⇔	High
	Money Creek; End of trout stream portion to Root R	07040008-521	⇓	Low
	Root River, South Branch; Canfield Cr to Willow Cr	07040008-555	⇓	Low
	Root River, South Branch; Headwaters to Class 1B, 2A, 3B	07040008-586	⇑	Medium

Watershed	Impaired Stream Reaches	AUID	Degree of Impairment Relative to all Monitored Streams and Rivers in Basin	Strength of Data
Cedar/Shell Rock Rivers	Cedar River, Roberts Creek to Austin Dam	07080201-502	⇔	High
	Cedar River, Rose Creek to Woodbury Creek	07080201-501	⇔	High
	Shell Rock River, Albert Lea Lake to Goose Creek	07080202-501	⇑	High

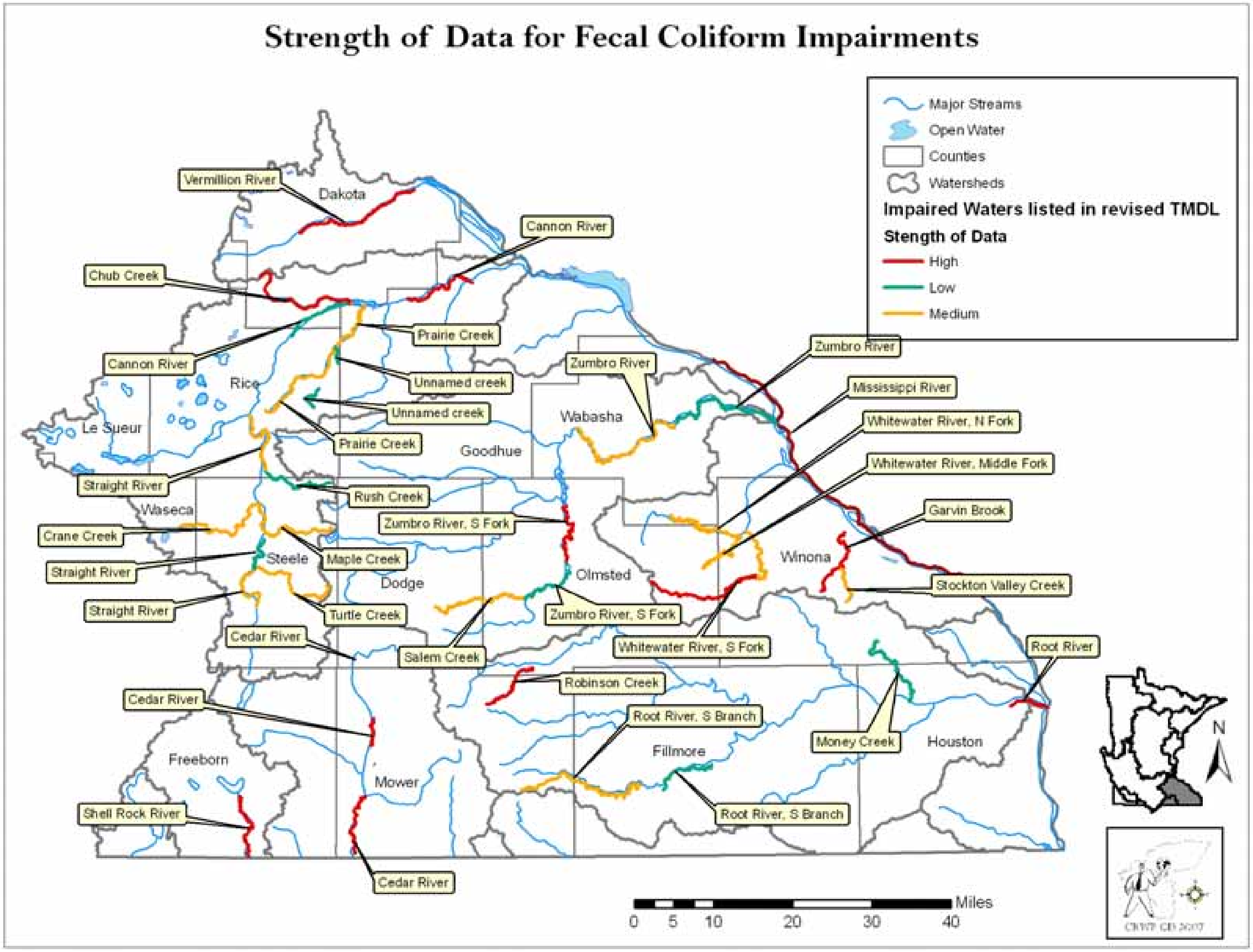


Figure 4 – Map of impaired reaches (2004) showing strength of data

3.1 Point Source and Non-point Source Discussion

These 39 impairments are set in a landscape that includes numerous point and non-point sources of fecal coliform pollution. By definition, the point sources are those that are included in the waste load allocation of the TMDL; however, only one of those sources is a point source in the traditional sense: wastewater treatment facilities (WWTF). This source is relatively easy to identify and is currently managed well by the National Pollutant Discharge Elimination System (NPDES). Section 5.1 of this plan discusses WWTF and notes that treatment failures ("bypasses") are the primary concern related to this source of fecal coliform loading to surface waters.

The other components of the waste load allocation – permitted livestock facilities, MS4 communities and straight-pipe septic systems – are all practices that occur "on the land," making them somewhat more akin to the non-point sources that are grouped in the load allocation of the TMDL. These sources are often weather driven – i.e. carried to surface waters by way of overland runoff. These "on the land" point sources, along with the non-point sources outlined in the load allocation, are the primary sources of fecal coliform pollution in our southeast Minnesota landscape, according to the best available monitoring, research and professional judgment, and therefore make up the core focus of this implementation plan.

Thus, some of the guidance provided in the following pages is directed at "non-point source management" (section 4) and some at "point source management" (section 5). However, the overall goal is to focus on how human and animal waste is handled and managed on the land.

4.0 Non-point source management

This section addresses management of the four main types of non-point sources of fecal coliform bacteria, and provides information about conservation tillage and buffer strips. Background information about each type of source, activities that could be undertaken to reduce fecal coliform loading, possible project partners, barriers to success, and critical geographic areas are discussed.

Precisely which individual sources within these aggregate categories are significant contributors of fecal coliform bacteria and, therefore, need to be reduced, is beyond the scope of this document. These sources will be identified through specific reduction projects. Implementation efforts should target the highest-risk, highest-contributing individual sources of fecal coliform bacteria. Several of the strategies build upon a solid foundation of state rules (feedlots, manure management, ISTS, stormwater, and municipal wastewater and biosolids) and county-delegated programs, such as promotion of buffers, rotational grazing, and conservation tillage.

4.1 Grazing and pasture management

Background

From the 1960's to the present, the need for pasture lands to support beef and dairy production has declined significantly. In the 1960's there were over a half-million acres of pasture land. As of 1997 pasture acres had decreased to 368,000 acres (National Resources Inventory, NRCS). In addition, producers have found growing corn and soybeans on their better land to be more profitable. Land that has extreme slope, poor soil profile or other factors that make it unsuitable for row crop production have been left for pasture and grazing. With pressure to keep maximum acres in crop production, producers have chosen to let cattle graze areas that are prone to erosion, have less productive soils, or are in close proximity to water bodies.

There is a difference between pastures and feedlots. As per Minnesota Rules 7020, pastures are defined as "areas where grass or other growing plants are used for grazing and where the concentration of animals is such that a vegetation cover is maintained during the growing season except in the immediate vicinity of temporary supplemental feeding and watering devices". Feedlots refer to buildings and lots where animals are confined for feeding, breeding, and raising where manure may accumulate. Feedlots are discussed in section 4.2.

Overgrazed or mismanaged pastures exist within the Basin and are potential sources of fecal contamination of surface water. Factors that influence the transport of fecal material and nutrients to surface waters are currently being explored through preliminary studies under a 319 grant project by Mark Zumwinkle in cooperation with the Fillmore County SWCD (personal communication, Mark Zumwinkle). This work is focused on the effects of prescribed grazing, continuous grazing and stubble height on transport of bacteria, with publication projected for Fall of 2007.

In order to reduce this source of fecal coliform, grazing must be managed. One method to accomplish this is the practice of rotational grazing. Under this strategy, livestock are rotated through partitioned paddocks every few days, thus spending less time by the streams and allowing vegetation to regrow (Sovell, 2000). Development of a grazing management plan will aid in supporting robust vegetative cover that will reduce transport of fecal material. Some producers have plans, but they do need to avoid overgrazing in riparian areas.

Reduction Strategies:

- An accurate inventory and mapping of overgrazed lands and pastures that present the potential of significant manure runoff especially in sensitive areas.
- Engage grazing specialists to assist producers with pasture management options.
- Fencing to limit livestock access to water.
- Installation of watering systems.
- Workshops, tours and demonstration projects.
- Riparian buffers: funding, installation and maintenance.
- Streamlining the process to producers to install buffers through NRCS (EQIP and other programs).

Partners:

Possible partners in grazing and pasture management include:

- Producers.
- Soil and Water Conservation District Staff.
- NRCS.
- Technical Service Providers (TSP).
- County FSA Officers.
- Township Officials.
- Planning and Zoning Officials.

Barriers to success:

Barriers to success in grazing and pasture management include:

- Land owners and producers may lack knowledge.
- Traditions that resist change.
- Lack of facilitators and technical staff to engage producers.

- Lack of funding.
- Cost of fencing and watering systems.
- Complicated processes in planning and orchestrating riparian buffer installation.
- Pastures are not as clearly regulated as feedlots on the state and local level.

Milestones

1. An inventory of overgrazed pastures and areas that need attention will be completed for the Basin by 2010.
2. Grazing specialists will be available to assist producers in all counties in the Basin.
3. Producers will implement managed grazing practices on 50% of the lands where needed (as identified in item 1inventory) by 2015.

Critical areas:

Critical areas include pastures that allow livestock unlimited access to ephemeral or perennial streams, shaded areas on sloping ground where cattle may loaf and concentrate manure, and areas with steep gradient to streams that increase the potential for transport of fecal material.

Grazing should be encouraged and well managed in all southeast Minnesota watersheds. Priority for management should be given to the Whitewater River and Root River basins – both of which feature topography that is often difficult to plant but is conducive to pasture.

4.2 Feedlot management

Background:

Feedlots without adequate runoff controls are a significant source of fecal bacteria during periods of spring melt and high rainfall events. Figure 5 shows a feedlot next to a stream that has flooded while figure 6 provides an example of manure containment that will not allow runoff. Feedlots need to be built and operated so that water running over and through them does not wash manure off the feedlot and into ditches, streams and other water bodies.

Minnesota Rules Chapter 7020 governs the storage, transportation, disposal, and utilization of animal manure and process wastewaters from feedlots. There are four major sections in the rules:

1. Registration program.
2. Permit program.
3. Delegated county program (all counties in the Basin, except Olmsted, are delegated counties).
4. Technical standards for discharge, design, construction, operation, and closure.

A provision of the feedlot rules is the Open Lot Agreement (OLA) in Minnesota Rules 7020.2300 subparts 4, 5, and 6. This provision offers a gradual and flexible approach for smaller feedlots to reduce manure-contaminated runoff into waters of the state. To be eligible for the OLA, a feedlot must have registered by January, 2002, have fewer than 300 animal units, and have pollution hazards. Eligible feedlots had until October, 2005 to sign up and implement the first phase of necessary improvements. Work must be completed by October, 2010.

Figure 5 – Cows in an inundated feedlot adjacent to a stream

Figure 6 – Manure contained in a concrete storage area.

Table 5 shows the varying numbers of animal units per species per county. These numbers are most likely an overestimate as they are the capacity for which the producers register but may not actually have on site.

Table 6 provides a summary of the number of feedlots per county as reported in the initial implementation plan (2003) and as provided by county feedlot officers in January, 2007. This table shows there is variability regarding the numbers of small feedlots per county as well as the numbers that have OLA agreements and plans prepared. Resources should be directed to the areas with greater numbers of feedlots that need to prepare and implement OLA plans.

Table 5– Animal Units per County as of December 2006
(Registered numbers – actual numbers on the ground may be less due to registration capacity of feedlots.)

County	Dairy	Beef	Swine	Poultry	Other	Total
Dakota	13,819	17,693	12,235	2,786	2,025	48,558
Dodge	21,859	13,483	42,968	6,254	1,140	85,704
Fillmore	59,653	104,221	59,391	7,456	6,339	237,060
Freeborn	3,196	15,119	69,847	1,229	1,240	90,631
Goodhue	42,000	43,000	36,000	3,400	3,100	127,500
Houston	37,932	30,901	8,840	500	1,000	79,173
Le Sueur	8,214	17,039	30,147	1,688	764	57,852
Mower	15,626	20,596	102,240	869	1,827	141,158
Olmsted	23,425	32,360	14,207	3,504	4,590	78,086
Rice	22,300	17,500	36,300	9,500	3,000	88,600
Steele	15,000	5,000	45,000	8,000	500	73,500
Wabasha	40,311	33,737	9,147	539	995	84,729
Waseca	7158	11587	74465	3276	770	97,256
Winona	64,538	31,119	11,027	3,842	3,738	114,264

Table 6 – Updated County Feedlot Inventory and Open Lot Agreement (registered and permitted feedlots). An Open Lot Agreement (OLA) is required for feedlots with fewer than 300 animal units with pollution hazards.

County	Total Number of Feedlots		Number of Feedlots < 300 au		Number of Feedlots 300-999 au		Number of Feedlots >1,000 au		Enrolled in Open Lot Agreement	OLA Plan prepared
	2003	**2006**	**2003**	**2006**	**2003**	**2006**	**2003**	**2006**	**2006**	**2006**
Dakota	291	293	231	235	58	58	2	0	210	210
Dodge	460	510	367	436	81	63	12	11	80	12
Fillmore	1534	1057	1354	914	174	134	6	9	432	250
Freeborn	449	471	431	396	16	63	2	12	89	NA
Goodhue	*996*	1080	890	1002	92	66	14	12	650	100
Houston	481	676	457	645	23	28	1	3	575	100
Le Sueur	314	262	245	201	62	56	7	5	11	11
Mower	822	833	674	700	139	115	9	18	26	12
Olmsted	645	708	586	641	52	35	7	2	103	14
Rice	1225	1064	1125	989	91	66	9	9	166	100
Steele	576	410	497	345	67	54	12	11	27	21
Wabasha	680	698	561	662	108	28	11	3	575	100
Waseca	329	329	225	249	70	58	34	22	5	4
Winona	847	845	715	778	121	63	11	4	464	Estimate 25-50%

Several projects have already taken place to assist in sign-up with the open lot agreement and installation of feedlot fixes (see Table 3). A summary of project results for the SEMWRB project, known as Feedlot I, are presented in Table 7. This project took place from 2001 – 2005. The purpose of this project was to inform all livestock producers about new feedlot rules and to achieve 90% signup of Open Lot Agreement by eligible producers in priority areas. The results indicate that some counties have achieved complete sign-up and the producers are on their way to developing plans. Projects similar to this that encompass the entire Basin could be done to assist the producers in developing OLA plans and implementing feedlot fixes.

Table 7 – Results of the Feedlot I grant project 2001-2005
(Open Lot Agreement Sign-up Results for entire county for eight counties in southeast Minnesota)

	Dodge	Fillmore	Goodhue	Houston	Olmsted	Rice	Wabasha	Winona	Total
Feedlots under 300 A.U. that have been **registered**	453	1092	1020	582	618	1450	640	778	6633
Estimate producers who **should be enrolled in the** OLA because runoff could reach surface water	120	600	675	250	211	158	635	466	3115
OLA's which have been **signed**	68	291	430	434	73	154	555	290	2295
% of OLA's signed of those who should be enrolled	57%	49%	64%	100%	35%	97%	87%	62%	69%
OLA plans **developed for partial fixes**	21	95	85	30	9	4	88	0	332
OLA plans **implemented for partial fixes**	7	3	38	21	7	1	33	0	110
OLA plans **developed for complete fixes**	3	95	14	290	5	33	31	0	471
OLA plans **implemented for complete fixes**	3	60	10	64	1	26	20	0	184

Reduction Strategies:

- Each county should prioritize feedlots according to pollution potential.
- Feedlot management regulations should be implemented consistently.

- Management should extend beyond the feedlot to temporary holding sites like fair grounds, auction yards and slaughterhouses.
- A Basin-wide feedlot inventory should be available to stakeholders, via the MPCA webpage, to assist in development of fecal coliform reduction projects.
- Counties should actively pursue open lot agreement signups.
- Solutions to feedlot runoff problems prescribed via the open lot agreement (many of which are "low cost fixes") should be implemented.
- Encourage producers to do periodic self-audits to identify and correct feedlot problems.
- Enlist collaborators such as milk producer associations, cattle producer associations, crop commodity researchers,and county agencies.

Partners:
NRCS should facilitate planning, cost-share funding and implementation of feedlot BMPs. University of Minnesota Extension for technical information and educational resources. MPCA and county feedlot officers for permitting and inspection. BALMM, SEMWRB, and other county and state agencies, and producer associations. County and township governance boards should also be included in educational activities and planning activities that involve farmers.

Barriers:
- Lack of education for producers, township officials and community members regarding feedlot regulations and strategies for reducing pollution potential has limited the level of understanding and commitment to progress.
- Limited funding to support cost-share practices has prevented some producers from implementing low-cost feedlot fixes that would address significant sources of pollution.
- Producer resistance.
- Producer perception that entering into a planning and implementation phase entails too much complex paperwork.
- Lack of feedlot inventory, registration, inspection and data-tracking of individual feedlot information.

4.3 Manure management
Background:
Manure management strategies and policies governing feedlot management are closely related and may be combined in one farm management program. State feedlot rules (MN Rules Chapter 7020) require manure application record-keeping and manure management planning. Exact requirements vary according to size of operation, pollution risk of application based on method, the location and timing of application. Manure mis-application and over-application may be major factors in pollution especially on land that is 300 feet or less from surface waters, with sinkholes or karst, or with steep slopes. Figure 7 depicts the application of liquid manure.

Figure 7 – Liquid manure application.

Proper manure application generally requires incorporation into the soil with tillage soon after the manure reaches the ground; incorporation is in many cases a BMP for odor control. However, tillage destroys the residue cover that no-till farmers work diligently to retain in an effort to reduce erosion. Research and experimentation should be undertaken to find ways to use manure effectively in a no-till environment. In addition, methods of combining strip-tillage and strip application of manure in the crop zone should be developed.

Reduction Strategies:
Effective manure management will reduce fecal coliform contamination if application is governed by the four "Cs" of manure usage: content, calibration, consistency and critical areas.

Content:
It is imperative that farmers know what the manure contains. Manure testing for content of nitrogen, phosphorous, and potassium should be done to provide the opportunity to apply the proper amount.

Calibration:
Farmers need to calibrate their equipment so the amount of manure applied per acre can be effectively managed to suit crop needs. Whether liquid, solid or semi-solid manure is applied it is possible to utilize fairly simple equipment and minimal calculations to arrive at the application rate. Sophisticated manure flow valve systems and documentation devices are also available.

Consistency:
Through the establishment of the content of the manure and the calibration of the system used, over-application and under-application can be avoided. Through soil sampling and adjustment of manure rates a more consistent fertility level can be provided for crop uptake needs.

Critical Areas:
By avoiding steep slopes, riparian areas, sinkholes and open tile intakes manure can be applied in a manner that will minimize potential for runoff and subsequent loading of pathogens to surface water. Identifying and avoiding these critical areas are keys to proper manure management.

A new tool in 2007 for facilities with < 300 animal units is the "mini" manure management plan. This plan has been developed by the MPCA as a basic planning tool for facilities that are not required to have a full scale manure management plan. It walks producers through calibration of manure spreaders, nutrient testing, and setbacks. The focus of this plan is to manage nitrogen and meet setback requirements, but it will also work to reduce fecal coliform runoff. Staff from MPCA, county feedlot offices and SWCDs can assist producers in completing this short plan.

Manure composting may be beneficial in particular operations because it destroys pathogens and reduces the volume of manure. Composted manure is generally of more even nutrient content and is more convenient to apply. Composting facilities can be costly and may be more suited to larger operations in which economies of scale may allow the installation of the required structures and purchase of handling equipment. The capacity to compost mortalities provides added benefits to animal producers.

Past thinking has encouraged farmers to apply manure in sufficient quantity to meet the nitrogen needs of the ensuing crop. This practice may result in over-application of phosphorus. Manure management plans should to be formulated with thought given to both phosphorus and nitrogen needs. Such recalculation may allow reduction of the amount of manure applied per acre. Additional research should be done to assess the amount of nutrient and fecal bacteria transfer from areas with varied manure rates, including transfer to sub-surface tile drainage.

MPCA and University of Minnesota Extension should be key players in revising and improving educational efforts regarding manure management. Manure application contractors are required to meet established standards in compliance with the permit process. Some county manure management staff and feedlot officers have noted that more rigorous training of the employees of manure management contractors would be beneficial. Complete documentation of manure applied and assurance of compliance with setback and rate requirements should be required. The following points should be considered as required content in manure management education programs:

- Setback requirements for surface waters, tile inlets and sensitive areas.
- Site selection rules for application and storage of manure.
- Timely incorporation using tools that result in minimal residue disturbance.
- Reference manure application rates to phosphorus uptake needs of the following crop.
- Promote manure composting and other methods that reduce pathogens.
- Promote runoff controls, riparian buffers and runoff diversion structures.
- Promote the use of the Nitrogen Rate Calculator (available through University of Minnesota and Iowa State University), an on-line tool for producers to use in planning crop nutrient programs.
- Monitor tile line discharge under a variety of conditions, different manure application practices and different tillage practices.
- Provide commercial manure applicators with opportunities for more education, especially for their employees. Require proper record-keeping and documentation in a uniform, Basin-wide database.
- Encourage the private producer who applies manure to have a flow meter so application rates can be documented.
- Use of mini-manure management plan for small producers not required to have full plans.

Barriers:

Barriers to progress include:

- Lack of data on farmer compliance.
- Differing levels of implementation of feedlot regulations.
- Inconsistent application of manure management guidelines.
- Inadequate levels of technical and financial assistance.
- Lack of Basin-wide inspection and enforcement of manure management plans.

- Lack of education regarding required setbacks for manure application for compliance with shoreland regulations.
- Lack of monitoring information does not allow streams to be classified as priority areas.
- Lack of staff to inventory feedlots and develop manure management plans is a major impediment to progress.

Critical Areas:
Identifying and avoiding critical areas are keys to proper manure management. By avoiding steep slopes, riparian areas, sinkholes and open tile intakes manure can be applied in a manner that will minimize potential for runoff and subsequent loading of pathogens to surface water As noted in Minnesota Rules 7020, minimum setbacks for manure application must be followed. These areas include: land that is 300 feet from lakes, streams, wetlands, ditches, and open tile intakes and 50 feet from wells and sinkholes. Areas with steep slopes and karst features should also be a priority.

4.4 Individual Sewage Treatment Systems (ISTS)

Background
Over the past 5 years a great deal has been learned about the extent of wastewater treatment problems in Southeast Minnesota, significant experience has been gained with strategies to deal with these problems. Many recommendations contained in this section were generated by the steering committee for the Southeast Minnesota Wastewater Initiative, also known as the "Sewer Squad", although input was requested by all stakeholders through BALMM meetings and surveys sent to decision makers and stakeholders. The Sewer Squad is made up of a diverse group of people and organizations involved in wastewater treatment in Southeast Minnesota. It includes local county ISTS staff from Rice, Dodge, Mower, Steele, and Le Sueur counties, Bea Hoffman from the Southeast Minnesota Water Resources Board, Doug Malchow from University of Minnesota Extension, Dave Legvold from the Cannon River Watershed Partnership, Aaron Wills and Sheila Craig, facilitators for the Southeast Minnesota Wastewater Initiative project, and staff from the MPCA. The Sewer Squad has built up extensive capacity and experience working with small communities with inadequate wastewater treatment and with the problem of failing and straight-pipe septic systems in general across Southeast Minnesota.

Reduction Strategies
Use a Problem Area Approach
In the original Implementation Plan, reduction strategies were organized by target audience. Based on experience gained from five plus years of implementation activity, it is more effective to organize reduction strategies by problem area. The two problem areas are 1) small, unsewered communities with inadequate wastewater treatment and 2) individual homes with inadequate wastewater treatment. By organizing the reduction strategies under these two problem areas the implementation plan will provide a clear guide for counties, watershed groups, townships, nonprofits, and residents regarding what approaches are needed to address fecal coliform pollution from septic systems.

A small, unsewered community is defined as a cluster of five or more homes and businesses not served by centralized wastewater treatment. A small, unsewered community could include any of the following areas: incorporated cities, areas within incorporated cities, unincorporated villages, manufactured home parks, subdivisions, lake shore developments, and other clusters of homes and businesses. **Inadequate treatment includes** one of, or a combination of the following: a community straight pipe (Figure 8), individual straight pipes, other surfacing systems, poor soils, small lots, known well contamination from onsite systems, cesspools, drywells, or cases where no specific information is known about the quality of wastewater treatment in the community.

Figure 8 – Outlet of a straight pipe from a community in southeast Minnesota.

<u>Reduction Strategies for Small, Unsewered Communities with Inadequate Wastewater Treatment</u>

1. **Make facilitators available to provide educational and technical assistance –** Provide the necessary financial resources to ensure the continued availability of facilitators to assist communities.

   Facilitators are critical resources for small communities, especially unincorporated ones, as they undertake a community wastewater project. There is a maze of decisions communities must go through and without facilitators it is extremely difficult for them to understand the situation, explore all the options, and ultimately implement a solution. Additionally, wastewater facilitators often serve the role of helping small communities to understand the need for proper wastewater treatment. In the post-project assessment done for the original Southeast Minnesota Wastewater Initiative grant (Wastewater I), facilitation has been rated by the communities as the most important resource provided through the grant. Facilitation ranked ahead of financial assistance and educational assistance.

2. **Homeowner/Project Incentive** – Provide financial incentives to small communities and homeowners. Through regional, county, or watershed-based projects, provide small grants or cost-share funds to communities pursuing wastewater treatment solutions to do needs assessments and feasibility studies.

   Small communities beginning the community wastewater process face numerous challenges such as engaging community members, developing leadership, learning how to work together as a community, and clearly defining the objective of the group. Coming up with the necessary financial resources to do a needs assessment to help the community fully understand the current wastewater treatment situation or a feasibility study to determine the appropriate solution can be very challenging for many of these small communities. Often the median income of the community is well below the state average, or a community is unincorporated and thus may have no financial resources since there is no local unit of government. Lessening the burden on communities at the outset helps to keep the community process afloat and to empower community members who support taking responsibility for the wastewater treatment situation in the community.

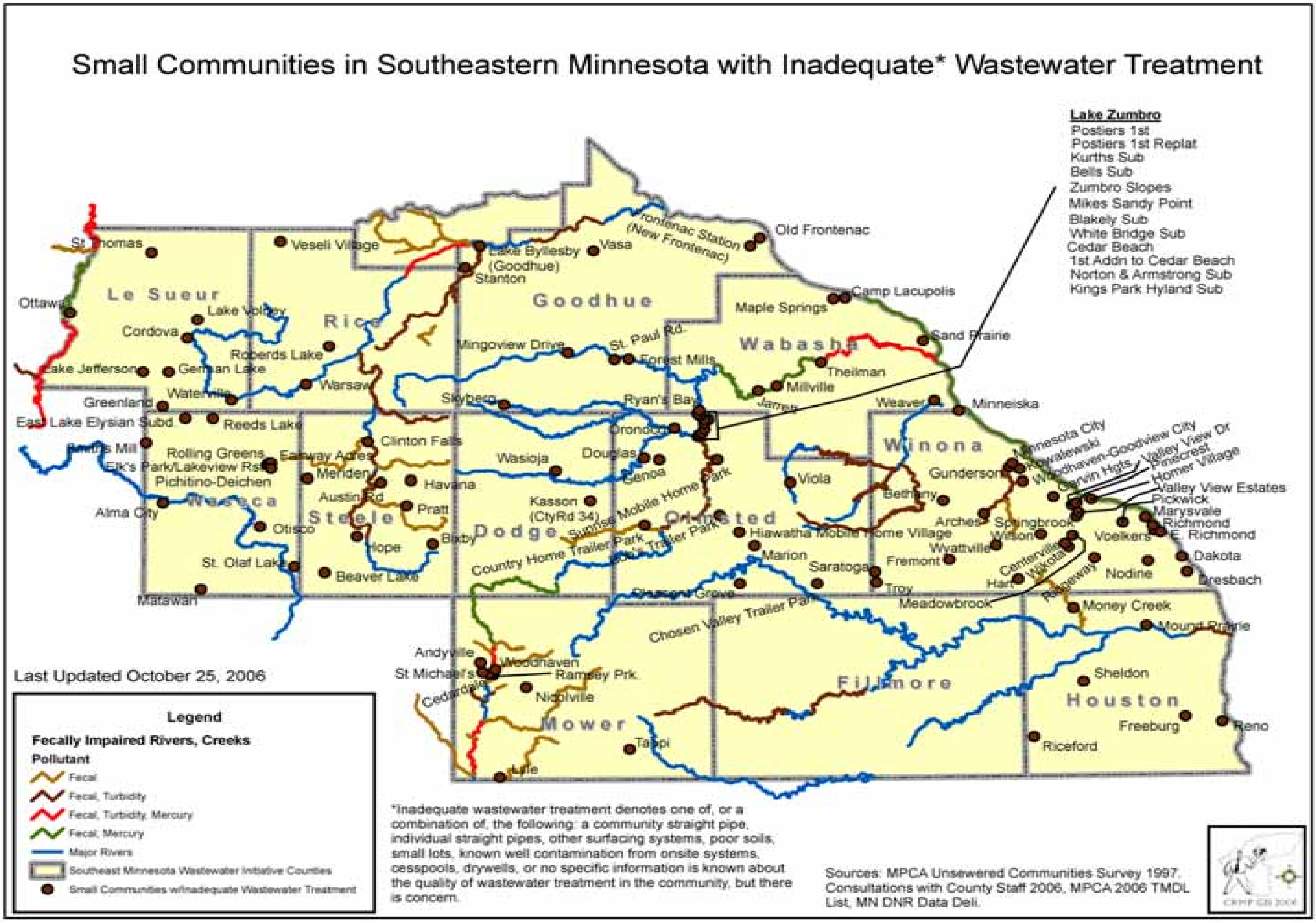
3. **Education –** Provide educational resources to residents. Some examples of topics include - the importance of proper wastewater treatment, wastewater treatment options, community structures to undertake and manage a wastewater treatment project, the role of a task force and task force formation, decision making skills, hiring wastewater treatment professionals, financing options, and septic system homeowner education. In the Basin, University of Minnesota Extension Service is an essential resource for this educational assistance.

4. **Point-of-Sale –** All counties in the Lower Mississippi Basin should adopt a requirement in their ISTS ordinance which requires an ISTS to be compliant at the point-of-sale. A second option is to mandate such a rule in state statute for all counties in Minnesota.

5. **MPCA Protocol and Priority List for Notice of Violation –** The MPCA should develop a protocol for enforcement of both incorporated and unincorporated communities. MPCA prioritize communities with inadequate wastewater treatment to work with based on their proximity to surface water listed as impaired for fecal coliform, size, and level of wastewater treatment.

6. **Map and Inventory of Small Communities with Inadequate Wastewater Treatment –** Maintain an updated map and inventory of small communities with inadequate wastewater treatment with fecal coliform impaired waters. This map is provided in Figure 9. This map is based on information provided by counties in the Basin and is only as accurate as the information each county provided. Some counties have inventoried their small communities' wastewater treatment practices. Others have not or are unwilling to provide the information because they are not eager to enforce in small communities. As more county ISTS inventories are completed, it is expected that new communities will be added to this map and communities that are currently listed will be taken off due to verification that adequate wastewater treatment is occurring in the community. Additionally, through work of the Southeast Minnesota Wastewater Initiative project numerous small communities in the Basin are working to come into compliance.

Figure 9 – Small Communities in Southeastern Minnesota with Inadequate Wastewater Treatment



Reduction Strategies for Individual Homes

1. **Matrix of County ISTS Policies** – Work for uniformity in county policies and implementation of county policies throughout the Basin.
    a. **Point-of-Sale –** Encourage all counties to adopt a point-of-sale requirement in their ISTS ordinance which requires an ISTS to be compliant at the point-of-sale **or** mandate point-of-sale in state statute.
    b. **Countywide Loan Program** – All counties should set-up a countywide loan program with property tax payback. Countywide loan programs have a number of advantages over AgBMP loan programs. AgBMP loans come through banks which means homeowners who do not have good credit history may not be able to get a loan. With a countywide loan program however usually all that is required is that property taxes are current. AgBMP loans have a loan origination fee which adds extra cost for the homeowner. A countywide loan program does not. Countywide loan programs also offer more flexibility as to what types of systems can get loans. For instance countywide loan programs can loan to mobile home parks or campgrounds. AgBMP loans are limited to individuals.
    c. **Uniformity of implementation of county policies -** MPCA conducts audit of county ISTS programs to determine adequacy of performance in a number of key areas, including spot checks on recent ISTS installations, level of effort on ISTS inspections and follow-through on noncompliant systems, and dealing with contractors. Conduct audits of three counties in 2007, evaluate results, and plan additional audits in future years.

2. **County or Watershed-based Inventory** – Encourage and provide resources for county or watershed based inventories of failing and straight-pipe septic systems. Allow flexibility for counties to choose what approach suits them, but give preference to the model developed under the MPCA funded Fillmore County pilot project.
    a. Fillmore County Model to locate and upgrade straight-pipe septic systems:
        i. **Public Information Campaign**
        ii. **County records check -** Locate all homes which have either no septic system permit on record or a permit pre-dating 1996. These systems will be inspected.
        iii. **Funding for Staff Time -** Financial resources to pay for additional staff time to do inspections.
        iv. **Homeowner Incentives** – Financial incentives provided to homeowners who upgrade a system found to be a straight pipe and attend a septic system operation and maintenance class.
        v. **Homeowner Education** – Provide free class for homeowners on septic system operation and maintenance.

3. **Homeowner Incentives –** Provide financial resources for regional, county, or watershed initiatives that target specific areas for increased compliance to include homeowner incentives. Incentives could include design cost, permit cost, or attendance at Operation and Maintenance classes.

4. **Education –**
    a. **Homeowners -** Provide educational resources to residents. Some examples of topics include - the importance of proper wastewater treatment, wastewater treatment options, community structures to undertake and manage a wastewater treatment

project, role of a task force and task force formation, hiring wastewater treatment professionals, financing options, and operation and management of ISTS and other treatment systems. University of Minnesota Extension Service is an essential resource for educational assistance in the Basin.

b. **Elected Officials, e.g. county commissioners, township officers and SWCD supervisors –** Through workshops and contact with community facilitators, inform elected officials of proper ISTS operation, community approaches to wastewater treatment, environmental problems from inadequate treatment, and the status of ISTS in their communities.

5. **County tracking of operation and maintenance** – Provide resources for counties to improve their tracking of required operation and maintenance of ISTS by homeowners. This could include pumping reminders like Dakota and Washington County currently have or other approaches developed by counties to assist in keeping track of annual maintenance needs.

6. **Research**
   a. **Operation & Maintenance –** Provide resources for continued research into the benefits of proper operation and maintenance of ISTS both for extending system life and to lower the release of untreated or partially treated sewage into the environment that endangers public health.
   b. **Alternative Sewage Treatment Options** – Provide resources for continued research on treatment options that work on small lots, poor soils or under other limiting conditions.

<u>Additional Reduction Strategies</u>
Oversight of septage disposal is an emerging area of concern in the Basin. Currently each county has an ordinance regulating septage disposal although requirements in each county vary widely. In practice, enforcement of county septage disposal ordinances is virtually non-existent due to lack of county staff time devoted to the issue. Counties may need additional resources to adequately enforce their septage disposal ordinance and the MPCA should increase its involvement in this area. MPCA should consider a comprehensive review of county ordinances regulating septage disposal and a pilot program to track land application of septage and other biosolids by pumpers and landowners.

Additional requirements that were recommended by stakeholders and should be considered by MPCA and local counties include:

- Require compliance inspections every five years for ISTS
- Require all cities and counties with ISTS to have a 10 year plan to upgrade all systems
- Require all septic systems to be part of a sanitary sewer district either run by the county or some other public entity

Barriers:

- Misconceptions about what is a conforming system and what is a failing system
- Unwillingness of many funders to pay for cost share or incentives for ISTS upgrades
- Lack of enforcement of county ordinances

Milestones:
Milestone #1 - 50% of the small communities shown in Figure X (there are currently 120) to be removed from the map. Communities will be removed from the map for the following reasons:

- All septic systems in the community have been brought into compliance.
- A community wastewater system has been implemented.
- Verification that adequate sewage treatment is occurring in the community. It is difficult to ascertain sewage treatment practices in small communities without an inventory of ISTS in the community, which some counties are reluctant to do.

Milestone #2 - 50% of the counties in the Basin have found and fixed all straight-pipes.

Critical Areas:

- RV parks, camper areas and campgrounds
- Homes located in Shoreland

4.5 Conservation Practices

4.5.1 Tillage
Since tillage began at the time of settlement of the Lower Mississippi River Basin, nearly 50 percent of the organic matter of soils has been lost. Organic matter is dramatically reduced when heavy tillage incorporates oxygen into the soil and disaggregates, or breaks up, the soil. Once the soil is disaggregated, it is exposed to wind and water erosion, which further deplete the organic materials in the most productive few inches of topsoil. With lowered organic matter fecal material runoff is more likely.

Less aggressive tilling can build organic matter, and re-aggregate soil. Published in Reeder (2000), P.R. Hill showed that soil aggregation in a no-till regime compared to soil aggregation in moldboard plowing regime over 5 years of continuous corn showed a 120 percent increase in the top two inches of soil. Ridge-till showed a 35 percent increase in soil aggregation and chisel plowing showed a 31 percent increase. Plowing brought the soil back to its original disaggregated state. Conservation tillage practices are credited with saving more than 1 billion tons of soil per year nationally on cropland. (NRCS, 2000) Building soil's ability to resist erosion is best accomplished through tillage practices that do not disaggregate the soil structure. Figure 10 show adjacent no-till and conventionally tilled areas. In conventional tillage more disaggregated soil is available for erosion.

Conservation tillage is a cost-effective way to build organic matter and reduce field runoff that may include runoff contaminated with fecal material. In times of increasing fuel and equipment costs, these methods of reduced tillage and fewer trips over the field provide considerable financial benefit to the producer. No-till farming has also been shown to dramatically reduce fuel and equipment costs while providing the most effective way to reduce erosion and transport of fecal material. However, producers perceive that Minnesota's climate and soils that are slow to warm up in the spring are major factors that compel them to use heavy tillage to expose black soils to the sun's warmth. The University of Minnesota Extension Service publication, "Tillage Best Management Practices for Water Quality Protection in Southeastern Minnesota" can serve as an effective tool in facilitating changes in tillage practices with farmers.

Figure 10 – Example of no-till and conventional tillage practices.

In recent years techniques of strip tilling have provided an acceptable compromise between no-till and heavy tillage. Like no-till farming, acceptance of this practice is slow and farmers fear yield loss if new techniques are employed. Strip tillage may offer a way to combine the benefits of no-till and effective manure application while retaining enough residue to greatly reduce manure-laden runoff.

Reduction Strategies

Activity	Partners	Barriers
Implement cost share incentives to acquire no-till, strip-till or conservation tillage equipment.	County Commissioners and Staff, NRCS, SWCD.	Lack of funding.
Provide a facilitator to meet with producers for total farm planning which includes planning and installing tillage practices complemented by buffers.	Local watershed organizations, MPCA, NRCS, SWCD.	Funded position is required.
Advocate for federal farm subsidy programs to include strong incentives for stewardship of natural resources and runoff prevention.	County Commissioners and Staff, NRCS, SWCD, Citizens and land owners.	
Reinstate tillage transects in each county and watershed.	Local watershed organizations, MPCA, SWCD.	

4.5.2 Buffer strips

Conservation buffers have become a familiar part of many Midwestern farm landscapes. The National Conservation Buffer Initiative reported that nationwide, more than 1.2 million miles of conservation buffers equating to 4.5 million acres of buffer had been installed by the early part of the 21st century. Nearly half of these buffers were enrolled through continuous Conservation Reserve Program (CRP) or Conservation Reserve Enhancement Program (CREP) initiatives(Conservation Technology Information Center, 2002).

Buffers remove pollutants through deposition, infiltration and dilution.(Dosskey, 2001) Deposition is accomplished as the vegetative cover of the buffer area retards the flow of runoff allowing suspended sediments and fecal material to drop into the buffer. Infiltration is allowed to occur in the buffered area owing to its healthier soil structure that is rendered more permeable through a vigorous root and organic matter presence. Dilution can occur when pollutant-bearing runoff is mixed with captured rainwater in the buffer zone. Infiltration augments the process of dilution by reducing the amount of polluted nutrient-bearing and pesticide-bearing water that must be blended with rainwater. (Dosskey, 2001) In addition, buffers transform pollutants through biological and chemical processes of adsorption to soil particles, degradation and assimilation. (National Research Council, 2002) Buffers also provide valued wildlife habitat.

Buffer design can have significant effects on performance. Buffers offer the last line of defense in capturing runoff and sediments from sloping fields. Riparian buffers are recognized as vital strips of habitat that perform a great number of biological and physical functions to safeguard water quality and wetland health. (National Research Council, 2002) Selection of appropriate vegetative species to meet the requirements of each specific farming operation and the needs for protection of each water resource is important.

Maintenance of buffers must be addressed on two fronts: assuring consistent, even flow over the buffered area and maintaining the plants that make up the buffered area. Areas of trapped sediment must be cared for and resolved. Burning and harvesting of biomass may be acceptable methods of preserving plant vigor and excluding invasive species. Iowa State University recommends harvesting or burning buffer grasses every year or two after the first five years of growth. (Iowa State University; University Extension, 1997.) However, accumulated nutrients, sediments and fecal bacteria appear to be released during subsequent runoff flows and reduce net retention of pollutants (Coyne et. al., 1998, and Young et. al., 1980).

One example of a project that is increasing the amount of buffers is taking place in Goodhue County. The idea, based on a Grant County, MN model, is to use existing programs, incentives, and ordinances to place buffers on the landscape. The county Shoreland Ordinance which states that 50' of perennial vegetation must be maintained along water courses of Goodhue County (mainly DNR waters) is the ordinance that is sited. Staff will use aerial photos to locate areas that appear to be potential violations in each township and will mail those violators a letter with a map of the buffer site. In that letter, existing programs and information are promoted which landowners could use to enroll the buffer and to get compensated for their efforts. If violators do not respond or simply do not want anything to do with the programs, then a letter from the County Commissioners and the SWCD Board will be sent out with background of why it is important to buffer streams, the incentives available, the support of this initiative, and the ordinance which states that a vegetated buffer is needed. Any enforcement issues that escalate further than that will he handled by the planning and zoning department. Because staff wanted to be able to site the ordinance, they informed the planning and zoning commission, and the county commissioners before starting out.

The next step was to gather local support from various watershed organizations, county entities and finally the county board. County staff will also attend township board meetings to present this initiative. (Personal communication, Beau Kennedy, Goodhue County Water Planner, February 22, 2007.)

Buffers as Part of a Total Management System

Buffer design and installation will not offer a long-term and effective solution to source reduction of fecal contamination, eroded soil, nutrient transport and chemical pollution if a total system approach is not considered. A properly installed and maintained buffer is destined to become choked with eroded soil, fecal material and chemicals resulting in its eventual failure to perform the intended functions. Stated succinctly, buffer strips are not a one-solution cure-all if other agricultural practices do not support the work that buffers are expected to perform. Buffer strips cannot prevent the damage that improper manure application and inappropriate tillage cause in upland areas. It makes little sense to install buffers alongside areas that are moldboard plowed, field cultivated repeatedly, and left open to erosion and transport of manure in runoff. Upland practices should be developed along with buffer implementation so the two proven practices can work together. By combining buffers with no-till or strip till and backing up no-till and strip till with buffers, dramatic source reductions of fecal material and sediment can be realized.

Reduction Strategies

Activity	**Partners**	**Barriers**
Public ditch cleaning and reconditioning requires buffer installation	NRCS, SWCD, County Commissioners and Staff, Private land owners.	Cost. Public perception/willingness to cooperate.
Allow varied methods of harvesting biomass and control of unwanted species in buffers.	SWCD, DNR, MPCA, landowners, citizens.	Regulations governing harvesting and burning of CRP and CREP lands are too restrictive and complicated.
Provide facilitators to bring together resources in planning and installing buffers.	Local watershed organizations, NRCS, SWCD, MPCA.	Lack of staff time.
Develop more flexible buffer width requirements.	NRCS, SWCD, County government.	Difficult to shift present policy to more individualized program for each land owner.

5.0 Point source management

The Revised Regional TMDL (April, 2006) breaks down the Wasteload Allocation (point sources) segment into four source categories:

1. Permitted Wastewater Treatment Facilities
2. Communities Subject to MS4 NPDES Requirements (Urban Stormwater)
3. Livestock Facilities Requiring NPDES Permits
4. "Straight Pipe" Septic Systems

The following sections provided detail regarding these source categories.

5.1 Permitted wastewater treatment facilities (from the Revised TMDL)

The great majority of the urban population in the Lower Mississippi River Basin is served by centralized sewage treatment, which includes disinfection at the final treatment stage. All permitted wastewater treatment facilities are required to monitor their effluent to ensure that concentrations of specific pollutants remain within levels specified in the discharge permit. Effluent limits require that fecal coliform concentrations remain below 200 organisms per 100 milliliters from April 1 through October 31. This is accomplished through disinfection of the wastewater at the final treatment stage, through chlorination or equivalent processes. The MPCA regularly reviews the Discharge Monitoring Reports from wastewater treatment facilities to determine whether permit violations have occurred. The previous TMDL study (2002) found relatively few violations. This was confirmed in a review of information for 2004 and 2005.

Emergency bypasses at wastewater treatment facilities are an occasional source of bacteria and other pollutants. These bypasses are also referred to as sanitary sewer overflows (SSO's). Wastewater treatment plants and sanitary sewer systems are designed to handle at least 100 gallons of water per person per day, as well as the additional flow generated by commercial and industrial establishments. If the amount of water entering a system exceeds the design capacity of the system, some of the untreated wastewater is discharged to the environment. This event is called a bypass because the wastewater has bypassed part or all of the treatment process. Efforts to minimize or eliminate wastewater bypasses are managed through the NPDES program.

As part of the previous Regional TMDL (2002), wastewater treatment facility reports for 2001 were examined to identify cities where one or more bypasses had occurred. In calendar year 2001, 24 cities in the Lower Mississippi River Basin reported one or more bypasses. Most of these cities (21) experienced bypasses one or two times. These were judged to be isolated occurrences triggered by extreme rainfall events, particularly flooding that occurred early in May and June. As such, bypasses are not expected to reoccur at these facilities unless caused by extreme weather and flooding.

For three of the cities, bypasses occurred three or more times, signifying structural problems that needs to be corrected. The most common structural problem contributing to wastewater bypasses is inflow and infiltration into the wastewater collection system. This problem can be compounded by limited hydraulic capacity at the wastewater treatment facility. Based on these criteria, three cities were considered to have a chronic bypass problem: Claremont, Kasson, and West Concord. Each of these cities has upgraded their wastewater treatment facilities since 2001 and no longer have chronic bypass problems. A review of information for 2004 and 2005 revealed no facilities with chronic bypass issues.

No facilities in the Basin are known to currently have combined storm and sanitary sewer systems, which may lead to combined sewer overflow (CSO) discharges to surface waters. The City of Red Wing on the Mississippi River did correct such interconnections several years ago. There is a need for an on-going commitment on the part of communities and the state to ensure that wastewater treatment continues at the high level it currently appears to be at. Diligence with regard to maintenance and upgrading of infrastructure is also important.

5.2 Urban stormwater

Background

Sources

Water that runs off the land after a rainfall or snowmelt event is considered stormwater (MN Stormwater Manual, 2005). Pervious surfaces allow stormwater to infiltrate into the ground whereas impervious surfaces and saturated soils cause the water to runoff. As the water flows it may pick up pollutants from the surface such as sediment, pesticides, and fecal material.

In an urban environment fecal material sources include pet waste, wildlife, sanitary sewer leaks, illicit connections to storm sewers, and in some cases septic systems (MPCA, Protect W qual, Date?). The fecal material then contributes phosphorus, nitrogen and pathogens (bacteria and viruses) to the receiving waters - streams, rivers, lakes, and wetlands (MN Stormwater Manual, 2005). The U.S. Environmental Protection Agency's National Urban Runoff Project (NURP) looked at fecal coliform levels in stormwater at 17 sites across the nation. NURP found that coliform bacteria were present at high levels in urban runoff at levels that exceed EPA water quality criteria at the time of and soon after storm events (EPA, 1999).

Although some potential source categories of fecal coliform bacteria are known, identifying the exact sources for reduction can be difficult. For example, pets may not be common in a certain area while birds may be (Jones, 2003). A study by Young and Thackston (1999) found that the density of housing, population, development, percent impervious area, and apparent domestic animal density were related to fecal bacteria levels. In the Vermillion River watershed, the Middle and North Creek Bacteria Study has been initiated to help identify fecal coliform sources within a more urban environment. One of the upstream tributaries in the Vermillion River Watershed is located in a fully developed suburban environment, devoid of any individual septic systems. However, fecal coliform concentrations in this stream remain well above the state standard for much of the growing season and under a variety of flow regimes. Identification of fecal coliform sources in these types of urban environments within the Lower Mississippi River Basin remains challenging.

Regulation

A municipal separate storm sewer system (MS4) is a conveyance or system of conveyances (roads with drainage systems, municipal streets, catch Basins, curbs, gutters, ditches, man-made channels, storm drains):

- Owned or operated by a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage districts, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act that discharges to waters of the United States;

- Designed or used for collecting or conveying stormwater;
- Which is not a combined sewer; and
- Which is not part of a publicly owned treatment works.

In Minnesota, stormwater discharges from MS4s are regulated through the use of National Pollutant Discharge Elimination System (NPDES) permits. NPDES permits are legal documents. Through this permit, the owner or operator is required to develop a stormwater pollution prevention program (SWPPP) that incorporates best management practices (BMPs) (MPCA, MS4 web page). Phase I of the program covers large municipalities (population 100,000 or greater) such as Minneapolis and St. Paul. Phase II of the NPDES rules covers MS4s located in "urbanized areas" and on a case-by-case basis those MS4s located outside of urbanized areas (MPCA, 2001). Table 8 provides a list of the MS4s in the Lower Mississippi River Basin and their populations.

A General Permit for stormwater discharge (Permit No. MNR040000) went into effect on June 1, 2006. The MS4 permit has six program elements that are called "minimum control measures" which the permittee must implement:

1. Public Education and Outreach
2. Public Participation/Involvement
3. Illicit Discharge Detection and Elimination
4. Construction Site Runoff Control
5. Post Construction Runoff Control
6. Pollution Prevention/Good Housekeeping

Permitees need to evaluate the effectiveness of their chosen BMPs to determine whether the BMPs are reducing the discharge of pollutants from their systems to the "maximum extent practicable". Implementation of BMPs will help to reduce fecal coliform in stormwater.

As part of that General Permit, MS4s that discharge to an "impaired water" for which there is a total maximum daily load (TMDL) allocation for stormwater sources must meet special conditions (see permit Part IV.D). According to Part IV. D: "*You must review whether changes may be warranted in your Storm Water Pollution Prevention Program to Reduce the impact of your discharge. If a USEPA-approved TMDL(s) has been developed, You must review the adequacy of your Storm Water Pollution Prevention Program to meet the TMDL's Waste Load Allocation set for Storm Water sources. If the Storm Water Pollution Prevention Program is not meeting the applicable requirements, schedules and objectives of the TMDL, Your must modify your Storm Water Pollution Prevention Program, as appropriate, within 18 months after the TMDL Waste Load Allocation is approved*."

The MS4 systems in the Lower Mississippi River Basin will need to be mindful of the Fecal Coliform TMDL and the need to comply with the above regulation in relation to that TMDL.

Table 8 - MS4s in the Lower Mississippi River Basin

Mandatory Small MS4 (updated June 22, 2006)	Population (U.S. Census 2000)	Housing Units (U.S. Census 2000)
City of Apple Valley	45,527	16,536
Cascade Township	3,183	1,103
Dakota County	NA – permit covers county owned and operated facilities	NA
Empire Township	1,638	524
City of Farmington	12,365	4,233
Haverhill Township	1,601	543
Houston County	1,020	459
City of Lakeville	43,128	13,799
Marion Township	6,159	2,244
MNDOT Outstate District	NA – permit covers state roadways and maintenance facilities	NA
Olmsted County	NA – permit covers roadways inside the urbanized area	NA
City of Rochester	85,806	35,346
Rochester Community /Technical College	NA	NA
Rochester Township	2,916	1,024
City of Rosemount	14,619	4,845
Total	**217,962**	**79,656**

MS4s population 10,000 or more and MS4s population 5,000 or more (located within ½ mile of a river, lake or stream with a TMDL)	Population (U.S. Census 2000)	Housing Units (U.S. Census 2000)
Albert Lea	18,356	8,133
Austin	23,314	10,261
Faribault	20,818	7,668
Hastings	18,204	6,758
Northfield	17,147	5,119
Owatonna	22,434	8,940
Red Wing	16,116	6,867
Winona	27,069	10,666
Waseca (Discharge to Clear Lake, Impaired Water)	8,493	3,563
Total	**171,951**	**67975**

Reduction Strategies

Urban stormwater management is an important component of fecal coliform reduction in the basin. Many of the MS4 systems are being issued their first stormwater permits in 2007. Given that there will be many new permits and that management of urban fecal coliform sources is a developing science, it follows that it may take several permit cycles to evaluate and understand the effectiveness of the following management practices.

Activity	Partners	Barriers
Reduce geese populations (mostly in park areas and stormwater ponds)	USFWS, DNR, MS4 Communities, Citizens	Mowing parks near water, longer grass could discourage geese. Public perception, federal and state hunting laws
Inspections of foundation drains to locate and disconnect clear water sources to sanitary sewer to avoid overflows.	City staff, citizens, private contractors	Public perception/willingness to cooperate
Inflow and Infiltration (I&I) control measures (reduce clear water infiltration)	City staff, private contractors	Cost
Combined Sewer Overflow and Sanitary Sewer Overflow control measures	City staff, private contractors	Cost
Creation of stormwater treatment facilities (infiltration/filtration Basins, wetlands, buffer strips, biofiltration)	MS4 officials and staff, SWCD, DNR, MPCA, contractors, citizens.	Retrofits are difficult, as land is typically not readily available in areas where large storm sewers discharge (i.e. adjacent to lakes). In general, the cost of land is prohibitive Also need adequate wildlife management to control geese near ponds or fecal coliform will increase.
Small-scale stormwater treatment (routing downspouts to yard, rain gardens, rain barrels)	MS4 officials and staff, SWCD, DNR, MPCA, contractors, citizens.	Education, construction norms
Educating dog park users about pet waste collection	MS4 staff, local watershed organizations, veterinarians, humane society	Lack of staff time to ID effective communication methods, develop and distribute educational materials
Establishing and maintaining riparian buffers at dog parks	MS4 Park and Recreation departments	Money to design and install effective plantings
Providing more general education to pet owners	Pet shelters, veterinarians, neighborhood associations, local watershed organizations, MPCA	Lack of staff time to ID effective communication methods, develop and distribute educational materials
Developing a public awareness campaign for urban areas regarding stormwater	MPCA, SWCD, BWSR, MS4 communities, watershed organizations.	Lack of staff time to ID effective communication methods, develop and distribute educational materials
Source identification	MS4, MPCA, local watershed groups, Met Council	Funds and staff time for monitoring and research
Street Sweeping	City Staff	Cost
Illicit Discharge Detection and Elimination (mapping, inspections, ordinances)	City Staff	Staff time

Best Management Practices specific to addressing fecal coliform pollution in MS4s have also been tabulated in a draft summary sheet authored by MPCA and local MS4s:

Fecal Coliform BMP Summary Sheet

Public Education

- Evaluate existing ordinances or develop ordinances regarding the management of pet waste
- Develop a public awareness campaign for urban storm water management, in general
- Develop and distribute educational materials specifically about pet waste management

Public Participation

- Install pet waste bag dispensers at key locations for public use.

Illicit Discharge Detection and Elimination

- Map the storm water management system (e.g., iInventory existing BMPs within each storm water drainage area)
- Inspect a minimum of 20% of outfalls per year
- Identify illicit discharges and develop a plan to eliminate them
- Identify discharges to your conveyance system from permitted industrial and commercial storm water
- Determine the importance of Combined Sewer Overflows and wastewater bypasses
- Identify cross-connections between the sanitary and storm sewer systems (e.g., inspect foundation drains to locate and disconnect clear water sources to sanitary sewers to avoid overflow)
- Implement an inflow/infiltration assessment and correction program (e.g., slip line old inflow and infiltration prone sections of sanitary sewers)
- Develop and implement a response plan for reports of sanitary sewer overflows
- Extend municipal sewer service to areas with failing septic systems
- Provide a dump station for RV waste

Construction Site Erosion and Sediment Control

- Develop a regulatory program for erosion and sediment control on construction sites

Post-Construction Storm Water Management

- Identify wildlife population centers and evaluate source control BMPs (e.g., wildlife feeding bans, permits to oil and shake eggs, goose harassment programs, special hunts, etc,) or treatment BMPs (e.g., riparian buffers) in these areas
- Identify effective structural BMPs (e.g., wet detention basins, infiltration/filtration basins, constructed wetlands, bioretention systems, sand filters, riparian buffers, etc.) and develop a strategy for implementing them (MPCA can provide additional guidance on structural BMPs that are effective for fecal coliform bacteria)
- Develop an urban forestry program

- Consider the development of a modeling program or monitoring plan to evaluate fecal coliform bacteria load reductions (monitoring could include BMP effectiveness monitoring, source identification, and BMP maintenance monitoring)
- Disconnect impervious surfaces to promote infiltration/filtration (e.g., disconnecting roof gutters and downspouts so they drain to vegetated areas)

Good Housekeeping for Municipal Operations

- Street sweeping
- Inspect and maintain structural BMPs

The Basin Scoping Document Strategy 4A (BALMM,2001) includes some additional recommendations, many of which address fecal coliform pollution directly or indirectly:

<u>Action 1</u>: Encourage municipalities and local units of government to consider ordinance requirements for Better Site Design (BSD) also know as Low Impact Development (LID). Better Site Design promotes more green space and less imperviousness along with better natural areas preservation. BSD coupled with appropriate Best Management Practices (BMPs) such as swales and wet detention ponds provide for the least impact to wetlands, lakes and streams. BSDs minimize runoff generation up front instead of trying to retrofit BMPs. Traditional development plans should be revisited at the earliest possible phase in the approval process, particularly with regard to minimizing road lengths, widths, and *cul de sac* designs, decreasing large lot sizes and peak parking lot sizing designs.

<u>Action 2:</u> Encourage all communities to adopt the principles of the EPA Phase II Construction Stormwater requirements. While only certain communities are required to obtain the Municipal Separate Storm Sewer System (MS4, NPDES) permits, the principal requirements should guide all communities in their development decisions

<u>Action 3: Protect cool water streams.</u>
Communities should require protection of the temperature status of cold- water streams. Practices that promote infiltration and maintain or increase the base flow of streams should be encouraged. Pre-treatment for pollutants may also be required for protection of ground water quality.
<u>Action 4:</u> Encourage all communities to set minimum stormwater standards by policy or ordinance. Some examples might be:

- No new direct discharges without treatment for sediment or other pollutants.
- Maximize ground water recharge. Runoff peaks and volumes controlled to not exceed stream geomorphology limits.
- Special protection for critical areas.

<u>Action 5</u>: Ensure that there are plans for BMP maintenance. Support local, county, and state efforts to enforce the existing ordinances or rules.

<u>Action 6</u>: Support the development of stormwater alternative management or BSD demonstration projects.

Finally, it is recommended that urban stormwater monitoring occur in one or several representative urban or suburban watersheds to establish a baseline level of impairment against which the effectiveness of future stormwater runoff prevention or treatment measures can be evaluated.

In addition to the MS4 system permits and SWPPPs, documents/plans for stormwater reduction and treatment for parts of the Basin also exist such as: the South Zumbro Watershed Storm Water and Capitol Improvement Plan (September 2003) for Olmsted and Dodge County, the Vermillion River Watershed Plan (November, 2005), and many other city and county water plans. While these plans may not have been designed specifically to reduce fecal coliform the implementation steps for stormwater reduction will have that affect.

Indicators of Progress / Milestones

For MS4 Permittes:

1. MS4 Permittees submit permit applications and SWPPs: 2006 or 2007.
2. Permittees assess reduction needs, determine whether SWPPP should be modified: 2007 – 2011.
3. SWPPP Implementation: 2007-2011.

General Indicators

4. Public education campaigns are in effect in for all MS4s and other small communities in the Lower Mississippi River Basin regarding fecal coliform reduction 2007 – 2011 (this is part of SWPPP implementation, but could be greater than just MS4 communities).
5. Case studies featuring stormwater reduction efforts of Lower Mississippi River Basin communities completed by 2011.
6. Stormwater sector adopts practices to achieve fecal coliform reductions by 2021.
7. Develop system to tract BMPs in small towns by 2011.

Critical Areas

- Surface waters for which a significant percentage of drainage is urban land area
- Dog parks along riparian areas
- Geese congregating areas
- Vermillion River Watershed – Middle and North Creek subwatersheds

5.3 Livestock facilities requiring NPDES permits (Revised TMDL, April 2006)

The MPCA currently uses the federal definition of a Concentrated Animal Feeding Operations (CAFO) in its regulation of animal feedlots. In Minnesota, the following types of livestock facilities are issued, and must operate under, a National Pollutant Discharge Elimination System (NPDES) permit: a) all federally defined (CAFOs), some of which are under 1000 animal units in size; and b) all CAFOs and non-CAFOs which have 1000 or more animal units.

There are presently 137 livestock facilities or feedlots operating under NPDES permits in the Lower Mississippi River Basin of Minnesota; 103 within the impaired reach watersheds covered in this report. These feedlots must be designed to totally contain runoff, and manure management planning requirements are more stringent than for smaller feedlots. In accordance with the State of Minnesota's agreement with EPA, CAFO's with state-issued General NPDES permits must be inspected twice during every five year permitting cycle and CAFO's with state issued Individual NPDES permits are inspected annually.

The vast majority of livestock facilities in the Lower Mississippi River Basin in Minnesota are not CAFO's subject to NPDES permit requirements. Nevertheless, they are subject to state feedlot rules which include provisions for registration, inspection, permitting, and upgrading. Much of this work is accomplished through delegation of authority from the state to county government.

5.4 Straight pipe systems

Under the 2006 “straight pipe” law (MN Statute Section 115.55), a straight-pipe system means “a sewage disposal system that transports raw or partially settled sewage directly to a lake, a stream, a drainage system, or ground surface.” Straight pipe systems are considered imminent threats to public health. One aspect of MCEA’s legal challenge of the original TMDL report was that straight pipe septic systems should treated as point sources and thus be included in the wasteload allocation of the TMDL. This was upheld by the court on the grounds that a “pipe is a pipe, and the straight pipe system should be considered a point source and thus incorporated into the wasteload allocation”.

Because straight pipe systems are illegal they have been given a zero wasteload allocation. This does not mean that straight pipe systems do not contribute to the total load of fecal coliform in southeast Minnesota. In fact, each county in the Basin may have up to several hundred or more straight pipe systems which are contributing significantly to the total load of fecal coliform in the Basin. The zero wasteload allocation given to straight pipe septic systems in the revised TMDL means that to reach the total allowable load of fecal coliform set out in the TMDL, straight pipe systems must be upgraded to compliant septic systems so as to contribute a zero wasteload in the Basin.

A straight pipe system contributes a much greater fecal coliform load than a nonconforming or failing septic system because the untreated or partially treated wastewater is transported directly to surface water. In contrast a nonconforming or failing septic system does have some degree of soil treatment. Due to greater fecal coliform loading by a straight pipe system and a greater risk to human health, management measures designed to address straight pipe systems should be given priority over management measures designed to address failing septic systems by local governments and by state and federal agencies when reviewing applications for funding. Recommended management measures are laid out in Section 4.4. Community facilitators and ISTS inventories which include onsite inspections are especially effective management measures to precipitate the upgrade of straight pipe septic systems.

6.0 Source reduction

The Revised Fecal Coliform TMDL (April, 2006) document provides the wasteload and load allocations for each impaired reach in the Basin. The wasteload allocations included: permitted wastewater treatment facilities, communities subject to MS4 NPDES requirements, livestock facilities requiring NPDES permits, and straight pipe systems. The load allocation section encompasses all the non-point sources such as: feedlots, manure management, overgrazed pastures, and ISTS. The contribution for each source category and thus the loads vary based on flow zones – high, moist, mid, dry, and low. Values are expressed in trillion organisms per month and percent of total monthly loading capacity.

This section of the implementation plan provides a table (Table 9) depicting the source areas where reductions will be required for each impaired reach. Some of the source reduction will need to take place upstream of impaired reaches rather than within the reach itself. For example, the Cannon River, Pine Creek to Belle Creek, has no MS4 Communities within its watershed, however there are MS4 Communities upstream will contribute to the fecal coliform concentrations in this reach. The existence of straight pipe systems for waste discharge are illegal and as such are not given a load allocation in the TMDL. However, they still exist and need to be remediated, so they are included as a source reduction category.

Permitted wastewater treatment facilities are anticipated to remain at or below their permit limits (which equals the load allocation in the TMDL). Reduction from these facilities will need to be taken into account internally at the plants, if the communities they serve increase in size, as they will not be able to legally exceed their permit limits for fecal coliform. Fecal colifrom discharge is reported by the facilities in their Discharge Monitoring Reports. Livestock facilities with NPDES Permits are not allowed to discharge their waste. It is important to document that these facilities exist in some reaches or upstream of them, so that they can be evaluated periodically to ensure they are handling waste as permitted. Some cases of accidental discharge could occur releasing large quantities of fecal coliform to the water. Wastewater treatment facilities and livestock facilities with NPDES permits are not expected to require source reductions and are not included in Table 9.

The following assumptions were made, and helped to prioritize source reductions for each reach:

1. Reviewed the Revised TMDL document and noted the sources listed under each reach.
2. All reaches had cultivated land as a land use. The assumption was made that if cultivated land was present then manure management could be an issue through land application of manure.
3. Feedlots are assumed to be present in all reaches.
4. Reaches with greater than 10% of the land use listed as grassland were marked off for Pastures. The assumption was made that these areas were more likely to have grazing. Some other reaches have been marked for pastures based on information provided by stakeholders.
5. MS4 systems were listed in the Revised TMDL for the reaches they are in.
6. Straight Pipes are assumed to exist in all reaches, unless information from stakeholders indicated otherwise.

Table 9 - Source reduction focus areas per impaired reach

Watershed	Impaired Stream Reaches	AUID	Pastures	Feedlots	Manure Management	ISTS	MS4	Straight Pipes
Vermillion River	Vermillion River, South Branch Vermillion River to Hastings Dam	07040001-506		X	X	X	X	X
	Vermillion River, Below trout stream portion to South Branch Vermillion River	07040001-507		X	X	X	X	X
Cannon River	Cannon River, Pine Creek to Belle Creek	07040002-502		X	X	X	X	X
	Straight River, Maple Creek to Crane Creek	07040002-503		X	X	X	X	X
	Prairie Creek, Headwaters to Cannon River	07040002-504		X	X	X		X
	Rush Creek; Headwaters to Straight R	07040002-505		X	X	X		x
	Cannon River; Northfield Dam to Lk Byllesby inlet	07040002-509		X	X	X	X	X
	Unnamed Creek; Headwaters to Prairie Cr	07040002-512		X	X	X		X
	Unnamed Tributary to Prairie Creek; Unnamed Cr to Unnamed Cr	07040002-513		X	X	x		X
	Straight River; Rush Cr to Cannon R	07040002-515		X	X	X	X	X
	Crane Creek; Headwaters (Watkins Lk) to Straight R	07040002-516		X	X	X	X	X
	Straight River; CD #25 to Turtle Cr	07040002-517		X	X	X		X
	Turtle Creek; Headwaters to Straight R	07040002-518		X	X	X		X
	Maple Creek; Headwaters to Straight R	07040002-519	X	X	X	X	X	X

Watershed	Impaired Stream Reaches	AUID	Pastures	Feedlots	Manure Management	ISTS	MS4	Straight Pipes
Cannon River (continued)	Chub Creek; Headwaters to Cannon R	07040002-528	X	X	X	X		X
	Straight River; Turtle Cr to Owatonna Dam	07040002-535		X	X	X	X	X
Whitewater River	Whitewater River, South Fork; Headwaters to trout stream portion	07040003-505	X	X	X	X		X
	Whitewater River, South Fork; trout stream portion above N Fk Whitewater R	07040003-512	X	X	X	X		X
	Whitewater River, Middle Fork; trout stream portion	07040003-514	X	X	X	X		X
	Garvin Brook; Class 1B, 2A, 3B portion	07040003-542	X	X	X	X		X
	Logan Branch; End trout stream portion to North Fk Whitewater R	07040003-536	X	X	X	X		X
	Whitewater River, North Fork; Unnamed Cr to Unnamed Cr (below Class 7)	07040003-553	X	X	X	X		X
	Whitewater River, North Fk; Unnamed Cr to Mid Fk Whitewater R	07040003-554	X	X	X	X		X
	Stockton Valley Creek; Trout stream portion to Garvin Br	07040003-559	X	x	X	X		x
Zumbro River	Zumbro River; West Indian Cr to Mississippi R	07040004-501	X	X	x	X	X	X
	Zumbro River; Cold Cr to West Indian Cr	07040004-502	X	X	X	X	X	X
	Salem Creek; Lower 15 miles (Class 2c portion) to South Fk Zumbro R	07040004-503	X	X	X	X		X
	Zumbro River, South Fk; Cascade Cr to Zumbro Lk	07040004-507	X	X	X	X	X	X

Watershed	Impaired Stream Reaches	AUID	Pastures	Feedlots	Manure Management	ISTS	MS4	Straight Pipes
Zumbro River (Continued)	Zumbro River, South Fork;Silver Lk Dam to Cascade Cr	07040004-533	X	X	X	X	X	X
	Zumbro River, South Fork; Bear Cr to Oakwood Dam	07040004-535	X	X	X	X	X	X
	Zumbro River, South Fork; Salem Cr to Bear Cr	07040004-536	X	X	X	X	X	X
Root River	Root River; Thompson Cr to Mississippi R	07040008-501	X	X	X	X		X
	Robinson Creek; Headwaters to N Br Root R	07040008-503		X	X	X		X
	Money Creek; End of trout stream portion to Root R	07040008-521	X	X	X	X		X
	Root River, South Branch; Canfield Cr to Willow Cr	07040008-555	X	X	X		X	
	Root River, South Branch; Headwaters to Class 1B, 2A, 3B	07040008-586		X	X		X	X
Cedar/Shell Rock Rivers	Cedar River, Roberts Creek to Austin Dam	07080201-502		X	X	X		X
	Cedar River, Rose Creek to Woodbury Creek	07080201-501		X	X	X	X	X
	Shell Rock River, Albert Lea Lake to Goose Creek	07080202-501		X	X	X	X	X

7.0 Monitoring

In order to determine the effectiveness of source reduction strategies, it will be necessary to monitor fecal coliform levels.

7.1 Review of existing monitoring

There are several groups and agencies that are currently monitoring waters in the Lower Mississippi River Basin for fecal coliform. A list of these groups, sites and frequency of monitoring is provided in Table 10.

Table 10 – Current fecal coliform monitoring activities

Watershed	Organization	Sites	Frequency
Lower Mississippi River Basin	MPCA	Milestone Monitoring program has 10 sites (see table 11) Seven are tributary sites and three are main stem Mississippi River sites.	10 samples collected in 2 out of 5 years, sites were monitored in 2006
Vermillion River	Metropolitan Council	River Monitoring Program, 3 sites	40 times per year (began E. coli in 2006)
	Vermillion River Watershed Joint Powers Organization	Vermillion River Monitoring Network, 7 sites	Approximately 15 grab samples per year
		Middle and North Creek Bacteria Study, 12 sites	Five times a month during the growing season, began in 2006
Straight River	Steele County Environmental Services	Seven sites on the Straight river in Steele County	One sample per week April-October, 2004-2006 as part of 319 project. This will continue in 2007.
Cannon River	Cannon River Watershed Partnership (Upper Cannon Assessment Project)	6 sites on Cannon River from Shields lake to Cannon Lake	Five samples per month April-Oct in 2007 and 2008
Cannon River	Cannon River Watershed Partnership (Surface Water Assessment Project)	Several sites each on the Little Cannon River, Belle Creek, Spring Brook, also the Cannon River from Faribault to Northfield	Five samples per month April-Oct in 2007 and 2008

Watershed	Organization	Sites	Frequency
Cannon River	North Cannon River Watershed Management Organization	6 sites in the Chub Creek watershed monitored every 4 years	Monthly low flow and event samples
Root River	Fillmore County SWCD	One site on the South Branch Root River in Forestville State Park	Two per month year round, since 1998
	Fillmore County SWCD	Twenty five subwatersheds	Three times a year: spring snowmelt, summer runoff event, summer baseflow
	MDA	Grazing Study 3 small watersheds with uniform land use	Samples of runoff during rainfall events as well as runoff generated by a rainfall simulator

Table 11 : MPCA Milestone Monitoring Sites in the Lower Mississippi River Basin

River Basin	ID Number	Site Location
Lower Mississippi	VR-32.5	VERMILLION R BR ON BLAINE AVE 4 MI NE FARMINGTON
	CA-13	CANNON RIVER AT BRIDGE ON CSAH-7 AT WELCH
	ST-18	STRAIGHT R NEAR CSAH-1 1 MI SE OF CLINTON FALLS
	UM-738	MISSISSIPPI R LOCK & DAM #5 3 MI SE OF MINNEISKA
	WWR-26	WHITEWATER R S FK N OF CR-115 3.5 MI NW OF UTICA
	GB-4.5	GARVIN BROOK AT CSAH-23, SW OF MINNESOTA CITY
	ZSF-5.7	ZUMBRO R S FORK AT CSAH-14, 3 MI N OF ROCHESTER
	UM-698	MISSISSIPPI R BELOW US-14 BRIDGE AT LA CROSSE
	UM-714	MISSISSIPPI R LOCK & DAM #6 AT TREMPEALEAU, WIS
	RT-3	ROOT RIVER AT BRIDGE ON MN-26 3 MI EAST OF HOKAH
	CD-10	CEDAR RIVER AT CSAH-4, 3 MILES SOUTH OF AUSTIN
	CD-24	CEDAR RIVER AT CSAH-2, 0.5 MILES EAST OF LANSING
	SR-1.2	SHELL ROCK R BR ON CSAH-1 1 MI W OF GORDONSVILLE

7.2 Future Monitoring

The Revised TMDL (April 2006) indicates that a monitoring system will take place through a Basinwide initiative as well as a targeted watershed component. Much of the existing monitoring will continue in the future.

The Basinwide component consists of a repetition of intensive monitoring of fecal coliform bacteria concentrations at Minnesota Milestone sites that took place in 1997/1998. This monitoring was conducted five times per month during the recreational use season, with monthly geometric means calculated to determine whether the standard of 200 org./100 ml was being exceeded or not. This will be repeated in 2007/2008 .

In addition, targeted watersheds will be monitored in 2008/2009. In addition to comparing geometric monthly means from both time periods, a comparison will be made of samples taken at lower flows during dry weather periods, when continuous sources such as ISTS are believed to dominate fecal coliform loadings. This will be done in the following watersheds: Prairie Creek, Straight River, Vermillion River, Whitewater River, South Branch Root River, and Cedar River watersheds.

A water quality assessment (305b), based on monitoring data collected within the previous ten years at these and other sites (maintained by Met Council, Corps of Engineers, etc.), is scheduled for 2009 and at five-year intervals thereafter. This baseline monitoring system will be used to assess whether streams of the Basin are in full support, partial support, or nonsupport of designated water uses, based on concentrations of fecal coliform bacteria and other parameters.

The MPCA will be responsible for implementing this monitoring plan, with assistance from partners in the target watersheds listed above. Possible funding for the various components of this monitoring plan include section 319 nonpoint source funds and Clean Water Legacy funds.

During discussions with stakeholders several issues important to monitoring were raised:

1. A monitoring plan should be developed for the Basin to include the existing sites (such as MPCA Milestone sites), impaired reaches, and reaches that still need assessment.
2. There is a need for monitoring of small sections of impaired reaches before and after BMPs and other reduction activities take place to evaluate effectiveness of these efforts.
3. Monitoring should occur on all existing impaired reaches each year at several locations and during various flow conditions.
4. Collection, analysis and dissemination of all monitoring data should be done on a yearly basis. MPCA and local partners should make a concerted effort towards dedicating staff to this task and should publish a report on the data annually.
5. Research projects should be conducted to help identify sources of fecal coliform, especially in suburban and urban watersheds which have no obvious sources.
6. Presently, changes to some of the water quality standards in Minn. Rules Ch. 7050 are being proposed. Among those changes are shifting from fecal coliform to *E. coli*, which is being set at an equivalent level to provide an equivalent level of protection. Specifically, the change takes into account water analysis studies that show an average of 63 percent of fecal coliform bacteria to be *E. coli* and, thereby, sets *E. coli* standards, for most situations, at that percentage of the current fecal coliform standard (e.g., monthly geometric mean of 126 *E. coli* bacteria/100 ml). Therefore, to adapt fecal coliform TMDL allocations to the future *E. coli* standard a simple ratio of 0.63 should be applied.

7.3 Low Cost Alternatives

The current methods for evaluating a water body for fecal coliform contamination require submittal of a grab sample to a certified laboratory. Samples should be collected five times per month so that a geometric mean value can be calculated. This process is somewhat time consuming and can become expensive. Local watershed groups with citizen volunteers have expressed interest in knowing if a water body has high levels of fecal coliform and would like to be able to determine this in a simple, low cost manner. The Citizen Monitoring Bacteria Project (which included volunteers from Minnesota), a study of low-cost E. coli analysis methods, found there were four methods that worked well for volunteers: IDEXX Colilert Quanti-Tray, IDEXX Colisure Quanti-Tray, Coliscan Easygel incubated at 35°C, and the 3M Petrifilm (O'Brien, 2006). The results from these methods compared well with laboratory results. Vail et. al. (2003) found also a significant correlation between E. coli counts from environmental water samples analyzed using the 3M Petrifilm and three common laboratory methods.

While Minnesota may not be ready to approve these methods for use in categorizing a water body as impaired, it would be a useful tool for screening and monitoring streams and rivers for *E. coli*. This could be used in a variety of ways such as: to enhance classroom education, volunteer knowledge, public awareness, local decision making, targeting resources, and general water quality assessment.

7.4 Research & Development

In addition to monitoring for both assessment and effectiveness purposes, there are needs in the areas of research and the development of tools in order for implementation of mitigation measures and BMPs to move forward effectively and efficiently. These include, but are not limited to:

- Sources of fecal coliform in cities and urban areas
- Load reduction capabilities for applicable structural and non-structural BMPs
- Models to evaluate loading sources and track fecal coliform load reduction
- Methods to evaluate pollutant migration pathways and delivery mechanisms from fecal coliform sources to surface waters
- DNA "fingerprinting" to identify sources of fecal coliform

Such research would further understanding of pathogens in surface water, and greatly support both future TMDL studies and implementation efforts by allowing for more quantified approaches to both. A goal of this implementation plan is to encourage such research and development.

8.0 Coordination

8.1 Roles and Responsiblities

From the very beginning of the Regional Fecal Coliform TMDL Project, a broad array of state and local agencies and stakeholders have been involved through the Basin Alliance for the Lower Mississippi in Minnesota (BALMM). This locally led alliance of land and water resource agencies formed in late 1999 in order to coordinate efforts to protect and improve water quality in the Lower Mississippi River Basin.

The MPCA has had the main responsibility for completing the revised Regional TMDL study. However, ensuring that the source-reduction objectives and water quality targets of the Regional TMDL are met is very much a shared responsibility. The following grid shows the main local, state and federal agencies responsible for the key fecal coliform source-reduction categories.

Table 12: Agency Roles and Responsibilities for Fecal Coliform Source-Reduction Categories

Source-Reduction Category	Leading Local Agencies	Leading State Agencies	Leading Federal Agencies
Feedlot Runoff	Counties, SWCDs	MPCA, BWSR	NRCS
Manure Management	Extension, SWCDs, Counties	MPCA, MDA, BWSR	NRCS
Pasture Management	SWCDs, Extension	BWSR, MDA	NRCS
ISTS	Counties	MPCA, PFA, BWSR (Ag BMP loans)	EPA
Small Communities with Inadequate Wastewater Treatment	Counties	MPCA, PFA	EPA, USDA Rural Development
Urban Stormwater	Municipalities, Counties, SWCDs, Townships, MNDOT	MPCA	EPA
Municipal Wastewater	Municipalities	MPCA	EPA
Shoreland Management	SWCDs, Counties	DNR, MPCA	NRCS, USFWS
Conservation Tillage	Extension, SWCDs	BWSR, University of Minnesota	NRCS

As is evident from Table 12, a large number of agencies at the local, state and federal level are responsible for the source-reduction management activities. However, the key strategies of the implementation plan for fecal coliform source reduction are built on a foundation of local government and local watershed organization program activity. Coordinating these activities to ensure that effective and workable strategies are developed and implemented in a timely fashion is the role of state and federal agencies such as BWSR, MPCA, and NRCS. The following are regional groups which can play an important role in augmenting the local county government programs to the implement source reduction strategies which will meet the water quality objectives of the Regional TMDL.

Basin Alliance for the Lower Mississippi in Minnesota (BALMM) provides overall coordination amongst local, regional, state and federal agencies concerned with natural resources management in the Basin. The Lower Mississippi River Basin Plan Scoping Document 2001 developed by BALMM contains water quality objectives upon which there is broad agreement. This includes achievement of the fecal coliform bacteria standard within the decade. The Basin plan also includes strategies for achieving water quality objectives.. BALMM provides ongoing coordination among agencies through monthly meetings, a regular e-mail newsletter, and widely recognized leadership with regard to regional water quality management.

Members of the Alliance include Soil and Water Conservation District managers, county water planners, and regional staff of the Board of Soil and Water Resources, Pollution Control Agency, Natural Resources Conservation Service, U.S. Fish and Wildlife Service, University of Minnesota Extension, Department of Natural Resources, the Southeastern Minnesota Water Resources Board, the Cannon River Watershed Partnership, Zumbro River Watershed Partnership, the City of Rochester and others. BALMM is coordinated by Norman Senjem at the MPCA.

The Southeast Minnesota Water Resources Board (SEMWRB) is a joint powers board of eleven counties: Dodge, Fillmore, Goodhue, Houston, Le Sueur, Mower, Olmsted, Rice, Steele, Wabasha, and Winona. The SEMWRB continues to play an active role in coordinating county activities in the Basin with respect to feedlots (working to reduce runoff from small feedlots through implementing the Open Lot Agreement) and ISTS.

Southeast Minnesota SWCD Technical Support Joint Powers Board is a joint powers board of 11 Southeast Minnesota SWCDs that provides additional engineering and technical assistance to nonpoint source pollution control projects in the Basin, with a concentration on feedlots. The JPB receives funding from BWSR and challenge grants to employ engineers and feedlot technicians who provide free assistance to producers for cost-share projects.

Area 7, Minnesota Association of Soil and Water Conservation Districts Association – an association that takes a leading role in promoting soil conservation practices including conservation tillage and urban/suburban stormwater management.

Cannon River Watershed Partnership – A nonprofit organization that coordinates water quality monitoring, restoration, and implementation activities within the Cannon River watershed.

Zumbro River Watershed Partnership – A non-profit organization, formed with a mission "To Promote the Protection and Improvement of the Zumbro River Watershed". The organization is member driven, with a strong partner connection to provide the best community and professional attention to watershed topics.

Whitewater River Watershed Partnership – A joint powers board of SWCDs and counties in Winona, Wabasha and Olmsted Counties, which coordinates assessment and implementation activities in the Whitewater River watershed.

University of Minnesota Extension– The University takes a lead role in developing and promoting conservation tillage, and in conducting training and education on the proper management of ISTS.

8.2 Small Watershed Scale Approach

Scale is an important dimension to consider when planning implementation strategies to achieve water quality goals. When implementation activities began under the original Lower Mississippi Fecal Coliform TMDL Implementation Plan in 2003, a basinwide approach was initiated to address the sources of fecal coliform pollution. Implementation activities were initiated which focused on addressing the most widespread sources found throughout the Basin (e.g. feedlots, noncompliant septic systems, small communities with inadequate wastewater treatment) and to attain the greatest number of implemented BMPs and largest cumulative fecal coliform load reductions. At the time a basinwide approach was more efficient than attempting isolated efforts to raise the level of local activity in one county at a time.

Now that basinwide implementation activities have been underway for nearly 5 years, it is appropriate to look at more targeted implementation strategies focused on smaller spatial units, such as small watersheds. Due to the large geographic area, a basinwide approach looks at the sources of fecal coliform bacteria and the land use practices of the region in the aggregate. A small watershed scale approach focuses on scaling down an source reduction activity from the regional scale to the local scale. Focusing efforts on a small watershed scale offers the opportunity for source reduction activities that are targeted to the particulars of the watershed.

Framework

A small watershed approach depends, like a Basinwide approach, on involving a broad array of state, federal, and local agencies and stakeholders. For the purposes of this implementation plan, a small watershed is not defined in terms of acreage. It is more appropriate to define a small watershed as a watershed which is small enough so that it can be looked at spatially. To be effective, the agencies, organizations, and stakeholders participating in an implementation project focused on a small watershed must be able to conduct a source inventory that looks at all the point and non-point sources discussed in this implementation plan. For a small watershed scale implementation project to be successful, all of the agencies and organizations with responsibility and jurisdiction over source-reduction categories in the small watershed being targeted must participate in the project. As an example, if only the county feedlot officer, SWCD and NRCS participate in a small watershed project, reductions may occur from agricultural sources but not from ISTS and stormwater. An agency or organization that initiates and/or coordinates a small watershed project must involve all state, federal and local agencies and stakeholders from the very beginning of the planning of the project.

8.3 Suggestions for the future

During the course of revising this document surveys were sent to decision makers and stakeholders as well as having a meeting to discuss what the implementation plan should contain. Some of the suggestions and comments that were provided applied to a range of management measures and are listed here for consideration as we move into the future:

Suggestions/Comments

- Better assurance that the BMPs will be implemented. Voluntary is not enough, since that is what we have now, with the impairments.
- Good outreach materials available that include solid scientific data and results of data studies.
- Protect waters that are still in good shape (nondegredation); emphasize proactive protection.
- Move from “projects” to an institutionalized approach/operation/process/funding
- Legislature fully fund Clean Water Legacy Act
- Support grass-based livestock production.
- Increased perennial vegetation.

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