

METROPOLITAN COUNCIL ENVIRONMENTAL SERVICES 2002 STREAM MONITORING REPORT

Chapter 1: Introduction

Background: MCES Stream Monitoring Program

Storm water runoff in both urban and rural areas carries non-point source pollutants from diverse and widely scattered sources to Twin Cities Metropolitan Area (TCMA) streams and rivers. To determine the extent of non-point source pollutant loading from tributaries to the Mississippi, Minnesota, and St. Croix Rivers, to provide the information necessary for development of target pollutant loads for these tributary watersheds, and to evaluate the effectiveness of watershed best management practices for reducing non-point source pollution and improving water quality in streams and rivers, Metropolitan Council Environmental Services (MCES) and local partners are currently monitoring at 28 stations on 26 streams in the TCMA and in the vicinity of Mankato, MN. These streams are monitored during significant runoff events, such as snowmelt and heavy rainfalls, and during baseflow conditions, to help determine the sources and extent of non-point sources of pollution.

The MCES Stream Monitoring Program was initiated in the late 1980's. At that time, it was recognized that point source pollution controls alone would be insufficient to attain the water quality goals of the Federal Clean Water Act, as amended through 1987, in the Lower Minnesota River. During the 1988-1992 period, MCES built and began operating seven automated water quality monitoring stations on six major tributary streams in the Lower Minnesota River Basin within the TCMA. The purpose of these seven stations was to assess the nature and extent of non-point source pollution loading to the Lower Minnesota River via monitoring of stream flow and water quality conditions.

As concern about non-point source pollution impacts grew, MCES began expanding its stream monitoring program to the Mississippi and St. Croix River Basins as well. Several reasons have driven a rapid growth of the program since the mid 1990's. First, the Metropolitan Council is mandated by state law (MN Statute 473.157) to establish target pollutant loads for TCMA watersheds. Second, the collection of surface water quality information is relevant to the Metropolitan Council's regional planning and modeling efforts. Finally, the stream monitoring program presents an opportunity for MCES to stimulate and support water quality monitoring efforts at a local level, thereby promoting local resource stewardship and decision making. All of these objectives are important components of the Council's smart growth mission. In support of this multi-faceted mission, long-term stream monitoring data are critical for understanding non-point source pollutant impacts on water quality at the watershed level, and for documenting water quality improvements as non-point source best management practices are implemented in TCMA watersheds.

During the 1995-2000 period, MCES and local partners built and began operating 14 new stations in the TCMA. Of these 14 stations, several are no longer operational or are currently being operated by other governmental units, leaving nine stations that are now being operated by MCES and partners. During the 1998-2000 period, with state funding received from the Minnesota Legislature via a grant from the Minnesota Pollution Control Agency (MPCA), eight new stations were built in the TCMA and four new stations were built in the Middle Minnesota River Basin near Mankato, MN. The eight new TCMA stations are operated cooperatively by MCES and local partners, while the four new Middle Minnesota River Basin stations are operated cooperatively by MCES and the Minnesota Department of Agriculture (MDA).

A complete record of all MCES stream monitoring stations and their years of operation is available on the MCES website: <http://www.metrocouncil.org/environment/RiversLakes>. Also available on the website is detailed information about MCES river, lake, and wastewater treatment plant monitoring programs.

2002 Stream Monitoring Data

This report presents the 2002 annual monitoring data from 28 MCES stream monitoring stations. The 2002 hydrologic, water chemistry, and biological data and information for each of the 28 stations are presented in Chapter 2. Chapter 3 provides comparisons of 2001 and 2002 hydrologic and water chemistry data between streams and major river basins, and also examines compliance with water quality standards for trace metals, chloride, and bacteria.

Table 1 presents an alphabetical listing of all current MCES stream monitoring stations by major river basin (Mississippi, Minnesota, and St. Croix). Maps depicting monitoring station locations in the TCMA and in the vicinity of Mankato, MN (Middle Minnesota River Basin) are presented as Figures 1 and 2, respectively.

2002 Precipitation

Annual 2002 statewide total precipitation data and departure-from-normal precipitation data, obtained from the Minnesota State Climatology office, are presented in Figures 3 and 4, respectively. According to the State Climatology Office, 2002 precipitation totals in the TCMA ranged from 36 inches in the southwest portion of the region to 40 inches in the north-central, eastern, and southeastern portions of the region (Figure 3). Generally, most of the TCMA received 40 inches of precipitation. Each of the seven counties within the TCMA experienced a six- to ten-inch increase in precipitation compared to the normal level (Figure 4). In the vicinity of Mankato, MN, a drier precipitation pattern was evident, with 2002 precipitation totals ranging from 24 inches to 28 inches (Figure 3). Total precipitation amounts in the Mankato area were two to four inches below the normal level (Figure 4).

Compared to 2001, 2002 was a much wetter year in the TCMA, but a slightly drier year in the Mankato area. The seasonal distribution of precipitation was substantially different in 2002 than in 2001. Compared to the spring of 2001, when many of the MCES stream

monitoring stations experienced above-normal flow conditions and flooding, the spring of 2002 was characterized by very little snowmelt and runoff. While normal precipitation patterns were evident during the summer and fall of 2001, wet conditions prevailed in the TMCA during the summer and fall of 2002. Numerous heavy storms in 2002 led to higher than average stream flows and multiple sampling events in the TCMA. In the Mankato area, however, summer and fall precipitation patterns in 2001 were fairly similar to those in 2002.

Table 1. MCES Stream Monitoring Stations

Major Basin	Monitoring Station (Station Code)	Page Number
Mississippi River		
	Bassett Creek (BS)	9
	Battle Creek (BA)	17
	Beltline Interceptor (BT)	27
	Cannon River (CN)	31
	Crow River (CW)	39
	Crow River, South Fork (CWS)	47
	Fish Creek (FC)	55
	Minnehaha Creek (MH)	65
	Rum River (RUM)	75
	Vermillion River (VR)	83
Minnesota River		
Middle Minnesota River Basin (Near Mankato, MN)	Beauford Ditch (BD)	93
	Blue Earth River (BU)	101
	Le Sueur River (LE)	111
	Little Cobb River (LC)	121
Minnesota River		
Lower Minnesota River Basin (Twin Cities Metropolitan Area)	Bevens Creek, Lower (LBE)	131
	Bevens Creek, Upper (UBE)	141
	Bluff Creek (BL)	151
	Carver Creek (CA)	159
	Credit River (CR)	167
	Eagle Creek (EA)	173
	Nine Mile Creek (NM)	183
	Riley Creek (RI)	191
	Sand Creek (SA)	201
	Willow Creek (WI)	211
St. Croix River		
	Browns Creek (BR)	219
	Carnelian-Marine Outlet (CM)	229
	Silver Creek (SI)	237
	Valley Creek (VA)	247

Chapter 2: Stream Monitoring Station Information and 2002 Results

Organization of the 2002 stream monitoring data in Chapter 2 of this report is alphabetical by station name, within the three major river basins: Mississippi, Minnesota, and St. Croix. Information about each monitoring station is presented in the following format (x = Station Code, as indicated in Table 1):

Table 1.x: Monitoring Station Information

Figure 1.x: Monitoring Station Location and Watershed Characteristics

Figure 2.x: 2002 Hydrograph, Precipitation, and Sampling Information

Table 2.x: 2002 Water Chemistry Information

Table 3.x: 2002 Annual Loading Information for Suspended Solids and Nutrients

Figure 3.x: 2002 Hydrograph with Total Suspended Solids and Nitrate Nitrogen Concentrations

Figure 4.x: 2002 Hydrograph with Total and Dissolved Phosphorus Concentrations

Table 4.x: Comparison of 2001-2002 Hydrology and Water Chemistry

Table 5.x: 2002 Macroinvertebrate Monitoring Results and Metrics

Monitoring Station Information

General information about each stream monitoring station (location and drainage area, station operator, MCES contact information, watershed district or watershed management organization, a station overview, and 2002 monitoring year information) is presented in Table 1.x. A map depicting each monitoring station location, stream course, watershed boundary, and land use characteristics within the watershed is presented as Figure 1.x.

Monitoring Equipment, Methods, and Results

The following information on MCES stream monitoring equipment and methods is a generalized summary that is applicable to all stations. Some subtle variations exist between stations with regard to the equipment and methods used for monitoring. For detailed information about equipment and methods at a particular monitoring station, please refer to the stream monitoring section of the MCES website:

<http://www.metrocouncil.org/environment/RiversLakes>. A detailed “MCES Quality Assurance Program Plan for Stream Monitoring” is also available in the stream monitoring section of the website.

Flow Monitoring

Each automated monitoring station continuously records 15-minute data on water level (stage) and flow, along with temperature and conductivity. A rating curve is maintained during ice-free conditions. When winter ice cover creates very difficult conditions for accurate flow and rating curve measurements, winter flows are estimated. The annual 2002 stream hydrograph, based upon daily average flows, is presented in Figure 2.x.

Precipitation Monitoring

Most stations collect continuous precipitation data via a tipping-bucket rain gauge. Daily and annual precipitation information for 2002 is also presented in Figure 2.x. For those stations without a rain gauge, the 2002 precipitation information has been obtained from another gauge in the same watershed or in an adjoining watershed.

Water Chemistry Monitoring

Water chemistry samples are collected during baseflow and runoff conditions. Baseflow conditions are typically represented by monthly grab samples. Runoff conditions are typically represented by flow-weighted composite samples collected during all runoff events in the open-water season (March-November), including the spring snowmelt period. Figure 2.x portrays all water chemistry samples obtained during baseflow and runoff conditions throughout the monitoring year, in conjunction with the annual hydrograph.

All water chemistry samples are analyzed by the MCES Laboratory. The water quality variables analyzed by the laboratory include: total chloride, hardness, total metals (Cd, Cr, Cu, Ni, Pb, Zn), total Kjeldahl nitrogen, nitrate-nitrogen, total and dissolved phosphorus, total and volatile suspended solids, and turbidity. Transparency tube measurements are obtained in the field. Summary statistics for concentrations of these water chemistry variables in 2002 were calculated using SPSS and are presented in Table 2.x. Concentrations of total suspended solids and nitrate nitrogen in relation to the 2002 hydrograph are presented in Figure 3.x. Concentrations of total and dissolved phosphorus in relation to the 2002 hydrograph are presented in Figure 4.x. All 2002 water chemistry data for each monitoring station are presented in Appendix 1, which is available by request or via the MCES website.

Annual loading information for selected water chemistry variables (total suspended solids, total and dissolved phosphorus, and nitrate-nitrogen) was calculated using FLUX and is presented in Table 3.x.

A year-to-year comparison of select hydrologic and water chemistry data for 2001 and 2002 is presented in Table 4.x.

Biological Monitoring

Macroinvertebrate samples are collected once or twice annually (spring and/or fall) at all wadeable stations, using the multi-habitat method. Macroinvertebrate monitoring results and metrics for 2002 are presented in Table 5.x.