

Metropolitan Council Environmental Services 2001 Stream Monitoring Report



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METROPOLITAN COUNCIL ENVIRONMENTAL SERVICES 2001 STREAM MONITORING REPORT

Introduction

Background: MCES Stream Monitoring Program

Storm water runoff in both urban and rural areas carries nonpoint source pollutants from diverse and widely scattered sources to Twin Cities Metropolitan Area (TCMA) streams and rivers. To determine the extent of nonpoint 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 nonpoint 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 nonpoint 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.

2001 Stream Monitoring Data

This report presents the 2001 annual monitoring data from 26 of the 28 MCES stream monitoring stations. In 2001, the Beltline Interceptor station was being upgraded to an above-ground location, and the Bluff Creek monitoring station was out of service for much of the year due to major flooding impacts. 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.

Annual 2001 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, 2001 precipitation totals in the TCMA ranged from 24 inches in the southwest portion of the region to 40 inches in the north-central portion of the region (Figure 3). Generally, most of the TCMA received 28 to 32 inches of precipitation. Portions of Hennepin, Anoka, and Ramsey Counties experienced a four-inch increase in precipitation compared to the normal level (see Figure 4). However, most other portions of the TCMA experienced a two-inch decrease in total precipitation, with small parts of Dakota, Scott and Hennepin Counties seeing a four-inch decrease.

In spite of near-normal to slightly above-normal annual precipitation in 2001, the spring of 2001 was characterized by many occurrences of flooded streams and rivers in the Upper Mississippi River Basin. According to the United States Geological Survey (USGS), record setting flows were recorded at eight continuous streamflow gauging stations throughout the Upper Mississippi River Basin. Thirteen additional stations recorded their second or third highest peak flows on record (USGS Fact Sheet 002-02, 2002). The four main factors contributing to widespread spring flooding in 2001 included significant precipitation in the autumn of 2000, heavy winter snowfall, a late winter snowmelt, and record-breaking April precipitation (State Climatology Office, 2002).

Many of the MCES stream monitoring stations also experienced above-normal flow conditions and flooding in the spring of 2001. Once snowmelt commenced in late March, composite sampling began at most MCES stations and continued throughout April and into May, as the snowmelt concluded but the rain kept falling.

Table 1. MCES Stream Monitoring Stations

Major Basin	Monitoring Station (Station Code)	Page Number
Mississippi River		
	Bassett Creek (BS)	9
	Battle Creek (BA)	14
	Beltline Interceptor (BT)	20 No 2001 Data
	Cannon River (CN)	23
	Crow River (CW)	28
	Crow River, South Fork (CWS)	33
	Fish Creek (FC)	38
	Minnehaha Creek (MH)	44
	Rum River (RUM)	50
	Vermillion River (VR)	55
Minnesota River		
Middle Minnesota River Basin (Near Mankato, MN)	Beauford Ditch (BD)	62
	Blue Earth River (BU)	67
	Le Sueur River (LE)	73
	Little Cobb River (LC)	79
Minnesota River		
Lower Minnesota River Basin (Twin Cities Metropolitan Area)	Bevens Creek, Lower (LBE)	85
	Bevens Creek, Upper (UBE)	91
	Bluff Creek (BL)	97 No 2001 Data
	Carver Creek (CA)	101
	Credit River (CR)	107
	Eagle Creek (EA)	114
	Nine Mile Creek (NM)	121
	Riley Creek (RI)	126
	Sand Creek (SA)	131
	Willow Creek (WI)	137
St. Croix River		
	Browns Creek (BR)	142
	Carnelian-Marine Outlet (CM)	149
	Silver Creek (SI)	154
	Valley Creek (VA)	159

Report Format

Organization of the 2001 stream monitoring data in 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: 2001 Hydrograph with Rainfall and Sampling Information

Table 2.x: 2001 Water Chemistry Information

Table 3.x: 2001 Annual Loading Information for Suspended Solids and Nutrients

Table 4.x: 2001 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 2001 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 MCES website: <http://www.metrocouncil.org/environment/RiversLakes>.

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. Since winter ice cover creates very difficult conditions for accurate flow and rating curve measurements, winter flows are estimated. The annual stream hydrograph, based upon daily average flows, is presented in Figure 2.x.

Rainfall Monitoring

Most stations collect continuous rainfall data via a tipping-bucket rain gauge. Daily and annual rainfall information is also presented in Figure 2.x.

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 were calculated using SPSS and are presented in Table 2.x.

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.

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 are presented in Table 4.x.

Glossary of Stream Monitoring Terms

A glossary of key stream monitoring terms that appear throughout this report is presented at the end of the report.