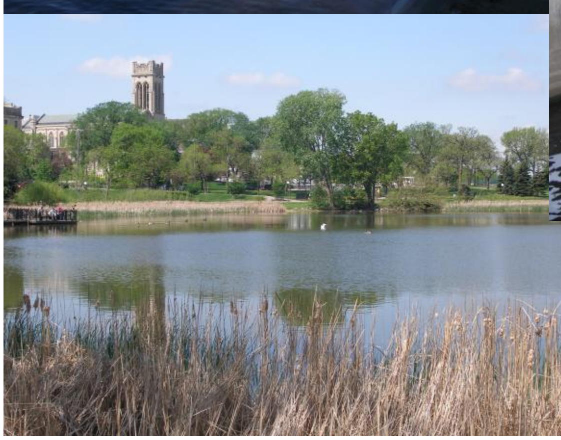
**Please take the time to read the following important information:**

Pursuant to the following data limitations, the MWMO does not support interpretation of the data other than what is presented in the report. Data analysis and the resulting assumptions made for a given site will have limited levels of reliability at grab sample locations and during the first three to five years of flow-weighted monitoring. The MWMO will not use site data for decision-making until there are three to five years of flow-weighted records available. The MWMO does not support assumptions or findings that result from analysis of these data prior to these minimum criteria being met. Results from five years or more of flow-weighted monitoring will be used to establish a water quality baseline for stormwater discharges entering the Mississippi River, to determine pollutant loads entering the Mississippi River and to evaluate the effects of MWMO projects and programs on water quality.

# ANNUAL MONITORING REPORT
# 2006





**Mississippi Watershed Management Organization**

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# 1.0 EXECUTIVE SUMMARY

This report details the results of the Mississippi Watershed Management Organization's (MWMO's) 2006 monitoring season. MWMO staff will complete an annual monitoring report summarizing the year's results and outlining the next year's work plan by June 30 of each year. The report is available on the MWMO website at www.mwmo.org.

The MWMO monitors water quality in the watershed's storm sewer system, the Mississippi River, and Loring Pond. Within these systems, major factors influencing water quality include: the amount of precipitation, timing of precipitation events, and land use practices in the watershed. Long-term monitoring of stormwater outfalls is necessary to characterize the impacts of various land use practices on surface water runoff within the MWMO and, ultimately, the Mississippi River. Water quality in the Mississippi River is also influenced by precipitation and land use practices in the entire Mississippi River basin upstream of the MWMO. Long-term monitoring of the river will aid the understanding of upstream weather pattern and land use impacts on the MWMO watershed.

The 2006 monitoring season included collection of water quality samples from six locations in the Mississippi River, one in Loring Pond, and five stormwater outfalls. Runoff from a large parking lot was also monitored as part of a proposed best management practice installation site.

The 2006 monitoring season was the first season with two full-time monitoring staff. The MWMO hired a full-time Environmental Technician I in June. Two dedicated staff allowed the MWMO to increase monitoring efficiency, develop monitoring protocols, and begin development of a Quality Assurance/Quality Control Policy. The MWMO was able to automate two stormwater monitoring locations to begin collecting flow information for loading analyses.

The MWMO reach of the Mississippi River is listed on the Minnesota 303(d) Impaired Waters list for fecal coliform impairment. Fecal coliform concentrations continued to exceed Minnesota water quality standards in 2006 during the months of August and September. E. coli concentrations also exceeded proposed water quality standards in August and September. Long-term monitoring of the river and stormwater outfalls to the river is necessary to evaluate fecal coliform inputs from within the watershed compared to inputs from upstream sources.

Fecal coliform concentrations in Loring Pond exceeded Minnesota water quality standards in July, August, and September 2006. E. coli concentrations also exceeded proposed water quality standards in July, August, September, and October 2006. Loring Pond is not listed on the Minnesota Impaired Waters List. Further monitoring is necessary to determine if Loring Pond is an impaired water. The MWMO will continue to monitor Loring Pond and notify the MPCA if another exceedance occurs in 2007.

The MWMO continued monitoring stormwater in 2007. Water quality standards do not exist for stormwater; therefore, data were not compared to standards but are presented in subsequent sections. The MWMO will continue to monitor stormwater outfalls to develop a record of baseline data to characterize stormwater quality within the watershed.

The MWMO monitored runoff from a large asphalt parking lot in 2005 and 2006. The purpose of the study was to collect samples pre- and post-construction of a BMP installation to evaluate the effectiveness of the BMP. A raingarden was scheduled to be constructed in the parking lot in Spring 2006; however, due to circumstances beyond the MWMO's control, the project was not completed. However, pre-construction data were collected and provide useful information for future land use decisions. Data are presented in subsequent sections.

## 2.0 INTRODUCTION

This report details the results of the Mississippi Watershed Management Organization's (MWMO) 2006 monitoring season. MWMO staff will complete an annual monitoring report summarizing the year's results and outlining the next year's work plan by June 30 of each year. The report is available on the MWMO website at www.mwmo.org.

The MWMO established the monitoring program to provide a scientific basis for identifying and evaluating water quality and quantity issues and implementing solutions to improve water quality and reestablish natural water regimes in the watershed. The objectives of the program include:

- Monitor biological, chemical, and physical parameters of water resources in the watershed;
- Monitor water quality within the watershed:
    - Develop a record of baseline data to characterize water quality and identify pollutants that exceed water quality standards, and
    - Assess pollutants listed on the Minnesota "Polluted Waters" list for the Total Maximum Daily Load (TMDL) process;
- Assess the volume and rate of water movement in the watershed;
- Develop and agree upon a standardized set of parameters and sample collection, data analysis, and reporting standards with organizations in the watershed;
- Develop partnerships and collaborate with other organizations and/or agencies both inside and outside the watershed boundaries to improve water quality in the Mississippi River; and
- Assess land use impacts on water quality.

The 2006 monitoring season included collection of water quality samples from six locations in the Mississippi River, one in Loring Pond, and five stormwater outfalls. Refer to Figure 1 in Appendix A for the monitoring locations. Descriptions of the sampling sites are found in the MWMO 2005 Annual Monitoring Report at www.mwmo.org.

## 3.0 BACKGROUND

The MWMO was established in 1985 by a Joint Powers Agreement among member organizations. The MWMO watershed boundaries are shown in Figure 1 in Appendix A. The MWMO is a unique organization, as it includes a reach of the Mississippi River, while other local watershed districts and organizations include land and water resources up to the river's shore but not extending into the river itself. The reach of the Mississippi River included in the MWMO extends from 53rd Avenue in north Minneapolis downstream to Lock and Dam 1 (Ford Dam) in south Minneapolis. Another unique feature of the MWMO is that its boundaries include only one lake, Loring Pond.

Minnesota regulations require that the MWMO protect water quality in the watershed. Minnesota Rules Chapter 7050 requires that all water bodies comply with state water quality standards. Furthermore, section 303D of the Federal Water Pollution Control Act (commonly known as the Clean Water Act) requires states to develop TMDLs for waters with impaired uses. Impaired waters are those waters that exceed water quality standards for their classified use. Some typical classifications include drinking water and aquatic life and recreation (swimming and fishing). According to Minnesota Rules Chapter 7050, the reach of the Mississippi River within the MWMO watershed is divided into two sections for classification. The most restrictive classifications are recorded in Table 1.

**Table 1.** Water use classifications for waterbodies in the MWMO

| **Waterbody** | **Water Use Classification** |
|---|---|
| Mississippi River, MWMO upstream boundary to Upper Saint Anthony Falls | 1C, 2Bd Domestic consumption (drinking water) |
| Mississippi River, Upper Saint Anthony Falls to Lock & Dam 1 (Ford Dam) | 2B Aquatic life and recreation |
| Loring Pond | 2B Aquatic life and recreation |

The MWMO reach of the Mississippi River is listed on Minnesota's impaired waters list. The Minnesota Pollution Control Agency divided the reach of the Mississippi River flowing through the MWMO into three sections. Table 2 lists the impaired reaches of the river and the corresponding pollutants of concern. The Minnesota Pollution Control Agency has not yet written TMDLs for these reaches of the river.

**Table 2.** Impaired waters' pollutants

| **Impaired Mississippi River Reach** | **Pollutant** |
|---|---|
| MWMO upstream boundary to Upper Saint Anthony Falls | Fecal coliform, Mercury, Polychlorinated biphenyls (PCBs) |
| Upper Saint Anthony Falls to Lower Saint Anthony Falls | Mercury, PCBs |
| Lower Saint Anthony Falls to Lock & Dam 1 (Ford Dam) | Fecal coliform, Mercury |

Mercury and PCBs are listed for fish consumption advisories; therefore, this report will address fecal coliform only.

Protecting water quality in the Mississippi River is a complicated task. The reach of the Mississippi River flowing through the MWMO is densely urbanized with commercial, industrial, residential, park lands, and downtown Minneapolis land uses contributing to the volume and quality of the water entering the river through the stormsewer system. The MWMO monitors stormwater outfalls to determine the contributions of surface runoff in the watershed to water quality in the river. However, the entire Mississippi River basin upstream of the MWMO watershed contributes to water quality in the MWMO's reach of the river.

The upper Mississippi River is a large, dynamic river system that includes runoff from forested areas near the source at Lake Itasca, agricultural runoff from the Central region of Minnesota, and the urbanized areas of St. Cloud and the north Twin Cities Metro area. As precipitation produces surface runoff, precipitation differences throughout the upper Mississippi River basin can affect water flow and water quality in the MWMO's reach of the Mississippi River. It is possible that Mississippi River flows could increase, and water quality could periodically decline, even though it has not rained in the watershed, if large amounts of rainfall have washed pollutants from the land upstream of the watershed into the river. The MWMO, through coordination with other watershed organizations and districts, plans to investigate upstream impacts on water quality to discern the effects precipitation in other portions of the state has on water quality in the MWMO's reach of the Mississippi River.

Further complicating the investigation of water volume and quality in the river are inputs of groundwater, as well as recharge to groundwater from the river. Groundwater may carry pollutants from upstream in the Mississippi River basin to the MWMO reach of the river. Pollutants may also leach from the river into the groundwater system. It is quite difficult to track potential groundwater inputs from such a large area as the Mississippi River basin to the MWMO reach of the river. The MWMO has long-term plans to coordinate with organizations and agencies in the upper portion of the basin to improve water quality in the Mississippi River.

## 4.0 METHODOLOGY

In 2006, the MWMO examined water quality from four types of locations: rivers, lakes, stormwater outfalls, and specific land uses. River and lake samples were collected in the Mississippi River and Loring Pond. Stormwater outfall samples were collected from stormsewers at the point of discharge to the river. Sample collection locations for Best Management Practices vary with each practice. Mississippi River and Loring Pond samples were collected between April and October, while stormwater samples were collected between March and October. Land use samples were collected in April, May, and July during rain events.

### 4.1 Sample Collection, Handling, and Preservation

*Mississippi River and Loring Pond*

Grab samples were collected from six locations in the Mississippi River and one location in Loring Pond. Samples were collected in lab-sterilized, 250-ml plastic bottles. Collection occurred away from shore, in approximately three feet of water. For the river, samples were taken in positive flow (no back eddies or stagnant water) and upstream of the monitoring technician to prevent contamination by the disturbed river bottom. To collect samples, the monitoring technician plunged an opened, inverted bottle to one foot below the water surface, turned it upward to fill, and brought it out of the water (Figure 2). The technician then poured some of the sample out to provide headspace for the laboratory.

Samples were labeled, stored on ice in a cooler, and delivered to the lab by the monitoring technician after the final sample was collected. Analyses conducted on these samples did not require preservation.

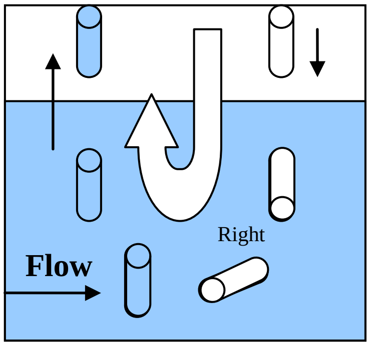



**Figure 2.** Diagram of sample collection method

Samples were collected weekly for base flow and up to three times per month for storm events.

*Stormwater Outfalls*

Grab samples were collected from five stormwater outfalls in the MWMO watershed. Samples were collected in lab cleansed (non-sterile) 2-gallon plastic bottles. Samples were collected with a one-gallon plastic bottle mounted on the end of a telescoping pole. The container was rinsed one time with the water to be sampled before the sample was collected. After collection, the sample was transferred to the 2-gallon bottle. The bottle was capped after it was filled, with headspace included.

An ISCO 6712 automatic sampler (Teledyne Isco, Inc., Lincoln, NE) was installed at the 1NE stormwater outfall in July. The sampler housed 24 one-liter plastic bottles for sample collection. Velocity, water level, and flow data were collected with an ISCO 750 area velocity meter (Teledyne Isco, Inc., Lincoln, NE) that attached to the automatic sampler. When the meter detected water level above baseflow, it triggered the sampler to begin sampling. Once triggered, the sampler rinsed the sample tubing twice before drawing the sample into the containers. Samples were collected on a flow-paced basis, with one liter (one bottle) collected every 150,000 gallons throughout the storm event. The bottles were rinsed three times with deionized (DI) water free of pollutants between storm events. Once collected, the bottles were composited as one sample into a 2-gallon plastic bottle by the monitoring technician. An automated precipitation gauge was installed at the site in September.

Samples were labeled and placed in a cooler for transport to the lab by the monitoring technician. Samples were dropped off at the lab after collection of the last sample. Laboratory personnel split the sample and preserved it as needed for the various analyses.

Stormwater samples were collected for a maximum of three storm events per month and twice per month during baseflow, if baseflow conditions were present.

*Land Uses*

Stormwater samples were collected from parking lot runoff routed through a 12-inch concrete pipe. Data were collected with the same ISCO setup as the stormwater outfall detailed above. When the meter detected a water level above 1.3 inches, it triggered the sampler to begin sampling. Once triggered, the sampler rinsed the sample tubing twice before drawing the sample into the containers. Four one-liter bottles were filled with the initial runoff from a storm event. Additional samples were collected on a flow-paced basis, with one liter (one bottle) collected every 3000 gallons throughout the storm event. The bottles were rinsed three times with deionized (DI) water free of pollutants between storm events. Once collected, the initial four bottles were composited as one sample into a 2-gallon plastic bottle, and the remaining samples were composited, with equal amounts poured into a 2-gallon bottle.

Monitoring technicians collected samples from the automatic sampler at the earliest possible time following the storm event. The samples were composited into the two larger bottles, labeled, stored on ice in a cooler, and delivered to the lab following collection. Laboratory personnel split the samples and preserved them as needed for the various analyses.

### 4.2 Sampling Quality Control

Blank samples of DI water were submitted to the laboratories periodically to verify that sample containers were clean and samples were not contaminated during travel. Duplicate samples were submitted periodically to verify that sampling and laboratory procedures did not jeopardize the data.

### 4.3 Laboratory Analyses

The MWMO used two laboratories for analyses. Bacteria samples were analyzed at the Minneapolis Department of Health Laboratory. All other samples were analyzed at the Metropolitan Council Environmental Services Laboratory. Refer to Table 3 in Appendix B for a list of sample parameters the labs used, the analysis methods, and information regarding certification.

Each laboratory followed strict protocol for quality assurance and quality control. Information regarding laboratory protocol is available from MWMO staff.

### 4.4 Parameters Information

The MWMO has conducted extensive research regarding the parameters of concern. Parameter information includes definitions, sources, impacts to various organisms, and water quality standards, as well as others. Refer to Table 4 in Appendix C for the comprehensive list of parameters information. Refer to Table 5 in Appendix D for unit conversions.

## 4.5 Data Analysis

The following data cleaning techniques were used to ensure quality data:

- Duplicates were omitted from analysis;
- Suspect data were flagged and verified with the laboratory;
- For values greater than the maximum detection level, the maximum detection level + 1 was used for analysis;
- Values less than the minimum detection level were changed to half the minimum detection level for analysis;
- For approximate values that were less than the minimum detection level, the approximate value was used for analysis; and
- regression techniques were used to interpolate automated flow data that were missing due to equipment malfunctions.

For the Mississippi River and Loring Pond, grab sample data were compared to the Minnesota water quality standards for their most restricted water use classification. Water quality standards do not exist for stormwater; therefore, data were not compared to standards but are presented in subsequent sections.

## 4.6 Cold Climate Considerations

Minnesota is considered a cold climate state, requiring special consideration in runoff management. MWMO staff takes this into consideration when writing the annual work plan for the program. The Minnesota Stormwater Manual (Minnesota Stormwater Steering Committee, 2005) outlines the cold climate considerations in Chapter 9.

# 5.0 PRECIPITATION

Precipitation controls surface runoff and is arguably the greatest factor controlling surface water quality. As stated in 3.0 Background, water quality in the MWMO reach of the Mississippi River is affected by precipitation in the entire Mississippi River basin upstream of the MWMO, including tributary watersheds to the river. The following graph shows precipitation for six locations along the Mississippi River: two in the watershed (Lower Saint Anthony Falls and Lock & Dam 1) and four between St. Cloud and the MWMO northern boundary (Figure 3). Precipitation for the watershed only is shown in Figure 4. The MWMO acknowledges a link between precipitation and the water quality data shown in the following sections. However, the MWMO does not support quantitative analysis of this relationship because precipitation data are not representative of the entire Mississippi River basin contributing to the MWMO watershed.

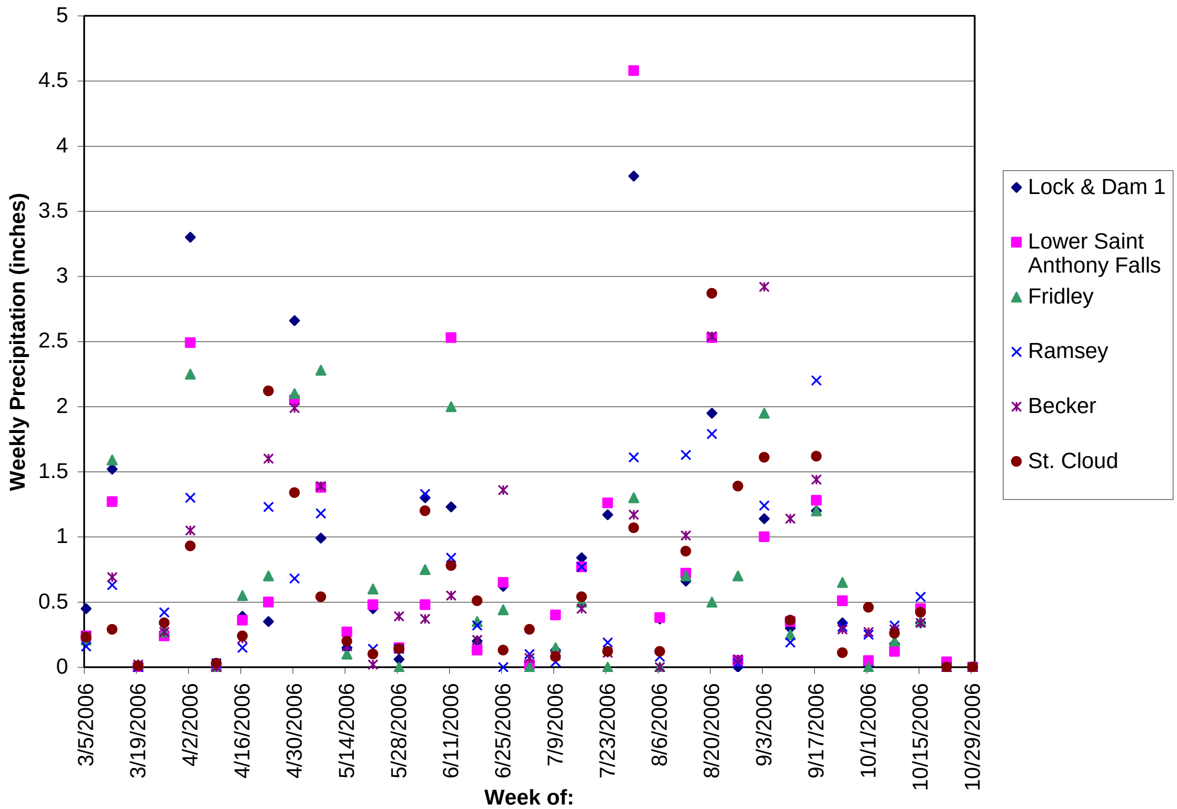



**Figure 3.** Precipitation for six locations along the Mississippi River

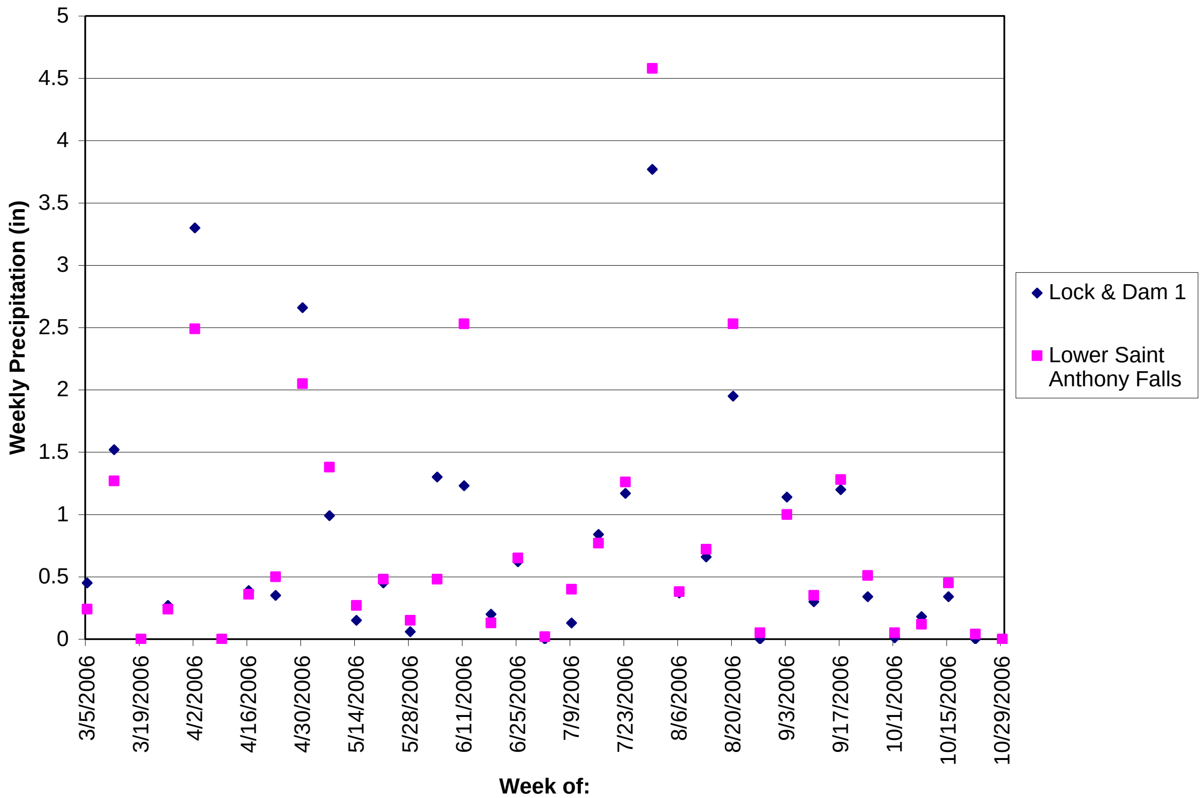



**Figure 4.** Precipitation for two locations in the MWMO watershed

## 6.0 MISSISSIPPI RIVER

The MWMO monitors six locations in the Mississippi River. Refer to the 2005 Annual Monitoring Report for site-specific details and information regarding site selection.

### 6.1 Water Level

Water level (typically referred to as *stage*) data show the rise and fall of the river in response to precipitation. These data are complicated by the dams at Saint Anthony Falls and Lock and Dam 1. The river pools behind the dams; therefore, control activities at the dam cause changes in river stage even without rainfall. Stage data for the six MWMO monitoring locations on the Mississippi River are shown in Figure 5. Stage values are based upon a selected benchmark of 100 feet. Data were not available for the Mississippi Park Boat Launch until June because the MWMO waited until the dock was installed before installing the staff gauge. Data are comparable among dates for a single location but not comparable among locations.

The data indicate the Mississippi River's response to the drought-like precipitation conditions throughout the summer. The Camden and Mississippi Park Boat Launch sites are located outside the pool of Saint Anthony Falls Dam. These locations most accurately depict river level responses to precipitation, as they are not as heavily impacted by controls at the dams compared to the other sites.

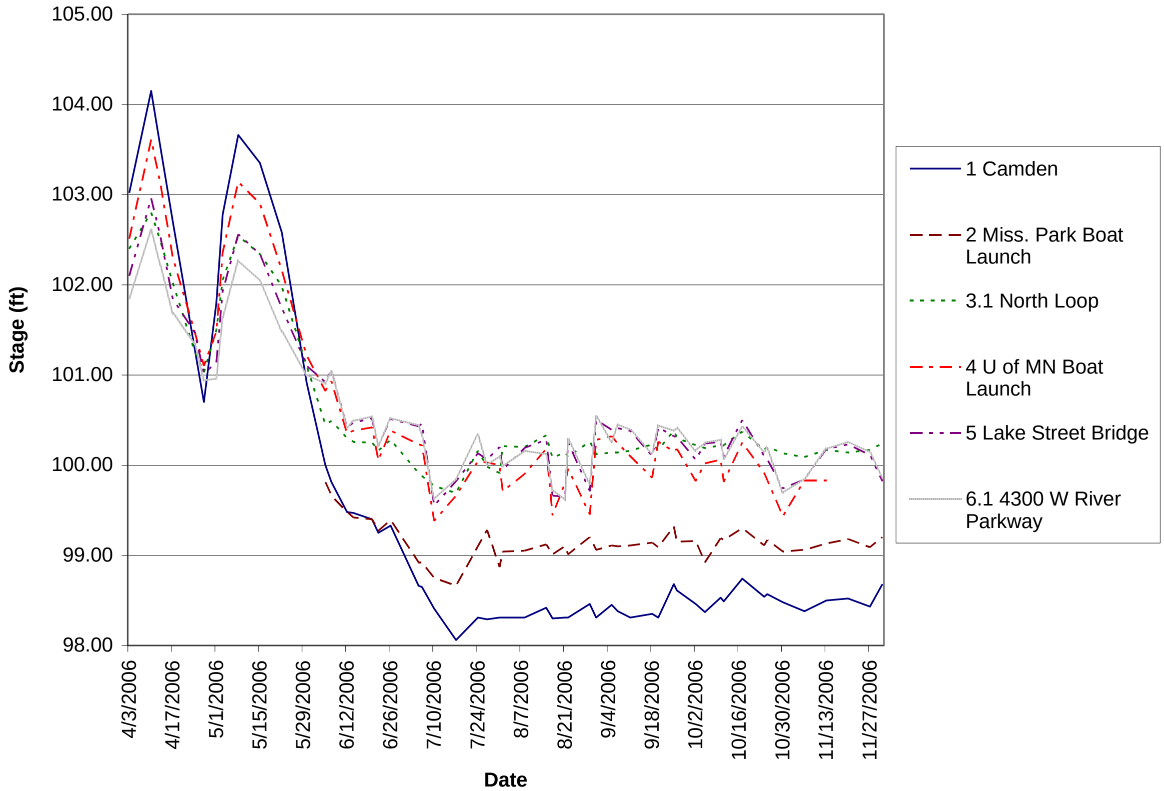



**Figure 5.** Mississippi River stage data based on a 100-foot benchmark

### 6.2 Monitoring Results

*Fecal Coliform*

As noted is Section 3.0 Background, the MWMO reach of the Mississippi River is listed as an impaired water for fecal coliform pollution. The MPCA fecal coliform standard for 2Bd and 2B waters is 200 colony forming units (CFU) /100 mL of water. This standard is a monthly geomean of at least five grab samples taken each month. The geomean is equal to the nth root of the product of the n terms:

$$Geomean_{\bar{y}} = \sqrt[n]{y_1 y_2 y_3 \dots y_n}$$

The 2006 monitoring season results show that sites 2, 4, and 5 of the Mississippi River sites exceeded the standard in August. Sites 1 and 2 also exceeded the standard in September (Figure 6).

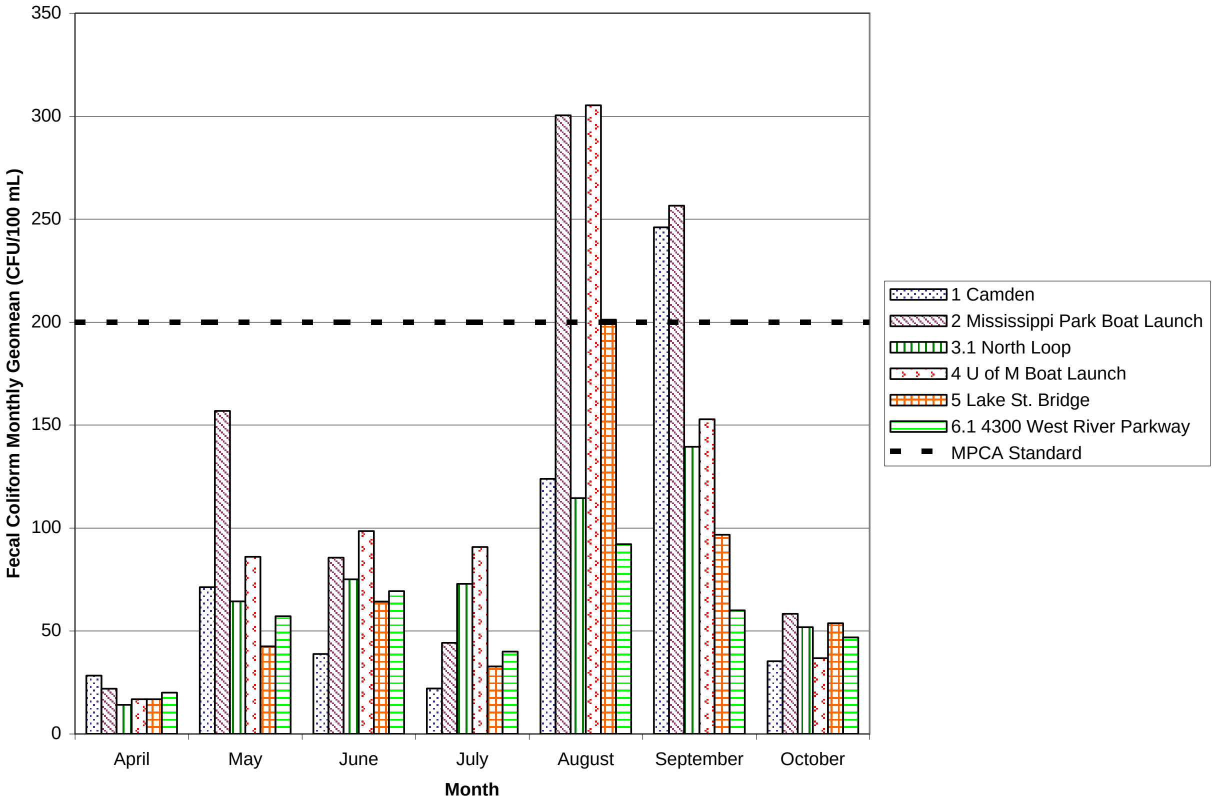



**Figure 6.** Fecal coliform monthly geomeans for the Mississippi River monitoring sites

The MPCA fecal coliform standard also states that fecal coliform cannot exceed 2000 CFU/100 mL in more than 10% of the samples taken in one month. The sites did not exceed this standard during any sampling month. Table 6 presents a summary of fecal coliform exceedances. The fecal coliform concentrations for each sample collected are shown in Appendix E.

**Table 6.** Sites that exceed monthly fecal coliform standards in the Mississippi River

| Month | Sites that exceed monthly geomean | Sites that exceed 2000 CFU/100 mL in > 10% of samples | Sites that do not exceed the standards |
|---|---|---|---|
| April | None | None | All |
| May | None | None | All |
| June | None | None | All |
| July | None | None | All |
| August | 2, 4, 5 | None | 1, 3.1, 6.1 |
| September | 1, 2 | None | 3.1, 4, 5, 6.1 |
| October | None | None | All |

Two additional factors should be considered when evaluating these results. First, these results are based on a maximum of 8 samples collected per month. Had more samples been collected, the data may have exhibited different results. Second, two unique features of the MWMO watershed are the Upper and Lower Saint Anthony Falls. The Mississippi River water mixes as it flows over the falls, likely affecting water quality.

*E. coli*

The MPCA has proposed a change from fecal coliform to E. coli standards for bacteria monitoring in Minnesota. The proposed standard for E. coli in 2B and 2Bd waters is 126 CFU/100 mL for a monthly geomean of at least five samples. In anticipation of this changeover, the MWMO monitored e. coli concentrations to develop a historical record of e. coli in the Mississippi River. Sites 2, 4, and 6.1 exceeded the e. coli standard in August. Sites 1, 2, and 3.1 also exceeded the proposed standard in September (Figure 7). The e. coli concentrations are shown in Appendix E.

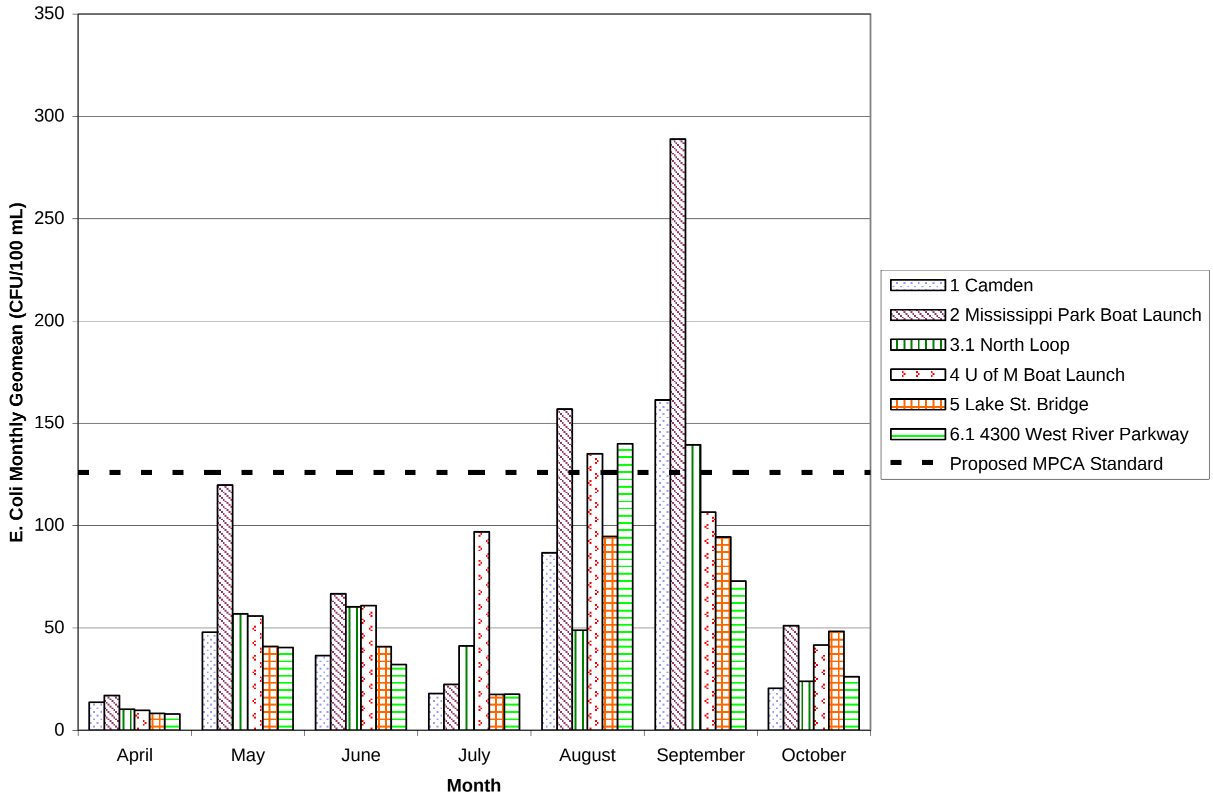



**Figure 7.** E. coli monthly geomeans for the Mississippi River monitoring sites

These results are highly dependant on precipitation, both in the watershed and upstream; therefore, results may differ drastically from year to year. The MWMO does not support interpretation or assumptions based solely on one year of data. The MWMO will collect data on the Mississippi River for 3-5 years to provide baseline data for development of TMDLs in the watershed.

*Dissolved Oxygen, pH, Transparency, and Specific Conductivity*

The MWMO monitored dissolved oxygen, pH, transparency, and specific conductivity on a weekly basis throughout the 2006 sampling season. These parameters are basic measures that indicate the health of a waterbody, as they contribute to survival of fish and other aquatic organisms and plants. Refer to Table 4 in Appendix C for important information regarding each parameter and to Appendix E for the monitoring data.

## 7.0 LORING POND

Loring Pond is the only lake in the MWMO watershed. It is not listed on the impaired waters list. Refer to the 2005 Annual Monitoring Report for an overview and history of Loring Pond. Refer to Figure 1 in Appendix A for the location of Loring Pond.

## 7.1 Water Level

The MWMO monitors stage in Loring Pond with the MPRB staff gauge installed on the large pond outlet. Water level fluctuations throughout the 2006 sampling season are shown in Figure 8. Water levels were based upon a selected benchmark of 100 feet.

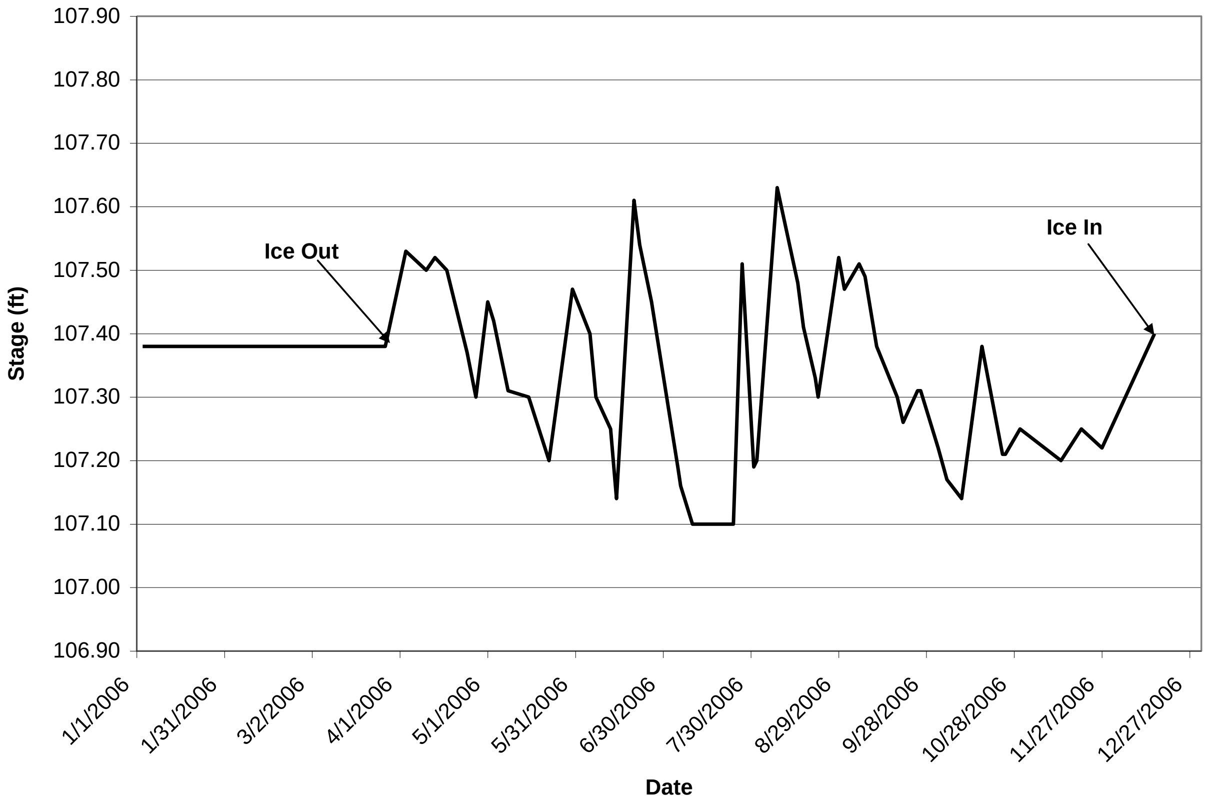



**Figure 8.** Loring Pond stage data based on a 100-foot benchmark

## 7.2 Monitoring Results

*Fecal coliform*

Loring Pond is classified for 2B water use; therefore, the same water quality standards apply as for the Mississippi River monitoring sites. Figure 9 shows that Loring Pond exceeded the fecal coliform standard in July, August, and September. Fecal coliform and e. coli concentrations are shown in Figure 10. These data show that Loring Pond exceeded the fecal coliform standard in July. The results are highly dependent on precipitation; therefore, results may differ drastically from year to year. The MPCA lists waterbodies as impaired when 2 exceedances occur in a three-year period (MPCA, 2003). Loring Pond is not currently listed on the impaired waters list. In 2005, Loring Pond exceeded the MPCA standard; however, the exceedance occurred during only one month that coincided with above-average precipitation. The MWMO will continue to monitor Loring Pond and notify the MPCA if another exceedance occurs in 2007.

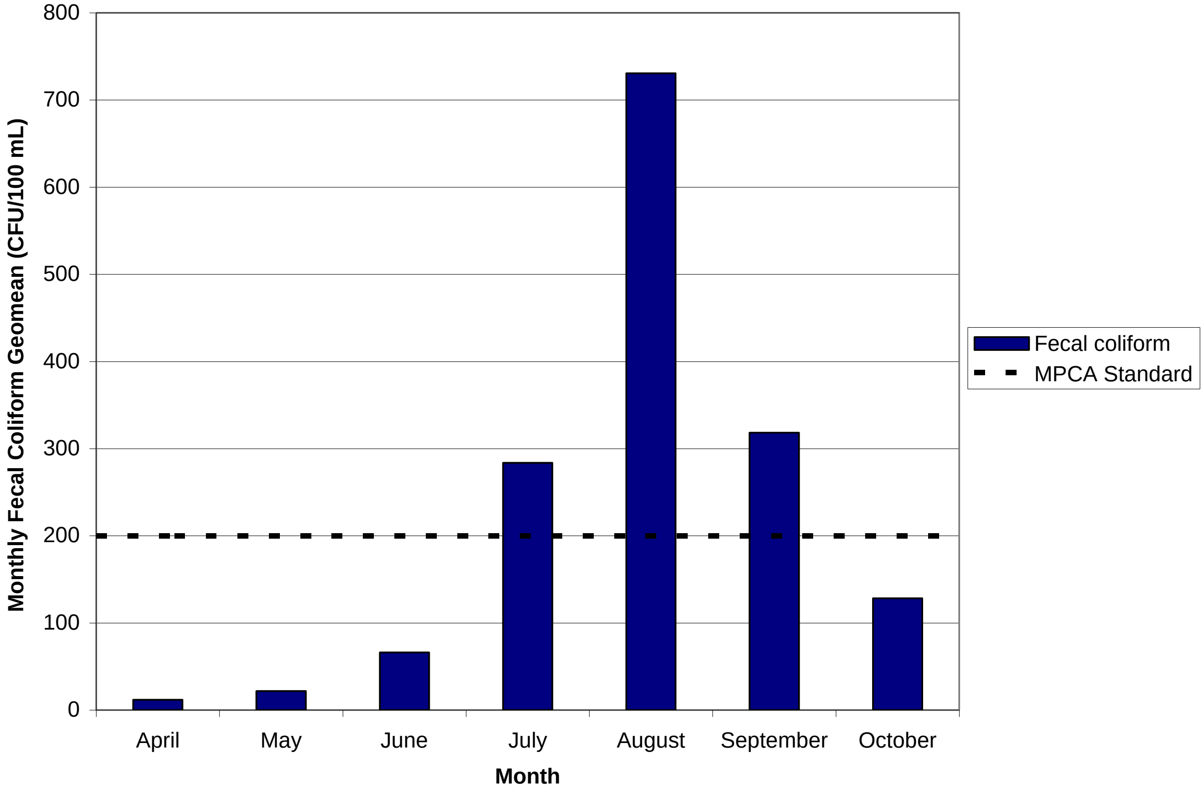



**Figure 9.** Fecal coliform monthly geomeans for Loring Pond

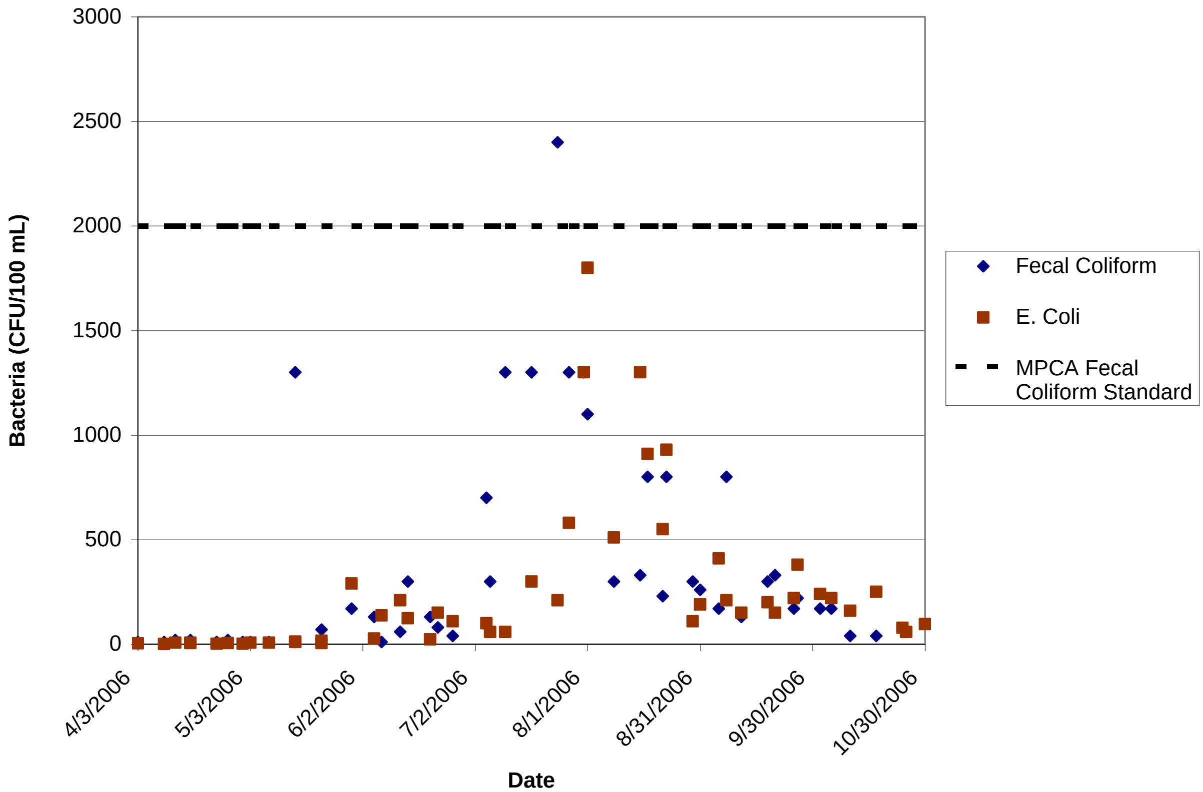



**Figure 10.** Fecal coliform and E. coli concentrations for Loring Pond

*E. Coli*

Loring Pond exceeded the proposed MPCA standard in July, August, September, and October (Figure 11).

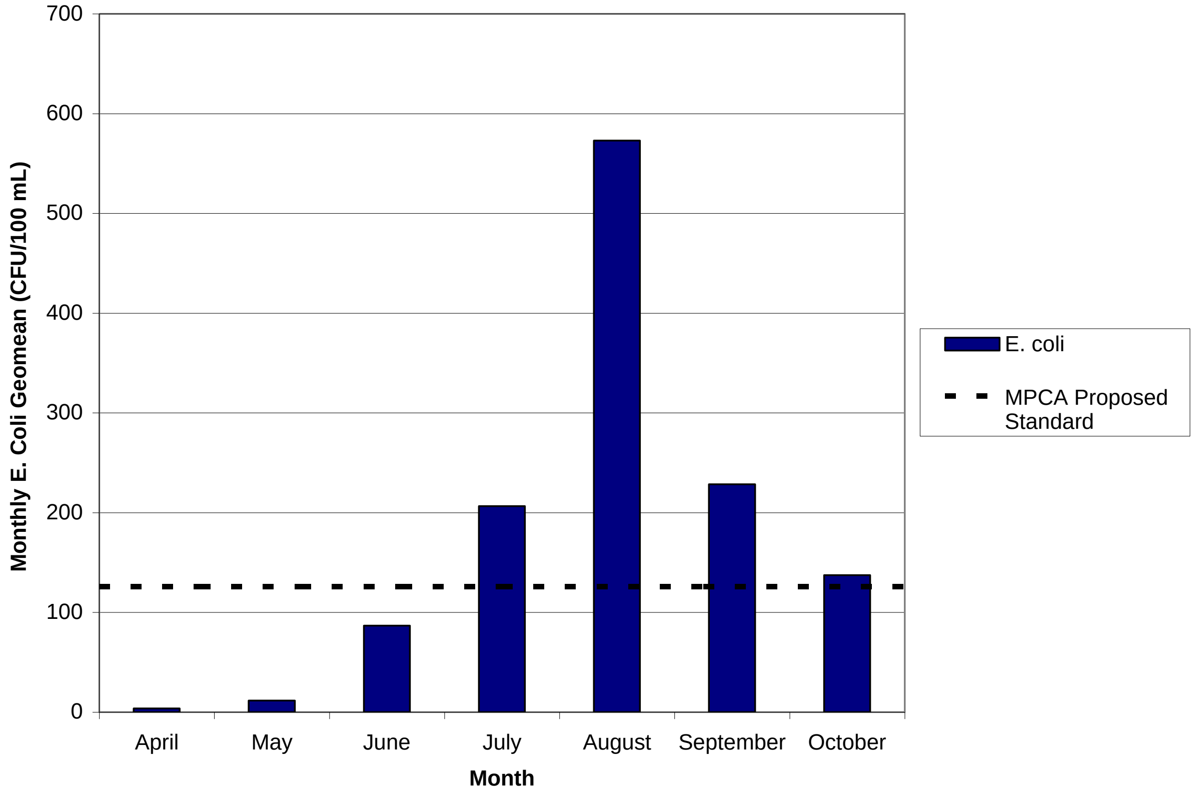



**Figure 11.** E. coli monthly geomeans for Loring Pond

*Dissolved Oxygen, pH, Transparency, and Specific Conductivity*

Dissolved oxygen, pH, and specific conductivity often differ greatly in lakes compared with rivers due to the closed nature of the system. While rivers are always receiving "new" water from upstream, lakes contain the same water throughout the sampling season. Precipitation, stormwater, and occasional pumping of water from the recharge well are the major water inputs to Loring Pond. Figure 12 exhibits the dissolved oxygen, pH, transparency, and specific conductivity data for Loring Pond.

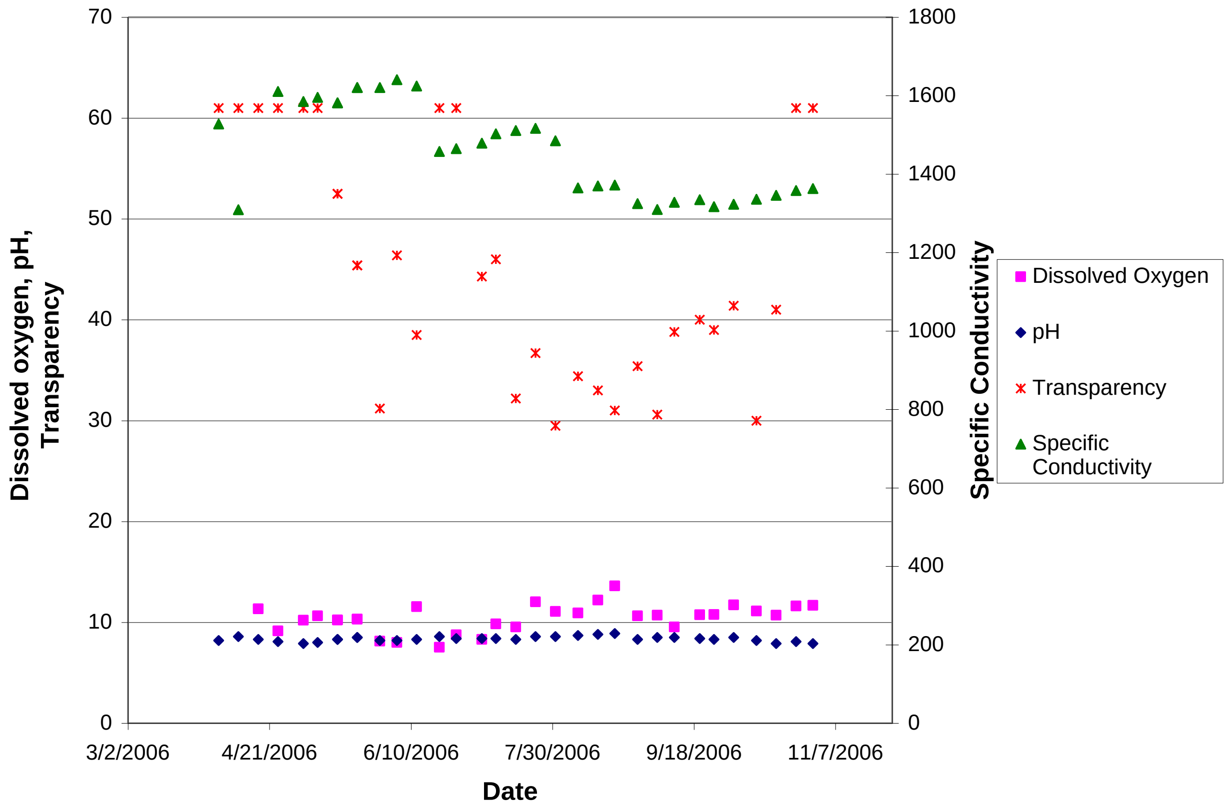



**Figure 12.** Dissolved oxygen in mg/L, pH, transparency in cm, and specific conductivity in µS for Loring Pond

## 8.0 STORMWATER OUTFALLS

The MWMO monitored five stormwater outfalls into the Mississippi River. The monitored outfalls were chosen because they are the most extensive drainage systems within the watershed, and they are accessible. Refer to the 2005 Annual Monitoring Report for site descriptions. Water quality data for each stormwater outfall are provided in this section. Refer to Figure 1 in Appendix A for the outfall locations.

Land uses in the sewersheds affect water quality. A sewershed refers to the area that drains to one stormwater outfall. The amount of impervious surfaces and potential pollutants differ between land uses such as industrial and residential. A future objective of the monitoring program is to investigate the impacts of specific land uses on water quality. Refer to Table 7 in Appendix F for land uses in the sewersheds.

### 8.1 Water Level

Water level in a stormwater outfall is very different from water levels in the Mississippi River and Loring Pond. Stormsewers respond to rainfall very quickly, with water levels rising many feet within a short time frame, sometimes only minutes depending on the size and intensity of the storm event. Some outfalls only contain water during precipitation events, while others have baseflow throughout the year. Stormsewer outfalls 1NE, 4PP, and 6UMN have baseflow throughout the year. Water levels (stage) for each stormwater outfall are listed in Tables 8-12, in Appendix F. Water level data collected with the automated equipment at 1NE are presented in Figure 13.

It should be noted that as the Mississippi River water level rises above the base of the stormwater outfalls, river tailwater may affect the water level in the outfall.

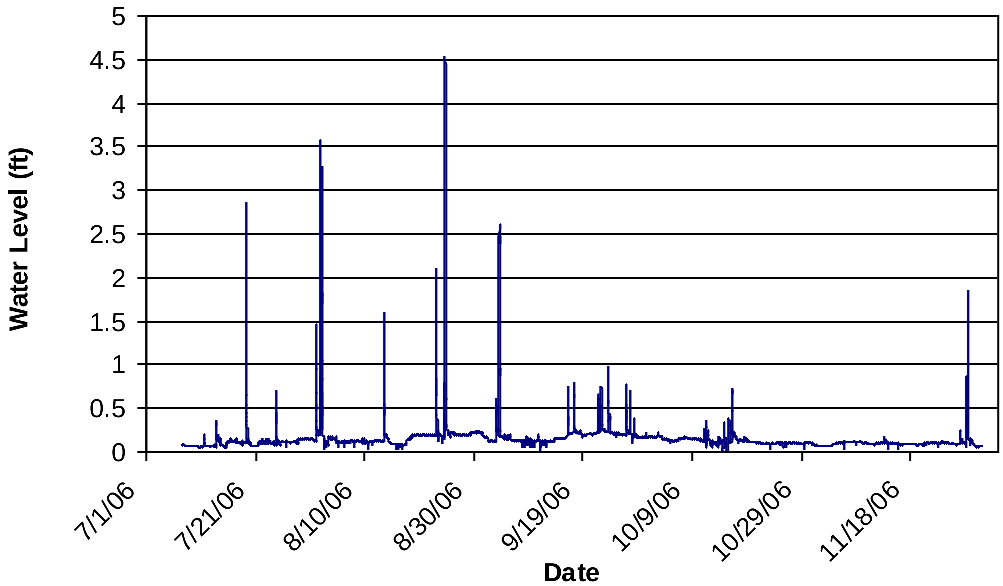



**Figure 13.** Water level in feet for 1NE

**8.2 Monitoring Results**

The MPCA does not have water quality criteria for stormsewer systems; therefore, data are not compared with standards. The MWMO monitors stormwater outfalls to characterize surface runoff in the watershed and determine land contributions to water quality in the Mississippi River. Samples are collected for bacteria, nutrients, sediment, inorganic, organic, and metals analyses. The MWMO will not draw conclusions or make assumptions based on this data until 3-5 years of accurate flow-weighted composite data are available. The data are presented in Tables 8-12 in Appendix F.

Discharge data collected with the automated equipment at 1NE are presented in Figure 14.

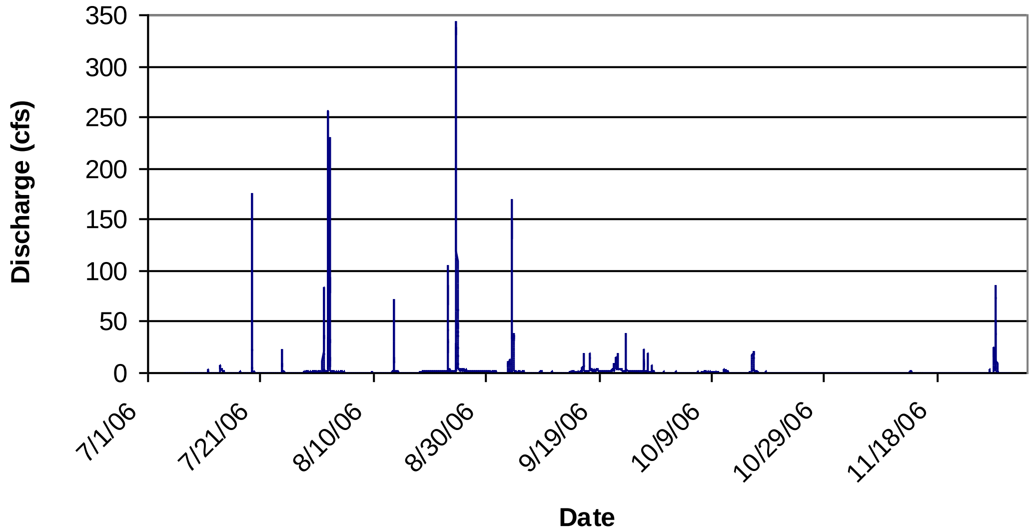



**Figure 14.** Discharge in cubic feet per second (cfs) for 1NE

## 9.0 SPECIAL STUDIES

The MWMO installed an ISCO 6712 automated sampler (Teledyne Isco, Inc., Lincoln, NE) in a stormwater pipe draining a 1.6 acre, asphalt parking lot in downtown Minneapolis in late September 2005. The purpose of the study was to collect samples pre- and post-construction of a BMP installation to evaluate the effectiveness of the BMP. A raingarden was scheduled to be constructed in the parking lot in spring 2006; however, due to circumstances beyond the MWMO's control, the project fell through. However, pre-construction data were collected and provide useful information for future land use decisions.

### 9.1 Monitoring Results

The MPCA does not have water quality criteria for parking lot runoff; therefore, data are not compared with standards. However, pollutant loads were calculated based on the discharge and pollutant concentrations measured for various size rain events and a snowmelt event. The data are reported in Table 13 in Appendix G. The pollutant loads characterized runoff from this 1.6 acre, asphalt parking lot.

## 10.0 WORK PLAN

### 10.1 Assessment of 2006

The MWMO completed its monitoring objectives for 2006. A full-time environmental technician was hired to carry out the field monitoring activities in the Mississippi River, Loring Pond, and the stormwater outfalls. Staff installed automated monitoring equipment in the 1NE and 6UMN stormsewers. The 1NE site has functioned properly, but 6UMN only operated for one month until a large storm event damaged the pressure transducer in the area velocity meter beyond repair. In cooperation with the MPCA, staff developed QA/QC protocol for the MWMO monitoring program during first quarter 2007. The protocol ensures that MWMO data will be acceptable to the MPCA. Staff continued to develop partnerships with organizations both inside and outside the watershed boundaries to prevent duplication of monitoring activities and provide a solid network of information regarding monitoring methodology and techniques.

### 10.2 2007 Work Plan

The MWMO will continue to monitor all the sites listed in this report. Goals for 2007 include:

- Installing automated sampling equipment at stormwater outfalls 2NNBC and 4PP;
- Installing new equipment at the 6UMN outfall;
- Install a new automated sampling site in the Saint Anthony stormsewer to investigate water quantity and quality exiting the MWMO portion of Saint Anthony;
- Monitor water quality in the Kasota Ponds;
- Hire a contractor to develop rating curves and stormwater monitoring protocol for various conditions including: baseflow, storm event flow, and Mississippi River tailwater present in the stormsewer;
- Complete the current literature review that is underway to examine available protocol for monitoring a big river system, such as the Mississippi River;
- Conduct data cleaning and analysis for 2007 monitoring data; and
- Continue to develop partnerships to aid improvement of water quality in the watershed.

## 11.0 RECOMMENDATIONS

MWMO staff agree that collecting water quantity and possibly quality data from the monitoring sites via remote communications will increase efficiency of the monitoring program. The MWMO should investigate the potential to collect data through remote networks.

Future needs of the MWMO include 1) knowledge of the contribution of fecal coliform to the Mississippi River from within the MWMO boundaries relative to the remainder of the upper Mississippi River watershed for development of TMDLs for the current impairment and 2) knowledge of the inputs of phosphorus and turbidity to the river from the MWMO watershed relative to the rest of the Upper Mississippi River Basin for the Lake Pepin TMDL.

**References**

Connecticut Sea Grant. 1999. Clean Waters Starting in Your Home and Yard. Fact Sheet #1. Groton, CT.

Minneapolis Public Works Department. 2005. Stormwater Management Program and Annual Report. City of Minneapolis and Minneapolis Park & Recreation Board, Minneapolis, MN.

Minnesota Pollution Control Agency. 2003. Guidance Manual for Assessing the Quality of Minnesota Surface Waters for the Determination of Impairment. Minnesota Pollution Control Agency, St. Paul, MN.

Minnesota Stormwater Steering Committee. 2005. The Minnesota Stormwater Manual. Minnesota Pollution Control Agency, St. Paul, MN. http://www.pca.state.mn.us/water/stormwater/stormwater-manual.html

**APPENDIX A**

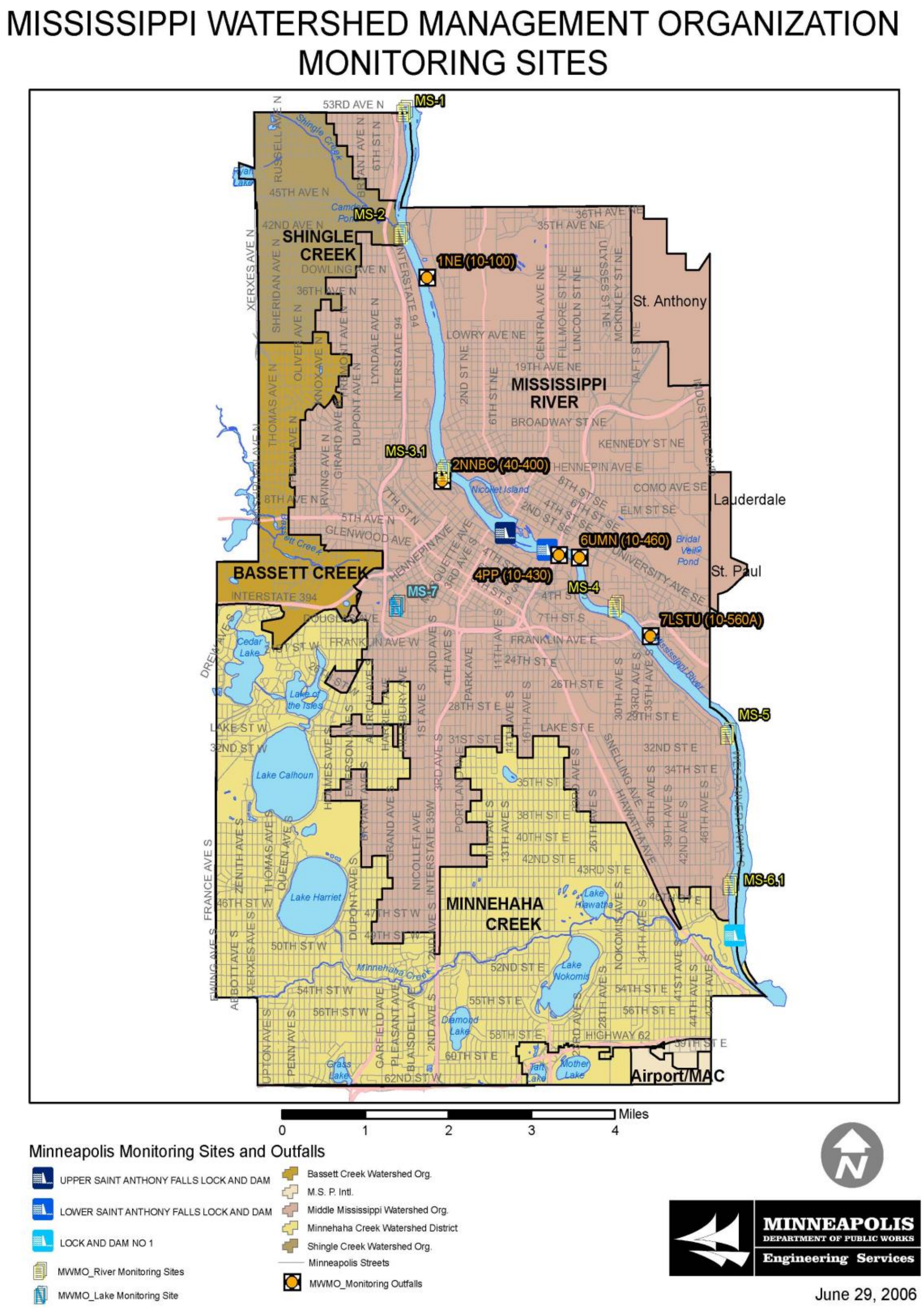



**Figure 1.** MWMO watershed and monitoring sites

**APPENDIX B**

**Table 3.** Laboratory information for each analyte

| Analyte | Lab | Method | Certified |
|---|---|---|---|
| Total Metals (Copper, Nickel, Lead, Zinc, Cadmium, Chromium, Mercury) | Metropolitan Council | EPA 200.8 with ATP (Mercury) EPA 245.7 | Yes |
| Total Soluble Metals | Metropolitan Council | EPA 200.8 with ATP (Mercury) EPA 245.7 | Yes |
| Total Chemical Oxygen Demand | Metropolitan Council | EPA 410.4 | Yes |
| Carbonaceous Biological Oxygen Demand (CBOD) 5-Day | Metropolitan Council | Standard Methods 5210B 18th Edition | Yes |
| Total 5-day BOD | Metropolitan Council | Standard Methods 5210B 18th Edition | No* |
| Total Organic Carbon | Metropolitan Council | EPA 415.1 wet oxidation; auto sampler; settled sample; NDIR detection | NA |
| Total & Volatile Suspended Solids | Metropolitan Council | EPA 160.2 ATP | Yes |
| Total Dissolved Solids | Metropolitan Council | Standard Methods 2540C 18th Edition | No |
| Total Alkalinity | Metropolitan Council | EPA 310.2 | Yes |
| Total Hardness | Metropolitan Council | Standard Methods 314B 15th Edition | NA |
| Total Chlorides | Metropolitan Council | EPA 325.2 | No |
| Total Sulfates | Metropolitan Council | Standard Methods 425C 15th Edition | No |
| Fluoride | Minneapolis Department of Health | Standard Methods 20th Edition 4500-$F^-$ D. SPADNS Method, Ref SM 20th ed.P 4-82 | No |

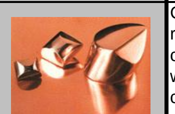
**Table 3 continued.** Laboratory information for each analyte

| Analyte | Lab | Method | Certified |
|---|---|---|---|
| Total Phosphorus plus Total Kjeldahl Nitrogen | Metropolitan Council | EPA 351.2 & 365.4 ATP | Yes |
| Dissolved Phosphorus | Metropolitan Council | EPA 351.2 & 365.4 ATP | Yes |
| Orthophosphorus | Metropolitan Council | EPA 365.2 | Yes |
| Total Ammonia Nitrogen | Metropolitan Council | EPA 350.1 | Yes |
| Nitrate & Nitrite Nitrogen | Metropolitan Council | EPA 353.1 Chloroform preservation | Yes |
| Total Volatile Organic Compounds | Metropolitan Council | EPA 624/625 | Yes |
| Oil and Grease | Metropolitan Council | Soxhlet extraction using Freon, dry at 130C and weigh<br>Standard Methods 503C 15th Ed. | NA |
| Fecal Coliform | Minneapolis Department of Health | Standard Methods 20$^{th}$ Edition 9221E fecal coliform test using EC medium. SM 20$^{th}$ ed. P 9-54 | Yes |
| E. coli | Minneapolis Department of Health | EPA method 1603 | Yes |

*No = Indicates that the lab follows standard certification test methods but has not sought certification from the Minnesota Department of Health.
NA = The Minnesota Department of Health does not have certification for the analyte.

## APPENDIX C

**Table 4.** Parameters information

| Parameter | Definition | Sources | Transport to Water | Pollution Concerns for Humans | Pollution Concerns for Wildlife | Pollution Concerns for Plants | Risk Threshold for Humans | Risk Threshold for Wildlife | Risk Threshold for Plants |
|---|---|---|---|---|---|---|---|---|---|
| **Mercury**  | Mercury (Hg) is a heavy, silver-white, poisonous metallic element that is liquid at ordinary temperatures and is used especially in scientific instruments. | Combustion point sources such as waste incineration and boilers account for 85% of anthropogenic mercury emissions. Other sources include chlor-alkali production and smelting. | Emitted mercury vapor is converted to soluble forms and deposited by rain onto soil and water. | Subacute (moderate) exposure causes tremors, emotional changes, insomnia, and psychotic reactions characterized by delirium, hallucinations and suicidal tendency. | Mercury bioaccumulates in fish. Birds fed inorganic mercury show a reduction in food intake and subsequent poor growth. | Terrestrial plants are generally insensitive to the toxic effects of mercury compounds. | Urine mercury levels of 5 µg/g creatinine are the safe limit. Urine mercury levels are reported in micrograms/gram of creatinine (a component of urine used as an indicator of kidney function). | Microorganisms: for inorganic mercury 5 micrograms/l.*7 | Aquatic plants: concentrations approaching 1 mg/l for inorganic mercury but much lower concentrations for organic mercury.*8 |
| **Lead**  | Lead (Pb) is a soft, heavy metallic element found mostly in combination and used especially in pipes, cable sheaths, batteries, solder and shields against radioactivity. | Lead pollution occurs through the mining, smelting and refining of lead and the burning of petroleum fuels containing lead. Other sources include: lead shot, fishing weights, metal protection, paints and stains, manufacturing and atmospheric deposition. | Lead is transported to water by surface water runoff, atmospheric deposition, recreational activities, residential painting and scraping. | Higher (see thresholds) levels of lead in the blood can damage kidneys, blood and the nervous system. At very high levels lead poisoning can cause mental retardation, coma, convulsions, or death. | Typical symptoms of lead toxicity in young stages of fish include spinal deformity and blackening of the tail region. Arrested development and delayed hatching have been observed in frog and toad eggs exposed to lead. | Lead can be toxic to plants. | Higher blood lead levels are equal to or greater than 25 micrograms per deciliter. | Lead salts are acutely toxic to aquatic invertebrates: >0.1 mg/L freshwater organisms: >40 mg/L The maximum acceptable toxicant limit (MATC) is between 0.04 and 0.198 mg/liter. | Canadian pond-weed and duckweed sustained 50% damage at lead acetate concentrations of 136 and 16.3 mg/liter respectively. |
| **Zinc**  | Zinc (Zn) is a bluish white, crystalline, metallic element of low to medium hardness. It is an essential micronutrient for both plants and animals and is used especially as a protective coating for iron and steel. | Sources of Zinc include: most rocks and many minerals, erosion, igneous emissions, forest fires, mining, zinc production facilities, iron and steel production, metal corrosion, metal protection, road salts, and manufacturing. | Zinc is transported to surface water via atmospheric deposition. | Zinc poisoning can cause gastrointestinal distress, nausea, and diarrhea. | | Zinc toxicity in plants generally causes disturbances in metabolism. | | Zinc is acutely toxic to freshwater invertebrates in the range from 0.07 mg/liter for a water flea to 575 mg/liter for an isopod. Acutely lethal concentrations for freshwater fish are in the range of 0.066–2.6 mg/liter. | The critical leaf tissue concentration of zinc for an effect on growth in most species of plants is in the range of 200–300 mg/kg dw. |
| **Nickel**  | Nickel (Ni) is a silver-white, hard, metallic element capable of a high polish and resistant to corrosion that is used chiefly in alloys and as a catalyst. | Sources of nickel include: batteries, metal protection, fossil fuel combustion, incinerators, gasoline consumption, asphalt, manufacturing, and atmospheric deposition. | Nickel is transported to water via wastewater from various industrial processes. Acid rain may leach nickel as well as other metals from plants and soil. | Nickel can increase the risk of lung and nasal cancers and cause severe damage to the respiratory system, frontal headaches, vertigo, nausea, vomiting, dermatitis, insomnia, and irritability. | Nickel toxicity in aquatic invertebrates varies considerably, according to species and abiotic factors. Nickel can be acutely toxic to aquatic organisms. | Nickel can be toxic to terrestrial plants. | There is evidence of a cancer risk in workers who had been exposed to soluble nickel concentrations of the order of 1-2 mg/m3. | Nickel can be acutely toxic to water fleas at 0.5 mg/liter, some freshwater snail species at 0.2 mg/liter and in a bivalve at 1100 mg/liter. Fish generaly fall within the range of 4-20 mg/liter. | Nickel levels exceeding 50 mg/kg dry weight are toxic for most plants. |
| **Copper**  | Copper (Cu) is a common reddish metallic element that can be drawn or stretched into wire and is one of the best conductors of heat and electricity. | Copper is widely distributed in nature in the elemental state and in compounds. Other sources include smelting operations, municipal incinerators and copper mines. | Copper is transported to water through corrosion of household plumbing systems, erosion of natural deposits and mining and smelting operations. | High doses of copper have been shown to cause stomach and intestinal distress, liver and kidney damage, and anemia. | | | The main risk of acute exposure to copper is from fumes (metal fume fever). Acute exposure has not been reported from ingestion. | | |
| **Cadmium**  | Cadmium (Cd) is a bluish white, malleable, ductile, toxic, metallic element used especially in protective platings and in bearing metals. | Cadmium is widely distributed in the earth's crust. Volcanic activity is a major natural source of atmospheric cadmium release. The largest human aquatic source is smelting of non-ferrous metal ores. | Cadmium is transported to rivers by weathering, erosion, industrial sources and atmospheric deposition. | Symptoms of chronic cadmium poisoning include: bone lesions, spontaneous fractures, skeletal deformities, decreased height and pain resulting from pressure on bones. Severe poisoning can cause death. | Cadmium can bioaccumulate in mussels and fish. | | | | |
| **Chromium**  | Chromium (Cr) is a blue-white, metallic element found naturally only in combination and used especially in alloys and in electroplating. | Chromium occurs everywhere in nature. Other sources include: electroplating, metal corrosion, metal protection, wood preservatives, paints and stains, and manufacturing. | Chromium is transported to water by weathering, erosion, industrial sources, and atmospheric deposition. | Oral ingestion of chromium causes liver and kidney necrosis and poisoning of blood-forming organs. | Chromium (VI) can have high to moderate acute toxic effects on birds or land animals. This can mean death of birds, animals, or fish. | Chromium (VI) can have high to moderate acute toxic effects on plants. This can mean death or low growth rates in plants. | In adult human subjects, the lethal oral dose is 50 -70 mg soluble chromates/kg body weight. | | |
| **Soluble Metals** Copper, Nickel, Lead, Zinc, Cadmium, and Chromium  | Soluble metals is a measurement of all metals and metal compounds that dissolved in a water sample. Aluminum, chromium and iron are some metals with soluble compounds. | Soluble metals can be found in toys, paper products, paints, art materials and residual oil fly ash (ROFA). | Soluble metals are transported to water directly from metal etching industries and indirectly from atmospheric deposition of dust and ROFA. | | | | | | |

*Not to exceed 200 organisms per 100 milliliters as a geometric mean of not less than five samples in any calendar month, nor shall more than ten percent of all samples taken during any calendar month individually exceed 2000 organisms per 100 milliliters. The standard applies only between April 1 and October 31.

**CS: "Chronic Standard" the highest water concentration of a toxicant to which organisms can be exposed indefinitely without causing chronic toxicity.

***MS: "Maximum standard" is the highest concentration of a toxicant in water to which aquatic organisms can be exposed for a brief time with zero to slight mortality. The MS equals the FAV divided by two.

****FAV: "Final acute value" is an estimate of the concentration of a pollutant corresponding to the cumulative probability of 0.05 in the distribution of all the acute toxicity values for the genera or species from the acceptable acute toxicity tests conducted on a pollutant.

*5 EPA has established National Secondary Drinking Water Regulations that set non-mandatory water quality standards for 15 contaminants. EPA does not enforce these "secondary maximum contaminant levels" or "SMCLs." They are established only as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color and odor. These contaminants are not considered to present a risk to human health at the SMCL.

*6 Secondary standards are unenforceable but recommended guidelines for contaminants that may cause cosmetic or aesthetic effects in drinking water.

*7 Inorganic mercury occurs as salts of its divalent and monovalent cationic forms such as Mercuric chloride ($HgCl_2$), Mercurous chloride ($Hg_2Cl_2$) and Mercuric sulfide (HgS).

*8 Organic mercury compounds, sometimes called organomercurials, are those containing covalent bonds between carbon and mercury. Examples are methylmercury, dimethylmercury and methylmercury chloride.

**Table 4 continued.** Parameters information

| Parameter | Minnesota Standard for 2b Waters | Minnesota Standard for 2bd Waters | EPA Standard | Lab Testing Method | Sources |
|---|---|---|---|---|---|
| **Mercury**<br> | Mercury: in micrograms per liter (µg/l) at a hardness of 200 mg/l<br>CS**: 0.0069<br>MS***: 2.4<br>FAV****: 4.9 | Mercury: in µg/l at a hardness of 200 mg/l<br>CS: 0.0069<br>MS: 2.4<br>FAV: 4.9 | | EPA 200.8 with ATP (Mercury) EPA 245.7 | Minnesota Rules Chapter 7050.0222 Specific Standards of Quality and Purity for Class 2 Waters of the State; Aquatic Life and Recreation. (2b and 2bd Standards.)<br>http://www.inchem.org/documents/ehc/ehc/ehc118.htm (Sources, Transport, Effects)<br>http://drcranton.com/mercury/Mercury_test_results.htm (Human Threshold)<br>http://limnology.wisc.edu/personnel/ggsass/Ice_angler_Hg.pdf<br>http://www.talktransplant.co.uk/transcaretemplates/glossary.aspx (Definition of Creatinine)<br>http://www.ccohs.ca/oshanswers/chemicals/chem_profiles/mercury/health_mercury.html (Use of Creatinine)<br>http://www.greenfacts.org/glossary/mno/organic-mercury-compounds.htm (Organic Mercury Definition)<br>http://www.inchem.org/documents/cicads/cicads/cicad50.htm (Inorganic Mercury Definition)<br>http://images.google.com/imgres?imgurl=http://app.idph.state.il.us/envhealth/mercury/images/Sub_Mercury-<br>http://app.idph.state.il.us/envhealth/mercury/Students/Information.htm(pic.) |
| **Lead**<br> | Lead: in µg/l at a hardness of 200 mg/l<br>CS: 7.7<br>MS: 197<br>FAV: 396 | Lead: in µg/l at a hardness of 200 mg/l<br>CS: 7.7<br>MS: 197<br>FAV: 396 | | EPA 200.8 with ATP (Mercury) EPA 245.7 | Minnesota Rules Chapter 7050.0222 Specific Standards of Quality and Purity for Class 2 Waters of the State; Aquatic Life and Recreation. (2b and 2bd Standards.)<br>http://www.m-w.com/cgi-bin/dictionary (Definition)<br>http://www.inchem.org/documents/ehc/ehc/ehc85.htm#SectionNumber:1.2 (Health and Thresholds)<br>http://www.inchem.org/documents/ehc/ehc/ehc003.htm#PartNumber:8 (Human Symptoms)<br>http://www.epa.gov/glnpo/bnsdocs/mercsrce/merc_srce.html#II. (Human, Source)<br>http://www.site.uottawa.ca:4321/astronomy/index.html#lead(pic.) |
| **Zinc**<br> | Zinc: in µg/l at a hardness of 200 mg/l<br>CS: 191<br>MS: 211<br>FAV: 421 | Zinc: in µg/l at a hardness of 200 mg/l<br>CS: 191<br>MS: 211<br>FAV: 421 | | EPA 200.8 with ATP (Mercury) EPA 245.7 | Minnesota Rules Chapter 7050.0222 Specific Standards of Quality and Purity for Clas 2 Waters of the State; Aquatic Life and Recreation. (2b and 2bd Standards.)<br>http://www.m-w.com/dictionary/Zinc (Definition)<br>http://www.inchem.org/documents/ehc/ehc/ehc221.htm#4.1.2 (Source and Transport)<br>http://www.inchem.org/documents/ehc/ehc/ehc221.htm#1.8 (Thresholds)<br>http://www.neyco.fr/pages/page_activite.php?id_famille=1&id_sous_famille=10&lg=fr(pic.) |
| **Nickel**<br> | Nickel: in µg/l at a hardness of 200 mg/l<br>CS: 283<br>MS: 2549<br>FAV: 5098 | Nickel: in µg/l at a hardness of 200 mg/l<br>CS: 283<br>MS: 2549<br>FAV: 5098 | **Drinking water:**<br>10-day health advisory child 1.0 mg/liter<br>10-day health advisory adult 3.5 mg/liter<br>Acceptable daily intake 0.35 mg/liter | EPA 200.8 with ATP (Mercury) EPA 245.7 | Minnesota Rules Chapter 7050.0222 Specific Standards of Quality and Purity for Clas 2 Waters of the State; Aquatic Life and Recreation. (2b and 2bd Standards.)<br>http://www.m-w.com/dictionary/Nickel (Definition)<br>http://www.inchem.org/documents/hsg/hsg/hsg062.htm#SectionNumber:2.1 (Transport)<br>http://www.epa.gov/OGWDW/dwh/c-ioc/nickel.html (Health and Transport)<br>http://www.inchem.org/documents/hsg/hsg/hsg062.htm (Health Tthresholds)<br>http://www.neyco.fr/pages/page_activite.php?id_famille=1&id_sous_famille=10&lg=fr(pic.) |
| **Copper**<br> | Copper: in µg/l at a hardness of 200 mg/l<br><br>CS: 15<br>MS: 34<br>FAV: 68 | Copper: in µg/l at a hardness of 200 mg/l<br><br>Cs: 15<br>MS: 34<br>FAV: 68 | | EPA 200.8 with ATP (Mercury) EPA 245.7 | Minnesota Rules Chapter 7050.0222 Specific Standards of Quality and Purity for Clas 2 Waters of the State; Aquatic Life and Recreation. (2b and 2bd Standards.)<br>http://www.google.com/search?hl=en&lr=&oi=defmore&defl=en&q=define: copper nickel lead….<br>http://www.m-w.com/cgi-bin/dictionary (Definition)<br>http://www.epa.gov/OGWDW/dwh/t-ioc/copper.html (Human Concerns, Sources, and Drinking Water Standards)<br>http://www.epa.gov/safewater/mcl.html (Health and Sources)<br>http://www.inchem.org/ (Health Threshold)<br>http://www.deeco.net/anodes/home.htm(pic.) |
| **Cadmium**<br> | Cadmium: in µg/l at a hardness of 200 mg/l<br>CS: 2.0<br>MS: 73<br>FAV: 146 | Cadmium: in µg/l at a hardness of 200 mg/l<br>CS: 2.0<br>MS: 73<br>FAV: 146 | | EPA 200.8 with ATP (Mercury) EPA 245.7 | Minnesota Rules Chapter 7050.0222 Specific Standards of Quality and Purity for Clas 2 Waters of the State; Aquatic Life and Recreation. (2b and 2bd Sstandards)<br>http://www.m-w.com/dictionary/Cadmium (Definition)<br>http://www.inchem.org/documents/pims/chemical/cadmium.htm#PartTitle:2.%20%20%20%20SUMMARY (Human)<br>http://www.lenntech.com/Periodic-chart-elements/Cd-en.htm (Wildlife)<br>http://www.theodoregray.com/PeriodicTableDisplay/index7S.1.html(pic.) |
| **Chromium**<br> | Chromium (+3) µg/l at a hardness of 200 mg/l<br>CS: 356<br>MS: 3064<br>FAV: 6120 | Chromium (+3) µg/l at a hardness of 200 mg/l<br>CS: 356<br>MS: 3064<br>FAV: 6120 | | EPA 200.8 with ATP (Mercury) EPA 245.7 | Minnesota Rules Chapter 7050.0222 Specific Standards of Quality and Purity for Clas 2 Waters of the State; Aquatic Life and Recreation. (2b and 2bd Standards.)<br>http://www.m-w.com/dictionary/Chromium (Definition)<br>http://www.inchem.org/documents/ehc/ehc/ehc61.htm (Human Threshold)<br>http://www.npi.gov.au/database/substance-info/profiles/25.html#environmentaleffects (Pollution Effects Plants and Animals)<br>http://www.theodoregray.com/PeriodicTableDisplay/index7S.1.html(pic.) |
| **Soluble Metals**<br>Copper, Nickel, Lead, Zinc, Cadmium, and Chromium<br> | | | | EPA 200.8 with ATP (Mercury) EPA 245.7 | http://www.cdc.gov/niosh/nmam/pdfs/chapter-m.pdf (Definition and Source)<br>http://www.epa.gov/ORD/NRMRL/pubs/600r01056/600R01056chap6.pdf (Source)<br>http://www.pointbrewsupply.com/index.php?cPath=42_50&osCsid=44255bb29fe2b61c814c4cb437164157(pic.) |

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*5 EPA has established National Secondary Drinking Water Regulations that set non-mandatory water quality standards for 15 contaminants. EPA does not enforce these "secondary maximum contaminant levels" or "SMCLs." They are established only as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color and odor. These contaminants are not considered to present a risk to human health at the SMCL.

*6 Secondary standards are unenforceable but recommended guidelines for contaminants that may cause cosmetic or aesthetic effects in drinking water.

**Table 4 continued.** Parameters information

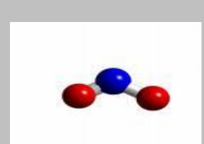
| Parameter | Definition | Sources | Transport to Water | Pollution Concerns for Humans | Pollution Concerns for Wildlife | Pollution Concerns for Plants | Risk Threshold for Humans | Risk Threshold for Wildlife | Risk Threshold for Plants |
|---|---|---|---|---|---|---|---|---|---|
| **Fluoride**  | Fluoride is a chemical compound. To form fluoride, the gaseous element Fluorine (F) combines with other more electropositive elements (like sodium) or radicals (atoms with an unpaired electron). | Fluoride is a mineral found naturally in soil and water. Fluoride is added to drinking water and can also come from industrial, agricultural, dental, or medical sources. | Fluoride is transported to water when it is added to domestic water supplies. Fluoride is usually transported through the water cycle complexed with aluminum. Fluoride is not readily leached from soils. | Too much fluoride in the diet can cause vomiting, abdominal pain, diarrhea, cyanosis, severe weakness, dyspnoea, muscle spasms, paresis and paralysis, cardiovascular disorders, convulsions, coma, and death. | Fluoride poisoning causes fish to become apathetic, lose weight, have periods of violent movement, and wander aimlessly. Finally there is a loss of equilibrium accompanied by tetany and death. | Adverse effects of toxic concentrations on plants include: chlorosis, peripheral necrosis, leaf distortion, and malformation of abnormal fruit development. | | | Fluoride can affect plants at concentrations as low as 20mg/kg dry weight. |
| **Total Chlorides**  | Total Chlorides is a measurement of all the chloride ions in a sample. Chloride ions are formed when the element chlorine picks up one electron from the anion Cl-1. Chloride = 1chlorine atom + 1 electron. | Chloride can be found naturally in soil and rocks. Other sources of chloride include: fertilizers, salts, chlorine, plastics, human and animal waste, effluent from industrial plants, and the drilling of oil and gas wells. | Chlorides are transported to water by surface water runoff, leaching of animal waste into ground water, salts, treated wastewater, and atmospheric deposition. | | High levels of chloride can harm aquatic organisms if it interferes with the organism's osmo-regulatory abilities. | Chloride is relatively nontoxic. At high concentrations (1000 mg/L), it is corrosive and can be harmful to vegetation and microinvertebrates. Chloride concentration in the ocean is 35,000 mg/L. | | | |
| **Total Kjeldahl Nitrogen**  | Total Kjeldahl Nitrogen is nitrogen in the form of organic proteins or their decomposition product ammonia, as measured by the Kjeldahl Method. | Sources of nitrogen include: fertilizers, animal manure, legumes (soybeans and alfalfa), domestic effluents, atmospheric deposition, and soil nitrogen. Earth's atmosphere is 78% nitrogen gas. | Nitrogen is transported to water via surface water runoff from agriculture fields, atmospheric deposition, point source pollution (sewage treatment plants), erosion, plant materials, animal waste, and fertilizers. | | | | | | |
| **Total Ammonia Nitrogen**  | Total ammonia nitrogen consists of two forms of ammonia, $NH_3$ and $NH_4^+$. The first is unionized ammonia and the second is ionized. Free ammonia ($NH_3$-N) and ionized-ammonia ($NH_4^+$-N) represent two forms of reduced inorganic nitrogen which exist in equilibrium. | Sources of ammonia nitrogen include: fertilizers, pesticides, human and animal waste, cleaning products, fossil fuel and biomass combustion, coal to coke plants, metallurgic operations, ceramic production, strip mining, chemical synthesis, waste gas treatment, explosives production, refrigeration equipment production, oil refineries, food processing, atmospheric deposition, and plant materials. | Total ammonia nitrogen is transported to water by atmospheric deposition, surface water runoff, and point source pollution. | Toxic concentrations of ammonia in humans may cause loss of equilibrium, convulsions, coma, and death. | Bacteria that oxidize ammonia require significant amounts of dissolved oxygen. Dissolved oxygen could be reduced enough to cause fish kills depending on the amount of ammonia in the water. | | | $NH_3$ has been reported toxic to fresh water organisms at concentrations ranging from 0.53 22.8 mg/L. | |
| **Nitrate-Nitrogen**  | Nitrate-nitrogen ($NO_3$-N) is a commonly used lawn and agricultural fertilizer. It is also a chemical formed in the decomposition of waste materials, such as manure and sewage. | Nitrate and nitrite sources include: gasoline consumption, fertilizers, pesticides, soil treatments, soil erosion, sanitary waste, manufacturing, animal waste, atmospheric deposition, and plant materials. | Nitrogen is transported to water via agricultural runoff, atmospheric deposition, point source pollution (sewage treatment plants), erosion, decay of plant materials, and animal waste. | Excess nitrates in drinking water have been linked to human health problems, including heart conditions and birth defects. | Nitrate reactions in fresh water can cause oxygen depletion. | | | Nitrate levels below 0.5 mg/l seem to have no effect on warm water fish. | |
| **Nitrite-Nitrogen**  | Nitrite is an unstable form of nitrogen that might be found in small amounts along with nitrate. Bacteria in water quickly convert nitrites $[NO_2^-]$ to nitrates $[NO_3^-]$. | Nitrate and nitrite sources include: gasoline consumption, fertilizers, pesticides, soil treatments, soil erosion, sanitary waste, manufacturing, animal waste, atmospheric deposition, and plant materials. | Nitrogen is transported to water via surface water runoff from agriculture fields, atmospheric deposition, point source pollution (sewage treatment plants), erosion, decay of plant materials, and animal waste. | Nitrites react directly with hemoglobin in human blood and other warm-blooded animals to produce methemoglobin. Methemoglobin destroys the ability of red blood cells to transport oxygen. | Nitrites can produce a serious condition in fish called "brown blood disease" in which nitrite in the blood turns the blood a chocolate-brown color. | | Water with nitrite levels exceeding 1.0 mg/l should not be used for feeding babies. | Nitrite-nitrogen levels below 90 mg/l and nitrate levels below 0.5 mg/l seem to have no effect on warm water fish. | |

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**Table 4 continued.** Parameters information

| Parameter | Minnesota Standard for 2b Waters | Minnesota Standard for 2bd Waters | EPA Standard | Lab Testing Method | Sources |
|---|---|---|---|---|---|
| **Fluoride**<br> | | | | Standard Methods 20th Edition 4500-F- D. SPADNS Method, Ref SM 20th ed.P 4-82. | http://www.google.com/search?hl=en&lr=&oi=defmore&defl=en&q=define:fluoride (Definition)<br>http://www.inchem.org/documents/ehc/ehc/ehc36.htm#SubSectionNumber:1.1.2 (Sources)<br>http://www.greenfacts.org/fluoride/fluorides-3/02-environment.htm (Transport)<br>http://en.wikipedia.org/wiki/Sodium_fluoride(pic.) |
| **Total Chlorides**<br> | Chloride: in mg/l<br>CS: 230<br>MS: 860<br>FAV: 1720 | Chloride: in mg/l<br>CS: 230<br>MS: 860<br>FAV: 1720<br><br>Not to exceed 230 mg/L more than once every three years. | **Drinking water**: 250 mg/L | EPA 325.2 | Minnesota Rules Chapter 7050.0222 Specific Standards of Quality and Purity for Class 2 Waters of the State; Aquatic Life and Recreation. (2b and 2bd standards.)<br>http://www.kgs.ku.edu/Hydro/Publications/2005/OFR05_34/OFR2005_34.pdf (Sources and Transport)<br>http://www.lenntech.com/Periodic-chart-elements/N-en.htm(nitrogen pic.) |
| **Total Kjeldahl Nitrogen**<br> | | | | EPA 351.2 & 365.4 ATP | Stormwater Management Program and Annual Report (Minneapolis Public Works Department, 2005)<br>http://co.water.usgs.gov/midconherb/html/st.louis.hypoxia.html (Sources)<br>http://www.lenntech.com/Periodic-chart-elements/N-en.htm(nitrogen pic.) |
| **Total Ammonia Nitrogen**<br> | Ammonia unionized: µg/l<br>CS: 40<br>MS: None<br>FAV : None | Ammonia unionized: µg/l<br>CS: 40<br>MS: None<br>FAV : None | | EPA350.1 | http://www.water-research.net/Watershed/ammonia.htm (Definition, Sources and Thresholds.)<br>http://bridge.ecn.purdue.edu/~piwc/w3-research/free-ammonia/nh3.html (Definition and Information)<br>http://www.inchem.org/documents/ehc/ehc/ehc54.htm#SectionNumber:1.3 (Ammonia)<br>http://www.linco.com/nh3gears.htm(pic.) |
| **Nitrate-Nitrogen**<br> | | | | EPA 353.1 Chloroform preservation | http://www.uwsp.edu/cnr/gndwater/privatewells/Nitrate%20and%20Nitrite%20Nitrogen.htm<br>http://www.water-research.net/nitrite.htm# (Sources and Chemical Compound)<br>http://www.state.ky.us/nrepc/water/wcpno.htm (Transport)<br>Clean Waters fact sheet #1 (Connecticut Sea Grant, 1999)<br>http://www.linco.com/nh3gears.htm(ammonium nitrate pic.) |
| **Nitrite-Nitrogen**<br> | | | | EPA 353.1 Chloroform preservation | http://www.state.ky.us/nrepc/water/wcpno.htm (Definition, Sources, Transport and Risks)<br>http://www.3dchem.com/inorganicmolecule.asp?id=445(pic.) |

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**Table 4 continued.** Parameters information

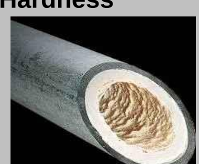
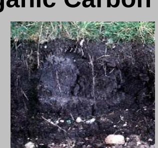
| Parameter | Definition | Sources | Transport to Water | Pollution Concerns for Humans | Pollution Concerns for Wildlife | Pollution Concerns for Plants | Risk Threshold for Humans | Risk Threshold for Wildlife | Risk Threshold for Plants |
|---|---|---|---|---|---|---|---|---|---|
| **Total Phosphorus**  | Total phosphorus includes dissolved and particulate phosphorus. Phosphorus (P) is a highly reactive, poisonous, nonmetallic element occurring naturally in phosphates. | Sources of phosphorus include: agricultural drainage, wastewater, certain industrial discharges, fossil fuel combustion, incinerators, gasoline consumption, fertilizers, pesticides, soil treatments, soil erosion, sanitary waste, manufacturing, animal waste, atmospheric deposition, and plant materials. | Phosphorus is transported to water via surface water runoff from agricultural fields, atmospheric deposition, point source pollution (sewage treatment plants), erosion, plant materials, animal waste and fertilizers. | | Excessive algal blooms caused by an overabundance of limiting nutrients (phosphorus) decreases dissolved oxygen in water bodies and kills fish. | Dense algal blooms block light, killing plants and increasing nutrients avalable to algae which further increases algae blooms. | | | |
| **Orthophosphate**  | Orthophosphate (also known as phosphoric acid) is inorganic phosphate or phosphate that is not associated with organic material. | Sources of orthophosphate include: rocks and soils, human and animal waste, pulp and paper mills, vegetable and fruit processing plants, chemical and fertilizer manufacturing plants, detergents, agricultural runoff, and some lawn fertilizers. | Orthophosphate is transported to water directly by point sources and indirectly by surface water runoff. | | | | | | |
| **Total Sulfates**  | Total sulfates is a measurement of all the sulfates in a sample. Sulfates are mineral salts containing sulfur. | Sulfates occur as microscopic particles (aerosols) resulting from fossil fuel and biomass combustion. Sulfates are released from decaying plants and animals, mines, tanneries, steel and pulp mills, and textile plants. Sulfates are also a large component of seawater. | Sulfates are transported into water by household and industrial wastewater and surface water runoff. | Ingesting water that contains over 500 mg/L sulfates can cause diarrhea, intestinal pain, dehydration, and slight decrease in normal stomach acidity. | | One concern is that sulfates increase the acidity of the atmosphere and form acid rain. High concentrations of sulfates can damage aquatic plants. | | | |
| **Total Hardness**  | Total hardness is defined as the sum of calcium and magnesium concentrations, both expressed as calcium carbonate [$CaCO_3$], in milligrams per liter. | Calcium carbonate comes from chalk, limestone, marble, coral, and calcite. Calcium carbonate (calcite) comprises about 4% of the earth's crust by weight. | Slightly acidic water dissolves calcium carbonate and carries it to water bodies. | | | | | | |
| **Total Alkalinity** | Total alkalinity is the total concentration of bases (molecules with one or two nitrogen containing ring structures) in water expressed as parts per million (ppm) or milligrams per liter (mg/L) of calcium carbonate $CaCO_3$. Alkalinity is different than hardness because it includes sodium and potassium carbonate. | Sources of alkalinity are similar to sources of hardness. Alkalinity can come from chalk, limestone, marble, coral, and calcite. Sodium is the sixth most abundant element in the earth's crust at about 2.6-3%. Potassium is the seventh most abundant and makes up about 1.5% by weight of the earth's crust. | Slightly acidic water dissolves calcium carbonate, sodium carbonate, and potassium carbonate and carries them to water bodies. | | | | | | |
| **Total Organic Carbon**  | Total organic carbon is the mass of carbon present in a water sample, excluding the carbon present as $CO_2$ and/or carbonates. Organic carbon is carbon that has been incorporated in an organism. | Organic carbon (organic matter) sources include: decomposing plant and animal material, humic substances, agricultural runoff, and municipal and industrial effluents. | Organic carbon is transported to water by atmospheric deposition, surface water runoff, and point sources. | | | | | | |

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**Table 4 continued.** Parameters information

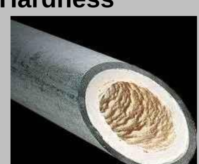
| Parameter | Minnesota Standard for 2b Waters | Minnesota Standard for 2bd Waters | EPA Standard | Lab Testing Method | Sources |
|---|---|---|---|---|---|
| **Total Phosphorus**  | | | | EPA 351.2 & 365.4 ATP | http://www.theodoregray.com/periodictabledisplay/Elements/015/index.s9.html(pic. White pure phosphorus) |
| **Orthophosphate**  | | | | EPA 365.2 | http://bcn.boulder.co.us/basin/data/NUTRIENTS/info/TP.html<br>http://www.ci.falls-church.va.us/services/aboutorthophosphate.html<br>http://www.epa.gov/dclead/phosphoric_acid_health_effects_sheet_FINAL.pdf<br>http://extoxnet.orst.edu/faqs/safedrink/phos.htm<br>http://www.water-research.net/phosphate.htm<br>http://www.indiamart.com/acid-india/(phosphoric acid pic.) |
| **Total Sulfates**  | | | Sulfate in drinking water currently has a secondary maximum contaminant level (SMCL)*5 of 250 milligrams per liter (mg/L), based on aesthetic effects (i.e., taste and odor). | Standard Methods 425C 15th Edition | Minnesota Rules Chapter 7050.0222 Specific Standards of Quality and Purity for Clas 2 Waters of the State; Aquatic Life and Recreation. (2b and 2bd standards.)<br>http://en.wikipedia.org/wiki/Sulfates<br>http://www.epa.gov/safewater/sulfate.html<br>http://www.dhfs.state.wi.us/eh/ChemFS/fs/Sulfates.htm (Sources, Human Concerns and Transport)<br>http://www.enardoni.com/sandra/(sea Spray picture) |
| **Total Hardness**  | | | | Standard Methods 314B 15th Edition | http://www.bfhd.wa.gov/info/tds.php (Definition)<br>http://www.deq.state.mi.us/documents/deq-ead-tas-whitings.pdf (Sources)<br>http://www.lenntech.com/Periodic-chart-elements/Ca-en.htm (Information)<br>http://www.watertiger.net/water_solutions/well/hardness.htm(Limescale) |
| **Total Alkalinity**  | | | | EPA 310.2 | http://msucares.com/pubs/infosheets/is1334.htm (Definition)<br>http://www.webelements.com/webelements/elements/text/K/key.html (Definition of Potassium)<br>http://images.antiagingconference.com/files/1103/aagateway/glossaryofterms.asp (Definition) |
| **Total Organic Carbon**  | | | | EPA 415.1 wet oxidation; auto sampler; settled sample; NDIR detection | http://www.fleckvalves.com/water%20dictionary.htm (Definition)<br>http://bcn.boulder.co.us/basin/data/COBWQ/info/TOC.html (Information)<br>http://www.wwnorton.com/college/geo/earth2/glossary/o.htm#19 (Definition of Organic Carbon)<br>http://www.nsc.org/ehc/glossar1.htm<br>http://www.sfrc.ufl.edu/Extension/ssfor11.htm<br>http://www.athro.com/geo/trp/gub/coal.html (peat picture) |

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**Table 4 continued.** Parameters information

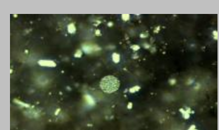
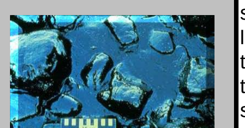
| Parameter | Definition | Sources | Transport to Water | Pollution Concerns for Humans | Pollution Concerns for Wildlife | Pollution Concerns for Plants | Risk Threshold for Humans | Risk Threshold for Wildlife | Risk Threshold for Plants |
|---|---|---|---|---|---|---|---|---|---|
| **Total Volatile Suspended Solids**  | Total Volatile Suspended Solids (VSS) is a measure representing the sum of all the VSS in a sample. VSS are those solids lost on ignition (heating to 550 degrees C). | Sources of VSS include: fuel combustion, road salts, asphalt, fertilizers, pesticides, soil treatments, paints and stains, plastics, sanitary waste, manufacturing, animal waste, and atmospheric deposition. | VSS are transported to water directly from spills and indirectly from surface water runoff and atmospheric deposition. | | | | | | |
| **Total Dissolved Solids**  | Total Dissolved Solids (TDS) is that portion of solids in water that can pass through a 2 micron filter. | Sources of TDS include: fuel combustion, road salts, asphalt, fertilizers, pesticides, soil treatments, sanitary waste, plant materials, and atmospheric deposition. | TDS are transported to water by point sources from industry and nonpoint sources from surface water runoff. | | | | | | |
| **Total Suspended Solids**  | Total suspended solids (TSS) include all particles suspended in water which will not pass through a filter. | Sources of TSS include: sanitary and industrial wastewater, soil erosion, fossil fuel and biomass combustion, fertilizers, pesticides, soil treatments, atmospheric deposition, and plant materials. | TSS is transported to water by point sources from industry and by nonpoint sources from surface water runoff. | | Total suspended solids blanket river beds destroying fish habitat, smother fish and insect eggs, clog gills, suffocate newly-hatched larvae, reduce growth rates and lower resistance to disease. | | | | |
| **Oil and grease**  | Oil is a greasy liquid of vegetable, animal, mineral, or synthetic origin. Grease is a lubricant composed of oil and thickened with a soap or other thickener to a semisolid or solid consistency. | Sources of oil and grease pollution include: incomplete combustion, tire particles, food preparation, asphalt and manufacturing, and urban runoff from: vehicles, parking lots, roads, machinery, filling stations, and garages. | Oil and grease are transported to water from spills, watercraft, vehicles, atmospheric deposition, and surface water runoff. | | Oil spills cause wildlife to suffer loss of insulative capability, dehydration, GI tract disorders, destruction of red blood cells, pneumonia, skin and eye irritation, and impaired reproduction. | Aquatic plants are subject to contact, smothering, toxicity, and chronic long-term effects that may result from the physical and chemical properties of spilled oil. | | | |
| **Fecal Coliform**  | Fecal coliform is a bacteria that lives in the intestinal tract of warm-blooded animals. | Fecal coliform is found in the fecal material of warm-blooded animals. Major sources include agriculture and feedlots. | Fecal coliform is transported to water from domestic sewage and nonpoint runoff. | Fecal coliform can cause Typhoid Fever, viral and bacterial Gastroenteritis, and Hepatitis A. | | | Body Contact: <200 colonies/ 100ml | | |
| **Escherichia Coli (E. Coli)**  | E. coli is a bacteria that is distinguished from total coliform by its ability to grow at elevated temperatures. | E. coli is found in the fecal material of warm-blooded animals. Major sources include agriculture and feedlots. | E. coli is transported to water from domestic sewage and nonpoint source runoff. | E. coli can inflame intestinal walls. | | | The exact amount harmful to humans is not known but believed to be very small. | | |

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**Table 4 continued.** Parameters information

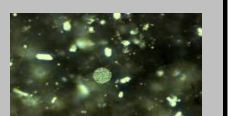
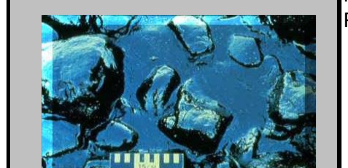
| Parameter | Minnesota Standard for 2b Waters | Minnesota Standard for 2bd Waters | EPA Standard | Lab Testing Method | Sources |
|---|---|---|---|---|---|
| **Total Volatile Suspended Solids**  | | | | EPA 160.2 ATP | http://www.bfhd.wa.gov/info/tss.php (Source and Definition)<br>http://www.uic.edu/classes/cmeng/cmeng420/tssSOP.pdf (Definition)<br>http://www.shutterstock.com/s/gasoline/cat-p3.html?searchterm=gasoline (picture) |
| **Total Dissolved Solids**  | | | The U.S. Environmental Protection Agency sets a secondary standard*6 of 500 mg/l TDS in drinking water. | Standard Methods 2540C 18th Edition | http://www.bfhd.wa.gov/info/tds.php (Definition)<br>http://www.epa.gov/safewater/mcl.html#mcls (Standard)<br>http://www.drjbs.com/filling.html(pic.) |
| **Total Suspended Solids**  | | | | EPA 160.2 ATP | http://www.deq.state.mi.us/documents/deq-swq-npdes-TotalSuspendedSolids.pdf (Definition and Sources)<br>http://www.see.leeds.ac.uk/research/igs/people/raiswell/sulphide.htm(pic.) |
| **Oil and grease**  | Oil: µg/l<br>CS: 500<br>MS: 5000<br>FAV: 10,000 | Oil: µg/l<br>CS: 500<br>MS: 5000<br>FAV: 10,000 | | Soxhlet extraction using Freon, dry at 130C, and weigh. | Minnesota Rules Chapter 7050.0222 Specific Standards of Quality and Purity for Class 2 Waters of the State; Aquatic Life and Recreation. (2b and 2bd Standards.)<br>web.mit.edu/environment/ehs/topic/spcc_ref/glossary.html (Definition)<br>www.climatechangenorth.ca/H1_Glossary.html (Definition)<br>www.fi.edu/fellows/fellow2/jan99/new/oilvocab.html (Definition)<br>www.oilanalysis.com/dictionary/default.asp (Definition)<br>wordnet.princeton.edu/perl/webwn (Definition)<br>www.oilanalysis.com/dictionary/default.asp (Definition)<br>http://www.stormwaterauthority.org/pollutants/default.aspx (Dources)<br>http://www.epa.gov/oilspill/pdfs/chap5.pdf (Effects on Wildlife) |
| **Fecal Coliform**  | Not to exceed 200 colonies/100mL* | Not to exceed 200 colonies/100mL* | **Drinking water** <1 colony/100mL<br>**Body contact** <200 colonies/ 100mL<br>**Fishing and boating** <1000 colonies/100mL<br>**Domestic water supply for treatment** <2000 colonies/100mL | Standard Methods 20th Edition 9221E fecal coliform test using EC medium. SM 20th ed. pp: 9-54. | Minnesota Rules Chapter 7050.0222 Specific Standards of Quality and Purity for Class 2 Waters of the State; Aquatic Life and Recreation. (2b and 2bd standards.)<br>http://www.state.ky.us/nrepc/water/wcpfcol.htm<br>http://www.switzerland.k12.in.us/Watershed/fecal.html<br>http://www.oasisdesign.net/water/quality/coliform.htm<br>http://www.epa.gov/ost/pc/ambientwqc/bacteria1986.pdf<br>lakes.net/beachcast/bw_waterborne.html(pic.) |
| **Escherichia Coli (E. Coli)**  | Proposed 126 colonies/100mL | Proposed 126 colonies/100mL | **Drinking water**<br>Maximum Contaminant Level: 0.0 | EPA method 1603 | Minnesota Rules Chapter 7050.0222 Specific Standards of Quality and Purity for Class 2 Waters of the State; Aquatic Life and Recreation. (2b and 2bd standards.)<br>http://www.state.ky.us/nrepc/water/wcpfcol.htm (xx)<br>http://www.switzerland.k12.in.us/Watershed/fecal.html<br>http://www.oasisdesign.net/water/quality/coliform.htm<br>http://www.epa.gov/ost/pc/ambientwqc/bacteria1986.pdf<br>http://www.about-ecoli.com/page3.htm (risks to people)<br>http://www.epa.gov/safewater/mcl.html#mcls (MCL Drinking water) |

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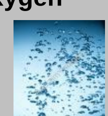
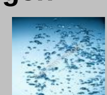
**Table 4 continued.** Parameters information

| Parameter | Definition | Sources | Transport to Water | Pollution Concerns for Humans | Pollution Concerns for Wildlife | Pollution Concerns for Plants | Risk Threshold for Humans | Risk Threshold for Wildlife | Risk Threshold for Plants |
|---|---|---|---|---|---|---|---|---|---|
| **Total Chemical Oxygen Demand**  | Total chemical oxygen demand (COD) is a measurement of the amount of oxygen required to degrade the organic compounds in water. | Sources of organic compounds include: organic material, paints and stains, manufacturing, atmospheric deposition, and plant materials. | Organic carbon is transported to water via surface water runoff, atmospheric deposition, and point and nonpoint source pollution. | | | | | | |
| **Carbonaceous Biological Oxygen Demand**  | Carbonaceous (consisting of or containing carbon) Biological Oxygen Demand (CBOD) is caused by the breakdown of organic molecules such as cellulose and sugars into carbon dioxide and water. | Sources of organic molecules include: human and animal waste, plant materials, soil erosion, lawn fertilizers, paper, urban runoff, atmospheric deposition, and industrial sources. | Organic compounds are transported to water directly from point sources and indirectly from surface water runoff. CBOD increases when the availability of sunlight and nutrients are increased in a water body. | | | | | | |
| **Total 5-day BOD**  | Total 5-day Biochemical (or biological) Oxygen Demand (BOD) measures the amount of oxygen consumed by biochemical oxidation of waste contaminants in a 5-day period. | Sources of BOD causing waste include: human and animal waste, plant materials, soil erosion, lawn fertilizers, paper, urban runoff, atmospheric deposition, and industrial sources. | BOD is transported to water directly from point sources and indirectly from surface water runoff. BOD increases when the availability of sunlight and nutrients are increased in a water body. | | | | | | |
| **Temperature**  | Temperature is a measure of the degree of heat intensity. | The sun is the main source of heat to water bodies. Power plants contribute hot water to rivers by releasing heated cooling water. | The sun's rays transfer heat to water, blacktop transfers heat to water, and power plants discharge used cooling water into streams and rivers. | Warmer water allows for faster growth of bacteria. | Warm water holds less oxygen than cold water. Warmer temperatures increase metabolic rates of organisms. These two factors stress aquatic species. | Temperature affects plant communities. Changing the temperature range of an aquatic system can transform plant communities. | | The temperature range at which different organisms can survive varies. In general, trout live in water from 35-75 degrees Fahrenheit. | |
| **Dissolved Oxygen**  | Dissolved oxygen (D.O.) is oxygen that has been dissolved in water and is therefore freely available to aquatic organisms. | Dissolved oxygen comes from the atmosphere and photosynthesis. D.O. is depleted when microorganisms decompose organic material. | Waves and tumbling water mix air into the water where oxygen readily dissolves. Aquatic plants and algae release D.O. as a byproduct of photosynthesis. | | Oxygen is essential for fish, invertebrate, plant, and aerobic bacteria respiration. Lower levels of D.O. mean more stress on aquatic organisms. | Aquatic plants use oxygen at night and on very cloudy days for respiration, otherwise they produce oxygen as a byproduct. | | Dissolved oxygen levels below 3 mg/L are stressful to most aquatic organisms. Levels below 2 or 1 mg/L will not support fish. | |
| **pH**  | pH is a measure of the acidity of a solution. pH is equal to the negative logarithm of the concentration of hydrogen ions in a solution. A pH of 7 is neutral, less than 7 is acidic and greater than 7 is basic. | Sulfur dioxide (SO2) and nitrogen oxides (NOx) are sources of acidity and come from fossil fuel combustion. Burning coal produces fly ash that contains metal oxides, which raise the pH of water. | Acids are transported to water through wet and dry deposition of acid from the atmosphere. Bases are transported to water by air pollution (fly ash from coal burning) and water pollution (soaps and oxides). | | | | | | |
| **Conductivity**  | Conductivity is a measure of a solution's ability to carry an electrical current. The measurement is used in fresh water analyses to obtain a rapid estimate of dissolved solids or salts content of a water sample. | Conductivity and dissolved solids share the same sources: fossil fuel combustion, incinerators, road salts, asphalt, fertilizers, pesticides, soil treatments, sanitary waste, animal waste, atmospheric deposition, and plant materials. | Point sources from industry and nonpoint sources from surface water runoff. | | | | | | |

*Not to exceed 200 organisms per 100 milliliters as a geometric mean of not less than five samples in any calendar month, nor shall more than ten percent of all samples taken during any calendar month individually exceed 2000 organisms per 100 milliliters. The standard applies only between April 1 and October 31.
**CS: "Chronic Standard" the highest water concentration of a toxicant to which organisms can be exposed indefinitely without causing chronic toxicity.
***MS: "Maximum standard" is the highest concentration of a toxicant in water to which aquatic organisms can be exposed for a brief time with zero to slight mortality. The MS equals the FAV divided by two.
****FAV: "Final acute value" is an estimate of the concentration of a pollutant corresponding to the cumulative probability of 0.05 in the distribution of all the acute toxicity values for the genera or species from the acceptable acute toxicity tests conducted on a pollutant.
*5 EPA has established National Secondary Drinking Water Regulations that set non-mandatory water quality standards for 15 contaminants. EPA does not enforce these "secondary maximum contaminant levels" or "SMCLs." They are established only as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color and odor. These contaminants are not considered to present a risk to human health at the SMCL.
*6 Secondary standards are unenforceable but recommended guidelines for contaminants that may cause cosmetic or aesthetic effects in drinking water.

**Table 4 continued.** Parameters information

| Parameter | Minnesota Standard for 2b Waters | Minnesota Standard for 2bd Waters | EPA Standard | Lab Testing Method | Sources |
|---|---|---|---|---|---|
| **Total Chemical Oxygen Demand**  | | | | EPA 410.4 | Minneapolis Public Works (Sources)<br>http://www.scpscience.com/products/Water%20Analysis/cod.asp (Definition)<br>http://home.iprimus.com.au/elouera7/bushwalk.htm leaves in water pic.) |
| **Carbonaceous Biological Oxygen Demand**  | | | | Standard Methods 5210B 18th Edition | http://www.justbeef.ca/compost.html (steaming compost picture)<br>http://www.weblife.org/humanure/glossary.html (Definition)<br>http://www.deqstate.mi.us/documents/deq-swq-mpdes-BiologicalOxygenDemand.pdf (Sources) |
| **Total 5-day BOD**  | | | | Standard Methods 5210B 18th Edition | http://www.waterandagroindustry.org/forum/forum.asp?ofact=0&ofmsgid=&ofdisp=0&ofpage=&ofrand=1083578<br>http://water.usgs.gov/owq/FieldManual/Chapter7/7.0.html (Definition)<br>http://www.fivecreeks.org/monitor/bod.html<br>http://www.sciencenews.org/articles/20030628/fob1.asp (picture of water) |
| **Temperature**  | | | Temperature is a non-priority pollutant and is species dependent. | Thermometer | http://www.lenntech.com/aquatic/heat.htm (Wildlife)<br>http://www.istockphoto.com/file_search.php?action=file&text=%22mercury%22&abe10f7e5afbbb3a79ce619739541149=mercury(pic.) |
| **Dissolved Oxygen**  | MPCA: 5 mg/L | MPCA: 5 mg/L | | Dissolved Oxygen meter | http://library.marist.edu/diglib/EnvSci/archives/hudsmgmt/ny-njharborestuaryprogram/glossary.html (Definition)<br>http://www.cotf.edu/ete/modules/waterq/wqdissolvedo2.html (Everything else)<br>http://www.acclaimimages.com/_gallery/_pages/0243-0609-1208-2847.html(pic.) |
| **pH**  | | | | | http://www.policyalmanac.org/environment/archive/acid_rain.shtml (Transportation, Source) |
| **Conductivity**  | | | | | http://www.enr.state.nc.us/neuse/files/glossary.htm (Definition) |

*Not to exceed 200 organisms per 100 milliliters as a geometric mean of not less than five samples in any calendar month, nor shall more than ten percent of all samples taken during any calendar month individually exceed 2000 organisms per 100 milliliters. The standard applies only between April 1 and October 31.

**CS: "Chronic Standard" the highest water concentration of a toxicant to which organisms can be exposed indefinitely without causing chronic toxicity.

***MS: "Maximum standard" is the highest concentration of a toxicant in water to which aquatic organisms can be exposed for a brief time with zero to slight mortality. The MS equals the FAV divided by two.

****FAV: "Final acute value" is an estimate of the concentration of a pollutant corresponding to the cumulative probability of 0.05 in the distribution of all the acute toxicity values for the genera or species from the acceptable acute toxicity tests conducted on a pollutant.

*5 EPA has established National Secondary Drinking Water Regulations that set non-mandatory water quality standards for 15 contaminants. EPA does not enforce these "secondary maximum contaminant levels" or "SMCLs." They are established only as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color and odor. These contaminants are not considered to present a risk to human health at the SMCL.

*6 Secondary standards are unenforceable but recommended guidelines for contaminants that may cause cosmetic or aesthetic effects in drinking water.

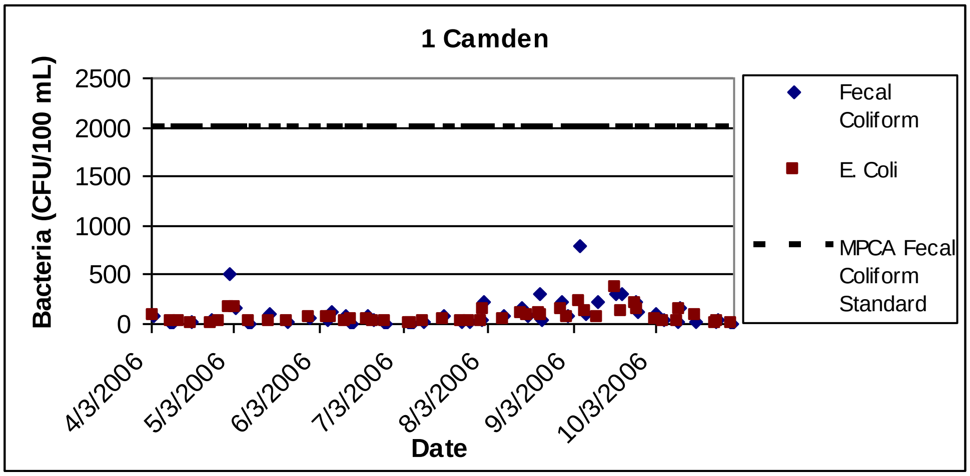
**APPENDIX D**

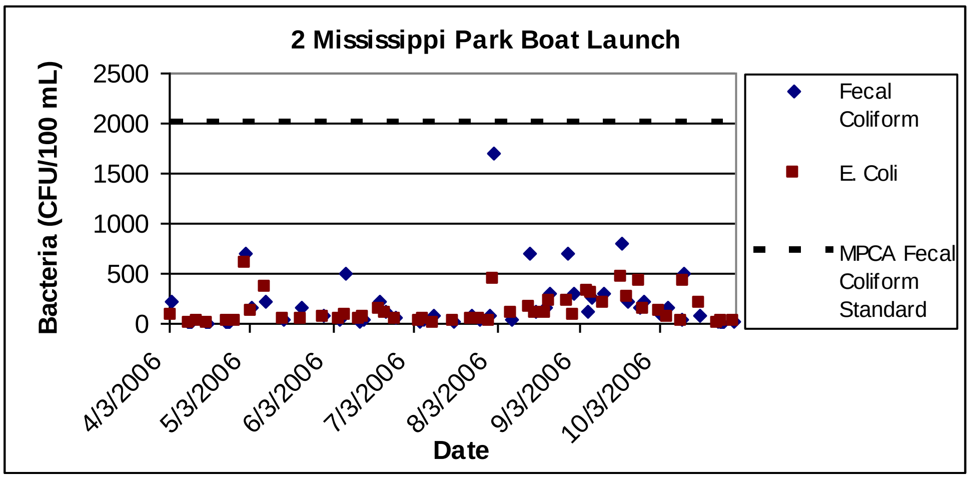
**Table 5.** Unit conversions

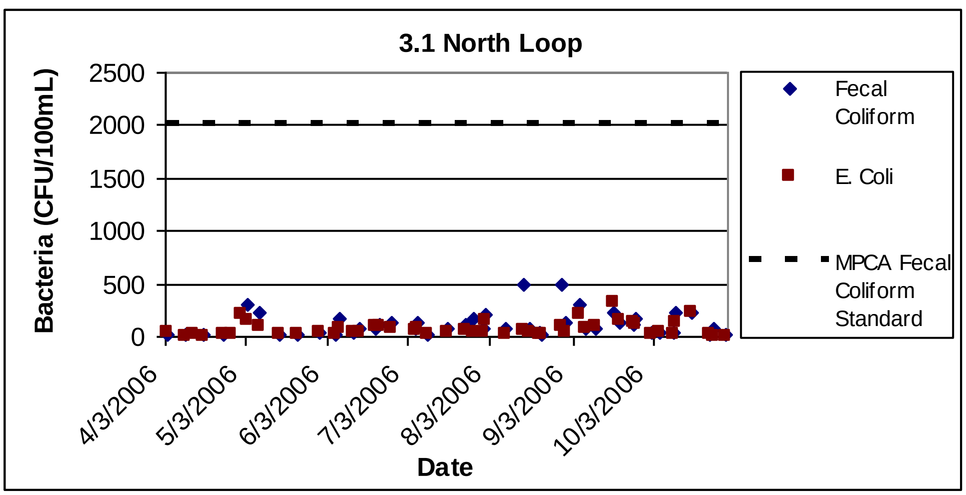
| Unit | Unit Conversion |
|---|---|
| 1 L | 1000 mL |
| 1 gallon | 3.78 L |
| 1 g | 1000 mg |
| 1 mg | 1000 µg |
| 1 mg/L | 1 ppm |
| 1 µg/L | 1 ppb |
| 1 m | 100 cm |
| 1 in | 2.54 cm |
| 1 ft | 12 in |

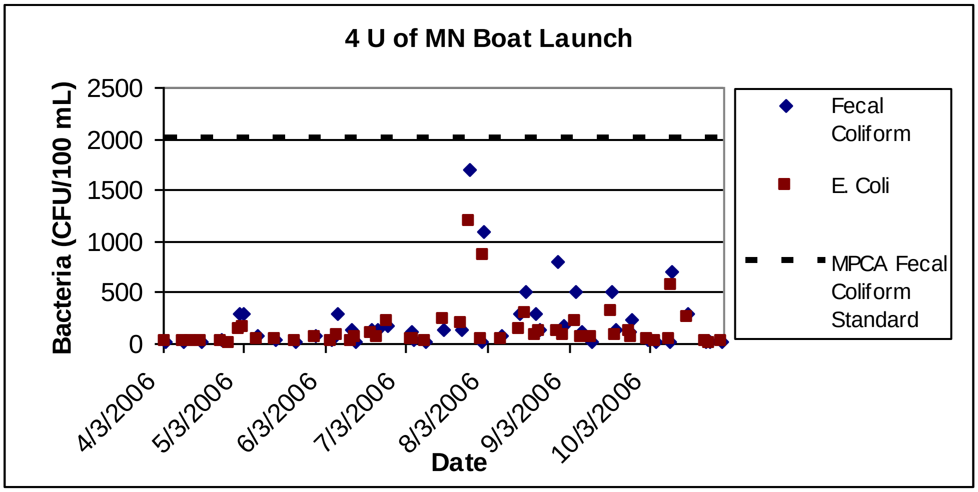
## APPENDIX E

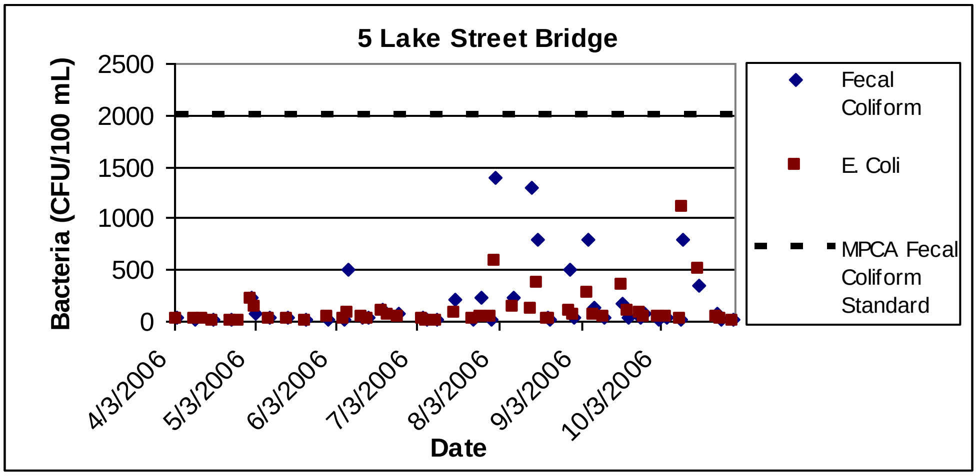
Mississippi River fecal coliform and e. coli concentrations

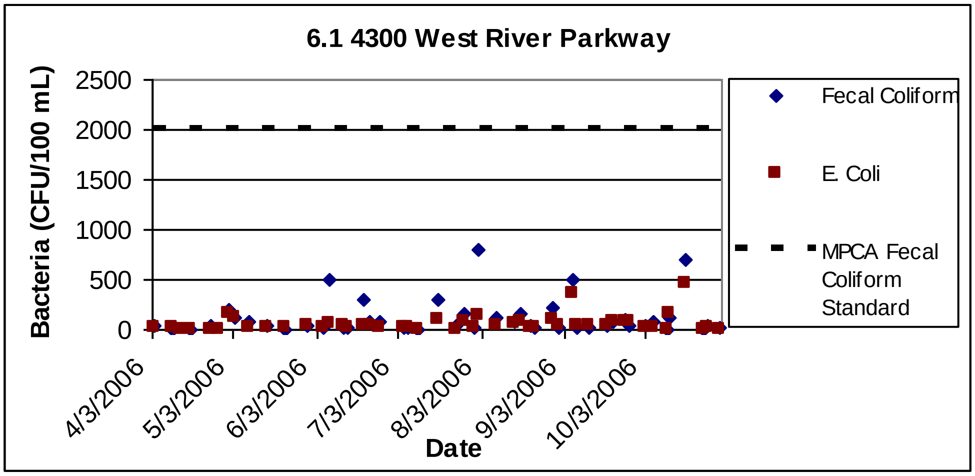


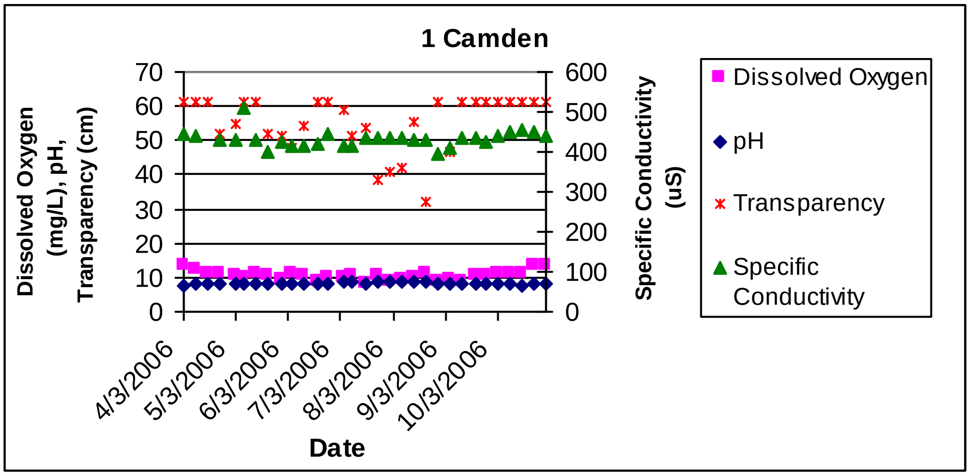



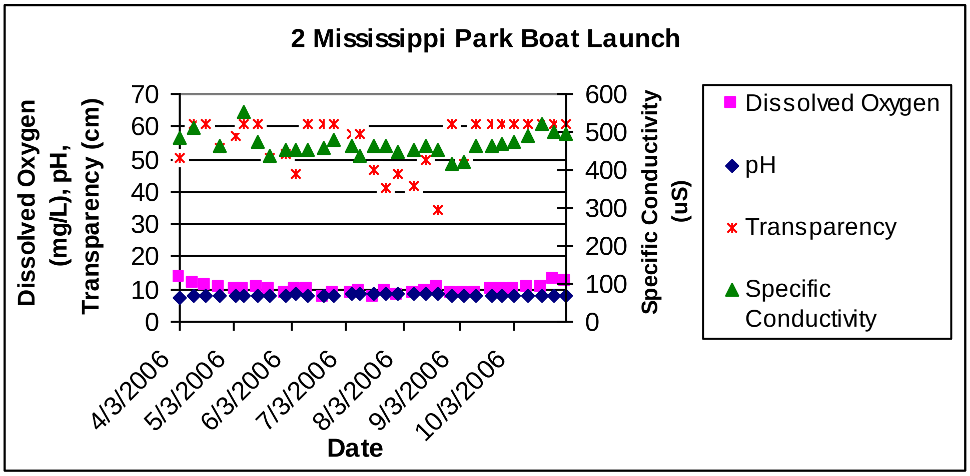

4 U of MN Boat Launch
Bacteria (CFU/100 mL)
2500
2000
1500
1000
500
0
4/3/2006
5/3/2006
6/3/2006
7/3/2006
8/3/2006
9/3/2006
10/3/2006
Date
Fecal Coliform
E. Coli
MPCA Fecal Coliform Standard

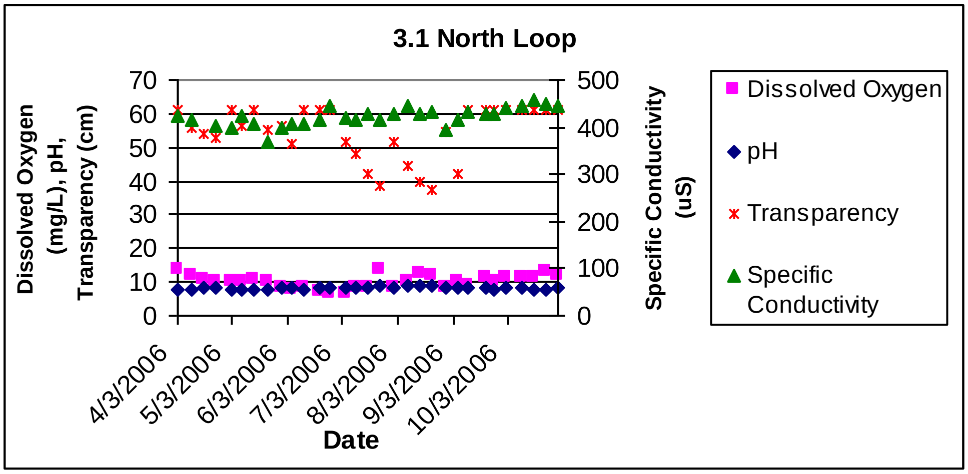

5 Lake Street Bridge
Bacteria (CFU/100 mL)
2500
2000
1500
1000
500
0
4/3/2006
5/3/2006
6/3/2006
7/3/2006
8/3/2006
9/3/2006
10/3/2006
Date
Fecal Coliform
E. Coli
MPCA Fecal Coliform Standard

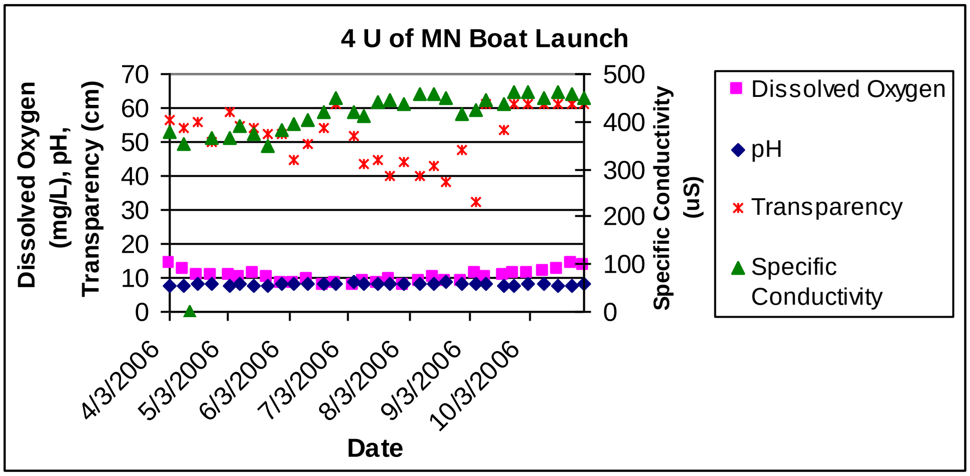

6.1 4300 West River Parkway
Bacteria (CFU/100 mL)
2500
2000
1500
1000
500
0
4/3/2006
5/3/2006
6/3/2006
7/3/2006
8/3/2006
9/3/2006
10/3/2006
Date
Fecal Coliform
E. Coli
MPCA Fecal Coliform Standard

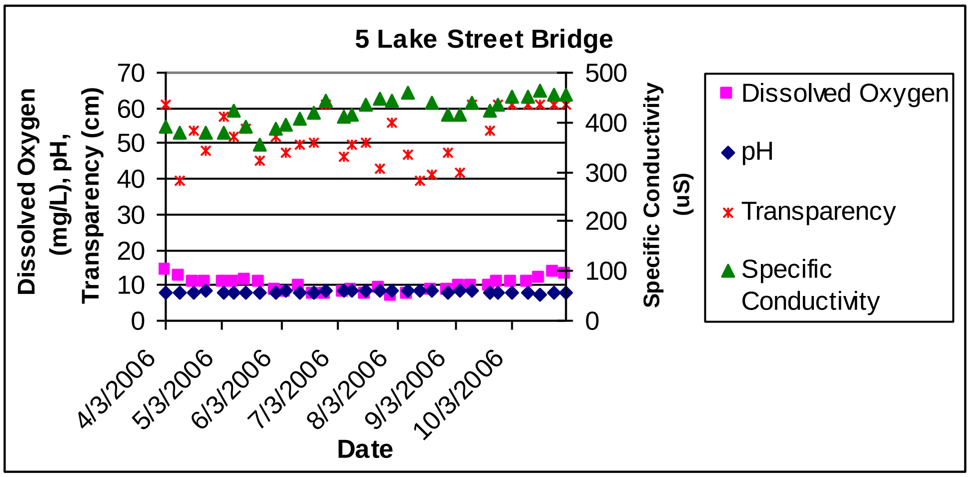
Mississippi River dissolved oxygen (mg/L), pH, transparency (cm) and specific conductivity (µS) monitoring results

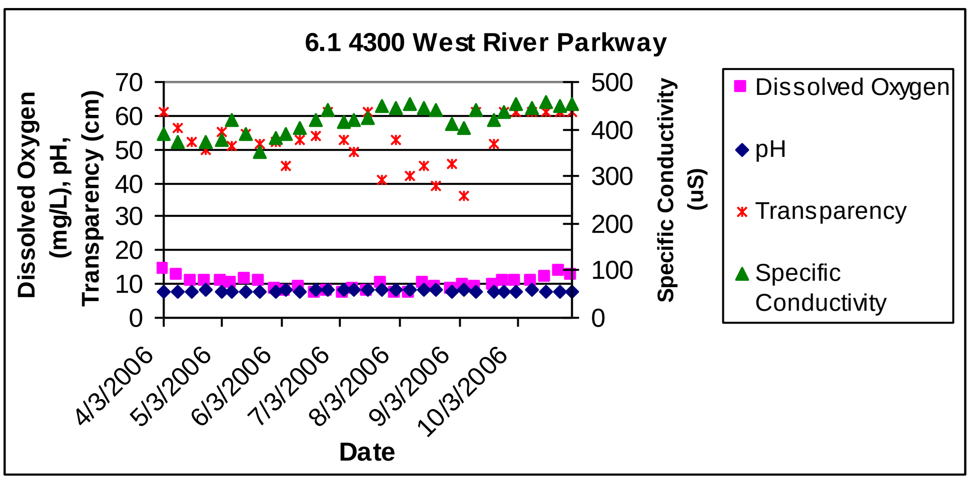



4 U of MN Boat Launch
Dissolved Oxygen (mg/L), pH, Transparency (cm)
Specific Conductivity (uS)
Date
0
10
20
30
40
50
60
70
0
100
200
300
400
500
4/3/2006
5/3/2006
6/3/2006
7/3/2006
8/3/2006
9/3/2006
10/3/2006
Dissolved Oxygen
pH
Transparency
Specific Conductivity


5 Lake Street Bridge
Dissolved Oxygen (mg/L), pH, Transparency (cm)
Specific Conductivity (uS)
Date
0
10
20
30
40
50
60
70
0
100
200
300
400
500
4/3/2006
5/3/2006
6/3/2006
7/3/2006
8/3/2006
9/3/2006
10/3/2006
Dissolved Oxygen
pH
Transparency
Specific Conductivity


6.1 4300 West River Parkway
Dissolved Oxygen (mg/L), pH, Transparency (cm)
Specific Conductivity (uS)
Date
0
10
20
30
40
50
60
70
0
100
200
300
400
500
4/3/2006
5/3/2006
6/3/2006
7/3/2006
8/3/2006
9/3/2006
10/3/2006
Dissolved Oxygen
pH
Transparency
Specific Conductivity

**APPENDIX F**

**Table 7.** Stormwater sewersheds' major land uses

| Stormwater Sewershed | Major Land Uses |
|---|---|
| 1NE Excel Power Plant | Residential, Industrial |
| 2NNBC Old Bassetts Creek | Residential, Commercial |
| 4PP 35W Bridge | Residential, Heavy Industry |
| 6UMN U of M Coal Storage Facility | Residential, Commercial |
| 7LSTU Franklin Bridge | Residential, Industrial, Commercial |

**Table 8.** Monitoring results for 1NE outfall

| Date | Sample Time | Sample Type | Water Temp (F) | Dissolved Oxygen (mg/L) | Conductivity (uS) | Specific Conductivity (uS) | pH | Transparency (cm) | Salinity (ppt) | Width of water* (ft) | Fecal Coliform (counts/100 mL) | E. coli (counts/100 mL) | Fluoride (mg/L) | Total Dissolved Solids (mg/L) | Sulfate (mg/L) | Dissolved Phosphorus (mg/L) | Ortho Phosphorous (mg/L) | Total Kjeldahl Nitrogen (mg/L) | Ammonia Nitrogen (mg/L) | Nitrite N (mg/L) | Nitrate N (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/3/2006 | | LIQ | 47.5 | 10.45 | 2778.0 | 4043.0 | 6.9 | | 2.1 | 2 | | | | | | | | | | | |
| 1/9/2006 | | | | | | | | | | 1.25 | | | | | | | | | | | |
| 2/28/2006 | | | 45.3 | 11.48 | 935.0 | 1409.0 | 7.8 | | 0.7 | 1 | | | | | | | | | | | |
| 3/9/2006 | 13:15 | LIQ | 45.5 | 11.80 | 1061.0 | 1604.0 | 7.8 | 61.0 | 0.8 | 1 | | | | 966 | 115 | | | 2.80 | 0.65 | 0.06 | 0.99 |
| 3/9/2006 | 13:15 | FILT | 45.5 | 11.80 | 1061.0 | 1604.0 | 7.8 | 61.0 | 0.8 | 1 | | | | | | 0.129 | 0.110 | | | | |
| 3/20/2006 | 12:45 | LIQ | 43.3 | 11.56 | 1418.0 | 2207.0 | 7.5 | | 1.1 | 1.5 | | | | 1240 | 97 | | | 0.62 | 0.15 | 0.015 | 1.04 |
| 3/20/2006 | 12:45 | FILT | 43.3 | 11.56 | 1418.0 | 2207.0 | 7.5 | | 1.1 | 1.5 | | | | | | 0.036 | 0.025 | | | | |
| 3/30/2006 | 11:50 | LIQ | 43.7 | 11.34 | 1164.0 | 1800.0 | 7.9 | 4.4 | 0.9 | 2.5 | | | | 1030 | 45 | | | 2.50 | 0.29 | 0.09 | 1.06 |
| 3/30/2006 | 11:50 | FILT | 43.7 | 11.34 | 1164.0 | 1800.0 | 7.9 | 4.4 | 0.9 | 2.5 | | | | | | 0.182 | 0.080 | | | | |
| 4/27/2006 | 12:06 | | 49.5 | | | | | | | 1 | | 8500 | 0.58 | | | | | | | | |
| 4/28/2006 | 10:54 | LIQ | 48.7 | 11.02 | 983.0 | 1404.0 | 7.8 | 61.0 | 0.7 | 1 | | | | 897 | 180 | | | 0.68 | 0.10 | 0.04 | 2.62 |
| 4/28/2006 | 10:54 | FILT | 48.7 | 11.02 | 983.0 | 1404.0 | 7.8 | 61.0 | 0.7 | 1 | | | | | | 0.038 | 0.012 | | | | |
| 4/28/2006 | 14:19 | LIQ | 53.6 | 10.21 | 168.1 | 223.8 | 7.7 | 7.3 | 0.1 | 3 | | | | 164 | 5 | | | 4.50 | 0.97 | 0.10 | 0.66 |
| 4/28/2006 | 14:19 | FILT | 53.6 | 10.21 | 168.1 | 223.8 | 7.7 | 7.3 | 0.1 | 3 | | | | | | 0.535 | 0.435 | | | | |
| 5/1/2006 | 11:04 | | 53.2 | | | | | | | 3 | 5000 | 5400 | 0.21 | | | | | | | | |
| 5/12/2006 | 12:00 | LIQ | 50.0 | 10.82 | 231.6 | 325.0 | 7.4 | 5.8 | 0.2 | 3 | | | | 189 | 9 | | | 1.40 | 0.14 | 0.05 | 0.44 |
| 5/12/2006 | 12:00 | FILT | 50.0 | 10.82 | 231.6 | 325.0 | 7.4 | 5.8 | 0.2 | 3 | | | | | | 0.177 | 0.151 | | | | |
| 5/31/2006 | 12:00 | LIQ | 53.1 | 10.52 | 1026.0 | 1376.0 | 7.7 | 61.0 | 0.7 | 1 | 16001 | 9200 | | 920 | 172 | | | 1.40 | 0.51 | 0.015 | 2.61 |
| 5/31/2006 | 12:00 | FILT | 53.1 | 10.52 | 1026.0 | 1376.0 | 7.7 | 61.0 | 0.7 | 1 | 16001 | 9200 | | | | 0.094 | 0.101 | | | | |
| 6/7/2006 | 12:52 | | 56.3 | | | | | | | 1 | 2400 | 122 | 0.59 | | | | | | | | |
| 6/13/2006 | 14:40 | LIQ | 57.4 | 9.39 | 898.0 | 1135.0 | 7.8 | 19.7 | 0.6 | 1 | | | | 772 | 154 | | | 0.89 | 0.21 | 0.03 | 1.70 |
| 6/13/2006 | 14:40 | FILT | 57.4 | 9.39 | 898.0 | 1135.0 | 7.8 | 19.7 | 0.6 | 1 | | | | | | 0.052 | 0.041 | | | | |
| 6/14/2006 | 11:32 | | 55.4 | | | | | | | 1 | 130 | 100 | 0.51 | | | | | | | | |
| 6/22/2006 | 11:40 | | 56.1 | | | | | | | 1 | 16001 | 19001 | 0.64 | | | | | | | | |
| 6/23/2006 | 11:45 | LIQ | 56.3 | 9.67 | 992.0 | 1269.0 | 7.9 | 61.0 | 0.6 | 1 | | | | 801 | 114 | | | 0.65 | 0.15 | 0.015 | 4.11 |
| 6/23/2006 | 11:45 | FILT | 56.3 | 9.67 | 992.0 | 1269.0 | 7.9 | 61.0 | 0.6 | 1 | | | | | | 0.040 | 0.025 | | | | |
| 7/6/2006 | 11:55 | | 64.4 | | | | | | | 1 | 1300 | 730 | 0.47 | | | | | | | | |
| 7/11/2006 | 11:55 | | 60.8 | 8.73 | 598.0 | 722.0 | 7.4 | | 0.4 | | | | | | | | | | | | |
| 7/13/2006 | 10:30 | LIQ | 65.3 | 8.44 | 536.0 | 612.0 | 7.6 | 61.0 | 0.3 | | | | | 382 | 68 | | | 0.60 | 0.12 | 0.14 | 0.95 |
| 7/13/2006 | 10:30 | FILT | 65.3 | 8.44 | 536.0 | 612.0 | 7.6 | 61.0 | 0.3 | | | | | | | 0.080 | 0.064 | | | | |
| 7/19/2006 | | LIQ | 75.0 | 5.26 | 281.9 | 287.6 | 8.0 | | 0.1 | | | | | 174 | 12 | | | 2.40 | 0.13 | 0.11 | 0.58 |
| 7/19/2006 | | FILT | 75.0 | 5.26 | 281.9 | 287.6 | 8.0 | | 0.1 | | | | | | | 0.045 | 0.028 | | | | |
| 7/24/2006 | | LIQ | | | | | | | | | | | | 203 | 19 | | | 2.20 | 0.01 | 0.13 | 0.55 |
| 7/24/2006 | | FILT | 77.0 | 2.95 | 289.5 | 289.6 | 7.3 | 10.0 | 0.1 | | | | | | | 0.043 | 0.013 | | | | |
| 7/27/2006 | 11:30 | | 68.4 | | | | | | | | 1100 | 2700 | 0.85 | | | | | | | | |
| 7/28/2006 | 12:00 | LIQ | 71.2 | 7.9 | 505.0 | 538.0 | 7.8 | 61.0 | 0.3 | | | | | 347 | 59 | | | 0.90 | 0.25 | 0.15 | 1.00 |
| 7/28/2006 | 12:00 | FILT | 71.2 | 7.9 | 505.0 | 538.0 | 7.8 | 61.0 | 0.3 | | | | | | | 0.109 | 0.107 | | | | |
| 8/1/2006 | 12:08 | | 75.2 | | | | | | | | 16001 | 9200 | 0.27 | | | | | | | | |
| 8/1/2006 | 13:30 | LIQ | 79.3 | 5.46 | 341.7 | 333.1 | 7.5 | | 0.2 | | | | | 172 | 10 | | | 2.00 | 0.01 | 0.07 | 0.58 |
| 8/1/2006 | 13:30 | FILT | 79.3 | 5.46 | 341.7 | 333.1 | 7.5 | | 0.2 | | | | | | | 0.051 | 0.040 | | | | |
| 8/1/2006 | 18:08 | LIQ | 75.6 | 6.87 | 213.1 | 216.3 | 7.5 | 8.0 | 0.1 | | | | | 160 | 9 | | | 1.20 | 0.10 | 0.04 | 0.43 |
| 8/1/2006 | 18:08 | FILT | 75.6 | 6.87 | 213.1 | 216.3 | 7.5 | 8.0 | 0.1 | | | | | | | 0.076 | 0.060 | | | | |
| 8/11/2006 | 12:00 | LIQ | 68.0 | 8.35 | 629.0 | 629.0 | 7.9 | 61.0 | 0.3 | | | | | 442 | 76 | | | 0.53 | 0.15 | 0.18 | 1.08 |
| 8/11/2006 | 12:00 | FILT | 68.0 | 8.35 | 629.0 | 629.0 | 7.9 | 61.0 | 0.3 | | | | | | | 0.099 | 0.097 | | | | |
| 8/13/2006 | 10:26 | LIQ | 68.7 | 5.83 | 119.0 | 130.6 | 7.8 | 9.3 | 0.1 | | | | | 132 | 12 | | | 1.00 | 0.08 | 0.11 | 0.72 |
| 8/13/2006 | 10:26 | FILT | 68.7 | 5.83 | 119.0 | 130.6 | 7.8 | 9.3 | 0.1 | | | | | | | 0.072 | 0.042 | | | | |
| 8/17/2006 | 11:46 | | 64.2 | | | | | | | | 16001 | 19000 | | | | | | | | | |
| 8/22/2006 | 11:28 | | | | | | | | | | 10 | 1 | | | | | | | | | |
| 8/23/2006 | 3:04 | LIQ | 70.7 | 7.57 | 148.0 | 158.6 | 7.8 | 10.2 | 0.1 | | | | | 128 | 10.12 | | | 2.50 | 0.42 | 0.06 | 0.67 |
| 8/23/2006 | 3:04 | FILT | 70.7 | 7.57 | 148.0 | 158.6 | 7.8 | 10.2 | 0.1 | | | | | | | 0.244 | 0.154 | | | | |
| 8/30/2006 | 13:20 | LIQ | 70.7 | 7.98 | 331.5 | 354.9 | 7.7 | 61.0 | 0.2 | | | | | 227 | 35.46 | | | 1.10 | 0.63 | 0.09 | 0.60 |
| 8/30/2006 | 13:20 | FILT | 70.7 | 7.98 | 331.5 | 354.9 | 7.7 | 61.0 | 0.2 | | | | | | | 0.190 | 0.165 | | | | |
| 8/31/2006 | 11:50 | | 69.1 | | | | | | | | 10 | 1 | 0.86 | | | | | | | | |
| 9/7/2006 | 11:35 | | 65.7 | | | | | | | | 5000 | 2500 | 0.38 | | | | | | | | |
| 9/12/2006 | 12:00 | LIQ | 58.6 | 9.39 | 1058.0 | 1312.0 | 7.5 | 61.0 | 0.7 | | | | | 831 | 156.33 | | | 0.59 | 0.14 | 0.23 | 1.24 |
| 9/12/2006 | 12:00 | FILT | 58.6 | 9.39 | 1058.0 | 1312.0 | 7.5 | 61.0 | 0.7 | | | | | | | 0.042 | 0.020 | | | | |
| 9/12/2006 | 12:10 | | 59.0 | 9.39 | 1060.0 | 1310.0 | 7.8 | 61.0 | 0.7 | | | | | | | | | | | | |
| 9/18/2006 | 12:10 | | 57.7 | | | | | | | | 40 | 1 | 0.66 | | | | | | | | |
| 9/22/2006 | 12:20 | LIQ | 58.3 | 9.72 | 169.0 | 210.7 | 7.3 | 26.2 | 0.1 | | | | | 141 | 15.38 | | | 0.84 | 0.16 | 0.05 | 0.47 |
| 9/22/2006 | 12:20 | FILT | 58.3 | 9.72 | 169.0 | 210.7 | 7.3 | 26.2 | 0.1 | | | | | | | 0.162 | 0.098 | | | | |
| 9/26/2006 | 11:45 | | 61.3 | | | | | | | | 10 | 1 | | | | | | | | | |
| 9/28/2006 | 12:00 | LIQ | 54.3 | 9.7 | 252.9 | 333.4 | 7.3 | 28.0 | 0.2 | | | | | 216 | 28.55 | | | 0.98 | 0.13 | 0.015 | 0.35 |
| 9/28/2006 | 12:00 | FILT | 54.3 | 9.7 | 252.9 | 333.4 | 7.3 | 28.0 | 0.2 | | | | | | | 0.054 | 0.039 | | | | |
| 10/5/2006 | 12:10 | | 57.2 | | | | | | | | 16000 | 4800 | | | | | | | | | |
| 10/11/2006 | 13:15 | | 48.6 | | | | | | | | 16001 | 21000 | 1.09 | | | | | | | | |
| 10/16/2006 | 12:20 | | 54.1 | 10.04 | 245.7 | 324.0 | 7.3 | 10.0 | 0.2 | | | | | | | | | | | | |
| 10/18/2006 | 12:05 | LIQ | 50.5 | 10.14 | 866.0 | 1203.0 | 7.7 | 61.0 | 0.6 | | | | | 792 | | | | 1.20 | 0.11 | 0.015 | 0.59 |
| 10/18/2006 | 12:05 | FILT | 50.5 | 10.14 | 866.0 | 1203.0 | 7.7 | 61.0 | 0.6 | | | | | | | | 0.050 | | | | |
| 10/25/2006 | 11:43 | | 52.5 | | | | | | | | 9000 | 14000 | 0.5 | | | | | | | | |
| 10/26/2006 | 12:10 | FILT | 51.4 | 10.35 | 982.0 | 1348.0 | 7.7 | 61.0 | 0.7 | | | | | | | | 0.014 | | | | |
| 11/27/2006 | 11:40 | | 46.9 | | | | | | | | 16001 | 25000 | 0.58 | | | | | | | | |
| 11/28/2006 | 11:55 | | 45.7 | 12.03 | 97.0 | 145.3 | 6.8 | 10.0 | 0.1 | | | | | | | | | | | | |
| 11/28/2006 | 3:03 | | 37.4 | 12.16 | 93.6 | 161.7 | 6.3 | | 0.1 | | | | | | | | | | | | |

< 5 samples for the geometric mean
All duplicates are omitted from analysis.
Red font indicates suspect data.
Green font indicates value was greater than the maximum detetion limit. MDL+1 was the value used for analysis.
Blue font indicates the value was below the minimum detection limit, and 1/2 the MDL was used as the value for analysis.
Maroon font equals values was ~. Value used for analysis was the ~value.
LIQ = Analysis performed on sample as received
FILT = Sample filtered through 0.45 membrane filter; analysis performed on fitrate
*Automated stage data collection begun by July 10

**Table 8 continued.** Monitoring results for 1NE outfall

| Date | Sample Time | Sample Type | Alkalinity (mg/L CaCO3) | Chloride ion (mg/L) | Hardness (mg/L CaCO3) | COD (mg/L) | Total Organic Carbon (mg/L) | CBOD 5-day (mg/L) | TBOD 5-day (mg/L) | Copper (mg/L) | Nickel (mg/L) | Lead (mg/L) | Zinc (mg/L) | Cadmium (mg/L) | Chromium (mg/L) | Oil and Grease (mg/L) | Tetrachloroethene (ug/L) | Trichlorofluoromethane (ug/L) | 1,2-Dichloroethane-d4 (% Recovered) | Benzene-d6 (% Recovered) | Ethyl Benzene-d10 (% Recovered) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/3/2006 | | LIQ | | 996 | | | | | | | | | | | | | | | | | |
| 1/9/2006 | | | | 144 | | | | | | | | | | | | | | | | | |
| 2/28/2006 | | | | | | | | | | | | | | | | | | | | | |
| 3/9/2006 | 13:15 | LIQ | 264 | 255 | 424 | 44 | | 6.9 | 8.7 | | | | | | | 0.5 | | | | | |
| 3/9/2006 | 13:15 | FILT | | | | | 9.80 | | | | | | | | | | | | | | |
| 3/20/2006 | 12:45 | LIQ | 224 | 511 | 238 | 28 | | 4.8 | 4.8 | | | | | | | 0.5 | | | | | |
| 3/20/2006 | 12:45 | FILT | | | | | 5.40 | | | | | | | | | | | | | | |
| 3/30/2006 | 11:50 | LIQ | 113 | 461 | 134 | 144 | | 140.0 | 145.0 | 0.0340 | 0.0120 | 0.0278 | 0.1760 | 0.00002 | 0.0133 | 0.5 | | | | | |
| 3/30/2006 | 11:50 | FILT | | | | | 15.80 | | | 0.0133 | 0.0049 | 0.0010 | 0.0179 | 0.00002 | 0.0042 | | | | | | |
| 4/27/2006 | 12:06 | | | | | | | | | | | | | | | | | | | | |
| 4/28/2006 | 10:54 | LIQ | 346 | 150 | 566 | 15 | | 1.0 | 1.0 | | | | | | | | | | | | |
| 4/28/2006 | 10:54 | FILT | | | | | 3.40 | | | | | | | | | | | | | | |
| 4/28/2006 | 14:19 | LIQ | 33 | 34 | 42 | 162 | | 47.0 | 47.0 | | | | | | | | | | | | |
| 4/28/2006 | 14:19 | FILT | | | | | 23.50 | | | | | | | | | | | | | | |
| 5/1/2006 | 11:04 | | | | | | | | | | | | | | | | | | | | |
| 5/12/2006 | 12:00 | LIQ | 56 | 64 | 68 | 68 | | 11.0 | 12.0 | | | | | | | 4 | | | | | |
| 5/12/2006 | 12:00 | FILT | | | | | 8.40 | | | | | | | | | | | | | | |
| 5/31/2006 | 12:00 | LIQ | 367 | 124 | 568 | 29 | | 6.7 | 7.1 | 0.0038 | 0.0099 | 0.0002 | 0.0114 | 0.00002 | 0.0003 | 0.5 | | | | | |
| 5/31/2006 | 12:00 | FILT | | | | | 3.60 | | | | | | | | | | | | | | |
| 6/7/2006 | 12:52 | | | | | | | | | | | | | | | | | | | | |
| 6/13/2006 | 14:40 | LIQ | 271 | 114 | 476 | 28 | | 1.1 | 1.6 | | | | | | | 5 | | | | | |
| 6/13/2006 | 14:40 | FILT | | | | | 4.50 | | | | | | | | | | | | | | |
| 6/14/2006 | 11:32 | | | | | | | | | | | | | | | | | | | | |
| 6/22/2006 | 11:40 | | | | | | | | | | | | | | | | | | | | |
| 6/23/2006 | 11:45 | LIQ | 366 | 106 | 530 | 19 | | 0.5 | 1.2 | | | | | | | 0.5 | | | | | |
| 6/23/2006 | 11:45 | FILT | | | | | 3.60 | | | | | | | | | | | | | | |
| 7/6/2006 | 11:55 | | | | | | | | | | | | | | | | | | | | |
| 7/11/2006 | 11:55 | | | | | | | | | | | | | | | | 0.65 | 0.5 | 93 | 96 | 92 |
| 7/13/2006 | 10:30 | LIQ | 139 | 62 | 236 | 32 | | 0.5 | 0.5 | | | | | | | 0.5 | | | | | |
| 7/13/2006 | 10:30 | FILT | | | | | 4.00 | | | | | | | | | | | | | | |
| 7/19/2006 | | LIQ | 49 | 44 | 74 | 100 | | 4.0 | 5.6 | 0.0310 | 0.0076 | 0.0210 | 0.1040 | 0.0002 | 0.0074 | 3 | | | | | |
| 7/19/2006 | | FILT | | | | | 9.50 | | | 0.0043 | 0.0026 | 0.0005 | 0.0053 | 0.00002 | 0.0013 | | | | | | |
| 7/24/2006 | | LIQ | 58 | 36 | 88 | 99 | | 6.7 | 13.0 | | | | | | | 6 | | | | | |
| 7/24/2006 | | FILT | | | | | 13.30 | | | | | | | | | | | | | | |
| 7/27/2006 | 11:30 | | | | | | | | | | | | | | | | | | | | |
| 7/28/2006 | 12:00 | LIQ | 119 | 56 | 194 | 17 | | 2.1 | 2.7 | | | | | | | 2 | | | | | |
| 7/28/2006 | 12:00 | FILT | | | | | 3.80 | | | | | | | | | | | | | | |
| 8/1/2006 | 12:08 | | | | | | | | | | | | | | | | | | | | |
| 8/1/2006 | 13:30 | LIQ | 54 | 40 | 64 | 86 | | 9.1 | 15.0 | 0.0130 | 0.0047 | 0.0100 | 0.0870 | 0.0001 | 0.0039 | 2 | | | | | |
| 8/1/2006 | 13:30 | FILT | | | | | 13.80 | | | | | | | | | | | | | | |
| 8/1/2006 | 18:08 | LIQ | 45 | 37 | 70 | 62 | | 3.6 | 3.6 | 0.0164 | 0.0073 | 0.0163 | 0.0620 | 0.00006 | 0.0063 | 1 | | | | | |
| 8/1/2006 | 18:08 | FILT | | | | | 7.80 | | | 0.0048 | 0.0019 | 0.0005 | 0.0048 | 0.00002 | 0.0023 | | | | | | |
| 8/11/2006 | 12:00 | LIQ | 165 | 76 | 260 | 13 | | 0.5 | 0.5 | | | | | | | 0.5 | | | | | |
| 8/11/2006 | 12:00 | FILT | | | | | 3.80 | | | | | | | | | | | | | | |
| 8/13/2006 | 10:26 | LIQ | 42 | 21 | 58 | 75 | | 5.4 | 13.0 | | | | | | | 0.5 | | | | | |
| 8/13/2006 | 10:26 | FILT | | | | | 8.90 | | | | | | | | | | | | | | |
| 8/17/2006 | 11:46 | | | | | | | | | | | | | | | | | | | | |
| 8/22/2006 | 11:28 | | | | | | | | | | | | | | | | | | | | |
| 8/23/2006 | 3:04 | LIQ | 37 | 18 | 48 | 104 | | 4.7 | 12.0 | | | | | | | 3 | | | | | |
| 8/23/2006 | 3:04 | FILT | | | | | 15.60 | | | | | | | | | | | | | | |
| 8/30/2006 | 13:20 | LIQ | 52 | 46 | 116 | 14 | | 0.5 | 0.5 | | | | | | | 4 | | | | | |
| 8/30/2006 | 13:20 | FILT | | | | | 3.50 | | | | | | | | | | | | | | |
| 8/31/2006 | 11:50 | | | | | | | | | | | | | | | | | | | | |
| 9/7/2006 | 11:35 | | | | | | | | | | | | | | | | | | | | |
| 9/12/2006 | 12:00 | LIQ | 346 | 124 | 562 | 15 | | 0.5 | 0.5 | | | | | | | 2 | | | | | |
| 9/12/2006 | 12:00 | FILT | | | | | 3.20 | | | | | | | | | | | | | | |
| 9/12/2006 | 12:10 | | | | | | | | | | | | | | | | 0.65 | 0.5 | 90 | 94 | 104 |
| 9/18/2006 | 12:10 | | | | | | | | | | | | | | | | | | | | |
| 9/22/2006 | 12:20 | LIQ | 54 | 20 | 70 | 32 | | 2.0 | 3.6 | 0.0061 | 0.0027 | 0.0039 | 0.0320 | 0.00002 | 0.0029 | 0.5 | | | | | |
| 9/22/2006 | 12:20 | FILT | | | | | 8.30 | | | 0.0041 | 0.0019 | 0.0004 | 0.0071 | 0.00002 | 0.0019 | | | | | | |
| 9/26/2006 | 11:45 | | | | | | | | | | | | | | | | | | | | |
| 9/28/2006 | 12:00 | LIQ | 80 | 30 | 124 | 38 | | 7.3 | 9.7 | | | | | | | 0.5 | | | | | |
| 9/28/2006 | 12:00 | FILT | | | | | 9.50 | | | | | | | | | | | | | | |
| 10/5/2006 | 12:10 | | | | | | | | | | | | | | | | | | | | |
| 10/11/2006 | 13:15 | | | | | | | | | | | | | | | | | | | | |
| 10/16/2006 | 12:20 | | | | | | | | | | | | | | | | 0.65 | 0.5 | 99 | 93 | 106 |
| 10/18/2006 | 12:05 | LIQ | 325 | 116 | | 34 | | 6.0 | 7.0 | | | | | | | | | | | | |
| 10/18/2006 | 12:05 | FILT | | | | | | | | | | | | | | | | | | | |
| 10/25/2006 | 11:43 | | | | | | | | | | | | | | | | | | | | |
| 10/26/2006 | 12:10 | FILT | | | | | | | | | | | | | | | | | | | |
| 11/27/2006 | 11:40 | | | | | | | | | | | | | | | | | | | | |
| 11/28/2006 | 11:55 | | | | | | | | | | | | | | | | 0.65 | 0.5 | 111 | 104 | 97 |
| 11/28/2006 | 3:03 | | | | | | | | | | | | | | | | | | | | |

< 5 samples for the geometric mean
All duplicates are omitted from analysis.
Red font indicates suspect data.
Green font indicates value was greater than the maximum detetion limit. MDL+1 was the value used for analysis.
Blue font indicates the value was below the minimum detection limit, and 1/2 the MDL was used as the value for analysis.
Maroon font equals values was ~. Value used for analysis was the ~value.
LIQ = Analysis performed on sample as received
FILT = Sample filtered through 0.45 membrane filter; analysis performed on fitrate

**Table 9.** Monitoring results for 2NNBC outfall

| Date | Sample Time | Sample Type | Water Temp (F) | Dissolved Oxygen (mg/L) | Conductivity (uS) | Specific Conductivity (uS) | pH | Transparency (cm) | Salinity (ppt) | Stage* (ft) | Fecal Coliform (counts/100 mL) | E. coli (counts/100 mL) | Fluoride (mg/L) | Total Dissolved Solids (mg/L) | Sulfate (mg/L) | Dissolved Phosphorus (mg/L) | Ortho Phosphorous (mg/L) | Total Kjeldahl Nitrogen (mg/L) | Ammonia Nitrogen (mg/L) | Nitrite N (mg/L) | Nitrate N (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/13/2006 | | | 41.2 | | | | | | 2.3 | 1.94 | | | | | | | | | | | |
| 3/30/2006 | 11:00 | LIQ | 45.1 | 7.64 | 1473.0 | 2222.0 | 7.9 | 3.3 | 1.1 | 2.34 | | | | 796 | 36 | | | 3.70 | 0.46 | 0.13 | 1.36 |
| 3/30/2006 | 11:00 | FILT | 45.1 | 7.64 | 1473.0 | 2222.0 | 7.9 | 3.3 | 1.1 | 2.34 | | | | | | 0.201 | 0.139 | | | | |
| 4/10/2006 | | | 48.7 | | | | | | | 4.01 | | | | | | | | | | | |
| 4/27/2006 | | | | | | | | | | 2.22 | | | | | | | | | | | |
| 4/28/2006 | 13:50 | LIQ | 54.0 | 9.44 | 270.5 | 358.3 | 7.8 | 8.0 | 0.2 | 2.20 | | | | 234 | 11 | | | 8.40 | 1.11 | 0.09 | 0.70 |
| 4/28/2006 | 13:50 | FILT | 54.0 | 9.44 | 270.5 | 358.3 | 7.8 | 8.0 | 0.2 | 2.20 | | | | | | 0.287 | 0.201 | | | | |
| 5/1/2006 | 10:40 | | 54.9 | | | | | | | 2.72 | 1300 | 1200 | | | | | | | | | |
| 5/12/2006 | 11:30 | LIQ | 52.2 | 9.20 | 344.6 | 468.3 | 7.2 | 17.0 | 0.2 | 3.50 | | | | 250 | 24 | | | 2.20 | 0.45 | 0.06 | 0.74 |
| 5/12/2006 | 11:30 | FILT | 52.2 | 9.20 | 344.6 | 468.3 | 7.2 | 17.0 | 0.2 | 3.50 | | | | | | 0.161 | 0.130 | | | | |
| 6/7/2006 | 12:00 | | 72.0 | | | | | | | 1.69 | 2200 | 1400 | 0.88 | | | | | | | | |
| 6/13/2006 | 14:05 | LIQ | 71.2 | 3.36 | 1025.0 | 1091.0 | 7.5 | 61.0 | 0.5 | 1.51 | | | | 669 | 82 | | | 0.87 | 0.34 | 0.04 | 0.55 |
| 6/13/2006 | 14:05 | FILT | 71.2 | 3.36 | 1025.0 | 1091.0 | 7.5 | 61.0 | 0.5 | 1.51 | | | | | | 0.041 | 0.037 | | | | |
| 6/22/2006 | 11:17 | | 69.3 | | | | | | | 1.37 | 40 | 37 | 0.61 | | | | | | | | |
| 6/23/2006 | 11:20 | LIQ | 70.5 | 5.28 | 912.0 | 979.0 | 7.6 | 61.0 | 0.5 | 1.37 | | | | 607 | 93 | | | 0.60 | 0.34 | 0.06 | 0.60 |
| 6/23/2006 | 11:20 | FILT | 70.5 | 5.28 | 912.0 | 979.0 | 7.6 | 61.0 | 0.5 | 1.37 | | | | | | 0.042 | 0.038 | | | | |
| 7/6/2006 | 11:28 | | 74.7 | | | | | | | 1.09 | 40 | 50 | 1.04 | | | | | | | | |
| 7/12/2006 | 15:25 | | 79.2 | 3.73 | 1027.0 | 1005.0 | 7.6 | 61.0 | 0.5 | 0.86 | | | | | | | | | | | |
| 7/13/2006 | 11:45 | LIQ | 79.7 | 5.07 | 1069.0 | 1039.0 | 7.5 | 61.0 | 0.5 | 0.96 | | | | 630 | 97 | | | 0.77 | 0.22 | 0.015 | 0.71 |
| 7/13/2006 | 11:45 | FILT | 79.7 | 5.07 | 1069.0 | 1039.0 | 7.5 | 61.0 | 0.5 | 0.96 | | | | | | 0.095 | 0.078 | | | | |
| 7/27/2006 | 11:15 | | 79.9 | | | | | | | 1.19 | 500 | 82 | 0.33 | | | | | | | | |
| 7/28/2006 | 11:35 | LIQ | 79.9 | 5.70 | 1008.0 | 978.0 | 7.6 | 61.0 | 0.5 | 1.35 | | | | 613 | 86 | | | 0.55 | 0.23 | 0.015 | 0.55 |
| 7/28/2006 | 11:35 | FILT | 79.9 | 5.70 | 1008.0 | 978.0 | 7.6 | 61.0 | 0.5 | 1.35 | | | | | | 0.093 | 0.099 | | | | |
| 8/1/2006 | 11:50 | | 80.2 | | | | | | | 1.40 | 16001 | 8800 | 0.51 | | | | | | | | |
| 8/2/2006 | 12:55 | LIQ | 73.4 | 6.32 | 415.7 | 432.2 | 7.3 | 27.5 | 0.2 | 1.35 | | | | 254 | 29 | | | 0.61 | 0.07 | 0.015 | 0.70 |
| 8/2/2006 | 12:55 | FILT | 73.4 | 6.32 | 415.7 | 432.2 | 7.3 | 27.5 | 0.2 | 1.35 | | | | | | 0.115 | 0.114 | | | | |
| 8/23/2006 | 10:20 | LIQ | 72.0 | 6.42 | 370.6 | 391.5 | 7.5 | 24.8 | 0.2 | 1.39 | | | | 241 | 27.48 | | | 1.10 | 0.34 | 0.05 | 0.66 |
| 8/23/2006 | 10:20 | FILT | 72.0 | 6.42 | 370.6 | 391.5 | 7.5 | 24.8 | 0.2 | 1.39 | | | | | | 0.154 | 0.127 | | | | |
| 8/24/2006 | 15:16 | | 72.9 | 6.04 | 473.0 | 495.0 | 7.5 | 19.0 | 0.2 | 1.33 | | | | | | | | | | | |
| 9/7/2006 | 11:15 | | 78.4 | | | | | | | 1.34 | 10 | 1 | 1.02 | | | | | | | | |
| 9/22/2006 | 11:40 | LIQ | 59.7 | 8.62 | 222.4 | | 7.0 | 25.0 | 0.1 | 1.45 | | | | 230 | 26.76 | | | 0.64 | 0.16 | 0.03 | 2.36 |
| 9/22/2006 | 11:40 | FILT | 59.7 | 8.62 | 222.4 | | 7.0 | 25.0 | 0.1 | 1.45 | | | | | | 0.067 | 0.061 | | | | |
| 9/28/2006 | 11:45 | LIQ | 68.9 | 3.44 | 769.0 | 841.0 | 7.1 | | 0.4 | 1.58 | | | | 515 | 61.03 | | | 1.40 | 0.20 | 0.05 | 0.87 |
| 9/28/2006 | 11:45 | FILT | 68.9 | 3.44 | 769.0 | 841.0 | 7.1 | | 0.4 | 1.58 | | | | | | 0.283 | 0.215 | | | | |
| 10/16/2006 | 11:20 | LIQ | 56.8 | 8.69 | 310.6 | 395.5 | 7.1 | 19.0 | 0.2 | 1.40 | | | | 267 | | | | 1.80 | 0.39 | 0.06 | 0.67 |
| 10/16/2006 | 11:20 | FILT | 56.8 | 8.69 | 310.6 | 395.5 | 7.1 | 19.0 | 0.2 | 1.40 | | | | | | 0.654 | 0.494 | | | | |
| 10/16/2006 | 11:31 | | 57.0 | 8.57 | 313.9 | 398.5 | 7.2 | 21.2 | 0.2 | 1.40 | | | | | | | | | | | |
| 10/18/2006 | 12:30 | LIQ | 64.4 | 6.65 | 816.0 | 943.0 | 7.6 | 61.0 | 0.5 | 1.53 | | | | 580 | | | | 1.10 | 0.25 | 0.015 | 0.89 |
| 10/18/2006 | 12:30 | FILT | 64.4 | 6.65 | 816.0 | 943.0 | 7.6 | 61.0 | 0.5 | 1.53 | | | | | | 0.269 | 0.161 | | | | |
| 11/28/2006 | 10:26 | | 46.2 | 11.71 | 76.2 | 113.0 | 6.5 | 9.0 | 0.1 | 1.90 | | | | | | | | | | | |

< 5 samples for the geometric mean
All duplicates are omitted from analysis.
Red font indicates suspect data.
Green font indicates value was greater than the maximum detetion limit. MDL+1 was the value used for analysis.
Blue font indicates the value was below the minimum detection limit, and 1/2 the MDL was used as the value for analysis.
Maroon font equals values was ~. Value used for analysis was the ~value.
LIQ = Analysis performed on sample as received
FILT = Sample filtered through 0.45 membrane filter; analysis performed on fitrate
*River tailwater is always mixing with stormwater

**Table 9 continued.** Monitoring results for 2NNBC outfall

| Date | Sample Time | Sample Type | Alkalinity (mg/L CaCO3) | Chloride ion (mg/L) | Hardness (mg/L CaCO3) | COD (mg/L) | Total Organic Carbon (mg/L) | CBOD 5-day (mg/L) | TBOD 5-day (mg/L) | Copper (mg/L) | Nickel (mg/L) | Lead (mg/L) | Zinc (mg/L) | Cadmium (mg/L) | Chromium (mg/L) | Oil and Grease (mg/L) | Tetrachloroethene (ug/L) | Trichlorofluoromethane (ug/L) | 1,2-Dichloroethane-d4 (% Recovered) | Benzene-d6 (% Recovered) | Ethyl Benzene-d10 (% Recovered) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/13/2006 | | | | | | | | | | | | | | | | | | | | | |
| 3/30/2006 | 11:00 | LIQ | 76 | 360 | 99 | 232 | | 280.0 | 145.0 | 0.0690 | 0.0147 | 0.0810 | 0.3410 | 0.00002 | 0.0202 | 18 | | | | | |
| 3/30/2006 | 11:00 | FILT | | | | | 22.7 | | | 0.0175 | 0.0043 | 0.0015 | 0.0200 | 0.00002 | 0.0045 | | | | | | |
| 4/10/2006 | | | | | | | | | | | | | | | | | | | | | |
| 4/27/2006 | | | | | | | | | | | | | | | | | | | | | |
| 4/28/2006 | 13:50 | LIQ | 41 | 76 | 76 | 159 | | 37.0 | 39.0 | | | | | | | | | | | | |
| 4/28/2006 | 13:50 | FILT | | | | | 19.3 | | | | | | | | | | | | | | |
| 5/1/2006 | 10:40 | | | | | | | | | | | | | | | | | | | | |
| 5/12/2006 | 11:30 | LIQ | 78 | 69 | 108 | 75 | | 21.0 | 21.0 | | | | | | | 9 | | | | | |
| 5/12/2006 | 11:30 | FILT | | | | | 12.7 | | | | | | | | | | | | | | |
| 6/7/2006 | 12:00 | | | | | | | | | | | | | | | | | | | | |
| 6/13/2006 | 14:05 | LIQ | 279 | 120 | 418 | 16 | | 1.0 | 1.5 | 0.0095 | 0.0045 | 0.0016 | 0.0102 | 0.00002 | 0.0005 | 4 | | | | | |
| 6/13/2006 | 14:05 | FILT | | | | | 4.7 | | | | | | | | | | | | | | |
| 6/22/2006 | 11:17 | | | | | | | | | | | | | | | | | | | | |
| 6/23/2006 | 11:20 | LIQ | 301 | 95 | 418 | 15 | | 3.5 | 4.0 | | | | | | | 0.5 | | | | | |
| 6/23/2006 | 11:20 | FILT | | | | | 2.9 | | | | | | | | | | | | | | |
| 7/6/2006 | 11:28 | | | | | | | | | | | | | | | | | | | | |
| 7/12/2006 | 15:25 | | | | | | | | | | | | | | | | 0.65 | 0.5 | 91 | 92 | 92 |
| 7/13/2006 | 11:45 | LIQ | 299 | 99 | 440 | 31 | | 0.5 | 0.5 | | | | | | | 0.5 | | | | | |
| 7/13/2006 | 11:45 | FILT | | | | | 3.7 | | | | | | | | | | | | | | |
| 7/27/2006 | 11:15 | | | | | | | | | | | | | | | | | | | | |
| 7/28/2006 | 11:35 | LIQ | 304 | 89 | 428 | 14 | | 1.9 | 1.7 | | | | | | | 2 | | | | | |
| 7/28/2006 | 11:35 | FILT | | | | | 3.0 | | | | | | | | | | | | | | |
| 8/1/2006 | 11:50 | | | | | | | | | | | | | | | | | | | | |
| 8/2/2006 | 12:55 | LIQ | 120 | 37 | 164 | 22 | | 1.7 | 2.2 | 0.0048 | 0.0036 | 0.0050 | 0.0200 | 0.00002 | 0.0022 | 0.5 | | | | | |
| 8/2/2006 | 12:55 | FILT | | | | | 4.6 | | | 0.0028 | 0.0025 | 0.0004 | 0.0067 | 0.00002 | 0.0016 | | | | | | |
| 8/23/2006 | 10:20 | LIQ | 111 | 35 | 142 | 35 | | 5.0 | 6.7 | 0.0067 | 0.0040 | 0.0055 | 0.0270 | 0.00002 | 0.0020 | 2 | | | | | |
| 8/23/2006 | 10:20 | FILT | | | | | 9.1 | | | | | | | | | | | | | | |
| 8/24/2006 | 15:16 | | | | | | | | | | | | | | | | 0.65 | 0.5 | 98 | 101 | 107 |
| 9/7/2006 | 11:15 | | | | | | | | | | | | | | | | | | | | |
| 9/22/2006 | 11:40 | LIQ | 91 | 36 | 138 | 23 | | 2.0 | 2.8 | 0.0057 | 0.0039 | 0.0047 | 0.0300 | 0.00002 | 0.0047 | 0.5 | | | | | |
| 9/22/2006 | 11:40 | FILT | | | | | 4.8 | | | 0.0032 | 0.0032 | 0.0004 | 0.0086 | 0.00002 | 0.0035 | | | | | | |
| 9/28/2006 | 11:45 | LIQ | 201 | 98 | 292 | 29 | | 2.6 | 4.1 | | | | | | | 0.5 | | | | | |
| 9/28/2006 | 11:45 | FILT | | | | | 8.3 | | | | | | | | | | | | | | |
| 10/16/2006 | 11:20 | LIQ | 94 | 44 | | 91 | | 15.5 | 18.0 | 0.0143 | 0.0038 | 0.0102 | 0.0720 | 0.0002 | 0.0030 | | | | | | |
| 10/16/2006 | 11:20 | FILT | | | | | 24.2 | | | | | | | | | | | | | | |
| 10/16/2006 | 11:31 | | | | | | | | | | | | | | | | 0.65 | 0.5 | 99 | 94 | 104 |
| 10/18/2006 | 12:30 | LIQ | 307 | 84 | | 19 | | 0.5 | 1.2 | | | | | | | | | | | | |
| 10/18/2006 | 12:30 | FILT | | | | | | | | | | | | | | | | | | | |
| 11/28/2006 | 10:26 | | | | | | | | | | | | | | | | 0.65 | 0.5 | 99 | 92 | 111 |

< 5 samples for the geometric mean

All duplicates are omitted from analysis.

Red font indicates suspect data.

Green font indicates value was greater than the maximum detetion limit. MDL+1 was the value used for analysis.

Blue font indicates the value was below the minimum detection limit, and 1/2 the MDL was used as the value for analysis.

Maroon font equals values was ~. Value used for analysis was the ~value.

LIQ = Analysis performed on sample as received

FILT = Sample filtered through 0.45 membrane filter; analysis performed on fitrate

**Table 10.** Monitoring results for 4PP outfall

| Date | Sample Time | Sample Type | Water Temp (F) | Dissolved Oxygen (mg/L) | Conductivity (uS) | Specific Conductivity (uS) | pH | Transparency (cm) | Salinity (ppt) | Stage* (ft) | Fecal Coliform (counts/100 mL) | E. coli (counts/100 mL) | Fluoride (mg/L) | Total Dissolved Solids (mg/L) | Sulfate (mg/L) | Dissolved Phosphorus (mg/L) | Ortho Phosphorous (mg/L) | Total Kjeldahl Nitrogen (mg/L) | Ammonia Nitrogen (mg/L) | Nitrite N (mg/L) | Nitrate N (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/3/2006 | 13:05 | | 47.3 | 9.45 | 2164.0 | 3156.0 | 7.2 | | 1.7 | 0.42 | | | | | | | | | | | |
| 2/28/2006 | 14:00 | | 48.0 | 10.45 | 1036.0 | 1496.0 | 7.7 | | 0.8 | 0.26 | | | | | | | | | | | |
| 3/9/2006 | 12:05 | LIQ | 49.3 | 10.30 | 991.0 | 1405.0 | 8.0 | 61.0 | 0.7 | 0.25 | | | | 829 | 89 | | | 0.45 | 0.12 | 0.015 | 1.07 |
| 3/9/2006 | 12:05 | FILT | 49.3 | 10.30 | 991.0 | 1405.0 | 8.0 | 61.0 | 0.7 | 0.25 | | | | | | 0.021 | 0.025 | | | | |
| 3/20/2006 | 14:35 | LIQ | 48.2 | 9.90 | 1384.0 | 1995.0 | 7.6 | | 1.0 | 0.34 | | | | 1070 | 79 | | | 0.5 | 0.12 | 0.03 | 1.03 |
| 3/20/2006 | 14:35 | FILT | 48.2 | 9.90 | 1384.0 | 1995.0 | 7.6 | | 1.0 | 0.34 | | | | | | 0.051 | 0.023 | | | | |
| 3/30/2006 | 10:28 | LIQ | 45.9 | 10.20 | 716.0 | 1069.0 | 7.9 | 1.5 | 0.5 | 0.50 | | | | 651 | 25 | | | 8.9 | 0.49 | 0.13 | 1.33 |
| 3/30/2006 | 10:28 | FILT | 45.9 | 10.20 | 716.0 | 1069.0 | 7.9 | 1.5 | 0.5 | 0.50 | | | | | | 0.123 | 0.075 | | | | |
| 4/24/2006 | | | 52.0 | 10.00 | 1009.0 | 1372.0 | | | 0.7 | | | | | | | | | | | | |
| 4/27/2006 | 11:00 | | 52.0 | | | | | | | 0.24 | | 2 | 0.43 | | | | | | | | |
| 4/28/2006 | 10:22 | LIQ | 52.0 | 10.51 | 1075.0 | 1462.0 | 7.9 | 61.0 | 0.7 | 0.25 | | | | 854 | 97 | | | 0.48 | 0.04 | 0.015 | 1.43 |
| 4/28/2006 | 10:22 | FILT | 52.0 | 10.51 | 1075.0 | 1462.0 | 7.9 | 61.0 | 0.7 | 0.25 | | | | | | 0.012 | 0.018 | | | | |
| 4/28/2006 | 13:18 | LIQ | 54.0 | 10.87 | 159.5 | 211.2 | 8.0 | 7.0 | 0.1 | 1.63 | | | | 145 | 8 | | | 12 | 1.28 | 0.11 | 0.73 |
| 4/28/2006 | 13:18 | FILT | 54.0 | 10.87 | 159.5 | 211.2 | 8.0 | 7.0 | 0.1 | 1.63 | | | | | | 0.34 | 0.276 | | | | |
| 5/1/2006 | 10:12 | | 53.8 | | | | | | | 0.76 | 16000 | 9800 | 0.1 | | | | | | | | |
| 5/12/2006 | 10:55 | LIQ | 49.1 | 10.86 | 1599.0 | 2254.0 | 7.3 | 14.0 | 0.1 | 1.76 | | | | 120 | 12 | | | 2 | 0.33 | 0.06 | 0.42 |
| 5/12/2006 | 10:55 | FILT | 49.1 | 10.86 | 1599.0 | 2254.0 | 7.3 | 14.0 | 0.1 | 1.76 | | | | | | 0.222 | 0.196 | | | | |
| 5/31/2006 | 11:10 | LIQ | 54.0 | 10.02 | 1123.0 | 1127.0 | 7.7 | 61.0 | 0.8 | 0.25 | 130 | 112 | | 919 | 102 | | | 0.62 | 0.05 | 0.015 | 1.52 |
| 5/31/2006 | 11:10 | FILT | 54.0 | 10.02 | 1123.0 | 1127.0 | 7.7 | 61.0 | 0.8 | 0.25 | 130 | 112 | | | | 0.024 | 0.019 | | | | |
| 6/7/2006 | 11:22 | | 55.2 | | | | | | | 0.24 | 3000 | 1400 | 0.16 | | | | | | | | |
| 6/13/2006 | 13:33 | LIQ | 54.0 | 9.41 | 1083.0 | 1432.0 | 7.8 | 61.0 | 7.8 | 0.24 | | | | 854 | 93 | | | 0.6 | 0.09 | 0.015 | 1 |
| 6/13/2006 | 13:33 | FILT | 54.0 | 9.41 | 1083.0 | 1432.0 | 7.8 | 61.0 | 7.8 | 0.24 | | | | | | 0.026 | 0.022 | | | | |
| 6/14/2006 | 10:32 | | 54.1 | | | | | | | 0.26 | 170 | 30 | 0.39 | | | | | | | | |
| 6/22/2006 | 10:43 | | 55.4 | | | | | | | 0.26 | 5000 | 310 | 0.45 | | | | | | | | |
| 6/23/2006 | 11:00 | LIQ | 55.4 | 9.33 | 1048.0 | 1360.0 | 7.8 | 61.0 | 0.7 | 0.25 | | | | 812 | 62 | | | 0.61 | 0.10 | 0.015 | 0.85 |
| 6/23/2006 | 11:00 | FILT | 55.4 | 9.33 | 1048.0 | 1360.0 | 7.8 | 61.0 | 0.7 | 0.25 | | | | | | 0.025 | 0.029 | | | | |
| 7/6/2006 | 10:52 | | 55.8 | | | | | | | 0.26 | 40 | 25 | 0.36 | | | | | | | | |
| 7/12/2006 | 12:45 | LIQ | 58.1 | 9.03 | 1044.0 | 1306.0 | 7.8 | 61.0 | 0.7 | 0.26 | | | | | | | | | | | |
| 7/12/2006 | 12:45 | FILT | 58.1 | 9.03 | 1044.0 | 1306.0 | 7.8 | 61.0 | 0.7 | 0.26 | | | | | | | | | | | |
| 7/13/2006 | 12:25 | LIQ | 56.8 | 9.12 | 1091.0 | 1387.0 | 7.8 | 61.0 | 0.7 | 0.27 | | | | 835 | 90 | | | 0.92 | 0.03 | 0.04 | 1.55 |
| 7/13/2006 | 12:25 | FILT | 56.8 | 9.12 | 1091.0 | 1387.0 | 7.8 | 61.0 | 0.7 | 0.27 | | | | | | 0.05 | 0.038 | | | | |
| 7/27/2006 | 10:45 | | | | | | | | | 0.24 | 800 | 510 | 0.84 | | | | | | | | |
| 7/28/2006 | 11:15 | LIQ | 57.7 | 9.13 | 1045.0 | 1315.0 | 7.8 | 61.0 | 0.7 | 0.24 | | | | 803 | | | | 0.83 | 0.09 | 0.03 | 1.12 |
| 7/28/2006 | 11:15 | FILT | 57.7 | 9.13 | 1045.0 | 1315.0 | 7.8 | 61.0 | 0.7 | 0.24 | | | | | | 0.061 | 0.070 | | | | |
| 8/1/2006 | 11:25 | | 66.4 | | | | | | | 0.31 | 16001 | 22000 | 0.27 | | | | | | | | |
| 8/2/2006 | 12:45 | LIQ | 68.0 | 8.21 | 296.7 | 328.2 | 7.3 | 52.0 | 0.2 | 0.60 | | | | 191 | 20 | | | 0.4 | 0.02 | 0.015 | 0.56 |
| 8/2/2006 | 12:45 | FILT | 68.0 | 8.21 | 296.7 | 328.2 | 7.3 | 52.0 | 0.2 | 0.60 | | | | | | 0.051 | 0.044 | | | | |
| 8/11/2006 | 11:20 | LIQ | 59.2 | 8.59 | 1047.0 | 1290.0 | 7.8 | 61.0 | 0.6 | 0.25 | | | | 792 | 87 | | | 0.77 | 0.06 | 0.03 | 1.12 |
| 8/11/2006 | 11:20 | FILT | 59.2 | 8.59 | 1047.0 | 1290.0 | 7.8 | 61.0 | 0.6 | 0.25 | | | | | | 0.029 | 0.023 | | | | |
| 8/17/2006 | 10:59 | | 59.9 | | | | | | | 0.29 | 16001 | 47000 | | | | | | | | | |
| 8/22/2006 | 10:45 | | 57.4 | | | | | | | 0.27 | 70 | 13 | | | | | | | | | |
| 8/23/2006 | 12:10 | LIQ | 64.8 | 7.62 | 329.4 | 378.5 | 7.6 | 37.8 | 0.2 | 0.58 | | | | 249 | 22.62 | | | 1.1 | 0.30 | 0.06 | 0.97 |
| 8/23/2006 | 12:10 | FILT | 64.8 | 7.62 | 329.4 | 378.5 | 7.6 | 37.8 | 0.2 | 0.58 | | | | | | 0.138 | 0.113 | | | | |
| 8/24/2006 | 14:00 | | 62.2 | 7.83 | 664.0 | 787.0 | 7.5 | 20.8 | 0.4 | 0.59 | | | | | | | | | | | |
| 8/30/2006 | 12:30 | LIQ | 56.8 | 9.42 | 1121.0 | 1424.0 | 7.8 | 61.0 | 0.7 | 0.27 | | | | 940 | 95.82 | | | 0.63 | 0.07 | 0.06 | 1.34 |
| 8/30/2006 | 12:30 | FILT | 56.8 | 9.42 | 1121.0 | 1424.0 | 7.8 | 61.0 | 0.7 | 0.27 | | | | | | 0.035 | 0.032 | | | | |
| 8/31/2006 | 11:03 | | 56.7 | | | | | | | 0.26 | 300 | 84 | 0.34 | | | | | | | | |
| 9/7/2006 | 10:48 | | 57.0 | | | | | | | 0.28 | 3000 | 27 | 0.29 | | | | | | | | |
| 9/12/2006 | 11:15 | LIQ | 55.8 | 9.66 | 1087.0 | 1405.0 | 7.7 | 61.0 | 0.7 | 0.27 | | | | 853 | 98.27 | | | 0.48 | 0.03 | 0.22 | 1.04 |
| 9/12/2006 | 11:15 | FILT | 55.8 | 9.66 | 1087.0 | 1405.0 | 7.7 | 61.0 | 0.7 | 0.27 | | | | | | 0.043 | 0.029 | | | | |
| 9/18/2006 | 11:18 | | 55.8 | | | | | | | 0.26 | 300 | 18 | 0.28 | | | | | | | | |
| 9/22/2006 | 11:15 | LIQ | 56.7 | 9.78 | 282.1 | 360.1 | 7.2 | 22.0 | 0.2 | 0.53 | | | | 220 | 20.96 | | | 0.85 | 0.16 | 0.015 | 0.74 |
| 9/22/2006 | 11:15 | FILT | 56.7 | 9.78 | 282.1 | 360.1 | 7.2 | 22.0 | 0.2 | 0.53 | | | | | | 0.091 | 0.066 | | | | |
| 9/26/2006 | 11:00 | | 55.4 | | | | | | | 0.25 | 40 | 9 | | | | | | | | | |
| 9/28/2006 | 11:15 | LIQ | 55.0 | 9.72 | 1083.0 | 1412.0 | 7.4 | 61.0 | 0.7 | 0.25 | | | | 871 | 88.63 | | | 1.2 | 0.05 | 0.015 | 1.33 |
| 9/28/2006 | 11:15 | FILT | 55.0 | 9.72 | 1083.0 | 1412.0 | 7.4 | 61.0 | 0.7 | 0.25 | | | | | | 0.02 | 0.026 | | | | |
| 10/5/2006 | 11:18 | | 55.0 | | | | | | | 0.28 | 3000 | 1000 | | | | | | | | | |
| 10/11/2006 | 12:10 | | 53.6 | | | | | | | 0.30 | 16001 | 20000 | 0.58 | | | | | | | | |
| 10/16/2006 | 10:50 | | 54.7 | 9.05 | 375.8 | 492.2 | 7.3 | 14.0 | 0.2 | 0.52 | | | | | | | | | | | |
| 10/16/2006 | 10:45 | LIQ | 54.7 | 9.20 | 354.4 | 464.1 | 7.3 | 15.0 | 0.2 | 0.52 | | | | 392 | | | | 2.8 | 0.52 | 0.12 | 0.74 |
| 10/16/2006 | 10:45 | FILT | 54.7 | 9.20 | 354.4 | 464.1 | 7.3 | 15.0 | 0.2 | 0.52 | | | | | | 0.986 | 0.590 | | | | |
| 10/18/2006 | 11:30 | LIQ | 53.4 | 9.48 | 1037.0 | 1383.0 | 7.7 | 61.0 | 0.7 | 0.26 | | | | 834 | | | | 1.1 | 0.05 | 0.015 | 0.92 |
| 10/18/2006 | 11:30 | FILT | 53.4 | 9.48 | 1037.0 | 1383.0 | 7.7 | 61.0 | 0.7 | 0.26 | | | | | | | 0.027 | | | | |
| 10/25/2006 | 11:05 | | 52.2 | | | | | | | 0.26 | 40 | 9 | 0.25 | | | | | | | | |
| 10/26/2006 | 11:20 | FILT | 52.0 | 10.11 | 1045.0 | 1422.0 | 7.5 | 61.0 | 0.7 | 0.26 | | | | | | | 0.021 | | | | |
| 11/27/2006 | 10:48 | | 50.2 | | | | | | | 0.26 | 16000 | 4000 | 0.36 | | | | | | | | |
| 11/28/2006 | 10:07 | | 46.4 | 12.29 | 44.3 | 65.6 | 6.7 | 11.0 | 0.0 | 2.39 | | | | | | | | | | | |

< 5 samples for the geometric mean
All duplicates are omitted from analysis.
Red font indicates suspect data.
Green font indicates value was greater than the maximum detetion limit. MDL+1 was the value used for analysis.
Blue font indicates the value was below the minimum detection limit, and 1/2 the MDL was used as the value for analysis.
Maroon font equals values was ~. Value used for analysis was the ~value.
LIQ = Analysis performed on sample as received
FILT = Sample filtered through 0.45 membrane filter; analysis performed on fitrate
*When stage was not recorded, river tailwater was mixing with stormwater or the water was frozen

**Table 10 continued.** Monitoring results for 4PP outfall

| Date | Sample Time | Sample Type | Alkalinity (mg/L CaCO3) | Chloride ion (mg/L) | Hardness (mg/L CaCO3) | COD (mg/L) | Total Organic Carbon (mg/L) | CBOD 5-day (mg/L) | TBOD 5-day (mg/L) | Copper (mg/L) | Nickel (mg/L) | Lead (mg/L) | Zinc (mg/L) | Cadmium (mg/L) | Chromium (mg/L) | Oil and Grease (mg/L) | Tetrachloroethene (ug/L) | Trichlorofluoromethane (ug/L) | 1,2-Dichloroethane-d4 (% Recovered) | Benzene-d6 (% Recovered) | Ethyl Benzene-d10 (% Recovered) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/3/2006 | 13:05 | | | 856 | | | | | | | | | | | | | | | | | |
| 2/28/2006 | 14:00 | | | 251 | | | | | | | | | | | | | | | | | |
| 3/9/2006 | 12:05 | LIQ | 286 | 214 | 414 | 12 | | 0.5 | 0.5 | | | | | | | 0.5 | | | | | |
| 3/9/2006 | 12:05 | FILT | | | | | 2.3 | | | | | | | | | | | | | | |
| 3/20/2006 | 14:35 | LIQ | 237 | 424 | 302 | 28 | | 3.7 | 3.7 | | | | | | | 0.5 | | | | | |
| 3/20/2006 | 14:35 | FILT | | | | | 3.8 | | | | | | | | | | | | | | |
| 3/30/2006 | 10:28 | LIQ | 108 | 236 | 156 | 592 | | 300.0 | 145.0 | 0.1720 | 0.0350 | 0.2200 | 0.7830 | 0.0005 | 0.0590 | 45 | | | | | |
| 3/30/2006 | 10:28 | FILT | | | | | 17.7 | | | 0.0172 | 0.0044 | 0.0011 | 0.0124 | 0.00002 | 0.0083 | | | | | | |
| 4/24/2006 | | | | | | | | | | | | | | | | | | | | | |
| 4/27/2006 | 11:00 | | | | | | | | | | | | | | | | | | | | |
| 4/28/2006 | 10:22 | LIQ | 284 | 234 | 506 | 12 | | 1.0 | 1.0 | | | | | | | | | | | | |
| 4/28/2006 | 10:22 | FILT | | | | | 1.5 | | | | | | | | | | | | | | |
| 4/28/2006 | 13:18 | LIQ | 28 | 22 | 52 | 193 | | 36.0 | 46.0 | | | | | | | | | | | | |
| 4/28/2006 | 13:18 | FILT | | | | | 22.8 | | | | | | | | | | | | | | |
| 5/1/2006 | 10:12 | | | | | | | | | | | | | | | | | | | | |
| 5/12/2006 | 10:55 | LIQ | 47 | 29 | 62 | 84 | | 19.0 | 21.0 | | | | | | | 12 | | | | | |
| 5/12/2006 | 10:55 | FILT | | | | | 12.5 | | | | | | | | | | | | | | |
| 5/31/2006 | 11:10 | LIQ | 296 | 247 | 408 | 11 | | 1.0 | 1.0 | 0.0018 | 0.0062 | 0.0001 | 0.0064 | 0.00002 | 0.0002 | 0.5 | | | | | |
| 5/31/2006 | 11:10 | FILT | | | | | 2.4 | | | | | | | | | | | | | | |
| 6/7/2006 | 11:22 | | | | | | | | | | | | | | | | | | | | |
| 6/13/2006 | 13:33 | LIQ | 273 | 233 | 498 | 9 | | 1.0 | 1.0 | | | | | | | 0.5 | | | | | |
| 6/13/2006 | 13:33 | FILT | | | | | 2.3 | | | | | | | | | | | | | | |
| 6/14/2006 | 10:32 | | | | | | | | | | | | | | | | | | | | |
| 6/22/2006 | 10:43 | | | | | | | | | | | | | | | | | | | | |
| 6/23/2006 | 11:00 | LIQ | 283 | 226 | 474 | 21 | | 0.5 | 1.1 | | | | | | | 0.5 | | | | | |
| 6/23/2006 | 11:00 | FILT | | | | | 2.3 | | | | | | | | | | | | | | |
| 7/6/2006 | 10:52 | | | | | | | | | | | | | | | | | | | | |
| 7/12/2006 | 12:45 | LIQ | | | | | | | | | | | | | | | 2.99 | 0.5 | 92 | 96 | 90 |
| 7/12/2006 | 12:45 | FILT | | | | | | | | | | | | | | | | | | | |
| 7/13/2006 | 12:25 | LIQ | 266 | 228 | 462 | 32 | | 1.5 | 1.9 | | | | | | | 2 | | | | | |
| 7/13/2006 | 12:25 | FILT | | | | | 3.0 | | | | | | | | | | | | | | |
| 7/27/2006 | 10:45 | | | | | | | | | | | | | | | | | | | | |
| 7/28/2006 | 11:15 | LIQ | 280 | 200 | 478 | 18 | | 1.3 | 1.1 | | | | | | | 2 | | | | | |
| 7/28/2006 | 11:15 | FILT | | | | | 2.7 | | | | | | | | | | | | | | |
| 8/1/2006 | 11:25 | | | | | | | | | | | | | | | | | | | | |
| 8/2/2006 | 12:45 | LIQ | 64 | 46 | 106 | 16 | | 1.2 | 1.6 | 0.0044 | 0.0022 | 0.0068 | 0.0210 | 0.00002 | 0.0017 | 0.5 | | | | | |
| 8/2/2006 | 12:45 | FILT | | | | | 2.3 | | | 0.0022 | 0.0017 | 0.0005 | 0.0057 | 0.00002 | 0.0015 | | | | | | |
| 8/11/2006 | 11:20 | LIQ | 294 | 201 | 454 | 25 | | 5.5 | 6.2 | | | | | | | 0.5 | | | | | |
| 8/11/2006 | 11:20 | FILT | | | | | 4.8 | | | | | | | | | | | | | | |
| 8/17/2006 | 10:59 | | | | | | | | | | | | | | | | | | | | |
| 8/22/2006 | 10:45 | | | | | | | | | | | | | | | | | | | | |
| 8/23/2006 | 12:10 | LIQ | 72 | 53 | 120 | 37 | | 5.0 | 7.3 | 0.0078 | 0.0030 | 0.0067 | 0.0300 | 0.00002 | 0.0017 | 3 | | | | | |
| 8/23/2006 | 12:10 | FILT | | | | | 8.4 | | | | | | | | | | | | | | |
| 8/24/2006 | 14:00 | | | | | | | | | | | | | | | | 2.05 | 2.09 | 97 | 98 | 105 |
| 8/30/2006 | 12:30 | LIQ | 297 | 228 | 500 | 10 | | 0.5 | 0.5 | | | | | | | 2 | | | | | |
| 8/30/2006 | 12:30 | FILT | | | | | 1.9 | | | | | | | | | | | | | | |
| 8/31/2006 | 11:03 | | | | | | | | | | | | | | | | | | | | |
| 9/7/2006 | 10:48 | | | | | | | | | | | | | | | | | | | | |
| 9/12/2006 | 11:15 | LIQ | 305 | 227 | 498 | 10 | | 0.5 | 0.5 | | | | | | | 0.5 | | | | | |
| 9/12/2006 | 11:15 | FILT | | | | | 2.1 | | | | | | | | | | | | | | |
| 9/18/2006 | 11:18 | | | | | | | | | | | | | | | | | | | | |
| 9/22/2006 | 11:15 | LIQ | 78 | 51 | 120 | 30 | | 2.3 | 4.2 | 0.0116 | 0.0027 | 0.0067 | 0.0330 | 0.00002 | 0.0040 | 0.5 | | | | | |
| 9/22/2006 | 11:15 | FILT | | | | | 5.5 | | | 0.0068 | 0.0051 | 0.0007 | 0.0076 | 0.00002 | 0.0031 | | | | | | |
| 9/26/2006 | 11:00 | | | | | | | | | | | | | | | | | | | | |
| 9/28/2006 | 11:15 | LIQ | 266 | 230 | 360 | 10 | | 0.5 | 0.5 | | | | | | | 0.5 | | | | | |
| 9/28/2006 | 11:15 | FILT | | | | | 2.5 | | | | | | | | | | | | | | |
| 10/5/2006 | 11:18 | | | | | | | | | | | | | | | | | | | | |
| 10/11/2006 | 12:10 | | | | | | | | | | | | | | | | | | | | |
| 10/16/2006 | 10:50 | | | | | | | | | | | | | | | | 1.67 | 0.5 | 102 | 95 | 104 |
| 10/16/2006 | 10:45 | LIQ | 100 | 60 | | 190 | | | | 0.0340 | 0.0052 | 0.0106 | 0.1030 | 0.00002 | 0.0051 | | | | | | |
| 10/16/2006 | 10:45 | FILT | | | | | 50.6 | | | | | | | | | | | | | | |
| 10/18/2006 | 11:30 | LIQ | 295 | 218 | | 14 | | 1.2 | 1.5 | | | | | | | | | | | | |
| 10/18/2006 | 11:30 | FILT | | | | | | | | | | | | | | | | | | | |
| 10/25/2006 | 11:05 | | | | | | | | | | | | | | | | | | | | |
| 10/26/2006 | 11:20 | FILT | | | | | | | | | | | | | | | | | | | |
| 11/27/2006 | 10:48 | | | | | | | | | | | | | | | | | | | | |
| 11/28/2006 | 10:07 | | | | | | | | | | | | | | | | 0.65 | 0.5 | 99 | 92 | 111 |

< 5 samples for the geometric mean
All duplicates are omitted from analysis.
Red font indicates suspect data.
Green font indicates value was greater than the maximum detetion limit. MDL+1 was the value used for analysis.
Blue font indicates the value was below the minimum detection limit, and 1/2 the MDL was used as the value for analysis.
Maroon font equals values was ~. Value used for analysis was the ~value.
LIQ = Analysis performed on sample as received
FILT = Sample filtered through 0.45 membrane filter; analysis performed on fitrate

**Table 11.** Monitoring results for 6UMN outfall

| Date | Sample Time | Sample Type | Water Temp (F) | Dissolved Oxygen (mg/L) | Conductivity (uS) | Specific Conductivity (uS) | pH | Transparency (cm) | Salinity (ppt) | Stage* (ft) | Fecal Coliform (counts/100 mL) | E. coli (counts/100 mL) | Fluoride (mg/L) | Total Dissolved Solids (mg/L) | Sulfate (mg/L) | Dissolved Phosphorus (mg/L) | Ortho Phosphorous (mg/L) | Total Kjeldahl Nitrogen (mg/L) | Ammonia Nitrogen (mg/L) | Nitrite N (mg/L) | Nitrate N (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/3/2006 | 13:34 | LIQ | 45.9 | 11.08 | 1340.0 | 2003.0 | 7.4 | | 1.0 | 3.97 | | | | | | | | | | | |
| 2/28/2006 | 13:00 | LIQ | 50.9 | 11.03 | 1395.0 | 1939.0 | 7.6 | | 1.0 | | | | | | | | | | | | |
| 3/9/2006 | 11:34 | LIQ | 51.8 | 10.57 | 1000.0 | 1367.0 | 7.9 | | 0.7 | 3.44 | | | | 820 | 92 | | | 0.58 | 0.03 | 0.015 | 5.57 |
| 3/9/2006 | 11:34 | FILT | 51.8 | 10.57 | 1000.0 | 1367.0 | 7.9 | | 0.7 | 3.44 | | | | | | 0.043 | 0.013 | | | | |
| 3/20/2006 | 15:07 | LIQ | 48.9 | 10.94 | 1152.0 | 1640.0 | 7.8 | | 0.8 | 4.09 | | | | 964 | 71 | | | 0.66 | 0.10 | 0.015 | 3.81 |
| 3/20/2006 | 15:07 | FILT | 48.9 | 10.94 | 1152.0 | 1640.0 | 7.8 | | 0.8 | 4.09 | | | | | | 0.051 | 0.030 | | | | |
| 3/30/2006 | 9:54 | LIQ | 47.7 | 10.95 | 876.0 | 1272.0 | 7.8 | 3.4 | 0.6 | | | | | 739 | 57 | | | 2.30 | 0.31 | 0.07 | 2.81 |
| 3/30/2006 | 9:54 | FILT | 47.7 | 10.95 | 876.0 | 1272.0 | 7.8 | 3.4 | 0.6 | | | | | | | 0.101 | 0.059 | | | | |
| 4/24/2006 | | | 54.1 | 10.13 | 833.0 | 1100.0 | | | 0.5 | | | | | | | | | | | | |
| 4/27/2006 | 10:29 | | 53.1 | | | | | | | 4.31 | | 1 | 0.41 | | | | | | | | |
| 4/28/2006 | 9:47 | LIQ | 53.2 | 10.45 | 1046.0 | 1398.0 | 7.9 | 61.0 | 0.7 | 4.22 | | | | 874 | 96 | | | 0.58 | 0.01 | 0.015 | 6.11 |
| 4/28/2006 | 9:47 | FILT | 53.2 | 10.45 | 1046.0 | 1398.0 | 7.9 | 61.0 | 0.7 | 4.22 | | | | | | 0.030 | 0.003 | | | | |
| 4/28/2006 | 12:34 | LIQ | 54.7 | 9.66 | 626.0 | 819.0 | 7.9 | 10.0 | 0.4 | 4.27 | | | | 479 | 45 | | | 4.60 | 1.32 | 0.16 | 1.79 |
| 4/28/2006 | 12:34 | FILT | 54.7 | 9.66 | 626.0 | 819.0 | 7.9 | 10.0 | 0.4 | 4.27 | | | | | | 0.265 | 0.150 | | | | |
| 5/1/2006 | 9:47 | | 54.5 | | | | | | | | 16000 | 2200 | | | | | | | | | |
| 5/12/2006 | 10:14 | LIQ | 50.4 | 10.81 | 247.8 | 344.9 | 7.2 | 24.5 | 0.2 | 6.12 | | | | 192 | 24 | | | 1.10 | 0.14 | 0.05 | 1.05 |
| 5/12/2006 | 10:14 | FILT | 50.4 | 10.81 | 247.8 | 344.9 | 7.2 | 24.5 | 0.2 | 6.12 | | | | | | 0.117 | 0.083 | | | | |
| 5/22/2006 | 11:24 | | 54.0 | 0.44 | 996.0 | 1318.0 | 7.9 | 9.3 | 0.7 | | | | | | | | | | | | |
| 5/31/2006 | 10:22 | LIQ | 58.5 | 9.42 | 1127.0 | 1405.0 | 7.9 | 61.0 | 0.7 | | 300 | 165 | | 907 | 111 | | | 0.73 | 0.01 | 0.015 | 5.16 |
| 5/31/2006 | 10:22 | FILT | 58.5 | 9.42 | 1127.0 | 1405.0 | 7.9 | 61.0 | 0.7 | | 300 | 165 | | | | 0.005 | 0.008 | | | | |
| 6/7/2006 | 10:50 | | 60.6 | | | | | | | 4.02 | 20 | 20 | 0.40 | | | | | | | | |
| 6/13/2006 | 12:55 | LIQ | 55.9 | 10.18 | 1055.0 | 1355.0 | 8.0 | 61.0 | 0.7 | 3.59 | | | | 891 | 108 | | | 0.37 | 0.01 | 0.015 | 6.72 |
| 6/13/2006 | 12:55 | FILT | 55.9 | 10.18 | 1055.0 | 1355.0 | 8.0 | 61.0 | 0.7 | 3.59 | | | | | | 0.005 | 0.007 | | | | |
| 6/14/2006 | 9:56 | | 60.8 | | | | | | | 3.40 | 40 | 8 | 0.42 | | | | | | | | |
| 6/22/2006 | 10:10 | | 59.5 | | | | | | | 3.07 | 500 | 13 | 0.43 | | | | | | | | |
| 6/23/2006 | 10:00 | LIQ | 59.2 | 8.93 | 1112.0 | 1372.0 | 8.0 | 61.0 | 0.7 | 3.33 | | | | 890 | 112 | | | 0.50 | 0.01 | 0.015 | 6.47 |
| 6/23/2006 | 10:00 | FILT | 59.2 | 8.93 | 1112.0 | 1372.0 | 8.0 | 61.0 | 0.7 | 3.33 | | | | | | 0.015 | 0.011 | | | | |
| 7/6/2006 | 10:23 | | 60.6 | | | | | | | 3.15 | 20 | 28 | 0.33 | | | | | | | | |
| 7/12/2006 | 11:15 | | 58.1 | 9.64 | 1063.0 | 1330.0 | 7.9 | 61.0 | 0.7 | | | | | | | | | | | | |
| 7/13/2006 | 12:50 | LIQ | 64.4 | 8.41 | 1139.0 | 1315.0 | 8.0 | 61.0 | 0.7 | | | | | 900 | 105 | | | 0.63 | 0.01 | 0.015 | 5.69 |
| 7/13/2006 | 12:50 | FILT | 64.4 | 8.41 | 1139.0 | 1315.0 | 8.0 | 61.0 | 0.7 | | | | | | | 0.005 | 0.005 | | | | |
| 7/19/2006 | | LIQ | 70.3 | 6.37 | 156.4 | 168.1 | 8.2 | | 0.1 | | | | | 123 | 9 | | | 1.60 | 0.24 | 0.05 | 0.93 |
| 7/19/2006 | | FILT | 70.3 | 6.37 | 156.4 | 168.1 | 8.2 | | 0.1 | | | | | | | 0.036 | 0.027 | | | | |
| 7/27/2006 | 10:23 | | 66.2 | | | | | | | 2.72 | 1300 | 150 | | | | | | | | | |
| 7/28/2006 | 10:45 | LIQ | 58.3 | 9.82 | 987.0 | 1232.0 | 7.9 | 61.0 | 0.6 | 2.17 | | | | 828 | 94 | | | 0.71 | 0.01 | 0.015 | 5.62 |
| 7/28/2006 | 10:45 | FILT | 58.3 | 9.82 | 987.0 | 1232.0 | 7.9 | 61.0 | 0.6 | 2.17 | | | | | | 0.032 | 0.022 | | | | |
| 8/1/2006 | 10:57 | | 69.8 | | | | | | | 2.55 | 16001 | 9200 | | | | | | | | | |
| 8/1/2006 | 13:30 | LIQ | 75.0 | 4.86 | 396.5 | 405.1 | 7.3 | 22.6 | 0.2 | 2.55 | | | | 217 | 22 | | | 2.20 | 0.04 | 0.17 | 1.43 |
| 8/1/2006 | 13:30 | FILT | 75.0 | 4.86 | 396.5 | 405.1 | 7.3 | 22.6 | 0.2 | 2.55 | | | | | | 0.047 | 0.022 | | | | |
| 8/1/2006 | 18:25 | LIQ | 71.4 | 7.04 | 213.4 | 226.9 | 7.2 | 22.8 | 0.1 | 2.61 | | | | 132 | 11 | | | 0.96 | 0.05 | 0.04 | 1.02 |
| 8/1/2006 | 18:25 | FILT | 71.4 | 7.04 | 213.4 | 226.9 | 7.2 | 22.8 | 0.1 | 2.61 | | | | | | 0.063 | 0.059 | | | | |
| 8/11/2006 | 10:47 | LIQ | 62.8 | 8.89 | 1110.0 | 1307.0 | 7.8 | 61.0 | 0.7 | 2.60 | | | | 930 | 107 | | | 0.31 | 0.03 | 0.015 | 6.59 |
| 8/11/2006 | 10:47 | FILT | 62.8 | 8.89 | 1110.0 | 1307.0 | 7.8 | 61.0 | 0.7 | 2.60 | | | | | | 0.023 | 0.008 | | | | |
| 8/13/2006 | 10:22 | LIQ | 68.0 | 7.17 | 239.7 | 265.1 | 7.8 | 24.5 | 0.1 | 2.59 | | | | 130 | 14 | | | 1.40 | 0.39 | 0.05 | 1.26 |
| 8/13/2006 | 10:22 | FILT | 68.0 | 7.17 | 239.7 | 265.1 | 7.8 | 24.5 | 0.1 | 2.59 | | | | | | 0.055 | 0.036 | | | | |
| 8/17/2006 | 10:35 | | 63.3 | | | | | | | 2.40 | 500 | 430 | 0.36 | | | | | | | | |
| 8/22/2006 | 10:20 | | 63.0 | | | | | | | 3.01 | 300 | 11 | 0.37 | | | | | | | | |
| 8/24/2006 | 13:23 | | 63.1 | 8.30 | 674.0 | 791.0 | 7.7 | 20.0 | 0.4 | 3.23 | | | | | | | | | | | |
| 8/30/2006 | 11:30 | LIQ | 63.3 | 8.84 | 1126.0 | 1319.0 | 7.9 | 39.8 | 0.7 | 2.78 | | | | 850 | 95.69 | | | 0.80 | 0.01 | 0.05 | 5.72 |
| 8/30/2006 | 11:30 | FILT | 63.3 | 8.84 | 1126.0 | 1319.0 | 7.9 | 39.8 | 0.7 | 2.78 | | | | | | 0.021 | 0.015 | | | | |
| 8/31/2006 | 10:30 | | 63.9 | | | | | | | 3.27 | 500 | 12 | 0.37 | | | | | | | | |
| 9/7/2006 | 10:21 | | 63.7 | | | | | | | 3.21 | 110 | 70 | 0.36 | | | | | | | | |
| 9/12/2006 | 10:45 | LIQ | 59.5 | 9.14 | 1097.0 | 1348.0 | 7.8 | 61.0 | 0.7 | 3.16 | | | | 839 | 101.53 | | | 0.48 | 0.01 | 0.22 | 5.91 |
| 9/12/2006 | 10:45 | FILT | 59.5 | 9.14 | 1097.0 | 1348.0 | 7.8 | 61.0 | 0.7 | 3.16 | | | | | | 0.005 | 0.010 | | | | |
| 9/18/2006 | 10:30 | | 56.8 | | | | | | | 2.86 | 500 | 250 | 0.29 | | | | | | | | |
| 9/22/2006 | 10:50 | LIQ | 57.4 | 9.62 | 350.7 | 443.4 | 7.1 | 21.2 | 0.2 | 3.37 | | | | 176 | 18.37 | | | 0.79 | 0.23 | 0.04 | 0.6 |
| 9/22/2006 | 10:50 | FILT | 57.4 | 9.62 | 350.7 | 443.4 | 7.1 | 21.2 | 0.2 | 3.37 | | | | | | 0.107 | 0.098 | | | | |
| 9/26/2006 | 10:35 | | 58.1 | | | | | | | 3.37 | 40 | 18 | | | | | | | | | |
| 9/26/2006 | 22:30 | LIQ | 59.4 | 9.00 | 572.0 | 704.0 | 7.1 | 61.0 | 0.3 | | | | | 452 | 51.2 | | | 1.40 | 0.01 | 0.04 | 3.55 |
| 9/26/2006 | 22:30 | FILT | 59.4 | 9.00 | 572.0 | 704.0 | 7.1 | 61.0 | 0.3 | | | | | | | 0.048 | 0.032 | | | | |
| 9/28/2006 | 10:45 | LIQ | 54.7 | 9.84 | 838.0 | 1099.0 | 7.5 | 61.0 | 0.5 | 2.68 | | | | 749 | 95.78 | | | 1.10 | 0.01 | 0.015 | 4.95 |
| 9/28/2006 | 10:45 | FILT | 54.7 | 9.84 | 838.0 | 1099.0 | 7.5 | 61.0 | 0.5 | 2.68 | | | | | | 0.018 | 0.014 | | | | |
| 10/5/2006 | 10:53 | | 57.2 | | | | | | | 3.02 | 3000 | 500 | | | | | | | | | |
| 10/11/2006 | 11:30 | | 52.5 | | | | | | | 2.86 | 1300 | 1200 | 0.36 | | | | | | | | |
| 10/16/2006 | 5:17 | LIQ | 54.5 | 9.96 | 408.7 | 537.0 | 7.3 | 19.4 | 0.3 | 3.31 | | | | 365 | | | | 2.30 | 0.37 | 0.03 | 1.85 |
| 10/16/2006 | 5:17 | FILT | 54.5 | 9.96 | 408.7 | 537.0 | 7.3 | 19.4 | 0.3 | 3.31 | | | | | | 0.389 | 0.256 | | | | |
| 10/16/2006 | 10:00 | | 54.0 | 9.80 | 376.4 | 497.7 | 7.3 | 24.4 | 0.2 | 3.20 | | | | | | | | | | | |
| 10/18/2006 | 11:00 | LIQ | 52.5 | 10.20 | 949.0 | 1281.0 | 7.5 | 61.0 | 0.6 | 3.14 | | | | 846 | | | | 1.20 | 0.04 | 0.015 | 5.66 |
| 10/18/2006 | 11:00 | FILT | 52.5 | 10.20 | 949.0 | 1281.0 | 7.5 | 61.0 | 0.6 | 3.14 | | | | | | | 0.015 | | | | |
| 10/25/2006 | 10:40 | | 48.9 | | | | | | | 2.91 | 80 | 1 | 0.31 | | | | | | | | |
| 10/26/2006 | 10:45 | FILT | 52.2 | 10.14 | 961.0 | 1305.0 | 7.7 | 61.0 | 0.7 | 2.85 | | | | | | | 0.009 | | | | |
| 11/27/2006 | 10:15 | | 49.6 | | | | | | | 2.97 | 20 | 1 | 0.36 | | | | | | | | |
| 11/28/2006 | 9:18 | | 49.8 | 10.98 | 169.1 | 237.6 | 7.3 | 8.0 | 0.1 | 2.94 | | | | | | | | | | | |
| 11/28/2006 | 12:28 | | 51.4 | 10.33 | 167.3 | 229.4 | 6.7 | 9.5 | 0.1 | 3.24 | | | | | | | | | | | |

< 5 samples for the geometric mean
All duplicates are omitted from analysis.
Red font indicates suspect data.
Green font indicates value was greater than the maximum detetion limit. MDL+1 was the value used for analysis.
Blue font indicates the value was below the minimum detection limit, and 1/2 the MDL was used as the value for analysis.
Maroon font equals values was ~. Value used for analysis was the ~value.
LIQ = Analysis performed on sample as received
FILT = Sample filtered through 0.45 membrane filter; analysis performed on fitrate
*When stage was not recorded, river tailwater was mixing with stormwater or the water was frozen

**Table 11 continued.** Monitoring results for 6UMN outfall

| Date | Sample Time | Sample Type | Alkalinity (mg/L CaCO3) | Chloride ion (mg/L) | Hardness (mg/L CaCO3) | COD (mg/L) | Total Organic Carbon (mg/L) | CBOD-5day (mg/L) | TBOD 5-day (mg/L) | Copper (mg/L) | Nickel (mg/L) | Lead (mg/L) | Zinc (mg/L) | Cadmium (mg/L) | Chromium (mg/L) | Oil and Grease (mg/L) | Tetrachloroethene (ug/L) | Trichlorofluoromethane (ug/L) | 1,2-Dichloroethane-d4 (% Recovered) | Benzene-d6 (% Recovered) | Ethyl Benzene-d10 (% Recovered) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/3/2006 | 13:34 | LIQ | | 487 | | | | | | | | | | | | | | | | | |
| 2/28/2006 | 13:00 | LIQ | | 358 | | | | | | | | | | | | | | | | | |
| 3/9/2006 | 11:34 | LIQ | 328 | 163 | 540 | 12 | | 0.5 | 0.5 | | | | | | | 1 | | | | | |
| 3/9/2006 | 11:34 | FILT | | | | | 2.6 | | | | | | | | | | | | | | |
| 3/20/2006 | 15:07 | LIQ | 264 | 323 | 290 | 27 | 3.0 | 2.1 | 2.2 | | | | | | | 0.5 | | | | | |
| 3/20/2006 | 15:07 | FILT | | | | | 4.3 | | | | | | | | | | | | | | |
| 3/30/2006 | 9:54 | LIQ | 156 | 238 | 240 | 181 | | 140.0 | 145.0 | 0.0450 | 0.0162 | 0.0380 | 0.2260 | 0.00002 | 0.0219 | 14 | | | | | |
| 3/30/2006 | 9:54 | FILT | | | | | 14.4 | | | 0.0111 | 0.0071 | 0.0005 | 0.0119 | 0.00002 | 0.0051 | | | | | | |
| 4/24/2006 | | | | | | | | | | | | | | | | | | | | | |
| 4/27/2006 | 10:29 | | | | | | | | | | | | | | | | | | | | |
| 4/28/2006 | 9:47 | LIQ | 321 | 170 | 590 | 16 | | 1.0 | 1.0 | | | | | | | | | | | | |
| 4/28/2006 | 9:47 | FILT | | | | | 2.0 | | | | | | | | | | | | | | |
| 4/28/2006 | 12:34 | LIQ | 122 | 104 | 210 | 215 | | 66.0 | 59.0 | | | | | | | | | | | | |
| 4/28/2006 | 12:34 | FILT | | | | | 37.6 | | | | | | | | | | | | | | |
| 5/1/2006 | 9:47 | | | | | | | | | | | | | | | | | | | | |
| 5/12/2006 | 10:14 | LIQ | 77 | 36 | 126 | 73 | | 10.0 | 12.0 | | | | | | | 8 | | | | | |
| 5/12/2006 | 10:14 | FILT | | | | | 8.1 | | | | | | | | | | | | | | |
| 5/22/2006 | 11:24 | | | | | | | | | | | | | | | | | | | | |
| 5/31/2006 | 10:22 | LIQ | 339 | 176 | 596 | 14 | | 2.2 | 2.0 | 0.0039 | 0.0094 | 0.0010 | 0.0124 | 0.00002 | 0.0053 | 2 | | | | | |
| 5/31/2006 | 10:22 | FILT | | | | | 3.5 | | | | | | | | | | | | | | |
| 6/7/2006 | 10:50 | | | | | | | | | | | | | | | | | | | | |
| 6/13/2006 | 12:55 | LIQ | 310 | 176 | 588 | 7 | | 1.0 | 1.0 | | | | | | | 0.5 | | | | | |
| 6/13/2006 | 12:55 | FILT | | | | | 2.6 | | | | | | | | | | | | | | |
| 6/14/2006 | 9:56 | | | | | | | | | | | | | | | | | | | | |
| 6/22/2006 | 10:10 | | | | | | | | | | | | | | | | | | | | |
| 6/23/2006 | 10:00 | LIQ | 315 | 168 | 548 | 15 | | 0.5 | 1.1 | | | | | | | 0.5 | | | | | |
| 6/23/2006 | 10:00 | FILT | | | | | 2.2 | | | | | | | | | | | | | | |
| 7/6/2006 | 10:23 | | | | | | | | | | | | | | | | | | | | |
| 7/12/2006 | 11:15 | | | | | | | | | | | | | | | | 0.65 | 0.5 | 95 | 99 | 102 |
| 7/13/2006 | 12:50 | LIQ | 301 | 162 | 566 | 27 | | 0.5 | 0.5 | | | | | | | 2 | | | | | |
| 7/13/2006 | 12:50 | FILT | | | | | 2.3 | | | | | | | | | | | | | | |
| 7/19/2006 | | LIQ | 40 | 15 | 62 | 66 | | 1.8 | 3.2 | 0.0222 | 0.0084 | 0.0300 | 0.1170 | 0.0003 | 0.0097 | 3 | | | | | |
| 7/19/2006 | | FILT | | | | | 6.6 | | | 0.0046 | 0.0021 | 0.0003 | 0.0036 | 0.00002 | 0.0026 | | | | | | |
| 7/27/2006 | 10:23 | | | | | | | | | | | | | | | | | | | | |
| 7/28/2006 | 10:45 | LIQ | 317 | 145 | 532 | 12 | | 1.2 | 0.5 | | | | | | | 4 | | | | | |
| 7/28/2006 | 10:45 | FILT | | | | | 2.4 | | | | | | | | | | | | | | |
| 8/1/2006 | 10:57 | | | | | | | | | | | | | | | | | | | | |
| 8/1/2006 | 13:30 | LIQ | 79 | 29 | 112 | 105 | | 13.0 | 16.0 | 0.0160 | 0.0063 | 0.0082 | 0.0880 | 0.0002 | 0.0052 | 3 | | | | | |
| 8/1/2006 | 13:30 | FILT | | | | | 20.0 | | | | | | | | | | | | | | |
| 8/1/2006 | 18:25 | LIQ | 49 | 19 | 82 | 36 | | 1.6 | 3.1 | 0.0100 | 0.0041 | 0.0109 | 0.0500 | 0.0001 | 0.0046 | 4 | | | | | |
| 8/1/2006 | 18:25 | FILT | | | | | 4.4 | | | 0.0028 | 0.0016 | 0.0003 | 0.0050 | 0.00002 | 0.0027 | | | | | | |
| 8/11/2006 | 10:47 | LIQ | 299 | 159 | 544 | 10 | | 0.5 | 0.5 | | | | | | | 0.5 | | | | | |
| 8/11/2006 | 10:47 | FILT | | | | | 2.4 | | | | | | | | | | | | | | |
| 8/13/2006 | 10:22 | LIQ | 46 | 16 | 70 | 46 | | 4.2 | 6.1 | | | | | | | 0.5 | | | | | |
| 8/13/2006 | 10:22 | FILT | | | | | 7.0 | | | | | | | | | | | | | | |
| 8/17/2006 | 10:35 | | | | | | | | | | | | | | | | | | | | |
| 8/22/2006 | 10:20 | | | | | | | | | | | | | | | | | | | | |
| 8/24/2006 | 13:23 | | | | | | | | | | | | | | | | 0.65 | 0.5 | 95 | 99 | 102 |
| 8/30/2006 | 11:30 | LIQ | 310 | 147 | 484 | 13 | | 0.5 | 1.8 | | | | | | | 2 | | | | | |
| 8/30/2006 | 11:30 | FILT | | | | | 2.2 | | | | | | | | | | | | | | |
| 8/31/2006 | 10:30 | | | | | | | | | | | | | | | | | | | | |
| 9/7/2006 | 10:21 | | | | | | | | | | | | | | | | | | | | |
| 9/12/2006 | 10:45 | LIQ | 342 | 151 | 528 | 9 | | 0.5 | 0.5 | | | | | | | 3 | | | | | |
| 9/12/2006 | 10:45 | FILT | | | | | 2.5 | | | | | | | | | | | | | | |
| 9/18/2006 | 10:30 | | | | | | | | | | | | | | | | | | | | |
| 9/22/2006 | 10:50 | LIQ | 74 | 22 | 98 | 144 | | 5.3 | 4.7 | 0.0124 | 0.0029 | 0.0072 | 0.0400 | 0.00002 | 0.0029 | 0.5 | | | | | |
| 9/22/2006 | 10:50 | FILT | | | | | 6.0 | | | 0.0050 | 0.0020 | 0.0007 | 0.0093 | 0.00002 | 0.0018 | | | | | | |
| 9/26/2006 | 10:35 | | | | | | | | | | | | | | | | | | | | |
| 9/26/2006 | 22:30 | LIQ | 158 | 74 | 262 | 36 | | 5.9 | 7.2 | | | | | | | 0.5 | | | | | |
| 9/26/2006 | 22:30 | FILT | | | | | 9.0 | | | 0.0055 | 0.0062 | 0.0002 | 0.0083 | 0.00002 | 0.0021 | | | | | | |
| 9/28/2006 | 10:45 | LIQ | 290 | 123 | 258 | 16 | | 1.4 | 1.8 | | | | | | | 0.5 | | | | | |
| 9/28/2006 | 10:45 | FILT | | | | | 4.2 | | | | | | | | | | | | | | |
| 10/5/2006 | 10:53 | | | | | | | | | | | | | | | | | | | | |
| 10/11/2006 | 11:30 | | | | | | | | | | | | | | | | | | | | |
| 10/16/2006 | 5:17 | LIQ | 121 | 52 | | 115 | | 41.0 | 40.0 | | | | | | | | | | | | |
| 10/16/2006 | 5:17 | FILT | | | | | 28.3 | | | | | | | | | | | | | | |
| 10/16/2006 | 10:00 | | | | | | | | | | | | | | | | 0.65 | 0.5 | 97 | 94 | 105 |
| 10/18/2006 | 11:00 | LIQ | 329 | 160 | | 9 | | 0.5 | 0.5 | | | | | | | | | | | | |
| 10/18/2006 | 11:00 | FILT | | | | | | | | | | | | | | | | | | | |
| 10/25/2006 | 10:40 | | | | | | | | | | | | | | | | | | | | |
| 10/26/2006 | 10:45 | FILT | | | | | | | | | | | | | | | | | | | |
| 11/27/2006 | 10:15 | | | | | | | | | | | | | | | | | | | | |
| 11/28/2006 | 9:18 | | | | | | | | | | | | | | | | | | | | |
| 11/28/2006 | 12:28 | | | | | | | | | | | | | | | | 0.65 | 0.5 | 115 | 104 | 97 |

< 5 samples for the geometric mean
All duplicates are omitted from analysis.
Red font indicates suspect data.
Green font indicates value was greater than the maximum detetion limit. MDL+1 was the value used for analysis.
Blue font indicates the value was below the minimum detection limit, and 1/2 the MDL was used as the value for analysis.
Maroon font equals values was ~. Value used for analysis was the ~value.
LIQ = Analysis performed on sample as received
FILT = Sample filtered through 0.45 membrane filter; analysis performed on filtrate

**Table 12.** Monitoring results for 7LSTU outfall

| Date | Sample Time | Sample Type | Water Temp (F) | Dissolved Oxygen (mg/L) | Conductivity (uS) | Specific Conductivity (uS) | pH | Transparency (cm) | Salinity (ppt) | Stage* (ft) | Fecal Coliform (counts/100 mL) | E. coli (counts/100 mL) | Fluoride (mg/L) | Total Dissolved Solids (mg/L) | Sulfate (mg/L) | Dissolved Phosphorus (mg/L) | Ortho Phosphorous (mg/L) | Total Kjeldahl Nitrogen (mg/L) | Ammonia Nitrogen (mg/L) | Nitrite N (mg/L) | Nitrate N (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/30/2006 | 9:00 | LIQ | 43.7 | 11.80 | 539.0 | 835.0 | 7.8 | 3.5 | 0.4 | 1.96 | | | | 486 | 25 | | | 2.90 | 0.42 | 0.08 | 0.90 |
| 3/30/2006 | 9:00 | FILT | 43.7 | 11.80 | 539.0 | 835.0 | 7.8 | 3.5 | 0.4 | 1.96 | | | | | | 0.087 | 0.039 | | | | |
| 4/13/2006 | 10:55 | | 53.4 | | | | | | | 4.45 | | 58 | 0.2 | | | | | | | | |
| 4/24/2006 | | | 57.9 | 10.00 | 418.2 | 524.0 | | | 0.3 | 2.95 | | | | | | | | | | | |
| 4/28/2006 | 12:01 | LIQ | 52.3 | 10.30 | 866.0 | 1173.0 | 8.0 | 7.6 | 0.6 | 1.5 | | | | 631 | 52 | | | 4.90 | 1.14 | 0.22 | 1.96 |
| 4/28/2006 | 12:01 | FILT | 52.3 | 10.30 | 866.0 | 1173.0 | 8.0 | 7.6 | 0.6 | 1.5 | | | | | | 0.244 | 0.156 | | | | |
| 5/1/2006 | 8:54 | | 53.2 | | | | | | | 1.8 | 2400 | 1200 | 0.2 | | | | | | | | |
| 5/12/2006 | 9:35 | LIQ | 50.0 | 10.27 | 200.6 | 280.8 | 7.1 | 19.0 | 0.1 | 2.95 | | | | 167 | 13 | | | 1.40 | 0.27 | 0.06 | 0.48 |
| 5/12/2006 | 9:35 | FILT | 50.0 | 10.27 | 200.6 | 280.8 | 7.1 | 19.0 | 0.1 | 2.95 | | | | | | 0.093 | 0.063 | | | | |
| 7/28/2006 | 9:55 | LIQ | 69.3 | 8.02 | 748.0 | 815.0 | 7.9 | 61.0 | 0.4 | Dry | | | | 548 | 46 | | | 0.80 | 0.12 | 0.06 | 0.98 |
| 7/28/2006 | 9:55 | FILT | 69.3 | 8.02 | 748.0 | 815.0 | 7.9 | 61.0 | 0.4 | Dry | | | | | | 0.040 | 0.041 | | | | |
| 8/2/2006 | 10:39 | LIQ | 70.7 | 8.25 | 132.8 | 142.2 | 7.2 | 12.0 | 0.1 | 1 | | | | 97 | 5 | | | 0.59 | 0.01 | 0.015 | 0.44 |
| 8/2/2006 | 10:39 | FILT | 70.7 | 8.25 | 132.8 | 142.2 | 7.2 | 12.0 | 0.1 | 1 | | | | | | 0.056 | 0.042 | | | | |
| 8/23/2006 | 9:50 | LIQ | 68.9 | 8.42 | 565.0 | 618.0 | 7.5 | 23.4 | 0.3 | 0 | | | | 396 | 22.02 | | | 1.10 | 0.13 | 0.05 | 0.38 |
| 8/23/2006 | 9:50 | FILT | 68.9 | 8.42 | 565.0 | 618.0 | 7.5 | 23.4 | 0.3 | 0 | | | | | | 0.050 | 0.037 | | | | |
| 8/24/2006 | 12:35 | | 69.6 | 7.38 | 290.0 | 314.8 | 7.4 | 9.0 | 0.2 | 0.7 | | | | | | | | | | | |
| 9/22/2006 | 9:55 | LIQ | 56.5 | 10.28 | 293.3 | 374.9 | 7.1 | 8.5 | 0.2 | 0.79 | | | | 240 | 14.49 | | | 1.00 | 0.17 | 0.04 | 0.48 |
| 9/22/2006 | 9:55 | FILT | 56.5 | 10.28 | 293.3 | 374.9 | 7.1 | 8.5 | 0.2 | 0.79 | | | | | | 0.043 | 0.034 | | | | |
| 11/28/2006 | 9:40 | | 46.9 | 12.40 | 77.5 | 113.8 | 6.8 | 1.0 | 0.1 | 1.6 | | | | | | | | | | | |

< 5 samples for the geometric mean
All duplicates are omitted from analysis.
Red font indicates suspect data.
Green font indicates value was greater than the maximum detetion limit. MDL+1 was the value used for analysis.
Blue font indicates the value was below the minimum detection limit, and 1/2 the MDL was used as the value for analysis.
Maroon font equals values was ~. Value used for analysis was the ~value.
LIQ = Analysis performed on sample as received
FILT = Sample filtered through 0.45 membrane filter; analysis performed on fitrate
*When stage was not recorded, the water level did not reach the gauge or the water was frozen

**Table 12 continued.** Monitoring results for 7LSTU outfall

| Date | Sample Time | Sample Type | Alkalinity (mg/L CaCO3) | Chloride ion (mg/L) | Hardness (mg/L CaCO3) | COD (mg/L) | Total Organic Carbon (mg/L) | CBOD-5day (mg/L) | TBOD 5-day (mg/L) | Copper (mg/L) | Nickel (mg/L) | Lead (mg/L) | Zinc (mg/L) | Cadmium (mg/L) | Chromium (mg/L) | Oil and Grease (mg/L) | Tetrachloroethene (ug/L) | Trichlorofluoromethane (ug/L) | 1,2-Dichloroethane-d4 (% Recovered) | Benzene-d6 (% Recovered) | Ethyl Benzene-d10 (% Recovered) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/30/2006 | 9:00 | LIQ | 107 | 160 | 138 | 161 | | 140 | 145 | 0.0400 | 0.0126 | 0.0530 | 0.3150 | 0.00006 | 0.0167 | 8 | | | | | |
| 3/30/2006 | 9:00 | FILT | | | | | 13.0 | | | 0.0058 | 0.0005 | 0.0005 | 0.0104 | 0.00002 | 0.0045 | | | | | | |
| 4/13/2006 | 10:55 | | | | | | | | | | | | | | | | | | | | |
| 4/24/2006 | | | | | | | | | | | | | | | | | | | | | |
| 4/28/2006 | 12:01 | LIQ | 237 | 124 | 308 | 221 | | 54 | 61 | | | | | | | | | | | | |
| 4/28/2006 | 12:01 | FILT | | | | | 37.5 | | | | | | | | | | | | | | |
| 5/1/2006 | 8:54 | | | | | | | | | | | | | | | | | | | | |
| 5/12/2006 | 9:35 | LIQ | 58 | 34 | 78 | 61 | | 15 | 15 | | | | | | | 4 | | | | | |
| 5/12/2006 | 9:35 | FILT | | | | | 11.6 | | | | | | | | | | | | | | |
| 7/28/2006 | 9:55 | LIQ | 241 | 93 | 312 | 30 | | 2.4 | 2.6 | | | | | | | 2 | | | | | |
| 7/28/2006 | 9:55 | FILT | | | | | 7.0 | | | | | | | | | | | | | | |
| 8/2/2006 | 10:39 | LIQ | 34 | 17 | 52 | 32 | | 0.5 | 0.5 | 0.0130 | 0.0034 | 0.0165 | 0.0460 | 0.00010 | 0.0048 | 2 | | | | | |
| 8/2/2006 | 10:39 | FILT | | | | | 4.1 | | | 0.0041 | 0.0015 | 0.0008 | 0.0059 | 0.00002 | 0.0036 | | | | | | |
| 8/23/2006 | 9:50 | LIQ | 139 | 99 | 190 | 42 | | 6 | 3.85 | 0.0066 | 0.0039 | 0.0062 | 0.0260 | 0.00002 | 0.0016 | 2 | | | | | |
| 8/23/2006 | 9:50 | FILT | | | | | 8.6 | | | | | | | | | | | | | | |
| 8/24/2006 | 12:35 | | | | | | | | | | | | | | | | 0.65 | 0.5 | 94 | 101 | 108 |
| 9/22/2006 | 9:55 | LIQ | 97 | 51 | 120 | 62 | | >7.6 | 16 | 0.0162 | 0.0046 | 0.0143 | 0.0700 | 0.00006 | 0.0126 | 9 | | | | | |
| 9/22/2006 | 9:55 | FILT | | | | | 10.3 | | | 0.0051 | 0.0023 | 0.0005 | 0.0041 | 0.00002 | 0.0090 | | | | | | |
| 11/28/2006 | 9:40 | | | | | | | | | | | | | | | | 0.65 | 0.5 | 95 | 89 | 106 |

< 5 samples for the geometric mean
All duplicates are omitted from analysis.
Red font indicates suspect data.
Green font indicates value was greater than the maximum detetion limit. MDL+1 was the value used for analysis.
Blue font indicates the value was below the minimum detection limit, and 1/2 the MDL was used as the value for analysis.
Maroon font equals values was ~. Value used for analysis was the ~value.
LIQ = Analysis performed on sample as received
FILT = Sample filtered through 0.45 membrane filter; analysis performed on fitrate

## APPENDIX G

**Table 13.** BMP monitoring results

| | Storm Event Date | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water quantity** | 10/12/2005 | | 10/17/2005 | | 3/17/2006† | | 4/2/2006 | | 4/6/2006 | | 4/20/2006 | | 4/20/2006 | | 5/8/2006 | | 5/8/2006 | | 7/19/2006 | | 7/19/2006 | |
| Sample type | Initial | | Initial | | Composite†† | | Composite | | Composite | | Initial | | Composite | | Initial | | Composite | | Initial | | Composite | |
| Total precipitation (inches) | 0.04 | | 0.04 | | 0.06 | | 0.63 | | 0.55 | | 0.06 | | 0.17 | | 0.06 | | 0.05 | | 0.03 | | 0.44 | |
| Precipitation intensity (in/hr)††† | 0.12 | | 0.12 | | 0.12 | | 0.08 | | 0.16 | | 0.18 | | 0.20 | | 0.18 | | 0.18 | | 0.09 | | 0.18 | |
| | Liters | Gallons | Liters | Gallons | Liters | Gallons | Liters | Gallons | Liters | Gallons | Liters | Gallons | Liters | Gallons | Liters | Gallons | Liters | Gallons | Liters | Gallons | Liters | Gallons |
| Water volume (L) | 6116 | 1616 | 5947 | 1571 | 75776 | 20018 | 190034 | 50202 | 113579 | 30004 | 4078 | 1077 | 24975 | 6598 | 5097 | 1346 | 81043 | 21409 | 5182 | 1369 | 52584 | 13891 |
| **Water quality** | | | | | | | | | | | | | | | | | | | | | | |
| pH | NA | | 7.5 | | NA | | NA | | NA | | 7.6* | | 7.9* | | NA | | NA | | 6.6 | | 6.4 | |
| **Parameter loads** | kilograms | pounds | kilograms | pounds | kilograms | pounds | kilograms | pounds | kilograms | pounds | kilograms | pounds | kilograms | pounds | kilograms | pounds | kilograms | pounds | kilograms | pounds | kilograms | pounds |
| Suspended solids | 0.43 | 0.94 | 0.84 | 1.86 | NA | NA | 10.45 | 23.04 | 20.10 | 44.32 | 2.06 | 4.53 | 2.55 | 5.62 | 1.32 | 2.91 | 10.86 | 23.94 | 2.63 | 5.80 | 1.47 | 3.25 |
| Volatile suspended solids | 0.10 | 0.22 | 0.14 | 0.30 | NA | NA | 2.85 | 6.28 | 3.63 | 8.01 | 0.48 | 1.06 | 0.70 | 1.54 | 0.38 | 0.84 | 2.19 | 4.82 | 1.27 | 2.81 | 0.63 | 1.39 |
| Total dissolved solids | 0.53 | 1.17 | 0.67 | 1.48 | NA | NA | 9.12 | 20.11 | 2.61 | 5.76 | 0.63 | 1.39 | 1.12 | 2.48 | 0.53 | 1.17 | 1.30 | 2.86 | 0.55 | 1.22 | 1.47 | 3.25 |
| Sulfate | 0.16 | 0.35 | 0.12 | 0.26 | NA | NA | 0.57 | 1.26 | 0.11 | 0.25 | 0.06 | 0.13 | 0.01 | 0.03 | 0.05 | 0.10 | 0.16 | 0.36 | 0.05 | 0.10 | 0.03 | 0.06 |
| Total Phosphorus | 8.32E-04 | 1.83E-03 | 1.50E-03 | 3.30E-03 | NA | NA | 1.84E-02 | 4.06E-02 | 2.62E-02 | 5.78E-02 | 4.12E-03 | 9.08E-03 | 1.04E-02 | 2.30E-02 | 2.73E-03 | 6.01E-03 | 1.32E-02 | 2.91E-02 | 2.51E-03 | 5.53E-03 | 3.10E-03 | 6.84E-03 |
| Total kjeldahl nitrogen | 0.02 | 0.05 | 0.02 | 0.04 | NA | NA | 0.08 | 0.18 | 0.12 | 0.28 | 0.02 | 0.04 | 0.03 | 0.07 | 0.03 | 0.06 | 0.21 | 0.46 | 0.02 | 0.05 | 0.08 | 0.19 |
| Ammonia nitrogen | 0.01 | 0.03 | 0.01 | 0.02 | NA | NA | 0.03 | 0.06 | 0.04 | 0.08 | 0.00 | 0.01 | 0.02 | 0.03 | 0.00 | 0.01 | 0.10 | 0.22 | 0.01 | 0.02 | 0.04 | 0.10 |
| Nitrite | 3.67E-04 | 8.09E-04 | 4.16E-04 | 9.18E-04 | NA | NA | 2.85E-03 | 6.28E-03 | 1.70E-03 | 3.76E-03 | 4.08E-04 | 8.99E-04 | 3.75E-04 | 8.26E-04 | 3.06E-04 | 6.74E-04 | 1.22E-03 | 2.68E-03 | 2.59E-04 | 5.71E-04 | 7.89E-04 | 1.74E-03 |
| Nitrate | 0.02 | 0.04 | 0.01 | 0.02 | NA | NA | 0.03 | 0.07 | 0.03 | 0.07 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.04 | 0.10 | 0.01 | 0.02 | 0.04 | 0.08 |
| Chloride | 0.02 | 0.04 | 0.04 | 0.09 | 57.97 | 127.80 | 0.38 | 0.84 | 0.23 | 0.50 | 0.07 | 0.14 | 0.07 | 0.17 | 0.06 | 0.13 | 0.08 | 0.18 | 0.02 | 0.03 | 0.05 | 0.12 |
| Hardness (CaCO3) | 0.24 | 0.54 | 0.24 | 0.52 | NA | NA | 1.52 | 3.35 | 1.36 | 3.00 | 0.15 | 0.32 | 0.65 | 1.43 | 0.15 | 0.34 | 1.38 | 3.04 | 0.24 | 0.53 | 0.95 | 2.09 |
| Chemical Oxygen Demand | 0.61 | 1.33 | 0.84 | 1.86 | NA | NA | 7.60 | 16.76 | 9.20 | 20.28 | 1.32 | 2.90 | 2.15 | 4.74 | 1.08 | 2.38 | 5.02 | 11.08 | 1.73 | 3.80 | 2.16 | 4.75 |
| Total Biological Oxygen Demand (5-day) | 0.08 | 0.18 | 0.12 | 0.28 | NA | NA | 0.10 | 0.21 | 0.15 | 0.33 | 0.11 | 0.23 | 0.30 | 0.66 | 0.22 | 0.48 | 0.73 | 1.61 | 0.11 | 0.24 | 0.32 | 0.70 |
| Total Copper | 1.00E-04 | 2.21E-04 | 1.61E-04 | 3.54E-04 | 1.83E-03 | 4.04E-03 | 2.11E-03 | 4.65E-03 | NA | NA | NA | NA | NA | NA | NA | NA | 1.40E-03 | 3.09E-03 | 2.54E-04 | 5.60E-04 | 4.26E-04 | 9.39E-04 |
| Soluble Copper | 4.53E-05 | 9.98E-05 | 5.29E-05 | 1.17E-04 | 3.41E-04 | 7.52E-04 | 3.99E-04 | 8.80E-04 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 6.27E-05 | 1.38E-04 | 3.31E-04 | 7.30E-04 |
| Total Nickel | 3.06E-05 | 6.74E-05 | 4.70E-05 | 1.04E-04 | 7.12E-04 | 1.57E-03 | 7.79E-04 | 1.72E-03 | NA | NA | NA | NA | NA | NA | NA | NA | 5.02E-04 | 1.11E-03 | 6.43E-05 | 1.42E-04 | 9.99E-05 | 2.20E-04 |
| Soluble Nickel | 1.47E-05 | 3.24E-05 | 1.19E-05 | 2.62E-05 | 1.82E-04 | 4.01E-04 | 9.50E-05 | 2.09E-04 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 1.50E-05 | 3.31E-05 | 8.94E-05 | 1.97E-04 |
| Total Lead | 5.20E-05 | 1.15E-04 | 9.45E-05 | 2.08E-04 | 1.08E-03 | 2.39E-03 | 1.18E-03 | 2.60E-03 | NA | NA | NA | NA | NA | NA | NA | NA | 8.19E-04 | 1.80E-03 | 1.30E-04 | 2.86E-04 | 8.41E-05 | 1.85E-04 |
| Soluble Lead | 1.22E-06 | 2.70E-06 | 1.19E-06 | 2.62E-06 | 7.58E-06 | 1.67E-05 | 6.65E-06 | 1.47E-05 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 1.55E-06 | 3.43E-06 | 1.05E-05 | 2.32E-05 |
| Total Zinc | 3.98E-04 | 8.78E-04 | 1.02E-03 | 2.24E-03 | 7.96E-03 | 1.75E-02 | 1.06E-02 | 2.35E-02 | NA | NA | NA | NA | NA | NA | NA | NA | 8.02E-03 | 1.77E-02 | 1.72E-03 | 3.79E-03 | 1.84E-03 | 4.06E-03 |
| Soluble Zinc | 3.24E-04 | 7.15E-04 | 1.96E-04 | 4.33E-04 | 1.46E-03 | 3.22E-03 | 1.01E-03 | 2.22E-03 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 3.37E-04 | 7.43E-04 | 1.21E-03 | 2.67E-03 |
| Total Cadmium | 5.50E-07 | 1.21E-06 | 2.97E-07 | 6.55E-07 | 1.52E-06 | 3.34E-06 | 3.80E-06 | 8.38E-06 | NA | NA | NA | NA | NA | NA | NA | NA | 1.62E-06 | 3.57E-06 | 1.55E-06 | 3.43E-06 | 1.05E-06 | 2.32E-06 |
| Soluble Cadmium | 2.45E-07 | 5.39E-07 | 1.19E-07 | 2.62E-07 | 1.52E-06 | 3.34E-06 | 3.80E-06 | 8.38E-06 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 2.59E-07 | 5.71E-07 | 1.05E-06 | 2.32E-06 |
| Total Chromium | 2.39E-05 | 5.26E-05 | 4.58E-05 | 1.01E-04 | 9.47E-04 | 2.09E-03 | 8.93E-04 | 1.97E-03 | NA | NA | NA | NA | NA | NA | NA | NA | 5.92E-04 | 1.30E-03 | 6.27E-05 | 1.38E-04 | 1.89E-04 | 4.17E-04 |
| Soluble Chromium | 1.04E-05 | 2.29E-05 | 1.01E-05 | 2.23E-05 | 2.20E-04 | 4.84E-04 | 2.28E-04 | 5.03E-04 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 9.85E-06 | 2.17E-05 | 1.79E-04 | 3.94E-04 |
| Oil and Grease | NA | NA | NA | NA | 9.09E-01 | 2.00E+00 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 5.67E-01 | 1.25E+00 | 3.11E-02 | 6.85E-02 | 2.63E-02 | 5.80E-02 |
| Mercury | 7.34E-08 | 1.62E-07 | 7.14E-08 | 1.57E-07 | 9.09E-07 | 2.00E-06 | 2.28E-09 | 5.03E-09 | 1.36E-06 | 3.00E-06 | NA | NA | NA | NA | 1.78E-07 | 3.93E-07 | 2.43E-06 | 5.36E-06 | 1.55E-07 | 3.43E-07 | 6.31E-07 | 1.39E-06 |

†Storm event is a combination of rainfall and snowmelt
††Water from the initial sample was omitted from the composite
†††Precipitation intensity = Precipitation for the sample/duration of precipitation for the sample
*pH measured in the sample container before the sample was submitted to the lab
NA = Parameter not analyzed