MWMO

Protect it. Pass it on.

MISSISSIPPI WATERSHED MANAGEMENT ORGANIZATION

Annual Monitoring Report 2011

MWMO Watershed Bulletin: 2012-1

Annual Monitoring Report 2011

Prepared by: Kari Oquist, Water Resources Specialist and Freya Rowland and Brian Jastram, Environmental Specialists

Completion Date: April 2012

Acknowledgements

The Mississippi Watershed Management Organization (MWMO) thanks the following groups for their cooperation and assistance with MWMO monitoring activities: the City of Minneapolis Departments of Public Works, Regulatory Services, and Environmental Services, City of Saint Anthony Village Public Works Department, Minnesota Department of Transportation, and Saint Anthony Falls Laboratory at the University of Minnesota.

■ ■ ■

Suggested citation:
Mississippi Watershed Management Organization. 2012. *Annual Monitoring Report 2011*. MWMO Watershed Bulletin 2012-1. 66pp.

Front Cover: East Kasota Pond (above) Outfall Site 1NE (below)
East Kasota Pond looking south. This is a shallow wetland with turtle and bird species.
The 1NE stormwater outfall monitoring site. It is an 8-foot diameter, corrugated metal pipe. *Photographs by B. Jastram, Mississippi Watershed Management Organization.*

Protect it. Pass it on.
MISSISSIPPI WATERSHED MANAGEMENT ORGANIZATION

2522 Marshall Street NE
Minneapolis, Minnesota 55418

(612) 465-8780
(612) 465 8785 fax

www.mwmo.org

Protect it. Pass it on.

MISSISSIPPI WATERSHED MANAGEMENT ORGANIZATION

Annual Monitoring Report 2011

MWMO Watershed Bulletin: 2012-1

Abstract

In 2011, The Mississippi Watershed Management Organization (MWMO) continued monitoring in the Mississippi River, Loring Pond, stormwater drainage systems, and Kasota Ponds wetlands.

Under Section 303(D) of the Federal Clean Water Act, the 12-mile reach of the Mississippi River in the MWMO is listed on the 303(D) Total Maximum Daily Load (TMDL) list as impaired for fecal coliform. The Minnesota Pollution Control Agency (MPCA) has moved from a fecal coliform standard to an *E. coli* standard, therefore all fecal coliform impairments are now evaluated with *Escherichia coli* (*E. coli*) data. *E. coli* concentrations in the Mississippi River exceeded Minnesota water quality standards during the months of June, July, September, and October in 2011. Long-term monitoring of the river and stormwater drainage systems is necessary to evaluate bacteria inputs from within the watershed compared to inputs from upstream sources.

In 2011, samples were collected from Loring Pond by Minneapolis Park and Recreation Board (MPRB) staff during their routine water quality sampling and analyzed for *E. coli*. The sampling location was moved to the deepest portion of the lake; however, surface water samples were still collected for *E. coli* analysis. Loring Pond is not listed on the 303(D) TMDL list because the MPCA has not assessed lakes for bacteria. Data are submitted to the MPCA on an annual basis.

The MWMO continued monitoring stormwater and wetlands in 2011. There are no water quality standards for stormwater; so, rather than comparing to standards, stormwater results are presented in the report. The MPCA wetlands' water quality criteria indicate that wetland water quality should maintain background conditions. Background water quality has not yet been determined for MWMO wetlands. MWMO initiated biological sampling in Kasota Ponds during summer 2011. MWMO collected macroinvertebrate samples in order to establish baseline Index of Biological Integrity (IBI) data for the wetlands. Aquatic vegetation surveys were also conducted to establish baseline records.

Protect it. Pass it on.

MISSISSIPPI WATERSHED MANAGEMENT ORGANIZATION

2522 Marshall Street NE
Minneapolis, Minnesota 55418

(651) 287 0948
(651) 287 1308 fax

www.mwmo.org

Annual Monitoring Report 2011

Table of Contents

List of Tables

List of Figures

Annual Monitoring Report 2011

Executive Summary

The annual monitoring report details the results of the Mississippi Watershed Management Organization's (MWMO) 2011 monitoring season. MWMO staff complete an annual monitoring report summarizing the year's results and outlining the next year's work plan each year. The report is available on the MWMO website at **www.mwmo.org**.

The MWMO monitors water quality in the watershed's stormwater drainage system and in the Mississippi River, Loring Pond, and Kasota Ponds (wetlands). 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 is necessary to characterize the impact 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 patterns and land use impacts on the MWMO watershed.

The 2011 monitoring season included collection of water quality samples from seven locations in the Mississippi River, one in Loring Pond, five stormwater outfalls to the Mississippi River, one stormwater pipe at the jurisdictional boundary of Saint Anthony Village and Minneapolis, and seven locations in the three wetlands known as Kasota Ponds. The MWMO had a total of six automated stormwater monitoring sites in 2011.

The 12-mile reach of the Mississippi River in the MWMO is listed on the Federal Clean Water Act Section 303(D) Total Maximum Daily Load (TMDL) list as impaired for fecal coliform. The Minnesota Pollution Control Agency (MPCA) has moved from a fecal coliform standard to an *E. coli* standard, therefore all fecal coliform impairments are now evaluated with *E. coli* data. *E. coli* concentrations exceeded Minnesota water quality standards in 2011 during the months of June, July, September, and October. Long-term monitoring of both the river and the stormwater outfalls to the river is necessary to evaluate *E. coli* inputs from within the watershed compared to those inputs from upstream sources. The MPCA initiated the Upper Mississippi River Bacteria TMDL Project in 2008 to develop daily *E. coli* load limits for the Mississippi River (MPCA, 2012).

The MWMO continued monitoring stormwater in 2011. 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 drainage systems to develop a record of baseline data to characterize stormwater quality within the watershed. The MWMO also provided stormwater data to the MPCA for TMDL projects within the watershed.

The MWMO continued monitoring the Kasota Ponds wetlands in 2011. Samples were collected for nutrients, sediment, inorganics, and metals analyses. The MPCA water quality criteria indicate that wetland water quality should maintain background conditions. Background water quality has not yet been determined for MWMO wetlands.

Introduction

The annual monitoring report details the results of the MWMO's 2011 monitoring season. MWMO staff complete an annual monitoring report summarizing the year's results and outlining the next year's work plan 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 are to:

- 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
    - Assess pollutants listed on the Minnesota Impaired Waters list for the TMDL process
- Collect rate and volume data for the Mississippi River and key subwatersheds
- Monitor performance of stormwater management practices
- Collaborate with stakeholders to identify and apply a standardized data collection and assessment approach
- 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
- Assess land use impact on water quality
- Participate in the technical development and update of statewide monitoring databases
- Make data accessible to the public and public entities and to MWMO staff for use as an education tool (e.g. BMP performance data)
- Develop an emergency monitoring plan in case of emergencies affecting water resources

The 2011 monitoring season included collection of water quality samples from seven locations in the Mississippi River, one in Loring Pond, six stormwater sites, and seven wetland sites in the Kasota Ponds. Refer to Figures A.1 and A.2. in Appendix A for the monitoring locations. Descriptions of the sampling sites are found in subsequent sections of this report.

Background

The MWMO was established in 1985 by a Joint Powers Agreement among member organizations. (The MWMO watershed boundaries are shown in Figure A.1 in Appendix A.) The MWMO is a unique organization in that it includes a reach of the Mississippi River. 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 waterbodies comply with state water quality standards. Furthermore, section 303(D) 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. Table 1 highlights the most restrictive classifications.

The MWMO's reach of the Mississippi River is listed on Minnesota's 303(D) TMDL list for fecal coliform, mercury, and polychlorinated biphenyls (PCBs). The MPCA 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 MPCA has written a statewide TMDL for mercury (MPCA, 2007).

Mercury and PCBs are listed on the 303(D) TMDL list for aquatic 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 stormwater drainage system. The MWMO monitors stormwater outfalls to determine the contributions of surface runoff from the watershed to water quality in the river.

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, Domestic consumption (drinking water) 2Bd Aquatic life and recreation and source of 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

Table 2. Pollutants in impaired waters

Impaired Mississippi River Reach	Pollutant
MWMO upstream boundary to Upper Saint Anthony Falls	Fecal coliform, mercury in fish tissue, polychlorinated biphenyls (PCBs) in fish tissue
Upper Saint Anthony Falls to Lower Saint Anthony Falls	Mercury in fish tissue, PCBs in fish tissue
Lower Saint Anthony Falls to Lock & Dam 1 (Ford Dam)	Fecal coliform, mercury in fish tissue

That being said, 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 Saint 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.

Thus, if large amounts of rainfall have washed pollutants from the land upstream into the river, it is possible that flows could increase and water quality could decline, even though it has not rained in the watershed. In cooperation with other watershed organizations and districts, the MWMO plans to investigate the upstream impact on water quality to discern the effect 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 the inputs of groundwater and the recharge to groundwater from the river. Groundwater may carry pollutants from upstream in the Mississippi River basin to the MWMO's 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 an area as large as the Mississippi River basin to the MWMO's 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.

Precipitation Monitoring

Precipitation determines surface runoff and is arguably the greatest factor controlling surface water quality. As stated in Background, water quality in the MWMO's 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.

Table 3 shows precipitation for several locations in the Upper Mississippi River basin between St. Cloud and the Minneapolis St. Paul International Airport. Refer to Figure A.3 in Appendix A for the locations of the precipitation gauges. Precipitation at sites 1NE and 10SA were collected by the MWMO. Data at the SAFL site were collected by SAFL. Precipitation at Lock and Dam 1 was measured by the United States Army Corps of Engineers. Precipitation data from all of the other sites were downloaded from the Minnesota Climatology Working Group website.

Table 3. Monthly precipitation at several locations in the Upper Mississippi River basin

	St. Cloud[1]	Becker[2]	New Hope[3]	1NE[4]	10SA[5]	SAFL[6]	Lock and Dam 1[7]	Chanhassen[8]	Minneapolis St. Paul International Airport[9]
January	0.97	0.93	1.04	0.00	0.51	0.01	0.91	0.98	1.00
February	0.88	0.93	0.86	0.09	0.06	0.15	1.65	1.14	1.12
March	2.02	1.92	2.26	1.35	1.69	1.47	2.37	2.32	2.06
April	2.15	3.60	3.67	4.39	3.01	2.61	2.81	3.02	2.80
May	5.51	5.62	6.26	3.83	3.96	2.91	5.15	4.78	4.04
June	2.87	3.09	4.16	3.83	3.90	4.11	4.63	3.98	5.28
July	5.63	9.67	6.36	8.04	8.60	6.95	6.96	5.38	5.23
August	5.32	3.23	4.54	3.38	4.31	3.60	3.87	4.27	3.03
September	0.74	0.61	0.31	0.09	0.22	0.36	0.50	0.26	0.36
October	1.43	0.79	0.78	0.42	0.62	0.52	0.93	0.78	0.70
November	0.23	0.14	0.22	0.09	0.20	0.08	0.15	0.16	0.30
December	0.40	0.12	0.44	0.36	0.51	0.49	0.79	0.91	0.99
Total	28.15	30.65	30.90	25.87	27.59	23.26	30.72	27.98	26.91

[1] Location: Latitude 45.54413 Longitude -94.07082, Source: **http://climate.umn.edu/hidradius/radius.asp**

[2] Location: Latitude 45.42064 Longitude -93.93335, Source: **http://climate.umn.edu/hidradius/radius.asp**

[3] Location: Latitude 45.0167 Longitude -93.3667, Source: **http://climate.umn.edu/hidradius/radius.asp**

[4] Location: Latitude 45.02389 Longitude -93.2772, Source: MWMO data

[5] Location: Latitude 45.01278 Longitude -93.2203, Source: MWMO data

[6] Location: Latitude 44.98239 Longitude -93.254932, Source: Personal communication with Chris Ellis, Saint Anthony Falls Laboratory

[7] Location: Latitude 44.91497 Longitude -93.254932, Source: **http://www.mvp-wc.usace.army.mil/projects/Lock1.shtm**

[8] Location: Latitude 44.8514 Longitude -93.5650, Source**: http://climate.umn.edu/hidradius/radius.asp**

[9] Location: Latitude 44.88306 Longitude: -93.22889, Source: **http://climate.umn.edu/hidradius/radius.asp**

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 the precipitation data are not representative of the entire Mississippi River basin contributing to the MWMO watershed. Also, MWMO staff were not able to determine which sites contained heated precipitation gauges to measure snow water equivalent. Table B.1 in Appendix B shows which precipitation events were sampled at each stormwater monitoring site.

Mississippi River Monitoring

The MWMO monitors seven locations in the Mississippi River. Six sites are MWMO long-term monitoring sites and are described in the following section. The seventh site—MR853.5E, located between Upper and Lower Saint Anthony Falls—was added in 2010 to provide data for development of the Upper Mississippi River Bacteria TMDL project that is managed by the MPCA. The monitoring sites are identified by the river mile upstream from Cairo, Illinois, and from the nearest riverbank to the sample collection point. E refers to the east bank and W refers to the west bank. The highest river mile is the furthest upstream.

Site Descriptions

MR859.1W (Camden): The Camden site is the northernmost monitoring site in the MWMO's watershed. It is located in the North Mississippi Regional Park at the intersection of 53rd Avenue and North Lyndale in Minneapolis. The terrain surrounding the site is mostly deciduous forest with a grassland transition zone by the road. Footpaths lead from the paved trail by the road, through the forest to the river and along the river. The footpaths may cause minimal erosion. There is a concrete levy wall and boulders at the sampling site and an outfall just upstream. The river is shallow (3-5'), rocky, and swift (in places) with sandbars up and downstream. Water levels fluctuate at this site more than any other in the watershed. Storm events can raise the water level three feet. Waterfowl are commonly seen in the river and on shore. Rabbits, bald eagles, a Blanding's Turtle and a beaver have also been observed.

MR857.6W (MPRB Boat Launch): This site is located adjacent to MPRB land. A paved parking lot leads to the river and boat launch. During the warmer months, a floating dock rests directly upstream from the boat launch. Flat and forested terrain surround the parking lot and boat launch area with some grassy areas and paved and unpaved trails leading up and downstream, respectively. The river bottom near shore is silty mud, gravel and large stones. The river is deeper here than at MR859.1W and can have a swift current after rainfall. The monitoring site is upstream of the dock foundation. It is located downstream of the mouth of Shingle Creek.

MR854.9W (North Loop): The North Loop site is downstream from the Mississippi Park and Boat Launch site. It is adjacent to a shaded park area with picnic tables, trails, grass and trees. The river bank is steep and covered in brush. The shore and shallows at the sampling site are composed of loose rocks and sand. The monitoring site is at the base of a stairway that leads to the river.

MR853.5E (Saint Anthony Falls Laboratory): The Saint Anthony Falls Laboratory (SAFL) site is located between Upper and Lower Saint Anthony Falls. It is located just upstream from the mouth of SAFL's outdoor stream laboratory. The shore is rocky.

MR852.2E (University of Minnesota Boat Launch): The University of Minnesota Boat Launch site is the first river site downstream from Saint Anthony Falls. It is located in the Mississippi River Gorge, behind Coffman Union on the University of Minnesota East Bank Campus. A paved path leading from a parking lot wraps around a grassy area and angles left down to the sampling site. The surrounding terrain consists of Cottonwood forest along the river and a large grassy area behind the trees. The gently sloping bank leads to a sandy shore that continues into the river. The site is a regular entrance point to the river for approximately one hundred geese that graze on the grass in the open area. Goose droppings are common here.

MR849.9W (Lake Street Bridge): This site is located beneath the Lake Street Bridge. There is parking on the street by the bridge and a foot path leads down into the gorge to the sampling site. The elevation drops over seventy feet from the street to the river. Just upstream of the site are a small outfall and the Minneapolis rowing club boat facility. There is tall grass along the river and trees on the sides of the gorge. There is a steep, three-foot river bank leading to a rocky shore. The river bottom is sandy with limestone boulders and gravel (riprap).

MR848.1W (4300 West River Parkway): This monitoring site is the farthest downstream in the MWMO's watershed. There is a parking lot and a paved path from the parking lot into the gorge. There are foot paths leading down the bluffs to the river. The site is surrounded by hardwood forest and is just upstream from a stormwater outfall. The shore and river bottom are made up of sand and large, flat limestone rocks. The Ford Dam is less than one mile downstream from the monitoring site.

Methodology

Sample Collection, Handling, and Preservation

Grab samples were collected from seven locations in the Mississippi River. Staff followed sampling procedures outlined in the MWMO's Standard Operating Procedure for Surface Water Sampling (2011). Samples were collected in lab-sterilized 125 milliliter (mL) plastic bottles. Collection occurred away from shore, in approximately three feet of water. Samples were taken in positive flow (no back eddies or stagnant water) and upstream of the monitoring specialist to prevent contamination by the disturbed river bottom. To collect samples, the monitoring specialist plunged an opened, inverted bottle one foot below the water surface, turned it upward to fill, and brought it out of the water (Figure 1). The specialist then poured some of the sample out to provide headspace for the laboratory.

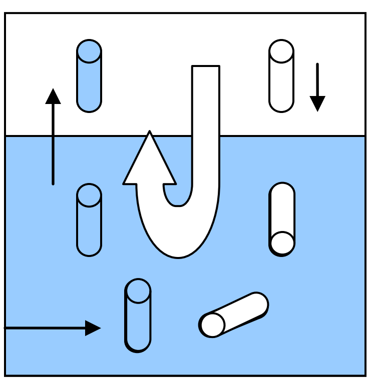

Figure 1. Diagram of sample collection method

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

Dissolved oxygen, conductivity, salinity, temperature, and pH data for each site were collected using YSI ProPlus meter (YSI Inc., Yellow Springs, OH). The meter probe was placed in the water approximately one foot below the surface. Data were recorded when the values stabilized.

Sampling Quality Control

The MWMO staff followed the quality control protocol outlined in the MWMO Ambient Surface Water Monitoring Quality Assurance Project Plan (2010). Blank samples of Deionized (DI) water were submitted to laboratories once a month to verify that sample containers were clean and samples were not contaminated during travel. In addition, ten percent of all samples were collected in duplicate to verify that sampling and laboratory procedures did not jeopardize the data.

Laboratory Analyses

Mississippi River samples were analyzed at the Three Rivers Park District Laboratory. Refer to Table C.1 in Appendix C for a list of sample parameters, the laboratories used for analysis, the analysis methods, and information regarding certification.

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

Water Elevation Monitoring

Mississippi River water elevation data (typically referred to as stage data) were collected at six monitoring sites. River water elevation data show the rise and fall of the river in response to flow controls at dams, precipitation and snow melt. MWMO data are equivalent to data collected by agencies using the North American Vertical Datum, 1988 (NAVD88).

Water elevations in the Mississippi River are complicated by the dams at Saint Anthony Falls and Lock and Dam 1. Since the river pools behind the dams, control activities at the dam cause changes in river elevation, even in the absence of precipitation. River water elevations for the six long-term MWMO monitoring locations on the Mississippi River are shown in Figures 2 and 3. In 2011, installation of staff gauges at five sites was delayed due to above-average rainfall and high river flow. Site MR859.1W was not delayed and was installed on March 17. Gauges at sites MR852.2E and MR848.1W were installed on June 23 and gauges at sites MR857.6W, MR854.9W, and MR849.9W were installed on July 18. Elevation data were not recorded at site MR853.5E. Other time periods with missing data were the result of either high river water levels (the staff gauges were submerged underwater) or low river water levels during which river water levels were well below the lowest elevation of the staff gauge).

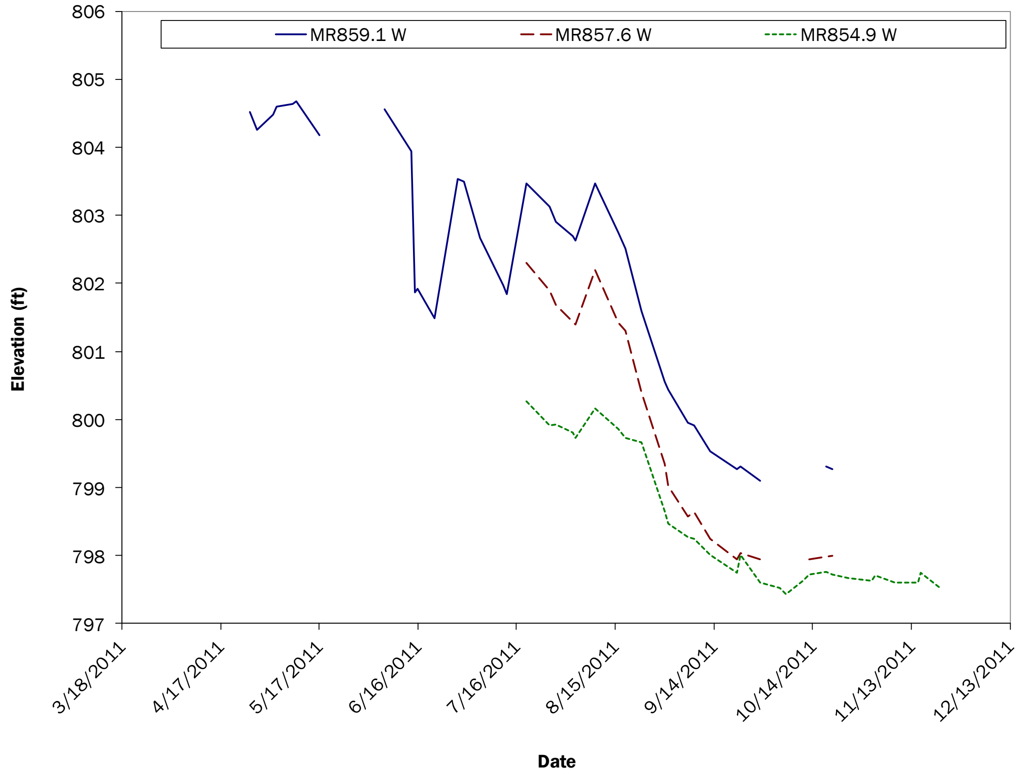

Figure 2. Mississippi River water elevations at three monitoring sites upstream of Saint Anthony Falls

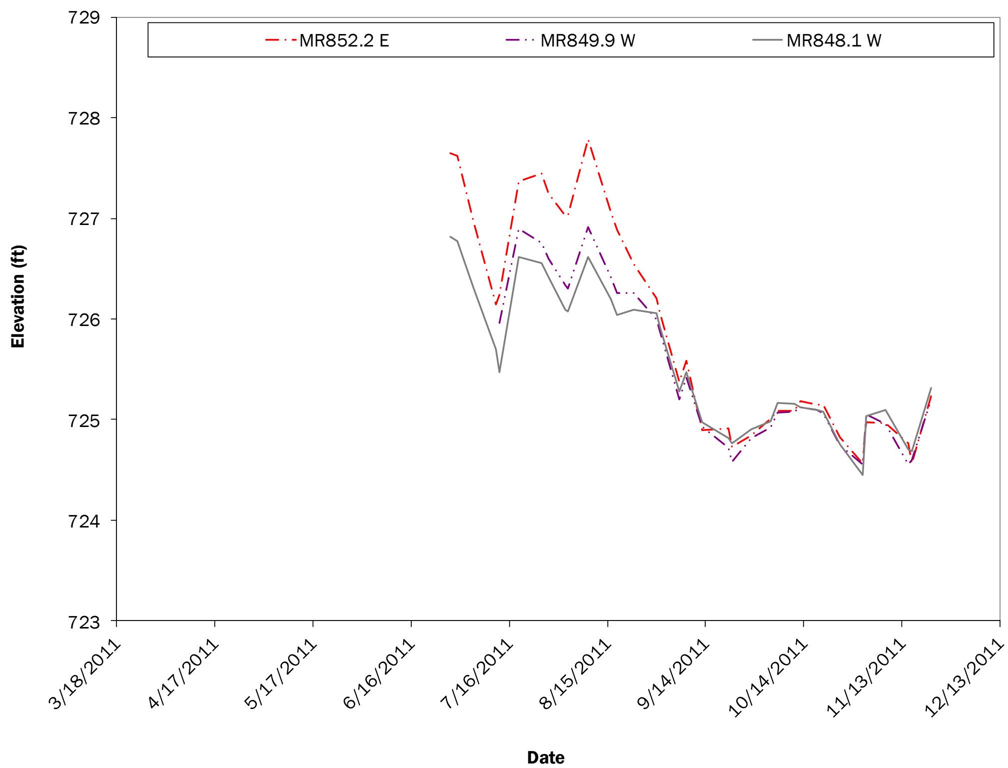

Figure 3. Mississippi River water elevations at three monitoring sites downstream of Saint Anthony Falls

Mississippi River Monitoring Results

E. coli

The MWMO's reach of the Mississippi River is listed as an impaired water for fecal coliform pollution. In 2008, the MPCA changed the bacteria water quality standard from fecal coliform to *E. coli* for bacteria monitoring in Minnesota. The standard for *E. coli* in 2B and 2Bd waters is 126 CFU/100mL for a monthly geomean of at least five samples. The geomean is equal to the nth root of the product of the n terms:

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

Figure 4 shows the 2011 monthly geomeans of *E. coli* data for the Mississippi River monitoring sites. Site MR857.6W exceeded the *E. coli* standard in June, July, September and October 2011. Sites MR854.9W and MR849.9W exceeded the standard in September and October 2011. Site MR859.1W exceeded the standard in September 2011. The *E. coli* data are presented in Appendix D.

The MPCA *E. coli* standard also states that *E. coli* cannot exceed 1260 CFU/100mL in more than 10% of the samples taken in one month. With the exception of site MR852.2E, every site exceeded this standard in various months. However, the small number of samples collected each month greatly affects these results. Table 4 presents a summary of *E. coli* exceedances.

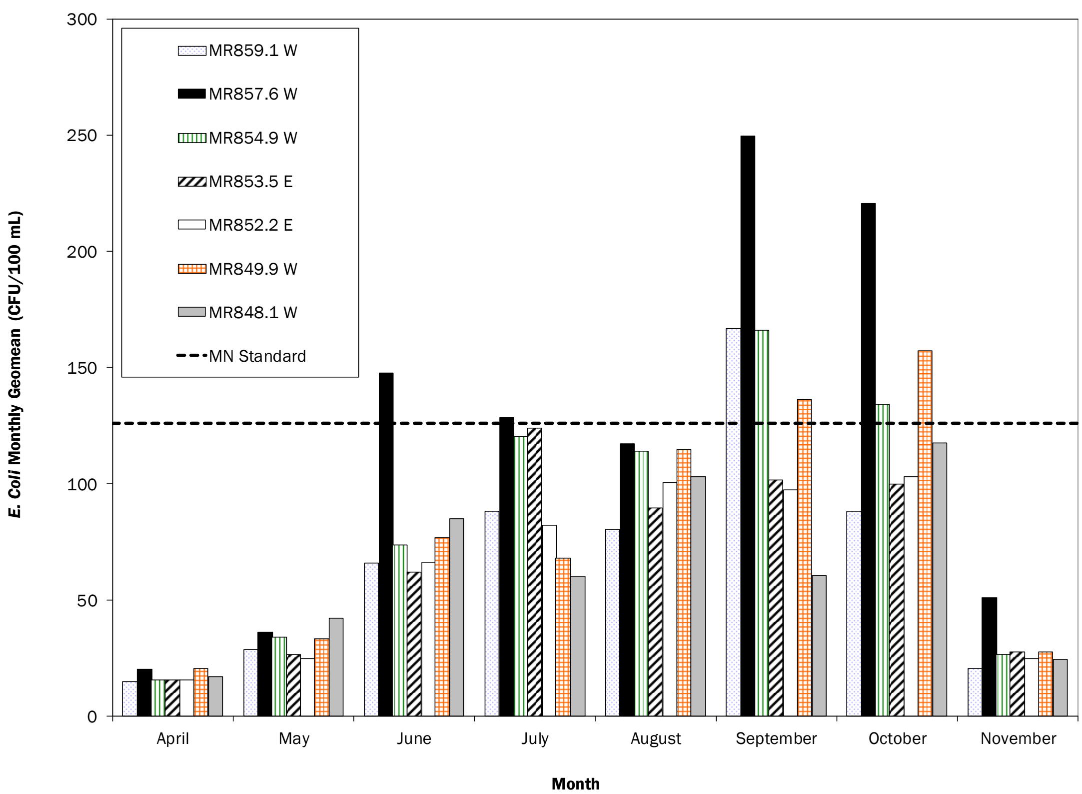

Figure 4. 2011 monthly geomeans for *E. coli* data for the Mississippi River monitoring sites

Table 4. Sites that exceed the monthly *E. coli* geomean for the Mississippi River in 2011

Month	Sites that exceed monthly geomean	Sites that exceed 1260 CFU/100 mL in > 10% of samples	Sites that do not exceed the standards
April	None	None	All
May	None	None	All
June	MR857.6W	MR857.6W, MR848.1W	MR859.1W, MR 854.9W, MR853.5E, MR852.2E, MR849.9W
July	MR857.6W	MR859.1W, MR857.6W, MR854.9W, MR853.5 E	MR852.2E, MR849.9W, MR848.1W
August	None	None	All
September	MR859.1W, MR857.6W, MR854.9W, MR849.9W	MR857.6W, MR854.9W, MR849.9W	MR853.5E, MR852.2E, MR848.1W
October	MR857.6W, MR854.9W, MR849.9W	MR854.9W, MR848.1W, MR849.9W	MR859.1W, MR853.5E, MR852.2E
November	None	None	All

As these results are highly dependent on precipitation—both in the watershed and upstream—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 continue to collect data on the Mississippi River to provide data for development of TMDLs in the watershed.

Two additional factors should be considered when evaluating these results. First, these results are based on a maximum of eight 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 Upper and Lower Saint Anthony Falls. The Mississippi River water mixes as it flows over the falls, likely affecting water quality.

Loring Pond Monitoring

Loring Pond is the only lake (Minnesota Department of Natural Resources Lake ID 27065500) in the MWMO watershed. Refer to Figure A.1 in Appendix A for the location of Loring Pond. Loring Pond has an area of 5.16 acres and maximum depth of 16 feet. Loring Pond is classified for 2B (aquatic life and recreation) water use, therefore the same water quality standards apply as for the Mississippi River monitoring sites. Loring pond has been monitored for *E. coli* since 2003. Water quality monitoring for Loring Pond is conducted by MPRB.

Site Description

Loring Pond consists of two small bays. The smaller north bay is connected to the larger bay, with a walking bridge spanning the connection. There is an outfall located on the large bay; however, water only flows out during high lake levels. The monitoring site is on the east side of the bridge on the north side of the large bay next to a large tree. The surrounding area has a garden, lawns, emergent plants along the lakeshore and trees throughout the park. The shore at the sampling site is exposed soil, and the pond bottom is sticky clay. In the warmer months, there is an abundance of submerged plants.

Methodology

Sample Collection, Handling, and Preservation

The MWMO suspended monitoring activities at Loring Pond in 2011 and coordinated with MPRB staff to have them collect samples for *E. coli* analysis during their routine water quality sampling activities. The sampling location was moved to the deepest portion of the lake; however, surface water samples were still collected for *E. coli* analysis.

Sampling Quality Control

The MWMO staff followed the quality control protocol outlined in the MWMO Ambient Surface Water Monitoring Quality Assurance Project Plan (2010). Blank samples of DI water were submitted to laboratories once a month to verify that sample containers were clean and samples were not contaminated during travel. In addition, ten percent of all samples were collected in duplicate to verify that sampling and laboratory procedures did not jeopardize the data.

Laboratory Analyses

Samples were analyzed for *E. Coli* at Instrumental Research, Inc. Refer to Table C.1 in Appendix C for a list of sample parameters, the laboratories used for analysis, the analysis methods, and information regarding certification.

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

Loring Pond Monitoring Results

MPRB staff collected water samples two times each month from May through September and one time in April and October; therefore, there were not enough data to calculate the monthly geomean and compare with water quality standards (Table 5). Loring Pond is not listed on the 303(D) TMDL list because the MPCA does not assess lakes that are less than 10 acres in size. Data are submitted to the MPCA on an annual basis.

Table 5. Loring Pond *E. coli* data for 2011

Date/Time	*E. coli* MPN/100 mL
4/21/11 10:45	3
5/13/11 10:15	3
5/23/11 11:30	166
6/08/11 10:00	74
6/22/11 11:30	435
7/07/11 10:45	255
7/21/11 11:30	589
8/04/11 10:50	613
8/17/11 10:45	2302
9/07/11 11:30	1149
9/20/11 12:00	445
10/26/11 11:20	108

Stormwater Monitoring

The MWMO monitored five stormwater outfalls into the Mississippi River and one stormwater pipe at the jurisdictional boundary of Saint Anthony Village and Minneapolis. The monitored outfalls were chosen because they are the most extensive subwatershed drainage systems within the watershed, and they are accessible. (Refer to Figure A.1 in Appendix A for the outfall locations.) Site descriptions and water quality data for each stormwater outfall are provided in this section.

A stormwater drainage system refers to the area that drains to one stormwater outfall. Land uses in the stormwater drainage systems affect water quality. The amount of impervious surfaces and potential pollutants differs between industrial and residential land uses. A future objective of the monitoring program is to investigate the impact of specific land uses on water quality. Refer to the Annual Monitoring Report 2007 (MWMO, 2009) for land uses in the watershed.

Site Descriptions

1NE (Excel Riverside Plant) River Mile (R.M.) 857.2: 1NE is the northernmost outfall monitored by the MWMO. The outfall is located on the east bank of the Mississippi River on the Excel Riverside Power Plant property. The stormwater drainage system drains water from northeast Minneapolis. The outfall is a 96-inch diameter, corrugated iron pipe. The stormwater drainage system has continuous base flow.

2NNBC (Old Bassett's Creek Tunnel Outlet) R.M. 854.8: The 2NNBC outfall drains water from the Near North Minneapolis neighborhoods and Bassett's Creek and enters the river in a park in the North Loop neighborhood of Minneapolis on the west bank of the Mississippi River. Bassett's Creek was buried and routed through a tunnel in 1890. In 1992, the creek was rerouted through a new tunnel that enters the Mississippi River just downstream from Upper Saint Anthony Falls. There are paths leading from a parking lot to the outfall. The semi-elliptical outfall is approximately 11 feet high and 15 feet wide. Water from Bassett's Creek only flows through this original outfall during overflow periods. Bassett's Creek is monitored by the MPRB, in cooperation with the Metropolitan Council, approximately one-quarter mile upstream of where the creek enters the City of Minneapolis stormwater drainage system.

4PP (35W Bridge) R.M. 853.2: This outfall is located below Lower Saint Anthony Falls Lock and Dam on the west bank of the Mississippi River. It drains stormwater from the Phillips and Powderhorn neighborhoods in Minneapolis, as well as water from the I-35W freeway. Access to the outfall is gained from Lower Saint Anthony Falls Lock and Dam service road. The semi-elliptical tunnel is 14 feet high and 14 feet wide. There is continuous base flow in this stormwater drainage system. Northern pike fish have been observed at the outfall during spawning season.

6UMN (University of Minnesota Coal Storage Facility) R.M. 853.0: 6UMN is located on the east bank of the Mississippi River, downstream from Saint Anthony Falls, behind the University of Minnesota heating plant. The outfall drains water from the City of Minneapolis and the University of Minnesota. This semi-elliptical tunnel is eight feet high and eight feet wide with a rounded top and slightly U-shaped base. There is continuous base flow in this stormwater drainage system.

7LSTU (Bridal Veil Tunnel) R.M. 851.6: 7LSTU is the farthest downstream outfall monitored by the MWMO. It is located on the East Bank of the Mississippi River, between the I-94 Bridge and Franklin Avenue Bridge. The outfall drains water from the Cities of Lauderdale and Saint Paul and the University of Minnesota, Minneapolis campus. The tunnel is cathedral shaped and, it is 10 feet high and 6.5 feet wide. At the mouth of the outfall, five square, concrete pillars baffle (slow) water flow, and an iron stilling basin captures floatable debris.

10SA (Saint Anthony Village): 10SA differs from the other MWMO stormwater monitoring sites as it is located near the top of a stormwater drainage system rather than at the bottom near the outfall to the Mississippi River. The MWMO chose to monitor this location to investigate the quantity and quality of stormwater from the southern portion of Saint Anthony Village (594 acres) as it enters Minneapolis. The concrete stormwater pipe is 54 inches in diameter with continuous base flow.

Methodology

Sample Collection, Handling, and Preservation

Grab and composite samples were collected from six stormwater sites in the MWMO watershed. Staff followed sampling procedures outlined in the MWMO's Standard Operating Procedure for Stormwater Sampling (2011). Samples were collected in laboratory cleansed (non-sterile) two gallon plastic bottles. Samples were collected with the two gallon sample bottle mounted on the end of a telescoping pole or with the automatic sampler described below. The bottle was capped after it was filled, with headspace included.

ISCO 6712 automatic samplers (Teledyne Isco, Inc., Lincoln, NE) were used at sites 1NE, 4PP, 6UMN, and 10SA. The samplers housed twenty-four one-liter plastic bottles for sample collection. Velocity, water level, and flow data were collected with an ISCO 750 Area Velocity Flow Module (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. Once collected, the bottles were composited by pouring an equal amount of water from each sampler bottle into a two gallon plastic bottle by the monitoring specialist. The bottles were rinsed twice with tap water and once with deionized (DI) water free of pollutants between storm events. Automated precipitation gauges were used at 1NE and 10SA sites to gather precipitation data in the watershed.

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

Dissolved oxygen, conductivity, salinity, temperature, and pH data were measured using YSI ProPlus meter. The data were measured directly in the stormwater drainage system or in a separate container of stormwater.

Stormwater samples were collected for a minimum of three precipitation events per month, as long as that many events occurred. If baseflow conditions were present, samples were collected twice per month from March to November, and once per month during the winter months to assess baseflow concentration of parameters.

Remote Data Access Network

The MWMO designed and deployed a remote data access network in 2008. The network was designed to collect real-time monitoring data at the stormwater sites. The network provided instantaneous data about stormwater level, velocity and flow, precipitation, and automated sample collection. The data were available instantaneously from any computer, allowing MWMO staff to respond more quickly to sample collection and equipment failures. The network used radios to link six automatic water samplers to the internet, enabling the MWMO staff to view stormwater data, automated sample collection, and rainfall from the office. Radios were located at two additional locations, the SAFL roof and the Moos Tower roof on the University of Minnesota East Bank Campus, to provide line-of-sight communication between all of the monitoring sites. Refer to Figure A.4 in Appendix A for the real-time monitoring network.

Equipment for the real-time monitoring network included the area velocity meters and ISCO automatic samplers described previously, dataloggers, antennas, and radios to send data to a central location. All data were stored at SAFL. As previously described, the area velocity meters provided stormwater level and velocity readings to the automatic samplers. The automatic samplers stored these readings and calculated the volume of water that flowed past the sensors.

MWMO staff installed a CR800 Measurement and Control Datalogger (Campbell Scientific, Inc., Logan, UT) at each stormwater monitoring location. The datalogger retrieved data from the automatic sampler. Data were then transmitted via RF450 Spread Spectrum Radios (Campbell Scientific, Inc., Logan, UT) and Yagi or omnidirectional antennas (Campbell Scientific, Inc., Logan, UT) to an NL100 Network Link Interface (Campbell Scientific, Inc., Logan, UT). The NL100 allowed communication between the dataloggers and a network-linked computer in order to store the logged data in a useable data file. Vista Data Vision software (Vista Engineering, Reykjavik, Iceland) displayed the data on webpages in graphical and tabular form so it could be viewed in real time.

Sampling Quality Control

The MWMO staff followed the quality control protocol outlined in the MWMO Ambient Surface Water Monitoring Quality Assurance Project Plan (2010). Blank samples of DI water were submitted to laboratories once a month to verify that sample containers were clean and samples were not contaminated during travel. In addition, ten percent of all samples were collected in duplicate to verify that sampling and laboratory procedures did not jeopardize the data.

Laboratory Analyses

Fluoride samples were analyzed at Pace Analytical Services, Inc. All other samples were analyzed at the Metropolitan Council Environmental Services Laboratory. Refer to Table C.1 in Appendix C for a list of sample parameters, the laboratories used for analysis, 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.

Parameters Information

The MWMO has conducted extensive research regarding the parameters of concern. Parameter information includes definitions, sources, impact on various organisms, and water quality standards, as well as others. Refer to the MWMO 2006 Annual Monitoring Report (MWMO, 2007) for the comprehensive list of parameters.

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
- Statistical regression techniques were used to interpolate automated flow data that were missing due to equipment malfunctions (MWMO, 2011)

Water Level Monitoring

Water level in a stormwater pipe is very different from water level in the Mississippi River and Loring Pond. Stormwater pipes respond quickly to rainfall, so water levels may rise many feet within a few minutes, depending on the size and intensity of the storm event. Some stormwater pipes only contain water during precipitation events, while others have baseflow throughout the year. Stormwater monitoring sites 1NE, 4PP, 6UMN, and 10SA have baseflow throughout the year.

Water level data collected with automated equipment are presented in Figures 5-8. It should be noted that, as the Mississippi River water level rose above the base of the stormwater outfalls, river tailwater affected the water level in the stormwater pipes. This greatly impacted stormwater levels in 2011, as above-average snowfall during the winter and above-average rainfall in the spring resulted in tailwater in several of the stormwater outfalls. Water levels at 1NE show Mississippi River tailwater in the pipe from March 28 through April 22 and May 25 through June 5 (Figure 5). Also at 1NE, water level data were not collected between July 16 and July 26 due to equipment damage. Water levels at 4PP show tailwater in the pipe from January 1 through January 13, March 19 through June 11, June 18 through July 8 and July 15 through August 19 (Figure 6). Water levels at 6UMN show tailwater in the pipe from January 1 through January 12, March 22 through June 12, June 22 through July 8, and July 16 through August 19 (Figure 7). Data are not shown after October 9 because the site was vandalized in October 2011 and is being redesigned to prevent future acts of vandalism. Water level data for 7LSTU and 2NNBC were not available due to Mississippi River tailwater in the stormwater tunnel.

Data for 7LSTU and 2NNBC are not included, as the data were not accurate due to Mississippi River tailwater in the stormwater tunnels during the monitoring season.

Stormwater Monitoring Results

The MPCA does not have water quality criteria for stormwater drainage systems, therefore data are not compared with standards. The MWMO monitors stormwater 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 E.1 – E.6 in Appendix E. In 2011, the MWMO began monitoring specific conductivity with continuous monitoring equipment at 10SA to provide the MPCA with detailed data for the Twin Cities Metro Area Chloride Project (Figure 9).

Discharge data collected with the automated equipment are presented in Figures 10-13. These figures show the same omissions of data described in the stormwater water level section.

Discharge data for 7LSTU and 2NNBC were not available due to Mississippi River tailwater in the stormwater tunnel during the monitoring season.

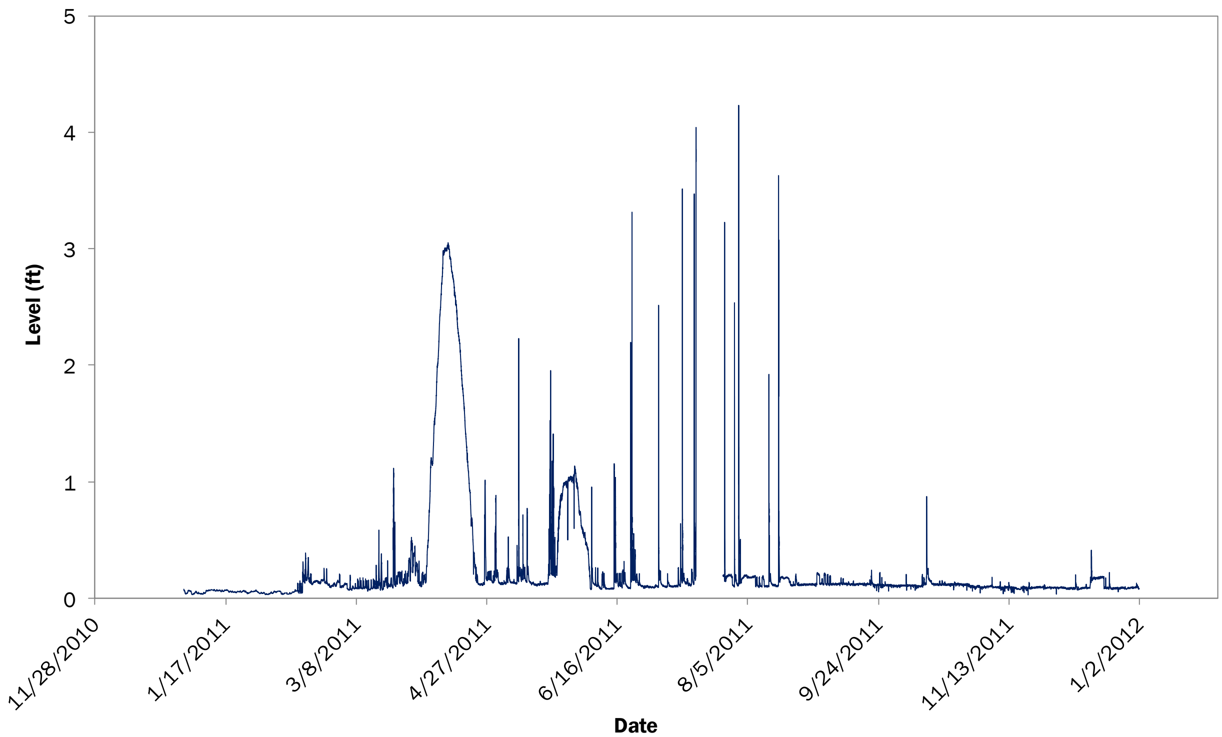

Figure 5. Water level for 1NE outfall

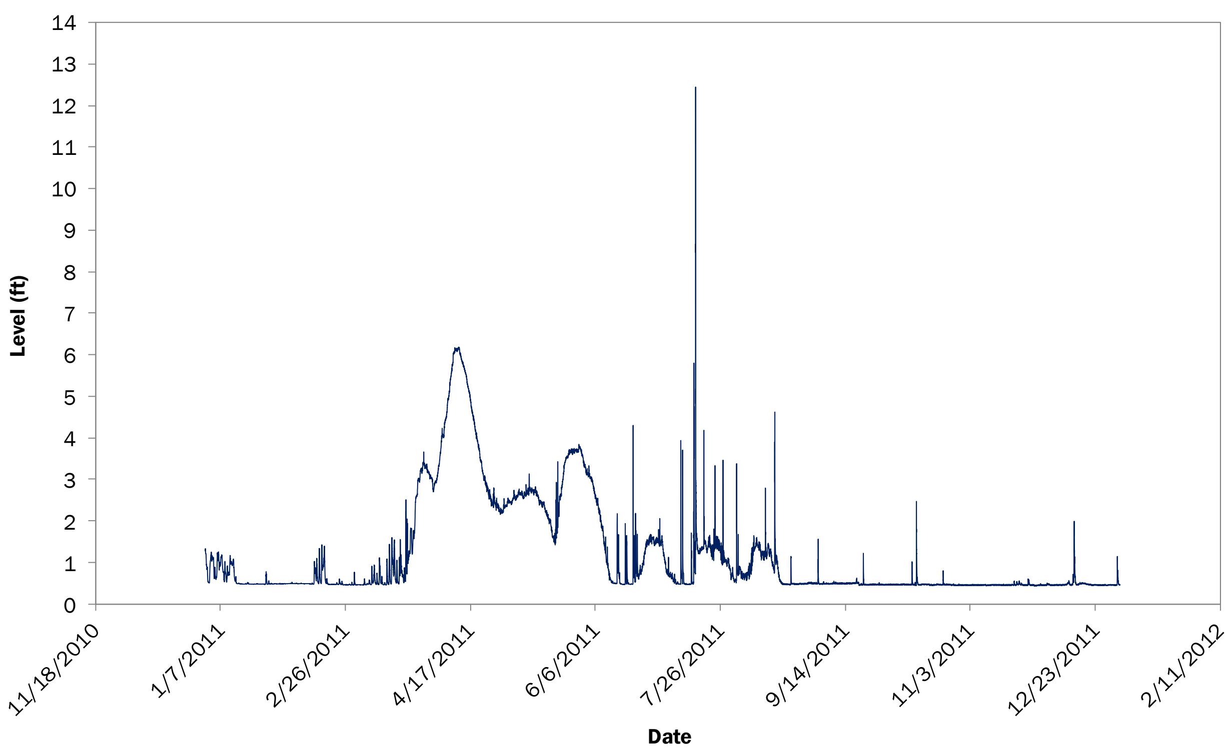

Figure 6. Water level for 4PP outfall

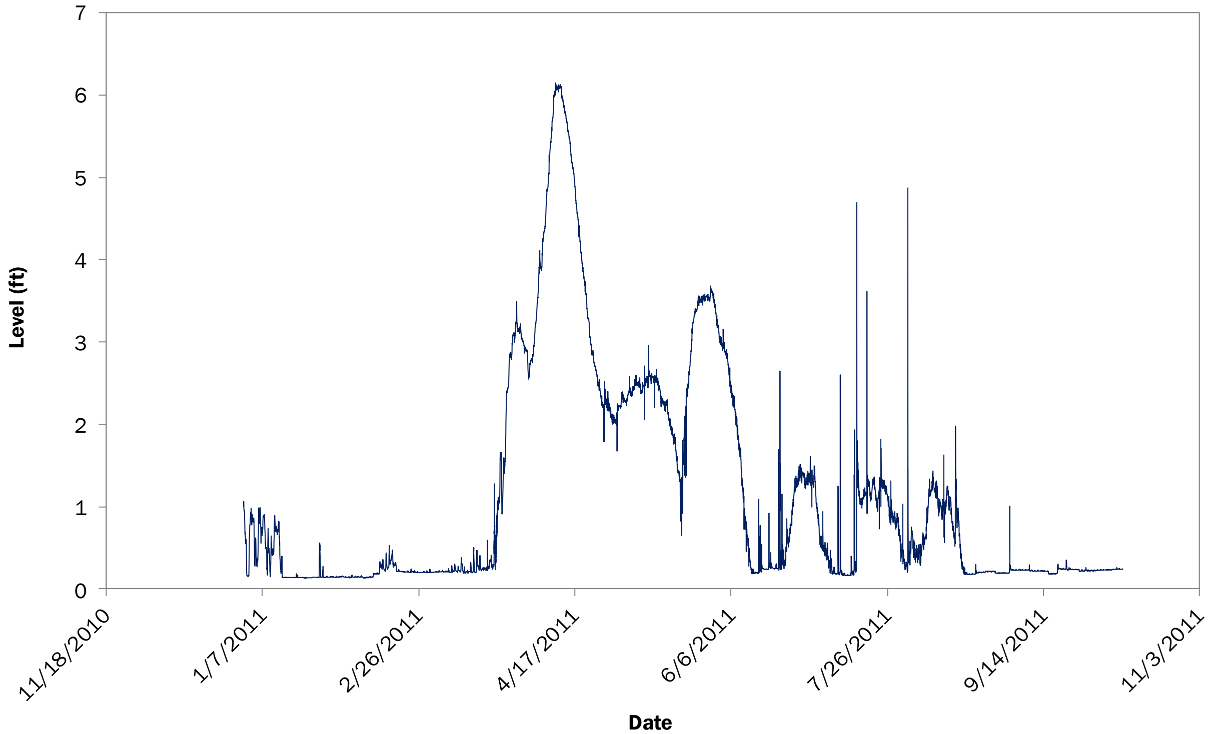

Figure 7. Water level for 6UMN outfall

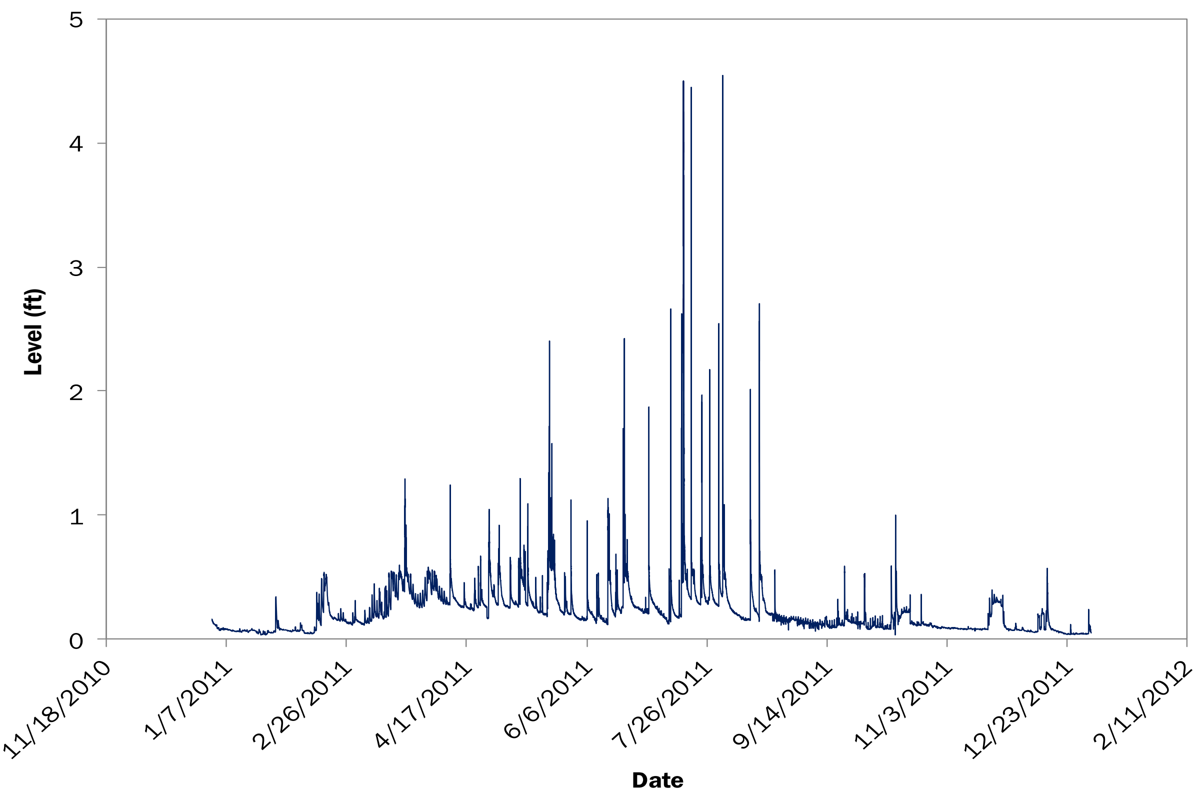

Figure 8. Water level for 10SA stormwater drainage system

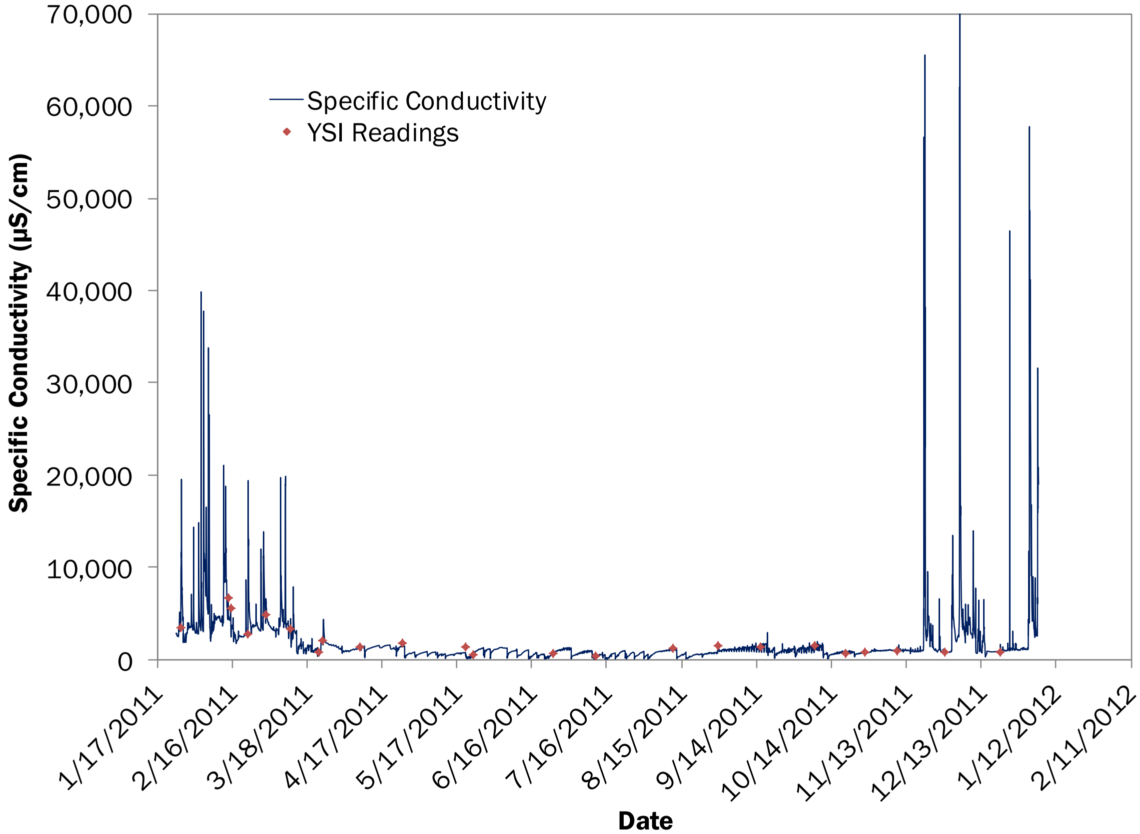

Figure 9. Continuous specific conductivity monitoring data for 10SA stormwater drainage system. Points represent YSI readings taken in the tunnel to compare to conductivity sensor readings.

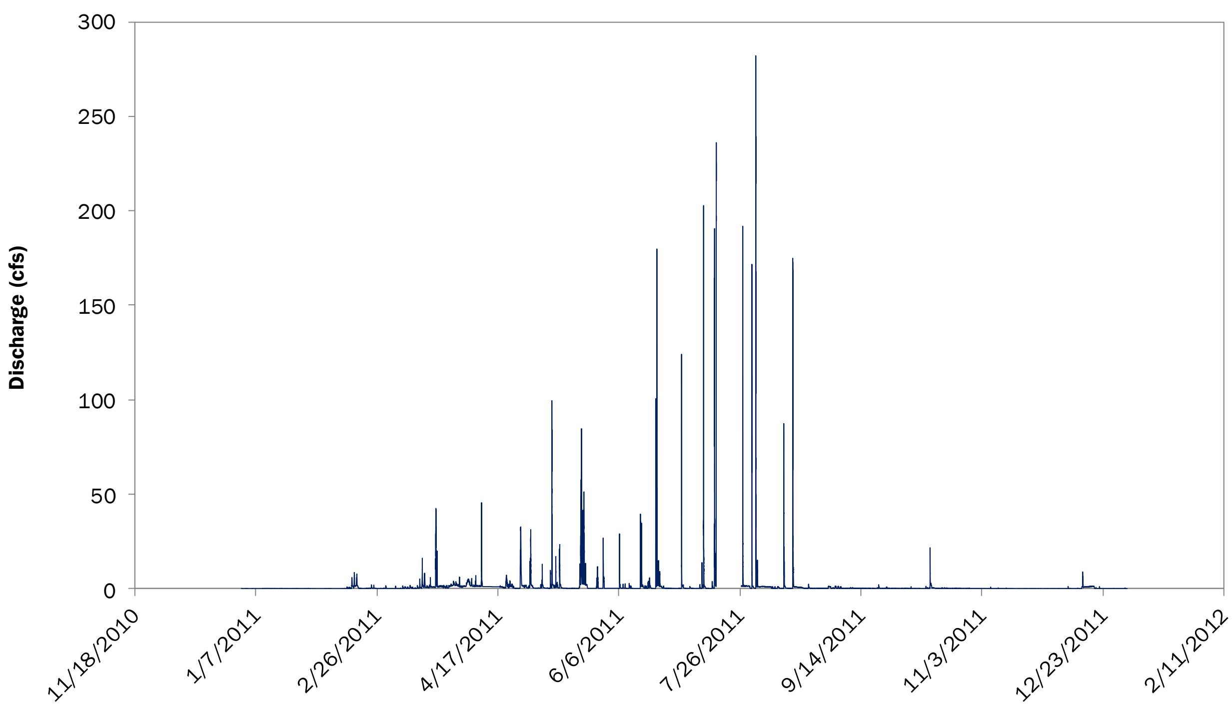

Figure 10. Discharge for 1NE outfall

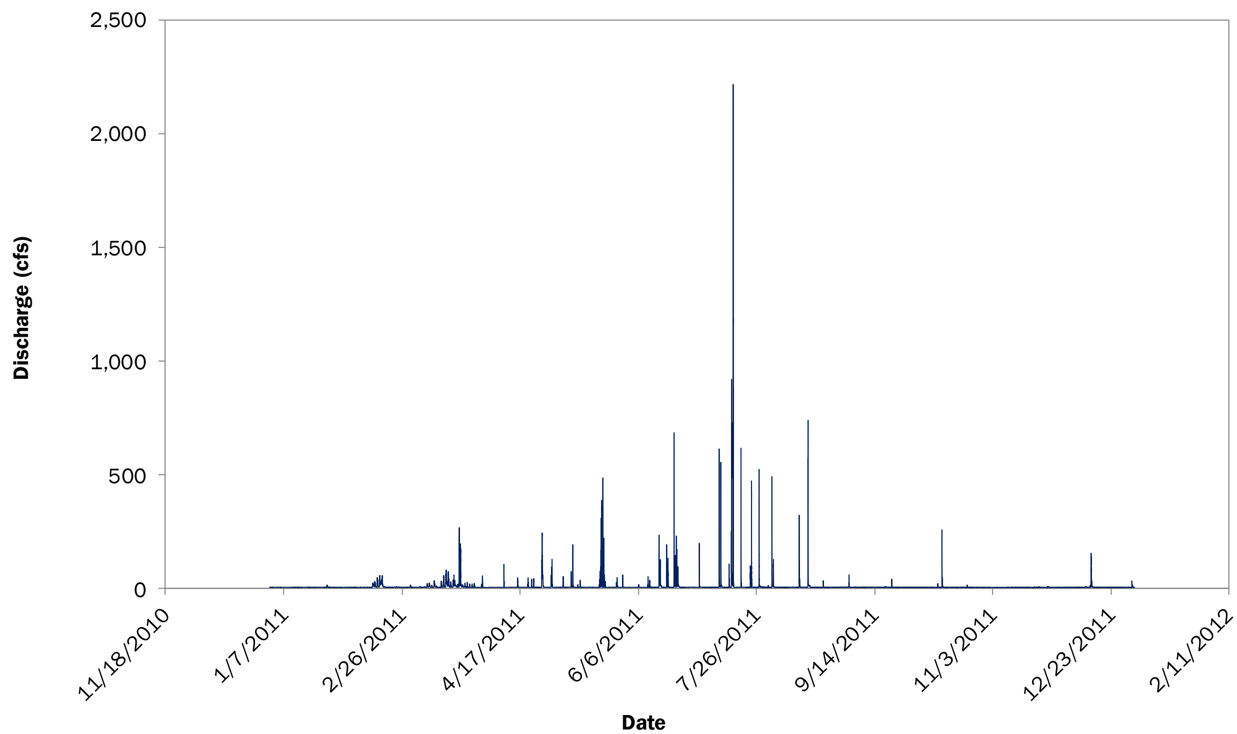

Figure 11. Discharge for 4PP outfall

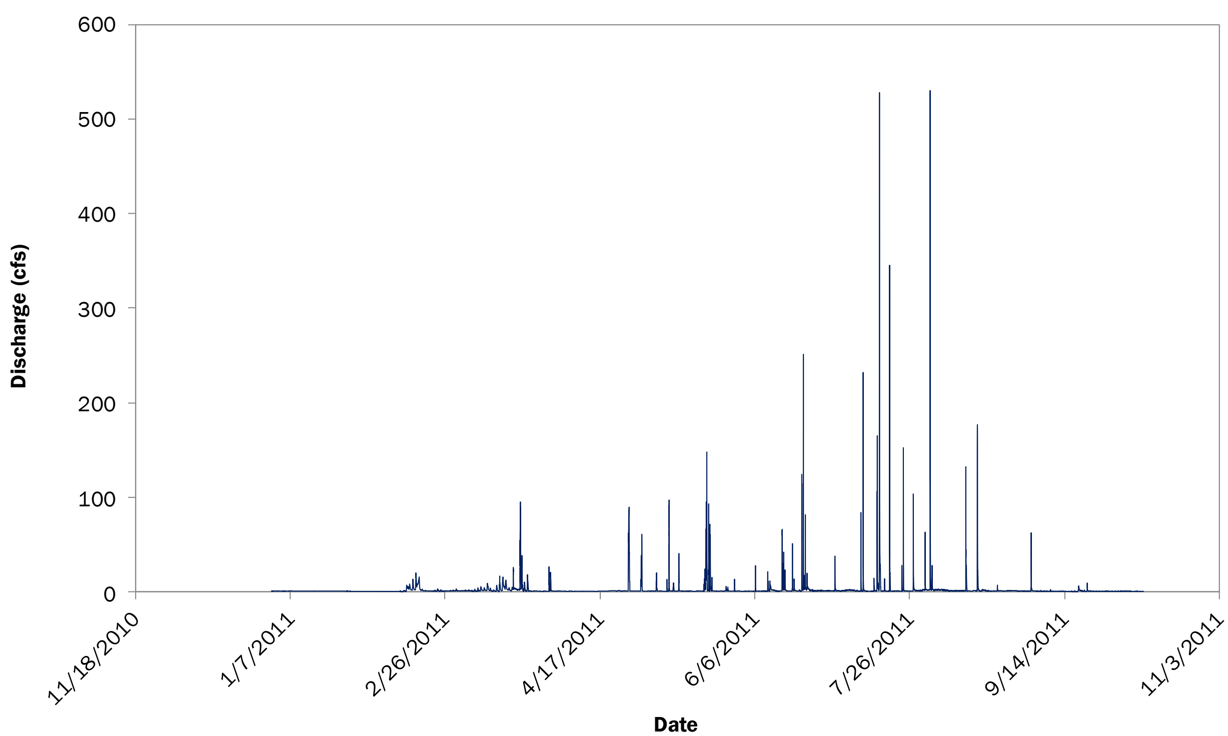

Figure 12. Discharge for 6UMN outfall

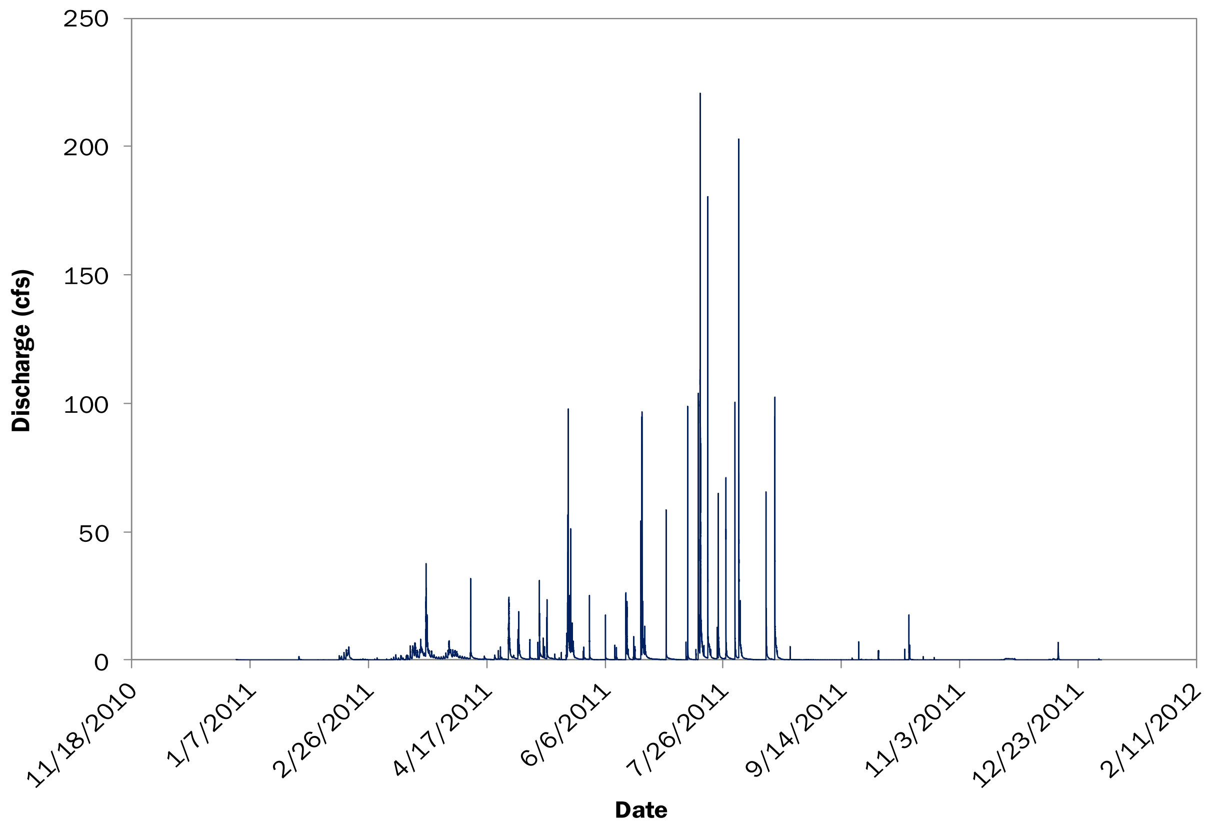

Figure 13. Discharge for 10SA stormwater drainage system

Kasota Ponds Monitoring

The MWMO monitored seven locations in the Kasota Ponds (KP). (See Figure A.2 in Appendix A for wetland sampling locations). In 2011, the MWMO monitored biological health of the KP for the first time. In July 2011, the KP wetlands were sampled for macrophyte (wetland plant) and macroinvertebrate (large aquatic invertebrate) assemblages. These data were used to calculate the health of the KP wetlands relative to other wetlands in the state and as reference for future biological monitoring.

Site Description

KPN (Kasota Pond North): KPN is the northernmost pond. It is located west of Highway 280 and south of the intersection of North Hunting Valley Road and West Doswell Avenue. The two sites located in this pond were KPNW and KPNS. KPNW is located on the southwest side of the pond. KPNS is located on the southern side of the pond near the railroad tracks. (See Figure A.2. in Appendix A for the wetland sampling locations.) The area surrounding the pond is heavily vegetated with nonnative species such as buckthorn and burdock. KPN is dense with cattails and aquatic plants during the summer months. The bottom of the pond contains organic matter, silt, and clay.

KPE (Kasota Pond East): KPE is the largest of the ponds. It is also known as Mallard Marsh. It is located southwest of the intersection of Highway 280 and Kasota Avenue. The three sites monitored in KPE were KPEN, KPEW, and KPEE. KPEN is located near the middle of the north side of the pond. KPEW is located near the middle of the west side of the pond, nearest to the railroad tracks. KPEE is located near the middle of the east side of the pond. There is a grassy buffer area surrounding most of the pond. Railroad tracks run alongside the west side of the pond, with approximately three feet of riprap between the tracks and the pond. Turtles and ducks are frequently observed in KPE. This wetland is dense with cattails and aquatic plants during the summer months. The bottom of the pond contains organic matter, silt, and clay.

KPW (Kasota Pond West): KPW is located just west of KPE. The two sites monitored at this pond were KPWN and KPWE. KPWN is located on the northeast side of the pond near an outfall pipe. KPWE is located on the southeast side of the pond, also near an outfall pipe. KPW receives runoff from a parking lot and the rail yard. Dense algal blooms are observed in KPW during the summer months while other types of aquatic vegetation are seldom present in this pond. The pond has a sandy bottom.

Methodology

Sample Collection, Handling, and Preservation

Grab samples were collected from seven locations in the KP wetlands once a month throughout the year. Collection occurred away from shore, in approximately three feet of water. Samples were collected in laboratory cleansed (non-sterile) two-gallon plastic bottles. To collect samples, the monitoring specialist plunged an opened, inverted bottle one foot below the water surface, turned it upward to fill, and brought it out of the water. The specialist then poured some of the sample out to provide headspace for the laboratory. Dissolved oxygen, conductivity, salinity, temperature, and pH data were collected concurrently in the wetland using the methods described for the Mississippi River. When ice was present, staff conducted sampling activities by drilling a hole in the ice.

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

MWMO has been collecting water quality data at the three KP wetlands since 2008. In 2011, monitoring was expanded to explore the biological health of the wetlands. In July 2011, the KP wetlands were sampled for macrophyte (wetland plant) and macroinvertebrate (large aquatic invertebrate) assemblages. These data were used to calculate the health of the KP wetlands relative to other wetlands in the state and to establish baseline records for the wetlands.

Macroinvertebrate samples were collected following the MWMO's Standard Operating Procedure for Wetland Macroinvertebrate Sampling (2011) adapted from the MPCA's Macroinvertebrate Community Sampling Protocol for Depressional Wetland Monitoring Sites (MPCA). Samples were collected using dipnets and activity traps in June and July 2011. Macroinvertebrates were preserved in 95% ethyl alcohol and later identified to the genus or family level by staff at Fortin Consulting. MWMO staff calculated an IBI score for each wetland using methods described in Indexes of Biological Integrity for Large Depressional Wetlands in Minnesota (Gernes and Helgen, 2002).

The original IBI calculation includes ten metrics but only nine were used in the KP IBI calculations. We eliminated the metric that evaluates chironomid diversity at the species level, as samples were only classified to family or genus level. Three other metrics may have been affected by identification of samples only to the family or genus level. These include the total invertebrate, leech, and snail taxa metrics. As a result of lower taxonomic resolution, the calculated overall IBI scores for each wetland may be lower than they really are, but this should not have had a large effect.

Wetland vegetation was sampled using the relevé sampling method following the MWMO's Standard Operating Procedure for Wetland Vegetation Sampling (2011) adapted from the MPCA's Standard Operating Procedure for Aquatic Plant Community Sampling for Depressional Wetland Monitoring Sites (MPCA). Vegetation samples were collected in July 2011 and an IBI was calculated for each wetland following methods described in Indexes of Biological Integrity for large depressional wetlands in Minnesota (Gernes and Helgen, 2002). Water quality samples were collected in concurrence with biological sampling activities.

Sampling Quality Control

The MWMO staff followed the quality control protocol outlined in the MWMO Ambient Surface Water Monitoring Quality Assurance Project Plan (2010). Blank samples of DI water were submitted to laboratories once a month to verify that sample containers were clean and samples were not contaminated during travel. In addition, ten percent of all samples were collected in duplicate to verify that sampling and laboratory procedures did not jeopardize the data.

Laboratory Analyses

Samples were analyzed at the Metropolitan Council Environmental Services Laboratory. Refer to Table C.1 in Appendix C for a list of sample parameters, the laboratories used for analysis, 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.

Parameters Information

The MWMO has conducted extensive research regarding the parameters of concern. Parameter information includes definitions, sources, impact on various organisms, and water quality standards, as well as others. Refer to the MWMO 2006 Annual Monitoring Report (2007) for the comprehensive list of parameters.

Water Quality Monitoring Results

The MWMO monitors Kasota Ponds to characterize water quality in its wetlands. Samples are collected for nutrients, sediment, inorganic, and metals analyses. The MPCA water quality criteria indicate that wetland water quality should maintain background conditions. Background water quality has not yet been determined for MWMO wetlands. The data are presented in Tables F.1 – F.7 in Appendix F.

Biological Monitoring Results

Macrophytes

Macrophyte assessments showed all three wetlands to be in poor health relative to other wetlands in the state of Minnesota (Figure 14). KP East (Table 6) and North (Table 7) were dominated by cattails and lacked diversity. KP West did not have any macrophytes present and so received a score of zero. Instead it was dominated by the algae, and specifically *Aphanizomenon*, a common cyanobacterial species.

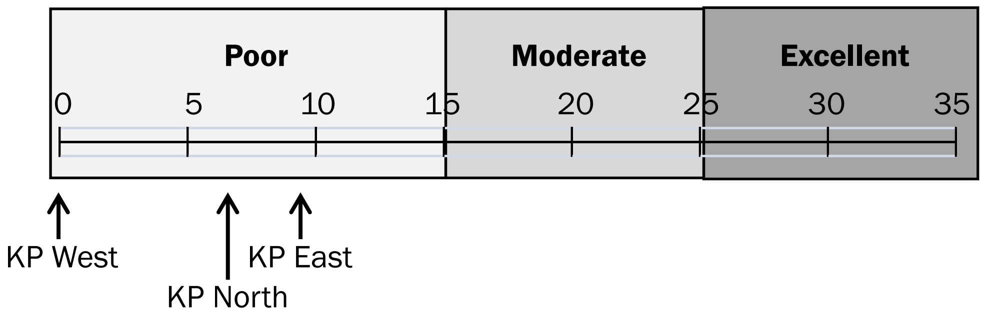

Figure 14. Macrophyte IBI scores showing health relative to other wetlands in the state as set by the MPCA

Table 6. Macrophyte IBI scores for KP East

Macrophyte Metrics	Value	Score
Vascular genera	5	1
Nonvascular genera	0	1
Grass-like genera	0	1
Carex cover	0	1
Utricularia present	no	1
Aquatic guild	4	3
Persistent litter	63%	1
Total Score		**9**

Table 7. Macrophyte IBI scores for KP North

Macrophyte Metrics	Value	Score
Vascular genera	2	1
Nonvascular genera	0	1
Grass-like genera	0	1
Carex cover	0	1
Utricularia present	no	1
Aquatic guild	2	1
Persistent litter	63%	1
Total Score		**7**

Macroinvertebrates

The macroinvertebrate assemblages of KP indicated the wetlands are in poor to moderate health (Figure 15). KP West, which had no plants, was on the border between poor and moderate health (Table 8). KP East, which had the highest macrophyte IBI score, also had the highest macroinvertebrate IBI score (Table 9). KP North had the lowest score (Table 10).

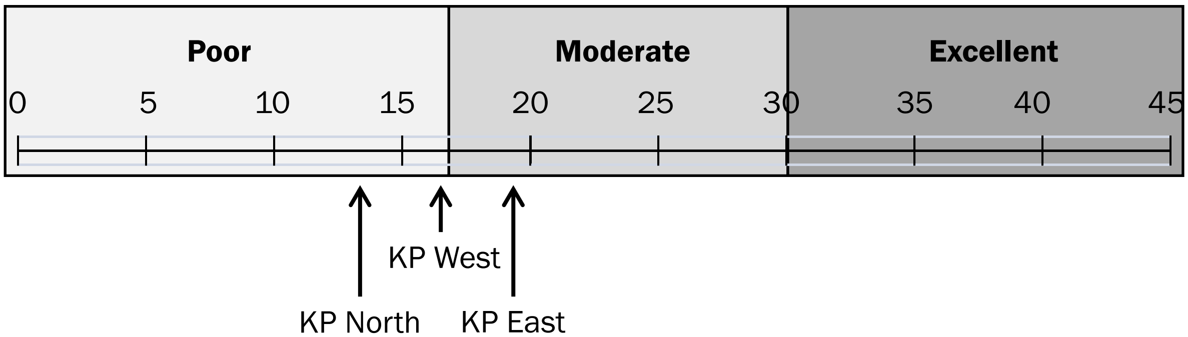

Figure 15. Macroinvertebrate IBI scores from KP relative to health as set by the MPCA

Table 8. Macroinvertebrate IBI scores for KP West

Invertebrate Metrics	Value	Score
Total number of invertebrate taxa	15	1
Odonata taxa	0	1
Leech taxa	3	3
Snail taxa	2	1
ETSD (# genera of mayflies, caddisflies, fingernail clams, dragonflies)	0	1
Number of intolerant taxa	0	1
Tolerant taxa proportion of sample count[a]	54.2%	3
Dominate three taxa as proportion of sample count[a]	89.3%	1
Corixidae proportion of beetles and bugs in AT[b]	28.6%	5
Total Score		**17**

[a] Dip net samples only
[b] Activity trap (AT) samples only

Table 9. Macroinvertebrate IBI scores for KP East

Invertebrate Metrics	Value	Score
Total number of invertebrate taxa	22	1
Odonata taxa	2	1
Leech taxa	3	3
Snail taxa	2	1
ETSD (# genera of mayflies, caddisflies, fingernail clams, dragonflies)	5	3
Number of intolerant taxa	3	3
Tolerant taxa proportion of sample count[a]	70.8%	1
Dominate three taxa as proportion of sample count[a]	77.8%	1
Corixidae proportion of beetles and bugs in AT[b]	16.4%	5
Total Score		**19**

[a] Dip net samples only
[b] Activity trap (AT) samples only

Table 10. Macroinvertebrate IBI scores for KP North

Invertebrate Metrics	Value	Score
Total number of invertebrate taxa	16	1
Odonata taxa	1	1
Leech taxa	1	1
Snail taxa	1	1
ETSD (# genera of mayflies, caddisflies, fingernail clams, dragonflies)	3	1
Number of intolerant taxa	3	3
Tolerant taxa proportion of sample count[a]	42.5%	3
Dominate three taxa as proportion of sample count[a]	83.2%	1
Corixidae proportion of beetles and bugs in AT[b]	91.8%	1
Total Score		**13**

[a] Dip net samples only
[b] Activity trap (AT) samples only

Biological monitoring provides a good indicator of the health of the wetlands. Hydrology and water chemistry monitoring report physical and chemical conditions in a wetland, but animals and plants living in the wetlands indicate the overall health of the wetland. Monitoring the ecological condition of wetlands shows how the biota react to changes in their environment.

All of the Kasota Ponds were in poor health with regards to aquatic plant (macrophyte) communities. The macroinvertebrate (large, spineless animal) communities indicated that the wetlands are in poor to moderately poor health. These results are unsurprising given the proximity of KP to highly disturbed areas including rail yards, industrial centers, and highway 280. Unless efforts are made to restore the wetlands, the IBI scores are not likely to change.

Work Plan

Assessment of 2011

The MWMO completed all of its monitoring objectives for 2011. Staff conducted biological monitoring at the Kasota Ponds. The MWMO continued to share data through the MPCA EQuIS database and the Annual Monitoring Report. Staff also continued to assist Minneapolis with their illicit discharge detection program. Plans were also developed to aid Minneapolis with their National Pollutant Discharge Elimination System (NPDES) monitoring and to begin developing big river monitoring methodology for the MWMO's reaches of the Mississippi River.

Additional work conducted by the MWMO included partnering with the MPCA to provide technical expertise and data collection for the Twin Cities Metropolitan Area (TCMA) Chloride Project and the Upper Mississippi River Bacteria TMDL. The MWMO installed new monitoring equipment at stormwater site 10SA to collect continuous conductivity data for the chloride project.

2012 Work Plan

The 2012 work plan for the MWMO's monitoring program includes:

- Acquire a second monitoring vehicle and a boat to enhance the MWMO's monitoring activities
- Expand precipitation monitoring network using citizen precipitation recorders
- Restore the 6UMN monitoring site with new concrete pad, electricity connection, and monitoring cabinet
- Continue to monitor five stormwater outfall sites using automated samplers. The 2NNBC site will be monitored by grab samples when there is positive flow from the tunnel to river in 2012
- Continue monitoring three wetlands (Kasota Ponds) in St. Paul
- Continue to monitor seven sites on the Mississippi River and six stormwater sites for *E. coli* and submit the data to MPCA for the Upper Mississippi River Bacteria TMDL
- Start working on developing monitoring protocol for big river monitoring
- Research and work on the methodology to calculate pollutant loading from stormwater outfall sites and complete the estimates of pollutant loading for one site
- Work with the City of Minneapolis and Minneapolis Parks and Recreation Board to collect data for the City of Minneapolis's National Pollutant Discharge Elimination System (NPDES) permit
- Coordinate with the City of Minneapolis to assist with their illicit discharge monitoring program
- Work with the MPCA to assist with the Upper Mississippi River Bacteria TMDL
- Work with the MPCA to assist with the Twin Cities Metro Area Chloride Project
- Work with the City of Minneapolis to develop a work scope for a feasibility study to assess the old Bassett's Creek tunnel for sediment removal and use as a stormwater storage and treatment facility
- Work with the City of Minneapolis Environmental Services staff to enhance their erosion and sediment control inspections program
- Work on developing partnerships with state and federal agencies to develop the long-term comprehensive monitoring program for the Mississippi River within the reach of the MWMO
- Share MWMO data through the MPCA EQuIS database and the Annual Monitoring Report

References

Gernes, M.C. and J.C. Helgen. 2002. Indexes of Biological Integrity (IBI) for Large Depressional Wetlands in Minnesota. Minnesota Pollution Control Agency, Final Report to U.S. Environmental Protection Agency. Assistance #CD-985879-01. Available at **http://www.pca.state.mn.us/index.php/view-document.html?gid=6100** (accessed 01/2012).

Minnesota Pollution Control Agency. 2007. *Minnesota Statewide Mercury Total Maximum Daily Load*. Minnesota Pollution Control Agency, Saint Paul, MN, March 2007. 75 p. available at **www.pca.state.mn.us/publications/wq-iw4-01b.pdf** (accessed 01/2012).

Minnesota Pollution Control Agency. 2010. *Mississippi Watershed Management Organization Ambient Surface Water Monitoring Program Quality Assurance Project Plan*. 33 p.

Minnesota Pollution Control Agency. 2012. "TMDL Project: Upper Mississippi River – Bacteria". *Minnesota's Impaired Waters and TMDLs* available at **http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/tmdl-projects/upper-mississippi-river-basin-tmdl-projects/project-upper-mississippi-river-bacteria.html?menuid=&redirect=1** (accessed 01/2012).

Minnesota Pollution Control Agency. Aquatic Plant Community Sampling Procedure for Depressional Wetland Monitoring Sites. Available at **http://www.pca.state.mn.us/index.php/view-document.html?gid=6111** (accessed 01/2012).

Minnesota Pollution Control Agency. Macroinvertebrate community sampling protocol for depressional wetland monitoring sites. Available at **http://www.pca.state.mn.us/index.php/view-document.html?gid=6101** (accessed 01/2012).

Minnesota Stormwater Steering Committee. 2008. *The Minnesota Stormwater Manual – Version 2*. Minnesota Pollution Control Agency, Saint Paul, MN, 883 p. available at **http://www.pca.state.mn.us/index.php/water/water-types-and-programs/stormwater/stormwater-management/minnesota-s-stormwater-manual.html** (accessed 01/2012).

Mississippi Watershed Management Organization. 2007. *2006 Annual Monitoring Report*. 54 p. available at **www.mwmo.org/docs.html** (accessed 01/2012).

Mississippi Watershed Management Organization. 2009. *Annual Monitoring Report 2007*. MWMO Watershed Bulletin 2009-1. 49 p. available at **www.mwmo.org/docs.html** (accessed 03/2012).

Mississippi Watershed Management Organization. 2010. *Annual Monitoring Report 2008*. MWMO Watershed Bulletin 2010-1. 56 p. available at **www.mwmo.org/docs.html** (accessed 03/2012).

Mississippi Watershed Management Organization. 2011. *Standard Operating Procedure for Data Processing*. MWMO SOP: Data Processing – 2011. 3pp.

Mississippi Watershed Management Organization. 2011. *Standard Operating Procedure for Stormwater Sampling*. MWMO SOP: Stormwater Sampling – 2011. 5pp.

Mississippi Watershed Management Organization. 2011. *Standard Operating Procedure for Surface Water Sampling*. MWMO SOP: Surface Water Sampling – 2011. 5pp.

Mississippi Watershed Management Organization. 2011. *Standard Operating Procedure for Wetland Macroinvertebrate Sampling*. MWMO SOP: Wetland Macroinvertebrate Sampling – 2011. 5 pp.

Mississippi Watershed Management Organization. 2011. *Standard Operating Procedure for Wetland Vegetation Sampling*. MWMO SOP: Wetland Vegetation Sampling – 2011. 5 pp.

Appendix A – Watershed Maps

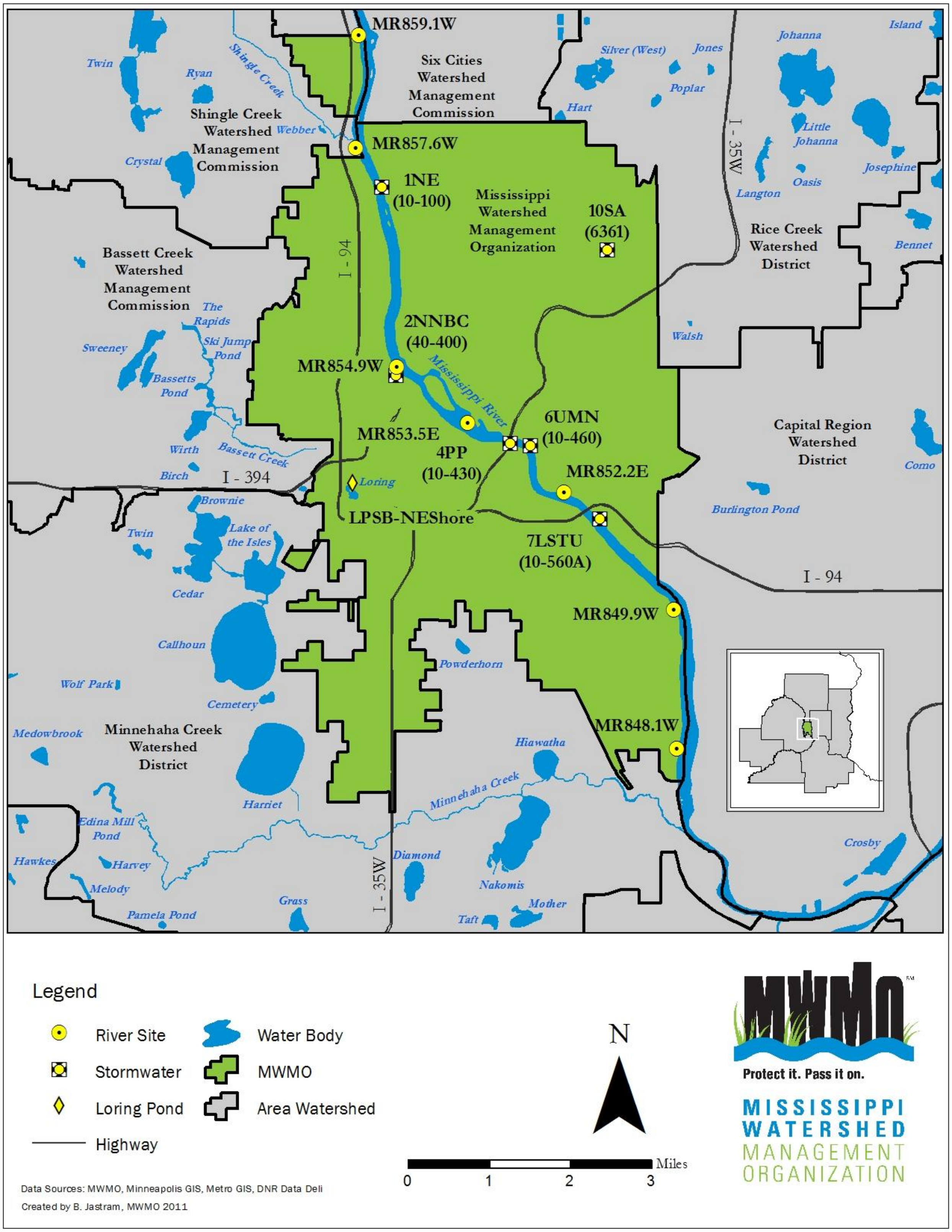

Figure A.1. MWMO watershed boundary and monitoring sites

Figure A.2. Kasota Ponds monitoring sites

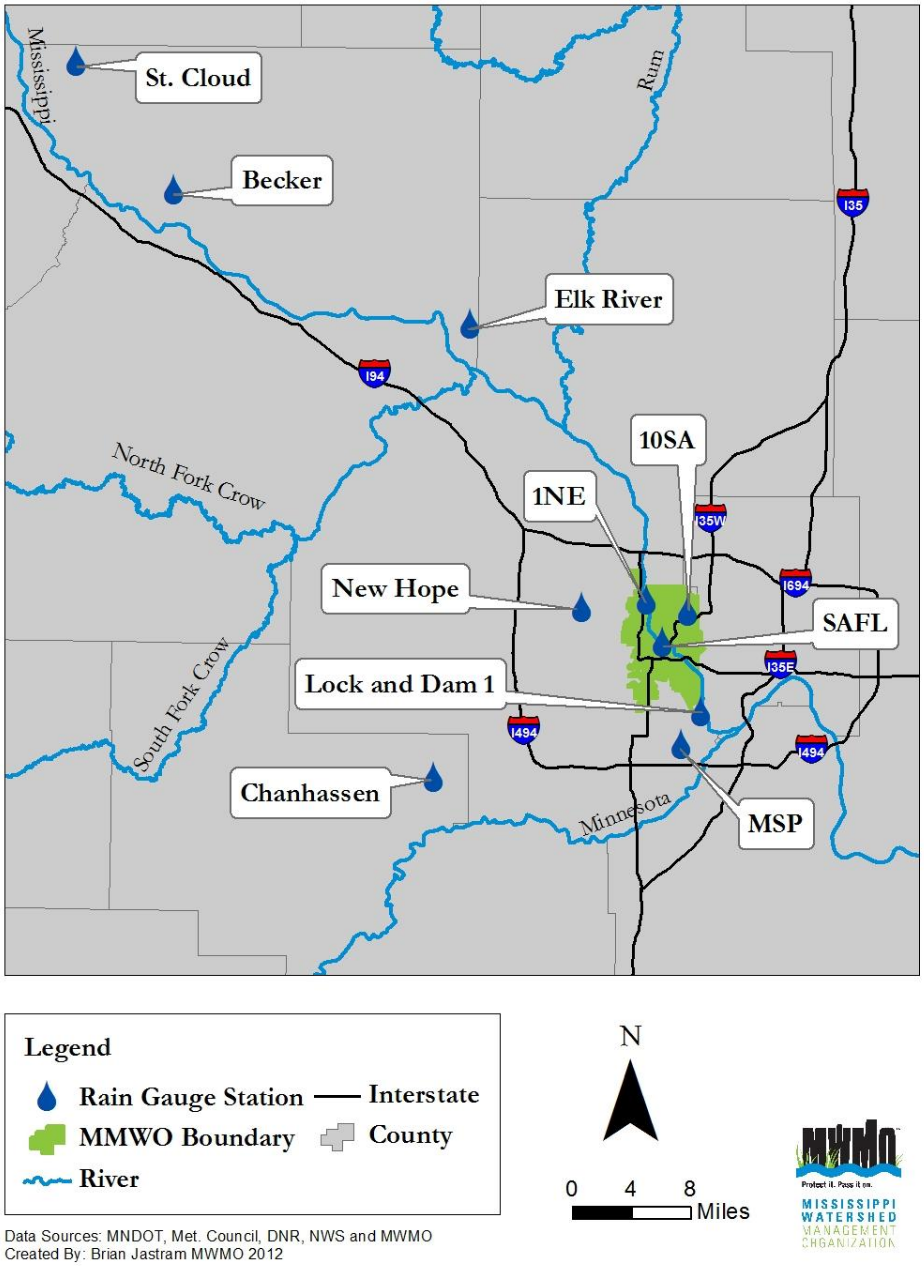

Figure A.3. Precipitation gauges in the Upper Mississippi River Basin

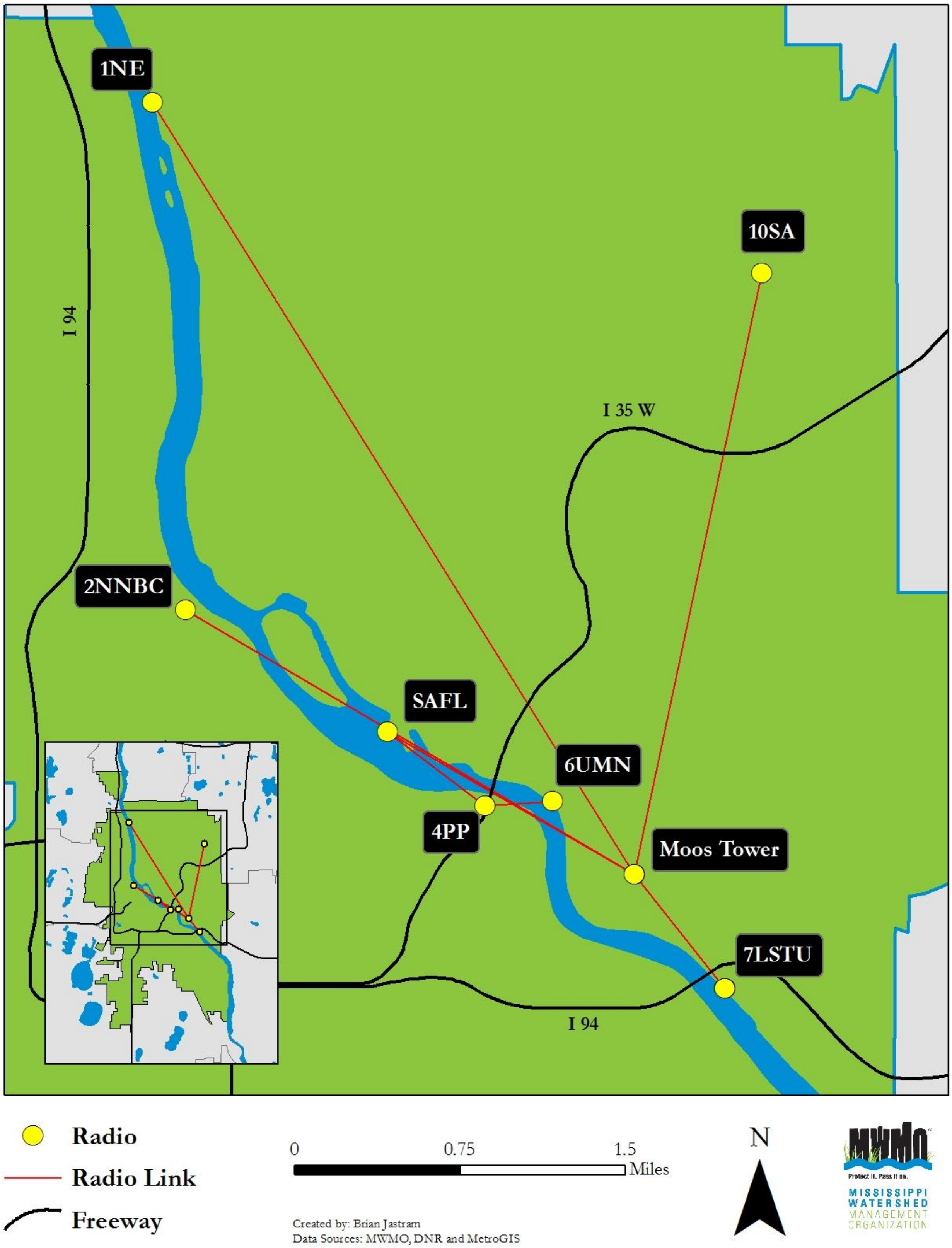

Figure A.4. Real-time monitoring network

Appendix B – Precipitation Event Sampling Data

Table B.1. Precipitation event data and samples collected. A precipitation event is defined as being greater than 0.10 inches and separated by 8 hours. The rain gauge is located at Saint Anthony Falls Laboratory.

Event	Start Date/Time	End Date/Time	Precip. (inches)	Duration (hours)	Intensity (in/hr)	Sample Type	Site 1NE	Site 10SA	Site 2NNBC	Site 4PP	Site 6UMN	Site 7LSTU
1†	1/27/2011 11:26	1/27/11 15:17 PM	n/a	n/a	n/a	Composite	—	X(l)	—	—	—	—
2†	2/13/2011 13:16	2/13/2011 21:47	n/a	n/a	n/a	Composite	—	X(l)	—	—	—	—
3†	2/14/2011 12:01	2/14/2011 16:17	n/a	n/a	n/a	Composite	—	X(l)	—	—	—	—
4†	2/15/2011 12:11	2/16/2011 1:40	n/a	n/a	n/a	Cmp. & Grab	X	X	X	X	X	—
5†	2/16/2011 12:16	2/17/2011 16:53	n/a	n/a	n/a	Cmp. & Grab	X(l)	X(l)	X(l)	X(l)	X(l)	—
6	2/23/2011 10:20	2/23/2011 14:40	0.13	4.25	0.03		—	—	—	—	—	—
7†	3/8/2011 13:26	3/8/2011 16:45	n/a	n/a	n/a	Composite	—	X(l)	—	—	—	—
8†	3/9/2011 11:55	3/9/2011 16:41	n/a	n/a	n/a	Composite	—	X(l)	—	—	—	—
9†	3/14/2011 1:45	3/14/2011 19:15	n/a	n/a	n/a	Composite	—	X(l)	—	—	—	—
10†	3/15/2011 12:06	3/16/2011 2:09	n/a	n/a	n/a	Cmp. & Grab	XX(l)	X(l)	—	X(l)	X	—
11†	3/16/2011 11:51	3/17/2011 6:34	n/a	n/a	n/a	Cmp. & Grab	X(l)	X(l)	—	—	X(l)	—
12†	3/17/2011 11:05	3/18/2011 6:09	n/a	n/a	n/a	Cmp. & Grab	X(l)	X(l)	—	—	x	—
13†	3/19/2011 1:59	3/21/2011 14:12	n/a	n/a	n/a	Composite	—	X(l)	—	—	—	—
14	3/22/2011 3:25	3/23/2011 0:25	0.87	21.00	0.04	Cmp. & Grab	XX(l)	XX(l)	X	X	X	X
15	3/24/2011 14:45	3/24/2011 18:30	0.14	3.75	0.04		—	—	—	—	—	—
16	3/25/2011 12:00	3/25/2011 16:15	0.19	4.25	0.04		—	—	—	—	—	—
17	3/31/2011 23:00	4/1/2011 3:25	0.20	4.50	0.04		—	—	—	—	—	—
18	4/10/2011 0:55	4/10/2011 4:25	0.26	3.50	0.07		—	X(l)	—	—	—	—
19	4/15/2011 8:45	4/16/2011 9:30	0.11	0.75	0.15		—	—	—	—	—	—
20	4/20/2011 4:30	4/20/2011 10:50	0.12	6.25	0.02		—	—	—	—	—	—
21	4/26/2011 2:40	4/26/2011 15:30	1.30	12.50	0.10	Cmp. & Grab	X(e)	(e)	X(le)	(e)	X(le)	X(le)
22	4/30/2011 3:15	4/30/2011 13:45	0.44	10.25	0.04	Composite	X(l)	X(l)	—	—	—	—
23	5/5/2011 2:25	5/5/2011 6:25	0.14	4.00	0.04	Composite	—	X(l)	—	—	—	—
24	5/8/2011 14:05	5/8/2011 15:35	0.12	1.50	0.08		—	—	—	—	—	—
25	5/9/2011 6:10	5/9/2011 8:30	0.31	2.25	0.14	Cmp. & Grab	X(le)	X(le)	—	X(le)	—	X(le)
26	5/12/2011 9:50	5/12/2011 19:45	0.12	10.00	0.01	Composite	X(l)	X(l)	—	—	—	—
27	5/20/2011 11:30	5/21/2011 13:00	1.14	1.50	0.76	Composite	X(l)	X(l)	—	—	—	—
28	5/22/2011 12:50	5/23/2011 3:35	0.67	14.75	0.05		—	—	—	—	—	—
29	5/27/2011 17:20	5/28/2011 1:55	0.15	8.50	0.02		—	—	—	—	—	—
30	5/30/2011 10:00	5/30/2011 10:50	0.16	0.50	0.32	Composite	—	X(l)	—	—	—	—
31	6/6/2011 4:20	6/6/2011 16:50	0.11	12.50	0.01		—	—	—	—	—	—
32	6/10/2011 2:30	6/10/2011 7:35	0.17	5.00	0.03		—	—	—	—	—	—
33	6/10/2011 19:35	6/11/2011 1:05	0.10	5.50	0.02		—	—	—	—	—	—
34	6/14/2011 17:45	6/15/2011 8:50	1.15	15.00	0.08	Composite	X(le)	X(le)	X(e)	X(e)	X(e)	X(e)
35	6/15/2011 17:00	6/15/2011 18:00	0.15	1.00	0.15		—	—	—	—	—	—
36	6/17/2011 22:50	6/18/2011 3:10	0.23	4.25	0.05		—	—	—	—	—	—
37	6/18/2011 13:50	6/18/2011 16:55	0.14	3.00	0.05		—	—	—	—	—	—
38	6/21/2011 2:50	6/21/2011 4:50	0.88	2.00	0.44	Composite	X(l)	X(l)	—	—	—	—
39	6/21/2011 14:15	6/22/2011 7:20	1.08	17.00	0.06		—	—	—	—	—	—
40	6/22/2011 19:40	6/23/2011 4:35	0.12	9.00	0.01		—	—	—	—	—	—
41	7/1/2011 20:15	7/1/2011 21:00	0.25	0.75	0.33		—	—	—	—	—	—
42	7/10/2011 5:40	7/10/2011 7:00	0.31	1.25	0.25	Composite	—	X(l)	—	—	—	—
43	7/10/2011 22:40	7/11/2011 0:45	1.50	2.00	0.75		—	—	—	—	—	—
44	7/14/2011 9:55	7/14/2011 12:45	0.17	2.75	0.06		—	—	—	—	—	—
45	7/15/2011 9:15	7/15/2011 18:35	1.51	9.25	0.16	Grab	—	—	X	X	X	X
46	7/16/2011 3:15	7/16/2011 6:40	2.23	3.50	0.64		—	—	—	—	—	—
47	7/19/2011 11:35	7/19/2011 12:05	0.88	0.50	1.76	Compoiste	—	X	—	—	—	—
48	7/23/2011 9:00	7/23/2011 10:40	0.13	1.75	0.07	Compoiste	—	X(l)	—	—	—	—
49	7/23/2011 22:05	7/23/2011 23:10	0.34	1.00	0.34		—	—	—	—	—	—
50	7/27/2011 1:20	7/27/2011 3:50	0.42	2.50	0.17	Composite	X(l)	X(l)	—	—	—	—
51	8/1/2011 11:20	8/1/2011 15:25	1.42	4.00	0.36	Cmp. & Grab	X(l)	X(l)	X(l)	—	—	X(l)
52	8/2/2011 5:00	8/2/2011 8:55	0.11	4.00	0.03		—	—	—	X(e)	X(e)	—
53	8/13/2011 1:55	8/13/2011 7:40	0.62	5.75	0.11	Compoiste	—	X(l)	—	—	—	—
54	8/16/2011 18:55	8/16/2011 21:00	1.38	2.00	0.69	Composite	—	X(l)	—	—	X(l)	—
55	9/3/2011 2:25	9/3/2011 12:40	0.23	10.25	0.02	Composite	—	—	—	X(l)	X(l)	—
56	10/12/2011 0:20	10/12/2011 22:00	0.36	21.75	0.02	Cmp. & Grab	X(l)	X(le)	—	XX(l)	—	—
57	12/14/2011 1:55	12/14/2011 23:25	0.44	21.50	0.02	Cmp. & Grab	X(l)	X(l)X(l)	X(l)	X(l)	X(l)	X(l)

† snowmelt event.
n/a = not applicable.
X = full suit of analytes.
X(ec) = event sampled with E. coli.
(ec) = event sampled with E. coli only.
X(l) = event sampled with limited parameters generally due to holding times.

Appendix C – Laboratory Methods and Certification

Table C.1. Laboratory methods and certification 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 Rev 2.0	Yes
Carbonaceous Biological Oxygen Demand (CBOD) 5-Day	Metropolitan Council	SM 5210 B-01	Yes
Total 5-day BOD	Metropolitan Council	SM 5210 B-01	No*
Total Organic Carbon	Metropolitan Council	SM 5310 A & C	n/a
Total & Volatile Suspended Solids	Metropolitan Council	SM 2540 D	Yes
Total Dissolved Solids	Metropolitan Council	SM 2540 C	No
Total Alkalinity	Metropolitan Council	EPA 310.2	Yes
Total Hardness	Metropolitan Council	SM 2340 C-97	Yes
Total Chlorides	Metropolitan Council	EPA 300.0 Rev 2.1/SM 4500-CI E-97	Yes
Total Sulfates	Metropolitan Council	EPA 300.0 Rev 2.1	Yes

*No = Indicates that the lab follows standard certification test methods but has not sought certification from the Minnesota Department of Health.

n/a = The Minnesota Department of Health does not have certification for the analyte.

Table C.1 continued. Laboratory methods and certification for each analyte

Analyte	Lab	Method	Certified
Fluoride	Pace Analytical Services, Inc.	SM 4500-F SPADNS Method, Ref SM 20th ed. P 4-82	Yes
Total Phosphorus plus Total Kjeldahl Nitrogen	Metropolitan Council	EPA 365.4 & EPA 351.2 Rev 2.0	Yes
Dissolved Phosphorus	Metropolitan Council	EPA 365.4	Yes
Orthophosphorus	Metropolitan Council	SM 4500-P E	Yes
Total Ammonia Nitrogen	Metropolitan Council	EPA 350.1 Rev 2.0	Yes
Nitrate & Nitrite Nitrogen	Metropolitan Council	4500 NO3 H-00	Yes
Total Volatile Organic Compounds	Metropolitan Council	EPA 624/625	Yes
Oil and Grease	Metropolitan Council	SM 5520 D	n/a
E. coli	Three Rivers Park District Water Resources Laboratory	SM 9223 B	Yes
E. coli	Instrumental Research, Inc.	SM 9223 B	Yes

n/a = The Minnesota Department of Health does not have certification for the analyte.

Appendix D – Mississippi River Data

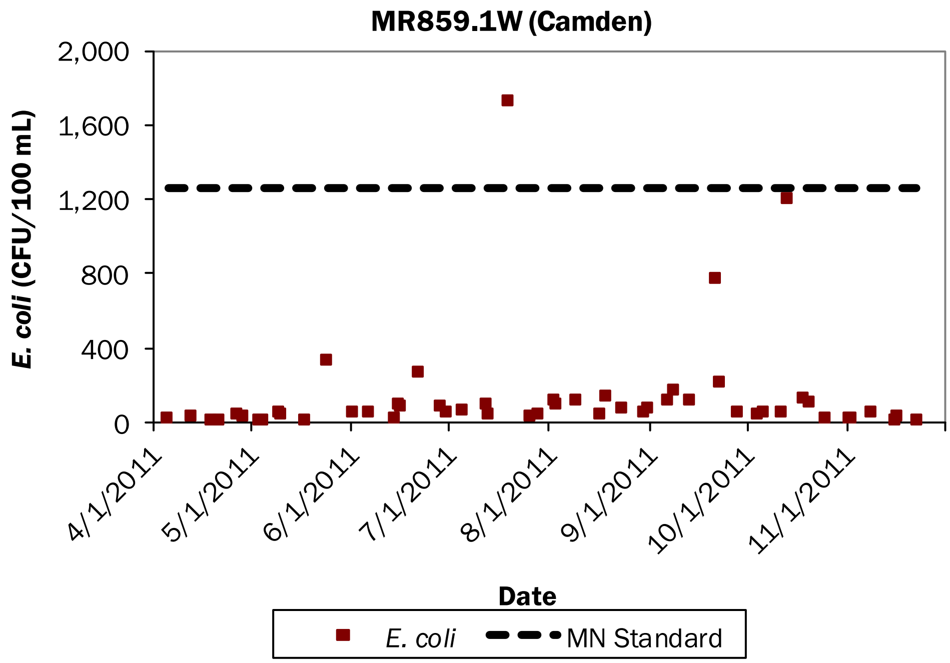

Figure D.1. *E. coli* data for MR859.1W

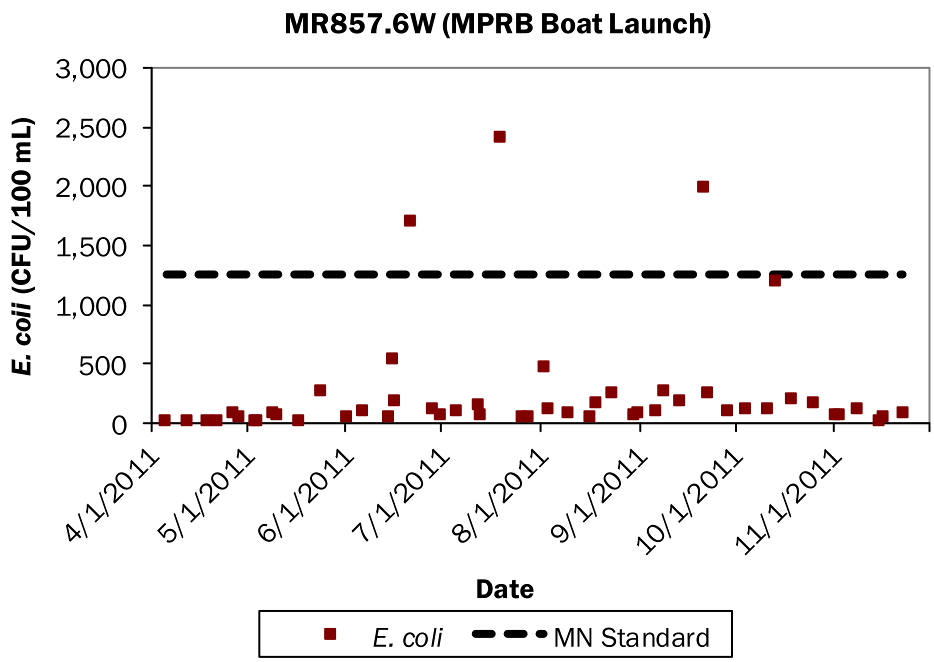

Figure D.2. *E. coli* data for MR857.6W

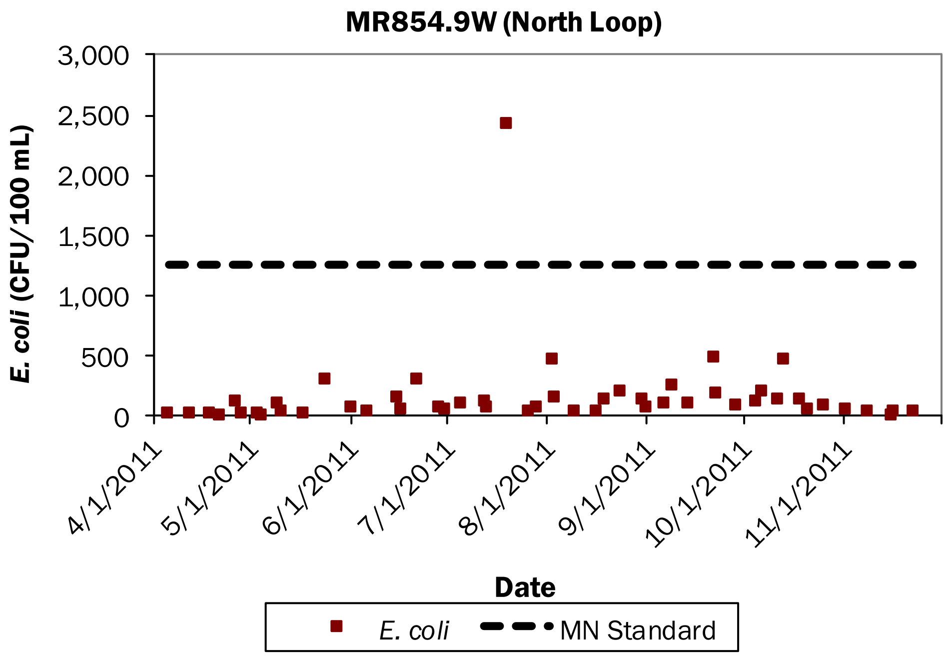

Figure D.3. *E. coli* data for MR854.9W

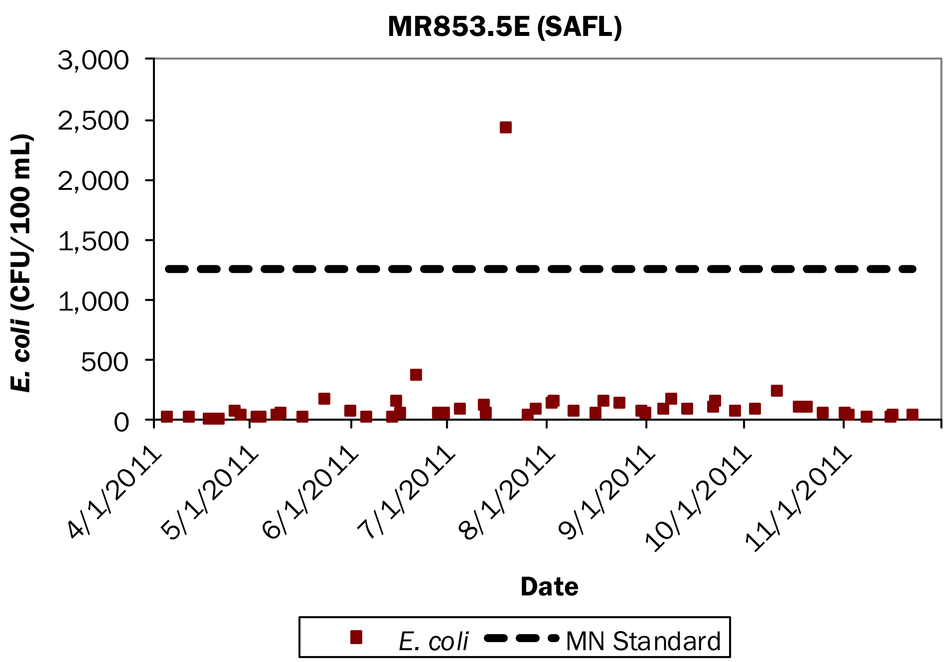

Figure D.4. *E. coli* data for MR853.5E

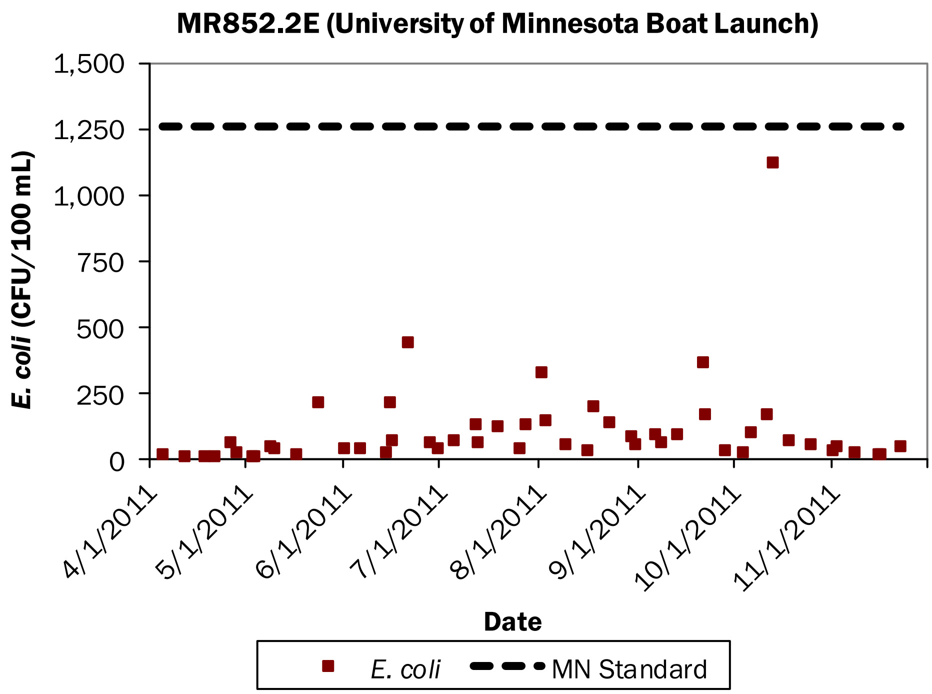

Figure D.5. *E. coli* data for MR852.2E

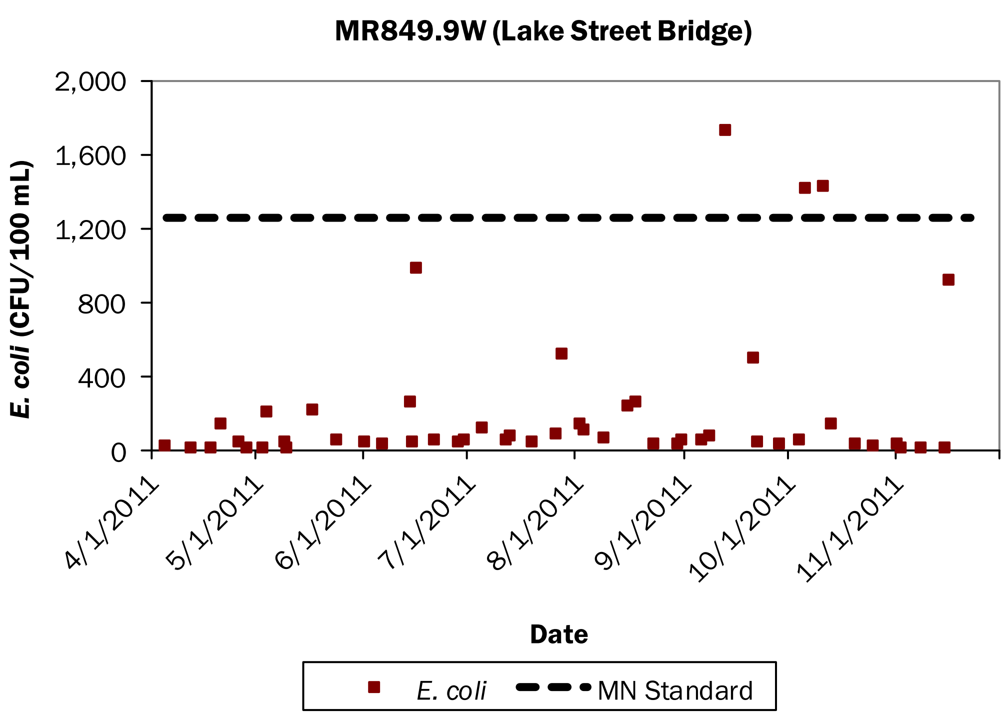

Figure D.6. *E. coli* data for MR849.9W

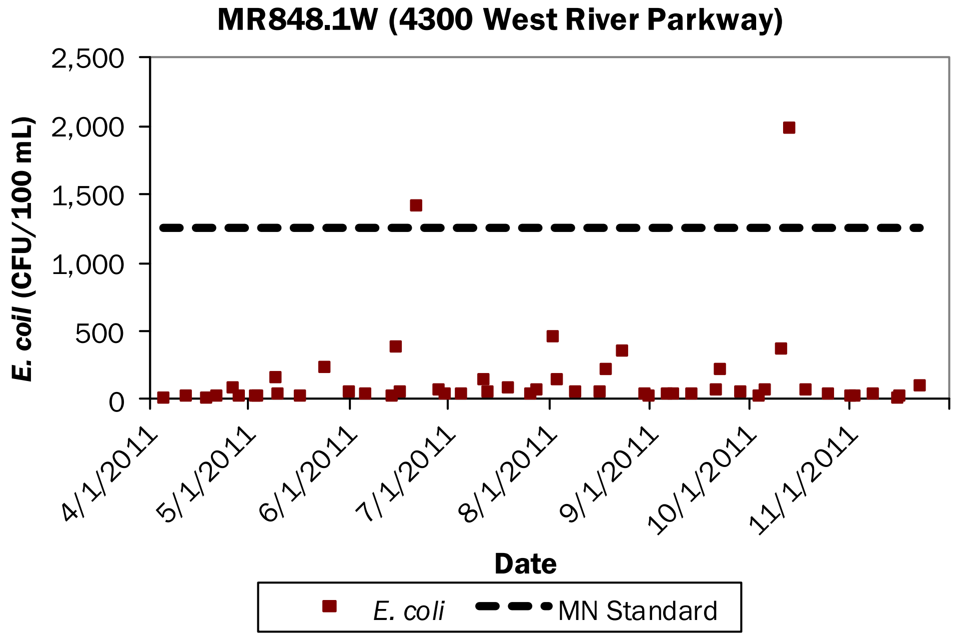

Figure D.7. *E. coli* data for MR848.1W

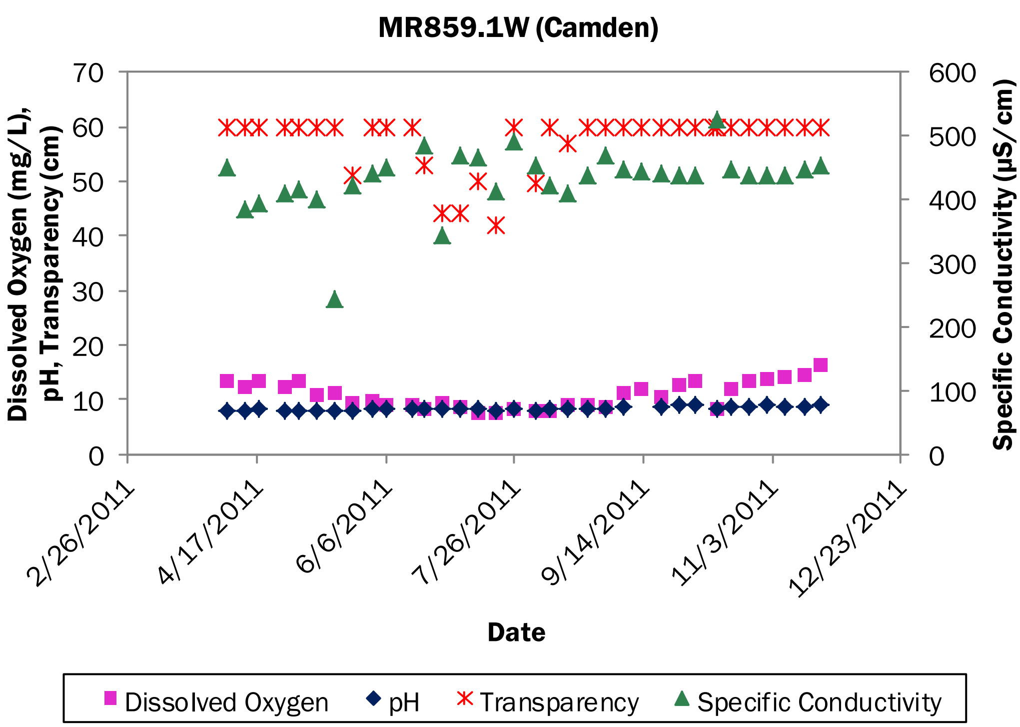

Figure D.8. Dissolved oxygen, pH, transparency, and specific conductivity for MR859.1W

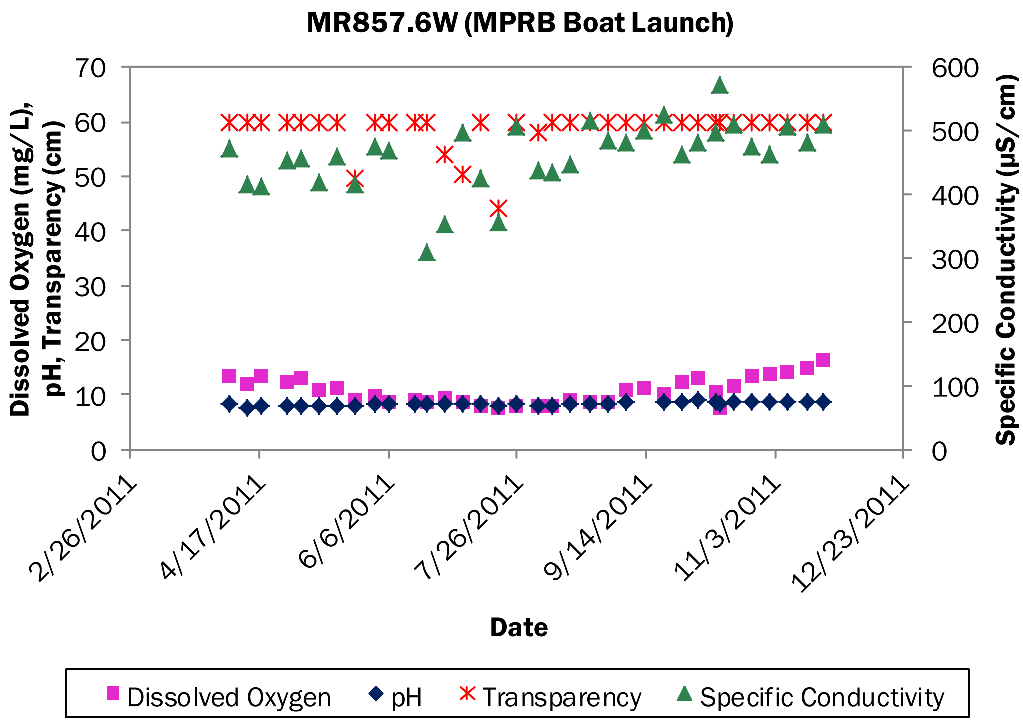

Figure D.9. Dissolved oxygen, pH, transparency, and specific conductivity for MR857.6W

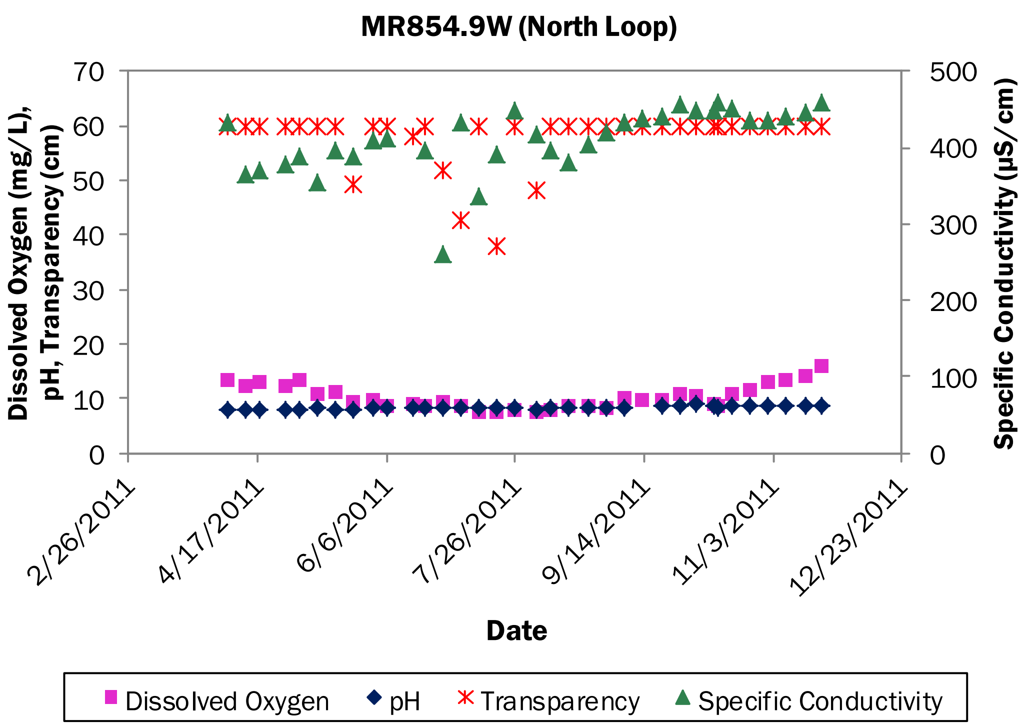

Figure D.10. Dissolved oxygen, pH, transparency, and specific conductivity for MR854.9W

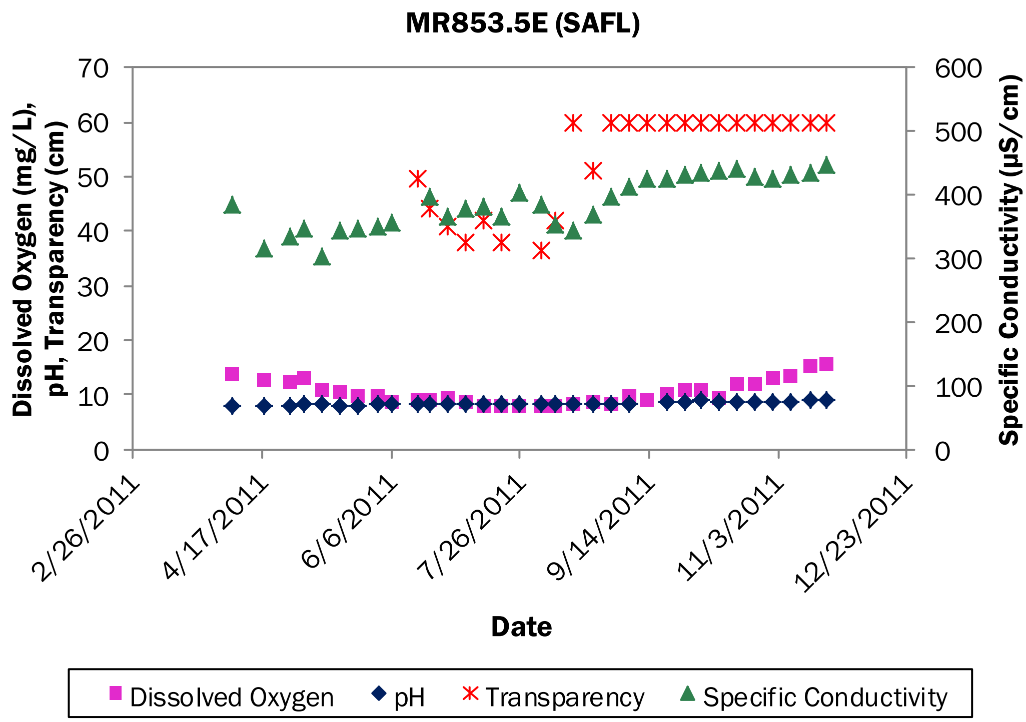

Figure D.11. Dissolved oxygen, pH, transparency, and specific conductivity for MR853.5E

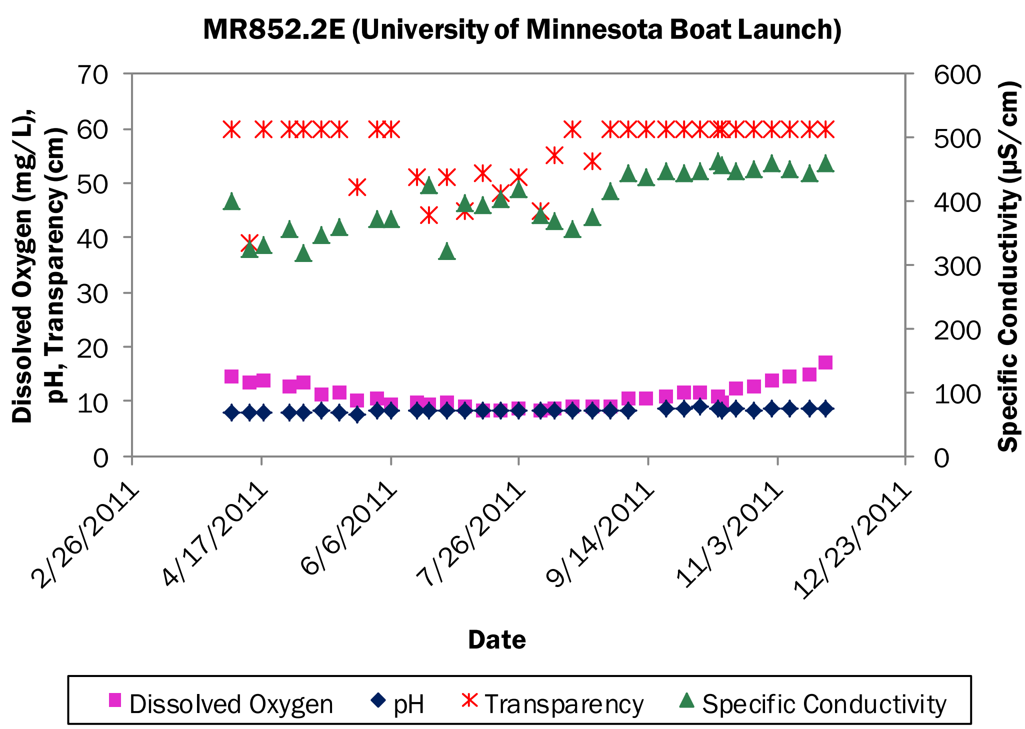

Figure D.12. Dissolved oxygen, pH, transparency, and specific conductivity for MR852.2E

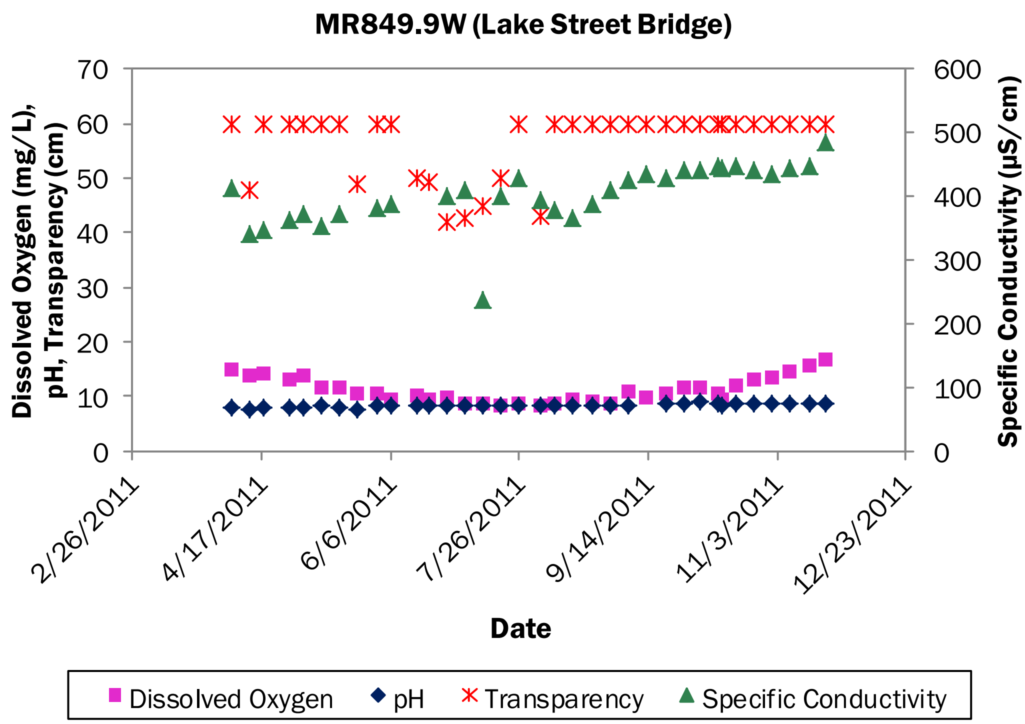

Figure D.13. Dissolved oxygen, pH, transparency, and specific conductivity for MR849.9W

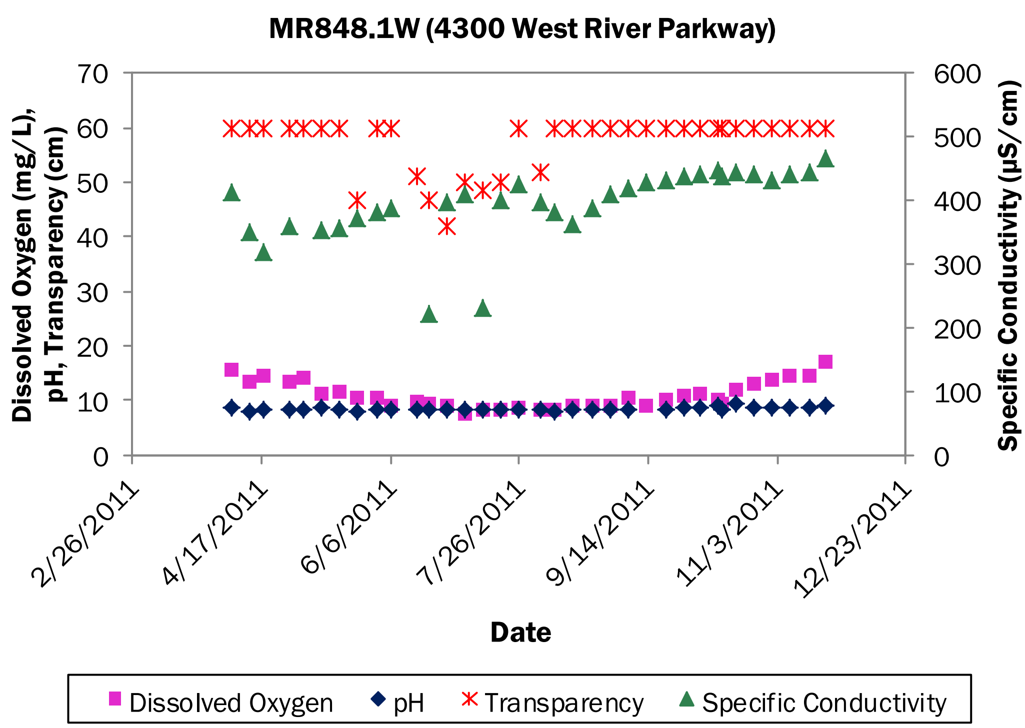

Figure D.14. Dissolved oxygen, pH, transparency, and specific conductivity for MR848.1W

Appendix E – Stormwater Monitoring Results

Table E.1. Monitoring results for 1NE outfall

Start Date Start Time	End Date End Time	Sample Type	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Specific Conductivity (µS/cm)	pH	Transparency (cm)	Salinity (ppt)	*E. coli* (CFU/ 100 mL)	Fluoride (mg/L)	Total Suspended Solids (mg/L)	Volatile Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Sulfate (mg/L)	Dissolved Phosphorus (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)
1/26/2011 10:55	1/26/2011 10:56	Base Grab	22	42.4	11.81	976	1,542	7.78	> 60.0	0.78	–	–	~ 2	< 1	~ 1,030	–	–	~ 0.020	–	0.77	–	–	–
2/15/2011 12:08	2/16/2011 4:05	Melt Composite	32	37.4	12.53	2,153	3,719	7.35	5.6	1.94	–	–	107	36	2,000	2.07	0.224	0.451	0.217	4.20	1.35	0.14	0.56
2/16/2011 11:26	2/16/2011 17:04	Melt Composite	41	49.5	10.66	1,391	1,963	7.63	5.1	1.01	–	–	120	35	1,320	14.60	0.181	0.445	0.171	3.90	0.93	0.10	0.49
2/22/2011 10:30	2/22/2011 10:31	Base Grab	18	40.6	12.23	1,054	1,715	7.68	> 60.0	0.87	–	–	~ 2	< 1	~ 1,030	–	–	~ 0.036	–	2.10	–	–	–
3/10/2011 10:05	3/10/2011 10:06	Base Grab	28	40.8	12.27	1,698	2,758	7.62	22.0	1.42	–	–	14	~ 4	1,550	85.20	~ 0.032	0.096	0.016	1.50	0.33	0.05	2.18
3/15/2011 14:00	3/15/2011 14:01	Melt Grab	36	38.5	13.26	555	939	8.09	4.0	0.46	–	–	142	37	506	10.70	0.147	0.391	0.140	2.50	0.43	0.10	0.35
3/15/2011 14:23	3/15/2011 17:39	Melt Composite	32	46.9	11.01	878	1,290	7.66	3.4	0.65	–	–	183	69	710	10.40	0.170	0.528	0.141	3.60	0.64	0.14	0.42
3/16/2011 13:06	3/16/2011 23:45	Melt Composite	50	55.0	9.73	535	698	7.45	9.8	0.34	–	–	90	31	345	10.40	0.169	0.364	–	2.00	0.52	0.05	0.36
3/17/2011 12:17	3/17/2011 18:48	Melt Composite	32	44.2	11.85	310	475	7.57	10.1	0.23	–	–	58	19	234	7.78	0.187	0.359	0.178	1.50	0.37	0.03	0.39
3/22/2011 12:35	3/22/2011 12:36	Rain Grab	37	37.9	13.24	237	404	7.53	10.6	0.19	–	–	–	–	175	7.62	0.087	0.494	0.081	2.40	0.28	0.04	0.59
3/22/2011 5:05	3/22/2011 11:45	Rain Composite	31	44.1	11.91	193	297	7.35	5.8	0.14	–	–	48	~ 14	238	15.30	0.137	0.249	0.134	1.30	0.37	0.05	1.17
4/25/2011 11:05	4/25/2011 11:06	Base Grab	55	53.4	9.73	1,034	1,377	7.57	> 60.0	0.69	–	–	3	~ 1	856	120.00	~ 0.017	~ 0.026	0.014	0.92	0.13	< 0.03	3.91
4/26/2011 4:02	4/26/2011 8:17	Rain Composite	40	44.1	10.26	120	185	7.38	11.8	0.09	–	–	–	–	104	4.71	0.091	0.374	0.073	2.00	0.15	< 0.03	0.23
4/26/2011 9:12	4/26/2011 9:12	Rain Grab	45	48.6	–	–	–	–	–	–	1,260	–	–	–	–	–	–	–	–	–	–	–	–
4/30/2011 4:16	4/30/2011 14:59	Rain Composite	35	42.6	9.85	133	210	7.39	17.8	0.10	–	–	–	–	91	8.26	~ 0.049	0.291	–	2.50	0.58	0.04	0.71
5/4/2011 9:05	5/4/2011 9:05	Base Grab	50	47.7	–	–	–	–	–	–	37	0.24	–	–	–	–	–	–	–	–	–	–	–
5/9/2011 8:50	5/9/2011 8:50	Rain Grab	50	54.3	–	–	–	–	–	–	1,515	–	–	–	–	–	–	–	–	–	–	–	–
5/9/2011 9:05	5/9/2011 9:06	Rain Grab	56	–	–	–	–	–	–	–	–	–	–	–	154	6.28	~ 0.027	0.314	0.022	1.70	0.09	0.03	0.49
5/12/2011 10:46	5/12/2011 13:15	Rain Composite	50	55.9	6.90	208	268	7.36	8.0	0.13	–	–	–	–	115	5.09	0.066	0.487	–	2.20	0.50	0.07	0.62
5/18/2011 11:37	5/18/2011 11:38	Base Grab	60	53.8	10.54	1,217	1,616	7.44	> 60.0	0.82	–	–	~ 1	~ 1	1,040	171.00	~ 0.010	~ 0.027	0.011	1.10	0.06	< 0.03	4.47
5/21/2011 4:00	5/21/2011 9:25	Rain Composite	65	63.9	5.69	124	144	7.15	26.2	0.07	–	–	–	–	81	4.58	0.051	0.200	–	1.40	0.24	0.04	0.32
6/8/2011 10:15	6/8/2011 10:16	Base Grab	75	59.7	9.68	1,240	1,518	8.03	> 60.0	0.77	–	–	~ 2	~ 1	1,000	156.00	~ 0.049	~ 0.043	0.026	1.00	0.06	< 0.03	3.79
6/14/2011 8:51	6/14/2011 8:51	Base Grab	65	52.2	–	–	–	–	–	–	517	0.26	–	–	–	–	–	–	–	–	–	–	–
6/14/2011 18:44	6/15/2011 9:54	Rain Composite	70	70.9	5.71	163	196	7.20	29.1	0.09	–	–	66	~ 26	93	5.08	0.097	0.271	–	1.40	0.11	0.04	0.26
6/15/2011 9:35	6/15/2011 9:35	Rain Grab	65	62.6	–	–	–	–	–	–	4,610		–	–	–	–	–	–	–	–	–	–	–
6/21/2011 3:46	6/21/2011 18:46	Rain Composite	65	70.9	6.19	67	71	7.55	9.7	0.03	–	–	–	–	91	2.05	0.063	0.401	0.048	2.10	0.17	0.05	0.30
6/27/2011 11:00	6/27/2011 11:05	Base Grab	70	65.7	8.51	1,285	1,462	8.18	> 60.0	0.74	–	–	~ 2	~ 1	903	131.50	~ 0.024	~ 0.045	0.025	0.91	< 0.02	< 0.03	2.90
6/30/2011 8:33	6/30/2011 8:33	Base Grab	73	55.0	–	–	–	–	–	–	19	0.26	–	–	–	–	–	–	–	–	–	–	–
7/7/2011 9:30	7/7/2011 9:31	Base Grab	80	65.5	8.66	1,414	1,612	8.10	> 60.0	0.82	–	–	~ 2	~ 1	969	99.10	~ 0.020	~ 0.019	0.010	0.77	~ 0.04	< 0.03	3.00
7/13/2011 9:00	7/13/2011 9:00	Base Grab	75	64.8	–	–	–	–	–	–	40	0.23	–	–	–	–	–	–	–	–	–	–	–
7/25/2011 12:00	7/25/2011 12:01	Base Grab	80	70.9	7.74	644	688	7.90	26.0	0.34	–	–	15	14	445	59.90	0.170	0.370	0.138	2.30	~ 0.02	< 0.03	1.24
7/27/2011 3:23	7/27/2011 6:35	Rain Composite	80	75.7	7.54	114	116	7.93	13.9	0.05	–	–	173	37	63	4.32	0.071	0.253	0.072	1.20	0.17	< 0.03	0.36
7/28/2011 9:55	7/28/2011 9:55	Base Grab	80	72.9	–	–	–	–	–	–	166	0.12	–	–	–	–	–	–	–	–	–	–	–
7/30/2011 23:14	7/31/2011 0:27	Rain Composite	80	80.2	5.36	178	172	7.28	23.9	0.08	–	–	228	70	84	5.54	0.087	0.263	–	0.98	0.22	0.07	0.39

Table E.1 continued. Monitoring results for 1NE outfall

Start Date Start Time	End Date End Time	Sample Type	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Specific Conductivity (µS/cm)	pH	Transparency (cm)	Salinity (ppt)	*E. coli* (CFU/ 100 mL)	Fluoride (mg/L)	Total Suspended Solids (mg/L)	Volatile Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Sulfate (mg/L)	Dissolved Phosphorus (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)
8/1/2011 13:36	8/2/2011 2:06	Rain Composite	80	77.2	6.42	57	57	7.39	10.8	0.03	—	—	852	~ 108	78	2.53	0.050	0.282	0.041	1.50	0.37	0.04	0.37
8/9/2011 10:05	8/9/2011 10:06	Base Grab	68	65.1	8.39	1,062	1,215	8.02	> 60.0	0.61	—	—	4	~ 2	769	96.50	0.268	0.411	0.231	3.40	0.93	0.37	2.93
8/18/2011 10:54	8/18/2011 10:54	Base Grab	75	67.1	—	—	—	—	—	—	579	0.15	—	—	—	—	—	—	—	—	—	—	—
8/22/2011 11:08	8/22/2011 11:09	Base Grab	75	61.0	9.72	1,337	1,611	8.05	> 60.0	0.82	—	—	< 1	~ 1	1,020	174.00	~ 0.025	~ 0.023	0.014	0.73	~ 0.04	< 0.03	3.11
8/31/2011 11:43	8/31/2011 11:43	Base Grab	75	61.9	—	—	—	—	—	—	770	0.24	—	—	—	—	—	—	—	—	—	—	—
9/8/2011 10:30	9/8/2011 10:30	Base Grab	75	59.9	—	—	—	—	—	—	387	0.25	—	—	—	—	—	—	—	—	—	—	—
9/12/2011 10:27	9/12/2011 10:28	Base Grab	77	62.1	9.46	1,318	1,568	8.04	> 60.0	0.79	—	—	< 1	< 1	1,005	188.50	~ 0.011	< 0.010	0.013	0.65	0.08	0.04	2.67
9/22/2011 9:50	9/22/2011 9:50	Base Grab	60	57.2	—	—	—	—	—	—	> 2,420	0.25	—	—	—	—	—	—	—	—	—	—	—
9/26/2011 10:35	9/26/2011 10:36	Base Grab	57	58.1	9.73	1,239	1,550	8.13	> 60.0	0.79	—	—	~ 1	< 1	1,050	—	—	~ 0.029	0.015	0.81	0.17	0.04	2.30
10/6/2011 10:04	10/6/2011 10:04	Base Grab	70	59.7	—	—	—	—	—	—	488	0.24	—	—	—	—	—	—	—	—	—	—	—
10/12/2011 10:52	10/12/2011 10:53	Base Grab	65	61.5	8.72	1,082	1,294	7.86	> 60.0	0.65	—	—	4	3	814	155.00	0.074	0.178	0.071	1.90	0.33	0.05	2.72
10/12/2011 12:42	10/13/2011 16:41	Rain Composite	55	59.0	6.82	264	326	7.00	13.4	0.16	—	—	179	73	—	58.00	0.446	0.956	0.417	2.80	~ 0.02	< 0.03	< 0.05
10/20/2011 10:24	10/20/2011 10:24	Base Grab	50	54.3	—	—	—	—	—	—	387	0.25	—	—	—	—	—	—	—	—	—	—	—
10/26/2011 10:24	10/26/2011 10:25	Base Grab	45	53.4	10.08	1,163	1,552	7.83	> 60.0	0.79	—	—	~ 1	~ 1	1,030	226.00	~ 0.018	~ 0.020	0.015	0.63	0.12	< 0.03	1.91
11/2/2011 9:42	11/2/2011 9:42	Base Grab	45	54.7	—	—	—	—	—	—	866	0.26	—	—	—	—	—	—	—	—	—	—	—
11/10/2011 9:50	11/10/2011 9:51	Base Grab	35	47.3	9.91	1,093	1,597	7.87	> 60.0	0.81	—	—	7	~ 1	1,120	332.00	~ 0.023	0.053	0.018	1.80	0.99	0.09	1.43
11/15/2011 10:05	11/15/2011 10:05	Base Grab	40	52.3	—	—	—	—	—	—	387	0.24	—	—	—	—	—	—	—	—	—	—	—
11/21/2011 10:10	11/21/2011 10:11	Base Grab	25	48.4	10.52	1,206	1,730	7.99	> 60.0	0.88	—	—	~ 1	~ 1	1,150	224.00	~ 0.018	< 0.010	0.011	1.10	0.39	0.05	1.77
12/14/2011 9:40	12/14/2011 9:41	Rain Grab	37	46.4	11.23	2,093	3,100	7.58	2.8	1.62	—	—	83	37	1,800	—	—	0.690	—	6.70	—	—	—
12/19/2011 10:26	12/19/2011 10:27	Base Grab	34	41.2	12.97	319	514	7.76	> 60.0	0.25	—	—	< 1	< 1	301	—	—	0.227	—	0.82	—	—	—

Table E.1 continued. Monitoring results for 1NE outfall

Start Date Start Time	End Date End Time	Sample Type	Alkalinity (mg/L CaCO3)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	Chemical Oxygen Demand (mg/L)	Total Organic Carbon (mg/L)	Carbonaceous Biological Oxygen Demand 5-day (mg/L)	Total Biological Oxygen Demand 5-day (mg/L)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)	Oil and Grease (mg/L)
1/26/2011 10:55	1/26/2011 10:56	Base Grab	—	133	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2/15/2011 12:08	2/16/2011 4:05	Melt Composite	66	1,228	144	147	14.6	16.0	20.0	< 0.0100	0.0300	< 0.0200	< 0.0200	< 0.0030	0.0160	0.0410	0.2860	< 0.0010	< 0.0010	< 0.0100	0.0140	< 6
2/16/2011 11:26	2/16/2011 17:04	Melt Composite	56	765	128	128	17.3	9.8	14.0	—	—	—	—	—	—	—	—	—	—	—	—	9
2/22/2011 10:30	2/22/2011 10:31	Base Grab	—	305	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3/10/2011 10:05	3/10/2011 10:06	Base Grab	226	657	392	44	8.5	3.0	4.3	—	—	—	—	—	—	—	—	—	—	—	—	13
3/15/2011 14:00	3/15/2011 14:01	Melt Grab	58	222	76	106	11.1	4.2	6.4	—	—	—	—	—	—	—	—	—	—	—	—	7
3/15/2011 14:23	3/15/2011 17:39	Melt Composite	57	323	96	170	16.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3/16/2011 13:06	3/16/2011 23:45	Melt Composite	52	142	104	76	8.3	—	—	0.0047	0.0166	0.0011	0.0047	~ 0.0004	0.0147	0.0331	0.1390	< 0.0002	~ 0.0003	0.0016	0.0065	< 6
3/17/2011 12:17	3/17/2011 18:48	Melt Composite	46	84	92	60	8.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	< 6
3/22/2011 12:35	3/22/2011 12:36	Rain Grab	24	61	52	172	7.3	4.9	6.8	—	—	—	—	—	—	—	—	—	—	—	—	6
3/22/2011 5:05	3/22/2011 11:45	Rain Composite	61	72	88	55	9.3	4.5	6.2	0.0040	0.0117	0.0010	0.0032	0.0006	0.0095	0.0233	0.0736	< 0.0002	< 0.0002	0.0026	0.0049	< 6
4/25/2011 11:05	4/25/2011 11:06	Base Grab	314	183	484	22	5.3	< 1.0	1.2	—	—	—	—	—	—	—	—	—	—	—	—	10
4/26/2011 4:02	4/26/2011 8:17	Rain Composite	29	33	56	112	9.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7
4/30/2011 4:16	4/30/2011 14:59	Rain Composite	38	29	56	125	6.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	< 6
5/9/2011 9:05	5/9/2011 9:06	Rain Grab	35	45	68	65	6.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	< 6
5/12/2011 10:46	5/12/2011 13:15	Rain Composite	52	38	—	174	7.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	15
5/18/2011 11:37	5/18/2011 11:38	Base Grab	398	208	604	16	3.4	< 1.0	< 1.0	—	—	—	—	—	—	—	—	—	—	—	—	< 6
5/21/2011 4:00	5/21/2011 9:25	Rain Composite	33	15	56	76	4.9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	< 6
6/8/2011 10:15	6/8/2011 10:16	Base Grab	366	208	560	20	5.3	< 1.0	< 1.0	—	—	—	—	—	—	—	—	—	—	—	—	8
6/14/2011 18:44	6/15/2011 9:54	Rain Composite	46	33	60	42	5.6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	< 6
6/21/2011 3:46	6/21/2011 18:46	Rain Composite	27	13	52	88	6.6	4.4	5.8	—	—	—	—	—	—	—	—	—	—	—	—	< 6
6/27/2011 11:00	6/27/2011 11:05	Base Grab	361	197	522	24	4.6	< 1.0	< 1.0	—	—	—	—	—	—	—	—	—	—	—	—	< 6
7/7/2011 9:30	7/7/2011 9:31	Base Grab	381	237	710	~ 14	4.0	< 1.0	< 1.0	0.0019	0.0018	0.0046	0.0046	< 0.0001	< <0.0001	0.0039	0.0052	< 0.0002	< 0.0002	~ 0.0001	0.0002	< 6
7/25/2011 12:00	7/25/2011 12:01	Base Grab	172	85	272	62	12.2	5.3	> 7.8	—	—	—	—	—	—	—	—	—	—	—	—	< 6
7/27/2011 3:23	7/27/2011 6:35	Rain Composite	23	9	44	63	5.5	4.2	7.0	—	—	—	—	—	—	—	—	—	—	—	—	< 6
7/30/2011 23:14	7/31/2011 0:27	Rain Composite	34	12	68	54	6.6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	< 6
8/1/2011 13:36	8/2/2011 2:06	Rain Composite	17	3	36	65	3.6	3.6	6.7	—	—	—	—	—	—	—	—	—	—	—	—	11
8/9/2011 10:05	8/9/2011 10:06	Base Grab	306	150	436	56	15.0	2.5	5.4	—	—	—	—	—	—	—	—	—	—	—	—	< 6
8/22/2011 11:08	8/22/2011 11:09	Base Grab	350	209	588	22	3.7	< 1.0	< 1.0	—	—	—	—	—	—	—	—	—	—	—	—	< 6
9/12/2011 10:27	9/12/2011 10:28	Base Grab	387	199	570	~ 14	4.0	< 1.0	< 1.0	—	—	—	—	—	—	—	—	—	—	—	—	< 6
9/26/2011 10:35	9/26/2011 10:36	Base Grab	223	192	576	~ 14	5.3	< 1.0	< 1.0	—	—	—	—	—	—	—	—	—	—	—	—	< 6
10/12/2011 10:52	10/12/2011 10:53	Base Grab	329	139	508	50	18.1	5.7	7.0	—	—	—	—	—	—	—	—	—	—	—	—	< 6
10/12/2011 12:42	10/13/2011 16:41	Rain Composite	85	33	140	193	33.9	—	—	0.0180	0.0457	0.0032	0.0077	0.0013	0.0167	0.0223	0.1800	< 0.0002	~ 0.0004	0.0019	0.0068	—
10/26/2011 10:24	10/26/2011 10:25	Base Grab	391	191	620	17	5.0	< 1.0	< 1.0	—	—	—	—	—	—	—	—	—	—	—	—	< 6
11/10/2011 9:50	11/10/2011 9:51	Base Grab	399	170	800	26	6.4	< 1.0	2.1	—	—	—	—	—	—	—	—	—	—	—	—	< 6
11/21/2011 10:10	11/21/2011 10:11	Base Grab	385	231	720	22	4.9	< 1.0	1.0	—	—	—	—	—	—	—	—	—	—	—	—	< 6
12/14/2011 9:40	12/14/2011 9:41	Rain Grab	—	777	—	—	—	—	—	—	0.0225	—	0.0061	—	0.0151	—	0.1780	—	~ 0.0002	—	0.0078	—
12/19/2011 10:26	12/19/2011 10:27	Base Grab	—	69	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table E.2. Monitoring results for 2NNBC outfall

Start Date Start Time	End Date End Time	Sample Type	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Specific Conductivity (µS/cm)	pH	Transparency (cm)	Salinity (ppt)	*E. coli* (CFU/ 100 mL)	Fluoride (mg/L)	Total Suspended Solids (mg/L)	Volatile Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Sulfate (mg/L)	Dissolved Phosphorus (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)
2/15/2011 14:50	2/15/2011 14:51	Melt Grab	38	42.4	11.31	2,232	3,523	7.73	10.0	1.85	–	–	44	16	2,040	32.30	0.177	0.325	0.143	3.20	0.99	0.11	1.50
2/16/2011 15:10	2/16/2011 15:11	Melt Grab	45	39.7	12.36	1,335	2,206	8.09	7.2	1.12	–	–	69	23	1,200	14.70	0.100	0.301	0.101	2.60	0.81	0.08	0.92
2/17/2011 15:00	2/17/2011 15:01	Melt Grab	44	37.6	12.46	842	1,446	7.70	10.0	0.72	–	–	66	26	774	12.50	0.161	0.326	0.135	2.60	0.64	0.08	0.60
3/22/2011 10:20	3/22/2011 10:21	Rain Grab	38	36.0	13.17	208	369	7.88	5.0	0.18	–	–	197	32	179	7.62	0.123	0.383	0.118	1.50	0.32	0.04	0.42
4/26/2011 15:20	4/26/2011 15:21	Rain Grab	45	48.0	10.80	262	379	7.94	17.4	0.18	–	–	30	~ 8	202	9.04	0.072	0.127	0.066	0.68	0.08	< 0.03	0.27
6/15/2011 13:10	6/15/2011 13:10	Rain Grab	65	63.1	–	–	–	–	–	–	3,450	–	–	–	–	–	–	–	–	–	–	–	–
7/15/2011 12:01	7/15/2011 0:02	Rain Grab	70	71.8	7.85	55	58	8.02	11.7	0.03	–	–	195	50	64	2.82	0.141	0.392	0.063	1.60	0.28	< 0.03	0.36
8/1/2011 16:31	8/1/2011 16:32	Rain Grab	75	73.8	5.82	209	217	7.78	–	0.10	–	–	33	~ 8	118	5.64	0.122	0.211	0.124	1.20	0.29	0.03	0.46
9/22/2011 13:03	9/22/2011 13:03	Base Grab	60	61.9	–	–	–	–	–	–	2,420	1.90	–	–	–	–	–	–	–	–	–	–	–
9/26/2011 11:28	9/26/2011 11:29	Base Grab	55	60.1	5.09	1,639	1,996	7.49	50.3	1.02	–	–	8	~ 3	1,265	165.00	0.070	0.496	0.029	2.20	0.84	0.07	1.98
10/6/2011 13:16	10/6/2011 13:16	Base Grab	70	62.4	–	–	–	–	–	–	178	2.65	–	–	–	–	–	–	–	–	–	–	–
10/12/2011 11:07	10/12/2011 11:08	Base Grab	70	64.4	4.22	1,527	1,763	7.37	> 60.0	0.90	–	–	4	~ 2	1,100	155.00	0.757	0.949	0.510	2.25	0.48	0.07	3.50
10/20/2011 11:13	10/20/2011 11:13	Base Grab	50	56.7	–	–	–	–	–	–	238	3.30	–	–	–	–	–	–	–	–	–	–	–
10/26/2011 10:55	10/26/2011 10:56	Base Grab	45	56.1	4.41	1,552	1,993	7.30	> 60.0	1.02	–	–	8	4	1,290	188.00	0.222	0.668	0.110	2.30	0.66	0.07	4.11
11/2/2011 12:58	11/2/2011 12:58	Base Grab	45	57.2	–	–	–	–	–	–	115	3.40	–	–	–	–	–	–	–	–	–	–	–
11/10/2011 10:30	11/10/2011 10:31	Base Grab	35	56.7	4.74	1,661	2,120	7.47	> 60.0	1.09	–	–	5	~ 2	1,350	172.00	0.599	0.906	0.395	1.80	0.67	0.05	5.12
11/15/2011 13:47	11/15/2011 13:47	Base Grab	40	55.6	–	–	–	–	–	–	39	3.30	–	–	–	–	–	–	–	–	–	–	–
11/21/2011 10:50	11/21/2011 10:51	Base Grab	25	47.3	3.76	4,247	6,209	7.33	47.4	3.39	–	–	6	3	3,660	129.00	0.802	0.864	0.492	3.30	0.84	0.09	4.48
12/14/2011 16:05	12/14/2011 16:06	Rain Grab	35	42.4	12.75	629	992	8.40	4.4	0.49	–	–	242	82	515	–	–	0.907	–	2.70	–	–	–
12/19/2011 10:58	12/19/2011 10:59	Base Grab	32	50.2	5.60	1,436	2,006	7.15	> 60.0	1.03	–	–	15	5	1,240	–	–	0.816	–	2.40	–	–	–

Table E.2 continued. Monitoring results for 2NNBC outfall

Start Date Start Time	End Date End Time	Sample Type	Alkalinity (mg/L CaCO3)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	Chemical Oxygen Demand (mg/L)	Total Organic Carbon (mg/L)	Carbonaceous Biological Oxygen Demand 5-day (mg/L)	Total Biological Oxygen Demand 5-day (mg/L)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)	Oil and Grease (mg/L)
2/15/2011 14:50	2/15/2011 14:51	Melt Grab	74	944	184	90	10.8	12.00	15.0	< 0.0100	0.0200	< 0.0200	< 0.0200	< 0.0030	0.0110	0.0580	0.1560	< 0.0010	< 0.0010	< 0.0100	< 0.0100	8
2/16/2011 15:10	2/16/2011 15:11	Melt Grab	179	687	124	91	14	9.10	14	–	–	–	–	–	–	–	–	–	–	–	–	< 6
2/17/2011 15:00	2/17/2011 15:01	Melt Grab	50	360	104	92	11.4	10.00	14.0	0.0100	0.0200	< 0.0200	< 0.0200	< 0.0030	0.0160	0.0540	0.1370	< 0.0010	< 0.0010	< 0.0100	< 0.0100	6
3/22/2011 10:20	3/22/2011 10:21	Rain Grab	45	75	104	92	8.9	2.70	4.1	0.0043	0.0199	0.0009	0.0064	0.0008	0.0239	0.0145	0.1140	< 0.0002	~ 0.0003	0.0031	0.0085	< 6
4/26/2011 15:20	4/26/2011 15:21	Rain Grab	37	84	88	32	8	2.90	4	–	–	–	–	–	–	–	–	–	–	–	–	< 6
7/15/2011 12:01	7/15/2011 0:02	Rain Grab	20	5	32	86	6.5	5.20	6.7	0.0021	0.0259	~ 0.0005	0.0060	0.0006	0.0345	0.0054	0.1460	< 0.0002	~ 0.0003	0.0080	0.0100	< 6
8/1/2011 16:31	8/1/2011 16:32	Rain Grab	44	28	68	36	5.9	3.40	5.6	–	–	–	–	–	–	–	–	–	–	–	–	< 6
9/26/2011 11:28	9/26/2011 11:29	Base Grab	382	378	654	43	13.4	1.15	1.8	0.0024	0.0044	0.0029	0.0030	< 0.0001	0.0005	0.0058	0.0099	< 0.0002	< 0.0002	0.0031	0.0010	< 6
10/12/2011 11:07	10/12/2011 11:08	Base Grab	320	325	572	58	25.1	2.55	3.3	–	–	–	–	–	–	–	–	–	–	–	–	~ 8
10/26/2011 10:55	10/26/2011 10:56	Base Grab	400	395	700	60	14.6	2.20	2.7	0.0034	0.0041	0.0035	0.0029	< 0.0001	0.0009	0.0145	0.0099	< 0.0002	< 0.0002	0.0006	0.0009	< 6
11/10/2011 10:30	11/10/2011 10:31	Base Grab	396	393	870	58	15.3	1.30	1.8	–	–	–	–	–	–	–	–	–	–	–	–	< 6
11/21/2011 10:50	11/21/2011 10:51	Base Grab	389	1,846	740	91	14.8	5.30	5.9	–	–	–	–	–	–	–	–	–	–	–	–	< 6
12/14/2011 16:05	12/14/2011 16:06	Rain Grab	–	244	–	–	–	–	–	–	0.0561	–	0.0105	–	0.0542	–	0.3790	–	0.0007	–	0.0176	–
12/19/2011 10:58	12/19/2011 10:59	Base Grab	–	358	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table E.3. Monitoring results for 4PP outfall

Start Date Start Time	End Date End Time	Sample Type	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Specific Conductivity (µS/cm)	pH	Transparency (cm)	Salinity (ppt)	*E. coli* (CFU/ 100 mL)	Fluoride (mg/L)	Total Suspended Solids (mg/L)	Volatile Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Sulfate (mg/L)	Dissolved Phosphorus (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)
1/26/2011 12:55	1/26/2011 12:56	Base Grab	20	48.4	10.61	1,176	1,687	8.91	> 60.0	0.86	—	—	~ 1	< 1	1,020	—	—	~ 0.034	—	0.79	—	—	—
2/15/2011 14:30	2/15/2011 14:31	Melt Grab	38	41.5	12.07	2,836	4,542	7.60	3.4	2.42	—	—	196	70	1,980	29.70	0.204	0.545	0.195	6.10	1.51	0.22	0.72
2/16/2011 13:50	2/16/2011 13:51	Melt Grab	50	45.1	11.61	2,484	3,752	7.65	4.8	1.89	—	—	120	~ 50	1,990	26.50	0.167	0.387	0.165	4.60	1.37	0.15	0.79
2/17/2011 13:27	2/17/2001 13:28	Melt Grab	43	39.6	13.01	1,271	2,106	7.73	6.8	1.07	—	—	97	38	1,040	20.10	0.235	0.438	0.201	3.80	1.21	0.13	0.71
2/22/2011 10:55	2/22/2011 10:56	Base Grab	18	37.9	11.36	1,142	1,949	7.62	> 60.0	0.98	—	—	16	7	1,120	—	—	~ 0.025	—	0.51	—	—	—
3/10/2011 10:40	3/10/2011 10:41	Base Grab	29	48.2	10.02	1,229	1,772	7.64	> 60.0	0.90	—	—	~ 1	< 1	1,030	68.50	~ 0.014	~ 0.033	0.015	0.57	0.06	< 0.03	1.37
3/15/2011 15:02	3/15/2011 15:03	Melt Grab	36	39.9	12.83	1,024	1,689	7.79	5.3	0.85	—	—	121	53	1,040	24.20	0.120	0.340	0.110	3.20	0.65	0.12	0.76
3/22/2011 10:55	3/22/2011 10:56	Rain Grab	38	36.7	13.85	166	291	7.68	9.5	0.14	—	—	81	28	159	8.33	0.098	0.232	0.088	1.10	0.37	0.03	0.29
4/26/2011 12:45	4/26/2011 12:45	Rain Grab	45	47.7	—	—	—	—	—	—	780	—	—	—	—	—	—	—	—	—	—	—	—
5/9/2011 11:32	5/9/2011 11:33	Rain Grab	55	32.0	—	—	—	—	—	—	1,989	—	—	—	204	16.80	~ 0.016	0.278	0.012	1.50	< 0.02	0.05	0.43
6/14/2011 12:30	6/14/2011 12:30	Base Grab	70	54.7	—	—	—	—	—	—	345	0.17	—	—	—	—	—	—	—	—	—	—	—
6/15/2011 12:44	6/15/2011 12:44	Rain Grab	65	61.7	—	—	—	—	—	—	4,110	—	—	—	—	—	—	—	—	—	—	—	—
6/20/2011 13:05	6/20/2011 13:06	Base Grab	74	55.0	9.48	1,029	1,343	8.12	—	0.68	—	—	29	~ 4	835	39.20	0.039	0.173	0.043	0.63	0.07	< 0.03	1.62
7/7/2011 11:33	7/7/2011 11:34	Base Grab	80	66.9	8.84	1,266	1,417	8.27	> 60.0	0.71	—	—	~ 1	~ 1	789	86.80	~ 0.026	0.066	0.030	0.50	~ 0.04	< 0.03	1.79
7/13/2011 12:05	7/13/2011 12:05	Base Grab	78		—	—	—	—	—	—	770	0.21	—	—	—	—	—	—	—	—	—	—	—
7/15/2011 12:54	7/15/2011 12:56	Rain Grab	70	71.2	8.56	72	76	7.88	12.5	0.03	—	—	213	44	57	1.28	0.089	0.282	0.042	1.04	0.16	< 0.03	0.16
8/2/2011 11:35	8/2/2011 11:35	Rain Grab	80	67.6	—	—	—	—	—	—	17,330	—	—	—	—	—	—	—	—	—	—	—	—
8/18/2011 13:17	8/18/2011 13:17	Base Grab	75	64.0	—	—	—	—	—	—	1,986	0.14	—	—	—	—	—	—	—	—	—	—	—
8/22/2011 11:55	8/22/2011 11:56	Rain Grab	75	56.7	9.90	1,060	1,352	8.16	> 60.0	0.68	—	—	~ 2	~ 1	826	88.70	~ 0.038	0.057	0.032	0.65	0.10	0.03	1.95
8/31/2011 12:25	8/31/2011 12:25	Base Grab	70	57.6	—	—	—	—	—	—	109	0.18	—	—	—	—	—	—	—	—	—	—	—
9/3/2011 3:36	9/3/2011 6:40	Unknown Discharge Composite	70	60.8	8.74	544	656	7.55	—	0.32	—	—	186	58	409	34.80	0.051	0.167	—	0.95	0.12	0.08	0.98
9/8/2011 12:51	9/8/2011 12:51	Base Grab	75	58.6	—	—	—	—	—	—	79	0.16	—	—	—	—	—	—	—	—	—	—	—
9/12/2011 11:35	9/12/2011 11:36	Base Grab	84	58.1	9.76	1,118	1,397	8.23	> 60.0	0.70	—	—	~ 1	< 1	828	83.30	~ 0.035	~ 0.020	0.027	0.39	0.06	< 0.03	2.14
9/21/2011 6:46	9/21/2011 8:19	Rain Composite	58	44.1	11.07	456	701	7.97	—	0.34	—	—	61	26	—	36.60	0.073	0.232	—	1.40	0.08	0.04	1.19
9/22/2011 12:40	9/22/2011 12:40	Base Grab	60	54.9	—	—	—	—	—	—	> 2,420	0.16	—	—	—	—	—	—	—	—	—	—	—
9/26/2011 12:34	9/26/2011 12:35	Base Grab	59	56.1	10.21	1,064	1,367	8.35	> 60.0	0.69	—	—	~ 1	~ 1	848	82.70	~ 0.035	~ 0.049	0.025	0.53	0.06	< 0.03	1.97
10/4/2011 12:55	10/4/2011 12:55	Base Grab	70	56.8	—	—	—	—	—	—	133	0.15	—	—	—	—	—	—	—	—	—	—	—
10/12/2011 11:50	10/12/2011 11:51	Base Grab	70	57.4	9.73	1,078	1,362	8.15	57.4	0.69	—	—	6	~ 1	794	84.30	~ 0.029	~ 0.048	0.029	0.45	~ 0.04	< 0.03	1.68
10/12/2011 12:29	10/12/2011 20:47	Rain Composite	55	58.5	7.42	232	289	7.40	10.0	0.14	—	—	171	69	136	11.50	0.146	0.734	0.142	3.40	~ 0.02	< 0.03	< 0.05
10/20/2011 11:39	10/20/2011 11:39	Base Grab	50	52.2	—	—	—	—	—	—	1,046	0.14	—	—	—	—	—	—	—	—	—	—	—
10/26/2011 12:33	10/26/2011 12:34	Base Grab	45	53.6	9.84	1,069	1,422	8.04	> 60.0	0.72	—	—	~ 2	~ 1	848	94.75	~ 0.022	~ 0.037	0.024	0.40	0.06	< 0.03	1.89
11/2/2011 12:35	11/2/2011 12:35	Base Grab	45	53.1	—	—	—	—	—	—	53	0.11	—	—	—	—	—	—	—	—	—	—	—
11/10/2011 11:03	11/10/2011 11:04	Base Grab	35	50.4	10.21	987	1,376	8.29	> 60.0	0.69	—	—	5	~ 1	797	90.50	~ 0.040	~ 0.041	0.023	0.64	~ 0.04	< 0.03	1.86
11/15/2011 13:26	11/15/2011 13:26	Base Grab	40	52.0	—	—	—	—	—	—	31	0.15	—	—	—	—	—	—	—	—	—	—	—
11/21/2011 11:32	11/21/2011 11:33	Base Grab	25	48.0	11.02	1,085	1,566	8.45	> 60.0	0.79	—	—	10	~ 1	930	86.00	~ 0.022	~ 0.035	0.025	0.39	~ 0.05	< 0.03	2.16
12/14/2011 12:16	12/14/2011 12:16	Rain Grab	40	49.8	9.70	1,328	1,864	7.94	7.4	0.95	—	—	25	16	1,090	—	—	0.181	—	1.60	—	—	—
12/19/2011 11:25	12/19/2011 11:26	Base Grab	32	48.9	10.36	941	1,342	7.90	> 60.0	0.67	—	—	~ 1	< 1	780	—	—	~ 0.044	—	0.50	—	—	—
12/31/2011 21:00	1/1/2012 4:16	Rain Composite	20	43.9	6.40	2,814	4,334	7.59	4.4	2.31	—	—	125	60	2,330	—	—	0.455	—	3.35	—	—	—

Table E.3 continued. Monitoring results for 4PP outfall

Start Date Start Time	End Date End Time	Sample Type	Alkalinity (mg/L CaCO3)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	Chemical Oxygen Demand (mg/L)	Total Organic Carbon (mg/L)	Carbonaceous Biological Oxygen Demand 5-day (mg/L)	Total Biological Oxygen Demand 5-day (mg/L)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)	Oil and Grease (mg/L)
1/26/2011 12:55	1/26/2011 12:56	Base Grab	–	316	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2/15/2011 14:30	2/15/2011 14:31	Melt Grab	71	1,431	244	270	17.4	> 23.0	> 23.0	0.0250	0.0680	< 0.0200	< 0.0200	< 0.0030	0.0350	0.0410	0.3950	< 0.0010	< 0.0010	< 0.0100	0.0250	27
2/16/2011 13:50	2/16/2011 13:51	Melt Grab	65	1,211	196	188	23.3	18.0	25.0	–	–	–	–	–	–	–	–	–	–	–	–	13
2/17/2011 13:27	2/17/2001 13:28	Melt Grab	76	554	132	136	16.1	13.0	18.0	0.0130	0.0320	< 0.0200	< 0.0200	< 0.0030	0.0160	0.0460	0.1850	< 0.0010	< 0.0010	< 0.0100	0.0140	12
2/22/2011 10:55	2/22/2011 10:56	Base Grab	–	447	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3/10/2011 10:40	3/10/2011 10:41	Base Grab	276	329	508	20	3.4	1.8	2.0	–	–	–	–	–	–	–	–	–	–	–	–	< 6
3/15/2011 15:02	3/15/2011 15:03	Melt Grab	97	496	160	150	12.4	11.5	16.0	–	–	–	–	–	–	–	–	–	–	–	–	15
3/22/2011 10:55	3/22/2011 10:56	Rain Grab	36	56	76	82	6.7	4.6	6.8	0.0062	0.0226	0.0007	0.0038	0.0007	0.0180	0.0280	0.1240	< 0.0002	< 0.0002	0.0037	0.0084	< 6
5/9/2011 11:32	5/9/2011 11:33	Rain Grab	57	56	128	58	6.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	< 6
6/20/2011 13:05	6/20/2011 13:06	Base Grab	276	253	472	24	3.5	< 1.0	< 1.0	–	–	–	–	–	–	–	–	–	–	–	–	< 7
7/7/2011 11:33	7/7/2011 11:34	Base Grab	305	283	522	~ 12	2.9	< 1.0	< 1.0	0.0009	0.0015	0.0018	0.0018	< 0.0001	< 0.0001	0.0040	0.0040	< 0.0002	< 0.0002	~ 0.0001	0.0003	< 6
7/15/2011 12:54	7/15/2011 12:56	Rain Grab	11	2	32	68	5.8	3.8	4.9	0.0028	0.0218	~ 0.0005	0.0059	0.0006	0.0378	0.0127	0.0995	< 0.0002	~ 0.0002	0.0104	0.0103	6
8/22/2011 11:55	8/22/2011 11:56	Rain Grab	280	245	464	17	2.5	< 1.0	< 1.0	–	–	–	–	–	–	–	–	–	–	–	–	< 5
9/3/2011 3:36	9/3/2011 6:40	Unknown Discharge Composite	134	107	228	120	10.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
9/12/2011 11:35	9/12/2011 11:36	Base Grab	296	253	488	~ 13	3.2	2.2	2.7	–	–	–	–	–	–	–	–	–	–	–	–	6
9/21/2011 6:46	9/21/2011 8:19	Rain Composite	147	102	260	92	13.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
9/26/2011 12:34	9/26/2011 12:35	Base Grab	297	247	496	16	3.5	< 1.0	< 1.0	–	–	–	–	–	–	–	–	–	–	–	–	< 6
10/12/2011 11:50	10/12/2011 11:51	Base Grab	304	252	508	20	5.9	1.4	1.6	–	–	–	–	–	–	–	–	–	–	–	–	< 6
10/12/2011 12:29	10/12/2011 20:47	Rain Composite	68	32	100	176	29.0	36.0	46.0	0.0155	0.0448	0.0020	0.0065	0.0020	0.0382	0.0469	0.2060	< 0.0002	~ 0.0004	0.0046	0.0120	–
10/26/2011 12:33	10/26/2011 12:34	Base Grab	321	261	528	~ 13	2.8	< 1.0	1.1	–	–	–	–	–	–	–	–	–	–	–	–	–
11/10/2011 11:03	11/10/2011 11:04	Base Grab	300	227	512	~ 14	2.6	< 1.0	< 1.0	–	–	–	–	–	–	–	–	–	–	–	–	< 6
11/21/2011 11:32	11/21/2011 11:33	Base Grab	315	301	508	~ 10	3.4	< 1.0	< 1.0	–	–	–	–	–	–	–	–	–	–	–	–	< 6
12/14/2011 12:16	12/14/2011 12:16	Rain Grab	–	423	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12/19/2011 11:25	12/19/2011 11:26	Base Grab	–	210	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12/31/2011 21:00	1/1/2012 4:16	Rain Composite	–	1,477	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table E.4. Monitoring results for 6UMN outfall

Start Date Start Time	End Date End Time	Sample Type	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Specific Conductivity (µS/cm)	pH	Transparency (cm)	Salinity (ppt)	*E. coli* (CFU/ 100 mL)	Fluoride (mg/L)	Total Suspended Solids (mg/L)	Volatile Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Sulfate (mg/L)	Dissolved Phosphorus (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)
1/26/2011 11:58	1/26/2011 11:59	Base Grab	20	46.2	11.31	1,065	1,581	8.12	> 60.0	0.80	–	–	< 1	< 1	948	–	–	~ 0.020	–	0.75	–	–	–
2/15/2011 13:40	2/15/2011 13:41	Melt Grab	38	42.6	12.25	1,998	3,148	7.78	3.0	1.64	–	–	185	52	1,880	26.30	0.100	0.451	0.101	3.80	0.82	0.17	0.74
2/16/2011 13:10	2/16/2011 13:11	Melt Grab	46	43.5	12.41	1,692	2,626	7.81	3.4	1.36	–	–	148	~ 40	1,350	22.90	0.094	0.294	0.091	2.20	0.67	0.11	0.68
2/17/2011 14:25	2/17/2011 14:26	Melt Grab	43	39.6	13.09	1,001	1,662	7.65	5.1	0.84	–	–	152	37	878	11.90	0.090	0.270	0.084	2.30	0.71	0.09	0.49
2/22/2011 13:42	2/22/2011 13:43	Base Grab	18	46.6	10.88	6,606	9,751	7.82	> 60.0	5.48	–	–	~ 8	~ 4	5,170	–	–	0.079	–	0.81	–	–	–
3/10/2011 11:15	3/10/2011 11:16	Base Grab	29	40.6	11.96	1,031	1,677	7.87	> 60.0	0.85	–	–	~ 1	~ 1	967	64.20	0.050	~ 0.040	0.022	0.72	0.08	< 0.03	2.90
3/15/2011 14:35	3/15/2011 14:36	Melt Grab	38	43.5	12.37	704	1,091	7.89	5.1	0.54	–	–	216	60	578	18.60	0.128	0.454	0.114	2.60	0.47	0.12	0.65
3/22/2011 11:25	3/22/2011 11:26	Rain Grab	38	41.2	12.17	312	503	7.56	7.2	0.24	–	–	104	~ 24	230	7.34	0.079	0.222	0.080	0.84	0.22	0.03	0.26
4/26/2011 12:00	4/26/2011 12:01	Rain Grab	45	47.3	10.35	319	465	7.60	5.8	0.23	180	–	–	–	87	3.52	0.051	0.199	0.047	0.69	0.07	< 0.03	0.13
6/14/2011 11:46	6/14/2011 11:46	Base Grab	70	58.6	–	–	–	–	–	–	> 2,420	–	–	–	–	–	–	–	–	–	–	–	–
6/15/2011 10:06	6/15/2011 10:06	Rain Grab	65	60.8	–	–	–	–	–	–	3,080	0.24	–	–	–	–	–	–	–	–	–	–	–
6/20/2011 12:05	6/20/2011 12:06	Base Grab	70	61.3	9.45	610	732	8.36	> 60.0	0.36	–	–	3	~ 1	733	77.50	~ 0.036	0.080	0.093	0.71	~ 0.05	< 0.03	1.44
6/27/2011 12:54	6/27/2011 12:55	Base Grab	70	56.8	9.87	625	796	8.37	> 60.0	0.39	–	–	~ 1	< 1	801	81.90	0.073	0.065	0.057	0.56	< 0.02	< 0.03	1.51
7/7/2011 11:00	7/7/2011 11:01	Base Grab	80	62.1	8.65	1,218	1,446	8.26	> 60.0	0.73	–	–	~ 2	~ 1	806	90.60	~ 0.018	~ 0.033	~ 0.007	0.57	< 0.02	< 0.03	1.47
7/13/2011 11:14	7/13/2011 11:14	Base Grab	75	63.1	–	–	–	–	–	–	162	0.25	–	–	–	–	–	–	–	–	–	–	–
7/15/2011 11:22	7/15/2011 11:24	Rain Grab	70	68.4	7.99	126	139	8.00	10.0	0.06	–	–	172	29	92	5.17	0.055	0.202	0.046	1.20	1.44	0.04	0.94
8/2/2011 12:14	8/2/2011 12:14	Rain Grab	80	68.7	–	–	–	–	–	–	9,800	–	–	–	–	–	–	–	–	–	–	–	–
8/16/2011 19:13	8/16/2011 20:40	Rain Composite	75	72.9	7.97	65	68	7.59	23.0	0.03	–	–	68	15	66	2.58	0.031	0.139	0.030	0.82	0.13	< 0.03	0.32
8/18/2011 12:34	8/18/2011 12:34	Base Grab	75	65.3	–	–	–	–	–	–	66	0.20	–	–	–	–	–	–	–	–	–	–	–
8/22/2011 12:32	8/22/2011 12:33	Base Grab	75	61.0	9.79	1,156	1,392	8.36	> 60.0	0.70	–	–	< 1	~ 1	825	95.40	~ 0.033	~ 0.039	0.034	0.50	~ 0.03	< 0.03	1.97
8/31/2011 11:00	8/31/2011 11:00	Base Grab	75	60.8	–	–	–	–	–	–	132	0.23	–	–	–	–	–	–	–	–	–	–	–
9/3/2011 5:13	9/3/2011 12:45	Unknown Discharge Composite	70	59.0	9.36	372	460	7.39	–	0.22	–	–	88	32	282	26.10	0.327	0.489	–	1.00	0.10	0.07	0.91
9/8/2011 12:18	9/8/2011 12:18	Base Grab	75	61.2	–	–	–	–	–	–	517	0.24	–	–	–	–	–	–	–	–	–	–	–
9/12/2011 12:00	9/12/2011 12:01	Base Grab	84	60.1	9.39	1,142	1,393	8.32	> 60.0	0.70	–	–	~ 1	< 1	820	88.10	~ 0.034	~ 0.011	0.023	0.58	~ 0.06	< 0.03	1.90
9/22/2011 12:05	9/22/2011 12:05	Base Grab	60	55.8	–	–	–	–	–	–	133	0.23	–	–	–	–	–	–	–	–	–	–	–
9/26/2011 12:52	9/26/2011 12:53	Base Grab	60	57.4	9.85	1,082	1,367	8.28	> 60.0	0.69	–	–	< 1	< 1	854	81.80	~ 0.017	0.051	0.018	0.43	~ 0.04	< 0.03	1.77
10/6/2011 12:19	10/6/2011 12:19	Base Grab	70	58.6	–	–	–	–	–	–	579	0.30	–	–	–	–	–	–	–	–	–	–	–
10/13/2011 11:02	10/13/2011 11:03	Base Grab	55	57.9	9.51	836	1,048	8.07	> 60.0	0.52	–	–	~ 2	~ 2	609	65.45	0.102	0.150	0.099	0.80	~ 0.03	< 0.03	1.30
10/20/2011 12:16	10/20/2011 12:16	Base Grab	50	54.0	–	–	–	–	–	–	–	0.20	–	–	–	–	–	–	–	–	–	–	–
10/26/2011 12:00	10/26/2011 12:01	Base Grab	45	53.8	10.14	982	1,304	8.25	> 60.0	0.66	–	–	7	~ 1	811	89.20	~ 0.024	~ 0.039	0.019	–	~ 0.05	< 0.03	1.77
11/2/2011 11:50	11/2/2011 11:50	Base Grab	45	52.5	–	–	–	–	–	–	36	0.20	–	–	–	–	–	–	–	–	–	–	–
11/10/2011 11:58	11/10/2011 11:59	Base Grab	35	51.4	10.97	984	1,352	8.37	> 60.0	0.68	–	–	~ 2	~ 1	801	88.00	~ 0.014	~ 0.025	0.011	0.29	< 0.02	< 0.03	1.81
11/15/2011 12:48	11/15/2011 12:48	Base Grab	40	52.3	–	–	–	–	–	–	< 1	0.17	–	–	–	–	–	–	–	–	–	–	–
11/21/2011 12:09	11/21/2011 12:10	Base Grab	25	49.6	10.74	1,569	2,213	8.16	> 60.0	1.14	–	–	~ 2	~ 1	1,330	82.60	~ 0.016	~ 0.021	0.017	–	~ 0.02	< 0.03	1.91
12/14/2011 10:55	12/14/2011 10:56	Rain Grab	37	49.1	10.09	981	1,394	7.91	5.4	0.70	–	–	50	20	804	–	–	0.232	–	2.00	–	–	–
12/19/2011 11:45	12/19/2011 11:46	Base Grab	32	49.1	11.19	878	1,249	8.10	> 60.0	0.63	–	–	~ 2	~ 1	723	–	–	0.050	–	0.45	–	–	–

Table E.4 continued. Monitoring results for 6UMN outfall

Start Date Start Time	End Date End Time	Sample Type	Alkalinity (mg/L CaCO3)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	Chemical Oxygen Demand (mg/L)	Total Organic Carbon (mg/L)	Carbonaceous Biological Oxygen Demand 5-day (mg/L)	Total Biological Oxygen Demand 5-day (mg/L)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)	Oil and Grease (mg/L)
1/26/2011 11:58	1/26/2011 11:59	Base Grab	–	299	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2/15/2011 13:40	2/15/2011 13:41	Melt Grab	100	877	204	192	11.5	13.0	19.0	< 0.0100	0.0440	< 0.0200	< 0.0200	< 0.0300	0.0440	< 0.0200	0.2640	< 0.0010	< 0.0010	< 0.0100	0.0200	12
2/16/2011 13:10	2/16/2011 13:11	Melt Grab	68	759	200	146	17.0	9.3	13.0	–	–	–	–	–	–	–	–	–	–	–	–	–
2/17/2011 14:25	2/17/2011 14:26	Melt Grab	33	496	156	104	10.0	7.2	10.0	< 0.0100	0.0250	< 0.0200	< 0.0200	< 0.0300	0.0280	< 0.0200	0.1560	< 0.0010	< 0.0010	< 0.0100	0.0120	21
2/22/2011 13:42	2/22/2011 13:43	Base Grab	–	3042	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3/10/2011 11:15	3/10/2011 11:16	Base Grab	317	287	508	17	3.5	< 1.0	< 1.0	–	–	–	–	–	–	–	–	–	–	–	–	< 6
3/15/2011 14:35	3/15/2011 14:36	Melt Grab	94	213	184	142	10.6	5.2	9.2	–	–	–	–	–	–	–	–	–	–	–	–	7
3/22/2011 11:25	3/22/2011 11:26	Rain Grab	41	81	84	76	8.7	3.2	4.6	0.0043	0.0199	0.0012	0.0061	0.0011	0.0229	0.0116	0.0116	< 0.0002	< 0.0002	0.0047	0.0091	< 6
4/26/2011 12:00	4/26/2011 12:01	Rain Grab	20	16	52	49	9.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6
6/20/2011 12:05	6/20/2011 12:06	Base Grab	307	189	472	19	2.9	< 1.0	< 1.0	–	–	–	–	–	–	–	–	–	–	–	–	< 7
6/27/2011 12:54	6/27/2011 12:55	Base Grab	340	226	508	18	3.0	< 1.0	< 1.0	–	–	–	–	–	–	–	–	–	–	–	–	6
7/7/2011 11:00	7/7/2011 11:01	Base Grab	347	255	572	21	4.9	4.3	4.6	0.0024	0.0027	0.0051	0.0052	< 0.0001	~ 0.0001	0.0064	0.0064	< 0.0002	< 0.0002	0.0002	0.0003	< 6
7/15/2011 11:22	7/15/2011 11:24	Rain Grab	23	8	60	59	7.0	4.1	5.4	0.0054	0.0191	0.00086	0.0046	~ 0.00044	0.0223	0.0062	0.0752	< 0.0002	< 0.0002	0.0069	0.0069	< 6
8/16/2011 19:13	8/16/2011 20:40	Rain Composite	18	6	60	41	3.3	2.7	4.4	–	–	–	–	–	–	–	–	–	–	–	–	< 6
8/22/2011 12:32	8/22/2011 12:33	Base Grab	355	220	555	13	2.8	< 1.0	< 1.0	–	–	–	–	–	–	–	–	–	–	–	–	< 6
9/3/2011 5:13	9/3/2011 12:45	Unknown Discharge Composite	109	68	168	82	11.4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
9/12/2011 12:00	9/12/2011 12:01	Base Grab	356	218	508	~ 8	2.5	< 1.0	< 1.0	–	–	–	–	–	–	–	–	–	–	–	–	6
9/26/2011 12:52	9/26/2011 12:53	Base Grab	349	226	508	~ 14	7.2	< 1.0	< 1.0	–	–	–	–	–	–	–	–	–	–	–	–	< 6
10/13/2011 11:02	10/13/2011 11:03	Base Grab	278	144	434	17	7.4	1.8	2.2	–	–	–	–	–	–	–	–	–	–	–	–	–
10/26/2011 12:00	10/26/2011 12:01	Base Grab	354	215	536	~ 13	3.1	< 1.0	< 1.0	–	–	–	–	–	–	–	–	–	–	–	–	< 6
11/10/2011 11:58	11/10/2011 11:59	Base Grab	331	205	524	~ 10	2.2	< 1.0	< 1.0	–	–	–	–	–	–	–	–	–	–	–	–	< 6
11/21/2011 12:09	11/21/2011 12:10	Base Grab	368	491	516	22	4.1	2.3	2.3	–	–	–	–	–	–	–	–	–	–	–	–	12
12/14/2011 10:55	12/14/2011 10:56	Rain Grab	–	244	–	–	–	–	–	–	0.0172	–	–	–	0.0104	–	0.1210	–	< 0.0002	–	0.0053	–
12/19/2011 11:45	12/19/2011 11:46	Base Grab	–	147	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table E.5. Monitoring results for 7LSTU outfall

Start Date Start Time	End Date End Time	Sample Type	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Specific Conductivity (µS/cm)	pH	Transparency (cm)	Salinity (ppt)	*E. coli* (CFU/ 100 mL)	Fluoride (mg/L)	Total Suspended Solids (mg/L)	Volatile Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Sulfate (mg/L)	Dissolved Phosphorus (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)
3/22/2011 9:20	3/22/2011 9:21	Rain Grab	38	35.2	14.92	255	459	8.19	2.0	0.22	–	–	370	78	277	7.58	0.142	0.913	0.130	2.60	0.34	0.04	0.38
4/26/2011 11:05	4/26/2011 11:06	Rain Grab	45	46.6	12.07	195	288	8.31	4.5	0.14	480	–	–	–	178	5.29	0.108	0.583	0.080	1.90	~ 0.03	< 0.03	< 0.05
5/9/2011 10:36	5/9/2011 10:37	Rain Grab	55	53.1	–	–	–	–	–	–	882	–	–	–	254	12.00	~ 0.034	0.249	0.030	1.40	0.21	0.05	0.69
6/15/2011 10:37	6/15/2011 10:37	Rain Grab	65	62.1	–	–	–	–	–	–	4,350	–	–	–	–	–	–	–	–	–	–	–	–
7/15/2011 10:34	7/15/2011 10:35	Rain Grab	70	70.7	8.75	155	166	8.29	2.3	0.08	–	–	639	115	163	10.20	0.107	1.050	0.084	3.10	0.56	< 0.06	0.78
8/1/2011 15:03	8/1/2011 15:04	Rain Grab	75	70.5	9.02	102	109	8.48	–	0.05	–	–	514	~ 97	175	3.76	0.150	1.280	0.149	3.10	0.24	< 0.30	< 0.50
11/10/2011 13:22	11/10/2011 13:23	Base Grab	35	50.0	10.77	1,483	2,077	8.27	> 60.0	–	–	–	4	~ 1	1,280	154.00	~ 0.012	~ 0.025	0.060	0.59	< 0.02	< 0.03	1.64
11/15/2011 12:03	11/15/2011 12:03	Base Grab	40	51.8	–	–	–	–	–	–	182	0.24	–	–	–	–	–	–	–	–	–	–	–
11/21/2011 12:55	11/21/2011 12:56	Base Grab	25	46.6	11.39	2,234	3,299	8.21	22.2	–	–	–	15	7	2,010	50.80	~ 0.023	0.065	0.022	1.30	0.21	0.05	1.52
12/14/2011 11:47	12/14/2011 11:48	Rain Grab	40	46.6	11.15	1,275	1,885	8.01	3.2	–	–	–	116	55	1,040	–	–	0.439	–	3.40	–	–	–

Table E. 5 continued. Monitoring results for 7LSTU outfall

Start Date Start Time	End Date End Time	Sample Type	Alkalinity (mg/L CaCO3)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	Chemical Oxygen Demand (mg/L)	Total Organic Carbon (mg/L)	Carbonaceous Biological Oxygen Demand 5-day (mg/L)	Total Biological Oxygen Demand 5-day (mg/L)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)	Oil and Grease (mg/L)
3/22/2011 9:20	3/22/2011 9:21	Rain Grab	60	83	116	232	13.2	14.3	21.0	0.0064	0.0602	0.0014	0.0153	0.0010	0.1360	0.0068	0.4510	< 0.0002	0.0013	0.0050	0.0198	12
4/26/2011 11:05	4/26/2011 11:06	Rain Grab	46	60	88	154	14.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	12
5/9/2011 10:36	5/9/2011 10:37	Rain Grab	68	86	124	66	8.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	< 6
7/15/2011 10:34	7/15/2011 10:35	Rain Grab	34	19	84	271	12.5	9.8	15.0	0.0044	0.0550	0.0010	0.0190	~ 0.0003	0.0803	0.0038	0.3340	< 0.0002	0.0008	0.0067	0.0205	23
8/1/2011 15:03	8/1/2011 15:04	Rain Grab	< 10	12	72	187	5.7	5.3	14.0	–	–	–	–	–	–	–	–	–	–	–	–	6
11/10/2011 13:22	11/10/2011 13:23	Base Grab	390	390	695	30	6.3	1.1	1.2	0.0019	0.0021	0.0105	0.0108	< 0.0001	~ 0.0001	0.0030	0.0032	< 0.0002	< 0.0002	0.0003	0.0003	< 6
11/21/2011 12:55	11/21/2011 12:56	Base Grab	381	844	612	60	9.0	4.6	5.8	–	–	–	–	–	–	–	–	–	–	–	–	< 6
12/14/2011 11:47	12/14/2011 11:48	Rain Grab	–	447	–	–	–	–	–	–	0.0376	–	0.0094	–	0.0295	–	0.2890	–	~ 0.0003	–	0.0137	–

Table E.6. Monitoring results for 10SA stormwater drainage system

Start Date Start Time	End Date End Time	Sample Type	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Specific Conductivity (µS/cm)	pH	Transparency (cm)	Salinity (ppt)	*E. coli* (CFU/ 100 mL)	Fluoride (mg/L)	Total Suspended Solids (mg/L)	Volatile Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Sulfate (mg/L)	Dissolved Phosphorus (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)
1/26/2011 10:30	1/26/2011 10:31	Base Grab	20	41.2	12.57	2,106	3,393	7.30	> 60.0	1.77	–	–	~ 1	< 1	2,110	–	–	~ 0.028	–	1.50	–	–	–
1/27/2011 11:26	1/27/2011 17:17	Melt Composite	25	44.2	11.78	1,355	2,077	7.62	17.6	1.06	–	–	64	20	–	31.20	~ 0.037	0.684	–	2.10	0.28	0.11	0.96
2/13/2011 13:16	2/13/2011 21:47	Melt Composite	35	51.8	10.22	6,497	8,868	7.34	4.8	4.97	–	–	–	–	5,000	38.30	0.058	0.307	0.043	4.70	1.15	0.19	0.91
2/14/2011 12:01	2/14/2011 16:17	Melt Composite	34	48.2	10.26	3,719	5,349	7.57	7.8	2.89	–	–	57	23	3,010	25.60	0.096	0.320	0.123	3.50	1.14	0.13	0.66
2/15/2011 12:11	2/16/2011 1:40	Melt Composite	32	45.5	11.37	2,243	3,370	7.40	10.1	1.77	–	–	43	~ 17	1,810	18.30	0.112	0.288	0.120	2.50	0.88	0.10	0.60
2/16/2011 12:16	2/17/2011 16:53	Melt Composite	22	37.6	11.73	1,396	2,400	7.17	16.0	1.22	–	–	35	13	1,280	12.80	0.220	0.218	0.197	2.00	0.50	0.07	0.69
2/22/2011 9:45	2/22/2011 9:46	Base Grab	15	38.5	14.37	1,626	2,747	7.59	> 60.0	1.41	–	–	~ 1	~ 1	1,530	–	–	0.074	–	1.40	–	–	–
3/8/2011 13:26	3/8/2011 16:45	Melt Composite	28	46.9	9.53	3,032	4,458	7.36	4.4	2.38	–	–	–	–	–	21.90	~ 0.040	0.475	–	3.40	0.49	0.12	0.97
3/9/2011 11:55	3/9/2011 16:41	Melt Composite	28	47.5	10.70	3,035	4,415	7.41	4.3	2.36	–	–	–	–	2,400	14.70	~ 0.043	0.357	0.028	2.80	0.47	0.10	0.70
3/10/2011 9:20	3/10/2011 9:21	Base Grab	28	38.3	12.96	2,476	4,200	7.51	25.2	2.21	–	–	8	3	2,300	23.60	~ 0.035	0.079	0.021	1.70	0.54	0.06	0.90
3/14/2011 13:45	3/14/2011 19:15	Melt Composite	32	48.4	11.70	1,039	1,491	7.69	10.2	0.75	–	–	176	~ 11	775	14.30	0.174	0.322	0.132	1.90	0.25	0.05	0.48
3/15/2011 12:06	3/16/2011 2:09	Melt Composite	31	47.1	11.60	1,247	1,826	7.51	7.2	0.93	–	–	111	39	955	14.80	0.092	0.324	0.098	2.20	0.41	0.09	0.67
3/16/2011 11:51	3/17/2011 6:34	Melt Composite	50	49.6	11.52	706	995	7.23	17.4	0.49	–	–	36	12	505	–	–	0.244	–	1.40	–	–	–
3/17/2011 11:05	3/18/2011 6:09	Melt Composite	35	48.9	11.72	646	919	7.42	19.6	0.46	–	–	32	12	464	–	–	0.288	–	1.20	–	–	–
3/19/2001 13:59	3/21/2011 2:12	Rain Composite	37	39.2	12.45	604	1,007	7.29	20.0	0.50	–	–	33	~ 10	527	13.30	0.145	0.244	–	1.70	0.22	0.03	1.87
3/22/2011 13:15	3/22/2011 13:16	Rain Grab	35	35.1	13.08	443	796	7.45	20.5	0.39	–	–	–	–	338	10.20	0.096	0.302	0.108	1.50	0.24	< 0.03	1.10
3/22/2011 4:16	3/22/2011 20:18	Rain Composite	30	44.1	12.20	379	583	7.33	9.6	0.28	–	–	39	9	380	11.80	0.143	0.269	0.131	1.40	0.26	< 0.03	1.33
4/10/2011 3:49	4/10/2011 8:38	Rain Composite	40	56.1	8.93	435	559	8.78	6.6	0.27	–	–	–	–	328	14.40	~ 0.038	0.525	0.046	3.60	0.55	0.06	1.12
4/13/2011 9:10	4/13/2011 9:11	Base Grab	45	47.5	12.06	1,105	1,610	8.97	> 60.0	0.82	–	–	16	6	939	73.80	~ 0.039	0.098	0.039	1.30	~ 0.05	0.04	3.34
4/21/2011 9:40	4/21/2011 9:40	Base Grab	40	45.5	–	–	–	–	–	–	33	0.14	–	–	–	–	–	–	–	–	–	–	–
4/22/2011 16:06	4/23/2011 9:01	Rain Composite	55	53.4	10.39	759	1,011	7.74	14.4	0.50	–	–	–	–	563	30.70	~ 0.045	0.139	–	1.50	0.11	0.04	1.56
4/25/2011 10:10	4/25/2011 10:11	Base Grab	55	50.0	11.19	1,242	1,742	7.46	> 60.0	0.89	–	–	~ 2	~ 1	983	72.00	~ 0.022	~ 0.040	0.017	1.10	~ 0.05	0.03	2.85
4/26/2011 9:40	4/26/2011 9:40	Rain Grab	45	47.5	–	–	–	–	–	–	330	–	–	–	–	–	–	–	–	–	–	–	–
4/30/2011 3:37	5/1/2011 1:59	Rain Composite	34	45.0	11.88	1,152	1,744	7.45	25.0	0.88	–	–	–	–	216	12.80	~ 0.037	0.153	–	1.60	0.39	0.03	0.98
5/4/2011 9:30	5/4/2011 9:30	Base Grab	50	48.6	–	–	–	–	–	–	18	0.14	–	–	–	–	–	–	–	–	–	–	–
5/5/2011 2:44	5/5/2011 7:02	Rain Composite	50	59.5	10.06	360	441	7.69	18.3	0.21	–	–	–	–	248	13.40	0.200	0.160	0.049	2.50	1.18	0.06	1.27
5/9/2011 9:15	5/9/2011 9:15	Rain Grab	55	53.6	–	–	–	–	–	–	583		–	–	–	–	–	–	–	–	–	–	–
5/9/2011 6:16	5/9/2011 13:05	Rain Composite	70	64.4	7.85	427	493	7.93	12.6	0.24	–	–	–	–	269	9.01	~ 0.022	0.376	0.016	2.80	0.37	0.04	0.70
5/12/2011 10:08	5/12/2011 14:14	Rain Composite	60	57.2	8.80	227	287	7.25	10.2	0.14	–	–	–	–	153	9.56	~ 0.020	0.329	–	2.60	0.64	0.06	0.81
5/18/2011 12:07	5/18/2011 12:08	Base Grab	63	55.6	10.08	944	1,222	7.68	> 60.0	0.61	–	–	3	~ 2	689	41.15	~ 0.051	0.089	0.053	0.93	0.09	0.05	1.82
5/21/2011 3:18	5/21/2011 7:38	Rain Composite	60	64.0	6.27	132	152	7.30	25.6	0.03	–	–	–	–	116	4.61	~ 0.042	0.170	–	1.10	0.27	0.04	0.37
5/27/2011 10:03	5/27/2011 10:05	Base Grab	57	57	10.24	918	1,172	8.16	> 60.0	0.59	–	–	–	–	687	63.95	0.066	0.100	0.065	0.85	~ 0.07	0.05	3.80
5/30/2011 10:11	5/30/2011 19:08	Rain Composite	72	–	–	–	–	–	> 20.0	–	–	–	151	~ 47	237	13.80	~ 0.041	0.278	–	1.80	0.25	0.06	0.99
6/8/2011 11:06	6/8/2011 11:07	Base Grab	76	63.9	8.94	589	684	8.32	> 60.0	0.33	–	–	~ 2	~ 2	646	48.50	0.069	0.130	0.052	1.10	0.06	0.07	1.71
6/14/2011 9:40	6/14/2011 9:40	Base Grab	65	59.0	–	–	–	–	–	–	328	0.35	–	–	–	–	–	–	–	–	–	–	–
6/14/2011 18:14	6/16/2011 2:08	Rain Composite	70	71.4	6.71	77	82	7.55	50.0	0.04	–	–	32	~ 9	108	5.82	0.052	0.123	–	0.79	0.07	0.03	0.28
6/15/2011 8:52	6/15/2011 8:52	Rain Grab	65	62.6	–	–	–	–	–	–	2,755	–	–	–	–	–	–	–	–	–	–	–	–
6/21/2011 3:03	6/22/2011 5:36	Rain Composite	65	70.9	6.43	69	74	7.62	22.6	0.03	–	–	–	–	72	3.97	0.052	0.198	0.034	1.60	0.22	0.03	0.33
6/27/2011 11:27	6/27/2011 11:29	Base Grab	70	63.3	9.41	845	988	8.33	> 60.0	0.49	–	–	~ 1	~ 1	598	44.00	0.064	0.097	0.067	0.78	< 0.02	0.04	2.00
6/30/2011 9:00	6/30/2011 9:00	Base Grab	75	66.0	–	–	–	–	–	–	210	0.25	–	–	–	–	–	–	–	–	–	–	–

Table E.6 continued. Monitoring results for 10SA stormwater drainage system

Start Date Start Time	End Date End Time	Sample Type	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Specific Conductivity (µS/cm)	pH	Transparency (cm)	Salinity (ppt)	*E. coli* (CFU/ 100 mL)	Fluoride (mg/L)	Total Suspended Solids (mg/L)	Volatile Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Sulfate (mg/L)	Dissolved Phosphorus (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)
7/7/2011 10:22	7/7/2011 10:23	Base Grab	80	67.6	8.02	912	1,012	8.41		0.50	–	–	~ 1	~ 1	582	45.00	0.134	0.226	0.137	1.00	< 0.02	< 0.03	2.03
7/10/2011 22:43	7/11/2011 2:17	Base Composite	80	83.3	6.33	68	64	7.68	21.2	0.03	–	–	132	~ 28	85	3.63	~ 0.046	0.208	0.047	1.10	0.12	< 0.03	0.34
7/13/2011 9:31	7/13/2011 9:31	Base Grab	75	70.0	–	–	–	–	–	–	749	0.13	–	–	–	–	–	–	–	–	–	–	–
7/19/2011 23:32	7/19/2011 3:19	Rain Composite	95	86.5	6.38	86	78	7.22	22.5	0.03	–	–	128	~ 19	50	2.96	0.082	0.195	–	1.10	0.32	0.03	0.44
7/23/2011 22:15	7/24/2011 8:33	Rain Composite	80	77.2	5.91	166	165	7.45	37.0	0.08	–	–	31	8	104	7.53	0.055	0.101	–	0.71	0.24	0.05	0.52
7/25/2011 11:30	7/25/2011 11:31	Base Grab	80	72.0	7.98	704	744	8.1	> 60.0	0.36	–	–	8	~ 2	476	41.00	0.072	0.111	0.074	0.73	~ 0.04	0.04	4.74
7/26/2011 3:22	7/26/2011 7:50	Rain Composite	68	78.4	7.37	142	139	7.90	26.8	0.06	–	–	107	15	84	4.81	~ 0.046	0.164	0.042	0.79	0.15	< 0.03	0.35
7/28/2011 10:28	7/28/2011 10:28	Base Grab	80	75.2	–	–	–	–	–	–	114	0.13	–	–	–	–	–	–	–	–	–	–	–
7/30/2011 22:56	7/31/2011 0:18	Rain Composite	80	80.1	5.13	104	101	7.39	32.2	0.05	–	–	94	22	48	2.64	0.050	0.159	–	1.10	0.26	0.04	0.32
8/1/2011 13:28	8/1/2011 15:27	Rain Composite	80	74.5	7.04	63	65	7.33	24.4	0.03	–	–	67	~ 14	51	2.09	~ 0.045	0.152	0.056	0.85	0.23	< 0.03	0.32
8/9/2011 9:27	8/9/2011 9:28	Base Grab	68	68.9	8.11	992	1,985	8.26	> 60.0	0.54	–	–	~ 1	< 1	689	53.65	0.090	0.109	0.103	0.82	< 0.02	< 0.03	2.97
8/13/2001 2:11	8/13/2011 14:52	Rain Composite	80	78.4	6.02	165	163	7.46	> 60.0	0.08	–	–	29	8	111	5.41	0.097	0.172	–	1.10	0.15	0.05	0.35
8/16/2011 18:52	8/16/2011 21:59	Rain Composite	75	74.7	7.38	59	61	7.41	33.2	0.03	–	–	53	12	53	0.89	0.051	0.105	0.053	0.54	0.08	< 0.03	0.23
8/18/2011 10:27	8/18/2011 10:27	Base Grab	75	72.0	–	–	–	–	–	–	866	< 0.10	–	–	–	–	–	–	–	–	–	–	–
8/22/2011 10:35	8/22/2011 10:36	Base Grab	75	70.2	8.39	776	837	8.23	> 60.0	0.41	–	–	~ 2	3	553	37.10	0.078	0.089	0.084	0.64	< 0.02	< 0.03	2.02
8/31/2011 12:06	8/31/2011 12:06	Base Grab	75	69.4	–	–	–	–	–	–	866	0.17	–	–	–	–	–	–	–	–	–	–	–
9/8/2011 10:56	9/8/2011 10:56	Base Grab	75	67.3	–	–	–	–	–	–	> 2,420	0.25	–	–	–	–	–	–	–	–	–	–	–
9/12/2011 11:15	9/12/2011 11:16	Base Grab	84	66.9	8.42	1,081	1,209	8.46	> 60.0	0.60	–	–	7	~ 1	721	54.30	0.161	0.188	0.168	1.00	~ 0.03	< 0.03	3.06
9/22/2011 10:35	9/22/2011 10:35	Base Grab	60	60.8	–	–	–	–	–	–	2,420	0.18	–	–	–	–	–	–	–	–	–	–	–
9/26/2011 10:00	9/26/2011 10:01	Base Grab	55	61.9	9.35	675	805	8.46	> 60.0	0.40	–	–	< 1	< 1	508	29.50	0.148	0.158	0.131	0.89	0.09	0.07	1.58
10/6/2011 10:35	10/6/2011 10:35	Base Grab	70	61.9	–	–	–	–	–	–	8,660	0.31	–	–	–	–	–	–	–	–	–	–	–
10/12/2011 10:25	10/12/2011 10:26	Base Grab	68	64.8	8.57	532	611	8.36	> 60.0	0.30	–	–	7	6	376	16.30	0.193	0.297	0.167	1.10	< 0.02	< 0.03	< 0.05
10/12/2011 12:33	10/12/2011 20:30	Rain Composite	60	59.5	6.02	122	149	7.09	31.0	0.07	–	–	206	53	101	5.05	0.267	0.629	0.244	2.30	~ 0.02	< 0.03	0.21
10/20/2011 10:49	10/20/2011 10:49	Base Grab	50	56.3	–	–	–	–	–	–	> 2,420	0.47	–	–	–	–	–	–	–	–	–	–	–
10/26/2011 9:55	10/26/2011 9:56	Base Grab	50	57.6	9.84	530	667	8.05	> 60.0	0.33	–	–	~ 2	~ 1	421	21.20	0.162	0.194	0.153	0.64	~ 0.02	< 0.03	0.30
11/2/2011 10:31	11/2/2011 10:31	Base Grab	45	54.5	–	–	–	–	–	–	235	0.63	–	–	–	–	–	–	–	–	–	–	–
11/15/2011 10:52	11/15/2011 10:52	Base Grab	40	56.1	–	–	–	–	–	–	1,986	0.76	–	–	–	–	–	–	–	–	–	–	–
11/21/2011 9:33	11/21/2011 9:34	Base Grab	35	48.9	10.66	1,736	2,472	8.16	> 60.0	1.28	–	–	~ 2	~ 2	1,400	19.30	0.332	0.407	0.322	1.30	~ 0.02	0.05	0.92
11/22/2011 10:07	11/22/2011 10:07	Base Grab	35	51.6	–	–	–	–	–	–	> 2,420	–	–	–	–	–	–	–	–	–	–	–	–
12/14/2011 10:30	12/14/2011 10:31	Rain Grab	40	45.9	11.60	1,068	1,596	7.96	5.8	0.81	–	–	25	14	886	–	–	0.289	–	1.70	–	–	–
12/14/2011 13:06	12/14/2011 17:53	Rain Composite	32	48.0	11.02	434	628	7.82	5.8	0.31	–	–	168	57	310	–	–	0.391	–	1.70	–	–	–
12/19/2011 9:45	12/19/2011 9:46	Base Grab	34	47.5	11.94	559	871	8.00	53.8	0.43	–	–	3	~ 2	483	–	–	0.168	–	0.94	–	–	–

Table E.6 continued. Monitoring results for 10SA stormwater drainage system

Start Date Start Time	End Date End Time	Sample Type	Alkalinity (mg/L CaCO3)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	Chemical Oxygen Demand (mg/L)	Total Organic Carbon (mg/L)	Biological Oxygen Demand 5-day (mg/L)	Biological Oxygen Demand 5-day (mg/L)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)	Oil and Grease (mg/L)
1/26/2011 10:30	1/26/2011 10:31	Base Grab	–	905	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1/27/2011 11:26	1/27/2011 17:17	Melt Composite	227	552	308	38	5.6	–	–	< 0.0100	< 0.0100	< 0.0200	< 0.0200	< 0.0030	< 0.0030	< 0.0200	< 0.0200	< 0.0010	< 0.0010	< 0.01000	<0.010	–
2/13/2011 13:16	2/13/2011 21:47	Melt Composite	91	3,047	236	232	18.5	–	–	0.0140	0.0400	< 0.0200	< 0.0200	< 0.0030	0.0180	0.0310	0.2040	< 0.0010	< 0.0010	< 0.01000	0.02500	–
2/14/2011 12:01	2/14/2011 16:17	Melt Composite	70	1,861	176	112	11.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	< 6
2/15/2011 12:11	2/16/2011 1:40	Melt Composite	57	1,047	160	88	9.7	8.0	11.0	< 0.0100	0.0160	< 0.0200	< 0.0200	< 0.0030	0.0040	< 0.0200	0.0900	< 0.0010	< 0.0010	< 0.01000	<0.010	< 6
2/16/2011 12:16	2/17/2011 16:53	Melt Composite	46	770	144	62	10.2	–	–	< 0.0100	0.0120	< 0.0200	< 0.0200	< 0.0030	< 0.0030	0.0250	0.0850	< 0.0010	< 0.0010	< 0.01000	<0.010	< 6
2/22/2011 9:45	2/22/2011 9:46	Base Grab	–	727	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3/8/2011 13:26	3/8/2011 16:45	Melt Composite	94	1,484	200	156	15.3	–	–	0.0083	0.0234	0.0019	0.0081	~ 0.0002	0.0110	0.0073	0.1120	< 0.0002	~ 0.0002	0.00550	0.01540	–
3/9/2011 11:55	3/9/2011 16:41	Melt Composite	70	1,456	144	217	14.5	–	–	0.0081	0.0334	0.0015	0.0095	~ 0.0002	0.0176	0.0063	0.1900	< 0.0002	~ 0.0004	0.00600	0.02160	–
3/10/2011 9:20	3/10/2011 9:21	Base Grab	115	1,319	260	54	9.4	3.0	4.3	–	–	–	–	–	–	–	–	–	–	–	–	< 6
3/14/2011 13:45	3/14/2011 19:15	Melt Composite	130	328	196	54	12.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3/15/2011 12:06	3/16/2011 2:09	Melt Composite	76	512	136	113	14.5	5.9	9.9	–	–	–	–	–	–	–	–	–	–	–	–	6
3/16/2011 11:51	3/17/2011 6:34	Melt Composite	–	224	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3/17/2011 11:05	3/18/2011 6:09	Melt Composite	–	205	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3/19/2001 13:59	3/21/2011 2:12	Rain Composite	115	225	196	50	8.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	< 6
3/22/2011 13:15	3/22/2011 13:16	Rain Grab	70	103	108	86	8.0	2.1	5.0	–	–	–	–	–	–	–	–	–	–	–	–	< 6
3/22/2011 4:16	3/22/2011 20:18	Rain Composite	69	123	140	68	7.6	2.6	4.2	0.0031	0.0063	0.0011	0.0025	~ 0.0002	0.0028	0.0091	0.0259	< 0.0002	< 0.0002	0.00180	0.00300	~ 6
4/10/2011 3:49	4/10/2011 8:38	Rain Composite	74	100	112	251	9.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	30
4/13/2011 9:10	4/13/2011 9:11	Base Grab	310	329	52	41	6.4	1.6	2.7	0.0025	–	0.0015	–	< 0.0001	–	< 0.0100	–	< 0.0002	–	0.00069	–	< 6
4/22/2011 16:06	4/23/2011 9:01	Rain Composite	142	169	224	61	8.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8
4/25/2011 10:10	4/25/2011 10:11	Base Grab	311	353	460	30	7.0	1.1	1.4	–	–	–	–	–	–	–	–	–	–	–	–	8
4/30/2011 3:37	5/1/2011 1:59	Rain Composite	76	69	116	50	6.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	< 6
5/5/2011 2:44	5/5/2011 7:02	Rain Composite	79	74	112	90	14.6	16.0	21.0	–	–	–	–	–	–	–	–	–	–	–	–	–
5/9/2011 6:16	5/9/2011 13:05	Rain Composite	48	90	84	120	7.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7
5/12/2011 10:08	5/12/2011 14:14	Rain Composite	57	48	92	99	6.4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	9
5/18/2011 12:07	5/18/2011 12:08	Base Grab	256	196	379	29	6.8	2.5	2.9	–	–	–	–	–	–	–	–	–	–	–	–	< 6
5/21/2011 3:18	5/21/2011 7:38	Rain Composite	36	17	76	42	4.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	17
5/27/2011 10:03	5/27/2011 10:05	Base Grab	336	129	446	19	6.0	< 1.0	~ 1.1	–	–	–	–	–	–	–	–	–	–	–	–	< 6
5/30/2011 10:11	5/30/2011 19:08	Rain Composite	72	54	136	99	7.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
6/8/2011 11:06	6/8/2011 11:07	Base Grab	267	141	372	28	7.9	1.2	2.1	–	–	–	–	–	–	–	–	–	–	–	–	< 6
6/14/2011 18:14	6/16/2011 2:08	Rain Composite	46	462	80	28	5.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	< 6
6/21/2011 3:03	6/22/2011 5:36	Rain Composite	33	15	84	53	6.6	2.6	4.6	–	–	–	–	–	–	–	–	–	–	–	–	< 6
6/27/2011 11:27	6/27/2011 11:29	Base Grab	291	118	368	24	6.2	< 1.0	1.2	–	–	–	–	–	–	–	–	–	–	–	–	< 6

Table E.6 continued. Monitoring results for 10SA stormwater drainage system

Start Date Start Time	End Date End Time	Sample Type	Alkalinity (mg/L CaCO3)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	Chemical Oxygen Demand (mg/L)	Total Organic Carbon (mg/L)	Biological Oxygen Demand 5-day (mg/L)	Biological Oxygen Demand 5-day (mg/L)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)	Oil and Grease (mg/L)
7/7/2011 10:22	7/7/2011 10:23	Base Grab	273	154	356	31	7.2	< 1.0	1.3	0.0070	0.0074	0.0017	0.0021	< 0.0001	< 0.0001	0.0086	0.0050	< 0.0002	< 0.0002	0.00031	0.00031	< 6
7/10/2011 22:43	7/11/2011 2:17	Base Composite	25	12	48	50	7.3	4.5	7.3	–	–	–	–	–	–	–	–	–	–	–	–	< 6
7/19/2011 23:32	7/19/2011 3:19	Rain Composite	18	5	48	42	3.9	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10
7/23/2011 22:15	7/24/2011 8:33	Rain Composite	30	12	60	20	4.9	–	–	–	–	–	–	–	–	–	–	–	–	–	–	< 5
7/25/2011 11:30	7/25/2011 11:31	Base Grab	255	69	316	18	6.6	< 1.0	1.4	–	–	–	–	–	–	–	–	–	–	–	–	< 6
7/26/2011 3:22	7/26/2011 7:50	Rain Composite	36	12	60	39	5.5	4.0	5.3	–	–	–	–	–	–	–	–	–	–	–	–	< 6
7/30/2011 22:56	7/31/2011 0:18	Rain Composite	19	8	52	40	5.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	< 6
8/1/2011 13:28	8/1/2011 15:27	Rain Composite	16	5	40	34	3.1	2.1	4.0	–	–	–	–	–	–	–	–	–	–	–	–	6
8/9/2011 9:27	8/9/2011 9:28	Base Grab	349	133	448	29	7.0	< 1.0	< 1.0	–	–	–	–	–	–	–	–	–	–	–	–	< 6
8/13/2001 2:11	8/13/2011 14:52	Rain Composite	41	16	60	37	5.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7
8/16/2011 18:52	8/16/2011 21:59	Rain Composite	16	4	52	32	3.4	2.1	3.5	–	–	–	–	–	–	–	–	–	–	–	–	< 6
8/22/2011 10:35	8/22/2011 10:36	Base Grab	209	99	344	22	5.4	< 1.0	1.2	–	–	–	–	–	–	–	–	–	–	–	–	8
9/12/2011 11:15	9/12/2011 11:16	Base Grab	341	175	460	24	9.3	< 1.0	< 1.0	–	–	–	–	–	–	–	–	–	–	–	–	< 6
9/26/2011 10:00	9/26/2011 10:01	Base Grab	263	97	328	22	6.7	< 1.0	1.2	–	–	–	–	–	–	–	–	–	–	–	–	< 6
10/12/2011 10:25	10/12/2011 10:26	Base Grab	203	57	236	62	23.8	7.5	8.9	–	–	–	–	–	–	–	–	–	–	–	–	24
10/12/2011 12:33	10/12/2011 20:30	Rain Composite	49	13	72	144	19.5	–	–	0.0143	–	0.0014	0.0064	~ 0.0003	0.0082	0.0090	0.0927	< 0.0002	< 0.0002	0.00270	0.00770	–
10/26/2011 9:55	10/26/2011 9:56	Base Grab	244	73	292	37	9.4	1.3	1.6	–	–	–	–	–	–	–	–	–	–	–	–	< 6
11/21/2011 9:33	11/21/2011 9:34	Base Grab	113	637	316	60	13.5	5.8	7.2	–	–	–	–	–	–	–	–	–	–	–	–	< 6
12/14/2011 10:30	12/14/2011 10:31	Rain Grab	–	475	–	–	–	–	–	–	0.0149	–	0.0036	–	0.0052	–	0.0733	–	< 0.0002	–	0.00450	–
12/14/2011 13:06	12/14/2011 17:53	Rain Composite	–	115	–	–	–	–	–	–	0.0413	–	0.0074	–	0.0139	–	0.1880	–	~ 0.0003	–	0.01450	–
12/19/2011 9:45	12/19/2011 9:46	Base Grab	–	102	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Appendix F – Kasota Ponds Monitoring Results

Table F.1. Monitoring results for KPEE

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Specific Conductivity (µS/cm)	pH	Salinity (ppt)	Total Suspended Solids (mg/L)	Volatile Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)
4/13/2011	11:05	45	55.6	10.08	1,654	2,139	7.62	1.10	4	3	1,190	0.050	< 0.005	1.10	< 0.02	< 0.03	< 0.05	595	420	0.0008	~ 0.0005	0.0012	0.0012	< 0.0001	< 0.0001	< 0.0100	< 0.0100	< 0.0002	< 0.0002	0.00210	0.00210
5/6/2011	12:00	65	57.9	9.84	1,785	2,236	7.47	1.15	~ 2	~ 2	1,310	< 0.010	< 0.005	0.79	< 0.02	< 0.03	< 0.05	611	428	0.0008	0.0008	0.0011	0.0011	< 0.0001	~ 0.0001	~ 0.0010	0.0126	< 0.0002	< 0.0002	0.00019	0.00019
6/10/2011	11:30	65	66.2	4.39	—	—	7.16	0.05	~ 1	~ 1	1,210	~ 0.019	~ 0.007	1.00	< 0.02	< 0.03	< 0.05	648	368	< 0.0050	< 0.0050	0.0011	0.0011	< 0.0001	< 0.0001	0.0103	0.0103	< 0.0002	< 0.0002	0.00022	~ 0.00010
7/14/2011	11:21	65	72.7	3.21	1,596	1,674	7.26	0.85	~ 1	~ 1	1,040	~ 0.035	~ 0.006	0.83	< 0.02	< 0.03	< 0.05	437	296	< 0.0003	< 0.0003	0.0011	0.0011	< 0.0001	< 0.0001	0.0023	0.0023	< 0.0002	< 0.0002	0.00044	0.00044
8/10/2011	11:08	70	73.9	2.95	1,190	1,231	7.22	0.61	11	~ 7	679	0.072	~ 0.006	1.10	0.13	< 0.03	< 0.05	311	292	< 0.0003	~ 0.0003	0.0008	0.0009	< 0.0001	~ 0.0001	~ 0.0011	0.0024	< 0.0002	< 0.0002	0.00037	0.00037
9/14/2011	11:18	55	62.4	2.60	1,234	1,461	7.31	0.74	5	3	779	~ 0.030	< 0.005	1.20	0.24	< 0.03	< 0.05	373	328	< 0.0003	< 0.0003	0.0009	0.0009	< 0.0001	< 0.0001	0.0039	0.0039	< 0.0002	< 0.0002	0.00052	0.00052
9/14/2011	11:20	55	62.4	2.60	1,234	1,461	7.31	0.74	6	~ 2	803	0.055	< 0.005	1.20	0.25	< 0.03	< 0.05	372	332	< 0.0003	< 0.0003	0.0008	0.0009	< 0.0001	< 0.0001	0.0010	0.0010	< 0.0002	< 0.0002	0.00055	0.00055
9/14/2011	11:19	55	62.4	2.60	1,234	1,461	7.31	0.74	6	3	791	0.055	< 0.005	1.20	0.25	< 0.03	< 0.05	373	330	< 0.0003	< 0.0003	0.0008	0.0009	< 0.0001	< 0.0001	~ 0.0024	~ 0.0024	< 0.0002	< 0.0002	0.00054	0.00054
10/19/2011	10:58	45	46.6	5.47	1,139	1,680	7.67	0.85	3	3	954	~ 0.045	~ 0.008	1.60	0.33	0.03	0.06	451	376	< 0.0010	< 0.0010	< 0.0010	0.0010	< 0.0001	< 0.0001	0.0052	0.0052	< 0.0002	< 0.0002	0.00050	~ 0.00008
11/14/2011	11:25	45	42.3	8.15	1,152	1,824	7.69	0.93	6	4	1,040	~ 0.038	~ 0.007	1.70	0.83	0.03	0.25	500	424	< 0.0030	~ 0.0005	< 0.0030	0.0014	< 0.0010	~ 0.0005	< 0.0080	< 0.0080	< 0.0020	< 0.0002	< 0.00080	0.00016
12/21/2011	11:56	25	35.2	32.05	1,371	2,458	8.07	1.25	6	5	1,390	0.051	< 0.005	1.30	< 0.02	< 0.03	< 0.05	672	544	< 0.0003	0.0006	0.0009	0.0012	< 0.0001	~ 0.0004	< 0.0008	0.0055	< 0.0002	< 0.0002	< 0.00050	< 0.00050

Table F.2. Monitoring results for KPEN

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Specific Conductivity (µS/cm)	pH	Salinity (ppt)	Total Suspended Solids (mg/L)	Volatile Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)
1/27/2011	13:00	26	33.6	0.17	1,425	2,640	6.98	1.34	41	17	1,460	0.894	0.226	5.00	2.62	< 0.03	< 0.05	634	628	< 0.0100	< 0.0100	< 0.0200	< 0.0200	< 0.0030	< 0.0030	< 0.0200	< 0.0200	< 0.0010	< 0.0010	< 0.01000	< 0.01000
2/24/2011	11:50	22	34.0	0.25	1,600	2,943	6.85	1.50	40	20	1,570	1.040	0.516	5.80	3.64	< 0.03	< 0.05	741	800	< 0.0100	< 0.0100	< 0.0200	< 0.0200	< 0.0030	< 0.0030	< 0.0200	0.0300	< 0.0010	< 0.0010	< 0.01000	< 0.01000
4/13/2011	10:55	50	55.9	10.86	—	—	7.67	0.06	5	4	1,220	~ 0.037	< 0.005	1.00	< 0.02	< 0.03	< 0.05	633	428	0.0006	0.0006	0.0012	0.0012	< 0.0001	< 0.0001	< 0.0100	< 0.0100	< 0.0002	< 0.0002	0.00410	0.00410
5/6/2011	11:50	65	57.2	9.43	1,773	2,244	7.47	1.16	48	16	1,270	0.154	< 0.005	1.40	< 0.02	< 0.03	< 0.05	613	424	0.0008	0.0038	0.0011	0.0020	< 0.0001	0.0018	0.0067	0.0219	< 0.0002	< 0.0002	0.00018	0.00150
6/10/2011	11:22	65	65.5	5.55	1,777	2,026	7.29	1.04	3	~ 2	1,060	~ 0.024	~ 0.007	0.88	< 0.02	< 0.03	< 0.05	613	356	< 0.0050	< 0.0050	0.0016	0.0016	< 0.0001	~ 0.0001	~ 0.0009	~ 0.0014	< 0.0002	< 0.0002	0.00031	0.00031
7/14/2011	11:11	65	72.1	3.00	1,550	1,633	7.27	0.82	~ 1	~ 1	936	~ 0.042	~ 0.008	0.99	< 0.02	< 0.03	< 0.05	404	308	~ 0.0004	~ 0.0004	0.0011	0.0010	< 0.0001	< 0.0001	0.0055	~ 0.0009	< 0.0002	< 0.0002	0.00025	0.00025
8/10/2011	10:56	70	72.7	2.70	1,138	1,193	7.19	0.59	7	3	651	~ 0.039	~ 0.008	0.85	~ 0.04	< 0.03	< 0.05	288	268	~ 0.0004	~ 0.0004	0.0008	0.0008	< 0.0001	< 0.0001	0.0018	0.0018	< 0.0002	< 0.0002	0.00029	0.00029
9/14/2011	10:59	52	63.0	1.91	1,197	1,408	7.47	0.71	~ 2	~ 2	798	~ 0.031	< 0.005	0.92	0.08	< 0.03	< 0.05	359	320	~ 0.0003	~ 0.0003	0.0012	0.0012	< 0.0001	< 0.0001	0.0308	0.0308	< 0.0002	< 0.0002	0.00052	0.00052
10/19/2011	10:50	45	47.1	3.58	1,129	1,654	7.64	0.84	5	3	928	0.098	~ 0.008	2.00	0.36	< 0.03	< 0.05	456	384	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0001	~ 0.0001	< 0.0008	0.0068	< 0.0002	< 0.0002	0.00097	0.00097
11/14/2011	11:18	45	41.4	8.34	1,134	1,823	7.68	0.92	7	4	1,050	~ 0.029	< 0.005	1.70	0.86	0.03	0.31	483	432	~ 0.0004	~ 0.0005	0.0013	0.0014	< 0.0001	0.0006	0.0041	0.0041	< 0.0002	< 0.0002	0.00025	0.00025
12/21/2011	11:46	25	39.4	29.68	1,318	2,197	7.92	1.12	31	28	1,240	0.229	~ 0.006	2.80	< 0.02	< 0.03	< 0.05	562	528	< 0.0003	0.0008	0.0009	0.0012	< 0.0001	0.0011	~ 0.0014	0.0066	< 0.0002	< 0.0002	< 0.00050	< 0.00050

Table F.3. Monitoring results for KPEW

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Specific Conductivity (µS/cm)	pH	Salinity (ppt)	Total Suspended Solids (mg/L)	Volatile Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)
1/27/2011	12:50	26	34.3	0.23	1,395	2,551	7.04	1.30	52	26	1,460	0.489	0.037	3.40	1.85	< 0.03	< 0.05	736	616	< 0.0100	< 0.0100	< 0.0200	< 0.0200	< 0.0030	< 0.0030	< 0.0200	< 0.0200	< 0.0010	< 0.0010	< 0.01000	< 0.01000
2/24/2011	11:30	22	33.4	0.35	1,546	2,879	6.90	1.47	30	~ 14	1,600	0.872	0.215	5.00	2.94	< 0.03	0.14	735	632	< 0.0100	< 0.0100	< 0.0200	< 0.0200	< 0.0030	< 0.0030	< 0.0200	< 0.0200	< 0.0010	< 0.0010	< 0.01000	< 0.01000
4/13/2011	10:45	45	55.4	9.10	1,638	2,125	7.69	1.09	23	19	1,180	0.118	< 0.005	2.10	< 0.02	< 0.03	< 0.05	622	260	~ 0.0005	0.0007	0.0010	0.0013	< 0.0001	< 0.0001	< 0.0100	< 0.0100	< 0.0002	< 0.0002	0.00240	0.00240
5/6/2011	11:40	65	57.0	10.25	1,780	2,260	7.47	1.17	~ 1	2	1,270	~ 0.019	0.013	0.90	< 0.02	< 0.03	< 0.05	612	436	0.0007	0.0007	0.0012	0.0012	< 0.0001	< 0.0001	~ 0.0009	0.0090	< 0.0002	< 0.0002	0.00018	0.00018
6/10/2011	11:11	65	68.0	5.36	—	—	7.57	0.05	3	3	1,160	~ 0.025	~ 0.008	1.10	< 0.02	< 0.03	< 0.05	634	364	< 0.0050	< 0.0050	0.0011	0.0011	< 0.0001	< 0.0001	~ 0.0008	0.0030	< 0.0002	< 0.0002	0.00031	0.00031
7/14/2011	11:02	65	73.4	0.70	1,623	1,688	7.34	0.85	5	4	986	0.091	0.014	0.96	< 0.02	< 0.03	< 0.05	425	322	< 0.0003	~ 0.0006	0.0010	0.0009	< 0.0001	~ 0.0001	0.0040	0.0049	< 0.0002	< 0.0002	0.00034	0.00034
8/10/2011	10:44	70	72.9	2.79	1,171	1,226	7.21	0.61	~ 2	~ 1	669	~ 0.046	~ 0.009	0.93	0.09	< 0.03	< 0.05	304	284	0.0007	< 0.0003	0.0010	0.0010	< 0.0001	< 0.0001	0.0112	0.0112	< 0.0002	< 0.0002	0.00045	0.00045
9/14/2011	10:50	50	63.0	1.91	1,197	1,408	7.47	0.71	7	5	783	0.061	~ 0.006	1.50	0.44	< 0.03	< 0.05	362	324	< 0.0003	< 0.0003	0.0009	0.0009	< 0.0001	< 0.0001	0.0029	0.0029	< 0.0002	< 0.0002	0.00047	0.00047
10/19/2011	10:42	45	46.6	4.33	1,117	1,652	7.78	0.84	3	~ 2	939	~ 0.033	~ 0.008	1.30	0.30	0.04	0.10	439	400	< 0.0010	< 0.0010	< 0.0010	0.0011	< 0.0001	< 0.0001	0.0039	0.0039	< 0.0002	< 0.0002	0.00092	0.00092
11/14/2011	11:09	45	41.0	5.34	1,120	1,814	7.68	0.92	4	3	1,050	~ 0.047	< 0.005	1.50	0.54	< 0.03	0.52	496	432	~ 0.0005	~ 0.0006	0.0012	0.0013	< 0.0001	~ 0.0003	0.0020	0.0030	< 0.0002	< 0.0002	0.00024	0.00024
12/21/2011	11:35	25	38.1	27.15	1,365	2,325	7.88	1.19	9	8	1,330	0.089	< 0.005	1.70	< 0.02	< 0.03	< 0.05	639	548	< 0.0003	< 0.0003	0.0010	0.0010	< 0.0001	~ 0.0002	< 0.0001	0.0057	< 0.0002	< 0.0002	< 0.00050	< 0.00050

Table F.4. Monitoring results for KPNS

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Specific Conductivity (µS/cm)	pH	Salinity (ppt)	Total Suspended Solids (mg/L)	Volatile Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)
1/27/2011	11:00	25	33.8	0.30	1,142	2,112	6.49	1.06	46	20	1110	0.742	0.027	2.20	0.59	< 0.03	< 0.05
2/24/2011	9:45	22	34.2	0.35	1,472	2,702	6.83	1.38	39	~ 17	1390	0.655	0.042	2.40	0.78	< 0.03	< 0.05
4/13/2011	10:00	46	53.6	4.43	1,467	1,954	7.46	1.00	~ 2	~ 1	1080	~ 0.026	< 0.005	0.92	0.07	< 0.03	0.16
5/6/2011	11:00	65	54.3	9.79	1,191	1,567	7.09	0.79	3	~ 2	886	~ 0.014	< 0.005	0.71	< 0.02	< 0.03	< 0.05
6/10/2011	10:10	65	66.9	1.75	689	771	7.25	0.05	6	~ 5	804	0.083	~ 0.005	1.10	< 0.02	< 0.03	< 0.05
7/14/2011	10:07	65	71.6	0.87	1,006	1,066	7.15	0.53	6	~ 4	627	0.145	0.018	1.60	< 0.02	< 0.03	< 0.05
8/10/2011	10:14	70	70.2	1.25	650	700	7.11	0.34	10	~ 6	393	0.082	~ 0.008	0.81	< 0.02	< 0.03	< 0.05
9/14/2011	9:59	55	62.2	3.60	853	1,013	7.18	0.50	7	3	568	~ 0.028	< 0.005	0.70	< 0.02	< 0.03	< 0.05
10/19/2011	9:51	45	46.8	9.19	1,045	1,539	7.92	0.78	6	3	903	~ 0.029	< 0.005	0.88	< 0.02	< 0.03	< 0.05
11/14/2011	10:05	45	40.1	12.69	1,200	1,971	7.65	1.00	5	~ 2	1200	~ 0.022	< 0.005	0.56	< 0.02	< 0.03	0.06
12/21/2011	10:30	25	35.2	15.26	1,797	3,224	7.54	1.66	5	3	1890	0.062	< 0.005	1.20	< 0.02	< 0.03	< 0.05

Date	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)
1/27/2011	507	492	< 0.0100	< 0.0100	< 0.0200	< 0.0200	< 0.0030	< 0.0030	0.0240	0.0240	< 0.0010	< 0.0010	< 0.01000	< 0.01000
2/24/2011	619	548	< 0.0100	< 0.0100	< 0.0200	< 0.0200	< 0.0030	< 0.0030	< 0.0200	< 0.0200	< 0.0010	< 0.0010	< 0.01000	< 0.01000
4/13/2011	499	412	0.0007	0.0009	0.0012	0.0013	< 0.0001	< 0.0001	0.0211	0.0224	< 0.0002	< 0.0002	0.00170	0.00170
5/6/2011	397	372	0.0014	0.0016	0.0009	0.0009	< 0.0001	~ 0.0003	0.0023	0.0059	< 0.0002	< 0.0002	0.00021	0.00026
6/10/2011	319	328	< 0.0050	< 0.0050	0.0009	0.0009	< 0.0001	~ 0.0002	~ 0.0010	0.0030	< 0.0002	< 0.0002	0.00052	0.00052
7/14/2011	219	228	< 0.0003	< 0.0003	0.0008	0.0007	< 0.0001	~ 0.0002	0.0024	0.0024	< 0.0002	< 0.0002	0.00035	0.00035
8/10/2011	135	180	< 0.0003	~ 0.0004	0.0006	0.0007	< 0.0001	0.0005	0.0048	0.0048	< 0.0002	< 0.0002	0.00052	0.00052
9/14/2011	230	256	~ 0.0004	0.0006	0.0008	0.0010	< 0.0001	0.0011	0.0038	0.0038	< 0.0002	< 0.0002	0.00095	0.00095
10/19/2011	381	418	< 0.0010	< 0.0010	< 0.0010	~ 0.0011	< 0.0001	0.0011	~ 0.0010	0.0080	< 0.0002	< 0.0002	0.00073	0.00073
11/14/2011	556	556	~ 0.0006	0.0008	0.0011	0.0015	< 0.0001	0.0013	0.0019	0.0029	< 0.0002	< 0.0002	0.00021	0.00025
12/21/2011	926	950	< 0.0003	< 0.0003	0.0013	0.0013	< 0.0001	0.0007	0.0051	0.0051	< 0.0002	< 0.0002	< 0.00050	< 0.00050

Table F.5. Monitoring results for KPNW

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Specific Conductivity (µS/cm)	pH	Salinity (ppt)	Total Suspended Solids (mg/L)	Volatile Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)
1/27/2011	10:40	25	34.3	0.27	1,059	1,936	6.72	0.97	49	21	1,050	0.567	0.038	2.30	0.59	< 0.03	< 0.05	402	476
2/24/2011	9:25	22	34.2	0.42	1,291	2,369	7.46	1.20	28	18	1,280	0.638	0.092	3.10	1.07	< 0.03	< 0.05	594	436
4/13/2011	9:40	47	54.0	3.48	1,461	1,936	7.72	0.99	~ 2	~ 1	1,070	~ 0.021	< 0.005	0.97	0.07	< 0.03	0.13	497	416
5/6/2011	10:50	65	52.9	8.85	1,178	1,581	7.19	0.80	3	3	862	~ 0.041	< 0.005	1.00	< 0.02	< 0.03	< 0.05	409	320
6/10/2011	9:52	65	66.9	1.49	—	—	7.21	0.05	7	~ 5	816	0.085	~ 0.005	1.20	< 0.02	< 0.03	< 0.05	317	360
7/14/2011	9:55	65	71.6	0.54	1,000	1,060	7.06	0.53	8	4	616	0.111	0.015	1.20	< 0.02	< 0.03	< 0.05	205	240
8/10/2011	9:58	70	71.1	0.92	656	701	6.96	0.34	12	8	402	0.077	0.013	0.76	< 0.02	< 0.03	< 0.05	136	184
9/14/2011	9:41	55	62.8	2.74	854	1,007	7.04	0.50	12	8	564	0.058	< 0.005	0.73	< 0.02	< 0.03	< 0.05	227	262
10/19/2011	9:45	45	46.9	8.27	1,043	1,529	8.22	0.77	6	4	887	~ 0.028	< 0.005	0.90	< 0.02	< 0.03	< 0.05	386	392
11/14/2011	10:01	45	40.6	13.73	1,238	2,017	8.09	1.03	5	~ 2	1,190	~ 0.049	< 0.005	0.57	< 0.02	< 0.03	0.06	526	540
12/21/2011	10:10	25	37.0	8.86	1,792	3,109	7.07	1.61	11	6	1,800	0.063	< 0.005	1.30	< 0.02	< 0.03	< 0.05	868	870

Date	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)
1/27/2011	< 0.0100	< 0.0100	<0.020	< 0.0200	< 0.0030	0.0030	< 0.0200	< 0.0200	< 0.0010	< 0.0010	< 0.01000	< 0.01000
2/24/2011	< 0.0100	< 0.0100	<0.020	< 0.0200	< 0.0030	< 0.0030	< 0.0200	0.0200	< 0.0010	< 0.0010	< 0.01000	< 0.01000
4/13/2011	0.0006	0.0007	0.0012	0.0012	< 0.0001	< 0.0001	< 0.0100	< 0.0100	< 0.0002	< 0.0002	0.00200	0.00200
5/6/2011	0.0013	0.0015	0.0008	0.0010	< 0.0001	< 0.0001	0.0034	0.0043	< 0.0002	< 0.0002	0.00018	0.00023
6/10/2011	< 0.0050	< 0.0050	0.0008	0.0008	~ 0.0003	< 0.0001	0.0038	0.0038	< 0.0002	< 0.0002	0.00020	0.00020
7/14/2011	< 0.0003	< 0.0003	0.0007	0.0007	< 0.0001	~ 0.0002	0.0031	0.0031	< 0.0002	< 0.0002	0.00031	0.00031
8/10/2011	~ 0.0004	~ 0.0006	0.0006	0.0007	< 0.0001	~ 0.0005	~ 0.0018	0.0031	< 0.0002	< 0.0002	0.00051	0.00051
9/14/2011	~ 0.0005	0.0006	0.0008	0.0008	< 0.0001	0.0010	0.0208	0.0208	< 0.0002	< 0.0002	0.00082	0.00082
10/19/2011	< 0.0010	< 0.0010	<0.0010	0.0010	< 0.0001	0.0009	< 0.0008	0.0061	< 0.0002	< 0.0002	0.00078	0.00078
11/14/2011	0.0007	0.0009	0.0011	0.0012	< 0.0001	0.0010	0.0088	0.0025	< 0.0002	< 0.0002	0.00025	0.00025
12/21/2011	< 0.0003	~ 0.0006	0.0011	0.0017	< 0.0001	0.0008	0.0107	0.0595	< 0.0002	< 0.0002	< 0.00050	< 0.00050

Table F.6. Monitoring results for KPWE

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Specific Conductivity (µS/cm)	pH	Salinity (ppt)	Total Suspended Solids (mg/L)	Volatile Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)
1/27/2011	11:30	25	34.2	0.34	916	1,683	7.04	0.84	3	~ 2	902	0.090	0.015	2.60	1.04	< 0.03	< 0.05
2/24/2011	10:45	20	33.8	0.29	1,017	1,878	7.12	0.94	~ 6	~ 6	1,040	0.147	~ 0.009	3.20	1.23	< 0.03	0.70
4/13/2011	10:35	45	54.5	15.71	1,282	1,682	8.09	0.86	~ 4	~ 4	933	0.050	< 0.005	1.10	< 0.02	< 0.03	< 0.05
5/6/2011	11:30	65	55.4	11.10	1,531	1,987	7.46	1.02	3	~ 2	1,120	~ 0.035	< 0.005	1.30	~ 0.03	< 0.03	< 0.05
6/10/2011	10:50	65	70.2	2.85	1,677	1,809	7.61	0.92	9	~ 1	1,120	~ 0.024	~ 0.005	1.20	0.24	< 0.03	< 0.05
7/14/2011	10:43	65	75.9	2.21	973	985	7.51	0.48	3	~ 2	972	~ 0.049	~ 0.009	1.20	0.28	< 0.03	0.05
8/10/2011	10:36	70	75.4	3.40	1,027	1,046	7.50	0.52	5	3	607	~ 0.027	0.012	1.50	0.48	< 0.03	0.08
9/14/2011	10:19	50	67.3	7.04	1,011	1,127	7.87	0.56	6	4	623	~ 0.047	< 0.005	1.70	0.32	< 0.03	0.11
10/19/2011	10:26	45	50.4	3.97	848	1,183	7.83	0.59	~ 2	~ 1	670	~ 0.037	~ 0.009	1.40	0.30	< 0.03	0.08
11/14/2011	10:50	45	42.1	8.23	791	1,257	7.80	0.63	4	~ 1	709	~ 0.040	~ 0.007	1.60	0.74	0.03	0.11
12/21/2011	11:06	25	37.8	8.42	912	1,564	7.39	0.78	~ 2	~ 1	885	~ 0.029	< 0.005	1.70	0.49	0.04	0.27

Date	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)
1/27/2011	398	376	< 0.0100	< 0.0100	< 0.0200	< 0.0200	< 0.0030	< 0.0030	< 0.0200	< 0.0200	< 0.0010	< 0.0010	< 0.01000	< 0.01000
2/24/2011	498	404	< 0.0100	< 0.0100	< 0.0200	< 0.0200	< 0.0030	< 0.0030	< 0.0200	0.0640	< 0.0010	< 0.0010	< 0.01000	< 0.01000
4/13/2011	449	336	~ 0.0005	0.0008	0.0011	0.0013	< 0.0001	~ 0.0002	< 0.0100	< 0.0100	< 0.0002	< 0.0002	0.00250	0.00250
5/6/2011	531	404	0.0010	0.0010	0.0012	0.0013	< 0.0001	< 0.0001	0.0023	0.0079	< 0.0002	< 0.0002	0.00017	0.00017
6/10/2011	551	396	< 0.0050	< 0.0050	0.0012	0.0013	< 0.0001	0.0005	~ 0.0012	0.0041	< 0.0002	< 0.0002	~ 0.00010	0.00017
7/14/2011	391	320	~ 0.0006	0.0008	0.0014	0.0014	< 0.0001	~ 0.0004	0.0037	0.0037	< 0.0002	< 0.0002	0.00017	0.00021
8/10/2011	261	244	~ 0.0004	~ 0.0005	0.0011	0.0012	< 0.0001	~ 0.0004	~ 0.0010	~ 0.0013	< 0.0002	< 0.0002	0.00025	0.00025
9/14/2011	285	244	~ 0.0003	0.0007	0.0010	0.0015	< 0.0001	0.0005	0.0067	0.0067	< 0.0002	< 0.0002	0.00053	0.00053
10/19/2011	280	276	< 0.0010	< 0.0010	0.0012	0.0012	< 0.0001	~ 0.0004	0.0016	0.0019	< 0.0002	< 0.0002	0.00120	~ 0.00015
11/14/2011	292	298	0.0008	~ 0.0019	0.0016	~ 0.0024	~ 0.0002	~ 0.0007	0.0072	0.0086	< 0.0002	< 0.0002	~ 0.00016	~ 0.00050
12/21/2011	357	328	0.0014	0.0018	0.0011	0.0014	~ 0.0001	0.0008	0.0187	0.0187	< 0.0002	< 0.0002	< 0.00050	< 0.00050

Table F.7. Monitoring results for KPWN

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Specific Conductivity (µS/cm)	pH	Salinity (ppt)	Total Suspended Solids (mg/L)	Volatile Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)
1/27/2011	11:20	25	34.5	0.30	857	1,560	6.88	0.77	5	3	860	0.096	0.017	2.60	1.09	< 0.03	< 0.05	365	352	< 0.0100	< 0.0100	< 0.0200	< 0.0200	< 0.0030	< 0.0030	< 0.0200	0.0420	< 0.0010	< 0.0010	< 0.01000	< 0.01000
2/24/2011	10:30	20	35.4	0.22	965	1,726	7.10	0.86	7	~ 4	901	0.133	0.011	3.10	1.14	< 0.03	< 0.05	363	348	< 0.0100	< 0.0100	< 0.0200	< 0.0200	< 0.0030	< 0.0030	< 0.0200	0.0380	< 0.0010	< 0.0010	< 0.01000	< 0.01000
2/24/2011	10:32	20	35.4	0.22	965	1,726	7.10	0.86	6	~ 4	895	0.128	0.016	3.00	1.31	< 0.03	< 0.05	435	324	< 0.0100	< 0.0100	< 0.0200	< 0.0200	< 0.0030	< 0.0030	< 0.0200	0.0250	< 0.0010	< 0.0010	< 0.01000	< 0.01000
4/13/2011	10:25	45	54.0	19.16	1,299	1,718	7.99	0.87	6	6	954	0.073	< 0.005	1.30	< 0.02	< 0.03	< 0.05	467	352	~ 0.0005	0.0006	0.0011	0.0013	< 0.0001	~ 0.0002	< 0.0100	< 0.0100	< 0.0002	< 0.0002	0.00054	0.00054
5/6/2011	11:20	65	53.6	11.50	1,491	1,982	7.34	1.02	3	~ 2	1,140	~ 0.038	< 0.005	0.96	~ 0.03	< 0.03	< 0.05	519	400	0.0048	0.0048	0.0688	0.0688	0.0015	0.0015	0.0037	0.0037	< 0.0002	< 0.0002	0.00020	0.00020
6/10/2011	10:46	65	69.8	3.38	1,442	1,560	7.69	0.79	4	3	1,160	0.053	< 0.005	1.45	0.20	< 0.03	< 0.05	566	380	< 0.0050	< 0.0050	0.0010	0.0012	~ 0.0002	~ 0.0002	0.0025	0.0025	< 0.0002	< 0.0002	0.00019	0.00019
7/14/2011	10:35	65	75.7	2.54	1,554	1,575	7.52	0.79	~ 2	~ 1	999	~ 0.042	~ 0.006	1.20	0.24	< 0.03	< 0.05	408	340	~ 0.0005	~ 0.0005	0.0013	0.0013	< 0.0001	~ 0.0002	0.0050	0.0050	< 0.0002	< 0.0002	0.00018	0.00018
8/10/2011	10:26	70	75.0	5.39	1,049	1,072	7.46	0.53	6	4	588	~ 0.035	< 0.005	1.50	0.47	< 0.03	0.07	279	248	~ 0.0004	0.0007	0.0010	0.0012	< 0.0001	0.0006	~ 0.0010	0.0021	< 0.0002	< 0.0002	0.00020	0.00020
9/14/2011	10:14	50	67.5	6.89	1,014	1,128	7.82	0.56	7	5	624	~ 0.019	< 0.005	1.30	0.32	< 0.03	0.10	282	264	~ 0.0004	0.0007	0.0011	0.0015	< 0.0001	0.0006	0.0095	0.0095	< 0.0002	< 0.0002	0.00056	0.00056
10/19/2011	10:22	45	50.5	3.56	835	1,161	7.98	0.58	3	~ 2	670	~ 0.039	~ 0.008	1.40	0.30	< 0.03	0.07	287	280	< 0.0010	< 0.0010	0.0013	0.0013	< 0.0001	0.0007	0.0027	0.0027	< 0.0002	< 0.0002	0.00063	0.00063
11/14/2011	10:40	45	41.5	9.36	775	1,243	7.84	0.62	~ 1	~ 1	710	~ 0.037	~ 0.007	1.30	0.74	0.03	0.10	291	344	0.0007	0.0007	0.0014	0.0018	~ 0.0001	0.0008	0.0018	0.0026	< 0.0002	< 0.0002	0.00021	0.00021
12/21/2011	11:00	25	39.0	9.37	928	1,556	7.25	0.78	~ 2	~ 1	863	~ 0.023	< 0.005	1.90	0.44	0.04	0.25	372	332	~ 0.0005	~ 0.0006	0.0011	0.0011	< 0.0001	0.0007	0.0034	0.0089	< 0.0002	< 0.0002	< 0.00050	< 0.00050