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STATE OF ILLINOIS
Pollution Control Board

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PROPOSED AMENDMENTS TO	)	**R2004-025**
DISSOLVED OXYGEN STANDARD	)	**Rulemaking – Public Water**
35 ILL ADM. CODE 302.206	)	
	)	
	)	

NOTICE OF FILING

PLEASE TAKE NOTICE that the Environmental Law & Policy Center, Prairie Rivers Network and Sierra Club have filed MOTION TO SUSPEND CONSIDERATION OF PROPOSED AMENDMENTS TO THE DISSOLVED OXYGEN STANDARD PENDING DEVELOPMENT OF DRAFT IMPLEMENTATION RULES and MEMORANDUM IN SUPPORT OF MOTION TO SUSPEND CONSIDERATION OF PROPOSED AMENDMENTS TO THE DISSOLVED OXYGEN STANDARD PENDING DEVELOPMENT OF DRAFT IMPLEMENTATION RULES.

Respectfully submitted,

Albert F. Ettinger
Senior Staff Counsel, Environmental Law & Policy Center and counsel in this matter for Prairie Rivers Network and Sierra Club

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IN THE MATTER OF:	)	
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PROPOSED AMENDMENTS TO DISSOLVED OXYGEN STANDARD 35 ILL ADM. CODE 302.206	)))))	**R2004-025 Rulemaking – Public Water**

MOTION TO SUSPEND CONSIDERATION OF PROPOSED AMENDMENTS TO THE DISSOLVED OXYGEN STANDARD PENDING DEVELOPMENT OF DRAFT IMPLEMENTATION RULES

The Environmental Law & Policy Center of the Midwest, Prairie Rivers Network and the Sierra Club hereby move that the Board suspend consideration of the proposal to loosen dissolved oxygen standards until the Board is presented with the details regarding the implementation rules that the proponents expect will be adopted to implement the proposed standard. In support of this motion, movants state:

1. In their petition, pre-filed testimony and testimony given at the hearing held June 29, 2004, the petitioner Illinois Association of Wastewater Agencies ("IAWA") makes frequent reference to implementation procedures to be adopted by the Illinois Environmental Protection Agency that are to complement the proposed standards changes and provide protections to Illinois Waters and aquatic life that are not present in the proposed standards. The testimony of IAWA's principal witness, Professor James E. Garvey, explicitly proposes recommendations regarding monitoring times, locations and methods that can only be made enforceable through adoption of implementation rules by IEPA. Two sentences in the proposed standards appear to anticipate adoption of implementation rules that will require

certain monitoring, but these sentences stating how certain monitoring should be done do not provide any of the necessary details and would not have the force of law.

2. Particularly given the misunderstanding that arose from the adoption in 1996 of ammonia standards without the Board having specific knowledge of implementation procedures that would be adopted by the Agency under those standards (R94-01), the Board has required the Agency to present evidence in the standards proceeding of any implementation rules to be adopted. This is very sound policy as the environmental and economic effects of proposed standards revisions can be markedly affected by the implementation rules adopted under the standards.

3. In this case, the petitioner has not presented even the barest outline of the implementation rules that the Agency will or should adopt. As of June 29, there apparently had not even been serious discussions by the petitioner with the Agency regarding rules regarding monitoring or how the monitoring that the petitioner's proposal presumes will occur could be done or paid for.

4. There is no need for the Board to rush to consider this proposed change without having access to information regarding implementation rules. First of all, no standards changes can go into effect until they are approved by the U.S. Environmental Protection Agency. Alaska Clean Water Alliance v. U.S. EPA, 1997 U.S. Dist. LEXIS 11144, 27 ELR 21330 (W.D. Wash. 1997) Under 40 CFR 131.6(f), U.S. EPA cannot consider approval of Illinois standards until presented with "information on general policies applicable to state standards

which may affect their application and implementation." There is then no advantage in the Board racing through to a decision on a standards revision without knowledge of the implementation rules. The standards revision cannot go into effect without development of the implementation rules.

5. Moreover, there is no urgency for making the proposed change:

   a. Illinois is allowed to have dissolved oxygen standards that are more protective than the existing federal National Criteria Document (Hearing Exhibit 2). Anyway, the current Illinois standards are not, in fact, more protective than the NCD.
   b. There is no evidence that any total maximum daily load studies to be done in the next two years will be affected by the dissolved oxygen standard.
   c. Development of nutrient standards would not be facilitated by adoption of revised dissolved oxygen standards. Nutrients cause impairments of Illinois waters that are not directly related to minimum oxygen levels.
   d. It is unclear that any treatment costs are now being increased as a result of the current dissolved oxygen standards. If there are such costs, they should be examined on a case-by-case basis. They cannot properly be used as a justification for a precipitant change in statewide dissolved oxygen standards.

6. A hearing in this matter is currently scheduled for August 12, 2004, in Springfield. It is not an economical use of the time and resources of the Board or the participants to hold the hearing as scheduled. In addition to the lack of any information as to implementation rules,

basic information regarding the U.S. Geological Survey dissolved oxygen studies, on which the IAWA relies in its petition, has only very recently been made available to the parties. The data produced by those studies is complex and will require weeks to analyze properly. Moreover, data collected by Professor Garvey and some of his students in Ohio River tributaries, on which Professor Garvey has relied in formulating key portions of his opinions, has still not been made available to the movants.

7. Movants will certainly not be ready to offer testimony regarding the proposal on August 12 given the lack of:
   - information about implementation procedures,
   - the lack of time to identify and analyze the dissolved oxygen data on which the IAWA relies,
   - the need to identify the range of aquatic life present in the waters being used by Dr. Garvey as representative of all Illinois waters, and
   - the need to identify all of the Illinois aquatic life that may be affected by the proposed weakening of standards.

8. If the hearing is held in this matter on August 12, it should be limited to presentation by Professor Garvey of his expert opinions as supplemented by study of the data provided by USGS and the Ohio River tributary data of Dr. Garvey and his students. Any further hearing should not be scheduled until such time as specific information is provided about the implementation procedures to be used, including data on how the Agency would find the resources needed to follow them. Preferably this information regarding implementation

procedures will come in the form of draft rules that have been accepted as workable by Illinois EPA.

9. A memorandum in support of this motion is being filed with this motion.

WHEREFORE, Sierra Club, ELPC and Prairie Rivers Network move that the Board order that consideration of the petition be suspended until such time as the petitioner presents evidence as to the specific implementation rules that it is expected will be adopted to implement the proposed standards and the numerous recommendations regarding monitoring that are made by its expert in this proceeding.

Respectfully submitted,

Albert F. Ettinger
Senior Staff Counsel, Environmental Law & Policy Center and counsel in this matter for Prairie Rivers Network and Sierra Club

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MEMORANDUM IN SUPPORT OF MOTION TO SUSPEND CONSIDERATION OF PROPOSED AMENDMENTS TO THE DISSOLVED OXYGEN STANDARDS PENDING DEVELOPMENT OF DRAFT IMPLEMENTATION RULES

The petition for changes to the dissolved oxygen ("DO") standards filed by the Illinois Association of Wastewater Agencies ("IAWA") is not ripe for consideration by the Board.

IAWA with its petition has raised important questions; some of which will have to be addressed in the coming years by the Board. Also, IAWA is to be commended for enlisting Professor James Garvey who has presented interesting studies and scientific hypotheses. However, the basic studies on dissolved oxygen levels in Illinois waters on which the IAWA petition and Professor Garvey rely, have not been adequately analyzed and have not been available to the public long enough to allow a scientifically sound review process. More critically, implementation rules that are presupposed by the petition and that are necessary for allowing any amendments to Illinois dissolved oxygen standards have not even begun to be formulated.

The Environmental Law & Policy Center of the Midwest, Prairie Rivers Network and the Sierra Club are open to discussions of the Illinois dissolved oxygen standards. But revisions should not be considered by the Board until after the necessary implementation rules have been developed and the critical scientific data has been collected and analyzed.

If the Board follows its own sound past practices with regard to this petition, it will suspend consideration of the petition to allow development of implementation procedures. This would also allow proper development and analysis of the evidence regarding Illinois dissolved oxygen levels and their effect on all the state's aquatic life.

There is no reason to consider changes to the dissolved oxygen standards before the necessary implementation rules have been developed and there has been adequate time to analyze the data on which the petition rests. Federal law does not require or even encourage Illinois to weaken its current dissolved oxygen standards. There is no reason to believe that adopting dissolved oxygen amendments now, even if that could be done in a scientifically sound manner, will aid in developing nutrient standards. It is unclear that amendments to the dissolved oxygen standards will affect development of total maximum daily load (TMDL) studies required by 33 U.S.C. § 1313(d) or their implementation and there has been no specific testimony indicating that any NPDES permit limits are now being affected by the current dissolved oxygen standards.

I. The Board Should Await Presentation of Information on the Proposed Implementation Rules Before Considering this Proposed Amendment to Standards

In its petition, pre-filed testimony and testimony given at the hearing held June 29, 2004, the IAWA makes frequent reference to implementation procedures to be adopted by the Illinois Environmental Protection Agency ("IEPA"). The IAWA proposal itself alludes to these procedures with two provisions regarding the forms of dissolved oxygen monitoring that "should" be done. These implementation procedures are to complement the proposed standards changes and provide protections to Illinois waters and aquatic life that are not present in the proposed standards. See Hearing Exhibit 1 pp. 4, 38- 40.

Testimony given in response to questions asked at the June 29 hearing further shows that the petition and IAWA's principle witness, Professor Garvey, presume that implementation procedures will be adopted that will render the standards proposal more protective of Illinois aquatic life. Asked about certain monitoring proposals he made, Dr. Garvey testified as follows:

> Dr Garvey: In our report we recommend taking the oxygen measurements at the place where the midges would be, not where the mayflies would be, which we would consider the most conservative place to measure oxygen.
> Mr. Ettinger: Okay. You recommend that. How do you expect that recommendation to be implemented?
> Dr. Garvey: I hope the Illinois EPA will basically adopt that in their implementation guidelines. I mean, that's not my job. It's just a recommendation that [Dr.] Whiles and I made.
> Mr. Ettinger: But you hope the Illinois EPA will do that?
> Dr. Garvey: Well, if they're going to follow our report sure. (Tr. 118)

Later, in response to a question by Ms. Alisa Liu it was confirmed that IAWA expects Illinois EPA to write implementation procedures, but that drafting of implementation procedures has not progressed beyond the stage of "hoping":

> Ms. Liu: I noticed that although you recommended those things, they didn't actually show up in the proposal. Is that something that you're planning to propose to the EPA to put into their implementation procedures?
> Dr. Garvey: You know, Matt Whiles and I talked about this. I think – our understanding is and that's obviously, something to be discussed here is – the belief would be that that would end up in the implementation of this, you know, when IEPA is figuring out how to do this. So our hope would be that this would be included.
> Ms. Liu: Is it IAWA's intent to propose something to the agency in terms of implementation procedures or are you relying on the agency to come up with –
> Mr. Streicher: No. We were hoping to work with the agency when they developed those implementation procedures.

Later, Mr. Roy Harsch, IAWA counsel, testified that it is anticipated that a process will begin in the next few months that will lead to the development of implementation rules. (Tr. 200)

Unless the Board intends to buy "a pig in the poke" it really should not adopt standards that presume the adoption of implementation rules without obtaining clear evidence as to the rules that will be adopted, or what they will accomplish. Recent history makes clear the importance of the Board seeing proposed implementation rules when considering standards.

In the R94-1(B) ammonia water quality standards proceeding, there was discussion of the implementation procedures regarding "effluent modified waters" (See 35 Ill. Adm. Code 302.213) and a number of other issues regarding implementation, but the Board and the public were not shown a draft of the implementation rules prior to adoption of the standards amendment. This resulted in serious disputes that delayed consideration of hundreds of permits. In R02-19, Mr. Michael Callahan on behalf of the IAWA testified regarding the serious problems which resulted from the parties to R94-1(B) coming away from the proceeding without a clear understanding of the likely implementation procedures for the new standards. (R02-19, Callahan Testimony, March 25, 2002, Tr. 16, 25-8) Based on this bad experience, IAWA did not go forward with its 2002 ammonia proposal without being confident of the implementation rules that would be applied by the Agency. (Id.)

After R94-1(B), the Agency provided the Board with draft implementation rules with regard to two water quality standards proposals, R97-25 (the Great Lakes standards) and R01-13 (Antidegradation). In both cases, the ability of the Board and the public to understand how the standards would be implemented was critical to the proceeding. As was stated by IEPA's Toby Frevert in R01-13 in describing the draft Agency implementation procedures that were submitted in that proceeding with the Agency antidegradation standard proposal:

> The Agency has attached as an exhibit to this rule making its proposed procedures … to implement the Board's standard during Illinois EPA's administration of the permit programs.
>
> We believe it is important to identify up front how the Agency intends to operate this administrative responsibility. And that proposed set of procedures is there to make available to permit applicants and other interested parties the process that we think we would follow. (R01-13, proceedings of November 17, 2000, Tr. 20-1)

In R02-11 the Board did decide to send to First Notice certain water quality standards although the implementation procedures had not been presented to the Board. The Board explained this decision in an Opinion and Order of June 20, 2002, stating:

> In general, the Board agrees that seeing implementation procedures for the water quality standards is important. The Board's hearing officer strongly urged the Agency to provide the Board with copies of the implementation rules as part of the Agency's comments. Tr.2 at 149 The Agency chose not to do so. While it would be helpful to know the implementation procedures in developing comprehensive water quality regulations, in this proceeding the Board believes that the Agency has sufficient federal guidance and experience to develop implementation procedures which ensure that water quality standards are protective of aquatic life.
>
> In this regard, the Board notes that the Agency has been issuing permits implementing the General Use Water Quality Standards, including standards based on hardness for a number of years. Further, the Agency has already developed detailed procedures for implementing the Lake Michigan Basin Water Quality Standards that address reasonable potential determination. *See* 35 Ill. Adm. Code 352.

The situation in which the Board allowed a standards change to go to First Notice without seeing implementation procedures in R02-11 could hardly be more different from the situation presented to the Board in the instant proceeding. Here, everything strongly supports following the Board's general practice of requiring submission of implementation procedures before considering amendments to standards. No federal guidance or other information has been presented with the petition to show what the implementation procedures would be like. No one suggests that IEPA has any experience in performing dissolved oxygen monitoring or developing permit limits in a way that would follow Professors Garvey and While's recommendations. Indeed, IEPA indicated at the June 29 hearing in this proceeding that it had no idea how IAWA's proposal might be implemented. Regarding how IEPA might implement the IAWA proposal, Mr. Frevert testified:

> We'll get to that and help you deal with that later, but I'm not prepared to go into any detail today. My eyes are rolling and I'm thinking we're speculating about all sorts of exotic, expensive monitoring requirements and permitting conditions and other things that have incredible secondary and tertiary impacts, so don't ask me to answer today. (Tr. 144)

Certainly it would not be prudent for the Board to adopt standards amendments based on the assumption that they will be implemented with the monitoring and permitting procedures recommended by Dr. Garvey. Our only hint as to what the Agency thinks of the Garvey/While's recommendations is that they make "eyes roll" and may be too "exotic" or expensive to use.

As noted by Board staff (Tr. 139), IAWA's proposed dissolved oxygen standards do not provide for the monitoring that IAWA's expert recommends for the implementation of the standards. Further, the IAWA proposal is not nuanced. It reduces the minimum to 3.5 mg/L in every water body in the state except for Lake Michigan no matter how exceptional the water body, where the water body is located, the nature of the water body and what species are found in the water. Within water bodies, the proposal does not differentiate between samples taken in riffles and the bottom of reservoir pools. It alludes to implementation procedures by indicating how certain monitoring "should" be done, but the likely effect of these provisions is anything but clear.[1]

If IAWA is bent on going forward at this time, it could propose implementation procedures itself and ask that they be adopted as Board rules.[2] However, if IAWA wants to work out implementation procedures with IEPA and other parties, it should come back to the Board after it has done so.[3] It should not ask the Board to adopt standards on the assumption that implementation procedures will be adopted without giving the Board and the public a realistic idea of what those implementation procedures will look like.

In addition to the lack of implementation rules, there are a host of other reasons why more time is needed before the Board can judiciously consider changes to the dissolved oxygen standards. Time is needed to analyze the data and science alleged to support the IAWA proposal. At the time of the hearing, neither IAWA's expert nor anyone else had had time to consider the Fox River data or United States Geological Service data that is alleged to support the proposal. (Tr. 177) The Ohio River tributary data collected by Professor Garvey's students on which he relies has not been processed or subjected to peer review. (Tr. 87, 114-15) Data has not been

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[1] Just what is the legal effect of saying in a standard that certain monitoring "should" be done in a particular manner? Does that somehow compel the data be collected in that manner? If a violation is found in a manner that does not comply with the manner that "should" be used, does that mean that the violation does not count and everyone can go on polluting as if the violation was not found?

[2] In the Great Lakes Water Quality Standards proceeding and the antidegradation proceeding, language originally proposed for Agency implementation procedures was adopted as Board regulations.

[3] No standards changes can go into effect until they are approved by the U.S. Environmental Protection Agency. Alaska Clean Water Alliance v. U.S. EPA, 1997 U.S. Dist. LEXIS 11144, 27 ELR 21330 (W. D. Wash. 1997) Under 40 CFR 131.6(f), U.S. EPA cannot even consider approval of Illinois standards until presented with "information on general policies applicable to state standards which may affect their application and implementation."

collected on the fish assemblage for the limited number of waters for which there is dissolved oxygen data (Tr. 182) although IAWA proposes to amend statewide standards based on scientific conclusions drawn from the apparently healthy fishery in those few waters.[4]

II. There is no urgency for making the proposed change

IAWA offers a number of practical reasons for the Board to amend Illinois' dissolved oxygen standards. None of these reasons support going forward to consider a petition without the Board being able to review the necessary implementation procedures and scientific data.

A. Federal law does not forbid Illinois having dissolved oxygen standards more protective than the federal National Criteria Document and, in any event, the current standards are not more protective than the NCD.

Mr. Harsch at the hearing suggested as a reason for adopting the proposal that, "Under the Clean Water Act, Section 33 U.S. Code 1331(c): States are required to revise water quality standards within three years of the adoption of national criteria by USEPA." (Tr. 10) Mr. Harsch then made statements that could have been understood to mean that the current dissolved oxygen standards should have been revised within three years of the issuance of the April 1986 U.S. EPA National Criteria Document ("NCD") to conform to that document. (Id.) Whatever Mr. Harsch intended to say, the Board certainly should not race to adopt new standards based on a misunderstanding of federal requirements.

[4] In fact, there is a host of other studies and data that should be collected before Illinois dissolved oxygen standards are weakened. As stated by Dr Garvey, there is currently no region specific data for Illinois (Tr. 46), there is very little pre-dawn data (Tr. 84-5), studies that might be relevant to endangered species have not been assembled (Tr. 92), riffle DO levels have not been measured although that needs to be done (Tr. 93), and there are no studies of the chronic effects of low DO levels on aquatic life that can be trusted. (Tr. 114)

First, 33 U.S.C. § 1313(c) does not require Illinois to conform to the 1986 NCD. Section 1313(c) of the Clean Water Act requires states to adopt criteria "for all toxic pollutants listed pursuant to section 1317(a)(1) for which criteria have been published …" But dissolved oxygen is not a priority toxic pollutant subject to Section 1317(a)(1); it is not a toxic pollutant at all. Illinois is certainly not prohibited from having dissolved oxygen standards that are stronger than the NCD. Apparently every state in the region has standards as stringent as Illinois' with the debatable exception of Ohio. (Tr. 164-5)[5]

More critically, Illinois' current dissolved oxygen standards conform to the NCD; the IAWA proposed standards do not. The 1986 NCD provides for standards identical to the current Illinois dissolved oxygen standards of 6.0 mg/L for the 7 day average and 5.0 mg/L minimum for all periods of the year in which early life stages are present. This includes all embryonic and larval stages and all juvenile forms up to 30 days following hatching. (IAWA Ex.2 p.34)[6] The NCD provides for less stringent standards during periods in which early life stages are not present but limits this provision with a very important condition:

> The flexibility afforded by such a dichotomy [between early life stages and other periods] in criteria carries with it the responsibility to accurately determine the presence or absence of the more sensitive stages prior to invocation of the less stringent criteria. Such presence/absence data must be more site-specific than national in scope so that temperature, habitat or calendar specification are not possible this document. <u>In the absence of such site-specific determination the default criteria would be those that would protect all life stages year-round …</u> (Hearing Exhibit 2. p.4) (emphasis added)

[5] Ohio's standards, unlike the IAWA proposal, do not violate the 1986 NCD because Ohio has apparently done the site specific identification of exceptional waters and sensitive periods that it is necessary to do under the NCD if it is intended to adopt standards that do not protect early development stages for the whole year.

[6] The IAWA proposal does not even provide for a 30 day juvenile period for the federally endangered pallid sturgeon. (Tr. 174)

Professor Garvey has repeatedly acknowledged that site-specific data is not available for Illinois and that the IAWA is not proposing site-specific standards. (Tr. 51, 58, 133-4) Accordingly, the criteria recommended by the 1986 NCD are essentially Illinois' current criteria. Certainly, the IAWA has offered no site-specific justification that would allow Illinois to claim the more lenient standards for the entire state and for more than the period November through February that was proposed by IAWA and Dr. Robert Sheehan in R94-01 as the period when sensitive life stages are not present.[7]

If the object is to conform Illinois' dissolved oxygen standards to federal criteria, Illinois' standards should be left alone.

B. Proper development of nutrient standards would not be assisted by adoption of a revised dissolved oxygen standards because nutrients cause impairments of Illinois waters that are not directly related to minimum oxygen levels.

Another consideration IAWA submits to support adoption now of less stringent dissolved oxygen standards is the fact that nutrient standards are now being developed for Illinois. See Testimony of Michael Callahan. (Tr. 31)[8] Actually, dissolved oxygen standards may be largely irrelevant to the development of nutrient standards. Nutrient standards and controls on nutrient pollution are needed as soon as possible in order to control unnatural algal blooms and plant growth no matter what is ultimately decided regarding dissolved oxygen standards.

U.S. EPA has described the damage caused by excess nutrients, stating:

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[7] Still further, the IAWA proposal does not have the 30-day minimum average present in the NCD.

[8] Illinois currently has a standard for phosphorus of 0.05 mg/L for lakes of sufficient size (302.205) and a drinking water standard for nitrate of 10 mg/L. (302.34) Illinois does not have nutrient standards that protect streams or rivers (including impounded rivers) and does not have standards to protect downstream waters such as the Mississippi River or the Gulf the Mexico.

Human health problems can be attributed to nutrient enrichment. One serious human health problem associated with nutrient enrichment is the formation of trihalomethanes (THMs). Trihalomethanes are carcinogenic compounds that are produced when certain organic compounds are chlorinated and bromated as part of the disinfection process in a drinking water facility. Trihalomethanes and associated compounds can be formed from a variety of organic compounds including humic substances, algal metabolites and algal decomposition products. The density of algae and the level of eutrophication in the raw water supply has been correlated with the production of THMs.

Effects directly related to nutrients can also result in human health problems. … The USEPA has an established maximum contaminant level of 10 mg/L because nitrates in drinking water can cause potentially fatal low oxygen levels in the blood when ingested by infants. Nitrate concentrations as low as 4 mg/L in drinking water supplies from rural areas have also been linked to an increased risk of non-Hodgkin lymphoma.

* * *

Nutrient impairment can cause problems other than those related to human health. One of the most expensive problems caused by nutrient enrichment is the increased treatment required for drinking water... Adverse ecological effects associated with nutrient enrichment include reductions in dissolved oxygen (DO) and the occurrence of HABs (harmful algal blooms). High algal and macrophyte biomass may be associated with severe diurnal swings in DO and pH in some water bodies. Low DO can release toxic metals from sediments contaminating habitats of local aquatic organisms. In addition, low DO can cause increased availability of toxic substances like ammonia and hydrogen sulfide, reducing acceptable habitat for most aquatic organisms, including valuable game fish. Decreased water clarity (increased turbidity) can cause loss of macrophytes and creation of dense algal mats. Loss of macrophytes and enrichment may alter the native composition and species diversity of aquatic communities.[9]

In addition, nutrients, particularly phosphorus, can cause high pH levels which themselves can be harmful to aquatic life. Walter K. Dodds, Freshwater Ecology, Academic Press (2002) p. 341-42. Bringing this home, there are recent studies showing that algal blooms are causing violations of pH standards in dammed pools in the Fox River. See Victor Santucci Jr. and Stephen R. Gephard, Fox River Fish Passage Feasibility Study,

[9] U.S. Environmental Protection Agency, Nutrient Criteria, Technical Guidance Manual, Rivers and Streams, EPA -822-B-00-002 (July 2000) (pp. 4-5, citations omitted).

http://www.co.kane.il.us/kcstorm/dams/fishpssg/final.pdf., pp. 42-54. (Exhibit A to this memorandum) Earlier with regard to the Fox River, the Illinois Natural History Survey wrote of the effect of elevated phosphorus levels on the Fox:

> High nutrient inputs and still-water environments created by the numerous channel dams situated along the entire main stem of the Fox River in Illinois promote excessive algal growths. Very high phosphorus levels appear to promote and sustain massive algal blooms along the Fox River. ...
>
> Pronounced algal growth will continue to produce fluctuating DO levels behind the low channel dams unless significant reduction in phosphorus levels occurs.[10]

In short, by creating algal blooms and blooms of cyanobacteria, nutrients cause a host of problems for Illinois drinking water, recreational uses and aquatic life, only some of which problems relate directly to dissolved oxygen.[11] Nutrient pollution is known to cause violation of at least three Illinois water quality standards:

> 302.203 which states that "Water of the State shall be free from sludge or bottom deposits, floating debris, visible oil, odor, plant or algal growth, color or turbidity of other than natural origin,"
>
> 302.204 which provides that pH shall be within the range of 6.5 to 9.0 except for natural causes, and
>
> 302.206 Dissolved Oxygen.

Hasty adoption of amendments to the dissolved oxygen standards will not make it any easier to determine the levels of phosphorus and nitrogen that cause unnatural plant or algal growth or violations of pH standards. The fact of the matter is that it is going to be very difficult

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[10] Illinois State Water Survey, Considerations in Water Use Planning for the Fox River, Contract Report 586 (September 1995) pp. 100, 104, 113, 120,122.

to establish predictive scientific relationships between nutrient levels and dissolved oxygen minimums, particularly in rivers and streams. (see Garvey testimony Tr. 77-8) The focus of those that have been trying to develop nutrient standards has been to discover the relationship between nutrient levels and unnatural plant or algal growth. Walter K. Dodds and Eugene B. Welch, Establishing nutrient criteria in streams, J.N. Am Benthol Soc., 2000, 19(1):186-196.

Illinois' dissolved oxygen standards will figure prominently in the calculations of the Illinois' nutrient standards only in the improbable event that proper science concludes that to avoid violating the Illinois dissolved oxygen standards there must be a lower nutrient level than that required to prevent unnatural plant or algal growth. It is now expected that decisions on such questions will be needed in 2007 or 2008. (Callahan Testimony Tr. 64) This leaves plenty of time to develop well considered dissolved oxygen standards supported by practical implementation procedures.

C. It is unknown if any total maximum daily load studies to be done in the next two years will be affected by the dissolved oxygen standards.

IAWA has presented testimony that hundreds of TMDLs must be done because of dissolved oxygen impairments and argues that this is a reason to amend Illinois standards. (Tr. 40) But we do not know the number of dissolved oxygen TMDLs that could be avoided if the weaker standards IAWA proposes were adopted because we do not know how many of the waters that are impaired under current standards would pass under the IAWA proposal. (Tr. 195)

[11] In addition, Illinois nutrient pollution is contributing to hypoxia in the Gulf of Mexico and current U.S. EPA policy requires that Illinois standards protect downstream waters including the Gulf.

We do know that waters on the TMDL list are placed there using biological testing and criteria to identify impairments and that Dr. Garvey favors the use of these methods. (Ex. 1 p. 33) We do know that the dissolved oxygen violations found were based on measurements taken during daylight hours, when dissolved oxygen concentrations are higher, rather that pre-dawn because IEPA has only recently had access to early morning data. (Tr.84-5) We also know that the E. Branch of the Du Page River and Salt Creek TMDLs, which were the subject of testimony during the hearing (Tr. 20-1), would have had to be done for dissolved oxygen even if the IAWA standards were adopted. Both of these waters had dissolved oxygen levels that fell below 3.5 mg/L or fell below 5.0 mg/L during the March to June period. (Portions of the Draft TMDLs for Salt Creek and East Branch DuPage River, Exhibit B to this memorandum)

We also know that IEPA has proposed to do TMDLs involving dissolved oxygen for less than thirty water segments over the next two years. (Draft Illinois 2004 Section 303(d) List pp. 13-7, Exhibit C) Of these 30 potential TMDLs, it is unknown if any of the waters would have avoided dissolved oxygen TMDLs under the proposed IAWA standards.[12] Given that each of these waters were found to have violated current dissolved oxygen standards from infrequently taken samples taken during the daytime, it is very likely that all of these waters would be found to have significant dissolved oxygen problems even if Dr. Garvey's recommendations were accepted.

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[12] If there are scheduled TMDLs for dissolved oxygen for which the water segment involved would not have violated DO standards under the IAWA proposal, ELPC, Sierra Club and Prairie Rivers would agree to have them delayed pending resolution of the questions relating to dissolved oxygen standards. After all, there are hundreds of other impaired waters in the queue waiting for TMDLs to be done.

D. If any treatment costs are now being increased as a result of the current dissolved oxygen standards, they should be examined on a case-by-case basis.

It is also unclear that any permit limits are being affected by the supposed stringency of the current dissolved oxygen standards. Illinois permit writers do not use modeling to set NPDES permit limits for CBOD or BOD to avoid violations of dissolved oxygen standards as permit writers in neighboring states do (e.g. Michigan, Exhibit D), Illinois permit writers simply apply the cookie cutter effluent limits set forth in 35 Ill. Adm. Code 309.120 which do not involve any reference to the dissolved oxygen standards.[13]

There has been testimony that recently some sewerage dischargers have been asked to maintain a minimum dissolved oxygen level of 6 mg/L in their discharge to prevent violations of the current dissolved oxygen standards (Tr. 63) but no details have been provided. We have no idea how much money would be saved by dischargers if the Board adopted the IAWA standards. Additionally, we do not know if there are substantial costs to meet current standards, whether some sort of variance or site specific relief would be appropriate. Certainly, alleged increased wastewater treatment costs cannot properly be used as a justification for a precipitant change in the statewide dissolved oxygen standards without real evidence, supported by cost figures, showing that dischargers are now being asked to spend substantial sums for water treatment that they would not have to pay under the proposed standards.

[13] The East Branch Du Page and Salt Creek TMDL implementation plans might potentially affect permit limits for discharges to those two waters if that is found to be necessary after IEPA tries a number of other steps to meet standards.

II. CONCLUSION

Neither the science nor the necessary implementation procedures have been considered and developed sufficiently to allow amendments to Illinois dissolved oxygen standards to be considered properly. The Board should order that consideration of the petition be suspended until such time as the Petitioner presents evidence as to the specific implementation procedures that it is expected will be adopted to implement the proposed standards.

Respectfully submitted,

Albert F. Ettinger
Senior Staff Counsel, Environmental Law & Policy Center and counsel in this matter for Prairie Rivers Network and Sierra Club

July 21, 2004

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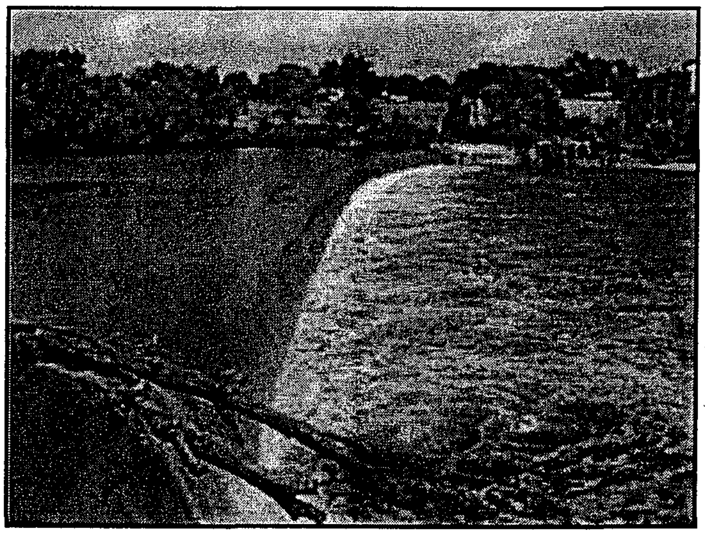
Fox River Fish Passage Feasibility Study

Final Report



Victor J. Santucci, Jr. and Stephen R. Gephard
Principal Investigators

Submitted to:
Illinois Department of Natural Resources
C2000 Ecosystem Program
One Natural Resources Way
Springfield, Illinois 62702

April 2003

EXHIBIT A

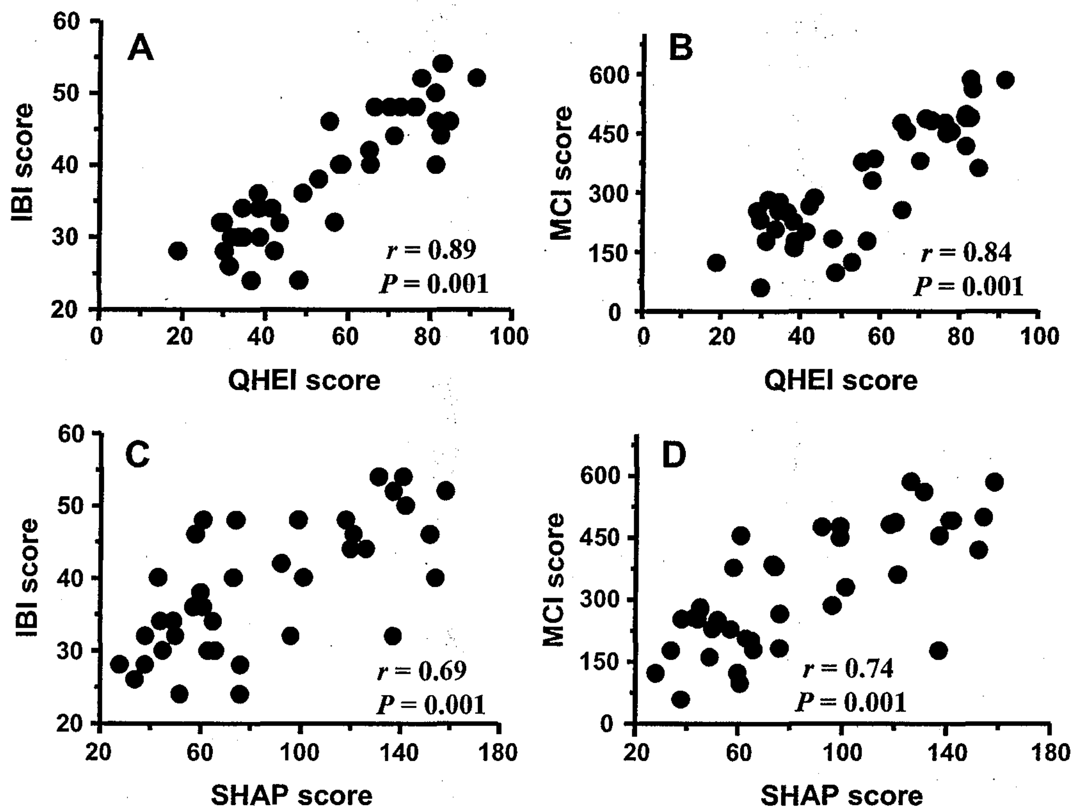


Figure 10. Relationships between (A) the Qualitative Habitat Evaluation Index (QHEI) and the Index of Biotic Integrity (IBI), (B) QHEI and the Macroinvertebrate Condition Index (MCI), (C) the Stream Habitat Assessment Procedure (SHAP) and IBI, and (D) SHAP and MCI. Fish and macroinvertebrate communities and habitat were assessed at 40 stations on the Fox River between McHenry and Dayton, Illinois during July through early September 2000.

Water Quality

Dissolved oxygen varied on a daily basis at all stations such that concentrations increased during the day and declined at night (Table D1). However, the magnitude of these daily fluctuations was substantially higher at impounded stations than free-flowing stations (Figure 11). Dissolved oxygen concentrations in impounded areas were as high as 17.8 mg/L (>200% saturation) and as low as 2.6 mg/L (Table 19). With few exceptions, dissolved oxygen in free-flowing areas varied between 5 and 10 mg/L. On average, maximum dissolved oxygen concentrations were higher for impounded stations than free-flowing stations (13.8±0.8 vs. 9.8±0.4 mg/L; repeated-measures ANOVA, $P = 0.001$) and minimum concentrations were lower in impoundments (4.2±0.7 vs. 5.7±0.7 mg/L; $P = 0.02$).

Although daily extremes in dissolved oxygen varied between free-flowing and impounded portions of river, mean concentrations were similar between habitat types (repeated measures ANOVA, $P = 0.40$; Table 20). Likewise, mean values of other water quality parameters were

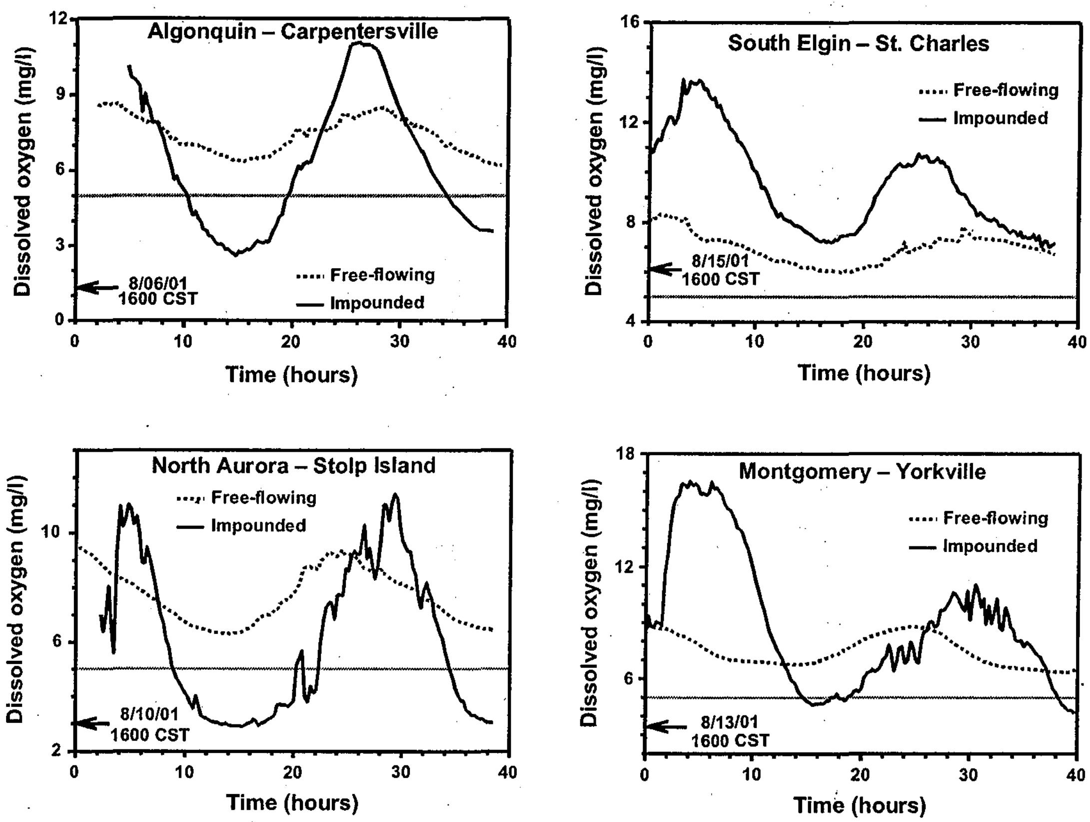


Figure 11. Dissolved oxygen concentrations at free-flowing and impounded stations in four segments of the Fox River, Illinois. Dissolved oxygen was measured at each station with continuous recording Datasondes over a 40-hour period in August 2001. The horizontal line represents the 5-mg/L ambient water standard for dissolved oxygen (Illinois EPA).

similar at free-flowing and impounded locations ($P > 0.13$). In contrast, sampling time had a significant effect on mean values for 9 of 16 parameters (Table 20). Dissolved oxygen and seven additional parameters were higher during p.m. than a.m. sample periods ($P < 0.03$) and nitrate/nitrite nitrogen was lower during p.m. sampling ($P = 0.01$). Seven parameters did not vary with time period ($P > 0.08$). The significant habitat x time interactions observed for dissolved oxygen concentration and % saturation resulted because differences in dissolved oxygen between a.m. and p.m. sample periods were greater for impounded stations than free-flowing stations.

Comparisons of water quality data to recommended guidelines showed that the Fox River was nutrient enriched and supported high algal biomass (Tables 9 and D1). We present means of samples from above and below dam stations and a.m. and p.m. time periods for total phosphorus and nitrogen, chlorophyll a, and turbidity because these parameters either were similar between habitat type and time period (nutrients and turbidity; Table 20) or differences were small relative to the degree that concentrations exceeded guidelines (chlorophyll a; Table D1). Total phosphorus was near the recommended guideline for Phosphorus Zone 4 Midwestern streams at

Table 19. Mean (minimum - maximum) temperature, dissolved oxygen, specific conductance, and pH for free-flowing and impounded habitats in 11 segments of the Fox River between McHenry and Dayton, Illinois. Data were collected from August 6-17, 2001 with continuously recording Datasondes and by point sampling at the beginning, middle, and end of each 40 h monitoring period. Sondes were set mid channel 1-1.5 ft. off bottom and point measurements were made at the surface, mid depth, and bottom of mid channel, left-of-center, and right-of-center locations along cross channel transects that included the sonde location. Battery failure reduced the number of sonde readings for the Carpentersville and Dayton above dam stations.

Segment and station	Habitat	River mile	Number of readings	Temperature (°C)	Dissolved oxygen (mg/L)	Dissolved oxygen (% saturation)	Specific conductance (µs/cm)	pH (units)
Stratton - Algonquin								
Stratton below dam	Free-flowing	98.77	173	29.6 (28.8 - 30.7)	6.9 (5.7 - 8.8)	92.5 (76.6 - 119.7)	656 (648 - 731)	8.5 (8.4 - 8.7)
Algonquin above dam	Impounded	82.64	182	29.2 (28.4 - 30.2)	5.8 (3.3 - 11.8)	77.3 (44.5 - 160.9)	777 (709 - 802)	8.3 (8.1 - 8.6)
Algonquin - Carpentersville								
Algonquin below dam	Free-flowing	82.51	175	29.3 (28.4 - 30.2)	7.4 (5.3 - 11.7)	99.7 (70.5 - 154.6)	895 (716 - 993)	8.3 (8.1 - 8.5)
Carpentersville above dam	Impounded	78.27	98	29.4 (28.0 - 30.7)	5.5 (2.6 - 11.3)	74.1 (33.9 - 154.0)	840 (770 - 873)	8.2 (7.5 - 8.6)
Carpentersville - Elgin								
Carpentersville below dam	Free-flowing	78.11	172	29.9 (27.2 - 31.1)	7.3 (4.8 - 9.5)	99.3 (62.7 - 131.6)	852 (730 - 901)	8.3 (8.0 - 8.7)
Elgin above dam	Impounded	71.99	180	29.4 (27.6 - 32.7)	5.4 (3.2 - 15.8)	73.4 (42.9 - 224.4)	909 (812 - 979)	8.4 (8.1 - 9.0)
Elgin - South Elgin								
Elgin below dam	Free-flowing	71.57	174	29.7 (27.8 - 31.3)	7.2 (5.4 - 9.7)	98.6 (71.1 - 135.6)	887 (684 - 926)	8.4 (8.2 - 8.7)
South Elgin above dam	Impounded	68.31	188	29.2 (27.5 - 32.0)	7.7 (3.3 - 14.5)	103.7 (43.2 - 242.0)	938 (846 - 980)	8.4 (8.1 - 9.0)
South Elgin - St. Charles								
South Elgin below dam	Free-flowing	68.08	156	23.4 (21.9 - 24.9)	6.9 (5.9 - 8.3)	83.7 (71.6 - 103.0)	861 (833 - 883)	8.2 (7.0 - 8.5)
St. Charles above dam	Impounded	60.69	181	23.5 (21.8 - 25.5)	9.5 (6.1 - 15.7)	114.7 (71.8 - 195.2)	863 (784 - 873)	8.7 (7.9 - 9.0)
Geneva - North Batavia								
Geneva below dam	Free-flowing	58.56	179	23.4 (21.8 - 24.7)	8.0 (6.8 - 9.5)	95.9 (81.0 - 116.4)	877 (819 - 903)	8.6 (8.2 - 8.8)
North Batavia above dam	Impounded	56.49	189	23.4 (21.9 - 29.9)	6.0 (2.8 - 13.3)	72.1 (34.1 - 178.3)	857 (820 - 903)	8.6 (8.4 - 9.0)
South Batavia - North Aurora								
South Batavia below dam	Free-flowing	54.75	175	27.4 (25.7 - 29.3)	7.2 (4.7 - 10.1)	94.4 (59.5 - 135.4)	831 (798 - 850)	8.9 (8.8 - 9.0)
North Aurora above dam	Impounded	52.69	180	27.0 (25.1 - 29.5)	5.6 (2.8 - 11.1)	72.7 (35.5 - 144.8)	832 (815 - 848)	8.9 (8.7 - 9.0)
North Aurora - Stolp Island								
North Aurora below dam	Free-flowing	52.52	175	27.3 (25.1 - 29.9)	7.7 (6.1 - 9.4)	99.7 (75.7 - 127.7)	826 (804 - 847)	8.8 (8.7 - 9.0)
Stolp Island above dam	Impounded	49.03	180	26.9 (24.8 - 30.4)	6.2 (2.9 - 14.4)	80.4 (36.6 - 197.3)	853 (821 - 879)	8.8 (8.5 - 9.1)
Hurds Island - Montgomery								
Hurd's Island below dam	Free-flowing	48.32	182	23.0 (21.5 - 24.3)	6.8 (5.8 - 8.2)	81.5 (69.5 - 99.6)	874 (789 - 895)	8.5 (8.3 - 8.8)
Montgomery above dam	Impounded	46.85	190	23.0 (21.4 - 24.6)	7.2 (5.2 - 9.2)	85.8 (59.8 - 109.6)	926 (867 - 953)	8.4 (8.2 - 8.7)
Montgomery - Yorkville								
Montgomery below dam	Free-flowing	46.76	181	25.5 (24.2 - 26.9)	7.5 (6.3 - 9.8)	93.5 (78.2 - 112.4)	871 (859 - 887)	8.8 (8.7 - 9.0)
Yorkville above dam	Impounded	36.56	186	24.0 (21.7 - 27.6)	9.1 (4.2 - 16.8)	112.5 (50.0 - 214.9)	905 (861 - 934)	8.9 (8.6 - 9.4)
Yorkville - Dayton								
Yorkville below dam	Free-flowing	36.41	183	25.2 (22.5 - 27.7)	9.6 (6.6 - 12.7)	119.5 (80.1 - 158.6)	853 (819 - 933)	9.0 (8.8 - 9.3)
Dayton above dam	Impounded	5.80	32	25.6 (24.4 - 27.2)	13.2 (10.0 - 17.8)	166.9 (121.7 - 225.2)	839 (828 - 854)	9.3 (9.2 - 9.4)

Table 20. Water quality parameter means (±1 standard error) and results of repeated-measures ANOVA examining the effects of habitat type, time period, and habitat x time interactions on water quality in the Fox River between McHenry and Dayton, Illinois. Water samples were collected from August 6-17, 2001 in free-flowing and impounded habitats during a.m. (0613 - 0940 hours) and p.m. (1830 -2242 hours) time periods. $P \leq 0.05$ indicates significance.

	Habitat type			Time period			Habitat x Time interaction
Parameter	Free-flowing	Impounded	*P*	a.m.	p.m.	*P*	*P*
Temperature (°C)	26.2±0.6	26.2±0.6	0.98	25.3±0.6	27.1±0.6	0.001	0.92
Dissolved oxygen (mg/L)	7.4±0.3	8.0±0.8	0.40	5.9±0.3	9.4±0.6	0.001	0.01
Dissolved oxygen (% saturation)	93.2±4.3	101.8±10.1	0.33	73.4±3.9	121.6±7.1	0.001	0.02
Specific conductance (µS/cm)	818.2±15.4	835.2±11.0	0.53	830.0±14.4	823.3±12.6	0.25	0.61
pH (units)	8.6±0.1	8.7±0.1	0.54	8.5±0.1	8.8±0.1	0.001	0.56
Turbidity (NTU)	43.2±1.5	40.5±1.7	0.30	42.4±1.5	41.3±1.8	0.61	0.90
Total suspended solids (mg/L)	46.5±2.5	42.1±1.4	0.20	41.8±1.8	46.8±2.3	0.04	0.56
Total organic carbon (mg/L)	12.8±0.5	12.4±0.4	0.62	11.9±0.3	13.2±0.5	0.001	0.53
Chlorophyll a (µg/L)	136.0±9.0	148.1±9.7	0.40	127.5±6.3	156.6±10.9	0.02	0.53
Total phosphorus (mg/L)	0.42±0.03	0.42±0.03	0.96	0.42±0.03	0.41±0.03	0.37	0.34
Total dissolved phosphorus (mg/L)	0.19±0.02	0.19±0.02	0.90	0.19±0.02	0.19±0.02	0.78	0.90
Total nitrogen (mg/L)	2.83±0.12	2.74±0.12	0.69	2.86±0.12	2.71±0.12	0.09	0.09
Total Kjeldahl nitrogen (mg/L)	2.22±0.05	2.14±0.05	0.39	2.17±0.04	2.19±0.06	0.60	0.02
Ammonia nitrogen (mg/L)	0.11±0.01	0.07±0.01	0.14	0.10±0.01	0.09±0.01	0.47	0.72
Unionized ammonia (mg/L)	0.019±0.002	0.016±0.002	0.26	0.014±0.002	0.021±0.002	0.01	0.94
Nitrate/nitrite nitrogen (mg/L)	0.61±0.09	0.59±0.10	0.94	0.69±0.10	0.51±0.09	0.01	0.40

Stratton Dam (0.11 mg/L), increased to the 90th percentile between Stratton and South Elgin (0.54 mg/L), and remained elevated at all downstream stations (Figure 12). A modest decrease in phosphorus concentrations was evident between the Yorkville and Dayton dams, a reach of river with over 26 uninterrupted miles of free-flowing habitat. Total nitrogen followed a pattern similar to total phosphorus except that peak nitrogen concentrations were near the 50th percentile for Nitrogen Zone 2 Midwestern streams (4.0 mg /L) and the decrease in nitrogen at the southernmost stations was more substantial (Figure 12). Total Kjeldahl nitrogen was above the 25th percentile guideline at all sampling stations whereas ammonia nitrogen, unionized ammonia, and nitrate/nitrite nitrogen remained at low to moderate levels throughout the study area (Tables 20 and D1). Like Kjeldahl nitrogen, chlorophyll a concentrations and turbidity were high at all sampling stations relative to recommended guidelines (Figure 13). High organic nitrogen (compared to free ammonia and non-organic forms), chlorophyll a, suspended solids, and turbidity were indicative of the extremely high algal biomass that we observed in the Fox River during summer and fall 2000 and 2001.

Standard violations for dissolved oxygen and pH were widespread and of long duration in impounded reaches throughout the study area, but they occurred infrequently and for shorter time periods in free-flowing habitats. Minimum dissolved oxygen concentrations were below the 5-mg/L standard at 8 of 11 impounded stations during the first sampling event (Figure 14) and all

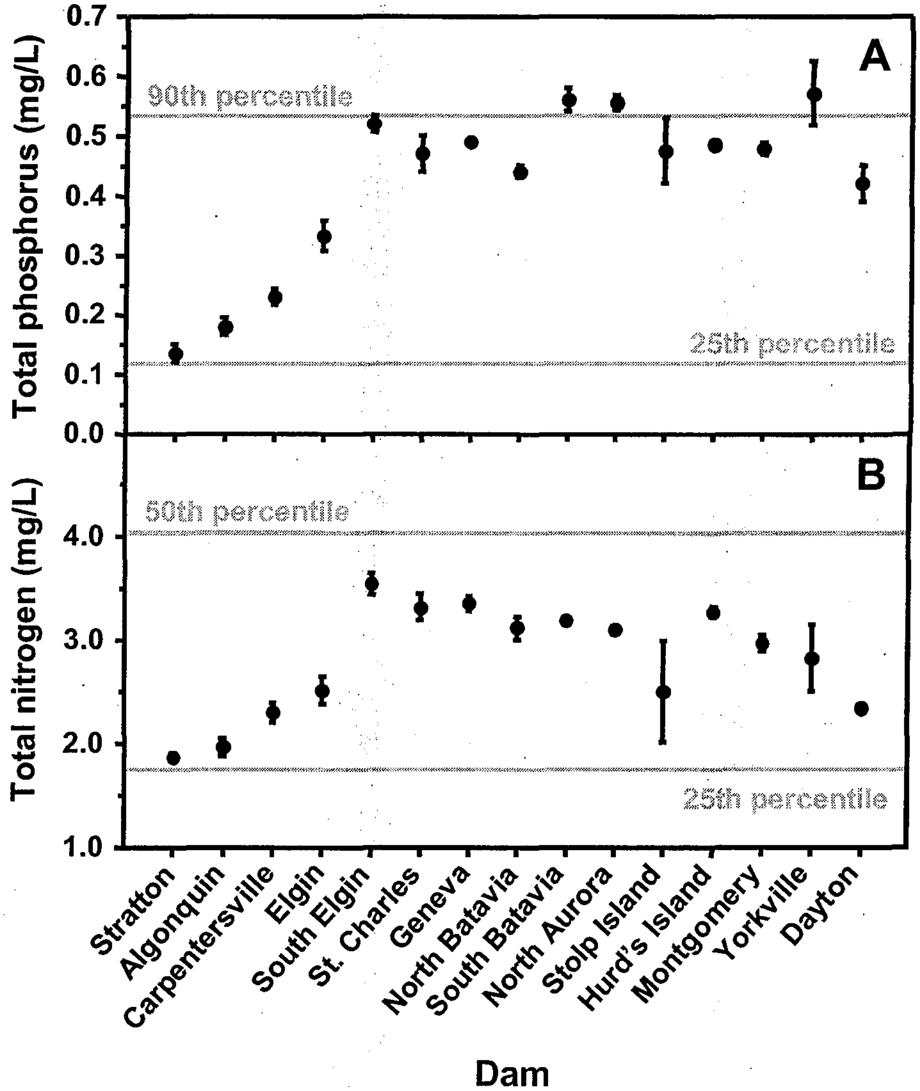


Figure 12. Mean concentrations of (A) total phosphorus and (B) total nitrogen measured at 15 dams on the Fox River between McHenry and Dayton, Illinois. Samples were collected during the early morning and evening at above and below dam stations in August 2001. Percentile guidelines are based on data from over 100 Midwestern streams (Robertson et al. 2001). Vertical lines represent 1 SE.

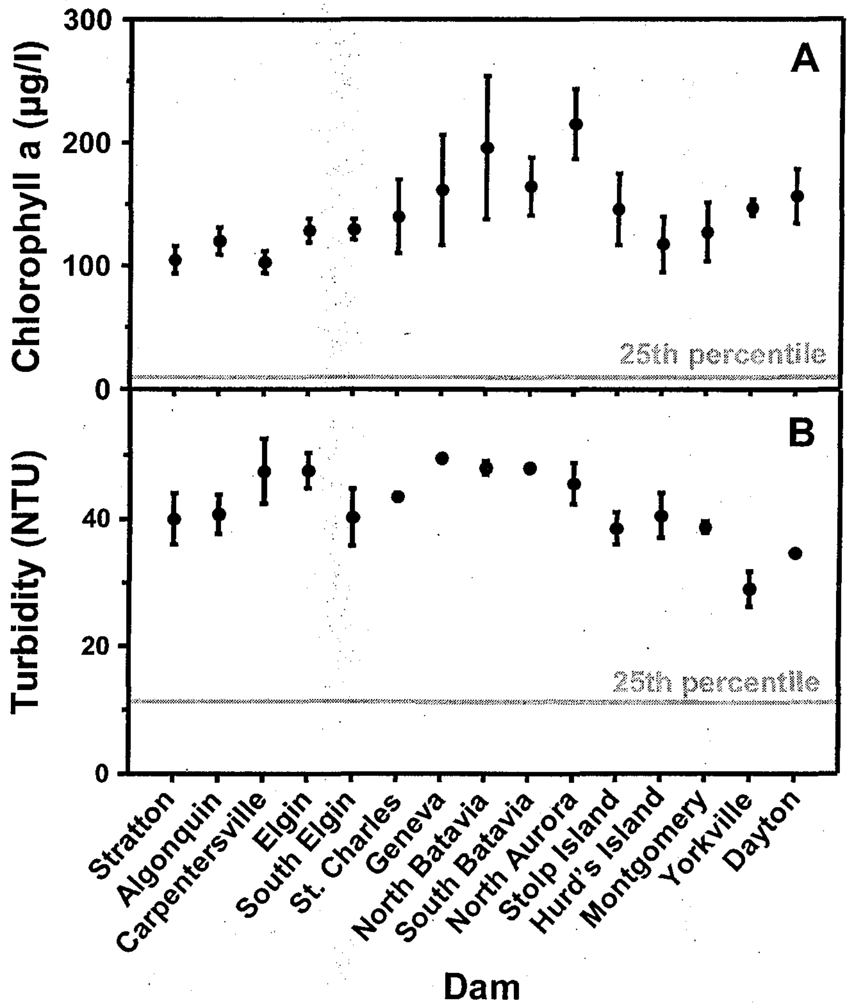


Figure 13. Mean concentrations of (A) chlorophyll a and (B) turbidity measured at 15 dams on the Fox River between McHenry and Dayton, Illinois. Samples were collected during the early morning and evening at above and below dam stations in August 2001. Percentile guidelines are based on all season data from Level III ecoregion VI streams (U.S. EPA 2000). Vertical lines represent 1 SE.

four impoundments monitored during the second event (Table D2). When substandard conditions existed in impounded areas, they typically lasted for more than 8 hours in a 24-hour period (>15 hours at two stations; Table 21). In contrast, dissolved oxygen dipped below the standard at only 2 of 11 stations in the free-flowing river and these conditions lasted for only a short time (<2 hours). Maximum pH was above 9.0 units in the Stolp Island, Yorkville, and Dayton impoundments and near violation in impounded areas from Elgin to North Aurora (maximum pH = 9.0; Figure 14). These maximums tended to occur during p.m. sampling when oxygen concentrations were at highly supersaturated levels. The duration of elevated pH ranged from less than 1 hour at Stolp Island to 11.75 hours in Yorkville and 24 hours in Dayton. The

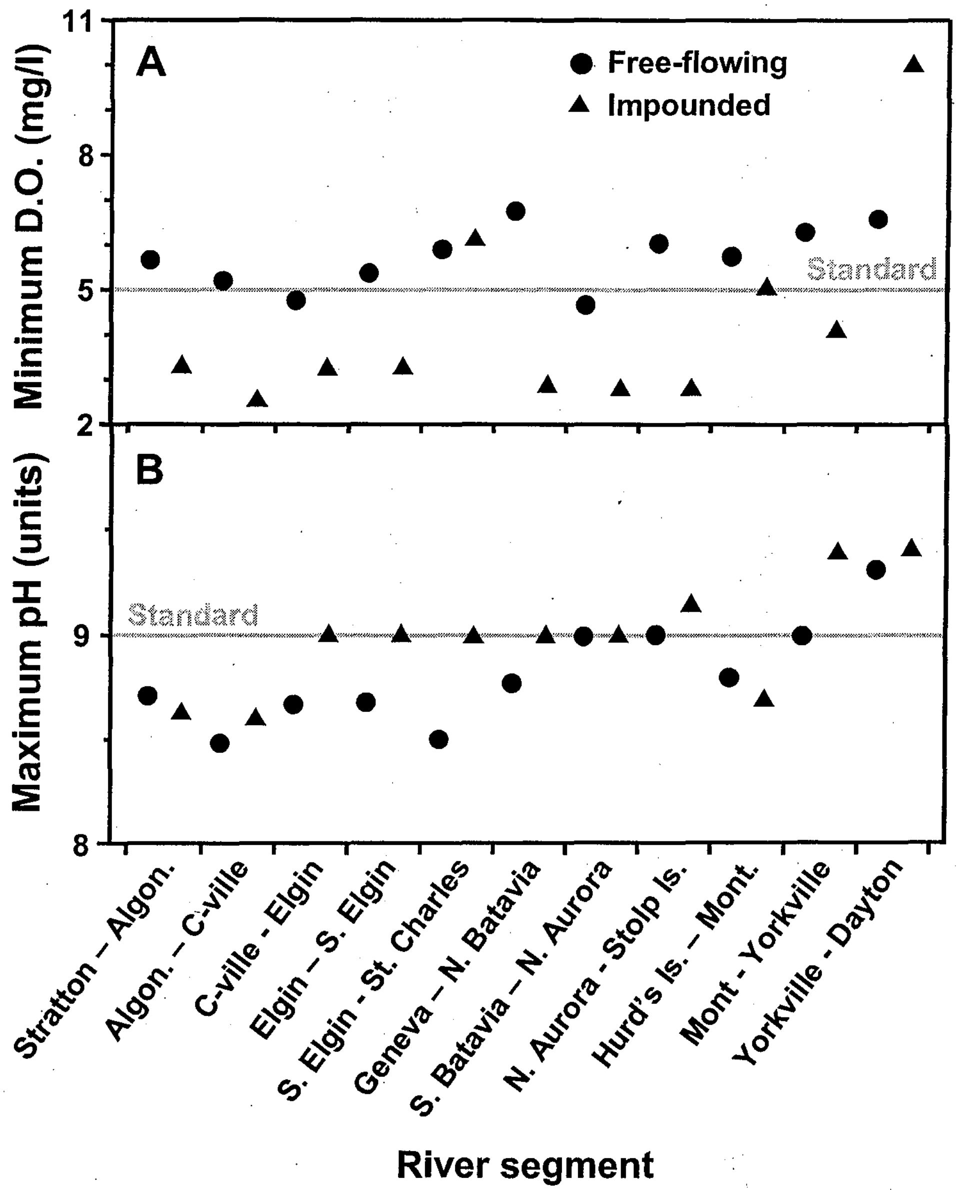


Figure 14. Minimum dissolved oxygen concentrations (A) and maximum pH values (B) for free-flowing and impounded stations in the Fox River between McHenry and Dayton, Illinois. Parameters were measured at each station with continuous recording Datasondes and by point sampling over a 40-hour period in August 2001. Standard lines represent Illinois EPA ambient water quality standards for each parameter.

Yorkville below-dam station was the only free-flowing station with a pH standard violation, although it lasted for 13 hours in a 24-hour period (Table 21).

Substandard oxygen conditions were widespread throughout impoundments monitored during the second sampling event. Low dissolved oxygen concentrations began in the uppermost reaches of impounded areas and, except for the St. Charles pool, continued downstream to the dams (Figure 15). Minimum dissolved oxygen levels dropped below 5 mg/L in the upper

Table 21. Duration of below standard dissolved oxygen concentrations (<5 mg/L) and above standard pH levels (>9.0 units) for free-flowing and impounded habitats in 11 segments of the Fox River between McHenry and Dayton, Illinois. Data were collected from August 6-17, 2001 with continuously recording Datasondes and by point sampling at the beginning, middle, and end of each 40 h monitoring period.

			Duration (hours in 24 h period)	
Segment and station	Habitat	River mile	Dissolved oxygen	pH
Stratton - Algonquin				
Stratton below dam	Free-flowing	98.77	0.00	0.00
Algonquin above dam	Impounded	82.64	15.00	0.00
Algonquin - Carpentersville				
Algonquin below dam	Free-flowing	82.51	0.00	0.00
Carpentersville above dam	Impounded	78.27	9.25	0.00
Carpentersville - Elgin				
Carpentersville below dam	Free-flowing	78.11	1.00	0.00
Elgin above dam	Impounded	71.99	15.50	0.00
Elgin - South Elgin				
Elgin below dam	Free-flowing	71.57	0.00	0.00
South Elgin above dam	Impounded	68.31	1.50	0.00
South Elgin - St. Charles				
South Elgin below dam	Free-flowing	68.08	0.00	0.00
St. Charles above dam	Impounded	60.69	0.00	0.00
Geneva - North Batavia				
Geneva below dam	Free-flowing	58.56	0.00	0.00
North Batavia above dam	Impounded	56.49	8.25	0.00
South Batavia - North Aurora				
South Batavia below dam	Free-flowing	54.75	1.75	0.00
North Aurora above dam	Impounded	52.69	12.75	0.75
North Aurora - Stolp Island				
North Aurora below dam	Free-flowing	52.52	0.00	0.00
Stolp Island above dam	Impounded	49.03	13.50	5.25
Hurds Island - Montgomery				
Hurd's Island below dam	Free-flowing	48.32	0.00	0.00
Montgomery above dam	Impounded	46.85	0.00	0.00
Montgomery - Yorkville				
Montgomery below dam	Free-flowing	46.76	0.00	0.00
Yorkville above dam	Impounded	36.56	3.75	11.75
Yorkville - Dayton				
Yorkville below dam	Free-flowing	36.41	0.00	13.00
Dayton above dam	Impounded	5.80	0.00	24.00

reaches of the St. Charles impoundment, but they remained high (>8 mg/L) in the lower reaches throughout the 16-h sampling event. Comparisons of horizontal and vertical samples at impounded and free-flowing stations showed mean dissolved oxygen concentrations were similar among horizontal locations (left, mid, and right channel; repeated-measures ANOVA, $P > 0.07$; Table 22). Dissolved oxygen also was similar among vertical locations (surface, mid depth, bottom) in free-flowing areas ($P > 0.10$), but it decreased from surface to bottom in impounded areas ($P = 0.001$). Other variables showed patterns similar to dissolved oxygen when comparisons were made among horizontal and vertical locations at free-flowing and impounded

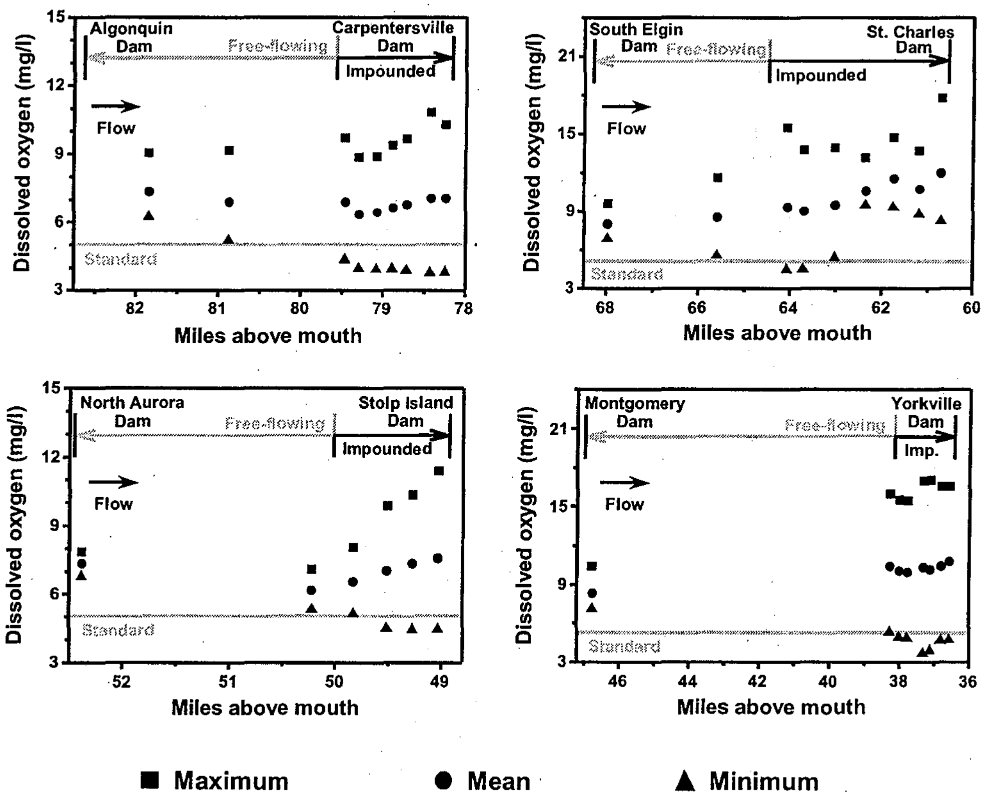


Figure 15. Mean, maximum, and minimum dissolved oxygen concentrations at free-flowing and impounded stations in four segments of the Fox River, Illinois. Dissolved oxygen was measured in each segment with continuous recording Datasondes (four stations) and by point sampling (6-9 transects) over a 16-hour period in August and September 2001.

stations (Table 22). The location x time period interaction was not significant for any measured variables ($P > 0.28$).

Stable low flows in combination with warm water temperatures were necessary for substandard oxygen and pH conditions to occur in Fox River impounded areas. Extremes in measured water quality parameters existed at the St. Charles above dam long-term monitoring station during early August 2001 when flows were stable between 350 and 500 cfs (as measured at the Algonquin gage; Figure 16). Increases in flow above 500 cfs between day 16 and 28 resulted in decreases in water temperature, specific conductance, and pH to more moderate levels and reductions in the magnitude of diel oxygen extremes. Stable low flow conditions between days 28 and 36 again resulted in elevated water quality measures after which measures declined with increased flows on day 36 (Figure 16). Historic flow data suggest that conditions favoring poor water quality may occur annually from mid July through mid October.

Table 22. Mean (±1 standard error) temperature, dissolved oxygen, specific conductance, and pH and results of repeated-measures ANOVA examining the effects of vertical and horizontal sampling locations for free-flowing and impounded habitats in the Fox River between McHenry and Dayton, Illinois. Water samples were collected from August 6-17, 2001 during a.m. (0613 - 0940 hours) and p.m. (1830 -2242 hours) time periods. $P \leq 0.05$ indicates significance.

	Vertical sample location				Horizontal sample location			
Habitat and parameter	Surface	Mid depth	Bottom	*P*	Left of center	Mid channel	Right of center	*P*
Free-flowing								
Temperature (°C)	26.2±0.6	26.2±0.6	26.2±0.6	0.10	26.1±0.6	26.2±0.6	26.2±0.6	0.17
Dissolved oxygen (mg/L)	7.4±0.3	7.3±0.3	7.3±0.3	0.14	7.3±0.3	7.4±0.3	7.3±0.3	0.29
Dissolved oxygen (% saturation)	94.2±4.1	93.0±4.1	92.3±4.12	0.001	92.6±4.2	93.7±4.4	93.2±4.0	0.65
Specific conductance (μS/cm)	822.0±14.6	821.4±14.7	820.7±14.7	0.63	813.0±16.5	818.1±15.4	833.0±13.5	0.10
pH (units)	8.6±0.1	8.6±0.1	8.6±0.1	0.11	8.6±0.1	8.6±0.1	8.6±0.1	0.62
Impounded								
Temperature (°C)	26.2±0.6	26.1±0.6	25.9±0.6	0.12	26.0±0.6	26.0±0.6	26.1±0.6	0.31
Dissolved oxygen (mg/L)	8.2±0.8	7.7±0.7	7.2±0.7	0.001	7.7±0.7	7.4±0.7	7.9±0.8	0.08
Dissolved oxygen (% saturation)	104.0±10.2	97.8±9.4	90.7±8.8	0.001	98.1±9.4	94.5±9.2	99.9±9.7	0.07
Specific conductance (μS/cm)	834.2±10.8	836.0±11.0	838.5±11.0	0.03	834.4±11.0	837.4±11.0	837.0±10.9	0.37
pH (units)	8.7±0.1	8.6±0.1	8.6±0.1	0.004	8.6±0.1	8.6±0.1	8.6±0.1	0.28

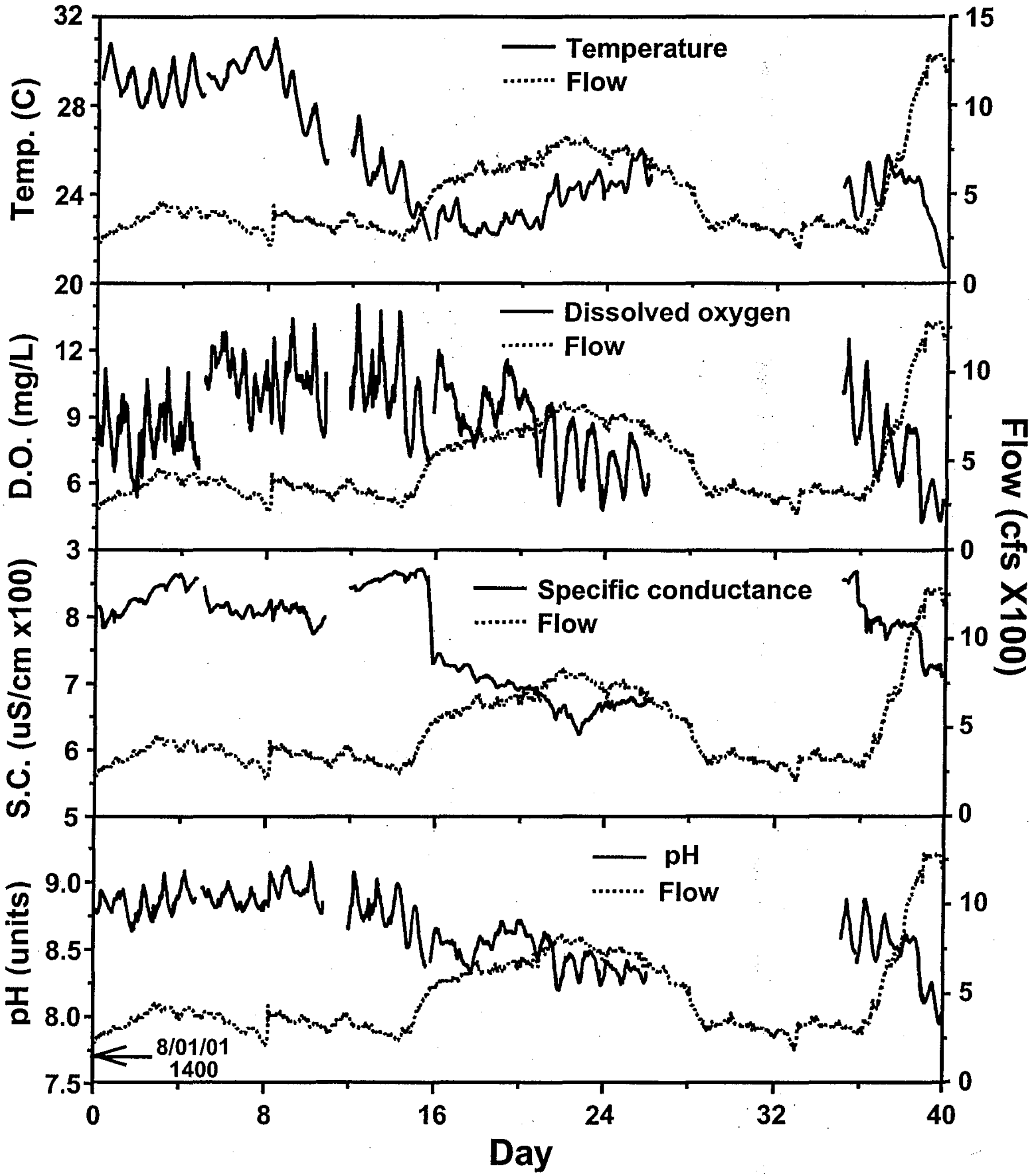


Figure 16. Temperature, dissolved oxygen, specific conductance, and pH for the St. Charles above dam station (US IMP) in the Fox River, Illinois. Water quality variables were measured at a depth of 6.5 ft. with a continuous recording Datasonde from August 1 through September 10, 2001. Flow was recorded at the Algonquin gage (USGS 2002).

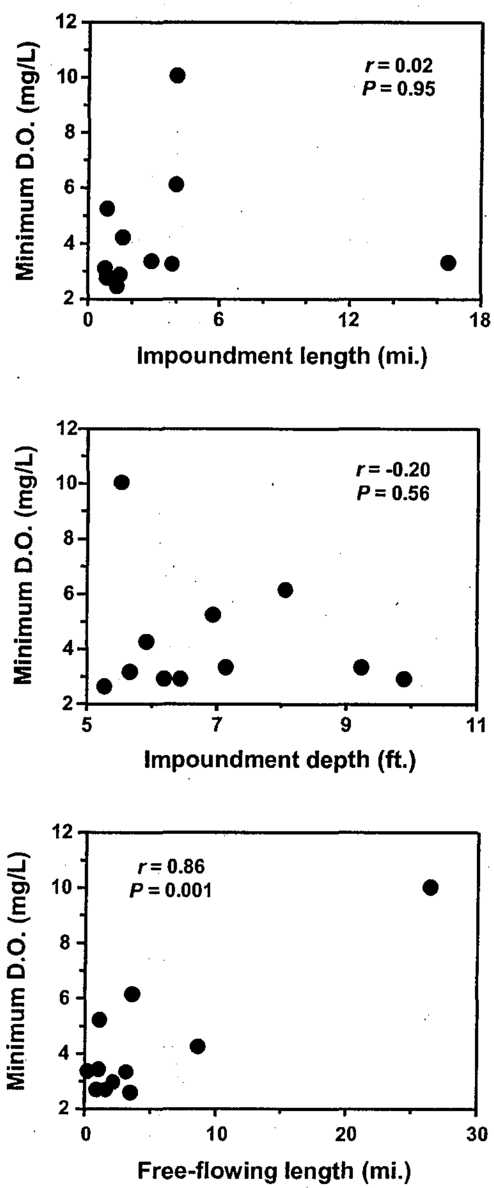


Figure 17. Relationships between minimum dissolved oxygen concentration and impoundment length, impoundment maximum depth, and length of upstream free-flowing habitat for 11 Fox River segments between McHenry and Dayton, Illinois.

Hydrologic conditions appeared to have a greater effect on the occurrence of substandard dissolved oxygen than impoundment morphology. We found no relationship between minimum dissolved oxygen concentration and impoundment length (Pearson correlation, $r = 0.02$, $P = 0.95$) or impoundment depth ($r = -0.02$, $P = 0.56$; Figure 17). Likewise, no relation was observed for duration of oxygen standard violation and impoundment length or depth ($r < 0.32$, $P = 0.35$). In contrast, length of free-flowing habitat above impounded areas was positively correlated with minimum dissolved oxygen concentrations ($r = 0.86$, $P = 0.001$; Figure 17).

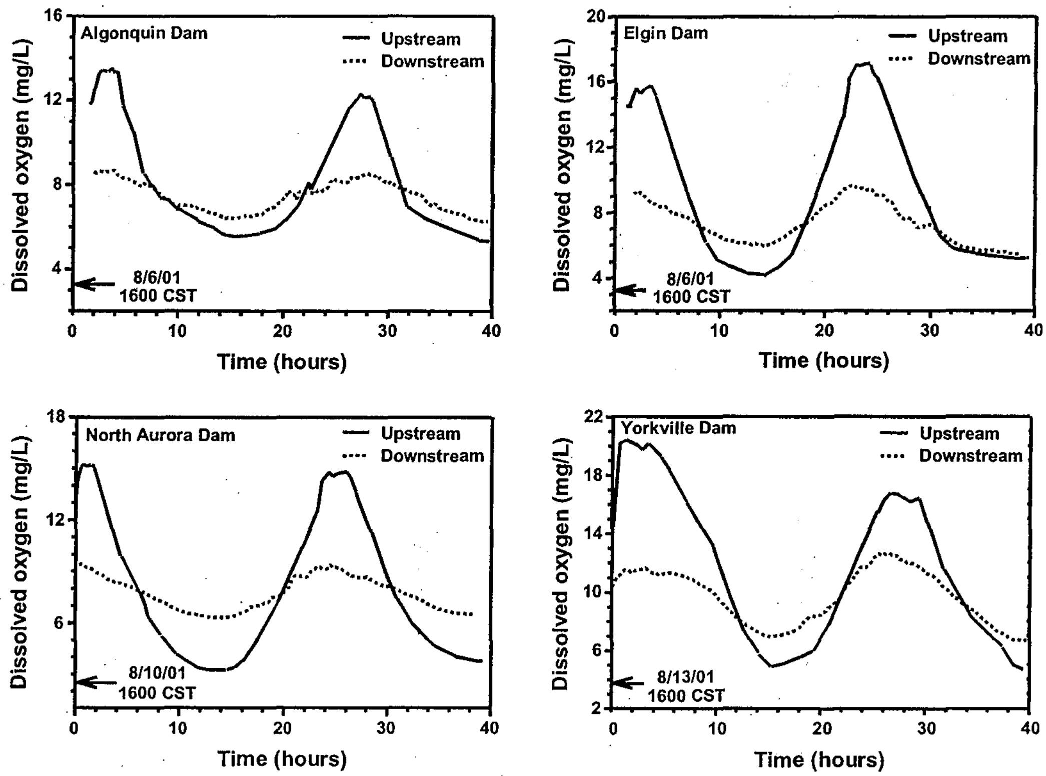


Figure 18. Dissolved oxygen concentrations at upstream impounded and downstream free-flowing stations for four dams in the Fox River, Illinois. Dissolved oxygen was measured at each station with continuous recording Datasondes over a 40-hour period in August 2001. Upstream data has been transformed based on point sampling to reflect surface dissolved oxygen concentrations.

While these data suggest longer free-flowing reaches above impoundments may improve dissolved oxygen conditions in downstream impounded areas, this result must be regarded with caution due to the predominance of short free-flowing reaches within our study area.

Above dam-below dam comparisons showed that dams released oxygen to the atmosphere during the day and added oxygen to the river at night (Figure 18). For example, water flowing over the Algonquin Dam lost about 5 mg/L of dissolved oxygen at 2000 CST on August 10 and gained about 1 mg/L at 0400 CST on August 11 (Figure 18). We used surface estimates for these comparisons because dissolved oxygen concentrations differed between surface and near-bottom impounded locations (Figure 19) and the timing of peaks in the diel oxygen cycle suggested that surface water flowed over dams during the low flow conditions that we monitored. Peaks in dissolved oxygen concentrations occurred at the same time for above-dam surface and below dam locations whereas above-dam near-bottom peaks lagged behind surface peaks by about 2 hours (Figure 19). The amount of oxygen added to the river or lost to the atmosphere by dams appeared to be related to the degree of oxygen saturation in upstream impounded waters and the physical aeration capabilities of each dam. During the day, oxygen

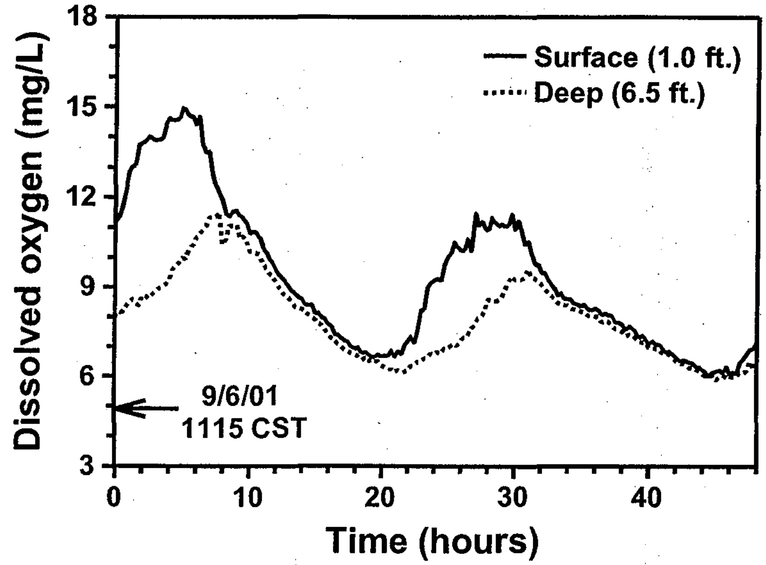


Figure 19. Dissolved oxygen concentrations for depths of 1.0 and 6.5 ft. at the St. Charles above dam station (US IMP) in the Fox River, Illinois. Dissolved oxygen was measured with continuous recording Datasondes set simultaneously for a 48-hour period in September 2001.

was released to the atmosphere as supersaturated water from the impoundments flowed over the dams. Conversely, when oxygen concentrations were low in impoundments at night, oxygen was added to water as it plunged into the river below each dam. The overall effect of water flowing over dams during a 24-hour period was a net loss in oxygen from the river (see area between upstream and downstream curves; Figure 18).

Macrohabitat Quantity

Fifteen mainstem dams impounded 47% of the 100 miles of river between Pistakee Lake and Dayton, Illinois (Table 23). As a result of these dams, 55% of the river's 4,665 acres was classified as impounded habitat. Impoundments ranged in size from 6 to 856 acres and the largest ones formed behind the Algonquin, Stratton, St. Charles, and Dayton dams. Impoundments averaged 250 to 620 ft. in width and typically were less than double the width of free-flowing areas. Free-flowing habitat did not exist above the Stratton Dam, ranged in area from 11 to 179 acres (0.3 to 3.6 mi.) between Stratton and Montgomery, and was most abundant in the lower river below the Montgomery Dam (Table 23).

The distribution of macrohabitat features varied over the river's length, among river segments formed by dams, and between free-flowing and impounded areas. Major tributaries were absent from 7 of 15 segments and occurred most frequently in the lower river below Yorkville (Table 24). No major tributaries were available to fish in the middle portion of river between St. Charles and Montgomery because 6 of 7 segments lacked tributaries and access to Mill Creek (South Batavia-North Aurora segment) was blocked by an insurmountable dam

Draft Report

Total Maximum Daily Loads for the East Branch of the DuPage River, Illinois

Submitted to

Illinois Environmental Protection Agency

P.O. Box 19276
1021 North Grand Avenue East
Springfield, IL 62794-9276

December 2002

Prepared by

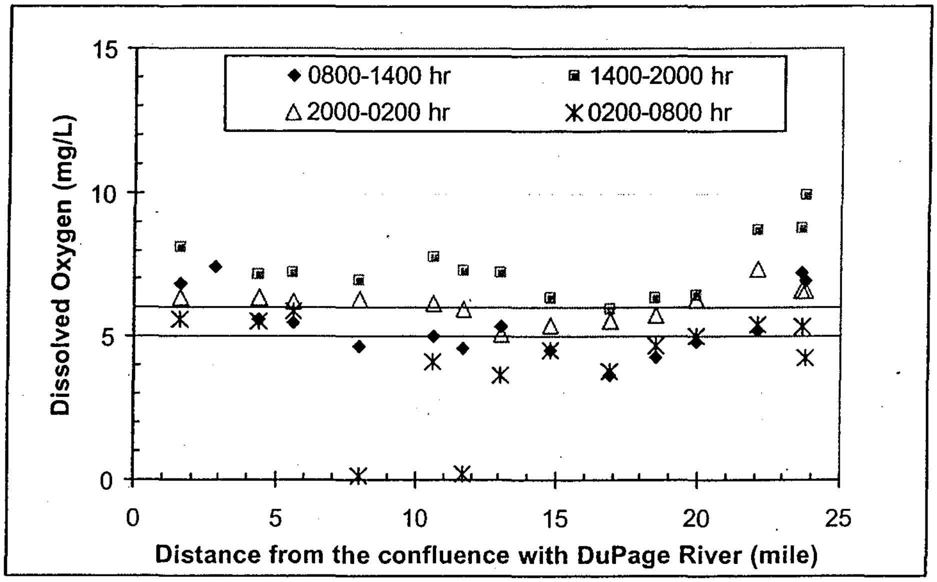
CH2MHILL
CH2M HILL Inc.
13921 Park Center Road
Suite 600
Herndon, VA 20171

In association with

Applied Environmental Engineering, LLC and
AQUA TERRA Consultants

EXHIBIT B

FIGURE 4-7
Diel Data Collected at Many East Branch of the DuPage River Sites on June 24–25, 1997, and the Water Quality Standards for DO



The analysis of East Branch DO and its potential sources provided key information necessary to identify the modeling needs and selecting an appropriate model. DO TMDL evaluations for East Branch will be developed using the QUAL2E model. The DO problem has been characterized as one associated with low- to medium-flow conditions in the summer months. The QUAL2E model can adequately simulate DO and other water quality constituents (e.g., BOD, nutrient) contributing to DO problems under a given flow condition. After being calibrated using diel sampling data, the model will be used to develop the DO TMDL using a critical low-flow condition.

4.5 Summary

Table 4-2 summarizes all the pollutants listed on the 303(d) list for East Branch. Also listed are any WQS/TMDL endpoints, other supporting data, and potential sources.

Draft Report

Total Maximum Daily Loads for Salt Creek, Illinois

Submitted to

Illinois Environmental Protection Agency

P.O. Box 19276
1021 North Grand Avenue East
Springfield, Illinois 62794-9276

July 2003

Prepared by

CH2MHILL
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13921 Park Center Road
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Herndon, Virginia 20171

In association with

AQUA TERRA Consultants and
Applied Environmental Engineering, LLC

FIGURE 4-13
Monthly DO Data at the Addison Creek Site (station 05532000) by Sample Date and the Water Quality Standards for DO
Data collected during daytime hours.

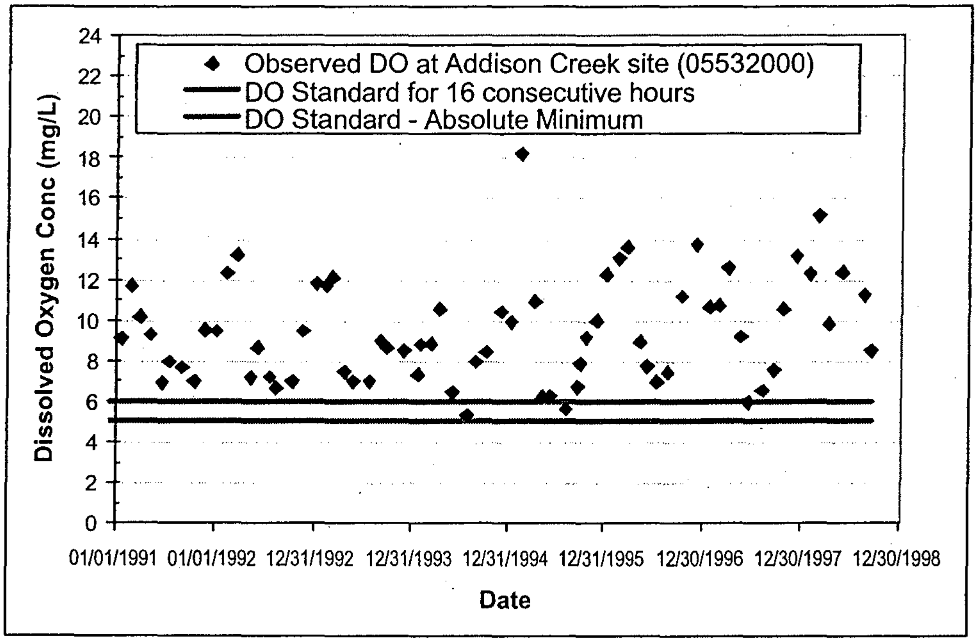

FIGURE 4-14
Diel DO Data Collected at 16 Salt Creek Sites on June 27 and 28, 1995, and the Water Quality Standards for DO

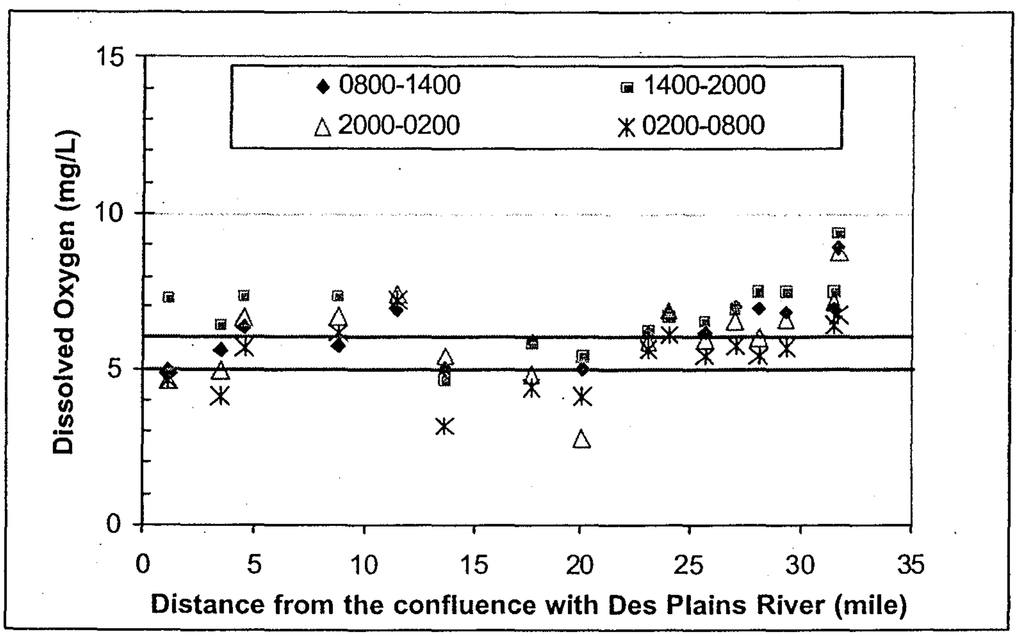

FIGURE 5-5
Observed and Modeled Dissolved Oxygen Concentrations at Different Locations in Salt Creek (June 27 and 28, 1995)

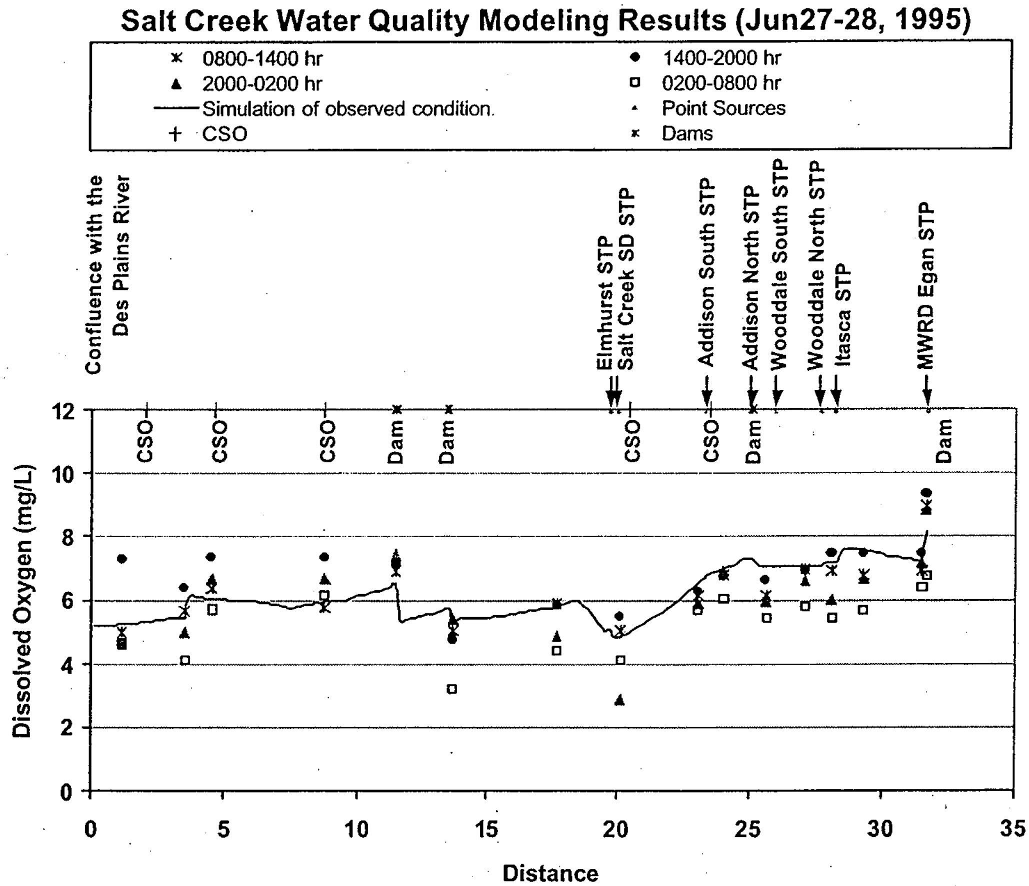

Figure 5-5 shows the observed DO concentrations at each sampling time interval as points and the simulated DO concentration as a solid line. The simulated DO concentrations were based on the steady-state modeling originally done by the USGS (1996). The horizontal axis in the plot shows the distance upstream from the confluence of the Salt Creek with the Des Plaines River. A set of points at a given distance represents the observed concentrations at different times of the day. Location of the point sources, dams, and CSOs are shown along the top horizontal axis.

The DO concentrations (Figure 5-5) violated the WQS (5 mg/L minimum) at 1.1 to 4.5 miles and 11.5 to 23.1 miles. The DO concentrations between 11.5 to 23.1 miles were less than 6 mg/L in all samples, indicating a potential violation of the 16-hour average DO standard of 6 mg/L. Low DO concentrations (the minimum observed DO concentration of 2.84 mg/L at 20.1 miles) in nighttime samples are believed to be caused by high BOD and low DO concentrations in point source and/or St. Charles Road CSOs discharges. Monitoring data revealed that the St. Charles Road CSO was flowing under dry weather conditions. The discharge from the CSO contained high BOD concentrations (e.g., 444 mg/L of CBOD).

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Illinois
Environmental
Protection Agency

Bureau of Water
PO Box 19276
Springfield, IL 62794-9276

IEPA/BOW/04-005

April 2004

DRAFT

Illinois 2004 Section 303(d) List

Illinois Environmental Protection Agency
Bureau of Water
Watershed Management Section

EXHIBIT C

Table 4. Tentative Long-term TMDL Schedule

Year	Number of Watersheds Scheduled for TMDLs
2003 - 2004	21
2004 - 2005	25
2005 - 2006	25
2006 - 2007	27
2007 - 2008	27
2008 - 2009	27
2009 - 2010	27
2010 - 2011	22
2011 - 2012	22
2012 - 2013	22
2013 - 2014	22
2014 - 2015	22
2015 - 2016	22
2016 - 2017	16

Table 5. Two-Year Schedule for TMDL Development

Hydrologic Unit Code	2002 303(d) Watershed ID	Segment ID	Segment Name	Miles/ Acres	Designated Uses	Potential Causes	Potential Sources
0713001201	ILDA04	RDG	CARLINVILLE	168	1-P, 20-F, 21-X, 42-P, 44-P, 50-P	595, 910, 2100, 2210, 9910	1000, 1050, 1100, 7550, 7700, 8700, 8960, 9000
	ILDA04	RDH	BEAVER DAM	56.5	1-P, 20-F, 21-F, 42-P, 44-P, 50-X	910, 2210, 9910	1000, 1050, 1100, 8960
	ILDA04	SDT	GILLESPIE OLD	71	1-P, 20-F, 21-F, 42-P, 44-P, 50-P	595, 910, 2100, 2210, 9910	1000, 1050, 1100, 7550, 7700, 8960, 9000
	ILDA04	SDU	GILLESPIE NEW	207	1-F, 20-F, 21-F, 42-P, 44-P, 50-F	910, 2100, 2210, 9910	1000, 1050, 1100, 7550, 7700, 8700, 8960
	ILDA04	DA 04*	Macoupin Cr.	19.73	20-P, 21-F, 42-N	595, 1100, 1220, 1710, 9910	1000, 5000, 7000, 9000
	ILDA04	DA 05	Macoupin Cr.	43.89	20-P, 21-F	595, 925, 1220, 1500, 9910	200, 1000, 1050, 1100, 5000, 7000, 7400, 7550
	ILDA04	DAZN	Briar Cr.	3.97	20-P	1220, 1610, 9910	200, 7000, 7100, 7550, 7600
0512011105	ILBM02	RBL	PARIS TWIN EAST	162.8	1-F, 20-F, 21-F, 42-P, 44-P, 50-F	910, 2100, 2210, 9910	7550, 7700, 8700, 8930, 8960
	ILBM02	RBX	PARIS TWIN WEST	56.7	1-X, 20-P, 21-F, 42-P, 44-P, 50-F	910, 2100, 2210, 9910	7550, 7700, 8930, 8960
	ILBM02	BM 02	Sugar Cr.	12.87	20-F, 42-N(1)	1710	9000
	ILBM02	BM C2	Sugar Cr.	2.95	20-P	900, 1100, 1220, 1500	200, 7000, 7400
0713000405	ILDK17	SDA	EVERGREEN	700	1-F, 20-F, 21-F, 42-F, 44-P, 50-F	910, 2100	1000, 1050, 1100, 8700, 8960
0714020205	ILSOF	SOF	Kinmundy New	107	1-F, 20-F, 42-F, 44-F, 50-P	595	9000
	ILSOI	SOI	PATOKA OLD	6	1-X, 20-X, 21-X, 42-X, 44-X, 50-P	595	9000
	ILSOB	SOB	FARINA	4	1-P, 20-F, 21-X, 42-F, 44-P, 50-P	500, 530, 595, 900, 910	8951, 9000
	ILROZY	ROZY	KINMUNDY	20	1-X, 20-X, 21-F, 42-X, 44-X, 50-P	595	9000
	ILSOJ	SOJ	PATOKA NEW	6	1-X, 20-X, 21-X, 42-X,	595	9000

Hydrologic Unit Code	2002 303(d) Watershed ID	Segment ID	Segment Name	Miles/ Acres	Designated Uses	Potential Causes	Potential Sources
					44-X, 50-P		
	ILSOG	SOG	Kinmundy Borrow Pit	5	1-F, 20-F, 42-F, 44-F, 50-P	595	9000
	ILOK01	OK 01	E. Fk. Kaskaskia R.	17.13	20-P, 42-P	1220, 1710, 9910	1000, 1050, 1100, 9000
	ILOKA01	OKA 02	N. Fk. Kaskaskia R.	15.31	20-P, 50-P	594, 595, 1000, 1220, 9910	1000, 1050, 1100, 5000, 9000
	ILOKA01	OKA 01	N. Fk. Kaskaskia R.	10.25	20-P, 21-F, 42-F, 50-P	594, 595, 1000, 1220, 9910	1000, 1050, 1100, 5000, 9000
0512011205	ILBEZX01	RBP	OAKLAND	23.4	1-P, 20-P, 21-F, 42-N, 44-N, 50-P	595, 910, 1100, 2100, 2210, 9910	1000, 1050, 1100, 7550, 7700, 8960, 9000
	ILBEZX01	RBK	WALNUT POINT	58.7	1-P, 20-F, 21-X, 42-P, 44-P, 50-X	900, 910, 930, 1100, 1220, 2100, 2200, 2210	1000, 1050, 1100, 8500, 8960
	ILBE14	BE 14*	Embarras R.	5.56	20-P, 21-X, 42-N	925, 1000, 1100, 1220, 1710, 2100, 9910	1000, 1050, 1100, 1600, 9000
0714020404	ILODL02	ROZA	HIGHLAND SILVER	550	1-P, 20-P, 21-P, 42-P, 44-N, 50-P	595, 910, 1100, 1220, 2100, 2210, 9312, 9318, 9910	1000, 1050, 1100, 1350, 1400, 8500, 9000
0512010906	ILBPJ03	RBO	HOMER	80.8	1-P, 20-F, 21-F, 42-P, 44-P, 50-X	910, 2100, 2210, 9910	1000, 1050, 1100, 7550, 7700, 8960
	ILBPJ03	BPJ 03	Salt Fk. Vermilion R.	9.97	20-P, 21-X, 50-P	594, 925, 930, 1730, 2100, 9910	200, 1000, 9000
	ILBPJ03	BPJ 09*	Salt Fk. Vermilion R.	13.62	20-P, 21-X	610, 925, 1000, 1730, 2100, 9910	200, 1000
	ILBPJ03	BPJ 10	Salt Fk. Vermilion R.	13.6	20-P, 50-P	610, 925, 930, 1000, 1730, 2100, 9910	200, 1000, 9000
	ILBPJ03	BPJ 08	Salt Fk. Vermilion R.	3.17	20-P, 50-P	594, 610, 925, 930, 1000, 1730, 2100, 9910	200, 1000, 9000
	ILBPJ03	BPJ 12	Salt Fk. Vermilion R.	3.07	20-P, 21-X	610, 925, 1000, 1730, 2100, 9910	200, 1000
0512010904	ILBPJ03	BPJ 09	Salt Fk. Vermilion R.	13.62	20-P, 21-X	610, 925, 1000, 1730, 2100, 9910	200, 1000
	ILBPJD02	BPJD02	Spoon Br.	13.71	20-P	1220, 1610	1000, 7000

Hydrologic Unit Code	2002 303(d) Watershed ID	Segment ID	Segment Name	Miles/ Acres	Designated Uses	Potential Causes	Potential Sources
0512010903	ILBPJC06	BPJC08	Saline Br.	15.52	20-P	925, 1220, 1610	1000, 7000
	ILBPJC06	BPJC06	Saline Br.	10.26	20-P	593, 610, 925, 1610, 1730, 2100, 9322, 9326, 9339, 9910	200, 1000, 7000, 7100, 8500, 9000
0713001104	ILDD04	SDL	MAUVAISSE TERRE	172	1-P, 20-P, 21-F, 42-N, 44-N, 50-P	7550, 7700, 8700, 8960, 9000	595, 910, 930, 2100, 2210, 9910
	ILDD04	DDC	N. Fk. Mauvaise Terre C	14.03	20-P	595, 925, 1220, 2100	1000, 1050, 1100, 7000, 9000
	ILDD04	DD 04	Mauvaise Terre R.	36.55	20-F, 21-F, 42-N	1710	9000
0512010813	ILBO07	RBS	GEORGETOWN	46.1	1-X, 20-F, 21-X, 42-N, 44-P, 50-X	910, 1620, 2100, 2210, 9910	100, 1000, 1050, 1100, 7550, 7700, 8960
0512010814	ILBO07	BO 07	Little Vermilion R.	5.11	20-F, 42-N	1710	9000
0512011404	ILC19	C 19*	Little Wabash R.	35.89	20-P, 21-F, 42-P, 50-P	595, 1000, 1100, 1220, 1510, 1710, 2100, 3100, 9910	1000, 1050, 1100, 7000, 7300, 9000
	ILC21	C 21	Little Wabash R.	31.11	20-F, 21-F, 42-F, 50-P	595	9000
0512011401	ILRCF	RCF	MATTOON	765	1-F, 20-F, 21-F, 42-P, 44-P, 50-F	910, 2100, 2210, 9910	1000, 1050, 1100, 7550, 7700, 8700, 8960
	ILRCG	RCG	PARADISE (COLES)	176	1-P, 20-P, 21-F, 42-P, 44-P, 50-F	900, 910, 925, 1000, 1100, 2210	200, 1000, 1050, 1100, 7000, 7400, 8960
	ILRCE	RCE	SARA	765	1-F, 20-F, 21-X, 42-F, 44-P, 50-P	595, 910, 2100, 2210	9000
	ILCSB07	CSB 08	E. Br. Green Cr.	5.63	20-P	595, 1220, 9910	1000, 1100, 1600
	ILC21	C 21*	Little Wabash R.	31.11	20-F, 21-F, 42-F, 50-P	595	9000
	ILCSB07	CSB 07	E. Br. Green Cr.	3.23	20-P	1100, 1220, 2100, 9910	1000, 1050, 1100, 1600
0512011402	ILCP01	CP-EF-C2	Salt Cr.	2.33	20-P	925, 1220, 9910	200, 1000, 1050, 1100, 4000
	ILCP01	CP 04	Salt Cr.	1.88	20-P, 21-F	1100, 2100, 9910	1000, 1050, 1100
	ILCP01	CP-EF-C4	Salt Cr.	1.76	20-P	925, 9910	200, 1000, 1050, 1100, 4000
	ILCPD01	CPD 03	Second Salt Cr.	1.38	20-P	597, 1100, 1220, 2100, 9910	1000, 1050, 1100, 1600, 9000

Hydrologic Unit Code	2002 303(d) Watershed ID	Segment ID	Segment Name	Miles/ Acres	Designated Uses	Potential Causes	Potential Sources
	ILCPD01	CPD 01	Second Salt Cr.	2.67	20-P	1100, 1220, 2100, 9910	1000, 1350, 1400, 1600
	ILCP01	CP-TU-C3	Salt Cr.	0.81	20-P	595, 9910	200, 1000, 1050, 1100
	ILCPD01	CPD 04	Second Salt Cr.	2.91	20-N	1100, 1220, 2100, 9910	1000, 1050, 1100, 1600
	ILCPC01	CPC-TU-C1	First Salt Cr.	1.44	20-P	595, 1220, 9910	200, 1000, 1050, 1100
0713001202	ILDAG01	SDZF	HETTICK	110	1-P, 20-F, 21-F, 42-P, 44-P, 50-X	900, 910, 1220, 2210	1000, 7000, 7400, 8960
	ILDAG01	RDF	OTTER	765	1-P, 20-F, 21-F, 42-P, 44-P, 50-P	595, 2210	200, 1000, 1050, 1100, 7000, 7400, 7550, 7700, 7900, 9000
	ILDAG01	RDZP	PALMYRA - MODESTO	35	1-P, 20-F, 21-X, 42-P, 44-P, 50-P	595, 1000, 1220, 2210	200, 1000, 1050, 1100, 7000, 7400, 8700, 8960, 9000
	ILDAG01	DAG 02	Hodges Cr.	10.69	20-P	1220	9000
0714020302	ILOIL01	ROL	GLENN SHOALS	1350	1-F, 20-F, 21-F, 42-P, 44-P, 50-F	910, 2100, 2210, 9910	1000, 1050, 1100, 7550, 7700, 8700, 8960
	ILOIL01	ROT	HILLSBORO OLD	108.7	1-P, 20-F, 21-X, 42-P, 44-P, 50-P	595, 910, 2100, 2210, 9910	8700, 8960, 9000
0512010909	ILBPG09	RBD	VERMILION	608	1-P, 20-F, 21-F, 42-P, 44-P, 50-P	900, 925, 930, 1100, 1220, 2100, 2210	1000, 1050, 1100, 7000, 7400, 7550, 7700, 8700, 8960, 9000
	ILBPGD01	BPGD	Hoopeston Br.	4.72	20-P	925, 1220, 9910	100, 200, 400, 7000
	ILBPG10	BPG 10	N. Fk. Vermilion R.	24.25	20-P, 21-X	925, 1610	200, 1000, 7000
	ILBPG09	BPG 09	N. Fk. Vermilion R.	5.91	20-F, 42-N	1710	9000
	ILBPG09	BPG 05	N. Fk. Vermilion R.	9.81	20-F, 50-P	930	9000
0512011506	ILRCT	RCT	WAYNE CITY SCR	8	1-P, 20-F, 42-P, 44-P, 50-P	595, 2100, 2210, 9910	1000, 1050, 1100, 9000
	ILCA03	CA 03	Skillet Fk.	7.18	20-P, 21-P, 42-N	595, 1000, 1100, 1220, 1610, 1710, 2100, 3100, 9410, 9910	1000, 1050, 1100, 7000, 7100, 9000
	ILCA03	CA 05	Skillet Fk.	10.96	20-P, 21-P, 42-F, 50-P	595, 1000, 1100, 1220, 1610, 2100, 3100, 9410	1000, 1050, 1100, 7000, 7100, 9000
0512011502	ILRCD	RCD	STEPHEN A.	525	1-P, 20-F, 21-F, 42-P,	910, 2100, 2210, 9910	1000, 1050, 1100, 7550, 7700,

Hydrologic Unit Code	2002 303(d) Watershed ID	Segment ID	Segment Name	Miles/ Acres	Designated Uses	Potential Causes	Potential Sources
			FORABES		44-P, 50-X		8700, 8960
	ILRBF	RBF	SAM DALE	194	1-P, 20-F, 21-X, 42-N, 44-P, 50-X	910, 2100, 2210, 9910	1000, 1050, 1100, 7550, 7700
	ILCA06	CA 06	Skillet Fk.	16.63	20-P, 21-P, 42-F	595, 1000, 1100, 1220, 2100, 3100, 9410	1000, 1050, 1100, 9000
	ILCAW01	CAW 04	Dums Cr.	25.38	20-P	1220	1000, 1350, 1400, 1600
	ILCA06	CA 09	Skillet Fk.	19.77	20-P, 21-P	1220, 9410	9000
	ILCAR01	CAR 01	Brush Cr.	21.27	20-P	595, 1220	1000, 1600, 9000
0512011503	ILCAN01	CAN 01	Horse Cr.	28.21	20-P, 21-F	595, 1220	1000, 1600, 9000

Note: Although all causes for which impairment has been identified are shown in this table, TMDLs are currently done only for causes for which a water quality standard exists.

Table 5 includes the TMDL watersheds in progress. It is anticipated that TMDL development for each watershed will be completed approximately two years from the initiation date. Stage 1 is scheduled to take a maximum of nine months. Stage 2 is optional and the time frame will depend on the type and quantity of additional data required. Stage 3 has a maximum time frame of 18 months. To date, contractors are doing all TMDL development work for Illinois EPA.

B. TMDL Implementation Status

The Illinois EPA views TMDLs as a tool for developing water quality based solutions that are incorporated into an overall watershed management approach. The TMDL establishes the link between water quality standards attainment and water quality based control actions. For these control actions to be successful, they must be developed in conjunction with local involvement, which incorporate regulatory, voluntary and incentive-based approaches with existing applicable laws and programs. The Four programs that have provided funds for implementation of TMDL watersheds are: the Illinois Nonpoint Source Management Program, the Illinois Clean Lakes Program (ICLP), the Priority Lake and Watershed Implementation Program (PLWIP) and the Conservation Practices Program (CPP).

The Illinois EPA administers the Illinois Nonpoint Source Management Program, the ICLP and the PLWIP. The Illinois Nonpoint Source Management Program was developed to meet the requirements of Section 319 of the Clean Water Act (CWA). Section 319 projects can include educational programs and nonpoint source pollution control projects such as Best Management Practices (BMPs). The ICLP is a financial assistance grant program that supports lake owners' interest and commitment to long-term, comprehensive lake management and ultimately results in improved water quality and enhanced lake use. The PLWIP supports lake protection/restoration activities at "priority" lakes where causes and sources of problems are apparent, project sites are highly accessible, project size is relatively small, and local entities are in a position to quickly implement needed treatments. Table 7 includes past and present projects in TMDL watersheds funded under these programs.

Beginning in July of 2002, the Illinois Department of Agriculture (IDoA) began shifting a portion of its Conservation Practices Program (CPP) funds to Soil and Water Conservation Districts (SWCDs) to more directly address water quality concerns within TMDL watersheds. This program gives incentive payments to landowners/operators within that watershed to promote the use of management practices that reduce/control the movement of pollutants causing the water quality impairment.

Metals (statistical guideline)
9510 = arsenic
9520 = cadmium
9530 = copper
9541 = chromium (total)
9550 = lead
9560 = mercury
9580 = zinc
9591 = barium
9594 = iron
9595 = manganese
9596 = nickel
9597 = silver

Conventional Pollutants and Stressors
0600 = ammonia (unionized ammonia)
0610 = ammonia nitrogen (total ammonia)
0700 = chlorine
0720 = cyanide (as free cyanide)
0750 = sulfates
0800 = fluoride
0810 = asbestos
0910 = total phosphorus (numeric standard)
9910 = total phosphorus (statistical guideline)
0925 = total nitrogen as N
0930 = nitrate nitrogen
0940 = nitrite nitrogen
0950 = nitrate/nitrite (nitrate + nitrite as N)
1000 = pH
1100 = sedimentation/siltation
1220 = dissolved oxygen
1320 = total dissolved solids (TDS)
1330 = chlorides
1400 = water temperature
1500 = other flow regime alterations
1510 = fish barriers (fish passage)
1610 = habitat assessment (streams)
1620 = habitat assessment (lakes)
1710 = total fecal coliform bacteria
1720 = Escherichia coli
1730 = fish kills
1900 = oil and grease
2100 = total suspended solids (TSS)
2200 = aquatic plants (native)
2210 = excess algal growth
2500 = turbidity
2610 = non-native aquatic plants
2620 = non-native fish/shellfish/zooplankton

Pesticides
3100 = atrazine
3200 = cyanazine
3300 = alachlor
3400 = metolachlor
3500 = metribuzin
3600 = trifluralin
3700 = butylate

10) **Potential Sources of Impairment** - Indicates the potential sources that contribute to the potential causes listed above.

POINT SOURCES

100 : industrial point sources
200 : municipal point sources
210 : major municipal point sources
400 : combined sewer overflows
500 : collection system failure
800 : wildcat sewer
900 : domestic wastewater lagoons

State of Michigan
DEQ
Department of Environmental Quality

Surface Water Quality Division

Permits Section

Biochemical Oxygen Demand (BOD)

Biochemical Oxygen Demand, or BOD, is a measure of the quantity of oxygen consumed by microorganisms during the decomposition of organic matter. BOD is the most commonly used parameter for determining the oxygen demand on the receiving water of a municipal or industrial discharge. BOD can also be used to evaluate the efficiency of treatment processes, and is an indirect measure of biodegradable organic compounds in water.

Imagine a leaf falling into a stream. The leaf, which is composed of organic matter, is readily degraded by a variety of microorganisms inhabiting the stream. Aerobic (oxygen requiring) bacteria and fungi use oxygen as they break down the components of the leaf into simpler, more stable end products such as carbon dioxide, water, phosphate and nitrate. As oxygen is consumed by the organisms, the level of dissolved oxygen in the stream begins to decrease

Water can hold only a limited supply of dissolved oxygen and it comes from only two sources- diffusion from the atmosphere at the air/water interface, and as a byproduct of photosynthesis. Photosynthetic organisms, such as plants and algae, produce oxygen when there is a sufficient light source. During times of insufficient light, these same organisms consume oxygen. These organisms are responsible for the diurnal (daily) cycle of dissolved oxygen levels in lakes and streams.

If elevated levels of BOD lower the concentration of dissolved oxygen in a water body, there is a potential for profound effects on the water body itself, and the resident aquatic life. When the dissolved oxygen concentration falls below 5 milligrams per liter (mg/l), species intolerant of low oxygen levels become stressed. The lower the oxygen concentration, the greater the stress. Eventually, species sensitive to low dissolved oxygen levels are replaced by species that are more tolerant of adverse conditions, significantly reducing the diversity of aquatic life in a given body of water. If dissolved oxygen levels fall below 2 mg/l for more than even a few hours, fish kills can result. At levels below 1 mg/l, anaerobic bacteria (which live in habitats devoid of oxygen) replace the aerobic bacteria. As the anaerobic bacteria break down organic matter, foul-smelling hydrogen sulfide can be produced.

BOD is typically divided into two parts- carbonaceous oxygen demand and nitrogenous oxygen demand. Carbonaceous biochemical oxygen demand (CBOD) is the result of the breakdown of organic molecules such a cellulose and sugars into carbon dioxide and water. Nitrogenous oxygen demand is the result of the breakdown of proteins. Proteins contain sugars linked to nitrogen. After the nitrogen is "broken off" a sugar molecule, it is usually in the form of ammonia, which is readily converted to nitrate in the environment. The conversion of ammonia

EXHIBIT D

to nitrate requires more than four times the amount of oxygen as the conversion of an equal amount of sugar to carbon dioxide and water.

When nutrients such as nitrate and phosphate are released into the water, growth of aquatic plants is stimulated. Eventually, the increase in plant growth leads to an increase in plant decay and a greater "swing" in the diurnal dissolved oxygen level. The result is an increase in microbial populations, higher levels of BOD, and increased oxygen demand from the photosynthetic organisms during the dark hours. This results in a reduction in dissolved oxygen concentrations, especially during the early morning hours just before dawn.

In addition to natural sources of BOD, such as leaf fall from vegetation near the water's edge, aquatic plants, and drainage from organically rich areas like swamps and bogs, there are also anthropogenic (human) sources of organic matter. If these sources have identifiable points of discharge, they are called point sources. The major point sources, which may contribute high levels of BOD, include wastewater treatment facilities, pulp and paper mills, and meat and food processing plants.

Organic matter also comes from sources that are not easily identifiable, known as nonpoint sources. Typical nonpoint sources include agricultural runoff, urban runoff, and livestock operations. Both point and nonpoint sources can contribute significantly to the oxygen demand in a lake or stream if not properly regulated and controlled.

Performing the test for BOD requires significant time and commitment for preparation and analysis. The entire process requires five days, with data collection and evaluation occurring on the last day. Samples are initially seeded with microorganisms and saturated with oxygen (Some samples, such as those from sanitary wastewater treatment plants, contain natural populations of microorganisms and do not need to be seeded.). The sample is placed in an environment suitable for bacterial growth (an incubator at 20° Celsius with no light source to eliminate the possibility of photosynthesis). Conditions are designed so that oxygen will be consumed by the microorganisms. Quality controls, standards and dilutions are also run to test for accuracy and precision. The difference in initial DO readings (prior to incubation) and final DO readings (after 5 days of incubation) is used to determine the initial BOD concentration of the sample. This is referred to as a BOD_5 measurement. Similarly, carbonaceous biochemical oxygen test performed using a 5-day incubation is referred to as a $CBOD_5$ test.

Water Quality Standards for BOD

Although there are no Michigan Water Quality Standards pertaining directly to BOD, effluent limitations for BOD must be restrictive enough to insure that the receiving water will meet Michigan Water Quality Standards for dissolved oxygen.

Rule 64 of the Michigan Water Quality Standards (Part 4 of Act 451) includes minimum concentrations of dissolved oxygen that must be met in surface waters of the state. This rule states that surface waters designated as coldwater fisheries must meet a minimum dissolved oxygen standard of 7 mg/l, while surface waters protected for warmwater fish and aquatic life must meet a minimum dissolved oxygen standard of 5 mg/l.

Biochemical Oxygen Demand Limitations in NPDES Permits

Typically, $CBOD_5$ limits are placed in NPDES permits for all facilities which have the potential to contribute significant quantities of oxygen consuming substances to waters of the state. These limits are developed in direct correlation with limits for ammonia nitrogen and dissolved oxygen. The nitrogenous oxygen demand is computed separately because of the difference in oxygen demand (as explained above) and because the rate of oxygen consumption over time varies from carbonaceous oxygen demand. Ammonia is further considered separately because in sufficient levels (dependant upon several variables) it can also be toxic to living organisms.

In determining $CBOD_5$ limits, stream modelers use computer models which simulate actual stream conditions. Model inputs include the flow of the receiving stream, the quantity of water to be discharged, the decay rate for the particular type of wastewater, the stream's slope, and temperature. Other upstream or downstream dischargers are also considered in the model. The modeler determines maximum limits for $CBOD_5$ and ammonia nitrogen and minimum limits for dissolved oxygen. These limits are selected to insure that Water Quality Standards for dissolved oxygen are met in the receiving water.

Permit-related questions and comments? Contact Fred Cowles, cowlesf@michigan.gov
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Last revision: April 30, 2001

http://www.deq.state.mi.us/swq/permits/parameters/bod.html

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CERTIFICATE OF SERVICE

I, Albert F. Ettinger, certify that on July 21, 2004, I filed MOTION TO SUSPEND CONSIDERATION OF PROPOSED AMENDMENTS TO THE DISSOLVED OXYGEN STANDARD PENDING DEVELOPMENT OF DRAFT IMPLEMENTATION RULES and MEMORANDUM IN SUPPORT OF MOTION TO SUSPEND CONSIDERATION OF PROPOSED AMENDMENTS TO THE DISSOLVED OXYGEN STANDARD PENDING DEVELOPMENT OF DRAFT IMPLEMENTATION RULES. An original and 9 copies was filed, on recycled paper, with the Illinois Pollution Control Board, James R. Thompson Center, 100 West Randolph, Suite 11-500, Chicago, IL 60601, and copies were served via United States Mail and via facsimile to those individuals on the included service list.

Respectfully submitted,

Albert F. Ettinger
Senior Staff Counsel, Environmental Law & Policy Center and counsel in this matter for Prairie Rivers Network and Sierra Club

July 21, 2004

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