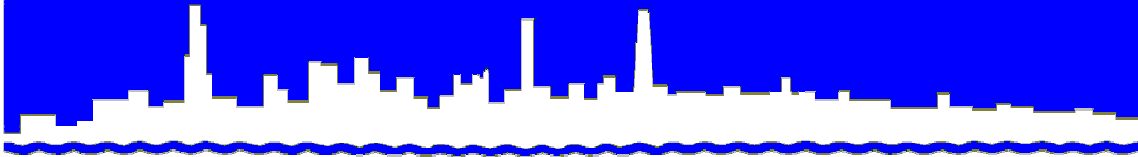


Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***RESEARCH AND DEVELOPMENT
DEPARTMENT***

REPORT NO. 06-48

**WATER AND SEDIMENT QUALITY ALONG THE
ILLINOIS WATERWAY FROM THE LOCKPORT LOCK
TO THE PEORIA LOCK DURING 2005**

September 2006

Metropolitan Water Reclamation District of Greater Chicago
100 East Erie Street Chicago, Illinois 60611-2803 312-751-5600

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September 2006

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DISCLAIMER

Mention of proprietary equipment and chemicals in this report does not constitute endorsement by the Metropolitan Water Reclamation District of Greater Chicago.

SUMMARY

During May, August, and October 2005, the Metropolitan Water Reclamation District of Greater Chicago (District) conducted water quality surveys at 49 monitoring stations along a 133 nautical mile reach of the Illinois Waterway from the Lockport Lock to the Peoria Lock. Sediment quality was assessed at 14 of the monitoring stations in October. Based on results from the 2005 surveys, the following conclusions can be made concerning the water and sediment quality along the study reach:

Water Quality

During 2005, the mean concentration of total suspended solids (TSS) increased steadily in the downstream direction of the Illinois Waterway from the Lockport Pool (9 mg/L) to the lower Peoria Pool (63 mg/L).

The mean concentration of five-day biochemical oxygen demand (BOD₅) remained between 4–5 mg/L throughout the entire sampling reach.

The mean dissolved oxygen (DO) concentration increased substantially along the waterway from the Lockport Pool (5.2 mg/L) to the upper Peoria Pool (11.3 mg/L). In the lower Peoria Pool, mean DO fell slightly (10.3 mg/L).

There was an increase in the mean pH from the Lockport Pool (6.9) to the lower Peoria Pool (8.6).

The mean ammonia nitrogen (NH₄-N), nitrite plus nitrate nitrogen (NO₂+NO₃-N), and total nitrogen (TN) concentrations decreased between the Lockport Pool and the lower Peoria Pool. The mean values decreased from 0.62, 6.23, and 7.68 mg/L, respectively, in the Lockport Pool to 0.25, 2.70, and 4.09 mg/L, respectively, in the lower Peoria Pool.

There was a continuous increase in the mean concentration of un-ionized ammonia (NH₃-N) between the Lockport Pool (0.003 mg/L) and the lower Peoria Pool (0.043 mg/L). This is due largely to the increase in water pH that occurs along this reach.

The mean total Kjeldahl nitrogen (TKN) concentration decreased from the Lockport Pool (1.46 mg/L) to the Marseilles Pool (0.85 mg/L), and then increased to a mean of 1.39 mg/L in the lower Peoria Pool.

There was a considerable decrease in the mean total phosphorus (TP) concentration along the Illinois Waterway from the Lockport Pool (1.30 mg/L) to the lower Peoria Pool (0.68 mg/L).

Mean chlorophyll *a* substantially increased in concentration along the Illinois Waterway from the Brandon Road Pool (10.5 µg/L) to the lower Peoria Pool (79.5 µg/L).

The mean concentration of cyanide was between 0.003–0.006 mg/L throughout the Illinois Waterway sampling reach.

There was a slight decrease in mean phenols concentration along the Illinois Waterway from the Lockport Pool (0.010 mg/L) to the lower Peoria Pool (0.008 mg/L).

After peaking in the Brandon Road Pool, there were dramatic drops in the geometric mean density of Fecal Coliform (FC) and *E. coli* throughout the Dresden Island Pool. Fecal coliform and *E. coli* densities then remained fairly uniform along the Illinois Waterway until a spike in the lower Peoria Pool. The overall decreases in FC and *E. coli* from Lockport to the lower Peoria Pool were 109 to 31 cfu/100 mL, and 24 to 16 cfu/100 mL, respectively.

Mean total concentrations of arsenic, cadmium, chromium, copper, lead, mercury, nickel, and silver were relatively constant from the Lockport to the lower Peoria Pool. Mean total zinc was highest from the Lockport through the Dresden Pools and decreased in the Marseilles through the lower Peoria Pool. The mean total iron and manganese concentrations in the lower Peoria Pool were more than twice the mean total iron and manganese concentrations in the upstream pools.

The mean dissolved concentrations of arsenic, cadmium, chromium, copper, lead, mercury, nickel, and silver remained fairly uniform from the Lockport Pool downstream to the lower Peoria Pool. Mean values of dissolved manganese and zinc were highest in the Lockport through the Dresden Island Pools and then were relatively uniform downstream to the lower Peoria Pool. Mean values of dissolved iron decreased from the Lockport to the Marseilles Pool, increased in the Starved Rock Pool, and finally decreased throughout the rest of the sampling reach.

Sediment Quality

The mean total solids (TS) concentration sediment fluctuated throughout the Illinois Waterway and was highest in the Starved Rock Pool.

There was generally a decrease in the mean total volatile solids (TVS) from the Lockport Pool (12 percent) to the Starved Rock Pool (2 percent), and then a slight increase until the lower Peoria Pool (6 percent).

Mean ammonia nitrogen in sediment substantially decreased from 157 mg/kg in the Lockport Pool to a mean of 1 mg/kg in the Starved Rock Pool. Ammonia nitrogen increased again from Starved Rock to the lower Peoria Pool where the mean was 75 mg/kg.

The mean concentration of TKN in sediment decreased from the Lockport Pool (18,263 mg/kg) to the Starved Rock Pool (39 mg/kg) and increased downstream to the lower Peoria Pool (1,633 mg/kg).

Total phosphorus in the sediment decreased along the Illinois Waterway from the Lockport Pool (5,880 mg/kg) to the Starved Rock Pool (59 mg/kg), and increased until the lower Peoria Pool (858 mg/kg).

The mean concentration of total cyanide in the sediment decreased between the Lockport Pool (4.133 mg/kg) and the Starved Rock Pool (0.014 mg/kg). There was then an increase in cyanide into the lower Peoria Pool (0.169 mg/kg).

The mean concentration of phenols in the sediment was highest in the Brandon Road Pool (0.575 mg/kg) and generally decreased until the lower Peoria Pool (0.069 mg/kg).

Although the concentrations of the 11 trace metals measured in the sediment were quite variable among the 14 monitoring stations, considerably higher levels of cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, and zinc were measured in the Lockport and Brandon Road Pools compared to the Dresden Island, Marseilles, and Starved Rock Pools. There were also elevated levels of arsenic, iron, manganese, and mercury in some of the sediment from the Peoria pools. Station number 32 in the upper Peoria Pool showed an unusually high arsenic concentration of 11 mg/kg in the sediment.

Elevated concentrations of mercury were detected at Stations 1 (1.2530 mg/kg) and 44 (1.1680) in the Lockport and lower Peoria Pools, respectively.

INTRODUCTION

The Illinois Waterway provides a water resource for agricultural and urban drainage, commercial and recreational navigation, electric power generation, fishing, industrial and public water supply, and other recreational activities. A principal function of this waterway is for stormwater and treated wastewater conveyance. At the upstream end of the Illinois Waterway, the District operates three major water reclamation plants in Cook County, Illinois, whose treated discharges make up approximately 90 percent of all point source treated wastewater flows entering the Illinois Waterway. These three water reclamation plants provided wastewater treatment for an average flow of 1,099 million gallons per day in 2005.

The District first began monitoring the Illinois Waterway in 1977. With the exception

of 1998, the District has conducted annual water quality surveys from the Lockport Lock to the Peoria Lock, a distance of 133 river miles, since 1984. Forty-nine monitoring stations in six navigational pools were selected for study. The primary purpose of the monitoring program is to assess water quality changes downstream of the District's major point source wastewater discharges. A secondary objective is to characterize the sediment chemistry at selected monitoring stations.

This report presents the results from the water and sediment quality surveys conducted during 2005. Data from previous years have been compiled in formal annual reports only for 1977, 1983–85, 1989, 1991, 2002, 2003, and 2004.

DESCRIPTION OF THE STUDY AREA

Illinois Waterway

The Illinois Waterway extends from Grafton, Illinois, located on the Mississippi River upstream of St. Louis, Missouri, to Lake Michigan in Chicago, Illinois. The 327-mile waterway is composed of a series of eight navigational pools (Lockport, Brandon Road, Dresden Island, Marseilles, Starved Rock, Peoria, La Grange, and Alton), whose lengths and U.S. Army Corps of Engineers waterway mile-point designations are presented in Table 1.

The pools were created in the 1930s by lock and dam structures to maintain the water depths required for commercial navigation.

The present study area is a 133-mile reach of the Illinois Waterway extending from the Lockport Lock to the Peoria Lock (Figures 1 and 2).

Monitoring Stations

Forty-nine monitoring stations were selected for the study (Figures 1 and 2). Two stations were located on the Chicago Sanitary and Ship Canal (CSSC), 8 on the Des Plaines River, and 39 stations on the Illinois River. Table 2 lists the locations of the 49 monitoring stations.

TABLE 1: ILLINOIS WATERWAY NAVIGATIONAL POOLS

Pool	Inclusive Waterway Mile-Points	Length (Miles)
Lockport	327.2 - 291.0	36.2
Brandon Road	291.0 - 286.0	5.0
Dresden Island	286.0 - 271.5	14.5
Marseilles	271.5 - 247.0	24.5
Starved Rock	247.0 - 231.0	16.0
Peoria	231.0 - 157.6	73.4
LaGrange	157.6 - 80.2	77.4
Alton	80.2 - 0.0	80.2

FIGURE 1: MAP OF THE ILLINOIS WATERWAY FROM LOCKPORT TO MARSEILLES SHOWING SAMPLING STATIONS 1 TO 21

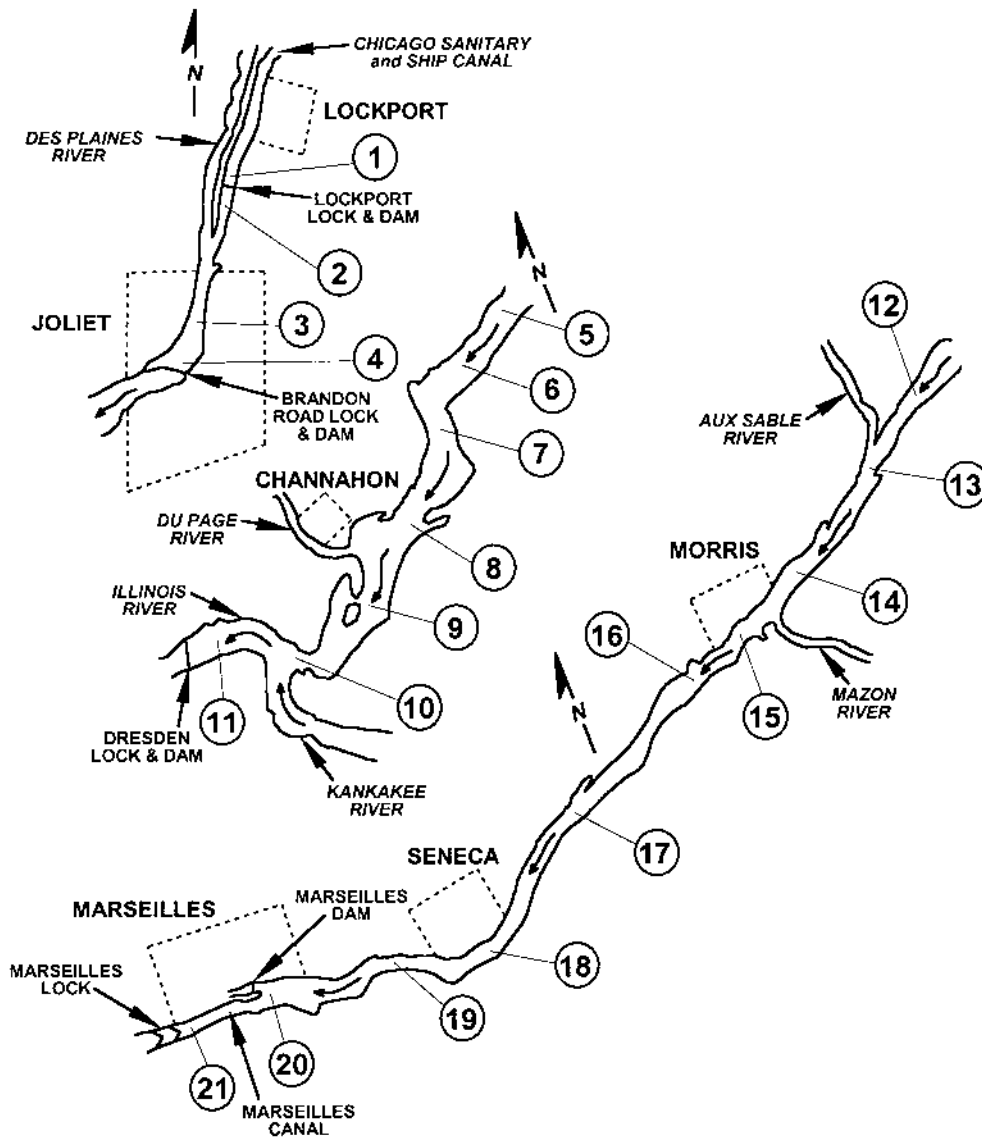


FIGURE 2: MAP OF ILLINOIS WATERWAY FROM OTTAWA TO PEORIA SHOWING SAMPLING STATIONS 22 TO 49

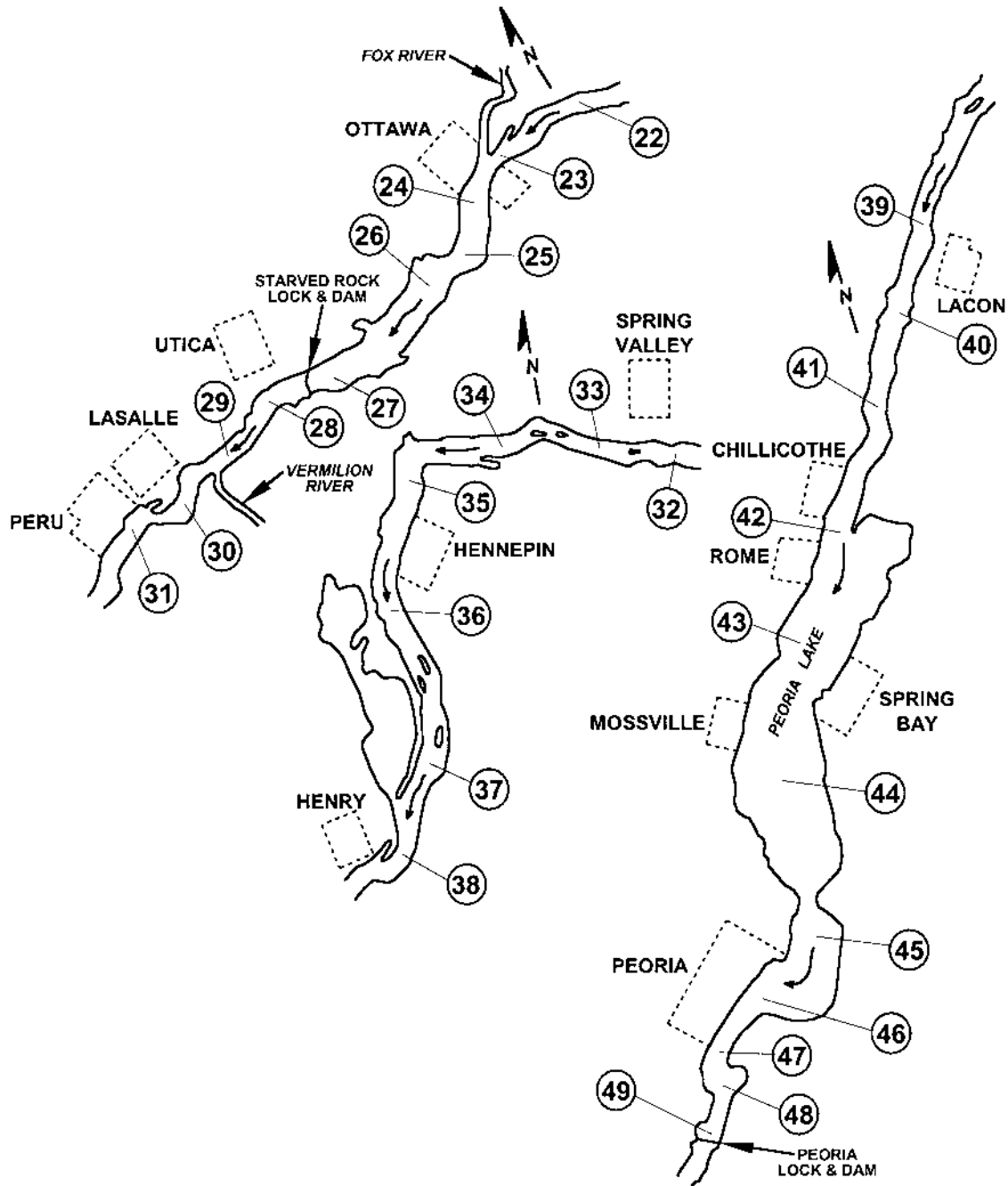


TABLE 2: MONITORING STATIONS ALONG THE ILLINOIS WATERWAY
FROM LOCKPORT LOCK TO PEORIA LOCK

Station Number	Waterway	Waterway Mile-Point Location	Navigational Pool
1	Chicago Sanitary and Ship Canal	291.5	Lockport
2	Chicago Sanitary and Ship Canal	290.5	Brandon Road
3	Des Plaines River	287.3	Brandon Road
4	Des Plaines River	286.5	Brandon Road
5	Des Plaines River	285.0	Dresden Island
6	Des Plaines River	282.8	Dresden Island
7	Des Plaines River	280.5	Dresden Island
8	Des Plaines River	278.0	Dresden Island
9	Des Plaines River	276.1	Dresden Island
10	Des Plaines River	274.0	Dresden Island
11	Illinois River	272.4	Dresden Island
12	Illinois River	270.0	Marseilles
13	Illinois River	268.9	Marseilles
14	Illinois River	265.0	Marseilles
15	Illinois River	263.0	Marseilles
16	Illinois River	261.6	Marseilles
17	Illinois River	256.0	Marseilles
18	Illinois River	253.0	Marseilles
19	Illinois River	250.0	Marseilles
20	Illinois River	247.5	Marseilles
21	Illinois River	246.0	Starved Rock
22	Illinois River	243.7	Starved Rock
23	Illinois River	240.6	Starved Rock
24	Illinois River	238.5	Starved Rock
25	Illinois River	236.8	Starved Rock
26	Illinois River	234.5	Starved Rock
27	Illinois River	231.7	Starved Rock

TABLE 2 (Continued): MONITORING STATIONS ALONG THE ILLINOIS WATERWAY
FROM LOCKPORT LOCK TO PEORIA LOCK

Station Number	Waterway	Waterway Mile-Point Location	Navigational Pool
28	Illinois River	229.6	Peoria
29	Illinois River	226.9	Peoria
30	Illinois River	224.7	Peoria
31	Illinois River	222.6	Peoria
32	Illinois River	219.8	Peoria
33	Illinois River	217.1	Peoria
34	Illinois River	213.4	Peoria
35	Illinois River	209.4	Peoria
36	Illinois River	205.0	Peoria
37	Illinois River	200.4	Peoria
38	Illinois River	196.9	Peoria
39	Illinois River	190.0	Peoria
40	Illinois River	186.4	Peoria
41	Illinois River	183.2	Peoria
42	Illinois River	179.0	Peoria
43	Illinois River	174.9	Peoria
44	Illinois River	170.9	Peoria
45	Illinois River	165.3	Peoria
46	Illinois River	162.8	Peoria
47	Illinois River	160.6	Peoria
48	Illinois River	159.4	Peoria
49	Illinois River	158.2	Peoria

MATERIALS AND METHODS

Field Monitoring and Laboratory Analysis

Water. *Chemical Constituents.* Water samples for chemical analyses were collected from the 49 monitoring stations on May 2–6, May 9–13, August 1–5, August 8–12, October 3–7, and October 10–14, 2005. Samples were collected at a depth of three feet below the water surface in the center of the waterway with a submersible drainage pump. Water samples were collected for dissolved trace metal analysis by the Environmental Monitoring and Research Division (EM&R) personnel with an air-driven Teflon bellows pump. Samples were filtered in the field through a 0.45 μm high capacity in-line groundwater sampling capsule (Gelman Laboratory) attached to the bellows pump. Prior to sample collection, the Teflon bellows pump was flushed with one gallon of de-ionized water followed by river water for two minutes. Except for FC and *E. coli*, all water samples were transported to the Cecil Lue-Hing R&D Laboratory in iced, insulated chests within 24 hours of collection. PDC Laboratories in Peoria, Illinois, were contracted to retrieve water samples from EM&R personnel and perform FC and *E. coli* analysis.

The constituents analyzed in water, sample containers used, and preservation methods are presented in [Table 3](#). Water temperature, turbidity, conductivity, DO, and pH were measured in the field using a calibrated YSI Incorporated Model 6600 water quality monitor. In the laboratory, all constituents were analyzed using procedures established by the United States Environmental Protection Agency (USEPA) or described in the 19th Edition of [Standard Methods for the Examination of Water and Wastewater \(Standard Methods\)](#) (1995).

The concentration of un-ionized ammonia was calculated using the equation given by IEPA in Section 302.407 of Title 35.

Bacteria. Water samples for FC and *E. coli* analyses were collected from the 49 stations on the same day and at the same time as the chemical constituents. Samples were collected with a submersible drainage pump at a depth of three feet below the water surface in the center of the waterway. The sample was poured into a sterile, 175-mL plastic bottle containing 0.3 mL of a 15 percent solution of sodium thiosulfate and 0.1 mL of a 10 percent solution of EDTA. The bacteria samples were kept cool in iced, insulated chests. The analyses were performed within 24 hours by membrane filter analysis as described in [Standard Methods](#).

Chlorophyll a. Water samples for chlorophyll analysis were collected at 22 selected monitoring stations (2, 3, 5, 7, 10, 11, 15, 18, 20, 22, 25, 27, 28, 31, 34, 36, 38, 41, 42, 44, 45, and 48) in the same manner as described for chemical constituents. The sample was poured into a 1-liter, wide-mouth, amber plastic bottle containing 1 mg of magnesium carbonate. The water samples were stored in iced, insulated chests. In the laboratory, the water samples were analyzed for chlorophyll *a*, *b*, and *c* using methods described in [Standard Methods](#).

Dissolved Mercury. The Method Detection Limit (MDL) for total and dissolved mercury was 0.00005 mg/L during 2005. Dissolved mercury analysis was only analyzed if the total mercury value was greater than twice the MDL (0.00010 mg/L).

Sediment. *Chemical Constituents.* Sediment samples were collected during the 2005

TABLE 3: CONSTITUENTS ANALYZED, SAMPLE CONTAINERS, AND PRESERVATION METHODS FOR WATER SAMPLES COLLECTED FROM THE ILLINOIS WATERWAY STUDY AREA

Constituent and Abbreviation	Units of Measure	Sample Container	Preservative
Water Temperature	°C	NA	Measured in Field
Total Suspended Solids (TSS)	mg/L	Plastic	Cool, 4°C
Turbidity	NTU	NA	Measured in Field
Conductivity	µS/cm	NA	Measured in Field
Five-Day Biochemical Oxygen Demand (BOD ₅)	mg/L	Plastic	Cool, 4°C
Dissolved Oxygen	mg/L	NA	Measured in Field
pH	units	NA	Measured in Field
Ammonia Nitrogen (NH ₄ -N)	mg/L	Plastic	Cool, 4°C, H ₂ SO ₄ to pH <2
Un-ionized Ammonia (NH ₃ -N)*	mg/L	---	---
Total Kjeldahl Nitrogen (TKN)	mg/L	Plastic	Cool, 4°C, H ₂ SO ₄ to pH <2
Nitrite plus Nitrate Nitrogen (NO ₂ +NO ₃ -N)	mg/L	Plastic	Cool, 4°C, H ₂ SO ₄ to pH <2
Total Phosphorus (TP)	mg/L	Plastic	Cool, 4°C
Chlorophyll <i>a</i>	µg/L	Plastic, Amber	Cool, 4°C, MgCO ₃
Total Cyanide (TCN)	mg/L	Plastic	NaOH to pH 12
Phenols	mg/L	Glass	H ₂ SO ₄ to pH <2
Total and Soluble Metals (Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Silver, and Zinc)	mg/L	Plastic	HNO ₃ to pH <2
Fecal Coliform (FC)	cfu/100 mL	Sterile Plastic	Cool, 4°C, EDTA, and Thiosulfate

NA = Not Applicable.

*Determined by calculation using water temperature, pH and NH₄-N.

survey at 14 of the 49 monitoring stations (1, 2, 5, 8, 12, 18, 23, 28, 32, 35, 38, 41, 44, and 48). Over the period of October 3–7, 2005, one sediment sample was taken with a 6- x 6-inch Ponar grab sampler from each of the 14 stations. The sediment sample was transferred to a wide-mouth quart glass jar and analyzed for TS, TVS, ammonia, TKN,

NO₂+NO₃-N, TP, TCN, phenols, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, and zinc. The constituents analyzed, sample containers, and preservation methods are summarized in Table 4. All constituents were analyzed according to procedures found in Standard Methods.

TABLE 4: CONSTITUENTS ANALYZED, SAMPLE CONTAINERS, AND PRESERVATION METHODS FOR SEDIMENT SAMPLES COLLECTED FROM THE ILLINOIS WATERWAY STUDY AREA

Constituent and Abbreviation	Units of Measure ¹	Sample Container	Preservative
Total Solids (TS)	percent	Glass	Cool, 4°C
Total Volatile Solids (TVS)	percent	Glass	Cool, 4°C
Ammonia Nitrogen (NH ₄ -N)	mg/kg	Glass	Cool, 4°C
Total Kjeldahl Nitrogen (TKN)	mg/kg	Glass	Cool, 4°C
Nitrite plus Nitrate Nitrogen (NO ₂ +NO ₃ -N)	mg/kg	Glass	Cool, 4°C
Total Phosphorus (TP)	mg/kg	Glass	Cool, 4°C
Total Cyanide (TCN)	mg/kg	Glass	Cool, 4°C
Phenols	mg/kg	Glass	Cool, 4°C
Total and Soluble Metals (Arsenic, Cadmium, Chromium Copper, Iron, Lead, Manganese, Mercury, Nickel, Silver, and Zinc)	mg/kg	Glass	Cool, 4°C

¹Expressed on a dry weight basis.

RESULTS AND DISCUSSION

Water Quality

Water quality in lotic ecosystems can be evaluated by assessing a combination of biological, chemical, and physical parameters, including bacterial levels, the concentrations of dissolved gases, dissolved and suspended inorganic and organic compounds, nutrients, water temperature, and rate of flow. Methods for measuring the biological and chemical constituents, and the physical properties of water are well defined, and they have considerable precision. While sediment data can reflect long-term conditions, water samples are indicative of the water quality only at the time of monitoring.

In order to describe water quality in the Illinois Waterway, the 133-mile study area was divided by navigational pool: (1) Lockport (Station 1), (2) Brandon Road (Stations 2–4), (3) Dresden Island (Stations 5–11), (4) Marseilles (Stations 12–20), (5) Starved Rock (Stations 21–27), and (6) Peoria, upper Peoria (Stations 28–41), and lower Peoria (Stations 42–49). The Peoria Pool was subdivided based on geo-morphological differences between the upper and lower reaches.

The concentrations of the 38 constituents measured at each of the 49 monitoring stations, including calculated values for unionized ammonia and total nitrogen, are presented in [Appendices AI](#) through [AVII](#). The water quality data for selected parameters are summarized by navigational pool in [Table 5](#). When the analytical result was less than the MDL, the MDL value was used to calculate the mean.

Dissolved mercury data are not reported in the appendices because the few stations analyzed for dissolved mercury generally resulted in values less than the MDL. Dissolved mercury was only analyzed if the

total mercury value was greater than twice the MDL ($<0.10 \mu\text{g/L}$).

The dissolved mercury results were below the MDL of $0.05 \mu\text{g/L}$ at Stations 41, 45, 47, and 49 during the month of May. Dissolved mercury concentrations were below the MDL at Stations 11, 15, and 44 during August. During October, dissolved mercury measured $0.05 \mu\text{g/L}$ at Station 34 and was below the MDL at Station 19.

Spatial Variability Along the Illinois Waterway. *Total Suspended Solids.* As shown in [Figure 3](#), TSS generally increased in concentration from Lockport to the Peoria Pool. The increase in TSS along the Illinois Waterway may be related to an increase in agricultural runoff. There was a sharp increase in TSS near Station 43 in Peoria Lake in 2005. TSS remained relatively elevated throughout the rest of the lower Peoria Pool. A peak of similar magnitude was present in 2003 and 2004 near the same station.

Dissolved Oxygen. Dissolved oxygen concentration trends along the Illinois Waterway are shown in [Figure 4](#). The dramatic increase in DO between Stations 4 and 5 is directly attributable to the natural re-aeration resulting from water passing over the Brandon Road Dam. The mean DO concentration along the Illinois Waterway was above 9.0 mg/L below the Dresden Island Lock and Dam.

Ammonia Nitrogen. Ammonia nitrogen rapidly decreased in the Brandon Road and Dresden Island Pools ([Figure 5](#)). Mean $\text{NH}_4\text{-N}$ remained relatively uniform from Marseilles to the upper Peoria Pool, where the concentration began to increase throughout the rest of the sampling reach.

Total Nitrogen. As shown in [Figure 6](#), there was a general decrease in TN concentration from the Lockport Pool to the lower Peoria Pool. The sharp decrease in TN between

Stations 10 and 12 may be attributable to the confluence of the Kankakee River with the Des Plaines River.

TABLE 5: SUMMARY OF WATER QUALITY FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2005

Navigational Pool	Constituents ^a	Range	Average
Lockport	Water Temperature (°C) ^b	16.1 – 32.0	24.5
	TSS	4 – 12	9
	Turbidity (NTU) ^b	3 – 21	10
	Conductivity (μS/cm) ^b	552 – 1,160	811
	BOD ₅	<2 – 6	5
	Dissolved Oxygen (DO) ^b	4.7 – 5.9	5.2
	pH (units) ^b	6.1 – 7.4	6.9
	NH ₄ -N	0.19 – 1.42	0.62
	NH ₃ -N	<0.001 – 0.006	0.003
	TKN	0.84 – 2.17	1.46
	NO ₂ +NO ₃ -N	4.19 – 8.85	6.23
	TN	5.03 – 11.02	7.68
	TP	0.83 – 1.86	1.30
	Chlorophyll <i>a</i> (μg/L)	No Data	No Data
	Total Cyanide	<0.003 – 0.017	0.006
	Phenols	0.006 – 0.013	0.010
	FC (cfu/100 mL)	20 – 350	109 ^c
<i>E. coli</i> (cfu/100 mL)	<10 – 140	24 ^c	
Brandon Road	Water Temperature (°C) ^b	14.2 – 31.7	23.8
	TSS	3 – 19	12
	Turbidity (NTU) ^b	5 – 22	13
	Conductivity (μS/cm) ^b	564 – 1,239	841
	BOD ₅	<2 – 7	4
	Dissolved Oxygen (DO) ^b	4.9 – 8.4	6.4
	pH (units) ^b	6.5 – 7.7	7.2
	NH ₄ -N	0.14 – 1.10	0.47
	NH ₃ -N	<0.001 – 0.009	0.004
	TKN	0.90 – 4.11	1.50
	NO ₂ +NO ₃ -N	3.91 – 9.73	6.18
	TN	4.81 – 11.65	7.68
	TP	0.89 – 1.79	1.29

TABLE 5 (CONTINUED): SUMMARY OF WATER QUALITY FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2005

Navigational Pool	Constituents ^a	Range	Average
Brandon Road (Continued)	Chlorophyll <i>a</i> (µg/L)	2.1 – 27.5	10.5
	Total Cyanide	<0.003 – 0.003	0.003
	Phenols	<0.003 – 0.013	0.008
	FC (cfu/100 mL)	10 – 7,000	260 ^c
	<i>E. coli</i> (cfu/100 mL)	10 – 800	81 ^c
Dresden Island	Water Temperature (°C) ^b	12.8 – 33.7	24.5
	TSS	<3 – 69	14
	Turbidity (NTU) ^b	4 – 69	17
	Conductivity (µS/cm) ^b	582 – 1,265	884
	BOD ₅	<2 – 9	4
	Dissolved Oxygen (DO) ^b	5.4 – 11.1	7.9
	pH (units) ^b	7.2 – 8.2	7.6
	NH ₄ -N	0.06 – 0.80	0.32
	NH ₃ -N	0.001 – 0.021	0.007
	TKN	0.73 – 1.93	1.19
	NO ₂ +NO ₃ -N	2.45 – 8.40	5.80
	TN	3.18 – 9.72	6.99
	TP	0.66 – 1.77	1.22
	Chlorophyll <i>a</i> (µg/L)	1.7 – 37.8	15.0
	Total Cyanide	<0.003 – 0.005	0.003
	Phenols	<0.003 – 0.013	0.008
	FC (cfu/100 mL)	<10 – 600	87 ^c
<i>E. coli</i> (cfu/100 mL)	<10 – 170	29 ^c	
Marseilles	Water Temperature (°C) ^b	11.7 – 31.4	22.7
	TSS	<3 – 140	15
	Turbidity (NTU) ^b	1 – 203	19
	Conductivity (µS/cm) ^b	606 – 1,081	780
	BOD ₅	<2 – 6	4
	Dissolved Oxygen (DO) ^b	6.3 – 12.3	9.3
	pH (units) ^b	7.5 – 8.6	8.0
	NH ₄ -N	<0.02 – 0.41	0.12
	NH ₃ -N	<0.001 – 0.030	0.008
	TKN	0.53 – 1.45	0.85
	NO ₂ +NO ₃ -N	2.75 – 7.38	4.11
TN	3.48 – 8.67	4.96	

TABLE 5 (CONTINUED): SUMMARY OF WATER QUALITY FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2005

Navigational Pool	Constituents ^a	Range	Average
Marseilles (Continued)	TP	0.32 – 1.40	0.78
	Chlorophyll <i>a</i> (µg/L)	8.2 – 88.5	26.2
	Total Cyanide	<0.003 – 0.003	0.003
	Phenols	<0.003 – 0.015	0.007
	FC (cfu/100 mL)	<10 – 14,000	24 ^c
	<i>E. coli</i> (cfu/100 mL)	<10 – 40	13 ^c
Starved Rock	Water Temperature (°C) ^b	11.6 – 31.5	22.3
	TSS	3 – 140	23
	Turbidity (NTU) ^b	3 – 76	20
	Conductivity (µS/cm) ^b	631 – 947	786
	BOD ₅	<2 – 8	4
	Dissolved Oxygen (DO) ^b	6.1 – 17.4	10.5
	pH (units) ^b	7.1 – 8.9	8.3
	NH ₄ -N	<0.02 – 0.37	0.09
	NH ₃ -N	<0.001 – 0.065	0.011
	TKN	0.60 – 3.24	1.02
	NO ₂ +NO ₃ -N	1.91 – 6.70	3.58
	TN	2.70 – 7.81	4.60
	TP	0.30 – 1.31	0.69
	Chlorophyll <i>a</i> (µg/L)	14.8 – 148.1	51.7
	Total Cyanide	<0.003 – 0.003	0.003
	Phenols	<0.003 – 0.015	0.006
	FC (cfu/100 mL)	<10 – 80	19 ^c
<i>E. coli</i> (cfu/100 mL)	<10 – 20	11 ^c	
Upper Peoria	Water Temperature (°C) ^b	11.7 – 31.0	22.4
	TSS	13 – 75	30
	Turbidity (NTU) ^b	16 – 1,230	44
	Conductivity (µS/cm) ^b	624 – 915	790
	BOD ₅	<2 – 10	4
	Dissolved Oxygen (DO) ^b	5.4 – 16.9	11.3
	pH (units) ^b	7.7 – 9.0	8.5
	NH ₄ -N	0.03 – 0.61	0.15
	NH ₃ -N	0.002 – 0.154	0.030
	TKN	0.63 – 3.56	1.35

TABLE 5 (CONTINUED): SUMMARY OF WATER QUALITY FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2005

Navigational Pool	Constituents ^a	Range	Average
Upper Peoria (Continued)	NO ₂ +NO ₃ -N	1.57 – 5.62	3.27
	TN	2.38 – 8.87	4.61
	TP	0.22 – 0.87	0.60
	Chlorophyll <i>a</i> (µg/L)	18.0 – 134.9	66.2
	Total Cyanide	<0.003 – 0.003	0.003
	Phenols	<0.003 – 0.023	0.009
	FC (cfu/100 mL)	<10 – 200	14 ^c
	<i>E. coli</i> (cfu/100 mL)	<10 – 40	12 ^c
Lower Peoria	Water Temperature (°C) ^b	13.0 – 30.1	21.9
	TSS	26 – 234	63
	Turbidity (NTU) ^b	28 – 1,257	90
	Conductivity (µS/cm) ^b	658 – 889	795
	BOD ₅	3 – 9	5
	Dissolved Oxygen (DO) ^b	4.5 – 18.9	10.3
	pH (units) ^b	8.3 – 9.0	8.6
	NH ₄ -N	0.02 – 0.83	0.25
	NH ₃ -N	0.003 – 0.142	0.043
	TKN	0.74 – 3.54	1.39
	NO ₂ +NO ₃ -N	0.97 – 5.83	2.70
	TN	1.93 – 8.14	4.09
	TP	0.23 – 1.36	0.68
	Chlorophyll <i>a</i> (µg/L)	18.7 – 139.5	79.5
	Total Cyanide	<0.003 – 0.003	0.003
	Phenols	<0.003 – 0.016	0.008
	FC (cfu/100 mL)	<10 – 2,200	31 ^c
	<i>E. coli</i> (cfu/100 mL)	<10 – 130	16 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

FIGURE 3: MEAN TOTAL SUSPENDED SOLIDS CONCENTRATION AT 49 STATIONS ALONG THE ILLINOIS WATERWAY FROM THE LOCKPORT LOCK TO THE PEORIA LOCK DURING MAY, AUGUST, AND OCTOBER 2005

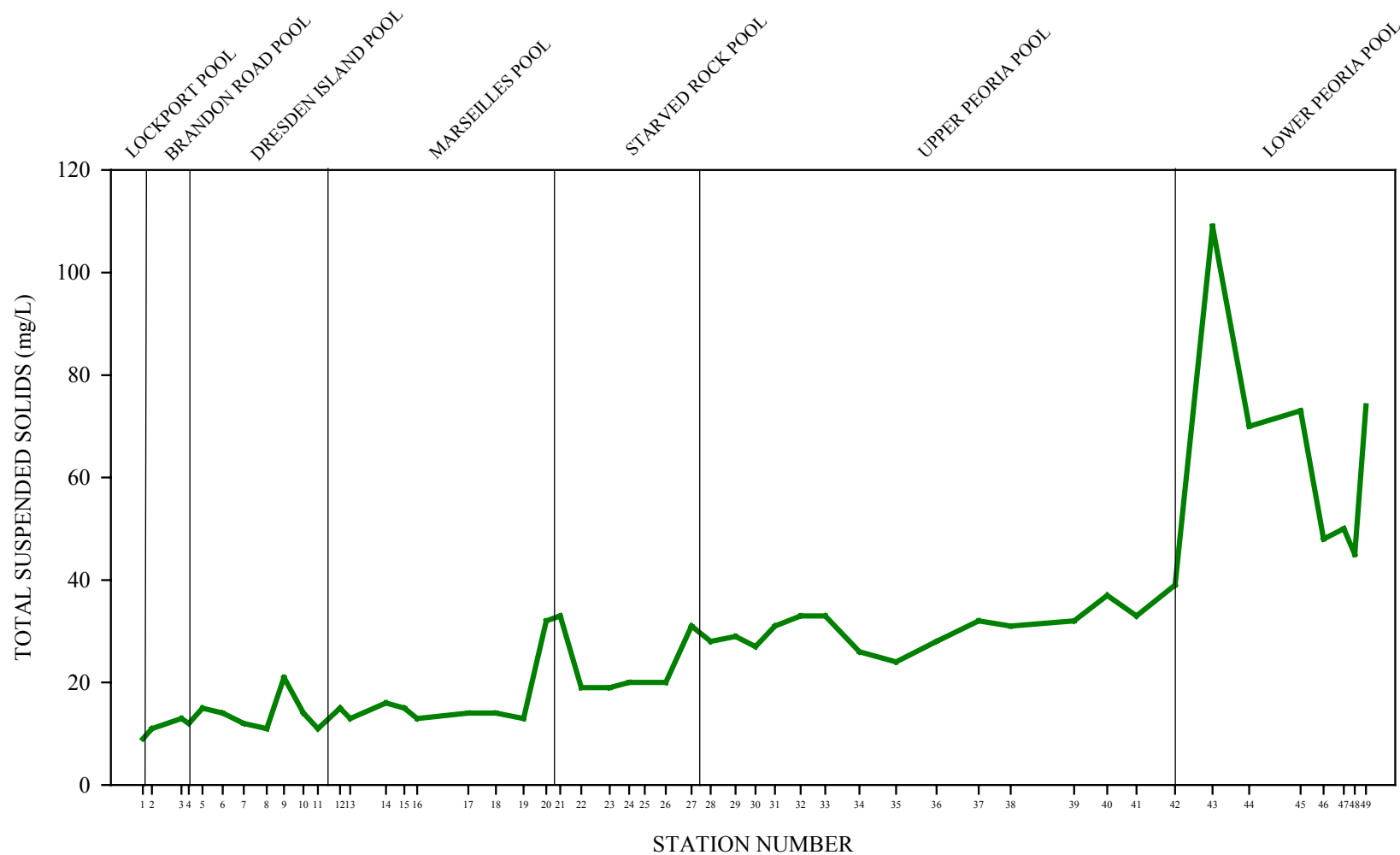


FIGURE 4: MEAN DISSOLVED OXYGEN CONCENTRATION AT 49 STATIONS ALONG THE ILLINOIS WATERWAY FROM THE LOCKPORT LOCK TO THE PEORIA LOCK DURING MAY, AUGUST, AND OCTOBER 2005

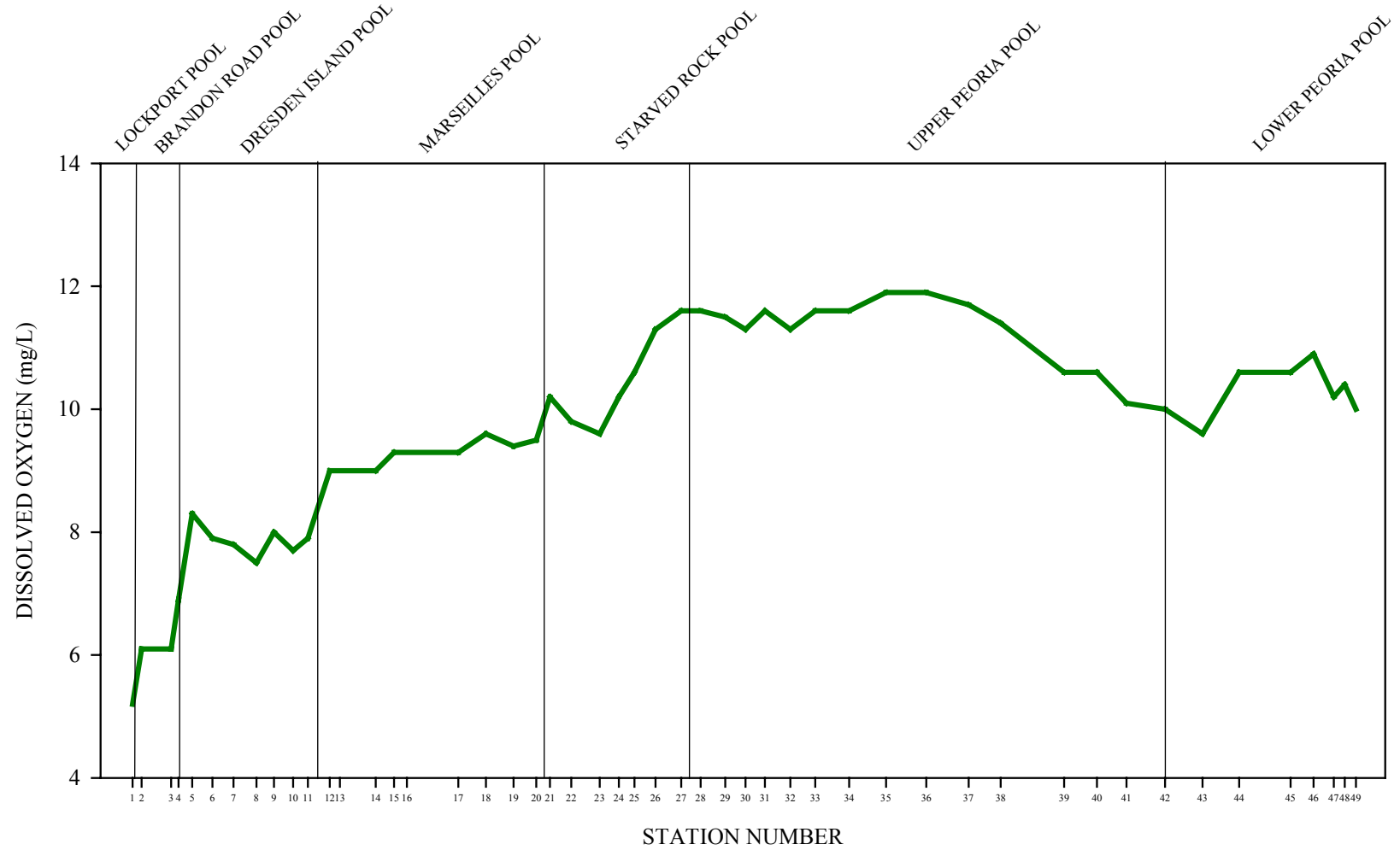


FIGURE 5: MEAN AMMONIA NITROGEN CONCENTRATION AT 49 STATIONS ALONG THE ILLINOIS WATERWAY FROM THE LOCKPORT LOCK TO THE PEORIA LOCK DURING MAY, AUGUST, AND OCTOBER 2005

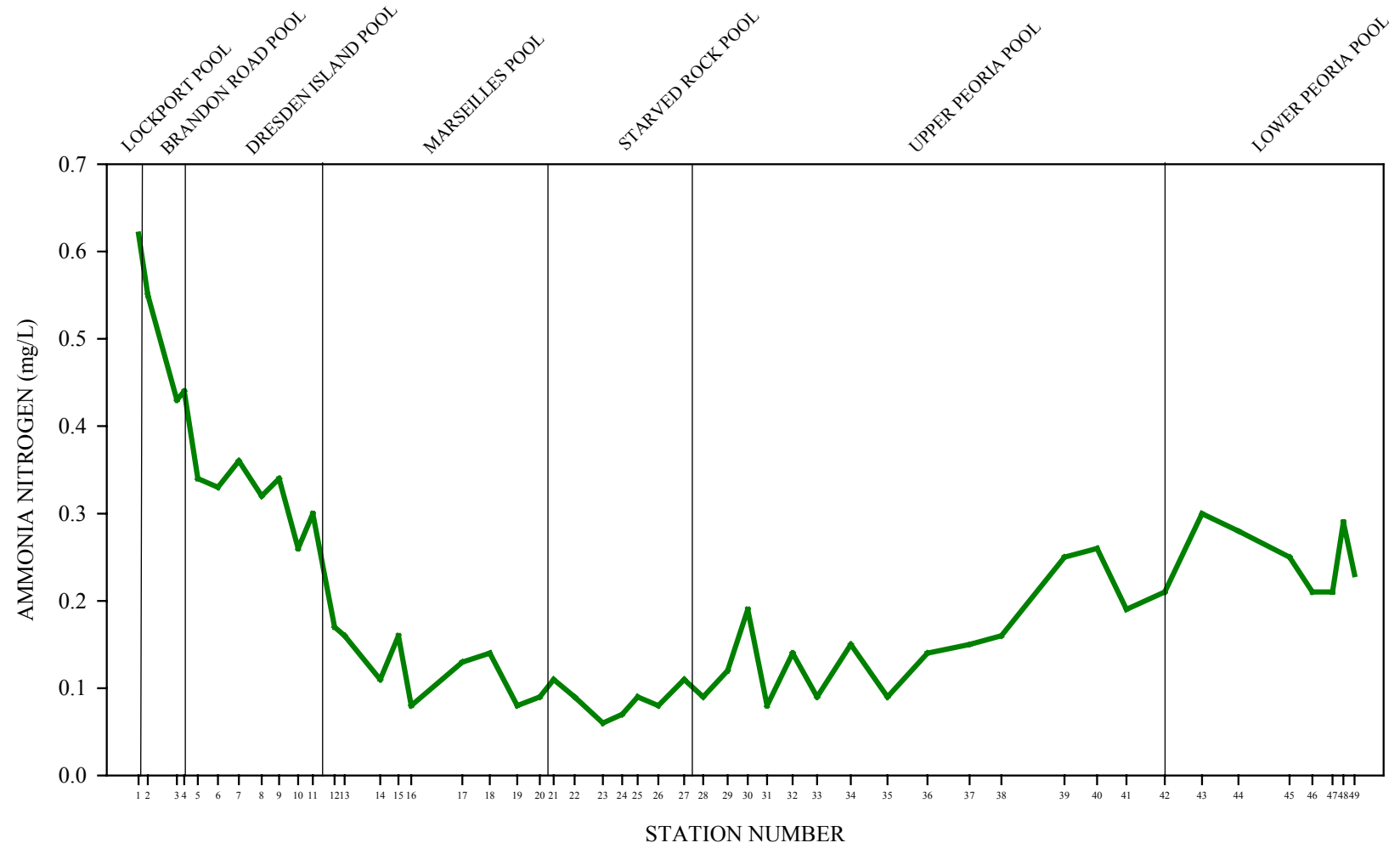
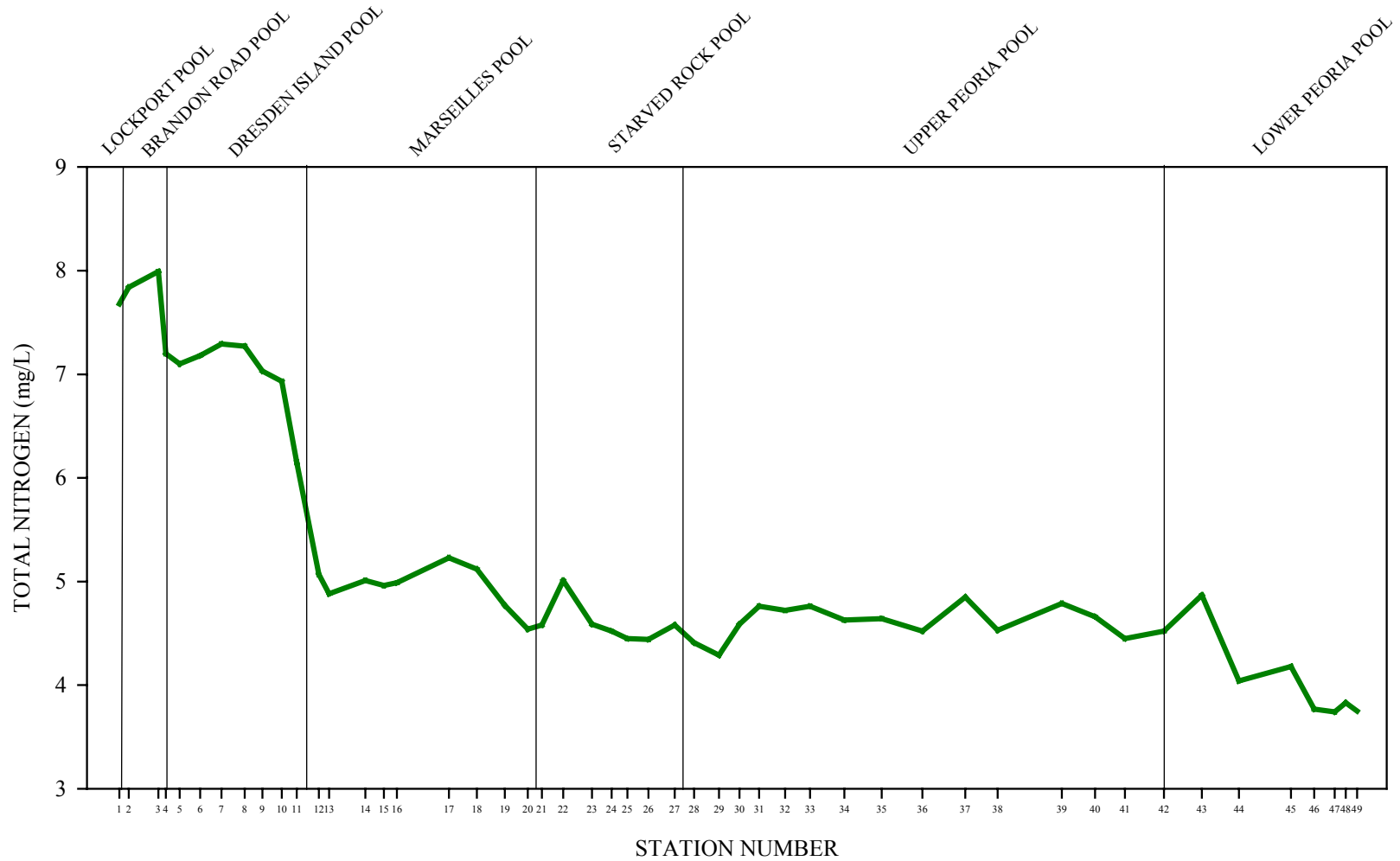


FIGURE 6: MEAN TOTAL NITROGEN CONCENTRATION AT 49 STATIONS ALONG THE ILLINOIS WATERWAY FROM THE LOCKPORT LOCK TO THE PEORIA LOCK DURING MAY, AUGUST, AND OCTOBER 2005

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Total Phosphorus. Mean concentrations of TP generally decreased along the Illinois Waterway from the Lockport Pool to the upper Peoria Pool and then increased slightly in the lower Peoria Pool as shown in [Figure 7](#). The sharp decrease in TP between Stations 10 and 12 may be attributable to the confluence of the Kankakee River with the Des Plaines River.

Fecal Coliform. Geometric mean FC peaked in the Brandon Road Pool, decreased drastically along the Dresden Island Pool, and then remained fairly uniform along the Illinois Waterway into the Peoria Pool ([Figure 8](#)). FC sharply increased in the lower Peoria Pool at Station 47.

Trace Metals. Mean total concentrations of arsenic, cadmium, chromium, copper, lead, mercury, nickel, and silver were relatively constant from the Lockport to the lower Peoria Pool ([Table 6](#)). Mean total zinc was highest from the Lockport through the Dresden Pool and decreased in the Marseilles through the lower Peoria Pool. The mean total iron and manganese concentrations in the lower Peoria Pool were more than twice the mean total iron and manganese concentrations in the upstream pools.

The mean dissolved concentrations of arsenic, cadmium, chromium, copper, lead, mercury, nickel, and silver remained fairly uniform from the Lockport Pool downstream to the lower Peoria Pool ([Table 6](#)). Mean values of dissolved manganese and zinc were highest in the Lockport through the Dresden Island Pools and then were relatively uniform downstream to the lower Peoria Pool. Mean values of dissolved iron decreased from the Lockport to the Marseilles Pool, increased in the Starved Rock Pool, and finally decreased throughout the rest of the sampling reach.

Nutrient Flux

Total loads of TN and TP were estimated by multiplying their concentrations at a given point by the discharge at that point. Discharge data were obtained from the United States Geological Survey (USGS) Web site. The sampling stations in common with USGS gauging stations included Stations 1 (Lockport Pool), 26 (Starved Rock Pool), 39 (Upper Peoria Pool), and 49 (Lower Peoria Pool). The nutrient flux was determined in tons per day for each of these four stations during the six sampling events ([Table 7](#)).

Total phosphorus load was slightly higher during October at Stations 1, 39, and 49, possibly due to allochthonous materials (e.g. fall leaf litter) breaking down in the waterway. Total phosphorus flux during various seasons fluctuated throughout the Illinois Waterway and spatial patterns were not consistent.

Total nitrogen load remained relatively constant at Station 1 throughout the year. At Stations 26, 39, and 49, TN load was significantly higher during the month of May, most likely due to agricultural runoff and drainage. In May, the load of TN increased moving downstream along the Illinois Waterway, whereas in August, TN either fluctuated or decreased between the Lockport and Peoria Pools. During the first week of October, TN load increased from Lockport to the Upper Peoria Pool, but the load during the second week was highest at Lockport, decreased, and then remained relatively constant throughout the rest of the stations. Nitrogen sources and flux are further evaluated and discussed in the Addendum Report entitled, "Isotopic Composition of Nitrate in the Illinois Waterway, 2005," at the end of this report.

FIGURE 7: MEAN TOTAL PHOSPHORUS CONCENTRATION AT 49 STATIONS ALONG THE ILLINOIS WATERWAY FROM THE LOCKPORT LOCK TO THE PEORIA LOCK DURING MAY, AUGUST, AND OCTOBER 2005

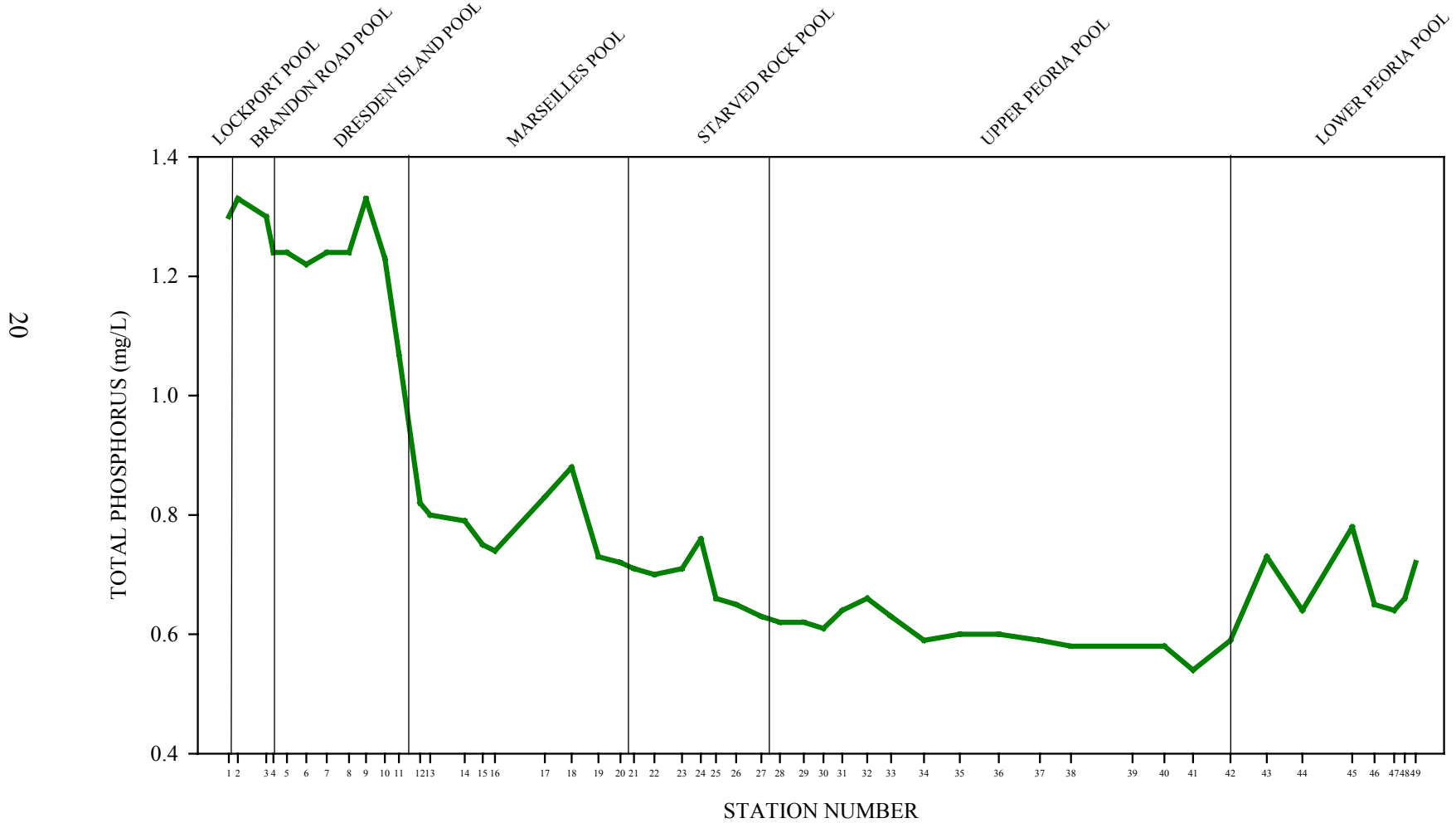


FIGURE 8: GEOMETRIC MEAN FECAL COLIFORM AT 49 STATIONS ALONG THE ILLINOIS WATERWAY FROM THE LOCKPORT LOCK TO THE PEORIA LOCK DURING MAY, AUGUST, AND OCTOBER 2005

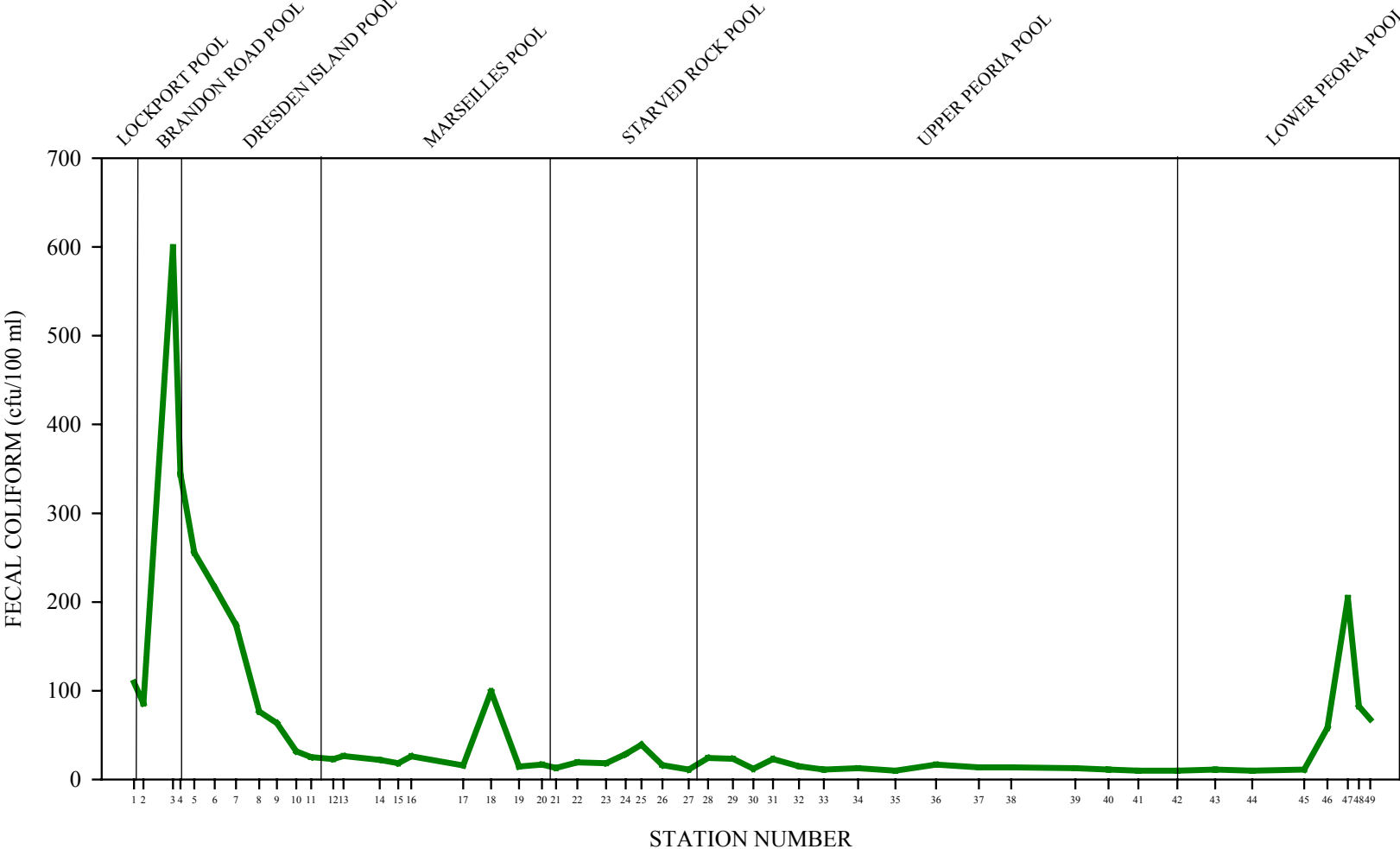


TABLE 6: SUMMARY OF METALS CONCENTRATIONS FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2005

Navigational Pool	Constituents ^a	Range	Average
Lockport	Total Arsenic	All values <0.003	<0.003
	Dissolved Arsenic	All values <0.002	<0.002
	Total Cadmium	<0.0004 – 0.0021	0.0009
	Dissolved Cadmium	<0.0003 – 0.0012	0.0007
	Total Chromium	All values <0.004	<0.004
	Dissolved Chromium	<0.0007 – 0.0013	0.0009
	Total Copper	0.009 – 0.023	0.014
	Dissolved Copper	<0.002 – 0.002	0.002
	Total Iron	0.173 – 0.378	0.261
	Dissolved Iron	0.011 – 0.031	0.023
	Total Lead	0.003 – 0.010	0.006
	Dissolved Lead	<0.0009 – 0.0050	0.0027
	Total Manganese	0.0164 – 0.0374	0.0251
	Dissolved Manganese	0.0076 – 0.0318	0.0183
	Total Mercury (µg/L)	All values <0.05	<0.05
	Total Nickel	<0.002 – 0.008	0.004
	Dissolved Nickel	0.002 – 0.005	0.004
	Total Silver	All values <0.0008	<0.0008
	Dissolved Silver	<0.0003 – 0.0004	0.0003
	Total Zinc	0.025 – 0.046	0.032
Dissolved Zinc	0.003 – 0.029	0.017	
Brandon Road	Total Arsenic	<0.003 – 0.003	0.003
	Dissolved Arsenic	<0.002 – 0.004	0.002
	Total Cadmium	<0.0004 – 0.0016	0.0008
	Dissolved Cadmium	<0.0003 – 0.0011	0.0005
	Total Chromium	<0.004 – 0.004	0.004
	Dissolved Chromium	<0.0007 – 0.0013	0.0010
	Total Copper	0.008 – 0.021	0.014
	Dissolved Copper	<0.002 – 0.002	0.002
	Total Iron	0.209 – 0.502	0.331
	Dissolved Iron	0.012 – 0.031	0.019
	Total Lead	0.002 – 0.012	0.007
	Dissolved Lead	<0.0009 – 0.0059	0.0028
	Total Manganese	0.0188 – 0.0396	0.0270
	Dissolved Manganese	0.0071 – 0.0297	0.0162

TABLE 6 (Continued): SUMMARY OF METALS CONCENTRATIONS FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2005

Navigational Pool	Constituents ^a	Range	Average
Brandon Road (Continued)	Total Mercury (µg/L)	<0.05 – 0.08	0.05
	Total Nickel	<0.002 – 0.007	0.004
	Dissolved Nickel	0.002 – 0.005	0.004
	Total Silver	All values <0.0008	<0.0008
	Dissolved Silver	<0.0003 – 0.0004	0.0003
	Total Zinc	0.022 – 0.045	0.033
	Dissolved Zinc	<0.002 – 0.024	0.015
Dresden Island	Total Arsenic	<0.003 – 0.003	0.003
	Dissolved Arsenic	<0.002 – 0.009	0.002
	Total Cadmium	<0.0004 – 0.0024	0.0008
	Dissolved Cadmium	<0.0003 – 0.0015	0.0005
	Total Chromium	<0.004 – 0.006	0.004
	Dissolved Chromium	<0.0007 – 0.0016	0.0009
	Total Copper	0.006 – 0.023	0.014
	Dissolved Copper	<0.002 – 0.003	0.002
	Total Iron	0.177 – 1.073	0.343
	Dissolved Iron	0.004 – 0.039	0.016
	Total Lead	<0.002 – 0.018	0.007
	Dissolved Lead	<0.0009 – 0.0076	0.0029
	Total Manganese	0.0177 – 0.0494	0.0306
	Dissolved Manganese	<0.0004 – 0.0264	0.0108
	Total Mercury (µg/L)	<0.05 – 0.12	0.05
	Dissolved Mercury (µg/L)	All values <0.05	<0.05
	Total Nickel	<0.002 – 0.007	0.004
	Dissolved Nickel	0.002 – 0.005	0.004
	Total Silver	<0.0008 – 0.0008	0.0008
	Dissolved Silver	<0.0003 – 0.0003	0.0003
Total Zinc	0.013 – 0.085	0.032	
Dissolved Zinc	<0.002 – 0.023	0.014	
Marseilles	Total Arsenic	All values <0.003	<0.003
	Dissolved Arsenic	<0.002 – 0.005	0.002
	Total Cadmium	<0.0004 – 0.0017	0.0007
	Dissolved Cadmium	<0.0003 – 0.0014	0.0005

TABLE 6 (Continued): SUMMARY OF METALS CONCENTRATIONS FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2005

Navigational Pool	Constituents ^a	Range	Average
Marseilles (Continued)	Total Chromium	<0.004 – 0.005	0.004
	Dissolved Chromium	<0.0007 – 0.0013	0.0008
	Total Copper	0.004 – 0.021	0.011
	Dissolved Copper	All values <0.002	<0.002
	Total Iron	0.029 – 1.510	0.348
	Dissolved Iron	<0.004 – 0.099	0.014
	Total Lead	<0.002 – 0.011	0.005
	Dissolved Lead	<0.0009 – 0.0070	0.0031
	Total Manganese	0.0164 – 0.1431	0.0363
	Dissolved Manganese	<0.0004 – 0.0100	0.0023
	Total Mercury (µg/L)	<0.05 – 0.11	0.06
	Dissolved Mercury (µg/L)	All values <0.05	<0.05
	Total Nickel	<0.002 – 0.005	0.003
	Dissolved Nickel	<0.002 – 0.003	0.002
	Total Silver	<0.0008 – 0.0010	0.0008
	Dissolved Silver	<0.0003 – 0.0004	0.0003
	Total Zinc	0.013 – 0.052	0.020
Dissolved Zinc	<0.002 – 0.016	0.007	
Starved Rock	Total Arsenic	All values <0.003	<0.003
	Dissolved Arsenic	<0.002 – 0.004	0.002
	Total Cadmium	<0.0004 – 0.0020	0.0007
	Dissolved Cadmium	<0.0003 – 0.0018	0.0005
	Total Chromium	<0.004 – 0.004	0.004
	Dissolved Chromium	<0.0007 – 0.0017	0.0008
	Total Copper	0.004 – 0.023	0.012
	Dissolved Copper	<0.002 – 0.002	0.002
	Total Iron	0.206 – 1.196	0.377
	Dissolved Iron	<0.004 – 0.410	0.021
	Total Lead	<0.002 – 0.024	0.006
	Dissolved Lead	<0.0009 – 0.0084	0.0031
	Total Manganese	0.0202 – 0.0989	0.0377
	Dissolved Manganese	<0.0004 – 0.0392	0.0023
	Total Mercury (µg/L)	<0.05 – 0.10	0.05
Total Nickel	<0.002 – 0.005	0.003	

TABLE 6 (Continued): SUMMARY OF METALS CONCENTRATIONS FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2005

Navigational Pool	Constituents ^a	Range	Average
Starved Rock (Continued)	Dissolved Nickel	<0.002 – 0.003	0.002
	Total Silver	<0.0008 – 0.0010	0.0008
	Dissolved Silver	<0.0003 – 0.0004	0.0003
	Total Zinc	0.012 – 0.039	0.018
	Dissolved Zinc	<0.002 – 0.021	0.007
Upper Peoria	Total Arsenic	<0.003 – 0.003	0.003
	Dissolved Arsenic	<0.002 – 0.006	0.002
	Total Cadmium	<0.0004 – 0.0017	0.0008
	Dissolved Cadmium	<0.0003 – 0.0016	0.0005
	Total Chromium	All values <0.004	<0.004
	Dissolved Chromium	<0.0007 – 0.0013	0.0008
	Total Copper	0.006 – 0.027	0.012
	Dissolved Copper	<0.002 – 0.002	0.002
	Total Iron	0.169 – 1.373	0.533
	Dissolved Iron	<0.004 – 0.025	0.010
	Total Lead	<0.002 – 0.012	0.005
	Dissolved Lead	<0.0009 – 0.0078	0.0029
	Total Manganese	0.0233 – 0.1090	0.0481
	Dissolved Manganese	<0.0004 – 0.0055	0.0013
	Total Mercury (µg/L)	<0.05 – 0.12	0.06
	Dissolved Mercury (µg/L)	<0.05 – 0.05	0.05
	Total Nickel	<0.002 – 0.005	0.003
	Dissolved Nickel	<0.002 – 0.004	0.002
	Total Silver	<0.0008 – 0.0011	0.0008
	Dissolved Silver	<0.0003 – 0.0005	0.0003
Total Zinc	0.011 – 0.038	0.020	
Dissolved Zinc	<0.002 – 0.025	0.005	
Lower Peoria	Total Arsenic	All values <0.003	<0.003
	Dissolved Arsenic	<0.002 – 0.010	0.002
	Total Cadmium	<0.0004 – 0.0023	0.0009
	Dissolved Cadmium	<0.0003 – 0.0015	0.0005
	Total Chromium	<0.004 – 0.008	0.004
	Dissolved Chromium	<0.0007 – 0.0014	0.0008
	Total Copper	0.005 – 0.027	0.013
	Dissolved Copper	<0.002 – 0.002	0.002

TABLE 6 (Continued): SUMMARY OF METALS CONCENTRATIONS FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2005

Navigational Pool	Constituents ^a	Range	Average
Lower Peoria (Continued)	Total Iron	0.448 – 5.249	1.289
	Dissolved Iron	<0.004 – 0.081	0.013
	Total Lead	0.002 – 0.014	0.006
	Dissolved Lead	<0.0009 – 0.0086	0.0032
	Total Manganese	0.0512 – 0.2278	0.1036
	Dissolved Manganese	<0.0004 – 0.0227	0.0021
	Total Mercury (µg/L)	<0.05 – 0.14	0.07
	Dissolved Mercury (µg/L)	All values <0.05	<0.05
	Total Nickel	<0.002 – 0.009	0.004
	Dissolved Nickel	<0.002 – 0.004	0.003
	Total Silver	All values <0.0008	<0.0008
	Dissolved Silver	<0.0003 – 0.0004	0.0003
	Total Zinc	0.015 – 0.069	0.024
	Dissolved Zinc	<0.002 – 0.030	0.005

^aExpressed in mg/L except where noted.

TABLE 7: FLUX OF TOTAL NITROGEN AND TOTAL PHOSPHORUS AT STATIONS 1, 26, 39, AND 49 ALONG THE ILLINOIS WATERWAY DURING 2005 SAMPLING EVENTS

Station No./ Date	Discharge (ft ³ /s) ^a	Total Phosphorus Flux (tons/day)	Total Nitrogen Flux (tons/day)
<u>Station 1</u>	<u>Chicago Sanitary and Ship Canal</u>		
05/02/05	1,626	4.78	41.40
05/13/05	2,288	11.48	68.01
08/01/05	2,288	6.48	38.82
08/12/05	2,639	9.25	41.78
10/03/05	3,524 ^b	7.89	47.81
10/14/05	3,457 ^b	15.29	78.79
<u>Station 26</u>	<u>Illinois River</u>		
05/03/05	4,700	4.44	69.72
05/12/05	6,340	6.33	90.80
08/02/05	2,700	5.75	28.55
08/11/05	4,880	11.71	45.15
10/04/05	4,420	10.73	54.60
10/13/05	2,700	4.15	28.62
<u>Station 39</u>	<u>Illinois River</u>		
05/04/05	6,780	5.67	156.72
05/11/05	7,420	4.60	116.88
08/03/05	3,950	8.42	38.99
08/10/05	3,640	6.68	26.70
10/05/05	5,910	10.84	70.62
10/12/05	3,500	7.17	33.23
<u>Station 49</u>	<u>Illinois River</u>		
05/05/05	10,200	7.15	183.78
05/10/05	7,680	4.97	111.86
08/04/05	2,870	7.28	20.36
08/09/05	3,050	7.24	16.62
10/06/05	4,770	8.23	39.88
10/11/05	2,880	10.56	20.51

^aDischarge data accessed from United States Geological Survey Web site.

^bHistorical mean discharge data used for this date.

Waterway Use Designations

The Illinois Pollution Control Board (IPCB) has designated water uses for particular waters within the State of Illinois. All waters in Illinois are designated as General Use except those designated as Secondary Contact and Indigenous Aquatic Life waters. The CSSC and the Des Plaines River from its confluence with the CSSC to the Interstate Highway 55 (I-55) bridge are classified as Secondary Contact waters (Stations 1–8). The Des Plaines River downstream of the I-55 bridge (Station 9) and the Illinois River are General Use waters (Stations 10–49).

Water Quality Violations. *Dissolved Oxygen.* The DO standard for General Use waters was not achieved on August 4 at Station 49 (4.5 mg/L) or on August 10 at Station 42 (4.7 mg/L) in the lower Peoria Pool. The General Use Standard is 5.0 mg/L.

Fecal Coliform. During 2005 summer monitoring (August), FC exceeded the General Use Standard of 400 cfu/100 mL at Stations 16 and 18 in the Marseilles Pool and Station 47 in the lower Peoria Pool with measured FC values of 540, 14,000, and 550 cfu/100 mL, respectively. During fall monitoring (October), FC measured 510 cfu/100 mL at Station 9 in the Dresden Island Pool and 2,200 cfu/100mL at Station 46 in the lower Peoria Pool. Station 9 also violated the General Use Standard for FC twice during the previous year (2004).

Total Mercury. The Water Quality Standard for the Protection of Human Health for total mercury in General Use waters is 0.012 µg/L. The concentration of total mercury at all but four stations in the sampling area equaled or exceeded the MDL of 0.05 µg/L at some time during 2005. The total mercury values for the remaining stations and dates were less than the MDL, so it is not known

whether they were in violation of the Human Health Standard.

Sediment Quality

Sediment quality can considerably impact overlying water quality, benthic community structure, food chain dynamics, and other elements of freshwater ecosystems. Since sediment acts as a reservoir for persistent or bioaccumulative contaminants, sediment data reflects a long-term record of quality.

The concentrations of the eight general chemistry constituents measured in sediment at each of the 14 selected monitoring stations are presented in [Table 8](#). The concentrations of 11 measured trace metals for these same stations are presented in [Table 9](#).

The mean total solids (TS) in sediment fluctuated throughout the Illinois Waterway and were highest in the Starved Rock Pool (78.9 percent).

There was generally a decrease in the mean total volatile solids (TVS) from the Lockport Pool (12 percent) to the Starved Rock Pool (2 percent), and then a slight increase until the lower Peoria Pool (6 percent).

Mean ammonia nitrogen in sediment substantially decreased from 157 mg/kg in the Lockport Pool to a mean of 1 mg/kg in the Starved Rock Pool. Ammonia nitrogen increased again from Starved Rock to the lower Peoria Pool where the mean was 75 mg/kg.

The mean concentration of TKN in sediment decreased from the Lockport Pool (18,263 mg/kg) to the Starved Rock Pool (39 mg/kg) and increased downstream to the lower Peoria Pool (1,633 mg/kg).

Total phosphorus in the sediment decreased along the Illinois Waterway from the

TABLE 8: CHEMICAL CHARACTERISTICS OF SEDIMENT COLLECTED FROM MONITORING STATIONS IN THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, OCTOBER 2005

Station No.	Navigational Pool	Constituents (Expressed on a dry weight basis)							
		Total Solids (%)	Total Volatile Solids (% of Total)	Ammonia Nitrogen (mg/kg)	Total Kjeldahl Nitrogen (mg/kg)	Nitrite + Nitrate Nitrogen (mg/kg)	Total Phosphorus (mg/kg)	Total Cyanide (mg/kg)	Phenols (mg/kg)
1	Lockport	38.7	12	157	18,263	12	5,880	4.133	0.318
2	Brandon Road	25.7	15	231	10,093	15	5,331	0.913	0.575
5	Dresden Island	63.6	4	24	878	4	1,433	0.096	0.216
8	Dresden Island	32.2	12	11	8,058	1	3,329	0.543	0.611
12	Marseilles	74.1	1	3	283	2	734	0.039	0.350
18	Marseilles	69.9	2	7	582	2	487	0.047	0.060
23	Starved Rock	78.9	2	1	39	1	59	0.014	0.072
28	Peoria	75.7	1	7	89	2	155	0.020	0.058
32	Peoria	73.6	6	10	650	4	437	0.046	0.551
35	Peoria	70.0	3	31	642	6	646	0.037	0.087
38	Peoria	72.6	2	12	179	4	707	0.043	0.054
41	Peoria	44.6	9	104	1,430	6	1,202	0.155	0.069
44	Peoria	38.1	7	72	2,202	9	1,206	0.160	0.081
48	Peoria	64.3	4	77	1,063	5	510	0.177	0.056

TABLE 9: TRACE METALS IN SEDIMENT COLLECTED FROM MONITORING STATIONS IN THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, OCTOBER 2005

Station No.	Navigational Pool	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Silver	Zinc
(mg/kg dry weight)												
1	Lockport	2	23.5	231	222	29,085	250	400	1.2530	84	3.7	1,213
2	Brandon Road	<1	10.4	155	213	27,114	184	469	0.2070	47	2.7	902
5	Dresden Island	<1	1.2	30	29	15,506	60	285	0.6190	27	<0.3	151
8	Dresden Island	<1	6.3	98	135	23,224	118	546	0.6660	40	0.2	555
12	Marseilles	<1	0.6	16	15	8,948	16	284	0.0895	16	<0.3	95
18	Marseilles	<1	0.4	10	10	7,829	14	223	0.4580	11	<0.3	62
23	Starved Rock	2	0.6	10	5	6,670	9	162	0.3450	9	<0.3	45
28	Peoria	1	0.3	2	3	4,526	3	111	0.2160	1	<0.3	23
32	Peoria	11	1.3	9	11	13,426	17	237	0.5690	11	<0.3	117
35	Peoria	2	0.9	10	9	8,638	11	225	0.9360	7	<0.3	92
38	Peoria	2	0.9	9	7	11,032	10	325	0.3750	9	<0.3	94
41	Peoria	1	2.4	32	32	19,981	30	608	0.4440	21	<0.3	208
44	Peoria	3	2.6	39	41	21,324	34	569	1.1680	26	<0.3	233
48	Peoria	4	1.3	22	21	16,802	20	424	0.2660	21	<0.3	119

Lockport Pool (5,880 mg/kg) to the Starved Rock Pool (59 mg/kg), and increased until the lower Peoria Pool (858 mg/kg).

The mean concentration of total cyanide in the sediment decreased between the Lockport Pool (4.133 mg/kg) and the Starved Rock Pool (0.014 mg/kg). There was then an increase in cyanide into the lower Peoria Pool (0.169 mg/kg).

The concentration of phenols in the sediment was highest in the Dresden Island Pool (0.611 mg/kg), decreased substantially through the Marseilles Pool, and remained low. Although the concentrations of the 11 trace metals measured in the sediment were quite variable among the 14 monitoring stations, considerably higher levels of cadmium, chromium, copper, iron, lead,

manganese, mercury, nickel, silver, and zinc were measured in the Lockport and Brandon Road Pools compared to the Dresden Island, Marseilles, and Starved Rock Pools. There were also elevated levels of arsenic, iron, manganese, and mercury in some of the sediment from the Peoria Pools. Station 32 in the upper Peoria Pool showed an unusually high arsenic concentration of 11 mg/kg in the sediment.

Elevated concentrations of mercury were detected at Stations 1 (1.2530 mg/kg) and 44 (1.1680 mg/kg) in the Lockport and lower Peoria Pools, respectively.

APPENDIX AI

WATER QUALITY AT STATION 1 IN THE LOCKPORT POOL
DURING MAY, AUGUST, AND OCTOBER 2005

TABLE AI-1: WATER QUALITY AT STATION 1 IN THE CHICAGO SANITARY AND SHIP CANAL MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	16.1 ^b	32.0 ^b	24.5
Total Suspended Solids	4	12	9
Turbidity (NTU)	3 ^b	21 ^b	10
Conductivity (µS/cm)	552 ^b	1,160 ^b	811
Five-Day Biochemical Oxygen Demand	<2	6	5
Dissolved Oxygen	4.7 ^b	5.9 ^b	5.2
pH (units)	6.1 ^b	7.4 ^b	6.9
Ammonia Nitrogen	0.19	1.42	0.62
Un-ionized Ammonia	<0.001	0.006	0.003
Total Kjeldahl Nitrogen	0.84	2.17	1.46
Nitrite plus Nitrate Nitrogen	4.19	8.85	6.23
Total Nitrogen	5.03	11.02	7.68
Total Phosphorus	0.83	1.86	1.30
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.017	0.006
Phenols	0.006	0.013	0.010
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0021	0.0009
Dissolved Cadmium	<0.0003	0.0012	0.0007
Total Chromium	<0.004	0.004	0.004
Dissolved Chromium	<0.0007	0.0013	0.0009
Total Copper	0.009	0.023	0.014
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.173	0.378	0.261
Dissolved Iron	0.011	0.031	0.023
Total Lead	0.003	0.010	0.006
Dissolved Lead	<0.0009	0.0050	0.0027
Total Manganese	0.0164	0.0374	0.0251
Dissolved Manganese	0.0076	0.0318	0.0183
Total Mercury (µg/L)	<0.05	<0.05	<0.05
Total Nickel	<0.002	0.008	0.004
Dissolved Nickel	0.002	0.005	0.004
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0004	0.0003
Total Zinc	0.025	0.046	0.032
Dissolved Zinc	0.003	0.029	0.017
Fecal Coliform (cfu/100 mL)	20	350	109 ^c
E.coli (cfu/100 mL)	<10	140	24 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

APPENDIX AII

WATER QUALITY AT STATIONS 2–4 IN THE BRANDON ROAD POOL
DURING MAY, AUGUST, AND OCTOBER 2005

TABLE AII-1: WATER QUALITY AT STATION 2 IN THE CHICAGO SANITARY AND SHIP CANAL MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	16.0 ^b	31.7 ^b	24.5
Total Suspended Solids	5	18	11
Turbidity (NTU)	5 ^b	15 ^b	11
Conductivity (µS/cm)	564 ^b	1,162 ^b	814
Five-Day Biochemical Oxygen Demand	<2	7	5
Dissolved Oxygen	5.2 ^b	7.1 ^b	6.1
pH (units)	6.5 ^b	7.6 ^b	7.0
Ammonia Nitrogen	0.16	1.10	0.55
Un-ionized Ammonia	<0.001	0.009	0.004
Total Kjeldahl Nitrogen	1.08	1.92	1.49
Nitrite plus Nitrate Nitrogen	4.29	9.73	6.35
Total Nitrogen	5.56	11.65	7.84
Total Phosphorus	0.90	1.79	1.33
Chlorophyll <i>a</i> (µg/L)	2.7	18.2	7.5
Total Cyanide	<0.003	0.003	0.003
Phenols	0.003	0.009	0.007
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.004	0.002
Total Cadmium	0.0004	0.0016	0.0008
Dissolved Cadmium	<0.0003	0.0011	0.0006
Total Chromium	<0.004	0.004	0.004
Dissolved Chromium	<0.0007	0.0013	0.0010
Total Copper	0.008	0.019	0.014
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.219	0.424	0.339
Dissolved Iron	0.013	0.031	0.021
Total Lead	0.004	0.012	0.008
Dissolved Lead	<0.0009	0.0051	0.0030
Total Manganese	0.0188	0.0363	0.0257
Dissolved Manganese	0.0073	0.0297	0.0171
Total Mercury (µg/L)	<0.00005	0.00008	0.00006
Total Nickel	<0.002	0.007	0.004
Dissolved Nickel	0.003	0.005	0.004
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0004	0.0003
Total Zinc	0.029	0.045	0.035
Dissolved Zinc	0.003	0.024	0.014
Fecal Coliform (cfu/100 mL)	10	320	85 ^c
E. coli (cfu/100 mL)	10	110	32 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AII-2: WATER QUALITY AT STATION 3 IN THE DES PLAINES RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	14.2 ^b	31.0 ^b	23.4
Total Suspended Solids	4	19	13
Turbidity (NTU)	5 ^b	18 ^b	14
Conductivity (µS/cm)	607 ^b	1,239 ^b	857
Five-Day Biochemical Oxygen Demand	<2	5	4
Dissolved Oxygen	5.7 ^b	7.1 ^b	6.1
pH (units)	6.9 ^b	7.7 ^b	7.2
Ammonia Nitrogen	0.14	0.70	0.43
Un-ionized Ammonia	0.001	0.008	0.004
Total Kjeldahl Nitrogen	1.07	4.11	1.73
Nitrite plus Nitrate Nitrogen	4.36	9.12	6.26
Total Nitrogen	5.43	10.46	7.99
Total Phosphorus	0.97	1.62	1.30
Chlorophyll <i>a</i> (µg/L)	2.1	27.5	13.6
Total Cyanide	<0.003	0.003	0.003
Phenols	0.005	0.012	0.008
Total Arsenic	<0.003	0.003	0.003
Dissolved Arsenic	<0.002	0.004	0.003
Total Cadmium	<0.0004	0.0013	0.0008
Dissolved Cadmium	<0.0003	0.0009	0.0005
Total Chromium	<0.004	0.004	0.004
Dissolved Chromium	<0.0007	0.0013	0.0009
Total Copper	0.008	0.021	0.014
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.226	0.443	0.326
Dissolved Iron	0.013	0.025	0.019
Total Lead	0.004	0.011	0.007
Dissolved Lead	<0.0009	0.0059	0.0026
Total Manganese	0.0196	0.0395	0.0276
Dissolved Manganese	0.0088	0.0262	0.0160
Total Mercury (µg/L)	<0.05	0.07	0.05
Total Nickel	<0.002	0.006	0.004
Dissolved Nickel	0.002	0.005	0.004
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.025	0.041	0.032
Dissolved Zinc	0.004	0.022	0.015
Fecal Coliform (cfu/100 mL)	110	7,000	600 ^c
E. coli (cfu/100 mL)	10	800	152 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AII-3 WATER QUALITY AT STATION 4 IN THE DES PLAINES RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	14.3 ^b	30.5 ^b	23.5
Total Suspended Solids	3	17	12
Turbidity (NTU)	10 ^b	22 ^b	14
Conductivity (µS/cm)	569 ^b	1,235 ^b	853
Five-Day Biochemical Oxygen Demand	<2	5	4
Dissolved Oxygen	4.9 ^b	8.4 ^b	6.9
pH (units)	7.1 ^b	7.7 ^b	7.3
Ammonia Nitrogen	0.16	0.66	0.44
Un-ionized Ammonia	0.001	0.008	0.005
Total Kjeldahl Nitrogen	0.90	1.58	1.27
Nitrite plus Nitrate Nitrogen	3.91	8.56	5.92
Total Nitrogen	4.81	9.90	7.20
Total Phosphorus	0.89	1.60	1.24
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.003	0.003
Phenols	0.005	0.013	0.008
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.002	0.002
Total Cadmium	<0.0004	0.0015	0.0008
Dissolved Cadmium	<0.0003	0.0011	0.0005
Total Chromium	<0.004	0.004	0.004
Dissolved Chromium	<0.0007	0.0013	0.0010
Total Copper	0.010	0.021	0.015
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.209	0.502	0.329
Dissolved Iron	0.012	0.024	0.018
Total Lead	0.002	0.011	0.007
Dissolved Lead	<0.0009	0.0056	0.0029
Total Manganese	0.0189	0.0396	0.0278
Dissolved Manganese	0.0071	0.0270	0.0155
Total Mercury (µg/L)	<0.05	0.05	0.05
Total Nickel	<0.002	0.007	0.004
Dissolved Nickel	0.002	0.005	0.003
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.022	0.041	0.031
Dissolved Zinc	<0.002	0.023	0.014
Fecal Coliform (cfu/100 mL)	120	600	344 ^c
E. coli (cfu/100 mL)	40	410	109 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

APPENDIX AIII

WATER QUALITY AT STATIONS 5–11 IN THE DRESDEN ISLAND POOL DURING
MAY, AUGUST, AND OCTOBER 2005

TABLE AIII-1: WATER QUALITY AT STATION 5 IN THE DES PLAINES RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	12.8 ^b	33.7 ^b	24.5
Total Suspended Solids	<3	69	14
Turbidity (NTU)	4 ^b	69 ^b	17
Conductivity (µS/cm)	582 ^b	1,265 ^b	884
Five-Day Biochemical Oxygen Demand	<2	9	4
Dissolved Oxygen	5.4 ^b	11.1 ^b	7.9
pH (units)	7.2 ^b	8.2 ^b	7.6
Ammonia Nitrogen	0.06	0.80	0.32
Un-ionized Ammonia	0.001	0.021	0.007
Total Kjeldahl Nitrogen	0.73	1.93	1.19
Nitrite plus Nitrate Nitrogen	2.45	8.40	5.80
Total Nitrogen	3.18	9.72	6.99
Total Phosphorus	0.66	1.77	1.22
Chlorophyll <i>a</i> (µg/L)	1.7	37.8	15.0
Total Cyanide	<0.003	0.005	0.003
Phenols	<0.003	0.013	0.008
Total Arsenic	<0.003	0.003	0.003
Dissolved Arsenic	<0.002	0.002	0.002
Total Cadmium	<0.0004	0.0018	0.0008
Dissolved Cadmium	<0.0003	0.0012	0.0005
Total Chromium	<0.004	0.004	0.004
Dissolved Chromium	<0.0007	0.0011	0.0008
Total Copper	0.010	0.017	0.014
Dissolved Copper	<0.002	0.003	0.002
Total Iron	0.236	0.523	0.364
Dissolved Iron	0.006	0.025	0.019
Total Lead	0.003	0.012	0.007
Dissolved Lead	<0.0009	0.0076	0.0040
Total Manganese	0.0177	0.0439	0.0300
Dissolved Manganese	0.0094	0.0248	0.0142
Total Mercury (µg/L)	<0.05	0.05	0.05
Total Nickel	<0.002	0.006	0.004
Dissolved Nickel	0.002	0.005	0.004
Total Silver	<0.0008	0.0008	0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.023	0.043	0.032
Dissolved Zinc	<0.002	0.023	0.014
Fecal Coliform (cfu/100 mL)	50	600	256 ^c
E. coli (cfu/100 mL)	90	170	126 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AIII-2: WATER QUALITY AT STATION 6 IN THE DES PLAINES RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	18.1 ^b	33.7 ^b	26.2
Total Suspended Solids	<3	21	14
Turbidity (NTU)	10 ^b	63 ^b	23
Conductivity (µS/cm)	582 ^b	1,258 ^b	875
Five-Day Biochemical Oxygen Demand	3	7	5
Dissolved Oxygen	6.1 ^b	9.8 ^b	7.9
pH (units)	7.4 ^b	7.8 ^b	7.5
Ammonia Nitrogen	0.15	0.52	0.33
Un-ionized Ammonia	0.003	0.014	0.007
Total Kjeldahl Nitrogen	0.77	1.52	1.22
Nitrite plus Nitrate Nitrogen	3.63	8.06	5.96
Total Nitrogen	4.40	9.57	7.18
Total Phosphorus	0.89	1.77	1.22
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.003	0.003
Phenols	0.005	0.013	0.008
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.004	0.003
Total Cadmium	<0.0004	0.0017	0.0009
Dissolved Cadmium	<0.0003	0.0015	0.0006
Total Chromium	<0.004	0.006	0.004
Dissolved Chromium	<0.0007	0.0012	0.0010
Total Copper	0.010	0.023	0.014
Dissolved Copper	<0.002	0.003	0.002
Total Iron	0.285	0.629	0.368
Dissolved Iron	0.007	0.039	0.020
Total Lead	0.002	0.012	0.007
Dissolved Lead	<0.0009	0.0042	0.0020
Total Manganese	0.0184	0.0435	0.0313
Dissolved Manganese	0.0057	0.0264	0.0148
Total Mercury (µg/L)	<0.05	0.07	0.05
Total Nickel	<0.002	0.007	0.004
Dissolved Nickel	0.003	0.005	0.004
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.023	0.049	0.034
Dissolved Zinc	<0.002	0.023	0.015
Fecal Coliform (cfu/100 mL)	90	480	216 ^c
E. coli (cfu/100 mL)	30	110	51 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AIII-3: WATER QUALITY AT STATION 7 IN THE DES PLAINES RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	16.3 ^b	33.7 ^b	25.5
Total Suspended Solids	5	18	12
Turbidity (NTU)	7 ^b	26 ^b	16
Conductivity (µS/cm)	599 ^b	1,253 ^b	880
Five-Day Biochemical Oxygen Demand	<2	7	4
Dissolved Oxygen	5.4 ^b	9.4 ^b	7.8
pH (units)	7.2 ^b	7.9 ^b	7.5
Ammonia Nitrogen	0.10	0.78	0.36
Un-ionized Ammonia	0.002	0.015	0.007
Total Kjeldahl Nitrogen	0.81	1.56	1.22
Nitrite plus Nitrate Nitrogen	3.73	8.16	6.06
Total Nitrogen	4.54	9.72	7.29
Total Phosphorus	0.95	1.64	1.24
Chlorophyll <i>a</i> (µg/L)	4.5	30.1	14.5
Total Cyanide	<0.003	0.003	0.003
Phenols	0.003	0.009	0.007
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.004	0.002
Total Cadmium	0.0004	0.0020	0.0009
Dissolved Cadmium	<0.0003	0.0011	0.0006
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0012	0.0009
Total Copper	0.009	0.017	0.014
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.255	0.397	0.299
Dissolved Iron	0.004	0.027	0.017
Total Lead	0.002	0.011	0.007
Dissolved Lead	<0.0009	0.0047	0.0026
Total Manganese	0.0193	0.0413	0.0297
Dissolved Manganese	0.0019	0.0250	0.0124
Total Mercury (µg/L)	<0.05	0.07	0.05
Total Nickel	<0.002	0.007	0.004
Dissolved Nickel	0.002	0.005	0.004
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0003	0.0003
Total Zinc	0.020	0.039	0.032
Dissolved Zinc	<0.002	0.023	0.014
Fecal Coliform (cfu/100 mL)	70	470	174 ^c
E. coli (cfu/100 mL)	<10	170	26 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AIII-4: WATER QUALITY AT STATION 8 IN THE DES PLAINES RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	15.6 ^b	32.9 ^b	24.8
Total Suspended Solids	<3	22	11
Turbidity (NTU)	4 ^b	69 ^b	21
Conductivity (µS/cm)	628 ^b	1,259 ^b	889
Five-Day Biochemical Oxygen Demand	3	4	3
Dissolved Oxygen	5.5 ^b	9.5 ^b	7.5
pH (units)	7.3 ^b	7.9 ^b	7.5
Ammonia Nitrogen	0.20	0.58	0.32
Un-ionized Ammonia	0.002	0.011	0.006
Total Kjeldahl Nitrogen	0.95	1.93	1.36
Nitrite plus Nitrate Nitrogen	4.19	7.61	5.92
Total Nitrogen	5.14	8.99	7.27
Total Phosphorus	1.03	1.51	1.24
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.005	0.003
Phenols	0.005	0.008	0.007
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.005	0.003
Total Cadmium	<0.0004	0.0017	0.0008
Dissolved Cadmium	<0.0003	0.0013	0.0006
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0015	0.0009
Total Copper	0.007	0.020	0.014
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.200	0.464	0.317
Dissolved Iron	0.009	0.028	0.016
Total Lead	<0.002	0.010	0.006
Dissolved Lead	<0.0009	0.0057	0.0022
Total Manganese	0.0226	0.0417	0.0295
Dissolved Manganese	<0.0004	0.0242	0.0108
Total Mercury (µg/L)	<0.05	0.05	0.05
Total Nickel	<0.002	0.007	0.004
Dissolved Nickel	0.003	0.005	0.004
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.024	0.039	0.031
Dissolved Zinc	<0.002	0.022	0.015
Fecal Coliform (cfu/100 mL)	10	280	76 ^c
E. coli (cfu/100 mL)	<10	70	19 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AIII-5: WATER QUALITY AT STATION 9 IN THE DES PLAINES RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	14.7 ^b	32.2 ^b	22.6
Total Suspended Solids	5	69	21
Turbidity (NTU)	7 ^b	29 ^b	15
Conductivity (µS/cm)	660 ^b	1,256 ^b	899
Five-Day Biochemical Oxygen Demand	3	5	4
Dissolved Oxygen	5.4 ^b	10.9 ^b	8.0
pH (units)	7.4 ^b	8.0 ^b	7.6
Ammonia Nitrogen	0.06	0.80	0.34
Un-ionized Ammonia	0.002	0.012	0.006
Total Kjeldahl Nitrogen	0.85	1.49	1.23
Nitrite plus Nitrate Nitrogen	4.09	7.56	5.81
Total Nitrogen	5.16	9.05	7.03
Total Phosphorus	1.08	1.71	1.33
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.003	0.003
Phenols	0.004	0.012	0.009
Total Arsenic	<0.003	0.003	0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0024	0.0009
Dissolved Cadmium	<0.0003	0.0006	0.0004
Total Chromium	<0.004	0.004	0.004
Dissolved Chromium	<0.0007	0.0016	0.0009
Total Copper	0.009	0.022	0.016
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.208	1.073	0.443
Dissolved Iron	0.006	0.021	0.014
Total Lead	0.005	0.018	0.008
Dissolved Lead	<0.0009	0.0044	0.0023
Total Manganese	0.0205	0.0494	0.0347
Dissolved Manganese	<0.0004	0.0231	0.0104
Total Mercury (µg/L)	<0.05	0.07	0.06
Total Nickel	<0.002	0.007	0.004
Dissolved Nickel	0.002	0.005	0.004
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.021	0.085	0.039
Dissolved Zinc	<0.002	0.022	0.015
Fecal Coliform (cfu/100 mL)	<10	510	63 ^c
E. coli (cfu/100 ml)	<10	170	26 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AIII-6: WATER QUALITY AT STATION 10 IN THE DES PLAINES RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	14.1 ^b	31.5 ^b	24.0
Total Suspended Solids	6	29	14
Turbidity (NTU)	6 ^b	27 ^b	15
Conductivity (µS/cm)	662 ^b	1,250 ^b	900
Five-Day Biochemical Oxygen Demand	<2	4	3
Dissolved Oxygen	5.9 ^b	9.5 ^b	7.7
pH (units)	7.2 ^b	7.9 ^b	7.7
Ammonia Nitrogen	0.09	0.50	0.26
Un-ionized Ammonia	0.001	0.010	0.006
Total Kjeldahl Nitrogen	0.96	1.41	1.14
Nitrite plus Nitrate Nitrogen	4.05	8.12	5.80
Total Nitrogen	5.08	9.51	6.93
Total Phosphorus	1.00	1.44	1.23
Chlorophyll <i>a</i> (µg/L)	7.2	37.8	17.6
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.006	0.012	0.009
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.002	0.002
Total Cadmium	0.0004	0.0018	0.0008
Dissolved Cadmium	<0.0003	0.0010	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0014	0.0010
Total Copper	0.009	0.015	0.012
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.242	0.435	0.342
Dissolved Iron	0.005	0.020	0.014
Total Lead	0.003	0.010	0.007
Dissolved Lead	<0.0009	0.0075	0.0038
Total Manganese	0.0193	0.0459	0.0293
Dissolved Manganese	<0.0004	0.0206	0.0078
Total Mercury (µg/L)	<0.05	<0.05	<0.05
Total Nickel	<0.002	0.006	0.004
Dissolved Nickel	0.002	0.005	0.004
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.021	0.042	0.030
Dissolved Zinc	<0.002	0.019	0.013
Fecal Coliform (cfu/100 mL)	<10	310	32 ^c
E. coli (cfu/100 mL)	<10	70	19 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AIII-7: WATER QUALITY AT STATION 11 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	12.8 ^b	31.5 ^b	23.6
Total Suspended Solids	3	25	11
Turbidity (NTU)	4 ^b	23 ^b	13
Conductivity (µS/cm)	667 ^b	1,216 ^b	861
Five-Day Biochemical Oxygen Demand	<2	4	3
Dissolved Oxygen	6.0 ^b	10.0 ^b	7.9
pH (units)	7.3 ^b	8.2 ^b	7.8
Ammonia Nitrogen	0.08	0.80	0.30
Un-ionized Ammonia	0.001	0.021	0.010
Total Kjeldahl Nitrogen	0.73	1.25	0.94
Nitrite plus Nitrate Nitrogen	2.45	8.40	5.21
Total Nitrogen	3.18	9.65	6.15
Total Phosphorus	0.66	1.44	1.07
Chlorophyll <i>a</i> (µg/L)	9.8	33.9	15.3
Total Cyanide	<0.003	0.004	0.003
Phenols	0.007	0.012	0.009
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.009	0.003
Total Cadmium	0.0004	0.0016	0.0008
Dissolved Cadmium	<0.0003	0.0013	0.0005
Total Chromium	<0.004	0.004	0.004
Dissolved Chromium	<0.0007	0.0015	0.0010
Total Copper	0.006	0.015	0.011
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.177	0.360	0.272
Dissolved Iron	0.005	0.018	0.014
Total Lead	0.004	0.008	0.006
Dissolved Lead	<0.0009	0.0059	0.0032
Total Manganese	0.0189	0.0401	0.0300
Dissolved Manganese	<0.0004	0.0152	0.0053
Total Mercury (µg/L)	<0.05	0.12	0.06
Total Nickel	<0.002	0.006	0.004
Dissolved Nickel	0.002	0.005	0.003
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0003	0.0003
Total Zinc	0.013	0.035	0.025
Dissolved Zinc	<0.002	0.019	0.011
Fecal Coliform (cfu/100 mL)	<10	120	25 ^c
E. coli (cfu/100 mL)	<10	10	10 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

APPENDIX AIV

WATER QUALITY AT STATIONS 12–20 IN THE MARSEILLES POOL
DURING MAY, AUGUST, AND OCTOBER 2005

TABLE AIV-1: WATER QUALITY AT STATION 12 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	11.8 ^b	31.4 ^b	22.9
Total Suspended Solids	<3	26	15
Turbidity (NTU)	4 ^b	203 ^b	44
Conductivity (µS/cm)	640 ^b	968 ^b	780
Five-Day Biochemical Oxygen Demand	<2	5	4
Dissolved Oxygen	6.5 ^b	11.8 ^b	9.0
pH (units)	7.8 ^b	8.5 ^b	8.0
Ammonia Nitrogen	0.07	0.33	0.17
Un-ionized Ammonia	0.002	0.019	0.010
Total Kjeldahl Nitrogen	0.73	1.06	0.84
Nitrite plus Nitrate Nitrogen	2.75	6.08	4.23
Total Nitrogen	3.48	7.14	5.07
Total Phosphorus	0.38	1.19	0.82
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.003	0.014	0.007
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.004	0.002
Total Cadmium	0.0004	0.0015	0.0007
Dissolved Cadmium	<0.0003	0.0009	0.0004
Total Chromium	<0.004	0.004	0.004
Dissolved Chromium	<0.0007	0.0012	0.0009
Total Copper	0.006	0.014	0.010
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.203	0.494	0.342
Dissolved Iron	0.007	0.099	0.027
Total Lead	0.003	0.010	0.005
Dissolved Lead	<0.0009	0.0063	0.0034
Total Manganese	0.0188	0.0452	0.0344
Dissolved Manganese	<0.0004	0.0100	0.0036
Total Mercury (µg/L)	<0.05	0.10	0.06
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0004	0.0003
Total Zinc	0.016	0.029	0.021
Dissolved Zinc	<0.002	0.012	0.008
Fecal Coliform (cfu/100 mL)	<10	70	23 ^c
E. coli (cfu/100 mL)	<10	40	16 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AIV-2: WATER QUALITY AT STATION 13 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	11.7 ^b	31.3 ^b	22.8
Total Suspended Solids	<3	25	13
Turbidity (NTU)	1 ^b	23 ^b	13
Conductivity (µS/cm)	639 ^b	967 ^b	776
Five-Day Biochemical Oxygen Demand	<2	4	3
Dissolved Oxygen	6.5 ^b	11.8 ^b	9.0
pH (units)	7.7 ^b	8.5 ^b	8.0
Ammonia Nitrogen	0.06	0.37	0.16
Un-ionized Ammonia	0.001	0.019	0.009
Total Kjeldahl Nitrogen	0.68	0.95	0.76
Nitrite plus Nitrate Nitrogen	2.81	5.83	4.12
Total Nitrogen	3.51	6.78	4.88
Total Phosphorus	0.32	1.15	0.80
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.003	0.003
Phenols	0.005	0.012	0.007
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0014	0.0008
Dissolved Cadmium	<0.0003	0.0009	0.0004
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0013	0.0009
Total Copper	0.005	0.017	0.011
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.131	0.593	0.325
Dissolved Iron	0.007	0.037	0.017
Total Lead	<0.002	0.009	0.004
Dissolved Lead	<0.0009	0.0067	0.0033
Total Manganese	0.0164	0.0502	0.0354
Dissolved Manganese	<0.0004	0.0085	0.0026
Total Mercury (µg/L)	<0.05	0.10	0.07
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0004	0.0003
Total Zinc	0.014	0.021	0.018
Dissolved Zinc	<0.002	0.016	0.009
Fecal Coliform (cfu/100 mL)	10	160	26 ^c
E. coli (cfu/100 mL)	<10	20	16 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AIV-3: WATER QUALITY AT STATION 14 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	11.8 ^b	31.0 ^b	22.8
Total Suspended Solids	<3	27	16
Turbidity (NTU)	8 ^b	25 ^b	15
Conductivity (µS/cm)	634 ^b	941 ^b	779
Five-Day Biochemical Oxygen Demand	<2	6	4
Dissolved Oxygen	6.4 ^b	11.6 ^b	9.0
pH (units)	7.7 ^b	8.4 ^b	8.0
Ammonia Nitrogen	0.05	0.17	0.11
Un-ionized Ammonia	0.001	0.013	0.006
Total Kjeldahl Nitrogen	0.73	1.14	0.85
Nitrite plus Nitrate Nitrogen	2.95	5.60	4.17
Total Nitrogen	3.72	6.74	5.01
Total Phosphorus	0.40	1.11	0.79
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.004	0.011	0.007
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.005	0.003
Total Cadmium	<0.0004	0.0015	0.0009
Dissolved Cadmium	<0.0003	0.0010	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0009	0.0008
Total Copper	0.005	0.018	0.011
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.234	0.639	0.344
Dissolved Iron	<0.004	0.027	0.014
Total Lead	<0.001	0.009	0.005
Dissolved Lead	<0.0009	0.0060	0.0027
Total Manganese	0.0188	0.0518	0.0359
Dissolved Manganese	<0.0004	0.0076	0.0024
Total Mercury (µg/L)	<0.05	0.10	0.06
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	0.0008	0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.014	0.028	0.022
Dissolved Zinc	<0.002	0.009	0.007
Fecal Coliform (cfu/100 mL)	<10	60	22 ^c
E. coli (cfu/100 mL)	10	20	13 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AIV-4: WATER QUALITY AT STATION 15 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	11.7 ^b	31.1 ^b	22.8
Total Suspended Solids	<3	27	15
Turbidity (NTU)	4 ^b	20 ^b	12
Conductivity (µS/cm)	631 ^b	924 ^b	765
Five-Day Biochemical Oxygen Demand	<2	5	4
Dissolved Oxygen	6.3 ^b	11.6 ^b	9.3
pH (units)	7.6 ^b	8.6 ^b	8.0
Ammonia Nitrogen	0.05	0.41	0.16
Un-ionized Ammonia	0.001	0.027	0.011
Total Kjeldahl Nitrogen	0.63	1.16	0.88
Nitrite plus Nitrate Nitrogen	2.99	5.16	4.08
Total Nitrogen	3.93	5.97	4.96
Total Phosphorus	0.38	1.11	0.75
Chlorophyll <i>a</i> (µg/L)	8.2	59.6	21.7
Total Cyanide	<0.003	0.003	0.003
Phenols	0.004	0.014	0.007
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0013	0.0007
Dissolved Cadmium	<0.0003	0.0009	0.0004
Total Chromium	<0.004	0.004	0.004
Dissolved Chromium	<0.0007	0.0011	0.0008
Total Copper	0.008	0.013	0.010
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.218	0.631	0.342
Dissolved Iron	0.004	0.017	0.011
Total Lead	0.002	0.011	0.005
Dissolved Lead	<0.0009	0.0055	0.0027
Total Manganese	0.0198	0.0509	0.0355
Dissolved Manganese	<0.0004	0.0065	0.0021
Total Mercury (µg/L)	<0.05	0.11	0.07
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0003	0.0003
Total Zinc	0.016	0.025	0.020
Dissolved Zinc	<0.002	0.009	0.007
Fecal Coliform (cfu/100 mL)	<10	100	18 ^c
E. coli (cfu/100 mL)	<10	40	16 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AIV-5: WATER QUALITY AT STATION 16 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	11.8 ^b	31.0 ^b	22.7
Total Suspended Solids	5	21	13
Turbidity (NTU)	6 ^b	23 ^b	14
Conductivity (µS/cm)	628 ^b	939 ^b	772
Five-Day Biochemical Oxygen Demand	<2	6	4
Dissolved Oxygen	6.8 ^b	11.5 ^b	9.3
pH (units)	7.7 ^b	8.5 ^b	8.0
Ammonia Nitrogen	0.04	0.13	0.08
Un-ionized Ammonia	0.001	0.011	0.005
Total Kjeldahl Nitrogen	0.53	1.45	0.89
Nitrite plus Nitrate Nitrogen	2.98	5.29	4.10
Total Nitrogen	3.83	6.74	4.99
Total Phosphorus	0.33	1.03	0.74
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.004	0.013	0.007
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0012	0.0006
Dissolved Cadmium	<0.0003	0.0010	0.0004
Total Chromium	<0.004	0.004	0.004
Dissolved Chromium	<0.0007	0.0008	0.0008
Total Copper	0.006	0.021	0.011
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.029	0.437	0.290
Dissolved Iron	<0.004	0.017	0.011
Total Lead	0.002	0.009	0.005
Dissolved Lead	<0.0009	0.0057	0.0034
Total Manganese	0.0230	0.0463	0.0342
Dissolved Manganese	<0.0004	0.0053	0.0021
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	<0.002	0.003	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0003	0.0003
Total Zinc	0.013	0.024	0.018
Dissolved Zinc	<0.002	0.011	0.008
Fecal Coliform (cfu/100 mL)	<10	540	26 ^c
E. coli (cfu/100 mL)	<10	10	10 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AIV-6: WATER QUALITY AT STATION 17 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	12.0 ^b	30.9 ^b	22.6
Total Suspended Solids	4	27	14
Turbidity (NTU)	2 ^b	18 ^b	12
Conductivity (µS/cm)	616 ^b	1,081 ^b	804
Five-Day Biochemical Oxygen Demand	<2	5	3
Dissolved Oxygen	6.8 ^b	11.8 ^b	9.3
pH (units)	7.6 ^b	8.5 ^b	8.1
Ammonia Nitrogen	<0.02	0.38	0.13
Un-ionized Ammonia	<0.001	0.026	0.008
Total Kjeldahl Nitrogen	0.60	1.29	0.87
Nitrite plus Nitrate Nitrogen	3.20	7.38	4.44
Total Nitrogen	4.11	8.67	5.32
Total Phosphorus	0.36	1.06	0.83
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.003	0.015	0.008
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0014	0.0008
Dissolved Cadmium	<0.0003	0.0012	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0009	0.0008
Total Copper	0.010	0.016	0.012
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.218	0.624	0.358
Dissolved Iron	<0.004	0.014	0.010
Total Lead	0.002	0.009	0.005
Dissolved Lead	<0.0009	0.0060	0.0033
Total Manganese	0.0203	0.0496	0.0347
Dissolved Manganese	<0.0004	0.0035	0.0019
Total Mercury (µg/L)	<0.05	0.07	0.06
Total Nickel	<0.002	0.005	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0003	0.0003
Total Zinc	0.013	0.028	0.020
Dissolved Zinc	<0.002	0.015	0.009
Fecal Coliform (cfu/100 mL)	<10	40	16 ^c
E. coli (cfu/100 mL)	<10	10	10 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AIV-7: WATER QUALITY AT STATION 18 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	12.2 ^b	30.9 ^b	22.6
Total Suspended Solids	4	32	14
Turbidity (NTU)	3 ^b	37 ^b	18
Conductivity (µS/cm)	648 ^b	998 ^b	792
Five-Day Biochemical Oxygen Demand	<2	6	4
Dissolved Oxygen	7.4 ^b	12.1 ^b	9.6
pH (units)	7.7 ^b	8.5 ^b	8.1
Ammonia Nitrogen	<0.02	0.40	0.14
Un-ionized Ammonia	<0.001	0.030	0.011
Total Kjeldahl Nitrogen	0.54	1.24	0.97
Nitrite plus Nitrate Nitrogen	3.08	6.19	4.15
Total Nitrogen	3.83	7.43	5.12
Total Phosphorus	0.40	1.40	0.88
Chlorophyll <i>a</i> (µg/L)	14.8	62.1	25.8
Total Cyanide	<0.003	0.003	0.003
Phenols	0.005	0.010	0.007
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.002	0.002
Total Cadmium	<0.0004	0.0017	0.0008
Dissolved Cadmium	<0.0003	0.0012	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0008	0.0008
Total Copper	0.005	0.014	0.010
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.186	0.457	0.332
Dissolved Iron	<0.004	0.015	0.010
Total Lead	0.002	0.009	0.005
Dissolved Lead	<0.0009	0.0070	0.0032
Total Manganese	0.0177	0.0442	0.0328
Dissolved Manganese	0.0010	0.0030	0.0019
Total Mercury (µg/L)	<0.05	0.08	0.06
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	0.0010	0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.015	0.029	0.021
Dissolved Zinc	<0.002	0.009	0.007
Fecal Coliform (cfu/100 mL)	<10	30	14 ^c
E. coli (cfu/100 mL)	<10	14,000	99 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AIV-8: WATER QUALITY AT STATION 19 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	12.4 ^b	30.6 ^b	22.4
Total Suspended Solids	8	18	13
Turbidity (NTU)	4 ^b	20 ^b	14
Conductivity (µS/cm)	606 ^b	921 ^b	773
Five-Day Biochemical Oxygen Demand	<2	5	4
Dissolved Oxygen	7.2 ^b	12.2 ^b	9.4
pH (units)	7.6 ^b	8.4 ^b	8.0
Ammonia Nitrogen	<0.02	0.17	0.08
Un-ionized Ammonia	<0.001	0.012	0.006
Total Kjeldahl Nitrogen	0.66	1.00	0.84
Nitrite plus Nitrate Nitrogen	2.91	5.24	3.93
Total Nitrogen	3.76	6.22	4.77
Total Phosphorus	0.37	1.03	0.73
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.003	0.012	0.006
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0011	0.0007
Dissolved Cadmium	<0.0003	0.0012	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0009	0.0008
Total Copper	0.008	0.012	0.010
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.225	0.464	0.326
Dissolved Iron	<0.004	0.020	0.011
Total Lead	0.002	0.008	0.005
Dissolved Lead	<0.0009	0.0067	0.0033
Total Manganese	0.0285	0.0427	0.0345
Dissolved Manganese	<0.0004	0.0050	0.0023
Total Mercury (µg/L)	<0.05	0.11	0.06
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.016	0.021	0.018
Dissolved Zinc	<0.002	0.008	0.006
Fecal Coliform (cfu/100 mL)	<10	30	14 ^c
E. coli (cfu/100 mL)	10	20	13 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AIV-9: WATER QUALITY AT STATION 20 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	12.6 ^b	30.5 ^b	22.4
Total Suspended Solids	6	140	32
Turbidity (NTU)	4 ^b	98 ^b	27
Conductivity (µS/cm)	613 ^b	925 ^b	778
Five-Day Biochemical Oxygen Demand	<2	6	4
Dissolved Oxygen	7.3 ^b	12.3 ^b	9.5
pH (units)	7.5 ^b	8.5 ^b	8.1
Ammonia Nitrogen	0.03	0.18	0.09
Un-ionized Ammonia	<0.001	0.018	0.008
Total Kjeldahl Nitrogen	0.56	0.92	0.75
Nitrite plus Nitrate Nitrogen	2.88	5.06	3.79
Total Nitrogen	3.53	5.66	4.54
Total Phosphorus	0.36	0.96	0.72
Chlorophyll <i>a</i> (µg/L)	14.9	88.5	31.0
Total Cyanide	<0.003	0.003	0.003
Phenols	0.003	0.014	0.008
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0012	0.0008
Dissolved Cadmium	<0.0003	0.0014	0.0005
Total Chromium	<0.004	0.005	0.004
Dissolved Chromium	<0.0007	0.0008	0.0007
Total Copper	0.004	0.021	0.013
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.139	1.510	0.471
Dissolved Iron	<0.004	0.020	0.012
Total Lead	0.002	0.010	0.005
Dissolved Lead	<0.0009	0.0062	0.0027
Total Manganese	0.0213	0.1431	0.0490
Dissolved Manganese	<0.0004	0.0060	0.0022
Total Mercury (µg/L)	<0.05	0.08	0.06
Total Nickel	<0.002	0.005	0.003
Dissolved Nickel	0.002	0.002	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0004	0.0003
Total Zinc	0.013	0.052	0.022
Dissolved Zinc	<0.002	0.008	0.006
Fecal Coliform (cfu/100 mL)	<10	40	17 ^c
E. coli (cfu/100 mL)	<10	20	13 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

APPENDIX AV

WATER QUALITY AT STATIONS 21–27 IN THE STARVED ROCK POOL
DURING MAY, AUGUST, AND OCTOBER 2005

TABLE AV-1: WATER QUALITY AT STATION 21 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	12.2 ^b	30.6 ^b	22.4
Total Suspended Solids	7	140	33
Turbidity (NTU)	5 ^b	76 ^b	23
Conductivity (µS/cm)	631 ^b	916 ^b	777
Five-Day Biochemical Oxygen Demand	<2	8	5
Dissolved Oxygen	7.2 ^b	14.9 ^b	10.2
pH (units)	7.7 ^b	8.6 ^b	8.2
Ammonia Nitrogen	0.02	0.32	0.11
Un-ionized Ammonia	0.001	0.044	0.013
Total Kjeldahl Nitrogen	0.60	1.00	0.79
Nitrite plus Nitrate Nitrogen	2.94	5.04	3.79
Total Nitrogen	3.77	5.80	4.58
Total Phosphorus	0.30	0.90	0.71
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.003	0.007	0.005
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.002	0.002
Total Cadmium	<0.0004	0.0015	0.0008
Dissolved Cadmium	<0.0003	0.0012	0.0005
Total Chromium	<0.004	0.004	0.004
Dissolved Chromium	<0.0007	0.0011	0.0009
Total Copper	0.009	0.017	0.013
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.206	1.196	0.479
Dissolved Iron	0.005	0.016	0.012
Total Lead	0.003	0.010	0.006
Dissolved Lead	<0.0009	0.0060	0.0029
Total Manganese	0.0240	0.0989	0.0429
Dissolved Manganese	<0.0004	0.0024	0.0013
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	<0.002	0.005	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	0.0010	0.0008
Dissolved Silver	<0.0003	0.0003	0.0003
Total Zinc	0.015	0.039	0.021
Dissolved Zinc	<0.002	0.021	0.009
Fecal Coliform (cfu/100 mL)	<10	50	13 ^c
E. coli (cfu/100 mL)	<10	20	13 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AV-2: WATER QUALITY AT STATION 22 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	12.7 ^b	31.5 ^b	22.5
Total Suspended Solids	9	27	19
Turbidity (NTU)	3 ^b	24 ^b	16
Conductivity (µS/cm)	633 ^b	927 ^b	783
Five-Day Biochemical Oxygen Demand	<2	6	3
Dissolved Oxygen	6.6 ^b	12.8 ^b	9.8
pH (units)	7.2 ^b	8.5 ^b	8.0
Ammonia Nitrogen	<0.02	0.14	0.09
Un-ionized Ammonia	<0.001	0.021	0.007
Total Kjeldahl Nitrogen	0.69	1.12	0.88
Nitrite plus Nitrate Nitrogen	3.00	6.70	4.13
Total Nitrogen	3.75	7.50	5.01
Total Phosphorus	0.37	0.91	0.70
Chlorophyll <i>a</i> (µg/L)	14.8	69.4	30.2
Total Cyanide	<0.003	0.003	0.003
Phenols	0.003	0.010	0.006
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0012	0.0007
Dissolved Cadmium	<0.0003	0.0012	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0011	0.0008
Total Copper	0.006	0.017	0.012
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.215	0.694	0.398
Dissolved Iron	<0.004	0.012	0.008
Total Lead	0.002	0.008	0.005
Dissolved Lead	<0.0009	0.0063	0.0024
Total Manganese	0.0241	0.0442	0.0364
Dissolved Manganese	<0.0004	0.0033	0.0014
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	0.0010	0.0008
Dissolved Silver	<0.0003	0.0004	0.0003
Total Zinc	0.016	0.022	0.019
Dissolved Zinc	<0.002	0.009	0.006
Fecal Coliform (cfu/100 mL)	<10	80	19 ^c
E. coli (cfu/100 mL)	<10	10	10 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AV-3: WATER QUALITY AT STATION 23 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	11.6 ^b	30.5 ^b	22.2
Total Suspended Solids	3	43	19
Turbidity (NTU)	8 ^b	24 ^b	16
Conductivity (µS/cm)	632 ^b	947 ^b	781
Five-Day Biochemical Oxygen Demand	<2	8	5
Dissolved Oxygen	6.1 ^b	13.7 ^b	9.6
pH (units)	7.4 ^b	8.4 ^b	8.1
Ammonia Nitrogen	<0.02	0.12	0.06
Un-ionized Ammonia	<0.001	0.021	0.006
Total Kjeldahl Nitrogen	0.66	0.96	0.84
Nitrite plus Nitrate Nitrogen	2.91	5.31	3.75
Total Nitrogen	3.65	6.17	4.59
Total Phosphorus	0.34	0.87	0.71
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.003	0.010	0.005
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.002	0.002
Total Cadmium	<0.0004	0.0009	0.0005
Dissolved Cadmium	<0.0003	0.0012	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0013	0.0009
Total Copper	0.008	0.014	0.012
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.248	0.495	0.347
Dissolved Iron	0.006	0.020	0.011
Total Lead	0.003	0.007	0.005
Dissolved Lead	<0.0009	0.0055	0.0030
Total Manganese	0.0202	0.0494	0.0359
Dissolved Manganese	<0.0004	0.0029	0.0014
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.013	0.029	0.019
Dissolved Zinc	<0.002	0.011	0.007
Fecal Coliform (cfu/100 mL)	<10	40	18 ^c
E. coli (cfu/100 mL)	<10	20	13 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AV-4: WATER QUALITY AT STATION 24 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	11.6 ^b	30.8 ^b	22.2
Total Suspended Solids	10	35	20
Turbidity (NTU)	11 ^b	29 ^b	19
Conductivity (µS/cm)	645 ^b	927 ^b	789
Five-Day Biochemical Oxygen Demand	3	8	5
Dissolved Oxygen	7.3 ^b	13.7 ^b	10.2
pH (units)	7.1 ^b	8.6 ^b	8.2
Ammonia Nitrogen	<0.02	0.11	0.07
Un-ionized Ammonia	<0.001	0.026	0.009
Total Kjeldahl Nitrogen	0.91	1.39	1.11
Nitrite plus Nitrate Nitrogen	2.62	4.34	3.42
Total Nitrogen	3.74	5.61	4.52
Total Phosphorus	0.34	1.31	0.76
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.003	0.009	0.006
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.002	0.002
Total Cadmium	<0.0004	0.0014	0.0008
Dissolved Cadmium	<0.0003	0.0012	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0012	0.0008
Total Copper	0.008	0.023	0.013
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.257	0.367	0.319
Dissolved Iron	0.006	0.014	0.011
Total Lead	<0.002	0.008	0.005
Dissolved Lead	<0.0009	0.0054	0.0032
Total Manganese	0.0268	0.0447	0.0364
Dissolved Manganese	<0.0004	0.0022	0.0014
Total Mercury (µg/L)	<0.05	<0.05	<0.05
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0003	0.0003
Total Zinc	0.015	0.022	0.018
Dissolved Zinc	<0.002	0.010	0.007
Fecal Coliform (cfu/100 mL)	<10	70	29 ^c
E. coli (cfu/100 mL)	<10	20	13 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AV-5: WATER QUALITY AT STATION 25 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	11.8 ^b	30.5 ^b	22.3
Total Suspended Solids	10	37	20
Turbidity (NTU)	12 ^b	25 ^b	18
Conductivity (µS/cm)	668 ^b	909 ^b	794
Five-Day Biochemical Oxygen Demand	<2	7	4
Dissolved Oxygen	7.5 ^b	13.4 ^b	10.6
pH (units)	7.9 ^b	8.7 ^b	8.4
Ammonia Nitrogen	0.01	0.21	0.09
Un-ionized Ammonia	0.001	0.056	0.015
Total Kjeldahl Nitrogen	0.68	1.55	1.07
Nitrite plus Nitrate Nitrogen	2.56	4.78	3.38
Total Nitrogen	3.45	5.46	4.45
Total Phosphorus	0.33	0.88	0.66
Chlorophyll <i>a</i> (µg/L)	27.5	148.1	58.0
Total Cyanide	<0.003	0.003	0.003
Phenols	<0.003	0.011	0.007
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.004	0.002
Total Cadmium	<0.0004	0.0011	0.0007
Dissolved Cadmium	<0.0003	0.0013	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0017	0.0009
Total Copper	0.004	0.014	0.010
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.237	0.444	0.322
Dissolved Iron	<0.004	0.033	0.014
Total Lead	0.002	0.008	0.005
Dissolved Lead	<0.0009	0.0065	0.0030
Total Manganese	0.0270	0.0451	0.0359
Dissolved Manganese	<0.0004	0.0022	0.0014
Total Mercury (µg/L)	<0.05	<0.05	<0.05
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0004	0.0003
Total Zinc	0.014	0.017	0.016
Dissolved Zinc	<0.002	0.008	0.006
Fecal Coliform (cfu/100 mL)	<10	70	39 ^c
E. coli (cfu/100 mL)	<10	10	10 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AV-6: WATER QUALITY AT STATION 26 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	12.2 ^b	30.7 ^b	22.4
Total Suspended Solids	11	34	20
Turbidity (NTU)	11 ^b	30 ^b	20
Conductivity (µS/cm)	660 ^b	899 ^b	794
Five-Day Biochemical Oxygen Demand	<2	8	4
Dissolved Oxygen	7.9 ^b	14.0 ^b	11.3
pH (units)	8.1 ^b	8.7 ^b	8.4
Ammonia Nitrogen	<0.02	0.23	0.08
Un-ionized Ammonia	<0.001	0.065	0.015
Total Kjeldahl Nitrogen	0.78	1.50	1.04
Nitrite plus Nitrate Nitrogen	2.40	4.72	3.41
Total Nitrogen	3.43	5.50	4.44
Total Phosphorus	0.35	0.90	0.65
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.003	0.010	0.008
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0020	0.0009
Dissolved Cadmium	<0.0003	0.0018	0.0006
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0012	0.0008
Total Copper	0.007	0.013	0.011
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.219	0.383	0.301
Dissolved Iron	<0.004	0.018	0.011
Total Lead	0.003	0.012	0.006
Dissolved Lead	<0.0009	0.0063	0.0032
Total Manganese	0.0282	0.0407	0.0339
Dissolved Manganese	<0.0004	0.0029	0.0016
Total Mercury (µg/L)	<0.05	0.10	0.06
Total Nickel	<0.002	0.003	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.012	0.019	0.016
Dissolved Zinc	<0.002	0.012	0.007
Fecal Coliform (cfu/100 mL)	<10	30	16 ^c
E. coli (cfu/100 mL)	<10	10	10 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AV-7: WATER QUALITY AT STATION 27 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	11.7 ^b	30.1 ^b	22.3
Total Suspended Solids	18	45	31
Turbidity (NTU)	16 ^b	43 ^b	28
Conductivity (µS/cm)	642 ^b	912 ^b	785
Five-Day Biochemical Oxygen Demand	<2	3	3
Dissolved Oxygen	8.6 ^b	17.4 ^b	11.6
pH (units)	8.0 ^b	8.9 ^b	8.4
Ammonia Nitrogen	0.04	0.37	0.11
Un-ionized Ammonia	0.002	0.026	0.012
Total Kjeldahl Nitrogen	0.79	3.24	1.42
Nitrite plus Nitrate Nitrogen	1.91	4.57	3.17
Total Nitrogen	2.70	7.81	4.58
Total Phosphorus	0.31	0.86	0.63
Chlorophyll <i>a</i> (µg/L)	39.4	135.9	66.8
Total Cyanide	<0.003	0.003	0.003
Phenols	0.004	0.015	0.008
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0013	0.0008
Dissolved Cadmium	<0.0003	0.0010	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0016	0.0009
Total Copper	0.007	0.021	0.013
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.355	0.686	0.471
Dissolved Iron	0.007	0.410	0.078
Total Lead	<0.002	0.024	0.010
Dissolved Lead	<0.0009	0.0084	0.0038
Total Manganese	0.0306	0.0558	0.0429
Dissolved Manganese	<0.0004	0.0392	0.0077
Total Mercury (µg/L)	<0.05	<0.05	<0.05
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	0.0009	0.0008
Dissolved Silver	<0.0003	0.0003	0.0003
Total Zinc	0.015	0.024	0.019
Dissolved Zinc	<0.002	0.018	0.008
Fecal Coliform (cfu/100 mL)	<10	20	11 ^c
E. coli (cfu/100 mL)	<10	20	13 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

APPENDIX AVI

WATER QUALITY AT STATIONS 28–41 IN THE UPPER PEORIA POOL
DURING MAY, AUGUST, AND OCTOBER 2005

TABLE AVI-1: WATER QUALITY AT STATION 28 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	12.2 ^b	30.5 ^b	22.4
Total Suspended Solids	24	43	28
Turbidity (NTU)	21 ^b	40 ^b	27
Conductivity (µS/cm)	635 ^b	906 ^b	785
Five-Day Biochemical Oxygen Demand	<2	6	3
Dissolved Oxygen	8.7 ^b	16.1 ^b	11.6
pH (units)	7.7 ^b	9.0 ^b	8.5
Ammonia Nitrogen	0.03	0.16	0.09
Un-ionized Ammonia	0.002	0.041	0.015
Total Kjeldahl Nitrogen	0.92	2.15	1.28
Nitrite plus Nitrate Nitrogen	1.78	4.83	3.13
Total Nitrogen	2.71	6.98	4.41
Total Phosphorus	0.35	0.85	0.62
Chlorophyll <i>a</i> (µg/L)	40.8	134.9	68.6
Total Cyanides	<0.003	<0.003	<0.003
Phenols	0.006	0.017	0.009
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.002	0.002
Total Cadmium	<0.0004	0.0013	0.0008
Dissolved Cadmium	<0.0003	0.0015	0.0006
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0008	0.0007
Total Copper	0.008	0.027	0.014
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.328	0.542	0.434
Dissolved Iron	<0.004	0.011	0.009
Total Lead	0.003	0.010	0.006
Dissolved Lead	<0.0009	0.0060	0.0029
Total Manganese	0.0279	0.0515	0.0394
Dissolved Manganese	<0.0004	0.0022	0.0013
Total Mercury (µg/L)	<0.05	0.10	0.07
Total Nickel	<0.002	0.005	0.003
Dissolved Nickel	<0.002	0.002	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.013	0.038	0.022
Dissolved Zinc	<0.002	0.009	0.005
Fecal Coliform (cfu/100 mL)	<10	50	24 ^c
E. coli (cfu/100 mL)	<10	40	16 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVI-2: WATER QUALITY AT STATION 29 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	12.0 ^b	30.2 ^b	22.3
Total Suspended Solids	23	55	29
Turbidity (NTU)	18 ^b	1,230 ^b	223
Conductivity (µS/cm)	630 ^b	914 ^b	788
Five-Day Biochemical Oxygen Demand	<2	5	2
Dissolved Oxygen	8.4 ^b	16.1 ^b	11.5
pH (units)	8.1 ^b	9.0 ^b	8.5
Ammonia Nitrogen	0.07	0.27	0.12
Un-ionized Ammonia	0.004	0.107	0.028
Total Kjeldahl Nitrogen	0.63	1.59	1.19
Nitrite plus Nitrate Nitrogen	1.73	4.71	3.11
Total Nitrogen	2.61	6.12	4.29
Total Phosphorus	0.33	0.86	0.62
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.003	0.003
Phenols	0.006	0.017	0.009
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0013	0.0007
Dissolved Cadmium	<0.0003	0.0010	0.0005
Total Chromium	<0.004	0.004	0.004
Dissolved Chromium	<0.0007	0.0009	0.0008
Total Copper	0.009	0.015	0.012
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.251	0.537	0.440
Dissolved Iron	<0.004	0.014	0.009
Total Lead	0.002	0.008	0.005
Dissolved Lead	<0.0009	0.0061	0.0030
Total Manganese	0.0270	0.0594	0.0411
Dissolved Manganese	<0.0004	0.0014	0.0009
Total Mercury (µg/L)	<0.05	0.07	0.05
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.002	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.014	0.024	0.019
Dissolved Zinc	<0.002	0.009	0.006
Fecal Coliform (cfu/100 mL)	<10	200	23 ^c
E. coli (cfu/100 mL)	<10	20	13 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVI-3: WATER QUALITY AT STATION 30 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	11.7 ^b	30.1 ^b	22.2
Total Suspended Solids	20	45	27
Turbidity (NTU)	16 ^b	41 ^b	25
Conductivity (µS/cm)	624 ^b	909 ^b	783
Five-Day Biochemical Oxygen Demand	3	4	4
Dissolved Oxygen	8.4 ^b	15.9 ^b	11.3
pH (units)	8.3 ^b	8.9 ^b	8.5
Ammonia Nitrogen	0.05	0.61	0.19
Un-ionized Ammonia	0.004	0.135	0.039
Total Kjeldahl Nitrogen	0.93	2.30	1.42
Nitrite plus Nitrate Nitrogen	1.71	4.98	3.17
Total Nitrogen	2.64	7.28	4.59
Total Phosphorus	0.33	0.87	0.61
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.005	0.014	0.009
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.002	0.002
Total Cadmium	<0.0004	0.0012	0.0007
Dissolved Cadmium	<0.0003	0.0010	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0009	0.0008
Total Copper	0.006	0.015	0.011
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.193	0.469	0.380
Dissolved Iron	0.005	0.025	0.013
Total Lead	<0.002	0.007	0.004
Dissolved Lead	<0.0009	0.0049	0.0022
Total Manganese	0.0234	0.0539	0.0383
Dissolved Manganese	<0.0004	0.0015	0.0010
Total Mercury (µg/L)	<0.05	0.09	0.06
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0004	0.0003
Total Zinc	0.011	0.026	0.018
Dissolved Zinc	<0.002	0.009	0.006
Fecal Coliform (cfu/100 mL)	<10	30	12 ^c
E. coli (cfu/100 mL)	<10	10	10 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVI-4: WATER QUALITY AT STATION 31 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	11.8 ^b	30.5 ^b	22.3
Total Suspended Solids	19	53	31
Turbidity (NTU)	16 ^b	36 ^b	25
Conductivity (µS/cm)	624 ^b	912 ^b	786
Five-Day Biochemical Oxygen Demand	4	6	5
Dissolved Oxygen	9.4 ^b	15.2 ^b	11.6
pH (units)	8.1 ^b	8.9 ^b	8.5
Ammonia Nitrogen	0.05	0.12	0.08
Un-ionized Ammonia	0.004	0.048	0.016
Total Kjeldahl Nitrogen	0.81	2.39	1.41
Nitrite plus Nitrate Nitrogen	1.72	5.48	3.35
Total Nitrogen	2.80	7.87	4.76
Total Phosphorus	0.35	0.84	0.64
Chlorophyll <i>a</i> (µg/L)	38.3	119.5	65.6
Total Cyanide	<0.003	0.003	0.003
Phenols	0.004	0.012	0.007
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0013	0.0007
Dissolved Cadmium	<0.0003	0.0011	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0012	0.0008
Total Copper	0.006	0.015	0.010
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.304	0.920	0.508
Dissolved Iron	<0.004	0.017	0.010
Total Lead	<0.002	0.007	0.005
Dissolved Lead	<0.0009	0.0049	0.0028
Total Manganese	0.0300	0.0605	0.0440
Dissolved Manganese	<0.0004	0.0055	0.0021
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.002	0.002
Total Silver	<0.0008	0.0011	0.0009
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.017	0.033	0.023
Dissolved Zinc	<0.002	0.008	0.006
Fecal Coliform (cfu/100 mL)	<10	170	23 ^c
E. coli (cfu/100 mL)	<10	20	13 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVI-5: WATER QUALITY AT STATION 32 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	11.9 ^b	30.3 ^b	22.3
Total Suspended Solids	22	52	33
Turbidity (NTU)	19 ^b	31 ^b	24
Conductivity (µS/cm)	624 ^b	915 ^b	786
Five-Day Biochemical Oxygen Demand	4	8	5
Dissolved Oxygen	9.0 ^b	14.6 ^b	11.3
pH (units)	8.1 ^b	8.9 ^b	8.5
Ammonia Nitrogen	0.03	0.28	0.14
Un-ionized Ammonia	0.002	0.090	0.030
Total Kjeldahl Nitrogen	0.72	2.41	1.34
Nitrite plus Nitrate Nitrogen	1.72	5.45	3.39
Total Nitrogen	2.72	7.86	4.72
Total Phosphorus	0.38	0.84	0.66
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.003	0.003
Phenols	0.004	0.015	0.009
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0013	0.0009
Dissolved Cadmium	<0.0003	0.0016	0.0006
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0009	0.0008
Total Copper	0.008	0.015	0.011
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.271	0.625	0.479
Dissolved Iron	<0.004	0.016	0.011
Total Lead	0.002	0.008	0.005
Dissolved Lead	<0.0009	0.0058	0.0027
Total Manganese	0.0292	0.0625	0.0441
Dissolved Manganese	<0.0004	0.0024	0.0012
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	<0.002	0.005	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	0.0009	0.0008
Dissolved Silver	<0.0003	0.0004	0.0003
Total Zinc	0.014	0.034	0.020
Dissolved Zinc	<0.002	0.007	0.005
Fecal Coliform (cfu/100 mL)	<10	40	15 ^c
E. coli (cfu/100 mL)	<10	30	18 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVI-6: WATER QUALITY AT STATION 33 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	12.1 ^b	30.4 ^b	22.3
Total Suspended Solids	20	48	33
Turbidity (NTU)	17 ^b	41 ^b	25
Conductivity (µS/cm)	632 ^b	911 ^b	787
Five-Day Biochemical Oxygen Demand	<2	4	3
Dissolved Oxygen	8.9 ^b	15.1 ^b	11.6
pH (units)	8.1 ^b	8.9 ^b	8.5
Ammonia Nitrogen	0.04	0.14	0.09
Un-ionized Ammonia	0.003	0.055	0.017
Total Kjeldahl Nitrogen	0.79	2.78	1.37
Nitrite plus Nitrate Nitrogen	1.62	5.58	3.40
Total Nitrogen	2.47	8.36	4.76
Total Phosphorus	0.29	0.86	0.63
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.003	0.003
Phenols	0.005	0.014	0.009
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.002	0.002
Total Cadmium	<0.0004	0.0016	0.0009
Dissolved Cadmium	<0.0003	0.0011	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0009	0.0007
Total Copper	0.009	0.021	0.015
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.276	1.043	0.543
Dissolved Iron	<0.004	0.011	0.009
Total Lead	0.003	0.012	0.006
Dissolved Lead	<0.0009	0.0060	0.0028
Total Manganese	0.0353	0.0508	0.0451
Dissolved Manganese	<0.0004	0.0019	0.0011
Total Mercury (µg/L)	<0.05	0.08	0.06
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.015	0.036	0.024
Dissolved Zinc	<0.002	0.008	0.005
Fecal Coliform (cfu/100 mL)	<10	20	11 ^c
E. coli (cfu/100 mL)	<10	10	10 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVI-7: WATER QUALITY AT STATION 34 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	12.0 ^b	30.2 ^b	22.1
Total Suspended Solids	13	42	26
Turbidity (NTU)	19 ^b	30 ^b	23
Conductivity (µS/cm)	640 ^b	913 ^b	792
Five-Day Biochemical Oxygen Demand	5	10	8
Dissolved Oxygen	8.6 ^b	15.1 ^b	11.6
pH (units)	8.2 ^b	8.9 ^b	8.5
Ammonia Nitrogen	0.05	0.21	0.15
Un-ionized Ammonia	0.004	0.067	0.025
Total Kjeldahl Nitrogen	0.75	2.22	1.26
Nitrite plus Nitrate Nitrogen	1.57	5.55	3.37
Total Nitrogen	2.38	7.77	4.63
Total Phosphorus	0.26	0.76	0.59
Chlorophyll <i>a</i> (µg/L)	32.2	109.0	66.7
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.003	0.016	0.009
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0017	0.0009
Dissolved Cadmium	<0.0003	0.0016	0.0006
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0013	0.0008
Total Copper	0.009	0.015	0.012
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.225	0.622	0.411
Dissolved Iron	<0.004	0.014	0.010
Total Lead	<0.002	0.008	0.004
Dissolved Lead	<0.0009	0.0060	0.0028
Total Manganese	0.0233	0.0509	0.0407
Dissolved Manganese	<0.0004	0.0015	0.0010
Total Mercury (µg/L)	<0.05	0.11	0.06
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.013	0.032	0.020
Dissolved Zinc	<0.002	0.008	0.005
Fecal Coliform (cfu/100 mL)	<10	20	13 ^c
E. coli (cfu/100 mL)	<10	10	10 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVI-8: WATER QUALITY AT STATION 35 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	12.3 ^b	31.0 ^b	22.6
Total Suspended Solids	18	30	24
Turbidity (NTU)	19 ^b	39 ^b	27
Conductivity (µS/cm)	648 ^b	907 ^b	794
Five-Day Biochemical Oxygen Demand	<2	3	3
Dissolved Oxygen	8.6 ^b	15.1 ^b	11.9
pH (units)	8.2 ^b	9.0 ^b	8.5
Ammonia Nitrogen	0.03	0.12	0.09
Un-ionized Ammonia	0.002	0.045	0.016
Total Kjeldahl Nitrogen	0.73	1.91	1.32
Nitrite plus Nitrate Nitrogen	1.64	5.45	3.33
Total Nitrogen	2.51	7.36	4.64
Total Phosphorus	0.25	0.79	0.60
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.003	0.012	0.008
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0013	0.0008
Dissolved Cadmium	<0.0003	0.0012	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0010	0.0008
Total Copper	0.008	0.015	0.011
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.169	0.520	0.397
Dissolved Iron	<0.004	0.012	0.009
Total Lead	0.002	0.007	0.004
Dissolved Lead	<0.0009	0.0058	0.0036
Total Manganese	0.0248	0.0532	0.0398
Dissolved Manganese	<0.0004	0.0020	0.0010
Total Mercury (µg/L)	<0.05	0.09	0.06
Total Nickel	<0.002	0.003	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0004	0.0003
Total Zinc	0.014	0.022	0.018
Dissolved Zinc	<0.002	0.010	0.007
Fecal Coliform (cfu/100 mL)	<10	10	10 ^c
E. coli (cfu/100 mL)	<10	10	10 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVI-9: WATER QUALITY AT STATION 36 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	12.8 ^b	30.8 ^b	22.7
Total Suspended Solids	17	54	28
Turbidity (NTU)	20 ^b	37 ^b	26
Conductivity (µS/cm)	644 ^b	890 ^b	794
Five-Day Biochemical Oxygen Demand	<2	7	5
Dissolved Oxygen	9.1 ^b	16.4 ^b	11.9
pH (units)	8.1 ^b	8.9 ^b	8.6
Ammonia Nitrogen	0.04	0.34	0.14
Un-ionized Ammonia	0.002	0.096	0.029
Total Kjeldahl Nitrogen	0.67	1.86	1.23
Nitrite plus Nitrate Nitrogen	1.81	5.38	3.30
Total Nitrogen	2.73	7.24	4.52
Total Phosphorus	0.25	0.82	0.60
Chlorophyll <i>a</i> (µg/L)	26.7	108.7	68.4
Total Cyanide	<0.003	0.003	0.003
Phenols	0.005	0.012	0.009
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0014	0.0007
Dissolved Cadmium	<0.0003	0.0011	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0008	0.0008
Total Copper	0.009	0.014	0.012
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.306	0.627	0.479
Dissolved Iron	<0.004	0.018	0.010
Total Lead	<0.002	0.006	0.004
Dissolved Lead	<0.0009	0.0073	0.0034
Total Manganese	0.0278	0.0615	0.0460
Dissolved Manganese	<0.0004	0.0027	0.0012
Total Mercury (µg/L)	<0.05	0.09	0.06
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0003	0.0003
Total Zinc	0.014	0.027	0.018
Dissolved Zinc	<0.002	0.025	0.008
Fecal Coliform (cfu/100 mL)	<10	60	17 ^c
E. coli (cfu/100 mL)	<10	30	14 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVI-10: WATER QUALITY AT STATION 37 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	13.0 ^b	30.4 ^b	22.6
Total Suspended Solids	19	53	32
Turbidity (NTU)	23 ^b	35 ^b	28
Conductivity (µS/cm)	638 ^b	890 ^b	791
Five-Day Biochemical Oxygen Demand	4	5	4
Dissolved Oxygen	8.4 ^b	16.3 ^b	11.7
pH (units)	8.3 ^b	8.9 ^b	8.6
Ammonia Nitrogen	0.04	0.29	0.15
Un-ionized Ammonia	0.006	0.089	0.032
Total Kjeldahl Nitrogen	0.70	3.56	1.53
Nitrite plus Nitrate Nitrogen	1.92	5.31	3.32
Total Nitrogen	2.62	8.87	4.85
Total Phosphorus	0.24	0.82	0.59
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.005	0.013	0.009
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0016	0.0008
Dissolved Cadmium	<0.0003	0.0016	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0009	0.0008
Total Copper	0.008	0.014	0.012
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.349	0.887	0.546
Dissolved Iron	0.007	0.013	0.010
Total Lead	0.002	0.008	0.005
Dissolved Lead	<0.0009	0.0078	0.0033
Total Manganese	0.0288	0.0615	0.0475
Dissolved Manganese	<0.0004	0.0018	0.0010
Total Mercury (µg/L)	<0.05	0.08	0.06
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0003	0.0003
Total Zinc	0.014	0.024	0.017
Dissolved Zinc	<0.002	0.006	0.004
Fecal Coliform (cfu/100 mL)	<10	30	13 ^c
E. coli (cfu/100 mL)	<10	20	13 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVI-11: WATER QUALITY AT STATION 38 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	13.5 ^b	30.0 ^b	22.6
Total Suspended Solids	16	50	31
Turbidity (NTU)	26 ^b	57 ^b	35
Conductivity (µS/cm)	648 ^b	872 ^b	788
Five-Day Biochemical Oxygen Demand	4	5	5
Dissolved Oxygen	8.2 ^b	16.8 ^b	11.4
pH (units)	8.4 ^b	8.9 ^b	8.6
Ammonia Nitrogen	0.05	0.32	0.16
Un-ionized Ammonia	0.009	0.117	0.036
Total Kjeldahl Nitrogen	0.84	2.87	1.41
Nitrite plus Nitrate Nitrogen	1.84	5.25	3.12
Total Nitrogen	2.73	8.12	4.53
Total Phosphorus	0.23	0.83	0.58
Chlorophyll <i>a</i> (µg/L)	24.4	103.1	66.5
Total Cyanide	<0.003	0.003	0.003
Phenols	0.004	0.016	0.010
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.004	0.002
Total Cadmium	<0.0004	0.0013	0.0008
Dissolved Cadmium	<0.0003	0.0013	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0013	0.0009
Total Copper	0.006	0.015	0.010
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.299	0.865	0.571
Dissolved Iron	<0.004	0.015	0.010
Total Lead	<0.002	0.009	0.005
Dissolved Lead	<0.0009	0.0070	0.0034
Total Manganese	0.0316	0.0735	0.0517
Dissolved Manganese	<0.0004	0.0029	0.0015
Total Mercury (µg/L)	<0.05	0.08	0.06
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.004	0.002
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0005	0.0003
Total Zinc	0.013	0.025	0.017
Dissolved Zinc	<0.002	0.006	0.004
Fecal Coliform (cfu/100 mL)	<10	30	13 ^c
E. coli (cfu/100 mL)	<10	20	13 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVI-12: WATER QUALITY AT STATION 39 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	13.4 ^b	30.1 ^b	22.5
Total Suspended Solids	23	46	32
Turbidity (NTU)	24 ^b	43 ^b	34
Conductivity (µS/cm)	650 ^b	877 ^b	794
Five-Day Biochemical Oxygen Demand	3	5	4
Dissolved Oxygen	6.6 ^b	15.5 ^b	10.6
pH (units)	8.4 ^b	8.9 ^b	8.6
Ammonia Nitrogen	0.08	0.48	0.25
Un-ionized Ammonia	0.012	0.154	0.048
Total Kjeldahl Nitrogen	0.72	3.10	1.47
Nitrite plus Nitrate Nitrogen	1.89	5.47	3.32
Total Nitrogen	2.72	8.57	4.79
Total Phosphorus	0.23	0.79	0.58
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.003	0.003
Phenols	0.006	0.017	0.010
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.004	0.002
Total Cadmium	<0.0004	0.0016	0.0009
Dissolved Cadmium	<0.0003	0.0014	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0011	0.0008
Total Copper	0.009	0.014	0.011
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.412	0.896	0.660
Dissolved Iron	<0.004	0.012	0.009
Total Lead	0.002	0.009	0.005
Dissolved Lead	<0.0009	0.0064	0.0027
Total Manganese	0.0340	0.0764	0.0585
Dissolved Manganese	<0.0004	0.0020	0.0010
Total Mercury (µg/L)	<0.05	0.05	0.05
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.003
Total Silver	<0.0008	0.0008	0.0008
Dissolved Silver	<0.0003	0.0003	0.0003
Total Zinc	0.014	0.028	0.019
Dissolved Zinc	<0.002	0.006	0.004
Fecal Coliform (cfu/100 mL)	<10	20	13 ^c
E. coli (cfu/100 mL)	<10	10	10 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVI-13: WATER QUALITY AT STATION 40 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	14.0 ^b	29.5 ^b	22.5
Total Suspended Solids	22	75	37
Turbidity (NTU)	34 ^b	80 ^b	46
Conductivity (µS/cm)	666 ^b	859 ^b	793
Five-Day Biochemical Oxygen Demand	4	7	5
Dissolved Oxygen	5.4 ^b	16.9 ^b	10.6
pH (units)	8.4 ^b	9.0 ^b	8.6
Ammonia Nitrogen	0.07	0.55	0.26
Un-ionized Ammonia	0.012	0.130	0.048
Total Kjeldahl Nitrogen	0.66	2.67	1.43
Nitrite plus Nitrate Nitrogen	1.88	5.58	3.22
Total Nitrogen	3.04	8.25	4.66
Total Phosphorus	0.26	0.75	0.58
Chlorophyll <i>a</i> (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.003	0.003
Phenols	<0.003	0.014	0.009
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.006	0.003
Total Cadmium	<0.0004	0.0014	0.0008
Dissolved Cadmium	<0.0003	0.0012	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0013	0.0008
Total Copper	0.008	0.015	0.012
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.492	1.373	0.872
Dissolved Iron	0.005	0.014	0.010
Total Lead	0.002	0.011	0.007
Dissolved Lead	<0.0009	0.0067	0.0035
Total Manganese	0.0485	0.1090	0.0726
Dissolved Manganese	<0.0004	0.0026	0.0017
Total Mercury (µg/L)	<0.05	0.10	0.06
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.003
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.014	0.033	0.020
Dissolved Zinc	<0.002	0.006	0.004
Fecal Coliform (cfu/100 mL)	<10	20	11 ^c
E. coli (cfu/100 mL)	<10	10	10 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVI-14: WATER QUALITY AT STATION 41 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	13.7 ^b	30.0 ^b	22.6
Total Suspended Solids	18	70	33
Turbidity (NTU)	30 ^b	65 ^b	42
Conductivity (µS/cm)	670 ^b	863 ^b	794
Five-Day Biochemical Oxygen Demand	4	5	4
Dissolved Oxygen	5.5 ^b	15.9 ^b	10.1
pH (units)	8.3 ^b	8.9 ^b	8.6
Ammonia Nitrogen	0.08	0.32	0.19
Un-ionized Ammonia	0.013	0.096	0.036
Total Kjeldahl Nitrogen	0.76	2.42	1.23
Nitrite plus Nitrate Nitrogen	1.88	5.62	3.23
Total Nitrogen	2.76	8.04	4.45
Total Phosphorus	0.22	0.72	0.54
Chlorophyll <i>a</i> (µg/L)	18.0	105.5	61.5
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.003	0.023	0.010
Total Arsenic	<0.003	0.003	0.003
Dissolved Arsenic	<0.002	0.003	0.002
Total Cadmium	<0.0004	0.0014	0.0008
Dissolved Cadmium	<0.0003	0.0016	0.0006
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0011	0.0008
Total Copper	0.006	0.016	0.012
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.421	0.989	0.744
Dissolved Iron	<0.004	0.016	0.010
Total Lead	0.003	0.011	0.006
Dissolved Lead	<0.0009	0.0057	0.0023
Total Manganese	0.0446	0.0845	0.0652
Dissolved Manganese	<0.0004	0.0031	0.0016
Total Mercury (µg/L)	<0.05	0.12	0.07
Total Nickel	<0.002	0.004	0.003
Dissolved Nickel	<0.002	0.003	0.003
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0004	0.0003
Total Zinc	0.015	0.031	0.020
Dissolved Zinc	<0.002	0.006	0.004
Fecal Coliform (cfu/100 mL)	<10	10	10 ^c
E. coli (cfu/100 mL)	<10	20	13 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

APPENDIX AVII

WATER QUALITY AT STATIONS 42–49 IN THE LOWER PEORIA POOL
DURING MAY, AUGUST, AND OCTOBER 2005

TABLE AVII-1: WATER QUALITY AT STATION 42 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	13.8 ^b	30.1 ^b	22.6
Total Suspended Solids	26	56	39
Turbidity (NTU)	28 ^b	54 ^b	44
Conductivity (µS/cm)	673 ^b	875 ^b	795
Five-Day Biochemical Oxygen Demand	3	6	4
Dissolved Oxygen	4.7 ^b	15.1 ^b	10.0
pH (units)	8.3 ^b	8.8 ^b	8.6
Ammonia Nitrogen	0.10	0.34	0.21
Un-ionized Ammonia	0.015	0.081	0.035
Total Kjeldahl Nitrogen	0.84	2.31	1.31
Nitrite plus Nitrate Nitrogen	2.10	5.83	3.21
Total Nitrogen	3.13	8.14	4.52
Total Phosphorus	0.23	0.77	0.59
Chlorophyll a (µg/L)	18.7	108.1	61.3
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.003	0.014	0.008
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0018	0.0008
Dissolved Cadmium	<0.0003	0.0014	0.0006
Total Chromium	<0.004	0.004	0.004
Dissolved Chromium	<0.0007	0.0014	0.0008
Total Copper	0.005	0.022	0.012
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.481	1.746	0.928
Dissolved Iron	<0.004	0.081	0.028
Total Lead	0.002	0.010	0.006
Dissolved Lead	<0.0009	0.0073	0.0032
Total Manganese	0.0512	0.1042	0.0729
Dissolved Manganese	<0.0004	0.0091	0.0024
Total Mercury (µg/L)	<0.05	0.08	0.06
Total Nickel	<0.002	0.005	0.004
Dissolved Nickel	<0.002	0.003	0.003
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0003	0.0003
Total Zinc	0.015	0.029	0.021
Dissolved Zinc	<0.002	0.006	0.005
Fecal Coliform (cfu/100 mL)	<10	10	10 ^c
E. coli (cfu/100 mL)	<10	40	16 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVII-2: WATER QUALITY AT STATION 43 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	13.0 ^b	29.4 ^b	21.6
Total Suspended Solids	32	228	109
Turbidity (NTU)	41 ^b	183 ^b	74
Conductivity (µS/cm)	668 ^b	854 ^b	795
Five-Day Biochemical Oxygen Demand	3	8	5
Dissolved Oxygen	5.9 ^b	15.6 ^b	9.6
pH (units)	8.3 ^b	8.7 ^b	8.5
Ammonia Nitrogen	0.13	0.60	0.30
Un-ionized Ammonia	0.010	0.069	0.040
Total Kjeldahl Nitrogen	0.84	3.54	1.74
Nitrite plus Nitrate Nitrogen	1.91	5.50	3.13
Total Nitrogen	2.75	7.17	4.87
Total Phosphorus	0.32	1.04	0.73
Chlorophyll a (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.003	0.016	0.007
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.010	0.003
Total Cadmium	<0.0004	0.0017	0.0011
Dissolved Cadmium	<0.0003	0.0015	0.0006
Total Chromium	<0.004	0.007	0.005
Dissolved Chromium	<0.0007	0.0012	0.0009
Total Copper	0.012	0.020	0.015
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.607	3.446	1.803
Dissolved Iron	<0.0004	0.044	0.016
Total Lead	0.004	0.014	0.008
Dissolved Lead	<0.0009	0.0056	0.0033
Total Manganese	0.0692	0.1802	0.1085
Dissolved Manganese	0.0011	0.0036	0.0021
Total Mercury (µg/L)	<0.05	0.10	0.06
Total Nickel	<0.002	0.008	0.004
Dissolved Nickel	<0.002	0.003	0.003
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0003	0.0003
Total Zinc	0.020	0.047	0.031
Dissolved Zinc	<0.002	0.030	0.009
Fecal Coliform (cfu/100 mL)	<10	20	11 ^c
E. coli (cfu/100 mL)	<10	10	10 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVII-3: WATER QUALITY AT STATION 44 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	14.0 ^b	29.2 ^b	21.7
Total Suspended Solids	33	139	70
Turbidity (NTU)	41 ^b	176 ^b	85
Conductivity (µS/cm)	670 ^b	851 ^b	793
Five-Day Biochemical Oxygen Demand	3	6	5
Dissolved Oxygen	5.8 ^b	17.3 ^b	10.6
pH (units)	8.4 ^b	8.9 ^b	8.6
Ammonia Nitrogen	0.04	0.51	0.28
Un-ionized Ammonia	0.003	0.075	0.047
Total Kjeldahl Nitrogen	0.74	1.49	1.22
Nitrite plus Nitrate Nitrogen	1.58	5.20	2.82
Total Nitrogen	2.32	6.48	4.04
Total Phosphorus	0.25	1.04	0.64
Chlorophyll a (µg/L)	47.4	138.8	78.9
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.003	0.011	0.007
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.005	0.003
Total Cadmium	<0.0004	0.0015	0.0009
Dissolved Cadmium	<0.0003	0.0012	0.0005
Total Chromium	<0.004	0.008	0.005
Dissolved Chromium	<0.0007	0.0010	0.0008
Total Copper	0.005	0.017	0.013
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.705	4.063	1.745
Dissolved Iron	0.007	0.023	0.013
Total Lead	0.002	0.014	0.007
Dissolved Lead	<0.0009	0.0064	0.0028
Total Manganese	0.0715	0.2278	0.1127
Dissolved Manganese	0.0008	0.0037	0.0021
Total Mercury (µg/L)	<0.05	0.13	0.07
Total Nickel	<0.002	0.009	0.004
Dissolved Nickel	<0.002	0.003	0.003
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0004	0.0003
Total Zinc	0.016	0.049	0.027
Dissolved Zinc	<0.002	0.009	0.005
Fecal Coliform (cfu/100 mL)	<10	10	10 ^c
E. coli (cfu/100 mL)	<10	20	13 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVII-4: WATER QUALITY AT STATION 45 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	13.9 ^b	28.7 ^b	21.5
Total Suspended Solids	33	218	73
Turbidity (NTU)	49 ^b	182 ^b	82
Conductivity (µS/cm)	661 ^b	856 ^b	789
Five-Day Biochemical Oxygen Demand	3	7	6
Dissolved Oxygen	5.6 ^b	16.9 ^b	10.6
pH (units)	8.7 ^b	9.0 ^b	8.8
Ammonia Nitrogen	0.04	0.44	0.25
Un-ionized Ammonia	0.007	0.142	0.058
Total Kjeldahl Nitrogen	1.20	2.03	1.71
Nitrite plus Nitrate Nitrogen	1.18	5.09	2.48
Total Nitrogen	2.68	6.90	4.18
Total Phosphorus	0.27	1.18	0.78
Chlorophyll a (µg/L)	42.1	139.5	98.2
Total Cyanide	<0.003	0.003	0.003
Phenols	0.007	0.010	0.009
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.003	0.002
Total Cadmium	<0.0004	0.0023	0.0010
Dissolved Cadmium	<0.0003	0.0012	0.0005
Total Chromium	<0.004	0.004	0.004
Dissolved Chromium	<0.0007	0.0009	0.0008
Total Copper	0.009	0.021	0.014
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.556	5.249	1.772
Dissolved Iron	<0.004	0.013	0.009
Total Lead	0.002	0.011	0.006
Dissolved Lead	<0.0009	0.0068	0.0031
Total Manganese	0.0590	0.2267	0.1274
Dissolved Manganese	<0.0004	0.0227	0.0048
Total Mercury (µg/L)	<0.05	0.11	0.07
Total Nickel	<0.002	0.005	0.004
Dissolved Nickel	<0.002	0.004	0.003
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.016	0.069	0.029
Dissolved Zinc	<0.002	0.009	0.004
Fecal Coliform (cfu/100 mL)	<10	20	11 ^c
E. coli (cfu/100 mL)	<10	10	10 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVII-5: WATER QUALITY AT STATION 46 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	15.3 ^b	28.8 ^b	21.7
Total Suspended Solids	37	74	48
Turbidity (NTU)	39 ^b	91 ^b	65
Conductivity (µS/cm)	658 ^b	864 ^b	789
Five-Day Biochemical Oxygen Demand	4	8	5
Dissolved Oxygen	5.4 ^b	18.9 ^b	10.9
pH (units)	8.6 ^b	8.9 ^b	8.7
Ammonia Nitrogen	0.03	0.43	0.21
Un-ionized Ammonia	0.004	0.087	0.044
Total Kjeldahl Nitrogen	0.85	1.73	1.32
Nitrite plus Nitrate Nitrogen	0.98	5.04	2.46
Total Nitrogen	1.94	6.77	3.77
Total Phosphorus	0.25	0.94	0.65
Chlorophyll a (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.003	0.010	0.007
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	<0.002	<0.002
Total Cadmium	<0.0004	0.0015	0.0008
Dissolved Cadmium	<0.0003	0.0014	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0009	0.0008
Total Copper	0.011	0.017	0.013
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.634	2.082	1.058
Dissolved Iron	<0.004	0.018	0.010
Total Lead	0.004	0.011	0.007
Dissolved Lead	<0.0009	0.0086	0.0036
Total Manganese	0.0601	0.1556	0.1050
Dissolved Manganese	<0.0004	0.0032	0.0018
Total Mercury (µg/L)	<0.05	0.10	0.07
Total Nickel	<0.002	0.005	0.004
Dissolved Nickel	<0.002	0.003	0.003
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	<0.0003	<0.0003
Total Zinc	0.019	0.028	0.023
Dissolved Zinc	<0.002	0.006	0.004
Fecal Coliform (cfu/100 mL)	<10	2,200	58 ^c
E. coli (cfu/100 mL)	<10	40	25 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVII-6: WATER QUALITY AT STATION 47 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	14.0 ^b	30.1 ^b	22.2
Total Suspended Solids	33	70	50
Turbidity (NTU)	47 ^b	92 ^b	62
Conductivity (µS/cm)	658 ^b	874 ^b	798
Five-Day Biochemical Oxygen Demand	3	7	6
Dissolved Oxygen	5.6 ^b	16.9 ^b	10.2
pH (units)	8.6 ^b	8.8 ^b	8.7
Ammonia Nitrogen	0.05	0.48	0.21
Un-ionized Ammonia	0.008	0.081	0.040
Total Kjeldahl Nitrogen	0.79	1.73	1.27
Nitrite plus Nitrate Nitrogen	1.01	5.02	2.47
Total Nitrogen	1.93	6.71	3.74
Total Phosphorus	0.25	0.93	0.64
Chlorophyll a (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.003	0.013	0.008
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.007	0.003
Total Cadmium	<0.0004	0.0016	0.0008
Dissolved Cadmium	<0.0003	0.0013	0.0005
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0008	0.0008
Total Copper	0.009	0.027	0.016
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.552	1.764	1.067
Dissolved Iron	<0.004	0.015	0.011
Total Lead	0.003	0.010	0.006
Dissolved Lead	<0.0009	0.0078	0.0033
Total Manganese	0.0598	0.1474	0.1059
Dissolved Manganese	<0.0004	0.0018	0.0013
Total Mercury (µg/L)	<0.05	0.14	0.07
Total Nickel	<0.002	0.005	0.003
Dissolved Nickel	<0.002	0.003	0.003
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0004	0.0003
Total Zinc	0.017	0.026	0.021
Dissolved Zinc	<0.002	0.005	0.003
Fecal Coliform (cfu/100 mL)	70	550	205 ^c
E. coli (cfu/100 mL)	10	130	37 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVII-7: WATER QUALITY AT STATION 48 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	14.0 ^b	29.6 ^b	22.1
Total Suspended Solids	35	61	45
Turbidity (NTU)	43 ^b	1,257 ^b	256
Conductivity (µS/cm)	668 ^b	887 ^b	801
Five-Day Biochemical Oxygen Demand	4	8	6
Dissolved Oxygen	5.1 ^b	17.7 ^b	10.4
pH (units)	8.5 ^b	8.8 ^b	8.7
Ammonia Nitrogen	0.02	0.83	0.29
Un-ionized Ammonia	0.003	0.105	0.050
Total Kjeldahl Nitrogen	0.91	1.71	1.33
Nitrite plus Nitrate Nitrogen	1.00	5.05	2.51
Total Nitrogen	2.19	6.65	3.83
Total Phosphorus	0.24	0.93	0.66
Chlorophyll a (µg/L)	27.8	117.4	79.7
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.006	0.016	0.010
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.003	0.002
Total Cadmium	<0.0004	0.0014	0.0009
Dissolved Cadmium	<0.0003	0.0015	0.0006
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0008	0.0007
Total Copper	0.007	0.013	0.011
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.483	1.654	0.991
Dissolved Iron	0.004	0.013	0.010
Total Lead	0.004	0.010	0.006
Dissolved Lead	<0.0009	0.0060	0.0030
Total Manganese	0.0574	0.1506	0.1003
Dissolved Manganese	<0.0004	0.0020	0.0013
Total Mercury (µg/L)	<0.05	0.10	0.06
Total Nickel	<0.002	0.005	0.004
Dissolved Nickel	<0.002	0.003	0.003
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0004	0.0003
Total Zinc	0.017	0.025	0.020
Dissolved Zinc	<0.002	0.012	0.005
Fecal Coliform (cfu/100 mL)	20	360	82 ^c
E. coli (cfu/100 mL)	10	30	14 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

TABLE AVII-8: WATER QUALITY AT STATION 49 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents ^a	Minimum	Maximum	Mean
Water Temperature (°C)	14.2 ^b	29.8 ^b	22.2
Total Suspended Solids	30	234	74
Turbidity (NTU)	40 ^b	67 ^b	49
Conductivity (µS/cm)	669 ^b	889 ^b	804
Five-Day Biochemical Oxygen Demand	3	9	6
Dissolved Oxygen	4.5 ^b	16.8 ^b	10.0
pH (units)	8.4 ^b	8.8 ^b	8.6
Ammonia Nitrogen	0.05	0.62	0.23
Un-ionized Ammonia	0.007	0.069	0.034
Total Kjeldahl Nitrogen	1.01	1.60	1.24
Nitrite plus Nitrate Nitrogen	0.97	5.08	2.51
Total Nitrogen	2.02	6.68	3.75
Total Phosphorus	0.24	1.36	0.72
Chlorophyll a (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	0.004	0.016	0.010
Total Arsenic	<0.003	<0.003	<0.003
Dissolved Arsenic	<0.002	0.003	0.002
Total Cadmium	0.0004	0.0022	0.0010
Dissolved Cadmium	<0.0003	0.0014	0.0006
Total Chromium	<0.004	<0.004	<0.004
Dissolved Chromium	<0.0007	0.0009	0.0008
Total Copper	0.008	0.017	0.014
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.448	1.492	0.948
Dissolved Iron	0.007	0.016	0.011
Total Lead	0.002	0.010	0.005
Dissolved Lead	<0.0009	0.0070	0.0034
Total Manganese	0.0561	0.1377	0.0962
Dissolved Manganese	<0.0004	0.0020	0.0012
Total Mercury (µg/L)	<0.05	0.14	0.07
Total Nickel	<0.002	0.005	0.003
Dissolved Nickel	<0.002	0.004	0.003
Total Silver	<0.0008	<0.0008	<0.0008
Dissolved Silver	<0.0003	0.0003	0.0003
Total Zinc	0.016	0.033	0.022
Dissolved Zinc	<0.002	0.018	0.006
Fecal Coliform (cfu/100 mL)	10	140	68 ^c
E. coli (cfu/100 mL)	<10	30	14 ^c

^aExpressed in mg/L except where noted.

^bField measurement.

^cGeometric mean.

ADDENDUM TO REPORT

PREFACE TO ADDENDUM

Nitrogen Isotope Composition

During the October 2004 Illinois Waterway survey, 49 special samples were collected for stable nitrogen isotope ratio analysis by the University of Illinois at Chicago. Results of these analyses indicated that the overall isotopic composition of the nitrate in the Illinois River generally resembled isotope ratios associated with manure and septic system inputs.

In order to better understand the impact of seasonal agricultural activities, weather conditions, and flow on nitrate isotopes along the Illinois Waterway, a monthly sampling program was implemented during 2005. During routine Illinois Waterway surveys in May, August, and October, a sample was collected for nitrate isotope analysis from each of the 49 stations. Additional samples were collected for this analysis during April, June, July, September, and November at only seven of these stations.

This addendum entitled, *Isotopic Composition of Nitrate in the Illinois Waterway, 2005*, presents the results from the Illinois Waterway Nitrogen Isotope Sampling Project and was prepared by Neil Sturchio, Sam Huang, and M. Gonzalez-Meler from the University of Illinois, Chicago.

Isotopic Composition of Nitrate in the Illinois Waterway, 2005

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Introduction

The Illinois Waterway Monitoring Project of the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) has conducted annual water quality surveys along the Illinois Waterway from the Lockport Lock to the Peoria Lock since 1984. This represents a distance of 133 river miles, from upstream of the confluence of the Des Plaines and Kankakee Rivers to downstream of the City of Peoria. These surveys are done to monitor the impact of the large amount of treated effluent released into the waterway system by the MWRDGC.

The measurement of stable isotope ratios of nitrogen and oxygen in nitrate is known to provide useful constraints on the sources and transformations of nitrate in surface waters and ground waters. The MWRDGC contracted the University of Illinois at Chicago to obtain stable isotope ratio analyses of nitrogen and oxygen in nitrate, and hydrogen and oxygen in water, for their 2005 water quality survey. These isotopic parameters are not normally measured during the MWRDGC's annual surveys, but it was anticipated that valuable insights into the occurrence and behavior of nitrate in the Illinois River might be gained from including such measurements in the survey to complement other water quality data generated by the MWRDGC. The results of the stable isotope ratio measurements of nitrogen and oxygen in nitrate sampled during 2005 are the subject of this report. A supplemental report will be prepared based on the results of the hydrogen and oxygen isotope ratio measurements of the water samples collected during 2005.

The specific objectives of the stable isotope ratio measurements are: (1) to determine if different sources of nitrate can be distinguished isotopically in the Illinois River, (2) to determine if there is isotopic evidence for denitrification occurring in the Illinois River, and (3) how are different sources of nitrate and denitrification processes related to tributary inputs and river characteristics along the waterway, as well as seasonal changes in temperature, discharge, and agricultural activities.

Methods

Samples of river water were collected on a monthly basis by MWRDGC personnel from April through November 2005 as follows: as part of their regular water quality survey along the Illinois River, 49 stations were sampled in May, August, and October. Seven of these 49 stations also were sampled in April, June, July, September, and November (Addendum Table 1). In addition, treated effluent from the Stickney water reclamation plant was sampled monthly from March through November.

For river samples, water was pumped from a depth of three feet in mid-stream and passed through a 0.45 micron filter. About 250 mL of water from each station was collected and frozen in high-density polyethylene (HDPE) bottles. Samples for nitrate isotope analysis were stored frozen until analysis, except for a brief thawing for subsampling. Subsamples for hydrogen and oxygen isotope analysis and ion chromatography were preserved under refrigeration in 20-mL glass vials with polyseal caps and 60-mL HDPE bottles, respectively.

Stable isotope ratio analyses of nitrate were performed in replicate by the bacterial denitrification method of Casciotti et al. (2002), using a Finnigan Delta Plus isotope ratio mass spectrometer in continuous flow mode. Stable isotope analyses of hydrogen and oxygen in water were performed by the conventional hydrogen equilibration (Coplen et al., 1991) and carbon dioxide equilibration (Nelson, 2000) methods, respectively. All isotope ratios are reported in delta (δ) notation in units of per mil (‰) deviation relative to a standard reference material, where:

$$\delta = [(R_{\text{sample}}/R_{\text{standard}}) - 1] \times 1000$$

and R is the isotope ratio of $^2\text{H}/^1\text{H}$, $^{15}\text{N}/^{14}\text{N}$, or $^{18}\text{O}/^{16}\text{O}$. The standard reference materials used for normalization of ratios are Vienna Standard Mean Ocean Water (VSMOW) for H and O isotope ratios (Coplen, 1996), and atmospheric nitrogen for N isotope ratios. Analytical precision of isotope ratios is typically about $\pm 1\text{--}2\text{‰}$ for H isotope ratios in water, $\pm 0.1\text{--}0.2$ per mil for O isotope ratios in water, and $\pm 0.3\text{--}0.5$ ‰ for N and O isotope ratios in nitrate.

Concentrations of nitrate were measured by ion chromatography using a Dionex 500 ion chromatograph calibrated with certified reference solutions. Accuracies of nitrate concentrations are within $\pm 5\%$ of the value reported.

Water discharge data were obtained from the U.S. Geological Survey (<http://waterdata.usgs.gov/nwis/>), which records daily streamflow at four of the stations from which samples were collected for this study (#1, #26, #39, and #49).

Results and Discussion

Analytical results are listed in Addendum Tables AI and AII. The order of discussion of these results in the following pages is: nitrate concentration vs. river distance; nitrate flux vs. river distance; and correlations of the nitrogen and oxygen isotopic compositions of nitrate. The changes in nitrate concentration, flux, and isotopic composition with time are also discussed.

Nitrate concentration variations with river distance and time

Nitrate concentration data as a function of downstream river distance (beginning at station #1, Lockport Lock) for samples collected during May, August, and October 2005 are shown in Figure 1. Data from the October 2004 sampling is also shown for comparison, and the locations of major tributary streams are indicated by arrows. There are three key features of the data that are noteworthy. First, there is an overall decrease in nitrate concentration from Lockport to Peoria at all times of year. The greatest decrease in concentration is observed in October (both 2004 and 2005), when the nitrate concentration decreases by a factor of three to four between Lockport and Peoria. Second, the impact of tributaries on the nitrate concentration is substantial. For all four sampling events, nitrate concentration in the waterway decreases significantly downstream of the confluence of the Kankakee and Des Plaines Rivers. This indicates that the Des Plaines River has a higher concentration of nitrate (3–5 mg/L nitrate as NO₃-N) than the Kankakee River at all times of year. Third, there is a net decrease in nitrate concentration downstream of the Kankakee River during August and October, whereas during May there is a net increase of nitrate concentration downstream of the Kankakee River.

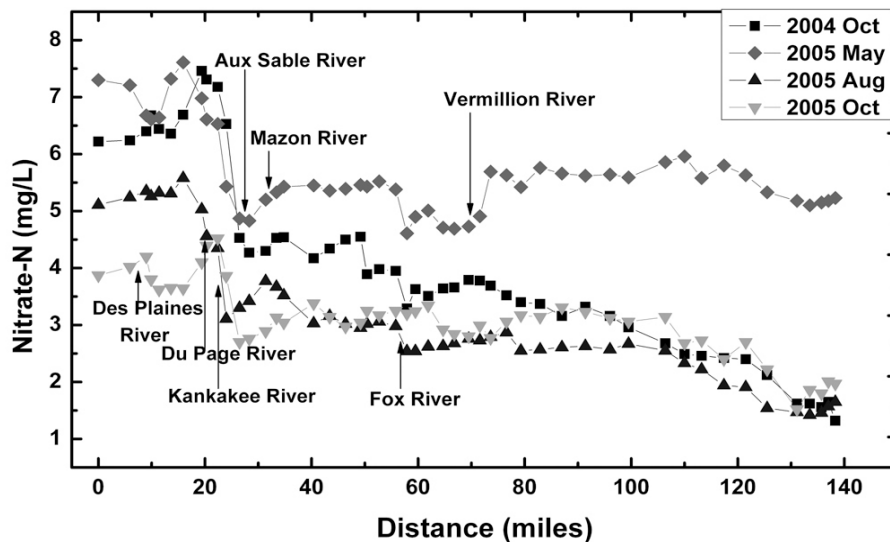


Figure 1. Nitrate concentration (mg/L NO₃-N) vs. river distance (miles) from Lockport Lock.

Nitrate flux variations with river distance and time

The total nitrate load carried by the river is best considered in terms of nitrate flux. Nitrate flux in the river is defined as the product of concentration and discharge. Using discharge data from the U. S. Geological Survey's streamflow monitoring network, nitrate flux at four stations was calculated for the times of sampling (Addendum Table AIII). Nitrate flux as a function of downstream river distance is shown in Figure 2. The data for August and October (both 2004 and 2005) show clearly a general trend of decreasing nitrate flux with downstream river distance between Lockport and Peoria. However, in May 2005 there is a substantial increase in nitrate flux over this distance, from about 30 tons NO₃-N/day at Lockport to 140 tons NO₃-N/day at Peoria. These observations indicate that during August and October, the principal input of nitrate to the waterway is upstream and there is a gradual removal of nitrate between Lockport and Peoria. However, during May, there is input of nitrate at many points along the waterway and there is a gradual increase in nitrate flux downstream. The most likely source of the additional nitrate downstream is agricultural runoff of fertilizer-derived nitrate.

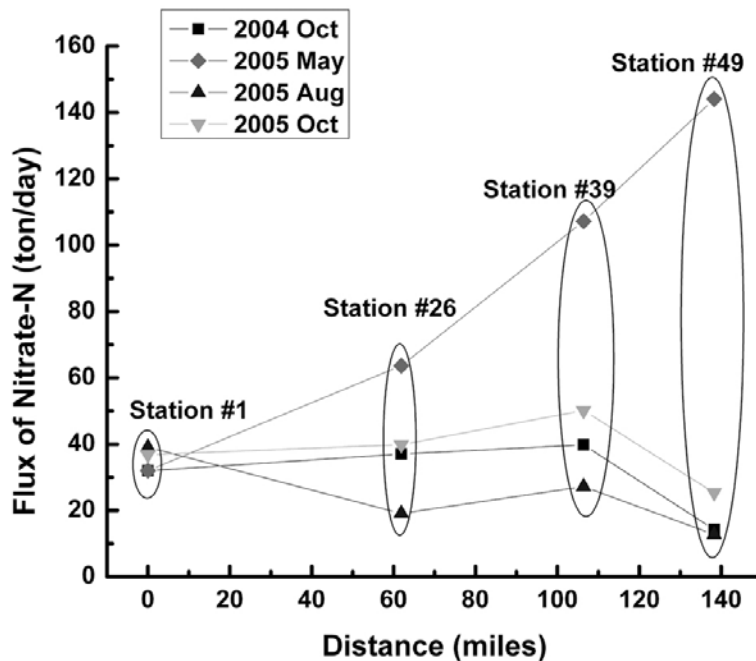


Figure 2. Nitrate flux (tons/day of NO₃-N) vs. river distance (miles) from Lockport Lock.

Isotopic composition of nitrate

Additional insights into the sources and removal mechanisms of nitrate can be gained from considering the isotopic compositions of nitrogen (N) and oxygen (O) in nitrate. [Figure 3](#) compares the correlations between $\delta^{18}\text{O}$ and $\delta^{15}\text{N}$ values of nitrate for each of the four major sampling events (October 2004, May 2005, August 2005, and October 2005) to date.

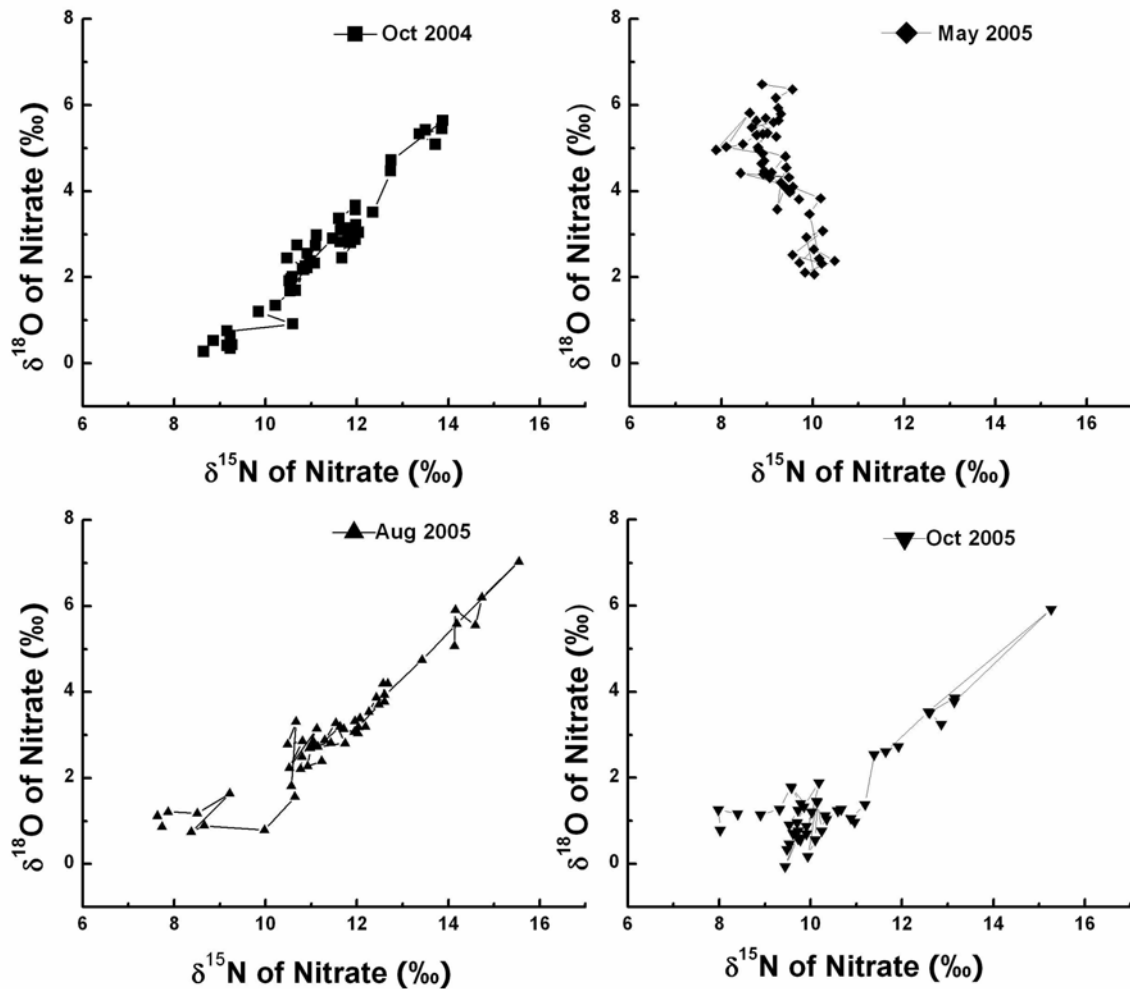


Figure 3. $\delta^{18}\text{O}$ (‰) vs. $\delta^{15}\text{N}$ (‰) of nitrate in the Illinois Waterway. Lines connect sampling stations in order from #1 to #49, from low values of $\delta^{18}\text{O}$ to high values of $\delta^{18}\text{O}$.

There is a similar pattern of increasing values with downstream distance in three of the four data sets (October 2004, August 2005, and October 2005). This pattern is consistent with

progressive denitrification with downstream distance, which is also consistent with the observed decreases in nitrate concentration and nitrate flux with downstream distance. Denitrification has a characteristic slope of 0.5 to 1.0 on a $\delta^{18}\text{O}$ vs. $\delta^{15}\text{N}$ diagram (Bottcher et al., 1990). However, during the May 2005 sampling, there was a distinct pattern of nitrate isotopic compositions, in which the $\delta^{15}\text{N}$ value decreased slightly while the $\delta^{18}\text{O}$ value increased with downstream distance. This pattern cannot be explained by denitrification, but it can be explained by mixing of isotopically distinct sources of nitrate. The gradual increase of nitrate flux with downstream distance observed during May 2005 (Figure 2) indicates that such mixing must have been occurring along the waterway at that time.

A subset of the 49 stations (#1, 4, 8, 20, 23, 30, and 39) was sampled during April, June, July, September, and November 2005 (Data shown in Addendum Table AII). When these data are combined with data from May, August, and October, the timing of the spring “mixing” can be resolved somewhat better (Figure 4). The data from April are similar to those from May, indicating that the input of fertilizer-derived nitrate was well underway by April. There is also a continuation of this input at a reduced level during June and July. By August, the pattern that had been observed in October 2004 had been re-established, and this pattern continued through November.

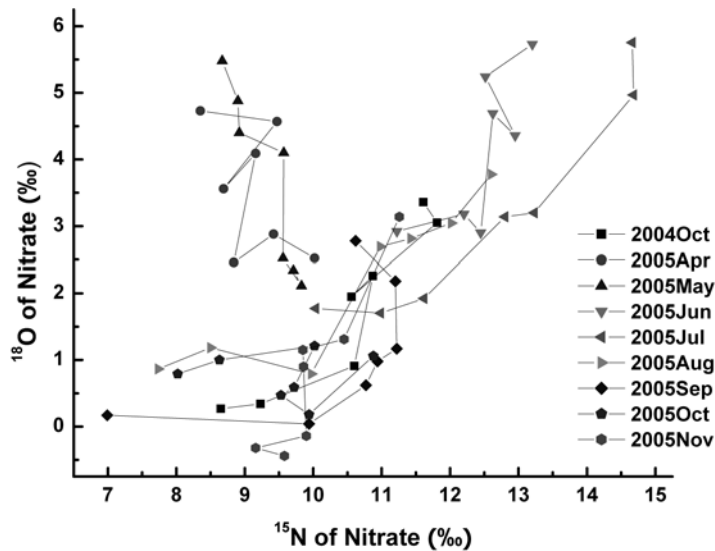


Figure 4. Monthly variations in nitrate isotopic composition in the Illinois Waterway.

The overall isotopic composition of nitrate in the waterway is generally similar to that of wastewater treatment plant effluents, and the apparent mixing observed during May 2005 is consistent with a two-component mixture of such effluent with fertilizer-derived nitrate (Figure 5). The isotopic composition of the nitrate in the May 2005 samples could also reflect a mixture between wastewater and atmospheric precipitation, but the required concentrations for the atmospheric nitrate endmember are much higher than typical nitrate concentrations in precipitation.

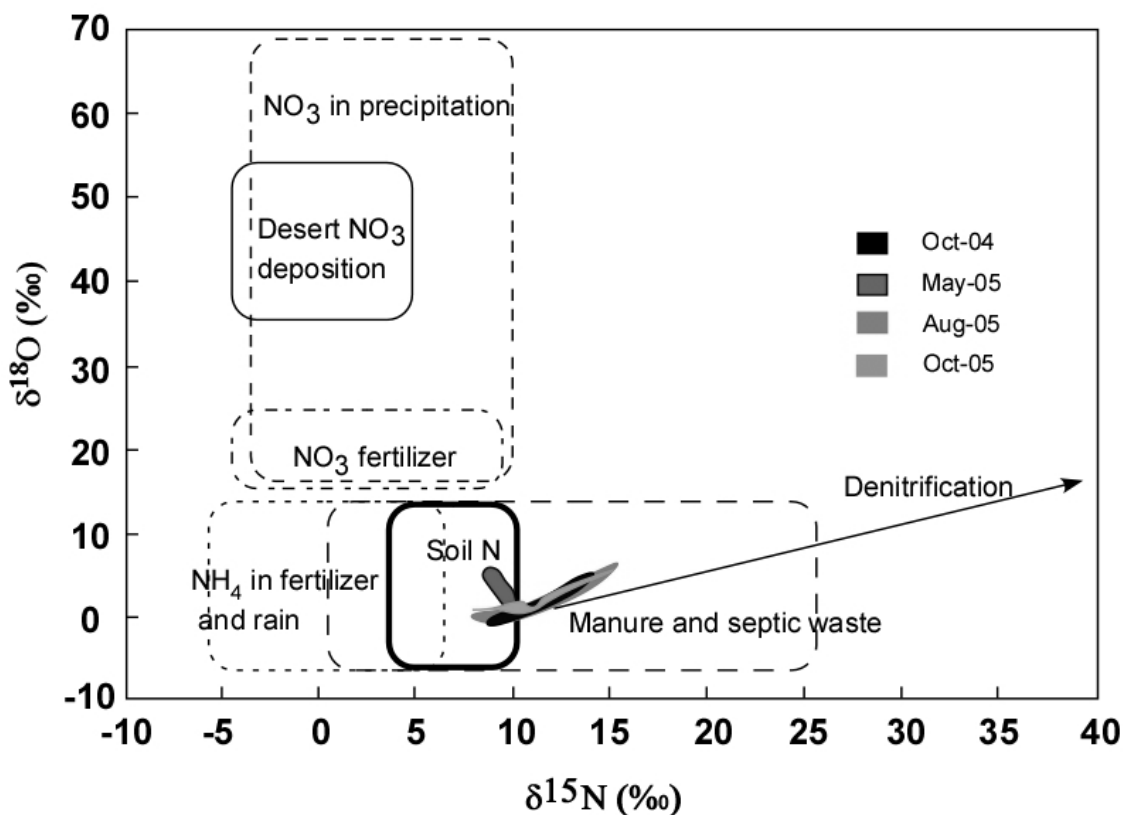


Figure 5. Comparison of Illinois Waterway nitrate, as sampled during October 2004 and May, August, and October 2005, with other common types of nitrate. Nitrate isotopic composition during October 2004 and August and October 2005 resembles that of typical wastewater treatment plant effluent affected by downstream denitrification. During May 2005, the nitrate isotopic composition resembles a mixture of wastewater nitrate with fertilizer nitrate from agricultural runoff. These comparisons are consistent with observed variations in nitrate flux (Figure 2).

Conclusions

1. The overall isotopic composition of the nitrate in the Illinois Waterway during the October 2004, August 2005, and October 2005 sampling events resembles that typical of municipal wastewater treatment plant effluent.
2. The variation of stable isotope ratios of nitrogen and oxygen in nitrate during the October 2004, August 2005, and October 2005 sampling events is consistent with progressive denitrification of the nitrate with downstream distance, which agrees with the decreasing nitrate flux observed between Lockport and Peoria during these sampling events.
3. During the May 2005 sampling event, the variations in nitrate isotopic composition in the Illinois Waterway resemble a mixture of wastewater treatment plant effluent and fertilizer-derived nitrate (agricultural runoff), in which the proportion of fertilizer-derived nitrate increases with downstream distance. This agrees with the increasing nitrate flux observed between Lockport and Peoria during this sampling event. Monthly sampling showed that the mixing observed in May was equally obvious in April and had continued impact into June and July. By August, the pattern that had been observed in October 2004 had been re-established. This pattern persisted through November 2005.
4. Stable isotope monitoring of nitrate in the Illinois Waterway must be conducted on a 12-month basis to provide a better understanding of the impact of seasonal agricultural activities, weather conditions, and river level on the occurrence and behavior of nitrate in the Illinois Waterway.

References

- Bottcher, J., Strebel, O., Voerkelius, S., and Schmidt, H.L., 1990. *Journal of Hydrology* **114**, 413-424.
- Casciotti K. et al., 2002. *Analytical Chemistry* 74, 4905-4912.
- Clarke I. and Fritz P., 1997. *Environmental Isotopes in Hydrogeology*: New York, Lewis Publishers, 328 p.
- Coplen, T. B., 1996, *Geochimica et Cosmochimica Acta* 60, 3359-3362.
- Coplen T. B. et al., 1991. *Analytical Chemistry* 63, 910-912.
- Nelson, S., 2000. *Geochimica Cosmochimica Acta* 4, 213-224.

ADDENDUM TABLE 1: ILLINOIS WATERWAY NITROGEN ISOTOPE STUDY
MONTHLY SAMPLING LOCATIONS AND ACCESS POINTS

Station No.	River Mile	Illinois Waterway Pool	Access Point (River Mile)
39	190.0	Peoria	Lacon ramp (189.0)
30	224.7	Peoria	LaSalle ramp (224.0)
23	240.6	Starved Rock	Ottawa ramp (239.7)
20	247.5	Marseilles	Illini State Park ramp (247.4)
8	278.0	Dresden Island	Big Basin Marina (277.8)
4	286.5	Brandon Road	Illinois Route 6 ramp (286.4)
1	291.5	Lockport	Cargill Elevator (292.6)

ADDENDUM APPENDIX A

ADDENDUM TABLE AI-1: NITRATE ISOTOPE DATA AT STATIONS 1 THROUGH 49
ALONG THE ILLINOIS WATERWAY DURING MAY 2005

Station No.	Waterway	NO ₃ -N (mg/L)	$\delta^{15}\text{N NO}_3$	$\delta^{18}\text{O NO}_3$
1	Chicago Sanitary and Ship Canal	7.30	9.71	2.34
2	Chicago Sanitary and Ship Canal	7.21	10.02	2.65
3	Des Plaines River	6.68	10.48	2.38
4	Des Plaines River	6.61	9.83	2.11
5	Des Plaines River	6.65	10.03	2.07
6	Des Plaines River	7.32	9.86	2.93
7	Des Plaines River	7.62	10.22	3.08
8	Des Plaines River	6.98	9.56	2.52
9	Des Plaines River	6.62	10.20	2.32
10	Des Plaines River	6.53	10.14	2.43
11	Illinois River	5.43	9.93	3.47
12	Illinois River	4.88	10.17	3.84
13	Illinois River	4.83	9.06	4.31
14	Illinois River	5.20	9.70	3.81
15	Illinois River	5.33	9.50	3.98
16	Illinois River	5.44	9.39	4.10
17	Illinois River	5.45	9.22	3.58
18	Illinois River	5.37	9.30	4.20
19	Illinois River	5.39	9.42	4.55
20	Illinois River	5.46	9.57	4.10
21	Illinois River	5.44	8.42	4.42
22	Illinois River	5.52	9.48	4.32
23	Illinois River	5.38	8.92	4.40
24	Illinois River	4.61	8.94	4.71
25	Illinois River	4.90	8.94	4.47
26	Illinois River	5.02	8.88	4.64
27	Illinois River	4.71	9.10	4.44
28	Illinois River	4.70	9.40	4.81
29	Illinois River	4.73	8.82	4.96
30	Illinois River	4.91	8.90	4.88
31	Illinois River	5.69	8.11	5.03
32	Illinois River	5.63	8.62	5.82
33	Illinois River	5.42	7.89	4.96
34	Illinois River	5.76	8.47	5.10
35	Illinois River	5.66	8.77	5.31
36	Illinois River	5.62	8.91	5.33
37	Illinois River	5.64	8.80	5.02
38	Illinois River	5.60	9.14	5.60

ADDENDUM TABLE AI-1 (Continued): NITRATE ISOTOPE DATA AT STATIONS
1 THROUGH 49 ALONG THE ILLINOIS WATERWAY DURING MAY 2005

Station No.	Waterway	NO ₃ -N (mg/L)	$\delta^{15}\text{N}$ NO ₃	$\delta^{18}\text{O}$ NO ₃
39	Illinois River	5.86	8.67	5.48
40	Illinois River	5.97	9.01	5.35
41	Illinois River	5.58	9.20	5.27
42	Illinois River	5.80	8.76	5.64
43	Illinois River	5.63	8.97	5.70
44	Illinois River	5.33	9.25	5.65
45	Illinois River	5.18	9.24	5.94
46	Illinois River	5.11	9.30	5.80
47	Illinois River	5.15	9.19	6.17
48	Illinois River	5.18	9.56	6.37
49	Illinois River	5.23	8.89	6.49

ADDENDUM TABLE AI-2: NITRATE ISOTOPE DATA AT STATIONS 1 THROUGH 49
ALONG THE ILLINOIS WATERWAY DURING AUGUST 2005

Station No.	Waterway	NO ₃ -N (mg/L)	ε ¹⁵ N NO ₃	ε ¹⁸ O NO ₃
1	Chicago Sanitary and Ship Canal	5.11	7.73	0.87
2	Chicago Sanitary and Ship Canal	5.24	7.63	1.12
3	Des Plaines River	5.35	7.86	1.21
4	Des Plaines River	5.26	8.50	1.18
5	Des Plaines River	5.32	9.22	1.64
6	Des Plaines River	5.31	8.37	0.75
7	Des Plaines River	5.58	8.66	0.90
8	Des Plaines River	5.04	9.97	0.79
9	Des Plaines River	4.56	10.64	1.57
10	Des Plaines River	4.35	10.56	1.81
11	Illinois River	3.11	10.67	3.31
12	Illinois River	3.30	10.48	2.78
13	Illinois River	3.42	10.80	2.86
14	Illinois River	3.78	10.52	2.24
15	Illinois River	3.67	11.12	3.15
16	Illinois River	3.52	10.80	2.49
17	Illinois River	3.03	10.77	2.21
18	Illinois River	3.16	11.23	2.40
19	Illinois River	3.03	10.92	2.28
20	Illinois River	2.95	10.98	2.69
21	Illinois River	3.02	11.04	2.85
22	Illinois River	3.06	11.04	2.75
23	Illinois River	2.99	11.43	2.82
24	Illinois River	2.55	11.29	2.88
25	Illinois River	2.54	11.54	3.28
26	Illinois River	2.62	11.74	2.81
27	Illinois River	2.63	11.14	2.73
28	Illinois River	2.69	11.63	3.20
29	Illinois River	2.77	11.71	3.13
30	Illinois River	2.73	12.02	3.05
31	Illinois River	2.79	12.06	3.39
32	Illinois River	2.87	11.94	3.08
33	Illinois River	2.55	11.95	3.32
34	Illinois River	2.57	12.19	3.20
35	Illinois River	2.62	12.03	3.18
36	Illinois River	2.63	12.48	3.71
37	Illinois River	2.57	12.26	3.53
38	Illinois River	2.68	12.42	3.87

ADDENDUM TABLE AI-2 (Continued): NITRATE ISOTOPE DATA AT STATIONS
1 THROUGH 49 ALONG THE ILLINOIS WATERWAY DURING AUGUST 2005

Station No.	Waterway	NO ₃ -N (mg/L)	$\delta^{15}\text{N}$ NO ₃	$\delta^{18}\text{O}$ NO ₃
39	Illinois River	2.55	12.60	3.78
40	Illinois River	2.33	12.57	4.20
41	Illinois River	2.22	12.67	4.19
42	Illinois River	1.94	12.60	3.93
43	Illinois River	1.91	13.43	4.74
44	Illinois River	1.54	14.18	5.59
45	Illinois River	1.47	15.54	7.03
46	Illinois River	1.42	14.73	6.19
47	Illinois River	1.46	14.59	5.55
48	Illinois River	1.57	14.15	5.91
49	Illinois River	1.65	14.14	5.07

ADDENDUM TABLE AI-3: NITRATE ISOTOPE DATA AT STATIONS 1 THROUGH 49
ALONG THE ILLINOIS WATERWAY DURING OCTOBER 2005

Station No.	Waterway	NO ₃ -N (mg/L)	δ ¹⁵ N NO ₃	δ ¹⁸ O NO ₃
1	Chicago Sanitary and Ship Canal	3.87	8.02	0.79
2	Chicago Sanitary and Ship Canal	4.02	7.98	0.97
3	Des Plaines River	4.20	8.40	1.44
4	Des Plaines River	3.80	8.63	2.22
5	Des Plaines River	3.62	8.90	1.14
6	Des Plaines River	3.65	9.32	1.27
7	Des Plaines River	3.64	9.57	1.49
8	Des Plaines River	4.10	10.02	1.21
9	Des Plaines River	4.39	9.43	1.30
10	Des Plaines River	4.52	10.04	1.79
11	Illinois River	3.87	9.78	1.74
12	Illinois River	2.71	9.58	1.78
13	Illinois River	2.76	9.52	1.48
14	Illinois River	2.89	9.53	0.91
15	Illinois River	3.13	9.72	1.25
16	Illinois River	3.05	9.70	0.96
17	Illinois River	3.38	9.85	1.49
18	Illinois River	3.14	10.18	1.91
19	Illinois River	2.98	9.91	0.70
20	Illinois River	3.04	9.72	0.59
21	Illinois River	3.25	9.44	0.23
22	Illinois River	3.17	9.72	0.77
23	Illinois River	3.25	9.53	0.47
24	Illinois River	3.20	9.48	0.34
25	Illinois River	3.24	9.77	0.56
26	Illinois River	3.34	9.61	0.71
27	Illinois River	2.92	9.77	0.61
28	Illinois River	2.84	9.91	1.15
29	Illinois River	2.80	10.13	1.13
30	Illinois River	2.99	9.94	0.55
31	Illinois River	2.78	10.10	0.85
32	Illinois River	3.06	10.14	1.00
33	Illinois River	3.17	10.24	1.10
34	Illinois River	3.14	10.32	1.11
35	Illinois River	3.31	10.35	1.04
36	Illinois River	3.23	10.59	1.24
37	Illinois River	3.12	10.67	1.24
38	Illinois River	3.06	10.96	0.62

ADDENDUM TABLE AI-3 (Continued): NITRATE ISOTOPE DATA AT STATIONS
1 THROUGH 49 ALONG THE ILLINOIS WATERWAY DURING OCTOBER 2005

Station No.	Waterway	NO ₃ -N (mg/L)	ε ¹⁵ N NO ₃	ε ¹⁸ O NO ₃
39	Illinois River	3.14	10.88	1.06
40	Illinois River	2.68	11.19	1.38
41	Illinois River	2.73	11.39	2.54
42	Illinois River	2.40	11.92	2.73
43	Illinois River	2.70	11.64	2.61
44	Illinois River	2.22	12.57	3.59
45	Illinois River	1.52	15.26	5.92
46	Illinois River	1.87	13.14	3.77
47	Illinois River	1.80	13.15	3.86
48	Illinois River	2.01	12.60	3.52
49	Illinois River	1.97	12.86	3.25

ADDENDUM TABLE AII-1: NITRATE ISOTOPE DATA AT STATIONS
1, 4, 8, 20, 23, 30, AND 39 ALONG THE ILLINOIS WATERWAY DURING
APRIL, JUNE, JULY, SEPTEMBER, AND NOVEMBER 2005

Station No.	Waterway	NO ₃ -N (mg/L)	ε ¹⁵ N NO ₃	ε ¹⁸ O NO ₃
APRIL				
	Stickney WRP Effluent*	7.03	8.08	2.10
1	Chicago Sanitary and Ship Canal	8.42	10.02	2.52
4	Des Plaines River	6.72	9.42	2.88
8	Des Plaines River	6.15	8.84	2.46
20	Illinois River	3.92	9.16	4.09
23	Illinois River	3.79	8.69	3.56
30	Illinois River	3.82	9.47	4.57
39	Illinois River	4.18	8.35	4.73
JUNE				
	Stickney WRP Effluent*	11.46	10.45	2.99
1	Chicago Sanitary and Ship Canal	4.54	11.22	2.92
4	Des Plaines River	4.72	12.20	3.18
8	Des Plaines River	5.00	12.45	2.90
20	Illinois River	2.41	12.62	4.69
23	Illinois River	3.55	12.95	4.36
30	Illinois River	2.99	12.52	5.24
39	Illinois River	2.71	13.20	5.73
JULY				
	Stickney WRP Effluent*	7.82	7.40	0.83
1	Chicago Sanitary and Ship Canal	5.22	10.04	1.77
4	Des Plaines River	5.30	10.99	1.70
8	Des Plaines River	4.94	11.62	1.92
20	Illinois River	3.25	12.80	3.14
23	Illinois River	3.07	13.23	3.20
30	Illinois River	2.20	14.68	4.97
39	Illinois River	1.90	14.66	5.75
SEPTEMBER				
	Stickney WRP Effluent*	7.22	8.03	-0.35
1	Chicago Sanitary and Ship Canal	3.37	8.39	-0.06
4	Des Plaines River	3.63	9.94	0.04
8	Des Plaines River	3.63	10.77	0.62
20	Illinois River	3.25	10.94	0.98
23	Illinois River	3.22	11.22	1.88
30	Illinois River	2.75	11.20	2.18
39	Illinois River	2.10	10.62	2.78

ADDENDUM TABLE AII-1 (Continued): NITRATE ISOTOPE DATA AT STATIONS
1, 4, 8, 20, 23, 30, AND 39 ALONG THE ILLINOIS WATERWAY DURING
APRIL, JUNE, JULY, SEPTEMBER, AND NOVEMBER 2005

Station No.	Waterway	NO ₃ -N (mg/L)	$\delta^{15}\text{N}$ NO ₃	$\delta^{18}\text{O}$ NO ₃
NOVEMBER				
	Stickney WRP Effluent*	6.82	8.98	-1.00
1	Chicago Sanitary and Ship Canal	5.22	9.58	-0.44
4	Des Plaines River	6.74	9.16	-0.32
8	Des Plaines River	6.55	9.90	-0.14
20	Illinois River	4.65	9.86	0.90
23	Illinois River	4.63	9.85	1.67
30	Illinois River	2.87	10.45	1.31
39	Illinois River	3.55	11.26	3.14

*Grab sample taken from the outfall at the Stickney Water Reclamation Plant.

ADDENDUM TABLE AIII-1: FLUX OF NITRATE NITROGEN AT STATIONS
1, 26, 39, AND 49 ALONG THE ILLINOIS WATERWAY DURING
2005 SAMPLING EVENTS

Date	Discharge (ft ³ /s) ^a	NO ₃ -N (mg/L)	Total NO ₃ -N Flux (ton/day)
Station 1 Chicago Sanitary and Ship Canal			
04/13/05	2,089	8.43	47.48
05/02/05	1,626	7.30	32.02
06/15/05	2,204	4.54	26.98
07/13/05	2,074	5.22	29.21
08/01/05	2,288	6.33	39.05
09/14/05	2,714	3.38	24.71
10/03/05	3,524 ^b	3.88	36.84
11/02/05	3,179 ^b	5.22	44.79
Station 26 Illinois River			
05/03/05	4,700	5.02	63.63
08/02/05	2,700	2.62	19.10
10/04/05	4,420	3.34	39.83
Station 39 Illinois River			
04/12/05	10,300	4.18	116.25
05/04/05	6,780	5.86	107.21
06/14/05	6,730	2.71	49.19
07/12/05	4,590	1.90	23.47
08/03/05	3,950	2.55	27.21
09/13/05	2,800	2.10	15.89
10/05/05	5,910	3.14	50.10
11/01/05	3,000	3.55	28.75
Station 49 Illinois River			
05/05/05	10,200	5.24	144.06
08/04/05	2,870	1.65	12.74
10/06/05	4,770	1.97	25.40

^aDischarge data accessed from United States Geological Survey Web site.

^bHistorical mean discharge data used for this date.