FINAL, 8-13-08

TECHNICAL SUPPORT DOCUMENT FOR SITE-SPECIFIC BORON STANDARD FOR THE SPRINGFIELD METRO SANITARY DISTRICT SPRING CREEK PLANT SANGAMON COUNTY, ILLINOIS

PREPARED FOR

CITY OF SPRINGFIELD OFFICE OF PUBLIC UTILITIES
SPRINGFIELD, ILLINOIS

PREPARED BY

HANSON

Hanson Professional Services Inc.

AUGUST 2008

PROJECT NO. 07E0039

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Springfield, Illinois

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HANSON PROFESSIONAL SERVICES INC.
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TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

LIST OF FIGURES

TABLE OF CONTENTS
(Continued)

EXECUTIVE SUMMARY

The City of Springfield, City Water Light and Power (CWLP) and the Springfield Metro Sanitary District (SMSD) are requesting a site-specific water quality standard for boron in the Sangamon River and the Illinois River as a result of proposed discharge from the Springfield Metro Sanitary District (SMSD) Spring Creek Plant. Operation of the air pollution control systems at the CWLP power plant causes elevated concentrations of boron in a plant effluent stream that is proposed to be transferred to the SMSD Spring Creek Wastewater Plant. The CWLP power plant is a critical power supply for Springfield and surrounding communities; the site-specific boron water quality standard is necessary to allow CWLP to continue to operate the power plant in compliance with its existing National Pollutant Discharge Elimination System (NPDES) permit and State and Federal air pollution regulations.

The NPDES Permit No. IL0021989 issued on June 24, 2004 for the SMSD Spring Creek Plant does not require monitoring of boron in discharges from Outfall 007 to the Sangamon River. However, the Illinois General Use water quality standard for boron is 1.0 mg/L set forth in 35 Illinois Administrative Code (IAC) 302.208(g). CWLP and SMSD intend to file a petition to the Illinois Pollution Control Board (IPCB) to request a site-specific water quality standard for boron, which would include an area of dispersion with boron concentrations ranging between 4.5 and 11.0 mg/L from SMSD Spring Creek Plant 007 STP Outfall to 182 yards downstream in the Sangamon River; 4.5 mg/L in the Sangamon River from 182 yards downstream of SMSD Outfall 007 to the confluence of the Sangamon River with Salt Creek, a distance of 39.0 river miles; 1.6 mg/L in the Sangamon River from the confluence of the Sangamon River with Salt Creek to the confluence of the Sangamon River with the Illinois River, a distance of 36.1 river miles; and 1.3 mg/L in the Illinois River from the confluence of the Illinois River with the Sangamon River to 100 yards downstream of the confluence of the Illinois River with the Sangamon River. This site-specific standard is based on a 7Q10 low-flow of 54.8 cfs having a boron concentration of 2.0 mg/L in the Sangamon River upstream of Spring

Creek and an SMSD Spring Creek Plant effluent flow of 17.5 cfs having a boron concentration of 11.0 mg/L based on the 7-day low flow from the plant. For the most part, the increase in the Sangamon River flow at Spring Creek is due to the discharge from the SMSD Spring Creek Plant.

This technical support document considers existing water quality data and biological studies that were obtained from several agencies including the Illinois Environmental Protection Agency (Illinois EPA), the Illinois Department of Natural Resources (IDNR) and the Illinois Natural History Survey (INHS). Stream flow information from the Illinois State Water Survey (ISWS) was used to predict boron levels in the Sangamon River. The discussion of possible toxicological effects of boron is based on existing published literature and from studies and technical documents produced for City Water, Light and Power (CWLP) of Springfield and for Central Illinois Light Company (CILCO) of Peoria in support of petitions for adjusted water quality standards for boron and a variance to an adjusted water quality standard for boron.

Four technical alternatives for complying with the Illinois General Use water quality standard for boron were evaluated. One alternate operating procedure was considered; three water treatment processes for the removal of boron were investigated. Conversion to a dry ash system has been studied by CWLP; however the particular waste stream that is the subject of this technical support document is generated by the air pollution control system and would not be eliminated by modifying the power plant ash handling system. It is notable that there are currently no known commercial processes being utilized to remove boron concentrations of this magnitude. Because treatment to remove the boron has been demonstrated to be infeasible, CWLP proposes to pretreat the boron-laden waste stream with conventional treatment processes for solids removal and then transfer the wastewater to the SMSD Spring Creek Plant. Boron tends to associate with small particulate matter; therefore the pretreatment process is designed to remove particulates from the waste stream.

It is not anticipated that the SMSD plant treatment process will substantially reduce the total boron in the waste stream, estimated to have an average flow rate of 187 gpm and a boron concentration of 450 mg/L. Reduction of the boron concentration in the wastewater stream anticipated for discharge by SMSD, in comparison to the concentration in CWLP's discharge, will not make its removal by SMSD any more feasible or economically reasonable than the removal alternatives studied by CWLP.

It was concluded that no technically feasible and economically reasonable alternative was available to CWLP or SMSD to meet the Illinois General Use water quality standard for boron. In contrast, lesser costs are associated with seeking a site-specific water quality standard for boron.

The site-specific boron water quality standard is justified because the Sangamon River is not used, nor is it expected to be used, for several purposes intended to be protected by the General Use water quality standard such as agricultural use, stock watering, or public and food processing water supply. In addition, the present General Use water quality standard for boron is unnecessarily stringent for the current use of the Sangamon River and the protection of aquatic life and wildlife, and no adverse impacts are expected from the proposed site-specific water quality standard for boron.

SECTION 1.0

PURPOSE AND SCOPE

SECTION 1.0

PURPOSE AND SCOPE

1.1 Purpose

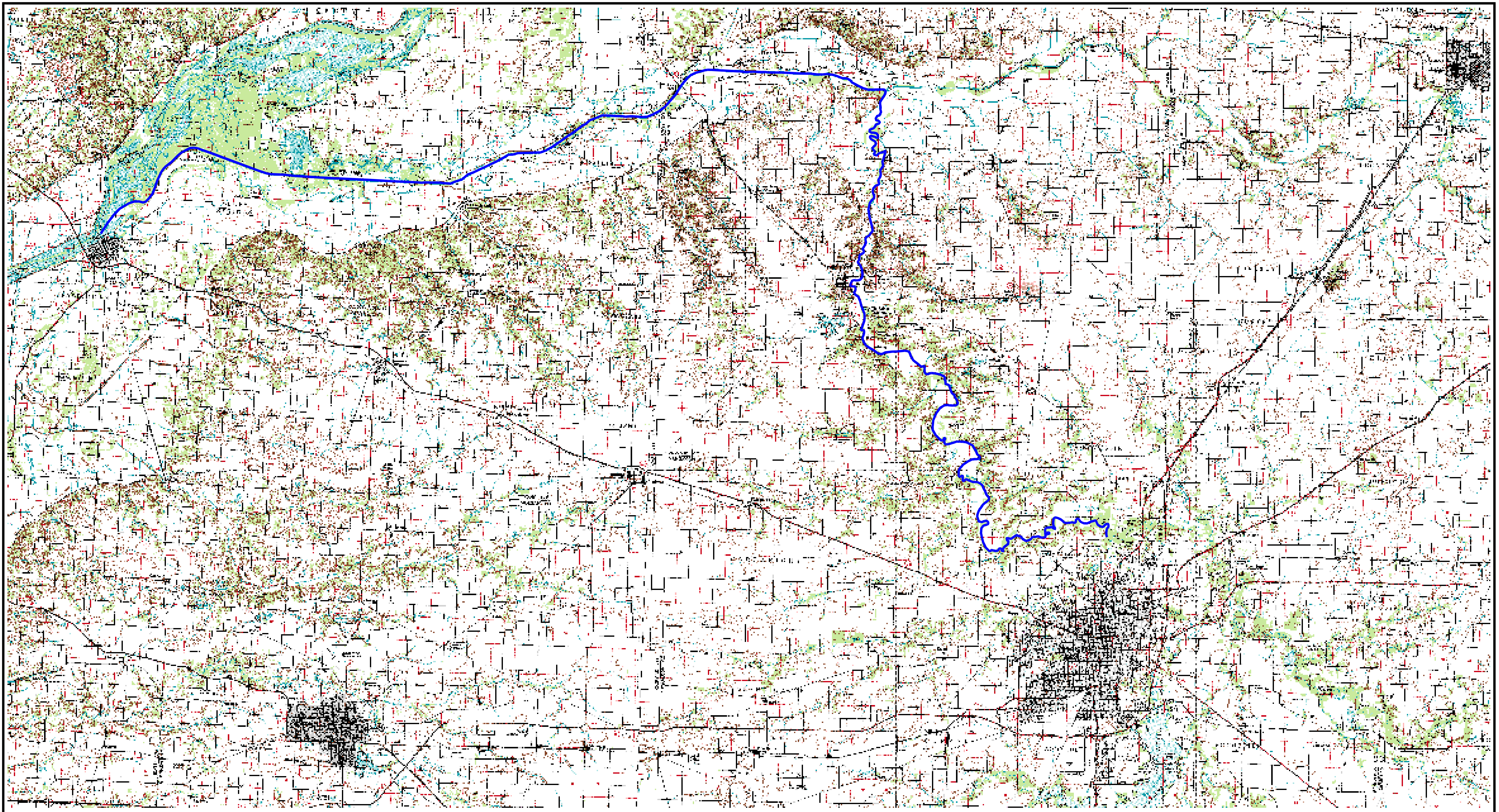
CWLP and the SMSD are requesting a site-specific water quality standard for boron in the Sangamon River and the Illinois River as a result of proposed discharge from the Springfield Metro Sanitary District (SMSD) Spring Creek Plant. The CWLP power plant in Springfield operates selective catalytic reduction (SCR) air pollution control systems for nitrous oxide removal and flue gas desulfurization systems (FGDS) for sulfur dioxide removal as required by its air operating permit. Apparently, SCR operations result in increased leaching of boron and/or increased boron solubility in the FGDS effluent water generated during gypsum dewatering. Operation of the air pollution control systems causes elevated concentrations of boron in the plant effluent stream that is proposed to be transferred to the SMSD Spring Creek Wastewater Plant. The CWLP power plant is a critical power supply for Springfield and surrounding communities; the site-specific boron water quality standard is necessary to allow CWLP to continue to operate the power plant in compliance with its existing NPDES permit and State and Federal air pollution regulations.

It is not anticipated that the SMSD Spring Creek plant treatment process will substantially reduce the total boron in the waste stream, estimated to have an average flow rate of 187 gpm and a boron concentration of 450 mg/L. However, the boron concentration discharged from the Spring Creek Plant will be equal to or less than 11.0 mg/L. Reduction of the boron concentration in the wastewater stream anticipated for discharge by SMSD, in comparison to the concentration in CWLP's discharge, will not make its removal by SMSD any more feasible or economically reasonable than the removal alternatives studied by CWLP.

Hanson Professional Services Inc. (Hanson) has conducted an evaluation of potential ecological and water quality impacts of boron discharged into the Sangamon River and prepared this Technical Support Document to support approval of the site-specific boron water quality standard intended to accommodate the proposed effluent from the SMSD Spring Creek Plant.

1.2 Scope

The National Pollutant Discharge Elimination System (NPDES) Permit No. IL0021989 issued on June 24, 2004 for the SMSD Spring Creek Plant does not require monitoring of boron in discharges from Outfall 007 to the Sangamon River. However, the Illinois General Use water quality standard for boron is 1.0 mg/L set forth in 35 Illinois Administrative Code (IAC) 302.208(g). CWLP and SMSD intend to file a petition to the Illinois Pollution Control Board (IPCB) to request a site-specific water quality standard for boron, which would include an area of dispersion with boron concentrations ranging between 4.5 and 11.0 mg/L from SMSD Spring Creek Plant 007 STP Outfall to 182 yards downstream in the Sangamon River; 4.5 mg/L in the Sangamon River from 182 yards downstream of SMSD Outfall 007 to the confluence of the Sangamon River with Salt Creek, a distance of 39.0 river miles; 1.6 mg/L in the Sangamon River from the confluence of the Sangamon River with Salt Creek to the confluence of the Sangamon River with the Illinois River, a distance of 36.1 river miles; and 1.3 mg/L in the Illinois River from the confluence of the Illinois River with the Sangamon River to 100 yards downstream of the confluence of the Illinois River with the Sangamon River. This site-specific standard is based on a 7Q10 low-flow of 54.8 cfs having a boron concentration of 2.0 mg/L in the Sangamon River upstream of Spring Creek and an SMSD Spring Creek Plant effluent flow of 17.5 cfs having a boron concentration of 11.0 mg/L based on the 7-day low flow from the plant. For the most part, the increase in the Sangamon River flow at Spring Creek is due to discharge from the SMSD Spring Creek Plant. The study area is shown in Figure 1-1.



HANSON
Hanson Professional Services Inc.

AREA OF STUDY

TECHNICAL SUPPORT DOCUMENT
FOR THE SITE-SPECIFIC BORON STANDARD
FOR THE SMSD SPRING CREEK PLANT
SPRINGFIELD, ILLINOIS

JOB NO. 07E0039

FIGURE 1-1

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This report addresses issues required for the petition, including: a description of the power plant operations that are the subject of the petition; a description of the wastewater treatment plant operations that are the subject of the petition; the qualitative and quantitative nature of the discharges from the power plant to the wastewater treatment plant in relation to their boron content; the qualitative and quantitative nature of the discharges from the wastewater treatment plant in relation to their boron content; a description of the area affected by the discharges; and a comparison of the environmental impacts of complying with the existing boron standard and of complying with the proposed site-specific boron water quality standard in relation to the aquatic ecology, hydrology, and water uses of the receiving stream. This report also includes an analysis of the compliance alternatives and their relative costs for implementation and operation to reduce boron concentrations in the effluent stream as well as a description of the proposed pretreatment system.

To address the petition requirements and to assess the impacts of the boron in the proposed SMSD discharge, Hanson reviewed existing water quality data and biological studies that were obtained from several agencies including the Illinois Environmental Protection Agency (Illinois EPA), the Illinois Department of Natural Resources (IDNR) and the Illinois Natural History Survey (INHS). Stream flow information from the Illinois State Water Survey (ISWS) was used to predict boron levels in the Sangamon River. The discussion of possible toxicological effects of boron is based on existing published literature and from studies and technical documents produced for CWLP of Springfield and for Central Illinois Light Company of Peoria in support of petitions for adjusted water quality standards for boron and a variance to an adjusted water quality standard for boron.

SECTION 2.0

FACILITY INFORMATION

SECTION 2.0
FACILITY INFORMATION

2.1 CWLP Plant Description

City Water, Light and Power (CWLP) owns and operates the V. Y. Dallman Power Station and the Lakeside Power Station at 3100 Stevenson Drive, Springfield, Sangamon County, Illinois. CWLP also operates a potable water treatment plant (filter plant) at this site. These plants generate electricity for the residents and businesses in Springfield and provide potable water to Springfield and surrounding communities. Approximately 186 people are employed at the power generating stations and an additional 19 people are employed at the water treatment plant. The facilities are staffed 24 hours per day, seven days per week.

The Dallman Power Station has an electric generating capacity of 352 megawatts and is comprised of three coal-fired units: Units 31, 32, and 33. The Dallman units were placed into service in 1968, 1972, and 1978, respectively. Units 31 and 32 are identical, each having 80 megawatts of generating capacity. The cyclone boilers in Units 31 and 32 operate at 1,250 psig and 950°F. Unit 33 includes a tangentially-fired boiler and has a generating capacity of 192 megawatts. Unit 33 operates at 2,400 psig and 1,000°F. Each of the three Dallman units is equipped with a flue gas desulfurization system (FGDS) that removes an average of 95 percent of the sulfur dioxide from the unit's flue gases and a selective catalytic reduction (SCR) air pollution control system for nitrous oxide removal. The SCRs are currently operated from May 1 through September 30. The SCRs will begin year round operation in 2009. The SCRs associated with units 31 and 32 remove about 89 percent of the nitrous oxides from the flue gases; the SCR associated with Unit 33 removes about 80 percent of the nitrous oxides from the flue gas.

The Lakeside Power Station began operation in 1935. Originally, there were eight boilers and seven turbine generators at the Lakeside plant. Only two boilers and two turbine generators are still in operation. Boilers 7 and 8 are identical 33-megawatt cyclone coal-fired units. Boiler 7-Turbine 6 went into operation in 1959 and Boiler 8-Turbine 7 began operation in 1964. Both units operate at 850 psig and 900°F. The Lakeside Power Station is slated to be retired in the near future.

Coal consumption at the CWLP facility is in excess of one million tons per year. The ash handling practices at CWLP are typical for a coal-fired power plant. Bottom ash and fly ash from all existing units are sluiced to ash ponds. The raw lake water used for sluicing is obtained from the once-through cooling water systems for the generator condensers. Three separate ash transport systems serve Dallman Units 31 and 32, Dallman Unit 33, and Lakeside.

A new electric generating unit referred to as Dallman Unit 4 is currently under construction. The Dallman Unit 4 will include a coal-fired boiler with a rated capacity of about 2,440 million Btu/hour and a steam turbine-generator with a nominal capacity of 250 megawatts. The new boiler will be equipped with low-NO_x combustion technology and the following air pollution control systems: selective catalytic reduction, a fabric filter, wet flue gas desulfurization, and a wet electrostatic precipitator. Bottom and fly ash from Dallman Unit 4 will be transported via dry ash handling systems as opposed to the sluice systems used at Dallman Units 31 and 32, Dallman Unit 33, and Lakeside.

The water treatment plant has a capacity of 48 million gallons per day (MGD). A conventional lime-softening/filtration/disinfection process is employed to produce potable water. Five clarifiers and 12 filters in the treatment process remove sediment and particulate matter from the raw lake water. Thickened sludge from the clarifiers and backwash water from the filters is discharged to the ash ponds located north of Spaulding Dam. The volume of sludge and backwash water discharged to the ash pond system varies and is dependent upon production volume and raw water characteristics. During periods of warm weather, powdered activated carbon (PAC) is added to the incoming lake water for control of various pesticides and herbicides. The PAC also assists with taste and odor control. The majority of the PAC is removed in the clarifiers and disposed in the ash ponds.

2.2 CWLP Plant Operation

Total coal usage at the CWLP complex averages 1.1 million tons per year. Table 2-1 details monthly coal usage from 2002 through 2007. The coal is delivered by truck from the International Coal Group Viper Mine near Elkhart, Illinois. Seed corn past the expiration date for planting is also burned at the CWLP facility. The monthly seed corn fired between 2003 and 2007 is shown in Table 2-2. Fuel oil is burned during boiler startup and during low-load operation. The monthly fuel oil usage for 2002 through 2007 is summarized in Table 2-3. The monthly gross generation in megawatt hours for 2002 through 2007 is presented in Table 2-4. The monthly gross thermal efficiency for this period is detailed in Table 2-5.

Cooling water at the CWLP complex is supplied by Lake Springfield. The lake is also the primary source of potable water for the City of Springfield and surrounding communities. Lake Springfield is a 4,224-acre reservoir constructed in 1934 by impoundment of Sugar Creek with Spaulding Dam. The two major streams flowing into the lake are Sugar Creek and Lick Creek, which drain into the upper end of the lake. Makeup of water lost by evaporation and other consumptive uses comes from the 265 square mile watershed. The watershed area is primarily a level to gently-sloping plain that is incised in the lower portions by the valleys of Sugar Creek and Lick Creek.

Raw water is withdrawn from Lake Springfield for cooling via four cooling water pumps for Dallman Units 31 and 32, two cooling water pumps for Dallman Unit 33, and two cooling water pumps for the Lakeside Station. These units utilize a once-through cooling water system, and thus there is no consumptive loss of the lake water for condenser cooling. Sluice water pumps draw water from the circulating cooling water system for the ash transport system and the FGDS. Cooling water for the ash hoppers

TABLE 2-1

CITY WATER, LIGHT AND POWER MONTHLY COAL USAGE 2002 - 2007 (in tons)

	2002	2003	2004	2005	2006	2007
January	94,866	90,771	114,169	119,746	115,679	103,912
February	78,733	89,426	106,839	97,188	103,368	115,417
March	67,325	80,817	90,970	102,075	67,553	106,017
April	76,325	66,958	77,042	69,361	65,752	62,796
May	72,265	81,580	97,478	100,534	73,677	98,991
June	110,183	83,529	94,567	110,420	105,296	109,777
July	126,323	119,039	107,286	117,390	107,946	105,956
August	121,674	120,803	98,249	114,034	114,090	111,873
September	103,000	89,139	96,670	110,323	100,401	
October	78,877	75,741	75,790	81,164	78,376	
November	78,967	85,773	87,606	110,263	85,879	
December	89,704	100,582	104,573	127,857	103,747	
Total	**1,098,242**	**1,084,158**	**1,151,239**	**1,260,355**	**1,121,764**	

TABLE 2-2

CITY WATER, LIGHT AND POWER
MONTHLY SEED CORN FIRED 2003 - 2007
(in tons)

	2003	**2004**	**2005**	**2006**	**2007**
January	0	1,619	376	1,359	2,808
February	367	1,129	248	2,187	2,350
March	92	1,633	259	2,417	873
April	188	1,555	1,484	1,506	856
May	434	1,283	585	1,083	0
June	128	1,708	721	305	860
July	1,078	1,470	1,470	885	252
August	1,643	1,721	1,573	1,581	1,251
September	0	1,099	644	0	
October	440	305	997	1,931	
November	636	373	2,331	1,820	
December	1,171	578	1,352	0	
Total	**6,176**	**14,473**	**12,040**	**15,074**	

TABLE 2-3

CITY WATER, LIGHT AND POWER
MONTHLY OIL USAGE 2002 - 2007
(in gallons)

	2002	2003	2004	2005	2006	2007
January	10,424	107,790	16,628	9,474	12,622	25,313
February	15,261	56,279	16,001	9,121	25,703	17,846
March	36,251	116,401	13,327	18,760	17,049	24,568
April	61,586	40,752	24,801	34,637	7,227	33,912
May	47,053	34,413	14,075	17,824	66,632	19,765
June	23,526	51,644	156,016	40,005	28,243	18,780
July	20,528	71,237	21,424	288,986	72,727	15,309
August	25,591	114,348	13,261	12,685	11,462	38,684
September	19,670	44,190	6,694	26,050	12,549	
October	20,287	37,190	29,886	110,954	46,430	
November	6,553	19,884	11,465	27,119	4,240	
December	18,882	12,565	20,856	18,495	33,434	
Total	**305,612**	**706,693**	**344,434**	**614,110**	**338,318**	

TABLE 2-4

CITY WATER, LIGHT AND POWER
MONTHLY GROSS GENERATION 2002 - 2007
(in megawatt hours)

	2002	2003	2004	2005	2006	2007
January	190,682	185,468	229,724	242,159	235,588	210,480
February	157,371	182,561	213,339	198,165	210,588	231,853
March	128,007	158,853	182,017	208,851	132,097	211,048
April	158,203	128,044	152,437	141,525	124,999	121,011
May	152,375	164,989	203,832	209,137	143,775	203,572
June	224,235	175,753	199,838	227,651	214,444	221,682
July	258,319	245,122	222,244	248,769	224,846	212,911
August	245,841	249,655	205,110	232,510	226,314	219,247
September	209,937	185,355	201,207	223,803	205,451	
October	163,899	154,026	156,304	167,107	162,345	
November	162,985	175,524	180,804	225,444	176,045	
December	184,275	206,036	214,441	254,602	208,168	
Total	**2,236,129**	**2,211,386**	**2,361,297**	**2,579,723**	**2,264,660**	

TABLE 2-5

CITY WATER, LIGHT AND POWER
MONTHLY GROSS THERMAL EFFICIENCY 2002 - 2007
(in percent)

	2002	2003	2004	2005	2006	2007
January	32.62	33.16	32.40	32.76	32.78	32.34
February	32.15	32.97	32.26	32.92	32.57	32.22
March	30.77	31.71	31.93	32.78	30.94	32.26
April	32.56	31.02	31.67	31.34	30.28	31.01
May	34.05	32.83	33.40	33.38	30.89	33.36
June	33.09	34.00	33.45	32.68	32.91	32.19
July	32.73	32.65	33.32	32.11	32.21	32.66
August	32.33	32.79	33.59	31.77	31.14	31.41
September	32.94	33.71	33.39	32.33	33.41	
October	33.71	32.84	33.39	32.93	32.88	
November	33.59	33.18	33.48	32.68	32.79	
December	33.40	33.07	33.23	32.27	32.16	
Annual	**32.83**	**32.83**	**32.96**	**32.50**	**32.08**	

and the water seals between the boilers and the ash hoppers is also taken from the circulating cooling water system.

The majority of the consumptive use of lake water for the facility is ash sluicing water, which accounts for about 3.9 million gallons of lake water usage per day. The ash transport systems discharge to two settling ponds (ash ponds). The ash ponds also receive wastewater treatment plant sludge, leachate collected from the scrubber sludge landfill, lime sludge from the filter plant, and miscellaneous water streams from the Dallman Power Station including the FGDS effluent water. The supernatant from these two ash ponds flows into a clarification pond. Combining wastewater from the various sources provides for settling and neutralization in the Clarification Pond. The ash sluice waters are typically acidic with suspended solids; the filter plant wastes are normally alkaline with excess lime availability; and the wastewater plant sludge contains polymer and coagulants for flocculation. The discharge from the Clarification Pond normally flows into Sugar Creek through CWLP's NPDES Outfall 004.

2.3 <u>CWLP Existing Outfall and Discharge Description</u>

CWLP's NPDES permit IL0024767, issued December 5, 2001, regulates discharges from 16 outfalls at the CWLP facility. Outfall numbers 001 through 011 apply to process discharges at the facility and are shown in Figure 2-1. Outfall numbers 012 through 016 apply to storm water runoff from the industrial site. Outfalls 003, 004, and 016 discharge into Sugar Creek; all of the other outfalls discharge into Lake Springfield. Discharge from Outfall 003 consists mainly of potable water and raw water collected from various equipment drains, floor drains, and roof drains at the Lakeside Power Station. The drainage is routed from the power plant through an underground pipe that outfalls into the Sugar Creek channel near the east side of the spillway at Spaulding Dam. Discharge from Outfall 003 has been identified as containing high concentration of boron, the result of contact with accumulations of ash in the discharge area. Effluent from the Ash Clarification Pond discharges into Sugar Creek through Outfall 004. This discharge also contains a high concentration of boron.

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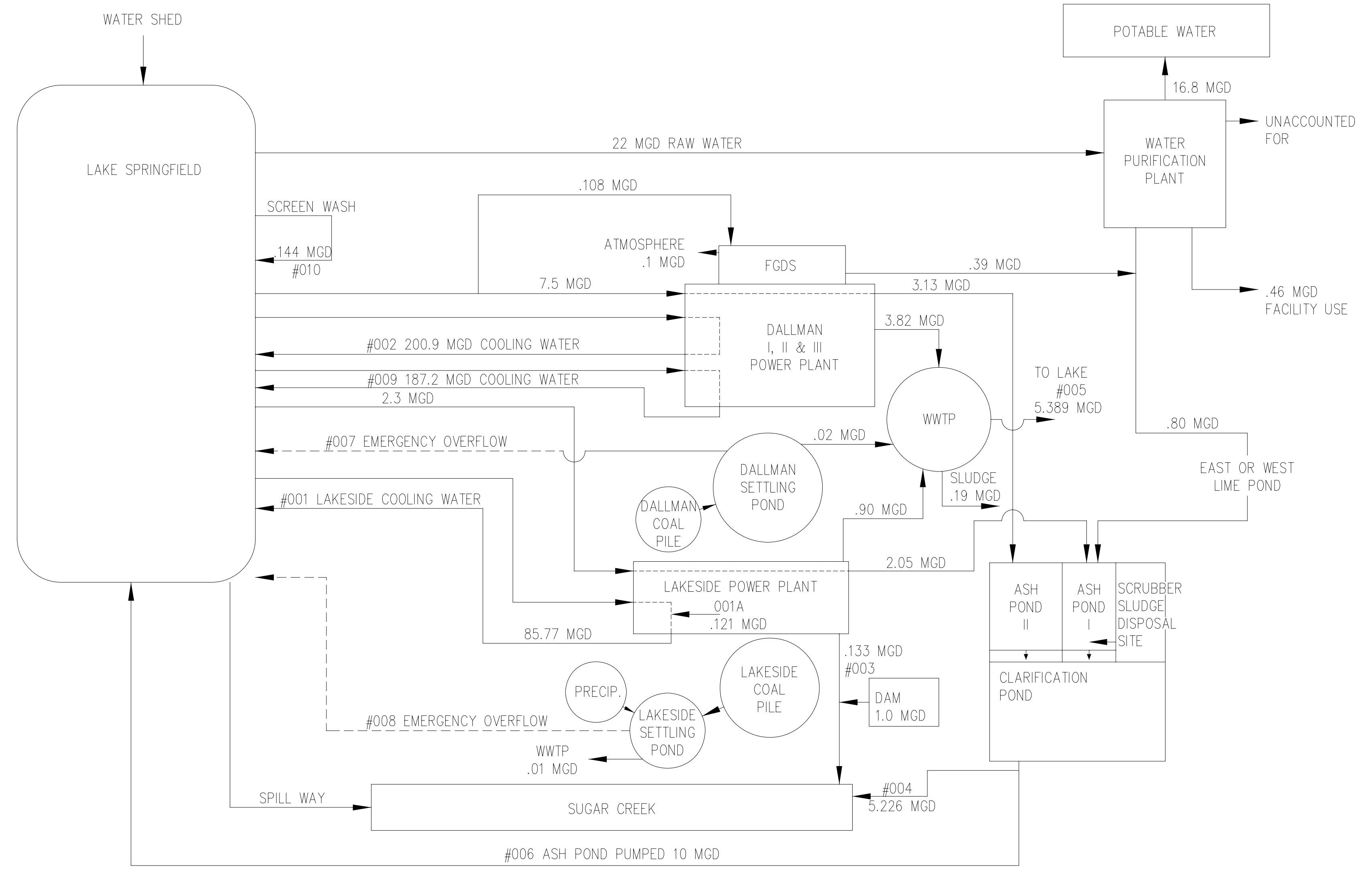


Hanson Professional Services Inc.

CWLP COMPLEX WATER FLOW SCHEMATIC

TECHNICAL SUPPORT DOCUMENT
FOR THE SITE-SPECIFIC BORON STANDARD
FOR THE SMSD SPRING CREEK PLANT
SPRINGFIELD, ILLINOIS

HANSON NO. 07E0039 FIGURE 2-1

The former NPDES permit IL0024767, issued September 29, 1993, required CWLP to limit and monitor the concentrations of boron in Outfall 003 and Outfall 004 discharges to Sugar Creek. The permit limit for boron was 1.0 mg/L, with compliance to be achieved by December 14, 1994. In response to the issuance of this permit, CWLP commissioned a study to evaluate the ecological and water quality impacts of boron levels discharged into Sugar Creek and associated sections of the Sangamon River and the South Fork of the Sangamon River (*Technical Support Document for Petition for Adjusted Boron Standards for Sugar Creek and the Sangamon River*, Hanson Engineers Incorporated, March 1994). Ultimately, CWLP petitioned the Illinois Pollution Control Board and was granted an adjusted standard for boron. The following adjusted standard for boron is now applicable: 11.0 mg/L from CWLP's Outfall 003 at Spaulding Dam on Sugar Creek to its confluence with SMSD's Sugar Creek Plant Outfall 008; 5.5 mg/L from SMSD's Outfall 008 to its confluence with the South Fork of the Sangamon River; and 2.0 mg/L from the confluence of Sugar Creek and the South Fork of the Sangamon River to 100 yards downstream of the confluence of the Sangamon River with Spring Creek, a total distance of approximately 20 river miles.

Historically, CWLP has been able to operate while meeting the adjusted boron standard in Sugar Creek. During normal plant operation, boron concentrations at Outfall 004 have been within the adjusted standard despite high boron concentrations in the FGDS effluent water stream generated during gypsum dewatering (FGDS blowdown). This FGDS blowdown, combined with seal water from the FGDS pumps, is mixed with the Water Treatment Plant sludge and transferred to the ash pond system. However since selective catalytic reduction (SCR) air pollution control systems for nitrous oxide removal were added to the three Dallman Units in 2003, CWLP has had difficulty complying with the adjusted standard for boron in Sugar Creek when the SCRs have been in operation. The SCRs operate during the ozone season, from May 1 through September 30. Apparently, trace ammonia concentrations from SCR operation results in increased leaching of boron and/or increased boron solubility in the Dallman ash pond, increasing boron levels to the clarification pond. The increased boron levels from the Dallman ash pond are below the adjusted standard, but when the boron content of the FGDS blowdown is added to the clarification pond, the boron concentration at Outfall 004 exceeds the adjusted standard in Sugar Creek. Although trace ammonia concentrations are also found in the gas stream to the FGDS, the effect on the boron concentration in the FGDS blowdown can not be quantified because operational variables within the FGDS process result in a wide range of boron levels in the FGDS blowdown. It is notable that conversion to a dry fly ash system will not eliminate this high boron FGDS effluent water stream since it is generated by the air pollution control equipment and is not associated with the fly ash disposal system.

2.4 Proposed CWLP Discharge to SMSD

CWLP proposes that, in lieu of discharging the FGDS effluent water to the ash pond system, the wastewater be collected, pretreated, and pumped to the SMSD Spring Creek Plant for treatment. This waste stream is estimated to have an average flow rate of 187 gallons per minute (gpm) or about 270,000 gallons per day (gpd) and a boron concentration of 450 mg/L. This estimated average flow includes FGDS effluent water from the Dallman Units 31 and 32, Dallman Unit 33, and Dallman Unit 4. Specifically, CWLP proposes constructing two 250,000 gallon holding tanks and a ClariCone™ solids contact clarifier with a 240 gpm capacity to pretreat the waste stream prior to pumping the water to the Spring Creek Plant for treatment. The ClariCone™ is designed to allow mixing, flocculation, and sedimentation to take place within a completely hydraulically driven vessel. The conically shaped concentrator maximizes the FGDS blowdown discharge concentration and allows plant personnel to visually monitor FGDS blowdown discharge. The pretreatment is not expected to significantly reduce the boron concentration, but will significantly reduce solids sent to the Spring Creek Plant. The ClariCone™ will recycle solids back to the FGD process.

2.5 Spring Creek Wastewater Plant Description

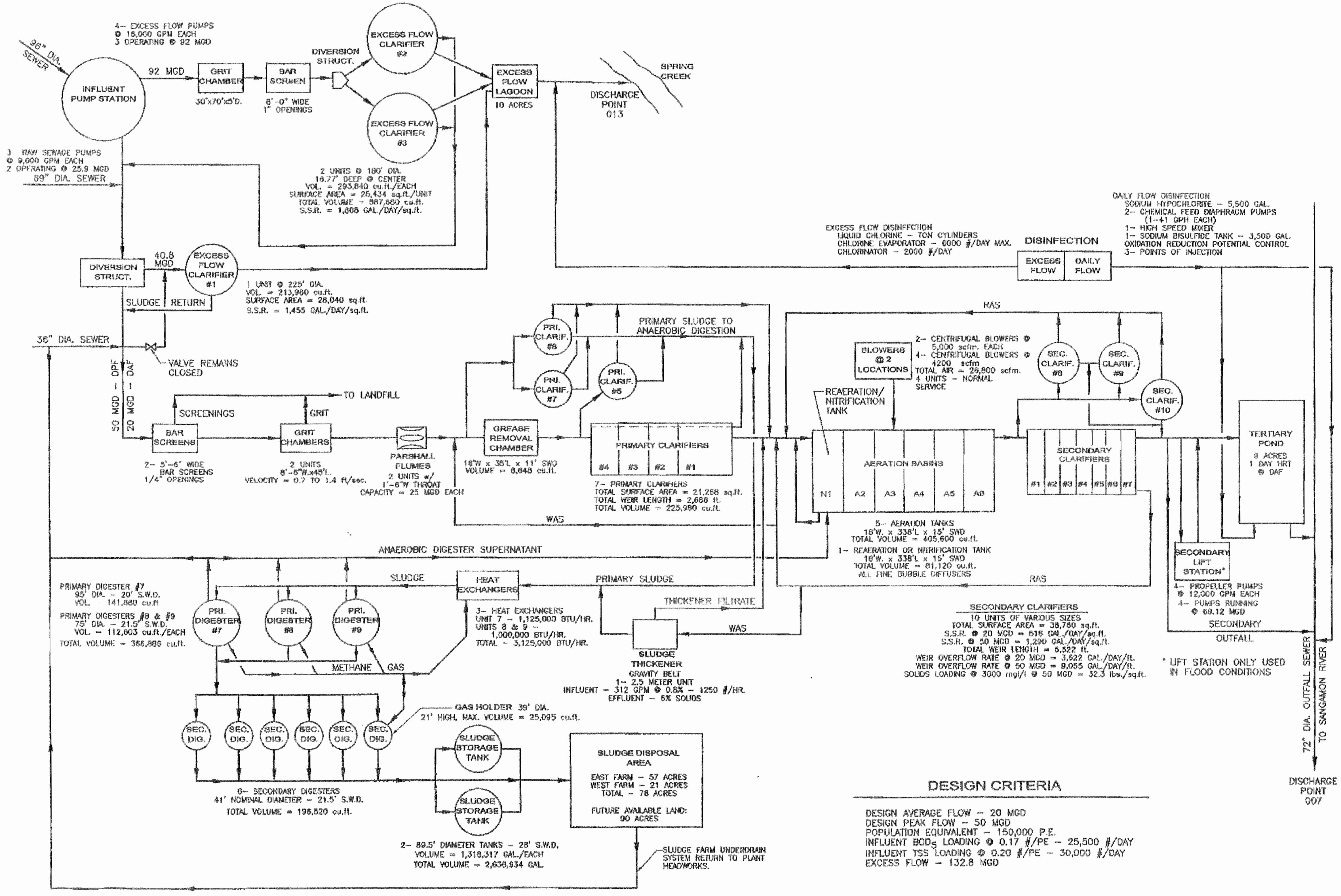
The Springfield Metro Sanitary District owns and operates the Spring Creek and Sugar Creek wastewater treatment plants. The Sugar Creek plant was put into service in

1973 and treats wastewater and storm water from the southeast and eastern sections of Springfield and adjacent service areas. The Spring Creek plant was constructed in 1928 with major improvements in the 1930s. It handles wastewater and storm water flows from the southwest, west and northern parts of Springfield and surrounding service areas. The last major improvements to increase the capacity of the Spring Creek plant were constructed in 1973.

The population served by the Spring Creek WWTP from 2000 U.S. Census data was 90,300 and has increased just over one percent per year on average for the previous ten years. It is an activated sludge treatment plant that provides from treatment and removal of biological oxygen demand (BOD), total suspended solids (TSS), ammonia and bacteria. The treatment plant consists of the following main unit processes as shown in Figure 2-2.

1. Screening for large solids removal,
2. Grit removal for removing heavier sand and grit particles
3. Primary clarifiers remove solids and biological matter
4. Aeration tanks are the main biological treatment process
5. Secondary clarifiers remove the remaining fine solids particles and activated sludge is returned from these clarifiers to the aeration tanks
6. Disinfection is performed on a seasonal basis from May through October
7. Anaerobic sludge digestion is used to stabilize primary and secondary waste sludge which is then stored and biosolids are land applied when weather permits
8. Excess flow clarifiers provide primary treatment during high flow storm events

The Spring Creek WWTP discharges its effluent into the Sangamon River at the confluence of Spring Creek and the river. The discharge from the treatment plant flows into a 72-inch diameter concrete pipe and is conveyed approximately 5,990 ft before



DESIGN CRITERIA

DESIGN AVERAGE FLOW – 20 MGD
DESIGN PEAK FLOW – 50 MGD
POPULATION EQUIVALENT – 150,000 P.E.
INFLUENT BOD_5 LOADING @ 0.17 #/PE – 25,500 #/DAY
INFLUENT TSS LOADING @ 0.20 #/PE – 30,000 #/DAY
EXCESS FLOW – 132.8 MGD

CMT
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05030-01-00

SPRINGFIELD METRO SANITARY DISTRICT
SPRING CREEK WASTEWATER TREATMENT PLANT

TECHNICAL SUPPORT DOCUMENT
FOR THE SITE-SPECIFIC BORON STANDARD
FOR THE SMSD SPRING CREEK PLANT
SPRINGFIELD, ILLINOIS

JOB NO. 07E0039
FIGURE 2-2

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discharging into the river. The 72-inch outfall sewer was constructed in 1973. The 7-day 10-year low flow in the Sangamon River upstream of the Spring Creek discharge is 54.8 cubic feet per second (cfs) or 35.4 MGD. The Spring Creek WWTP has a seasonal disinfection exemption that only requires disinfection for the months of May through October.

2.6 Spring Creek Wastewater Plant Operation

The Spring Creek wastewater plant operates 24 hours per day, seven days per week. The plant is staffed by 7 full-time operators from 7 a.m. to 11 p.m. There is a separate maintenance crew on site 8 hours per day, 5 days per week.

The Spring Creek plant has an average design capacity of 20 MGD. The average and maximum flows for 2004 through 2006 are detailed in Table 2-6.

Monthly flows in these three years have ranged from 11.8 MGD to a peak flow over 50 MGD. The design maximum flow of the plant is currently 50 MGD, which is greater than the 2005 peak of 49 MGD, but 49 MGD puts the plant at 98 percent of its rated maximum capacity.

On average the plant discharge is less than the 7-day 10-year low flow of the receiving stream, the Sangamon River which is 54.8 cfs or 35.4 MGD. A Spring Creek plant 7-day low flow of 11.31 MGD will be used for the calculation of the boron concentration under the proposed scenario. This flow rate is based on the 7-day low flow presented on the 2002 ISWS map. However, daily effluent flows as low as 9.29 MGD were observed in September 2007.

The requirements for complete treatment of flows to the Spring Creek WWTP as required by NPDES Permit No. IL0021989 are detailed in Table 2-7. SMSD anticipates there will be changes in the current NPDES permit after it expires July 31, 2009. At that

TABLE 2-6

SPRING CREEK WASTEWATER TREATMENT PLANT FLOWS 2004 - 2007

Year	Daily Average Flow (MGD)	Maximum Daily Flow (MGD)
2004	20.72	50
2005	20.39	49
2006	20.11	48
2007	19.12	48
2004-2007	**20.09**	**50**

TABLE 2-7

NPDES PERMIT NO. IL0021989

Effective Date: August 1, 2004
Expiration Date: July 31, 2009
Receiving Stream: Sangamon River
Discharge Number and Name: 007 STP Outfall

Design Average Flow (DAF):	20.0 MGD
Design Maximum Flow (DMF):	50.0 MGD
Carbonaceous Biochemical Oxygen Demand (CBOD5):	10 mg/L (mo. avg.) 20 mg/L (daily max.)
Total Suspended Solids (TSS):	12 mg/L (mo. avg.) 24 mg/L (daily max.)
Ammonia Nitrogen (March):	4.4 mg/L (mo. avg.) 10.1 mg/L (daily max.)
Ammonia Nitrogen (April, May, Sept., Oct.):	3.3 mg/L (mo. avg.) 6.4 mg/L (daily max.)
Ammonia Nitrogen (June-Aug.):	2.0 mg/L (mo. avg.) 6.4 mg/L (daily max.)
Ammonia Nitrogen (Nov.-Feb.):	7.9 mg/L (mo. avg.) 14.4 mg/L (daily max.)
Fecal Coliform (May-Oct.):	400 cfu/100 mL (daily max.)
Chlorine Residual (May-Oct.):	0.05 mg/L (daily max.)

time, construction should be underway for expansion of the treatment plant which will require NPDES permit modifications due to increased hydraulic capacity. The SMSD has given consideration to ammonia nitrogen and total phosphorus requirements for the future as discussed in more detail later in this report.

Based upon the 2006 plant influent data, the carbonaceous BOD_5 concentration ranges from 157 to 214 milligrams per liter (mg/L) with an average of 172 mg/L. The $CBOD_5$ removal after primary, secondary and tertiary treatment is about 98 percent, for an average effluent $CBOD_5$ of approximately 3 mg/L.

The total suspended solids (TSS) concentration has a range from 132 to 307 mg/L with an average of 198 mg/L for 2006. With a removal rate of over 96 percent, the discharge to the receiving stream had only 7.3 mg/L of TSS on average.

Although not designed for nitrification, through operational adjustments to the plant the SMSD has been able to meet their seasonal NPDES requirements for ammonia nitrogen. Data from 2006 shows a reduction of ammonia from an influent value of 12 mg/L to 1.38 mg/L in the tertiary effluent, which is over 88 percent removal. At the present time, ammonia nitrogen loading is at the plant’s maximum capacity. Recommended wastewater treatment plant improvements will be designed to provide ammonia nitrogen removal.

Total phosphorus removal is not currently regulated by Spring Creek’s discharge permit, so influent and effluent data values are not available. Plant expansion recommendations will take into account phosphorus removal requirements that are expected in the next permit renewal cycle.

2.7 Anticipated Spring Creek Plant Discharge

The temperature of the wastewater leaving the plant varied from a low of 50°F to a high of 78°F in 2006. Effluent leaves the plant on average at a pH between 6.4 and 8.0.

A current plant influent boron concentration of 0.25 mg/L was used as background to calculate the new concentration with the FGDS wastewater included in the flow stream. Based on the 7-day low effluent flow of 11.31 MGD combined with the FGDS wastewater at 0.27 MGD of added flow and a boron concentration of 450 mg/L, the wastewater treatment plant effluent would have a maximum boron concentration of 11.0 mg/L. It is anticipated that the boron will not be significantly affected by nor adversely affect the plant's treatment processes and therefore the effluent boron concentration is expected to mirror the influent concentration. The plant consistently meets NPDES regulated parameters as detailed in Table 2-8. Subsequently, the plant's effluent maximum boron concentration is estimated to be 11.0 mg/L. The boron concentration downstream in the Sangamon River is estimated to be 4.5 mg/L under this scenario.

In summary, pumping the CWLP FGDS wastewater to the SMSD Spring Creek Wastewater Treatment Plant is not expected to have any effect on the wastewater plant other than the increase in boron concentration in the effluent. The only reduction would be to bring CWLP back to compliant levels with NPDES Permit No. IL0024767 in Sugar Creek as was typical prior to SCR operation.

TABLE 2-8

SPRING CREEK WASTEWATER TREATMENT PLANT AVERAGE DISCHARGE PARAMETERS

Discharge Parameter	Permitted Value	Average Value (2006)
$CBOD_5$ (oxygen demand)	10 mg/L	3.2 mg/L
TSS (total suspended solids)	12 mg/L	7.3 mg/L
Ammonia Nitrogen	Varies from 2.0 to 7.9 mg/L	1.38 mg/L
Fecal Coliform (May-Oct.)	400 cfu/100 ml sample	98 cfu/100 ml
Chlorine Residual (May-Oct.)	0.05 mg/L	0.024 mg/L
Dissolved Oxygen	6.0 mg/L minimum	7.2 mg/L
pH	6 to 9 units	6.5 to 8.0 units

SECTION 3.0

RESOURCES OF THE SANGAMON RIVER

SECTION 3.0
RESOURCES OF THE SANGAMON RIVER

3.1 Sangamon River Basin

3.1.1 Geology and Physiography

The Sangamon River Basin is located in the Springfield Plain subsection of the Till Plains section of the Central Lowland Physiographic Province. The topography of the Springfield Plain is a relatively flat-lying glacial till plain moderately dissected by dendritic drainage systems. Elevations range from about 600 ft on uplands to 520 ft within the Sugar Creek, Sangamon River, and South Fork River Valleys.

Geologic mapping of the area indicates the Wisconsinan-aged loess deposits (predominantly silts of the Peoria Loess and Roxana Silt Formations) comprise the upper 8 to 12 ft of surficial material. A modern soil horizon has developed within the upper few feet of loess. The loess is often absent within stream valleys due to erosion.

Roughly 50 ft of glacial deposits (e.g., diamictons and alluvium) underlies the loess. The glacial deposits are commonly a poorly sorted mixture of clay, silt, and sand with lesser amounts of gravel, cobbles, and boulders. The thicknesses of the glacial deposits vary greatly due to variation in bedrock topography and surficial erosion.

The uppermost bedrock in the Sangamon River Valley is Pennsylvanian-aged sedimentary rock. The bedrock consists of cyclic sequences of sandstone, siltstone, shale, limestone, and coal. Bedrock outcrops are not uncommon along the Sangamon River and its tributaries.

3.1.2 Sangamon River

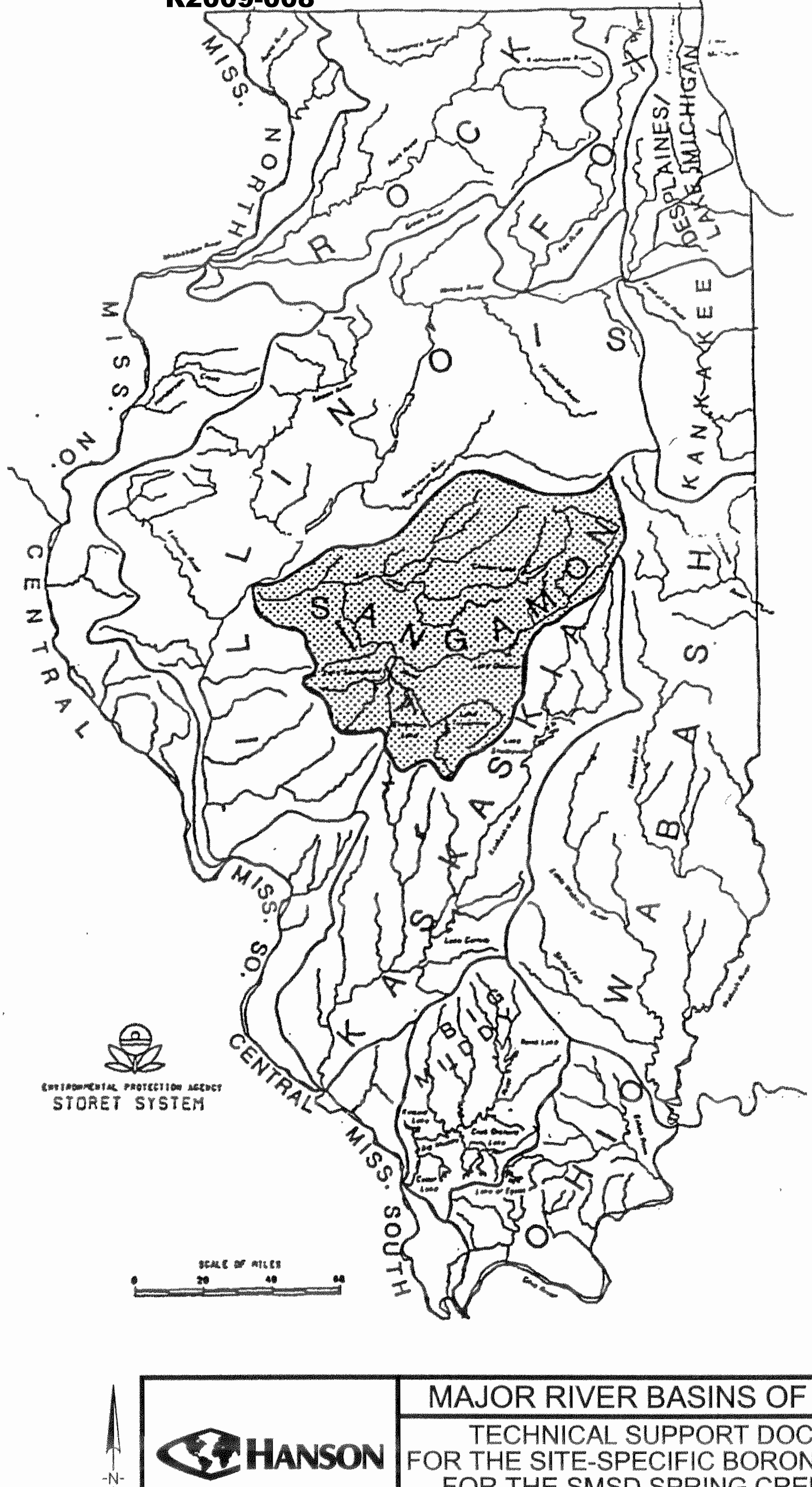
The watershed of the Sangamon River comprises about 5,419 square miles, all of which lie in the central part of Illinois (see Figures 3-1 and 3-2). The Sangamon River is within the Lower Illinois River Basin watershed. It includes either all or the major portions of McLean, Piatt, DeWitt, Macon, Logan, Sangamon, Christian, Menard, Mason, and Cass Counties, and minor portions of Tazewell, Ford, Champaign, Shelby, Montgomery, Macoupin, and Morgan Counties. Practically all of the area is tillable and, for the most part, is cultivated.

The Sangamon River originates in the central portion of McLean County at a point about 12 miles east of Bloomington and flows southeasterly for about 35 miles, then southwesterly about 110 miles. From Roby, the stream takes a northwesterly course for 64 miles to River Mile 34.5 where the Sangamon River is joined by Salt Creek, its largest tributary. At Mile 34.5, the Sangamon River makes a sharp right-angled turn to the west, flowing in a general westerly direction and joins the Illinois River near Mile 89 of that stream about 8 miles north of Beardstown. The total length of the Sangamon River is about 250 miles, while the length of the valley it occupies is about 170 miles.

At its source, the Sangamon River is about 850 ft above sea level. The total fall of the river from its source to its mouth is about 420 ft. In the upper 10 miles, the fall is 120 ft, or an average of 12 ft per mile, and for the remaining 240 miles of the river the fall is 300 ft, or an average of 1.25 ft per mile.

The Sangamon River’s low water width varies from 80 to 240 ft, with the average being 150 ft. The high water average width is about three-fourths of a mile.

The whole length of the Sangamon River is characterized by a series of pools and shoals; the latter, on the average, are about a mile apart. Average depths of these pools and shoals are 4 ft and 1 ft, respectively. There are five major impoundments within the



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Hanson Professional Services Inc.

MAJOR RIVER BASINS OF ILLINOIS

TECHNICAL SUPPORT DOCUMENT
FOR THE SITE-SPECIFIC BORON STANDARD
FOR THE SMSD SPRING CREEK PLANT
SPRINGFIELD, ILLINOIS

JOB NO. 07E0039

FIGURE 3-1

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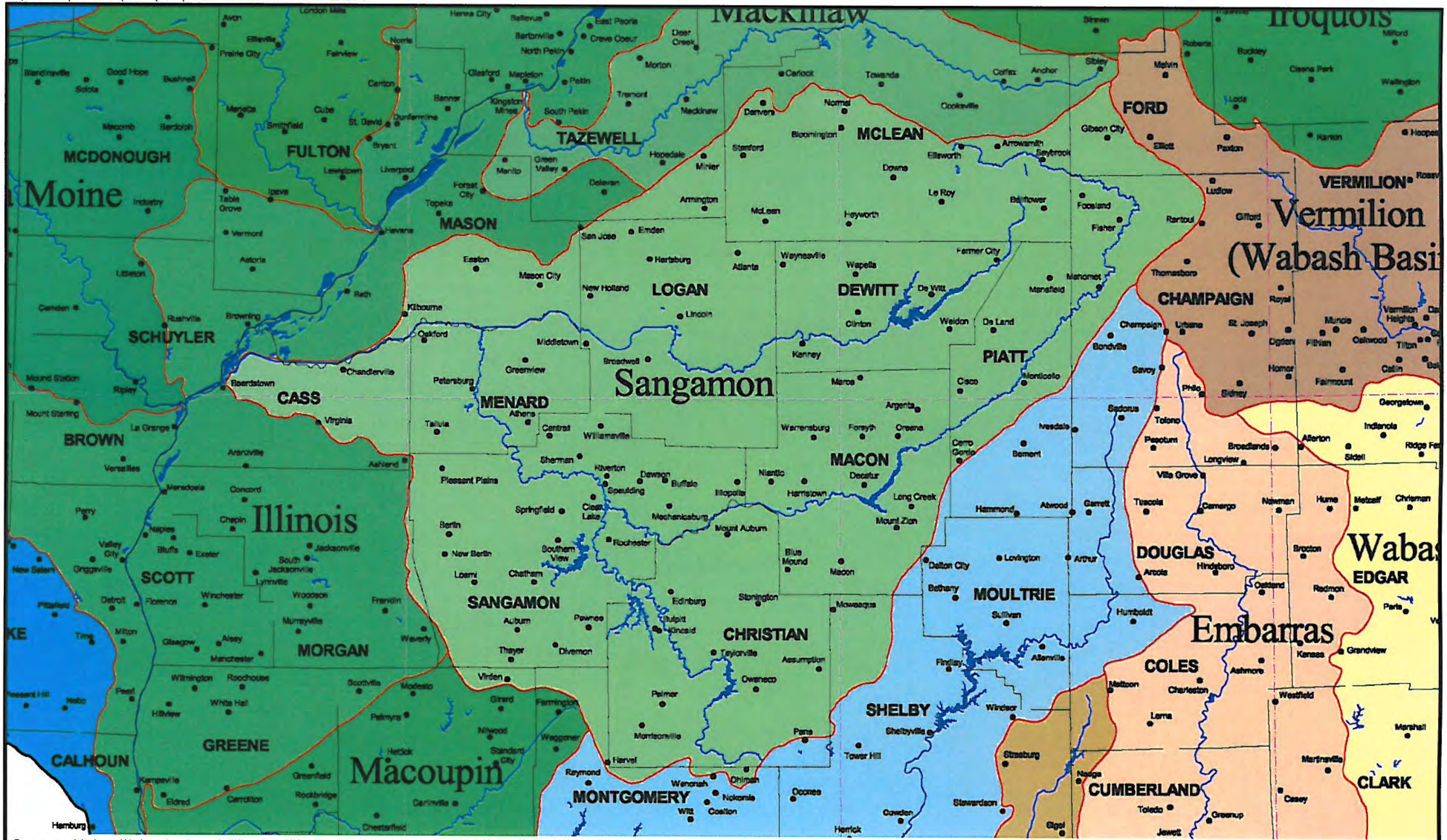

Source: Major Watersheds of Illinois, Illinois State Water Survey Website, 2007.

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SANGAMON RIVER WATERSHED

TECHNICAL SUPPORT DOCUMENT
FOR THE SITE-SPECIFIC BORON STANDARD
FOR THE SMSD SPRING CREEK PLANT
SPRINGFIELD, ILLINOIS

HANSON NO. 07E0039 FIGURE 3-2

basin: Lake Decatur (which is the only lake located directly on the Sangamon River), Lake Springfield, Lake Taylorville, Sangchris Lake, and Clinton Lake. Lake Decatur is the deepest portion of the river, with low water pool at a depth of 17 ft. The extreme flood stage varies from a minimum of 6 ft above low water at Decatur Dam to a maximum of 29 ft above low water just above Riverton. The average high water increment for the reach between Decatur and the mouth of the river is about 24 ft.

Hanson conducted a field survey on October 30, 2007 to characterize the general features of the Sangamon River downstream of the CWLP power plant discharge. Three areas were visited including: Riverside Park in Springfield; Petersburg at Illinois Route 123; and Oakford at Illinois Route 97. The river flow was low during the field visit with an approximate 70 cfs discharge at the Riverton U.S. Geological Survey (USGS) Gage Station.

The river through this section is a low gradient, meandering stream with an incised channel of about 15 ft below the adjacent landscape. The river width ranged from about 80 to 100 ft at Springfield to about 300 ft at Oakford. A major tributary, Salt Creek, empties into the Sangamon River about 8 miles upstream of Oakford. This lower section, below the confluence of Salt Creek, appears to have been channelized in the past and has scoured out a wider floodway in the sandier soils of this reach.

A few structures were observed: a former dam immediately upstream of the Spring Creek confluence in Springfield, and two rock check dams within a few hundred yards upstream and downstream of Illinois Route 123 in Petersburg. These structures have created riffle areas that are a source of oxygenation for the river during low flow. The sediments of the river substrate graded from a silt and sand mix to a totally sandy substrate at Oakford. Sandbars were much more frequent further downstream near Oakford giving the riverbed almost a braided stream appearance in the low flow period.

Most of the riparian corridor of this segment is wooded with typical floodplain forest species consisting primarily of silver maple, box elder, sycamore, and cottonwood. The trees appeared more mature on the upstream portion near Springfield with average ages around 40 to 50 years old. The forested areas near Petersburg and Oakford appeared much younger with early successional trees around 10 to 20 years old. The downstream area south of Petersburg also exhibited areas with more apparent agricultural use up to the river bank with very little to no riparian habitat.

According to the Illinois Streamflow Assessment Model (ISWS, 2007), the mean flow at the confluence with Spring Creek was 2,120 cfs for the base period from 1948 to 1997. During high flow periods, stream discharge can exceed 7,000 cfs at this location.

3.2 Sangamon River Environmental Quality

3.2.1 Water Uses

The types of water use and the extent of these uses were investigated for the Lower Sangamon River from its confluence with the South Fork of the Sangamon River at Riverton, Illinois to its confluence with the Illinois River near Beardstown, Illinois. The following organizations and agencies were contacted for information on known water uses for this reach of the Sangamon River: the Illinois State Water Survey (ISWS); the Illinois State Geological Survey (ISGS); the Illinois EPA; the Illinois Department of Natural Resources (IDNR), Office of Water Resources; the Illinois Department of Agriculture; the U.S. Army Corps of Engineers Rock Island District; and the Soil and Water Conservation Districts and the University of Illinois Extension Offices for Sangamon, Menard, Mason, and Cass Counties.

The Illinois EPA and ISWS reported several NPDES permitted discharges to the Sangamon River from Riverton to Beardstown. Table 3-1 lists the NPDES permitted discharges to this reach of the Sangamon River, and Figure 3-3 depicts the location of these discharges.

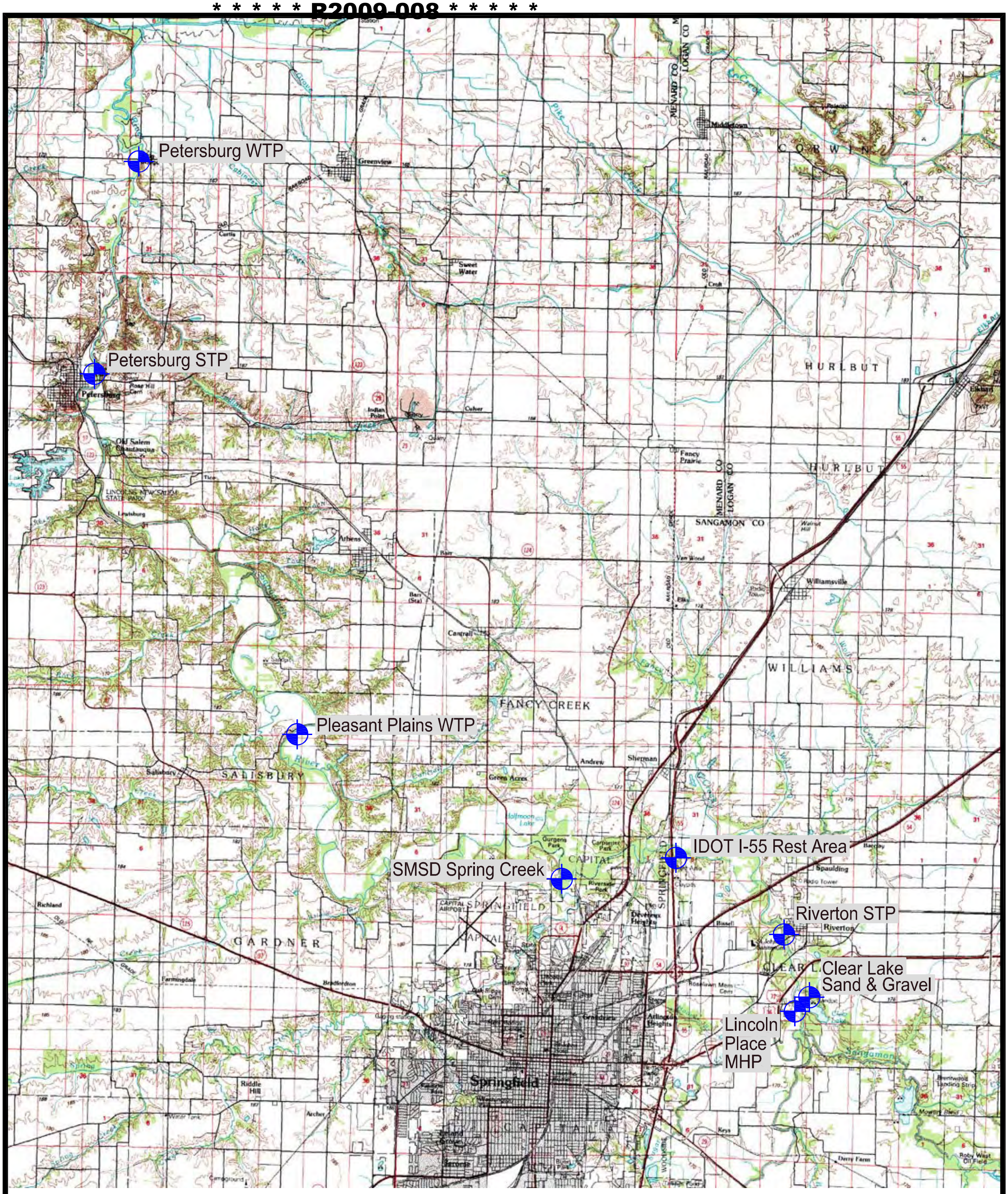
Other generally known uses of the Sangamon River include aquatic life habitat and recreation (boating, fishing, swimming). See Section 3.2.2 for further information

TABLE 3-1

NPDES PERMITTED DISCHARGES TO THE SANGAMON RIVER FROM THE CONFLUENCE OF THE SOUTH FORK OF THE SANGAMON RIVER TO THE ILLINOIS RIVER

NPDES Permit No.	Facility Name	Outfalls	Average Design Flow (MGD)
IL0026611	Clear Lake Sand and Gravel Co.	001-Surface water runoff 002-Surface water runoff 003-Surface water runoff	3
IL0062651	Lincoln Place Mobile Home Park	001- Sewage treatment plant discharge	0.053
IL0021041	Riverton Sewage Treatment Plant	001-Sewage treatment plant discharge, excess flow A01-Excess flow	0.529 Intermittent
ILG551034	Illinois DOT I-55 Sangamon Co. North	001-Sewage treatment plant discharge	0.01
IL0021989	Springfield Metro Sanitary District – Spring Creek	007-Sewage treatment plant discharge	20
IL0049824	Pleasant Plains Water Treatment Plant	001-Water treatment plant discharge	0.0003
IL0022233	Petersburg Sewage Treatment Plant	001-Sewage treatment plant discharge	0.5
IL0077691	Petersburg Water Treatment Plant	001-Water treatment plant discharge	0.089

Source: Illinois EPA, 2007 and ISWS, 2007



Background Source: USGS 1:100,000 DRG Files, Lincoln and Springfield, Illinois.

LEGEND

⊕ NPDES PERMIT DISCHARGES

SCALE IN MILES
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NPDES PERMIT DISCHARGES

TECHNICAL SUPPORT DOCUMENT
FOR THE SITE-SPECIFIC BORON STANDARD
FOR THE SMSD SPRING CREEK PLANT
SPRINGFIELD, ILLINOIS

HANSON NO. 07E0039

FIGURE 3-3

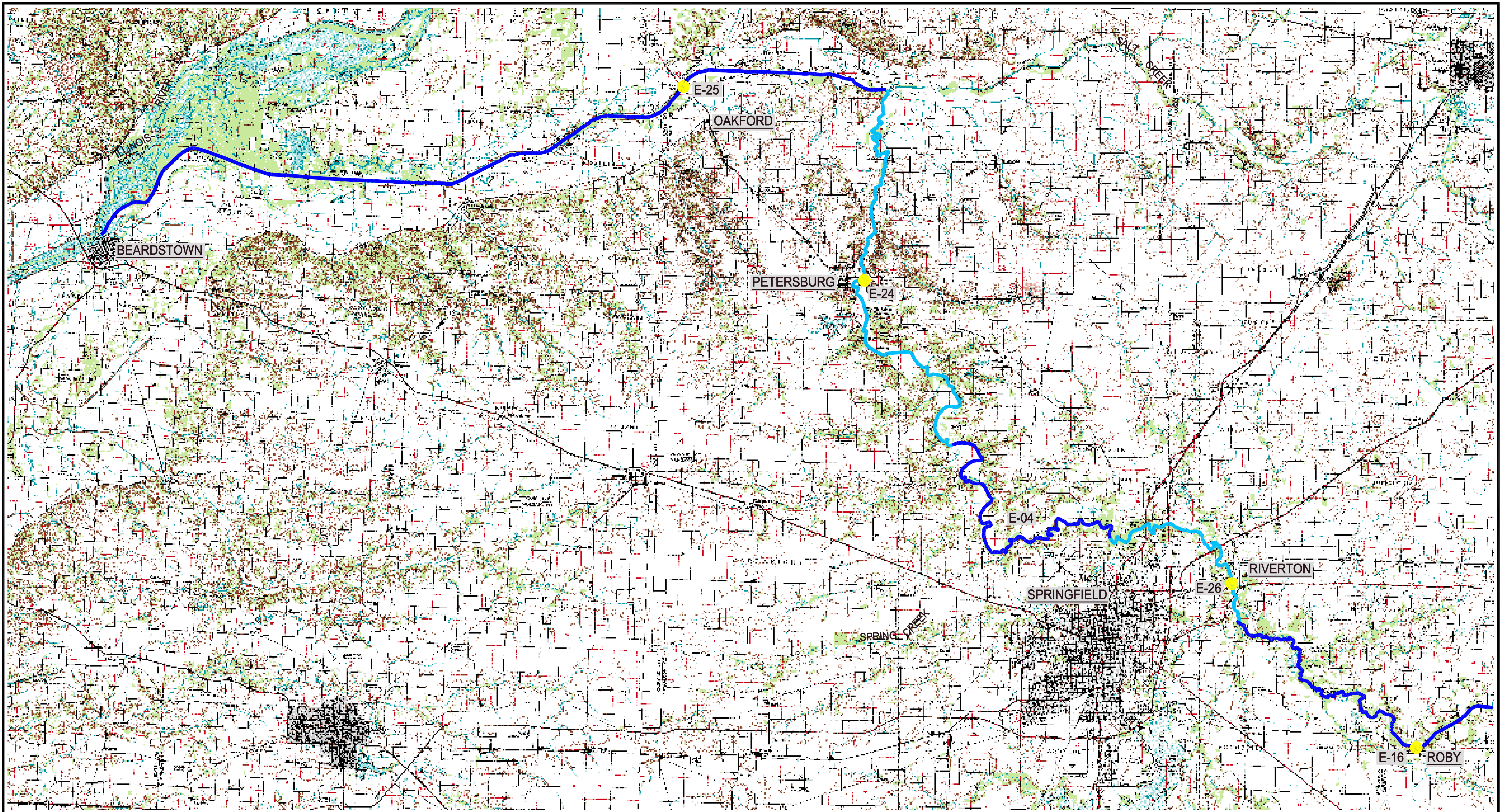
I:\07JOBS\07E0039\CADD\ENV\NPDES PERMIT DISCHARGES.DWG AUG 06, 2008 3:33PM BUSHU00909 regarding these uses. It is understood that irrigation is a protected use; however, use of this reach of the Sangamon River at issue for irrigation of agricultural land, golf courses, nurseries, etc., were not reported by the aforementioned contacts.

3.2.2 Water Quality

The Illinois EPA's *2006 Illinois Integrated Water Quality Report and Section 303(d) List* provides information on the condition of surface waters in the State of Illinois and provides a list of waters where uses are impaired, the Section 303(d) list. Information on four stream segments of the Sangamon River was used for this report. These stream segments include the Sangamon River from the South Fork of the Sangamon River to Spring Creek (E-26), the Sangamon River from Spring Creek to Richland Creek (E-04), the Sangamon River from Richland Creek to Salt Creek (E-24), and the Sangamon River from Salt Creek to the Illinois River (E-25) (see Figure 3-4). All four stream segments are included on the 2006 Section 303(d) list.

Stream segment E-26 of the Sangamon River is identified as impaired for the designated uses of aquatic life, fish consumption, and primary contact recreation (swimming). Potential causes of aquatic life impairment are boron, nitrogen, phosphorus, silver, total dissolved solids, and total suspended solids. Potential sources of these causes are industrial point source discharges, on-site treatment systems, runoff, municipal point source discharges, crop production, dams or impoundments, channelization, and streambank modifications/destabilization. A potential cause of fish consumption impairment is polychlorinated biphenyls from an unknown source. A potential cause of impairment of primary contact recreation is fecal coliform from an unknown source.

Stream segment E-04 of the Sangamon River is identified as impaired for the designated use of fish consumption. A potential cause of fish consumption impairment is polychlorinated biphenyls from an unknown source.



Background Source: USGS 1:100,000 DRG Files, Lincoln, Macomb, Meredosia and Springfield, Illinois.

LEGEND

● IEPA SAMPLING STATION

〰 SANGAMON RIVER STREAM SEGMENT

SCALE IN MILES
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ILLINOIS EPA STREAM SEGMENTS

TECHNICAL SUPPORT DOCUMENT
FOR THE SITE-SPECIFIC BORON STANDARD
FOR THE SMSD SPRING CREEK PLANT
SPRINGFIELD, ILLINOIS

HANSON NO. 07E0039

FIGURE 3-4

AUG 06, 2008 11:06 AM AUST00148
I:\07JOBS\07E0039\CADD\ENV\IEPA STREAM SEGMENTS.DWG

Stream segments E-24 and E-25 of the Sangamon River are identified as impaired for the designated use of fish consumption and primary contact recreation. A potential cause of fish consumption impairment is polychlorinated biphenyls from an unknown source, and a potential cause of impairment of primary contact recreation is fecal coliform from an unknown source.

3.2.3 Primary Productivity, Plankton, and Aquatic Macroinvertebrates

Previously conducted surveys of primary productivity or plankton surveys of the Sangamon River from Riverton to Beardstown have not been identified.

Aquatic macroinvertebrates are animals without backbones which are visible to the unaided eye and live at least part of their life cycles within or upon available aquatic substrates. Invertebrates in this group include annelids, macrocrustaceans, aquatic insects, and mollusks. Assessments of the ecological health of streams, rivers, and lakes are often determined by the composition of the aquatic macroinvertebrate communities (Barbour et al., 1999 and U.S. EPA, 2007).

Macroinvertebrate data are generally interpreted by an examination of community attributes: community structure, taxa richness, and use of the Macroinvertebrate Biotic Index (MBI). The MBI is the average of the summation of tolerance values assigned to each taxon collected and is weighted by their abundance. Low values indicate good stream conditions and water quality, and high values indicate a degraded stream and reduced water quality. The Illinois EPA guidelines for using biological information for assessing aquatic life use in streams are provided in Table 3-2.

The Illinois EPA in cooperation with the IDNR conducted Intensive Basin Surveys of the Lower Sangamon River basin in 1996 and 2003. Intensive Basin Surveys are a major source of information for assessments of aquatic life use. Macroinvertebrate sampling was conducted in selected stream segments of the Lower Sangamon River

TABLE 3-2

ILLINOIS GUIDELINES FOR USING BIOLOGICAL INFORMATION FOR ASSESSING AQUATIC LIFE USE IN STREAMS

Biological Indicator	**No Impairment**	**Moderate Impairment**	**Severe Impairment**
	Fully Supporting Aquatic Life Use (Good Resource Quality)	**Not Supporting Aquatic Life Use (Fair Resource Quality)**	**Not Supporting Aquatic Life Use (Poor Resource Quality)**
Macroinvertebrate Biotic Index (MBI)	MBI ≤ 5.9	5.9 < MBI ≤ 8.9	MBI > 8.9
Index of Biotic Integrity (IBI)	IBI ≥ 41	20 < IBI < 41	IBI ≤ 20

Source: Illinois EPA, 2006.

Basin including Stations E-50 (Riverside Park at Springfield), E-26 (Riverton), E-24 (Petersburg) and E-25 (Oakford). Illinois EPA conducted sampling at the Sangamon River near Riverside Park (E-50) in 1996, and changed the sampling location to Riverton (E-26) in 2003. Table 3-3 provides the macroinvertebrate species from the Sangamon River stations during the surveys. Macroinvertebrate data from Station E-16 located at Roby, Illinois are also provided for a comparison to a location upstream of the South Fork/Sugar Creek confluence with the Sangamon River.

Due to different sampling methodology for the 1996 and 2003 surveys, community comparisons between the years are not reliable (Illinois EPA, personal communication, 2007). Illinois EPA used a qualitative hand-picking method in 1996, and calculated MBIs using their modified Hilsenhoff MBI. In 2001, Illinois EPA switched to 20-jab macroinvertebrate sampling linked to an 11-transect habitat method. However, Hester-Dendy plate samplers were used to sample macroinvertebrates in the Sangamon River since the 20-jab sampling is not applicable to larger streams.

Based on the 1996 and 2003 MBI scores, all four Illinois EPA stations of the Sangamon River fully supported aquatic life, except for Station E-16 at Roby in 2003 which had an MBI of 6.1, indicating moderate impairment of aquatic life use. Station E-50 (Riverton) in 1996 had the lowest MBI score of 4.5 (highest quality) of the four stations surveyed.

3.2.4 Fisheries

Fisheries data are widely used to assess the biotic integrity of water resources. The Index of Biotic Integrity (IBI) was developed by Karr (1981) for use in small warmwater streams in central Illinois and Indiana. The original version included 12 metrics that reflected fish species richness and composition, number and abundance of indicator species, trophic organization and function, reproductive behavior, fish abundance, and condition of individual fish.

TABLE 3-3
MACROINVERTEBRATE SPECIES COLLECTED FROM THE SANGAMON RIVER

Macroinvertebrate Species	**E-16 Roby**	**E-50/26 Riverside Park/ Riverton**		**E-24 Petersburg**		**E-25 Oakford**	
	2003	**1996**	**2003**	**1996**	**2003**	**1996**	**2003**
Oligochaeta	2						
Decapoda							
Cambaridae						1	
Ephemeroptera							
Oligoneuriidae							
Isonychia sp.	1	7	3	19	2	7	
Baetidae							
Labiobaetis longipalpus				2		2	
Baetis intercalaris		6		1	1	1	13
Baetis propinquus							3
Callibaetis sp.		1		1		12	
Centroptilum sp.	7						
Heptageniidae							
Heptagenia pulla		1					
Heptagenia diabasia			1				
Stenonema sp.							7
Stenonema integrum	1	7	4	38	1	1	
Stenonema pulchellum		1	1				
Stenonema terminatum		4	5				
Tricorythidae							
Tricorythodes sp.	2	31	2	22	1	55	1
Caenidae							
Caenis sp.	88		8				
Caenis hilaris				3		28	
Caenis punctata		1		1			
Odonata							
Gomphidae							
Dromogomphus spinosus	1						
Erpetogomphus	1						
Gomphurus hybridus				1		2	
Gomphus sp.	1						
Coenagrionidae							
Argia sp.	3						
Argia moesta				1			
Argia tibialis			3	7		1	

Macroinvertebrate Species	E-16 Roby	E-50/26 Riverside Park/ Riverton		E-24 Petersburg		E-25 Oakford	
	2003	1996	2003	1996	2003	1996	2003
Megaloptera							
Corydalidae							
Corydalus cornutus		2		3		3	
Trichoptera							
Hydropsychidae			24		7		47
Cheumatopsyche sp.	1		18		22		7
Hydropsyche betteni							1
Hydropsyche bidens	1		75	4	163	21	67
Hydropsyche orris		35				1	
Hydropsyche simulans		11	34	25	22	6	57
Potamyia flava		3	41	8	53	7	96
Leptoceridae							
Nectopsyche candida	4	1	1	2		1	
Polycentropidae							
Cyrnellus sp.						1	
Cyrnellus fraternus	3		6		3		
Coleoptera							
Dryopidae							
Helichus lithophilus				2		1	
Elmidae							
Dubiraphia sp.	1						
Macronychus glabratus				1		1	
Stenelmis sp.			1				1
Stenelmis vittipennis		3		2			
Scirtidae							
Scirtes sp.				1			
Diptera							
Tipulidae							
Hexatoma sp.	1						
Simulidae							
Simulium sp.				1			2
Tanypodinae					1		
Ablabesmyia mallochi	6						
Ablabesmyia parajanta				1			
Larsia sp.	2						
Paramerina sp.					1		
Procladius sp.	12						
Thienemannimyia group	2	2	3	1			1
Orthocladiinae							
Cricotopus sp.				1			1

Macroinvertebrate Species	**E-16 Roby**	**E-50/26 Riverside Park/ Riverton**		**E-24 Petersburg**		**E-25 Oakford**	
	2003	**1996**	**2003**	**1996**	**2003**	**1996**	**2003**
Cricotopus bicinctus						3	
Nanocladius sp.			1				1
Rheocricotopus sp.			1				2
Chironomini	134						
Chironomus sp.		1		1		5	
Cryptochironomus sp.	1						
Cryptotendipes sp.	1						
Dicrotendipes sp.			1			1	
Dicrotendipes neomodestus	9						
Endochironomus nigricans				1			
Glyptotendipes sp.	13		36	5	65	6	7
Phaenopsectra sp.			1				
Polypedilum sp.	1		6		4		6
Polypedilum convictum		2				1	
Polypedium illinoense	3		2	4		4	
Polypedilum scalaenum	2						
Tanytarsini							
Paratanytarsus sp.			10			2	
Rheotanytarsus sp.		12	4		1		11
Tanytarsus sp.	4		2				
Empididae							
Hemerodromia sp.					1		1
Gastropoda							
Physidae							
Physa sp.				3			
Physella sp.			1				
Pelecypoda							
Unionidae		9				9	
Sphaeriidae							
Sphaerium sp.				9			
Corbiculidae							
Corbicula fluminae	2						
Pisidiidae	2						
Total abundance	**312**	**140**	**295**	**171**	**348**	**183**	**332**
Number of taxa	**27**	**20**	**24**	**30**	**15**	**27**	**17**
MBI	**6.1**	**4.5**	**5.6**	**4.8**	**5.9**	**5.2**	**5.0**

Source: Illinois EPA biological data from Intensive Basin Surveys, 1996 & 2003.

1) Station E-16 (Roby) was not surveyed for macroinvertebrates in 1996.

To provide an IBI scoring system more applicable to Illinois streams, the IBI scoring system used by the Illinois EPA and IDNR was revised based on years of sampling data in Illinois. Scores calculated using the new metrics are designated as Revised IBI (RIBI). According to IDNR and Illinois EPA (personal communication 2007), the RIBI was designed for smaller streams in Illinois, and a RIBI specifically for larger streams like the Sangamon River has not been completed. Therefore, use of the RIBIs to assess the quality of Sangamon River is limited.

Fisheries surveys of the Lower Sangamon River Basin were conducted by the IDNR in 1996 and 2003 as part of the Intensive Basin Surveys program (IDNR, 2004). Sampling was conducted in selected stream segments of the Lower Sangamon River Basin including Stations E-50 (Riverside Park at Springfield), E-26 (Riverton), E-24 (Petersburg) and E-25 (Oakford). As explained in Section 3.2.3, IDNR and Illinois EPA changed the sampling location to Riverton (E-26) in 2003. Fish data from Station E-16 located at Roby, Illinois are also provided for a comparison to fisheries quality of a location upstream of the South Fork/Sugar Creek confluence with the Sangamon River. Table 3-4 lists the fish species collected from each of the sampling locations shown in Figure 3-4, and also provides the number of species and designated IBI/RIBI scores.

The fish species collected at the Sangamon River stations were common for midwestern streams relative to stream size, and none are present on the state or federal endangered or threatened species list. The total number of fish and the number of fish species collected at the river stations were relatively equal. Station E-26 at Riverton had the lowest IBI/RIBI at 32/25, while the farthest downstream station, E-25 at Oakford, had the highest IBI/RIBI at 42/41.

The IDNR compared the 2003 IBI and RIBI scores with those calculated from previous sampling conducted in 1981-82 and 1996 (see Table 3-5). Based on the IBI scores, the three Sangamon River stations were relatively equal in 1981-82 and 2003 sampling dates. Station E-50/26 at Springfield/Riverton had a somewhat lower IBI of 32 than E-24 at Petersburg and E-25 at Oakford (IBIs of 40 and 38 respectively) in 1996.

TABLE 3-4

FISH SPECIES COLLECTED FROM THE SANGAMON RIVER - 1996 AND 2003

Fish Species	E-16 Roby(1)	E-50/26 Springfield/Riverton		E-24 Petersburg		E-25 Oakford	
	2003	1996	2003	1996	2003	1996	2003
Shortnose gar	0	0	0	3	0	1	0
Longnose gar	0	1	0	2	1	0	1
Bowfin	0	0	0	0	1	0	0
Gizzard shad	26	49	39	60	48	27	41
Goldeye	0	0	0	1	0	0	0
Mooneye	0	0	0	0	0	1	0
Grass carp	0	0	0	0	2	0	1
Carp	8	14	12	21	11	16	5
Suckermouth minnow	0	0	0	0	0	1	0
Red shiner	398	41	90	104	26	107	12
Spotfin shiner	2	0	0	0	0	0	0
Sand shiner	48	0	5	0	0	8	1
Steelcolor shiner	1	0	0	0	0	0	0
Emerald shiner	0	0	0	0	0	1	0
Bluntnose minnow	10	0	1	0	1	0	0
Bullhead minnow	2	9	5	21	10	8	4
Bigmouth buffalo	1	0	1	1	3	0	1
Smallmouth buffalo	0	13	11	16	30	23	21
Black buffalo	1	0	2	0	1	0	2
Quillback	1	2	0	2	0	5	3
River carpsucker	7	4	3	15	16	19	17
Highfin carpsucker	0	0	0	2	0	0	0
White sucker	0	0	0	1	0	0	0
Shorthead redhorse	2	4	2	13	3	20	18

Fish Species	**E-16 Roby(1)**	**E-50/26 Springfield/Riverton**		**E-24 Petersburg**		**E-25 Oakford**	
	2003	**1996**	**2003**	**1996**	**2003**	**1996**	**2003**
Golden redhorse	0	0	0	4	0	3	3
Silver redhorse	0	0	0	0	0	3	3
Channel catfish	38	6	22	12	7	7	10
Flathead catfish	2	5	5	5	8	2	4
Freckled madtom	3	0	0	0	0	0	0
Mosquitofish	1	0	0	0	0	0	0
Brook silverside	0	0	1	0	0	1	0
White bass	1	0	0	6	7	5	2
Black crappie	0	0	1	0	0	0	0
Largemouth bass	0	0	1	3	3	0	0
Smallmouth bass	0	0	0	0	0	0	1
White crappie	1	1	0	5	0	0	0
Green sunfish	2	2	1	1	0	0	0
Orangespotted sunfish	0	1	0	0	0	0	0
Bluegill	1	0	3	6	4	0	2
Walleye	0	1	0	0	0	0	0
Sauger	0	0	0	1	1	0	1
Slenderhead darter	0	0	0	0	5	0	0
Freshwater drum	17	4	4	22	21	26	32
Red shiner x spotfin hybrid	12	0	0	0	0	0	0
Striped x white bass hybrid	0	2	0	0	0	0	0
Total number fish	**585**	**159**	**211**	**327**	**211**	**284**	**185**
Total number species	**22**	**16**	**20**	**23**	**22**	**20**	**22**
IBI		**32**	**40**	**40**	**38**	**38**	**42**
Revised IBI (RIBI)	**27**	**24**	**25**	**36**	**32**	**32**	**41**

Sources: *Lower Sangamon Basin Survey, 2003, Data Summary*, Doug Carney, IDNR, 2004.
Illinois EPA biological data from Intensive Basin Surveys, 1996 and 2003.

1) Station E-16 (Roby) was not surveyed for fish in 1996.

TABLE 3-5

IBI COMPARISON IN THE SANGAMON RIVER FOR 1981-82, 1996 AND 2003 WITH REVISED IBI COMPARISONS BETWEEN 1996 AND 2003

Year	E-50/26 Springfield/Riverton		E-24 Petersburg		E-25 Oakford	
	IBI	RIBI	IBI	RIBI	IBI	RIBI
1981-82	30	-	-	-	29	-
1996	32	24	40	36	38	32
2003	40	25	38	32	42	41
Change since 1996	+8	+1	-2	-4	+4	+9

Source: Carney, 2005.

The Illinois EPA guidelines for using IBI information for assessing aquatic life use in streams is provided in Table 3-2. Based on the 1996 and 2003 RIBI scores, Stations E-16, E-50/26, and E-24 of the Sangamon River were moderately impaired for aquatic life use (fair quality fisheries). Station E-25 at Oakford in 2003 had an RIBI of 41, indicating full support of aquatic life use and good resource quality. The two upstream stations, E-50/26 (Riverside Park/Riverton) and E-16 (Roby), had lower RIBI scores than the other downstream stations surveyed. However, IBI scores for all stations except E-16, which was not surveyed, were relatively identical in 2003.

Subsequently, the IBI was adapted for use in Illinois through the Biological Stream Characterization (BSC) Work Group, consisting of the Illinois EPA, the IDNR, and the INHS. The Biological Stream Characterization (BSC) is a five-category stream quality classification based primarily on the attributes of lotic fish communities. The BSC classification scale ranges from a Unique Aquatic Resource (Class A) to a Restricted Aquatic Resource (Class E). The predominant stream quality indicator used in this process is the IBI, which forms a basis for describing the health or integrity of the fish community. When available fishery data are insufficient for calculating an IBI value, BSC criteria allow the use of sport fish information or macroinvertebrate data to rate streams.

Based on the latest publication of the BSC (Illinois EPA, 1996), the reach of the Sangamon River located in Sangamon, Menard, Mason, and Cass Counties were classified as Moderate Aquatic Resources (Class C streams). The BSC defines a Moderate Aquatic Resource as a fishery consisting of predominantly bullheads, sunfish, and carp. The species diversity and number of intolerant fish are reduced. Also, the trophic structure is skewed with an increased frequency of omnivores, green sunfish or tolerant species.

The IDNR conducted a catfish survey of the Lower Sangamon River in 2003 to assess channel catfish and flathead catfish populations (Carney, 2005). The Sangamon River provides an important commercial and recreational resource through catfish fishing. Sample locations included Riverton (E-26), Riverside Park in Springfield (E-50), Petersburg (E-24) and Oakford (E-25). Totals of 269 channel catfish and 96 flathead catfish were collected during this sampling effort. Upstream sites at Riverside Park and Riverton, where a total of 234 channel catfish and 73 flathead catfish, were more productive than the Petersburg and Oakford sites, where a total of 35 channel catfish and 23 flathead catfish were collected. Possible explanations provided by Carney for the upstream versus downstream population differences may involve population limiting parameters of habitat availability and fishing pressure. Based on this survey, both channel catfish and flathead catfish appear to maintain very good populations, in both numbers of fish and size ranges.

Based on the results of the 2003 IDNR fisheries and catfish surveys of the Lower Sangamon River and the BSC rankings, the Sangamon River in the Lower Sangamon River Basin appears to be moderate aquatic resource. The latest fisheries survey conducted by the IDNR collected similar number of species and total number of fish from the three stream stations located in the Lower Sangamon River Basin; although the lowest RIBI scores occurred at the Riverton station. However, RIBIs were developed for streams smaller in size than the Sangamon River. Also, the 2003 catfish survey determined that channel and flathead catfish populations were robust, especially at the Riverside Park/Riverton section of the Sangamon River.

3.2.5 Threatened and Endangered Species and Natural Areas

The IDNR, Division of Ecosystems and Environment was contacted for information on aquatic threatened and endangered species and natural areas of the Sangamon River from its confluence with the South Fork of the Sangamon River to the Illinois River (see correspondence in Appendix C). The Illinois Natural Heritage Database listed observed occurrences of the lake sturgeon (*Acipenser fulvescens*) and the redspotted sunfish (*Lepomis miniatus*) in the Sangamon River.

The lake sturgeon is a state endangered fish which inhabits large lakes and rivers. This species has occasionally been taken in the Illinois River mainstem by commercial fishermen, but was never common in the Illinois River basin. The only record for the Sangamon River was one individual taken in Menard County in 1996. The lake sturgeon does not reproduce in the Sangamon River (IDNR, 2000 and 2001).

The redspotted sunfish is a state threatened fish which is found in Illinois only in well-vegetated bottomland lakes and swamps in extreme southern Illinois and in bottomland lakes and streams in the sand region of Mason, Cass and Tazewell Counties. The redspotted sunfish was observed in the Sangamon River at its confluence with the Illinois River in Cass County. It is extremely rare in the Lower Sangamon River basin area, and appears to have been isolated from other populations of its species for a long period (IDNR, 2000 and 2001).

The Illinois Natural Heritage Database listed the Sangamon River from Richland Creek to Petersburg in Menard County as an Illinois Natural Areas Inventory (INAI) site. This reach of the Sangamon River was recognized as a Biologically Significant Stream because it supports a high diversity of native mussel species (Page et al., 1992).

SECTION 4.0

ISSUE OF CONCERN

SECTION 4.0
ISSUE OF CONCERN

4.1 Proposed Site-Specific Standard for Boron

A site-specific water quality standard for boron is requested to allow the Springfield Metro Sanitary District (SMSD) Spring Creek Plant to accept a pretreated industrial effluent stream from the City Water, Light and Power (CWLP) power plant. The stream to be pumped to the SMSD Spring Creek Plant from the CWLP facility is expected to have an average flow rate of 187 gpm and a boron concentration of 450 mg/L. A flow of 187 gpm is equivalent to 0.4166 cubic feet per second (cfs). Assuming that the typical municipal waste stream influent has a boron concentration of 0.25 mg/L, the maximum anticipated boron concentration in the SMSD plant effluent would be based on a 7-day low-flow period through the SMSD Spring Creek Plant of 17.5 cfs. A flow of 17.5 cfs is equivalent to 11.3 MGD.

Assuming complete mixing in the SMSD Spring Creek Plant, the boron concentration from the effluent stream can be calculated as follows:

$$C_{eff} = \frac{Q_{SMSD}\,(C_{SMSD}) + Q_{CWLP}\,(C_{CWLP})}{Q_{SMSD} + Q_{CWLP}}$$

where:

C_{eff} = the boron concentration in mg/L of the resultant Spring Creek Plant effluent after the proposed CWLP stream addition.

Q_{SMSD} = the water flow through the Spring Creek Plant in cfs not including the CWLP stream.

C_{SMSD} = the boron concentration in mg/L of the typical waste stream influent to the Spring Creek Plant not including the CWLP stream.

Q_{CWLP} = the anticipated flow from the proposed CWLP stream in cfs.

C_{CWLP} = the anticipated boron concentration of the proposed CWLP stream in mg/L.

After acceptance of the proposed pretreated industrial effluent CWLP waste stream, the maximum Spring Creek Plant effluent boron concentration is calculated to be 10.7 mg/L, using the 7-day low-flow of 17.5 cfs (11.3 MGD) per the 2002 ISWS map.

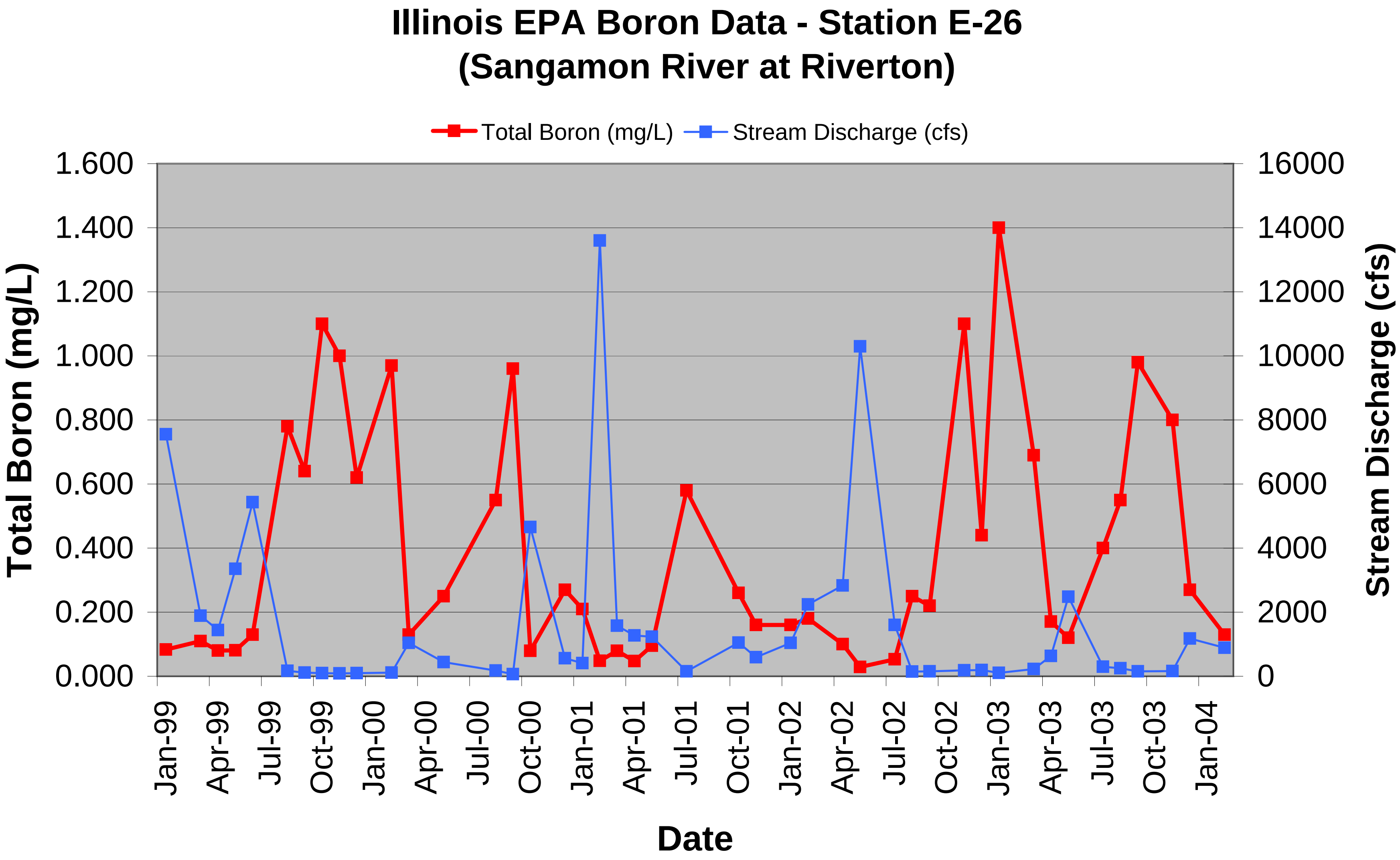
4.2 Boron Concentrations in Receiving Waters

4.2.1 Historic Boron Levels

Water quality data for the Sangamon River were requested from the Illinois EPA to determine boron levels during the recent past. Data were available for Illinois EPA Stations E-26 at Riverton, E-24 at Petersburg, and E-25 at Oakford from 1999 to 2004. These monitoring data are collected by the Illinois EPA as part of the Ambient Water Quality Monitoring Network (AWQMN) sampling program. Figures 4-1, 4-2, and 4-3 display the total boron concentrations at these three stream stations of the Sangamon River from 1999 to 2004. Data were not available from the Illinois EPA from March 2004 to present. The boron data are also provided in tabular format in Appendix D. Stream discharge volumes are also provided for Stations E-26 and E-25 for reference. Stream discharge volumes in cfs were obtained from the USGS National Water Information System (NWIS). Stream discharge information from 1999 to 2004 was not available for Station E-24 (the Sangamon River at Petersburg).

Station E-26 at Riverton had the highest total boron concentrations over the four year period, which is expected since this station is the closest downstream of the CWLP NPDES discharge locations. The Illinois General Use Water Quality Standard for total boron of 1.0 mg/L was exceeded four out of 44 sampling events at this station within the five year period, or about nine percent. However, no boron value exceeded the adjusted standard of 2.0 mg/L of boron. The highest boron concentration of 1.40 mg/L occurred in January 2003. The mean boron concentration at Riverton was 0.394 mg/L over the five year period from 1999 to 2004.

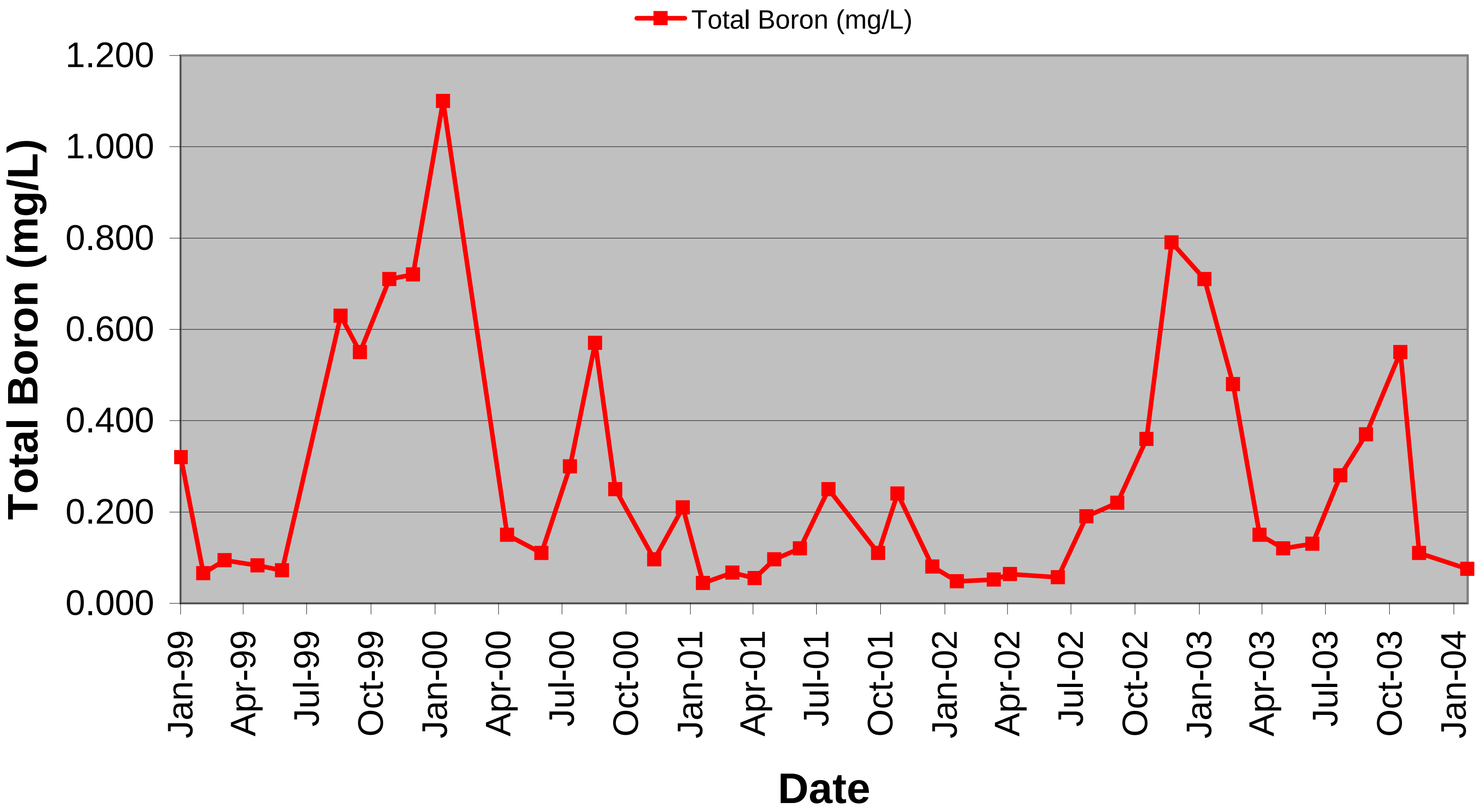
Figure 4-1



I:\07jobs\07E0039\Admin\10 Reference Data\Illinois EPA Ambient Monitoring Data\E24E26EL01_BoronOnly_StationCharts.xls
8/5/2008

Figure 4-2

Illinois EPA Boron Data - Station E-24 (Sangamon River at Petersburg)



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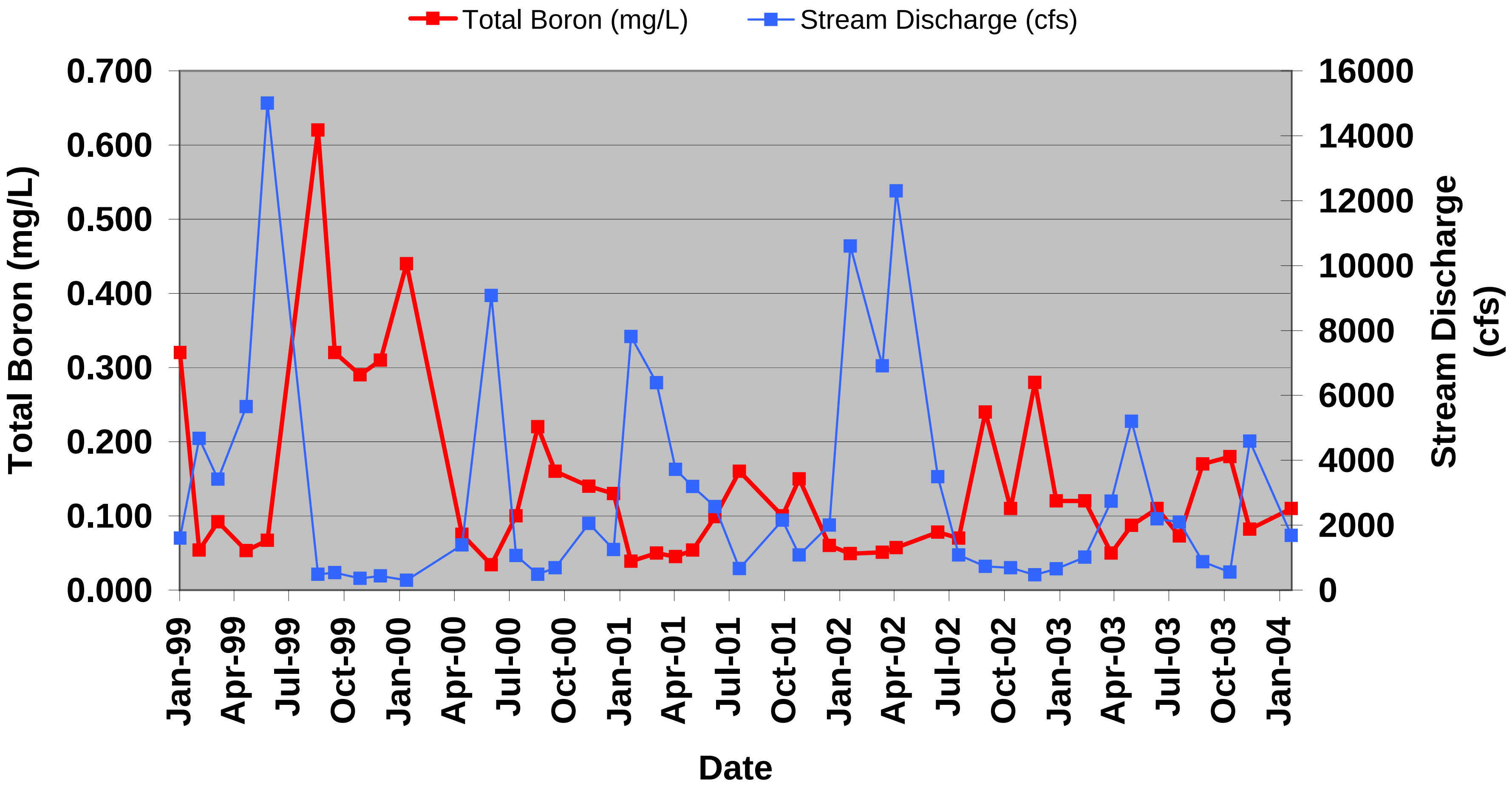
8/5/2008

Figure 4-3

Illinois EPA Boron Data - Station E-25
(Sangamon River at Oakford)



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8/5/2008

The total boron concentrations in the Sangamon River at Petersburg (Station E-24) ranged from 0.044 mg/L to 1.10 mg/L from 1999 to 2004. The highest concentration of 1.10 mg/L recorded in February 2000 was the only exceedance of the General Use standard for boron of the 44 sampling events. The mean boron concentration at Petersburg was 0.269 mg/L over the five year sampling period.

The total boron concentrations in the Sangamon River at Oakford (Station E-25) ranged from 0.034 mg/L to 0.620 mg/L and never exceeded the General Use standard for boron within the five year sampling period. The mean boron concentration at Station E-25 was 0.141 mg/L from 1999 to 2004.

Figures 4-1 and 4-3 illustrate the inverse relationship between boron concentration and stream discharge, which is expected. Boron concentrations were always higher during periods of low flow, and lower when stream levels were high. The average daily mean flows of the 44 sampling days were 1,641 cfs at Riverton and 3,088 cfs at Oakford. Lowest recorded flows were 63 cfs at Riverton and 300 cfs at Oakford. Highest recorded flows of the 44 sampling days were 13,600 cfs at Riverton and 15,000 cfs at Oakford.

In addition to reviewing Illinois EPA water quality data, Hanson sampled the Sangamon River on September 10, 17 and 24, 2007, and October 1, 2007 to determine recent boron concentrations upstream and downstream of the Spring Creek confluence during low stream flow conditions. A downstream sample at the Illinois Route 29 bridge (Site S-1) and upstream sample at Riverside Park (Site S-2) were collected on each date, as well as a sample from Spring Creek at the SMSD Plant. A blind duplicate sample was typically taken each week at either the upstream or downstream location for a quality control check.

Prairie Analytical Systems, Incorporated analyzed the stream samples. Prairie Analytical Systems is accredited by the Illinois EPA Laboratory Accreditation Program (IL ELAP). The results are summarized in Table 4-1 and provided in Appendix E. The

Illinois General Use Water Quality Standard for total boron of 1.0 mg/L was exceeded three of the four sampling dates at Riverside Park and the Illinois Route 29 bridge. However, only one sampling date at Riverside Park exceeded the adjusted standard of 2.0 mg/L of boron. Stream flow was extremely low during the sample month, which contributed to the higher boron concentrations. According to the USGS AWQMN, the mean discharge at the Riverton gaging station for the month of September during the last 10 years of record is 236 cfs.

The City of Springfield, Office of Public Utilities, City Water, Light and Power petitioned the Illinois Pollution Control Board and was granted an adjusted standard on December 1, 1994 for boron from Outfall 003 on Sugar Creek to 100 yards downstream of the confluence of the Sangamon River with Spring Creek in the Northeast Quarter of Section 10, in Springfield Township, Sangamon County. Pursuant to this grant, 35 IAC 304.105 does not apply to discharges from Outfalls 003 and 004 as regards boron concentrations that are less than or equal to:

1. 11.0 mg/L for boron from CWLP's Outfall 003 at Spaulding Dam on Sugar Creek to its confluence with the discharge of the Springfield Metropolitan Sanitary District's Sugar Creek Plant Outfall 008 in the Northeast Quarter of Section 31, Clear Lake Township, Sangamon County;

2. 5.5 mg/L for boron from the discharge of said sanitary district plant outfall on Sugar Creek to its confluence with the South Fork of the Sangamon River; and

3. 2.0 mg/L for boron from the confluence of Sugar Creek and the South Fork of the Sangamon Rivers to 100 yards downstream of the confluence of the Sangamon River with Spring Creek in the Northeast Quarter of Section 10, Springfield Township, Sangamon County.

The model presented in the *Technical Support Document for Petition for Adjusted Boron Standards for Sugar Creek and the Sangamon River* (Hanson Engineers Incorporated, March 1994) was reviewed to determine if the flows and/or boron concentrations utilized in the model could be updated to reduce the background boron

TABLE 4-1

SANGAMON RIVER BORON CONCENTRATIONS UPSTREAM AND DOWNSTREAM OF THE SMSD SPRING CREEK PLANT DISCHARGE SEPTEMBER AND OCTOBER 2007

Date	Total Boron (mg/L)		Stream Discharge (cfs)
	Sangamon River at IL Route 29 Bridge (Downstream)	Sangamon River at Riverside Park (Upstream)	Sangamon River at Riverton
9/10/2007	1.16	1.18	90
9/17/2007	1.15 1.12	1.35	55
9/24/2007	0.466	0.514 0.587	50
10/1/2007	1.43 1.43	2.14	48

concentration in the Sangamon River upstream from the confluence with Spring Creek. It was determined that the boron concentration presented in the 1994 model, 2.0 mg/L, was appropriate for use as the boron concentration in the Sangamon River for purposes of determining a site-specific boron standard after the addition of the proposed pretreated industrial effluent CWLP stream to the SMSD Spring Creek Plant.

4.2.2 Predicted Boron Levels

Assuming complete mixing of the Sangamon River and the SMSD Spring Creek Plant effluent, the boron concentration in the Sangamon River downstream from the confluence with Spring Creek can be calculated as follows:

$$C_{downstream} = \frac{Q_{upstream}\,(C_{upstream}) + Q_{eff}\,(C_{eff})}{Q_{upstream} + Q_{eff}}$$

where:

$C_{downstream}$ = the boron concentration in mg/L of the Sangamon River downstream from the confluence with Spring Creek after the addition of the proposed CWLP stream to the SMSD Spring Creek Plant.

$Q_{upstream}$ = the water flow in the Sangamon River upstream from the confluence with Spring Creek in cfs.

$C_{upstream}$ = the boron concentration in the Sangamon River upstream from the confluence with Spring Creek in mg/L.

Q_{eff} = the flow from the SMSD Sugar Creek Plant after the addition of the proposed CWLP waste stream cfs.

C_{eff} = the boron concentration of the SMSD Sugar Creek Plant after the addition of the proposed CWLP waste stream in mg/L.

Using the 7Q10 low-flow per the 2002 ISWS map of 54.8 cfs and a boron concentration of 2.0 mg/L in the Sangamon River upstream of the confluence with Spring Creek and an anticipated effluent flow of 17.5 cfs and a boron concentration of 11.0 mg/L from the Spring Creek Plant 7-day low flow, after complete dispersion in the Sangamon River, the maximum boron concentration in the Sangamon River downstream from Spring Creek is calculated to be 4.2 mg/L. In order to allow margin for fluctuation, a site-specific water quality standard for boron of 4.5 mg/L is requested for the

Sangamon River from 182 yards downstream of the SMSD Spring Creek Plant 007 STP Outfall to the confluence of the Sangamon River with Salt Creek. This implies that boron concentration in the Sangamon River the entire width of the river will be between 4.5 mg/L and 11.0 mg/L in the area between SMSD Outfall 007 and 182 yards downstream of Outfall 007.

Assuming a boron concentration of 0.25 mg/L from the Athens and the Petersburg wastewater treatment plants, the anticipated boron concentration of the Sangamon River at the confluence with Salt Creek will be 1.6 mg/L under minimum flow conditions. A maximum boron concentration of 1.3 mg/L is anticipated at the confluence of the Sangamon River and the Illinois River. The Illinois General Use water quality standard for boron of 1.0 mg/L is expected to be reached in the Illinois River 100 yards downstream from the confluence with the Sangamon River.

SECTION 5.0

ENVIRONMENTAL EFFECTS OF BORON

SECTION 5.0
ENVIRONMENTAL EFFECTS OF BORON

Boron is a dark brown element that is widespread in the environment but occurs naturally only in combined form, usually as borax, colemanite, boronatrocalcite, and boracite. Boron exists in natural sediments as borosilicates, which are considered biologically inert. Boron is typically released to the environment slowly and at low concentrations by natural weathering processes. Most of the natural boron compounds usually degrade or are transformed by natural weathering of rocks to borates or boric acid, which are the main boron compounds of ecological significance (Sprague, 1972).

5.1 <u>Distribution and Uses of Boron</u>

Proven commercial deposits of sodium tetraborate, from which borax is prepared, are concentrated in the Mojave Desert of California where ancient lakes or marshes have evaporated under arid conditions. The United States supplies 70 percent of the annual world demand for boron compounds. Boron is used in the production of glass and glass products, such as insulating fiberglass. It is also used in the manufacture of textiles, enamels, and glazes used as coatings on household and industrial products. Other products that include boron are: herbicides, insecticides, soaps, cleansers, cosmetics, antifreeze, high energy fuels, flame-proof compounds, corrosion inhibitors, and antiseptics.

Boron is widely distributed in surface water and ground water. The average surface water concentration for boron in the United States is about 0.1 mg/L, but concentrations vary greatly, depending on boron content of local geologic formations and anthropogenic sources of boron (Butterwick, et al., 1989). A survey of United States surface waters detected boron in 98 percent of 1,577 samples at concentrations ranging from 0.001 mg/L to 5.0 mg/L. Mean concentrations calculated for the 15 main geologic drainage basins in the continental United States ranged from 0.019 mg/L in the Western Great Lakes Basin to 0.289 mg/L in the Western Gulf Basin (Butterwick, et al., 1989). The concentration of boron in sea water is about 4.5 mg/L to 5.5 mg/L, varying with the local salinity (Butterwick, et al., 1989).

Most boron that occurs in the fresh water aquatic environment is due to the relatively high water solubility of all boron compounds, especially boron-containing laundry products and sewage (U.S. EPA, 1975). Another, although very localized, source of boron to the aquatic environment is coal ash. Many commercially-mined coal seams contain significant concentrations of boron. Of the total boron in coal, as much as 71 percent may be lost to the atmosphere upon combustion; however, more than 50 percent of the boron found in coal ash is readily water soluble (Pagenkopf and Connolly, 1982). The release of boron from coal fly ash to leachate water is dependent on the ash to water ratio: at 1 gm of ash/L, up to 90 percent of the boron is soluble; at 50 gm/L, only 40 percent is soluble: at 100 gm/L, less than 30 percent is soluble (Eisler, 1990).

5.2 Toxicological Effects of Boron

There is a large literature base documenting boron's effects on plants, especially crop plants, and a smaller literature base documenting boron's effects on animals. The following discussion focuses primarily on boron's effects on organisms associated with freshwater systems. The toxicology of boron to freshwater biota is most applicable since one use of the Sangamon River is supporting aquatic life, in addition to receiving permitted NPDES discharges and recreation.

5.2.1 Effects in Humans

The U.S. EPA classifies boron as a Group D element, meaning that there is no human and animal evidence of boron carcinogenicity. Papachristou et al. (1987) demonstrated that ingestion of water with 20 to 30 mg/L of boron can be considered to have no adverse effects on human health. However, boron has been reported to cause toxic effects in humans following oral, inhalation, and dermal exposures. Inhalation exposures to 14.4 mg/m^3 of borax dust have resulted in upper respiratory tract irritation, dryness of the mouth, nose, and throat, as well as irritation of the eye, but a level of 1.1 mg/m^3 produced no symptoms (Garabrant et al., 1984). One study (Gupta and Parrish, 1984) demonstrated toxicosis in adults at a dermal exposure of 645 grams of boric acid.

Oral doses of 15 to 20 grams of boric acid, equivalent to 0.25 to 0.3 g per kg of body weight, have been shown to be lethal to adults (U.S.EPA, 1975, and Eisler, 1990). Oral doses of 5 to 6 grams of borates have shown to be fatal to infants (from Eisler, 1990). Specific symptoms associated with oral doses include nausea, persistent vomiting, diarrhea, colicky abdominal pain, liver effects (jaundice), kidney disease, and dermatitis. In addition, oral exposures have been reported to cause headaches, tremors, restlessness, convulsions, weakness, and coma (ATSDR, 1992).

5.2.2 Effects in Other Mammals and Birds

In mammals, exposure to excessive boron may result in a reduced growth rate, loss of body weight, decreased sexual activity, and eye irritation. Reduced growth has been reported in cattle, dogs, rabbits, and rats (Eisler, 1990). However, Green and Weeth (1977) and Weeth et al. (1981, from Butterwick et al., 1989) found no overt signs of toxicosis in heifers exposed to 120 mg/L of boron and that 300 mg/L of boron is not acutely toxic to this species when consumed via drinking water. Brockman et al. (1985) found ingestion of 100 to 300 grams of boron, equivalent to 200 to 600 mg of boron per kg of body weight, to be lethal to cattle (from Eisler, 1990). Dogs were found to tolerate ingestion of 350 mg of boron per kg of feed for two years, but showed symptoms of toxicosis when fed 1,170 mg of boron per kg of feed after 38 weeks (Weir and Fisher, 1972). Rabbits showed growth retardation when fed 800 to 1,000 mg of borates per kg of body weight daily for four days. Rats exposed to drinking water containing boron concentrations of 150 to 300 mg/L had body weights 7.8 percent and 19.8 percent less than the control group (Seal and Weeth, 1980, from Moss and Nagpal, 2003).

Toxic effects of boron in birds have been exclusively studied in ducks and chickens. Results of chronic feeding studies using mallards demonstrate that diets containing 13 mg of boron per kg of feed weight produce no adverse effects, but those diets containing 1,000 mg/kg of boron are fatal (from Eisler, 1990). Stanley et al. (1996, from Moss and Nagpal,

2003) found significant adverse reproductive effects in mallards fed 900 mg of boron per kg of dry feed. Pendleton et al. (1995, from U.S. Department of the Interior, 1998) reported extremely rapid accumulation and elimination of boron in mallard tissues. Adult male mallards fed a diet containing 1,600 mg of boron per kg accumulated equilibrium levels of boron in liver tissue and blood within 2 to 15 days. After boron was removed from the mallards' diet, it was completely cleansed from the liver and blood within one day.

5.2.3 Effects in Fish and Amphibians

The following studies demonstrate tolerance ranges for some species of fish:

- Mann (1973) studied the effects of sodium perborate, boric acid, and borax upon eel fry, amphipods, rainbow trout, tubificid worms, and guppies. These boron (B) compounds were determined to be relatively non-toxic using 24-hour bioassay procedures. Detrimental effects occurred with exposure to concentrations of more than 250 mg/L (17 mg B/L) of sodium perborate, 5,000 mg/L (875 mg B/L) of boric acid, and 2,500 mg/L (282 mg B/L) of borax;

- Wallen, et al. (1957) studied mosquito fish (*Gambusia affinis)*, which are native to Illinois, using 96-hour bioassay procedures. No mortalities were observed in concentrations of boric acid up to 1,800 mg/L (315 mg B/L);

- Birge and Black (1977) studied the effects of boron exposures to channel catfish (*Ictalurus punctatus*) embryos and fry using a 9-day bioassay procedure. A median lethal concentration (LC_{50}) value of 155 mg B/L in soft water was determined for both borax and boric acid. In hard water, LC_{50} values were 71 and 22 mg B/L for borax and boric acid, respectively. The lowest-observed-effect concentrations (LOEC) for embryo-larval stages of the channel catfish ranged from 1.0 to 25.9 mg B/L, depending on water hardness and the boron compound administered (from Butterwick et al., 1989);

- Eisler (1990) indicated that 30 and 33 mg/L of boron are "safe" levels for game fish species such as the largemouth bass and bluegill;

- Turnball et al. (1954, from Butterwick et al., 1989) reported a 24-hour LC_{50} of 2,389 mg B/L for bluegill sunfish (*Lepomis macrochirus*);

- Birge and Black (1981) reported an 11-day LOEC of 12.17 mg B/L for freshly fertilized eggs of largemouth bass (*Micropterus salmoides*) (from Butterwick et al., 1989);

- Sensitive fish species such as freshwater coho (which are not present in the Sangamon River basin) show adverse effects with exposure to 113 mg B/L (Thompson, et al., 1976);

- The 6-hour minimum lethal dose level for minnows ranged from 3,145 to 3,407 mg B/L in a boric acid solution (NAS, 1973; and McKee and Wolf, 1963, from Butterwick et al., 1989); and

- Tests on the fathead minnow (*Pimeohales promelas*) egg-fry indicate a 30-day LOEC (reduction in growth) at 24 mg B/L and a 60-day LOEC (reduction in fry survival) at 88 mg B/L (Proctor & Gamble, 1979 (unpublished), from Butterwick et al., 1989).

The following studies have found amphibians to respond to boron at concentrations similar to those for fish:

- Boron compounds were found to be more toxic to embryos and larvae than to adult amphibians (Birge and Black, 1977);

- Developmental abnormalities have been observed in toads exposed to boron concentrations above 130 mg B/L (Eisler, 1990);

- Birge and Black (1977) found that no effects occurred on embryos of Fowler's toad (*Bufo fowleri*) until a concentration of 53 mg B/L in the form of boric acid was applied; and

- Birge and Black (1977) found that leopard frog (*Rana pipiens*) embryos suffered 100 percent lethality or teratogenesis in water treated with borax and boric acid at levels of 200 and 300 mg B/L, respectively. Post-hatched LC_{50} values for boric acid were 130 mg B/L in soft water and 135 mg B/L in hard water. In bioassays with borax, these values were 47 mg B/L and 54 mg B/L. The LOEC for embryo-larval stages of the leopard frog ranged from 9.60 to 86.0 mg B/L, depending on water hardness and the boron compound administered (from Butterwick et al., 1989).

The effects of boron on freshwater aquatic vertebrates applicable to the Sangamon River and the Illinois River are summarized in Table 5-1.

5.2.4 Effects in Invertebrates

The following studies show tolerance ranges to boron exposures for some aquatic invertebrates:

- According to Eisler (1990), aquatic fauna can usually tolerate up to 10 mg B/L in water for extended periods of time without adverse effects;

TABLE 5-1
REFERENCED EFFECTS OF BORON ON FRESHWATER AQUATIC LIFE APPLICABLE TO THE SANGAMON RIVER AND THE ILLINOIS RIVER

Species	Life Stage	Type of Test	Boron Compound Used	Water Source	Boron Concentration (mg B/L)	Test Response	Reference
VERTEBRATES							
Bufo fowleri (Fowler's toad)	Embryo-larval stages	Flow-through	Boric acid	Reconstituted	53.5 – 96.0(1)	7-day LOEC	Birge and Black (1977) in Moss and Nagpal (2003)
Gambusia afinis (mosquito fish)	Adult females	Static	Boric acid		<314	No mortalities in 96-hr	Wallen et al. (1957)
Ictalurus punctatus (channel catfish)	Embryo-larval stages	Flow-through	Borax	Reconstituted	1.04 – 25.9(1) 71 - 155	9-day LOEC 9-day LC_{50}	Birge and Black (1977); Birge and Black (1981) in Butterwick et al. (1989)
Ictalurus punctatus (channel catfish)	Embryo larval stages	Flow-through	Boric acid	Reconstituted	1.0 – 5.42(1) 22 - 155	9-day LOEC 9-day LC_{50}	Birge and Black (1977); Birge and Black in Butterwick et al. (1989)
Lepomis macrochirus (bluegill sunfish)	Average size 7 cm, 5 g	Static	Boron trifluoride	Tap	2,389	24-hr TLm	Turnball et al. (1954) in Butterwick et al. (1989)
Micropterus salmoides (largemouth bass)	Freshly fertilized eggs	Flow-through	Boric acid	Reconstituted	12.17	11-day LOEC	Birge and Black (1981) in Butterwick et al. (1989)
Minnow			Boric acid	Distilled & hard	3,145 – 3,407	6-hr minimum lethal dose	NAS (1973), McKee and Wolf (1963) in Butterwick et al. (1989)
Pimeohales promelas (fathead minnow)	Eggs and fry	Flow-through	Boric acid	Well	24 88	30-day LOEC (reduction in growth) 60-day LOEC (reduction in fry survival)	Proctor & Gamble (1979) (unpublished) in Butterwick et al. (1989)
Rana pipiens (leopard frog)	Embryo-larval stages	Flow-through	Borax	Reconstituted	9.6 – 10.5(1) 47 - 54	7-day LOEC 7.5-day LC_{50}	Birge and Black (1977); Birge and Black (1981) in Butterwick et al. (1989)
Rana pipiens (leopard frog)	Embryo-larval stages	Flow-through	Boric acid	Reconstituted	47.5 – 86.0(1) 130 - 135	7-day LOEC 7.5-day LC_{50}	Birge and Black (1977); Birge and Black (1981) in Butterwick et al. (1989)
INVERTEBRATES							
Chironomus decorus (midge)	Fourth instar	48-hr acute toxicity 96-hr chronic toxicity	Sodium tetraborate	Reconstituted	1,376 20	48-hr LC_{50} 96-hr significantly decreased growth rate	Maier and Knight (1991)

Species	Life Stage	Type of Test	Boron Compound Used	Water Source	Boron Concentration (mg B/L)	Test Response	Reference
Daphnia magna Straus (water flea)		Static	Boric acid	Lake Huron	133 13.6	48-hr LC_{50} 21-day LOEC	Gersich (1984)
Daphnia magna Straus (water flea)	<24 hr	48-hr static acute 21-day static renewal chronic	Boric acid	Carbon filtered	226 13	48-hr $L\ C_{50}$ 21-day LOEC	Lewis and Valentine (1981)
Tubifex sp. (tubificid worms)		24-hr toxicity	Borax		85 227	24-hr NOEC 24-hr LC_{100}	Mann (1973)
Tubifex sp. (tubificid worms)		24-hr toxicity	Boric acid		1,311 1,748	24-hr NOEC 24-hr LC_{100}	Mann (1973)
AQUATIC PLANTS							
Anacystis nidulans (blue green alga)			Boric acid		50 75 100	No effect on growth or organic constituents Significantly decreased growth and chlorophyll content Decrease in protein content causing inhibition in nitrate and nitrate reductase activity. Decreased chlorophyll content and photosynthesis inhibition within 72 hrs.	Martinez et al. (1986) in Eisler (1990)
Chlorella pyrenoidosa (green alga)					10 >100	No effect on growth or cell composition after 7 days Totally inhibitory for cell division and biomass synthesis in 72 hrs	Fernandez et al. (1984) and Maeso et al. (1985) in Eisler (1990)
Lemna minor (duckweed)			Boric acid		20	Growth inhibited after 7 days at pH 7.0	Frick (1985) in U.S. Department of the Interior (1998)
Lemna minor (duckweed)			Boron		100	Growth inhibited	Wang (1986)
Selenastrum capricornutum (green alga)	4 – 7 days old	72-hr static		Reconstituted	12.3	72-hr LOEC	Moss and Nagpal (2003)

(1) Dependent upon water hardness. See Sections 5.2.6 and 5.4 for a discussion of the potential effects to the Sangamon and Illinois Rivers in consideration of the low concentration toxicity levels reported in the Birge and Black studies (1977 and 1981).

- The 48-hour LC_{50} of the freshwater midge *Chironomus decorus* was 1,376 mg B/L when exposed to waterborne sodium tetraborate (Maier and Knight, 1991). Growth rate by *C. decorus* larvae significantly decreased at concentrations of 20 mg B/L and greater;

- Sea urchin embryos showed normal development with exposure to 37 mg B/L and lethality at 75 mg B/L (Kobayashi, 1971);

- A 48-hour LC_{50} value of 133 mg B/L was calculated for the cladoceran (*Daphnia magna*) to boric acid (Gersich, 1984). A boron concentration of 13.6 mg/L was shown to cause sublethal effects on *D. magna* in a 21-day study (Gersich, 1984);

- Lewis and Valentine (1981) similarly determined a 48-hour LC_{50} exposure value for boric acid of 226 mg B/L with a 21 day sublethal exposure level of 13.0 mg B/L for *D. magna*.

The effects of boron on freshwater aquatic invertebrates applicable to the Sangamon River and the Illinois River are summarized in Table 5-1.

5.2.5 Effects in Plants

Boron is essential for the growth of plants. Boron soil concentrations for optimum plant growth reportedly range from 0.1 to 0.5 mg/kg for several plant species (Butterwick et al., 1989). However, excess boron is known to be phytotoxic (Eisler, 1990). There is a small range between boron deficiency and boron toxicity in plants (Parks and Edwards, 2005). Boron toxicity has been reported in grasses, fruits, vegetables, grains, trees, and other terrestrial plants. Boron toxicity in plants is characterized by stunted growth, leaf malformation, browning and yellowing, chlorosis, necrosis, increased sensitivity to mildew, wilting, and inhibition of pollen germination and pollen tube growth. There is some evidence (Graham et al., 1987) that boron may accumulate to toxic levels in plants, particularly in the presence of a high phosphorus and low zinc environment.

The following studies demonstrate tolerance ranges to levels of boron exposure for some terrestrial plants:

- Toxic effects in plants, including leaf injury, were observed in 26 percent of plants at or below substrate concentrations that resulted in greatest growth, indicating considerable overlap between injurious and beneficial effects of boron in plants (Eaton, 1944);

- In general, deficiency effects in plants were evident when boron concentrations in soil solution were less than 2 mg B/L; optimal growth occurred at 2 to 5 mg B/L; and toxic effects were evident at 5 to 12 mg B/L. Sensitive species are known to include citrus, stone fruits, and nut trees; semitolerant species include cotton, tubers, cereals, grains, and olives; tolerant species usually include most vegetables (Gupta et al., 1985);

- Biggar and Fireman (1960) showed that, with neutral and alkaline soils of high absorption capacities, water containing 2 mg B/L might be used for some time without injury to sensitive plants; and

- Four species of turfgrass, Kentucky bluegrass, creeping bent, alta fescue, and colonial bent, were irrigated with water containing 4.8 mg B/L. These species of turfgrass were found to show excellent tolerance to higher levels of boron in soil solution, when the practice of frequent mowing is employed (Oertli et al., 1961).

Toxic effects observed in aquatic plants include inhibition of growth and reduced photosynthesis (Frick, 1985; Antia and Cheng, 1975; Rao, 1981) at various concentrations above 10 mg B/L and below 100 mg B/L. The following studies demonstrate tolerance ranges to levels of boron exposure for some aquatic plants:

- The blue green alga, (*Anacystis nidulans*), exhibits no adverse effects with respect to cell growth or organic constituents at 50 mg B/L and significant adverse effects at greater than 100 mg B/L over a 72-hour exposure (Eisler, 1990 based on Martinez et al., 1986). Martinez et al. (1986 in Eisler, 1990) found that a concentration of 75 mg B/L significantly decreased growth and chlorophyll content in this species;

- The green alga, (*Chlorella pyrenoidosa*), showed no effects on growth or cell composition after a 7-day exposure to 10 mg B/L and adverse effects at greater than 100 mg B/L in 72 hours (Fernandez et al., 1984 and Maeso et al., 1985 in Eisler, 1990);

- Duckweed, (*Lemna minor*), showed normal growth in 10 mg B/L and 20 mg B/L exposures and growth inhibitions at 100 mg B/L exposures (Wang, 1986); however, Frick (1985 in U.S. Department of the Interior, 1998) found that a concentration of 20 mg B/L was sufficient to inhibit the growth of duckweed at pH 7.0;

- Nineteen species of marine algae showed no effects from a 60-day exposure to 10 mg B/L and growth inhibition in 12 of 19 species at 100 mg B/L (Antia and Cheng, 1975).

The effects of boron on freshwater aquatic plants applicable to the Sangamon River and the Illinois River are summarized in Table 5-1.

5.2.6 Effects in Aquatic Organisms

The above studies, done on a diverse list of aquatic organisms, demonstrate the response to boron of three aquatic trophic levels: plant, invertebrate, and vertebrate (fish and amphibians). Boron effects on aquatic life are highly species specific and vary depending on the organism's life stage and environment. Based on previous studies, early stages are more sensitive to boron than later ones. Most aquatic organism toxicity studies have focused on the evaluation of lethal concentrations; however, other toxic effects have been reported.

While most laboratory toxicity studies are based on reconstituted water as the experimental medium, studies have shown that administering boron in natural water is less toxic than when administered in reconstituted water in the laboratory. Of all the species and life stages investigated in aquatic toxicity studies, the early life stages of rainbow trout (*Oncorhyncus mykiss*) appear to be most sensitive to boron. Initial studies in reconstituted water indicated a LOEC of 0.1 mg B/L. Procter and Gamble (unpublished, from Butterwick et al., 1989) found that when trout embryo-larval stages were exposed to boron in natural water courses, it was found to be substantially less toxic. Bingham (1982 in U. S. Department of Interior, 1998) reported finding wild, healthy trout in surface waters containing as much as 13 mg B/L. Black et al. (1993, from Moss and Nagpal, 2003) reported a 20-day NOEC (no-observed-effect concentration) of 18 mg B/L as boric acid for rainbow trout embryos. Therefore, the low-level effects observed in reconstituted laboratory water may not accurately predict the much higher first effect levels under natural water exposure conditions.

According to the Agency for Toxic Substances and Disease Registry (U.S. Public Health Service, 1992), it is unlikely that boron is bioconcentrated significantly by organisms in water. Other sources suggest that aquatic environments are not likely to experience boron bioaccumulation or biomagnifications (Wren et al., 1983; Butterwick et al., 1989).

Thompson et al. (1976) found no evidence of active bioaccumulation of boron in sockeye salmon (*Oncorhynchus nerka*) tissues or Pacific oyster (*Crassostrea gigas*).

City Water, Light and Power (CWLP) of Springfield was granted an adjusted stream standard for boron in 1994. The *Technical Support Document for Petition for Adjusted Boron Standards for Sugar Creek and the Sangamon River* (Hanson Engineers Incorporated, March 1994) presented scientific evidence showing no detectable degradation to Sugar Creek receiving discharges having boron levels as high as 18 mg/L (see in the matter of: Petition of the City of Springfield, Office of Public Utilities, for an Adjusted Standard from 35 Illinois Administrative Code 302.208(e), AS94-9.) The CWLP of Springfield study and the above-referenced studies demonstrate the toxicological effects of boron at varying concentrations on the biological community of an aquatic ecosystem. Overall, the results indicate that the Sangamon River biological community would not be observably affected by the anticipated maximum boron concentration of 4.5 mg/L downstream of the initial area of dispersion, or by the maximum boron concentration of 11.0 mg/L in the area of dispersion The Illinois River biological community would not be observably affected by the anticipated maximum boron concentration of 1.3 mg/L.

5.3 Environmental Effects of Current Boron Levels

Characterization of the water and biological quality of the Sangamon River in the Lower Sangamon River watershed is based on the 2006 Illinois Water Quality Report, Intensive Basin Survey results from 1996 and 2003, water quality data from the Ambient Water Quality Monitoring Network (AWQMN) from 1999 to 2004, and water sampling of the Sangamon River conducted in September and October 2007 by Hanson. Based on the water analyses, boron levels in the Lower Sangamon River were generally highest in stream segment E-26 (Riverton), followed by stream segment E-24 (Petersburg), and lowest in stream segment E-25 (Oakford). Boron concentrations in the Sangamon River have ranged from 0.029 mg/L to 2.14 mg/L. Mean concentrations at each station based on the Illinois EPA's AWQMN data were 0.394, 0.269, and 0.141 mg/L at Stations E-26, E-24, and E-25, respectively.

Based on the macroinvertebrate surveys in 1996 and 2003, the stream quality of the Sangamon River fully supports aquatic life use in all stream segments in the Lower Sangamon River watershed. The highest quality MBI score was at Station E-26 (Riverton) in 1996. The stream station upstream of the confluence of the South Fork of the Sangamon River and CWLP's discharges, E-16 at Roby, had a MBI value in 2003 of 6.1 indicating moderate impairment of aquatic life use. Therefore, current boron levels do not appear to be adversely affecting aquatic life in the Lower Sangamon River based on the MBI assessment, especially considering the lower quality score reported for the Roby location.

The results of the fisheries surveys conducted in 1996 and 2003 also do not reflect adverse effects from current boron levels in the Sangamon River. Although Stations E-50 and E-26, which are the closest downstream stations to the CWLP discharges, had the lowest IBIs/RIBIs of the three Lower Sangamon River stations, the IBI/RIBI scores of all three stations reflect fair resource quality, or moderate impairment for aquatic life use. Also, the RIBI reported for Station E-26 (Riverton) in 2003 is not substantially different from the RIBI reported for Station E-16 (Roby) (25 and 27 respectively). To reemphasize, use of the RIBI scores to assess the quality of the Sangamon River is limited since the RIBI was designed for smaller streams in Illinois. Raw IBI scores for all Lower Sangamon River stations were relatively identical in 2003.

The 2003 catfish survey of the Sangamon River by the IDNR determined that channel and flathead catfish populations were robust, especially at the Riverside Park/Riverton section. In light of the Birge and Black (1977) laboratory study which determined that the LC_1 value at 4 days posthatching ranged from 0.2 to 5.5 mg B/L for channel catfish (*Ictalurus punctatus*) fry subjected to varying boron compounds and water hardness concentrations, current boron levels do not appear to be adversely affecting the catfish populations.

5.4 Predicted Effects of the Proposed Site-Specific Boron Standard

To determine the potential for adverse effects of the proposed site-specific boron standard to the aquatic environment of the Sangamon River from the Spring Creek confluence to the Illinois River confluence, the conclusions of previous studies on boron toxicology (as summarized in Section 4.0) and CWLP's previous *Technical Support Document for Petition for Adjusted Boron Standards for Sugar Creek and the Sangamon River* (Hanson Engineers Incorporated, March 1994) were reviewed.

The freshwater fish species most sensitive to boron identified thus far is the rainbow trout (*Oncorhyncus mykiss*), although this cold-water species is not found in the Sangamon River. Initial studies indicated a LOEC of 0.1 mg B/L in reconstituted water (Butterwick et al, 1989; Parks and Edwards, 2005). However, while most laboratory toxicity studies have administered boron compounds using reconstituted water as the experimental medium, subsequent tests using boron in natural waters found that the LOEC for rainbow trout ranged from 1.1 to 1.73 mg B/L (Parks and Edwards, 2005). Other sources have reported that when trout embryo-larval stages were exposed to boron in natural waters, boron was found to be substantially less toxic (Black et al., 1993 in Moss and Nagpal, 2003; Butterwick et al., 1989; Loewengart, 2001).

Butterwick et al. (1989) concluded that early life stages of nonsalmonid fish species appear relatively resistant to aqueous exposure to boron. Species which have been studied and are known to be present in the Sangamon River include the fathead minnow (*Pimeohales promelas*) egg-fry (30-day LOEC of reduction in growth of 24 mg B/L), channel catfish (*Ictalurus punctatus*) embryo-larval stages (9-day LOEC of 1.04 to 25.9 mg B/L), and largemouth bass (*Micropterus salmoides*) eggs (11-day LOEC of 12.17 mg B/L). Again, boron involved with these studies was not administered using natural waters.

The Ministry of Water, Land and Air Protection of British Columbia conducted an exhaustive review of available boron toxicology studies to establish ambient water quality guidelines for boron (Moss and Nagpal, 2003). The report discussed the consistently low concentration toxicity levels found by Birge and Black studies (1977 and 1981, and Black et al., 1993) for a variety of aquatic species, and stated that these results cannot be reproduced by other studies using similar conditions and species. Therefore, the British Columbia researchers considered the Birge and Black studies as outliers and did not consider them in the development of the British Columbia guideline. The British Columbia Ministry of Environment, Lands and Parks (1997 in Moss and Nagpal, 2003) found a LOEL for growth of inhibition on the green algae (*Selenastrum capricornutum*) of 12.3 mg B/L. The Ministry of Water, Land and Air Protection used this concentration with a safety factor of 0.1 to derive the interim guideline for freshwater aquatic life of 1.2 mg/L.

The United States Department of the Interior also conducted an extensive literature review of the biological effects of boron on the aquatic environment in the *Guidelines for Interpretation of the Biological Effects of Selected Constituents in Biota, Water, and Sediment* (USDI, 1998). This report provided tentative predictions of boron effect levels for aquatic plants, aquatic invertebrates, fish, and amphibians. Predictions of no effect to toxicity threshold for these organisms were 0.5 to 10 mg B/L for aquatic plants, 6 to 13 mg B/L for aquatic invertebrates, 5 to 25 mg B/L for fish, and a toxicity threshold of less than 200 mg B/L for amphibians.

The *Technical Support Document for Petition for Adjusted Boron Standards for Sugar Creek and the Sangamon River* (Hanson Engineers Incorporated, 1994) demonstrated that the boron concentrations in the CWLP outfall discharges to Sugar Creek and consequently the South Fork and Sangamon River, which have been receiving outfall discharges as high as 18 mg/L of boron from the CWLP power plant since the 1960s, had no adverse effect on the aquatic communities being exposed to these boron levels. These boron levels, on occasion up to 8 mg/L in Sugar Creek, can be nearly twice as high as the site-specific standard of 4.5 mg/L for the Sangamon River 182 yards downstream of the Spring Creek Plant discharge proposed in this document. The 1994 *Technical Support Document for Petition for Adjusted Boron Standards for Sugar Creek and the Sangamon River* reported that the Sugar Creek Station EOA-01, located just downstream of the CWLP discharges, had MBI value ratings of very good to excellent and fish IBI values similar to Station E-16 of the Sangamon River at Roby, which is located upstream of the South Fork confluence. The overall stream quality of the various sampling locations of the South Fork, Sangamon River, or Sugar Creek did not show any pattern of degradation attributable to boron concentrations.

The predicted maximum boron concentration of 11.0 mg/L in the area of dispersion is not anticipated to adversely affect the aquatic communities in the Sangamon River. During a 7Q10 low flow, the worst case discharge boron concentration of 11.0 mg/L from the Spring Creek Plant is predicted to reach at least 4.5 mg/L within a distance of 182 yards in the Sangamon River. This location of the Sangamon River does not contain known endangered species habitat or important life habitat, intake structures of public or food processing water supplies, points of withdrawal for irrigation, or public access areas. The *Technical Support Document for Petition for Adjusted Boron Standards for Sugar Creek and the Sangamon River* (Hanson Engineers Incorporated, 1994) reported boron concentrations as high as 18 mg/L in the CWLP’s Outfall 003 discharging into Sugar Creek and demonstrated that the Sugar Creek biological community would not be adversely affected at or below a boron concentration of 11.0 mg/L.

Based on the reviews of existing toxicity studies, documents and reports, no adverse effects are anticipated to the biological components of the Sangamon River or the Illinois River as a result of the site-specific standard for boron (up to 11.0 mg/L).

SECTION 6.0

EVALUATION OF WATER TREATMENT ALTERNATIVES

SECTION 6.0
EVALUATION OF WATER TREATMENT ALTERNATIVES

Over the past decade, CWLP has reviewed numerous alternatives to comply with the General Water Quality Standard for boron in wastewater discharged from their Springfield Power Plant. Alternatives applicable to the pretreatment of the FGDS waste stream, expected to have an average flow rate of 187 gpm and a boron concentration of 450 mg/L, are discussed below. It is notable that there are currently no known commercially-demonstrated processes for treating a waste stream with a similar boron concentration.

6.1 Alternate Coal Source

The *Phase II SO_2 Compliance Study Report* (Burns & McDonnell, October 1998) evaluated switching the CWLP coal supply from Illinois coal to Power River Basin (PRB) coal, which is mined in the western United States. PRB coal is low-sulfur, low-boron coal as compared to coal mined in Illinois. The study noted that CWLP does not have any reliable way to receive rail delivered coal to the power plant and that the plant site is not large enough for unit train coal deliveries. However, with major modifications, limited rail unloading could be restored at the Dallman plant for delivery of PRB coals. Under this scenario, the PRB “unit trains” would be delivered to a Springfield railyard and then broken up for delivery to the Dallman plant. Two alternatives to on-site rail delivery were also identified by CWLP during this study. Both alternatives involved unloading the trains at an off-site facility and trucking the coal to the CWLP power plant.

Existing hammer mills would have to be retrofitted to accommodate the finer grade PRB coal and dust control systems would have to be installed. Additionally, truck dump operations would need to be enclosed to reduce dust emissions during unloading operations. CWLP test burns demonstrated the need for the addition of limestone to blend in the coal for use in the cyclone boilers which would require installation of a limestone storage silo and feed system. Further, the Burns & McDonnell study identified 13 areas of concern for operation of existing equipment and systems to burn PRB coal: forced draft fan capacity, induced draft fan capacity, coal feeder capacity, bowl mill capacity, exhauster capacity, coal pipe size, addition of mill inerting systems for prevention of fire and explosion, addition of mill wash nozzles, cyclone modifications, addition of cyclone slag flux agent, addition of a CO_2 inerting system to coal storage bunkers, addition of furnace cleaning lances, and modifications to the ash handling systems.

The Burns & McDonnell evaluation further noted that factors associated with PRB coal combustion such as increased gas flow, elevated precipitator inlet temperature, ash particle size, and fly ash/bottom ash split have significant influence on precipitator performance. It may not be possible for CWLP to achieve continuous air compliance under all operating conditions burning PRB coal in the existing power plant.

After considering the *Phase II SO_2 Compliance Study Report*, CWLP made a decision to add a FGDS to Dallman Units 31 and 32. Factors cited by CWLP in support of this decision:

- Lowest cost long term solution;
- Economic benefits for Springfield and the State of Illinois;
    - Burn Illinois coal
        - 100 coal mine related jobs
        - $10M+ in annual coal sales
    - 200 to 250 construction related jobs
- CWLP has successfully operated and maintained a FGDS on Unit 33 for 19 years;
- Gypsum byproduct sales would be $3,000,000/year; and
- The State of Illinois has budgeted $12.5M in Cost Sharing Funds to benefit Illinois jobs.

Further, CWLP cited the following disadvantages of using PRB Coal:

- Over $10M leaving Illinois annually;
- Shipping delays;
- Major railway modifications;
- Boiler modifications; and
- Concerns about explosive dust.

CWLP's decision to continue to burn Illinois coal is atypical of the utility industry. According to *The Illinois Coal Industry: Report of the Office of Coal Development* (Illinois Department of Commerce and Economic Opportunity, June 2006), although Illinois has an abundance of bituminous coal, only 13.5 percent, or 7.5 million tons, of the coal used by Illinois utilities and industrial users in 2005 was mined in Illinois. Illinois coal is used by the following utilities in Illinois: AmerenEnergy Generating's Coffeen and Meredosia plants, Springfield City Water, Light and Power, Southern Illinois Power Cooperative, and AmerenEnergy Resources' Duck Creek plant. Lower priced, lower-sulfur and lower-boron coals, primarily from the Powder River Basin of Wyoming, continue to make inroads in Midwestern and Eastern power plant markets. Table 6-1 details the tonnage and source of coal used by Illinois Utilities in 2005.

6.2 Dry Ash Systems

Conversion to a dry ash system has been studied by CWLP; however the particular waste stream that is the subject of this technical support document is generated by the air pollution control system and would not be eliminated by modifying the power plant ash handling system. It should however be acknowledged that conversion to a dry ash system could eventually reduce the total boron load to the Sangamon River. The new Dallman Unit 4 will include dry fly ash and bottom ash handling systems.

6.2.1 Dry Fly Ash

Conversion to a dry fly ash system has been considered by CWLP several times for water conservation purposes and for boron mitigation at the ash ponds. The report

TABLE 6-1

TONAGE AND SOURCE OF COAL USED BY ILLINOIS UTILITIES IN 2005

Name of Operating Company and Power Plant	State where Coal Mined	2005 Coal (Thousand Tons)
Ameren Energy Resources Duck Creek	Illinois	869
Ameren Energy Resources Edwards Station	Illinois Wyoming	51 2,810
Ameren Energy Resources Coffeen	Illinois Wyoming	2,274 27
Ameren Energy Resources Hutsonville	Indiana	403
Ameren Energy Resources Meredosia	Illinois Wyoming	149 592
Ameren Energy Resources Newton	Wyoming	4,269
Dynegy Midwest Generation Baldwin	Wyoming	5,900
Dynegy Midwest Generation Havana	Colorado Wyoming	10 1,271
Dynegy Midwest Generation Hennepin	Wyoming	933
Dynegy Midwest Generation Vermillion	Illinois Indiana	15 228
Dynegy Midwest Generation Wood River	Wyoming	1,718
Electric Energy, Inc. Joppa	Wyoming	5,195
Kincaid Generation, LLC Kincaid	Wyoming	4,785
Midwest Generation Joliet 9	Wyoming	1,188
Midwest Generation Crawford	Wyoming	1,530
Midwest Generation Fisk	Wyoming	774
Midwest Generation Joliet 29	Wyoming	2,400
Midwest Generation Powerton	Wyoming Illinois	4,834 29
Midwest Generation Waukegan	Wyoming	2,391
Midwest Generation Will County	Wyoming	2,782
Southern Illinois Power Cooperative Marion	Illinois Wyoming	1,063 242
Springfield City Water, Light and Power Dallman	Illinois	1,116
Springfield City Water, Light and Power Lakeside	Illinois	113

Water Study (Burns and McDonnell, February 2005) estimated that the installed equipment cost of converting all existing Dallman Units to dry fly ash would be $10,200,000. The report noted that the added equipment (ash silos, unloading equipment, dust control, truck traffics) would add significant operating cost to the total plant operating budget. The operating costs include disposal cost for the collected ash which CWLP is not currently paying for. Burns and McDonnell calculated the 2005 net present value of this conversion as $19,500,000. Assuming an interest rate of 8 percent, that equates to a 2008 net present value of $24,500,000 or, considering 66,489 electric services, a cost of $368 per electric service.

6.2.2 Dry Bottom Ash

The report *Water Conservation Study* (Sargent & Lundy, April 2004) investigated the use of a completely dry bottom ash handing system at the CWLP Dallman Power Station. The report noted that the Unit 31 and Unit 32 boilers produce a molten slag, requiring a water impounded tank to quench the slag and form smaller particles for disposal. Therefore, it was concluded that a dry bottom ash system was not feasible for Unit 31 and Units 32 boilers. Technically, a bottom ash system could be used for Unit 33. However, Sargent & Lundy stated in the report that the cost was significant, and the experience with this technology in the United States was limited. Therefore, Sargent & Lundy concluded that a dry bottom ash system for Unit 33 was not feasible. Burns & McDonnell concurred with this opinion in the report *Water Study*, stating that only Dallman Unit 33 is suitable for conversion to dry bottom ash due to existing equipment and space limitations. However it was stated that the cost-benefit ratio of switching Unit 33 to a dry bottom ash system is expected to be unfavorable, and industry experience with this type of system is limited. Thus, switching Unit 33 to dry bottom ash was not considered a favorable option.

6.3 Treatment Alternatives

The report *Water Study* (Burns & McDonnell, February 2005) compared treatment options for the removal of boron from FGDS wastewater. Burns & McDonnell noted that the FGDS wastewater contains extremely high concentrations of dissolved solids (including chlorides) and suspended solids that would make it difficult to use many less-expensive options to remove boron. This is because materials of construction would need to be corrosion resistant; certain processes such as reverse osmosis would have poor recovery due to the limitation on osmotic pressure, and the high suspended solids content would require pretreatment.

Furthermore, according to Burns & McDonnell, due to the high boron concentrations in the wastewater stream, the application of selective media, such as ion exchange resin or activated carbon, would require frequent regeneration or media change-out and would not be a realistic alternative. Also, chemical precipitation or co-precipitation of boron is not expected to be effective because of the relatively low concentration of boron in the wastewater compared to its solubility.

Burns & McDonnell concluded that general total dissolved solids (TDS) methods such as Reverse Osmosis (RO) and mechanical evaporation are the only proven technologies applicable for boron removal for the application at CWLP.

6.3.1 Brine Concentrator followed by Spray Dryer

Brine concentrators are mechanical evaporators that separate and recover water from the wastewater solution. According to Burns & McDonnell, the most commonly used brine concentrators are called falling film seeded slurry brine concentrators and most of these units use a vapor compressor to provide self-sufficient supply of steam to heat up the wastewater slurry. The heated wastewater evaporates and generates steam that is compressed and used for heating up the wastewater slurry again. The slurry is recirculated in a vertically mounted tube bundle (falling film heat exchanger), with the steam on the shell side. Due to the high concentrations of TDS and chlorides, the wetted materials are normally made from high-grade stainless steels and the tubes from titanium. These types of brine concentrators are very expensive. In addition, the vapor compressor and the slurry recirculation pumps consume a significant amount of electricity.

The concentrated bleed from the mechanical evaporator would be fed to a spray dryer where it is completely dried to a solid form for disposal. A typical spray dryer atomizes the wastewater slurry in a drying chamber where hot air containing combusted natural gas is injected. When the hot air meets the atomized wastewater, all the moisture in the slurry is vaporized, leaving behind the solids.

The report *Water Study* (Burns & McDonnell, February 2005) concluded that to accommodate periodic maintenance, and possible variation in the incoming wastewater flow rate, it would be desirable to have dual trains of the brine concentrator/spray dryer units, each designed for 50 percent of the maximum capacity required. The report *Water Study* (Burns & McDonnell, February 2005) presented an opinion that boron removal in FGDS water using a dual train brine concentrators followed by dual train spray dryers had a capital cost of $8,222,000 and an annual operating cost of $798,539.

6.3.2 Reverse Osmosis followed by Crystallizer and Spray Dryer

The report *Water Study* (Burns & McDonnell, February 2005) considered an RO process as an alternative to the first stage treatment with mechanical evaporation to concentrate the wastewater. However, due to the high concentrations of dissolved constituents in the FGDS blowdown stream, high recovery of an RO system is impossible due to the osmotic pressure and the pressure limitation of commercially available RO membranes. Burns & McDonnell concluded that because the FGDS blowdown contains very high concentration of sparingly soluble salts such as calcium (Ca), magnesium (Mg), sulfate, and silica, as well as high suspended solids (gypsum particles), it must be pretreated to reduce or replace those constituents before the water could be treated by an RO system.

An effective treatment to remove hardness (Ca and Mg) from water is a lime/soda softener, where lime and soda ash (also known as sodium carbonate or Na_2CO_3) are added to the water stream. The use of soda ash will add alkalinity necessary for the calcium and magnesium to precipitate. Essentially, the sodium ions (Na) present in the soda ash will replace the calcium and magnesium that is present.

The silica concentration will not be affected by the lime/soda softener as much as the calcium and magnesium. In fact, when concentrated in the RO system at neutral or acid pH, silica concentrations may exceed its solubility and cause a scaling problem on the RO membranes. At neutral or acid pH, boron may crystallize to form boric acid, which is a waxy substance that could also foul up the RO membranes. A high-pH RO system effectively solves this problem. Thus, following the lime soda softener, Burns & McDonnell considered a HERO system (a patented high-pH RO system design) RO system. A HERO is still a RO system, so its recovery is limited by the osmotic pressure.

Due to the limitation of the recovery of the HERO, the size of the crystallizer is much larger and more expensive than the spray dryer included after the brine concentrator. However, the cost of the HERO is generally less than that of a brine concentrator and it consumes less electricity. Compared to the brine concentrator/spray dryer design, the HERO design has some disadvantages. The brine concentrator option is more favorable than the HERO because it involves fewer components to operate. Also, the chemical consumption as well as solids removal (requiring disposal) of the lime/soda softener is significant. Finally, the energy consumption of the crystallizer is much higher that of the spray dryer. The report *Water Study* (Burns & McDonnell, February 2005) presented an opinion that boron removal in FGDS water using a lime/soda softener followed by dual train HERO systems had a capital cost of $6,120,000 and an annual operating cost of $1,118,649.

6.3.3 Electrocoagulation

In response to a request from the Illinois EPA, CWLP commissioned Burns & McDonnell to evaluate boron removal using electrocoagulation (EC). EC is a method of treating wastewater with electricity and sacrificial metal plates to cause contaminants in wastewater to become destabilized and precipitate. The EC reactor consists of metallic electrode plates separated by thin annular spaces. Wastewater in the annular space conducts electricity which dissolves the electrodes. The dissolved metal ions react with contaminants creating precipitates that are removed by filtration. The metal plates can be made from several materials, aluminum representing the most effective material in boron removal.

Contaminant reduction occurs via two mechanisms: flocculation/precipitation and adsorption. Adsorption occurs when contaminants electrostatically adhere to the flocculated solids and are removed along with the precipitates. The adsorption of boron on aluminum flocculants has been reported to be no greater than 20 percent of available boron when adsorption is not inhibited by other contaminants such as chlorides and sulfates, both of which exist in the FGDS wastewater in high concentrations.

Targeting boron specifically for removal by EC in the FGDS wastewater is more difficult because boron is known to exist in at least six pH dependent species in water. The predominant forms are boric acid [H_3BO_3] and borate [$B(OH)_4^-$]. Boric acid predominates at pH ranges below 4, whereas borate predominates at pH ranges above 12. Boric acid is a form that is difficult to remove by most available technologies. FGDS wastewater is in the 6.5 to 7.0 pH range; therefore 50 to 65 percent of the boron will be in the boric acid form.

Additionally, competing reactions from other FGDS wastewater constituents with lower activation energies may dramatically lower boron removal. Several chemical species such as chlorides and sulfates are present in large quantities in the FGD wastewater and have lower activation energies than boron. The aluminum ion would naturally react with these other chemical species before boron.

In their May 18, 2007 letter report evaluating boron removal using EC, Burns & McDonnell presented a capital cost for removal of boron in FGDS wastewater of $9,207,000 and annual operating costs of $14,074,000. Burns & McDonnell concluded that economically, EC is not recommended for FGDS wastewater due to high capital and operating costs relative to low boron removal efficiencies. Additionally these high operating costs are based on assumptions extrapolated from studies performed on wastewaters with characteristics much different the FGDS wastewater. While EC is technically feasible for boron removal from the FGDS wastewater, boron removal efficiency cannot be predicted due to lack of verified boron removal efficiencies in high boron and high TDS wastewaters. Boron removal efficiency is expected to be dramatically decreased from theoretical estimates due to competing reactions in the EC process.

6.3.4 Comparison of Treatment Alternatives

The costs presented for the three treatment alternatives for removal of boron discussed above are shown in Table 6-2. According to the Burns & McDonnell 2005 report *Water Study* and the 2007 letter report evaluating electrocoagulation, capital costs for the three water treatment alternatives for the removal of boron from the FGDS waste stream presented in section 6.2 of this technical support document ranges from $6.1 million to $9.2 million. The annual operating and maintenance cost of these three alternatives ranges from $0.80 million per year to $14 million per year. Assuming a power plant life of 30 years and an interest rate of 8 percent, the present value of the three water treatment alternatives was calculated to range from $22 million to $254 million.

TABLE 6-2

COST OF TREATMENT ALTERNATIVES FOR THE REMOVAL OF BORON

Treatment Process	**Capital Cost[1] ($)**	**Annual O&M[1] ($)**	**Present Value[2] ($)**	**Present Value per Electric Service[3] ($)**
Brine Concentrator followed by Spray Dryer	**8,222,000**	**798,539**	**22,100,000**	**333**
Reverse Osmosis followed by Crystallizer and Spray Dryer	**6,120,000**	**1,118,649**	**25,600,000**	**385**
Electrocoagulation	**9,207,000**	**14,074,000**	**254,000,000**	**3,822**

[1] **Costs from Burns and McDonald reports cited in sections 6.2.1, 6.2.2 and 6.2.3 of this report.**

[2] **Present Value calculated assuming Annual O & M Costs escalate by $40,000/year for the Brine Concentrator; $56,000/year for Reverse Osmosis; and $700,000/year for the Electrocoagulation process. Calculation also assumes power plant life of 30 years and an interest rate of 8 percent.**

[3.] **Cost based on 66,489 electric services (58,443 residential electric customers and 8,046 commercial electric customers)**

6.3.5 Boron Pilot Project

In December 2005, CWLP entered into a contract with Aquatech International Corporation to provide a Zero Liquid Discharge (ZLD) plant for the treatment of FGDS wastewater. The system to be provided consisted of two brine concentrators followed by spray dryers to treat the blowdown form the FDGS system at the power plant. However, as detailed design progressed, it became apparent that the use of a brine concentrator/spray dryer system to treat the FGDS blowdown was a unique application of this technology. The relative inexperience in this application translated into design changes as engineering of the system progressed. Additionally, the original scope of work and the associated cost increased several times. Finally, the costs became too high to proceed with the proposed brine concentrator system. At the time the system was abandoned, the capital cost had risen to $40 million and the annual operating and maintenance cost had risen to $3.7 million. Assuming the annual operation and maintenance cost will escalated by $185,00 per year, a treatment system life of 30 years, and an interest rate of 8 percent, this equates to a present value of $104,500,000 (a present value per electric service of $1,570). The question of how to dispose of large quantities of solid waste generated by the treatment system was never resolved; therefore the cost of waste disposal from the treatment process was not included in the aforementioned present value.

It is interesting to note that in the *Milliken Clean Coal Demonstration Project: A DOE Assessment*, which had a goal of achieving a zero-wastewater discharge, the brine concentration system did not work satisfactorily at any time during the demonstration. Construction of the Milliken Station began in April 1993 and ended in June 1995. Operations were initiated in January 1995 and completed in November 1998. The U.S. Department of Energy (DOE) dubbed the project a success except that the brine concentrator system never became fully operational. It is not surprising that CWLP has struggled with the same problem that the U.S. DOE failed to resolve.

6.4 Pretreatment of Water Proposed for Transfer to SMSD

SMSD has entered into a contract with CWLP to accept the FGDS wastewater stream for a price of $100,000/month provided that acceptance of this wastewater does not upset normal Spring Creek Plant operations. The stream to be pumped to the SMSD Spring Creek Plant from the CWLP facility is expected to have an average flow rate of 187 gpm and a boron concentration of 450 mg/L.

CWLP intends to treat the FGDS waste stream with conventional treatment processes for solids removal prior to pumping the wastewater to the SMSD Spring Creek Plant. Boron tends to associate with small particulate matter; therefore the pretreatment process will attempt to remove particulates from the waste stream. Laboratory jar tests have shown in some instances that up to ten percent of the boron in the wastewater can be removed with solids settling. Unfortunately, the jar test results have not been consistent and therefore, CWLP is not claiming any boron removal for purposes of calculating boron concentrations in this document.

CWLP proposes collecting the FGDS waste stream in a 250,000 gallon influent holding tank. This tank will provide about 22 hours of holding time for the waste stream, anticipated to be approximately 187 gpm. Wastewater collected in the influent holding tank will be fed to a ClariCone^{TM} solids contact clarifier with a 240 gpm capacity.

Operation of the patented ClariCone^{TM} has been demonstrated at over 300 installations nationwide. Mixing, tapered flocculation and sedimentation all take place within a completely hydraulically driven vessel. The ClariCone^{TM} maintains a dense, suspended, rotating slurry blanket that provides solids contact, accelerated floc formation and solids capture. The conically shaped concentrator maximizes the slurry discharge concentration and allows plant personnel to visually monitor slurry discharge. The large mass of retained slurry and unique helical flow pattern in the ClariCone^{TM} prevent short-circuiting and resists process upsets.

Supernatant from the ClariCone^{TM} will be collected in a second 250,000 gallon holding tank and pumped to the SMSD Spring Creek Plant. The pumps to be used for transferring the wastewater from the effluent holding tank to the Spring Creek Plant will be centrifugal with a variable frequency drive. One or more chemical feed system(s) will also be installed, operated and maintained by CWLP at locations immediately after the pretreatment system and/or on the SMSD collection system to mitigate odors and corrosion resulting from the FGDS wastewater.

The estimated capital cost of the pretreatment system including the pipeline to transfer the pretreated FGDS wastewater and chemical feed system(s) to control odor to the SMSD Spring Creek Plant is $15.5 million. The annual operating and maintenance cost, including the monthly payment to SMSD is $1.6 million. Assuming that the monthly payment to SMSD will remain fixed and other annual operating and maintenance costs will escalate by $10,000 per year, a pretreatment system life of 30 years, and an interest rate of 8 percent, this equates to a present value of $36,100,000 (a present value per electric service of $544).

SECTION 7.0

CONCLUSIONS AND RECOMMENDATIONS

SECTION 7.0

CONCLUSIONS AND RECOMMENDATIONS

CWLP and the SMSD are requesting a site-specific water quality standard for boron in the Sangamon River and the Illinois River as a result of proposed discharge from the Springfield Metro Sanitary District (SMSD) Spring Creek Plant. The CWLP power plant in Springfield operates selective catalytic reduction (SCR) air pollution control systems for nitrous oxide removal and flue gas desulfurization systems (FGDS) for sulfur dioxide removal as required by its air operating permit. Apparently, trace ammonia concentration from SCR operation results in increased leaching of boron and/or increased boron solubility in the FGDS effluent water generated during gypsum dewatering. Operation of the air pollution control systems causes elevated concentration of boron in the plant effluent stream that is proposed to be transferred to the SMSD Spring Creek Wastewater Plant. The site-specific standard for boron is necessary to allow CWLP to continue to operate the power plant in compliance with its existing NPDES permit and State and Federal air pollution regulations.

The General Use water quality standard for boron of 1.0 mg/L was established by the Illinois Pollution Control Board for the protection of aquatic life. The standard was based, in part, on boron toxicity to sensitive irrigated crops, such as citrus. This technical support document considers existing water quality data and biological studies that were obtained from several agencies including the Illinois Environmental Protection Agency (Illinois EPA), the Illinois Department of Natural Resources (IDNR) and the Illinois Natural History Survey (INHS). Stream flow information from the Illinois State Water Survey (ISWS) was used to predict boron levels in the Sangamon River. The discussion of possible toxicological effects of boron is based on existing published literature and from studies and technical documents produced for City Water, Light and Power (CWLP) of Springfield and for Central Illinois Light Company (CILCO) of Peoria in support of petitions for adjusted water quality standards for boron and a variance to an adjusted water quality standard for boron.

Four alternatives for complying with the General Use water quality standard for boron were evaluated for the plant effluent stream that is proposed to be transferred to the SMSD Spring Creek Plant. The FGDS waste stream is expected to have a flow rate of 187 gpm and a boron concentration of 450 mg/L. It is notable that there are currently no known commercially-demonstrated processes for treating a waste stream with a similar boron concentration. The least expensive technologically feasible alternative for reducing boron in the FGDS water would require a capital investment of $40 million, annual operating expenses of $3.7 million, and additional costs for infrastructure improvements and waste product disposal. In contrast, lesser costs are associated with CWLP and SMSD’s proposed approach of pretreating the FGDS waste stream with a conventional treatment processes for solids removal prior to pumping the wastewater to the SMSD Spring Creek Plant and seeking a site-specific standard for boron in the Sangamon River. It is estimated that the selected approach has a capital cost of $15.5 million and an annual operating cost of $400,000 in addition to the $100,000 per month that CWLP has agreed to pay SMSD for additional expenses associated with accepting the FGDS waste stream.

CWLP and SMSD propose that the water quality standard for boron set forth in 35 IAC 302.208(g) shall not apply to waters of the state that receive discharge from SMSD Outfall 007 of the Spring Creek Plant located at 3017 North 8th Street, Springfield, Illinois, owned by the Springfield Metro Sanitary District. Boron levels in such waters must meet the water quality standard for boron as set forth below.

1. 11.0 mg/L in an area of dispersion within the Sangamon River from SMSD Outfall 007 to 182 yards downstream from the confluence of Spring Creek with the Sangamon River;

2. 4.5 mg/L from 182 yards downstream of the confluence of Spring Creek with the Sangamon river to the confluence of Salt Creek with the Sangamon River, a distance of 39.0 river miles;

3. 1.6 mg/L from the confluence of Salt Creek with the Sangamon River to the confluence of the Sangamon River with the Illinois River, a distance of 36.1 river miles; and

4. 1.3 mg/L in the Illinois River from the confluence of the Illinois River with the confluence of the Sangamon River to 100 yards downstream of the confluence of the Illinois River with the Sangamon River.

The site-specific boron standard is justified because the current basis for the General Use Water Quality Standard (agricultural irrigation, stock watering, and drinking water) is not relevant to the Sangamon River downstream for the confluence with Spring Creek and, as previously discussed, are unnecessarily stringent for the protection of aquatic life. Based on the reviews of existing toxicity studies, documents and reports, and the previous *Technical Support Document for Petition for Adjusted Boron Standards for Sugar Creek and the Sangamon River* (Hanson Engineers Incorporated, 1994), no adverse effects are anticipated to the aquatic life of the Sangamon River or the Illinois River as a result of the proposed site-specific standard. The CWLP power plant is a critical power supply for Springfield and surrounding communities; the site-specific boron standard would allow the power plant to continue to operate in compliance with its NPDES permit and State and Federal air pollution regulations.

SECTION 8.0

REFERENCES

SECTION 8.0

REFERENCES

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APPENDIX A

SPRING CREEK PLANT NPDES PERMIT

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276, 217-782-3397
JAMES R. THOMPSON CENTER, 100 WEST RANDOLPH, SUITE 11-300, CHICAGO, IL 60601, 312-814-6026
217/782-0610
ROD R. BLAGOJEVICH, GOVERNOR RENEE CIPRIANO, DIRECTOR

JUN 24 2004

Springfield Metro Sanitary District
3017 North 8th Street
Springfield, Illinois 62707

Re: Springfield Metro Sanitary District
Spring Creek STP
NPDES Permit No. IL0021989
Final Permit

Gentlemen:

Attached is the final NPDES Permit for your discharge. The Permit as issued covers discharge limitations, monitoring, and reporting requirements. Failure to meet any portion of the Permit could result in civil and/or criminal penalties. The Illinois Environmental Protection Agency is ready and willing to assist you in interpreting any of the conditions of the Permit as they relate specifically to your discharge.

The Permit as issued is effective as of the date indicated on the first page of the Permit. You have the right to appeal any condition of the Permit to the Illinois Pollution Control Board within a 35 day period following the issuance date.

To assist you in meeting the self-monitoring and reporting requirements of your reissued NPDES permit, a supply of preprinted Discharge Monitoring Report (DMR) forms for your facility is being prepared. These forms will be sent to you prior to the initiation of DMR reporting under the reissued permit. Additional information and instructions will accompany the preprinted DMRs upon their arrival.

Should you have questions concerning the Permit, please contact Pratap Mehra at the telephone number indicated above.

Sincerely,

Alan Keller

Alan Keller, P.E.
Manager, Permit Section
Division of Water Pollution Control

SAK:DJS:PNM:03072901.dlk

Attachment: Final Permit

cc: Records
Compliance Assurance Section
Springfield Region
USEPA

ROCKFORD – 4302 North Main Street, Rockford, IL 61103 – (815) 987-7760 • DES PLAINES – 9511 W. Harrison St., Des Plaines, IL 60016 – (847) 294-4000
ELGIN – 595 South State, Elgin, IL 60123 – (847) 608-3131 • PEORIA – 5415 N. University St., Peoria, IL 61614 – (309) 693-5463
BUREAU OF LAND - PEORIA – 7620 N. University St., Peoria, IL 61614 – (309) 693-5462 • CHAMPAIGN – 2125 South First Street, Champaign, IL 61820 – (217) 278-5800
SPRINGFIELD – 4500 S. Sixth Street Rd., Springfield, IL 62706 – (217) 786-6892 • COLLINSVILLE – 2009 Mall Street, Collinsville, IL 62234 – (618) 346-5120
MARION – 2309 W. Main St., Suite 116, Marion, IL 62959 – (618) 993-7200

NPDES Permit No. IL0021989

Illinois Environmental Protection Agency

Division of Water Pollution Control

1021 North Grand Avenue East

Post Office Box 19276

Springfield, Illinois 62794-9276

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

Reissued (NPDES) Permit

Expiration Date: July 31, 2009

Issue Date: June 24, 2004
Effective Date: August 1, 2004

Name and Address of Permittee:

Springfield Metro Sanitary District
3017 North 8th Street
Springfield, Illinois 62707

Facility Name and Address:

Spring Creek STP
3017 North 8th Street
Springfield, Illinois
(Sangamon County)

Receiving Waters: Sangamon River

In compliance with the provisions of the Illinois Environmental Protection Act, Title 35 of the Ill. Adm. Code, Subtitle C, Chapter I, and the Clean Water Act (CWA), the above-named Permittee is hereby authorized to discharge at the above location to the above-named receiving stream in accordance with the standard conditions and attachments herein.

Permittee is not authorized to discharge after the above expiration date. In order to receive authorization to discharge beyond the expiration date, the Permittee shall submit the proper application as required by the Illinois Environmental Protection Agency (IEPA) not later than 180 days prior to the expiration date.

Alan Keller

Alan Keller, P.E.
Manager, Permit Section
Division of Water Pollution Control

SAK:PNM:03072901.dlk

NPDES Permit No. IL0021989

Effluent Limitations, Monitoring, and Reporting

FINAL

Discharge Number(s) and Name(s): 007 STP Outfall and 012 Tertiary Pond Emergency Spillway Outfall

Load limits computed based on a design average flow (DAF) of 20 MGD (design maximum flow (DMF) of 50 MGD).

Excess flow facilities (if applicable) shall not be utilized until the main treatment facility is receiving its maximum practical flow.

From the effective date of this Permit until the expiration date, the effluent of the above discharge(s) shall be monitored and limited at all times as follows:

	LOAD LIMITS lbs/day DAF (DMF)*			CONCENTRATION LIMITS MG/L				
Parameter	Monthly Average	Weekly Average	Daily Maximum	Monthly Average	Weekly Average	Daily Maximum	Sample Frequency	Sample Type
Flow (MGD)							Continuous	RIT
$CBOD_5$**	1668 (4170)		3336 (8340)	10		20	3 Days/Week	Composite
Suspended Solids	2002 (5004)		4003 (10008)	12		24	3 Days/Week	Composite
Dissolved Oxygen	Shall not be less than 6 mg/L						3 Days/Week	Grab
pH	Shall be in the range of 6 to 9 Standard Units						3 Days/Week	Grab
Fecal Coliform***	Daily Maximum shall not exceed 400 per 100 mL (May through October)						5 Days/Week	Grab
Chlorine Residual***						0.05	5 Days/Week	Grab
Ammonia Nitrogen as (N)								
March	734 (1835)		1685 (4212)	4.4		10.1	5 Days/Week	Composite
Apr,May, Sep, Oct	550 (1376)		1068 (2669)	3.3		6.4	5 Days/Week	Composite
June-August	334 (834)	834 (2085)	1068 (2669)	2.0	5.0	6.4	5 Days/Week	Composite
Nov.-Feb.	1318 (3294)		2402 (6005)	7.9		14.4	5 Days/Week	Composite

*Load limits based on design maximum flow shall apply only when flow exceeds design average flow.
**Carbonaceous BOD_5 ($CBOD_5$) testing shall be in accordance with 40 CFR 136.
***See Special Condition 8.

Flow shall be reported on the Discharge Monitoring Report (DMR) as monthly average and daily maximum.

Fecal Coliform shall be reported on the DMR as daily maximum.

pH shall be reported on the DMR as a minimum and a maximum.

Chlorine Residual shall be reported on DMR as daily maximum.

Dissolved oxygen shall be reported on DMR as minimum.

No combined sewage from clarifiers 2 and 3 shall discharge through Discharge Number 007 except during emergency situations. All flows through Discharge Numbers 007 and 012 shall comply with the requirements on this page.

For Discharge Number 012, the total flow in million gallons shall be reported on the Discharge Monitoring Report (DMR) in the quantity maximum column.

For Discharge Number 012, report the number of days of discharge in the comments section of the DMR.

NPDES Permit No. IL0021989

Effluent Limitations, Monitoring, and Reporting

FINAL

Discharge Number(s) and Name(s): 013 Treated Combined Sewage Outfall (Flows up to 133 MGD)

These flow facilities shall not be utilized until the main treatment facility is receiving its maximum practical flow.

From the effective date of this Permit until the expiration date, the effluent of the above discharge(s) shall be monitored and limited at all times as follows:

Parameter		CONCENTRATION LIMITS mg/L Monthly Average	Sample Frequency	Sample Type
Total Flow (MG)	See Below		Daily When Discharging	Continuous
BOD_5		Report	Daily When Discharging	Grab
Suspended Solids		Report	Daily When Discharging	Grab
Fecal Coliform	Daily Maximum Shall Not Exceed 400 per 100 mL		Daily When Discharging	Grab
pH	Shall be in the range of 6 to 9 Standard Units		Daily When Discharging	Grab
Chlorine Residual		0.75	Daily When Discharging	Grab

Total flow in million gallons shall be reported on the Discharge Monitoring Report (DMR) in the quantity maximum column.

Report the number of days of discharge in the comments section of the DMR.

Fecal Coliform shall be reported on the DMR as daily maximum.

Chlorine Residual shall be reported on the DMR as a monthly average concentration.

pH shall be reported on the DMR as a minimum and a maximum.

BOD_5 and Suspended Solids shall be reported on the DMR as a monthly average concentration.

Influent Monitoring, and Reporting

The influent to the plant shall be monitored as follows:

Parameter	Sample Frequency	Sample Type
Flow (MGD)	Continuous	RIT*
BOD_5	3 Days/Week	Composite
Suspended Solids	3 Days/Week	Composite

*Recording, Indicating, Totalizing

Influent samples shall be taken at a point representative of the Influent.

Flow (MGD) shall be reported on the Discharge Monitoring Report (DMR) as monthly average and daily maximum.

BOD_5 and Suspended Solids shall be reported on the DMR as a monthly average concentration.

NPDES Permit No. IL0021989

Special Conditions

SPECIAL CONDITION 1. This Permit may be modified to include different final effluent limitations or requirements which are consistent with applicable laws, regulations, or judicial orders. The IEPA will public notice the permit modification.

SPECIAL CONDITION 2. The use or operation of this facility shall be by or under the supervision of a Certified Class 1 operator.

SPECIAL CONDITION 3. The IEPA may request in writing submittal of operational information in a specified form and at a required frequency at any time during the effective period of this Permit.

SPECIAL CONDITION 4. The IEPA may request more frequent monitoring by permit modification pursuant to 40 CFR § 122.63 and Without Public Notice in the event of operational, maintenance or other problems resulting in possible effluent deterioration.

SPECIAL CONDITION 5. The effluent, alone or in combination with other sources, shall not cause a violation of any applicable water quality standard outlined in 35 Ill. Adm. Code 302.

SPECIAL CONDITION 6. Samples taken in compliance with the effluent monitoring requirements shall be taken at a point representative of the discharge, but prior to entry into the receiving stream.

SPECIAL CONDITION 7. This Permit may be modified to include requirements for the Permittee on a continuing basis to evaluate and detail its efforts to effectively control sources of infiltration and inflow into the sewer system and to submit reports to the IEPA if necessary.

SPECIAL CONDITION 8. Fecal Coliform limits for discharge point 007 are effective May thru October. Sampling of Fecal Coliform is only required during this time period.

The total residual chlorine limit is applicable at all times. If the Permittee is chlorinating for any purpose during the months of November through April, sampling is required on a daily grab basis. Sampling frequency for the months of May through October shall be as indicated on effluent limitations, monitoring and reporting page of this Permit.

SPECIAL CONDITION 9.

A. Publicly Owned Treatment Works (POTW) Pretreatment Program General Provisions

1. The Permittee shall implement and enforce its approved Pretreatment Program which was approved on October 23, 1985 and all approved subsequent modifications thereto. The Permittee shall maintain legal authority adequate to fully implement the Pretreatment Program in compliance with Federal (40 CFR 403), State, and local laws. The Permittee shall:

    a. Carry out independent inspection and monitoring procedures at least once per year, which will determine whether each significant industrial user (SIU) is in compliance with applicable pretreatment standards;

    b. Perform an evaluation, at least once every two (2) years, to determine whether each SIU needs a slug control plan. If needed, the SIU slug control plan shall include the items specified in 40 CFR § 403.8 (f)(2)(v);

    c. Update its inventory of Industrial Users (IUs) at least annually and as needed to ensure that all SIUs are properly identified, characterized, and categorized;

    d. Receive and review self monitoring and other IU reports to determine compliance with all pretreatment standards and requirements, and obtain appropriate remedies for noncompliance by any IU with any pretreatment standard and/or requirement;

    e. Investigate instances of noncompliance, collect and analyze samples, and compile other information with sufficient care as to produce evidence admissible in enforcement proceedings, including judicial action;

    f. Require development, as necessary, of compliance schedules by each industrial user for the installation of control technologies to meet applicable pretreatment standards; and,

    g. Maintain an adequate revenue structure for continued operation of the Pretreatment Program.

2 The Permittee shall issue/reissue permits or equivalent control mechanisms to all SIUs prior to expiration of existing permits or prior to commencement of discharge in the case of new discharges. The permits at a minimum shall include the elements listed in 40 CFR § 403.8(f)(1)(iii).

Special Conditions

3. The Permittee shall develop, maintain, and enforce, as necessary, local limits to implement the prohibitions in 40 CFR § 403.5 which prohibit the introduction of specific pollutants to the waste treatment system from any source of nondomestic discharge.

4. In addition to the general limitations expressed in Paragraph 3 above, applicable pretreatment standards must be met by all industrial users of the POTW. These limitations include specific standards for certain industrial categories as determined by Section 307(b) and (c) of the Clean Water Act, State limits, or local limits, whichever are more stringent.

5. The USEPA and IEPA individually retain the right to take legal action against any industrial user and/or the POTW for those cases where an industrial user has failed to meet an applicable pretreatment standard by the deadline date regardless of whether or not such failure has resulted in a permit violation.

6. The Permittee shall establish agreements with all contributing jurisdictions, as necessary, to enable it to fulfill its requirements with respect to all IUs discharging to its system.

7. Unless already completed, the Permittee shall within six (6) months of the effective date of this Permit submit to USEPA and IEPA a proposal to modify and update its approved Pretreatment Program to incorporate Federal revisions to the general pretreatment regulations. The proposal shall include all changes to the approved program and the sewer use ordinance which are necessary to incorporate the regulations commonly referred to as PIRT and DSS, which were effective November 16, 1988 and August 23, 1990, respectively. This includes the development of an Enforcement Response Plan (ERP) and a technical re-evaluation of the Permittee's local limits.

8. The Permittee's Pretreatment Program has been modified to incorporate a Pretreatment Program Amendment approved on October 1, 1996. The amendment became effective on the date of approval and is a fully enforceable provision of your Pretreatment Program.

   Modifications of your Pretreatment Program shall be submitted in accordance with 40 CFR § 403.18, which established conditions for substantial and nonsubstantial modifications.

B. Reporting and Records Requirements

1. The Permittee shall provide an annual report briefly describing the permittee's pretreatment program activities over the previous calendar year. Permittees who operate multiple plants may provide a single report providing all plant-specific reporting requirements are met. Such report shall be submitted no later than April 28 of each year, and shall be in the format set forth in IEPA's POTW Pretreatment Report Package which contains information regarding:

   a. An updated listing of the Permittee's industrial users.

   b. A descriptive summary of the compliance activities including numbers of any major enforcement actions, (i.e., administrative orders, penalties, civil actions, etc.), and the outcome of those actions. This includes an assessment of the compliance status of the Permittee's industrial users and the effectiveness of the Permittee's Pretreatment Program in meeting its needs and objectives.

   c. A description of all substantive changes made to the Permittee's Pretreatment Program. Changes which are "substantial modifications" as described in 40 CFR § 403.18(c) must receive prior approval from the Approval Authority.

   d. Results of sampling and analysis of POTW influent, effluent, and sludge.

   e. A summary of the findings from the priority pollutants sampling. As sufficient data becomes available the IEPA may modify this Permit to incorporate additional requirements relating to the evaluation, establishment, and enforcement of local limits for organic pollutants. Any permit modification is subject to formal due process procedures pursuant to State and Federal law and regulation. Upon a determination that an organic pollutant is present that causes interference or pass through, the Permittee shall establish local limits as required by 40 CFR § 403.5(c).

2. The Permittee shall maintain all pretreatment data and records for a minimum of three (3) years. This period shall be extended during the course of unresolved litigation or when requested by the IEPA or the Regional Administrator of USEPA. Records shall be available to USEPA and the IEPA upon request.

Special Conditions

3. The Permittee shall establish public participation requirements of 40 CFR 25 in implementation of its Pretreatment Program. The Permittee shall at least annually, publish the names of all IU's which were in significant noncompliance (SNC), as defined by 40 CFR § 403.8(f)(2)(vii), in the largest daily paper in the municipality in which the POTW is located or based on any more restrictive definition of SNC that the POTW may be using.

4. The Permittee shall provide written notification to the Deputy Counsel for the Division of Water Pollution Control, IEPA, 1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois 62794-9276 within five (5) days of receiving notice that any Industrial User of its sewage treatment plant is appealing to the Circuit Court any condition imposed by the Permittee in any permit issued to the Industrial User by Permittee. A copy of the Industrial User's appeal and all other pleadings filed by all parties shall be mailed to the Deputy Counsel within five (5) days of the pleadings being filed in Circuit Court.

C. Monitoring Requirements

1 The Permittee shall monitor its influent, effluent and sludge and report concentrations of the following parameters on monitoring report forms provided by the IEPA and include them in its annual report. Samples shall be taken at annual intervals at the indicated detection limit or better and consist of a 24-hour composite unless otherwise specified below. Sludge samples shall be taken of final sludge and consist of a grab sample reported on a dry weight basis.

STORET CODE	PARAMETER	Minimum detection limit
01097	Antimony	0.07 mg/L
01002	Arsenic	0.05 mg/L
01007	Barium	0.5 mg/L
01012	Beryllium	0.005 mg/L
01027	Cadmium	0.001 mg/L
01032	*Chromium (hex - grab not to exceed 24 hours)	0.01 mg/L
01034	Chromium (total)	0.05 mg/L
01042	Copper	0.005 mg/L
00718	Cyanide (grab) (weak acid dissociable)	10.0 ug/L
00720	Cyanide (grab) (total)	10.0 ug/L
00951	*Fluoride	0.1 mg/L
01045	Iron (total)	0.5 mg/L
01046	*Iron (Dissolved)	0.5 mg/L
01051	Lead	0.05 mg/L
01055	Manganese	0.5 mg/L
71900	Mercury	0.2 ug/L
01067	Nickel	0.005 mg/L
00556	*Oil (hexane soluble or equivalent) (Grab Sample only)	1.0 mg/L
32730	Phenols (grab)	0.005 mg/L
01147	Selenium	0.002 mg/L
01077	Silver (total)	0.003 mg/L
01059	Thallium	0.3 mg/L
01092	Zinc	0.025 mg/L

*(Influent and effluent only)

Unless otherwise indicated, concentrations refer to the total amount of the constituent present in all phases, whether solid, suspended or dissolved, elemental or combined including all oxidation states. Where constituents are commonly measured as other than total, the phase is so indicated.

2. The Permittee shall conduct an analysis for the one hundred and ten (110) organic priority pollutants identified in 40 CFR 122 Appendix D, Table II as amended. This monitoring shall be done annually and reported on monitoring report forms provided by the IEPA and shall consist of the following:

a. The influent and effluent shall be sampled and analyzed for the one hundred and ten (110) organic priority pollutants. The sampling shall be done during a day when industrial discharges are expected to be occurring at normal to maximum levels.

Samples for the analysis of acid and base/neutral extractable compounds shall be 24-hour composites.

Special Conditions

Five (5) grab samples shall be collected each monitoring day to be analyzed for volatile organic compounds. A single analysis for volatile pollutants (Method 624) may be run for each monitoring day by compositing equal volumes of each grab sample directly in the GC purge and trap apparatus in the laboratory, with no less than one (1) mL of each grab included in the composite.

Wastewater samples must be handled, prepared, and analyzed by GC/MS in accordance with USEPA Methods 624 and 625 of 40 CFR 136 as amended.

b. The sludge shall be sampled and analyzed for the one hundred and ten (110) organic priority pollutants. A sludge sample shall be collected concurrent with a wastewater sample and taken as final sludge.

Sampling and analysis shall conform to USEPA Methods 624 and 625 unless an alternate method has been approved by IEPA.

c. Sample collection, preservation and storage shall conform to approved USEPA procedures and requirements.

3. In addition, the Permittee shall monitor any new toxic substances as defined by the Clean Water Act, as amended, following notification by the IEPA.

4. Permittee shall report any noncompliance with effluent or water quality standards in accordance with Standard Condition 12(e) of this Permit.

5. Analytical detection limits shall be in accordance with 40 CFR 136. Minimum detection limits for sludge analyses shall be in accordance with 40 CFR 503.

SPECIAL CONDITION 10. The Permittee has undergone a Monitoring Reduction review and the influent and effluent sample frequency was reduced for BOD_5, $CBOD_5$, Suspended Solids and pH due to sustained compliance. The IEPA will require that the influent and effluent sampling frequency for these parameters be increased to 5 Days/Week if effluent deterioration occurs due to increased wasteload, operational, maintenance or other problems. The increased monitoring will be required Without Public Notice when a permit modification is received by the Permittee from the IEPA.

SPECIAL CONDITION 11. During January of each year the Permittee shall submit annual fiscal data regarding sewerage system operations to the Illinois Environmental Protection Agency/Division of Water Pollution Control/Compliance Assurance Section. The Permittee may use any fiscal year period provided the period ends within twelve (12) months of the submission date.

Submission shall be on forms provided by IEPA titled "Fiscal Report Form For NPDES Permittees".

SPECIAL CONDITION 12. The Permittee shall conduct biomonitoring of the effluent from Discharge Number 007.

Biomonitoring

1. Acute Toxicity - Standard definitive acute toxicity tests shall be run on at least two trophic levels of aquatic species (fish, invertebrate) representative of the aquatic community of the receiving stream. Testing must be consistent with Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms (Fifth Ed.) EPA/821-R-02-012. Unless substitute tests are pre-approved; the following tests are required:

   a. Fish - 96 hour static LC_{50} Bioassay using fathead minnows (Pimephales promelas).

   b. Invertebrate 48-hour static LC_{50} Bioassay using Ceriodaphnia.

2. Testing Frequency - The above tests shall be conducted using 24-hour composite samples unless otherwise authorized by the IEPA. Samples must be collected in the 18th, 15th, 12th, and 9th month prior to the expiration date of this Permit.

3. Reporting - Results shall be reported according to EPA/821-R-02-012, Section 12, Report Preparation, and shall be submitted to IEPA, Bureau of Water, Compliance Assurance Section within one week of receipt from the laboratory. Reports are due to the IEPA no later than the 16th, 13th, 10th, and 7th month prior to the expiration date of this Permit.

Special Conditions

4 Toxicity Reduction Evaluation - Should the results of the biomonitoring program identify toxicity, the IEPA may require that the Permittee prepare a plan for toxicity reduction evaluation and identification. This plan shall be developed in accordance with Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants, EPA/833B-99/002, and shall include an evaluation to determine which chemicals have a potential for being discharged in the plant wastewater, a monitoring program to determine their presence or absence and to identify other compounds which are not being removed by treatment, and other measures as appropriate. The Permittee shall submit to the IEPA its plan for toxicity reduction evaluation within ninety (90) days following notification by the IEPA. The Permittee shall implement the plan within ninety (90) days or other such date as contained in a notification letter received from the IEPA.

The IEPA may modify this Permit during its term to incorporate additional requirements or limitations based on the results of the biomonitoring. In addition, after review of the monitoring results, the IEPA may modify this Permit to include numerical limitations for specific toxic pollutants. Modifications under this condition shall follow public notice and opportunity for hearing.

SPECIAL CONDITION 13. For the duration of this Permit, the Permittee shall determine the quantity of sludge produced by the treatment facility in dry tons or gallons with average percent total solids analysis. The Permittee shall maintain adequate records of the quantities of sludge produced and have said records available for IEPA inspection. The Permittee shall submit to the IEPA, at a minimum, a semi-annual summary report of the quantities of sludge generated and disposed of, in units of dry tons or gallons (average total percent solids) by different disposal methods including but not limited to application on farmland, application on reclamation land, landfilling, public distribution, dedicated land disposal, sod farms, storage lagoons or any other specified disposal method. Said reports shall be submitted to the IEPA by January 31 and July 31 of each year reporting the preceding January thru June and July thru December interval of sludge disposal operations.

Duty to Mitigate. The Permittee shall take all reasonable steps to minimize any sludge use or disposal in violation of this Permit.

Sludge monitoring must be conducted according to test procedures approved under 40 CFR 136 unless otherwise specified in 40 CFR 503, unless other test procedures have been specified in this Permit.

Planned Changes. The Permittee shall give notice to the IEPA on the semi-annual report of any changes in sludge use and disposal.

The Permittee shall retain records of all sludge monitoring, and reports required by the Sludge Permit as referenced in Standard Condition 23 for a period of at least five (5) years from the date of this Permit.

If the Permittee monitors any pollutant more frequently than required by the Sludge Permit, the results of this monitoring shall be included in the reporting of data submitted to the IEPA.

Monitoring reports for sludge shall be reported on the form titled "Sludge Management Reports" to the following address:

Illinois Environmental Protection Agency
Bureau of Water
Compliance Assurance Section
Mail Code #19
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

SPECIAL CONDITION 14.

AUTHORIZATION OF
COMBINED SEWER AND TREATMENT PLANT DISCHARGES

The IEPA has determined that at least a portion of the collection system consists of combined sewers. References to the collection system and the sewer system refer only to those parts of the system which are owned and operated by the Permittee unless otherwise indiacted. The Permittee is authorized to discharge from the overflow(s)/bypass(es) listed below provided the diversion structure is located on a combined sewer and the following terms and conditions are met:

Special Conditions

Discharge Number	Location	Receiving Water
001	Oak Knolls CSO	Spring Creek
002	Amos Branch CSO	Town Branch
003	Town Branch CSO	Spring Creek
004	Bond and Patton	Spring Creek
005	Oak Ridge CSO	Spring Creek
006	Fairgrounds CSO	Spring Creek

Treatment Requirements

1. All combined sewer overflows and treatment plant bypasses shall be given sufficient treatment to prevent pollution and the violation of applicable water quality standards. Sufficient treatment shall consist of the following:

   a. All dry weather flows, and the first flush of storm flows shall meet all applicable effluent standards and the effluent limitations as required for the main STP outfall;

   b. Additional flows, but not less than ten times the average dry weather flow for the design year, shall receive a minimum of primary treatment and disinfection with adequate retention time; and,

   c. Additional flows, shall be treated to the extent necessary to comply with applicable water quality standards and the federal Clean Water Act, including the amendments pursuant to the Wet Weather Water Quality Act of 2000.

2. All CSO discharges authorized by this Permit shall be treated, in whole or in part, to the extent necessary to prevent accumulations of sludge deposits, floating debris and solids in accordance with 35 Ill. Adm. Code 302.203 and to prevent depression of oxygen levels.

3. Overflows during dry weather are prohibited. Dry weather overflows, if discovered, shall be reported to the IEPA pursuant to Standard Condition 12(e) of this Permit (24 hour notice).

4. The collection system shall be operated to optimize transport of wastewater flows and to minimize CSO discharges.

5. The treatment system shall be operated to maximize treatment of wastewater flows.

Nine Minimum Controls

6. The Permittee shall comply with the nine minimum controls contained in the National CSO Control Policy published in the Federal Register on April 19, 1994. The nine minimum controls are:

   a. Proper operation and maintenance programs for the sewer system and the CSOs (Compliance with this Item shall be met through the requirements imposed by Paragraph 8 of this Special Condition);

   b. Maximum use of the collection system for storage (Compliance with this Item shall be met through the requirements Imposed by Paragraphs 4, 5, and 8 of this Special Condition);

   c. Review and modification of pretreatment requirements to assure CSO impacts are minimized (Compliance with this Item shall be met through the requirements imposed by Paragraph 9 of this Special Condition);

   d. Maximization of flow to the POTW for treatment (Compliance with this Item shall be met through the requirements imposed by Paragraphs 4, 5, and 8 of this Special Condition);

   e. Prohibition of CSO's during dry weather (Compliance with this Item shall be met through the requirements imposed by Paragraph 3 of this Special Condition);

   f. Control of solids and floatable materials in CSO's (Compliance with this Item shall be met through the requirements imposed by Paragraphs 2 and 8 of this Special Condition);

   g. Pollution prevention programs which focus on source control activities (Compliance with this Item shall be met through the requirements imposed by Paragraph 6 of this Special Condition, **See Below**);

h. Public notification to ensure that citizens receive adequate information regarding CSO occurrences and CSO impacts (Compliance with this Item has been met through the inclusion of the public notice requirements associated with the issuance of this Permit and,

i. Monitoring to characterize impacts and efficiency of CSO controls (Compliance with this Item shall be met through the requirements imposed by Paragraphs 10 and 11 of this Special Condition).

A pollution prevention plan was approved by the IEPA for this collection/treatment system on May 2, 1997. The pollution prevention plan shall be reviewed and revised, if necessary, and presented to the general public at a public information meeting conducted by the Permittee within nine (9) months of the effective date of this Permit. The Permittee shall submit documentation that the pollution prevention plan complies with the requirements of this Permit and that the public information meeting was held. Such documentation shall be submitted to the IEPA within twelve (12) months of the effective date of this Permit and shall include a summary of all significant issues raised by the public, the Permittee's response to each issue, and two (2) copies of the "Pollution Prevention Plan Certification", one (1) with original signatures. Following the public meeting, the Permittee shall implement the pollution prevention plan within one (1) year and shall maintain a current pollution prevention plan, updated to reflect system modifications, on file at the sewage treatment works or other acceptable location and made available to the public. The pollution prevention plan shall be submitted to the IEPA upon written request.

Sensitive Area Considerations

7. Sensitive areas are any water in the immediate area of the discharge point designated as an Outstanding National Resource Water, found to contain either shellfish beds or threatened or endangered aquatic species or their habitat, used for primary contact recreation, or within the protection area for a drinking water intake structure.

The IEPA has determined that none of the outfalls listed in this Special Condition discharge to sensitive areas. However, this Permit may be reopened and modified, with Public Notice, to include additional CSO controls for these outfalls if information becomes available that causes the IEPA to reverse this determination and/or to include a schedule for relocating, controlling, or treating CSO flows to sensitive areas. If none of these are possible, the Permittee shall submit adequate justification at that time as to why these are not possible. Such justification shall be in accordance with Section II.C.3 of the National CSO Control Policy.

Operational and Maintenance Plans

8. The IEPA received a resubmittal of a CSO operational and maintenance plan ("CSO O&M plan") for this sewerage system on February 9, 1996. The Permittee shall review and revise, if needed, the CSO O&M plan to reflect system changes and any comments previously sent to the Permittee by the IEPA. The CSO O&M plan shall be presented to the general public at a public information meeting conducted by the Permittee within nine (9) months of the effective date of this Permit. The Permittee shall submit documentation that the public information meeting was held within twelve (12) months of the effective date of this Permit. Such submittal shall be submitted to the IEPA within twelve (12) months of the effective date of this Permit and shall include a summary of all significant issues raised by the public, the Permittee's response to each issue, and two (2) copies of the "CSO Operational Plan Checklist and Certification", one (1) with original signatures. Following the public meeting, the Permittee shall implement the CSO O&M plan within one (1) year and shall maintain a current CSO O&M plan, updated to reflect system modifications, on file at the sewage treatment works or other acceptable location and made available to the public. The CSO O&M plan shall be submitted to the IEPA upon written request.

The objectives of the CSO O&M plan are to reduce the total loading of pollutants entering the receiving stream and to ensure that the Permittee ultimately achieves compliance with water quality standards. These plans, tailored to the local governments's collection and waste treatment systems, shall include mechanisms and specific procedures where applicable to ensure:

a. Collection system inspection on a scheduled basis;

b. Sewer, catch basin, and regulator cleaning and maintenance on a scheduled basis;

c. Inspections are made and preventive maintenance is performed on all pump/lift stations;

d. Collection system replacement, where necessary;

e. Detection and elimination of illegal connections;

f. Detection, prevention, and elimination of dry weather overflows;

g. The collection system is operated to maximize storage capacity and the combined sewer portions of the collection system are operated to delay storm entry into the system; and,

h. The treatment and collection systems are operated to maximize treatment.

Sewer Use Ordinances

9. The Permittee, within six (6) months of the effective date of this Permit, shall review and where necessary, modify its existing sewer use ordinance to ensure it contains provisions addressing the conditions below. If no ordinance exists, such ordinance shall be developed and implemented within six (6) months from the effective date of this Permit. Sewer use ordinances are to contain specific provisions to:

   a. prohibit introduction of new inflow sources to the sanitary sewer system;

   b. require that new construction tributary to the combined sewer system be designed to minimize and/or delay inflow contribution to the combined sewer system;

   c. require that inflow sources on the combined sewer system be connected to a storm sewer, within a reasonable period of time, if a storm sewer becomes available;

   d. provide that any new building domestic waste connection shall be distinct from the building inflow connection, to facilitate disconnection if a storm sewer becomes available;

   e. assure that CSO impacts from non-domestic sources are minimized by determining which non-domestic discharges, if any, are tributary to CSO's and reviewing, and, if necessary, modifying the sewer use ordinance to control pollutants in these discharges; and,

   f. ensure that all publicly owned systems with combined sewers tributary to the Permittee's collection system have procedures in place adequate to ensure that the objectives, mechanisms, and specific procedures given in Paragraph 10 of this Special Condition are achieved.

   Upon completion of the review of the sewer use ordinance(s), the Permittee shall submit two (2) copies of a completed Certification of Sewer Use Ordinance Review with original signatures. The Permittee shall submit copies of the sewer use ordinance(s) to the IEPA upon written request.

   The Permittee shall enforce the applicable sewer use ordinances.

Long-Term Control Planning and Compliance with Water Quality Standards

10. a. Pursuant to Section 301 of the federal Clean Water Act, 33 U.S.C. § 1311, and 40 CFR § 122.4, discharges from the CSOs, including the outfalls listed in this Special Condition and any other outfall in this Permit listed as a "Treated Combined Sewage Outfall", shall not cause or contribute to violations of applicable water quality standards or cause use impairment in the receiving waters. In addition, discharges from CSOs shall meet all applicable requirements of 35 Ill. Adm. Code 306.305(a), (b), (c) and (d).

   b. Based on available information, it appears that the CSOs authorized in this Permit do not have a reasonable potential to cause or contribute to violations of applicable water quality standards or to cause use impairment in the receiving waters. However, should information causing the IEPA to reverse this conclusion become available, the IEPA will notify the Permittee in writing. The Permittee shall develop and implement a CSO Control Plan for assuring that the discharges from all CSOs (treated or untreated) authorized in this Permit comply with 10.a above, including the following steps:

      1. The Permittee shall develop and submit a Plan of Study ("POS") for CSO Assessment within six (6) months from the effective date of this Permit. Such POS shall incorporate the provisions of Title 35, Subtitle C, Chapter II, Part 375, Subpart D and shall include provisions to determine what percentage of the first flush for a 1.2 inch storm with a one hour duration is currently being treated by the Permittee. The POS shall also contain provisions to measure compliance with 35 Ill. Adm. Code 306.305(b) and to demonstrate compliance with water quality standards pursuant to the "demonstration approach" under Section II.C.4.b of the federal CSO Control Plan of 1994.

Special Conditions

2. The Permittee shall respond to an IEPA review letter in writing within ninety (90) days of the date of such an initial review letter, within thirty (30) days of any subsequent review letter(s), if any, and shall implement the POS and submit a CSO Assessment Report within eighteen (18) months of IEPA approval for the POS or by such date as indicated in the IEPA approval letter for the POS.

3. If the CSO Assessment Report indicates that the discharges from all CSOs (treated or untreated) authorized in this Permit fully comply with all applicable requirements of 35 Ill. Adm. Code 306.305(a), (b), (c), and (d), and do not cause or contribute to violations of water quality standards (including recreational uses), IEPA may make a determination that no additional CSO control is required.

4. If the IEPA determines that additional CSO controls are required, the Permittee will be notified in writing and shall complete a CSO Control Plan for complying with such regulations and bringing flows from all its CSOs (treated and untreated) into compliance with applicable standards, including water quality standards. Two (2) copies of this plan shall be submitted to the IEPA within twelve (12) months of the date of notification by the IEPA that additional CSO controls are necessary and shall contain a schedule for its implementation and provisions for re-evaluating compliance with applicable standards and regulations after implementation. The control plan shall be consistent with the "demonstration approach" under Section II.C.4.b of the federal CSO Control Policy of 1994.

   Required components of the LTCP include the following:

   a. Characterization, monitoring, and modeling of the Combined Sewer System (CSS);
   b. Consideration of Sensitive Areas;
   c. Evaluation of alternatives;
   d. Cost/Performance considerations;
   e. Revised CSO Operational Plan;
   f. Maximizing treatment at the treatment plant;
   g. Implementation schedule;
   h. Post-Construction compliance monitoring program; and
   i. Public participation.

Monitoring, Reporting and Notification Requirements

11. The Permittee shall monitor the frequency of discharge (number of discharges per month) and estimate the duration (in hours) of each discharge from each outfall listed in this Special Condition. Estimates of storm duration and total rainfall shall be provided for each storm event.

    For frequency reporting, all discharges from the same storm, or occurring within 24 hours, shall be reported as one. The date that a discharge commences shall be recorded for each outfall. Reports shall be in the form specified by the IEPA and on forms provided by the IEPA. These forms shall be submitted to the IEPA monthly with the DMRs and covering the same reporting period as the DMRs. Parameters (other than flow frequency), if required in this Permit, shall be sampled and reported as indicated in the transmittal letter for such report forms.

12. A public notification program in accordance with Section II.B.8 of the federal CSO Control Policy of 1994 shall be developed employing a process that actively informs the affected public. The program shall include at a minimum public notification of CSO occurrences and CSO impacts, with consideration given to including mass media and/or internet notification. The Permittee shall also consider posting signs in waters likely to be impacted by CSO discharges and at points where these waters are used for primary contact recreation. Provisions shall be made to include modifications of the program when necessary and notification to any additional affected public. The program shall be presented to the general public at a public information meeting conducted by the Permittee. The Permittee shall conduct the public information meeting within nine (9) months from the effective date of this Permit. The Permittee shall submit documentation that the public information meeting was held, shall submit a summary of all significant issues raised by the public and the Permittee's response to each issue, two (2) copies of the public notification program, and shall identify any modifications made to the program as a result of the public information meeting. The public information meeting documentation shall be submitted to the IEPA within twelve (12) months of the effective date of this Permit. The Permittee shall implement the public notification program within twelve (12) months of the effective date of this Permit.

13. If any of the CSO discharge points listed in this Special Condition are eliminated, or if additional CSO discharge points, not listed in this Special Condition, are discovered, the Permittee shall notify the IEPA in writing within one (1) month of the respective outfall elimination or discovery. Such notification shall be in the form of a request for the appropriate modification of this NPDES Permit.

Special Conditions

Summary of Compliance Dates in this CSO Special Condition

14. The following summarizes the dates that submittals contained in this Special Condition are due at the IEPA:

Submission of CSO Monitoring Data (Paragraph 11)	15th of every month
Elimination of a CSO or Discovery of Additional CSO locations (Paragraph 12)	1 month from discovery or elimination
Control (or Justification for No Control) of CSO's to Sensitive Areas (Paragraph 7)	3 months from date of IEPA Notification
Certification of Sewer Use Ordinance Review (Paragraph 9)	6 months from the effective date of this Permit
CSO Assessment POS (Paragraph 10)	6 months from the effective date of this Permit
Conduct Pollution Prevention, OMP, and PN Public Information Meeting (Paragraphs 6, 8 and 12) **No Submittal Due with this Milestone**	9 months from the effective date of this Permit
Submit Pollution Prevention Public, OMP, and PN Information Meeting Summary (Paragraphs 6, 8 and 12)	12 months from the effective date of this Permit
CSO Control Plan (Paragraph 10)	12 months from the date of IEPA notification
Submit CSO Assessment (Paragraph 10)	18 months from the date of IEPA POS approval

All submittals listed in this paragraph shall be mailed to the following address:

Illinois Environmental Protection Agency
Division of Water Pollution Control
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

Attention: CSO Coordinator, Compliance Assurance Section

All submittals hand carried shall be delivered to 1021 North Grand Avenue East.

Reopening and Modifying this Permit

15. The IEPA may initiate a modification for this Permit at any time to include requirements and compliance dates which have been submitted in writing by the Permittee and approved by the IEPA, or other requirements and dates which are necessary to carry the provisions of the Illinois Environmental Protection Act, the Clean Water Act, or regulations promulgated under those Acts. Public Notice of such modifications and opportunity for public hearing shall be provided.

SPECIAL CONDITION 15. To the extent different requirements are imposed by the Permittee's approved pretreatment program and this Permit, the stricker requirements shall be applicable.

SPECIAL CONDITION 16. The Permittee shall prepare a preliminary plan for biomonitoring and submit the plan to IEPA for review and approval within ninety (90) days of the effective date of this Permit. The Permittee shall begin biomonitoring of the effluent discharge within ninety (90) days after approval of the biomonitoring plan or other such date as contained in the IEPA's notification letter.

Biomonitoring

1. Acute Toxicity - Standard definitive acute toxicity tests shall be run on at least two (2) trophic levels of aquatic species (fish, invertebrate) representative of the aquatic community of the receiving stream. Testing must be consistent with Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms (Fifth Ed.) EPA-821-R-02-012. Results shall be reported in accordance with Section 12. Unless substitute tests are pre-approved; the following tests are required:

a. Fish - 96 hour static or static renewal LC_{50} Bioassay using 1- to 14-day old fathead minnows (Pimephales promelas).

b. Invertebrate 48-hour static LC_{50} Bioassay using Ceriodaphnia.

2. Testing Frequency - The above tests shall be conducted on a monthly basis for six (6) months within ninety (90) days following approval of the biomonitoring plan or other such date as contained in the IEPA's notification (approval) letter. Tests shall be performed using 24-hour composite effluent samples unless otherwise authorized by the IEPA. Results shall be submitted to IEPA within one (1) week of becoming available to the Permittee.

   Should the results of two (2) months of sampling indicate toxicity for each month, the Permittee may wish to contact the IEPA to request the discontinuance of further sampling at which time the IEPA may require the Permittee to begin the toxicity reduction evaluation and identification as outlined below.

3. Toxicity Assessment - Should the review of the results of the biomonitoring program identify toxicity, the IEPA may require that the Permittee prepare a plan for toxicity reduction evaluation and identification. This plan shall be developed in accordance with <u>Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants</u>, EPA/833B-99/002, and shall include an evaluation to determine which chemicals have a potential for being discharged in the plant wastewater, a monitoring program to determine their presence or absence and to identify other compounds which are not being removed by treatment, and other measures as appropriate. The Permittee shall submit to the IEPA its plan for toxicity reduction evaluation within ninety (90) days following notification by the IEPA. The Permittee shall implement the plan within ninety (90) days or other such date as contained in a notification letter received from the IEPA.

   The IEPA may modify this Permit during its term to incorporate additional requirements or limitations based on the results of the biomonitoring. In addition, after review of the monitoring results, the IEPA may modify this Permit to include numerical limitations for specific toxic pollutants. Modifications under this condition shall follow public notice and opportunity for hearing.

4 A minimum of two (2) plume studies at significantly different flow (and if possible temperature) conditions shall be performed. One (1) plume study should be conducted at or near annual low flow conditions, and mixing characteristics calculated for 7 day, 10 year flow conditions using data from both plume studies.

<u>SPECIAL CONDITION 17</u>. The Permittee shall record monitoring results on Discharge Monitoring Report Forms using one such form for each outfall each month.

In the event that an outfall does not discharge during a monthly reporting period, the DMR form shall be submitted with no discharge indicated.

The completed Discharge Monitoring Report forms shall be submitted to IEPA no later than the 15th day of the following month, unless otherwise specified by the permitting authority.

Discharge Monitoring Reports shall be mailed to the IEPA at the following address:

Illinois Environmental Protection Agency
Division of Water Pollution Control
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

Attention: Compliance Assurance Section, Mail Code # 19

APPENDIX B

CWLP NPDES PERMIT

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276

THOMAS V. SKINNER, DIRECTOR

217/782-0610

December 5, 2001

City of Springfield
Office of Public Utilities
City Water, Light and Power
Environmental Affairs
7th and Monroe Street
Springfield, Illinois 62757

SCREENED

Re: City of Springfield
City Water, Light and Power
NPDES Permit No. IL0024767
Final Permit

Gentlemen:

Attached is the final NPDES Permit for your discharge. The Permit as issued covers discharge limitations, monitoring, and reporting requirements. The failure of you to meet any portion of the Permit could result in civil and/or criminal penalties. The Illinois Environmental Protection Agency is ready and willing to assist you in interpreting any of the conditions of the Permit as they relate specifically to your discharge.

The Permit as issued is effective as of the date indicated on the first page of the Permit. You have the right to appeal any condition of the Permit to the Illinois Pollution Control Board within a 35 day period following the issuance date.

To assist you in meeting the self-monitoring and reporting requirements of your reissued NPDES permit, a supply of preprinted Discharge Monitoring Report (DMR) forms for your facility is being prepared. These forms will be sent to you prior to the initiation of DMR reporting under the reissued permit. Additional information and instructions will accompany the preprinted DMRs upon their arrival.

Should you have questions concerning the Permit, please contact Fred Rosenblum at the telephone number indicated above.

Very truly yours,

Thomas G. McSwiggin

Thomas G. McSwiggin, P.E.
Manager, Permit Section
Division of Water Pollution Control

TGM:FLR:01021601.bah

Attachment: Final Permit

cc: Records
Compliance Assurance Section
Springfield Region
Facility
US EPA

NPDES Permit No. IL0024767

Illinois Environmental Protection Agency

Division of Water Pollution Control

1021 North Grand Avenue East

P.O. Box 19276

Springfield, Illinois 62794-9276

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

Reissued (NPDES) Permit

SCREENED

Expiration Date: December 31, 2006

Issue Date: December 5, 2001
Effective Date: January 1, 2002

Name and Address of Discharger:

City of Springfield
Office of Public Utilities
City Water, Light and Power
Environmental Affairs
7th and Monroe Street
Springfield, Illinois 62757

Name and Address of Facility:

City Water, Light and Power
3100 Stevenson Drive
Springfield, Illinois 62707
(Sangamon County)

Discharge Number and Name:	Receiving Waters
001 Lakeside Condenser Cooling Water Outfall	Lake Springfield
B01 Miscellaneous Equipment Drains - Below Ground Seepage Water	Lake Springfield via Outfall 001
C01 Miscellaneous Equipment Drains - Sampling Sink	Lake Springfield via Outfall 001
D01 Lakeside 2 Boilers 7 and 8 Boiler Blowdown	Lake Springfield via Outfall 001
002 Dallman 1 and 2 Condenser Cooling Water Outfall	Lake Springfield
005 Industrial Wastewater Treatment Plant Outfall	Lake Springfield
006 Ash Pond Discharge to Lake Springfield	Lake Springfield via Outfall 002 and/or 009
007 Dallman Coal Pile Runoff	Lake Springfield
008 Lakeside Coal Pile Runoff	Lake Springfield
009 Dallman 3 Condenser Cooling Water Outfall	Lake Springfield
010 Dallman Plant Intake Screen Backwash	Lake Springfield
011 Scrubber Surge Pond Overflow	Lake Springfield
003 Lakeside Storm Sewer	Sugar Creek
004 Ash Pond Discharge to Sugar Creek	Sugar Creek
012 Stormwater Runoff from West Drainage Ditch and Dallman Fuel Oil Unloading Pad	Lake Springfield
013 Stormwater Runoff from East Drainage Ditch	Lake Springfield
015 Stormwater Runoff from Coal Crusher House Manholes	Lake Springfield
016 Stormwater Runoff from Landfill	Sugar Creek

In compliance with the provisions of the Illinois Environmental Protection Act, Title 35 of Ill. Adm. Code, Subtitle C and/or Subtitle D, Chapter 1, and the Clean Water Act (CWA), the above-named permittee is hereby authorized to discharge at the above location to the above-named receiving stream in accordance with the standard conditions and attachments herein.

Permittee is not authorized to discharge after the above expiration date. In order to receive authorization to discharge beyond the expiration date, the permittee shall submit the proper application as required by the Illinois Environmental Protection Agency (IEPA) not later than 180 days prior to the expiration date.

Thomas G. McSwiggin, P.E.
Manager, Permit Section
Division of Water Pollution Control

TGM:TGM:FLR\01021601.BAH

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

1. From the effective date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 001 -- Lakeside Condenser Cooling Water Outfall

This discharge consists of:	Approximate Flow
1. Lakeside 2 Condenser Cooling Water	45.88 MGD
2. Lakeside 2 Turbine Rooms 4, 5 and 6 Floor Drains	Intermittent
3. Lakeside 2 Turbine Rooms 4, 5 and 6 Roof Drains	Intermittent
4. Lakeside 2 Boiler Rooms 5, 6 and 7 Floor Drains	Intermittent
5. Lakeside 2 Boiler Rooms 5, 6 and 7 Roof Drains	Intermittent
6. Lakeside 1 and 2 Equipment Drains	Intermittent
7. Lakeside 2 Boilers 7 and 8 Boiler Blowdown	Intermittent
8. Cooling Water	2.88 MGD

PARAMETER	LOAD LIMITS lbs/day		CONCENTRATION LIMITS mg/l		SAMPLE FREQUENCY	SAMPLE TYPE
	30 DAY AVG.	DAILY MAX.	30 DAY AVG.	DAILY MAX.		
Flow (MGD)	See Special Condition No. 1				Daily	Continuous
Temperature	See Special Condition No. 4				Daily	Continuous
Total Residual Chlorine*				0.2	2/Month*	Grab*

*See Special Condition No. 5 and No. 10

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

1. From the effective date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: B01 - Miscellaneous Equipment Drains - Below Ground Seepage Water

	LOAD LIMITS lbs/day		CONCENTRATION LIMITS mg/l			
PARAMETER	30 DAY AVG.	DAILY MAX.	30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
					Approximate Flow: 0.0002 MGD	
Flow (MGD)	See Special Condition No. 1				1/Week	Single Reading Estimate
pH	See Special Condition No. 15				2/Month	Grab
Total Suspended Solids*			15	30	1/Month	Grab
Oil and Grease*			15	20	1/Month	Grab

*See Special Condition No. 23.

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

1. From the effective date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: C01 - Miscellaneous Equipment Drains - Sampling Sink

This discharge consists of:	Approximate Flow
1. Miscellaneous Equipment Drains	Intermittent
2. Lakeside 2 Boilers 7 and 8 Boiler Blowdown	0.0006 MGD
3. Lakeside 2 Boilers 7 and 8 Steam Condensate	0.0006 MGD
4. Non-contact Cooling Water	0.0006 MGD

	LOAD LIMITS lbs/day		CONCENTRATION LIMITS mg/l			
PARAMETER	30 DAY AVG.	DAILY MAX.	30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow (MGD)	See Special Condition No. 1				1/Week	Single Reading Estimate
pH	See Special Condition No. 2				2/Month	Grab
Total Suspended Solids*			15	30	1/Month	Grab
Oil and Grease*			15	20	1/Month	Grab

*See Special Condition No. 23.

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

1. From the effective date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: D01 - Lakeside 2 Boilers 7 and 8 Boiler Blowdown

	LOAD LIMITS lbs/day		CONCENTRATION LIMITS mg/l			
PARAMETER	30 DAY AVG.	DAILY MAX.	30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
					Approximate Flow: 0.005 MGD	
Flow (MGD)	See Special Condition No. 1				1/Week	Single Reading Estimate
pH	See Special Condition No. 2				2/Month	Grab

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE

1. From the effective date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 002 -- Dallman 1 and 2 Condenser Cooling Water Outfall

Approximate Flow: 173.0 MGD

This discharge consists of:

1. Dallman 1 and 2 Condensor Cooling Water
2. Dallman Ash Pond Sluice Water (See Special Condition No. 22)

PARAMETER	30 DAY AVG.	DAILY MAX.	30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow (MGD)	See Special Condition No. 1				Daily	Continuous
Temperature	See Special Condition No. 4				Daily	Continuous
Total Residual Chlorine***				0.2	2/Month*	Grab**
Total Residual Halogen***				0.05	2/Month*	Grab**
Boron	See Special Condition No. 20				2/Month****	Grab

*See Special Condition No. 5 and No. 10.
**See Special Condition No. 5.
***A discharge limit of 0.05 mg/l for total residual chlorine and total residual halogen shall apply when zebra mussel control chemicals are being added. The permittee shall indicate on the DMR forms when chlorine and bromine are being used for zebra mussel control.
****Boron shall be monitored on a 2/Month basis when Dallman Ash Pond Sluice Water is part of the discharge.

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

SCREENED

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	LOAD LIMITS lbs/day DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	CONCENTRATION LIMITS mg/l DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE

1. From the effective date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 003 – Lakeside Storm Sewer***

This discharge consists of:	Approximate Flow:
1. Lakeside 1 Turbine Rooms 1, 2 and 3 Floor Drains & Equipment Drains	Intermittent
2. Lakeside 1 Turbine Rooms 1, 2 and 3 Roof Drains	Intermittent
3. Lakeside 1 Boiler Rooms 2, 3 and 4 Floor Drains & Equipment Drains	Intermittent
4. Lakeside 1 Boiler Rooms 2, 3 and 4 Roof Drains	Intermittent
5. Lakeside 2 Turbine Rooms 6 and 7 Roof Drains	Intermittent
6. Lakeside 2 Boilers 7 and 8 Roof Drains	Intermittent
7. Lakeside 1 and 2 Intake Screen Backwash *	0.3 MGD
8. Screen Washings from Public Water Supply Intake	0.1 MGD
9. Spillway Gate Hydraulic Water *	Intermittent
10. Miscellaneous Equipment Drains	Intermittent
11. Public Water Supply Drain*	Intermittent

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	LOAD LIMITS lbs/day DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	CONCENTRATION LIMITS mg/l DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow (MGD)	See Special Condition No. 1				1/Week	Single Reading Estimate
pH	See Special Condition No. 2				1/Week	Grab
Total Suspended Solids			15.0	30.0	1/Week	24 Hour Composite
Oil and Grease****			15.0	20.0	1/Month	Grab
Boron**				11	2/Month	Grab
Iron (Total)	See Special Condition No. 19				2/Year	Grab

*Compliance Monitoring samples are collected ahead of this wastestream input to Outfall 003.
**See Special Condition No. 14.
***See Special Condition No. 18.
****See Special Conditon No. 23.

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

1. From the effective date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 004 -- Ash Pond Discharge***

This discharge consists of:	Approximate Flow:
1. Lakeside Plant Fly Ash and Bottom Ash	2.66 MGD
2. Dallman Plant Fly Ash and Bottom Ash	4.32 MGD
3. Non-Chemical Metal Cleaning Wastes *	Intermittent
4. Lime Sludge From the City Water Purification Plant	0.33 MGD
5. Flue Gas Desulfurization System Wastes *	Intermittent
6. Industrial Wastewater Treatment Plant Sludge	0.19 MGD
7. Water Treatment Plant Yard Drains	Intermittent
8. Scrubber Sludge Disposal Site Wastewater	0.043 MGD

	LOAD LIMITS lbs/day		CONCENTRATION LIMITS mg/l			
PARAMETER	30 DAY AVG.	DAILY MAX.	30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow (MGD)	See Special Condition No. 1				1/Week	Single Reading Estimate
pH	See Special Condition No. 15				2/Week	Grab
Total Suspended Solids			15.0	30.0	2/Week	24 Hour Composite
Oil and Grease****			15.0	20.0	1/Month	Grab
Boron**				11	2/Month	Grab

*This wastestream may be directed to the Industrial Wastewater Treatment System
**See Special Condition No. 14.
***See Special Condition No. 18.
****See Special Condition No. 23.

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

1. From the effective date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 005**

This discharge consists of:	Approximate Flow:
1. Demineralizer Regenerant Wastes	0.6 MGD
2. Lakeside 2 Boilers 7 and 8 Slag Tank Overflow	1.02 MGD
3. Lakeside 2 Boiler Rooms 7 and 8 Floor Drains	Intermittent
4. Lakeside 2 Turbine Rooms 6 and 7 Floor Drains	Intermittent
5. Lakeside 2 Boilers 5 and 6 Slag Tank Overflow	0.001 MGD
6. Dallman 1, 2 and 3 Boiler Blowdown, Evaporator and Deaerator Blowdown	0.44 MGD
7. Dallman 1, 2 and 3 Roof and Floor Drains	Intermittent
8. Dallman 1, 2 and 3 Condensate Storage Tank Wastes	Intermittent
9. Dallman 1, 2 and 3 Slag Tank Overflow	1.8 MGD
10. Dallman 1, 2 and 3 Sump Pumps	0.3 MGD
11. Dallman Plant Pyrite Removal Wastes	0.85 MGD
12. Crusher House and Control House Floor Drains	Intermittent
13. Flue Gas Desulfurization System Wastes*	Intermittent
14. Dallman Coal Pile Runoff (See Outfall No. 007)*	Intermittent
15. Dallman 1 and 2 Precipitator Area Drain	Intermittent
16. Non-chemical Metal Cleaning Wastes*	Intermittent
17. Dallman 1, 2 and 3 Equipment Drains	Intermittent
18. Lakeside Coal Pile Runoff (See Outfall No. 008)*	Intermittent
19. Dallman Fuel Oil Tank Berm Runoff	Intermittent
20. Lakeside 2 Turbine Rooms 4, 5 and 6 Floor Drains	Intermittent
21. Lakeside 2 Turbine Rooms 4, 5, 6 and 7 Roof Drains (See Outfall No. 008)*	Intermittent
22. Lakeside 2 Boiler Rooms 5, 6 and 7 Floor Drains	Intermittent
23. Lakeside 2 Boiler Rooms 5, 6 and 7 Roof Drains (See Outfall No. 008)*	Intermittent
24. Lakeside 1 and 2 Equipment Drains	Intermittent
25. Yard Drains	Intermittent
26. Lakeside 2 Fuel Oil Tank Berm and Unloading Pad Runoff	Intermittent

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow (MGD)	See Special Conditon No. 1				Daily	Continuous
pH	See Special Condition No. 15				Daily	Grab
Total Suspended Solids***			15.0	30.0	2/Month	24 Hour Composite
Oil and Grease***			15.0	20.0	1/Month	Grab
Iron (Total)***			2.0	4.0	2/Month	24 Hour Composite
Copper (Total)			0.026	0.042	1/Week	24 Hour Composite

* Discharge to the Industrial Wastewater Treatment Plant is an alternate routing.
**See Special Condition No. 18.
***See Special Condition 23.

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

1. From the effective date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 006 -- Ash Pond Discharge**

Approximate Flow:
Intermittent

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	LOAD LIMITS lbs/day DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	CONCENTRATION LIMITS mg/l DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow (MGD)	See Special Condition No. 1				1/Week	24 Hour Total
pH	See Special Condition No. 15				2/Week*	Grab
Total Suspended Solids			15.0	30.0	2/Week*	24 Hour Composite
Oil and Grease			15.0	20.0	2/Month	Grab

*Monitor if discharge occurs during the month excluding exercising diversion pump.
**See Special Condition Nos. 18, 21, and 22.

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	DAILY MAX.	• CONCENTRATION LIMITS mg/l 30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE

1. From the effective date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 007 -- Dallman Coal Pile Runoff*

This discharge consists of:	Approximate Flow
1. Dallman Coal Pile Runoff	Intermittent
2. Dallman 1 and 2 Precipitator Area Drain	Intermittent

PARAMETER	30 DAY AVG. (lbs/day)	DAILY MAX. (lbs/day)	30 DAY AVG. (mg/l)	DAILY MAX. (mg/l)	SAMPLE FREQUENCY	SAMPLE TYPE
Flow (MGD)	See Special Condition No. 1				1/Week	Single Reading Estimate
pH	See Special Condition No. 15				1/Week	Grab
Total Suspended Solids			15.0	30.0	1/Week	8 Hour Composite
Oil and Grease			15.0	20.0	1/Week	Grab
Iron (Total)			2.0	4.0	1/Week	8 Hour Composite

*See Special Condition No. 18.

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	LOAD LIMITS lbs/day DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	CONCENTRATION LIMITS mg/l DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE

1. From the effective date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 008 -- Lakeside Coal Pile Runoff*

This discharge consists of:	Approximate Flow:
1. Lakeside Coal Pile Runoff	Intermittent
2. Lakeside Plant Precipitator Area Runoff	Intermittent
3. Parking Lot Runoff	Intermittent
4. Lakeside 2 Turbine Rooms 4, 5, 6 and 7 Roof Drains	Intermittent
5. Lakeside 2 Boiler Rooms 5, 6 and 7 Roof Drains	Intermittent

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	LOAD LIMITS lbs/day DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	CONCENTRATION LIMITS mg/l DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow (MGD)	See Special Condition No. 1				1/Week	Single Reading Estimate
pH	See Special Condition No. 15				1/Week	Grab
Total Suspended Solids			15.0	30.0	1/Week	8 Hour Composite
Oil and Grease			15.0	20.0	1/Week	Grab
Iron (Total)			2.0	4.0	1/Week	8 Hour Composite

*See Special Condition No. 18.

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

1. From the effective date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 009 -- Dallman 3 Condenser Cooling Water Outfall

Approximate Flow: 187.1 MGD

This discharge consists of:

1. Dallman 3 Condensor Cooling Water
2. Dallman Ash Pond Sluice Water (See Special Condition No. 22)

	LOAD LIMITS lbs/day		CONCENTRATION LIMITS mg/l			
PARAMETER	30 DAY AVG.	DAILY MAX.	30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow (MGD)	See Special Condition No. 1				Daily	Continuous
Temperature	See Special Condition No. 4				Daily	Continuous
Total Residual Chlorine***				0.2	2/Month*	Grab**
Total Residual Halogen***				0.05	2/Month*	Grab**
Boron	See Special Condition No. 20				2/Month****	Grab

*See Special Conditions No. 5 and 10.
**See Special Condition No. 5.
***A discharge limit of 0.05 mg/l for total residual chlorine and total residual halogen shall apply when zebra mussel control chemicals are being added. The permittee shall indicate on the DMR forms when chlorine and bromine are being used for zebra mussel control.
****Boron shall be monitored on a 2/Month basis when Dallman Ash Pond Sluice Water is part of the discharge.

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

	LOAD LIMITS lbs/day		CONCENTRATION LIMITS mg/l			
PARAMETER	30 DAY AVG.	DAILY MAX.	30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE

1. From the effective date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 010 -- Dallman Plant Intake Screen Backwash*

Approximate Flow:
0.144 MGD

Flow (MGD)	See Special Condition No. 1	1/Week	Estimate

*In addition to the raw water taken from Lake Springfield, ash sluice water from the Dallman Ash Pond is routed to the Dallman Plant Intake. There shall be no discharge of collected debris from the intake screens. See Special Condition 22.

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

1. From the effective date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 011 -- Scrubber Surge Pond Overflow*

This discharge consists of:	Approximate Flow
1. Scrubber sludge storage pad runoff	Intermittent
2. Flue gas desulfurization wastes	Intermittent

	LOAD LIMITS lbs/day		CONCENTRATION LIMITS mg/l			
PARAMETER	30 DAY AVG.	DAILY MAX.	30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow (MGD)	See Special Condition No. 1				Daily	Single Reading Estimate
pH	See Special Condition 15				Daily	Grab
Total Suspended Solids			15.0	30.0	Daily	Grab

*See Special Condition No. 18.

Outfalls: 012, 013, 015 and 016 -- Stormwater Runoff*

*See Special Condition No. 17.

NPDES Permit No. IL0024767

Special Conditions

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SPECIAL CONDITON 1. Flow shall be reported as a monthly average and daily maximum.

SPECIAL CONDITION 2. The pH shall be in the range 6.0 to 10.standard units. The monthly minimum and monthly maximum values shall be reported on the DMR form.

SPECIAL CONDITION 3. Samples taken in compliance with the effluent monitoring requirements shall be taken at a point representative of the discharge, but prior to entry into the receiving stream.

SPECIAL CONDITION 4. The thermal discharge to Lake Springfield from the Lakeside plant shall not exceed 99°F more than 5 percent of the hours in the 12-month period ending with any month and the discharge from the Dallman plant shall not exceed 99°F more than 8 percent of the hours in the 12-month period ending with any month and at no time shall any discharge exceed 109°F.

SPECIAL CONDITION 5. Chlorine compounds, bromine compounds, or a mixture of both may be utilized for condenser microbiological control or for zebra mussel control in accordance with the following conditions:

a. Intermittent chlorine application:

A limit of 0.2 mg/l (instanteous maximum) total residual chlorine shall apply during intermittent chlorination (chlorine discharged for no more than two hours per unit per day).

b. Intermittent bromine or bromine/chlorine application:

The discharge shall be dehalogenated and a limit of 0.05 mg/l (daily maximum) shall apply.

c. Continuous chlorine, bromine, or bromine/chlorine application:

The discharge shall be dehalogenated and a limit of 0.05 mg/l (daily maximum) shall apply.

The reported mean concentration and maximum concentration of halogen shall be based on a concentration curve. The concentration curves shall be generated using grab samples with an analytical frequency of five minutes or less during the respective halogenation period of each unit allowing for lag time between the initiation of halogenation and the point of sampling before the first sample is taken. Concentration curves shall be submitted with monthly Discharge Monitoring Reports. The frequency and duration of the chlorine and bromine dosing periods plus the amount of chlorine and bromine applied shall be reported on the Discharge Monitoring Reports.

The permittee shall conduct a study on the effect of the addition of bromine to the power plant cooling water on the levels of THM's found in the drinking water if bromine or bromine/chlorine is applied. The study shall be submitted to the Illinois Environmental Protection Agency and the United States Environmental Protection Agency within 90 days of completion. Also, the permittee shall indicate when bromine is being added for zebra mussel control and when it is being used for microbiological control.

In addition, the permittee shall monitor semi-annually for bromide ions to determine the long term effect of bromide addition on THM's. This study shall be submitted to the IEPA and USEPA at the following addresses:

Illinois Environmental Protection Agency
Attn: Compliance Assurance Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

United States Environmental Protection Agency
Attn: 5WN-16J Rebecca Harvey, Chief
Region V
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Illinois Environmental Protection Agency
Attn: Permit Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Special Conditions

SPECIAL CONDITION 6. For the purpose of this permit discharges are limited to wastewater listed on the effluent pages for each permitted outfall.

SPECIAL CONDITION 7. There shall be no discharge of complexed chemical metal bearing wastestreams and associated rinses from chemical metal cleaning unless this permit has been modified to include the new dishcarge.

SPECIAL CONDITION 8. There shall be no discharge of polychlorinated biphenyl compounds.

SPECIAL CONDITION 9. To calculate the average daily flow for outfalls 001, 002 and 009 during the reporting period, the total number of pump hours observed is divided by the number of days in the month and then multiplied by the pump rate (gallons/hour). The minimum daily flow rate is determined by multiplying the lowest daily pump hour total by the pump rate. The maximum daily pump rate is calculated by multiplying the highest daily pump hour total by the pump rate.

SPECIAL CONDITION 10. During maintenance outages calcium hypochlorite may be used to passivate the condensers. During discharge of chlorinated wastewater from passivation of the main cooling condensers a minimum of three grab samples shall be taken at five minute intervals or less at the condenser cooling water outfall for each batch discharge allowing for lag time between chlorine discharge and the point of sampling before the first grab sample is taken. The individual values and average value for each set of samples shall be reported with monthly DMR forms including the time samples were collected, the time and duration of chlorine release plus the amount of chlorine applied.

If chlorinated wastewater is to be discharged as a result of these outage conditions for more than 2 hours per day the permittee must request this permit be modified to allow for such a practice.

SPECIAL CONDITION 11. The permittee shall record monitoring results on Discharge Monitoring Report forms using one such form for each discharge each month. The completed Discharge Monitoring Report form shall be submitted monthly to IEPA, no later than the 15th of the following month, unless otherwise specified by the Agency, to the following address:

Illinois Environmental Protection Agency
Division of Water Pollution Control
Compliance Assurance Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

SPECIAL CONDITION 12. If an applicable effluent standard or limitation is promulgated under Sections 301(b)(2)(C) and (D), 304(b)(2), and 307(a)(2) of the Clean Water Act and that effluent standard or limitation is more stringent than any effluent limitation in the permit or controls a pollutant not limited in the NPDES Permit, the Agency shall revise or modify the permit in accordance with the more stringent standard or prohibition and shall so notify the permittee.

treatment

SPECIAL CONDITION 13. The use or operation of this facility shall be by or under the supervision of a Certified Class K operator.

SPECIAL CONDITION 14. The permittee shall comply with all provisions of adjusted standard AS 94-9 dated December 1, 1994.

SPECIAL CONDITION 15. The pH shall be in the range of 6.0 to 9.0 standard units. The monthly minimum and monthly maximum values shall be reported on the DMR form.

SPECIAL CONDITION 16. In the event that water treatment additives other than those identified in the permit application are discharged, the permittee shall notify the Agency in accordance with the Standard Conditions (Attachment H) of this permit. The additives listed in previous applications include: Lime, Alum, Bentonite, Iron Sulfate, Cationic and Anionic Polymers, Carbon Dioxide, Chlorine Gas, Chlorine Dioxide, Calcium Hypochlorite, Sodium Chlorite, Sodium Bromide and a Polyglycol Biodispersant.

SPECIAL CONDITION 17.

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

A. A storm water pollution prevention plan shall be developed by the permittee for the storm water associated with industrial activity at this facility. The plan shall identify potential sources of pollution which may be expected to affect the quality of storm water discharges associated with the Industrial activity at the facility. In addition, the plan shall describe and ensure the implementation of practices which are to be used to reduce the pollutants in storm water discharges associated with industrial activity at the facility and to assure compliance with the terms and conditions of this permit.

B. The plan shall be completed within 180 days of the effective date of this permit. Plans shall provide for compliance with the terms of the plan within 365 days of the effective date of this permit. The owner or operator of the facility shall make a copy of the plan available to the Agency at any reasonable time upon request. [Note: If the plan has already been developed and implemented it shall be maintained in accordance with all requirements of this special condition.]

C. The permittee may be notified by the Agency at any time that the plan does not meet the requirements of this condition. After such notification, the permittee shall make changes to the plan and shall submit a written certification that the requested changes have been made. Unless otherwise provided, the permittee shall have 30 days after such notification to make the changes.

D. The discharger shall amend the plan whenever there is a change in construction, operation, or maintenance which may affect the discharge of significant quantities of pollutants to the waters of the State or if a facility inspection required by paragraph G of this condition indicates that an amendment is needed. The plan should also be amended if the discharger is in violation of any conditions of this permit, or has not achieved the general objective of controlling pollutants in storm water discharges. Amendments to the plan shall be made within the shortest reasonable period of time, and shall be provided to the Agency for review upon request.

E. The plan shall provide a description of potential sources which may be expected to add significant quantities of pollutants to storm water discharges, or which may result in non-storm water discharges from storm water outfalls at the facility. The plan shall include, at a minimum, the following items:

1. A topographic map extending one-quarter mile beyond the property boundaries of the facility, showing: the facility, surface water bodies, wells (including injection wells), seepage pits, infiltration ponds, and the discharge points where the facility's storm water discharges to a municipal storm drain system or other water body. The requirements of this paragraph may be included on the site map if appropriate.

2. A site map showing:

    i. The storm water conveyance and discharge structures;

    ii. An outline of the storm water drainage areas for each storm water discharge point;

    iii. Paved areas and buildings;

    iv. Areas used for outdoor manufacturing, storage, or disposal of significant materials, including activities that generate significant quantities of dust or particulates.

    v. Location of existing storm water structural control measures (dikes, coverings, detention facilities, etc.);

    vi. Surface water locations and/or municipal storm drain locations

    vii. Areas of existing and potential soil erosion;

    viii. Vehicle service areas;

    ix. Material loading, unloading, and access areas.

3. A narrative description of the following:

    i. The nature of the industrial activities conducted at the site, including a description of significant materials that are treated, stored or disposed of in a manner to allow exposure to storm water;

    ii. Materials, equipment, and vehicle management practices employed to minimize contact of significant materials with storm water discharges;

    iii. Existing structural and non-structural control measures to reduce pollutants in storm water discharges;

    iv. Industrial storm water discharge treatment facilities;

    v. Methods of onsite storage and disposal of significant materials;

4. A list of the types of pollutants that have a reasonable potential to be present in storm water discharges in significant quantities.

5. An estimate of the size of the facility in acres or square feet, and the percent of the facility that has impervious areas such as pavement or buildings.

6. A summary of existing sampling data describing pollutants in storm water discharges.

F. The plan shall describe the storm water management controls which will be implemented by the facility. The appropriate controls shall reflect identified existing and potential sources of pollutants at the facility. The description of the storm water management controls shall include:

1. Storm Water Pollution Prevention Personnel - Identification by job titles of the individuals who are responsible for developing, implementing, and revising the plan.

2. Preventive Maintenance - Procedures for inspection and maintenance of storm water conveyance system devices such as oil/water separators, catch basins, etc., and inspection and testing of plant equipment and systems that could fail and result in discharges of pollutants to storm water.

3. Good Housekeeping - Good housekeeping requires the maintenance of clean, orderly facility areas that discharge storm water. Material handling areas shall be inspected and cleaned to reduce the potential for pollutants to enter the storm water conveyance system.

4. Spill Prevention and Response - Identification of areas where significant materials can spill into or otherwise enter the storm water conveyance systems and their accompanying drainage points. Specific material handling procedures, storage requirements, spill clean up equipment and procedures should be identified, as appropriate. Internal notification procedures for spills of significant materials should be established.

5. Storm Water Management Practices - Storm water management practices are practices other than those which control the source of pollutants. They include measures such as installing oil and grit separators, diverting storm water into retention basins, etc. Based on assessment of the potential of various sources to contribute pollutants, measures to remove pollutants from storm water discharge shall be implemented. In developing the plan, the following management practices shall be considered:

    i. Containment - Storage within berms or other secondary containment devices to prevent leaks and spills from entering storm water runoff;

    ii. Oil & Grease Separation - Oil/water separators, booms, skimmers or other methods to minimize oil contaminated storm water discharges;

    iii. Debris & Sediment Control - Screens, booms, sediment ponds or other methods to reduce debris and sediment in storm water discharges;

Special Conditions

iv. Waste Chemical Disposal - Waste chemicals such as antifreeze, degreasers and used oils shall be recycled or disposed of in an approved manner and in a way which prevents them from entering storm water discharges.

v. Storm Water Diversion - Storm water diversion away from materials manufacturing, storage and other areas of potential storm water contamination;

vi. Covered Storage or Manufacturing Areas - Covered fueling operations, materials manufacturing and storage areas to prevent contact with storm water.

6. Sediment and Erosion Prevention - The plan shall identify areas which due to topography, activities, or other factors, have a high potential for significant soil erosion and describe measures to limit erosion.

7. Employee Training - Employee training programs shall inform personnel at all levels of responsibility of the components and goals of the storm water pollution control plan. Training should address topics such as spill response, good housekeeping and material management practices. The plan shall identify periodic dates for such training.

8. Inspection Procedures - Qualified plant personnel shall be identified to inspect designated equipment and plant areas. A tracking or follow-up procedure shall be used to ensure appropriate response has been taken in response to an inspection. Inspections and maintenance activities shall be documented and recorded.

G. The permittee shall conduct an annual facility inspection to verify that all elements of the plan, including the site map, potential pollutant sources, and structural and non-structural controls to reduce pollutants in industrial storm water discharges are accurate. Observations that require a response and the appropriate response to the observation shall be retained as part of the plan. Records documenting significant observations made during the site inspection shall be submitted to the Agency in accordance with the reporting requirements of this permit.

H. This plan should briefly describe the appropriate elements of other program requirements, including Spill Prevention Control and Countermeasures (SPCC) plans required under Section 311 of the CWA and the regulations promulgated thereunder, and Best Management Programs under 40 CFR 125.100.

I. The plan is considered a report that shall be available to the public under Section 308(b) of the CWA. The permittee may claim portions of the plan as confidential business information, including any portion describing facility security measures.

J. The plan shall include the signature and title of the person responsible for preparation of the plan and include the date of initial preparation and each amendment thereto.

Construction Authorization

K. Authorization is hereby granted to construct treatment works and related equipment that may be required by the Storm Water Pollution Prevention developed pursuant to this permit.

This Authorization is issued subject to the following condition(s).

1. If any statement or representation is found to be incorrect, this authorization may be revoked and the permittee there upon waives all rights thereunder.

2. The issuance of this authorization (a) does not release the permittee from any liability for damage to persons or property caused by or resulting from the installation, maintenance or operation of the proposed facilities; (b) does not take into consideration the structural stability of any units or part of this project; and (c) does not release the permittee from compliance with other applicable statutes of the State of Illinois, or other applicable local law, regulations or ordinances.

3. Plans and specifications of all treatment equipment being included as part of the stormwater management practice shall be included in the SWPPP.

Special Conditions

4. Construction activities which result from treatment equipment installation, including cleaning, grading and excavation activities which result in the disturbance of five acres or more of land area, are not covered by this authorization. The permittee shall contact the IEPA regarding the required permit(s).

REPORTING

L. The facility shall submit an annual inspection report to the Illinois Environmental Protection Agency. The report shall include results of the annual facility inspection which is required by Part G of the Storm Water Pollution Prevention Plan of this permit. The report shall also include documentation of any event (spill, treatment unit malfunction, etc.) which would require an inspection, results of the inspection, and any subsequent corrective maintenance activity. The report shall be completed and signed by the authorized facility employee(s) who conducted the inspection(s).

M. The first report shall contain information gathered during the one year time period beginning with the effective date of coverage under this permit and shall be submitted no later than 60 days after this one year period has expired. Each subsequent report shall contain the previous year's information and shall be submitted no later than one year after the previous year's report was due.

N. Annual inspection reports shall be mailed to the following address:

Illinois Environmental Protection Agency
Bureau of Water
Compliance Assurance Section
Annual Inspection Report
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

O. If the facility performs Inspections more frequently than required by this permit, the results shall be included as additional information in the annual report.

[illegible]

SPECIAL CONDITION 18. The Agency has determined that the effluent limitations in this permit constitute BAT/BCT for storm water which is treated in the existing treatment facilities (Outfalls 003, 004, 005, 006, 007, 008 and 011) for purposes of this permit reissuance, and no pollution prevention plan will be required for such storm water. In addition to the chemical specific monitoring required elsewhere in this permit, the permittee shall conduct an annual inspection of the facility site to identify areas contributing to a storm water discharge associated with industrial activity, and determine whether any facility modifications have occurred which result in previously-treated storm water discharges no longer receiving treatment. If any such discharges are identified the permittee shall request a modification of this permit within 30 days after the inspection. Records of the annual inspection shall be retained by the permittee for the term of this permit and be made available to the Agency on request.

SPECIAL CONDITION 19. The Permittee shall monitor Outfall 003 for Iron (Total) on a semi-annual basis. The results of these sampling analyses shall be included with the June and December monthly Discharge Monitoring Reports. The Agency may modify this permit as a result of these analyses to include limits for Iron (Total) and the appropriate monitoring frequency.

SPECIAL CONDITION 20. The permit may be modified as a result of these analyses to include limits for boron at outfall 002 and/or outfall 009 and include the appropriate monitoring frequency for boron at those outfalls. Modifications under this special condition shall follow public notice and opportunity for hearing.

SPECIAL CONDITION 21. Samples taken in compliance with the effluent monitoring requirements at the Outfall 006 Ash Pond discharge shall be taken at a point representative of the discharge but prior to entry into the Dallman Plant Intake.

SPECIAL CONDITION 22. In addition to the other requirements of this permit, the permittee shall comply with all procedures of the boron monitoring program submitted to the Agency on March 27, 2000. Agency approval shall be granted prior to changing the procedures identified in the boron monitoring program submitted to the Agency. The Ash Pond Effluent shall not be discharged from Outfall 002 and/or 009 if it becomes apparent that the procedures of the boron monitoring program can not be adhered to.

SPECIAL CONDITION 23. The permittee has undergone a monitoring reduction review and the effluent sample frequency has been reduced for the following parameters: total suspended solids at outfalls B01, C01, and 005; oil & grease at outfalls B01, C01, 003, 004, and 005; and iron (total) at outfall 005. the IEPA will require that the effluent sample frequency for total suspended solids and oil & grease at outfalls B01 and C01 be increased to the frequency of 2/month, that the sample frequency for oil & grease at outfalls 003, 004, and 005 be increased to the frequency of 2/month, and that the sample frequency for total suspended solids and iron (total) at outfall 005 be increased to the frequency of 1/week, If effluent deterioration occurs due to increased wasteload, operational, maintenance or other problems. The increased monitoring frequency will be required Without Public Notice when a permit is modification is received by the permittee from the IEPA.

SPECIAL CONDITION 24. The Permittee shall monitor the effluent and report concentrations (in mg/L) of the following listed parameters eighteen (18) months prior to the expiration date and again at twelve (12) months prior to the expiration date. The sample shall be a 24-hour effluent composite except as otherwise specifically provided below and the results shall be submitted on Discharge Monitoring Report Forms to IEPA unless otherwise specified by the IEPA. The parameters to be sampled and the minimum detection limits to be attained are as follows:

STORET CODE	PARAMETER	Minimum detection limit
01002	Arsenic	0.05 mg/L
01007	Barium	0.5 mg/L
01027	Cadmium	0.003 mg/L
01032	Chromium (hexavalent) (grab)	0.01 mg/L
01034	Chromium (total)	0.05 mg/L
01042	Copper	0.005 mg/L
00718	Cyanide (grab) (weak acid dissociable)	10.0 ug/L
00720	Cyanide (grab not to exceed 24 hours) (total)	10.0 ug/L
00951	Fluoride	0.1 mg/L
01045	Iron (total)	0.5 mg/L
01046	Iron (Dissolved)	0.5 mg/L
01051	Lead	0.05 mg/L
01055	Manganese	0.5 mg/L
71900	Mercury	0.2 ug/L
01067	Nickel	0.005 mg/L
00556	Oil (hexane soluble or equivalent) (Grab Sample only)	1.0 mg/L
32730	Phenols (grab)	0.005 mg/L
01147	Selenium	0.002 mg/L
01077	Silver (total)	0.003 mg/L
01092	Zinc	0.050 mg/L

Unless otherwise indicated, concentrations refer to the total amount of the constituent present in all phases, whether solid, suspended or dissolved, elemental or combined, including all oxidation states.

Attachment H

Standard Conditions

Definitions

Act means the Illinois Environmental Protection Act, 415 ILCS 5 as Amended.

Agency means the Illinois Environmental Protection Agency.

Board means the Illinois Pollution Control Board.

Clean Water Act (formerly referred to as the Federal Water Pollution Control Act) means Pub. L 92-500, as amended. 33 U.S.C. 1251 et seq.

NPDES (National Pollutant Discharge Elimination System) means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 402, 318 and 405 of the Clean Water Act.

USEPA means the United States Environmental Protection Agency.

Daily Discharge means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurements, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

Maximum Daily Discharge Limitation (daily maximum) means the highest allowable daily discharge.

Average Monthly Discharge Limitation (30 day average) means the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

Average Weekly Discharge Limitation (7 day average) means the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week.

Best Management Practices (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the State. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Aliquot means a sample of specified volume used to make up a total composite sample.

Grab Sample means an individual sample of at least 100 milliliters collected at a randomly-selected time over a period not exceeding 15 minutes.

24 Hour Composite Sample means a combination of at least 6 sample aliquots of at least 100 milliliters, collected at periodic intervals during the operating hours of a facility over a 24-hour period.

8 Hour Composite Sample means a combination of at least 3 sample aliquots of at least 100 milliliters, collected at periodic intervals during the operating hours of a facility over an 8-hour period.

Flow Proportional Composite Sample means a combination of sample aliquots of at least 100 milliliters collected at periodic intervals such that either the time interval between each aliquot or the volume of each aliquot is proportional to either the stream flow at the time of sampling or the total stream flow since the collection of the previous aliquot.

(1) **Duty to comply.** The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action, permit termination, revocation and reissuance, modification, or for denial of a permit renewal application. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

(2) **Duty to reapply.** If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. If the permittee submits a proper application as required by the Agency no later than 180 days prior to the expiration date, this permit shall continue in full force and effect until the final Agency decision on the application has been made.

(3) **Need to halt or reduce activity not a defense.** It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

(4) **Duty to mitigate.** The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

(5) **Proper operation and maintenance.** The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up, or auxiliary facilities, or similar systems only when necessary to achieve compliance with the conditions of the permit.

(6) **Permit actions.** This permit may be modified, revoked and reissued, or terminated for cause by the Agency pursuant to 40 CFR 122.62. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

(7) **Property rights.** This permit does not convey any property rights of any sort, or any exclusive privilege.

(8) **Duty to provide information.** The permittee shall furnish to the Agency within a reasonable time, any information which the Agency may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with the permit. The permittee shall also furnish to the Agency, upon request, copies of records required to be kept by this permit.

(9) **Inspection and entry.** The permittee shall allow an authorized representative of the Agency, upon the presentation of credentials and other documents as may be required by law, to:

- (a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;
- (b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
- (c) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
- (d) Sample or monitor at reasonable times, for the purpose of assuring permit compliance, or as otherwise authorized by the Act, any substances or parameters at any location.

(10) **Monitoring and records.**

- (a) Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.
- (b) The permittee shall retain records of all monitoring information, including all calibration and maintenance records, and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of this permit, measurement, report or application. This period may be extended by request of the Agency at any time
- (c) Records of monitoring information shall include:
  - (1) The date, exact place, and time of sampling or measurements.
  - (2) The individual(s) who performed the sampling or measurements;
  - (3) The date(s) analyses were performed;
  - (4) The individual(s) who performed the analyses;
  - (5) The analytical techniques or methods used; and
  - (6) The results of such analyses.
- (d) Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit. Where no test procedure under 40 CFR Part 136 has been approved, the permittee must submit to the Agency a test method for approval. The permittee shall calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals to ensure accuracy of measurements.

(11) **Signatory requirement.** All applications, reports or information submitted to the Agency shall be signed and certified.

- (a) **Application.** All permit applications shall be signed as follows:
  - (1) **For a corporation:** by a principal executive officer of at least the level of vice president or a person or position having overall responsibility for environmental matters for the corporation;
  - (2) **For a partnership or sole proprietorship:** by a general partner or the proprietor, respectively; or
  - (3) **For a municipality, State, Federal, or other public agency:** by either a principal executive officer or ranking elected official.
- (b) **Reports.** All reports required by permits, or other information requested by the Agency shall be signed by a person described in paragraph (a) or by a duly authorized representative of that person. A person is a duly authorized representative only if:
  - (1) The authorization is made in writing by a person described in paragraph (a), and
  - (2) The authorization specifies either an individual or a position responsible for the overall operation of the facility, from which the discharge originates, such as a plant manager, superintendent or person of equivalent responsibility; and
  - (3) The written authorization is submitted to the Agency

(c) **Changes of Authorization.** If an authorization under (b) is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of (b) must be submitted to the Agency prior to or together with any reports, information, or applications to be signed by an authorized representative.

(12) **Reporting requirements.**

(a) **Planned changes.** The permittee shall give notice to the Agency as soon as possible of any planned physical alterations or additions to the permitted facility.

(b) **Anticipated noncompliance.** The permittee shall give advance notice to the Agency of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

(c) **Compliance schedules.** Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

(d) **Monitoring reports.** Monitoring results shall be reported at the intervals specified elsewhere in this permit.

(1) Monitoring results must be reported on a Discharge Monitoring Report (DMR).

(2) If the permittee monitors any pollutant more frequently than required by the permit, using test procedures approved under 40 CFR 136 or as specified in the permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.

(3) Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified by the Agency in the permit.

(e) **Twenty-four hour reporting.** The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and time; and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. The following shall be included as information which must be reported within 24 hours:

(1) Any unanticipated bypass which exceeds any effluent limitation in the permit;

(2) Violation of a maximum daily discharge limitation for any of the pollutants listed by the Agency in the permit to be reported within 24 hours.

The Agency may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

(f) **Other noncompliance.** The permittee shall report all instances of noncompliance not reported under paragraphs (12)(c), (d), or (e), at the time monitoring reports are submitted. The reports shall contain the information listed in paragraph (12)(e).

(g) **Other information.** Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to the Agency, it shall promptly submit such facts or information.

(13) **Transfer of permits.** A permit may be automatically transferred to a new permittee if:

(a) The current permittee notifies the Agency at least 30 days in advance of the proposed transfer date;

(b) The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage and liability between the current and new permittees; and

(c) The Agency does not notify the existing permittee and the proposed new permittee of its intent to modify or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement.

(14) All manufacturing, commercial, mining, and silvicultural dischargers must notify the Agency as soon as they know or have reason to believe:

(a) That any activity has occurred or will occur which would result in the discharge of any toxic pollutant identified under Section 307 of the Clean Water Act which is not limited in the permit, if that discharge will exceed the highest of the following notification levels:

(1) One hundred micrograms per liter (100 ug/l);

(2) Two hundred micrograms per liter (200 ug/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/l) for 2,4-dinitrophenol and for 2-methyl-4,6 dinitrophenol; and one milligram per liter (1 mg/l) for antimony.

(3) Five (5) times the maximum concentration value reported for that pollutant in the NPDES permit application; or

(4) The level established by the Agency in this permit.

(b) That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the NPDES permit application.

(15) All Publicly Owned Treatment Works (POTWs) must provide adequate notice to the Agency of the following:

(a) Any new introduction of pollutants into that POTW from an indirect discharge which would be subject to Sections 301 or 306 of the Clean Water Act if it were directly discharging those pollutants; and

(b) Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

(c) For purposes of this paragraph, adequate notice shall include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

(16) If the permit is issued to a publicly owned or publicly regulated treatment works, the permittee shall require any industrial user of such treatment works to comply with federal requirements concerning:

(a) User charges pursuant to Section 204(b) of the Clean Water Act, and applicable regulations appearing in 40 CFR 35;

(b) Toxic pollutant effluent standards and pretreatment standards pursuant to Section 307 of the Clean Water Act; and

(c) Inspection, monitoring and entry pursuant to Section 308 of the Clean Water Act.

(17) If an applicable standard or limitation is promulgated under Section 301(b)(2)(C) and (D), 304(b)(2), or 307(a)(2) and that effluent standard or limitation is more stringent than any effluent limitation in the permit, or controls a pollutant not limited in the permit, the permit shall be promptly modified or revoked, and reissued to conform to that effluent standard or limitation.

(18) Any authorization to construct issued to the permittee pursuant to 35 Ill. Adm. Code 309.154 is hereby incorporated by reference as a condition of this permit.

(19) The permittee shall not make any false statement, representation or certification in any application, record, report, plan or other document submitted to the Agency or the USEPA, or required to be maintained under this permit.

(20) The Clean Water Act provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Clean Water Act is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions implementing Sections 301, 302, 306, 307, or 308 of the Clean Water Act is subject to a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than one year, or both.

(21) The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

(22) The Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit shall, including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

(23) Collected screening, slurries, sludges, and other solids shall be disposed of in such a manner as to prevent entry of those wastes (or runoff from the wastes) into waters of the State. The proper authorization for such disposal shall be obtained from the Agency and is incorporated as part hereof by reference.

(24) In case of conflict between these standard conditions and any other condition(s) included in this permit, the other condition(s) shall govern.

(25) The permittee shall comply with, in addition to the requirements of the permit, all applicable provisions of 35 Ill. Adm. Code, Subtitle C, Subtitle D, Subtitle E, and all applicable orders of the Board.

(26) The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit is held invalid, the remaining provisions of this permit shall continue in full force and effect.

SCREENED

(Rev. 3-13-98)

APPENDIX C

IDNR CORRESPONDENCE

From: "HEATHER RYAN" <HEATHER.RYAN@illinois.gov>
To: "Jeff Bushur" <JBushur@hanson-inc.com>
Date: 11/6/2007 11:06 AM
Subject: Re: Sangamon River Database Review
Attachments: DatabaseReviewforHanson.doc

Hi Jeff.

Attached please find a list of resources within the area of interest you specified for the Sangamon River. I included protected resources within approximately one mile of the Sangamon River. Let me know if you need any additional information.

Heather

Heather Ryan
Division of Ecosystems and Environment
Illinois Department of Natural Resources
One Natural Resources Way
Phone 217-785-5500
Fax 217-524-4177
heather.ryan@illinois.gov

>>> "Jeff Bushur" <JBushur@hanson-inc.com> 10/26/2007 3:58:21 PM >>>
Heather- As we discussed earlier on the phone, Hanson is requesting a Natural Heritage Database review for the Sangamon River from the confluence of the South Fork of the Sangamon River to the Sangamon River's confluence with the Illinois River (see attached map). Let me know if you require a written letter request rather than this e-mail.

Sincerely,

Jeffrey L. Bushur
Hanson Professional Services Inc.
1525 S. 6th St.
Springfield, IL 62703
(217) 788-2450
(217) 788-2503 (fax)
jbushur@hanson-inc.com

Natural Heritage Database Review
IDNR project code 0805266
11/07/07

Review of the Sangamon River from the confluence of the South Fork of the Sangamon River to the confluence with the Illinois River.

Sangamon County

T16N, R4W, S27 South Fork Sangamon River INAI site
T16N, R4W, S34 Clonophis kirtlandi (Kirtland's snake)
T16N, R4W, S33 & S34 Kevin and Linda Cox's Cory Woods Natural Heritage Landmark
T16N, R5W, S2 & S3 Carpenter Park INAI and Nature Preserve

T16N R5W, S4 Haliaeetus leucocephalus (Bald eagle)

Menard County

T17N, R6W, S22 through 18N, R7W, S1 Sangamon River – Petersburg INAI

T17N, R6W, S8 Tyto alba (Barn owl)

T17N, R6W, S3 Liatris scariosa var. nieuwlandii (Blazing star)

T18N, R7W, S13 Acipenser fulvescens (Lake sturgeon)

T19N, R7W, S1 & S2 Baugher Hill Prairie INAI and Nature Preserve

T19N, R7W, S11 and T19N, R7W, S3 Pseudacris streckeri (Illinois chorus frog)

Mason County

T20N, R8W, S36 Boltonia decurrens (Decurrent false aster)

T19N, R8W, S3 and T19N, R8W, S3 Menard County
Oakford Herbage INAI site and Tradescantia bracteata (Prairie spiderwort)

Cass County

T18N, R12W, S11 Lepomis miniatus (redspotted sunfish)

APPENDIX D

BORON WATER QUALITY DATA FOR THE SANGAMON RIVER – 1999-2004

Boron Water Quality Data for the Sangamon River
January 1999 to February 2004
Illinois EPA Ambient Water Quality Monitoring Network

Station E-26 Riverton, IL	
Date	Total Boron (mg/L)
01/27/99	0.083
03/01/99	0.110
04/06/99	0.080
05/13/99	0.081
06/14/99	0.130
08/09/99	0.780
09/14/99	0.640
10/28/99	1.100
11/29/99	1.000
12/27/99	0.620
02/07/00	0.970
03/23/00	0.130
05/25/00	0.250
08/14/00	0.550
09/11/00	0.960
10/11/00	0.079
12/11/00	0.270
01/11/01	0.210
02/26/01	0.048
03/27/01	0.079
04/24/01	0.047
05/23/01	0.095
07/18/01	0.580
10/22/01	0.260
11/26/01	0.160
01/15/02	0.160
02/13/02	0.180
04/08/02	0.100
05/21/02	0.029
07/01/02	0.053
08/13/02	0.250
09/24/02	0.220
11/07/02	1.100
12/19/02	0.440
01/30/03	1.400
03/11/03	0.690
04/21/03	0.170
05/22/03	0.120
07/07/03	0.400
08/12/03	0.550
09/18/03	0.980
11/06/03	0.800
12/11/03	0.270
02/04/04	0.130

Station E-24 Petersburg, IL	
Date	Total Boron (mg/L)
01/21/99	0.320
02/22/99	0.066
03/25/99	0.094
05/11/99	0.083
06/15/99	0.072
09/07/99	0.630
10/05/99	0.550
11/16/99	0.710
12/20/99	0.720
02/01/00	1.100
05/03/00	0.150
06/21/00	0.110
08/01/00	0.300
09/06/00	0.570
10/05/00	0.250
11/30/00	0.096
01/10/01	0.210
02/08/01	0.044
03/22/01	0.067
04/23/01	0.055
05/21/01	0.096
06/27/01	0.120
08/07/01	0.250
10/17/01	0.110
11/14/01	0.240
01/03/02	0.080
02/07/02	0.048
04/01/02	0.052
04/24/02	0.064
07/02/02	0.057
08/06/02	0.190
09/19/02	0.220
10/31/02	0.360
12/10/02	0.790
01/15/03	0.710
03/03/03	0.480
04/16/03	0.150
05/20/03	0.120
07/01/03	0.130
08/07/03	0.280
09/15/03	0.370
10/30/03	0.550
12/02/03	0.110
02/09/04	0.075

Station E-25 Oakford, IL	
Date	Total Boron (mg/L)
01/21/99	0.320
02/22/99	0.054
03/25/99	0.092
05/11/99	0.053
06/15/99	0.067
09/07/99	0.620
10/05/99	0.320
11/16/99	0.290
12/20/99	0.310
02/01/00	0.440
05/03/00	0.075
06/21/00	0.034
08/01/00	0.100
09/06/00	0.220
10/05/00	0.160
11/30/00	0.140
01/10/01	0.130
02/08/01	0.039
03/22/01	0.050
04/23/01	0.045
05/21/01	0.054
06/27/01	0.099
08/07/01	0.160
10/17/01	0.100
11/14/01	0.150
01/03/02	0.060
02/07/02	0.049
04/01/02	0.051
04/24/02	0.057
07/02/02	0.078
08/06/02	0.070
09/19/02	0.240
10/31/02	0.110
12/10/02	0.280
01/15/03	0.120
03/03/03	0.120
04/16/03	0.050
05/20/03	0.087
07/01/03	0.110
08/07/03	0.073
09/15/03	0.170
10/30/03	0.180
12/02/03	0.082
02/09/04	0.110

APPENDIX E

BORON ANAYLTICAL RESULTS - SEPTEMBER 2007 AND OCTOBER 2007

An Analytical
Testing Laboratory

Prairie Analytical
Systems, INCORPORATED

1210 Capital Airport Drive
Springfield, Illinois 62707
Phone: 217-753-1148
Fax: 217-753-1152
www.prairieanalytical.com

September 13, 2007

Mr. Jeff Busher
Hanson Professional Services
1525 South Sixth Street
Springfield, IL 62703

RE: CWLP Boron Stream Sampling

PAS Order No.: 0709097

Dear Mr. Jeff Busher:

Prairie Analytical Systems, Inc. received 3 samples on 9/10/2007 3:10:00 PM for the analyses presented in the following report.

All applicable quality control procedures met method specific acceptance criteria.

This report shall not be reproduced, except in full, without the prior written consent of Prairie Analytical Systems, Inc.

If you have any questions, please feel free to call me at (217) 753-1148.

Sincerely,

Michael D. Brophy
Project Manager

Prairie Analytical Systems, Inc. **Date:** *13-Sep-07*

CLIENT: Hanson Professional Services **Lab Order:** 0709097
Project: CWLP Boron Stream Sampling

Lab ID: 0709097-001 **Collection Date:** 9/10/2007 1:45:00 PM
Client Sample ID: S-1 **Matrix:** AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		Analyst: **JTC**
Boron	1.16	0.100		mg/L	10	9/12/2007 2:33:00 PM

Lab ID: 0709097-002 **Collection Date:** 9/10/2007 2:15:00 PM
Client Sample ID: S-2 **Matrix:** AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		Analyst: **JTC**
Boron	1.18	0.100		mg/L	10	9/12/2007 2:40:00 PM

Lab ID: 0709097-003 **Collection Date:** 9/10/2007 2:55:00 PM
Client Sample ID: S-3 **Matrix:** AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		Analyst: **JTC**
Boron	0.442	0.0500		mg/L	5	9/12/2007 2:47:00 PM

Qualifiers:

B - Analyte detected in the associated method blank.

E - Value above quantitation range.

H - Analysis performed past holding time.

HT - Sample received past holding time.

J - Analyte detected between RL and MDL.

R - RPD outside acceptance limits.

S - Spike recovery outside acceptance limits.

U - Analyte not detected (i.e. less than RL or MDL).

Chain of Custody Record

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Chicago Office - PO Box 2116 - Crystal Lake, IL 60039-2116 - Phone (847) 651-2604 - Facsimile (847) 458-9680

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Prairie Analytical Systems, INCORPORATED

Client	Hanson Professional Services Inc
Address	1525 South 6th Street
City, State Zip Code	Springfied, IL 62703
Phone / Facsimile No.	217-788-2450 / 217-788-5241
Client Project	CWLP Boron Stream Sampling
Location	Springfield, IL
Sampler(s) / Phone	Jeff Busher / 217-788-2450
Turnaround Time	Standard ☒ Rush ( ) Date Required:
P.O. # or Invoice To	JOB # 055 3047-5600
Contact Person	Jeff Busher

Analysis and/or method Requested: TOTAL BORON

Reporting
TACO
___ Resid
___ Ind/Comm
CALM
__ A __ B
__ C
RISC
___ Resid
___ Indust

Sample Description	Sampling Date	Sampling Time	Matrix Code[1]	Total # of Containers	Sample Comp	Sample Grab	TOTAL BORON								Laboratory Comments
S-1	9/10/07	1345	A	1		X	X								
S-2	↓	1415	A	1		X	X								
S-3	↓	1455	A	1		X	X								

[1] M = Matrix Code A - Aqueous DW - Drinking Water GW - Groundwater NA - Non-aqueous Liquid S - Solids O - Other (Specify)

Relinquished By	Date	Time	Received By	Date	Time	Method of Shipment
Jeff Busher	9/10/07	3:10 pm		9/10/07	3:10 pm	HAND

Special Instructions: In from field

Q/C Level 1✓ 2__ 3__ 4__

On Wet Ice Y / [✓ N]
Proper Preservation [✓ Y] / N

Temperature (°C) 25.3°C

Page 1 of 1

Copies: White - Client Yellow - PAS, Inc. Pink - Sampler

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September 21, 2007

Mr. Jeff Bushur
Hanson Professional Services
1525 South Sixth Street
Springfield, IL 62703

RE: CWLP Boron Stream Sampling PAS Order No.: 0709191

Dear Mr. Jeff Bushur:

Prairie Analytical Systems, Inc. received 4 samples on 9/17/2007 12:04:00 PM for the analyses presented in the following report.

All applicable quality control procedures met method specific acceptance criteria.

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If you have any questions, please feel free to call me at (217) 753-1148.

Sincerely,

Michael D. Brophy
Project Manager

Prairie Analytical Systems, Inc. **Date:** *21-Sep-07*

CLIENT: Hanson Professional Services **Lab Order:** 0709191
Project: CWLP Boron Stream Sampling

Lab ID: 0709191-001 **Collection Date:** 9/17/2007 10:30:00 AM
Client Sample ID: S-1 **Matrix:** AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		Analyst: **JTC**
Boron	1.15	0.0100		mg/L	1	9/19/2007 4:23:00 PM

Lab ID: 0709191-002 **Collection Date:** 9/17/2007 11:55:00 AM
Client Sample ID: S-2 **Matrix:** AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		Analyst: **JTC**
Boron	1.35	0.0100		mg/L	1	9/19/2007 5:05:00 PM

Lab ID: 0709191-003 **Collection Date:** 9/17/2007 11:24:00 AM
Client Sample ID: S-3 **Matrix:** AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		Analyst: **JTC**
Boron	0.430	0.0100		mg/L	1	9/19/2007 5:12:00 PM

Lab ID: 0709191-004 **Collection Date:** 9/17/2007 10:44:00 AM
Client Sample ID: S-4 **Matrix:** AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		Analyst: **JTC**
Boron	1.12	0.0100		mg/L	1	9/19/2007 5:19:00 PM

Qualifiers:

B - Analyte detected in the associated method blank.

E - Value above quantitation range.

H - Analysis performed past holding time.

HT - Sample received past holding time.

J - Analyte detected between RL and MDL.

R - RPD outside acceptance limits.

S - Spike recovery outside acceptance limits.

U - Analyte not detected (i.e. less than RL or MDL).

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Prairie Analytical Systems, INCORPORATED

Client	Hanson Professional Services Inc
Address	1525 South 6th Street
City, State Zip Code	Springfield, IL 62703
Phone / Facsimile No.	217-788-2450 / 217-788-5241
Client Project	CWLP Boron Stream Sampling
Location	Springfield, IL
Sampler(s) / Phone	Jeff Bushur / 217-788-2450
Turnaround Time	Standard ☒ Rush [ ] Date Required:
P.O. # or Invoice To	Job # 055 3047-5600
Contact Person	Jeff Bushur

Reporting: TACO — ___ Resid — ___ Ind/Comm; CALM — __ A __ B __ C; RISC — ___ Resid — ___ Indust

Sample Description	Sampling Date	Sampling Time	Matrix Code¹	Total # of Containers	Sample Comp	Sample Grab	Analysis and/or method Requested: Total Boron							Laboratory Comments
S-1	9/17/07	1030	A	1		X	X							
S-2	↓	1155	A	1		X	X							
S-3	↓	1124	A	1		X	X							
S-4	↓	1044	A	1		X	X							

¹ M = Matrix Code: A - Aqueous; DW - Drinking Water; GW - Groundwater; NA - Non-aqueous Liquid; S - Solids; O - Other (Specify)

Relinquished By	Date	Time	Received By	Date	Time	Method of Shipment
Jeff Bushur	9/17/07	12:04 pm		9/17/07	12:04	Hand

Special Instructions:

Q/C Level 1__ 2__ 3__ 4__

On Wet Ice Y / [✓ N]

Proper Preservation [✓ Y] / N

Temperature (°C) 20.1

Page 1 of 1

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September 26, 2007

Mr. Jeff Busher
Hanson Professional Services
1525 South Sixth Street
Springfield, IL 62703

RE: Boron Analysis / CWLP Boron Sampling PAS Order No.: 0709280

Dear Mr. Jeff Busher:

Prairie Analytical Systems, Inc. received 4 samples on 9/24/2007 11:47:00 AM for the analyses presented in the following report.

All applicable quality control procedures met method specific acceptance criteria.

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If you have any questions, please feel free to call me at (217) 753-1148.

Sincerely,

Michael D. Brophy
Project Manager

Prairie Analytical Systems, Inc.

Date: *26-Sep-07*

CLIENT: Hanson Professional Services
Lab Order: 0709280
Project: Boron Analysis / CWLP Boron Sampling

Lab ID: 0709280-001
Collection Date: 9/24/2007 11:30:00 AM
Client Sample ID: S-1
Matrix: AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		**Analyst: JTC**
Boron	0.466	0.0100		mg/L	1	9/24/2007 10:03:00 PM

Lab ID: 0709280-002
Collection Date: 9/24/2007 11:00:00 AM
Client Sample ID: S-2
Matrix: AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		**Analyst: JTC**
Boron	0.514	0.0100		mg/L	1	9/24/2007 10:24:00 PM

Lab ID: 0709280-003
Collection Date: 9/24/2007 10:42:00 AM
Client Sample ID: S-3
Matrix: AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		**Analyst: JTC**
Boron	0.340	0.0100		mg/L	1	9/24/2007 10:31:00 PM

Lab ID: 0709280-004
Collection Date: 9/24/2007 11:20:00 AM
Client Sample ID: S-4
Matrix: AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		**Analyst: JTC**
Boron	0.587	0.0100		mg/L	1	9/24/2007 10:38:00 PM

Qualifiers:

B - Analyte detected in the associated method blank.

E - Value above quantitation range.

H - Analysis performed past holding time.

HT - Sample received past holding time.

J - Analyte detected between RL and MDL.

R - RPD outside acceptance limits.

S - Spike recovery outside acceptance limits.

U - Analyte not detected (i.e. less than RL or MDL).

Chain of Custody Record

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Prairie Analytical Systems, Incorporated

Client	Hanson Professional Services Inc.	
Address	1525 S. 6th St	
City, State Zip Code	Springfield, IL 62703	
Phone / Facsimile No.	217-788-2450	217-788-5241
Client Project	CWLP Boron Sampling	
Location	Springfield, IL	
Sampler(s) / Phone	Jeff Busher	217-788-2450
Turnaround Time	Standard ☒ Rush [ ] Date Required:	
P.O. # or Invoice To	JOB # 05S3047-5600	
Contact Person	JEFF Busher	

Analysis and/or method Requested: Total Boron

Reporting
TACO
___ Resid
___ Ind/Comm
CALM
__ A __ B
__ C
RISC
___ Resid
___ Indust

Sample Description	Sampling Date	Sampling Time	Matrix Code¹	Total # of Containers	Sample Comp	Sample Grab	Total Boron	Laboratory Comments
S-1	9/24/07	11:30 am	A	1		X	X	
S-2		11:00 am	A	1		X	X	
S-3		10:42 am	A	1		X	X	
S-4		11:20 am	A	1		X	X	

¹ M = Matrix Code A - Aqueous DW - Drinking Water GW - Groundwater NA - Non-aqueous Liquid S - Solids O - Other (Specify)

Relinquished By	Date	Time	Received By	Date	Time	Method of Shipment
Jeff Busher	9/24/07	11:47 am.		9/24/07	11:47a	Hand

Special Instructions:

Q/C Level 1__ 2__ 3__ 4__

On Wet Ice Y / N

Proper Preservation Y / N

Temperature (°C) 26.2°

Page 1 of 1

Copies: White - Client Yellow - PAS. Inc Pink - Sampler

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October 05, 2007

Mr. Jeff Busher
Hanson Professional Services
1525 South Sixth Street
Springfield, IL 62703

RE: Boron Analysis PAS Order No.: 0710012

Dear Mr. Jeff Busher:

Prairie Analytical Systems, Inc. received 6 samples on 10/1/2007 11:52:00 AM for the analyses presented in the following report.

All applicable quality control procedures met method specific acceptance criteria.

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If you have any questions, please feel free to call me at (217) 753-1148.

Sincerely,

Michael D. Brophy
Project Manager

Prairie Analytical Systems, Inc.

Date: *05-Oct-07*

CLIENT: Hanson Professional Services
Project: Boron Analysis
Lab Order: 0710012

Lab ID: 0710012-001
Client Sample ID: S-1
Collection Date: 10/1/2007 11:31:00 AM
Matrix: AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		Analyst: **JTC**
Boron	1.43	0.100		mg/L	20	10/4/2007 11:51:00 PM

Lab ID: 0710012-002
Client Sample ID: S-2
Collection Date: 10/1/2007 11:00:00 AM
Matrix: AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		Analyst: **JTC**
Boron	2.14	0.100		mg/L	20	10/4/2007 11:59:00 PM

Lab ID: 0710012-003
Client Sample ID: S-3
Collection Date: 10/1/2007 11:18:00 AM
Matrix: AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		Analyst: **JTC**
Boron	0.138	0.0100		mg/L	2	10/5/2007 12:07:00 AM

Lab ID: 0710012-004
Client Sample ID: S-4
Collection Date: 10/1/2007 11:42:00 AM
Matrix: AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		Analyst: **JTC**
Boron	1.43	0.100		mg/L	20	10/5/2007 12:15:00 AM

Lab ID: 0710012-005
Client Sample ID: S-5
Collection Date: 10/1/2007 10:10:00 AM
Matrix: AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		Analyst: **JTC**
Boron	16.4	1.00		mg/L	200	10/5/2007 12:23:00 AM

Lab ID: 0710012-006
Client Sample ID: S-6
Collection Date: 10/1/2007 10:35:00 AM
Matrix: AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
METALS ANALYSIS		**SW6020**		**(SW3005A)**		Analyst: **JTC**
Boron	7.37	0.500		mg/L	100	10/5/2007 12:32:00 AM

Qualifiers:

B - Analyte detected in the associated method blank.

E - Value above quantitation range.

H - Analysis performed past holding time.

HT - Sample received past holding time.

J - Analyte detected between RL and MDL.

R - RPD outside acceptance limits.

S - Spike recovery outside acceptance limits.

U - Analyte not detected (i.e. less than RL or MDL).

Chain of Custody Record

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Client	Hanson Professional Services Inc.	Analysis and/or method Requested	Reporting
Address	1525 S. Sixth St.	Boron	TACO
City, State Zip Code	Springfield, IL 62703		____ Resid
Phone / Facsimile No.	217-788-2450 /		____ Ind/Comm
Client Project	CULP Boron Sampling		CALM
Location	Springfield IL		__ A __ B
Sampler(s) / Phone	Jeff Bushur, Ryan Lawless / 217-788-2450		__ C
Turnaround Time	Standard ☒ Rush [ ] Date Required:		RISC
P.O. # or Invoice To	07E0039-5000		____ Resid
Contact Person	Jeff Bushur		____ Indust

Sample Description	Sampling		Matrix Code[1]	Total # of Containers	Sample		Laboratory Comments
	Date	Time			Comp	Grab	
S-1	10-1-07	11:31 am	A	1		X	
S-2	10-1-07	11:00 am	A	1		X	
S-3	10-1-07	11:18 am	A	1		X	
S-4	10-1-07	11:42 am	A	1		X	
S-5	10-1-07	10:10 am	A	1		X	
S-6	10-1-07	10:35 am	A	1		X	

[1] M = Matrix Code A - Aqueous DW - Drinking Water GW - Groundwater NA - Non-aqueous Liquid S - Solids O - Other (Specify)

Relinquished By	Date	Time	Received By	Date	Time	Method of Shipment
Jeff Bushur	10-1-07	11:52 am		10/01/07	11:5	Hand

Special Instructions:

Q/C Level 1__ 2__ 3__ 4__

On Wet Ice [✓ Y] N

Proper Preservation [✓ Y] N

Temperature (°C) 24.6

Page _____ of _____

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TECHNICAL SUPPORT DOCUMENT FOR PETITION FOR ADJUSTED BORON STANDARDS FOR SUGAR CREEK AND THE SANGAMON RIVER

PREPARED FOR

City water light & power

PREPARED BY

HANSON ENGINEERS
INCORPORATED

MARCH 1994

PROJECT NO. 92S5034A

TECHNICAL SUPPORT DOCUMENT FOR PETITION FOR ADJUSTED BORON STANDARDS FOR SUGAR CREEK AND THE SANGAMON RIVER

Prepared for

CITY WATER, LIGHT AND POWER
Springfield, Illinois

Prepared by
Dan W. Jones
HANSON ENGINEERS INCORPORATED
1525 South Sixth Street
Springfield, Illinois 62703

MARCH 1994

TECHNICAL SUPPORT DOCUMENT FOR PETITION FOR ADJUSTED BORON STANDARDS FOR SUGAR CREEK AND THE SANGAMON RIVER

TABLE OF CONTENTS

TABLE OF CONTENTS

(Continued)

TABLE OF CONTENTS

(Continued)

APPENDICES

LIST OF TABLES

TABLE OF CONTENTS
(Continued)

LIST OF TABLES
(Continued)

LIST OF FIGURES

EXECUTIVE SUMMARY

The reissued NPDES permit IL0024767 requires the City Water, Light and Power (CWLP) electric generation station, located on Lake Springfield, to limit and monitor the concentrations of boron in its outfall discharges to Sugar Creek. The permit limit for boron is 1.0 mg/L with compliance to be achieved by December 14, 1994. This boron effluent discharge limit is based upon the Illinois General Use boron water quality stream standard of the Illinois Pollution Control Board (IPCB) as set forth in 35 Ill. Adm. Code 302.208(e). Historical data on the concentrations of boron in the existing discharges suggest that noncompliance with the effluent limitation in the permit will occur frequently.

Therefore, an upward adjustment for boron for the stream limitation is recommended. The recommended adjusted stream standards for boron are: 11.0 mg/L from CWLP outfall 003 to Springfield Metropolitan Sanitary District's (SMSD) Sugar Creek station outfall 008; 5.5 mg/L from outfall 008 to the confluence of Sugar Creek with the South Fork and the Sangamon River; and 2.0 mg/L from this confluence to 100 yds downstream of the confluence of the Sangamon River with Spring Creek, which receives the SMSD's Spring Creek station 007 outfall discharge. This report evaluates and compares the ecological and water quality impacts of boron levels discharged into Sugar Creek, the associated sections of the Sangamon River, and the South Fork of the Sangamon River which receive Sugar Creek flows. This evaluation assesses the effects of proposed adjusted standards for boron levels in Sugar Creek and the Sangamon River resulting from discharges into Sugar Creek from the CWLP electric generation station facilities.

The IEPA operates an Ambient Water Quality Monitoring Network (AWQMN) consisting of 208 fixed stations. Data from four of the AWQMN sampling stations were used in this report. Station E16, near Roby, is about 11 miles upstream of the confluence of the South Fork and Sugar Creek with the Sangamon River. Station E26, near Riverton, is 2.2 miles downstream from the confluence of the South Fork and Sugar Creek with the Sangamon. Site EO-01 is located on the South Fork at the Illinois Route 29 bridge and is about 4.7 miles upstream from its confluence with Sugar Creek and the Sangamon. Station EOA-01 is located on Sugar Creek at the Illinois Route 29 bridge about one mile southeast of Springfield.

Results of chemical water analyses for all four stations were within the federal and state guidelines. Sugar Creek appears to have had somewhat higher overall water quality during the 1987 USGS Water Year than the stretches of the South Fork and the Sangamon Rivers discussed in this report.

The percentage of samples with boron levels above the General Water Use standard of 1.0 mg/L was calculated for each monitoring station. Lake Springfield and the upstream South Fork and Sangamon River stations had no samples with boron levels above 1.0 mg/L. Only 2.5 percent of the SMSD sewage treatment plant outfall 008 discharges into Sugar Creek exceeded 1.0 mg/L boron, whereas 74.5 percent of the samples from the Sugar Creek station were above the 1.0 mg/L boron standard. The CWLP outfall discharges into Sugar Creek appear to be the primary sources of boron flowing from Sugar Creek into the Sangamon River and subsequently influencing the boron levels observed at the downstream Riverton station.

When comparing the maximum boron levels from the sampling locations to the proposed boron stream standards, only the CWLP Sugar Creek outfall 003 had samples above the proposed standard. However, except for very infrequent events, the CWLP outfall discharges would normally be in compliance with the recommended adjusted boron stream standard.

A mass balance of boron concentrations was calculated for several locations in Sugar Creek and the Sangamon River. The purpose of the calculations was to provide boron values that might be expected during critical low stream flow conditions (7Q10). A worst-case scenario was developed using a set of hypothetical criteria, which included high effluent boron concentrations and low stream and effluent flow rates.

This scenario suggests that with present effluent flows and boron concentrations, boron levels in Sugar Creek and the Sangamon River as far downstream as 100 yds below Spring Creek would not be expected to fall below the 1.0 mg/L General Use standard during 7Q10 flows.

Even though the Sangamon River may show boron levels below 1.0 mg/L during periods of "average" flow volume due to dilution factors, Sugar Creek would still be expected to have boron concentrations above 1.0 mg/L. However, this scenario also suggests that the requested boron stream standards, would be met at all locations.

Macroinvertebrate Biotic Index values are included in the 1985 and the 1989 stream studies on Sugar Creek conducted by the IEPA to assess and monitor the effects of the Springfield Sanitary District's Sugar Creek sewage treatment plant effluents on the condition of the receiving stream. Both studies concluded that the sewage treatment plant was having a slight to moderate impact on Sugar Creek.

A 1987-88 fisheries survey done for CWLP included closely associated portions of the South Fork, the Sangamon River, and Sugar Creek. Based on fish species diversity, it appears the Sangamon River is not being negatively influenced by Sugar Creek or the South Fork.

Several referenced toxicity studies, done on a diverse list of aquatic organisms, demonstrate the response to boron of three aquatic trophic levels: plant, invertebrate, and vertebrate (fish). The results indicate that the Sugar Creek-Sangamon River biological community would not be significantly affected at the proposed boron stream standards. A study on boron toxicity to turfgrass species, commonly used on golf courses, from irrigation waters was referenced. The study suggests toxicity problems would not be anticipated at the proposed adjusted standard should irrigation of golf courses be done from the Sangamon River. A direct investigation of potential toxicity of the CWLP discharges was conducted by the IEPA in August 1988. A bioassay was performed with effluent water samples on the invertebrate *Ceriodaphnia dubia* and on fathead minnows. No significant acute toxicity was observed for either species.

The impairments observed in overall stream quality for the four sampling stations are not attributable to documented concentrations of boron within the stream reaches in question. There are several known causes and sources for these impairments to stream quality. These elements include: siltation from agriculture; organic enrichment from agriculture and municipal sewage treatment plants; and habitat degradation and siltation from stream channelization. In addition to these impairment factors, an additional cause of stream quality limitation for Sugar Creek is the disruption to the aquatic habitat from flow regulation by Spaulding Dam.

As required in the process of petitioning for the adjusted stream standards, several compliance alternatives were considered. Two treatment alternatives were evaluated for boron removal to meet the effluent discharge standard. The selective ion exchange process employs a commercially available ion exchange resin that can be used for removing boron. Reverse osmosis is a process where moderate pressures are used to force water through semi-permeable membranes, which are relatively impervious to passage of various ions including boron. Two alternative operating procedures were also evaluated: conversion of the fly ash handling system to a dry method, and the use of a low boron coal. The present-worth values for these alternatives range from $19,750,000 to $99,800,000. The least expensive alternative appears to be selective ion exchange at a present worth of $19,750,000.

The assessment of the stream ecosystems presented in this document indicates that the boron concentrations in the CWLP outfall discharges have had no adverse effect on the aquatic communities being exposed to these boron levels. Impacts to resident biota are not anticipated from the proposed adjusted water quality standards for boron because the discharged boron concentrations will not change from the present concentrations.

The designated stream use of Sugar Creek of support of aquatic life is enhanced by the additional flow velocity and discharge augmentation of creek flow by water discharged from the CWLP power station during low flow months. The existing discharges especially augment movement of species whose passage may be blocked in low flow periods and sustain deeper water pools to accommodate pool species.

There are no known irrigation or potable water uses of Sugar Creek. No future uses of Sugar Creek are anticipated that would benefit from achieving the General Use water quality standard for boron. There are no known future plans to use Sugar Creek as a potable water supply or for any other withdrawal purpose such as irrigation. No impacts to any known current activities due to the water quality of Sugar Creek have occurred; therefore, none would be anticipated from alignment of the regulatory standard with the present concentrations.

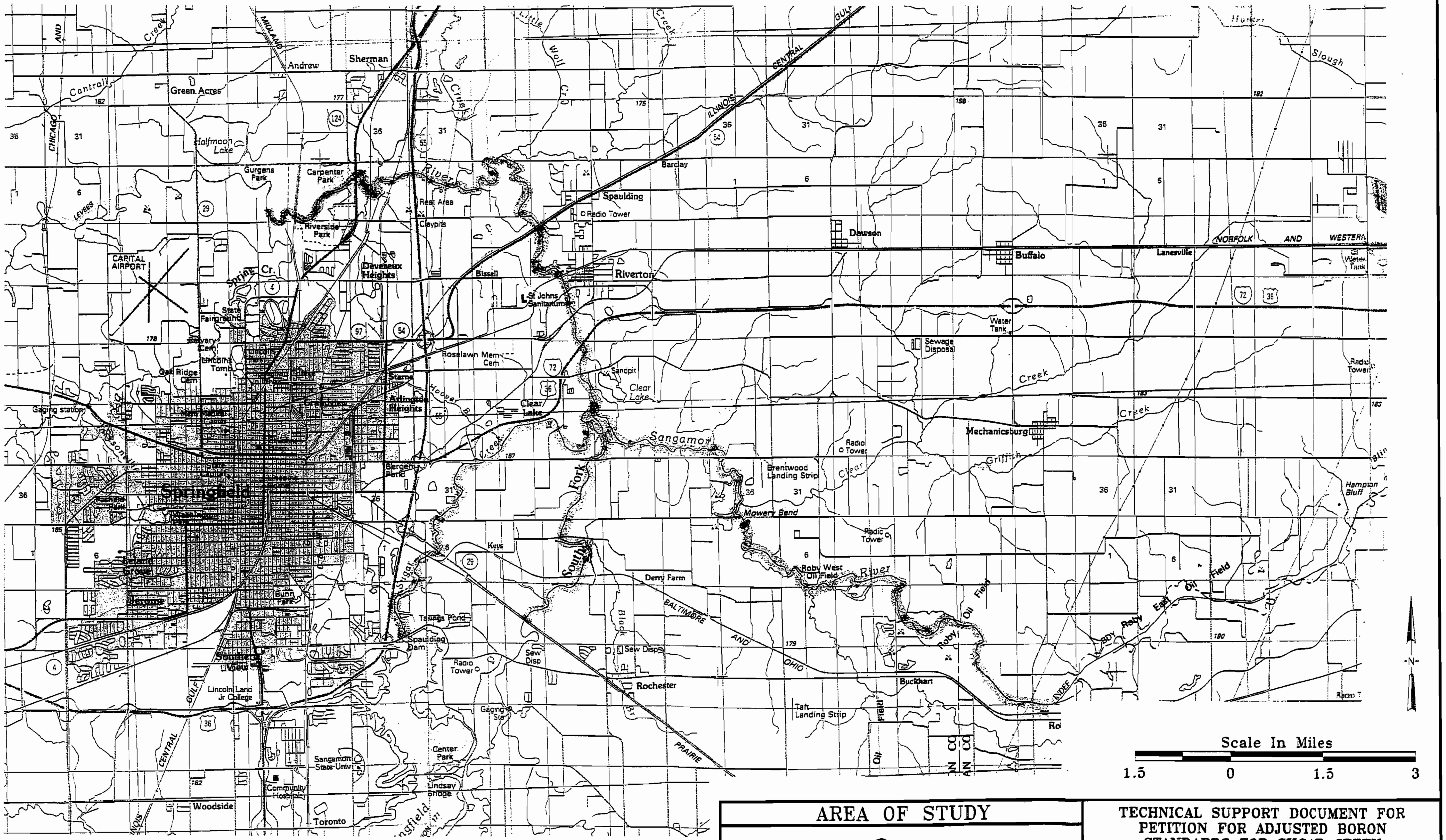
1.0 PURPOSE AND SCOPE

The purpose of this report is to evaluate and compare the ecological and water quality impacts of boron levels discharged into Sugar Creek, the associated sections of the Sangamon River, and the South Fork of the Sangamon River which receive Sugar Creek flows. The area of concern is shown in Figure 1.1. The purpose of this evaluation is to assess the effects of proposed adjusted stream standards for boron in relation to discharges into Sugar Creek from the City Water, Light and Power (CWLP) electric generation station facilities.

The reissued NPDES permit IL0024767 requires the CWLP power station, located on Lake Springfield, to limit and monitor the concentrations of boron in its outfall discharges to Sugar Creek. The permit limit for boron is 1.0 mg/L with compliance to be achieved by December 14, 1994. This boron effluent discharge limit is based upon the Illinois General Use boron water quality standard of the Illinois Pollution Control Board (IPCB) as set forth in 35 Ill. Adm. Code 302.208 (e). CWLP will file a petition to the IPCB to request adjusted boron stream standards for Sugar Creek and the associated downstream reach of the Sangamon River.

This report discusses issues required to be addressed in the petition, including: a description of the power plant operations that are the subject of the petition; a description of the area affected by the discharges; the qualitative and quantitative nature of these discharges in relation to their boron content; and a comparison of the environmental impacts of complying with the existing boron standard and of complying with the proposed boron standards in relation to the aquatic ecology, hydrology, and water uses of the receiving streams. This report also includes the required analysis of compliance alternatives and their relative costs for implementation and operation.

To address the petition requirements and to assess the impacts of the CWLP discharges and their boron levels, this report used existing water quality data and biological studies conducted by CWLP, the Illinois Environmental Protection Agency (IEPA), the U.S. Geological Survey (USGS), the Sangamon County Soil and Water Conservation District, the Illinois Department of Transportation (IDOT), and the Illinois Department of Conservation (IDOC).



AREA OF STUDY

TECHNICAL SUPPORT DOCUMENT FOR
PETITION FOR ADJUSTED BORON
STANDARDS FOR SUGAR CREEK
AND THE SANGAMON RIVER

HANSON ENGINEERS INCORPORATED

Job No. 92S5034A

Figure 1.1

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Stream flow information from the Illinois State Water Survey (ISWS) was used to predict possible boron levels during projected low flow (7Q10) periods for Sugar Creek and the downstream Sangamon River. The discussion of possible toxicological effects of boron are based on published studies and a bioassay done on a CWLP discharge by the IEPA.

2.0 FACILITY INFORMATION

2.1 Plant Description

The V.Y. Dallman Power Station at 3100 Stevenson Drive is located at the southeast edge of the City of Springfield, Illinois, adjacent to Lake Springfield and the Stevenson Drive interchange on Interstate Route 55 (Figure 2.1). The station is of the indoor type. Units 1 and 2 are identical 80 megawatt cyclone coal-fired units. Unit 1 went into service in 1968, and Unit 2 in 1972. Each unit operates at 1,250 psig and 950°F.

Unit 3 went into service in 1978. The unit operates at 2,400 psig and 1,000°F. Unit 3 is a 192 megawatt pulverized coal-fired unit. As part of the effort to reduce air emissions from the power plant, a flue gas desulfurization system for Unit 3 went into service in 1980. This scrubber removes over 80 percent of the sulphur dioxide from the unit's flue gases. The flue gas desulfurization system is a wet limestone forced oxidation system. The system is equipped with two absorber towers.

The Lakeside Power Station is also located at 3100 Stevenson Drive next to the Dallman plant. Originally, there were eight boilers and seven turbine generators at Lakeside. The first unit at Lakeside went into operation in 1935. Only two boilers and two turbine generators are still in operation. Boilers 7 and 8 are identical 33 megawatt cyclone coal-fired boilers. Boiler 7-Turbine 6 went into operation in 1959 and Boiler 8-Turbine 7 in 1964. Each unit operates at 850 psig and 900°F.

There are approximately 220 people employed at the Dallman and Lakeside power complex. The facility is staffed 24 hours per day, seven days per week.

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CWLP DISCHARGE OUTFALLS

HANSON ENGINEERS INCORPORATED

TECHNICAL SUPPORT DOCUMENT FOR
PETITION FOR ADJUSTED BORON
STANDARDS FOR SUGAR CREEK
AND THE SANGAMON RIVER

Job No. 92S5034A

Figure 2.1

2.2 Plant Operation

Total coal usage at the complex currently averages 950,000 tons per year. Table 2.1 shows the monthly coal usage per unit for 1990 through 1992. The coal is delivered by truck to the power station from the Turris Coal Company mine near Elkhart, Illinois. Table 2.1A shows the tons of coal supplied each year during the last 10 years by each of the coal company suppliers. The monthly fuel oil usage per unit for 1990 through 1992 is shown in Table 2.2.

The monthly gross generation per unit in kilowatt hours for 1990 through 1992 is shown in Table 2.3. The monthly capacity factor (turbine/generator) for 1990 through 1992 is presented in Table 2.4. The pounds of steam delivered to each turbine on a monthly basis for 1990 through 1992 is shown in Table 2.5. The monthly volume of water pump usage for 1990 through 1992 is shown in Table 2.6.

Operation of the boilers requires pure feed water in order to prevent scaling of boiler and turbine internals at high operating temperatures and pressures. Although demineralized water is used for the boiler feed water makeup, dissolved solids can still accumulate in the boiler steam drums. Boiler blowdown is required to keep solids below the desired levels. All blowdown from the boilers is piped to a flash tank. As the blowdown enters the flash tank, a portion of it is vaporized and vented to the atmosphere. The remaining liquid portion is sent to the wastewater treatment plant (Figure 2.2). Table 2.7 shows the volume of demineralizer and evaporator water production on a monthly basis for 1990 through 1992.

Cooling water for the ash hoppers and the water seals between the boilers and the ash hoppers is taken from the circulating cooling water system. The overflows from the ash hoppers is discharged to the power station complex's wastewater treatment system (Figure 2.2).

Sluice water pumps draw water from the circulating cooling water system for the ash transport system. Table 2.8 shows the monthly volume of ash sluice pump usage for the Dallman plant for 1990 through 1992. Ash sluice pump usage data for the Lakeside plant are not available. There are three separate ash transport systems in operation at the power station

TABLE 2.1

MONTHLY COAL USAGE PER UNIT (TONS)

1990	BOILER 7	BOILER 8	BOILER 31	BOILER 32	BOILER 33	TOTAL
JANUARY	0	50.60	10,440.80	20,850.60	42,481.50	73,823.50
FEBRUARY	492.55	1,135.55	14,672.60	4,030.35	44,417.20	64,748.25
MARCH	671.40	173.60	20,053.25	1,212.30	47,309.80	69,420.35
APRIL	9,862.45	10,158.90	23,967.50	24,052.60	0.00	68,041.45
MAY	1,013.35	914.45	5,564.75	16,358.90	39,339.35	63,190.80
JUNE	2,981.95	1,738.10	15,706.90	16,758.95	45,764.40	82,950.30
JULY	5,989.95	5,210.35	14,741.05	20,538.80	50,096.65	96,576.80
AUGUST	3,299.60	2,043.80	20,736.80	19,714.35	48,757.35	94,551.90
SEPTEMBER	4,592.25	2,954.05	19,567.00	11,136.60	38,441.70	76,691.60
OCTOBER	0.00	0.00	20,934.30	0.00	49,107.50	70,041.80
NOVEMBER	3,500.35	3,084.95	14,545.35	0.00	45,649.60	66,780.25
DECEMBER	2,636.30	678.50	20,663.80	7,730.05	47,926.80	79,635.45
TOTAL	35,040.15	28,142.85	201,594.10	142,383.50	499,291.85	906,452.45

1991	BOILER 7	BOILER 8	BOILER 31	BOILER 32	BOILER 33	TOTAL
JANUARY	267.00	147.05	20,770.00	19,711.45	47,130.65	88,026.15
FEBRUARY	945.35	868.55	18,521.75	18,598.85	38,098.75	77,033.25
MARCH	2,007.70	2,017.05	19,511.35	13,073.55	38,560.40	75,170.05
APRIL	7,397.45	10,126.50	24,318.05	25,042.95	0.00	66,884.95
MAY	331.50	6,500.80	3,480.60	22,976.95	47,934.75	81,224.60
JUNE	485.40	6,684.75	19,716.80	18,433.30	48,472.50	93,792.75
JULY	2,583.85	6,168.00	19,202.71	21,342.93	50,463.30	99,760.79
AUGUST	2,689.35	2,791.10	19,288.00	19,740.25	49,096.20	93,604.90
SEPTEMBER	2,279.25	725.25	14,610.40	18,872.86	42,416.55	78,904.31
OCTOBER	3,019.45	1,376.00	5,898.05	17,643.45	40,156.85	68,093.80
NOVEMBER	12.25	0.00	8,075.50	18,859.80	49,976.60	76,924.15
DECEMBER	725.30	846.50	19,786.25	4,798.10	51,133.35	77,289.50
TOTAL	22,743.85	38,251.55	193,179.46	219,094.44	503,439.90	976,709.20

1992	BOILER 7	BOILER 8	BOILER 31	BOILER 32	BOILER 33	TOTAL
JANUARY	3,846.15	909.15	3,050.55	20,676.40	51,257.00	79,739.25
FEBRUARY	0.00	0.00	7,709.35	11,404.70	49,071.40	68,185.45
MARCH	7,659.20	9,351.70	11,768.80	7,416.55	34,898.55	71,094.80
APRIL	10,130.30	9,997.75	22,582.15	26,365.70	0.00	69,075.90
MAY	8,311.95	8,445.50	24,145.80	21,089.40	10,624.70	72,617.35
JUNE	2,009.85	1,788.75	16,420.40	15,156.15	43,436.50	78,811.65
JULY	853.55	814.95	20,796.85	21,294.95	48,426.29	92,186.59
AUGUST	1,619.20	792.25	19,615.40	13,578.10	47,030.70	82,635.65
SEPTEMBER	2,271.00	1,309.65	8,246.35	19,713.25	42,935.82	74,476.07
OCTOBER	114.45	0.00	0.00	21,373.80	50,996.15	72,484.40
NOVEMBER	11,766.05	9,203.05	13.00	4,204.85	49,319.00	74,505.95
DECEMBER	271.70	11,724.35	24,794.80	0.00	49,689.00	86,479.85
TOTAL	48,853.40	54,337.10	159,143.45	182,273.85	477,685.11	922,292.91

TABLE 2.1A

COAL SUPPLIERS (TONS)

	TURRIS	MONTEREY #1	FREEMAN CROWN II	ZIEGLER MURDOCH
1983	525,752	0	164,675	88,990
1984	759,382	20,083	0	0
1985	701,312	0	0	0
1986	791,662	0	0	0
1987	840,292	0	0	0
1988	896,395	0	0	0
1989	906,649	0	0	0
1990	907,094	5,000	0	0
1991	988,593	0	0	0
1992	933,105	0	0	0
1993	1,019,802	0	0	0

TABLE 2.2

MONTHLY OIL USAGE PER UNIT (GALLONS)

1990	BOILER 7	BOILER 8	BOILER 31	BOILER 32	BOILER 33	TOTAL
JANUARY	0	9,107	368	2,765	755	12,995
FEBRUARY	4,244	5,167	4,062	3,986	7,597	25,056
MARCH	5,089	4,077	1,095	3,359	9,427	23,047
APRIL	2,662	982	1,148	4,787	0	9,579
MAY	146	23	959	5,412	12,670	19,210
JUNE	4,601	4,001	11,851	12,754	8,592	41,799
JULY	9,294	9,886	7,116	3,835	6,029	36,160
AUGUST	5,202	5,118	1,250	5,981	4,483	22,034
SEPTEMBER	56	1,324	1,908	1,309	16,309	20,906
OCTOBER	0	2,350	1,704	24	2,702	6,780
NOVEMBER	5,146	3,845	5,072	0	1,757	15,820
DECEMBER	765	331	1,742	7,623	18,305	28,766
TOTAL	37,205	46,211	38,275	51,835	88,626	262,152

1991	BOILER 7	BOILER 8	BOILER 31	BOILER 32	BOILER 33	TOTAL
JANUARY	3,503	4,857	1,901	5,864	23,498	39,623
FEBRUARY	2,238	2,718	1,398	1,173	10,553	18,080
MARCH	2,703	1,856	1,165	5,746	14,723	26,193
APRIL	1,199	179	2,286	963	2,820	7,447
MAY	1,627	1,996	4,919	2,028	13,724	24,294
JUNE	7,624	7,162	1,290	9,311	3,993	29,380
JULY	8,614	4,319	2,409	1,495	3,503	20,340
AUGUST	5,470	7,209	3,516	4,335	5,460	25,990
SEPTEMBER	3,622	4,749	3,044	4,649	3,146	19,210
OCTOBER	1,043	592	1,904	1,264	12,493	17,296
NOVEMBER	2,815	0	1,041	3,364	5,210	12,430
DECEMBER	6,904	7,000	2,333	212	535	16,984
TOTAL	47,362	42,637	27,206	40,404	99,658	257,267

1992	BOILER 7	BOILER 8	BOILER 31	BOILER 32	BOILER 33	TOTAL
JANUARY	5,454	1,676	4,187	3,092	1,966	16,375
FEBRUARY	0	0	2,534	4,849	1,093	8,476
MARCH	5,207	2,505	8,291	4,506	4,351	24,860
APRIL	239	288	6,451	2,627	0	9,605
MAY	2,534	4,107	1,437	5,768	74,512	88,358
JUNE	4,901	1,730	5,511	4,925	17,963	35,030
JULY	3,719	5,402	699	7,501	5,633	22,954
AUGUST	4,863	4,511	936	11,539	13,313	35,162
SEPTEMBER	2,708	5,531	730	5,707	15,834	30,510
OCTOBER	1,668	4	0	3,774	4,545	9,991
NOVEMBER	3,995	3,221	4,166	293	7,489	19,164
DECEMBER	2,540	2,203	2,352	0	3,876	10,971
TOTAL	37,828	31,178	37,294	54,581	150,575	311,456

TABLE 2-3

MONTHLY GROSS GENERATION PER UNIT (KILOWATT HOURS)

1990	TURBINE 6	TURBINE 7	GEN. 31	GEN. 32	GEN. 33	TOTAL
JANUARY	0	56,168	19,879,500	40,602,000	89,673,000	150,210,668
FEBRUARY	798,100	1,833,622	27,800,700	7,813,200	94,108,000	132,353,622
MARCH	1,031,000	274,000	38,312,300	2,342,800	99,368,500	141,328,600
APRIL	17,310,000	17,603,900	45,996,400	46,631,100	0	127,541,400
MAY	1,717,500	1,549,900	10,606,100	30,959,900	84,826,000	129,659,400
JUNE	5,186,600	2,927,500	30,204,400	31,842,000	99,208,000	169,368,500
JULY	10,582,000	8,787,700	28,312,500	39,407,100	106,322,000	193,411,300
AUGUST	5,593,400	3,437,900	39,423,000	37,557,000	102,999,000	189,010,300
SEPTEMBER	7,896,400	5,017,600	37,576,200	21,434,800	81,322,000	153,247,000
OCTOBER	0	0	40,584,300	0	104,874,000	145,458,300
NOVEMBER	5,946,600	5,287,000	27,616,700	0	97,463,000	136,313,300
DECEMBER	4,532,400	1,181,200	39,810,000	14,946,000	102,888,000	163,357,600
TOTAL	60,594,000	47,956,490	386,122,100	273,535,900	1,063,051,500	1,831,259,990

1991	TURBINE 6	TURBINE 7	GEN. 31	GEN. 32	GEN. 33	TOTAL
JANUARY	464,800	207,800	38,934,600	37,546,200	99,458,000	176,611,400
FEBRUARY	1,661,200	1,475,200	35,166,600	35,697,300	80,235,000	154,235,300
MARCH	3,453,900	3,412,700	37,222,900	25,102,000	81,463,000	150,654,500
APRIL	12,528,900	17,236,300	46,021,300	47,304,100	0	123,090,600
MAY	563,100	11,177,000	6,579,000	43,481,400	101,189,600	162,990,100
JUNE	825,500	11,111,000	37,684,300	35,267,000	102,815,000	187,702,800
JULY	4,418,700	10,288,600	36,407,500	40,549,500	106,705,000	198,369,300
AUGUST	4,565,100	4,632,600	36,679,200	37,368,500	103,760,000	187,005,400
SEPTEMBER	3,899,400	1,168,700	27,866,000	35,983,000	89,537,000	158,454,100
OCTOBER	5,146,200	2,359,900	11,182,200	33,468,000	84,303,000	136,459,300
NOVEMBER	6,100	0	15,319,200	35,859,000	104,813,000	155,997,300
DECEMBER	1,209,000	1,415,100	37,550,600	9,178,800	107,679,000	157,032,500
TOTAL	38,741,900	64,484,900	366,613,400	416,804,800	1,061,957,600	1,948,602,600

1992	TURBINE 6	TURBINE 7	GEN. 31	GEN. 32	GEN. 33	TOTAL
JANUARY	6,524,000	1,542,500	5,697,000	39,402,600	107,793,000	160,959,100
FEBRUARY	0	0	14,689,000	21,612,200	103,530,000	139,831,200
MARCH	12,948,200	15,823,300	22,161,700	14,014,400	73,898,900	138,846,500
APRIL	17,151,500	16,829,900	42,695,100	49,610,000	0	126,286,500
MAY	14,082,800	13,937,000	45,767,500	39,840,900	21,621,300	135,249,500
JUNE	3,408,900	2,935,000	31,039,700	28,651,100	91,017,000	157,051,700
JULY	1,428,100	1,320,100	39,606,300	40,387,000	101,742,000	184,483,500
AUGUST	2,760,300	1,226,400	37,170,600	25,888,200	98,513,000	165,558,500
SEPTEMBER	3,841,600	2,222,500	15,631,700	37,383,300	89,710,000	148,789,100
OCTOBER	188,200	0	0	40,468,500	106,423,000	147,079,700
NOVEMBER	19,942,900	15,619,000	0	8,048,200	103,313,000	146,923,100
DECEMBER	449,700	20,041,000	46,857,800	0	105,231,000	172,579,500
TOTAL	82,726,200	91,496,700	301,316,400	345,306,400	1,002,792,200	1,823,637,900

TABLE 2.4

CAPACITY FACTOR (TURBINE/GENERATOR)

1990	UNIT 7	UNIT 8	UNIT 31	UNIT 32	UNIT 33
JANUARY	0.000	0.000	0.285	0.584	0.566
FEBRUARY	0.014	0.054	0.437	0.123	0.664
MARCH	0.018	0.000	0.545	0.034	0.632
APRIL	0.553	0.564	0.682	0.697	0.000
MAY	0.042	0.042	0.149	0.437	0.537
JUNE	0.155	0.088	0.442	0.468	0.651
JULY	0.319	0.267	0.402	0.556	0.675
AUGUST	0.162	0.101	0.560	0.533	0.651
SEPTEMBER	0.244	0.156	0.549	0.318	0.529
OCTOBER	0.000	0.000	0.575	0.000	0.667
NOVEMBER	0.182	0.165	0.400	0.000	0.640
DECEMBER	0.130	0.032	0.561	0.213	0.653

1991	UNIT 7	UNIT 8	UNIT 31	UNIT 32	UNIT 33
JANUARY	0.004	0.000	0.552	0.538	0.628
FEBRUARY	0.048	0.046	0.554	0.568	0.559
MARCH	0.098	0.101	0.526	0.361	0.532
APRIL	0.399	0.553	0.683	0.708	0.000
MAY	0.009	0.340	0.094	0.615	0.643
JUNE	0.016	0.349	0.551	0.520	0.676
JULY	0.129	0.314	0.516	0.578	0.679
AUGUST	0.132	0.137	0.518	0.533	0.659
SEPTEMBER	0.116	0.031	0.408	0.527	0.587
OCTOBER	0.153	0.069	0.159	0.470	0.533
NOVEMBER	0.000	0.000	0.224	0.525	0.689
DECEMBER	0.025	0.037	0.530	0.131	0.687

1992	UNIT 7	UNIT 8	UNIT 31	UNIT 32	UNIT 33
JANUARY	0.194	0.043	0.080	0.554	0.688
FEBRUARY	0.000	0.000	0.222	0.326	0.706
MARCH	0.400	0.490	0.310	0.200	0.469
APRIL	0.552	0.539	0.633	0.743	0.000
MAY	0.436	0.429	0.653	0.574	0.130
JUNE	0.103	0.089	0.452	0.419	0.598
JULY	0.037	0.033	0.563	0.576	0.646
AUGUST	0.078	0.032	0.524	0.369	0.624
SEPTEMBER	0.110	0.062	0.227	0.544	0.588
OCTOBER	0.000	0.000	0.000	0.573	0.678
NOVEMBER	0.637	0.503	0.000	0.112	0.680
DECEMBER	0.010	0.607	0.662	0.000	0.672

MONTHLY STEAM DELIVERED TO TURBINES (POUNDS)

1990	TURBINE 31	TURBINE 32	TURBINE 33	TOTAL
JANUARY	167,220,000	315,140,000	529,858,000	1,012,218,000
FEBRUARY	232,800,000	89,263,926	560,490,000	882,553,926
MARCH	315,130,000	12,610,000	603,218,000	930,958,000
APRIL	397,030,000	396,890,000	5,500	793,925,500
MAY	87,880,000	250,650,000	541,676,000	880,206,000
JUNE	252,590,000	249,790,000	608,412,000	1,110,792,000
JULY	232,460,000	312,640,000	641,248,000	1,186,348,000
AUGUST	330,450,000	305,200,000	614,033,000	1,249,683,000
SEPTEMBER	314,570,000	182,660,000	484,711,000	981,941,000
OCTOBER	334,820,000	0	630,421,000	965,241,000
NOVEMBER	227,930,000	0	579,149,000	807,079,000
DECEMBER	336,170,000	108,500,000	621,108,000	1,065,778,000
TOTAL	3,229,050,000	2,223,343,926	6,414,329,500	11,866,723,426

1991	TURBINE 31	TURBINE 32	TURBINE 33	TOTAL
JANUARY	331,530,000	262,530,000	597,286,000	1,191,346,000
FEBRUARY	292,700,000	257,140,000	482,935,000	1,032,775,000
MARCH	305,240,000	185,240,000	486,227,000	976,707,000
APRIL	400,010,000	403,750,296	0	803,760,296
MAY	53,980,000	348,684,803	686,240,000	1,088,904,803
JUNE	311,050,000	301,533,915	689,283,000	1,301,866,915
JULY	284,070,000	334,550,405	714,097,000	1,332,717,405
AUGUST	294,600,000	309,083,251	696,917,000	1,300,600,251
SEPTEMBER	232,350,000	281,732,793	608,948,000	1,123,030,793
OCTOBER	95,540,000	224,958,582	568,303,000	888,801,582
NOVEMBER	129,830,000	231,117,111	714,638,000	1,075,585,111
DECEMBER	315,290,000	62,840,000	729,340,000	1,107,470,000
TOTAL	3,046,190,000	3,203,161,157	6,974,214,000	13,223,565,157

1992	TURBINE 31	TURBINE 32	TURBINE 33	TOTAL
JANUARY	47,930,000	289,720,000	724,215,000	1,061,865,000
FEBRUARY	126,860,000	180,225,696	691,828,000	998,913,696
MARCH	194,520,000	124,982,292	495,190,000	814,692,292
APRIL	372,870,000	436,001,533	0	808,871,533
MAY	388,410,000	347,651,049	119,704,000	855,765,049
JUNE	270,390,000	256,170,785	532,323,000	1,058,883,785
JULY	330,970,000	343,913,723	600,956,000	1,275,839,723
AUGUST	278,700,000	213,612,849	574,795,000	1,067,107,849
SEPTEMBER	143,120,000	318,594,176	533,155,000	994,869,176
OCTOBER	0	322,610,270	631,422,000	954,032,270
NOVEMBER	0	61,151,765	631,332,000	692,483,765
DECEMBER	395,530,000	0	638,752,000	1,034,282,000
TOTAL	2,549,300,000	2,894,634,138	6,173,672,000	11,617,606,138

TABLE 2-6

MONTHLY CIRCULATING WATER PUMP USAGE (GALLONS)

1990	UNIT 31 & 32	UNIT 33	TOTAL
JANUARY	2,394,630,000	*2,901,600,000*	5,296,230,000
FEBRUARY	1,451,940,000	1,184,820,000	2,636,760,000
MARCH	1,944,810,000	3,881,670,000	5,826,480,000
APRIL	4,581,150,000	0	4,581,150,000
MAY	3,232,110,000	5,050,110,000	8,282,220,000
JUNE	4,959,150,000	5,428,410,000	10,387,560,000
JULY	5,599,860,000	5,616,000,000	11,215,860,000
AUGUST	5,973,450,000	5,596,890,000	11,570,340,000
SEPTEMBER	4,332,300,000	4,096,950,000	8,429,250,000
OCTOBER	3,024,000,000	3,456,570,000	6,480,570,000
NOVEMBER	2,417,940,000	2,780,700,000	5,198,640,000
DECEMBER	2,378,040,000	3,370,380,000	5,748,420,000
TOTAL	42,289,380,000	43,364,100,000	85,653,480,000

Jan. 1990 (Unit 33) Estimated

1991	UNIT 31 & 32	UNIT 33	TOTAL
JANUARY	3,025,260,000	2,883,660,000	5,908,920,000
FEBRUARY	2,720,970,000	2,527,980,000	5,248,950,000
MARCH	2,535,330,000	3,969,030,000	6,504,360,000
APRIL	4,092,270,000	12,480,000	4,104,750,000
MAY	3,240,930,000	5,362,500,000	8,603,430,000
JUNE	5,465,670,000	5,432,310,000	10,897,980,000
JULY	5,986,260,000	5,620,290,000	11,606,550,000
AUGUST	5,802,090,000	5,612,100,000	11,414,190,000
SEPTEMBER	4,779,180,000	5,226,780,000	10,005,960,000
OCTOBER	3,241,140,000	5,174,520,000	8,415,660,000
NOVEMBER	2,684,430,000	5,552,430,000	8,236,860,000
DECEMBER	1,771,350,000	2,807,220,000	4,578,570,000
TOTAL	45,344,880,000	50,181,300,000	95,526,180,000

1992	UNIT 31 & 32	UNIT 33	TOTAL
JANUARY	1,806,210,000	2,806,830,000	4,613,040,000
FEBRUARY	1,407,630,000	3,004,560,000	4,412,190,000
MARCH	1,335,600,000	4,095,780,000	5,431,380,000
APRIL	3,597,300,000	0	3,597,300,000
MAY	4,875,360,000	2,336,880,000	7,212,240,000
JUNE	4,374,510,000	5,272,410,000	9,646,920,000
JULY	4,536,420,000	5,607,030,000	10,143,450,000
AUGUST	4,218,480,000	5,615,610,000	9,834,090,000
SEPTEMBER	4,344,480,000	5,616,000,000	9,960,480,000
OCTOBER	3,372,600,000	5,438,160,000	8,810,760,000
NOVEMBER	1,142,190,000	5,429,580,000	6,571,770,000
DECEMBER	1,503,810,000	3,648,060,000	5,151,870,000
TOTAL	36,514,590,000	48,870,900,000	85,385,490,000

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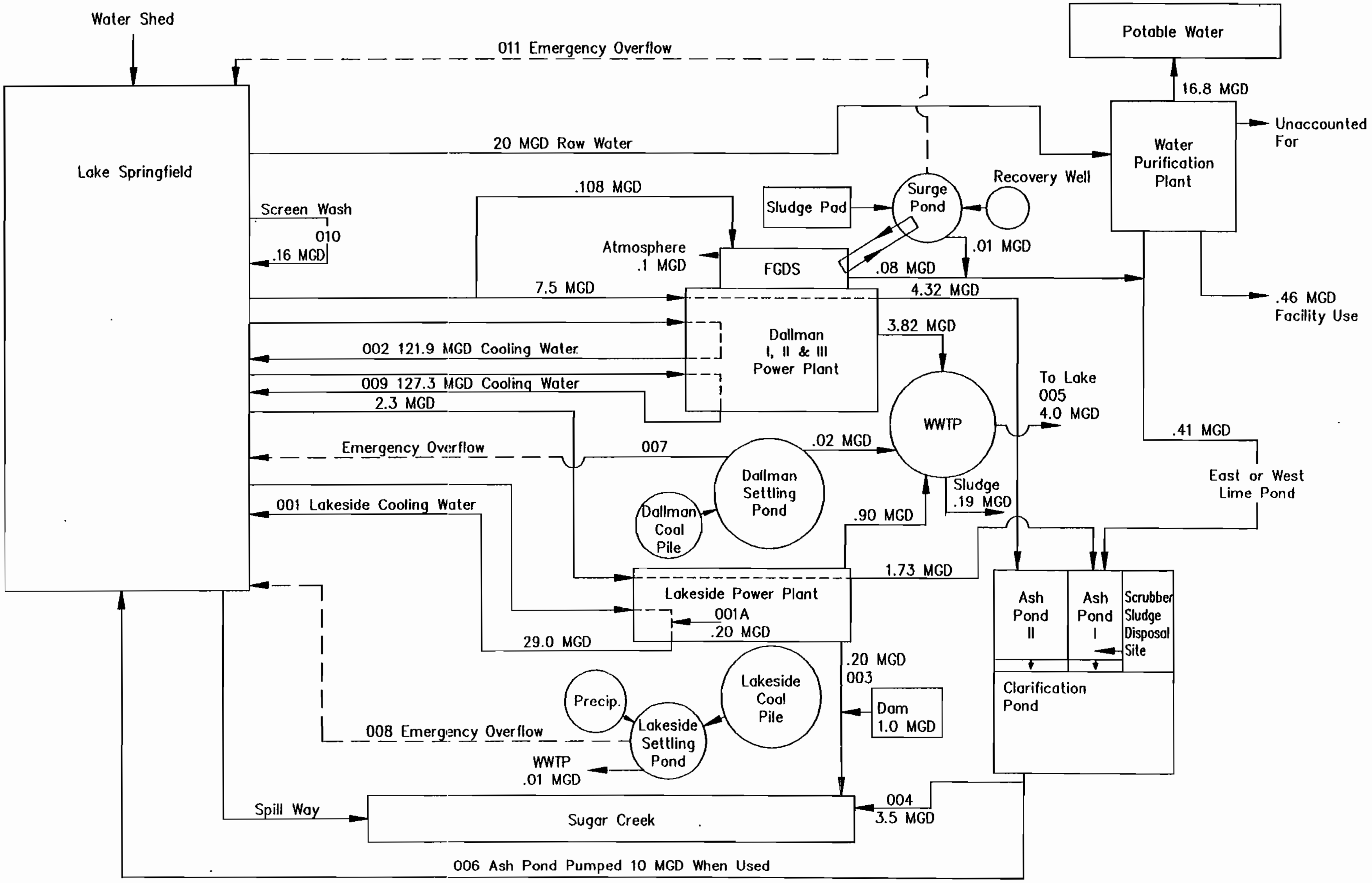


WATER FLOW SCHEMATIC CWLP POWER PLANT COMPLEX

HANSON ENGINEERS INCORPORATED

TECHNICAL SUPPORT DOCUMENT FOR
PETITION FOR ADJUSTED BORON
STANDARDS FOR SUGAR CREEK
AND THE SANGAMON RIVER

Job No. 92S5034A

Figure 2.2

DEMINERALIZER AND EVAPORATOR PRODUCTION(GALLONS)

1990	EAST DEMIN.	WEST DEMIN.	EVAPORATOR	TOTAL
JANUARY	1,421,800	1,035,100	146,550	2,603,450
FEBRUARY	832,500	1,127,000	466,360	2,425,860
MARCH	1,144,600	960,100	375,660	2,480,360
APRIL	1,391,500	1,073,400	119,940	2,584,840
MAY	1,116,700	995,400	283,910	2,396,010
JUNE	1,269,500	1,106,000	310,090	2,685,590
JULY	1,632,100	1,145,700	310,590	3,088,390
AUGUST	1,513,600	975,200	195,850	2,684,650
SEPTEMBER	1,522,300	1,325,600	263,250	3,111,150
OCTOBER	1,128,200	698,600	0	1,826,800
NOVEMBER	1,176,100	825,100	0	2,001,200
DECEMBER	1,477,300	1,126,300	0	2,603,600
TOTAL	15,626,200	12,393,500	2,472,200	30,491,900

1991	EAST DEMIN.	WEST DEMIN.	EVAPORATOR	TOTAL
JANUARY	1,214,700	1,380,000	80,910	2,675,610
FEBRUARY	1,130,100	1,305,400	125,820	2,561,320
MARCH	1,125,100	1,462,000	306,050	2,893,150
APRIL	991,600	466,500	543,670	2,001,770
MAY	1,088,300	904,300	693,800	2,686,400
JUNE	1,216,300	153,900	867,560	2,237,760
JULY	1,326,100	1,202,900	744,010	3,273,010
AUGUST	1,123,800	1,260,600	394,950	2,779,350
SEPTEMBER	1,289,100	946,500	125,580	2,361,180
OCTOBER	1,303,100	880,800	71,190	2,255,090
NOVEMBER	1,394,100	1,104,600	0	2,498,700
DECEMBER	806,900	1,438,900	423,150	2,668,950
TOTAL	14,009,200	12,506,400	4,376,690	30,892,290

1992	EAST DEMIN.	WEST DEMIN.	EVAPORATOR	TOTAL
JANUARY	824,800	1,195,700	515,800	2,536,300
FEBRUARY	1,444,000	1,102,200	65,570	2,611,770
MARCH	1,881,800	994,300	190,560	3,066,660
APRIL	1,151,600	1,094,500	0	2,246,100
MAY	1,794,100	1,768,000	547,920	4,110,020
JUNE	1,081,800	1,537,400	515,170	3,134,370
JULY	866,700	1,489,100	355,920	2,711,720
AUGUST	1,250,400	1,621,700	313,150	3,185,250
SEPTEMBER	1,557,200	965,600	531,000	3,053,800
OCTOBER	1,306,700	1,034,500	33,750	2,374,950
NOVEMBER	1,963,900	1,162,000	83,800	3,209,700
DECEMBER	1,737,000	898,200	967,900	3,603,100
TOTAL	16,860,000	14,863,200	4,120,540	35,843,740

TABLE 2.8

MONTHLY ASH SLUICE PUMP USAGE (GALLONS)

1990	UNIT 31 & 32	UNIT 33	TOTAL
JANUARY	*115,731,000*	181,656,000	297,387,000
FEBRUARY	8,676,000	119,916,000	128,592,000
MARCH	25,830,000	129,582,000	155,412,000
APRIL	123,678,000	29,520,000	153,198,000
MAY	62,442,000	118,404,000	180,846,000
JUNE	105,048,000	124,020,000	229,068,000
JULY	124,830,000	126,018,000	250,848,000
AUGUST	121,608,000	127,476,000	249,084,000
SEPTEMBER	91,422,000	129,132,000	220,554,000
OCTOBER	58,140,000	85,032,000	143,172,000
NOVEMBER	25,470,000	123,876,000	149,346,000
DECEMBER	85,338,000	129,132,000	214,470,000
TOTAL	948,213,000	1,423,764,000	2,371,977,000

Jan. 1990 (Unit 31 & 32) Estimated

1991	UNIT 31 & 32	UNIT 33	TOTAL
JANUARY	128,808,000	129,636,000	258,444,000
FEBRUARY	106,524,000	107,496,000	214,020,000
MARCH	122,706,000	107,136,000	229,842,000
APRIL	116,784,000	24,300,000	141,084,000
MAY	123,246,000	124,236,000	247,482,000
JUNE	96,156,000	124,164,000	220,320,000
JULY	125,532,000	129,420,000	254,952,000
AUGUST	123,462,000	124,740,000	248,202,000
SEPTEMBER	100,962,000	122,634,000	223,596,000
OCTOBER	107,856,000	103,716,000	211,572,000
NOVEMBER	101,502,000	121,770,000	223,272,000
DECEMBER	119,592,000	127,998,000	247,590,000
TOTAL	1,373,130,000	1,347,246,000	2,720,376,000

1992	UNIT 31 & 32	UNIT 33	TOTAL
JANUARY	102,654,000	129,438,000	232,092,000
FEBRUARY	79,416,000	118,638,000	198,054,000
MARCH	58,932,000	96,390,000	155,322,000
APRIL	122,256,000	0	122,256,000
MAY	128,412,000	65,934,000	194,346,000
JUNE	116,622,000	116,946,000	233,568,000
JULY	127,620,000	127,926,000	255,546,000
AUGUST	125,064,000	126,198,000	251,262,000
SEPTEMBER	122,688,000	121,680,000	244,368,000
OCTOBER	69,894,000	125,874,000	195,768,000
NOVEMBER	2,106,000	124,812,000	126,918,000
DECEMBER	126,252,000	126,612,000	252,864,000
TOTAL	1,181,916,000	1,280,448,000	2,462,364,000

complex. They are: Dallman Units 1 and 2, Dallman Unit 3, and Lakeside. All three systems are used to transport both bottom ash and fly ash from their respective boilers. The ash transport systems all discharge to the power station's ash ponds (Figure 2.2). Bottom ash and fly ash are deposited in the ash pond system through settling of suspended solids. On average, approximately 6.5 million gallons of water are discharged from the ash transport system to the ash ponds each day.

Sludge from the filter plant, scrubber, and ash from the two power stations are contained in two settling ponds north of Spaulding Dam near Sugar Creek. Effluent from these two settling ponds flows into a clarification pond. The discharge stream from the clarification ash pond is made up from the following wastewater sources:

Lakeside Plant Fly Ash and Bottom Ash	2.66 MGD
Dallman Plant Fly Ash and Bottom Ash	4.32 MGD
Non-Chemical Metal Cleaning Wastes	Intermittent
Lime Sludge from the City Water Purification Plant	0.33 MGD
Flue Gas Desulfurization System Wastes	Intermittent
Industrial Wastewater Treatment Plant Sludge	0.19 MGD
Water Treatment Plant Yard Drains	Intermittent
Scrubber Disposal Wastes (Leachate)	Intermittent

The fly ash and bottom ash sluice waters from Lakeside are pumped into the Lakeside ash pond, and the supernatant then discharges into the clarification pond. The Dallman fly ash and bottom ash sluice waters and the wastewater plant sludge are pumped through ash lines to the Dallman ash pond, where the supernatant goes into the clarification pond. The wastewaters from the filter plant are pumped to Lakeside ash pond with the supernatant discharging into the clarification pond. The flow rates from these waste sources vary depending upon the number of generating units in service.

Dallman ash pond was put into service in 1978 and has received bottom and fly ash from Dallman Units 31, 32, and 33. Bottom and fly ash from Lakeside's Units 6 and 7 started to be transported several years later. Approximately 70 percent of the original Dallman pond volume has been used.

The discharge from the clarification ash pond normally goes into Sugar Creek at outfall 004, shown in Figure 2.1. However, during low lake level periods when water conservation is necessary, the discharge can be pumped back into Lake Springfield (outfall 006). Flow from outfall 004 is controlled by a rectangular weir and gates. Water levels in the clarification pond vary depending on ash removal in the Dallman pond.

The treatment of these wastewater sources is a unique settling and neutralizing system. The ash sluice waters are normally acidic with floating suspended solids; the water plant wastes are normally basic with excess lime available; and the wastewater plant sludge contains polymer and other coagulants for flocculation. When all of these waste streams are blended together in the clarification ash pond, neutralization and settling takes place naturally without additional chemicals being fed.

The CO_2 feed system was installed to keep the pH between 6 and 9 as required by IEPA. This feed system is located inside of the outfall structure building and is fed from a storage tank outside of the building.

Total ash production is primarily a function of the coal source, combustion process, unit operational procedures, and total coal usage.

2.3 OUTFALL AND DISCHARGE DESCRIPTION

2.3.1 Outfall 003 - Lakeside Plant Storm Sewer

The source of this discharge is storm water runoff from the Lakeside Power Plant. The effluent is routed from the power plant by an underground pipe, which discharges into the Sugar Creek channel near the east side of the Spaulding Dam Spillway (Figures 2.1 and 2.2). Sampling of the outfall 003 discharge is conducted at this point before it enters the creek channel. This outfall may be picking up boron from inside the Lakeside Power Plant and from the actual discharge area where bottom ash was deposited from slag tank overflow during past discharges.

2.3.2 Outfall 004 - Ash Pond Discharge

Outfall 004 discharges into Sugar Creek from a clarification pond, which receives effluent from the Lakeside and Dallman Power Plants' ash and lime sludge ponds (Figures 2.1 and 2.2). Outfall 004 is sampled before it enters Sugar Creek. The Lakeside and Dallman ash ponds contribute boron to the discharge from this outfall.

2.3.3 Outfall 006 - Ash Pond Discharge

Outfall 006 is the same discharge (waste stream) as outfall 004, but is directed back to Lake Springfield at a maximum rate of 10 mgd during times of low lake levels (Figures 2.1 and 2.2). Under normal circumstances, outfall 004 is the preferred discharge point. Outfall 006 has only been used during periods of low lake levels as a supplement to pumping from the South Fork pumping station. Records show that since 1976, outfall 006 has been used 19 months in four episodes where low lake level conditions existed. Table 2.9 shows pumpage rates from these time periods for outfall 006.

TABLE 2.9

CLARIFICATION POND RECIRCULATING WATER PRODUCTION-OUTFALL 006
MILLIONS OF GALLONS

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	Totals
Jan.	0	0	0	0	111	45	0	0	0	0	0	0	0	175	144	0	0	475
Feb.	0	0	0	0	0	81	0	0	0	0	0	0	0	191	111	0	0	383
Mar.	0	0	0	0	0	155	0	0	0	0	0	0	0	47	52	0	0	254
Apr.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct.	0	0	0	0	72	0	0	0	0	0	0	0	53	0	0	0	0	125
Nov.	0	0	0	90	157	0	0	0	0	0	0	0	89	0	0	0	0	336
Dec.	0	0	0	68	216	0	0	0	0	0	0	0	182	201	0	0	0	667
	0	0	0	158	556	281	0	0	0	0	0	0	324	614	307	0	0	2240

3.0 RESOURCES OF SUGAR CREEK AND ASSOCIATED SANGAMON RIVER

3.1 Natural Features

3.1.1 Sangamon River Basin

The Sangamon River Basin (see Figure 3.1) is located in the Springfield Plain Division of the Central Lowland Physiographic Province. The surrounding topography is a relatively flat-lying glacial till plain moderately dissected by dendritic drainage systems. Elevations range from about 580 ft on uplands to 520 ft within the Sugar Creek, Sangamon River, and South Fork River Valleys.

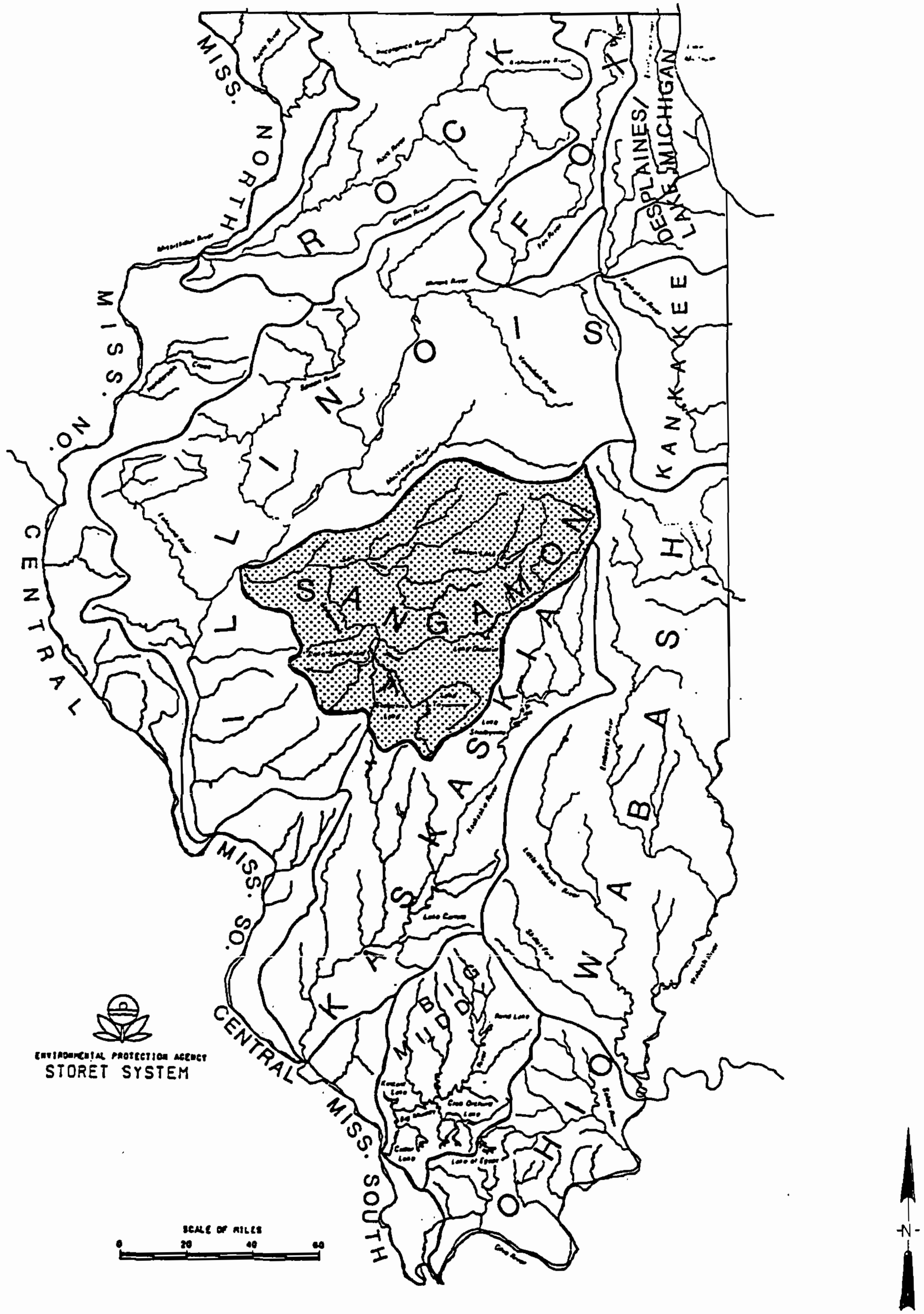
Geologic mapping of the area indicates the Wisconsinan-aged windblown loess (predominantly silt of the Peoria Loess and Roxana Silt formations) comprises the upper 100 to 150 in. of surficial material. Modern soils have developed within the upper few feet of loess material. The loess is often absent within stream valleys due to erosion.

Roughly 50 ft of glacial till underlies the loess. The glacial tills are commonly an unsorted mixture of compact clay, silt, and sand with lesser amounts of gravel, cobbles, and boulders. The thickness of the glacial till varies greatly due to variations in bedrock topography and stream erosion.

The uppermost bedrock is Pennsylvanian-aged sedimentary rock. The bedrock consists of cyclic sequences of sandstone, siltstone, shale, limestone, and coal. Bedrock outcrops are not uncommon along the Sangamon River and South Fork stream valleys.

3.1.2 Sangamon River

The watershed of the Sangamon River comprises about 5,419 square miles, all of which lie in the central part of Illinois (Figure 3.1). It includes either all or the major portions of McLean, Piatt, DeWitt, Macon, Logan, Sangamon, Christian, Menard, Mason, and Cass counties,



MAJOR RIVER BASINS OF ILLINOIS

HANSON ENGINEERS INCORPORATED

TECHNICAL SUPPORT DOCUMENT FOR
PETITION FOR ADJUSTED BORON
STANDARDS FOR SUGAR CREEK
AND THE SANGAMON RIVER

Job No. 92S5034A

Figure 3.1

I:\DRAWINGS\L\LOC-MAP.DWG 03/23/94 10:01 HWG and minor portions of Tazewell, Ford, Champaign, Shelby, Montgomery, Macoupin, and Morgan counties. Practically all of the area is tillable and, for the most part, is cultivated.

The Sangamon River originates in the central portion of McLean County at a point about 12 miles east of Bloomington and flows southeasterly for about 35 miles, then southwesterly about 110 miles. From Roby, the stream takes a northwesterly course for 64 miles to Mile 34.5 where the Sangamon River is joined by Salt Creek, its largest tributary. At Mile 34.5, the Sangamon River makes a sharp right-angled turn to the west, flowing in a general westerly direction and joins the Illinois River near Mile 89 of that stream about 8 miles above Beardstown. The total length of the Sangamon River is about 250 miles, while the length of the valley it occupies is about 170 miles.

At its source, the Sangamon River is about 850 ft above sea level. The total fall of the river from its source to its mouth is about 420 ft. In the upper 10 miles, the fall is 120 ft, or an average of 12 ft per mile, and for the remaining 240 miles of the river the fall is 300 ft, or an average of 1.25 ft per mile.

The Sangamon River's low water width varies from 80 to 240 ft, with the average being 150 ft. The high water average width is about three-fourths of a mile.

The whole length of the Sangamon River is characterized by a series of pools and shoals; the latter, on the average, are about a mile apart. Average depths of these pools and shoals are 4 ft and 1 ft. respectively. There are five major impoundments within the basin, including: Lake Decatur (which is the only lake located directly on the Sangamon River), Lake Springfield, Lake Taylorville, Sangchris Lake, and Clinton Lake. Lake Decatur is the deepest portion of the river, with low water pool at a depth of 17 ft. The extreme flood stage varies from a minimum of 6ft above low water at Decatur Dam to a maximum of 29 ft above low water just above Riverton. The average high water increment for the reach between Decatur and the mouth of the river is about 24 ft.

At Riverton, the Sangamon River can have bank-full discharges up to 6,000 cubic ft per second (cfs). In 1991 (USGS, 1991), the annual mean flow at Riverton was 2,299 cfs.

3.1.3 South Fork of the Sangamon River

The South Fork is the second largest tributary of the Sangamon River. The South Fork is about 88 miles long and drains an area of 885 square miles, which comprises 16 percent of the total Sangamon River watershed.

The South Fork originates in Christian County and flows northwest for 48 miles before entering the southeastern part of Sangamon County. It flows into a meander of the Sangamon River, which also receives flow from Sugar Creek about 4 miles east of Springfield. The stream has been dammed in Christian County to form Lake Taylorville (1,286 acres). The stream banks are lined with timber. Several riffle areas are present along the stream. Brush piles are very numerous in the stream, and there are few sand and gravel bars. Silt is the predominant bottom type, but some sand, gravel, and rubble are present. Most of the watershed is cropland.

The average width of the South Fork is 68 ft. The slope of the stream is very flat, with an average fall of less than 1 ft per mile. In 1991, the mean annual flow at Rochester was 774 cfs (USGS, 1991).

3.1.4 Sugar Creek

Sugar Creek originates in the extreme southwestern corner of Sangamon County and then swings south into Macoupin County for 6 miles before it turns north and again enters Sangamon County. The stream then meanders northeast for 15 more miles before entering Lake Springfield. Below the dam, the stream continues flowing northeast for 7 miles before emptying into the South Fork about 4 miles east of Springfield. At this point, the South Fork is combined with flow from a meander of the Sangamon River. Sugar Creek is a fifth order tributary to the South Fork.

The creek has an overall average width of about 20 ft with a gradient of 3.8 ft per mile. Stream width from Lake Springfield to the South Fork varies from 35 to 70 ft with a mean depth of 1.8 ft. The substrate is very soft and comprised primarily of silt/mud (26.7 percent), plant detritus (20 percent) and submerged logs (13.3 percent). Some sand and gravel is also present.

Sugar Creek is a series of pools and riffles with a thin band of timber along the banks. Brush piles are numerous in the stream. Sugar Creek flow is primarily controlled by the outflow from Lake Springfield.

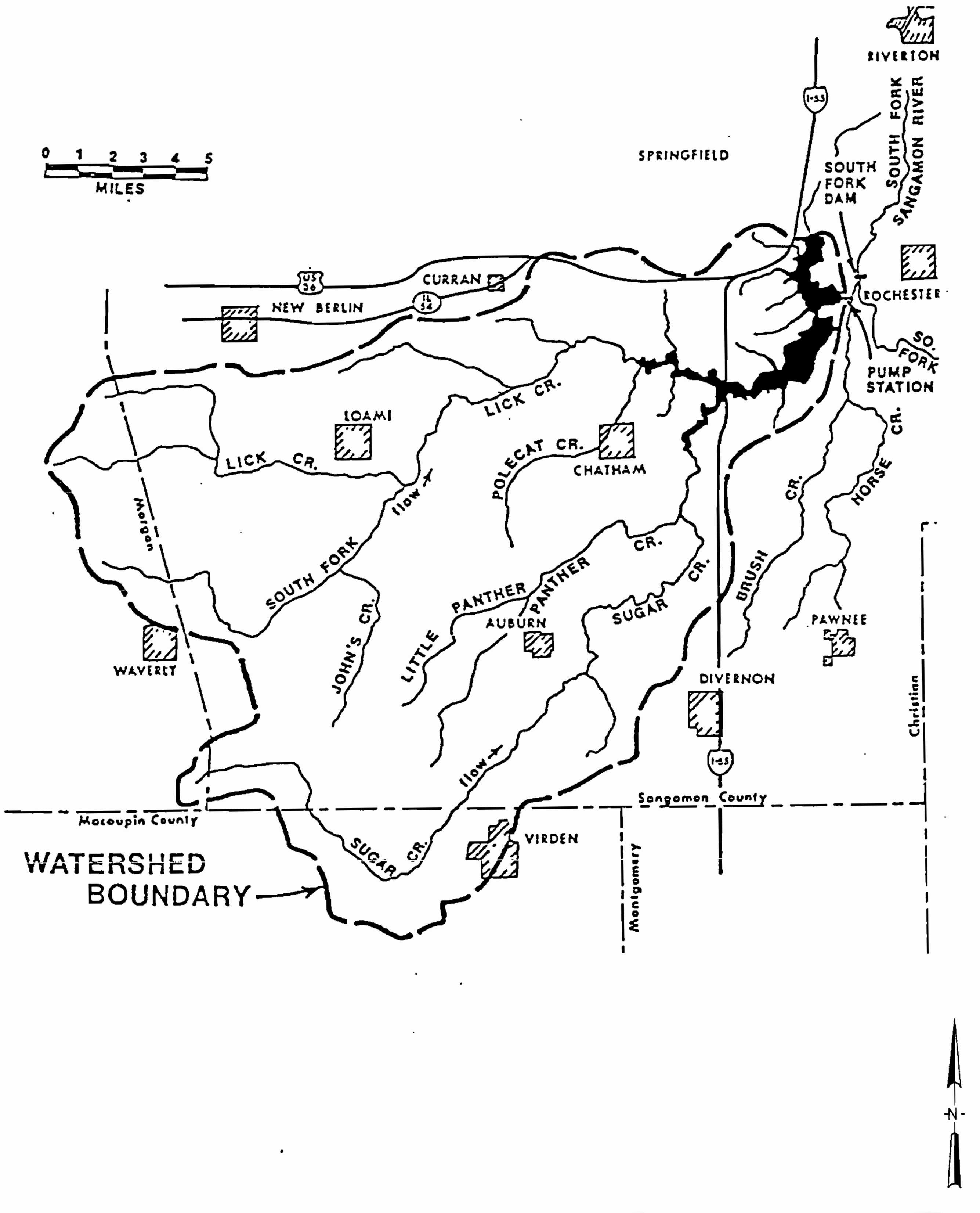
3.1.5 Lake Springfield

Lake Springfield is the largest municipally owned lake in Illinois, covering 6.6 square miles and encompassing 52,200 acre-ft (17 billion gallons) of storage in 1984 (at normal pool elevation of 559 ft msl). The deepest point is 30 ft with a mean depth of 12.5 ft. The lake is the primary source of potable water for the City of Springfield. It was constructed in 1934 by impoundment of Sugar Creek by the Spaulding Dam at the southeastern edge of Springfield.

The lake and its watershed are located south of Springfield in Sangamon, Morgan, and Macoupin Counties (Figure 3.2). The two major streams flowing into the lake are Sugar Creek and Lick Creek, which join at the upper end of the lake.

The watershed area covers 265 square miles and is primarily a level to gently-sloping plain which is incised in the lower portions by the valleys of Sugar and Lick Creeks. The streams in the upper portions of the watershed are shallow and less pronounced. Elevations vary from 700 ft msl at Waverly, Illinois, to 559 ft msl at Spaulding Dam.

The soils of the watershed formed in loess deposits up to 8 ft thick, which are underlain by Illinoisan drift. As shown in Table 3.1, the land use has been estimated as 88 percent cropland, 8 percent pasture, 1 percent woodland, and 3 percent other (Lee and Stall, 1977).



LAKE SPRINGFIELD WATERSHED

HANSON ENGINEERS INCORPORATED

TECHNICAL SUPPORT DOCUMENT FOR
PETITION FOR ADJUSTED BORON
STANDARDS FOR SUGAR CREEK
AND THE SANGAMON RIVER

Job No. 92S5034A Figure 3.2

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TABLE 3.1

LAKE SPRINGFIELD WATERSHED LAND USES

Land Use	Area (Acres)	Percent
Cropland	145, 522	88
Pasture	13,229	8
Woodland	1,654	1
Other	4,961	3
Total	165,366	100

(From CWLP, 1987)

3.2 ENVIRONMENTAL QUALITY

3.2.1 Water Uses

The types of water use and the extent of these uses were investigated for: Sugar Creek from Spaulding Dam to where it meets the South Fork of the Sangamon River, the lower half of the South Fork; and the Sangamon River from Roby to its confluence with Spring Creek just north of Springfield. The following organizations and agencies were contacted for information on known water uses for these stream reaches; the Illinois Department of Transportation, the Illinois State Water Survey, the Illinois Department of Energy and Natural Resources, the Illinois Environmental Protection Agency (state and regional offices), the Illinois Department of Agriculture, the Sangamon County Soil and Water Conservation District, the Sangamon County Cooperative Extension Service of the University of Illinois, and Springfield City Water, Light and Power.

There are no permitting requirements for water withdrawal from Illinois streams (e.g., crop irrigation), unless there is a stream modification involved (e.g., channelization, dam construction). According to the agencies contacted, there are no such permitted water uses on these stream reaches. The only public water supply in this area is Lake Springfield, which supplies the City of Springfield. None of the agencies contacted had any record or knowledge of any other present water withdrawal within these stream reaches. However, on October 1, 1993, public notice was given concerning an application for a construction permit for an intake and pumping station for irrigation water withdrawal from the Sangamon River north of Springfield, to supply the Rail Golf Course. As of this writing, no permit has been issued.

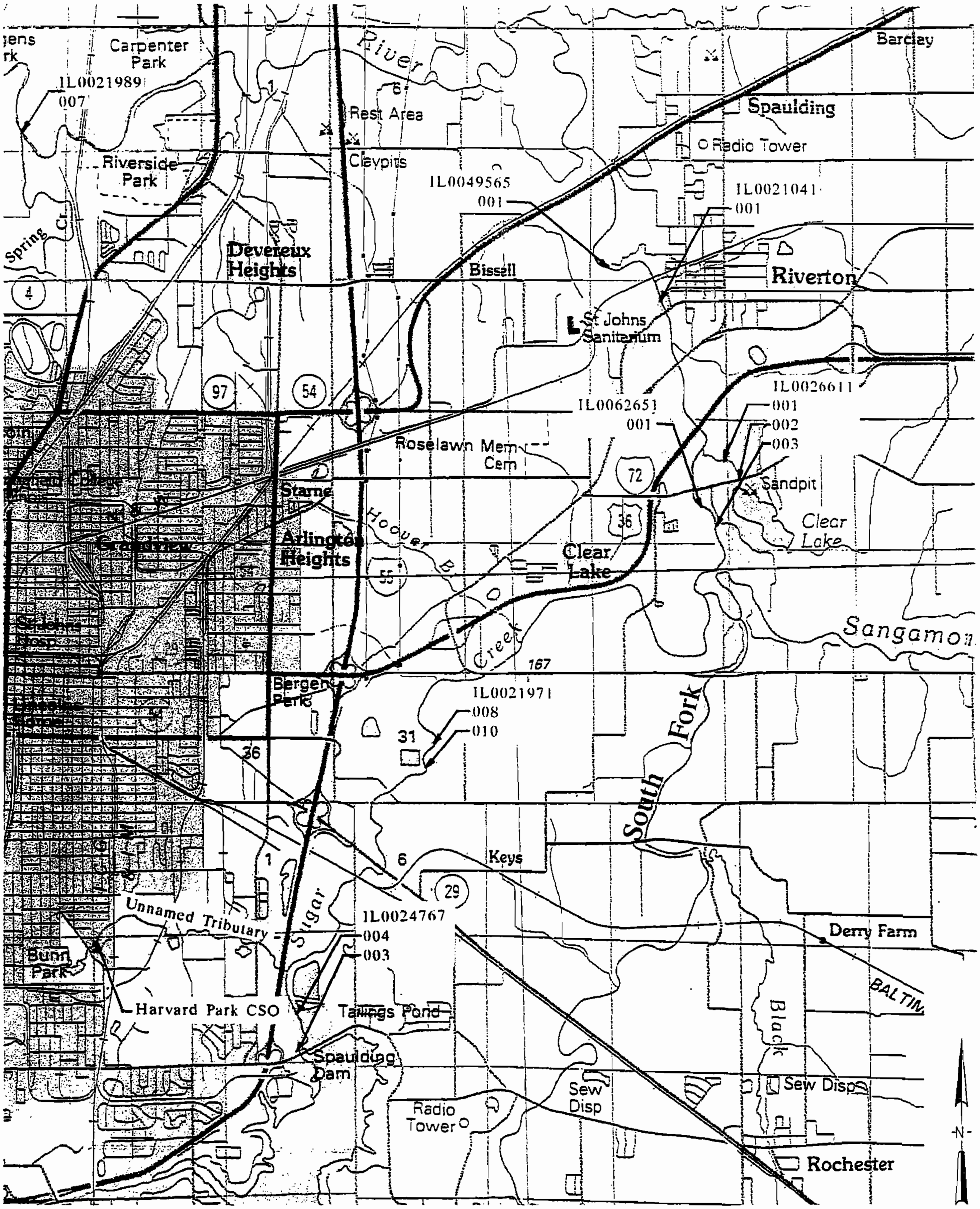
The primary permitted use of Sugar Creek from below Lake Springfield and the Sangamon River from its confluence with Sugar Creek and the South Fork downstream to its confluence with Spring Creek, north of Springfield, is receiving NPDES permitted discharges. Table 3.2 lists the NPDES permitted discharges for these receiving streams. Figure 3.3 shows the locations of these discharges. The City Water, Light and Power outfalls and the Springfield Metropolitan Sanitary District's (SMSD) Sugar Creek plant outfalls discharge into Sugar Creek.

TABLE 3.2

NPDES DISCHARGES TO SUGAR CREEK AND SANGAMON RIVER, SPAULDING DAM TO SPRING CREEK

Permit Holder	Permit I.D. No.	Outfall	Design Average Flow
City Water, Light & Power	IL0024767	003-Lakeside plant storm sewer 004-Ash pond discharge	0.40 MGD(intermittent) 7.54 MGD
Clear Lake Sand & Gravel, Inc.	IL0026611	001-Surface water runoff 002-Surface water runoff 003-Surface water runoff	
River Oaks Village Mobile Home Park	IL0062651	001-Sewage treatment plant discharge	0.053 MGD
Riverton Sewage Treatment Plant	IL0021041	001-Sewage treatment plant discharge	0.30 MGD
Hospital Sisters St. Francis Mother House and Convent	IL0049565	001-Sewage treatment plant discharge	0.135 MGD
Springfield Metro. Sanitary District-Sugar Creek	IL0021971	008-Sewage treatment plant discharge 010-Excess flow pond overflow	10.0 MGD 25-100 MGD
Springfield Metro.Sanitary District-Spring Creek	IL0021989	007-Sewage treatment plant discharge	13.9 MGD

(From IEPA, January 1993)



NPDES DISGHARGE POINTS

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TECHNICAL SUPPORT DOCUMENT FOR PETITION FOR ADJUSTED BORON STANDARDS FOR SUGAR CREEK AND THE SANGAMON RIVER

Job No. 92S5034A

Figure 3.3

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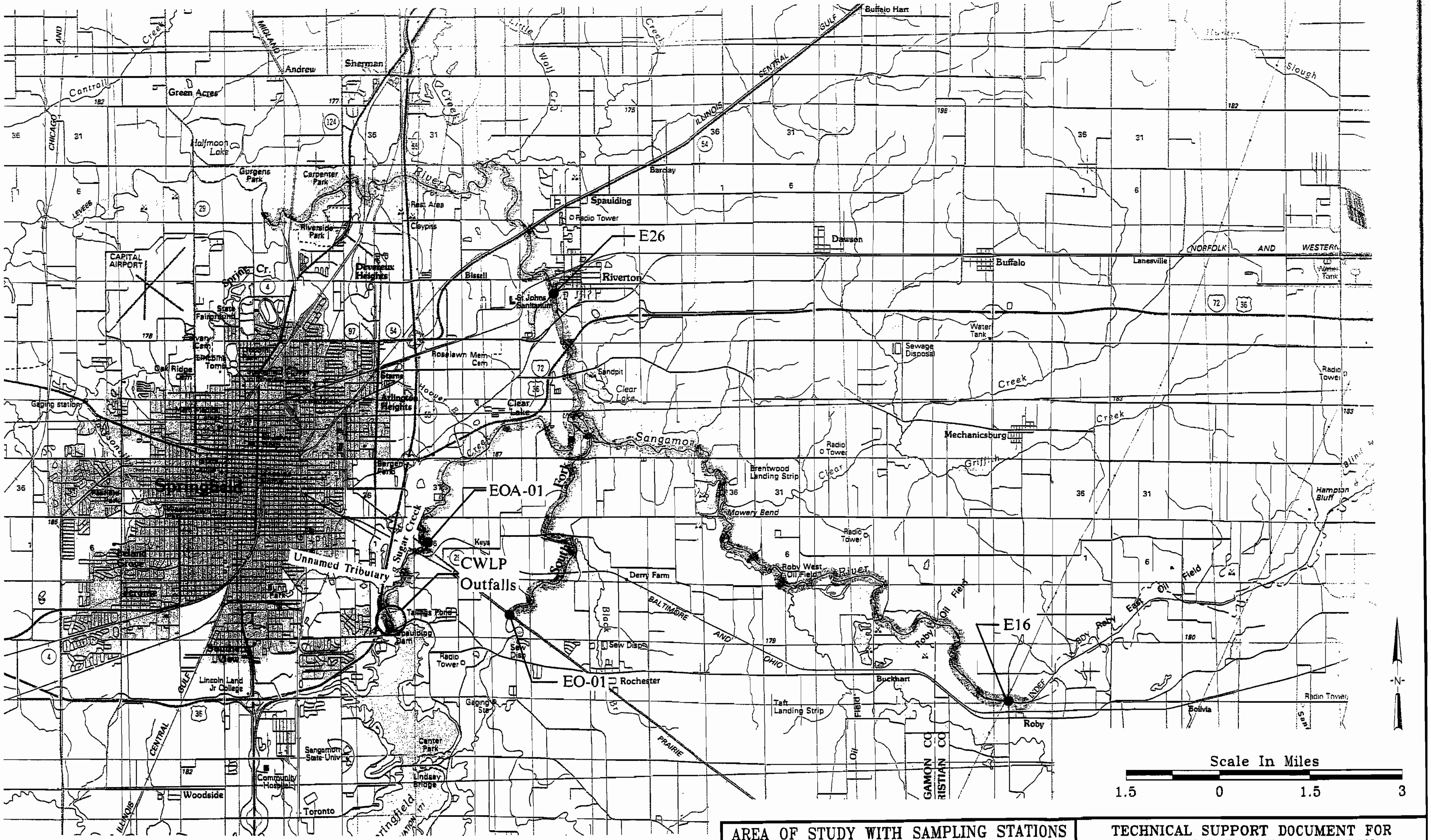
The SMSD's Spring Creek plant outfall discharges into Spring Creek at its confluence with the Sangamon River. The rest of the outfalls listed in Table 3.2 discharge into the Sangamon River between its confluences with the South Fork and Spring Creek.

3.2.2 Analytical Water Quality

The IEPA operates an Ambient Water Quality Monitoring Network (AWQMN) consisting of 208 fixed stations. This monitoring program is designed to establish baselines of water quality and characterize and define trends in the physical, chemical, and biological condition of the State's surface waters. Data from four of the AWQMN sampling stations were used in this report. Figure 3.4 shows the locations of the four stations within the area of study. Station E16, near Roby, is about 11 miles upstream of the confluence of the South Fork and Sugar Creek with the Sangamon River. Station E26, near Riverton, is 2.2 miles downstream from the confluence of the South Fork and Sugar Creek with the Sangamon River. Site EO-01 is located on the South Fork at the Illinois Route 29 bridge and is about 4.7 miles upstream from its confluence with Sugar Creek and the Sangamon River. Station EOA-01 is located on Sugar Creek at the Illinois Route 29 bridge about one mile southeast of Springfield.

Table 3.3 shows analytical data for the four AWQMN sampling stations. The 1987 Water Year Data Report was the last USGS publication with analytical data for station EOA-01. The values presented in Table 3.3 are calculated averages for samples taken during the period of October 1986 through September 1987. Analytical results for all four stations were within the federal and state guidelines listed in Table 3.3.

Of all four stations, EOA-01 on Sugar Creek had the lowest values for specific conductance, turbidity, chemical oxygen demand, total suspended solids, total volatile solids, nitrogen, and total iron. EOA-01 had a slightly higher average temperature than the other stations, possibly due to thermal influence from the upstream CWLP power station cooling operations in Lake Springfield near Spaulding Dam. The slightly higher values at EOA-01 for hardness, calcium, and sulfates could be due to the CWLP discharges, which are located about



AREA OF STUDY WITH SAMPLING STATIONS

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TECHNICAL SUPPORT DOCUMENT FOR
PETITION FOR ADJUSTED BORON
STANDARDS FOR SUGAR CREEK
AND THE SANGAMON RIVER

Job No. 92S5034A

Figure 3.4

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TABLE 3.3

WATER QUALITY DATA(1)

Parameter(2)	Maximum Allowable Level or Range	Sangamon R. Roby (E16)	Sangamon R. Riverton (E26)	South Fork (EO-01)	Sugar Creek (EOA-01)
Specific Conductance (umhos/cm)		835	731	573	672
pH (std. units)	6.5-9.0(3)	7.79	7.58	7.32	7.73
Temperature (°C)		13.4	13.8	13.1	14.1
Turbidity (NTU)		4.6	5.3	6.0	4.2
Dissolved Oxygen (mg/L)	>5.0(3)	9.6	9.6	8.9	9.0
Chemical Oxygen Demand (mg/L)		21	20	14.6	13.6
Hardness (mg/L as $CaCo_3$)		300	296	252	324
Calcium, total (mg/L)		66	67	58	82
Magnesium, total (mg/L)		34	33	27	30
Sodium, total (mg/L)		85	67	23	17
Potassium, total (mg/L)		3.8	3.8	2.6	3.4
Alkalinity (mg/Las $CaCo_3$)		233	209	169	___
Sulfate (mg/L)	500	82	86	63	155
Suspended Solids, total (mg/L)		39	58	53	26
Volatile Solids, total (mg/L)		7.0	7.4	6.6	4.1
Nitrogen (No_2+No_3) (mg/L)	10.0(4)	4.86	4.10	3.49	1.12
Nitrogen, (total ammonia) (mg/L)	15.0(3)	<1.026	<0.470	<0.138	<0.102
Aluminum, total (ug/L)		428	1088	1089	580
Barium, total (ug/L)	5000(3)	62	76	89	62
Beryllium, total (ug/L)	4.0(4)	<0.5	<0.8	<0.5	<0.5
Cadmium, total (ug/L)	50(3)	<3	<3	<3	<3
Chromium, total (ug/L)	16(3)	<5.3	<5.6	<5.4	<7.7
Cobalt, total (ug/L)		<7.8	<5.3	<6.7	<6.7
Copper, total (ug/L)	20(3)	<6.1	<5.6	<5.9	<5.2
Iron, total (ug/L)	2000 (dissolved)(3)	777	1657	1722	736
Lead, total (ug/L)	100(3)	<50	<61	<56	<56
Manganese, total (ug/L)	1000(3)	285	357	254	130
Mercury, total (ug/L)	0.5(3)	<0.08	<0.05	<0.06	___
Nickel, total (ug/L)	1000(3)	<5.9	<7.6	<7.2	13.7
Silver, total (ug/L)	5.0(3)	<3.0	<3.3	<3.0	<3.0
Strontium, total (ug/L)		131	146	150	196
Vanadium, total (ug/L)		<5.4	<6.3	<5.3	17.4
Zinc, total (ug/L)	1000(3)	<56	<50	<61	<61

(1) From USGS Illinois Water Resources Data, Water Year 1987, Volume 2. Water year 1987 is the last USGS publication with analytical data for Sugar Creek Station EOA-01.

(2) Data listed are tabulated annual averages for samples taken from the period of October 1986 through September 1987.

(3) Illinois Administrative Code, Title 35: Subtitle C, 1990.

(4) USEPA National Primary Drinking Water Regulations, 40 CFR 141, 1992.

3.5 stream miles upstream. Relatively higher values of these three parameters are commonly associated with discharges from coal mining and coal ash operations (Jones, et al., 1985). EOA-01 values for nitrite + nitrate nitrogen and for total ammonia nitrogen were well below the regulatory guideline limits and significantly below the values for the other three stations. The higher levels of nitrogen at the other three stations, especially for E16, could be due to influences from agricultural runoff.

Considering the parameter values presented in Table 3.3, Sugar Creek appears to have had somewhat higher overall water quality during the 1987 USGS Water Year than the stretches of the South Fork and the Sangamon River discussed here.

3.2.3 Aquatic Macroinvertebrates

Aquatic macroinvertebrates are invertebrates large enough to be seen by the unaided eye, which can be retained by a U.S. Standard No. 30 sieve (0.595 mm), and live at least part of their life cycles within or upon available aquatic substrates (Weber, 1973). Invertebrates in this group typically include annelids, macrocrustaceans, aquatic insects, and mollusks (Isom, 1978). Although macroinvertebrates were not routinely used in freshwater bioassays in the past, they have been extremely useful in water quality monitoring through studies of community diversity and as indicator organisms (Resh and Unzicker, 1975). Some of the characteristics of macroinvertebrates that make them advantageous for assessments of environmental impacts include:

- Limited mobility;
- Relatively long life cycles;
- Important members of aquatic food chains;
- Sensitivity to a wide range of pollutants;
- Known environmental requirements for key indicator groups;
- Ubiquitous distribution (occur where fish may not be present);
- Ease of collection.

Macroinvertebrate data are generally interpreted by an examination of community attributes: community structure, taxa richness, and use of the Macroinvertebrate Biotic Index (IEPA, 1990). Macroinvertebrate Biotic Index (MBI) is calculated by the following equation:

MACROINVERTEBRATE BIOTIC INDEX

$$MBI = \Sigma\ (n_i\ t_i)/N$$

where:
ni = No. individuals in each taxon
ti = Tolerance value for taxon
N = Total no. individuals

The MBI is a summation or average of tolerance values assigned to each taxon collected and is weighted by their abundance. Low values indicate good stream conditions or good water quality, and high values indicate a degraded stream or reduced water quality. According to present assessment methods, MBI values measure stream quality, on the following scale:

<5.0	excellent
5.0-6.0	very good
6.1-7.5	good/fair
7.6-10.0	poor
>10.0	very poor

MBI values are included in two Sugar Creek stream studies by the IEPA, which are provided in Appendix A. The April 1985 study and the July 1989 study were both conducted on the reach of Sugar Creek from the Illinois Route 29 bridge (equivalent to AWQMN EOA-01) to about 3.9 miles downstream of this station. The studies were performed to assess and monitor the effects of the Springfield Sanitary District's Sugar Creek sewage treatment plant (STP) effluents on the condition of the receiving stream. Water quality and macroinvertebrate samples were obtained from the same seven stations, which included the three main channel locations A-1, C-1, and C-2 (see Figure 3.5). Other similar studies for Sugar Creek from 1977, 1981, and 1988 are referenced in the 1985 and 1989 studies. Table 3.4 summarizes MBI values for the three main channel stations on Sugar Creek by year.

TABLE 3.4

MACROINVERTEBRATE BIOTIC INDEX VALUES FOR SUGAR CREEK

Sampling Location	MBI Values by Year				
	1977	1981	1985	1988	1989
A-1 (AWQMN EOA-01)	5.7	5.1	4.9		6.5
C-1	7.2	6.7	4.9	5.9	9.0
C-2	6.8	6.7	4.2		7.7

(From IEPA Stream Studies)

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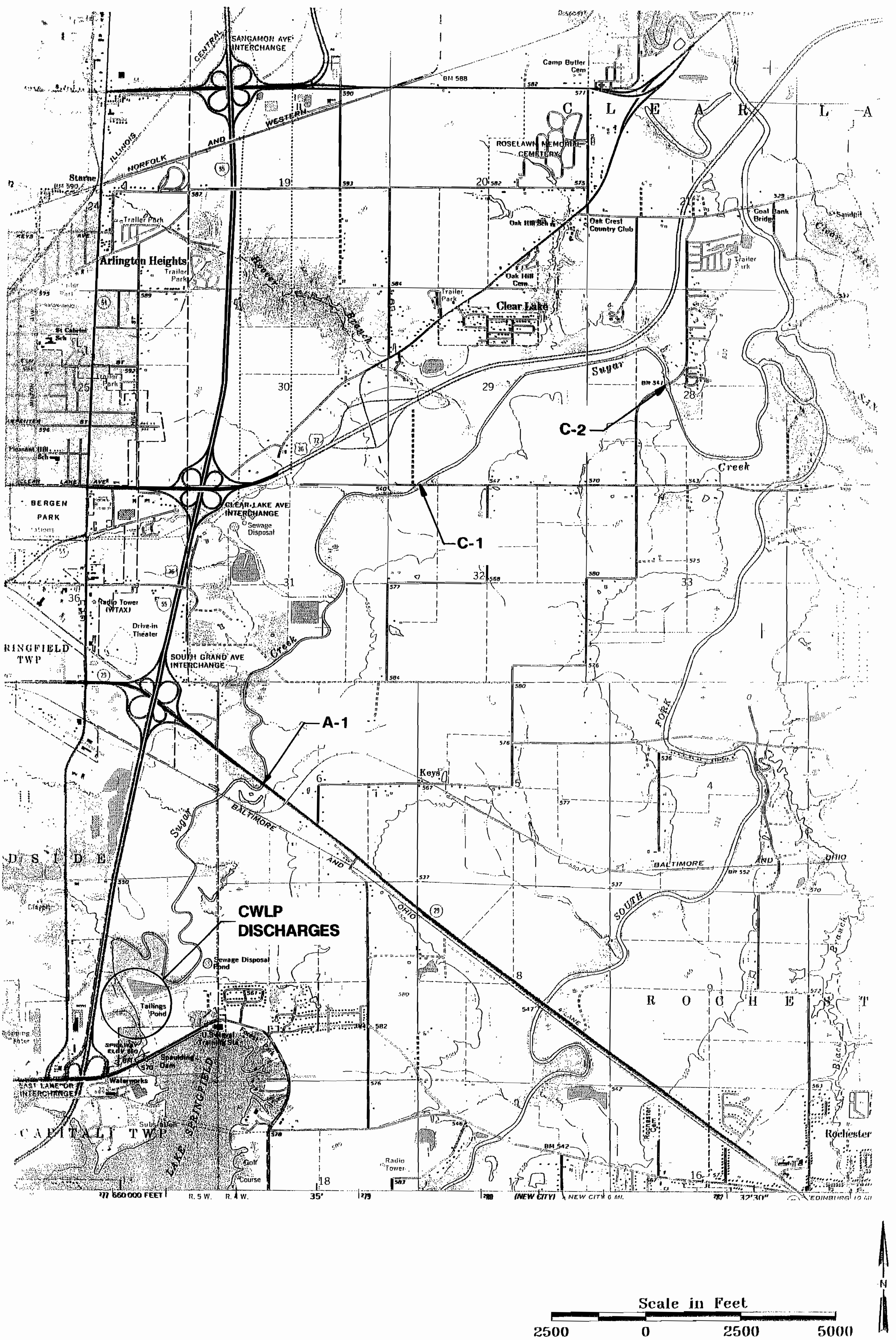


SUGAR CREEK MACROINVERTEBRATE SAMPLING STATIONS	TECHNICAL SUPPORT DOCUMENT FOR PETITION FOR ADJUSTED BORON STANDARDS FOR SUGAR CREEK AND THE SANGAMON RIVER
HANSON ENGINEERS INCORPORATED	Job No. 92S5034A Figure 3.5

Location A-1 (EOA-01) serves as the upstream control station for these IEPA monitoring surveys. Location A-1 had a lower (higher quality) MBI value than the locations downstream of the STP for each year studied except 1985 when all stations had excellent rating values. The 1985 and the 1989 studies both concluded that the STP was having a slight to moderate impact on this reach of Sugar Creek. This conclusion was based upon the MBI values as well as water quality data. The 1985 study states a provisional characterization of Sugar Creek as a moderate aquatic resource while the 1989 study rates Sugar Creek as partially supporting designated aquatic life uses with moderate impairment. These ratings are discussed in Section 3.3 (see Tables 3.9 and 3.16).

Table 3.16 contains MBI values for the upstream Sangamon location at Roby (E16), the downstream Sangamon River location at Riverton (E26), and the South Fork location (EO-01). MBI values were not provided for Sugar Creek (EOA-01) in the 1988-89 Illinois Water Quality Report. The MBI values shown in Table 3.4 for A-1 (EOA-01) were measured upstream of influence from the primary 008 Sugar Creek STP discharge and downstream of the CWLP discharges. The MBI quality range for A-1 was excellent to good. These values compare favorably with the MBI values for the South Fork and the Sangamon River given in Table 3.16. The average for the A-1 values listed in Table 3.4 is 5.6 which is in the very good MBI category. This value is slightly better than the 1988-89 MBI for E26 downstream at Riverton and substantially better than for the upstream location E16 at Roby.

3.2.4 Fisheries

Of the more than 180 species of fish that have been recorded in Illinois (Smith, 1979), a majority inhabit lotic environments. They occupy upper levels of aquatic food chains and are directly and indirectly affected by chemical and physical changes in their environment. While use of aquatic macroinvertebrates and water chemistry are integral components in the assessment of water quality and documentation of constituents causing impairment, the condition of the fishery is the most meaningful index of stream quality to the general public (Weber, 1973).

Use of fish to assess biotic integrity of water resources has received increased emphasis in recent years by a number of investigators (Karr, 1981; Hocutt, 1981; Stauffer, et al., 1976; Karr, et al., 1986). Karr (1981) listed several advantages for using fish as indicator organisms in monitoring programs:

- Life-history information is extensive for most species;
- Fish communities generally include a range of species that represent a variety of trophic levels;
- Fish are relatively easy to identify;
- Both acute toxicity and stress effects can be evaluated;
- Fish are typically present, even in the smallest streams and in all but the most polluted waters; and
- Results of fish studies can be directly related to the fishable waters mandate of the Clean Water Act (discussed in Section 3.3).

The Index of Biotic Integrity (IBI) was designed to include a range of attributes of fish populations. Its twelve measures, or metrics (Table 3.5), fall into three broad categories: species composition, trophic composition, and fish abundance and condition. Data are obtained for each of these metrics at a given site and compared to expected conditions at an unimpacted or relatively unimpacted site located in a similar geographical region and on a stream of comparable size. A number rating is then assigned to each metric based on whether its evaluation deviates strongly from, deviates somewhat from, or approximates expectations. The sum of the twelve ratings yields an overall site score. The strength of IBI is its ability to integrate information from individual, population, community, zoogeographic, and ecosystem levels into a single ecologically-based index of the quality of a water resource (Karr, et al., 1986).

When information is lacking on disease (metric 12), an Alternate Index of Biotic Integrity (AIBI) value may be calculated for fish samples. Calculation of the AIBI is accomplished in a manner identical to the method discussed above, except the disease metric score is derived from the average value of the preceding eleven metrics.

TABLE 3.5

INDEX OF BIOTIC INTEGRITY (IBI) METRICS USED TO ASSESS FISH COMMUNITIES IN ILLINOIS STREAMS

Category	Metric	Scoring Criteria		
		5	3	1
Species richness and composition	1. Total number of fish species	Expectations for metrics 1-5 vary with stream size and region.		
	2. Number and identity of darter species			
	3. Number and identity of sunfish species			
	4. Number and identity of sucker species			
	5. Number and identity of intolerant species			
	6. Proportion of individuals as green sunfish	<5%	5-20%	>20%
Trophic composition	7. Proportion of individuals as omnivores	<20%	20-45%	>45%
	8. Proportion of individuals as insectivorous cyprinids	>45%	45-20%	<20%
	9. Proportion of individuals as piscivores (top carnivores)	<5%	5-1%	<1%
Fish abundance and condition	10. Number of individuals in sample	Expectations for metric 10 vary with stream size and other factors		
	11. Proportion of individuals as hybrids	0%	>0-1%	>1%
	12. Proportion of individuals with disease, tumors, fin damage, and skeletal anomalies	0-2%	>2-5%	>5%

(from Karr, et al., 1986)

Table 3.6 lists the fish species collected from each of the three streams. The species list was compiled from a fisheries study done for CWLP in December 1987 through November 1988 (Appendix B). CWLP sampling locations are shown in Figure 3.6. Station 5 from the CWLP study correlates with AWQMN sampling station E26 at Riverton (see Figure 3.4). The CWLP study represents the most recent and complete fisheries data available for the areas of interest within these streams.

The number of fish species collected at the Sugar Creek and Sangamon River stations was relatively average for midwestern streams while that for the South Fork is slightly low for a stream of its size. The species listed in Table 3.6 are common for Illinois streams (Smith, 1979) and none are present on the state or federal endangered or threatened species lists (Herkert, 1992). The number of fish species collected was highest at the three Sangamon River stations with station 2 having the highest with 34 species. This station was immediately below the confluence with the South Fork. Station 5, located downstream at Riverton (E26), had only one less species with 33. Based on fish species diversity, it appears the Sangamon is not being negatively influenced by Sugar Creek or the South Fork. Station 1 (upstream) had fewer species (29) than either of the downstream Stations. The number of species collected at station 1 was not significantly different than the number of species observed from Sugar Creek station 4 (27 species).

Table 3.7 contains a compilation of fisheries data and indices. The IBI/AIBI values are very similar for each station. No value for this parameter was available for station E16 at Roby. However, a value was available from IDOC (personal communication) for AWQMN station E-05 which is five miles southeast of Niantic on the Sangamon River downstream of Lake Decatur. The station E-05 AIBI of 29.4 is similar to that of the other stations. As shown in Tables 3.8 and 3.9 (Section 3.3), these IBI/AIBI values put all four stream study stations in the second lowest category for stream quality. This is in contrast to the PIBI values, which rate all stations but EO-01 on the South Fork (no PIBI available) as having a potential stream quality value in the second highest category. In even greater contrast, the Water Quality Index (WQI) value for the Sugar Creek station EOA-01 (Table 3.16, Section 3.3) places it in the highest stream quality category.

TABLE 3.6

FISH SPECIES COLLECTED FROM SUGAR CREEK, SOUTH FORK, AND SANGAMON RIVER

Fish Species	STATION				
	1	2	3	4	5
	Sangamon R. upstream	Sangamon R. downstream	South Fork	Sugar Creek	Sangamon R. downstream (E26)
Longnose gar				X	X
Gizzard shad	X	X	X	X	X
Central stoneroller		X			
Common carp	X	X	X	X	X
Hornyhead chub	X	X			
Golden shiner				X	
Emerald shiner	X	X	X	X	X
Striped shiner	X	X			X
Bigmouth shiner	X				
Red shiner	X	X	X	X	X
Sand shiner	X	X	X	X	X
Redfin shiner			X		
Suckermouth minnow	X	X			X
Bluntnose minnow	X	X		X	X
Bullhead minnow	X	X	X	X	X
Creek chub	X	X			
River carpsucker	X	X	X	X	X
Quillback	X	X	X	X	X
Highfin carpsucker	X	X			
White sucker	X			X	X
Smallmouth buffalo		X			X
Bigmouth buffalo	X	X		X	
Black buffalo					X
Golden redhorse		X		X	X
Shorthead redhorse		X	X		X
Channel catfish	X	X	X	X	X
Flathead catfish		X	X	X	X
Tadpole madtom			X	X	

TABLE 3.6

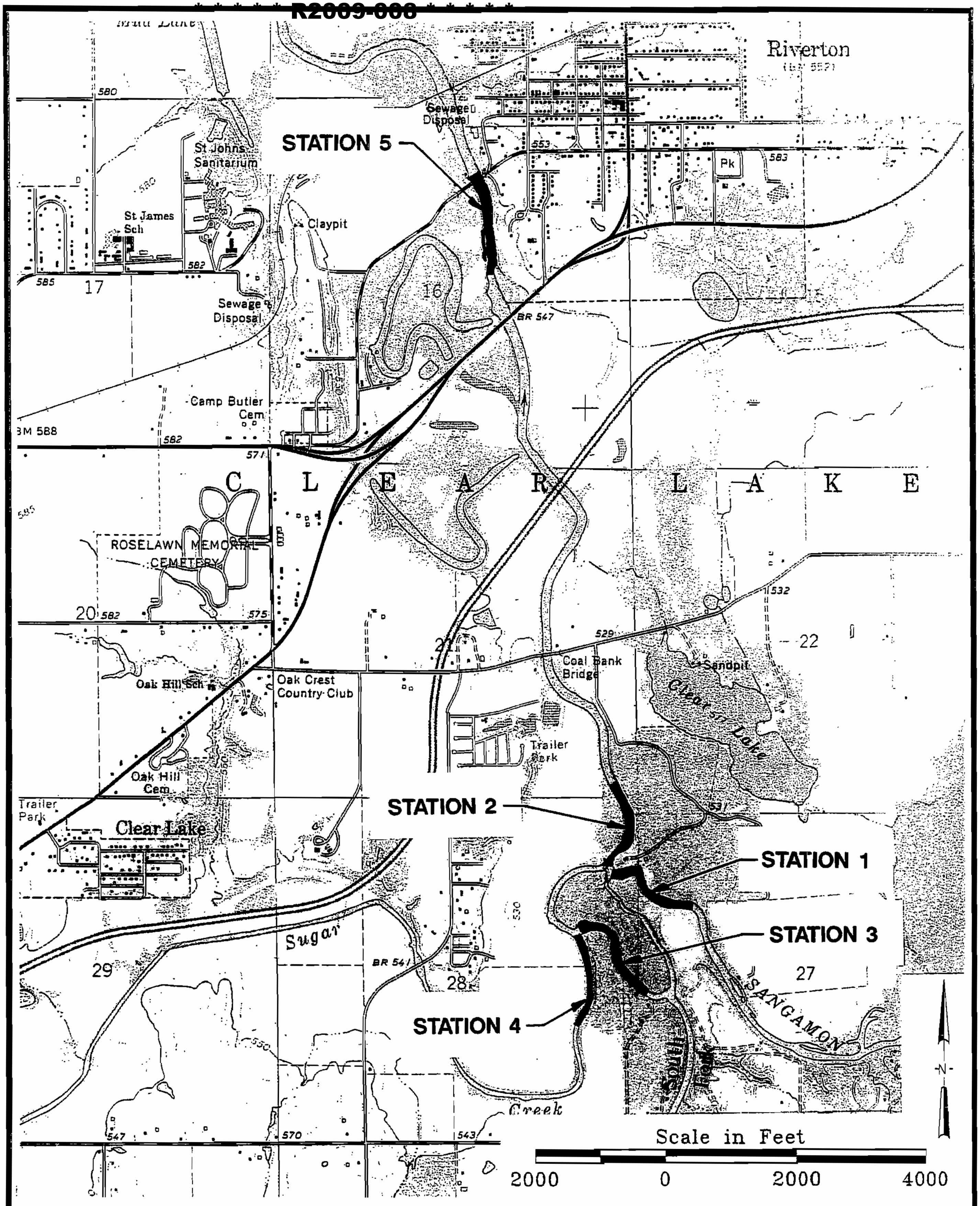
FISH SPECIES COLLECTED FROM SUGAR CREEK, SOUTH FORK, AND SANGAMON RIVER

(Continued)

Fish Species	STATION				
	1	2	3	4	5
	Sangamon R. upstream	Sangamon R. downstream	South Fork	Sugar Creek	Sangamon R. downstream (E26)
Blackstripe topminnow		X	X	X	X
Brook silverside	X	X	X	X	X
White bass	X	X	X	X	X
Yellow bass	X	X		X	X
Green sunfish	X	X	X	X	X
Orangespotted sunfish	X	X	X	X	X
Bluegill	X	X	X	X	X
Largemouth bass	X	X	X	X	X
White crappie	X	X	X	X	X
Black crappie	X	X			X
Blackside darter					X
Slenderhead darter	X	X			X
Walleye		X			X
Freshwater drum	X	X	X	X	X
No. spp.	29	34	22	27	33

42 Species Total for all methods and all stations.

(from CWLP Study 1987-88)



FISHERIES SAMPLING LOCATIONS

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TECHNICAL SUPPORT DOCUMENT FOR
PETITION FOR ADJUSTED BORON
STANDARDS FOR SUGAR CREEK
AND THE SANGAMON RIVER

Job No. 92S5034A Figure 3.6

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TABLE 3.7

FISHERIES DATA AND INDICES FOR STREAM SAMPLING STATIONS

	Sangamon River Upstream at Roby (E16)	Sangamon River Downstream at Riverton (E26)	South Fork (EO-01)	Sugar Creek (EOA-01)
No. of Species	29(1)	33(2)	22(3)	27(4)
IBI		30(5)	30.3(5)	29.5(6)
AIBI		29.4(8)	29(7)	
AIBI (E-05)	29.4(9)			
PIBI	45.5(5)	48.3(5)		42(6)

(1) Immediately upstream of confluence with South Fork, from CWLP 1987-88, Appendix B
(2) From CWLP Study 1987-88, Appendix B
(3) Immediately upstream of confluence with Sugar Creek, from CWLP 1987-88, Appendix B
(4) Immediately upstream of confluence with South Fork, from CWLP 1987-88, Appendix B
(5) IEPA 1988-89 Water Quality Report, Table 3.16
(6) IEPA STP Study, 1989
(7) From 1982 Data, Personal Communication IDOC
(8) From 1990 Data, Personal Communication IDOC
(9) From 1990 Data, Personal Communication IDOC,
Location E-05 below Lake Decatur on Sangamon River

3.3 Illinois Water Quality Report Status

3.3.1. Assessment Methods

The 1972 Federal Clean Water Act (CWA) sets goals of fishability and swimmability for the nation's water resources. The fishable goal of the CWA is defined as a level of water quality consistent with protection and propagation of balanced populations of shellfish, fish, and wildlife. The swimmable goal of the CWA is defined as providing a level of water quality which allows for recreational activities in and on the water. Attainment of these CWA goals is expressed in terms of meeting, partially meeting, or not meeting each goal.

Section 305 of the Clean Water Act requires assessment of the degree to which CWA fishable/swimmable goals have been attained. These goals are considered separate and independent criteria from the degree of designated use support (USEPA Guidelines, 1989). The degree of designated use support is described in terms of full support of uses, full but threatened support, partial support with minor impairment, partial support with moderate impairment, or nonsupport. Use support assessments for rivers and streams are based on ability to support aquatic life. The 1988-89 Illinois Water Quality Reports, prepared by the IEPA, was referenced to assess the water quality status of Sugar Creek and the associated portions of the Sangamon and the South Fork of the Sangamon River.

The determination of the degree to which Illinois streams support designated uses is based on a combination of biotic and abiotic data, intensive surveys, field observations, and professional judgment. Because aquatic life protection is considered the best indicator of Clean Water Act goals of fishable and swimmable waters, the use support process focuses on biotic data.

Biotic data consist of fishery and macroinvertebrate data. These data have been evaluated by the IEPA using the Index of Biotic Integrity (IBI) and the IEPA Macroinvertebrate Biotic Index (MBI). Biological Stream Characterization (BSC) is a five-tiered stream classification system based largely on IBI values and other fish community attributes (Table 3.8). Because the BSC rating process uses both fish and macroinvertebrate data, BSC categories closely resemble levels of use support. The general relationship of the five BSC categories, general water quality conditions, and other assessment indices to CWA use support assessment levels is shown in Table 3.9. The criteria for assessment of the fishable goal are shown in Table 3.10.

Abiotic data include water chemistry, fish tissue analysis, sediment chemistry, and physical habitat. Stream habitat data include depth, velocity, substrate and instream cover. These data have been used by the IEPA to predict biotic potential (PIBI). Water chemistry data were evaluated through the use of a Water Quality Index (WQI), which compares physical and chemical water quality data with established criteria and reports the results as a single value.

The USEPA (1989) defines waters that are swimmable as having both chemical and bacteriological quality sufficient to provide primary contact recreation. The IEPA uses both the Water Quality Index (WQI) and fecal coliform bacteria levels to assess rivers and streams for attainment of the swimmable goal, (Table 3.11). The Illinois Pollution Control Board bacterial water quality standard for general use and primary contact for fecal coliforms is 200 colonies/100 ml for the months of May through October.

3.3.2 Sangamon River Basin

A total of 1009.5 stream miles in the Sangamon River basin were assessed for designated aquatic life use support. Of these, 16.8 miles (1.7 percent) were nonsupportive of aquatic life; 89.0 miles (8.8 percent) had partial support/moderate impairment; 639.1 miles (63.3 percent) had partial support/minor impairment; and 264.6 miles (26.2 percent) were fully supportive of the aquatic life use (Table 3.12).

Attainment of the CWA fishable and swimmable goals is summarized in Table 3.13. Of 1009.5 stream miles assessed, 841.1 (83.3 percent) miles met the fishable goal. A total of 437. 3 stream miles were assessed on swimmable criteria; of these, 28.8 (6.6 percent) miles met the goal, while 311.5 (71.2 percent) partially met the goal, and 34.0 miles (7.8 percent) did not meet the swimmable goal. A total of 63 miles (14.4 percent) were considered to be not attainable as a result of disinfection exemptions.

TABLE 3.8

BIOLOGICAL STREAM CHARACTERIZATION (BSC) SUMMARY

Stream Class	BSC Category	IBI Range	MBI Range	Stream Quality Description
A	Unique Aquatic Resource	51-60	N/A	EXCELLENT. Comparable to the best situations without human disturbance; threatened and/or endangered species may be present.
B	Highly Valued Aquatic Resource	41-50	N/A	GOOD. Good fishery for important gamefish species; species richness may be somewhat below expectations for stream size or geographic region.
C	Moderate Aquatic Resource	31-40	N/A	FAIR. Fishery consists predominantly of bullhead, sunfish, and carp. Species diversity and number of intolerant fish reduced. Trophic structure skewed with increased frequency of omnivores, green sunfish and/or tolerant species.
D	Limited Aquatic ~~Resource~~	21-30	7.5-10.0	POOR. Fishery predominately ~~for carp; fish community~~ dominated by omnivores and tolerant forms.
E	Restricted Aquatic Resource	≤ 20	≥ 10.0	VERY POOR. Few fish of any species present; no sport fishery exists.

(from Illinois Water Quality Report 1988-89)

TABLE 3.9

SUMMARY OF USE SUPPORT ASSESSMENT CRITERIA FOR ILLINOIS STREAMS

	FULL SUPPORT		PARTIAL SUPPORT MINOR	PARTIAL SUPPORT MODERATE	NON-SUPPORT
USEPA GENERAL STREAM/WATER QUALITY CONDITION	Excellent	Very Good	Fair-Good	Poor	Very Poor
IEPA/IDOC BIOLOGICAL STREAM CHARACTERIZATION (BSC)	A Unique Aquatic Resource	B Highly Valued Resource	C Moderate Aquatic Resource	D Limited Aquatic Resource	E Restricted Aquatic Resource
FISH/Index of Biotic Integrity (IBI/AIBI)	51-60	41-50	31-40	21-30	<20
BENTHOS/Macroinvertebrate Biotic Index (MBI)	<5.0	5.0-6.0	6.0-7.5	7.5-10.0	>10.0
WATER STORET Water CHEMISTRY/Quality Index (WQI)	0-10	10-30	30-50	50-70	>70
WATER Total Suspended Solids CHEMISTRY/(TSS/mg/l)	<10	10-25	25-80	80-400	>400
STREAM/Potential Index of HABITAT/Biotic Integrity (PIBI)	51-60	41-50	31-40	<31	
STREAM IEPA Stream Sediment SEDIMENT/Classification	Nonelevated	Nonelevated-Slightly Elevated	Slightly Elevated	Elevated-Highly Elevated	Extreme

(From Illinois Water Quality Report, 1988-89)

TABLE 3.10

CRITERIA FOR ASSESSING CWA FISHABLE GOAL ATTAINMENT IN RIVERS AND STREAMS

Fishable	Partially Fishable	Not Fishable	Not Attainable
IBI 31-60 or If IBI is not available, then Full Partial/Minor	IBI 21-30 or If IBI is not available, then Partial/Moderate	IBI < 20 or existing fish advisory or If IBI is not available, then nonsupport	None

(From Illinois Water Quality Report, 1988-89.)

TABLE 3.11

CRITERIA FOR ASSESSING CWA SWIMMABLE GOAL ATTAINMENT IN RIVERS AND STREAMS

Swimmable	Partially Swimmable	Not Swimmable	Not Attainable
WQI <50 and fecal coliform mean <200	WQI <50 and fecal coliform mean >200	WQI >50 and fecal coliform mean >200	Secondary Contact
	or		Unprotected by disinfection exemptions
	WQI >50 and fecal coliform mean <200		

(From Illinois Water Quality Report, 1988-89.)

TABLE 3.12

DESIGNATED USE SUPPORT FOR THE SANGAMON RIVER BASIN

Degree of Use Support	Total Assessed (stream miles)
Fully supporting	264.6
Full but threatened support	0
Partial support with minor impairment	639.1
Partial support with moderate impairment	89.0
Not supporting	16.8
TOTAL	1009.5

~~(from Illinois Water Quality Report, 1988-89)~~

TABLE 3.13

ATTAINMENT OF CLEAN WATER ACT GOALS FOR THE SANGAMON RIVER BASIN

Goal Attainment	Fishable Goal (stream miles)	Swimmable Goal (stream miles)
Meeting	841.1	28.8
Partially meeting	159.1	311.5
Not meeting	9.2	34.0
Not attainable	0	63.0
Not assessed	0	572.2
TOTAL	1009.5	1009.5

(from Illinois Water Quality Report 1988-89)

Causes and sources resulting in less than full support within the Sangamon River basin are listed in Tables 3.14 and 3.15.

3.3.3 Sangamon River

The Sangamon River can be divided into three distinct segments: the lower Sangamon from the confluence with South Fork to the Illinois River; the middle Sangamon River between the South Fork and Lake Decatur; and the upper Sangamon River above Lake Decatur. The lower Sangamon River is affected by extensive stream channelization, removal of riparian vegetation and agricultural runoff. Several municipal wastewater treatment facilities and urban runoff from Springfield also impact the lower Sangamon River. These various sources of pollution contribute to the partial support of aquatic life with minor impairment found throughout the lower Sangamon River.

Upstream of Lake Decatur, the Sangamon River is less channelized with more riparian vegetation present. However, there is still considerable agricultural nonpoint runoff resulting in elevated levels of nutrients and siltation. Several small municipal wastewater treatment facilities also contribute to the nutrient load. As a result of these impacts, the upper Sangamon River was rated as providing partial support of the designated use with minor impairments.

The primary source of pollution within the middle reach of the Sangamon River is Decatur Sanitary District discharge, and storm and combined sewer overflows from Decatur. During dry weather, the impact from these point sources is compounded by the lack of water discharged from the Lake Decatur dam. Because of these factors, 16.8 miles of the Sangamon River have been rated as nonsupportive of aquatic life uses. Below this stretch, the middle Sangamon River improves to partial support with moderate impairment.

Table 3.16 summarizes the stream quality index ratings from the 1988-89 IEPA Illinois Water Quality Report for the four AWQMN survey stations. The MBI and PIBI (habitat assessment) index values both indicate higher quality conditions for site E26 than for site E16 upstream. The causes listed for water quality limitations for the two sites are the same; nutrient

TABLE 3.14

TOTAL SIZES OF WATERS NOT FULLY SUPPORTING USES AFFECTED BY VARIOUS CAUSE CATEGORIES FOR THE SANGAMON RIVER BASIN

Cause Category	Major Impact (stream miles)	Moderate/Minor Impact (stream miles)
Ammonia		22.8
Nutrients		744.0
pH		16.4
Siltation		744.9
Organic enrichment/DO	16.8	171.9
Flow alteration		1.4

(from Illinois Water Quality Report 1988-89)

TABLE 3.15

TOTAL SIZES OF WATERS NOT FULLY SUPPORTING USES AFFECTED BY VARIOUS SOURCE CATEGORIES FOR THE SANGAMON RIVER BASIN

Source Category	Major Impact (stream miles)	Moderate/Minor Impact (stream miles)
Point Sources		
Industrial		52.4
Municipal	72.9	244.1
Combined sewer overflows	85.6	62.4
Nonpoint sources		
Agricultural		
Nonirrigated crop production	22.0	650.1
Pasture land		543.2
Urban runoff/storm sewers		48.6
Resource extraction/exploration development		16.4
Hydrologic/habitat modification		
Channelization		115.5
Flow regulation/modification		13.8
Removal of riparian vegetation		61.1
Streambank modification/destabilization		44.5

(from Illinois Water Quality Report 1988-89)

loading, siltation, and organic enrichment. The level of effect from each of these causes is rated the same except for organic enrichment/dissolved oxygen reduction, which is rated as moderate for the upstream Roby site as compared to slight for the downstream Riverton site. The sources of these water quality limitations are listed as the same for both sites. However, municipal point sources and combined sewer overflows were both rated as a more negative influence on the water quality at Roby than at Riverton. Both sites were judged as partially meeting the fishable goal but not meeting the swimmable goals of the Clean Water Act. Considering all of the rating factors and index values, the downstream (E26) site at Riverton was rated as providing partial support of the designated aquatic life use with moderate impairment. The general water quality of the Sangamon River showed slight improvement from upstream to downstream in this particular segment of the river.

3.3.4 South Fork of the Sangamon River

The South Fork is generally impacted by siltation and nutrients from agricultural runoff. Several municipal wastewater treatment facilities also contribute to the nutrient load. As a result of these influences, all but 17.9 miles were rated as providing partial support with minor impairment of the designated stream use. The remaining stream miles are on small tributaries and were rated as full support streams.

Site EO-01 (Figure 3.4) is located on the South Fork upstream from the confluence with Sugar Creek and the Sangamon River. Ratings for this station are summarized in Table 3.16. Although the WQI rating was fair to good and the MBI rating was excellent, the IBI was poor, correlating with a BSC rating of D (limited aquatic resource). Causes of water quality limitations in this part of the South Fork are nutrient loading, siltation due to non-irrigated agriculture, and channelization. The fishable and swimmable CWA goals are both partially met at EO-01. Site EO-01 is rated as providing partial support of the designated aquatic life use with only minor impairment.

TABLE 3.16

STREAM CONDITION STATUS

Stream Location	Support of Designated Stream Use (aquatic life)	Fishable/ Swimmable Goal of Clean Water Act	Causes of Water Quality Limitations	Sources of Water Quality Limitations	Water Quality Index (WQI)	Macro-invertebrate Biotic Index (MBI)	Index of Biotic Integrity (IBI)	Predicted Index of Biotic Integrity (PIBI) (Habitat Assessment)
Sangamon River at Roby (E16)	partial with moderate impairment	partial/no	nutrient loading (slight) siltation (moderate) organic enrichment-D.O. (moderate)	municipal (high) combined sewer (high) non-irrigated crops (slight) pasture (slight)	62.1	7.3	--	45.5
Sangamon River at Riverton (E26)	partial with minor impairment	partial/no	nutrient loading (S) siltation (M) organic enrichment-D.O. (S)	municipal (S) combined sewer (S) non-irrigated crops (S) pasture (S)	62.4	5.7	30.0	48.3
South Fork of Sangamon River (EO-01)	partial with minor impairment	partial/partial	nutrient loading (S) siltation (M)	non-irrigated crops (S) channelization (S)	40.3	3.9	30.3	--
Sugar Creek (EOA-01)	partial with minor impairment	yes/partial	nutrient loading (S) siltation (M)	municipal (S) combined sewer (S) non-point sources (S) urban/sewage treatment plant (S) channelization (S) flow regulation/modification (S)	16.5	--	--	--

(from 1988-89 IEPA Water Quality Report)

3.3.5 Sugar Creek

Site EOA-01 is located on Sugar Creek at the Illinois Route 29 bridge southeast of Springfield (Figure 3.4). MBI, IBI, and PIBI values for this sampling station were not provided in the 1988-89 Illinois Water Quality Report. The WQI value of 16.5 indicates that this reach of Sugar Creek has very good stream and water quality (Table 3.9). This WQI value correlates with a BSC rating of B (highly valued resource) and a full support rating for designated aquatic life use. The causes of water quality limitations for Sugar Creek are slight nutrient loading and moderate siltation. Several sources of water quality limitations are listed. Non-point sources and municipal point sources, primarily from the City of Springfield, are all rated as having slight effects on water quality. The Springfield Metropolitan Sanitary District Sugar Creek sewage treatment plant is served by combined sanitary and storm sewers and has two combined sewer overflows (CSO) in the system. The first is the Harvard Park CSO located in the southeast corner of Springfield near the Bunn Park Golf Course (Figure 3.3). It discharges to an unnamed tributary of Sugar Creek upstream from the Ill. Rt. 29 bridge. The second CSO is located at the head end of the Sugar Creek plant and discharges directly to Sugar Creek when storm flows exceed 100 mgd. The Harvard Park CSO discharge into Sugar Creek is rated in Table 3.16 as having a slight effect on nutrient loading. Channelization is rated as a slight source of water quality impairment. Creek flow regulation/modification caused by the Spaulding Dam, which impounds the original Sugar Creek channel, is rated as a slight source of water quality limitation. In spite of all these causes and sources of water quality limitations, the WQI rating is very good. The fishable goal of the CWA is judged as being met for Sugar Creek with the swimmable goal being partially met. Considering all factors, this reach of Sugar Creek was rated as providing partial support of the designated aquatic life use with only minor impairment.

4.0 ISSUE OF CONCERN

4.1 Proposed Adjusted Water Quality Standards for Boron

NPDES Permit No. IL0024767 authorizes City Water, Light and Power to discharge effluent from their power station facility to Lake Springfield and Sugar Creek. Ash-bearing wastewater and miscellaneous low volume process wastewaters from the power station are discharged to an on-site ash pond system for solids removal, wastewater clarification, and pH adjustment. The NPDES permit, effective December 14, 1991, requires CWLP to monitor the concentration of boron, among other constituents, in the ash pond discharge (004) and the storm sewer discharge (003) to Sugar Creek. Beginning December 14, 1994, the permit establishes, for the first time, an effluent limitation (1.0 mg/L, based on the Illinois General Use stream quality standard) for boron as a daily maximum value not to be exceeded in grab samples collected twice monthly from these discharges. A copy of NPDES Permit IL 0024767 is attached as Appendix C.

Historical data on the concentrations of boron in the existing discharges (Section 4.3) suggest that noncompliance with the effluent limitation in the permit will occur frequently. Therefore, an upward adjustment for boron for the stream limitation is recommended. The recommended adjusted stream standards for boron are: 11.0 mg/L from CWLP outfall 003 to SMSD Sugar Creek station outfall 008; 5.5 mg/L form outfall 008 to the confluence of Sugar Creek with the South Fork and the Sangamon River; and 2.0 mg/L form this confluence to 100 yds downstream of the confluence of the Sangamon River with Spring Creek, north of Springfield, which receives the SMSD Spring Creek station 007 outfall discharge.

The Illinois General Use water quality standard established by the Illinois Pollution Control Board for boron is 1.0 mg/L. The Board originally adopted the present General Use water quality standards as part of Water Pollution Rule 203(f), by Order dated March 1972, in consolidated proceedings R70-8, R71-14 and R71-20 (Order, 3/7/72). The standards were promulgated to implement the requirements of the Clean Water Act, 33 U.S.C. 1251 et seq., and the State of Illinois NPDES program. Subsequently, the water quality standards were codified in their present location in Title 35 of the Illinois Administrative Code, Section 302.208(e). The numerical value of the boron standard has not changed from the initially-adopted value.

The present standard for boron is based on the USEPA's federal criterion, which is protective of sensitive crops, such as citrus, from irrigation waters high in boron. In adopting this standard, the Board recognized that "100% irrigation is unlikely in Illinois," but that "the uncontrolled discharge of large quantities of boron is clearly undesirable." (Order, 3/7/72). There are presently no known withdrawals for agricultural purposes on the described reaches of these streams. However, in October 1993 an application for construction was submitted to IDOT to facilitate irrigation of the Rail Golf Course from the Sangamon River on the north side of Springfield. As of this writing, no permit has been issued (Section 3.2.1). The most sensitive users of these streams are the biological communities. Based upon the incidental exposure to recreational users and an evaluation of boron's effects on various plants and aquatic organisms (Section 4.2.3), the use of the 1.0 mg/L limit is not supported. Results of various studies and discussions presented in the following sections support the proposed adjusted stream standards for boron.

4.2 Boron Characteristics

4.2.1 Properties

Boron is a dark brown element that is widespread in the environment but occurs naturally only in combined form, usually as borax, colemanite, boronatrocalcite, and boracite. Boron exists in sediments as borosilicates, which are considered biologically inert. It is released to the environment very slowly and at very low concentrations by natural weathering processes. Most of the natural boron compounds usually degrade or are transformed by natural weathering of rocks to borates or boric acid, which are the main boron compounds of ecological significance (Sprague, 1972).

4.2.2 Distribution and Uses

Proven commercial deposits of sodium tetraborate from which borax is prepared are concentrated in the Mojave Desert of California where ancient lakes or marshes have evaporated under arid conditions. The United States supplies 70 percent of the annual world demand for boron compounds. Boron is used in the production of glass and glass products such as textiles and insulating fiberglass. It is also used in the manufacture of enamels and glazes used as coatings on household and industrial products. Other products that include boron are: herbicides, insecticides, soaps, cleansers, cosmetics, antifreeze, high energy fuels, flame-proof compounds, corrosion inhibitors, and antiseptics.

Boron is widely distributed in surface water and ground water. The average surface water concentration for boron in the United States is about 0.1 mg/L (Butterwick, et al., 1989), but concentrations vary greatly, depending on boron content of local geologic formations and anthropogenic sources of boron (Butterwick, et al., 1989). A survey of U.S. surface waters detected boron in 98 percent of 1,577 samples at concentrations ranging from 0.001 mg/L to 5.0 mg/L. Mean concentrations calculated for the 15 drainage basins in the continental United States ranged from 0.019 mg/L in the Western Great Lakes Basin to 0.289 mg/L in the Western Gulf Basin (Butterwick, et al., 1989). The concentration of boron in sea water is about 4.5 mg/L to 5.5 mg/L, varying with the local salinity (Butterwick, et al., 1989).

Most boron that occurs in the fresh water aquatic environment is due to the relatively high water solubility of all boron compounds, especially boron-containing laundry products and sewage (USEPA, 1975). Another, although very localized, source of boron to the aquatic environment is from coal ash. Many commercially-mined coal seams contain significant concentrations of boron. Of the total boron in coal, as much as 71 percent may be lost to the atmosphere upon combustion; however, more than 50 percent of the boron found in coal ash is readily water soluble (Pagenkopf and Connolly, 1982). The release of boron from coal fly ash to leachate water is dependent on the ash to water ratio: at 1 gm of ash/L up to 90 percent of the boron is soluble: at 50 gm/L only 40 percent is released: at 100 gm/L less than 30 percent is soluble (Eisler, 1990).

4.2.3 Toxicology

Effects in Humans

Boron has been reported to cause toxic effects in humans following inhalation, oral, and dermal exposures. Inhalation exposures to 14.4 mg/m^3 of borax dust have resulted in upper respiratory tract irritation, dryness of the mouth, nose, and throat as well as irritation of the eye, but a level of 1.1 mg/m^3 produced no symptoms (Garabrant, et al., 1984). One study (Gupta and Parrish, 1984) demonstrated toxicosis in adults to a dermal exposure of 645 gms of boric acid.

Oral doses of 15-20 gms of boric acid, equivalent to 0.25-0.3 g/kg of body weight, have been shown to be lethal (USEPA, 1975, and Eisler, 1990). Oral doses of 5-6 gms of borates have shown to be fatal to infants (from Eisler, 1990). Specific symptoms associated with oral doses include nausea, persistent vomiting, diarrhea, colicky abdominal pain, liver effects (jaundice), kidney disease, and dermatitis. In addition, oral exposures have been reported to cause headaches, tremors, restlessness, convulsions, weakness, and coma (ATSDR, 1990). Papachristou et al. (1987) demonstrated that ingestion of water with 20-30 mg/L of boron can be considered to have no adverse effects on human health.

Effects in Other Vertebrates

In mammals, exposure to excessive boron results in a reduced growth rate, loss of body weight, decreased sexual activity, and eye irritation. Reduced growth has been reported in cattle, dogs, rabbits, and rats (Eisler, 1990). An oral dose of 120 mg/L of boron as borax for 10 days produces no overt signs of toxicosis in cattle. An oral dose of 150 mg/L of boron as borax for 30 days did produce symptoms of toxicosis in cattle. Ingestion of 100-300 gms of boron, equivalent to 200-600 mg of boron per kg of body weight, was found to be lethal to cattle (from Eisler, 1990).

Dogs were found to tolerate ingestion of 350 mg of boron per kg of feed for two years but showed symptoms of toxicosis when fed 1,170 mg of boron per kg of feed after 38 weeks

(Weir and Fisher, 1972). Rabbits showed growth retardation when fed 800-1,000 mg of borates per kg of body weight daily for four days. Results of chronic feeding studies using mallards demonstrate that diets containing 13 mg of boron per kg of feed weight produce no adverse effects, but those diets containing 1,000 mg/kg of boron are fatal (from Eisler, 1990).

Effects in Fish, Plants and Invertebrates

Boron is essential for the growth of higher plants. Boron soil concentrations for optimum plant growth reportedly range from 0.1 to 0.5 mg/kg for several plant species (Butterwick, et al., 1989); however, excess boron is known to be phytotoxic (Eisler, 1990). Boron toxicity has been reported in many species of grasses, fruits, vegetables, grains, trees, and other terrestrial plants. Boron toxicity in plants is characterized by stunted growth, leaf malformation, browning and yellowing, chlorosis, necrosis, increased sensitivity to mildew, wilting, and inhibition of pollen germination and pollen tube growth. There is some evidence (Graham, et al., 1987) that boron may accumulate to toxic levels in plants, particularly in the presence of a high phosphorus and low zinc environment.

The following studies demonstrate tolerance ranges to levels of boron exposure for some terrestrial plants:

- Toxic effect in plants-including leaf injury- were observed in 26 percent of plants at or below substrate concentrations that resulted in greatest growth, indicating considerable overlap between injurious and beneficial effects of boron in plants (Eaton, 1944);

- In general, deficiency effects in plants were evident when boron concentrations in soil solution were <2 mg/L; optimal growth occurred at 2 to 5 mg/L; and toxic effects were evident at 5 to 12 mg/L. Sensitive species are known to include citrus, stone fruits, and nut trees; semitolerant species include cotton, tubers, cereals, grains, and olives; tolerant species usually include most vegetables (Gupta, et al., 1985);

- Biggar and Fireman (1960) showed that with neutral and alkaline soils of high absorption capacities, water containing 2 mg/L boron might be used for some time without injury to sensitive plants;

- Four species of turfgrass, Kentucky bluegrass, creeping bent, alta fescue, and colonial bent, were irrigated with water containing 4.8 mg/L of boron. These species of turfgrass were found to show excellent tolerance to higher levels of boron in soil solution, when the practice of frequent mowing is employed (Oertli, et al., 1961).

Boron effects on aquatic life are highly species specific. Most aquatic organism toxicity studies have focused on the evaluation of lethal concentrations; however, other toxic effects have been reported. Toxic effects observed in aquatic plants include inhibition of growth and reduced photosynthesis (Frick, 1985; Antia and Cheng, 1975; Rao, 1981) at various concentrations below 100 mg/L of boron. Reproductive effects (i.e., reduction of number of broods, total young produced, mean brood size, and mean size of the young) have been reported for the aquatic invertebrate *Daphnia magna* (Gerisch, 1984; Lewis and Valentine, 1981). Developmental abnormalities have also been observed in toads (130 mg/L) and various fish following exposure to boron (Eisler, 1990).

The following studies demonstrate tolerance ranges to levels of boron exposure for some aquatic plants:

- The blue green alga, *Anacystis nidulans*, exhibits no adverse effects with respect to cell growth or organic constituents at 50 mg/L of boron and significant adverse effects at >100 mg/L over a 72-hour exposure (Eisler, 1990);

- The green alga, *Chlorella pyrenoidosa*, showed no effects on growth or cell composition after a 7-day exposure to 10 mg/L of boron and adverse effects at >100 mg/L boron (Eisler, 1990);

- Duckweed, *Lemna minor*, showed normal growth in 10 mg/L and 20 mg/L boron exposures and growth inhibitions at 100 mg/L boron exposures (Wang, 1986);
- Nineteen species of marine algae showed no effects from a 60-day exposure to 10 mg/L of boron and growth inhibition in 12 of 19 species at 100 mg/L of boron (Antia and Cheng, 1975).

The following studies show tolerance ranges to boron exposures for some aquatic invertebrates:

- Sea urchin embryos showed normal development with exposure to 37 mg/L boron and lethality at 75 mg/L of boron (Kobayashi, 1971);
- A 48-hour LC_{50} value of 133 mg/L as boron was calculated for *Daphnia magna* to boric acid (Gersich, 1984);
- Lewis and Valentine (1981) similarly determined a 48-hour LC_{50} exposure value for boric acid of 226 mg/L as boron with a sublethal exposure level of 13.0 mg/L as boron for *D. magna*;
- The lowest boron concentration shown to cause sublethal effects on the cladoceran *D. magna* in a 21-day study was 13.6 mg/L (Gersich, 1984).

The following studies demonstrate tolerance ranges for some species of fish:

- Mann (1973) studied the effects of sodium perborate, boric acid, and borax upon eel fry, amphipods, rainbow trout, tubificid worms, and guppies. These boron compounds were determined to be relatively non-toxic using 24-hour bioassay procedures. Detrimental effects occurred with exposure to concentrations of more than 250 mg/L of sodium perborate, 5,000 mg/L of boric acid, and 2,500 mg/L of borax.

- Wallen, et al. (1957) studied mosquito fish (*Gambusia affinis)*, which are native to Illinois, using 96-hour bioassay procedures. No mortalities were observed in concentrations of boric acid up to 1,800 mg/L (315 mg/L calculated as boron).

- Birge and Black (1977) studied the effects of boron exposures to channel catfish fry using a 9-day bioassay procedure. An LC_{50} value of 155 mg/L was determined for both borax and boric acid.

- Eisler (1990) indicated that 30 and 33 mg/L of boron are "safe" levels for game fish species such as the largemouth bass and bluegill; and

- Sensitive fish species such as freshwater coho (which are not present in the Sangamon River basin) show adverse effects with exposure to 113 mg/L of boron (Thompson, et al., 1976).

The above studies, done on a diverse list of aquatic organisms, demonstrate the response to boron of three aquatic trophic levels: plant, invertebrate, and vertebrate (fish). Evaluation of the overall effect of a compound on a biological system must include a study of the effects on the lowest tier of the food chain. These studies demonstrate that adverse effects on an aquatic food chain, and consequently the biological community structure of an aquatic ecosystem, would not be observed at or below a boron concentration of 11.0 mg/L. Overall, the results indicate that the Sugar Creek-Sangamon River biological community would not be significantly affected by the 11.0 mg/L boron stream standard proposed for the upper portion of Sugar Creek.

4.3 Boron Concentrations in Receiving Waters

4.3.1 Historic Boron Levels

Table 4.1 summarizes boron concentrations at nine monitoring locations within the local drainage area of the Sangamon River watershed (Figures 3.1, 3.3, and 3.4). Monitoring data from the Sugar Creek, South Fork, and Sangamon River locations are collected by the IEPA as part

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TABLE 4.1
Total Boron Concentrations (mg/l) For Monitoring Stations

Date	Lake Springfield Water Intake	CWLP Outfall 003	CWLP Outfall 004	Suger Creek @ Rt. 29 Bridge (EOA-01)	SMSD Spring Creek Sewage Treatment Plant Outfall - 007	SMSD Sugar Creek Sewage Treatment Plant Outfall - 008	Sangamon River @ Riverton, IL (E28)	Sangamon River @ Roby, IL (E16)	S. Fork of Sangamon River @ Rt. 29 Bridge (EO-01)
1/87			5.20	0.95			0.07	<0.05	0.06
2/87			4.60						
3/87			6.20	0.93			0.07	<0.05	0.07
4/87			2.70	1.03			0.16	0.07	0.05
5/87	<0.05		2.40	0.78			0.08	0.06	0.05
6/87				3.89			0.40	<0.05	0.16
7/87									
8/87			5.89	6.28			0.37	<0.05	<0.05
9/87			8.37	7.50			1.20	0.20	<0.05
10/87			8.10						
11/87				4.36			0.79	0.19	0.11
12/87				4.20			0.13	0.06	<0.05
1/88				6.20			0.06	<0.05	<0.05
2/88			4.17						
3/88			5.82	0.38			<0.05	<0.05	<0.05
4/88			3.95	0.28			<0.05	<0.05	<0.05
5/88	<0.05		5.31	3.90			0.20	<0.09	0.07
6/88			6.10	5.46			1.12	0.14	0.08
7/88									
8/88			7.67	7.80			1.82	0.20	0.15
9/88			10.19	7.48			1.17	0.25	0.12
10/88			6.38				1.48	0.20	
11/88				5.54			0.60	0.24	0.10
12/88			6.49	1.97			0.23	0.21	0.05
1/89			6.02	2.10			0.14	0.18	0.06
2/89			7.30	1.22			0.19	0.15	0.10
3/89		6.88	7.00						
4/89		7.52	5.40	1.12		0.38	0.08	<0.05	<0.05
5/89	0.24	7.13	5.31	4.77		0.73	0.10	0.05	<0.05
6/89		9.69	7.52	5.67	0.37	0.82	0.25	0.05	0.06
7/89		8.75	7.21	6.47	0.41	0.85			
8/89		16.86	6.13		0.44	0.82	0.87	0.12	0.10
9/89		18.70	7.93	5.04	0.39	0.51	0.35	0.08	0.09
10/89		3.30			0.61	0.94			
11/89		3.14	4.84	4.65	0.39	0.48	0.84	0.17	0.09
12/89				0.99	0.43	0.95	0.32	0.16	0.20

TABLE 4.1 (Continued)

Date	Lake Springfield Water Intake	CWLP Outfall 003	CWLP Outfall 004	Suger Creek @ Rt. 29 Bridge (EOA-01)	SMSD Spring Creek Sewage Treatment Plant Outfall - 007	SMSD Sugar Creek Sewage Treatment Plant Outfall - 008	Sangamon River @ Riverton, IL (E26)	Sangamon River @ Roby, IL (E16)	S. Fork of Sangamon River @ Rt. 29 Bridge (EO-01)
1/90		4.17	5.67	1.74	0.87	1.51	0.36	0.15	0.16
2/90		2.17	9.63		0.41	0.56			
3/90		1.85	8.99	1.65	0.63	0.81	<0.05	<0.05	<0.05
4/90		3.58	4.85	4.69	0.44	0.49	0.19	<0.05	0.08
5/90	0.03	4.31	4.08	0.31	0.30	0.35	0.06	<0.05	<0.05
6/90		2.18	5.97			0.57			
7/90				0.59		0.84	0.07	<0.05	0.07
8/90	0.01	0.48	6.90	3.60	0.32	0.30	0.21	<0.05	<0.05
9/90				4.84	0.39	0.36	0.68	0.15	0.08
10/90		1.60	8.60		0.35	0.34			
11/90				5.21	0.34	0.33	0.08	0.06	0.07
12/90		0.90	7.70	0.43		0.30	0.05	<0.05	<0.05
1/91				0.48	0.26	0.30	0.05	<0.05	0.08
2/91		0.18	6.70		0.28	0.28			
3/91			3.00	3.66	0.20	0.26	0.10	<0.05	<0.05
4/91				0.80	0.17	0.21	0.10	0.05	0.05
5/91	<0.05			0.28	0.22	0.27	0.02	<0.05	<0.05
6/91		0.44	7.30		0.24	0.25			
7/91		0.75	7.80	4.15	0.25	0.24	1.11	0.11	0.10
8/91		0.06	1.80	5.43	0.54	0.62			0.09
9/91				5.80	0.30	0.28	0.55	0.22	0.08
10/91		1.30		<0.05	0.32	0.31	0.99		
11/91					0.26	0.31		0.18	
12/91				4.70	0.31	0.33	0.10	0.07	
1/92		0.53	7.10	4.40	0.30	0.28	0.15	0.07	
2/92					0.33	0.29			
3/92			9.30	5.20	0.28	0.26	0.15	0.04	
4/92		0.44	4.70		0.28	0.28			
5/92		6.90			0.26	0.26			
6/92	0.06	8.00	6.00		0.23	0.22			
7/92		1.90	6.70		0.22	0.20			
8/92		7.60	7.20		0.26				
9/92		7.10	6.30		0.23				
10/92			5.50		0.23				

TABLE 4.1 (Continued)

Totals	Lake Springfield Water Intake	CWLP Outfall 003	CWLP Outfall 004	Suger Creek @ Rt. 29 Bridge (EOA-01)	SMSD Spring Creek Sewage Treatment Plant Outfall - 007	SMSD Sugar Creek Sewage Treatment Plant Outfall - 008	Sangamon River @ Riverton, IL (E26)	Sangamon River @ Roby, IL (E16)	S. Fork of Sangamon River @ Rt. 29 Bridge (EO-01)
Average	<0.07	4.51	6.12	<3.38	0.34	0.47	<0.39	<0.10	<0.08
Maximum	0.24	18.70	10.19	7.80	0.87	1.51	1.82	0.25	0.20
Minumum	0.01	0.06	1.80	<0.05	0.17	0.20	<0.05	<0.05	<0.05
No. of Values	7	31	50	47	38	40	47	47	43
% of Samples Above 1.0 mg/l	0	71	100	74.5	0	2.5	12.8	0	0
% of Samples Above 11.0 mg/l	0	6.4	0	0	0	0	0	0	0

of the Ambient Water Quality Monitoring Network (AWQMN) sampling program. These data are published in the annual U.S. Geological Survey Water Resource Data Reports for Illinois. The Lake Springfield boron data are collected annually by CWLP as part of the city water supply intake monitoring program. The boron data for the CWLP 003 and 004 outfalls (Figure 2.1) and Springfield Metropolitan Sanitary District (SMSD) Sugar Creek sewage treatment plant (STP) outfall 008 and the SMSD Spring Creek STP outfall 007 are collected as part of their required NPDES permit monitoring (see Table 3.2). No boron data are available for the CWLP 006 outfall which discharges into Lake Springfield.

The South Fork monitoring station (EO-01) at the Illinois Route 29 bridge and the Sangamon River station (E16) at Roby, Illinois serve as upstream control locations to assess any influence on boron levels in these streams from the stations shown in Table 4.1. These upstream stations had average boron levels of 0.08 mg/L and 0.10 mg/L, respectively, and have never exceeded the General Water Use standard of 1.0 mg/L for boron during the period of record shown. The maximum boron level for the Sangamon River at Roby was 0.25 mg/L.

The CWLP outfalls show the highest levels of boron for all locations shown. This is not unexpected because coal and coal ash are well known sources of naturally-occurring boron. For the period shown, outfall 003 averaged 4.51 mg/L for boron. Outfall 003 had a minimum recorded boron level of 0.06 mg/L and a maximum boron value of 18.70 mg/L in September 1989. Outfall 004 boron levels ranged from 1.80 mg/L to 10.19 mg/L and averaged 6.12 mg/L. The maximum values for 004 occurred in September of 1988, during an extended drought.

The only AWQMN sampling station on Sugar Creek downstream of Spaulding Dam is EOA-01 at the Illinois Route 29 bridge. This station is about 3.4 stream miles downstream from outfall 004. For the sampling period shown, boron levels ranged from <0.05 mg/L to 7.80 mg/L. The maximum occurred in August during the 1988 summer drought. Station EOA-01 averaged <3.38 mg/L for the reporting period. The average and maximum boron values for EOA-01 are significantly higher than for the upstream South Fork and Sangamon River control stations. The boron levels for the upstream Lake Springfield (average <0.07 mg/L) could not be contributing to the Sugar Creek boron levels observed at EOA-01.

The Sangamon River station E26 at Riverton is downstream of all AWQMN stations shown in Table 4.1. During the sampling period shown, the boron levels at E26 ranged from <0.05 mg/L to 1.82 mg/L. The maximum level occurred in August during the 1988 summer drought. The average boron level of <0.39 mg/L at E26 is 3.9 times higher than the average boron value for the upstream Sangamon station E16 at Roby. These two stations were sampled in the same months during the same time span. Outfall 008 from the SMSD sewage treatment plant averages 0.47 mg/L boron in its discharge to Sugar Creek. This outfall would contribute only to a minor extent to the boron levels seen at Riverton.

Table 4.1 shows the percentage of samples from each monitoring station that had boron levels above the General Water Use standard of 1.0 mg/L. The upstream stations E16 and EO-01 had no samples with boron levels above 1.0 mg/L. Boron levels for the Lake Springfield samples were never above 1.0 mg/L. Only 2.5 percent of the SMSD sewage treatment plant outfall 008 discharges into Sugar Creek exceeded 1.0 mg/L boron, whereas 74.5 percent of the Sugar Creek samples from station EOA-01 were above the 1.0 mg/L boron standard.

The boron levels at EOA-01 on Sugar Creek are clearly influenced by CWLP outfall discharges 003 and 004 into Sugar Creek. These outfall discharges appear to be the primary sources of boron flowing from Sugar Creek into the Sangamon River and subsequently influencing the boron levels observed at the Riverton station E26.

When comparing the maximum boron levels from the locations shown in Table 4.1 to the proposed boron stream standard of 11.0 mg/L for the upper reach of Sugar Creek, only the CWLP outfall 003 had samples above 11.0 mg/L. Outfall 003 had two samples (6.4 percent) with boron above 11.0 mg/L, with no other occurrences since September 1989. Except for very infrequent events such as these, outfall discharges 003 and 004 would normally be in compliance with adjusted boron stream standards of 11.0 mg/L for the upper reach of Sugar Creek, 5.5 mg/L for the lower reach of Sugar Creek, and 2.0 mg/L for the reach of the Sangamon River in question.

4.3.2 Predicted Low-Flow Boron Levels

A mass balance of boron concentrations was calculated for several locations in Sugar Creek and the Sangamon River. The purpose of the calculations was to provide boron values that might be expected during critical low stream flow conditions (7Q10). The 7Q10 flow is the lowest mean stream discharge for seven consecutive days at the ten-year recurrence interval.

The equation used in all of these calculations is:

$$Cds = \frac{Qus\ (Cus) + Qeff\ (Ceff)}{Qus + Qeff}$$

where:

Cds =	the boron concentration in mg/L downstream of the confluence of the effluent and the receiving stream.
Qus =	the water flow in cubic ft/sec. (cfs) upstream of the effluent discharge point.
Cus =	the boron concentration upstream of the effluent discharge point in mg/L.
Qeff =	the flow in cfs of the effluent discharge.
Ceff =	the boron concentration (mg/L) of the effluent.

The following assumptions were made in determining whether the boron concentration in Sugar Creek and the Sangamon River would fall below the 1.0 mg/L General Use standard.

- The average of the maximum flows for outfalls 003 and 004 for 1988 were used. This year was used due to the hot weather, which increased electricity consumption and water flow from the plant.

- The design flow of the outfall for St. Francis Convent was used (Table 3.2).

- For the Springfield and Riverton wastewater treatment plants, the average flows of the lowest three consecutive months within the last two years were used.

- The "effluent" was any stream or flow entering another stream or flow. For example, the confluence of the South Fork, Sangamon River and Sugar Creek was assumed to occur at a single point, necessitating expansion of the equation to include three flows. The results are the same as if Sugar Creek and the South Fork were first combined and then the Sangamon River was included.

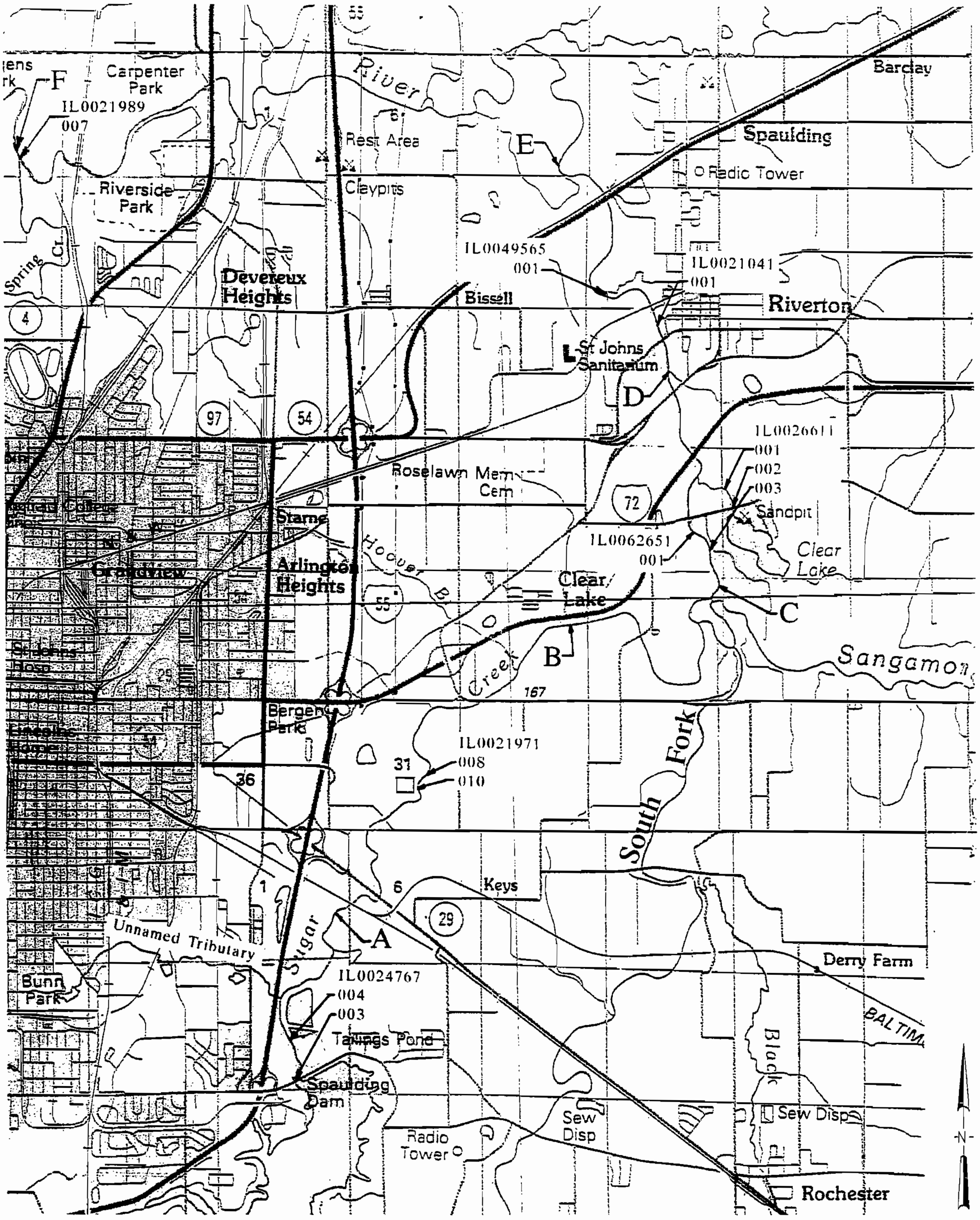
- Since the 7Q10 flow of Sugar Creek is 0.0 cfs, the flows from outfalls 003 and 004 were used as the only source of water in Sugar Creek. Under actual conditions other than 7Q10, flow may also be derived from Lake Springfield. This assumption is more conservative since it does not allow dilution of the boron concentrations in Sugar Creek from flow from Lake Springfield.

- The average boron concentrations were used for all "effluents" other than outfalls 003 and 004.

Figure 4.1 shows NPDES effluent points and the locations for which predicted boron concentrations were calculated. Table 4.2 gives the flow values and boron concentrations used in the calculations. The following predicted values present the most realistic worst-case scenario for boron concentrations in Sugar Creek and the Sangamon River.

Location (See Figure 4.1)	Boron Concentration (mg/L)	Flow (cfs)
A	10.46	8.15
B	5.06	17.75
C	1.53	61.45
D	1.53	61.66
E	1.52	61.91
F	1.22	83.41

The calculations suggest that with present effluent flows and boron concentrations, boron levels in Sugar Creek and the Sangamon River as far downstream as location F would not be expected to fall below the 1.0 mg/L General Use standard during 7Q10 flows. Even though the Sangamon River may show boron levels below 1.0 mg/L during periods of "average" flow



LOCATIONS FOR CALCULATED BORON VALUES

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STANDARDS FOR SUGAR CREEK
AND THE SANGAMON RIVER

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Figure 4.1

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TABLE 4.2

BORON CONCENTRATIONS AND FLOW RATES

	Location							
	003	004	007	008	South Fork (EO-01)	Sangamon River (E16)	St. Francis Convent	Riverton MSD
Q	0.26	7.89	21.5	9.6	1.1	42.6	0.21	0.25
C	18.70	10.19	0.34	0.47	0.08	0.1	0.40	0.40

Q = Flow value in cubic ft per second (cfs)

C = Boron concentration in mg/L

volume due to dilution factors, Sugar Creek would still be expected to have boron concentrations above 1.0 mg/L. Although the calculation for location F, downstream of the outfall 007 of SMSD's Spring Creek station, predicts a worst-case boron concentration of 1.22 mg/L, no excursions above the 1.0 mg/L General Use standard have been recorded at the downstream Petersburg sampling station. Overland flow and the contribution of small, intermittent, streams between 007 and the Petersburg sampling point probably dilute the boron concentration below the 1.0 mg/L standard.

Sampling at station E26 in the Sangamon River shows that excursions above the 1.0 mg/L standard do occur. However, most of the excursions occurred in 1988, when CWLP was operating at higher than normal levels. The calculated values are very similar to the actual sample values. At location D, the calculated boron value was 1.53 mg/L and the maximum boron sample concentration was 1.82 mg/L at E26 in August 1988.

As shown in Table 4.1, the percentage of samples with boron above 11.0 mg/L for outfalls 003 and 004 was 6.4 and 0.0, respectively. The frequency of occurrence for location A to reach the calculated maximum boron level of 10.46 mg/L would be very low. The maximum boron levels of 18.70 mg/L for outfall 003 and 10.19 mg/L for outfall 004 were used in the calculations. Only the 18.70 mg/L sample and one other boron sample (16.86 mg/L) for outfall 003 were at such an elevated level. No values for 004 were above 11.0 mg/L. All other values for 003 and 004 were below 9.7 mg/L, which would yield a calculated boron value below 10.0 mg/L at location A. Adding to the low chances of occurrence of boron above 11.0 mg/L at location A is the low probability of outfalls 003 and 004 simultaneously discharging their historic maximum boron levels.

In light of these calculations, CWLP could normally comply with adjusted standards for boron of: 11.0 mg/L from outfall 003 to SMSD's Sugar Creek station outfall 008; an adjusted standard of 5.5 mg/L from outfall 008 to the confluence of Sugar Creek with the South Fork and the Sangamon River; and an adjusted standard of 2.0 mg/L from this confluence to 100 yds below the confluence of Spring Creek with the Sangamon River, north of Springfield.

5.0 ENVIRONMENTAL EFFECTS OF BORON

5.1 Environmental Effects of Present and Past Boron Levels

As discussed earlier, the impairments observed in overall stream quality at sampling stations E16, E26, EO-01, and EOA-01 are not attributable to documented concentrations of boron within the stream reaches in question. Table 3.16 lists several known causes and sources for these impairments to stream quality. These elements include: siltation from agriculture; organic enrichment from agriculture and municipal sewage treatment plants; and habitat degradation and siltation from stream channelization. In addition to these impairment factors, an additional cause of stream quality limitation for Sugar Creek is the disruption to the aquatic habitat from flow regulation by Spaulding Dam.

The presence of Spaulding Dam on Sugar Creek results in a 7Q10 low flow of 0.0 cfs for Sugar Creek when no water is allowed over the dam. During moderate drought periods when Sugar Creek has no flow, the CWLP outfall 003 and 004 discharges (average design flow up to 7.94 MGD) may be an advantage to the aquatic ecosystem by providing larger and deeper pools in the creek channel than would exist without the discharges.

As discussed in Section 4.3.1, the predominant sources of boron in the stream sections being considered in this report are the CWLP outfalls 003 and 004. This is evident from the data presented in Table 4.1. However, there are no observable detrimental effects upon the receiving waters from these boron concentrations based on the data presented in this report.

The Water Quality Index values from Table 3.16 place the upstream station on the Sangamon River at Roby (E16) in the same poor stream quality rating category (partial support of designated stream use with moderate impairment) as the downstream station (E26) at Riverton, which receives the boron discharges from Sugar Creek. The Sugar Creek station EOA-01, just downstream of the CWLP discharges, was given the highest stream quality category rating of excellent with full support of the designated stream use of aquatic life support.

Table 3.16 gives a higher quality Macroinvertebrate Biotic Index (MBI) rating of very good for the downstream station (E26) at Riverton than for the upstream station (E16) at Roby, which was only rated fair. Table 3.4 gives an MBI category rating of very good to excellent for the first three years listed for the Sugar Creek station EOA-01. The MBI values were better for EOA-01 than for the other two stations (C-1 and C-2) for all four years of available data, except for 1985 when all stations were rated excellent, even though EOA-01 was closer to the CWLP outfalls. The other two stations (C-1 and C-2) were downstream from EOA-01 and from the SMSD sewage treatment plant's outfall 008. The IEPA studies (Appendix A) concluded that the sewage treatment plant discharges were having a slight to moderate influence on the downstream reaches of Sugar Creek. This may account for the higher quality MBI value for the upstream station EOA-01.

As seen in Table 3.7, the Index of Biotic Integrity (IBI and AIBI) values for all four stations listed are in the second lowest rating category. As shown in Table 3.9, this category has a stream quality description of "poor," a Biological Stream Characterization description of "limited aquatic resource," and a USEPA rating as being "partially supportive of the designated stream use of support of aquatic life, with moderate impairment." Table 3.6 shows the fish species collected during the 1987-88 fish survey done for CWLP. The location of each collection area is shown in Figure 3.6 of this report and in Exhibit 23B of that study (Appendix B). Locations 2 and 5 of that study are both on the Sangamon downstream of the confluence of Sugar Creek and the South Fork. Sampling of these two locations produced a higher number of fish species than any of the other locations. Location 2, with the highest number of species, was immediately downstream from the mouth of the South Fork and would have a higher exposure to Sugar Creek pollutants discussed in Section 3.2.2, including boron, than location 5 near Riverton. The South Fork (location 3) had the lowest number of fish species and also had the lowest boron levels of all stream stations listed in Table 4.1.

The overall stream quality of the various sampling locations discussed above do not show any pattern of degradation attributable to boron concentrations. No pattern of detrimental impacts from observed boron levels in the South Fork, Sangamon River, or Sugar Creek should be expected. This conclusion is supported by the evidence presented in the discussion on boron toxicity in Section 4.2.3 and boron stream concentrations in Section 4.3.1.

A direct investigation of potential toxicity of the CWLP discharges was conducted by the IEPA in August 1988. A bioassay was performed with effluent water samples on the invertebrate *Ceriodaphnia dubia* and on fathead minnows. No significant acute toxicity was observed for either species (See Appendix D). Chronic toxicity results were not reported due to poor control survival.

5.2 Predicted Effects of Achieving the General Use Water Quality Standard

No beneficial biological impacts are expected if the existing General Use water quality stream standard for boron (1.0 mg/L) is achieved. Significant differences due to boron concentrations in various stream quality index values and in biological communities between the downstream and upstream IEPA and AWQMN sampling stations discussed in this report have not been documented in surveys conducted by state agencies and CWLP. This suggests that the past 25 years of discharges from the CWLP power station have not had a negative impact on aquatic life in Sugar Creek or the Sangamon River.

There may be a negative impact if flows from the outfalls are reduced to achieve the existing General Use boron water quality stream standard. Reduction could occur if fly ash from the station were dry handled for disposal or if advanced physicochemical effluent treatment systems, such as reverse osmosis and mechanical evaporation were employed. The outfall discharges augment the flow in Sugar Creek, providing increased volume and flow for sustaining a more diverse fishery and biological community.

There are presently no known irrigation or potable water uses of Sugar Creek or the Sangamon River in the stream reaches studied. No future uses of Sugar Creek are anticipated that would benefit from achieving the General Use water quality stream standard for boron. There are no known future plans to use Sugar Creek as a potable water supply or for any other withdrawal purpose such as irrigation. No impacts to any known current activities due to the water quality of Sugar Creek have occurred; therefore, none would be anticipated from alignment of the regulatory standard with the present concentrations as proposed.

5.3 Predicted Effects of the Proposed Adjusted Water Quality Standards

The assessment of the stream ecosystems presented in this document indicate that the boron concentrations in the CWLP outfall discharges have had no adverse effect on the aquatic communities being exposed to these boron levels. Impacts to resident biota are not anticipated from the proposed adjusted water quality stream standards for boron because the discharged boron concentrations will not change from the present concentrations.

The designated stream use of support of aquatic life of Sugar Creek is enhanced by the additional flow velocity and discharge augmentation of creek flow by water discharged from the CWLP power station during low flow months. The existing discharges especially augment movement of species whose passage may be blocked in low flow periods and sustain deeper water pools to accommodate pool species.

The proposed adjusted water quality stream standards for boron are not expected to have any adverse impact on any known anticipated future uses of Sugar Creek or the Sangamon River. There is currently a potential for withdrawal of water from the Sangamon River on the north side of Springfield for irrigation of the Rail Golf Course (Section 3.2.1). As discussed in Section 4.2.3, research has shown that the turfgrass species normally planted on golf courses in this area have exhibited high tolerance to boron levels of more than 4.8 mg/L in irrigation waters. Boron toxicity problems are not anticipated in the event that irrigation is used for the golf course turfgrasses because the proposed adjusted boron stream standard is 2.0 mg/L for this reach of the Sangamon River. The proposed adjusted standard of 2.0 mg/L was based on a worst-case calculated maximum boron level of <1.52 mg/L (Section 4.3.2). No adverse impacts to any known current activities based on the water quality of Sugar Creek or the Sangamon River have occurred; therefore, none would be anticipated from alignment of the regulatory standard with the actual current boron concentrations.

6.0 EVALUATION OF ALTERNATIVES FOR COMPLYING WITH NPDES PERMIT BORON LIMIT

The NPDES Permit IL0024767 for the CWLP power station, reissued on November 14, 1991, contains a boron effluent limitation of 1.0 mg/L, which is to become effective on December 14, 1994. The average boron concentrations of the discharge from the CWLP outfalls 003 and 004 for the period of January 1987 through October 1992 are 4.51 mg/L and 6.12 mg/L, respectively, which are higher than the reissued permit limitation.

As required in the process of petitioning for an adjusted stream standard, several compliance alternatives were considered. Two treatment alternatives were evaluated for boron removal to meet the effluent discharge limitation. Two alternative operating procedures were also evaluated; conversion of the fly ash handling system to a dry method, and the use of a low boron coal.

The two treatment systems were based on treating 5,200 gpm of water from the ash pond outfall No. 004, which is 95 percent of the total discharge volume for both 004 and 003 combined (see NPDES permit, Appendix C).

6.1 Selective Ion Exchange

The selective ion exchange process employs a commercially available ion exchange resin. Rohm & Haas Company manufactures an ion exchange resin that can be used for removing boron (Rhom and Haas Bulletin IE-153a, October 1989, Amberlite IRA-743). The manufacturer claims a 90 percent boron removal rate for the resin. The selective ion exchange system would consist of ion exchange vessels, sulfuric or hydrochloric acid storage tanks (for resin regeneration) and chemical feed equipment (Figure 6.1). Physical space limitations at the 003 and 004 discharge points may make the installation and operation of the equipment impractical.

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DIAGRAM OF SELECTIVE ION EXCHANGE

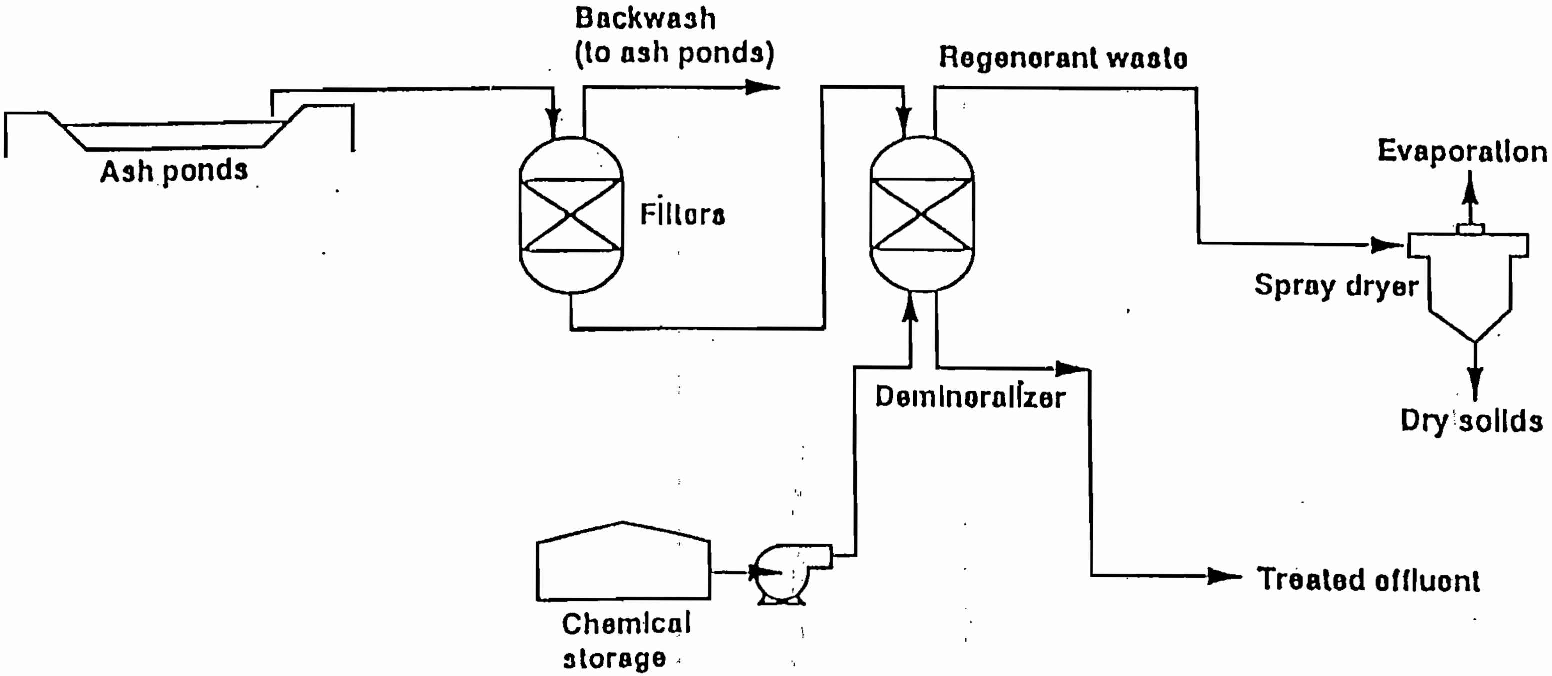

DIAGRAM OF SELECTIVE ION EXCHANGE

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Figure 6.1

Filters located upstream of the ion exchange vessels are used to remove suspended solids present in the ash pond discharge. When the resin is regenerated, wastewater is produced with a very high boron content. Cost estimates for this alternative include an evaporator or spray dryer for concentrating this wastewater or producing a dry waste product to facilitate disposal. However, additional costs would be incurred for landfilling or other proper disposal of the waste product.

6.2 Reverse Osmosis/Mechanical Evaporators

Reverse osmosis (RO) is a process where moderate pressures (e.g., 200 psi) are used to force water through semi-permeable membranes, which are relatively impervious to passage of various ions (Figure 6.2). The wastewater that does not pass through the membranes is known as RO reject and is typically 20-30 percent of the influent flow rate. A mechanical evaporator and spray dryer would be used to concentrate the RO reject and evaporate the resulting wastewater to dryness. The resulting dry product would then require landfilling or other suitable disposal at additional cost. The RO system also requires pretreatment with media filters, cartridge filters, and a scale inhibitor to minimize fouling of the membranes. Reverse osmosis will typically remove 60 to 98 percent of the influent boron over a pH range of 5.0 to 9.0. As with the selective ion exchange process, the physical space limitations at the 003 and 004 discharge points may make the installation and operation of the necessary equipment for this alternative impractical.

6.3 Dry Fly Ash Conversion

The alternative for dry removal of fly ash assumes that the contribution of boron in the ash pond discharge from bottom ash is not significant. Particle size and leaching characteristics of bottom ash tend to reduce the relative concentration of boron in bottom ash sluice water (Pagenkopf and Connolly, 1982; Sargent & Lundy, 1992). In this type of removal system, the dry fly ash is carried pneumatically to a storage silo. The dry fly ash has a small amount of moisture added as it is discharged from the silo into trucks to improve handling characteristics. It is then transported to a landfill.

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DIAGRAM OF REVERSE OSMOSIS/MECHANICAL EVAPORATORS

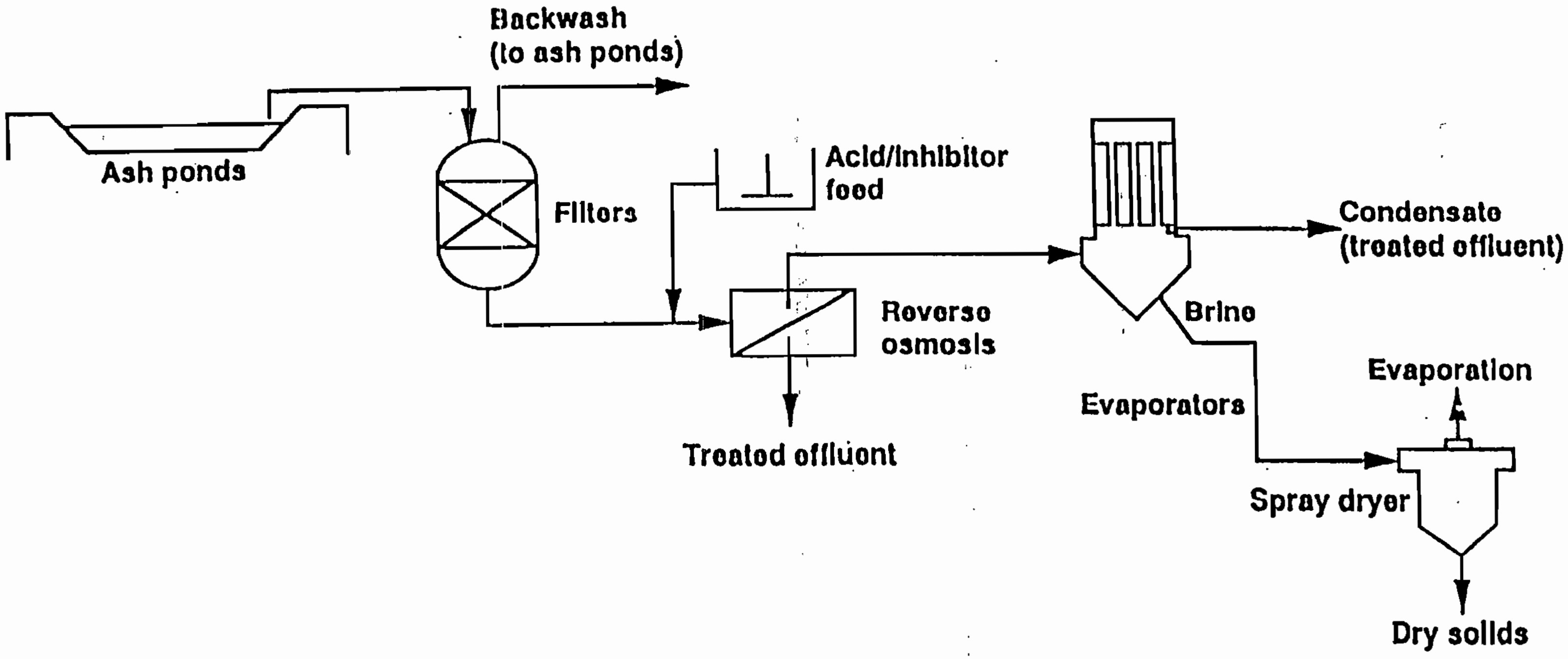

DIAGRAM OF REVERSE OSMOSIS/MECHANICAL EVAPORATORS

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STANDARDS FOR SUGAR CREEK
AND THE SANGAMON RIVER

Job No. 92S5034A

Figure 6.2

The cost estimate for this alternative included the assumed need for construction of three separate landfill cells by CWLP at 10 year intervals over the anticipated 30 year plant life span.

6.4 Alternative Coal

The use of an alternate coal with a boron content low enough to meet discharge standards may be possible. The estimate for low boron coal for this alternative is based on fuel studies conducted by Illinois Power in 1990 (Sargent & Lundy, 1992) on a central Appalachian source of low boron coal. Total operating costs are based on an annual consumption of 900,000 tons of coal per year. Calculations were made based on a low boron coal price of $28.50 per ton and a current high boron coal price of $23.49 per ton.

Western coal is a readily available source of alternative coal. Western coal is inherently lower in boron content than midwestern coal and produces fly ash significantly lower in boron (Dunham, 1992). However, western coal typically has a lower BTU value, which necessitates the use of larger volumes of coal to produce equivalent generating capacity as compared with typical midwestern coal. If additional coal use to offset reduction in generating capacity is not possible, then the purchase of replacement capacity would be required. Western coal typically produces more dust than the midwestern coal now being used which would require installation of additional dust suppression equipment.

The cost figures used in the estimate shown in Table 6.1 for CWLP to use an alternative low boron coal (e.g. western) were calculated only from a per ton purchase price based on current annual tonnage. Very significant additional costs would be involved for the capital investment required for boiler modifications to facilitate use of a coal with different ash and BTU characteristics from the present midwestern coal being used, for which the boilers were designed. Significant capital costs would also be incurred for the additional dust suppression equipment required for use with low boron coal.

TABLE 6.1

ADJUSTED STANDARD ALTERNATIVES ECONOMIC ANALYSIS

Alternative	Capital Cost	Annual Operating Cost	Present Value
1. Selective Ion Exchange	$11,900,000	$380,000	$19,750,000(1)
2. Reverse Osmosis/Mechanical Evaporators	$49,900,000	$2,410,000	$99,800,000(1)
3. Dry Fly Ash Conversion	$11,905,000	$450,000	$20,175,000
4. Alternate Coal	N/A	$4,509,000	$93,200,000(2)

(1) = Cost does not include additional costs for landfilling or other proper disposal of waste product.

(2) = Cost does not include additional costs for hauling, dust suppression, and boiler modification.

Additional purchasing and transportation costs would be incurred if additional coal volumes were needed to offset the lower generating capacity from use of a coal with lower BTU value. CWLP must rely on truck transportation for coal delivery due to the absence of more efficient and less costly railroad spurs to their power station.

Significant cost could also be incurred, additional to the alternative coal cost shown in Table 6.1, if purchase of replacement generating capacity is required.

6.5 Economics of Alternatives

The capital and annual operating costs for the four alternatives and their present minimum worth are listed in Table 6.1. Annual operating costs are escalated at a rate of 7 percent per year. This rate includes escalation for expected load growth for the utility. A power plant life of 30 years is used for economic analysis. The present worth of annual operating expenses is calculated using a cost of capital of 10 percent. All costs are in 1993 dollars.

The present minimum worth values for these alternatives range from $19,750,000 to $99,800,000. The least expensive alternative appears to be selective ion exchange at a present minimum worth of $19,750,000. However, due to the variations in expected performance of each alternative and the uncertainties associated with implementation of each alternative, there can be no assurance that compliance will be achieved with any alternative method.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The General Use stream standard for boron of 1.0 mg/L was established by the Illinois Pollution Control Board (IPCB) for the protection of aquatic life. This standard was based, in part, on known boron toxicity to sensitive irrigated crops, such as citrus. The reissued NPDES permit for the CWLP power station requires outfall discharges to meet the General Use standard limit for boron by December 14, 1994. The boron concentrations in the discharges from outfalls 003 and 004 from January 1987 through October 1992 averaged 4.51 mg/L and 6.12 mg/L, respectively, which exceeds the General Use boron standard. Based on a number of boron toxicity studies, these discharged boron levels are well below concentrations shown to cause detrimental effects to the types of organisms tested.

Studies of fish and macroinvertebrates within the Sugar Creek and associated South Fork and Sangamon River ecosystems showed no correlation between the quality of the populations and boron concentrations. The IEPA, in their biennial Illinois Water Quality Reports, attributed observed impairments in biological condition and stream quality of Sugar Creek and the Sangamon River to factors such as siltation, channelization, sewer effluents, and flow modification from Spaulding Dam.

Four alternatives for complying with the NPDES permit boron limit were evaluated. It was found that no physically practical or economically reasonable alternative is available to CWLP to comply with the permit limitation (and General Use water quality stream standard) for boron. The least expensive alternative for reducing boron discharge concentrations will require an investment of at least $19,750,000, with additional costs for waste product disposal, without assurance that compliance will be achieved. In contrast, minimal costs are associated with CWLP's present approach of seeking adjusted stream standards, and no adverse environmental or health impacts are anticipated.

The proposed adjusted water quality stream standards for boron are: 11.0 mg/L from the CWLP outfall 003 in Sugar Creek, near Spaulding Dam, to the SMSD Sugar Creek STP outfall 008; 5.5 mg/L from outfall 008 to the confluence of Sugar Creek with the South Fork and the

Sangamon River; and 2.0 mg/L for the Sangamon River from this confluence to 100 yds downstream of the confluence of Spring Creek with the Sangamon River, which is where the effluent from the SMSD Spring Creek STP outfall 007 is received. In light of the discussions put forth in this report, it is recommended that the proposed adjusted water quality stream standards for boron be adopted by the IPCB for Sugar Creek and the described reach of the Sangamon River. Regulatory support for this recommendation has been stated by the IEPA.

The recommended alternative boron water quality stream standards are justified because the current bases for the General Use standard (agricultural irrigation, stock watering, and drinking water) are not relevant to Sugar Creek or the Sangamon River and, as previously discussed, are unnecessarily stringent for the protection of aquatic life. No significant effects are expected from the proposed adjusted water quality stream standards because they will only reflect the current water quality of Sugar Creek, the Sangamon River, and the concentrations of boron in the outfall discharges from the CWLP power station. The adjusted water quality stream standards would allow the station to continue to discharge outfall effluents as it has since the 1960s. Historical data indicate not only that relatively diverse aquatic communities have existed in the presence of, but may also be dependent upon, discharges from the CWLP power station outfalls during low flow conditions. Thus, the outfall discharges will help provide for the maintenance of existing aquatic life and diversity.

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APPENDIX A

IEPA AQUATIC MACROINVERTEBRATE STUDIES OF SUGAR CREEK

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY MEMORANDU

File D-Sugar Creek comp

DATE: April 5, 1985

TO: Jim Park

md WHE

FROM: Matt Short and Bill Ettinger

SUBJECT: Stream Assessment Survey; Springfield Sugar Creek Sewage Treatment Plant; Sugar Creek (EOA)

DRAFT

TO Springfield office

Disapproved per 8/22/85 MZD Mtg

Introduction

The Springfield Sugar Creek sewage treatment plant is operated by the Springfield Sanitary District and is one of two treatment facilities serving the greater Springfield area. The Sugar Creek STP is located on the east edge of the city (pop. 100,100) near the intersection of Interstates 55 and 72 and discharges into Sugar Creek, a fifth order stream in the Sangamon River basin (Figure 1). The present treatment facility was constructed in the mid 1970's and consists of contact stabilization activated sludge, a polishing pond, excess flow treatment and chlorination. Design average flow for the facility is 10.0 mgd and design maximum flow is 25.0 mgd. According to IEPA records for 1984 the actual average monthly flow was 12.85 mgd. The Sugar Creek plant is served by combined sanitary and storm sewers and has two combined sewer overflows in the system. The first is called the Harvard Park CSO and is located in the southeast corner of Springfield near the Bunn Park Golf Course. It discharges to an unnamed tributary of Sugar Creek upstream from the Ill. Rt. 29 bridge. The second CSO is located at the head end of the Sugar Creek plant and discharges directly to Sugar Creek when storm flows exceed 100 mgd.

Two previous biological surveys on Sugar Creek in 1977 and 1981 indicated moderately impacted stream conditions downstream from the STP. The present survey, however, indicated slight improvements at Station A-1 and significant improvements at Stations C-1 and C-2. The improvement at the downstream stations was probably due to a process change begun at the Sugar Creek plant in 1983.

Survey Results and Discussion

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On September 11, 1984, biological and water quality samples were collected at five stations on Sugar Creek and its tributaries to determine the condition of stream environments upstream and downstream from the Springfield Sugar Creek sewage treatment plant. The macroinvertebrate biotic index (MBI) ranged from a high of 4.9 at Stations A-1 and C-1 to a low of 4.2 at Station C-2 indicating that the Springfield Sugar Creek plant was having little or no impact on Sugar Creek. Analysis of water quality data, which included ammonia, un-ionized ammonia, phosphorus, COD, nitrate-nitrite, water temperature and pH, indicated no violations of state water quality standards (Table 1).

DRAFT

Table 1. IEPA Stream Data for Sugar Creek
in the vicinity of Springfield, Illinois.
September 11, 1984

Site	River Mile	US/DS	MBI	Amm. mg/l	Un-ion Amm. mg/l	P mg/l	COD mg/l	NO_2+ NO_3 mg/l	Temp. °C	pH	Mean Depth ft.	Mean Width ft.	Velo-city ft/sec	CF
A-1	1.2	US	4.9	0.31	0.006	0.20	26	1.0	22.0	7.6	2.5	60	0.1	15
EFF-1	0.1	US	-	0.96	0.096	0.96	71	0.20	24.0	8.3	-	-	-	-
EFF-2	0	-	-	1.6	0.011	3.1	21	5.9	23.5	7.1	-	-	-	-
C-1	1.0	DS	4.9	0.89	0.017	1.3	28	2.9	22.5	7.6	2	33	0.7	46
C-2	2.7	DS	4.2	0.76	0.015	1.2	29	2.7	22.5	7.6	2.5	40	0.2	20
D-1	-	-	7.3	0.12	0.002	0.26	33	0.26	22.0	7.5	0.2	12	1.0	2
D-2	-	-	7.5	0.23	0.004	0.20	13	1.2	21.0	7.6	0.3	8	<0.1	0.

Because of Spaulding Dam on Lake Springfield, Sugar Creek has a 7-day 10-year low flow of zero. This periodic lack of dilution water has caused a chronic problem with ammonia for the Sugar Creek STP. In 1983, however, changes in solids monitoring and wasting at the facility appear to have increased the ammonia removal based on data obtained through December 1985. This reduction in ammonia could explain the improvement in stream conditions downstream from the discharge.

DRAFT

Effluent grab samples were collected from two different discharge points during the present survey (Figure 1). Effluent #1 was collected at the concrete outfall structure of the excess flow treatment pond. According to the Springfield Regional Office staff, the discharge from this pond is not continuous. Effluent #2 was collected from the effluent ditch just before it enters Sugar Creek. At this point, the ditch is no longer concrete but has a sand and clay bottom as well as clay banks. The flow in this ditch comes from the primary discharge of the Sugar Creek treatment facility.

In addition to the sampling sites on Sugar Creek, samples were also collected on two of its tributaries. Station D-1 was located on Hoover Branch, a small tributary that receives urban runoff from the Grandview area and some agricultural runoff east of I-55. Prior to 1977, a lift station in the Grandview area had also been identified as a potential discharger to Hoover Branch. During the present survey, biological sampling indicated the presence of moderate organic enrichment but the source of this enrichment was impossible to identify. The impact of Hoover Branch on Sugar Creek was probably negligible. Station D-2 was located on a small unnamed tributary that originates near the Bergen Park Golf Course, flows under I-55 and through the Sugar Creek STP property. It eventually becomes part of the discharge channel to Sugar Creek. This tributary receives urban runoff as well as the discharge from a storm sewer near Bergen Park. Biological sampling during the present survey indicated moderate organic enrichment which probably is contributed by urban runoff. The impact of this unnamed tributary on Sugar Creek was also probably negligible.

The stream potential of Sugar Creek has been provisionally characterized by IEPA biologists as a moderate aquatic resource (i.e., a stream capable of supporting an abundant and normally diverse macroinvertebrate and fish communities) while Hoover Branch and the unnamed tributary to Sugar Creek has been provisionally characterized as limited aquatic resources (i.e., a stream capable of supporting a macroinvertebrate and fish community of limited diversity).

Recommendations

1. Although stream conditions in 1984 were much improved over previous years, there is still not enough stream water quality data to indicate conclusively whether or not the chronic problem of ammonia has been eliminated. Therefore, additional in-stream water quality sampling should be conducted, particularly during low flow conditions, before a decision to add nitrification to the Springfield Sugar Creek sewage treatment plant is made.

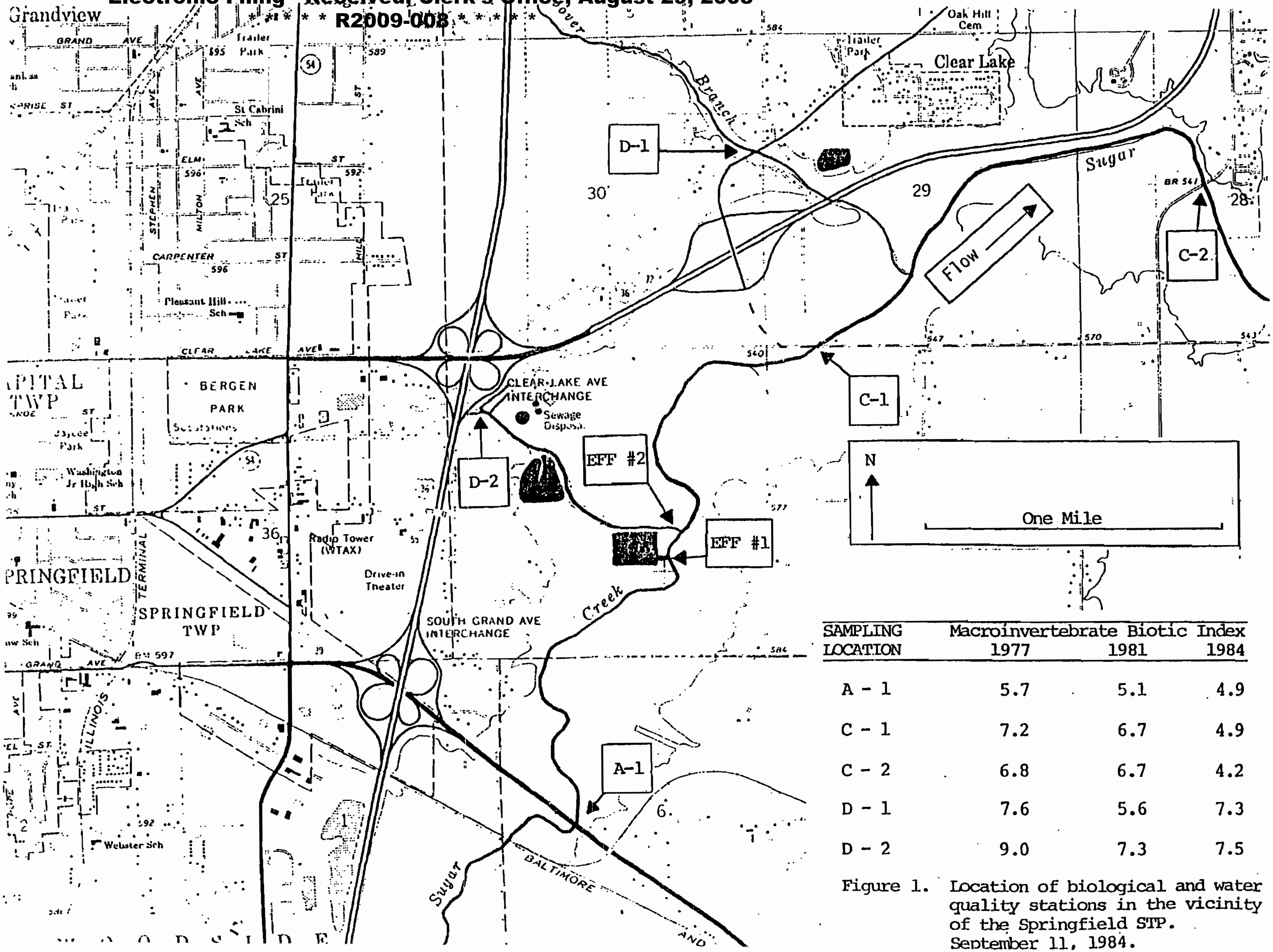
DRAFT

Recommendations, continued

2. Station C-1, located approximately one mile downstream from the Sugar Creek sewage treatment plant on the Mechanicsburg Road, is recommended as a provisional location to monitor any changes in water quality in Sugar Creek.

WHE:jg

cc: Bud Bridgewater - Region V - Springfield



SAMPLING LOCATION	Macroinvertebrate Biotic Index 1977	1981	1984
A - 1	5.7	5.1	4.9
C - 1	7.2	6.7	4.9
C - 2	6.8	6.7	4.2
D - 1	7.6	5.6	7.3
D - 2	9.0	7.3	7.5

Figure 1. Location of biological and water quality stations in the vicinity of the Springfield STP. September 11, 1984.

FACILITY RELATED STREAM SURVEY

Biological and Water Quality Survey of Sugar Creek (EOA), U.S. EPA Reach Index 07130007-002/on In the Vicinity of the Springfield Sanitary District Sugar Creek Wastewater Treatment Plant, Sangamon County, Illinois

July, 1989

Staff Report
Prepared by Matthew Short

State of Illinois
Illinois Environmental Protection Agency
Division of Water Pollution Control
Planning Section

INTRODUCTION

On July 26, 1989, biological and water quality samples were collected at three sites on Sugar Creek, Hoover Branch and Clear Lake Avenue Creek to determine the condition of stream environments upstream and downstream from the Springfield Sanitary District Sugar Creek sewage treatment plant (STP). Additional water quality samples were collected in May and September. The Sugar Creek STP is located at the east edge of the city (pop. 100,100), near the intersection of Interstates 55 and 72, and discharges into Sugar Creek, a fifth order stream in the Sangamon River basin (Figure 1). The present treatment facility consists of activated sludge, a polishing pond, excess flow treatment and chlorination. However, a year-round disenfection exemption was granted effective December 14, 1989. Design average flow for the facility is 10.0 mgd and design maximum flow is 25.0 mgd. The average flow from January - July, 1989 was 8.04 mgd. The Sugar Creek plant is served by combined sanitary and storm sewers and has two combined sewer overflows in the system. The first is called the Harvard Park CSO and is located in the southeast corner of Springfield near the Bunn Park Golf Course. It discharges to an unnamed tributary of Sugar Creek upstream from the Ill. Rt. 29 bridge. The second CSO is located at the head end of the Sugar Creek plant and discharges directly to Sugar Creek when storm flows exceed 100 mgd.

Because of Spaulding Dam on Lake Springfield, Sugar Creek has a 7-day 10-year low flow of zero. The stream receives a discharge from the ash ponds northeast of the dam and runoff from the CWLP plant.

A previous biological survey in 1985 indicated that the Sugar Creek STP discharge was having little or no impact on Sugar Creek.

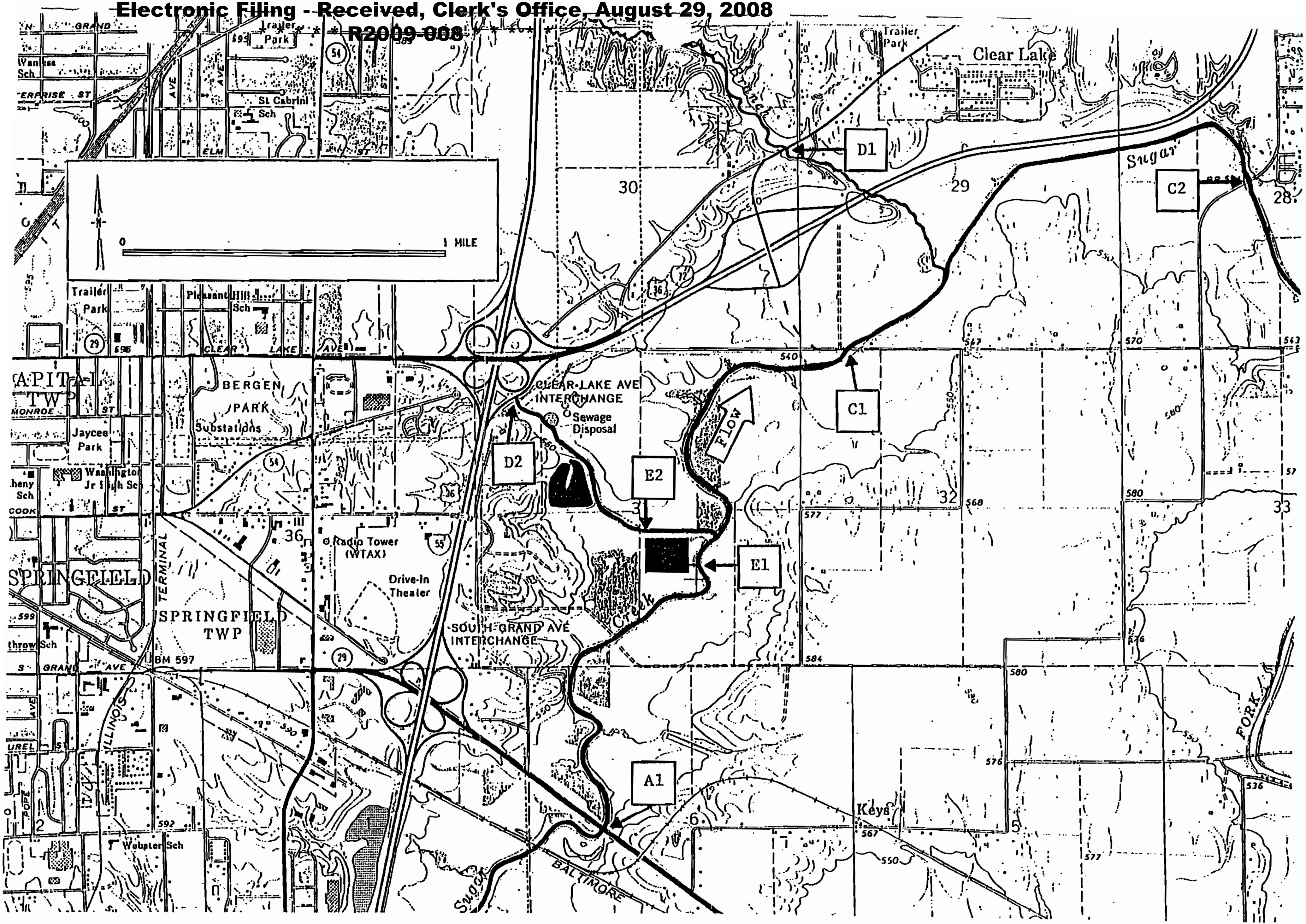


Figure 1. Location of biological and water quality stations in the vicinity of the Springfield Sugar Creek STP. 1989

METHODS

Macroinvertebrates

Qualitative macroinvertebrate samples were collected at each station with a U.S. Standard No. 30 sieve or handpicking organisms directly from all available instream habitats. A uniform or comparable sampling effort was made at each site. Identification of macroinvertebrate taxa were to field identifiable levels. A Macroinvertebrate Biotic Index (MBI) was calculated for each sample. The index reflects the degree of tolerance (on a scale of 0 to 11) of the macroinvertebrate community to oxygen demanding contaminants. Effects of these and other in-stream contaminants may be indicated by a high MBI, a low proportion of sensitive organisms, sparse aquatic life, and/or a low macroinvertebrate diversity. The MBI is an average of tolerance values for each taxon weighted by abundance and is used as a measure of stream degradation. Based on present assessment methods, MBI values reflect water quality as follows:

< 5.0	Excellent
5.0 - 6.0	Very Good
6.1 - 7.5	Good/Fair
7.6 - 10.0	Poor
> 10.0	Very Poor

Water Quality

Stream and effluent water quality samples were collected at each site using a hand held bottle or a weighted bottle sampler in accordance with IEPA/DWPC quality assurance procedures. Samples were placed on ice and shipped to the IEPA Champaign Laboratory for analysis. Water temperature, dissolved oxygen, pH and conductivity were measured in the field with a Hydrolab Model 4041. Water quality data were evaluated using state general use standards. The total dissolved solids standard, 1000 mg/l is equivalent to 1667 umhos/cm field conductivity.

Instream Habitat

Physical habitat data is used to evaluate the biotic potential (the fisheries resource that would be present in the absence of water quality limitations) of a stream segment. Habitat data and discharge were estimated at the majority of sampling sites. However at the furthest downstream station, habitat data were collected using six equally spaced transects along a 100 yard stream segment. Measurements for depth, water velocity and substrate composition were recorded at each transect. Observations were also made in pool-riffle development, instream cover, shading, riparian vegetation and adjacent land use practices. Discharge measurements were made according to U.S. Geological Survey methods. Stream hydrology and morphology as well as substrate values were calculated from the field data and used to predict the biotic potential of the study area. The predicted Index of Biotic Integrity (PIBI) ranges from 0 to 60 indicating a poor to excellent fisheries potential respectively (Appendix B).

RESULTS AND DISCUSSION

Macroinvertebrates

Station A1 was located on Sugar Creek 1.2 miles upstream from the effluent at the IL Rt. 29 bridge. This is the AWQMN Station EOA 01. The MBI was 6.5 and eight taxa were present indicating good/fair water quality (Table 1). The sample was comprised primarily of midges, Chironomidae (54%). There was no measurable flow and 1 to 3 inches of silt covered the substrate.

Station C1 was located on Sugar Creek 1.0 mile downstream from the Sugar Creek STP discharge at the Mechanicsburg Road bridge. The MBI was 9.0 and ten taxa were present indicating poor water quality (Table 1). The sample was comprised primarily of red ridges, Chironomus sp. (53.4%), which are tolerant to enrichment. This was significantly poorer than the sample collected in 1988 which had a field MBI of 5.9 with sixteen taxa present. The substrate was very soft and was comprised primarily of silt/mud 35%, plant detritus 15% and submerged logs 15% (Table 3).

Station C2 was located on Sugar Creek approximately 2.7 miles downstream from the Sugar Creek STP discharge. The MBI was 7.7 with nine taxa indicating poor water quality (Table 1). Only 48 organisms were collected at this site and the majority were midges (70.8%). As at Station C1, the substrate was very soft and was comprised primarily of silt/mud, 30% and plant detritus 30% (Table 3).

Station D1 was located on Hoover Branch, a small tributary that receives urban runoff from the Grandview area along with agricultural runoff. The MBI was 6.8 and four taxa were present indicating good/fair water quality (Table 1). The small stream size, 2.0 feet wide and lack of diversity in the sample indicate that this stream probably has intermittent flow during the summer.

Station D2 was located on Clear Lake Avenue Creek which originates near Bergen Park Golf Course, flows under the interstates and through the Sugar Creek STP property. It eventually becomes part of the discharge channel to Sugar Creek. The MBI was 7.0 and seven taxa were present indicating good/fair water quality (Table 1). Habitat is very limited since the stream has a concrete channel.

Water Quality

In May, violations in state general use water quality standards occurred for boron and iron at Stations A1, C1 and C2 on Sugar Creek. Fecal coliform counts exceeded 200/100 ml at Stations C2 on Sugar Creek, D1 on Hoover Branch and D2 on Clear Lake Avenue Creek. In July, violations occurred for boron at Stations A1, C1 and C2; iron at Stations C1 and C2; and dissolved oxygen at Stations A1, C1, C2 and D1. Fecal coliform counts exceeded 200/100 ml at Stations C1, C2, D1 and D2. In September, violations occurred for boron at Stations A1, C1 and C2; and iron at Stations A1, C1, C2 and D1. Fecal coliform counts exceeded 200/100 ml at all stations (Table 2).

Boron violations in Sugar Creek were due to elevated concentrations from the CWLP ash ponds effluent upstream from all sampling locations. Concentrations of boron in Sugar Creek are high enough to cause violations at AWQMN Station E

26 on the Sangamon River near Riverton during low flow periods. Iron violations were probably due to nonpoint background concentrations. The dissolved oxygen violations in July were probably due to a combination of several factors. Elevated water temperatures, a lack of aeration due to low flow and a high percentage of silt and plant detritus in the sediment affected dissolved oxygen levels on Sugar Creek. However, concentrations were lower downstream from the plant discharge in all three samples. Elevated fecal coliform levels were due to nonpoint sources.

Water quality parameters at Station C1 were similar to concentrations present during August-November, 1988.

Instream Habitat

Sugar Creek is a fifth order tributary to the South Fork Sangamon River. Stream width in the sample reach varied from 35 to 70 feet with a mean depth of 1.8 feet. Station C1 was the only station with measurable flow. The substrate was very soft and comprised primarily of silt/mud 26.7%, plant detritus 20%, and submerged logs 13.3%. Based on habitat, PIBI 42, Sugar Creek has the potential of a highly valued aquatic resource. A fish sample was collected on Sugar Creek in 1988 as part of a contract study for the City of Springfield. The Index of Biotic Integrity was 29.5 indicating the stream was supporting a limited aquatic resource.

SUMMARY

1. Macroinvertebrate samples indicated fair water quality upstream and poor water quality downstream from the Sugar Creek STP discharge indicating the plant was having a moderate to slight impact on 2.7 miles of Sugar Creek. Hoover Branch and Clear Lake Avenue Creek appeared to have little or no impact on Sugar Creek.

2. The Sugar Creek STP effluent, combined with poor instream conditions, resulted in violations of the dissolved oxygen standard downstream from the discharge in July. Boron violations in Sugar Creek were a result of the discharge from the CWLP ash ponds. Iron violations and elevated fecal coliform levels were primarily nonpoint related.

3. Based on habit, fish and water quality data Sugar Creek is rated as partially supporting designated aquatic life uses with moderate impairment.

4. Station C1, approximately 1.0 mile downstream from the Sugar Creek STP discharge, is recommended as a provisional site to monitor water quality changes on Sugar Creek.

MBS/is/0015w

cc: Toby Frevert, DWPC/Planning
Bud Bridgewater, DWPC/FOS - Springfield Region

Table 1. Macroinvertebrate data collected on Sugar Creek from the Springfield Sugar Creek facility related stream survey, July 26, 1989.

TAXON	TOLERANCE RATING	STATION				
		A-1	C-1	C-2	D-1	D-2
Unionidae	1.5					
Plecoptera	1.5					
Other Ephemeroptera	3.0					
Oligoneuriidae	3.0					
Calopterygidae	3.5					
Trichoptera (Non-Hydropsychidae)	3.5					
Heptageniidae	3.5					
Megaloptera	3.5					
Amphipoda	4.0					
Baetidae	4.0					
Tipulidae	4.0					
Corbicula	4.0					
Anisoptera	4.5		1	1		
Cambaridae	5.0				1	1
Ceratopogonidae	5.0					
Elmidae or Dryopidae	5.0	1	4	3		
Potamanthidae or Ephemeridae	5.0					
Sphaeriidae	5.0		2	3		
Caenidae or Tricorythidae	5.5	8	7			
Coenagrionidae	5.5	8	2			
Hydropsychidae	5.5					
Asellidae	6.0				100	46
Chironomidae (Non-Chironomus)	6.0	41	16	20	3	21
Simuliidae	6.0		9			
Turbellaria	6.0	2		1		
Other Gastropoda	6.0	3				
Planorbidae	6.5					
Helodidae	7.0					
Lymnaeidae	7.0					
Culicidae	8.0					
Hirudinea	8.0			1		1
Physidae	9.0	8	7	4	40	4
Other Diptera	10.0					
Oligochaeta	10.0		7	1		18
Chironomus or Red Chironomidae	11.0	5	63	14		2
	TOTAL	76	118	48	144	93
	TAXA	8	10	9	4	7
	MBI	6.5	9.0	7.7	6.8	7.0

Table 2. Water quality data for the Springfield SD Sugar Creek FRSS, May 18, 1989.

PARAMETER	GENERAL USE STANDARD	A1	B1	C1	C2	D1	D2
Field Water Temp., Deg. C.		19.1	18.6	19.0	18.7	18.4	15.2
Field pH, units	6.5-9.0	7.9	7.5	7.5	7.6	7.9	7.7
Field Dissolved Oxygen, mg/l	5.0 minimum	6.3	9.1	5.9	5.1	10.3	8.8
Field Conductivity, umhos/cm		918	1002	978	951	783	1117
Ammonia Nitrogen, mg/l	1.5/15b	0.19	2.8	1.4	1.5	0.2	0.64
**Unionized Ammonia, mg/l	0.04 maximum	0.006	0.033	0.017	0.022	0.005	0.009
Nitrate + Nitrite, mg/l		0.19	7.1	3.2	3.5	2.3	2.6
Total Phosphorus, mg/l		0.079	2.2	1.0	0.47	0.1	0.2
Dissolved Phosphorus, mg/l		0.02					
BOD, mg/l		3	15	6	7	3	2
BOD carb (Inh.), mg/l			10	6	5	3	2
COD, mg/l		20	40	26	29	14	12
Total Susp. Solids, mg/l		46	14	82	77	14	4
Mercury, ug/l	0.5 ug/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
T. Calcium, mg/l		114	77	102	95	80	107
T. Magnesium, mg/l		27	35	32	33	40	53
T. Sodium, mg/l		30	68	48	48	26	54
T. Potassium, mg/l		5.4	6.1	5.8	5.6	1.5	2
T. Aluminum, ug/l		1513	345	1206	1494	459	573
T. Barium, ug/l	5000 ug/l	80	34	73	75	75	99
T. Boron, ug/l	1000 ug/l	4562 *	851	2941 *	2441 *	144	177
T. Beryllium, ug/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
T. Cadmium, ug/l	50 ug/l	<3	<3	<3	<3	<3	<3
T. Chromium, ug/l	1050 ug/l	<5	19	<5	<5	<5	<5
T. Copper, ug/l	20 ug/l	6	20	<5	<5	<5	<5
T. Cobalt, ug/l		<5	<5	<5	<5	<5	<5
T. Iron, ug/l	1000 ug/l	1540 *	80	1238 *	1661 *	205	370
T. Lead, ug/l	100 ug/l	<5	<50	<50	<50	<50	<50
T. Manganese, ug/l	1000 ug/l	342	23	333	319	150	444
T. Nickel, ug/l	1000 ug/l	27	<5	16	15	<5	10
T. Silver,ug/l	5 ug/l	<3	<3	<3	<3	<3	<3
T. Strontium, ug/l		281	189	248	233	183	229
T. Vanadium, ug/l		19	<5	<5	9	<5	<5
T. Zinc, ug/l	1000 ug/l	<50	<50	<50	<50	<50	<50
**Hardness, mg/l		396	337	387	372	364	486
Fecal Coliform #/100ml		60	20	140	950	820	2800
Water Quality Index							

**calculated value

*State Water Quality Standard Violation

b The allowable concentration varies in accordance with water temperature and ph values. In general, as both temperature and pH decrease, the allowable value of ammonia nitrogen increases.

Table 2 (cont). Water quality data for the Springfield SD Sugar Creek FRSS, July 26, 1989.

PARAMETER	GENERAL USE STANDARD	A1	E2	C1	C2	D1	D2
Field Water Temp., Deg. C.		26.4	26.1	25.6	26.1	21.9	22.1
Field pH, units	6.5-9.0	8.2	8.2	7.4	7.4	7.0	7.7
Field Dissolved Oxygen, mg/l	5.0 minimum	4.0 *	7.9	3.1 *	2.6 *	4.4 *	7.3
Field Conductivity, umhos/cm		942	846	895	877	1232	776
Ammonia Nitrogen, mg/l	1.5/15b	<0.10	0.46	0.49	0.68	<0.10	0.17
** Unionized Ammonia, mg/l	0.04 maximum	0.010	0.043	0.008	0.011	<0.001	0.004
Nitrate + Nitrite, mg/l		<0.1	5.8	1.6	1.8	<0.1	1.1
Total Phosphorus, mg/l		0.07	2.0	0.8	0.93	0.19	0.62
Dissolved Phosphorus, mg/l		0.04					
BOD, mg/l		1	7	3	2	2	1
BOD carb (Inh.), mg/l			3	2	<1	<1	<1
COD, mg/l		15	35	21	22	26	13
Total Susp. Solids, mg/l		42	31	88	95	33	11
Mercury, ug/l	0.5 ug/l		<0.05	<0.05	<0.05	<0.05	<0.05
T. Calcium, mg/l		134	54	100	91	57	83
T. Magnesium, mg/l		27	23	27	26	23	31
T. Sodium, mg/l		31	87	48	54	29	36
T. Potassium, mg/l		5.8	6.0	6.2	5.5	2.6	2.2
T. Aluminum, ug/l		871	159	1029	1275	344	292
T. Barium, ug/l	5000 ug/l	63	22	61	63	76	83
T. Boron, ug/l	1000 ug/l	6468 *	818	4403 *	3973 *	55	292
T. Beryllium, ug/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
T. Cadmium, ug/l	50 ug/l	<3	<3	<3	<3	<3	<3
T. Chromium, ug/l	1050 ug/l	6	<5	<5	<5	<5	<5
T. Copper, ug/l	20 ug/l	<5	<5	<5	<5	<5	<5
T. Cobalt, ug/l		<5	<5	<5	<5	<5	<5
T. Iron, ug/l	1000 ug/l	900	236	1366 *	1682 *	520	532
T. Lead, ug/l	100 ug/l	10.6	<50	<50	<50	<50	<50
T. Manganese, ug/l	1000 ug/l	137	42	184	205	357	262
T. Nickel, ug/l	1000 ug/l	32	<5	<5	15	<5	6
T. Silver,ug/l	5 ug/l	<3	<3	<3	<3	<3	<3
T. Strontium, ug/l		314	130	253	235	131	197
T. Vanadium, ug/l		34	<5	14	19	<5	<5
T. Zinc, ug/l	1000 ug/l	<50	<50	<50	<50	<50	<50
** Hardness, mg/l		447	226	360	336	238	335
Fecal Coliform #/100ml		130	1100	1100	960	1100	1600
Water Quality Index							

**calculated value

*State Water Quality Standard Violation

b The allowable concentration varies in accordance with water temperature and ph values. In general, as both temperature and pH decrease, the allowable value of ammonia nitrogen increases.

Table 2 (cont). Water quality data for the Springfield SD Sugar Creek FRSS, September 13, 1989.

PARAMETER	GENERAL USE STANDARD	A1	E2	C1	C2	D1	D2
Field Water Temp., Deg. C.		17.8	19.7	18.7	18.2	16.0	15.9
Field pH, units	6.5-9.0	7.9	7.1	7.4	7.3	7.3	7.5
Field Dissolved Oxygen, mg/l	5.0 minimum	8.5	10.4	7.9	7.1	10.1	12.4
Field Conductivity, umhos/cm		1023	873	1098	884	532	562
Ammonia Nitrogen, mg/l	1.5/15b	0.18	2.0	1.1	1.2	<0.1	0.12
**Unionized Ammonia, mg/l	0.04 maximum	0.005	0.010	0.010	0.009	0.001	0.001
Nitrate + Nitrite, mg/l		0.48	7.6	3.2	3.3	0.45	1.2
Total Phosphorus, mg/l		0.1	1.9	1.0	0.86	0.14	0.16
Dissolved Phosphorus, mg/l		0.05	1.8	0.81	0.7	0.08	0.12
BOD, mg/l		3	7	6	6	4	2
BOD carb (Inh.), mg/l			4	3	3	3	1
COD, mg/l		16	27	26	25	22	16
Total Susp. Solids, mg/l		6	12	15	76	40	7
Mercury, ug/l	0.5 ug/l		<0.05	<0.05	<0.05	<0.05	<0.05
T. Calcium, mg/l		128	59	124	86	49	50
T. Magnesium, mg/l		31	26	34	26	20	16
T. Sodium, mg/l		31	70	52	49	29	40
T. Potassium, mg/l		6.5	5.5	6.6	5.1	2.0	1.8
T. Aluminum, ug/l		1450	129	2013	1187	734	229
T. Barium, ug/l	5000 ug/l	75	24	81	61	69	54
T. Boron, ug/l	1000 ug/l	5038 *	481	3984 *	2420 *	141	240
T. Berylium, ug/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
T. Cadmium, ug/l	50 ug/l	<3	<3	<3	<3	<3	<3
T. Chromium, ug/l	1050 ug/l	5	<5	<5	<5	<5	<5
T. Copper, ug/l	20 ug/l	<5	<5	11	<5	<5	<5
T. Cobalt, ug/l		<5	<5	<5	<5	<5	<5
T. Iron, ug/l	1000 ug/l	1857 *	174	2751 *	1651 *	1041 *	396
T. Lead, ug/l	100 ug/l	<5	<50	<50	<50	<50	<50
T. Manganese, ug/l	1000 ug/l	247	41	206	161	77	161
T. Nickel, ug/l	1000 ug/l	19	<5	13	6	<5	<5
T. Silver,ug/l	5 ug/l	<3	<3	<3	<3	<3	<3
T. Strontium, ug/l		303	144	292	206	115	118
T. Vanadium, ug/l		28	<5	21	12	<5	<5
T. Zinc, ug/l	1000 ug/l	<50	<50	<100	<50	<50	<50
**Hardness, mg/l		448	253	450	324	203	188
Fecal Coliform #/100ml		7200	100	6600	20000	2300	5500
Water Quality Index							

**calculated value

*State Water Quality Standard Violation

^b The allowable concentration varies in accordance with water temperature and ph values. In general, as both temperature and pH decrease, the allowable value of ammonia nitrogen increases.

Table 3. Summary of habitat characteristics in Sugar Creek, Hoover Branch and Clear Lake Ave. Creek from the Springfield SD Sugar Creek FRSS, July 26, 1989.

Habitat Parameter	A1	C1	C2	D1	D2
Stream Order	5	5	5	2	2
Mean Width (ft)	60.0	35.0	75.0	2.0	2.0
Mean Depth (ft)	2.0	1.5	5.0	0.2	0.2
Mean Velocity (ft/s)	0.0	0.8	<0.1	0.0	0.05
Discharge (cfs)	0	44.1	37.5	0	0.02
Instream Cover (%)	30	25	10	1	0
Pool (%)	100	15	100	98	0
Riffle (%)	0	5	0	1	1
Shading (ft)	50	50	50	0	25
Silt/Mud (%)	15	35	30	0	0
Sand (%)	0	5	20	0	0
Fine Gravel (%)	0	5	0	10	1
Medium Gravel (%)	5	5	0	20	1
Coarse Gravel (%)	5	5	0	10	0
Small Cobble (%)	5	5	0	30	1
Large Cobble (%)	15	5	5	30	0
Boulder (%)	25	5	5	0	0
Bedrock (%)	0	0	0	0	0
Claypan (%)	0	0	0	0	0
Plant Detritus (%)	15	15	30	0	0
Vegetation (%)	0	0	0	0	0
Submerged Logs (%)	15	15	10	0	0
Other (%)	0	0	0	0	97
Predicted IBI			42		

Appendix A. Location of stations for the Springfield SD Sugar Creek FRSS, 1989. All stations were in Sangamon County.

Station	Description
EOA 01 (A1)	Sugar Creek at IL Rt. 29, upstream from the discharge. T15N, R4W, NW6.
EOA-SS-E2	Sugar Creek STP effluent.
EOA-SS-C1	Sugar Creek at Mechanicsburg Road, 1.0 mile downstream from the discharge. T16N, R4W, NW32.
EOA-SS-C2	Sugar Creek 2.7 miles downstream from the discharge. T16N, R4W, SW28.
EOA-SS-D1	Hoover Branch at old Rt. 36. T16N, R4W, NE30.
EOA-SS-D2	Clear Lake Avenue Creek near the I-72 exit from I-55. T16N, R4W, NW31.

Appendix B. Summary of use support assessment criteria for Illinois stream

USEPA	Full Support		Partial Support		Non-Support
			Minor	Moderate	
General Stream/Water Quality Condition	Excellent	Very good	Good/Fair	Poor	Very Poor
IEPA/IDOC Biological Stream Characterization	Unique Aquatic Resource	Highly Valued Resource	Moderate Aquatic Resource	Limited Aquatic Resource	Restricted Aquatic Resource
Fish/Index of Biotic Integrity (IBI)	51-60	41-50	31-40	21-30	<20
Benthos/Macroinvertebrate Biotic Index (MBI)	<5.0	5.0-6.0	6.0-7.5	7.5-10.0	>10.0
Water Chemistry/Storet Water Quality Index (WQI)	<10	10-30	30-50	50-70	>70
Water Chemistry/Total Suspended Solids (TSS mg/l)	<10	10-25	25-80	80-400	>400
Stream Habitat/Potential Index of Biotic Integrity (PIBI)	51-60	41-60	31-40	<31	
Stream Sediment/IEPA Stream Sediment Classification	Nonelevated	Non- to Slightly Elevated	Slightly Elevated	Elevated -Highly Elevated	Extreme

From Illinois Water Quality Report, 1986-87

APPENDIX B

CWLP FISHERIES STUDY OF SUGAR CREEK, SOUTH FORK, AND SANGAMON RIVER

EA SCIENCE AND TECHNOLOGY
A Division of EA Engineering, Science, and Technology, Inc.
612 Anthony Trail • Northbrook, Illinois 60062
Telephone: (312) 564-3040

30 December 1988

Mr. Tom Skelly
Springfield City Water, Light, & Power
200 E. Lake Drive
Springfield, IL 62707

Dear Tom:

Enclosed please find the following:

(1) a summary of all the physicochemical measurements we made
(2) printouts summarizing all catch data
(3) information regarding sampling methods that is not in the proposal

Please call if you have any questions.

Sincerely,

Greg Seegert

Greg Seegert
Project Manager

METHODS

Gears used were as follows:

3-Phase AC Shock - The 3-phase AC system was powered by a 3000 watt Homelite generator. In July and August because of high (>2000) conductivities, we used only one or two droppers in Zones 5 and 6. Actual output was typically 15-18 amps and 150-170 volts. Initially we attempted to use all 3 phases, but our actual output dropped to about 10 amps and 120 volts, a combination insufficient to shock fish effectively. Thus, we switched to energizing only one or two electrodes.

Pram Shock - Pram electrofishing was accomplished using a Coeffelt Model VVP-2C electroshocker powered by a 1500 watt generator. The VVP-2C and the generator were mounted in a small pram. Electrofishing was conducted using a three-person crew; 2 people shocking, with the third person guiding the pram containing the electrofisher. Pram electrofishing was done using AC current; actual output varied from 500-900 watts.

Seine - Seine collections were made using either a 3/16-inch square mesh, 6 foot x 30 foot seine with a 6 x 6 x 6 foot bag; or a 15 ft. long x 6 foot deep straight seine with 3/16-inch mesh.

Stations 1, 2, 5, and 6 were seined each month using the 30 ft. seine, whereas the 15 ft seine was used at Stations 3 and 4. The 3-phase boom shocker was used at Stations 1, 2, 4, 5, and 6 in June and November. In July and August, Stations 5 and 6 were sampled using the boom shocker, with Stations 1-4 being sampled using the pram unit. Station 3 was not electrofished in June or November because a log jam prevented access with the boom shocker.

All other methodologies (e.g., sample processing procedures) followed those described in our proposal and were according to your specifications.

SUMMARY OF PHYSICOCHEMICAL MEASUREMENTS MADE IN THE SANGAMON RIVER DURING 1988.

	Station					
	1	2	3	4	5	6
Temperature (C)						
June 7-8	25.9	23.5	-	27.5	27.5	25.1
July 14-15	26.4	26.5	31.3	29.7	28.0	30.2
August 30-31	18.9	18.8	23.9	23.0	22.5	25.5
November 15-16	10.0	10.2	13.3	11.5	10.8	9.2
Dissolved Oxygen (mg/l)						
June 7-8	9.4	7.2	-	8.2	11.4	11.0
July 14-15	4.8	5.2	7.9	5.3	7.1	11.4
August 30-31	7.0	6.9	6.0	5.0	9.2	15.5
November 15-16	7.0	7.1	4.7	3.6	5.7	7.1
Conductivity*(μohm/cm)						
June 7-8	1156	1081	-	874	1144	1079
July 14-15	2425	2016	783	945	1960	1872
August 30-31	2408	2352	788	958	1976	1833
November 15-16	1780	994	653	684	1110	1652
Secchi (cm)						
June 7-8	60	51	-	34	53	35
July 14-15	40	36	50	40	35	27
August 30-31	28	28	20	10	26	18
November 15-16	18	23	56	24	14	25

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* Adjusted to 25C.

Locations of Stations sampled during EA Science and Technology fisheries collections on the Sangamon River, South Fork of the Sangamon River and Sugar Creek. Individual Stations 1-6 were split into two substations (A and B) after the December 1987 collection.

Stations: (See figures 1 and 2.)

1A - Sangamon River from the confluence of the South Fork upstream for 200 meters.

1B - Sangamon River from the upstream end of Station 1A upstream for 200 meters.

2A - Sangamon River from the downstream end of Station 2B downstream for 200 meters.

2B - Sangamon River from the confluence of the South Fork downstream for 200 meters.

3A - South Fork of the Sangamon River for 200 meters upstream of the confluence with Sugar Creek.

3B - South Fork of the Sangamon River beginning at the upstream end of Station 3A upstream for 200 meters.

4A - Sugar Creek for 200 meters upstream of the confluence with the South Fork of the Sangamon River.

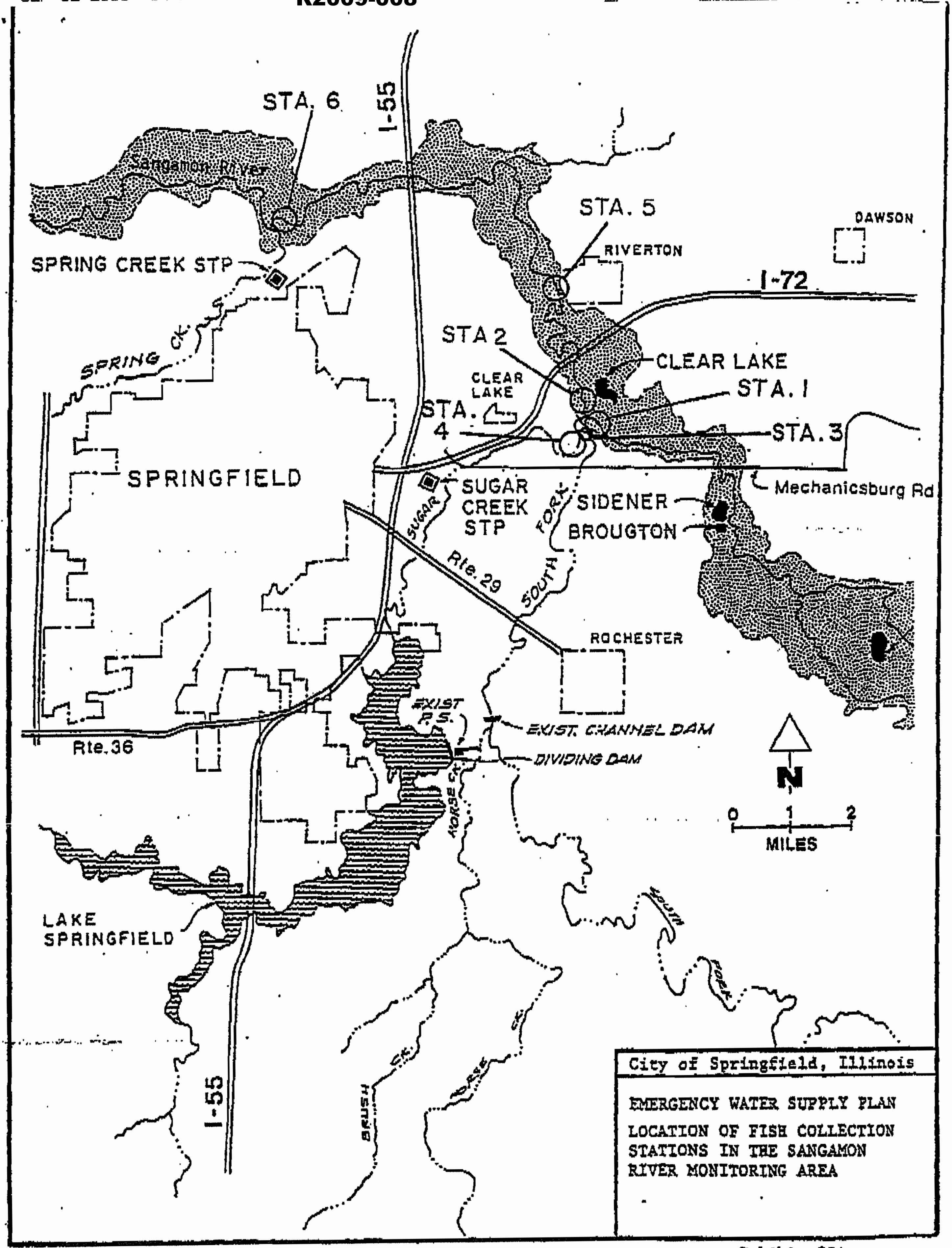
4B - Sugar Creek beginning at the upstream end of Station 4A upstream for 200 meters.

5A - Sangamon River for 200 meters downstream of Station 5B.

5B - Sangamon River from 50 meters upstream to 150 meters downstream of the public boat ramp at Wheeland Park in Riverton, Illinois.

6A - Sangamon River at Riverside Park from 30 meters upstream of the rock and crib dam upstream for 200 meters.

6B - Sangamon River from the upstream end of Station 6A upstream for 200 meters.

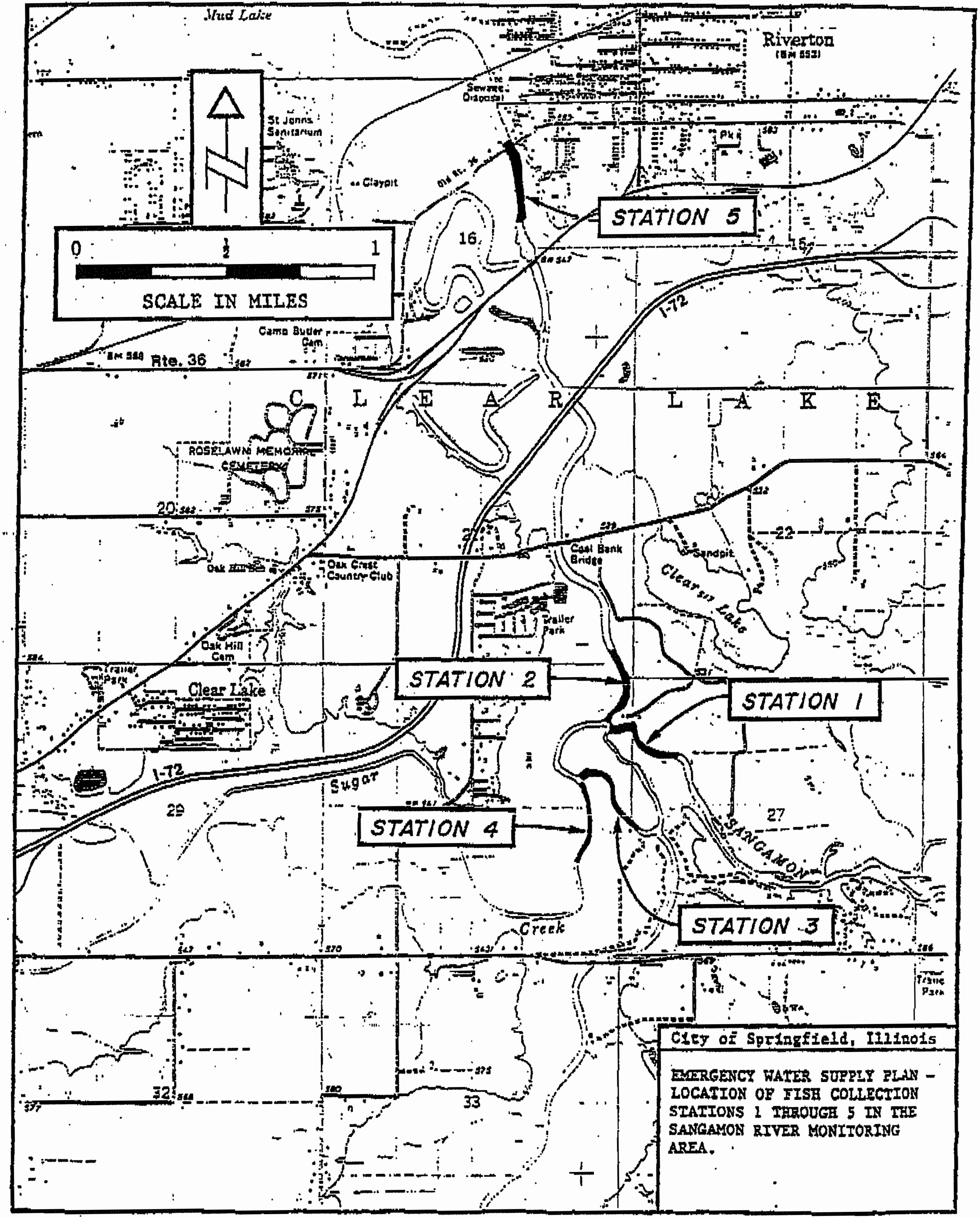


City of Springfield, Illinois

EMERGENCY WATER SUPPLY PLAN

LOCATION OF FISH COLLECTION STATIONS IN THE SANGAMON RIVER MONITORING AREA

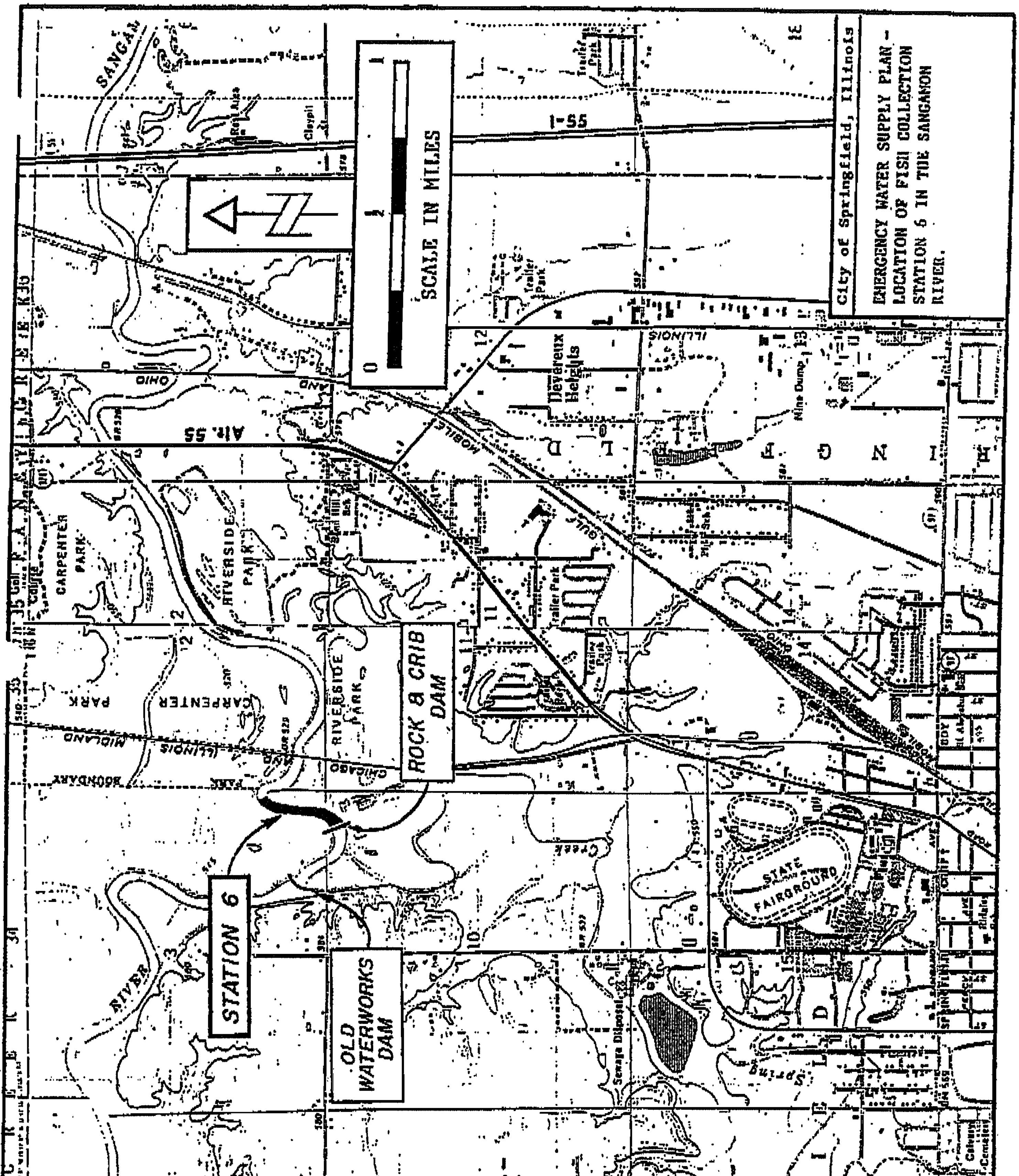
Exhibit 23A



City of Springfield, Illinois

EMERGENCY WATER SUPPLY PLAN - LOCATION OF FISH COLLECTION STATIONS 1 THROUGH 5 IN THE SANGAMON RIVER MONITORING AREA.

Exhibit 23B



City of Springfield, Illinois

EMERGENCY WATER SUPPLY PLAN - LOCATION OF FISH COLLECTION STATION 6 IN THE SANGAMON RIVER.

Exhibit 23C

TABLE . SUMMARY OF FISH COLLECTED FROM THE SANGAMON RIVER, 1 AND 2 DECEMBER 1987, EA Science and Technology, Inc.

Common Name	Scientific Name	Station 1		Station 2		Station 3		Station 4		Station 5		Station 6		Total	%
		Sh[a]	Se[a]	Sh	Se	Sh	Se	Sh	Se	Sh	Se	Sh	Se		
Longnose gar	*Lepisosteus osseus*									1				3	<1
Gizzard shad	*Dorosoma cepedianum*	21		63		2				18		210		314	19
Common carp	*Cyprinus carpio*	2		7		1				4		1		15	1
Emerald shiner	*Notropis atherinoides*	3								21		40	12	76	5
Red shiner	*N. lutrensis*	70	61	16	51	27	3		36	123	100	30	76	609	36
Red x spotfin shiner	*N. lutrensis* x *spilopterus*		2							1				3	<1
Sand shiner	*N. stramineus*	29	14	5	49	2				4	22	6	21	152	9
Unidentified shiner	*N. spp.*		1											1	<1
Bluntnose minnow	*Pimephales notatus*	2			2					3	4		2	11	1
Bullhead minnow	*P. vigilax*	23	25	14	14	3	1		8	22	63	29	39	241	14
Hornyhead chub	*Nocomis biguttatus*	1												3	<1
White sucker	*Catostomus commersoni*	1								1				2	<1
Highfin carpsucker	*Carpiodes velifer*	1												1	<1
River carpsucker	*C. carpio*	10		9				1		1		1		22	1
Quillback	*C. cyprinus*	13		6		1		2				1		23	1
Carpsucker spp.	*C. spp.*			2								2		4	<1
Smallmouth buffalo	*Ictiobus bubalus*			1						1		2		4	<1
Bigmouth buffalo	*I. cyprinellus*	1		2				3		1				7	<1
Golden redhorse	*Moxostoma erythrurum*			3										3	<1
Shorthead redhorse	*M. macrolepidotum*			1										3	<1
Channel catfish	*Ictalurus punctatus*	9		5				1		1				16	1
Flathead catfish	*Pylodictis olivaris*			1										3	<1
White bass	*Morone chrysops*	5		15				1		1		1		23	1
Yellow bass	*M. mississippiensis*			2						1		1		4	<1
Brook silverside	*Labidesthes sicculus*	2	1	1	1	7	1	1		22		2		30	2
Bluegill	*Lepomis macrochirus*	3	0	9	2	2		1	8	8		1		42	2
Green sunfish	*L. cyanellus*	1		2	2	2			5	6	1		1	20	1
Orangespotted sunfish	*L. humilis*					1				3			2	6	<1
Black crappie	*Pomoxis nigromaculatus*	1		1										2	<1
White crappie	*P. annularis*	1		2						9		1		13	1
Largemouth bass	*Micropterus salmoides*					2								2	<1
Freshwater drum	*Aplodinotus grunniens*	4		14						1				19	1
	Total Fish	211	112	101	121	50	5	10	57	251	190	336	153	1677	
	Total Species	21	5	21	7	11	3	7	4	21	5	14	7	29	
	Effort (No. of hauls or hrs)	1	2	1	2	0.5	2	0.5	2	1	2	1	2		

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[a] Sh = Electrofish
Se = Seine

Exhibit 30

Table . Numbers of fish collected by electrofishing from the Sangamon River during June, July and August 1988.

Stations	1A			1B			2A			2B			3A			3B			4A			4B			5A			5B			6A			6B		
	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug
Longnose gar, Lepisosteus osseus																				1	7											1				
Gizzard shad, Dorosoma cepedianum	8	10	9	6		3	6	11	25	14	3	16		3	24		1	20	16	2		16	2	12	17	24	36	5	16	30	14	1	25	17	2	28
Common carp, Cyprinus carpio			2					6	1	1	1			2	5			1	1	1		1	1	1	2			2	4	2	1	2				1
Central stoneroller, Campostoma anomalum											3																									
Suckermouth minnow, Phenacobius mirabilis		1				1		3			12	27																								
Emerald shiner, Notropis atherinoides						1						1									1			2		1	1		4	2						
Striped shiner, N. chrysocephalus										1																										
Bigmouth shiner, N. dorsalis																																				
Red shiner, N. lutrensis	6	35	311	16	21	219	11	33	156	11	163	380			6			5	1	4	7		28	23	6		11	15	1	2	13		8	22		25
Sand shiner, N. stramineus	2	5	19		4	26	4	15	31	2	26	110																								
Redfin shiner, N. umbratilis																																				
Golden shiner, Notemigonus crysoleucas																							1													
Bluntnose minnow, Pimephales notatus			1			1		2				4																								1
Bullhead minnow, P. vigilax	1		26		4	16	2	3	13	2	3	44			4			16		2	7	2	6	26	4	3	29	2	1	7	5		20	1		38
Hornyhead chub, Nocomis biguttatus												2																								
Creek chub, Semotilus atromaculatus												2																								
River carpsucker, Carpiodes carpio	3		2	4	3	8			1	2		4			4				2		1	2			5	2	3	7	9	10			1	1		2
Quillback, C. cyprinus	1	3	10	1	1	15	1	2	1	2	1	1			1										1		5	2	2	1	1		7	2		9
Highfin carpsucker, C. velifer				1					1																											
Unidentified Carpiodes					3				3																										5	1
Smallmouth buffalo, Ictiobus bubalus							1			2																				1				1		1
Bigmouth buffalo, I. cyprinellus							2												1														1			
Black buffalo, I. niger																													1							
Golden redhorse, Moxostoma erythrurum								1	1																3			1	2							
Shorthead redhorse, M. macrolepidotum																																				
Unidentified Ictiobinae		3																																		
Channel catfish, Ictalurus punctatus	7	4	33	7	10	28	2	8	3	7	12	13					1	1					8	1		1	1	2		2				1		
Flathead catfish, Pylodictis olivaris								1	1		4	5			1		1		1				8							1	1			1		
Tadpole madtom, Noturus gyrinus																																				
White bass, Morone chrysops			3	1							1	1						1			1							1		1	1			1		
Yellow bass, M. mississippiensis	2						2												1						3	1		1	1							
Brook silverside, Labidesthes sicculus								1										1	1		2	3		6	1		2			3	1					
Blackstripe topminnow, Fundulus notatus								1	2			1			3			9		3	1	2	1	2						1			2			
Green sunfish, Lepomis cyanellus		3	14		2	7	3	15	31		2	18		8	27		5	19		6	10	2	12	21	3		4	1		2	2	2			1	
Orangespotted sunfish, L. humilis											1				1			1		5	1			1		1							2			
Bluegill, L. macrochirus		8	7		1	10		3	22			7		3	54		4	88	1		15		2	19			4	5		10	3	3	8			1
Black crappie, Pomoxis annularis																														1						
White crappie, P. nigromaculatus															1															3						
Largemouth bass, Micropterus dolomieui		8	4						3		1	3		4	3		1	4		7	3		6	5									1			
Walleye, Stizostedion vitreum										2		1																		1						
Blackside darter, Percina maculata																																				
Slenderhead darter, P. phoxocephala						1						2																								
Freshwater drum, Aplodinotus grunniens	2	1	4	2			4			6	4	3			2			2	2			1		1	8	2	2	2	1	4	1	1				
No. Species	9	10	14	8	8	13	11	15	14	12	16	21		5	14		4	13	10	9	12	8	11	13	11	8	11	11	11	20	11	6	10	9	3	9
No. Fish	34	87	445	28	46	336	33	116	298	32	234	845		20	142		61	170	34	29	53	31	68	122	53	35	93	42	48	93	47	10	75	47	8	107

Exhibit 31

Table . Total biomass (g) of fish collected by electrofishing from the Sangamon River during June, July and August 1988.

Station:	1A			1B			2A			2B			3A			3B			4A			4B			5A			5B			6A			6B		
	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug
Longnose gar, Lepisosteus osseus																				5																
Gizzard shad, Dorosoma cepedianum	325	835	900	193		75	297	170	1910	653	220	930		310	2240		103	1600	1965	880	1025	1320	285	1385	579	3040	5300	121	1030	4015	465	170	1245	375	215	1560
Common carp, Cyprinus carpio			2800					445	1010	2360	6			1230	6990			1250	1200			890	3	610	1600			2600	4925	3660	2470	1550				2850
Central stoneroller, Campostoma anomalum											4																									
Suckermouth minnow, Phenacobius mirabilis		10				7		5			25	110																								
Emerald shiner, Notropis atherinoides						1						1									1			2		2	1		5	2						
Striped shiner, N. chrysocephalus										25																										
Bigmouth shiner, N. dorsalis																																				
Red shiner, N. lutrensis	15	130	275	30	25	185	20	70	125	15	300	440			4			4	1	6	4		20	12	6		6	35	1	2	19		4	22		15
Sand shiner, N. stramineus	2	8	25		6	40	1	15	30	2	19	100																								
Redfin shiner, N. umbratilis																																				
Golden shiner, Notemigonus crysoleucas																							3													
Bluntnose minnow, Pimephales notatus			1			1		2				4																								1
Bullhead minnow, P. vigilax	1		25		2	10	2	4	10	3	7	35			3			13		2	4	4	10	15	4	2	17	4	2	5	6		10	2		20
Hornyhead chub, Nocomis biguttatus												3																								
Creek chub, Semotilus atromaculatus												7																								
River carpsucker, Carpiodes carpio	452		32	1650	260	100			445	1175		650			2270				935		680	510			3105	580	515	3825	4050	8470			580	460		1310
Quillback, C. cyprinus	265	11	210	55	455	330	20	8	12	125	4	622			85										675		315	1510	730	25	75		155	75		158
Highfin carpsucker, C. velifer				295					425																											
Unidentified Carpiodes					10				20																										19	4
Smallmouth buffalo, Ictiobus bubalus							1360			3220																								660		1200
Bigmouth buffalo, I. cyprinellus							1070												255														780			
Black buffalo, I. niger																													3750							
Golden redhorse, Moxostoma erythrurum								335	400																1430			1040	1130							
Shorthead redhorse, M. macrolepidotum																																				
Unidentified Ictiobinae		2																																		
Channel catfish, Ictalurus punctatus	488	493	3653	845	1771	1960	22	251	995	301	197	1196					300	300					2385	240		150	10	330						90		
Flathead catfish, Pylodictis olivaris								143	150		1010	656			55		35		465				150							275				360		
Tadpole madtom, Noturus gyrinus																																				
White bass, Morone chrysops			300	65							65	85						70			60							65		90	80			85		
Yellow bass, M. mississippiensis	125						160												335						100	70		65	60	40						
Brook silverside, Labidesthes sicculus								3										3	3		1	5		5	2		4			3	3					
Blackstripe topminnow, Fundulus notatus								1	2			1			2			8		3	2	4	1	2						1			2			
Green sunfish, Lepomis cyanellus		24	120		51	140	14	371	415		25	265		285	490		119	315		239	135	39	309	384	140		15	22		60	29	40			35	
Orangespotted sunfish, L. humilis											4				1			13		3	1			1		3							1			
Bluegill, L. macrochirus		6	14		1	25		5	75			18		103	185		320	256	50		8		2	10			103	26		400	30	141	54			2
Black crappie, Pomoxis annularis																														75						
White crappie, P. nigromaculatus															3															350						
Largemouth bass, Micropterus dolomieui		3	261						31		1	44		115	193		1	22		90	19		6	28									40			
Walleye, Stizostedion vitreum										3330		31																		1340						
Blackside darter, Percina maculata																																				
Slenderhead darter, P. phoxocephala						1						2																								
Freshwater drum, Aplodinotus grunniens	253	250	735	240			515			1397	130	543			353			435	410			235		140	205	515	330		50	310	145	330				
No. Species	9	10	14	8	9	12	11	15	15	12	13	20		5	14		6	13	8	4	12	6	11	13	11	6	11	13	11	19	10	5	10	9	3	9
No. Fish	2318	1773	9101	35735	2821	2835	3519	1088	6065	12508	2875	5548		2151	14776		888	4267	6123	538	1950	3728	3176	2831	9572	4432	6815	10053	23133	20273	3122	2231	2681	2729	259	7140

Exhibit 32

Table . Numbers of fish collected by seine from the Sangamon River during June, July and August 1988.

Stations	1A			1B			2A			2B			3A			3B			4A			4B			5A			5B			6A			6B		
	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug
Longnose gar, Lepisosteus osseus																																1				
Gizzard shad, Dorosoma cepedianum				1					5						2		2	2		5			1		1										45	
Common carp, Cyprinus carpio														5												1						11			10	
Central stoneroller, Campostoma anomalum																																				
Suckermouth minnow, Phenacobius mirabilis							3	1			1															1		2	1							
Emerald shiner, Notropis atherinoides						1					1				1																					
Striped shiner, N. chrysocephalus				1		1						1																	1							
Bigmouth shiner, N. dorsalis			1		1	1																														
Red shiner, N. lutrensis	39	290	550	42	195	200	135	105	190	115	425	250			5	3	1	12	4	2	2		1	2	130	39	150	135	90	183	82	8	500	216	5	3
Sand shiner, N. stramineus	15	131	73	14	65	32	37	57	75	32	59	3														15	27	31	28		1	30	1	2	2	
Spotfin X Red shiner			1																																	
Redfin shiner, N. umbratilis														1																						
Unidentified Notropis											1																									
Golden shiner, Notemigonus crysoleucas																																				
Bluntnose minnow, Pimephales notatus			7		1	1		2	2		4															1			5	1		2	1			25
Bullhead minnow, P. vigilax	1	2	29		2	11	29	23	101	19	21	2		1	5	15	10	41	3	9	3	2	2	5	2	200	200	3	41	210	13	22	600	29	75	210
Hornyhead chub, Nocomis biguttatus			2								2	1																								
Creek chub, Semotilus atromaculatus			7		2	1				1	2																									
River carpsucker, Carpiodes carpio							1																													
Quillback, C. cyprinus			2		1	2																				1	1		2	4		1			3	5
Highfin carpsucker, C. velifer																																				
Unidentified Carpiodes		15	8		33	2					20															15			125				9		6	
Smallmouth buffalo, Ictiobus bubalus																																				
Bigmouth buffalo, I. cyprinellus																																				
Black buffalo, I. niger																																				
Golden redhorse, Moxostoma erythrurum																							1													
Shorthead redhorse, M. macrolepidotum														1																						
Unidentified Catostomidae	1						28	9		28															9			20			65	500		8		
Channel catfish, Ictalurus punctatus		9			3	6					1							1														5	2			1
Flathead catfish, Pylodictis olivaris																																				
Tadpole madtom, Noturus gyrinus															1				1																	
White bass, Morone chrysops							1				1																									
Yellow bass, M. mississippiensis																							1													
Brook silverside, Labidesthes sicculus		2	2		1			13	33		7			1	10		7	3		1	3			5	1	65	11		57	39		7	8		2	
Blackstripe topminnow, Fundulus notatus								1					2	1			1	8		2				1	2	43	13	1	16	1			1			2
Green sunfish, Lepomis cyanellus														1	2		1	1			1			2	2	2	1		3	1			12			1
Orangespotted sunfish, L. humilis			1						3					1	8	2		4		1	2		6	2			35			6		1			1	23
Bluegill, L. macrochirus			8					2	1		4			30	22		25	23		1	1			1			33			8						23
Unidentified Lepomis																										81			81						6	
Black crappie, Pomoxis annularis																																				
White crappie, P. nigromaculatus															7			1																		
Largemouth bass, Micropterus salmoides			1					1			1	1		4			5	3		10						1		1	3		1					
Walleye, Stizostedion vitreum																																				
Blackside darter, Percina maculata																																				5
Slenderhead darter, P. phoxocephala												1														1						1			1	1
Freshwater drum, Aplodinotus grunniens																																				
No. Species	3	5	12	4	9	10	6	9	8	3	13	7	1	10	10	3	8	11	3	8	5	1	6	7	6	12	9	6	11	8	4	11	8	3	9	11
No. Fish	56	449	692	58	304	258	234	212	406	175	549	259	2	46	63	20	52	97	8	35	12	2	12	18	347	466	471	193	387	453	162	589	1134	237	156	294

Exhibit 33

Table . Total biomass (g) of fish collected by seine from the Sangamon River during June, July and August 1988.

Stations	1A			1B			2A			2B			3A			3B			4A			4B			5A			5B			6A			6B		
	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug
Longnose gar, Lepisosteus osseus																																				
Gizzard shad, Dorosoma cepedianum				32					11						10		2	15		5			1		11										20	
Common carp, Cyprinus carpio														24												4						25			20	
Central stoneroller, Campostoma anomalum																																				
Suckermouth minnow, Phenacobius mirabilis							1	1			1															1		1	1							
Emerald shiner, Notropis atherinoides						1					1				1																					
Striped shiner, N. chrysocephalus				2		2						1																	1							
Bigmouth shiner, N. dorsalis			1		1	2																														
Red shiner, N. lutrensis	35	200	500	63	210	100	115	85	120	160	500	200			5	6	1	10	5	2	2		2	2	120	30	50	110	100	80	115	7	200	255	3	2
Sand shiner, N. stramineus	14	210	100	20	130	40	55	34	65	15	70	5														10	20	48	20		1	16	1	2	2	
Spotfin X Red shiner			1																																	
Redfin shiner, N. umbratilis														1																						
Unidentified Notropis											1																									
Golden shiner, Notemigonus crysoleucas	2						40			30						21			4			2			2			2			7			30		
Bluntnose minnow, Pimephales notatus			35		1	1		6	1		2															6			3	1		1	5			35
Bullhead minnow, P. vigilax		6	35		4	8		29	90	1	25	1		2	5		5	35		9	2		4	4		60	125		30	220		15	300		50	160
Hornyhead chub, Nocomis biguttatus			4				15				1	2																								
Creek chub, Semotilus atromaculatus			20		3	3					2																									
River carpsucker, Carpiodes carpio																																				
Quillback, C. cyprinus			30		13	6																				8	19		10	87		12			10	50
Highfin carpsucker, C. velifer																																				
Unidentified Carpiodes		29	20		75	5																				40			300				20		6	
Smallmouth buffalo, Ictiobus bubalus																																				
Bigmouth buffalo, I. cyprinellus																																				
Black buffalo, I. niger																																				
Golden redhorse, Moxostoma erythrurum	1						10			10															4			8			20			4		
Shorthead redhorse, M. macrolepidotum														2																						
Unidentified Ictiobinae								14																												
Channel catfish, Ictalurus punctatus		7			106	29					2							10	3													6	3			1
Flathead catfish, Pylodictis olivaris							23																													
Tadpole madtom, Noturus gyrinus															3																					
White bass, Morone chrysops											120														1											
Yellow bass, M. mississippiensis													3												3			2								
Brook silverside, Labidesthes sicculus		1	2		1			7	20		4			1	10		2	1		2	2			4	2	25	11		30	20		4	10		1	
Blackstripe topminnow, Fundulus notatus								1						1		6	1	6		5				1		25	11		10	1			1			1
Green sunfish, Lepomis cyanellus														30	2		1	1			9			3		1	1		2	3			9			1
Orangespotted sunfish, L. humilis			1						4					10	30			10		20	10		7	10			20			5		10			10	12
Bluegill, L. macrochirus			12					1	1		2			5	15		5	15		10	1			1			20			6						14
Unidentified Lepomis																										30			6		1				2	
Black crappie, Pomoxis annularis																																				
White crappie, P. nigromaculatus															15			1										5								
Largemouth bass, Micropterus salmoides			8					3			1	9		10			15	10		15						10			8							
Walleye, Stizostedion vitreum																																				
Blackside darter, Percina maculata																																				8
Slenderhead darter, P. phoxocephala												2														2						1			1	279
Freshwater drum, Aplodinotus grunniens																																				
No. Species	3	3	12	4	9	10	6	5	8	4	14	7	1	10	10	3	8	11	3	8	6	1	4	7	6	12	9	6	11	9	4	10	8	3	9	11
No. Fish	52	440	749	117	514	277	259	175	813	220	832	220	3	85	106	33	32	114	42	68	22	2	14	25	143	267	317	116	521	353	144	97	515	331	115	279

Exhibit 34

1988 SANGAMON RIVER FISH SUMMARIES
SUMMARY OF MONTHLY AND ANNUAL CATCHES

GEAR=ELECTRO

	MONTH					
	JUN 88	JUL 88	AUG 88	NOV 88	ANNUAL TOTAL	
	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS	
	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	PERCENT
SPECIES						
LONGNOSE GAR	0	5	0	0	5	0.001
GIZZARD SHAD	7096	7430	22085	11059	47670	11.599
CENTRAL STONEROLLER	0	4	0	0	4	0.001
COMMON CARP	11520	12159	21280	69950	114909	27.958
HORNYHEAD CHUB	0	0	3	0	3	0.001
GOLDEN SHINER	0	3	0	0	3	0.001
EMERALD SHINER	0	7	8	106	121	0.029
STRIPED SHINER	25	0	0	0	25	0.006
RED SHINER	163	552	1076	308	2099	0.511
SAND SHINER	5	78	195	14	292	0.071
SUCKERMOUTH MINNOW	0	38	117	0	155	0.038
BLUNTNOSE MINNOW	0	2	7	9	18	0.004
BULLHEAD MINNOW	26	29	167	260	482	0.117
CREEK CHUB	0	0	7	0	7	0.002
RIVER CARPSUCKER	12942	5930	14872	65738	99482	24.205
QUILLBACK	2850	1208	1742	34353	40153	9.770
HIGHFIN CARPSUCKER	295	0	425	0	720	0.175
UNID CARPIODES	0	29	24	32	85	0.021
WHITE SUCKER	0	0	0	1330	1330	0.324
SMALLMOUTH BUFFALO	5240	0	1200	1130	7570	1.842
BIGMOUTH BUFFALO	1825	0	780	1390	3995	0.972
BLACK BUFFALO	0	3750	0	0	3750	0.912
GOLDEN REDHORSE	2470	1525	400	1710	6105	1.485
SHORTHEAD REDHORSE	0	0	0	19	19	0.005
UNID ICTIOBINAE	0	2	0	0	2	0.000
CHANNEL CATFISH	2078	5553	8904	22785	39320	9.567
FLATHEAD CATFISH	825	1370	1136	470	3801	0.925
BLACKSTRIPE TOPMINNOW	4	5	20	0	29	0.007
BROOK SILVERSIDE	13	1	11	48	73	0.018
WHITE BASS	295	65	605	175	1140	0.277
YELLOW BASS	797	130	40	72	1039	0.253
GREEN SUNFISH	235	1498	2339	515	4587	1.116
ORANGESPOTTED SUNFISH	0	10	17	2	29	0.007
BLUEGILL	108	649	1160	843	2760	0.672
LARGEMOUTH BASS	0	218	638	816	1672	0.407
WHITE CRAPPIE	0	0	353	465	818	0.199
BLACK CRAPPIE	0	0	75	0	75	0.018
SLENDERHEAD DARTER	0	0	3	0	3	0.001
WALLEYE	3230	0	1377	0	4607	1.121
FRESHWATER DRUM	5433	1305	3900	11405	22043	5.363
TOTAL CATCH	57475	43555	84966	225004	411000	100.000

1988 SANGAMON RIVER FISH SUMMARIES
SUMMARY OF MONTHLY AND ANNUAL CATCHES

GEAR=SEINE

	MONTH					
	JUN 88	JUL 88	AUG 88	NOV 88	ANNUAL TOTAL	
	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS	
SPECIES	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	PERCENT
LONGNOSE GAR	0	0	0	0	0	0.000
GIZZARD SHAD	43	28	46	0	117	0.528
COMMON CARP	0	73	0	0	73	0.330
HORNYHEAD CHUB	0	1	6	3	10	0.045
EMERALD SHINER	0	1	2	201	204	0.921
STRIPED SHINER	2	1	3	5	11	0.050
BIGMOUTH SHINER	0	1	3	0	4	0.018
RED SHINER	1024	1240	1391	9029	12684	57.285
SAND SHINER	159	496	231	1195	2081	9.398
REDFIN SHINER	0	1	0	0	1	0.005
SPOTFIN X RED SHINER	0	0	1	0	1	0.005
UNID NOTROPIS	0	1	0	0	1	0.005
SUCKERMOUTH MINNOW	2	4	0	20	26	0.117
BLUNTNOSE MINNOW	0	9	54	27	90	0.406
BULLHEAD MINNOW	140	239	885	2740	4004	18.083
CREEK CHUB	1	5	23	0	29	0.131
RIVER CARPSUCKER	15	0	0	30	45	0.203
QUILLBACK	0	53	192	240	485	2.190
UNID CARPIODES	0	450	45	0	495	2.236
GOLDEN REDHORSE	0	0	0	113	113	0.510
SHORTHEAD REDHORSE	0	2	0	0	2	0.009
UNID ICTIOBINAE	57	14	0	5	76	0.343
CHANNEL CATFISH	0	121	43	5	169	0.763
TADPOLE MADTOM	3	0	3	0	6	0.027
BLACKSTRIPE TOPMINNOW	8	43	21	6	78	0.352
BROOK SILVERSIDE	1	78	110	63	252	1.138
WHITE BASS	23	120	0	0	143	0.646
YELLOW BASS	0	0	0	0	0	0.000
GREEN SUNFISH	2	34	25	157	218	0.985
ORANGESPOTTED SUNFISH	6	57	102	75	240	1.084
BLUEGILL	0	23	85	218	326	1.472
UNID LEPOMIS	0	39	0	0	38	0.172
LARGEMOUTH BASS	1	62	27	0	90	0.406
WHITE CRAPPIE	0	0	16	0	16	0.072
BLACKSIDE DARTER	5	0	2	0	7	0.032
SLENDERHEAD DARTER	0	4	3	0	7	0.032
TOTAL CATCH	1492	3199	3319	14132	22142	100.000

1988 SANGAMON RIVER FISH SUMMARIES
ELECTROFISHING CATCHES PER 200 METERS OF SHORE - SEINE CATCHES PER 2 HAULS

GEAR=ELECTRO

MONTH JUN 88

	LOCATION											
	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B
	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS
SPECIES												
NO FISH	0	0	0	0	0	0	0	0	0	0	0	0
GIZZARD SHAD	325	193	297	653	0	0	1965	1720	579	124	465	775
COMMON CARP	0	0	0	2360	0	0	1200	890	1800	2800	2470	0
STRIPED SHINER	0	0	0	25	0	0	0	0	0	0	0	0
RED SHINER	15	30	20	15	0	0	1	0	6	35	19	22
SAND SHINER	2	0	1	2	0	0	0	0	0	0	0	0
BULLHEAD MINNOW	1	0	2	3	0	0	0	4	4	4	6	2
RIVER CARPSUCKER	852	1850	0	1175	0	0	935	540	3105	3825	0	650
QUILLBACK	285	55	50	125	0	0	0	0	675	1510	75	75
HIGHFIN CARPSUCKER	0	295	0	0	0	0	0	0	0	0	0	0
SMALLMOUTH BUFFALO	0	0	1360	3220	0	0	0	0	0	0	0	650
BIGMOUTH BUFFALO	0	0	1070	0	0	0	755	0	0	0	0	0
GOLDEN REDHORSE	0	0	0	0	0	0	0	0	1430	1040	0	0
CHANNEL CATFISH	488	845	22	303	0	0	0	0	0	330	0	90
FLATHEAD CATFISH	0	0	0	0	0	0	465	0	0	0	0	360
BLACKSTRIPE TOPMINNOW	0	0	0	0	0	0	0	4	0	0	0	0
BROOK SILVERSIDE	0	0	0	0	0	0	3	5	2	0	3	0
WHITE BASS	0	65	0	0	0	0	0	0	0	65	80	85
YELLOW BASS	125	0	168	0	0	0	339	0	100	65	0	0
GREEN SUNFISH	0	0	14	0	0	0	0	30	140	22	29	0
BLUEGILL	0	0	0	0	0	0	50	0	0	28	30	0
WALLEYE	0	0	0	3230	0	0	0	0	0	0	0	0
FRESHWATER DRUM	255	240	515	1397	0	0	410	535	1731	205	145	0
TOTAL CATCH	2348	3573	3519	12508	0	0	6123	3728	9572	10053	3322	2729

1988 SANGAMON RIVER FISH SUMMARIES
ELECTROFISHING CATCHES PER 200 METERS OF SHORE - SEINE CATCHES PER 2 HAULS

GEAR=ELECTRO

MONTH JUL 88

	LOCATION											
	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B
	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS
SPECIES												
LONGNOSE GAR	0	0	0	0	0	0	5	0	0	0	0	0
GIZZARD SHAD	835	0	170	220	340	105	180	285	3080	1830	170	215
CENTRAL STONEROLLER	0	0	0	4	0	0	0	0	0	0	0	0
COMMON CARP	0	0	445	6	1230	0	0	3	0	8925	1550	0
GOLDEN SHINER	0	0	0	0	0	0	0	3	0	0	0	0
EMERALD SHINER	0	0	0	0	0	0	0	0	2	5	0	0
RED SHINER	130	25	70	300	0	0	6	20	0	1	0	0
SAND SHINER	8	6	15	49	0	0	0	0	0	0	0	0
SUCKERMOUTH MINNOW	10	0	5	23	0	0	0	0	0	0	0	0
BLUNTNOSE MINNOW	0	0	2	0	0	0	0	0	0	0	0	0
BULLHEAD MINNOW	0	2	4	7	0	0	2	10	2	2	0	0
RIVER CARPSUCKER	0	500	0	0	0	0	0	0	580	4850	0	0
QUILLBACK	11	455	8	4	0	0	0	0	0	730	0	0
UNID CARPIODES	0	10	0	0	0	0	0	0	0	0	0	19
BLACK BUFFALO	0	0	0	0	0	0	0	0	0	3750	0	0
GOLDEN REDHORSE	0	0	395	0	0	0	0	0	0	1130	0	0
UNID ICTIOBINAE	2	0	0	0	0	0	0	0	0	0	0	0
CHANNEL CATFISH	499	1771	251	197	0	300	0	2385	150	0	0	0
FLATHEAD CATFISH	0	0	145	1040	0	35	0	150	0	0	0	0
BLACKSTRIPE TOPMINNOW	0	0	1	0	0	0	3	1	0	0	0	0
BROOK SILVERSIDE	0	0	1	0	0	0	0	0	0	0	0	0
WHITE BASS	0	0	0	65	0	0	0	0	0	0	0	0
YELLOW BASS	0	0	0	0	0	0	0	0	70	60	0	0
GREEN SUNFISH	24	51	371	25	285	119	239	309	0	0	40	35
ORANGESPOTTED SUNFISH	0	0	0	4	0	0	3	0	3	0	0	0
BLUEGILL	1	1	1	0	183	320	0	2	0	0	141	0
LARGEMOUTH BASS	3	0	0	1	115	1	90	8	0	0	0	0
FRESHWATER DRUM	250	0	0	130	0	0	0	0	545	50	330	0
TOTAL CATCH	1773	2821	1884	2075	2153	880	528	3176	4432	21333	2231	269

1988 SANGAMON RIVER FISH SUMMARIES
ELECTROFISHING CATCHES PER 200 METERS OF SHORE - SEINE CATCHES PER 2 HAULS

GEAR=ELECTRO

MONTH AUG 88

LOCATION

	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B
	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS
SPECIES												
GIZZARD SHAD	900	75	1910	920	2140	1600	1035	1385	5300	4015	1245	1560
COMMON CARP	2880	0	1040	0	8990	1250	0	610	0	3660	0	2850
HORNYHEAD CHUB	0	0	0	3	0	0	0	0	0	0	0	0
EMERALD SHINER	0	1	0	1	0	0	1	2	1	2	0	0
RED SHINER	275	185	125	440	4	4	4	12	6	2	4	15
SAND SHINER	25	40	30	100	0	0	0	0	0	0	0	0
SUCKERMOUTH MINNOW	0	7	0	110	0	0	0	0	0	0	0	0
BLUNTNOSE MINNOW	1	1	0	4	0	0	0	0	0	0	0	1
BULLHEAD MINNOW	25	10	10	35	3	13	4	15	17	5	10	20
CREEK CHUB	0	0	0	7	0	0	0	0	0	0	0	0
RIVER CARPSUCKER	32	100	445	450	2270	0	680	0	515	8470	580	1330
QUILLBACK	240	330	12	622	85	0	0	0	115	25	155	158
HIGHFIN CARPSUCKER	0	0	425	0	0	0	0	0	0	0	0	0
UNID CARPIODES	0	0	20	0	0	0	0	0	0	0	0	4
SMALLMOUTH BUFFALO	0	0	0	0	0	0	0	0	0	0	0	1200
BIGMOUTH BUFFALO	0	0	0	0	0	0	0	0	0	0	780	0
GOLDEN REDHORSE	0	0	400	0	0	0	0	0	0	0	0	0
CHANNEL CATFISH	3653	1960	995	1196	0	300	0	240	40	520	0	0
FLATHEAD CATFISH	0	0	150	656	55	0	0	0	0	275	0	0
BLACKSTRIPE TOPMINNOW	0	0	2	1	2	8	2	2	0	1	2	0
BROOK SILVERSIDE	0	0	0	0	0	1	1	5	1	3	0	0
WHITE BASS	300	0	0	85	0	70	60	0	0	90	0	0
YELLOW BASS	0	0	0	0	0	0	0	0	0	40	0	0
GREEN SUNFISH	120	140	415	265	490	315	135	384	15	60	0	0
ORANGESPOTTED SUNFISH	0	0	0	0	1	13	1	1	0	0	1	0
BLUEGILL	14	25	75	18	185	256	8	10	103	400	64	2
LARGEMOUTH BASS	261	0	31	44	193	22	19	28	0	0	40	0
WHITE CRAPPIE	0	0	0	0	3	0	0	0	0	350	0	0
BLACK CRAPPIE	0	0	0	0	0	0	0	0	0	75	0	0
SLENDERHEAD DARTER	0	1	0	2	0	0	0	0	0	0	0	0
WALLEYE	0	0	0	37	0	0	0	0	0	1340	0	0
FRESHWATER DRUM	755	0	0	545	355	435	0	140	730	940	0	0
TOTAL CATCH	9481	2875	6085	5541	14776	4287	1950	2834	6843	20273	2881	7140

1988 SANGAMON RIVER FISH SUMMARIES
ELECTROFISHING CATCHES PER 200 METERS OF SHORE - SEINE CATCHES PER 2 HAULS

GEAR=ELECTRO

MONTH NOV 88

	LOCATION									
	1A	1B	2A	2B	4A	4B	5A	5B	6A	6B
	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS
SPECIES										
GIZZARD SHAD	3521	620	34	358	4490	870	595	359	0	212
COMMON CARP	0	3990	5660	24930	4490	10330	12260	4350	3940	0
EMERALD SHINER	0	4	11	3	0	0	59	15	0	14
RED SHINER	34	54	21	28	9	5	135	19	1	2
SAND SHINER	2	0	0	0	0	0	11	1	0	0
BLUNTNOSE MINNOW	0	2	2	2	2	0	0	0	0	1
BULLHEAD MINNOW	8	31	17	16	4	11	121	30	2	20
RIVER CARPSUCKER	5919	25	19295	16310	14000	3930	522	5737	0	0
QUILLBACK	1455	1490	6948	8368	8703	1582	1754	3435	60	558
UNID CARPIODES	0	0	0	0	0	0	22	0	10	0
WHITE SUCKER	0	0	570	0	760	0	0	0	0	0
SMALLMOUTH BUFFALO	0	0	0	0	0	0	0	0	1130	0
BIGMOUTH BUFFALO	0	0	0	0	0	0	0	0	1390	0
GOLDEN REDHORSE	0	0	540	530	0	0	640	0	0	0
SHORTHEAD REDHORSE	0	0	0	0	0	0	0	19	0	0
CHANNEL CATFISH	1575	850	9540	7955	0	130	1690	795	0	250
FLATHEAD CATFISH	0	0	410	0	60	0	0	0	0	0
BROOK SILVERSIDE	2	0	0	0	22	0	9	9	3	3
WHITE BASS	0	0	0	0	0	0	0	0	0	175
YELLOW BASS	0	0	0	0	0	60	12	0	0	0
GREEN SUNFISH	0	2	9	14	119	181	60	113	17	0
ORANGESPOTTED SUNFISH	0	0	0	0	0	0	0	0	2	0
BLUEGILL	4	0	6	0	0	0	21	276	348	188
LARGEMOUTH BASS	0	0	0	0	16	0	0	0	800	0
WHITE CRAPPIE	0	0	65	0	140	0	0	0	260	0
FRESHWATER DRUM	1605	0	1850	1790	710	1860	3070	520	0	0
TOTAL CATCH	14125	7068	44978	60304	33525	18959	20981	15678	7963	1423

1988 SANGAMON RIVER FISH SUMMARIES
ELECTROFISHING CATCHES PER 200 METERS OF SHORE - SEINE CATCHES PER 2 HAULS

GEAR=SEINE

MONTH JUN 88

	LOCATION											
	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B
	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS
SPECIES												
GIZZARD SHAD	0	32	0	0	0	0	0	0	11	0	0	0
STRIPED SHINER	0	2	0	0	0	0	0	0	0	0	0	0
RED SHINER	35	63	115	160	0	6	5	0	120	110	115	295
SAND SHINER	14	20	55	19	0	0	0	0	0	48	1	2
SUCKERMOUTH MINNOW	0	0	1	0	0	0	0	0	0	1	0	0
BULLHEAD MINNOW	2	0	40	30	0	21	4	2	2	2	7	30
CREEK CHUB	0	0	0	1	0	0	0	0	0	0	0	0
RIVER CARPSUCKER	0	0	15	0	0	0	0	0	0	0	0	0
UNID ICTIOBINAE	1	0	10	10	0	0	0	0	4	8	20	4
TADPOLE MADTOM	0	0	0	0	0	0	3	0	0	0	0	0
BLACKSTRIPE TOPMINNOW	0	0	0	0	3	0	0	0	3	2	0	0
BROOK SILVERSIDE	0	0	0	0	0	0	0	0	1	0	0	0
WHITE BASS	0	0	23	0	0	0	0	0	0	0	0	0
GREEN SUNFISH	0	0	0	0	0	0	0	0	2	0	0	0
ORANGESPOTTED SUNFISH	0	0	0	0	0	6	0	0	0	0	0	0
LARGEMOUTH BASS	0	0	0	0	0	0	0	0	0	0	1	0
BLACKSIDE DARTER	0	0	0	0	0	0	0	0	0	5	0	0
TOTAL CATCH	52	117	259	220	3	33	12	2	143	176	144	331

1988 SANGAMON RIVER FISH SUMMARIES
ELECTROFISHING CATCHES PER 200 METERS OF SHORE - SEINE CATCHES PER 2 HAULS

GEAR=SEINE

MONTH JUL 88

	LOCATION											
	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B
	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS	TOTAL GRAMS
SPECIES												
LONGNOSE GAR	0	0	0	0	0	0	0	0	0	0	0	0
GIZZARD SHAD	0	0	0	0	0	2	5	1	0	0	0	20
COMMON CARP	0	0	0	0	24	0	0	0	4	0	25	20
HORNYHEAD CHUB	0	0	0	1	0	0	0	0	0	0	0	0
EMERALD SHINER	0	0	0	1	0	0	0	0	0	0	0	0
STRIPED SHINER	0	0	0	0	0	0	0	0	0	1	0	0
BIGMOUTH SHINER	0	1	0	0	0	0	0	0	0	0	0	0
RED SHINER	200	210	85	600	0	1	2	2	30	100	7	3
SAND SHINER	210	130	38	70	0	0	0	0	10	20	16	2
REDFIN SHINER	0	0	0	0	1	0	0	0	0	0	0	0
UNID NOTROPIS	0	0	0	1	0	0	0	0	0	0	0	0
SUCKERMOUTH MINNOW	0	0	1	1	0	0	0	0	1	1	0	0
BLUNTNOSE MINNOW	0	1	1	2	0	0	0	0	1	3	1	0
BULLHEAD MINNOW	1	4	24	25	2	5	9	4	80	30	15	40
CREEK CHUB	0	3	0	2	0	0	0	0	0	0	0	0
QUILLBACK	0	13	0	0	0	0	0	0	8	10	12	10
UNID CARPIODES	29	75	0	0	0	0	0	0	40	300	0	6
GOLDEN REDHORSE	0	0	0	0	0	0	0	0	0	0	0	0
SHORTHEAD REDHORSE	0	0	0	0	2	0	0	0	0	0	0	0
UNID ICTIOBINAE	0	0	14	0	0	0	0	0	0	0	0	0
CHANNEL CATFISH	7	106	0	2	0	0	0	0	0	0	6	0
BLACKSTRIPE TOPMINNOW	0	0	1	0	1	1	5	0	25	10	0	0
BROOK SILVERSIDE	1	1	7	4	1	2	2	0	25	30	4	1
WHITE BASS	0	0	0	120	0	0	0	0	0	0	0	0
YELLOW BASS	0	0	0	0	0	0	0	0	0	0	0	0
GREEN SUNFISH	0	0	0	0	30	1	0	0	1	2	0	0
ORANGESPOTTED SUNFISH	0	0	0	0	10	0	20	7	0	0	10	10
BLUEGILL	0	0	1	2	5	5	10	0	0	0	0	0
UNID LEPOMIS	0	0	0	0	0	0	0	0	30	6	0	2
LARGEMOUTH BASS	0	0	3	1	10	15	15	0	10	8	0	0
SLENDERHEAD DARTER	0	0	0	0	0	0	0	0	2	0	1	1
TOTAL CATCH	448	544	175	832	86	32	68	14	267	521	97	115

1988 SANGAMON RIVER FISH SUMMARIES
ELECTROFISHING CATCHES PER 200 METERS OF SHORE - SEINE CATCHES PER 2 HAULS

GEAR=SEINE

MONTH AUG 88

	LOCATION											
	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B
	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL
	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS
SPECIES												
GIZZARD SHAD	0	0	11	0	20	15	0	0	0	0	0	0
HORNYHEAD CHUB	4	0	0	2	0	0	0	0	0	0	0	0
EMERALD SHINER	0	1	0	0	1	0	0	0	0	0	0	0
STRIPED SHINER	0	2	0	1	0	0	0	0	0	0	0	0
BIGMOUTH SHINER	1	2	0	0	0	0	0	0	0	0	0	0
RED SHINER	500	180	120	200	5	10	2	2	90	80	200	2
SAND SHINER	100	40	65	5	0	0	0	0	20	0	1	0
SPOTFIN X RED SHINER	1	0	0	0	0	0	0	0	0	0	0	0
BLUNTNOSE MINNOW	15	1	1	0	0	0	0	0	0	1	1	35
BULLHEAD MINNOW	35	8	90	1	5	35	2	4	125	120	300	160
CREEK CHUB	20	3	0	0	0	0	0	0	0	0	0	0
QUILLBACK	30	6	0	0	0	0	0	0	19	87	0	50
UNID CARPIODES	20	5	0	0	0	0	0	0	0	0	20	0
CHANNEL CATFISH	0	29	0	0	0	10	0	0	0	0	3	1
TADPOLE MADTOM	0	0	0	0	3	0	0	0	0	0	0	0
BLACKSTRIPE TOPMINNOW	0	0	0	0	0	6	0	1	11	1	1	1
BROOK SILVERSIDE	2	0	20	0	10	1	2	4	11	50	10	0
GREEN SUNFISH	0	0	0	0	2	1	5	3	1	3	9	1
ORANGESPOTTED SUNFISH	1	0	4	0	30	10	10	10	20	5	0	12
BLUEGILL	12	0	1	0	15	15	1	1	20	6	0	14
LARGEMOUTH BASS	8	0	0	9	0	10	0	0	0	0	0	0
WHITE CRAPPIE	0	0	0	0	15	1	0	0	0	0	0	0
BLACKSIDE DARTER	0	0	0	0	0	0	0	0	0	0	0	2
SLENDERHEAD DARTER	0	0	0	2	0	0	0	0	0	0	0	1
TOTAL CATCH	749	277	312	220	106	114	22	25	317	353	545	279

1988 SANGAMON RIVER FISH SUMMARIES
ELECTROFISHING CATCHES PER 200 METERS OF SHORE - SEINE CATCHES PER 2 HAULS

GEAR=SEINE

MONTH NOV 88

LOCATION

	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B
	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL
	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS	GRAMS
SPECIES												
HORNYHEAD CHUB	0	3	0	0	0	0	0	0	0	0	0	0
EMERALD SHINER	0	0	41	30	0	0	0	0	87	10	15	18
STRIPED SHINER	0	2	0	3	0	0	0	0	0	0	0	0
RED SHINER	715	605	1940	2970	220	500	21	65	370	1420	64	139
SAND SHINER	260	215	245	350	5	2	0	0	14	97	0	7
SUCKERMOUTH MINNOW	0	0	0	20	0	0	0	0	0	0	0	0
BLUNTNOSE MINNOW	0	4	2	12	0	0	0	0	2	7	0	0
BULLHEAD MINNOW	55	22	725	285	23	6	16	21	131	1300	109	47
RIVER CARPSUCKER	0	0	0	13	0	0	0	0	9	0	0	8
QUILLBACK	0	0	0	0	0	0	240	0	0	0	0	0
GOLDEN REDHORSE	0	0	0	3	0	0	110	0	0	0	0	0
UNID ICTIOBINAE	0	0	0	0	0	0	0	0	0	0	0	5
CHANNEL CATFISH	0	0	0	0	0	0	0	0	4	1	0	0
BLACKSTRIPE TOPMINNOW	0	0	0	0	1	1	2	2	0	0	0	0
BROOK SILVERSIDE	0	0	4	5	2	0	8	0	14	0	27	3
GREEN SUNFISH	0	0	8	12	25	2	43	8	9	29	11	10
ORANGESPOTTED SUNFISH	0	0	0	0	0	0	9	0	64	2	0	0
BLUEGILL	0	0	10	7	107	1	5	0	47	4	26	11
TOTAL CATCH	1030	851	2975	3710	383	512	454	96	751	2870	252	248

1988 SANGAMON RIVER FISH SUMMARIES
SUMMARY OF MONTHLY AND ANNUAL CATCHES

GEAR=SEINE

	MONTH					
	JUN 88	JUL 88	AUG 88	NOV 88	ANNUAL TOTAL	
	NUMBER	NUMBER	NUMBER	NUMBER	NUMBER	
	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	PERCENT
SPECIES						
LONGNOSE GAR	0	1	0	0	1	0.004
GIZZARD SHAD	2	53	5	0	60	0.264
COMMON CARP	0	27	0	0	27	0.119
HORNYHEAD CHUB	0	2	3	1	6	0.026
EMERALD SHINER	0	1	2	69	72	0.317
STRIPED SHINER	1	1	2	2	6	0.026
BIGMOUTH SHINER	0	1	2	0	3	0.013
RED SHINER	933	1160	2047	9374	13514	59.562
SAND SHINER	112	387	211	987	1697	7.479
REDFIN SHINER	0	1	0	0	1	0.004
SPOTFIN X RED SHINER	0	0	1	0	1	0.004
UNID NOTROPIS	0	-1	0	0	1	0.004
SUCKERMOUTH MINNOW	5	4	0	3	12	0.053
BLUNTNOSE MINNOW	0	15	37	13	65	0.286
BULLHEAD MINNOW	116	408	1419	3275	5218	22.998
CREEK CHUB	1	4	8	0	13	0.057
RIVER CARPSUCKER	1	0	0	3	4	0.018
QUILLBACK	0	8	14	1	23	0.101
UNID CARPIODES	0	214	19	0	233	1.027
GOLDEN REDHORSE	0	1	0	2	3	0.013
SHORTHEAD REDHORSE	0	1	0	0	1	0.004
UNID ICTIOBINAE	159	505	0	1	665	2.931
CHANNEL CATFISH	0	18	10	2	30	0.132
TADPOLE MADTOM	1	0	1	0	2	0.009
BLACKSTRIPE TOPMINNOW	5	64	26	5	100	0.441
BROOK SILVERSIDE	1	165	112	37	315	1.388
WHITE BASS	1	1	0	0	2	0.009
YELLOW BASS	0	1	0	0	1	0.004
GREEN SUNFISH	2	7	21	28	58	0.256
ORANGESPOTTED SUNFISH	2	12	83	19	116	0.511
BLUEGILL	0	62	120	107	289	1.274
UNID LEPOMIS	0	102	0	0	102	0.450
LARGEMOUTH BASS	1	27	5	0	33	0.145
WHITE CRAPPIE	0	0	8	0	8	0.035
BLACKSIDE DARTER	1	0	1	0	2	0.009
SLENDERHEAD DARTER	0	3	2	0	5	0.022
TOTAL CATCH	1344	3257	4159	13929	22689	100.000

1988 SANGAMON RIVER FISH SUMMARIES
SUMMARY OF MONTHLY AND ANNUAL CATCHES

GEAR=ELECTRO

MONTH

	JUN 88	JUL 88	AUG 88	NOV 88	ANNUAL TOTAL	
	NUMBER	NUMBER	NUMBER	NUMBER	NUMBER	
	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	PERCENT
SPECIES						
LONGNOSE GAR	0	2	0	0	2	0.041
GIZZARD SHAD	119	66	235	77	497	10.260
CENTRAL STONEROLLER	0	3	0	0	3	0.062
COMMON CARP	8	14	13	39	74	1.528
HORNYHEAD CHUB	0	0	2	0	2	0.041
GOLDEN SHINER	0	1	0	0	1	0.021
EMERALD SHINER	0	9	8	40	57	1.177
STRIPED SHINER	1	0	0	0	1	0.021
RED SHINER	109	327	1153	311	1900	39.224
SAND SHINER	5	52	190	14	261	5.388
SUCKERMOUTH MINNOW	0	16	28	0	44	0.908
BLUNTNOSE MINNOW	0	2	7	5	14	0.289
BULLHEAD MINNOW	19	19	248	197	483	9.971
CREEK CHUB	0	0	2	0	2	0.041
RIVER CARPSUCKER	26	12	39	127	204	4.211
QUILLBACK	11	9	52	98	170	3.509
HIGHFIN CARPSUCKER	1	0	1	0	2	0.041
UNID CARPIODES	0	8	4	3	15	0.310
WHITE SUCKER	0	0	0	3	3	0.062
SMALLMOUTH BUFFALO	4	0	2	1	7	0.145
BIGMOUTH BUFFALO	3	0	1	1	5	0.103
BLACK BUFFALO	0	1	0	0	1	0.021
GOLDEN REDHORSE	4	3	1	3	11	0.227
SHORTHEAD REDHORSE	0	0	0	1	1	0.021
UNID ICTIOBINAE	0	3	0	0	3	0.062
CHANNEL CATFISH	26	39	82	80	227	4.686
FLATHEAD CATFISH	3	8	8	2	21	0.434
BLACKSTRIPE TOPMINNOW	2	5	23	0	30	0.619
BROOK SILVERSIDE	6	1	16	32	55	1.135
WHITE BASS	4	1	7	1	13	0.268
YELLOW BASS	16	2	1	2	21	0.434
GREEN SUNFISH	11	59	150	16	236	4.872
ORANGESPOTTED SUNFISH	0	3	6	2	11	0.227
BLUEGILL	3	17	246	39	305	6.296
LARGEMOUTH BASS	0	20	32	3	55	1.135
WHITE CRAPPIE	0	0	4	3	7	0.145
BLACK CRAPPIE	0	0	1	0	1	0.021
SLENDERHEAD DARTER	0	0	3	0	3	0.062
WALLEYE	2	0	2	0	4	0.083
FRESHWATER DRUM	30	6	18	38	92	1.899
TOTAL CATCH	413	708	2585	1138	4844	100.000

1988 SANGAMON RIVER FISH SUMMARIES
ELECTROFISHING CATCHES PER 200 METERS OF SHORE - SEINE CATCHES PER 2 HAULS

GEAR=ELECTRO

MONTH JUN 88

	LOCATION											
	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B
	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER
SPECIES												
NO FISH	0	0	0	0	0	0	0	0	0	0	0	0
GIZZARD SHAD	8	6	6	14	0	0	16	16	17	5	14	17
COMMON CARP	0	0	0	1	0	0	1	1	2	2	1	0
STRIPED SHINER	0	0	0	1	0	0	0	0	0	0	0	0
RED SHINER	8	16	11	11	0	0	1	0	6	15	19	22
SAND SHINER	2	0	1	2	0	0	0	0	0	0	0	0
BULLHEAD MINNOW	1	0	2	2	0	0	0	2	4	2	5	1
RIVER CARPSUCKER	3	4	0	2	0	0	2	2	5	7	0	1
QUILLBACK	1	1	1	2	0	0	0	0	1	2	1	2
HIGHFIN CARPSUCKER	0	1	0	0	0	0	0	0	0	0	0	0
SMALLMOUTH BUFFALO	0	0	1	2	0	0	0	0	0	0	0	1
BIGMOUTH BUFFALO	0	0	2	0	0	0	1	0	0	0	0	0
GOLDEN REDHORSE	0	0	0	0	0	0	0	0	3	1	0	0
CHANNEL CATFISH	7	7	2	7	0	0	0	0	0	2	0	1
FLATHEAD CATFISH	0	0	0	0	0	0	1	0	0	0	1	1
BLACKSTRIPE TOPMINNOW	0	0	0	0	0	0	0	2	0	0	0	0
BROOK SILVERSIDE	0	0	0	0	0	0	1	3	1	0	1	0
WHITE BASS	0	1	0	0	0	0	0	0	0	1	1	1
YELLOW BASS	2	0	2	0	0	0	8	0	3	1	0	0
GREEN SUNFISH	0	0	3	0	0	0	0	2	3	1	2	0
BLUEGILL	0	0	0	0	0	0	1	0	0	1	1	0
WALLEYE	0	0	0	2	0	0	0	0	0	0	0	0
FRESHWATER DRUM	2	2	4	6	0	0	2	3	8	2	1	0
TOTAL CATCH	34	38	35	52	0	0	34	31	53	42	47	47

1988 SANGAMON RIVER FISH SUMMARIES
ELECTROFISHING CATCHES PER 200 METERS OF SHORE - SEINE CATCHES PER 2 HAULS

GEAR=ELECTRO

MONTH JUL 88

	LOCATION											
	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B
	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER
SPECIES												
LONGNOSE GAR	0	0	0	0	0	0	1	0	0	0	1	0
GIZZARD SHAD	10	0	2	3	3	1	2	2	24	16	1	2
CENTRAL STONEROLLER	0	0	0	3	0	0	0	0	0	0	0	0
COMMON CARP	0	0	1	1	2	0	1	1	0	6	2	0
GOLDEN SHINER	0	0	0	0	0	0	0	1	0	0	0	0
EMERALD SHINER	0	0	0	0	0	0	0	0	1	8	0	0
RED SHINER	55	21	55	163	0	0	4	28	0	1	0	0
SAND SHINER	5	6	15	26	0	0	0	0	0	0	0	0
SUCKERMOUTH MINNOW	1	0	3	12	0	0	0	0	0	0	0	0
BLUNTNOSE MINNOW	0	0	2	0	0	0	0	0	0	0	0	0
BULLHEAD MINNOW	0	1	3	3	0	0	2	6	3	1	0	0
RIVER CARPSUCKER	0	1	0	0	0	0	0	0	2	9	0	0
QUILLBACK	3	1	2	1	0	0	0	0	0	2	0	0
UNID CARPIODES	0	3	0	0	0	0	0	0	0	0	0	5
BLACK BUFFALO	0	0	0	0	0	0	0	0	0	1	0	0
GOLDEN REDHORSE	0	0	1	0	0	0	0	0	0	2	0	0
UNID ICTIOBINAE	3	0	0	0	0	0	0	0	0	0	0	0
CHANNEL CATFISH	4	10	3	12	0	1	0	8	1	0	0	0
FLATHEAD CATFISH	0	0	2	4	0	1	0	1	0	0	0	0
BLACKSTRIPE TOPMINNOW	0	0	1	0	0	0	3	1	0	0	0	0
BROOK SILVERSIDE	0	0	1	0	0	0	0	0	0	0	0	0
WHITE BASS	0	0	0	1	0	0	0	0	0	0	0	0
YELLOW BASS	0	0	0	0	0	0	0	0	1	1	0	0
GREEN SUNFISH	3	2	16	2	8	5	8	12	0	0	2	1
ORANGESPOTTED SUNFISH	0	0	0	1	0	0	1	0	1	0	0	0
BLUEGILL	1	1	3	0	3	4	0	2	0	0	3	0
LARGEMOUTH BASS	1	0	0	1	4	1	7	6	0	0	0	0
FRESHWATER DRUM	1	0	0	1	0	0	0	0	2	1	1	0
TOTAL CATCH	87	46	110	234	20	13	29	68	35	48	10	8

1988 SANGAMON RIVER FISH SUMMARIES
ELECTROFISHING CATCHES PER 200 METERS OF SHORE - SEINE CATCHES PER 2 HAULS

GEAR=ELECTRO

MONTH AUG 88

	LOCATION											
	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B
	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER
SPECIES												
BIZZARD SHAD	9	3	25	16	24	20	7	12	35	30	25	28
COMMON CARP	2	0	1	0	5	1	0	1	0	2	0	1
HORNYHEAD CHUB	0	0	0	2	0	0	0	0	0	0	0	0
EMERALD SHINER	0	1	0	1	0	0	1	2	1	2	0	0
RED SHINER	311	219	156	380	6	5	7	23	11	2	8	25
SAND SHINER	19	26	34	111	0	0	0	0	0	0	0	0
SUCKERMOUTH MINNOW	0	1	0	27	0	0	0	0	0	0	0	0
BLUNTNOSE MINNOW	1	1	0	4	0	0	0	0	0	0	0	1
BULLHEAD MINNOW	26	16	13	44	4	18	7	26	29	7	20	38
CREEK CHUB	0	0	0	2	0	0	0	0	0	0	0	0
RIVER CARPSUCKER	2	8	1	1	4	0	1	0	1	18	1	2
QUILLBACK	10	15	1	3	1	0	0	0	5	1	7	9
HIGHFIN CARPSUCKER	0	0	1	0	0	0	0	0	0	0	0	0
UNID CARPIODES	0	0	3	0	0	0	0	0	0	0	0	1
SMALLMOUTH BUFFALO	0	0	0	0	0	0	0	0	0	1	0	1
BIGMOUTH BUFFALO	0	0	0	0	0	0	0	0	0	0	1	0
GOLDEN REDHORSE	0	0	1	0	0	0	0	0	0	0	0	0
CHANNEL CATFISH	33	28	3	13	0	1	0	1	1	2	0	0
FLATHEAD CATFISH	0	0	1	5	1	0	0	0	0	1	0	0
BLACKSTRIPE TOPMINNOW	0	0	2	1	3	9	3	2	0	1	2	0
BROOK SILVERSIDE	0	0	0	0	0	1	2	8	2	3	0	0
WHITE BASS	3	0	0	1	0	1	1	0	0	1	0	0
YELLOW BASS	0	0	0	0	0	0	0	0	0	1	0	0
GREEN SUNFISH	14	7	31	18	27	19	10	21	1	2	0	0
ORANGESPOTTED SUNFISH	0	0	0	0	1	1	1	1	0	0	2	0
BLUEGILL	7	10	22	7	54	88	16	19	4	10	8	1
LARGEMOUTH BASS	4	0	3	3	9	4	3	5	0	0	1	0
WHITE CRAPPIE	0	0	0	0	1	0	0	0	0	3	0	0
BLACK CRAPPIE	0	0	0	0	0	0	0	0	0	1	0	0
SLENDERHEAD DARTER	0	1	0	2	0	0	0	0	0	0	0	0
WALLEYE	0	0	0	1	0	0	0	0	0	1	0	0
FRESHWATER DRUM	4	0	0	3	2	2	0	1	2	4	0	0
TOTAL CATCH	445	336	298	645	142	170	59	122	93	93	75	107

1988 SANGAMON RIVER FISH SUMMARIES
ELECTROFISHING CATCHES PER 200 METERS OF SHORE - SEINE CATCHES PER 2 HAULS

GEAR=ELECTRO

MONTH NOV 88

	LOCATION									
	1A	1B	2A	2B	4A	4B	5A	5B	6A	6B
	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER
SPECIES										
GIZZARD SHAD	20	4	1	10	24	5	4	5	0	4
COMMON CARP	0	2	4	15	3	6	4	3	2	0
EMERALD SHINER	0	1	3	1	0	0	22	5	0	8
RED SHINER	44	40	16	20	9	4	130	46	1	1
SAND SHINER	2	0	0	0	0	0	11	1	0	0
BLUNTNOSE MINNOW	0	1	1	1	1	0	0	0	0	1
BULLHEAD MINNOW	6	22	13	10	3	6	65	28	3	41
RIVER CARPSUCKER	12	2	38	28	23	7	5	12	0	0
QUILLBACK	5	3	20	19	16	7	13	12	1	2
UNID CARPIODES	0	0	0	0	0	0	2	0	1	0
WHITE SUCKER	0	0	1	0	2	0	0	0	0	0
SMALLMOUTH BUFFALO	0	0	0	0	0	0	0	0	1	0
BIGMOUTH BUFFALO	0	0	0	0	0	0	0	0	1	0
GOLDEN REDHORSE	0	0	1	1	0	0	1	0	0	0
SHORTHEAD REDHORSE	0	0	0	0	0	0	0	1	0	0
CHANNEL CATFISH	9	2	33	26	0	1	5	3	0	1
FLATHEAD CATFISH	0	0	1	0	1	0	0	0	0	0
BROOK SILVERSIDE	1	0	0	0	12	0	6	6	3	4
WHITE BASS	0	0	0	0	0	0	0	0	0	1
YELLOW BASS	0	0	0	0	0	1	1	0	0	0
GREEN SUNFISH	0	1	1	2	3	4	2	2	1	0
ORANGESPOTTED SUNFISH	0	0	0	0	0	0	0	0	2	0
BLUEGILL	2	0	1	0	0	0	6	9	15	6
LARGEMOUTH BASS	0	0	0	0	1	0	0	0	2	0
WHITE CRAPPIE	0	0	1	0	1	0	0	0	1	0
FRESHWATER DRUM	6	0	6	5	3	9	7	2	0	0
TOTAL CATCH	107	78	141	138	102	50	284	135	34	69

1988 SANGAMON RIVER FISH SUMMARIES
ELECTROFISHING CATCHES PER 200 METERS OF SHORE - SEINE CATCHES PER 2 HAULS

GEAR=SEINE

MONTH JUN 88

	LOCATION											
	1A TOTAL NUMBER	1B TOTAL NUMBER	2A TOTAL NUMBER	2B TOTAL NUMBER	3A TOTAL NUMBER	3B TOTAL NUMBER	4A TOTAL NUMBER	4B TOTAL NUMBER	5A TOTAL NUMBER	5B TOTAL NUMBER	6A TOTAL NUMBER	6B TOTAL NUMBER
SPECIES												
GIZZARD SHAD	0	1	0	0	0	0	0	0	1	0	0	0
STRIPED SHINER	0	1	0	0	0	0	0	0	0	0	0	0
RED SHINER	39	42	135	115	0	3	4	0	130	135	82	248
SAND SHINER	15	14	37	12	0	0	0	0	0	31	1	2
SUCKERMOUTH MINNOW	0	0	3	0	0	0	0	0	0	2	0	0
BULLHEAD MINNOW	1	0	29	19	0	15	3	2	2	3	13	29
CREEK CHUB	0	0	0	1	0	0	0	0	0	0	0	0
RIVER CARPSUCKER	0	0	1	0	0	0	0	0	0	0	0	0
UNID ICTIOBINAE	1	0	28	28	0	0	0	0	9	20	65	8
TADPOLE MADTOM	0	0	0	0	0	0	1	0	0	0	0	0
BLACKSTRIPE TOPMINNOW	0	0	0	0	2	0	0	0	2	1	0	0
BROOK SILVERSIDE	0	0	0	0	0	0	0	0	1	0	0	0
WHITE BASS	0	0	1	0	0	0	0	0	0	0	0	0
GREEN SUNFISH	0	0	0	0	0	0	0	0	2	0	0	0
ORANGESPOTTED SUNFISH	0	0	0	0	0	2	0	0	0	0	0	0
LARGEMOUTH BASS	0	0	0	0	0	0	0	0	0	0	1	0
BLACKSIDE DARTER	0	0	0	0	0	0	0	0	0	1	0	0
TOTAL CATCH	56	58	234	175	2	20	8	2	147	193	162	287

1988 SANGAMON RIVER FISH SUMMARIES
ELECTROFISHING CATCHES PER 200 METERS OF SHORE - SEINE CATCHES PER 2 HAULS

GEAR=SEINE

MONTH JUL 88

	LOCATION											
	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B
	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER
SPECIES												
LONGNOSE GAR	0	0	0	0	0	0	0	0	0	0	1	0
GIZZARD SHAD	0	0	0	0	0	2	5	1	0	0	0	45
COMMON CARP	0	0	0	0	5	0	0	0	1	0	11	10
HORNYHEAD CHUB	0	0	0	2	0	0	0	0	0	0	0	0
EMERALD SHINER	0	0	0	1	0	0	0	0	0	0	0	0
STRIPED SHINER	0	0	0	0	0	0	0	0	0	1	0	0
BIGMOUTH SHINER	0	1	0	0	0	0	0	0	0	0	0	0
RED SHINER	290	195	105	424	0	1	2	1	39	90	8	5
SAND SHINER	131	65	57	59	0	0	0	0	15	28	30	2
REDFIN SHINER	0	0	0	0	1	0	0	0	0	0	0	0
UNID NOTROPIS	0	0	0	1	0	0	0	0	0	0	0	0
SUCKERMOUTH MINNOW	0	0	1	1	0	0	0	0	1	1	0	0
BLUNTNOSE MINNOW	0	1	2	4	0	0	0	0	1	5	2	0
BULLHEAD MINNOW	2	2	23	21	1	10	9	2	200	41	22	75
CREEK CHUB	0	2	0	2	0	0	0	0	0	0	0	0
QUILLBACK	0	1	0	0	0	0	0	0	1	2	1	3
UNID CARPIODES	15	33	0	20	0	0	0	0	15	125	0	6
GOLDEN REDHORSE	0	0	0	0	0	0	0	1	0	0	0	0
SHORTHEAD REDHORSE	0	0	0	0	1	0	0	0	0	0	0	0
UNID ICTIOBINAE	0	0	5	0	0	0	0	0	0	0	500	0
CHANNEL CATFISH	9	3	0	1	0	0	0	0	0	0	5	0
BLACKSTRIPE TOPMINNOW	0	0	1	0	1	1	2	0	43	16	0	0
BROOK SILVERSIDE	2	1	13	7	1	7	3	0	65	57	7	2
WHITE BASS	0	0	0	1	0	0	0	0	0	0	0	0
YELLOW BASS	0	0	0	0	0	0	0	1	0	0	0	0
GREEN SUNFISH	0	0	0	0	1	1	0	0	2	3	0	0
ORANGESPOTTED SUNFISH	0	0	0	0	1	0	3	6	0	0	1	1
BLUEGILL	0	0	2	4	30	25	1	0	0	0	0	0
UNID LEPOMIS	0	0	0	0	0	0	0	0	81	15	0	6
LARGEMOUTH BASS	0	0	3	1	4	5	10	0	1	3	0	0
SLENDERHEAD DARTER	0	0	0	0	0	0	0	0	1	0	1	1
TOTAL CATCH	449	304	212	549	46	52	35	12	466	387	589	156

* * * * * 1988 SANGAMON RIVER FISH SUMMARIES

ELECTROFISHING CATCHES PER 200 METERS OF SHORE - SEINE CATCHES PER 2 HAULS

GEAR=SEINE

MONTH AUG 88

	LOCATION											
	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B
	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER
SPECIES												
GIZZARD SHAD	0	0	1	0	2	2	0	0	0	0	0	0
HORNYHEAD CHUB	2	0	0	1	0	0	0	0	0	0	0	0
EMERALD SHINER	0	1	0	0	1	0	0	0	0	0	0	0
STRIPED SHINER	0	1	0	1	0	0	0	0	0	0	0	0
BIGMOUTH SHINER	1	1	0	0	0	0	0	0	0	0	0	0
RED SHINER	550	200	190	250	5	12	2	2	150	183	500	3
SAND SHINER	73	32	75	3	0	0	0	0	27	0	1	0
SPOTFIN X RED SHINER	1	0	0	0	0	0	0	0	0	0	0	0
BLUNTNOSE MINNOW	7	1	2	0	0	0	0	0	0	1	1	25
BULLHEAD MINNOW	29	11	103	2	5	41	3	5	200	210	600	210
CREEK CHUB	7	1	0	0	0	0	0	0	0	0	0	0
QUILLBACK	2	2	0	0	0	0	0	0	1	4	0	5
UNID CARPIODES	8	2	0	0	0	0	0	0	0	0	9	0
CHANNEL CATFISH	0	6	0	0	0	1	0	0	0	0	2	1
TADPOLE MADTOM	0	0	0	0	1	0	0	0	0	0	0	0
BLACKSTRIPE TOPMINNOW	0	0	0	0	0	8	0	1	13	1	1	2
BROOK SILVERSIDE	2	0	33	0	10	1	3	5	11	39	8	0
GREEN SUNFISH	0	0	0	0	2	1	1	2	1	1	12	1
ORANGESPOTTED SUNFISH	1	0	3	0	8	4	2	2	35	6	0	22
BLUEGILL	8	0	1	0	22	23	1	1	33	8	0	23
LARGEMOUTH BASS	1	0	0	1	0	3	0	0	0	0	0	0
WHITE CRAPPIE	0	0	0	0	7	1	0	0	0	0	0	0
BLACKSIDE DARTER	0	0	0	0	0	0	0	0	0	0	0	1
SLENDERHEAD DARTER	0	0	0	1	0	0	0	0	0	0	0	1
TOTAL CATCH	692	258	408	259	63	97	12	18	471	453	1134	294

1988 SANGAMON RIVER FISH SUMMARIES
ELECTROFISHING CATCHES PER 200 METERS OF SHORE - SEINE CATCHES PER 2 HAULS

GEAR=SEINE

MONTH NOV 88

	LOCATION											
	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B
SPECIES	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER	TOTAL NUMBER
HORNYHEAD CHUB	0	1	0	0	0	0	0	0	0	0	0	0
EMERALD SHINER	0	0	14	9	0	0	0	0	31	4	5	6
STRIPED SHINER	0	1	0	1	0	0	0	0	0	0	0	0
RED SHINER	476	600	1950	2500	225	400	15	98	600	2100	160	250
SAND SHINER	250	200	163	265	5	2	0	0	19	75	0	8
SUCKERMOUTH MINNOW	0	0	0	3	0	0	0	0	0	0	0	0
BLUNTNOSE MINNOW	0	2	1	5	0	0	0	0	1	4	0	0
BULLHEAD MINNOW	47	23	1350	225	23	9	16	16	100	1300	120	46
RIVER CARPSUCKER	0	0	0	1	0	0	0	0	1	0	0	1
QUILLBACK	0	0	0	0	0	0	1	0	0	0	0	0
GOLDEN REDHORSE	0	0	0	1	0	0	1	0	0	0	0	0
UNID ICTIOBINAE	0	0	0	0	0	0	0	0	0	0	0	1
CHANNEL CATFISH	0	0	0	0	0	0	0	0	1	1	0	0
BLACKSTRIPE TOPMINNOW	0	0	0	0	1	2	1	1	0	0	0	0
BROOK SILVERSIDE	0	0	3	3	1	0	5	0	10	0	14	1
GREEN SUNFISH	0	0	3	2	5	1	6	2	3	1	4	1
ORANGESPOTTED SUNFISH	0	0	0	0	0	0	3	0	15	1	0	0
BLUEGILL	0	0	8	3	61	1	2	0	19	1	9	3
TOTAL CATCH	773	827	3492	3018	321	415	50	117	800	3487	312	317

APPENDIX C

NPDES PERMIT FOR CWLP

State of Illinois
ENVIRONMENTAL PROTECTION AGENCY

Mary A. Gade, Director
2200 Churchill Road, Springfield, IL 62794-9276

217/782-0610

September 29, 1993

RECEIVED

OCT 01 1993

ENVIRONMENTAL HEALTH & SAFETY

City of Springfield
Office of Public Utilities
City Water, Light and Power
Environmental Affairs
7th and Monroe Streets
Springfield, Illinois 62757

Re: City of Springfield, Office of Public Utilities
City Water, Light and Power
NPDES Permit No. IL0024767
Modification of NPDES Permit (After Public Notice)

Gentlemen:

The Illinois Environmental Protection Agency has reviewed the request for modification of the above-referenced NPDES Permit and issued a public notice based on that request. The final decision of the Agency is to modify the Permit as follows:

The use of sodium bromide in Dallman Condensor Units 1, 2 and 3: Cl_2/Br_2 will be used in a mole ratio of 4:1 for general microbiological control and 2:1 for zebra mussel control and microbiological control; and the addition of a polyglycol biodispersant in Dallman Condensor Unit 3 to improve the performance of chlorine dioxide for microbiological control. The discharge shall be dehalogenated during application of bromine and/or chlorine for zebra mussel control pursuant to the Federal Clean Water Act, since dehalogenation is best available treatment. Furthermore, a study on the effect of the addition of bromine to the power plant cooling water on the levels of THM's found in the drinking water is to be submitted to the IEPA and USEPA within 90 days of completion. In addition, semi-annual monitoring of the lake water for bromide ions will be required to determine the long term effect of bromine addition on THM's.

Also, new outfalls for stormwater runoff and special conditions involving a Stormwater Pollution Prevention Plan (SWPPP) and treated stormwater will be included.

Following Public Notice, the permit has been revised to include Outfalls 001a, 003, 004, 006, 007, 008 and 011 under the special condition on treated stormwater.

Enclosed is a copy of the modified Permit. You have the right to appeal this modification to the Illinois Pollution Control Board within a 30 day period following the modification date shown on the first page of the permit.

Should you have any question or comments regarding the above, please contact Fred Rosenblum of my staff.

Very truly yours,

Thomas G. McSwiggin

Thomas G. McSwiggin, P.E.
Manager, Permit Section
Division of Water Pollution Control

TGM:FLR:dks/1548v, 8-9

Attachment: Modified Permit

cc: Records
CAS
Springfield Region
USEPA
Facility

NPDES Permit No. IL0024767

Illinois Environmental Protection Agency

Division of Water Pollution Control

2200 Churchill Road

P.O. Box 19276

Springfield, Illinois 62794-9276

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

Modified (NPDES) Permit

Expiration Date: August 1, 1996

Issue Date: November 14, 1991
Effective Date: December 14, 1991
Modification Issue Date: September 29, 1993

Name and Address of Permittee:

City of Springfield
Office of Public Utilities
City Water, Light and Power
Environmental Affairs
7th and Monroe Street
Springfield, Illinois 62757

Facility Name and Address:

City Water, Light and Power
3100 Stevenson Drive
Springfield, Illinois 62707
Sangamon County

Discharge Number and Name:	Receiving Waters
001 Lakeside 1 and 2 Condenser Cooling Water Outfall	Lake Springfield
001(a) Lakeside Turbine Room, Boiler Room and Equipment Drains, Lakeside 2 Boiler Blowdown	Lake Springfield via Outfall 001
002 Dallman 1 and 2 Condenser Cooling Water Outfall	Lake Springfield
005 Industrial Wastewater Treatment Plant Outfall	Lake Springfield
006 Ash Pond Discharge to Lake Springfield	Lake Springfield
007 Dallman Coal Pile Runoff	Lake Springfield
008 Lakeside Coal Pile Runoff	Lake Springfield
009 Dallman 3 Condenser Cooling Water Outfall	Lake Springfield
010 Dallman Plant Intake Screen Backwash	Lake Springfield
011 Scrubber Surge Pond Overflow	Lake Springfield
003 Lakeside Storm Sewer	Sugar Creek
004 Ash Pond Discharge	Sugar Creek
012 Stormwater Runoff from West Drainage Ditch	Lake Springfield
013 Stormwater Runoff from East Drainage Ditch	Lake Springfield
014 Stormwater Runoff from Tank Farm	Lake Springfield
015 Stormwater Runoff from Coal Crusher House Manholes	Lake Springfield
016 Stormwater Runoff from Landfill	Sugar Creek

In compliance with the provisions of the Illinois Environmental Protection Act, Subtitle C and/or Subtitle D Rules and Regulations of the Illinois Pollution Control Board, and the Clean Water Act, the above-named permittee is hereby authorized to discharge at the above location to the above-named receiving stream in accordance with the standard conditions and attachments herein.

Permittee is not authorized to discharge after the above expiration date. In order to receive authorization to discharge beyond the expiration date, the permittee shall submit the proper application as required by the Illinois Environmental Protection Agency (IEPA) not later than 180 days prior to the expiration date.

Thomas G. McSwiggin, P.E.
Manager, Permit Section
Division of Water Pollution Control

TGM:FLR:dks/sp/1994q

Effluent Limitations and Monitoring

1. From the effective date of this permit until August 1, 1996, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 001 -- Lakeside 1 and 2 Condenser Cooling Water

This discharge consists of:	Approximate Flow
1. Lakeside 1 and 2 Condenser Cooling Water	29 MGD
2. Lakeside 2 Turbine Rooms 4, 5 and 6 Floor Drains	Intermittent
3. Lakeside 2 Turbine Rooms 4, 5, 6 and 7 Roof Drains	Intermittent
4. Lakeside 2 Boiler Rooms 5, 6 and 7 Floor Drains	Intermittent
5. Lakeside 2 Boiler Rooms 5 and 6 Roof Drains	Intermittent
6. Lakeside 1 and 2 Equipment Drains	Intermittent
7. Lakeside 2 Boilers 5, 6, 7 and 8 Boiler Blowdown	Intermittent

	LOAD LIMITS lbs/day		CONCENTRATION LIMITS mg/l			
PARAMETER	30 DAY AVG.	DAILY MAX.	30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow					Daily	Continuous
Temperature	See Special Condition 3					
Total Residual Chlorine				0.2	2/Month*	Grab*

*See Special Condition No. 4 and No. 9

NPDES Permit No. IL0024767

Effluent Limitations and Monitoring

1. From the effective date of this permit until August 1, 1996, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 001a — Lakeside Turbine Room, Boiler Room and Equipment Drains, Lakeside 2 Boiler Blowdown**

This discharge consists of:	Approximate Flow
1. Lakeside 2 Turbine Rooms 4, 5 and 6 Floor Drains	Intermittent
2. Lakeside 2 Turbine Rooms 4, 5, 6 and 7 Roof Drains	Intermittent
3. Lakeside 2 Boiler Rooms 5, 6 and 7 Floor Drains	Intermittent
4. Lakeside 2 Boiler Rooms 5 and 6 Roof Drains	Intermittent
5. Lakeside 1 and 2 Equipment Drains	Intermittent
6. Lakeside 2 Boilers 5, 6, 7 and 8 Boiler Blowdown	Intermittent
7. Yard Drains	Intermittent
8. Miscellaneous Equipment Drains	Intermittent

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	LOAD LIMITS lbs/day DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	CONCENTRATION LIMITS mg/l DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow					1/Week	Single Reading Estimate
pH	See Special Condition No. 1				2/Month	Grab
Total Suspended Solids			15.0	30.0	2/Month	24 Hour Composite
Oil and Grease			15.0	20.0	2/Month	Grab

**See Special Condition No. 19

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	LOAD LIMITS lbs/day DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	CONCENTRATION LIMITS mg/l DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE

1. From the effective date of this permit until August 1, 1996, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 002 — Dallman 1 and 2 Condenser Cooling Water Outfall

Approximate Flow

121.9 MGD

Flow					Daily	Continuous
Temperature	See Special Condition No. 3				Daily	Continuous
Total Residual Chlorine***				0.2	2/Month*	Grab**
Total Residual Halogen***				0.05	2/Month*	Grab**

*See Special Condition No. 4 and No. 9
**See Special Condition No. 4
***A discharge limit of 0.05 mg/l for total residual chlorine and total residual halogen shall apply when zebra mussel control chemicals are being added. The permittee shall indicate on the DMR forms when chlorine and bromine are being used for zebra mussel control.

Effluent Limitations and Monitoring

1. From the effective date of this permit until August 1, 1996, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 003 — Lakeside Storm Sewer***

This discharge consists of:	Approximate Flow
1. Lakeside 1 Turbine Rooms 1, 2 and 3 Floor Drains & Equipment Drains	Intermittent
2. Lakeside 1 Turbine Rooms 1, 2 and 3 Roof Drains	Intermittent
3. Lakeside 1 Boilers 2, 3 and 4 Boiler Blowdown	Intermittent
4. Lakeside 1 Boiler Rooms 2, 3 and 4 Floor Drains & Equipment Drains	Intermittent
5. Lakeside 1 Boiler Rooms 2, 3 and 4 Roof Drains	Intermittent
6. Lakeside 2 Turbine Rooms 6 and 7 Roof Drains	Intermittent
7. Lakeside 2 Boilers 7 and 8 Roof Drains	Intermittent
8. Lakeside 1 and 2 Intake Screen Backwash *	0.3 MGD
9. Screen Washings from Public Water Supply Intake	0.1 MGD
10. Spillway Gate Hydraulic Water *	Intermittent
11. Miscellaneous Equipment Drains	Intermittent
12. Public Water Supply Drain*	Intermittent

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	LOAD LIMITS lbs/day DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	CONCENTRATION LIMITS mg/l DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow					1/Week	Single Reading Estimate
pH	See Special Condition No. 1				1/Week	Grab
Total Suspended Solids			15.0	30.0	1/Week	24 Hour Composite
Oil and Grease			15.0	20.0	2/Month	Grab
Boron				1.0**	2/Month	Grab

*Compliance Monitoring samples are collected ahead of this wastestream input to Outfall 003.
**See Special Condition 13
***See Special Condition 19

Effluent Limitations and Monitoring

1. From the effective date of this permit until August 1, 1996, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 004 — Ash Pond Discharge***

This discharge consists of:	Approximate Flow
1. Lakeside Plant Fly Ash and Bottom Ash	2.66 MGD
2. Dallman Plant Fly Ash and Bottom Ash	4.32 MGD
3. Non-Chemical Metal Cleaning Wastes *	Intermittent
4. Lime Sludge From the City Water Purification Plant	0.33 MGD
5. Flue Gas Desulfurization System Wastes *	Intermittent
6. Industrial Wastewater Treatment Plant Sludge	0.19 MGD
7. Water Treatment Plant Yard Drains	Intermittent
8. Scrubber Sludge Disposal Site Wastewater	0.043 MGD

	LOAD LIMITS lbs/day		CONCENTRATION LIMITS mg/l			
PARAMETER	30 DAY AVG.	DAILY MAX.	30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow					1/Week	Single Reading Estimate
pH	See Special Condition No. 14				2/Week	Grab
Total Suspended Solids			15.0	30.0	2/Week	24 Hour Composite
Oil and Grease			15.0	20.0	2/Month	Grab
Boron				1.0**	2/Month	Grab
Copper (total)	See Special Conditions 15 & 16					
Silver (total)	See Special Conditions 15 & 16					

*This wastestream may be directed to the Industrial Wastewater Treatment System
**See Special Condition 13
***See Special Condition No. 19

Effluent Limitations and Monitoring

1. From the effective date of this permit until August 1, 1996, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 005**

This discharge consists of:		Approximate Flow
1.	Demineralizer Regenerant Wastes	0.6 MGD
2.	Lakeside 2 Boilers 7 and 8 Slag Tank Overflow	1.02 MGD
3.	Lakeside 2 Boiler Rooms 7 and 8 Floor Drains	Intermittent
4.	Lakeside 2 Turbine Rooms 6 and 7 Floor Drains	Intermittent
5.	Lakeside 2 Boilers 5 and 6 Slag Tank Overflow	0.001 MGD
6.	Dallman 1, 2 and 3 Boiler Blowdown, Evaporator and Deaerator Blowdown	0.44 MGD
7.	Dallman 1, 2 and 3 Roof and Floor Drains	Intermittent
8.	Dallman 1, 2 and 3 Condensate Storage Tank Wastes	Intermittent
9.	Dallman 1, 2 and 3 Slag Tank Overflow	1.8 MGD
10.	Dallman 1, 2 and 3 Sump Pumps	0.3 MGD
11.	Dallman Plant Pyrite Removal Wastes	0.85 MGD
12.	Crusher House and Control House Floor Drains	Intermittent
13.	Flue Gas Desulfurization System Wastes*	Intermittent
14.	Dallman Coal Pile Runoff (See Outfall No. 007)*	Intermittent
15.	Dallman 1 and 2 Precipitator Area Drain	Intermittent
16.	Non-chemical Metal Cleaning Wastes*	Intermittent
17.	Dallman 1, 2 and 3 Equipment Drains	Intermittent
18.	Lakeside Coal Pile Runoff (See Outfall No. 008)*	Intermittent

	LOAD LIMITS lbs/day		CONCENTRATION LIMITS mg/l			
PARAMETER	30 DAY AVG.	DAILY MAX.	30 DAY AVG.	DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow					Daily	Continuous
pH	See Special Condition No. 14				Daily	Continuous
Total Suspended Solids			15.0	30.0	1/Week	24 Hour Composite
Oil and Grease			15.0	20.0	2/Month	Grab
Iron (Total)			2.0	4.0	1/Week	24 Hour Composite
Iron (dissolved)				1.0	1/Week	24 Hour Composite
Copper (Total)			0.026	0.042	1/Week	24 Hour Composite

* Discharge to the Industrial Wastewater Treatment Plant is an alternate routing.

**See Special Condition No. 19

Effluent Limitations and Monitoring

1. From the effective date of this permit until August 1, 1996, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 006 -- Ash Pond Discharge***

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	LOAD LIMITS lbs/day DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	CONCENTRATION LIMITS mg/l DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
					Approximate Flow Intermittent	
Flow					1/Week	24 Hour Total
pH	See Special Condition No. 14				2/Week*	Grab
Total Suspended Solids			15.0	30.0	2/Week*	24 Hour Composite
Oil and Grease			15.0	20.0	2/Month	Grab
Boron				1.0**	2/Month	Grab

*Monitor if discharge occurs during the month excluding exercising diversion pump.
**See Special Condition 13
***See Special Condition No. 19

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	 DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	 DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE

1. From the effective date of this permit until August 1, 1996, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 007 — Dallman Coal Pile Runoff*

This discharge consists of:	Approximate Flow
1. Dallman Coal Pile Runoff	Intermittent
2. Dallman 1 and 2 Precipitator Area Drain	Intermittent

Flow					1/Week	Single Reading Estimate
pH	See Special Condition No. 14				1/Week	Grab
Total Suspended Solids			15.0	30.0	1/Week	8 Hour Composite
Oil and Grease			15.0	20.0	1/Week	Grab
Iron (Total)			2.0	4.0	1/Week	8 Hour Composite
Iron (Dissolved)				1.0	1/Week	8 Hour Composite

*See Special Condition No. 19

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	LOAD LIMITS lbs/day DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	CONCENTRATION LIMITS mg/l DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE

1. From the effective date of this permit until August 1, 1991, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 008 — Lakeside Coal Pile Runoff*

This discharge consists of:	Approximate Flow
1. Coal Pile Runoff	Intermittent
2. Lakeside Plant Precipitator Area Runoff	Intermittent
3. Parking Lot Runoff	Intermittent

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	LOAD LIMITS lbs/day DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	CONCENTRATION LIMITS mg/l DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow					1/Week	Single Reading Estimate
pH	See Special Condition No. 14				1/Week	Grab
Total Suspended Solids			15.0	30.0	1/Week	8 Hour Composite
Oil and Grease			15.0	20.0	1/Week	Grab
Iron (Total)			2.0	4.0	1/Week	8 Hour Composite
Iron (Dissolved)				1.0	1/Week	8 Hour Composite

*See Special Condition No. 19

Effluent Limitations and Monitoring

1. From the effective date of this permit until August 1, 1996, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 009 — Dallman 3 Condenser Cooling Water****

Approximate Flow
127.3 MGD

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	LOAD LIMITS lbs/day DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	CONCENTRATION LIMITS mg/l DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow					Daily	Continuous
Temperature	See Special Condition No. 3				Daily	Continuous
Total Residual Chlorine***				0.2	2/Month*	Grab**
Total Residual Halogen***				0.05	2/Month*	Grab**

*See Special Conditions No. 4 and 9
**See Special Condition No. 4
***A discharge limit of 0.05 mg/l for total residual chlorine and total residual halogen shall apply when zebra mussel control chemicals are being added. The permittee shall indicate on the DMR forms when chlorine and bromine are being used for zebra mussel control.
****See Special Condition No. 17

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	LOAD LIMITS lbs/day DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	CONCENTRATION LIMITS mg/l DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
1. From the effective date of this permit until August 1, 1996, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:						
Outfall: 010 — Dallman Plant Intake Sewer Backwash					Approximate Flow 0.16 MGD	
Flow					1/Week	Estimate

Effluent Limitations and Monitoring

1. From the effective date of this permit until August 1, 1996, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 011 -- Scrubber Surge Pond Overflow*

This discharge consists of:	Approximate Flow
1. Scrubber sludge storage pad runoff	Intermittent
2. Groundwater pumpage from the oil spill recovery well	Intermittent
3. Flue gas desulfurization wastes	Intermittent

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVG.	LOAD LIMITS lbs/day DAILY MAX.	CONCENTRATION LIMITS mg/l 30 DAY AVG.	CONCENTRATION LIMITS mg/l DAILY MAX.	SAMPLE FREQUENCY	SAMPLE TYPE
Flow					Daily	Single Reading Estimate
pH	See Special Condition 14				Daily	Grab
Total Suspended Solids			15.0	30.0	Daily	Grab

*See Special Condition No. 19

Outfalls: 012, 013, 014, 015 and 016 -- Stormwater Runoff*

Flow					When Discharging	Estimate

*See Special Condition No. 18

Special Conditions

Special Condition 1. The pH shall be in the range 6.0 to 10. The monthly minimum and monthly maximum values shall be reported on the DMR form.

Special Condition 2. Samples taken in compliance with the effluent monitoring requirements shall be taken at a point representative of the discharge; but prior to entry into Lake Springfield for outfalls 001, 002, 005, 006, 007, 008, 009, 010, 011; and prior to entry into the Sugar Creek for outfalls 003 and 004.

Special Condition 3. The thermal discharge to Lake Springfield from the Lakeside plant shall not exceed 99°F more than 5 percent of the hours in the 12-month period ending with any month and the discharge from the Dallman plant shall not exceed 99°F more than 8 percent of the hours in the 12-month period ending with any month and at no time shall any discharge exceed 109°F.

Special Condition 4. Chlorine compounds, bromine compounds, or a mixture of both may be utilized for condenser microbiological control or for zebra mussel control in accordance with the following conditions:

a. Intermittent chlorine application:

A limit of 0.2 mg/l (instanteous maximum) total residual chlorine shall apply during intermittent chlorination (chlorine discharged for no more than two hours per unit per day).

b. Intermittent bromine or bromine/chlorine application:

The discharge shall be dehalogenated and a limit of 0.05 mg/l (daily maximum) shall apply.

c. Continuous chlorine, bromine, or bromine/chlorine application:

The discharge shall be dehalogenated and a limit of 0.05 mg/l (daily maximum) shall apply.

The reported mean concentration and maximum concentration of halogen shall be based on a concentration curve. The concentration curves shall be generated using grab samples with an analytical frequency of five minutes or less during the respectove halogenation period of each unit allowing for lag time between the initiation of halogenation and the point of sampling before the first sample is taken. Concentration curves shall be submitted with monthly Discharge Monitoring Reports. The frequency and duration of the chlorine and bromine dosing periods plus the amount of chlorine and bromine applied shall be reported on the Discharge Monitoring Reports.

The permittee shall conduct a study on the effect of the addition of bromine to the power plant cooling water on the levels of THM's found in the drinking water if bromine or bromine/chlorine is applied. The study shall be submitted to the Illinois Environmental Protection Agency and the United States Environmental Protection Agency within 90 days of completion. Also, the permittee shall indicate when bromine is being added for zebra mussel control and when it is being used for microbiological control.

In addition, the permittee shall monitoring semi-annually for bromide ions to determine the long term effect of bromide addition on THM's. This study shall be submitted to the <u>IEPA</u> and <u>USEPA</u> at the following addresses:

Illinois Environmental Protection Agency
Attn: Compliance Assurance Section
2200 Churchill Road
P.O. Box 19276
Springfield, Illinois 62794-9276

United States Environmental Protection Agency
Attn: 5WQP-Tim Henry
Region V
77 West Jack Boulevard
Chicago, Illinois 60604-3590

Illinois Environmental Protection Agency
Attn: Permit Section
2200 Churchill Road
P.O. Box 19276
Springfield, Illinois 62794-9276

Special Condition 5. For the purpose of this permit discharges are limited to wastewater listed on the effluent pages for each permitted outfall.

Special Condition 6. There shall be no discharge of chemical metal cleaning wastes or associated rinses.

Special Conditions

Special Condition 7. There shall be no discharge of polychlorinated biphenyl compounds.

Special Condition 8. To calculate the average daily flow for outfalls 001, 002 and 009 during the reporting period, the total number of pump hours observed is divided by the number of days in the month and then multiplied by the pump rate (gallons/hour). The minimum daily flow rate is determined by multiplying the lowest daily pump hour total by the pump rate. The maximum daily pump rate is calculated by multiplying the highest daily pump hour total by the pump rate.

Special Condition 9. During maintenance outages calcium hypochlorite may be used to passivate the condensers. During discharge of chlorinated wastewater from passivation of the main cooling condensers a minimum of three grab samples shall be taken at five minute intervals or less at the condenser cooling water outfall for each batch discharge allowing for lag time between chlorine discharge and the point of sampling before the first grab sample is taken. The individual values and average value for each set of samples shall be reported with monthly DMR forms including the time samples were collected, the time and duration of chlorine release plus the amount of chlorine applied.

If chlorinated wastewater is to be discharged as a result of these outage conditions for more than 2 hours per day the permittee must request this permit be modified to allow for such a practice.

Special Condition 10. The permittee shall record monitoring results on Discharge Monitoring Report forms using one such form for each discharge each month. The completed Discharge Monitoring Report form shall be submitted monthly to IEPA, no later than the 15th of the following month, unless otherwise specified by the Agency, to the following address:

Illinois Environmental Protection Agency
Division of Water Pollution Control
Compliance Assurance Section
2200 Churchill Road
P.O. Box 19276
Springfield, Illinois 62794-9276

Special Condition 11. If an applicable effluent standard or limitation is promulgated under Sections 301(b)(2)(C) and (D), 304(b)(2), and 307(a)(2) of the Clean Water Act and that effluent standard or limitation is more stringent than any effluent limitation in the permit or controls a pollutant not limited in the NPDES Permit, the Agency shall revise or modify the permit in accordance with the more stringent standard or prohibition and shall so notify the permittee.

Special Condition 12. By such date as required by federal regulations the permittee shall complete and submit Form 2F (EPA Form 3510-2F) for those outfalls to be regulated under the new stormwater regulations.

Special Condition 13. The boron concentration limitation for Outfalls 003, 004 and 006 shall become effective three years from the effective date of this permit or upon compliance with the regulations, whichever comes first.

The permittee shall construct treatment equipment or develop an alternative means of compliance in accordance with the following schedule:

1. Preliminary Report	Within 6 months from the effective date of this permit
2. Progress Report	Within 12 months from the effective date of this permit
3. Progress Report	Within 18 months from the effective date of this permit
4. Provide the IEPA with a proposal for compliance. If treatment is chosen then a State construction permit shall be submitted at this time	Within 24 months from the effective date of this permit

Special Conditions

5. Progress Report	Within 30 months from the effective date of this permit
6. Achieve Compliance	Within 36 months from the effective date of this permit

Special Condition 14. The pH shall be in the range of 6.0 to 9.0. The monthly minimum and monthly maximum values shall be reported on the DMR form.

Special Condition 15. The permittee shall monitor Outfall 004 for Copper (total) and Silver (total), twice per month, for a period of six months from this permit effective date. Composite samples shall be taken in accordance with 40 CFR 136 with results being submitted on the discharge monitoring report forms and a summary being sent to the IEPA-Permit Section within nine months from the effective date of this permit. The detection limit of the analytical method used shall be sufficient to determine whether water quality standards could be violated by the discharge.

Special Condition 16. Following public notice and opportunity for hearing, the Agency may modify this permit during its term to include additional requirements and/or limitations as a result of the information received from Special Condition 15.

Special Condition 17. In the event that water treatment additives other than those identified in the permit application are discharged, the permittee shall notify the Agency in accordance with the Standard Conditions (Attachment H) of this permit. The additives listed in previous applications include: Lime, Alum, Bentonite, Iron Sulfate, Cationic and Anionic Polymers, Carbon Dioxide, Chlorine Gas, Chlorine Dioxide, Calcium Hypochlorite, Sodium Chlorite, Sodium Bromide and a Polyglycol Biodispersant.

Special Condition 18.

STORM WATER POLLUTION PREVENTION PLAN (SWPPP) FOR OUTFALLS 012, 013, 014, 015 and 016

A. A storm water pollution prevention plan shall be developed by the permittee for the storm water associated with industrial activity at this facility. The plan shall identify potential sources of pollution which may be expected to affect the quality of storm water discharges associated with the industrial activity at the facility. In addition, the plan shall describe and ensure the implementation of practices which are to be used to reduce the pollutants in storm water discharges associated with industrial activity at the facility and to assure compliance with the terms and conditions of this permit.

B. The plan shall be completed within 180 days of the effective date of this permit. Plans shall provide for compliance with the terms of the plan within 365 days of the effective date of this permit. The owner or operator of the facility shall make a copy of the plan available to the Agency at any reasonable time upon request.

C. The permittee may be notified by the Agency at any time that the plan does not meet the requirements of this condition. After such notification, the permittee shall make changes to the plan and shall submit a written certification that the requested changes have been made. Unless otherwise provided, the permittee shall have 30 days after such notification to make the changes.

D. The discharger shall amend the plan whenever there is a change in construction, operation, or maintenance which may affect the discharge of significant quantities of pollutants to the waters of the State or if a facility inspection required by paragraph G of this condition indicates that an amendment is needed. The plan should also be amended if the discharger is in violation of any conditions of this permit, or has not achieved the general objective of controlling pollutants in storm water discharges. Amendments to the plan shall be made within the shortest reasonable period of time, and shall be provided to the Agency for review upon request.

E. The plan shall provide a description of potential sources which may be expected to add significant quantities of pollutants to storm water discharges, or which may result in non-storm water discharges from storm water outfalls at the facility. The plan shall include, at a minimum, the following items:

Special Conditions

1. A topographic map extending one-quarter mile beyond the property boundaries of the facility, showing: the facility, surface water bodies, wells (including injection wells), seepage pits, infiltration ponds, and the discharge points where the facility's storm water discharges to a municipal storm drain system or other water body. The requirements of this paragraph may be included on the site map if appropriate.

2. A site map showing:

   i. The storm water conveyance and discharge structures;

   ii. An outline of the storm water drainage areas for each storm water discharge point;

   iii. Paved areas and buildings;

   iv. Areas used for outdoor manufacturing, storage, or disposal of significant materials, including activities that generate significant quantities of dust or particulates.

   v. Location of existing storm water structural control measures (dikes, coverings, detention facilities, etc.);

   vi. Surface water locations and/or municipal storm drain locations

   vii. Areas of existing and potential soil erosion;

   viii. Vehicle service areas;

   ix. Material loading, unloading, and access areas.

3. A narrative description of the following:

   i. The nature of the industrial activities conducted at the site, including a description of significant materials that are treated, stored or disposed of in a manner to allow exposure to storm water;

   ii. Materials, equipment, and vehicle management practices employed to minimize contact of significant materials with storm water discharges;

   iii. Existing structural and non-structural control measures to reduce pollutants in storm water discharges;

   iv. Industrial storm water discharge treatment facilities;

   v. Methods of onsite storage and disposal of significant materials;

4. A list of the types of pollutants that have a reasonable potential to be present in storm water discharges in significant quantities.

5. An estimate of the size of the facility in acres or square feet, and the percent of the facility that has impervious areas such as pavement or buildings.

6. A summary of existing sampling data describing pollutants in storm water discharges.

F. The plan shall describe the storm water management controls which will be implemented by the facility. The appropriate controls shall reflect identified existing and potential sources of pollutants at the facility. The description of the storm water management controls shall include:

   1. Storm Water Pollution Prevention Personnel - Identification by job titles of the individuals who are responsible for developing, implementing, and revising the plan.

   2. Preventive Maintenance - Procedures for inspection and maintenance of storm water conveyance system devices such as oil/water separators, catch basins, etc., and inspection and testing of plant equipment and systems that could fail and result in discharges of pollutants to storm water.

Special Conditions

3. Good Housekeeping - Good housekeeping requires the maintenance of clean, orderly facility areas that discharge storm water. Material handling areas shall be inspected and cleaned to reduce the potential for pollutants to enter the storm water conveyance system.

4. Spill Prevention and Response - Identification of areas where significant materials can spill into or otherwise enter the storm water conveyance systems and their accompanying drainage points. Specific material handling procedures, storage requirements, spill clean up equipment and procedures should be identified, as appropriate. Internal notification procedures for spills of significant materials should be established.

5. Storm Water Management Practices - Storm water management practices are practices other than those which control the source of pollutants. They include measures such as installing oil and grit separators, diverting storm water into retention basins, etc. Based on assessment of the potential of various sources to contribute pollutants, measures to remove pollutants from storm water discharge shall be implemented. In developing the plan, the following management practices shall be considered:

   i. Containment - Storage within berms or other secondary containment devices to prevent leaks and spills from entering storm water runoff;

   ii. Oil & Grease Separation - Oil/water separators, booms, skimmers or other methods to minimize oil contaminated storm water discharges;

   iii. Debris & Sediment Control - Screens, booms, sediment ponds or other methods to reduce debris and sediment in storm water discharges;

   iv. Waste Chemical Disposal - Waste chemicals such as antifreeze, degreasers and used oils shall be recycled or disposed of in an approved manner and in a way which prevents them from entering storm water discharges.

   v. Storm Water Diversion - Storm water diversion away from materials manufacturing, storage and other areas of potential storm water contamination;

   vi. Covered Storage or Manufacturing Areas - Covered fueling operations, materials manufacturing and storage areas to prevent contact with storm water.

6. Sediment and Erosion Prevention - The plan shall identify areas which due to topography, activities, or other factors, have a high potential for significant soil erosion and describe measures to limit erosion.

7. Employee Training - Employee training programs shall inform personnel at all levels of responsibility of the components and goals of the storm water pollution control plan. Training should address topics such as spill response, good housekeeping and material management practices. The plan shall identify periodic dates for such training.

8. Inspection Procedures - Qualified plant personnel shall be identified to inspect designated equipment and plant areas. A tracking or follow-up procedure shall be used to ensure appropriate response has been taken in response to an inspection. Inspections and maintenance activities shall be documented and recorded.

G. The permittee shall conduct an annual facility inspection to verify that all elements of the plan, including the site map, potential pollutant sources, and structural and non-structural controls to reduce pollutants in industrial storm water discharges are accurate. Observations that require a response and the appropriate response to the observation shall be retained as part of the plan. Records documenting significant observations made during the site inspection shall be submitted to the Agency in accordance with the reporting requirements of this permit.

H. This plan should briefly describe the appropriate elements of other program requirements, including Spill Prevention Control and Countermeasures (SPCC) plans required under Section 311 of the CWA and the regulations promulgated thereunder, and Best Management Programs under 40 CFR 125.100.

Special Conditions

I. The plan is considered a report that shall be available to the public under Section 308(b) of the CWA. The permittee may claim portions of the plan as confidential business information, including any portion describing facility security measures.

J. The plan shall include the signature and title of the person responsible for preparation of the plan and include the date of initial preparation and each amendment thereto.

REPORTING

K. The facility shall submit an annual inspection report to the Illinois Environmental Protection Agency. The report shall include results of the annual facility inspection which is required by Part G of the Storm Water Pollution Prevention Plan of this permit. The report shall also include documentation of any event (spill, treatment unit malfunction, etc.) which would require an inspection, results of the inspection, and any subsequent corrective maintenance activity. The report shall be completed and signed by the authorized facility employee(s) who conducted the inspection(s).

L. The first report shall contain information gathered during the one year time period beginning with the effective date of coverage under this permit and shall be submitted no later than 60 days after this one year period has expired. Each subsequent report shall contain the previous year's information and shall be submitted no later than one year after the previous year's report was due.

M. Annual inspection reports shall be mailed to the following address:

Illinois Environmental Protection Agency
Division of Water Pollution Control
Compliance Assurance Section
Annual Inspection Report
2200 Churchill Road
P.O. Box 19276
Springfield, Illinois 62794-9276

N. If the facility performs inspections more frequently than required by this permit, the results shall be included as additional information in the annual report.

SPECIAL CONDITION 19. The Agency has determined that the effluent limitations in this permit constitute BAT/BCT for storm water which is treated in the existing treatment facilities (Outfalls 001a, 003, 004, 005, 006, 007, 008 and 011) for purposes of this permit reissuance, and no pollution prevention plan will be required for such storm water. In addition to the chemical specific monitoring required elsewhere in this permit, the permittee shall conduct an annual inspection of the facility site to identify areas contributing to a storm water discharge associated with industrial activity, and determine whether any facility modifications have occurred which result in previously-treated storm water discharges no longer receiving treatment. If any such discharges are identified the permittee shall request a modification of this permit within 30 days after the inspection. Records of the annual inspection shall be retained by the permittee for the term of this permit and be made available to the Agency on request.

APPENDIX D

SUMMARY OF IEPA TOXICITY TEST OF CWLP OUTFALL DISCHARGE

Illinois Environmental Protection Agency 4500 South 6th, Springfield. IL 62706

217/786-6892

November 1, 1988

Sangamon County - Springfield City Water, Light & Power
Bioassay Sample Analysis

Mr. Louis Skibicki, Environmental Coordinator
City of Springfield
City Water, Light & Power
Municipal Building
Springfield, Illinois 62757

Dear Mr. Skibicki:

Enclosed are copies of analyses results for samples collected from City Water, Light & Power on August 22, August 24, and August 26, all in 1988. These results are forwarded for your information.

Sincerely,
ENVIRONMENTAL PROTECTION AGENCY

Tim Zook

Tim Zook
Environmental Protection Engineer
Field Operations Section
Division of Water Pollution Control

TDZ/jg

Enclosures

cc: CWL&P - Tom Skelly
Ecotoxicology - K. Christensen
DWPC/CAS - Pat Lindsey
DWPC/FOS/RU
Regional File✓

* * * * * [illegible] CITY TESTING UNIT

TOXICITY TEST SUMMARY

Facility: Springfield CWLP　　Permit #: IL0024767-004

Receiving water: Sugar Creek　　Location: Springfield (Region 5)

Effluent flow (X Mean / ___ Observed): 0.62 cfs　　Stream 7Q10: 0.0 cfs

Samples collected: 08/22/88　　Test(s) initiated: 08/23/88

Test(s) conducted:

ACUTE	CHRONIC
x 96-hr static fathead minnow	x 96-hr algal growth test
____ 96-hr flow-through fathead minnow	x 7-day fathead minnow growth test
x 48-hr static Ceriodaphnia dubia	x 7-day Ceriodaphnia brood test

Results: ACUTE

____ Acute toxicity observed for:

- ____ fathead minnow (LC50 = _____ % effluent)
- ____ Ceriodaphnia (LC50 = _____ % effluent)

x No significant acute toxicity observed

____ Potential acute toxicity: results inconclusive

Results: CHRONIC

____ Chronic toxicity observed for:

_____ fathead minnow:	survival NOEC, LOEC =	____________	% effluent
	growth NOEC, LOEC =	____________	% effluent
_____ Ceriodaphnia:	survival NOEC, LOEC =	____________	% effluent
	reproduction NOEC, LOEC =	____________	% effluent
_____ algae:	inhibition NOEC, LOEC =	____________	% effluent

x No significant chronic effect observed

____ Potential chronic effect: results inconclusive

Comments: Fathead minnow chronic test not reported due to poor control survival.

Completed by: Karen Christensen　　Date: 08/31/88

ezf/tstsum1

BORON CONCENTRATIONS AT CWLP OUTFALLS SINCE OCTOBER, 1992

DATE	OUTFALL 003	DATE	OUTFALL 004
		10/92	5.500
12/92	0.740	12/92	6.100
02/93	0.520	02/93	7.200
03/93	0.470	03/93	6.900
04/93	6.000		
05/93	3.200	05/93	5.700
06/93	3.200	06/93	6.000
07/93	7.500	07/93	6.200
08/93	7.100	08/93	7.800
11/93	0.820	11/93	7.300

Exhibit 2

GROUP EXHIBIT 3

BEFORE THE
ILLINOIS POLLUTION CONTROL BOARD

In the Matter of:

Petition of the City of Springfield,	)	AS94 -
Illinois, Office of Public Utilities	)	(Adjusted
for an Adjusted Standard from	)	Standard)
35 Ill. Adm. Code Section 302.208(e)	)	

AFFIDAVIT OF DAN W. JONES

I, DAN W. JONES, being first duly sworn, upon oath, states as follows:

1. I am employed by the Hanson Engineers, Incorporated, located in Springfield, Illinois, specializing in civil, structural and environmental engineering. My current position is that of Senior Biologist in the Environmental/Waste Management Department, and I have held this position for approximately three (3) years. Prior to that, I was employed as an Environmental Biologist with Peabody Coal Company for 16 years.

2. I hereby submit this affidavit in support of the Petition for an Adjusted Standard from the Illinois General Use Water Quality Standard for boron found at 35 Ill. Adm. Code 302.208(e).

3. The purpose of this Affidavit is to verify the material facts asserted in the Petition and the report entitled "Technical Support Document for Petition for Adjusted Boron Standards for Sugar Creek and the Sangamon River", filed herewith as Exhibit 1 to the Petition, as required by 35 Ill. Adm. Code Section 106.706.

4. I hereby verify that all material facts asserted in Paragraphs 10 through 29 of the Petition for an Adjusted Standard, and all material facts asserted in said report are true and correct, to the best of my knowledge.

5. If called to testify herein, I can competently testify to the above and foregoing from personal knowledge.

Dated this 29 day of April, 1994.

Dan W. Jones
DAN W. JONES

Subscribed and sworn to before me
this 29 day of April, 1994.

Nicky J. Huddleston
Notary Public

My commission expires 4-3-96.

GROUP EXHIBIT 3

BEFORE THE
ILLINOIS POLLUTION CONTROL BOARD

In the Matter of:

Petition of the City of Springfield,	**)**	**AS94 -**
Illinois, Office of Public Utilities	**)**	**(Adjusted**
for an Adjusted Standard from	**)**	**Standard)**
35 Ill. Adm. Code Section 302.208(e)	**)**	

AFFIDAVIT OF SUSAN A. CORCORAN

Susan A. Corcoran, being first duly sworn, upon oath states as follows:

1. I am employed by the City of Springfield, Office of Public Utilities, City Water, Light and Power in Springfield, Illinois. My title is Engineering Technician III in the Environmental Programs Section of the Environmental, Health and Safety Department. I have held this position since February 16, 1992, and have worked in the Environmental Section since July 1, 1988. My responsibilities include participation in City Water, Light and Power's compliance with state and federal water pollution control requirements, including NPDES Permit activities.

2. I submit this affidavit pursuant to 35 Ill. Adm. Code Section 106.706, in order to verify all material facts asserted in the Petition of City Water, Light and Power for Adjusted Standard from 35 Ill. Adm. Code Section 302.208(e).

3. I hereby verify that all material facts asserted in the Petition and the Exhibits attached to the Petition are true and correct to the best of my knowledge, information, and belief.

4. If called upon to testify, I can competently testify to the above and foregoing from personal knowledge.

Dated this 29 day of April, 1994.

"OFFICIAL SEAL"
DWIGHT J. MC FARLAND
NOTARY PUBLIC, STATE OF ILLINOIS
MY COMMISSION EXPIRES 2-27-96

Susan A. Corcoran
SUSAN A. CORCORAN

Subscribed and sworn to before me
this 29 day of April, 1994.

Dwight J. McFarland
Notary Public

My commission expires 2/27/96.